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STUDY OF END WEIR USING HEC-RAS OF GUNJWANI DAM SPILLWAY

N. J. SATHE
Associate Professor, Universal College of Engineering & Research, Pune
drnanasahebsathe10@gmail.com

A. V. SURVE
Research Scholar, Sinhgad College of Engineering, Pune

G. A. HINGE
Professor, BhivrabaiSawant College of Engineering &Research, Pune.

D. S. ASWAR
Assistant Professor, Sinhgad College of Engineering, Pune

ABSTRACT
Hydraulic jump is the phenomenon in which the flow changes from superundal flow to subundal flow. The hydraulic jump concept is widely used in any hydraulic structures for energy dissipater at d/s side of the hydraulic structures. Hence Study of hydraulic jump is very important in such field. The HEC-RAS software is used to simulate the flow over ogee spillway. This software is used to determine the location of hydraulic jump and the nature of corresponding water surface profile. Results obtained from the HEC-RAS software are compared with theExperimental results.
The Height of Ogee spillway of Gunjawani Dam is 22.76m and width of spillway 27 m.Design Discharge is 1280.03m^3/s and Length of stilling basin is 52 m.Top width of end weir is 0.6 m, height is 4m and bottom width is 2.6m. This research is useful for checking the feasibility of HEC-RAS software for prediction of location of hydraulic jump and to observe the features of channel flow.

KEYWORDS: Ogee spillway, HEC-RAS, location of hydraulic jump, End weir.

INTRODUCTION
A hydraulic jump occurs when a flow changes from shooting to tranquil. This occurs due to change the fluid height low to high and that point loss of energy. In that condition flow before jump is typically smooth turbulent and after jump it will be typically turbulent flow (rough) a hydraulic jump is used commonly as an effective energy dissipater at the downstream of the hydraulic structures.
This software's and numerical models is becoming essential for the study of behavior hydraulic jump because of reliabilities of these software's and their time and cost saving results. The HEC-RAS is one of the popular software for simulation of open channel flows. HEC-RAS is developed by US Army Corps of Engineers for simulation of river flows. This software simulates the 1-D flow in steady, unsteady and quasi flow conditions.
This software used for study different hydraulic parameters of channel flow such computation of water surface profile, head discharge relationship, sequent depths (Y_1&Y2),location of hydraulic jump etc. Though it is very commonly used software, its performance has been rarely evaluated. It has used for simulation of hydraulic jump. This has been commonly used for the determination of maximum capacity of floodway channel of a river, floodplain mapping and hydraulic mapping of a river stream, simulation of rapidly varied flows. By JihanMohmoodQasim publish the research carrying practical on single stepped broad crested weir in laboratory for simulation of flow over a single stepped broad crested weir and prediction of water surface profile and head discharge relationship. [1]
So according to latest works, HEC-RAS has been used for flood plains and river channels and rarely used for hydraulic structures.
In the present study, HEC-RAS has been used to simulate the flow over the ogee spillway to compute the water surface profile and to find the location of hydraulic jump. The results of this program are validated

using Experimental results of spillway on site proposed by WRD office Nashik. The effects due to variation of discharge values and corresponding tail water depths are observed. The purpose of this study is to check the reliability of the HEC-RAS and its limitations in finding the location of the hydraulic jump.

A. EXPERIMENTAL WORK:

The proposed to provide 27 m long ogee spillway having 12 * 8 (m) size 2 radial gates as overflow section. A horizontal stilling basin of 52 m length along with end weir is proposed as energy dissipation arrangement. The design discharge is 1280.03m^3/s.
A horizontal stilling basin is proposed to dissipate the energy Max. Flood value 1280.03m^3/s.

