COUNTERMEASURES FOR WATER LEVEL DROP DUE TO BED SCOUR IN THE MIDDLE YANGTZE RIVER: A NUMERICAL SIMULATION

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Bed scour in the Middle Yangtze River downstream the Three Gorges Reservoir in the next 20 years will be a major factor affecting the navigation conditions, which will substantially change the stage-discharge relationships at various sections up and down the river, especially at some shallow regions of the river channel. This paper presents a numerical simulation of the effectiveness of proposed engineering measures to reduce the intensity of bed scour and to maintain water level, by paving the river bed with a layer of cobble-sized rocks at several locations in a 63 km long section of the Yangtze River (Figure 1). This numerical model has been validated using field measurements, and has been used to predict the compare the effectiveness of alternative engineering measures, based on which the most efficientengineering layout is selected to achieve the maximum water level rise at Yichang Station near the Gezhouba Dam to facilitate navigation.

In this study a trail-and-error method was used to calibratethe roughness and eddy viscosity for various discharges, i.e., Q=3300m^3/s, 5010m^3/s, 17300m^3/s, 21100m^3/s, 31200m^3/s and 40200m^3/s, with the respective water stages obtained from field observations. In the numerical simulation the coefficient K_s is used, which is related to the Chezy roughness coefficient C and Manning's n through the logarithmic law.

The calculations are based on the assumption that the pavement will be applied only to those parts of the river bed which are submerged when the discharge is 5010m^3/s. After the pavements are completed, the surface of paved areas will be elevated by 0.5m to 1.0m with increased roughness. The effects of various pavement schemes are predicted (Table 1).

Simulation results indicate that the water level of Yichang will be maintained, or even increased, if the bed pavements are applied in the chosen sections of the river channel. At the same time, the velocity and hydraulic slope in the river channels will not increase significantly, with little effects on the local navigation conditions.

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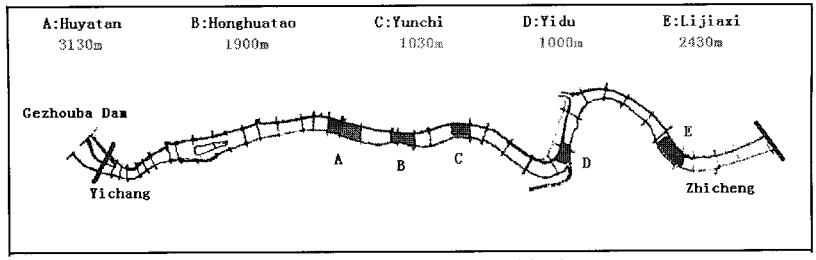

Fig. 1 Proposed locations of channel bed pavement

Table 1. Water levels for various pavement thicknesses (water discharge: 5010m^3/s)

Location	Initial Water Level (m)	No pavement		Thickness = 0.5m		Thickness = 1.0m	
		ΔWL(m)	WL(m)	ΔWL(m)	WL(m)	ΔWL(m)	WL(m)
Yichang	38.13	-0.14	37.99	0.13	38.26	0.21	38.34
Linjiangxi	37.29	-0.26	37.03	0.15	37.44	0.31	37.6
Huyatan	37.15	-0.23	36.92	0.17	37.32	0.30	37.45
Honghuatao	37.01	-0.26	36.75	0.05	37.06	0.14	37.15
Yunchi	36.91	-0.26	36.65	0.03	36.94	0.14	37.05
Yidu	36.72	-0.30	36.42	-0.02	36.70	0.09	36.81
Baiyang	36.53	-0.33	36.20	-0.01	36.52	0.11	36.64
Zhicheng	35.88	-0.40	35.48	-0.40	35.48	-0.40	35.48