

A STUDY OF THE BEIJING INTENSITY-DURATION-FREQUENCY CURVES

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EXTENDED SUMMARY

The urban rainwater system is one of the most important infrastructure elements in a modern city, as it has the extremely significant influence on urban development planning, enterprise production and the daily life of residents. In recent years, more and more cities are facing increased pressures on the development of urban infrastructure and urban residents' quality of life, and therefore people are becoming more aware of the influence of the urban drainage system, which is leading to strict requirements on the planning, design and management of these systems. The design and management of urban drainage relies on a clear understanding of the rainfall patterns and extremes, and requires suitable rainstorm intensity formulae for the region of interest. The rainstorm intensity formula is fundamental to determining the storm water design flow, and thus the planning and design of urban rain water drainage system. It directly affects the safety of the investment and urban drainage works. The rainstorm intensity formula is a mathematical expression that relates the return period (P), the rainstorm intensity (i), and the rainfall duration (t). Its credibility and accuracy is directly related to the quality and quantity of historical rainfall data. For various reasons, many cities in China have used outdated formulae which either rely on old data or borrow formulae from other regions that may not be suitable. Many of these formulae are based on 1970s data derivation, and therefore this approach is clearly unreasonable. Along with the development and progress of the city, we propose higher requirements in the development of these formulae and therefore in this paper, we have developed new formulae for Beijing. New meteorological and hydrological data provide favourable conditions for the revision of storm intensity formulae to improve their accuracy.

Beijing's current design rainstorm intensity formula was prepared in 1984 by the Beijing Municipal Engineering Design and Research Institute (Water Supply and Drainage Design Manual, 2004), using raingauge data from the Central Weather Bureau Observatory with a total of 40 years from 1941 to 1980. This formula has been used ever since in the planning and design of urban drainage systems in Beijing (the report referred to the "80 edition" formula or "original" formula).

On the one hand, due to the reform of the meteorological department and other reasons, the formula has been used for almost 30 years without updating. Statistically representative hydrological data is required for the development of the rainfall-intensity formulae, and longer rainfall series are typically better, so updated data (post-1980) is used in the analysis. So, the formula should be based on the new statistics for the revision and therefore expand the present study.

In this paper, we use an updated rainfall data model as well as updated data from recent years that the National Weather Service provided, and developed a set of systems which can be integrated seamlessly with electronic data provided by the National Weather Service, and through long-term data sample collection, frequency analysis, new intensity-duration-frequency formula can be derived. These can be compared with the current formulae. and In this study, the total technical route is shown in Figure 1.

Firstly, we use two sampling methods (Deng, 2006): Annual multi-sampling method and annual maximum value method, and the duration was increased. On the one hand, the annual maximum method is easy to get, and own a longer data series, on the other hand, China's water conservancy department has been using annual maximum method, this is for the future transition to the annual maximum sampling method provides the basis for research, but also for joint research and river hydrology provides a comparative platform. Using P-III distribution curves to conduct sample fitting

and a variety of calculation methods to obtain storm intensity formula we can produce more accurate formula results.

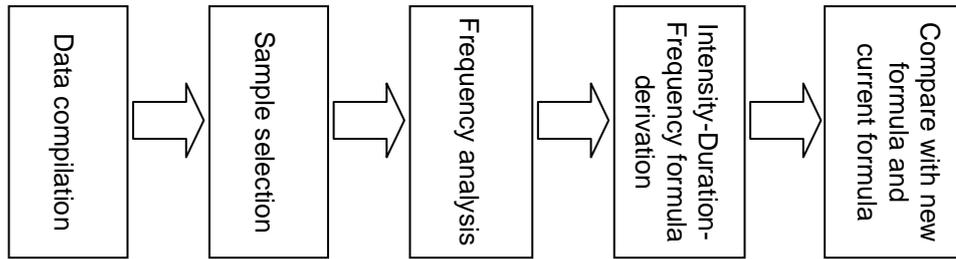


Figure 1. The total technical route

Secondly, based on nearly 68 years of actual rainfall data, the Beijing rainstorm intensity formula is derived through new method. Meanwhile, after preliminary analysis of the density distribution, Beijing Urban rainstorm intensity sample data in line with P-III distribution curve type. After the frequency analysis, we believe that the P-III distribution curve is the best fit for Beijing.

Thirdly, based on the recommendations and the literature on the existing water supply and drainage design manual, we use design values from the frequency analysis to determine the parameters, and then make the return period P , storm intensity i and rainfall duration t of relational tables (P - i - t relational tables), making use of six classical methods (Beijing method, Beijing simplified method, Nanjing method, Surface of least-squares method, Tongji University method and Direct fitting method) to choose a method that has the minimum error.

Fourthly, comparing the new formula and current formula, we can find significant differences between the two formulas. Finally, these research results provide a scientific basis and reference for urban rainwater planning and design work.

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