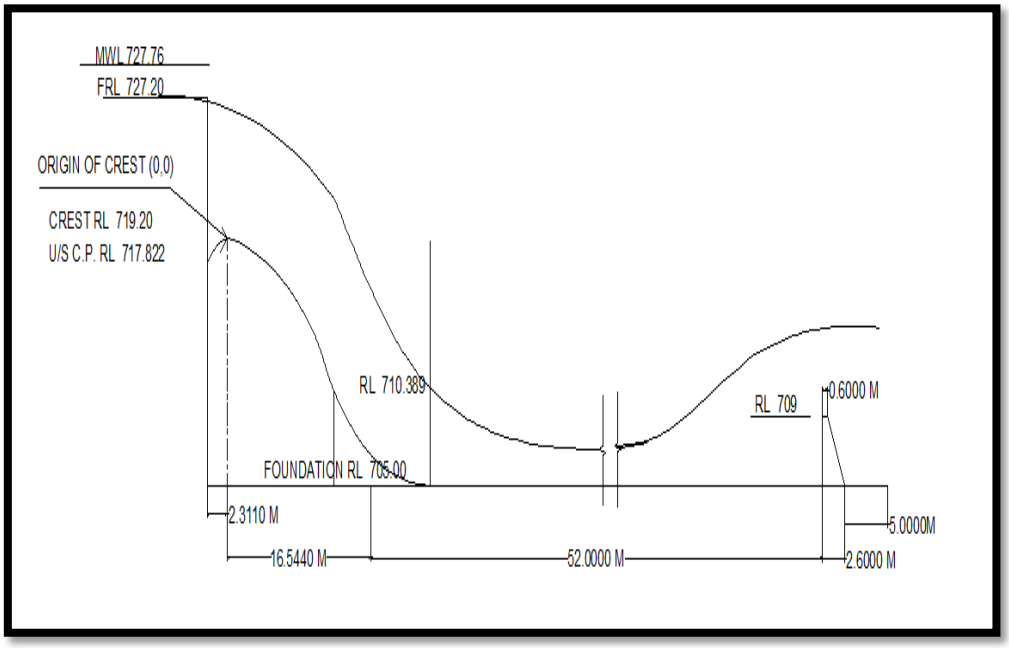

Fig.1: Schematic of actual design of spillway
Source: Government of Maharashtra WRD.

Table 1: Details of Spillway

Width of channel	27m
Length of stilling basin	52m
Height of the spillway	12m
Design discharge	799m^3/s
Height of the end weir	4m
Top length of the weir	0.6m
Bottom length of the weir	2.6m

B. DETERMINATION OF HYDRAULIC JUMP BY USING HEC – RAS:

After starting with the creation of the project following data are used for the determination:

1] GEOMETRIC DATA:

After drawing the line of channel to be designed geometric data are used such as station and elevation coordinates, reach length, Manning's coefficient and expansion and contraction coefficients.
For getting accuracy, 185s cross sections have been created at close intervals. Manning's coefficient used is 0.015.There are two gate are provide for regulating maximum discharge.

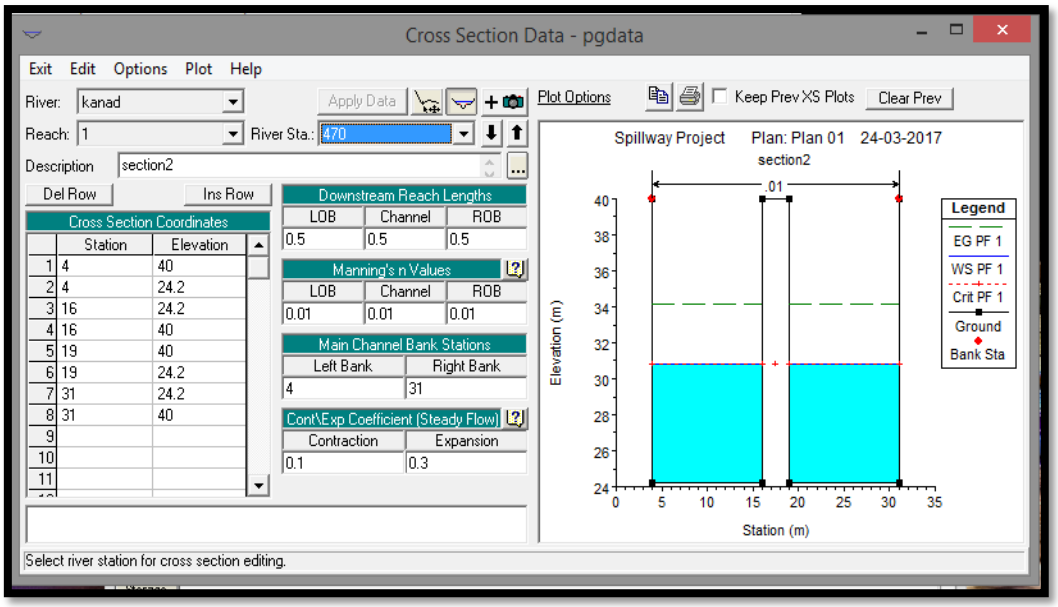

Fig.2: Cross section at the crest of spillway.

