CE 3372 WATER SYSTEMS DESIGN

DESIGN GUIDELINES – STORMWATER COLLECTION (FALL 2020)

STORMWATER COLLECTION SYSTEMS

- Stormwater collection systems convey water away from a source to an outlet or release at a desired location. Sources include:
  - Parking lots, roofs, residences, etc. Anything that produces runoff that can pond

REGULATORY GUIDANCE DOCUMENTS

- Regulatory guidance documents are a principal tool in system design, along with the designers creativity, and the owners access to right-of-way;
- FEMA (Federal Emergency Management Agency) writes federal regulations for construction, maintenance, treatment and operation of storm water facilities;
- EPA, USACOE, USBR all have roles;
- State Transportation Departments, Cities, EPAs(or equivalents) are charged with regulating aspects of the standards and permitting.

REPRESENTATIVE COMMUNITY MANUALS

- City of Lubbock
- City of Houston
- HCFCD
- Texas Department of Transportation Hydraulic Design Manual

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 stormwater collection system:

PROJECT LAYOUT - CONTINUED

- A designer would typically use some version of the following to design a stormwater collection system:
  1. Set up a drainage network layout on the area plan. Aerial photo plots to scale are excellent tools
  2. Determine the peak discharges at different locations (hydrology);
  3. Route discharges to outfall with/without drainage system - evaluate need for capacity;
  4. Project capacity for future expansion of the service areas.
  5. Design drainage infrastructure to control ponding depth in areas of interest.

PROJECT LAYOUT - CONTINUED

- A node is considered a junction point in a system where discharge can be attributed/assigned and ponding depth can be specified.
- Models use the nodes to calculate the water elevations, 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 stormwater system without the use of modeling software is quite possible, but large scale systems would be hard to design
  - 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 capacity.
  - 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 required capacity.

EXISTING DATA

- The capacities need to be compiled and situated on an area map.
- Once complete this map can help determine node locations and conduit dimensions for physical infrastructure schematic

PIPE DIAMETER

- The selected conduit dimensions 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.

JUNCTION LOCATION AND ELEVATION

- Location of junctions will depend upon the planned layout of the project site and the affect they will have upon the hydraulic model.
  - Collection node locations have substantial affect upon the overall model - and are a design feature
  - Conduit geometry have substantial affect upon the overall model - and are a design feature
  - Consideration of existing drainage is vital - the process is more detailed than a pipe network.

MATERIALS

- The conduit materials will effect system performance.
- Stormwater collection systems are built from RCP, 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.