CE 3372 WATER SYSTEMS DESIGN

DESIGN GUIDELINES – DRINKING WATER SUPPLY PART 2 (FALL 2020)

PROJECT LAYOUT

- Notice that most of the manuals spend considerable space explaining how drawings are to be submitted for approval.
- The actual layout is flexible (within right-of-way) and up to the hydraulic engineer to some extent.
- A designer would typically use some version of the following to design a new water distribution system:

PROJECT LAYOUT - CONTINUED

- A designer would typically use some version of the following to design a new water distribution system:
  1. Set up the system grid on the area plan. Aerial photo plots to scale are excellent tools
  2. Allocate average daily demands at nodes;
  3. Determine the peak factors;
  4. Estimate fire demands;
  5. Project demands for future expansion of the service areas.

PROJECT LAYOUT - CONTINUED

- A node is considered a junction point in a system where a demand can be attributed/assigned.
- Models use the nodes to calculate the system demands, pressures, water quality, and velocity.
- These items are usually prescribed in guidance documents with minimum/maximum acceptable values.

PROJECT LAYOUT - CONTINUED

- The practical design of a water system without the use of water distribution modeling software is possible, but requires a logical, economical approach of laying out the system (and some roll your own calculations)
  - professional quality software is inexpensive (free) so there is really no reason to design a system without using a hydraulic model - hence the guidance documents nearly demand a model.

PROJECT LAYOUT - CONTINUED

- Commercial software is usually far easier for a designer to use and integrated into other design tools, but is computationally about the same as free software
  - by all means a designer should use commercial software when it is available.

EXISTING DATA

- The designer will need reliable sources to determine demands.
  - Obviously a discussion with the owners is critical but the actual quantities will have to be calculated for a design situation.
- A land use plan or zoning map will help to determine the future demands.

EXISTING DATA

- The demands need to be compiled and situated on an area map.
- Once complete this map can help determine node locations and pipe diameter for the system schematic

PIPE DIAMETER

- The selected pipe diameters affect system hydraulics.
- The trench is the biggest cost, and the hydraulics should be used to set adequate pipe sizes.
  - Designers need to determine the proper pipe size in order to meet peak demands and fire protection while maintaining an adequate dynamic pressure in the system.

PRESSURE ZONES

- Pressure zones are set up to regulate pressure in locations where large grade changes will create too much pressure at the lower end of the system and not enough pressure in the higher ends.
  - More than an 80 feet differential will require a pressure zone.
  - In areas of even larger grade differentials, such as hill country or mountain communities, several consecutive pressure zones may be needed.

PRESSURE ZONES

- The following equations can assist in determining the HGLs for the pressure zones.
  - HGLMIN = Highest Elevation + (2.31x Minimum Working Pressure)
  - HGLMAX = Lowest Elevation + (2.31x Maximum Working Pressure)

JUNCTION LOCATION AND ELEVATION

- Location of junctions will depend more upon the planned layout of the project site than the affect they will have upon the hydraulic model.
  - In general grid distribution node locations have little affect upon the overall model since there are customer demands along the real system between nodes. Node locations and their elevations are more relative in large transmission mains.
  - Nodes generally should be placed at the lowest elevation of a looped system where the grades uctuate signicantly.

MATERIALS

- The pipe materials will effect system performance.
- Water distribution systems are built from ductile iron pipe, ABS, PVC, and HDPE.
  - All are good materials for specific applications and various fittings to join different materials are available.
- Different jurisdictions may specify specific materials; the designer needs to read the guidance document for the specific locale.