

JAL/MHEP/DAM/C-1/2015/4104
Date: 10.07.2015

TO WHOM IT MAY CONCERN

Sub: Execution of the work of Concrete Cut-Off Wall beneath upstream Cofferdam of Mangdechhu Hydroelectric Project located in Trongsa, Bhutan.

It is certified that M/s BAUER Spezialtiefbau GmbH, Registered office at BAUER Straße 1, 86522 Schrobenhausen, Germany, has executed the work of **Concrete Cut-Off Wall** for upstream Cofferdam of Mangdechhu Hydroelectric Power Project located on river Mangdechhu in Trongsa District of Central Bhutan, as a subcontractor to the main contractor M/s Jaiprakash Associates Ltd and for the principle employer Mangdechhu Hydroelectric Project Authority (MHPA).

M/s BAUER was engaged by M/s Jaiprakash Associates Ltd. (JAL) for the construction of **Concrete Cut-Off Wall** in the overburden & river sediments beneath upstream Cofferdam of Mangdechhu Hydroelectric Project built on Mangdechhu River for the purpose to prevent seepage in the main dam pit during its construction. M/s BAUER was able, together with M/s. JAL & MHPA to optimize for a solution with a cutter excavated trench and constructing a concrete diaphragm/cut-off wall across river to ensure sufficient water tightness of heterogeneous strata beneath the coffer dam. The design approach and most of the technical details were prepared by the experts of Bauer's head office in Schrobenhausen, Germany. To prevent the remaining risk of boulders sliding into the open trench, pre-treatment of the strata besides the trench was carried out which consisted of drilling boreholes and gravity grouted with cement/ bentonite mix. The logistic support and materials were provided by M/s Jaiprakash Associates Ltd.

The concrete cut off wall consisted of 43 panels with a nominal thickness of 1.2 m (3 ft 11¼ inch) on a coffer dam length of 107.8 m (353 ft 7 inch), overlapping with 30cm (1ft) with a maximum depth of 57.45 m (188ft 5¼ inch) was executed successfully. The job of pre-grouting with small diameter drillings and gravity grouting with cement/bentonite slurry with a maximum drilling depth of 64 m (209ft 11 inch) was also executed, to prevent any fall of boulders in the trench of cut off wall.

A total of 4575.7 m² (49234.5 ft²) of cut-off wall (without overlapping areas) was installed. After mobilization of equipment, the cut-off wall works started in February 2014 and were completed by mid-August 2014 as per schedule with extra quantity of around 15%. The total cost of the work was of the order of BTN/INR 995.00 Million.

At peak times, M/s BAUER had engaged up to 25 skilled expat employees on site in day and night shifts in addition to the approx. 30 local semi skilled workers to work and to ensure quality standards. It is to be mentioned that, during execution of all construction works, M/s BAUER's representatives on site had the full technical and logistical support in order to complete the Project with high rank on quality and performance. M/s BAUER was equipped with all professional ways for team preparedness and work execution and proactive in seeking a quick solutions for the site issues, maintaining highest standards of quality for the product and professional approach towards Health, Safety & Environment (HSE) was excellent.

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Description of the Geology:-

The Mangdechhu Valley has no slope-waste in the area of the very steep shores. It slopes in parts with an angle of up to 80° towards the existing river bed. The shore on the left side has more moderate slopes. There are also large scale colluvial slope overburdens, as well as river sediments. The soil material is very heterogeneous. The existing rock in the valley bottom also varies both in its course and its strength, i.e. on the left bank gneiss with individual quartzite deposits and on the right bank more weathered gneiss.

The project was executed within the agreed schedule. During execution of main concrete dam, it has been observed that the cut off wall is very effective and successfully arrested the seepage in around 60 m deep pit excavated in the river borne material.

FOR JAIPRAKASH ASSOCIATES LIMITED


(HARISH AGGARWAL)
Senior General Manager

