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# TECHNICAL SPECIFICATIONS

## KURCAJ BRIDGE



ATELIER 4  
ARCHITECTURE • ENGINEERING • CONSULTING



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*VERIFY ALL DIMENSIONS AND CONDITIONS ON SITE AND REPORT ANY DISCREPANCIES BEFORE PROCEEDING WITH THE IMPLEMENTATION WORKS.*



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## PREAMBLE

The information provided herein are drawn up to specify works and installations to exactly match the standards required to achieve the objectives of the project.

The Contractor shall certify the conformity of offered products with the specifications as requested below and shall furnish the Contracting Authority and the Supervisor with further certifications that prove the conformity of the goods with the standards as required.

General comprehension shall be achieved for the following:

Technical Specifications, Tables in the Technical Specifications or in the Bill of Quantity, Photos or Drawings do not imply a specific product or a specific manufacturer.

Works, products or installations proposed by the contractor which represent a higher degree of standard or a newer version shall be accepted whenever proven by the contractor.

Tables and enumerative descriptions in these specifications indicate a range for the contractor to propose the respective product; the above mentioned tolerances shall apply unless explicitly restricted.

The approval of an offered product is given by the Supervisor at building site only after presentation of an acceptable sample of each type.

All supplies, materials and products purchased must originate from an EU member state, a country that is a beneficiary of the European Neighbourhood and Partnership Instrument or a Member State of the European Economic Area or a country which has established reciprocal access to their external assistance with the EU. Please also refer to Article 19, paragraph 5 of the "EC Council Regulation No 1085/2006" (IPA regulations).



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Not every situation can be foreseen, therefore these specifications give an outline to the work and set a standard that is to be met. In cases where local practice overrides these specifications then it is up to the discretion and prudence of the Conservation Architect or Engineer in situ.

There are two technical parts to the project design.

The first pillar is this Technical Specifications Report, ordered as per common conservation trades and it is more oriented toward the materials, standards, and execution of the implementation works.

The second technical pillar is the Technical Report which includes the description of the site's conditions, structural systems and overview of conditions.

They are to be used in combination. They are, as in all complex conservation projects, interconnected and refer to one another as well as the Drawings and Bill of Quantities.

Locally available sizes for all elements described in this document can be used with the permission of the conservation architect or engineer. These documents are intended give an outline and standard of the work to be performed.

It is the responsibility of the contracted party carrying out the conservation works to request clarification to this, or any subsequent document, to the Conservation Architect or Engineer should there be any questions or misinterpretation.

All materials, sizes and installation listed in the drawings and specifications must be submitted to the Conservation Architect or Engineer for approval.

The project design required work interventions are based on these Technical Specifications, Drawings, and the Bill of Quantities. These three documents are linked to give the best possible description of each intervention.





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## 1. GENERAL REQUIREMENTS

### 1.1 SCOPE OF WORK

The main objective of the design for this site is to provide the restoration and rehabilitation of the Kurcaj Bridge.

The detailed design works include, but are not limited to, Architectural and Structural Works of Conservation.

The intervention on the heritage site consists in the:

- Full conservation, structural stabilization and a full restoration
- Terracing of the hillside allowing safer and easier physical access

All of these measures are outlined graphically in the **Drawings** and fiscally in the **Bill of Quantities**. The Bill of Quantities includes a basic outline for each section.

**Note:** If there are any elements that cause structural instability that are uncovered or observed during the works then these are also included in the scope of work.

If these areas are found, then they must be brought to the immediate attention of the conservation architect or engineer.

The intent of these documents (General Conditions, Technical Specifications, Drawings, and Bill of Quantity), along with other investigations and preliminary reports is to describe the work that the contractor will undertake. The contractor shall perform all of the work specified in these documents in good faith and execute the contract and such additional, extra, collateral and incidental work as required and necessary for the proper execution and completion of the work reasonably inferable from the contract. Contractor shall provide and pay for all labour, materials, equipment, tools, temporary water, light, power, transportation, shop drawings, and incidentals and other facilities and services necessary for proper execution and completion of the work, whether or not they are incorporated into the work.

The detailed design reports explain the order of the works as there are many elements that must be stabilized or removed before other work can be conducted. Therefore, the drawings and reports contain details concerning the conservation steps, what must be stabilized and structurally consolidated or removed before other work commence.

