

Geological Investigations for A Dam Project

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Abstract- A typical dam is a wall of solid material built across a river to block the flow of the river thus storing water in the lake that will form upstream of the dam as water continues to flow from the river upstream of the dam.

The main purpose of most dams is to create a permanent reservoir of water for use at a later time. The dam must be watertight (ie impermeable or impervious to water) so that water does not leak out of the dam and escape downstream. An essential part of a dam is therefore the "impermeable membrane", ie the watertight part of the dam that prevents water leaking out. As we shall see later, it is not necessary that the entire dam wall be watertight. The natural earth or rock on which the dam is built (ie the dam foundation) must also be watertight as must the river valley in which the storage reservoir forms. If these natural areas (dam foundation and storage area) are not watertight then water could leak out of the reservoir even if the dam itself is watertight.

Keywords- silting, overburden, durability

I. INTRODUCTION

The primary purpose of geological site investigations for a dam project is provide the information that dam designers require in order to design a safe dam structure and to be able to estimate with reasonable accuracy how much the dam is going to cost. The aim of the dam designers is to build the dam for the lowest cost consistent with currently accepted standards of safety.

II. INVESTIGATIONS

The engineering geologist must be able to answer the following questions;

- what is the depth of overburden that must be removed to reach an acceptable foundation for the dam wall;
- what are the rock types which make up the foundation and to what extent are they affected by surface weathering;
- what are the engineering properties of the foundation rock types (important properties are strength, deformability and durability);

- what is the geological structure of the foundation (ie jointing, faulting and folding of the rock strata). A full description of the defect pattern in the rock mass should include orientation, spacing, extent or persistence and aperture or openness;
- how permeable is the rock foundation (ie to what extent are the rock defects such as joints, faults and bedding open);
- where can adequate supplies of construction materials such as clay, sand, gravel and rock fill be obtained, preferably as close as possible to the dam site;
- will the rock that must be excavated to provide a spillway for the dam be acceptable for use as rock fill in the construction of the dam embankment;
- will the spillway require concrete lining and an energy dissipation structure at its downstream end or is the spillway rock sufficiently erosion resistant that these can be omitted.

In order to be able to answer the above questions the dam site must be explored by an experienced engineering geologist. Methods commonly used to explore sites for construction projects are;

- geological mapping of surface rock outcrops;
- geophysical surveys. Seismic refraction is often used to determine depth of overburden;
- excavation of trenches and pits using bulldozers, backhoes etc.;
- diamond core drilling. As usually carried out this method recovers an undisturbed, cylindrical sample (a core sample) about 50 mm in diameter from depths of a few metres to hundreds of metres, if necessary. Other types of drilling which recover disturbed samples may also be used in some circumstances;

The exploration methods above are listed in order of increasing cost. Most dam site investigations will employ several different methods, the exact mix of methods and the timing when each is carried out is something which is tailored to suit the particular geological problems of each individual dam site. These geological site investigations allow the engineering geologist to construct a "geological model" of the site which is then used by the dam designers as a basis on

which they can design a safe and economic dam structure appropriate to the geology of that particular site.

It is important to realise that even the most comprehensive site investigation programme cannot hope to reveal all the significant geological features of the site. It is therefore of critical importance that the actual geological conditions revealed during construction be compared with the geological model of the site derived from the site investigations. It is quite common for unexpected geological conditions to be revealed during construction which require changes to be made to the original design. A record of the site geology "as found" during construction is also of great value if problems develop later during the operation and maintenance phase.

III. ENVIRONMENT

A dam built across a river will obviously have a major effect on the river valley upstream of the dam which will be flooded as the new storage reservoir fills. Less obvious is that the river downstream of the dam will also be significantly affected. Large dam projects are highly individual in their design, geological setting and the construction materials used to build them. They are also individual in their impact on their environment. Some large dam projects in tropical Africa have created lakes hundreds of kilometres long in areas which had large local populations. The major impacts that these projects had on the plant, animal and human population of the area have been well documented, however it would be a mistake to assume that all dam projects necessarily have similar major impacts on the environment.

REFERENCES

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