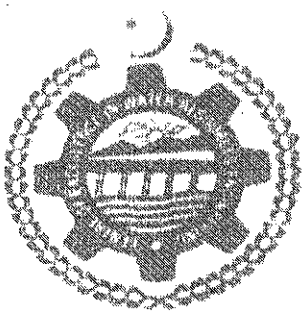
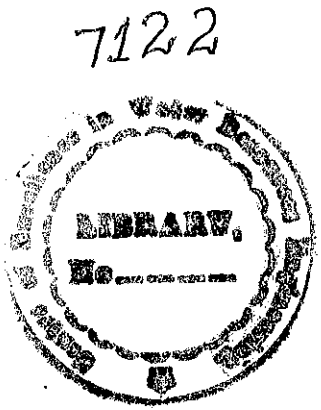
THESIS

CONSTRUCTION TECHNIQUES APPLIED IN MANGLA DAM RAISED EMBANKMENT





By

Muhammad Ashraf Khokhar
(2006-PG-WRE-52)

For the Degree of

MASTER OF SCIENCE

IN

WATER RESOURCES ENGINEERING

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering & Technology, Lahore, Pakistan.

2011

ABSTRACT

During construction of Mangla dam in 1962 – 67, future extension and raising provision in this mega project was recommended by 30 to 40 ft. In the present scenario and cope with the situation it was decided to regain and enhance the storage capacity of Mangla dam lost due to sedimentation/siltation in the reservoir. The average annual water availability for irrigation releases will be increased by 2.9 MAF. Other benefits will include increased flood alleviation, about 12% increment in average annual energy out put from existing power equipment, development of fisheries and increased economic activity in the area.

Mangla dam is the first dam in Pakistan which was raised. The construction of Mangla dam raising involves the different aspects of the dam raising such as planning, management and execution of various activities i.e. provision of access routes, utilization of different types of heavy construction machinery, simultaneous construction of various zones of embankment which need to be explored. The objectives of the study were to elaborate the construction techniques and machinery used in embankment raising and to investigate factors delaying the construction activities during raising.

The study area was limited to main dam where almost all the techniques, materials, machinery and processing activities were involved. Methodology adopted to achieve the study objectives was collection of construction records, study the sequence of different construction activities, details of construction machinery and their specific use and review of construction bottlenecks to identify the factors caused the delay of project.

The construction sequence involved for achieving the net 30 ft raising of dam was extension and raising of d/s shoulder upto crest excavation level i.e. 1190 ft., segmental excavation and re-filling upto 1234 ft level and filling from EL 1234 ft to EL 1264. Extention and raising of d/s shoulder upto EL 1190 ft was done in 10 ft vertical segments. Excavation upto 1234 ft level was carried out in 1000 ft segments then each 1000 ft was raised by filling. Every next 1000 ft excavation was allowed keeping in view the left over time i.e. upto June so that level of 1234 ft could be achieved for all excavated segments. This technique was followed in perspective of the anticipated flood which often occurs in the months of July to September. Above 1234 ft level there was not restriction of working in 1000 ft segments as maximum flood level was 1228 ft. About 39 million cubic yard material was used in placing of drainage mattress, core and filter material, u/s and d/s shoulders and slope protection. The major construction machinery deployed for embankment raising involved excavators, loaders, dozers graders, rollers, dumpers, water boozers, lower bed trailers, cranes and transit mixers. The project commencement date was June 2004 and contract completion date was September 2007 but completed actually in December 2009.

Various problems and construction bottlenecks like lease holders issues and scarcity of contractor's plant and equipment, shortage of filter material, difficulty in processing of filter material, curtailment of drainage mattress, financial implications were encountered during raising which delayed the project by 2 years and 3 months.

The study concludes that there was little difference in the details provided in the original Mangla Dam drawings and physically exposed conditions but dam was

raised primarily as per construction drawing without many changes. Study also concludes that major cause of delay was contractor's machinery which was short as compared to site requirements and partial utilization of dry season during 2006 to 2007 for crest excavation and back fill up to El 1234 ft due to non-availability of filter material and processed clay. The techniques applied in the construction of an under water embankment (toe weight) and raising of spillway and intake structure is recommended to be explored in future.