However, these priorities do not infringe on the staging and other works that can be prepared off-site or in conjunction with these important factors. It is the responsibility of the contracted party to conduct the works in the most efficient, cost effective, and time saving manner.



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## 1.2 UNITS OF MEASUREMENTS

In general, the units of measurements to be used in connection with this contract are metric units of mm, cm, m Km, N (Newton), Mg (1000 kg) and degrees Celsius (Co). Decimal points are written as ",". The units to which the contractor shall refer to for measurements are indicated in the respective Bill of Quantities for each individual item separately.

## 1.3 DISCREPANCIES

Before the contractor begins any work, they shall carefully review the all documents, drawings and specifications, inspect the site, and compare the documents comprising the contract with each other and with any additional information furnished by the Contracting Authority with the objective of discovering any errors, inconsistencies or omissions.

Should any of the above-described errors, discrepancies or omissions be found in the contract or should any discrepancy be found between the contract and the physical conditions at the site or in any subsequent drawings or addenda that may be provided thereafter, the contractor shall notify the Contracting Authority in writing, immediately.

Any work done after such discovery, unless authorized in writing by the Contracting Authority will be done at the contractor's expense. The contractor will not be allowed to take advantage of any error, omission, or discrepancy in the contract.

## 1.4 EXECUTION REQUIREMENTS

Particular attention is drawn to the fact that certain works require traditional and / or other professional expertise in conservation design and installation; the Contractor has to consider that the mentioned specifications and subsequent expenses are borne with the Contractor and are thus, to be included in the unit prices.

The Contractor shall in accordance to his own design, also propose and submit a methodology how to implement his design. The design shall be in accordance to the detailed design drawings and the material specified. All design, methodology and purchase shall be approved by the Supervisor. Only especially skilled and licensed technicians shall be authorized to install the system. The contractor shall provide to the Supervisor evidence of the qualifications of the nominated staff before commencement of works.

### 1.4.1 Degree of Skill, Care and Diligence

The contractor shall perform, or cause to be performed, all the work required of it under the terms and conditions of the contract with that degree of skill, care, and diligence normally exercised in performing that type of work in projects of a scope and magnitude comparable to the project. The contractor shall use their best efforts to assure timely and satisfactory completion of the work. The





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contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the contract, unless the contract gives other specific instructions concerning those matters.

The contractor has an obligation when directed by the Contracting Authority, shall promptly correct, or remove all work identified to be defective or incomplete. The contractor shall bear all costs.

Unauthorized work done without permission from the Contracting Authority as shown on the drawings or specifications will be considered as unauthorized.

#### 1.4.2 Faulty Works

Any work, which fails to comply with these Specifications, shall be rejected and the Contractor shall, at his own expense, repair any defects, as directed by Supervisor satisfaction.

#### 1.4.3 Materials

There will be no substitutions of materials on this project without written authorization of the conservation architect or engineer.

The materials shall comply with the specifications and used throughout the work. In the absence of a defined specification then the contractor will submit in writing a report of any required new materials. Testing of all materials including mortar, stone, sand, and other materials shall be conducted and approved by the conservation architect or engineer. All data sheets and materials identification and literature including product description, samples, and test along with the name of the manufacturer will be submitted to the Contracting Authority.

The conservation architect or engineer has the right to inspect any and all materials used to ensure quality and standards, at any time.

#### 1.4.4 Personnel

The Contractor shall provide the name and identification documents of all persons or subcontractors expected to work on the project to ADF prior to commencement of work. If any changes are required, then the Contractor shall submit in writing proposed changes.

#### 1.4.5 Information to be supplied to the Supervisor

The information to be supplied to the Supervisor shall include drawings showing the general arrangement of the temporary offices and any other temporary buildings or structures which he proposes to use, together with details of the constructional plant and temporary works, and all other devices which he proposes to adopt for the construction and completion of the whole of the works and, in addition, details of the labour strength, skilled and unskilled, and supervision arrangements.



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#### 1.4.6 Approval by Supervisor of Method Statements

The manner and the order in which it is proposed to execute the permanent works as described in the Contractor's method statements is subject to adjustment and approval by the Supervisor, and the Contract price shall be held to include any necessary adjustment required by the Supervisor during the course of the work.

#### 1.4.7 Additional Work

The contractor should submit to the Supervisor every additional work; a detailed drawing and the work should begin only after the Supervisor's approval.