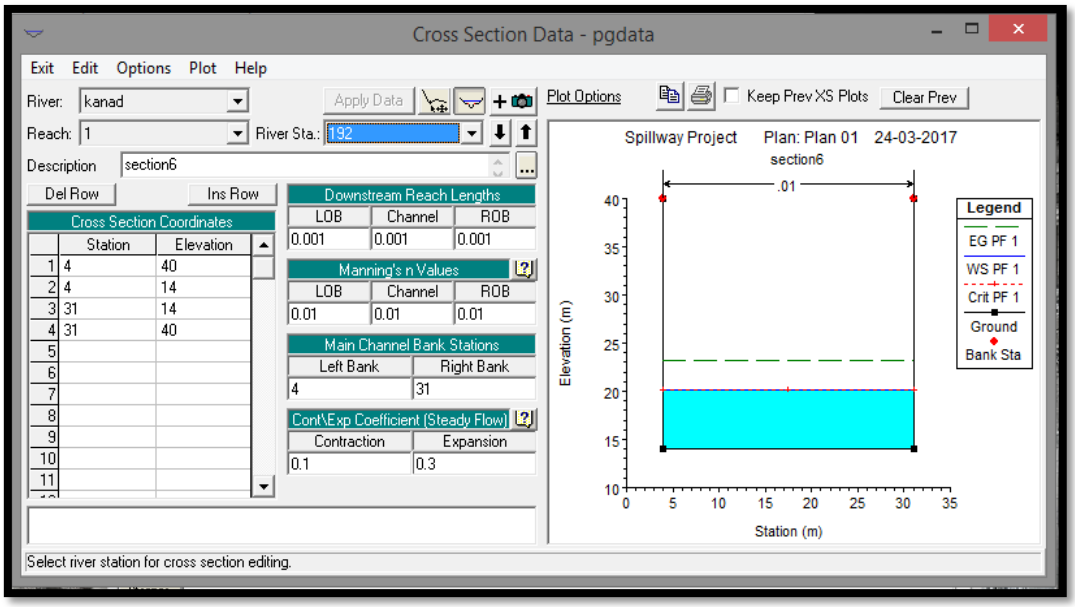

Fig.3: Cross section at the end weir of spillway

2] STEADY FLOW DATA:

These data include the flow profiles, flow rates or discharge values and boundary conditions. Boundary conditions include the head over spillway, flow rates and corresponding tail water depths.

After the filling of the above data program becomes ready for simulation. To run and simulation the mixed flow regime is used as flow changes from sub critical to super critical and super critical to sub critical again due to formation of hydraulic jump. After computation process water surface profiles and different output tables are observed.

HEC-RAS has a good ability to predict the characteristics of the flow over the ogee spillway as requires enough data for good results. Manning's coefficient and tail water depths are the requisites for this particular study.

