CIVIL ENGINEERING CONSTRUCTION

SBC2253

DAMS AND SPECIAL CONSTRUCTION

Sr Dr. Mohd Saidin Misnan

Department of Quantity Surveying

Faculty of Built Environment

Universiti Teknologi Malaysia

INTRODUCTION

"Massive dams are much more than simply machines to generate electricity and store water. They are concrete, rock and earth expressions of the dominant ideology of the technological age: icons of economic development and scientific progress to match nuclear bombs and motor cars."

~ Patrick McCully ~

INTRODUCTION

- Dam is a solid barrier constructed at a suitable location across a river valley to store flowing water.

INTRODUCTION

Storage of water is utilized for following objectives:

- Hydropower
- Irrigation
- Water for domestic consumption
- Drought and flood control
- For navigational facilities
- Other additional utilization is to develop fisheries

DAMS FUNCTIONS

Direct Storage Water Usage:

- **Private / Domestic** - Household purposes, Drinking water and landscape irrigation
- **Commercial** - Restaurants, hotels, golf courses, etc.
- **Irrigation** – Crop use. Water needs at the scale that large dams provide most often feed industrial farming practices.
- **Livestock** – Use for animal raising as well as other on-farm needs

DAMS FUNCTIONS

Direct Storage Water Usage (contd):

- **Industrial** – Cooling water (power generation, refineries, chemical plants), processing water (manufacturing; pulp and paper, food, high tech, etc.)
- **Mining** – hydraulic mining, various processes, settling ponds
- **General public supply** – Firefighting, public parks, municipal office buildings

DAMS FUNCTIONS

Indirect Storage Water Usage:

- **Hydroelectric Power** – Power generation is one of the most common purposes for the construction of large dams. It is promoted as a totally "clean" form of electricity.

- **Flood Control** – Dams even out the peaks and lows of a rivers natural flow cycle by calming seasonal flooding, then storing that water for gradual release year round.

- **Transportation** – Dam locks are used to move ships past large dams. This in conjunction with flood control make transportation feasible on rivers that were traditionally wild.

DAMS CLASSIFICATIONS

- Classifications based on type and materials of construction

Criteria for selection of best dam type:

1. Feasibility
   -topography, geology, and climate (& its effect on materials)

2. Cost
   -availability of construction materials near the site;
   accessibility of transportation facilities

DAMS CLASSIFICATION

Types	**Materials of Construction**
Gravity	Concrete, rubble masonary
Arch	Concrete
Buttress	Concrete, also timber & steel
Embankment	Earth or rock