#### 1.4.8 Confirmation of submissions

The contractor should sign proposals, details, sketches, accounts, information, materials, test certificate, whenever required by the Supervisor. The Supervisor will accept every submission and if appropriate will be answered to the contractor in accordance to any proper clause of contract conditions. Every submission should be done due to dates agree with the Supervisor and referring to the approved program and necessary time that the Supervisor needs to submit those works.

#### 1.4.9 As Built Drawings

This material should contain the complete set of drawings of the implemented works, including any additional drawings made during work implementation approved by the Supervisor, and the measurement handbook per each work volume.

#### 1.4.10 Road cleaning

Streets adjacent to the site shall be kept clean on a daily basis. The Contractor shall take necessary precautions to prevent excessive spoiling of streets such as wheel washing and covering of open lorries and containers leaving the site.

#### 1.4.11 Protection of Trees

All trees which are not approved for felling shall be protected against damage during the entire Contract Period using wooden boards strapped around the trunk of the tree extending up to a height of 2m. No trees with a trunk diameter greater than 10 cm measured at 1m above ground shall be felled without prior permission of the relevant authorities and the Supervisor.

### 1.5 HEALTH AND SAFETY

The Contractor shall implement all works in accordance with current European and Albanian Health and Safety at Work Standards.



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He shall develop and maintain a proactive approach to safety on site with providing the following:

- A site safety plan
- Nomination of a safety inspector
- Carrying out regular staff safety briefings
- Performing regular safety tours of the site with the Supervisor and
- Maintenance of accident statistics for presentation to the Supervisor each month.

## 2. SITE CONSTRUCTION

### 2.1 MOBILISATION

It is the contractor's responsibility to become familiar with these documents and contact the Contracting Authority or the conservation architect or engineer should there be any questions, concerns, or discrepancies. It is also the contractor's responsibility to visit the site and become familiar with the unique situations present at the site before beginning the works on the project.

The project is complicated; therefore, the scope / limits are also outlined in this document as well as clearly delineated on the drawings. Should there be any questions before, during, or after the work concerning scope the Contracting Authority must be contacted.

#### 2.1.1 Obtaining necessary implementation works permits

It the contractor's responsibilities to obtain the necessary implementation works permits, insurance, bonding, right-of-way, etc. It is also the contractor's responsibility to obtain all the necessary permissions to conduct the work outlined in these General Conditions, Technical Specification, and Drawings. No work shall commence until these permissions are obtained and a copy submitted to the Contracting Authority. It is the contractor's responsibility to obtain all permissions required to execute this scope of work. If the permissions have a time requirement this must also be respected and if reapplication is required, this is also the contractor's responsibility. All expenses for obtaining these permissions are the contractor's responsibility. The contractor must always maintain the work site in accordance with the requirements of these work permissions.

#### 2.1.2 Statements

Submit proposed transport, placement and connection procedures to the Supervisor for approval before work is started. Procedures shall provide for adjusted placement and coordination with other works in progress, a connection schedule of utility services, all necessary permits from utility supply companies, a detailed description of methods and equipment to be used for each operation and sequence of operations.



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### 2.1.3 Condition Surveys

In cases where neighbouring property could be touched or damaged by the container placement or the storage placement or the site board, then the Contractor shall carry out at his expense a detailed condition survey of the neighbouring property including photographic documentation a copy of which shall be presented to and approved by the Supervisor prior to commencement of the works.

## 2.2 REQUIREMENTS AND PRODUCTS

All products and items as described in the following have to be included within the scope of work by the contractor.

### 2.2.1 Site construction fence

For purposes of safeguarding and protection, if needed, the contractor has to erect a fence surrounding the construction site, to prevent unauthorized access.

The Contractor shall install a fence surrounding the construction that is made from steel or solid wooden panels or similar material. The height of the fence shall be not less than 2.80 m. The support of the fence shall be stable and solid as to the direction of the Supervisor.

### 2.2.2 Site Information Board

The contractor shall construct one board, carrying information supplied by and erected in the location specified by the Contracting Authority. The wording shall be presented in such a way as to be legible from a distance.

### 2.2.3 Site Office for Supervisor

Where itemised in the Bill of Quantities the Contractor shall provide appropriate office facilities for the exclusive use of the Supervisor and his staff for the duration of the Contract. Such offices shall have an area of min 25 sq.m. and shall be configured to provide, as a minimum, two offices, toilet facilities and a store room.

