

APPENDIX Nº6

CONSTRUCTION PROCESS

CURSO 2016-2017

TITULACIÓN: GRADO EN INGENIERÍA CIVIL

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CONSTRUCTION PROCESS

1. OBJECTIVE

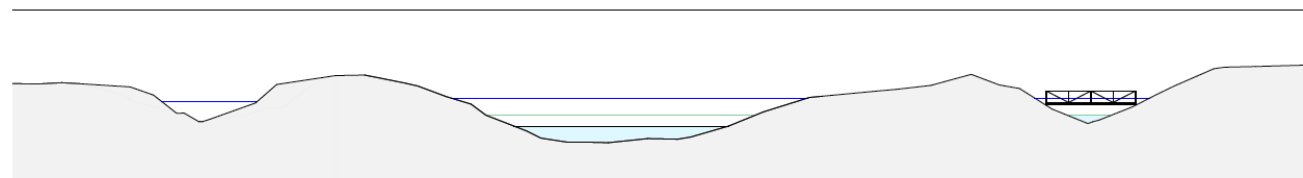
The purpose of the following appendix is the definition of the construction process of the footbridges, with the consecutive aim to produce a work breakdown structure and to establish the approximate time needed for the construction.

It is necessary to mention that the following concept is based on general assumptions, as there is not enough data provided in order to have the certainty of execution of the planned works in the manner presented in the following, which would simultaneously comply with the safety requirements and achieve the desired feasibility level. On an advanced project level, it would be necessary to execute a more detailed geotechnical investigation, e.g. in order to check if the ground can withstand the load of the chosen cranes and other machines, or if there would appear any slope instability or other ground problems. On a preliminary draft level, the following concept is considered as satisfactory.

2. CONSTRUCTION PROCESS

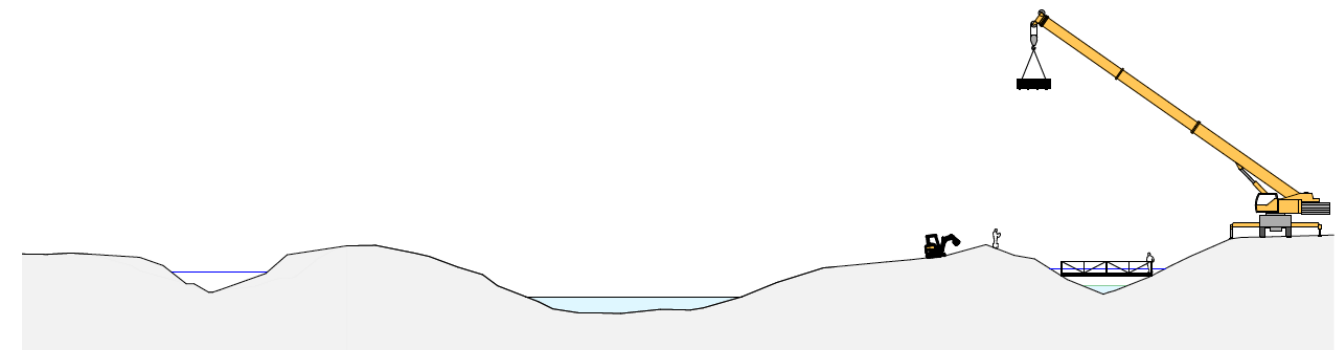
The difficulty of the construction process in the designated rural area of Cuenca lies rather in finding the optimal solution for the access ways to the site and to the island, which is not connected to the dryland in any way, than in the construction itself.

The process begins with the construction of the smaller footbridge, for which it is necessary to put up a provisional footbridge first in order to grant the workers easy access to the island.



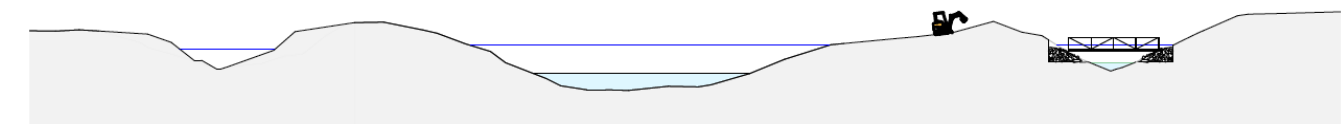
2.1 Initial conditions and the provisional footbridge

All the heavy machines and equipment needed is then to be carried over onto the island by a crane put up on the right shore as showed in the following draft.



