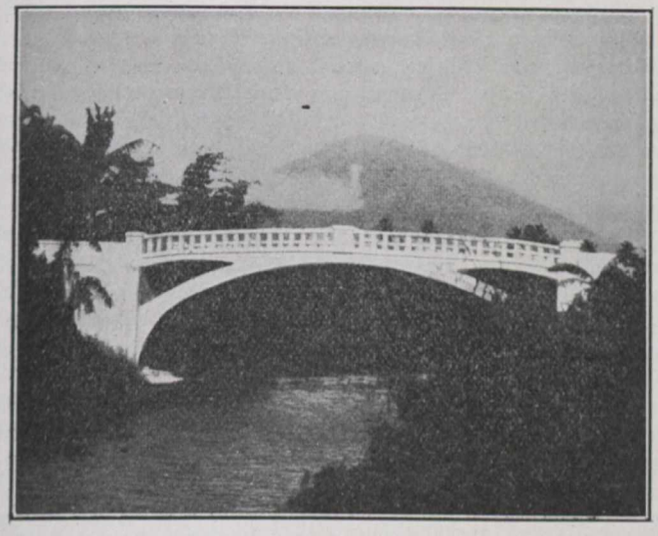
# CONCRETE BRIDGE IN PHILIPPINES.

A concrete arch recently built in the Philippine Islands is described by Jay A. Rossiler in a recent issue of The Contractor. The following is extracted from the article:

Cement comes from China to Manila and is trans-shipped for the provinces. Reinforcing steel comes from the States. It often takes over a month for an order to be filled. Stone is a local product and is either used as gravel or broken by hand, often is volcanic, black and porous. A greater factor of safety is used in this case. Sand is obtained locally and is usually a volcanic product, black and of good quality.



**Completed Concrete Highway Bridge.**

Some of the methods of construction can be shown by a description of a special project which, through a miscarriage of usual methods, was designed and constructed by the writer, the Guinobatan bridge in Albay province, southern Luzon.

The original bridge at this point was a three-span rubble masonry arch bridge, built by the Spaniards, which was destroyed either by the elements or during the insurrection. It might be well to note that the Spanish structures seldom have sufficient foundation and many of their bridges have been saved by undermining the foundations and placing new concrete under them. In this case the old masonry was in the river. The military forces built a wooden Howe truss on cut stone abutments fifteen feet high. This truss was practically worn out and rotted and had to be supported by two auxiliary bents in its 60-foot span. It was desired to replace this with a 60-foot arch of concrete, using the abutments as end retaining walls.

Data were obtained as per standard questions as far as it was possible, but as some of the information, such as cost of piles, etc., could not be obtained, a design was not forthcoming after six months. The old bridge being in such bad condition that a pony stepped through the floor, it was decided that as the money was waiting, it would be wise to start work at once on our own design. The district engineer issued orders to start at once, which the writer did with 250 men.

New foundations had to be placed under the old abutments as they were not built as arch foundations. This was done by building a sand bag cofferdam around the work and digging out in sections and filling in with concrete, which was completed without difficulty.

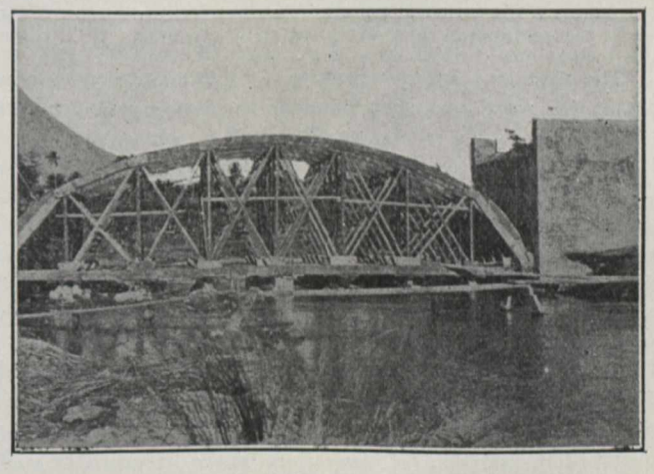
After spending time trying to clear the river of the rock from the old bridge, it was decided to build the foundation for the false work on the rocks. The river was about four feet deep over the rocks at this time, and the rock was in such a jumble that no wood could be made to stay on it. A large number of gunny sacks were obtained and filled half full of sand and these were then placed on the mass of rocks for a foundation. They were piled to the top of the water under each panel point of the false work. By experimenting it was found that these sacks would last about 50 days under water without rotting, so speed was imperative; 12-inch square timbers from the old bridge were laid on the sacks and the forms wedged up on them.

Using native carpenters, a rib of the proper shape was laid out and framed and the carpenters, none of whom had done this kind of work before, were then instructed to make six more exactly like the sample. Being good imitators, this was the easiest way to get it done. At the end of seven days the ribs were in place, bolted and wedged ready for the lagging.

There were seven ribs on 22-foot width of bridge and 2 inches by 12 inches lagging was used. Lagging was allowed to project 2 feet on each side by staggering them, and the projecting ends were used for bracing the side forms.

Several sheets of corrugated iron roofing were obtained, having been used on the cofferdam of one abutment, and a frame was nailed to them by using 2x4-inch flats. A concrete grout was poured into this frame and when nearly set, was cut up into blocks so that each corrugation left its mark on a block. These blocks, when set, were used to support the intradosal reinforcing, the rods being laid in the corrugations. It was not necessary to remove these blocks as they became a part of the final mass.

Stone was obtained by making an open agreement to pay fifty cents per cubic meter to anybody who would deliver it to a convenient place near the mixing boards. Natives



**Arch Forms Used in Bridge Construction.**

would rather work this way than by the day, as they can work when they feel like it. Many of them did this work by night and slept in the day. The requirement was that it must be clean river gravel of size as per sample, which was placed in a basket near the work. Any larger or smaller gravel was rejected.

Concrete was poured from mixing boards at each end of the bridge and wheeled to the centre. Fifty-six hours con-