The office container shall be ready-made from steel panels. Container should have windows on 2 sides. The container shall be burglar proof. The door of the container shall be lockable. All office containers should be equipped with the required furniture, computers and ancillaries, internet connection and heating.

The contractor has to cover the running and maintenance costs for the complete contract time.



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#### 2.2.4 Attendance upon the Supervisor's request

The Contractor shall provide to Supervisor all required attendance and , all equipment, tools and protective clothing, plastic bags for sampling, and survey assistants, chainmen and labourers, delivery personnel and transport, wooden pegs, iron pins and pickets, water, cement and aggregate for concreting, transport for labourers and materials, as may be required by the Supervisor and his staff for carrying out the sampling and laboratory testing activities and for checking, setting out, surveying, measuring or testing the work The Contractor shall provide all cleaners, labour, equipment, consumables and material which may be necessary for keeping all the buildings in a neat and clean condition, and any repairs shall be made immediately at the request of the Supervisor. The Contractor shall include in his rates in the Bill of Quantities, the cost of all attendance upon the Supervisor and his staff. No other payment shall be made in respect of attendance, except where a specific item is provided for in the Bill of Quantities.

#### 2.2.5 Protective Equipment

The contractor shall at commencement of the Works provide the Supervisor with protective clothing and equipment, as follows, and, as the Supervisor considers necessary, provide replacement items under the provisions for maintenance of the Supervisor's facilities. Prior to making this provision, the Contractor shall obtain a list of appropriate sizes from the Supervisor. as and where the Contractor's methodology, activities or planned testing programme may require additional protective equipment (such as gloves, ear plugs, goggles, torches etc.), the Contractor shall make these available to the Supervisors and when the need arises.

#### 2.2.6 First Aid Packs

The Contractor shall provide, to the Supervisor's satisfaction and compatible with current legislation, and maintain, two first aid packs. Each vehicle working within the site borders shall be provided with a first aid pack in accordance with the regulations in force and will be replenished, as necessary, together with the office supplies.

#### 2.2.7 Garbage Place for disposal

The work includes the preparation of a garbage place for construction waste and debris.

The storage place for disposals and garbage shall be located close to the work site in order to allow easy access and transport from the work site; the garbage place shall be emptied each evening at closure of the construction site. The garbage storage shall include the provision of 4 movable garbage bins on rolls with lockable covers.



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## 2.2.8 Sanitary facilities

The Contractor shall avail sanitary facilities in relation to the number of workers and staff on site, but at minimum 2 separate toilet cabins shall be provided.

All sanitary facilities shall be provided, installed, operated and maintenance by the contractor. The number of toilets has to be approved by the Supervisor.

## 2.2.9 Individual Power Generator

For the use of the Supervisor, the Contractor shall provide, install, operate and maintain a diesel power generator.

The power generator shall be equipped with a diesel engine and be of at least 4 kVA capacity.

## 2.2.10 Safeguarding

The Contractor has to provide services for safeguarding the object over 24 hours a day and 7 days per week.

A service for safeguarding the construction site shall be provided. The service providers shall be properly equipped with uniforms and mobile phones to connect to the next police station. A cabin with windows for surround view at the entrance of the construction site shall be provided, equipped with heating device and spotlight.

## 2.3 SCAFFOLDING

All scaffolding shall be designed and erected in accordance with the relevant standards. Only experienced and competent scaffolding erectors shall carry out erection. The Contractor shall ensure that any necessary modifications to the scaffolding during the course of the works shall be accepted by the scaffolding erector so that scaffolds shall remain suitable for the purpose for which they are intended throughout the works. The signed approval of the scaffolding shall be made visible at each ground level access point to the scaffolding. Working on unapproved scaffolding is strictly forbidden.

Care shall be taken that the load of any debris collecting on a scaffold does not exceed the loading for the design. The maximum permissible loading of the scaffolding shall be clearly visible at all ground level access points. All measures necessary shall be taken to prevent debris from being accidentally dislodged from the platform.

Steel scaffolding of trestle type, in accordance with local standards and regulations, including the supply of supports, maintenance, assembly, anchorage, dismantling etc. 15 cm toe boards shall be





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provided on all levels. Weatherproof sheeting or at least protective netting shall be provided on the outside of the scaffolding.

