10 Mistakes Every Drainage Engineer Has Made (And How to Avoid Them)

- Swapnil Dusane -

Drainage design involves a mix of hydrology, hydraulics, and real-world judgment. Early in the career, many engineers make avoidable mistakes — especially when it comes to drainage calculations and analysis. Below are 10 common mistakes drainage engineers often make, along with the correct approach.

1. Confusing Manning's Roughness for Sheet Flow with Channel Flow

Mistake: Using the same Manning's n value for sheet flow over pervious surfaces as for open channels, ditches, or pipes.

Correction: Manning's n for sheet flow is higher and depends on surface cover, not the shape or size of a channel. TR-55 Table 3-1 provides recommended n values specifically for sheet flow. For example, short grass in fair condition has an n of 0.24 for sheet flow, while the same grass in a swale/channel might use a lower value like 0.035.

2. Using the Physically Farthest Point Instead of the Hydraulically Longest Flow Path

Mistake: Delineating the time of concentration (Tc) from the physically farthest point from the outfall.

Correction: Tc should be based on the hydraulically longest path, not necessarily the physically farthest. Undeveloped or grass-covered land can result in slower velocities and a longer Tc due to higher resistance, even if the distance is shorter.

3. Not Updating Flow Paths When Impervious Area Changes

Mistake: Assuming that the flow path in the proposed condition remains the same as the existing even after adding impervious surfaces.

Correction: Adding impervious areas like roads or rooftops changes both runoff volume and routing. This may alter flow directions and speed. The Tc must be recalculated using updated land cover and flow path.

4. Adding Peak Flows from Multiple Subbasins Directly

Mistake: Summing peak flows from individual subbasins to estimate total peak discharge.

Correction: Peak flows don't occur simultaneously across subbasins. Instead, use hydrograph routing to combine flows correctly. TR-55 and HEC-HMS recommend computing a weighted Tc and curve number (CN) for the entire watershed to get total peak flow.

5. Assuming Channel Flow Velocity is Always 6 fps

Mistake: Using a default channel velocity (e.g., 6 fps) during Tc calculations.

Correction: Velocity should be calculated based on the actual cross-section, slope, and roughness of the conveyance (e.g., gutter, pipe, swale). For Tc calculations, assume bank-full (full flow) conditions and use Manning's equation.

6. Using Rational Method for Large Drainage Areas

Mistake: Applying the Rational Method for entire sites larger than 200 acres or detention pond design.

Correction: The Rational Method is best for areas under 200 acres for general runoff estimation and under 20 acres for detention inflow peak design. For larger areas, use HEC-HMS or unit hydrograph methods.

7. Ignoring Inlet Efficiency and Blocking Factors

Mistake: Assuming curb or grate inlets operate at 100% efficiency.

Correction: Inlets can be partially blocked by debris or limited by inlet geometry. Apply a clogging or safety factor (often 0.7 to 0.8 efficiency for grates). Refer to FHWA HEC-22 for inlet capture efficiency charts.

8. Designing Structures Without Manufacturer Input

Mistake: Designing custom sizes without referencing available precast/manufactured product specifications.

Correction: Always verify available sizes and load ratings from manufacturers to ensure constructability and availability. Designing a structure that's hard to fabricate or transport can delay projects and increase costs.

9. Selecting Incorrect Material Types Without Performance Consideration

Mistake: Choosing drainage pipe material (e.g., CMP vs. RCP) without evaluating hydraulic and structural implications.

Correction: Different materials have different Manning's n, strength, and lifespan. CMP (Corrugated Metal Pipe) has a higher n (~0.024–0.030), leading to more head loss compared to RCP (~0.012). Consider hydraulic performance, lifespan, and site conditions when selecting materials.

10. Not Accounting for Pond Tailwater or Downstream Conditions

Mistake: Ignoring the downstream water surface elevation or assuming free outfall in detention pond or culvert design.

Correction: If the downstream system (like a creek, storm sewer, or channel) is backwatered or surcharged during peak events, it affects your pond outflow rate. Always model tailwater conditions using HEC-RAS or a tailwater rating curve.

Focusing on these key aspects of drainage modeling — from accurate time of concentration calculations and proper roughness values to realistic flow path assumptions and material specifications — can significantly improve the precision of runoff estimates, the effectiveness of detention system design, and the reliability of infrastructure performance during peak storm events.