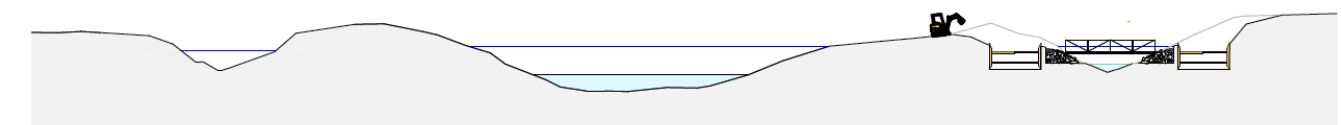
2.2 Equipment carried onto the island by the crane

Afterwards the process of grubbing, clearing and leveling the terrain can begin. The next step is the execution of the rockfill dams, which are to be placed on each riverbank approximately 8m deep. They allow for a safe progress of the earth works that are happening behind them, and provide a protection from the river.



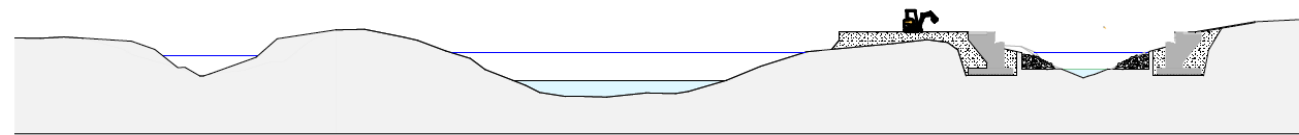
2.3 Construction of the rockfill dams

With the dams strengthening the borders of the riverbanks the excavation of the foundation ditches with a mechanical excavator can begin. To assure that the dug-up ditches are at no risk of collapsing, a trench shoring system is to be installed, followed by the formwork and the reinforcements needed for the construction of the foundations.



2.4 Installation of a trench shoring system

Next step is the concreting, which in the case of the foundation on the island is to be carried out with a concrete bucket carried over by the crane. Afterwards the drainage pipes can be placed and the finished foundations are ready to be filled with the filter material and the excavated soil.



2.5 Finished foundations

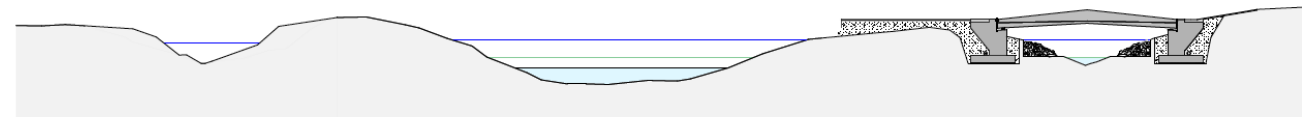
After the concrete reaches its necessary strength the work can proceed with the installation of the support bearings, which are to be placed on the concrete footings.



2.6 Division of the structure into three parts

Simultaneously the metal structure which consists of steel planes is to be transported and welded on the site. The bridges were divided into three parts to allow a convenient transport and a relatively not complicated welding.

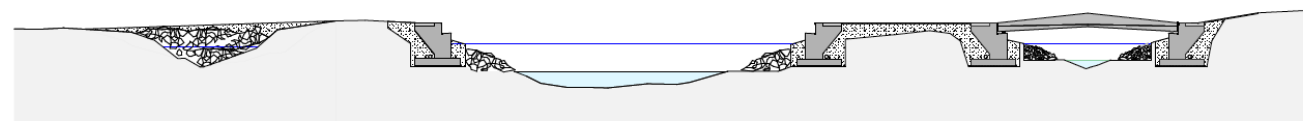
With all these works finished the crane with an adequate capacity (Liebherr LTM 10704.2) is to carry the completed structure onto the support bearings and after they are fixed onto the bridge, the main construction is completed.



2.7 The smaller footbridge put into place

The provisional footbridge can be taken away and the construction of the bigger bridge on the other side of the island can proceed.

The process for this structure is very similar, with the exception that an additional rockfill dam with a drivable path on top has to be constructed for the crane to access the island from that side. The filling-up of the affected waterbed has no significant influence on the water stream, the current being very low and still.