### 3. STEPS TO FOLLOW DURING IMPLEMENTATION

#### 3.1 CONSOLIDATION

To implement the structural consolidation of the bridge, during the implementation works, the following steps must be followed:

- Construction of a scaffolding to guarantee the stability of the arch, and for the realization of works.
- Works for river protection (referring to the project).
- Removing the pavement stones along with the filling material.
- Dismantling the stones from the masonry of the bridge and recording them accompanied by photographs.
- Installation of metal spacers to discipline the cables (spacers are placed in the arc joints referred to the project).
- Anchoring the wicks (ribbed stainless steel rebar with a diameter of 20mm) with a total length of 175 cm into the rock (with a socket length) of 100 cm on both sides of the bridge.
- Cable assembly (the spacers are fixed in position on the exterior of the arch. Once the steel cables are inserted into them, they are then connected to the anchor rods that have a free length of 75 cm, by means of two tensioners. The cables are easily tensioned using tensioners, one of which is placed on the key-stone and the other two on the abutments.).
- Placement of the inspection box with two lids having dimensions of 20x40x40cm (width x length x height), above each cable to allow monitoring, inspection and maintenance and to make possible interventions in the future. The tensioner which is placed inside this cast iron inspection box on the key stone can be equipped with a tension gauge to ensure maintaining its tension.
- Reconstruction of the masonry and arches of the two chambers in the initial positions.
- Application of tie-rods for reconstructed masonry.

In order to realize the placement of tie-rods, the following steps must be followed:



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- Preparation of the masonry through the preparation of a surface where the anchor plates of the tie-rod will be placed.
- Dimensioning, levelling and axis of the tie-rods. The minimum diameter of the tie-rods in each case will be not less than 16 mm, while the length of the straps is not more than 20 m. The tie-rod section should be smooth (non-ribbed).

Then it will be followed by:

- Backfilling the spaces between the walls and restoring the cobblestones.
- Disassembly of the scaffolding.

### 3.2 LANDSCAPE INTERVENTIONS

Besides the consolidation of the monument, the interventions around it in the landscape will be:

- Construction of the staircase with stone elements, which is not part of the monument, but will serve for access to the river bed.
- Alleys (retaining walls with gabion, gravel, sand, cobblestone).

## 4. MECHANICAL PROPERTIES OF THE MATERIALS

### 4.1 MORTAR

Mechanical properties of lime mortar should be in conformity to the Albanian standard STASH 510-81. The mortar test methodology is given in STASH 543-83. The mortar resistance will be determined testing cubes with dimensions 7.07x7.07x7.07cm, in wet conditions. The mortar must withstand at least 15 freeze-thaw cycles.

Tab 1. Mechanical properties of lime mortar

Mortar type	Proportion of volumes (Lime:Sand)	Mortar class (strength) (daN/cm <sup>2</sup> )	Lime wash (l)	Cement (kg)	Sand (m <sup>3</sup> )	Gypsum (kg)	Water (l)
Lime mortar, lime having consistence of 12 cm	1:3	4	350	-	0.99	-	120



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Important notes:

1. The above recipe has an orienting character, as in advance the mortar that must be placed in the site, has to be verified with laboratory tests to meet the requirements of mechanical resistance and durability as described above. In case the test results do not meet the technical requirements, then notify the structural engineer, for the review of the recipe.
2. Mortar components should be obtained from the nearest quarries, in order to identify as far as possible the constituent materials of the original mortar.
2. Do not use, for any reason, lime mortar combined with stainless steel elements.

## 4.2 STEEL

Mechanical properties of steel used in the project is given in the table below.

Tab 2. Mechanical properties of steel

Material	Density (kg/m <sup>3</sup> )	Brignell Hardness Number	Modulus of Elasticity (x10 <sup>3</sup> MPa)	Yielding stress (MPa)	Tensile strength (MPa)	Ultimate strain (%)	Coefficient of thermal expansion (x10 <sup>-6</sup> °C)
Iron / Steel for RC elements							
Iron and mild steel	7870	115	196	195	390	35	12
Ductile stainless steel (Hot rolled)	7970	150	196	295	590	10	17
Steel for high strength cables							
High-strength stainless steel (Cold rolled)	7970	300	206	785	980	5	17
Iron / Steel for tie rods, profiles and accessories: Class S275							
Iron and mild steel	7870	115	200	265	410	23	12



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## 5. INSTALLATION STEPS

### 5.1 STEPS FOR INSTALLING STAINLESS STEEL CABLES TO REINFORCE THE BRIDGE ARCH:

1. Drill holes with a length of 100 cm in the existing rock by means of rotating equipment, so that the drilling is smooth and does not cause the rock to crumble. The diameter of the holes will be 40 mm.