Materials

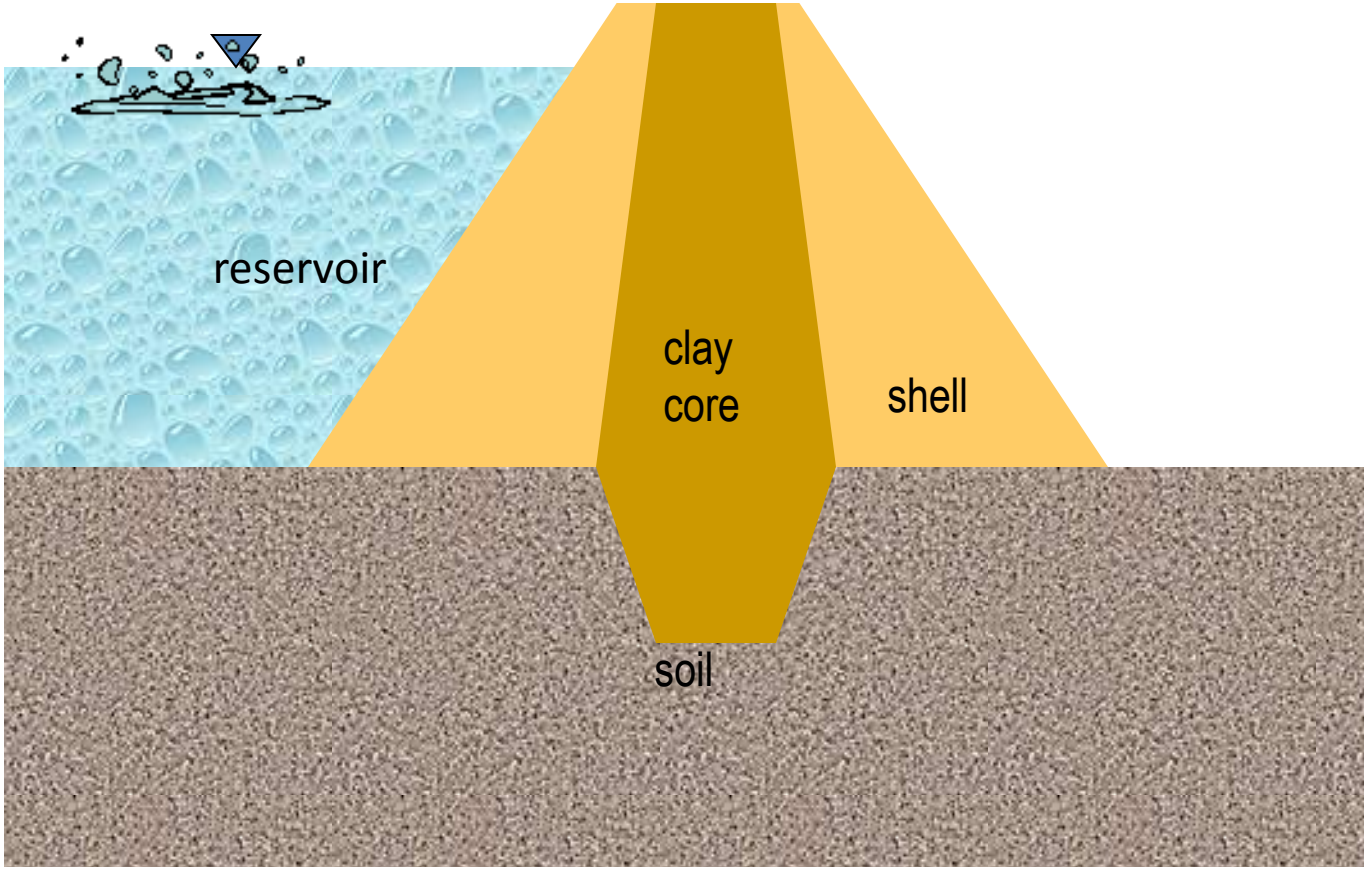
- Large amounts of soil, sand, stone and aggregate and concrete are need for dam construction.
- If available, these materials will be collected as near to the site of the dam as possible.
- The extraction of these materials requires large amounts of fossil fuels to operate the machinery.
- Air and water pollution result from the dust and mud that is created from this process .

TYPES OF DAMS

- Dams are built using several different methods. For the purpose of this project I will investigate the three main types of dams that can be built at extreme scales. These types are:
  - Gravity dams
  - Arch dams
  - Buttress dams

