The Navigation Engineering in Developed Hydropower Station

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ABSTRACT

The research of the navigation in Shu River hydropower station, by means of the integral hydraulic model exploring. Adopting guiding dividing duke as the one of major engineering measures while the dredging in waterway、the length of the duke and the configuration of the head consist the most important parameters .Based on the practical condition, there are several methods had been created. Then we corresponding to the fixed flow in each level and observing how the water flowing when they getting through the entrance area. The next step is recording the velocity and direction which consisting of the flow distribution. On the other hand, the data coming from the experiment will show us the instable flow and navigation obstruction satisfied the safety criterion or not. Based on the analysis of the phenomena and proposing the most proper blue print comprehensively.

KEY WORDS: guiding dividing duke , varying backwater zone，flowing condition，project approachment

INTRODUCTION

Shu River Hydropower Station project is the sixth cascade development planning of the of Hanjiang upper reaches. The major task of the comprehensive water conservancy project is generating electricity while acting as the role of navigation and flood control. The part of hydropower and flood control had been constructed and put into service. The auxiliary facilities such as guiding dividing duke have not been built .

THE PRESENT NAVIGATIONAL CONDITION OF THE PROJECT

According to the <Navigation standard of inland waterway >（GB50139-2004）, the level of the channel is IV which satisfied the need of ships that displacement are 500 tons . The maximum flow adapted in designing is 3000 m3/s and the common patterns of the ships are barges motivated by push motor while the sizes are 35m * 9.2m * 1.3m (length *width*draft depth). In order to reduce the cost of the project, the structures of navigation and sluices of flood passageway were put together closely in blueprint. As we know, the shape of Shu River is narrow and deep while the layout of hydraulic structures is relatively intensive. Obviously we cannot remove the present structures .The most unfavorable factor which affect navigation is the sluices and channel are close neighbor. When sluices works, the flow conditions of navigation in the downstream sharply deteriorated while the flow condition cannot meet the requirements of the navigation. On the other hand, the energy dissipator of sluices is underflow energy dissipation so that the outlet flow turbulent fluctuation. There are lots of vortexes hide in the flow and being a serious threat to navigation safety. As the blueprint shows, when flood coming, the navigation structures will be used to release the water which means the navigation resources are partly wasted. If the traffic flow is too small, it will cannot fit the practical need and the cost in navigation will raise. The construction and maintenance of navigation facilities and the profit is not in a state.
To maximizing the effectiveness of hub with the limited resources, the designer choose 1566 m3/s and 3000 m3/s as the full discharge of power station and maximum navigable discharge. Therefore the design and construction of the navigation wall is imperative. There are three most important factors that affect the function of the navigation wall: length, the geometric forms of the wall and the patterns of the duke head. The essay is written by the analyses of these three factors.

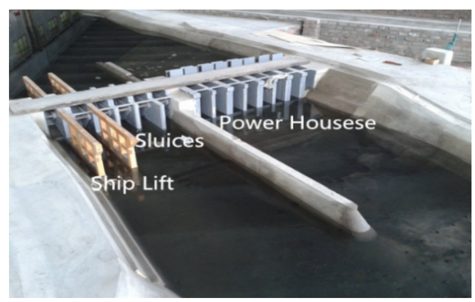

Fig. 1 Terminal layout

CONCEPTUAL DESIGN

Based on the requirements of designers, the channel was excavated to CS28 and extended 35.356m in downstream. After adjust the right boundary, the channel's width became 51m and the width of the gate is 44.5m. The riverbed was dredged to the cross section where is 250m apart from the bridge in downstream and a triangle section connected with gate. The measurement section is the gate area and the connection section. Since the length of the ship is 35 m, the gate area is 3 times the captain that is the scope of 105m and beyond this range is the connection segment. The shape of the cross section of the navigation wall is shown in Fig. 2. The elevation of the base is designed by different conditions in different sections while the height of the wall and the thickness of the base are also changed. The elevation of the

Last one was the Reflux velocity. The superiority of the Plan C is so overwhelming.

Besides the flow corresponding to the maximum velocity of Plan C was larger than that of the contrast distinctly under the same condition. The indicators had exceeded When the flow reached 2500 m^3/s . The bigger flow, the worse condition followed. In a word, the adaptability, practicability and improvement of the Plan C were more powerful.

Table 6 Parameter analysis in comparative experiment

program \ Plan		Plan C	Plan F
Longitudinal velocity	Excessive rates	0	0
	Total exceeding rate	33.3%	28.6%
	Vmax（m/s）	2.81	2.86
	condition	6	5
	Location	CS29	CS29
Transverse velocity	Excessive rates	0	22.2
	Total exceeding rate	19.0%	16.7%
	Vmax（m/s）	0.40	0.38
	condition	6	5
	Location	CS26	CS24
Reflux velocity	Excessive rates	22.2	27.8
	Total exceeding rate	9.5%	11.9%
	Vmax（m/s）	0.61	0.65
	condition	6	5
	Location	CS24	CS25

CONCLUSION

In summary, it is not difficult to find that the transition of longitudinal velocity was stable and the transverse velocity was greatly reduced and the reflux velocity was relatively weakened if we chose Plan C. All of the velocity index performing more reasonable and favorable than the contrast plan. The finally choice was the Plan C. Above all were the result of theoretical research as well the evaluation of the program also combined with the actual situation of the project.

At the same time, the research is accompanied with the slope regulation. If the plan came into operation, some engineering measures must be taken to reduce the longitudinal velocity in connection segment as well as limit the transverse and reflux velocity rigidly.

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