Project of Sanitary Engineering

Assignment 2: Design of a water distribution and wastewater drainage systems

Practical class for week 12:

- Previous work:
  - Check pressures
  - Check fire condition
  - Check minimum velocity

- Goals for week 12:
  - Location of appurtenances
  - Construction node’s map specifications (10 nodes)
  - Map layout for the sewage drainage system
  - Calculation of design flows

LOCATION OF APPURTENANCES: in a drawing with network map and topography

SECTIONING VALVES

DISCHARGE VALVES
  - In the lowest point of each sectionable pipe;
  - In intermediate points when pipe are very long, to reduce discharge time and minimize the number of consumers disturbed

FIRE HYDRANT
  - Close to side walks;
  - When possible in cross sections;
  - Minimum distance between fire hydrants – depends on the fire risk grade
Assignment 2: Design of a water distribution and wastewater drainage systems

- Flow by gravity;
- Branched network (no loops);
- Manhole location:
  - Whenever two or more pipes meet;
  - When pipe change direction, slope or diameter;
  - In straight lines, with a maximum distance of 60 or 100 m (for pipe without and with direct access)
- Maximum angle between pipes – 90°

Commercial curves available:
- 90º
- 45º
- 22° 30’
- 11° 15’
Determine accumulated population in each pipe

→ Fictional lengths – $L_i = L_c_i$
  
  $c_i \Rightarrow$ distribution coefficient
  
  $c_i = 1$ – both sides of the road
  
  $c_i = 0.5$ – only one side of the road
  
  $c_i = 0$ – no service (no wastewater collection)

→ Unit Population – PUP (inh/m)

$$PUP = \frac{P_{total}}{\sum L_i}$$

→ accumulated population in pipe $x$

$$P_{acum_x} = PUP \cdot L_{f_x, acum}$$

where $L_{f_x, acum}$ represents the sum of all $L_{f_i}$ that lead to pipe $x$, including that pipe contributing population.

### Design Flow

Determine the design flow for each pipe

→ average wastewater flow

$$Q_m = Pop \times Per \_capit \_consu \times Coef \_afluência$$

$$0.7 \leq Coef \_afluência \leq 0.9$$

→ Infiltration flow

$$0 < Q_e \leq Q_m$$

$$Q_e = Q_m \cdot D > 300 \text{mm}$$

$$Q_e = 500 \text{L/day/km/cm\phi}$$

$$Q_e = 1 \text{L/s/km}$$

→ Design flow → peak flow

$$Q_p = Q_m \cdot f_p + Q_i$$

$$f_p = 1.5 + \frac{60}{\sqrt{Pop}}$$

$f_{\text{máx}} = 5$