

Water Supply & Sanitary Engineering (DI05006021)

Unit 6: Sanitation System

Lecture 24: Methods of Collection: Water Carriage System & Comparison

GTU Diploma Engineering

Agenda

- Introduction to Water Carriage System
- Working Mechanism
- Advantages of Water Carriage System
- Disadvantages and Requirements
- Comparison: Conservancy vs. Water Carriage
- Conclusion on Collection Methods

What is the Water Carriage System?

- A system where water is used as the medium to convey waste from its source to the point of treatment and disposal.
- Feces, urine, and sullage are flushed away using water.
- The solid matter remains suspended in the flowing water.
- Requires a network of closed, underground pipes called sewers.

Working Mechanism

- Collection: Waste is collected in sanitary fittings (water closets, sinks) inside buildings.
- Flushing: A large volume of water flushes the waste into house drains.
- Conveyance: Gravity flows move the waste (now called sewage) through branch sewers to main sewers.
- Treatment: Sewage reaches a centralized Sewage Treatment Plant (STP) before final disposal.

Advantages: Health and Hygiene

- Highly hygienic: Waste is removed immediately, preventing putrefaction near homes.
- No manual handling of human waste, eliminating social stigma and health risks to workers.
- Closed underground system prevents foul odors, flies, and mosquito breeding.
- Drastically reduces the incidence of waterborne and vector-borne epidemic diseases.

Advantages: Operation and Architecture

- Reliability: Does not depend on a large manual workforce for daily collection.
- Architectural Freedom: Bathrooms and toilets can be located anywhere inside a building.
- Aesthetics: Underground sewers are invisible and maintain the aesthetic appearance of the city.
- Compactness: Requires less land area compared to trenching grounds.

Disadvantages: Cost and Complexity

- High Capital Cost: Requires immense investment for laying underground sewer networks and constructing STPs.
- High Water Requirement: Requires a continuous and abundant piped water supply (at least 135 LPCD) to function.
- Skilled Engineering: Designing and laying sewers at proper gradients requires high technical expertise.

Disadvantages: Environmental Risks

- Pollution Risk: If the STP fails or is inadequate, large volumes of concentrated sewage pollute receiving water bodies.
- Maintenance Difficulties: Blockages in underground sewers are difficult and hazardous to clear.
- Pumping Costs: Flat terrain may require pumping stations, increasing operational costs.

Comparison: Hygiene & Environment

Concept 1

Concept 2

Conservancy: Highly unhygienic; risk of flies, odors, and epidemics. Open drains.

Water Carriage: Highly hygienic; closed system, no odors or vector breeding.

Conservancy: Night soil used for manure; potential for groundwater pollution.

Water Carriage: Requires complex treatment; potential for severe surface water pollution if untreated.

Comparison: Economics & Resources

Concept 1

Concept 2

Conservancy: Low initial cost, high operating cost (labor).

Water Carriage: High initial cost, low operating cost (gravity flow).

Conservancy: Requires very little water.

Water Carriage: Requires abundant, continuous water supply.

Conservancy: Large labor force required.

Water Carriage: Skilled engineers and technicians required.

Comparison: Design & Urban Planning

Concept 1

Concept 2

Conservancy: Toilets must be on outer walls for sweeper access.
Prevents dense, high-rise development.

Water Carriage: Toilets can be anywhere. Essential for high-rise buildings and dense urban areas.

Conservancy: Requires large land for trenching outside city.

Water Carriage: Requires specific land for Sewage Treatment Plants.

Conclusion on Collection Methods

- The Water Carriage system is universally preferred for modern urban environments.
- The Conservancy system is virtually obsolete in cities due to human rights and health concerns.
- Transitioning from conservancy to water carriage requires simultaneous development of a reliable water supply network.

Summary

- Water carriage system uses water to transport waste automatically via underground pipes.
- It provides excellent hygiene and allows for modern building design.
- Requires high capital, abundant water, and skilled maintenance.
- It solves the health issues of the conservancy system but requires careful environmental management of the outfall.

Next Lecture Preview

- Types of Sewerage Systems.
- Separate System vs. Combined System.
- Partially Separate System.
- Advantages and disadvantages of each sewerage system.