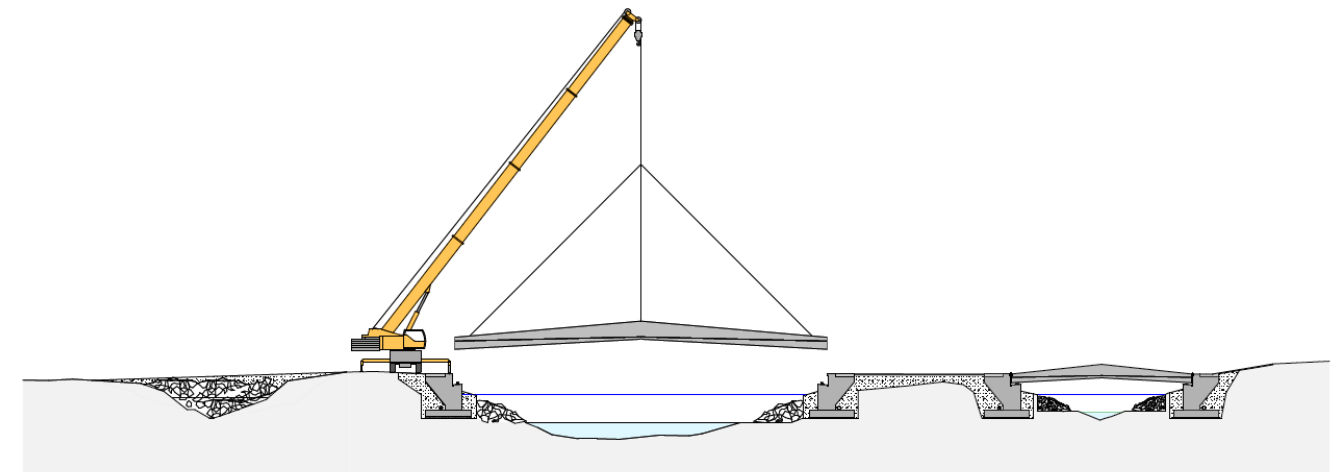


2.8 Construction of the rockfill dams

After grubbing, clearing and leveling the terrain the rockfill dams on each side are to be constructed as before and the excavations for the foundations can begin. This process is executed in the same manner as in the case

of the smaller footbridge. After finishing the footings and installing the support bearings, the crane (Liebherr LTM 1300 6.2), which this time has to be bigger in order to carry the load of the much heavier bridge, is to place the metal structure, previously welded and prepared on the site, on top of the supports.

After the crane has done its work the riverbed on the far left is to be cleared from the rocks.



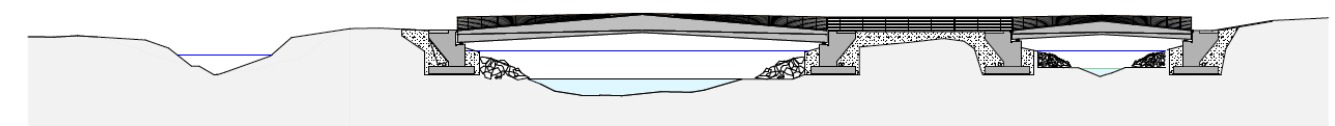
2.9 Placing of the bigger bridge by a crane

Having both structures in place, the finishing works can begin. This includes executing the embankments, laying a 1m long layer of roller-stamped concrete at the ends of the footbridges, followed by the construction of the outer access paths and the one on the island with gravel and powdered stone. The borders of the paths are to be marked with curbs, which are placed in concrete beds on each side.

The posts of the railing on the island are to be installed in between the curbs in concrete on the side where the water flows. The remaining posts belonging to the footbridges are to be welded onto the lateral construction and the timber handrail is to be screwed on top of them. Then the steel cables are to be installed in the designated holes and fixed in the last post on each side respectively.

As for the deck surfacing, the steel supports are to be welded on top of the steel plane, then the timber beams are to be screwed onto them, followed by the slats, screwed onto the beams finishing the whole construction.

Lastly a bed of cobblestones right next to the foundation on each side is to be placed building a slope in the direction of the river for an adequate drainage.



2.10 Finished construction