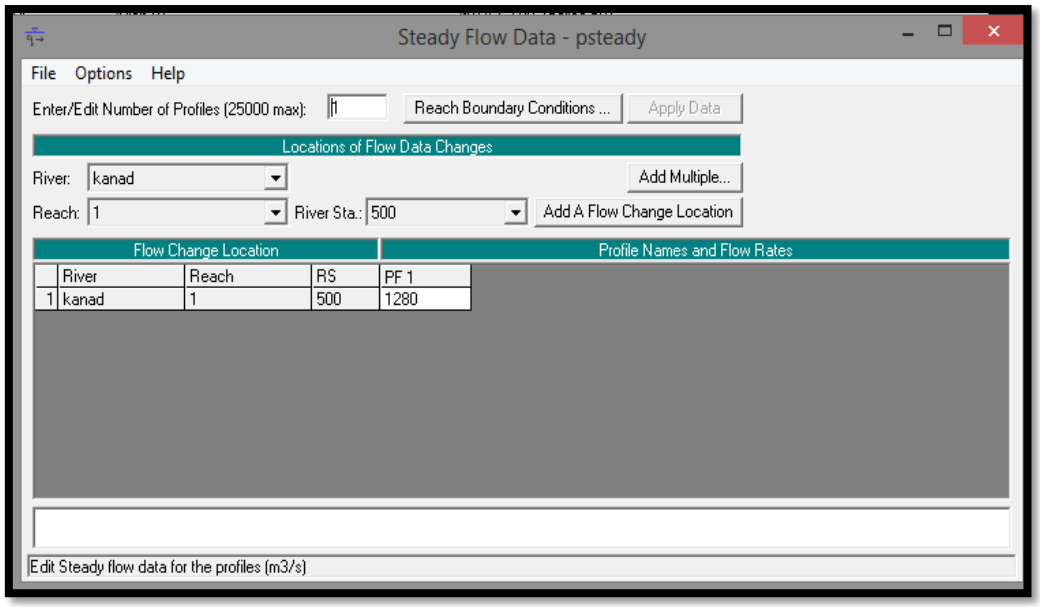

Fig.4:Steady Flow data Window

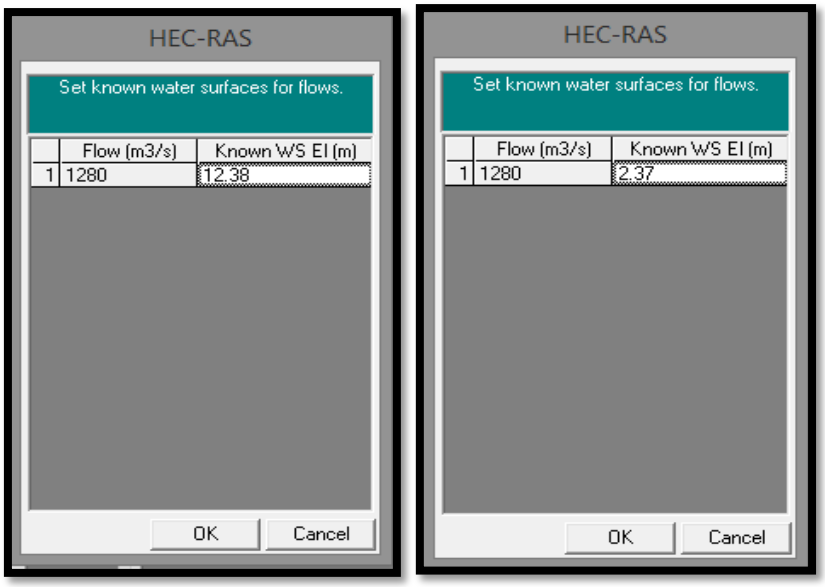

Fig.5:Steady Flow Window for 1280.03 m^3/s discharge.

RESULTS:

