MATS-TC: Automating Time of Concentration Through Multidisciplinary Collaboration

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MATS-TC: Automating Time of Concentration Through Multidisciplinary Collaboration

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Overview

- Time of Concentration
- Previous process
- Full Automation
- Outcome
- Moving Toward the Future
Time of Concentration
Time of Concentration

- Time of concentration (Tc) is the time required for runoff to travel from the hydraulically most distant point in the watershed to the outlet.
Velocity Method

- Adds the travel time of various flow types, the sum is the watershed’s TC
- Three main flow types
  - Sheet
  - Shallow Concentrated
  - Channel
- Each flow has its own formula for travel time
Travel Time Formulas

- **Sheet**

\[
T_t = \frac{0.007(n\ell)^{1.8}}{(P_2)^{0.5}S^{0.4}} \quad \text{(eq. 15-8)}
\]

where:
- \(T_t\) = travel time, h
- \(n\) = Manning's roughness coefficient (table 15–1)
- \(\ell\) = sheet flow length, ft
- \(P_2\) = 2-year, 24-hour rainfall, in
- \(S\) = slope of land surface, ft/ft

- **Shallow Concentration**

- **Channel**
"I HAD MY DOCTOR DO A D.N.A. BLOOD ANALYSIS. AS I SUSPECTED, I'M MISSING THE MATH GENE."
Types of Inputs

- Engineering Judgement
  - Depth/width/etc.
  - Channel Segmentation
  - Surface Description
  - Manning’s N
- Manual Editing
  - Rainfall (2yr, 24hr)
  - Channel Segmentation
- Arc Calculations
  - Slope
  - Length

- To still be automated
  - Landcover/Surface Description
  - Manning’s N
**Example**

- Base spreadsheet
- One per subbasin
- Heavy on manual manipulations
  - Summing the total
  - Hard to adjust/edit
  - Tedious
  - Poor Readability
  - Difficult to QC
  - Cumbersome to share
Manual Process

- Inputs created manually
  - Stream widths & depths
  - Stream segment splitting
  - Stream segment attribution

- Data Calculations
  - Data exported, processed, imported back
  - Formula components added manually
  - Large file size
The Beginning

- **Simple question**
  - Split line segments 0 – 100 feet | 100 feet – end

- **Questions of increasing complexity**
  - Add slope to each segment
  - Time of concentration calculations

- **Key indicators**
  - Repetitive; Multiple steps/outputs; Multiple data formats
Full Automation
Jumping Off Point

- Automating engineering decisions
  - Feasibility
  - Time
  - Level of effort
  - Accuracy
  - Quality
MATS Process

- Multi-disciplinary Automated Technical Solution
  - Collaborative approach
  - Finding commonalities
  - What’s needed/what’s possible/what’s available
  - Identify critical elements
Outcome
MATS-TC

- Process/Format Data
- Create TC Inputs
- Calculate Time of Concentration

QA/QC
Results and Benefits

- **TC**
  - Accuracy
  - Speed
  - Repeatability
  - Data Integrity
  - Project Time
  - Manual Processing
  - Subjective Decision Making
  - Human Error

- **MATS**
  - Collaboration
  - Communication
  - Innovation
  - Interdisciplinary Understanding
Moving Toward the Future
Next Steps

- **TC**
  - Refine as more areas are studied
  - Improve error handling and documentation
  - Test and update for a variety of different areas and situations

- **MATS**
  - Make collaboration contagious
  - Increase interdisciplinary understanding
  - Apply method to other workflows
Thank you!

- Questions? Please email us:
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