

Water Supply & Sanitary Engineering (DI05006021)

Unit 7: Drains and Sewers

Lecture 28: Catch Basins and Sewer Appurtenances

GTU Diploma Engineering

Agenda

- Street Inlets (Types and Functions)
- Catch Basins (Design and vs. Inlets)
- Inverted Siphons (Depressed Sewers)
- Grease and Oil Traps
- Clean-outs and Lamp Holes
- Stormwater Regulators

Street Inlets

- Definition: Street inlets are openings with gratings located along the roadside to admit surface stormwater runoff directly into the storm sewer or combined sewer.
- Types of Inlets:
 - 1. Curb Inlets: Vertical openings cut into the road curb. Good for streets with heavy traffic as they don't impede vehicles.
 - 2. Gutter Inlets: Horizontal iron gratings placed directly in the road gutter. Highly effective at catching water but can clog with leaves.
 - 3. Combination Inlets: Combines both curb and gutter openings for maximum efficiency.

Catch Basins: Purpose

- Problem with Simple Inlets: Street runoff carries heavy grit, sand, leaves, and debris. If these enter the main sewer, they cause silting and blockages.
- Definition: A Catch Basin is a specialized inlet structure provided with a deep sump (depression) designed to 'catch' and retain heavy debris before the water enters the sewer.
- Application: Essential in combined sewer systems where preventing grit deposition in the main pipe is highly critical.

Design and Components of Catch Basins

- Grate/Inlet: Allows water in while filtering out very large debris.
- Sump (Grit Chamber): The bottom of the basin is extended 0.6m to 0.9m below the outlet pipe to collect settled grit and sand.
- Hood / Baffle Wall: A downward-pointing hood or trap is placed over the outlet pipe. This prevents floating debris (oil, leaves) from exiting and acts as a water seal to block foul sewer gases from reaching the street.

Catch Basins vs. Street Inlets

Concept 1

Concept 2

Street Inlet:

- Direct entry into the sewer.
- No sump for grit collection.
- No gas trap.
- Low maintenance, used mainly for separate storm sewers.

Catch Basin:

- Retains grit and floating debris.
- Prevents foul gas escape using a hood trap.
- Requires frequent manual cleaning of the sump, otherwise, decomposing organic matter causes foul street odors. Used in

Inverted Siphons (Depressed Sewers)

- Problem: Gravity sewers cannot easily cross major physical obstructions at the same grade level (e.g., rivers, railway cuts, highways, or deep utility lines).
- Solution: An Inverted Siphon (or Depressed Sewer) is constructed.
- Definition: A section of sewer pipe that drops below the hydraulic grade line (HGL) to pass under the obstruction and rises back up on the other side.
- Unlike normal sewers, an inverted siphon always flows full and operates under hydraulic pressure.

Design Principles of Inverted Siphons

- **Maintaining Velocity:** Since it flows full, it is highly prone to silting if velocity drops. Minimum self-cleansing velocity of 0.9 m/s must be maintained.
- **Multiple Pipes:** To handle varying flows (Dry Weather vs Wet Weather) while maintaining high velocity, siphons are designed with 2 or 3 parallel pipes of varying diameters.
- **Weir Arrangement:** The inlet chamber has overflow weirs. Only the smallest pipe is used during low flow. When flow increases, water spills over the weir into the second, and then the third pipe.

Grease and Oil Traps

- Purpose: Intercepting chambers designed to remove oil, grease, and fat from wastewater before it enters the municipal sewer.
- Necessity: Oil and grease can solidify and form hard, impenetrable crusts on sewer walls, severely reducing pipe capacity or causing complete blockages.
- Location: Mandatory for commercial kitchens, restaurants, automobile garages, and specific industries.

Working of Grease Traps

- Mechanism: Sewage enters a large chamber where the flow velocity drastically drops.
- Separation: Due to lower density, oil and grease float to the surface (forming scum). Heavy solids settle to the bottom.
- Outlet Design: The outlet pipe draws water from the middle clear layer, leaving the floating grease and settled sludge behind.
- Maintenance: The trapped grease must be regularly skimmed off the top manually or mechanically.

Clean-outs and Lamp Holes

- Clean-outs: An inclined pipe extending from the underground branch sewer to the ground surface, fitted with a removable cap. Used for flushing or pushing rodding cables to clear obstructions in small sewers where manholes are too expensive.
- Lamp Holes: Small vertical pipes (stoneware or concrete) with a cover, provided between widely spaced manholes.
- A lamp is lowered into it. Workers in the adjacent manhole look for the light. If visible, the line is straight and clear. (Mostly obsolete with modern CCTV inspection).

Stormwater Regulators (Overflow Weirs)

- Purpose: Used in Combined Sewer Systems to protect treatment plants from hydraulic overload during heavy rainstorms.
- Function: They divert the excess volume of diluted stormwater directly to a natural outfall (river/lake).
- Mechanism: A side weir is constructed in the sewer. During dry weather, all foul sewage goes to the plant. During a storm, the water level rises above the weir crest, and the excess spills over into a relief pipe.
- This ensures the 'first flush' of polluted street water is treated, but the later, relatively clean stormwater is bypassed.

Summary

- Catch basins protect combined sewers from heavy grit but require frequent cleaning to prevent odors.
- Inverted siphons allow gravity sewers to cross physical obstructions by operating under pressure in multiple parallel pipes.
- Grease traps are essential commercial appurtenances to prevent the formation of 'fatbergs' in sewers.
- Stormwater regulators divert excess monsoon flow to prevent overloading treatment plants.

Next Lecture Preview

- Laying, Testing, and Maintenance of Sewers
- How are sewers actually constructed in the field?
- Excavation, bedding, and laying of pipes.
- Hydrostatic and Smoke testing for leakage.
- Sewer cleaning equipment and safety.