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Drainage Engineering (BTAI3103)

Module 4 Construction of Pipe Drainage Systems (Lecture-14: Materials for Pipe Drainage Systems)

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Materials for Drain Pipe

- ❖ The materials used for manufacturing drain pipes are
 - clay,
 - concrete, and
 - plastics.

- ❖ Criteria for pipe quality and for selecting the most suitable type of pipes are
 - resistance to mechanical damage,
 - resistance to chemical damage,
 - longevity, and
 - costs



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Clay Tiles

- ✓ Clay tiles used to be predominant type of drain pipes in Europe, from the first introduction of pipe drainage (before 1850), to about 1960-1970 (Cavelaars et al., 1994).
- ✓ Clay tiles were made from clay, shale, fireclay or mixture thereof and burnt (IS, 1983).
- ✓ These clay tiles had common diameters of 0.05 to 0.15 m, and came in lengths of 0.30 to 0.33 m



Fig: Clay Drainage Pipes



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Criteria for testing the quality of clay pipes are:

- shape (they should be straight, with straight-cut ends),
- absence of fissures and cracks (which can be judged by the sound when the pipe is hit),
- mechanical strength (breaking strength)
- should be uniformly burnt and
- should be free from minerals and chemicals that are known to cause slaking or disintegration of tiles (IS, 1983).



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Concrete Pipes

- Concrete pipes were used as field drains like clay tiles in various countries, until they virtually became obsolete with the introduction of plastic pipes
- In larger diameters, concrete pipes are still commonly used as collectors.
- There is practically no limit to their diameter, although for large diameters (i.e., >0.4 m), the concrete must be reinforced.
- Pipe ends are either straight, have a collar, or a spigot-and-groove.
- Water entry is almost exclusively through the joints between pipe sections. For larger diameters, some manufacturers supply rubber sealing rings.



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- Disadvantages of concrete pipes are their susceptibility to acidity and sulphate, which may be present in the soil.



Fig. Reinforced concrete drain pipes



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Plastic Pipes

- The introduction of plastic pipes for drainage started around 1960.
- Initially, straight-walled smooth pipes were used and later around 1970, corrugated pipes (Fig. 9.2b) were introduced
- Advantages of plastic over clay or concrete are
 - much lower weight per meter of pipe, and
 - greater length of pipe (at least several meters).
- Disadvantage of plastic pipes is the environmental pollution caused by the raw material (resin).



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- The three predominant materials for plastic pipes are
 - polyvinyl chloride (PVC),
 - high-density polyethylene (HDPE) and,
 - polypropylene (PP).

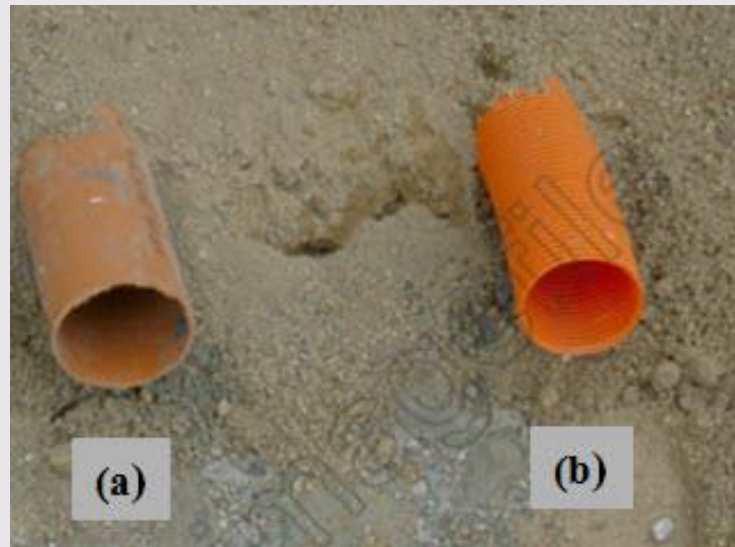


Fig. Plastic drain pipes: (a) Smooth pipe; (b) Corrugated pipe.



