28. COMPARISON OF THE TWO METHODS IN THE DESIGN FLOOD OF MEIZHOU RESERVOIR

Bingjie XU[1*], Tadashi YAMADA[2]

[1]Graduate School of Civil And Engineering, Chou University
（〒100-0014, Japan-Tokyo-Bunkyo-Kasuga　1-13-27）
[2]Department of Civil And Engineering, Chou University
（〒100-0014, Japan-Tokyo-Bunkyo-Kasuga　1-13-27）
＊ E-mail: *zoe2644@hotmail.com*

With the sustainable development of social economy and the speeding up of the modernization, the flood control problems caused people more and more attention. How to under the premise that ensures the safety of the reservoir itself maximize the comprehensive benefit is a significant research topic, the reservoir design flood analysis is one of the basic work in the study of the subject. Based on this consideration, this paper combined with the actual situation of Meizhou reservoir, in Guangdong province synthetic units line method and derivation formula method, by the design storm calculation in the design of the flood and the design results were analyzed. Design process and the conclusion can be used for reference in the similar projects.

Key Words : *synthetic unit hydrograph, derivation formula, flood peak flow*

1. INTRODUCTION

Meizhou reservoir is located at the Zeng river's middle reaches, 23°38`N, 114°38`E. The watershed of Meizhou reservoir is showed in **Fig.1**. The catchment area is 133 km^2, which is a tributary of the east river area. Meizhou reservoir is mainly used for flood control, combined with irrigation, power generation, water supply, etc. It is a comprehensive utilization of medium-sized water conservancy projects.

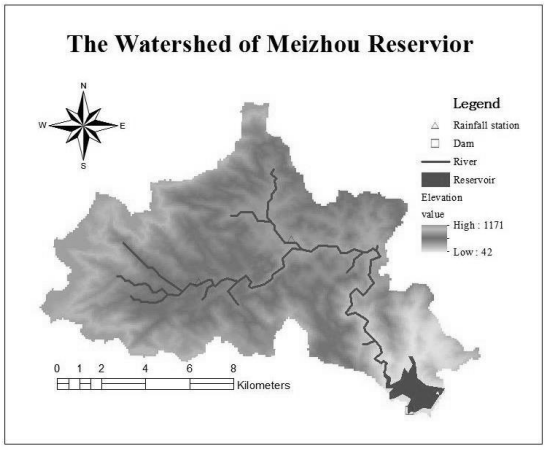

Fig.1 The watershed of Meizhou reservoir

Due to the lack of measured data of flow and Meizhou reservoir basin where the design floods frequency analysis calculated through the measured flow. So this article adopts the method of the estimation of design flood via design storm to calculate design flood.

This article chooses two stations as the representatives of the rainfall stations, using two methods to analysis and calculation.

2. METHODOLOGY

(1) Rational formula

Rational formula for design flood peak discharge Q_m first, to derive the design flood process line. The first iteration method is used to connections reasoning model of the basic formula design flood peak discharge by Q_m and corresponding τ values, and then according to the values of Q_m, τ province generalized flood process line table to find the corresponding to τ net rainfall during formation of the main peak flow process line, each time lines to flood process superposition to get the whole process of the flood.

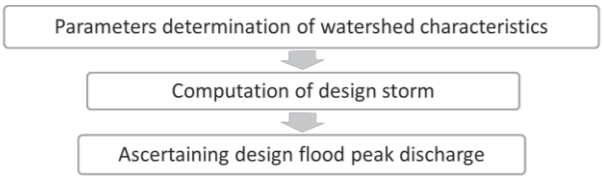

Fig.2 computation steps of rational formula

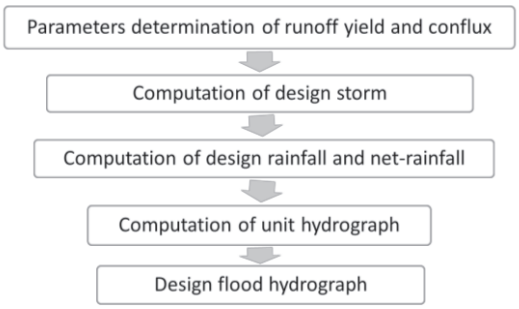

Fig.3 computation steps of synthetic unit hydrograph

The type selection chooses 597 times measured data of heavy rain in the catchment area of 2.3 ~ 950 km^2 and calculate in two formulas connections of Q_m and τ, the basic formulas is as follows:

$$Q_m=0.278F(\frac{S_P}{\tau_p^{n}-f}) \quad \text{(Eq.1)} \qquad \tau=\frac{0.278L}{mJ^{1/3}Q_m^{1/4}} \quad \text{(Eq.2)}$$

Q_m: Design flood peak discharge(m^3/s); F: Catchment area(km^2); n_p: Heavy rain attenuation index; S_P: Storm force, mm; f: The average loss rate(mm/h); τ: Concentration time(h); L: Length of the trunk(km); J: Slope; m: Convergence parameter.

The calculation steps of rational formula are shown in **Fig. 2**.

(2) Synthetic unit hydrograph

Guangdong synthetic unit hydrograph is through the in-depth study of Naci instantaneous unit line method, and learn from experience at home and abroad, puts forward a set of comprehensive unit line with Guangdong characteristics[1]. It chose 639 times rain and flood in the catchment area of Guangdong province of 2.30 ~ 950 km^2 of 50 stations to comprehensive analysis[2].

The abscissa and ordinate formula for this method:

$$u_i=\frac{q_i t_p}{W} \quad \text{(Eq.3)}$$

$$x_i=\frac{t_i}{t_p} \quad \text{(Eq.4)}$$

ui: The ordinate of dimensionless unit line (ratio); xi: The abscissa of dimensionless unit line (ratio); qi: The ordinate of unit line(m^3/s); ti: The abscissa of time unit line(h); tp: The rise time of unit line(h); W: Flood volume.

The calculation steps of synthetic unit hydrograph are shown in **Fig. 3**.

Table 1 The difference comparison of two methods

Item	Rational formula	Synthetic unit hydrograph
The dominant factors influencing *Qm*	River gradient	The rise time of unit line
Alter condition of basin	Not be considered	Be reflected with tp
Groundwater runoff	Not be considered	Comprehensive consideration
Zone of application	Hilly region	Guangdong region
Area of application	<500km2	<1000km2

Table 2 The results of the design peak flow m^3/s

Method	R.P. 100 years	R.P. 50 years	R.P. 20 years
Synthetic unit hydrograph	1183.78	1046.19	856.8
Rational formula	998	847	656

(R.P: tropical year)

3. DISCUSSION AND CONCLUSION

The basic thought and calculation steps are different in the rational formula and synthetic unit hydrograph. The difference comparison of two methods is shown in **Table 1**. Compared with the rational formula method, the synthetic unit hydrograph method consider conditions more comprehensive, and the scope of application is wider.

And as shown in **Table 2**, the results of two methods calculated value difference not more than 20%, so the calculation results of two methods is quite reasonable. And the results show the design peak flow used synthetic unit hydrograph are bigger than which used synthetic unit hydrograph. The main reason of that is because only the synthetic unit hydrograph considered the groundwater runoff.

From the method of calculation accuracy, Guangdong synthetic unit hydrograph is on the basis of the measured process simulation in the region, this method conforms to the regional flood characteristics, and the precision is higher; From a security perspective, the result of Guangdong synthetic unit hydrograph is larger. In conclusion, the results of Guangdong synthetic unit hydrograph is recommended.

REFERENCES

1) Guangdong rainstorm runoff check chart use manual, 1991.

2) Bell. The areal reduction factor in rainfall frequency estimation. IH Report No.35, Institute of Hydrology, Wallingford. 1976.