



Slot Mechanisms in Dams and Barrages

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Abstract— A dam is a barrier that stops or restricts the flow of surface water or underground streams. Reservoirs created by dams not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use, aquaculture, and navigability. Construction of Dams serves various purposes such as power generation, irrigation, flood control, etc. Dams are numerous times subjected to resist floods and tides which are dependent upon area they are situated in. During these crucial situations it is very necessary to maintain flow of water through floodgates and decide the number of gates to be opened. Due to continuous operation, dam gates are severely damaged due to various factors like – wind, air, moisture, etc. If not acted effectively, results may end up causing permanent damage to the structure and cost lives.

Index Terms— Ideal Mechanism, Three Slots Mechanism, Two Slots Mechanism, Two Slots Mechanism with Detachable Provision, Angle Section Slot Mechanism.

I. INTRODUCTION

Floodgates are the structural parts of the dams which are built to retain water of the catchment area (which is distributed to farmlands with the help of canals) and maintaining the Water level below FSL (Full Supply Level). During floods and High tides, water level crosses FSL which further leads the authorized officials to ease the excessive water into the river by operating floodgates. Volume of water to be spilled out into the body and height of the opening of Floodgate/Tidegate provided for the water to let go is determined by Mathematical Equations and calculations.



Image 1.1 Floodgate Mechanism

In case of barrages, during rainy season, floodgates are pulled up and rested on dogging beam. When rainy season ends, they are needed to be pushed down back into the service groove, to store the water. During this process, when operators try to insert gate into the service groove, the major problem occurs due to the high wind pressure which swings the 110 ton gate across the motor ropes, making it difficult to properly insert it into the groove. Due to the swinging action, the rubber seal fixed on the left, right and bottom of the gate have a chance to tear out due to the collusion with TISCERAL plate. Rubber seals are extremely expensive (1.5 crore collectively of 27 gates, according to Sulwade Barrage, Dhule records) hence it is very necessary to handle them carefully.



IMG 1.2 Damaged Rubber Seal

Various versions based on our research in ascending order**II. OBJECTIVES**

Our objective is to Design a slot mechanism which will help operators to lower the floodgates into service groove and prevent the wear and tear of rubber seal.

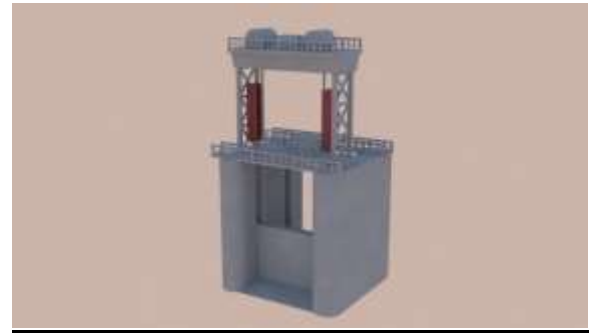
III. METHODOLOGY

As discussed earlier, lateral movement of the floodgate due to wind load is to be restricted. With some deep interchange of dialogue with site engineers, we came to the conclusion of designing such a mechanism which acts as a slot. The slot we plan to design should be dimensionally so perfect, that it will be able to receive the floodgate without any lateral movement. As we have dimension data of only the site we visited (Sulwade barrage), the slots we designed will only be applicable to the same barrage itself, as dimensions of floodgates vary from project to project. Although the slots we design are dimensionally functional for Sulwade barrage only, the idea of slots can be applicable to any functional floodgate throughout the world.

The slots will be made up of mild steel like the gate themselves. Initial talks with site engineers brought us to the finalization that mild steel will be more than capable of receiving and resisting the floodgate movement. The number of slots to be provided on the either sides of gate will be discussed further and positions of the same are decided after considering the dimensions of the gate.

Whenever the floodgate requires servicing (for applying anti-corrosion paint, or any other technical reason) the gates are needed to be removed from the system. In this case, the slots fixed will cause problems in removal of the gate. Taking this problem into consideration, we are going to design the slots that will be detachable from the system (version 2). With the slots being detachable, the slots used for service gate can also be used for emergency gates whenever the service gate requires servicing. Hence, no extra slots will be required for restricting the movement of emergency gate too.

