



## Book IV Chapter 4 The Rational Method

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### Overview

Well developed practice associated with the Rational Method.

Few new developments have occurred – no significant changes.

Only deterministic approach included in discussion of the Rational Method – Probabilistic interpretation in Regional Flood Method Chapter.

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### Overview

Rural and Urban approaches in same chapter.

Most changes in urban applications including

- $t_c$  estimation
- Representative flow length

These changes introduced to more correctly reflect theory.

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### Response Time Estimation

Defined as –

“ the time taken for a drop of rainfall falling on the most remote portion of the catchment to influence the discharge at the outlet of the catchment ”.

Note that this definition is not based on the travel time of a drop of rainfall.

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### Response Time Estimation

For surface flows,

- Rural Catchments
  - use the Bransby Williams equation
- Urban Catchments
  - Use the kinematic wave equation

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### Response Time Estimation

Kinematic equation with SI units is

$$t_c = \frac{L^{0.6} n^{0.6}}{i_e^{0.4} S_o^{0.3}}$$

Not useful in this form, so recommended equation is

$$t_c = \frac{7L^{0.6} n^{0.6}}{i_e^{0.4} S_o^{0.3}}$$

With  $t_c$  in minutes and  $i_e$  in mm/h.

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## Response Time Estimation

Application of the kinematic wave equation requires knowledge of

- Representative flow length –  $L$
- Slope –  $S_o$
- Roughness –  $n$
- Excess rainfall intensity -  $i_e$

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## Flow Length

The representative flow length is **not** the maximum flow length.

The representative flow length is a measure of the response time of a subcatchment.

Recommendation is that the representative flow length be 75% of the maximum flow length – typical values are 60 to 85% of the maximum length of flow path.

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## Slope

For consistency, the equal area slope will be recommended.

This slope is the mean of the slopes along the flow path rather than the mean slope.

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## Roughness

An expanded list of surface types will be included.

A range of values will be provided for all surface types.

Research has shown that the roughness increases with rainfall intensity.

Recommendation is that higher values in the range be used for larger events and lower values with more frequent events.

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## Excess Rainfall Intensity

Previous recommendation was for the rainfall intensity to be used.

This is valid for impervious surfaces but not appropriate for pervious surfaces.

New recommendation is for the rainfall excess intensity to be used. This recommendation is suitable for both pervious and impervious surfaces.

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