BASTELOS DAM
A SELF-SPILLWAY ROCKFILL DAM

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ADVANTAGEOUS OF CONCRETE DAMS AGAINST EMBANKMENT DAMS

Embarkment Dams has a higher cost due to the spillway as regarding the concrete dams.
CASTELO DE BODE DAM
Gravity concrete Dam

LAGOACHO DAM
Concrete facing Rockfill Dam
A SELF-SPILLWAY ROCKFILL DAM

Excessive head of water in the reservoir is relieved totally by flow through the rockfill.

- $Q_{\text{máx}} = 130 \text{ m}^3/\text{s}$. PR = 1000 years
- H = 22 m
- $V_{\text{res}} = 1,1 \times 10^6 \text{ m}^3/\text{s}$
- Upstream Bituminous Concrete Facing
Hydraulic Head

\[ Q_{\text{máx}} = 130 \text{ m}^3/\text{s} \]

\[ Q = \mu W \sqrt{2g H_d^{3/2}} \]

\[ H_d = 1.39 \text{ m} \]

Discharge capacity

\[ V_v = 0.56 \sqrt{2g \text{gedi}} \]

\[ Q = SV_v \]

\[ Q = 133.9 \text{ m}^3/\text{s} \]
MECHANISMS OF FAILURE OF THROUGH AND OVERFLOW ROCKFILL DAMS
Overflow-crest

Seepage-inner slope

Overflow-inner slope

Sliding

Obstruction of the crest

Settlement
MONITORING SYSTEM OF THE DAM
Hydraulic Behaviour on the Early Observation

There has been ever observed a water level above the sill of the spillway not exceeding 0.5 m.
LESSONS FROM BASTELOS DAM

While there is no greater experience and check the hydraulic behaviour in this type of dam, only must be adopted these solutions in structures with minimal risk.

• These dams have no freeboard and was µ not experimentally. It could be important correlate water reservoir levels with discharge, as to estimate $V_v$ and the active area.

• There is no guarantee that the porosity of the draining rockfill of Bastelos Dam is not equal to 0.35.
Evolution of **void ratio** in the self-spillway of Laughing Jack Dam (Tasmania) (Martins, R.; 1988)

<table>
<thead>
<tr>
<th>Period</th>
<th>Design</th>
<th>As built</th>
<th>30 years life</th>
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<tbody>
<tr>
<td>Void ratio</td>
<td>0.85</td>
<td>0.55 to 0.63</td>
<td>0.30 to 0.35</td>
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CONCLUSIONS

- Rockfill leads to sufficiently stable structures even when they are subjected to high seepage forces.
- **Rockfill structures can be an alternative solution for diversion works.**
- Failure is probably due to the displacement of blocks near the downstream slope toe resulting in the formation of a shear surface.

From the studies carried out to Bastelos Dam, with a 20 years satisfactory hydraulic and structural behaviour, it may be emphasized that self-spillway rockfill dams seem to be a good solution when well designed and constructed.
Thank you for your attention!

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Don’t forget the self-spillway rockfill dams!