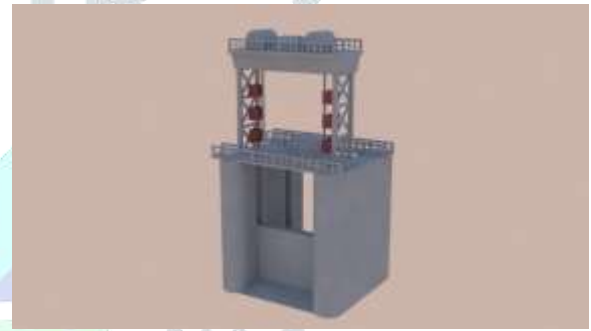
As we reached the end of designing this detachable mechanism, a new kind of picture crossed through our minds. Instead of designing such a complicated mechanism, we may just provide some angle sections made with mild steel to the corners of both the grooves. They will be cost effective and also sufficiently restrict the lateral movement of the floodgate. An equal angle section of 100X100X12 running up to 1 meter made up of mild steel will work just fine (Please refer version 3).

**Version 0 - Ideal Mechanism****Advantages**

1. Can resist excessive lateral movement

Disadvantages

1. Bulky and costly

**Version 1 - Three Slot Mechanism****Advantages**

1. Can resist moderate Lateral Movement
2. Cost effective over ideal version

Disadvantages

1. It is yet costly
2. Can interrupt Floodgate servicing.

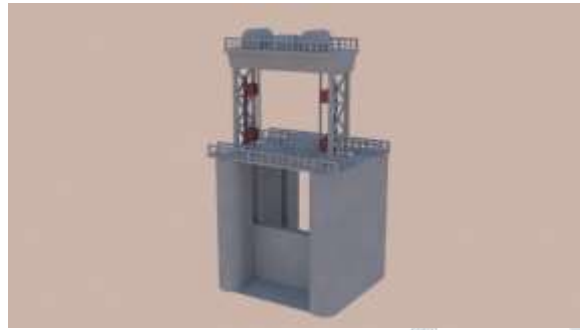
**Version 1.1 - Two Slot Mechanism**

Advantages

1. Can resist moderate Lateral Movement
2. Cost effective over version 1

Disadvantages

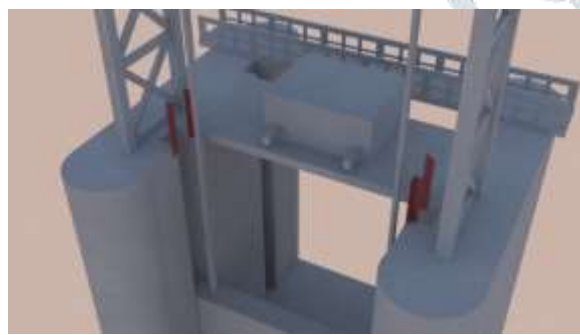
1. Problems may occur while removing floodgate from the groove during servicing

**Version 2 - Two Slot Mechanism with Detachable Provision**Advantages

1. Can be easily removed and relocated
2. Capable enough to resist moderate lateral movement

Disadvantages

1. It can be problematic to maintain such a mechanism
2. Requires monthly supervision

**Version 3 - Angle Section Slot Mechanism**Advantages

1. Extremely cost effective/cheap
2. Does not require detachable mechanism
3. Does not require excessive supervision/maintenance
4. Sufficiently resists lateral movement

Disadvantages

1. Requires attention towards the corrosion resistance

Image 3.1: Sulwade Barrage**IV. CONCLUSION**

With the slots provided, the rubber seals along the floodgate edges will be protected and the huge amount to replace them will be dispersed.

The lateral movement of the floodgate will effectively be restricted just before entering the groove.

The angles slots are so cheap and simple that they can be easily available and no expert labour will be required to attach them.

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