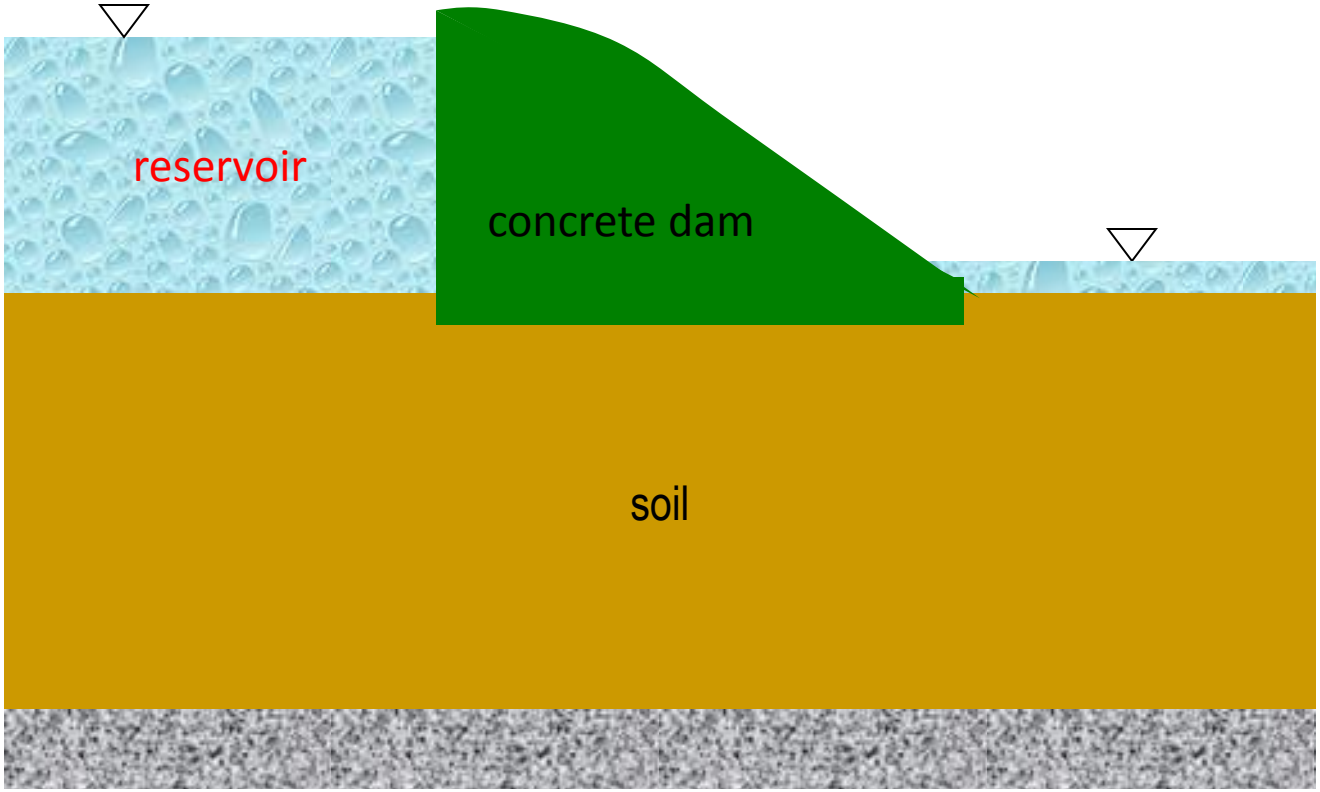
Materials of Construction

Earth Dams



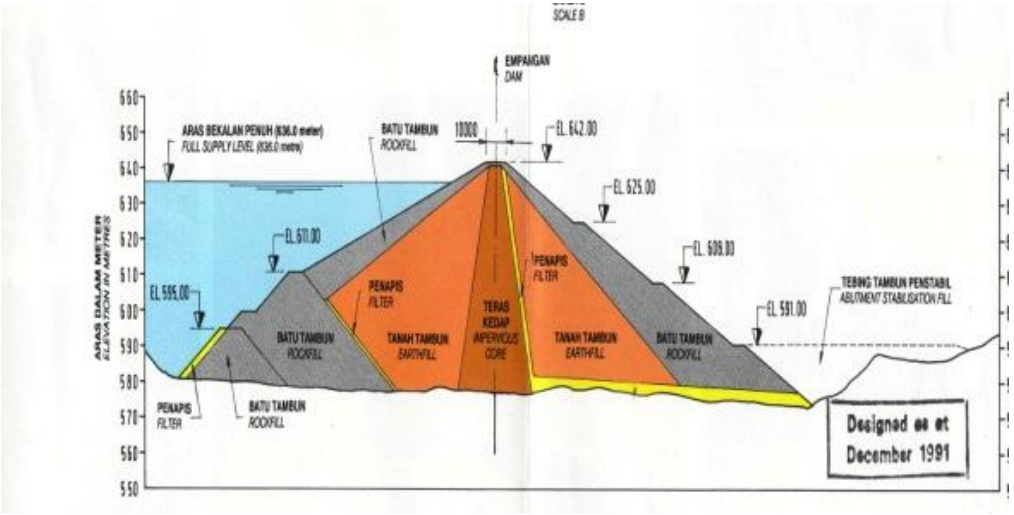
Materials of Construction

Concrete Dams



Gravity Dams

- Gravity Dams use their triangular shape and the sheer weight of their rock and concrete structure to hold back the water in the reservoir.



Gravity Dams

- Gravity dams are the most common type of large dam in the world because they are easy and cheap to build. They can also be built across long distances over relatively flat terrain. This makes them very applicable in non-mountainous regions. The largest gravity dam in the world is the Aswan Dam in Egypt.

Arch Dams

- Arch Dams utilize the strength of an arch to displace the load of water behind it onto the rock walls that it is built into.

