BUILDING WATER SUPPLY & SANITARY INSTALLATION

CHAPTER 4

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BUILDING WATER SUPPLY

Assume draw-offs on each all to be at the same level. Size for largest draw-off a branch, i.e. bath.
Purpose

Provide potable water supply to each fixture from water sources

For sanitation and fire protection
Types of System

- Direct connection from the main
- Pumped system
System Selection

• Demand (pressure and flow)
• Type of building occupancy
• Aesthetics
• Economy
• Use
• Maintainability
• Flexibility to failure
Storage Cisterns

- Capacity
  - Type and use of buildings
  - Likelihood and frequency of supply breakdown
  - Number of occupants
  - Pattern of use
Pipe sizing

- Layout to each fixtures
- Assume a pipe diameter
- Determine the flow rate
- Determine the effective pipe length
- Calculate the permissible loss of head
- Determine the pipe diameter
Fixtures flow rate

**Loading units** - a factor or number given to an appliance relating flow rate to the duration and frequency of use (probable usage).

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Flow rate (l/s)</th>
<th>Loading units (Z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) WC cistern / bidet / wash basin</td>
<td>0.125</td>
<td>0.50</td>
</tr>
<tr>
<td>(b) Flush valve (urinal)</td>
<td>0.125</td>
<td>0.50</td>
</tr>
<tr>
<td>(c) Sink</td>
<td>0.25</td>
<td>1.00</td>
</tr>
<tr>
<td>(d) Shower</td>
<td>0.25</td>
<td>1.00</td>
</tr>
<tr>
<td>(e) Bath</td>
<td>0.35</td>
<td>1.96</td>
</tr>
<tr>
<td>(f) Flush valve (WC)</td>
<td>0.52</td>
<td>4.32</td>
</tr>
<tr>
<td>(g) Laundry tub</td>
<td>0.25</td>
<td>1.00</td>
</tr>
<tr>
<td>(h) Washing machines (dish washer)</td>
<td>0.25</td>
<td>1.00</td>
</tr>
<tr>
<td>(i) Hose tap (20 nom-size)</td>
<td>0.30</td>
<td>1.44</td>
</tr>
<tr>
<td>(j) Hose tap (15 nom-size)</td>
<td>0.20</td>
<td>0.64</td>
</tr>
<tr>
<td>(k) Cistern for urinal</td>
<td>0.004</td>
<td>*</td>
</tr>
<tr>
<td>(l) Spray tap (Drinking fountain)</td>
<td>0.04</td>
<td>*</td>
</tr>
</tbody>
</table>

\[ Z = \left(\frac{q}{0.25}\right)^2 \]

For simultaneous flow

\[ Q = 0.25 \sqrt{Z_1 + Z_2 + \ldots + Z_n} \]
Fixtures flow rate

12 wash basins $\times 0.5 = 6$
10 WCs $\times 0.5 = 5$
2 urinals $\times 0.5 = 1$
2 sinks $\times 1 = 2$
Total loading units $= 14$

$Q = 0.25\sqrt{14} = 0.935 \text{ l/sec}$
Effective pipe length

Measure pipe length + equivalent pipe length

<table>
<thead>
<tr>
<th>Bore of pipe mm</th>
<th>Equivalent pipe length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elbow m</td>
</tr>
<tr>
<td>12</td>
<td>0.5</td>
</tr>
<tr>
<td>20</td>
<td>0.8</td>
</tr>
<tr>
<td>25</td>
<td>1.0</td>
</tr>
<tr>
<td>32</td>
<td>1.4</td>
</tr>
<tr>
<td>40</td>
<td>1.7</td>
</tr>
<tr>
<td>50</td>
<td>2.3</td>
</tr>
<tr>
<td>65</td>
<td>3.0</td>
</tr>
<tr>
<td>73</td>
<td>3.4</td>
</tr>
</tbody>
</table>
Effective pipe length

Assumed pipe diameter 20 mm.

double check valve assembly
stopvalve

pipe bend
1 m
0.25 m
eff
0.5 m
eff
3 m
eff

Measured pipe length 4.75 m.

<table>
<thead>
<tr>
<th>Pipe Component</th>
<th>Equivalent Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>elbows</td>
<td>2 × 0.8 = 1.6 m</td>
</tr>
<tr>
<td>tee</td>
<td>1 × 1.0 = 1.0 m</td>
</tr>
<tr>
<td>stopvalve</td>
<td>1 × 7.0 = 7.0 m</td>
</tr>
<tr>
<td>taps</td>
<td>2 × 3.7 = 7.4 m</td>
</tr>
<tr>
<td>check valves</td>
<td>2 × 4.3 = 8.6 m</td>
</tr>
</tbody>
</table>

Effective pipe length = 30.35 m
Head loss calculation

(b) available head (pressure)
- at the water main
- from the storage cistern
- at point of delivery

Available head (from cistern) = vertical distance in metres from water line in cistern to point under consideration
= head at main minus height above main
Available head (mains supply) = 20 m – 4 m
= 16 m head

Permissible head loss (m/m run) = \frac{\text{Available head (m)}}{\text{Effective pipe length (m)}}
Head loss calculation

Pressure at taps 45 m head

Flow rate for 2 taps 0.4 l/s

Permissible head loss = \frac{\text{available head (45 m)}}{\text{effective pipe length (30.55 m)}}

= 1.48 m/m run
Determine pipe diameter

For diameter of 20 mm
With Q = 0.93 l/sec
From the graph we’ve:
Head loss = 0.42 m/m  Ok!
V = 2.8 m/s   hmmm!

For diameter of 25 mm
With Q = 0.93 l/sec
From the graph we’ve:
Head loss = 0.15 m/m  ok!
V = 1.8 m/s   ok!
BUILDING SANITARY INSTALLATION

- Flushing valve
- Level of vent where required
- Spillover level
- WC pan
- Urinal
- Floor level

300 mm minimum
150 mm minimum
PLEASE READ!