# II-363 Effect Of River Bed Profile Uncertainty On Safety Margin

University Of Tokyo Student Member o Md. Mafizur Rahman

University Of Tokyo Fellow Nobuyuki Tamai

## 1 INTRODUCTION:

The change of the river cross sectional shape and the longitudinal bed profile are to some extent the consequences of the natural goemorphological change. The identification of its impact on the safety margin is the objective of the present study. The idealization of the existing channel section was done. The 1-D flow simulation was performed to simulate the flow for the natural sections and the idealized ones.

The investigation area covers a river reach of 13.0 kilometers of the Kinu river, in Japan. The downstream and upstream sections of the investigation reach are respectively 45.0 km. and 58.0 km. upstream of the Tone river confluence.

For Kinu river the annual cross-sectional river geometry map for the years 1977,1981,1983 and 1989 were obtained. The pitch was 0.5 km..

## 2 MATHEMATICAL MODEL:

Water surface profile for the reach for each year was computed by a 1-D model [4] using the standard step (step-profile) method [3] [5]for steady-flow condition.

## 3 IDEALIZATION OF SECTIONS

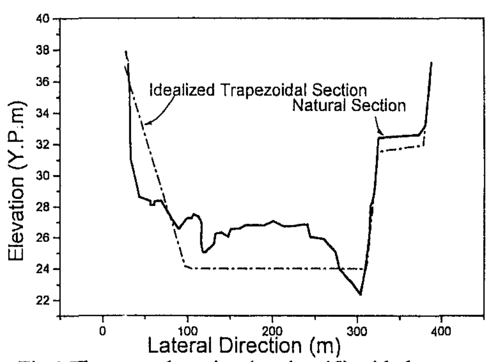


Fig.1 The natural section (section 45) with the equivalent idealized section.

The naturally existing sections were simplified through some idealization techniques. For idealization of the sections the total cross-sectional area was kept the same as that of the naturally existing section.

The idealization, was performed to an equivalent trapezoidal shape which resembles more or less to the sectional shapes found in the master plan of the Kinu river Fig.1.

The bottom point (thalweg) of all the sections were shifted to the (three point) moving average line found by averaging the existing longitudinal profile.

## 4 NUMERICAL EXPERIMENTATION AND ANALYSIS

In the first case of the 1-D simulation the natural sections were used where the thalweg points were assumed to lie on the natural longitudinal profile.

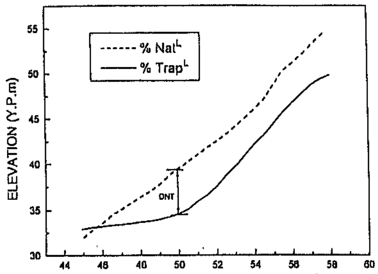


Fig.2 Water level stage of Kinu River simulated for the Naturally existing section and the sections idealised Trapezoidal shapes.

The similar method was followed for the idealized types of sections. This time, the thalweg points were shifted to the level of the moving averaged line of longitudinal profile. The deviation (Fig.2) of the longitudinal water surface stage profile between the cases of natural sections and the idealized sections was determined at each of the longitudinal locations where the cross sectional data were obtained. The simulated water surface found for the idealized sections were compared with those of the natural sections, for all the four years.

5. RESULT AND DISCUSSION:

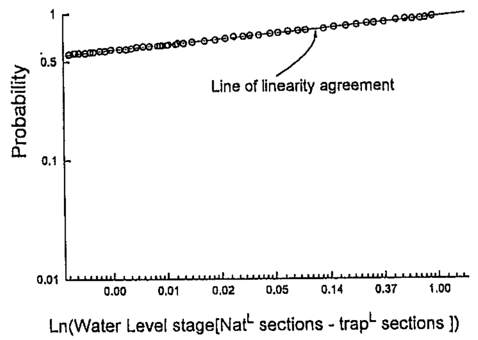


Fig.3 Distribution of Variation of Water Level simulated for the Natural sections and that of the idealized trapezoidal sections

The distribution of the difference of the water surface stage between the idealized case and the existing channel sections was found to follow the log-normal distribution [1]. The linearity of relationship of the variates and their cumulative frequencies when plotted in the log-normal probability paper is shown in Fig.3. The linear best fit line is drawn in the figures. The maximum, mean and the standard deviation of the deviations are also shown in Table 1. Respective log-normal parameters($\lambda$ and $\zeta$)and the chi-squared($\chi^2$) values [2] of goodness of fit test are also given.

The difference of the water level between the idealized trapezoidal sections and the natural sections were analyzed and the corresponding probability of flooding was found to be 1%. The mean and the standard deviations were 0.15m and 0.34m respectively.

Table 1. Statistics of the variations of bed and water surface deviation.

| Deviation for the profile of | Mean (m) | Std. Dev. (m) | Max. (m) | $\lambda$ | $\zeta$ | $\chi 2$ | $C_{1-\alpha,f}$ |
|---|---|---|---|---|---|---|---|
| Water stage (trap. section) | 0.15 | 0.34 | 0.93 | -2.8 | 1.3 | 8.3 | 77.9 |

6 CONCLUSION:

The return period of the exceedence of the water stage above the levee height is almost 100 years. For an existing river, such consequences should be taken into consideration for the detailed study of the reliability analysis.


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