CENTRALWATER AND POWER RESEARCH STATION

PHYSICAL MODEL STUDIES FOR PROPOSED BARRAGE ACROSS RIVER TAPI IN RUNDH – BHATHA, SURAT, GUJARAT.

STUDYOVERVIEW

The Surat Municipal Corporation (SMC) has awarded the barrage construction contract to M/s Unique Construction Company Ltd. Accordingly, the Manager of M/s Unique Construction Company Ltd., Surat, formally requested the Central Water and Power Research Station (CWPRS), Pune, to conduct physical model studies for the proposed barrage near Rundh-Bhatha, Surat, Gujarat to assess flow conditions and extract key hydraulic parameters influenced by the construction of the proposed barrage.

APPROACH

A geometrically similar physical model at a scale of 1:110 was developed at CWPRS to simulate the hydraulic behavior of the proposed barrage structure. The model represents approximately 3.5 km upstream and 1.5 km downstream of the barrage site, incorporating key features such as:

- Deep river channels and marginal spill areas
- Barrage structure including 57 bays (total length: 1017.50 m)
- Guide bunds, bridges, and adjacent floodplain (up to 2.0 km wide)
- River cross-sections recreated at 200 m intervals, based on 2021 post-monsoon survey data
- Smooth and rough plaster finishes simulated bed and overbank roughness.
- Standing waves introduced flow, and discharges were verified using a Rehbock weir.
- Seven water level gauges were strategically installed to capture flow behavior and hydraulic responses across the model.

As the 3D model was inadequate for detailed visualization near barrage components, a 2D Froude-scaled model (1:45) was constructed in a 1.2 m × 20 m glass flume, enabling detailed studies on hydraulic jump, stilling basin performance, and gate flow behavior through two full-width and two part-width bays.

KEYFINDINGS OF STUDY

- The proposed barrage alignment is found hydraulically satisfactory.
- The afflux due to barrage construction is negligible, considering the 57 bays spanning 1017.50 m.
- If no post-construction human interventions are introduced in the vicinity, the river regime will largely remain unchanged.
- In the 2D flume model, a swept-out hydraulic jump was observed for gate openings from 0.75 m to full (6.0 m) when the stilling basin level was at RL (-)2.5 m and FRL at RL 5.5 m.
- Further tests were conducted by incrementally deepening the stilling basin (in steps of 0.25 m and above) to evaluate jump containment.
- A stilling basin level at RL (-)3.5 m is deemed hydraulically satisfactory, with the hydraulic jump contained within 50% of the basin length, even under the worst-case tailwater conditions.

IMPACT/SIGNIFICANCE/OUTCOME

- The study provides a validated design basis for the proposed barrage, ensuring stable hydraulic behavior across various operating scenarios.
- The model study enhances confidence in the structural and hydraulic safety of the barrage and ensures minimal ecological and morphological impacts downstream.
- Results support informed decision-making and approval processes for the final barrage design and construction phases.

Location Map of the Barrage

2D Flume Model