2. Insert the wicks of the thread bars (ribbed stainless steel bars with a diameter of 20mm) with a length of 175 cm on both sides of the bridge in the rock, in an embedment length of 100 cm. Ensure the position of the thread bars to be in the centre by using centralizers. The free side should have thread cut of 20 cm. After insertion of the thread bars into the drilled holes, the hole is filled with epoxy resin or other binder that guarantees adhesion between the rock and the ribbed stainless steel thread bars.

3. Spacers are fixed to their position on the exterior of the arch. After the steel cables are inserted into the spacers they are connected to the anchor bars having a free length of 75 cm by means of two tensioners. The cables are easily tensioned using three tensioners, one of which is placed on the key-stone and the other two on the abutments. The tensioner on the key-stone can be equipped with a tension gauge and is therefore placed inside a cast iron inspection well (with two lids) to make inspection and maintenance easier. The inspection well, measuring 20x40x40cm (width x length x height), is placed above each cable to allow monitoring, inspection and maintenance and possible interventions in the future.

### 5.2 APPLICATION STEPS OF REINFORCEMENT TIE RODS

1. Preparation of the surface of the wall where anchoring plates will be set. Preparation consists of removing plaster, masonry repair locally.

2. Levelling the axis of tie rods. The pattern of the section of the cable ties will be smooth (not corrugated or ribbed). Minimum diameter of tie-rods in each case shall be not less than 16 mm, while the length of cable ties not exceeding 20 m.

3. Drilling of the walls and the introduction of tie rods will be made through rotary drilling equipment that does not provide vibration and shock. Tie-rods should be protected from atmospheric agents.

4. After hardening of non-expansive cement mortar which is placed between the anchor plate and masonry, the tie-rod is installed



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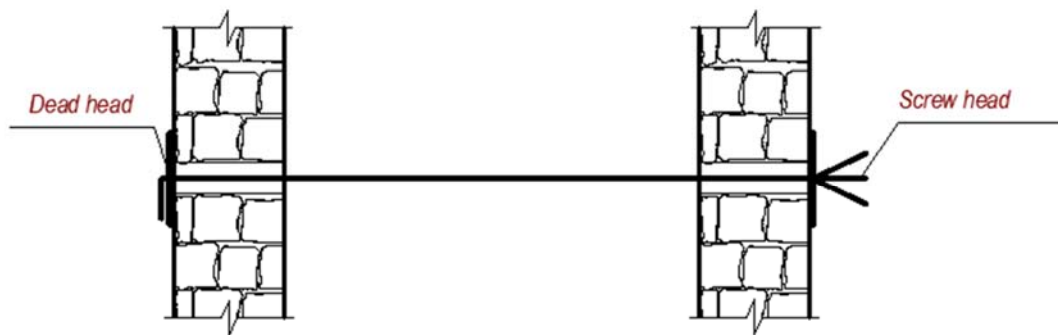


Figure 1. Details of Tie-rod Installation

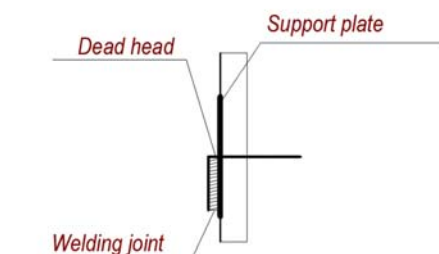


Figure 2. Details of Mounting Tie-rod to the Anchor Plate

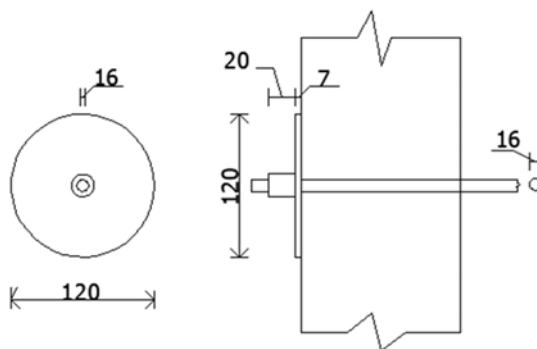


Figure 3. Details of Anchor Plate



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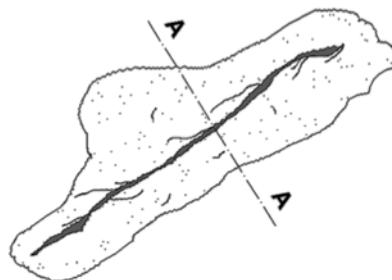
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### 5.3 RESTORATION OF STONE MASONRY WITH LIME MORTAR BY STITCHING METHOD