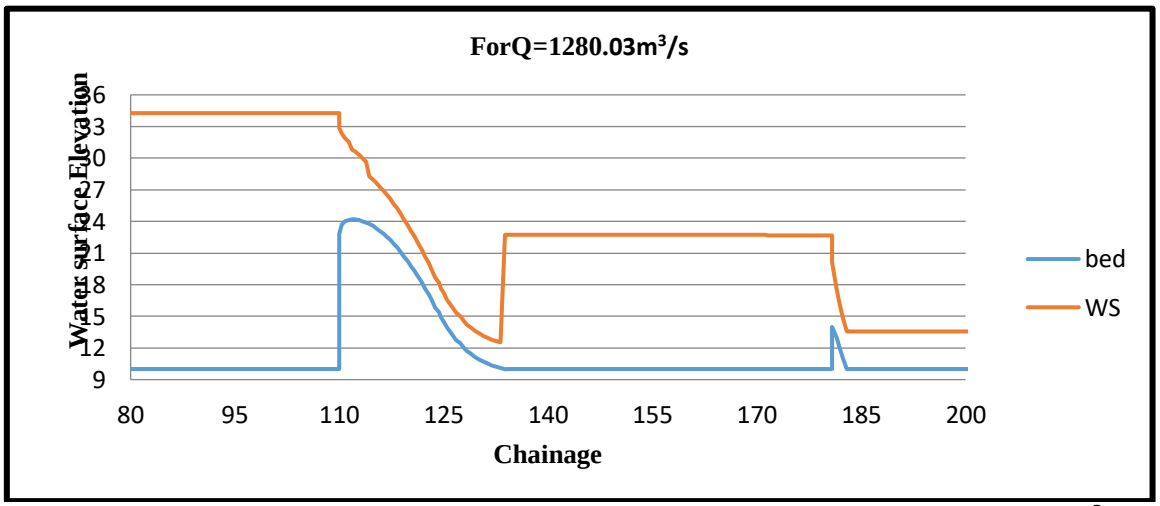

Fig.6: Water Surface Profile Obtained by HEC – RAS for Discharge 1280.03m^3/s.

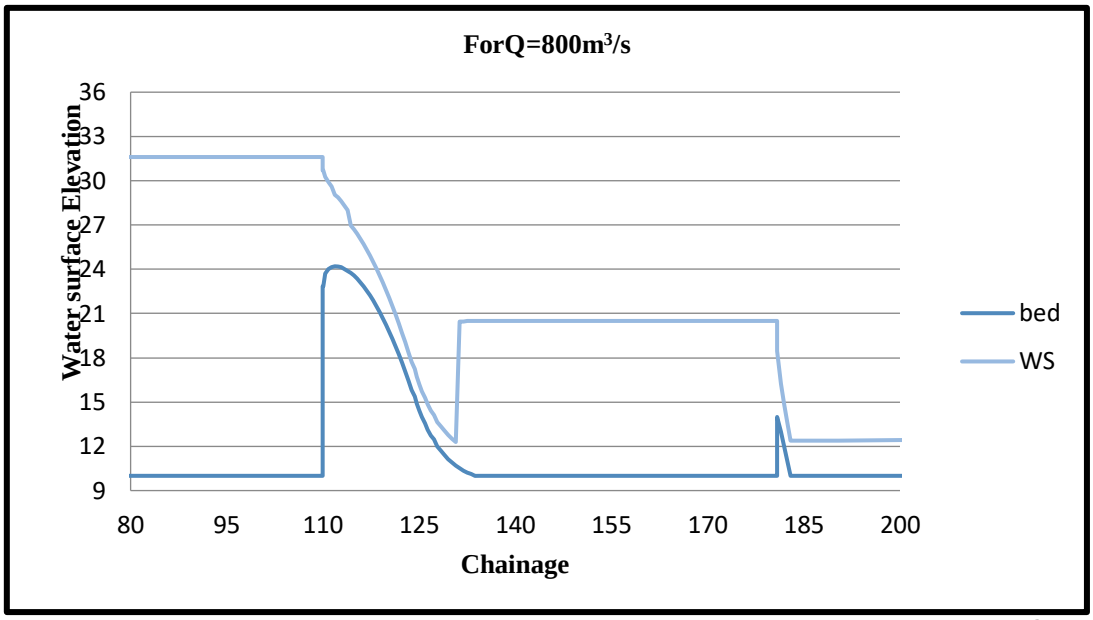

Fig.7: Water Surface profile Obtained by HEC – RAS for Discharge 800m^3/s.

The water surface profile obtained by the HEC-RAS shows the hydraulic jump will be submerged at toe of ogee spillway.

CONCLUSIONS:

As per the comparison of both the HEC-RAS and Experimental results it can be concluded that:

1. The location of the hydraulic jump predicted by HEC-RAS is satisfactory.
2. The range of Froude number obtained by HEC-RAS software is acceptable.
3. Merge the hydraulic jump within the stilling basin.
4. The Hydraulic Jump Occur at the Toe of Spillway and it will be move in downstream side when Discharge is increases.

Therefore, HEC-RAS performed the simulation of flow over the ogee spillway satisfactorily.

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