Arch Dams

- Arch dams can only be built where the walls of a canyon are of unquestionable stability. They must also be impervious to seepage around the dam, as this could be a source of dam falure in the future.
- Because of these factors, Arch dams can only be built in very limited locations.
- Arch dams use less materials than gravity dams, but are more expensive to construct due to the extensive amount of expertise required to build one.

Buttress Dams

- Buttress Dams use multiple reinforced columns to support a dam that has a relatively thin structure. Because of this, these dams often use half as much concrete as gravity dams

Composite Dams

Composite dams are combinations of one or more dam types. Most often a large section of a dam will be either an embankment or gravity dam, with the section responsible for power generation being a buttress or arch.

DAMS COMPONENTS

- Core
- Crest
- Spillway
- Gates
- Reservoir
- Flood gate
- Fish ladder
- Weir
- Penstock

DAM COMPONENTS

Spillway

Spillways are structures which either form part of dam and used when the reservoir are full. It also used to past the flood water safely and in a controlled way either over dam around or through it. There are some different types of spillway such as overflow spillway, side channel spillway and shaft spillway.

DAM COMPONENTS (Cont'd)

Gates

Vertical gates can be lowered or raised through a tunnel or across its entrance, to control the flow of water through it. Gates are often constructed from steel.

Reservoir

Reservoir is a large lake that's store the water. It can be natural or man made. Most man made lakes are stored behind dams.

DAM COMPONENTS (Cont'd)

Flood gates

It usually made from steel. It has a solid face in contact with water, which can be curved or flat. The gate is used to close off a hole through the dam or a gap at the top of a dam through which water can pass. When the reservoir gets full, the gates are opened to let some of the water out.

Fish Ladder

It made up of a series of stepped pools that link the river downstream of a dam to the reservoir behind it. Water flows continuously down the ladder during the migratory season for the fish that use the river.

DAM COMPONENTS (Cont'd)

Core.

A central section provided in some embankment dams, which is made from an impermeable material to stop water passing through the dam.

Crest

It is at the top of dam. It function same as the road and was constructed after the construction of dam is finished.

DAM COMPONENTS (Cont'd)

Weir.

It is small dam or barrage, used to hold water back, It is designed to pass excess water over the top

Penstock

It is a sluice or conduit used for control of water flow, especially into a hydroelectric power plant.

BASIC PROBLEMS OF DAMS CONSTRUCTION

Site Investigation

Investigate of site for a dam require sinking trial boring to determine the strata. Test can be made to measure the strength, elasticity, permeability and prevailing stresses in strata must be determined. Presence of ground water of other chemical solution harmful to the material to be use must be access.

BASIC PROBLEMS OF DAMS CONSTRUCTION (Cont'd)

Weaknesses Of Concrete

Concrete has many weaknesses because of the large volume of the dam and due to property and characteristic of concrete shrinkage, designed to place minimum tensile strain on the dam need to be secure.

Weaknesses Of Earth And Rock Fill

Soils and rock fragment lack the strength of concrete are much more permeable and posses less resistance to deteriorate and disturbance by flowing water.

BASIC PROBLEMS OF DAMS CONSTRUCTION (Cont'd)

The Earthquake Problem

Many large dams have been built in the seismically active regions. Despite a great deal of work on the distribution of seismic activity, the measurement of strong ground motions and the response of dams to such motion. The earthquake design of dams remain imprecise as this is difficult to be predicted.

THE ENVIRONMENTAL CONSEQUENCES OF DAMS

Effect On River Systems

Reducing the flow of water from a river changes the landscape it flows through, which in turn can affect the ecosystem flora and fauna. A dams hold back sediment, especially the heavy gravel and cobbles. The river, deprived of its sediment load, seeks to recapture it by eroding the downstream channel and banks, undermining bridges and other riverbank structures. Several meters typically erode riverbed within a decade of first closing a dam, the damage can extend for tens or even hundreds of kilometers below a dam.

THE ENVIRONMENTAL CONSEQUENCES OF DAMS (Cont'd)

Hydrological Effects

Dams also changes the pattern of the flow of a river, both reducing it overall volume and changing it seasonal variations. The nature of the impacts depends on the design, purpose and operation of the dam. Among other things. All parts of the river ecology can be impacted by changes to its flow.

THE ENVIRONMENTAL CONSEQUENCES OF DAMS (Cont'd)

Changes of flooding

The storage of water in dams can delay and reduces the floods downstream. River and floodplain ecosystems are closely adapted to a river flooding cycle.

THANK YOU