*PRERJA A-A PARA RESTAURIMIT*



*PRERJA A-A PAS RESTAURIMIT*

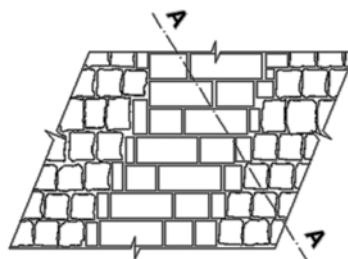


Fig. 4. Repairing masonry through "stitching" method.

The steps for the strengthening are:

- Demolition of existing plaster and drawing out masonry.
- Removing the elements of masonry affected by splitting and some other elements, to form a sufficient space for the introduction of new elements to the masonry, taking care to form a perimeter suitable for the connection old masonry with the new one and to create indentations and fugues which do not fall over each other.
- The introduction of new elements of masonry (stone or bricks), after cleaning and washing the cavities created with water, taking care in the formation of so-called notches. Must be used light expansive bond materials, composed of aggregates similar to what constitutes existing bonding material.

### 5.4 LOCAL LIME MORTAR INJECTION

Mortar injection will be realized according to the following steps:

1. In case when that the pipe of injection cannot penetrate directly to the crack, is necessary to use a drilling rotary machine (of 14 mm diameter) at the route of the blast. If the cracking lies on both sides, the holes will be made on both sides of masonry. The holes will have the depth depending to





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the thickness of masonry, while their minimum depth is 20 cm. The maximum distance between the injection holes shall be taken 40 cm.

2. Insert the pipe in each of the holes, to a depth of about 5 cm.
3. The filling of cracks or degraded joints from outside, will be with the same injection mortar, or when this is not possible must be used a rapid drying mortar.
4. Prepare the mixture to be injected with the drill rotary machine and brush. Injection of mixture must start from the bottom holes of the masonry continuing in the upper ones.
5. If the walls inside are filled with non-cohesive material and gaps, then for the purpose of saving materials and avoidance of over-strengthening local of masonry, mortar must be not-very fluid.

Tab 3. Injection According to Crack Width

Crack Width	Raccommended procedure
< 0.1mm	Injection with epoxy
0.3m to 3mm	Injection with cement grout that contains shrinkage reducing admixture
>10mm	Reconstruction of damaged area with new units. Cracks may sealed with mortar if the wall thickness is relatively small

## 5.5 REPAIR OF JOINTS WITH LIME MORTAR

To realize the repair of masonry surface, the following steps should be followed:

1. Initially, the part of the masonry that needs intervention will be carefully identified, is the parts where the mortar in the masonry joints are degraded and the part where the mortar in the joint is missing.
2. Once the problem has been identified, the joints should be carefully cleaned mechanically from debris and unconsolidated mortar.
3. Once the joints have been mechanically cleaned, they will be washed with running water.
4. Once they have been washed with running water, the mortar filling will start (when the problem is superficial). In case the damaged existing mortar goes deep in the masonry, then the new mortar will be injected to that depth. The mortar recipe should be designed according to the original masonry mortar, is according to the in-situ materials.



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5. If the masonry is non-plastered (which depends on the typology of the building) after the joints have been filled with mortar, the mortar will be cleaned from the surface of the stones so that it is not visibly invasive for the surface of the masonry units.

## 6. BLOCK WALLS (GABIONS)

Gabion walls will be built on the two shoulders of the bridge in order to protect the Kurcaj Bridge from the inflows of the Zeze River from the flood regime of maximum water level, to prevent erosion and lose the property of the rock under the action of constant hydrodynamic load. Protection of the river banks will be made by gabion wall since the cost of the intervention is lower than concrete because the stones of the area will be used. Gabion baskets will be built with skeletons with ribbed steel  $\varnothing 12$  mm and with galvanized nets  $\varnothing 3.5$  mm, also steel spacers will be placed according to the shape of the baskets. For filling the gabions, boulder stones with a diameter of  $\geq 30$  cm in all three dimensions (x, y, z) will be used.