

Appendix 6C-1 B, D, and E Factors - Application

**B, D and E Factors that Define Intensity-Duration-Frequency (IDF) Values*
for Use with the Rational Method and the Modified Rational Method**

The rainfall IDF values are described by the equation:

$$i = \frac{B}{(t_c + D)^E}$$

Where:

- i = Intensity, inches per hour (in/hr)
- t_c = Time of concentration, minutes (min)

The B, D and E factors for all counties and major cities have been tabulated in Appendix 6C-2. These values were derived by the Department using the Rainfall Precipitation Frequency data provided by NOAA's "Atlas 14" at the following Internet address: http://hdsc.nws.noaa.gov/hdsc/pfds/orb/va_pfds.html. A Microsoft EXCEL spreadsheet containing all the B, D, and E factors for the state of Virginia as shown in Appendix 6C-2 is available upon request or may be downloaded at the following Internet address: http://www.virginiadot.org/business/resources/B/BDE_values.xls.

It should be noted, since the regression procedure used to derive these values was predicated on 5 and 60 minute storm durations, that the accuracy of the calculations performed using these values decreases significantly for times of concentration in excess of 60 minutes and the error becomes greater as the time increases. For long storm durations and/or long times of concentration, the rainfall intensity and/or total point rainfall should be obtained directly from NOAA'S Precipitation Frequency Data Server at the Internet address shown above.

An example problem employing the above equation is shown below.

Given: Chesterfield County, Storm Duration (t_c) = 30 minutes

Find: 10-yr. frequency rainfall intensity

Solution: From Appendix 6C-2, for Chesterfield County and a 10-yr. event, read B = 50.71, D = 10.00, & E= 0.73. Substitute these values and a t_c of 30 into the above formula.

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$$i_{10} = B / (t_c + D)^E = 50.71 / (30 + 10.00)^{0.73} = 3.43 \text{ in/hr}$$

It should be noted that the above procedure could also be used for applications employing time of concentration (t_c) in hours and total rainfall (as opposed to rainfall intensity) in inches. It is merely necessary to multiply the calculated rainfall intensity (based on a t_c in minutes) by the time of concentration (in hours) to determine the total point rainfall.