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Drain Envelopes

- When a subsurface drain is installed, soil particles or aggregates may be carried into the pipe through the perforations in the pipe wall due to the drag force of the water.
- Drain envelopes are the porous material used to protect the drain pipe from soil particle entry.
- Qualitative guidelines for designing drain envelopes mainly consider soil texture



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Functions of Drain Envelopes

Filter function: to prevent or restrict soil particles from entering the pipe where they may settle and eventually clog the pipe;

Hydraulic function: to constitute a medium of good permeability around the pipe and thus reduce entrance resistance;

Bedding function: to provide-all-round support to the pipe in order to prevent damage due to the soil load. Note that large diameter plastic pipes are embedded in gravel especially for this purpose.



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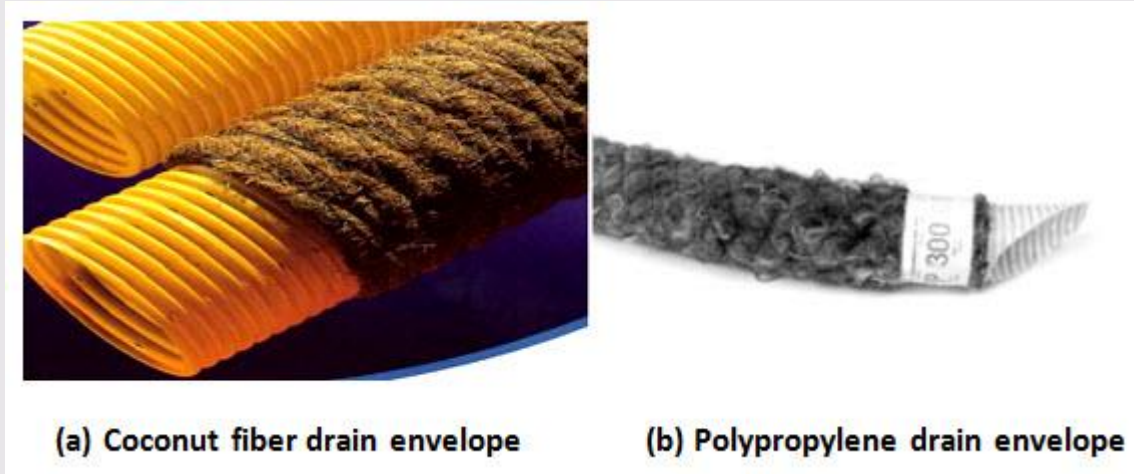
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Envelope Materials

- **Organic material-** mostly fibrous, and includes peat, coconut fiber and various organic waste products like straw, chaff, heather, and sawdust.
- **Mineral materials-** gravel, slag of various kinds (industrial waste products), or fired clay granules.
- **Synthetic materials-** polystyrene, nylon, acryl, and polypropylene.
- **Mineral fibers-** glass fiber, glass wool, and rock wool.



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(a) Coconut fiber drain envelope

(b) Polypropylene drain envelope

Fig. Drain-envelope materials: (a) Coconut fiber; (b) Polypropylene.

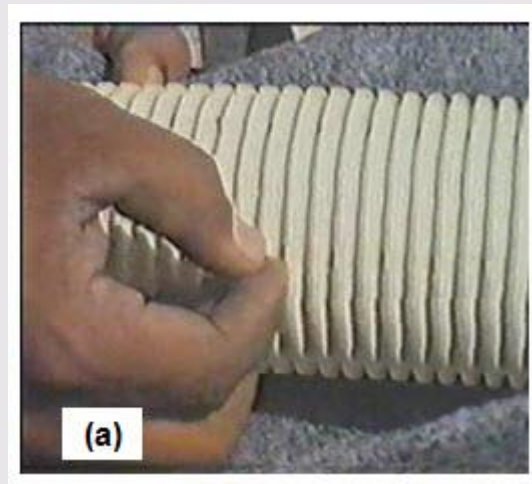


Fig. Corrugated perforated PVC pipe



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