



PMM Standard 9.10

City of St. Charles

Public Works Department

Final Design Checklist

Project Name _____

Project No. _____ Reviewed By: _____

Assigned Inspector _____

Design Project Manager _____

Final Field Check Date _____

July 2013

Scope and Purpose:

The City of St. Charles Public Works department strives to produce contract ready error free plans. The key to success is good communication and documented expectations and procedures for the design of projects. The Project Management Manual (PMM) serves as the guide to the development of the project plans and project decision making, the purpose of this document is to supplement the PMM and ensure project plan design and details are prepared in a uniform and complete manner and to provide a guide for quality assurance / quality control for plans let by the City of St. Charles Public Works Department.

Design Review

The primary responsibility for plan correctness and consistency lies with the Engineer of Record for the design plans. The plan review process completed by the City of St. Charles Public Works Department serves as another layer of QA / QC for the production of quality plans. It should be noted that QA / QC is expected to be performed by the design firm prior to submission of plans, specifications (including bid package) and estimate for review by the City of St. Charles. The submitted plans are expected to be relatively error free and complete.

Plans, Specifications and Estimate (PS&E) are expected to be submitted by the date specified online on ProjectManager.com. City staff will work to complete the design review within the specified timeframe. The design firm will work to complete all design revisions in order to deliver an on-time project letting as determined by the schedule specified online in ProjectManager.com. If additional time is necessary to finish the revision process, a change request needs to be submitted on ProjectManager.com for the extension in time as outlined in the PMM.

Ultimately the design of projects shall be in accordance with the standards outlined in the City's PMM. Any deviation from the standards requires a design exception approved by the Project Manager, Senior Project Manager, City Engineer and Public Works Director. The Design Exception Form can be found online at ProjectManager.com in the Standards Folder.

DESIGN STANDARDS USED(Most Recent Edition):

ROADWAY STANDARDS

- St. Louis County Highway Design Criteria
- AASHTO Policy on Geometric Design
- MoDOT EPG
- MoDOT LPA Manual
- AASHTO Roadside Design Guide
- MUTCD

SANITARY STANDARDS

- Ten States Standards
- MDNR Wastewater Design Criteria
- MSD Pump Station Design
- MSD Plan Preparation Guidelines

SIDEWALK AND BICYCLE FACILITIES STANDARDS

- AASHTO Guide for the Development of Bicycle Facilities
- ADAAG

WATER STANDARDS

- Ten States Standards
- AWWA Manuals of Water Supply
- City Water Std. Specs and Details

STORMWATER STANDARDS

- MSD Plan Preparation Guidelines
- MSD Standard Construction Specifications
- Army Corps of Engineers

OTHER STANDARDS

-
-
-

_____ Date of any Design Exception Approval (List on Title Sheet of Plans)

OUTSIDE CONSIDERATIONS

Legend

- x **Complete / OK**
- > **Needs Attention**
- na **Not Applicable**

*** - To be included by Preliminary Design Plan Submittal**

*** - To be included by Right-of-Way Plan Submittal**

All other items to be included on the Pre-Final PS&E submittal

Utility (Underground) Facilities

The design firm is encouraged to take early attention to the location of known and unknown underground utilities that might be encountered during construction. The use of Subsurface Utility Engineering (SUE) will be determined and required by section 4.1.1 of the Project Management Manual (PMM). The design engineer has been given access to the City's GIS information, showing existing utilities.

_____ Subsurface Utility Engineering has been employed *

_____ Project does not have the potential to impact subsurface utilities *

Utility Relocation Plan / Schedule of Adjustment

The design firm is required to coordinate with the utilities involved on the project and gather the utilities plan of relocation prior to bidding the project. The design firm will need to coordinate with all affected utility companies in accordance with the PMM.

Utility Relocation Plans have been received and shown on the design plans:

_____ Ameren Relocation * Date _____ Shown on Plans

_____ AT&T Relocation * Date _____ Shown on Plans

_____ Charter Relocation * Date _____ Shown on Plans

_____ Laclede Relocation * Date _____ Shown on Plans

_____ Missouri American Water Relocation * Date _____ Shown on Plans

_____ Other Relocation * Date _____ Shown on Plans

Other Agency Approvals

_____ Obtain any applicable permits and approvals from other regulating agencies. This to include, but not limited to, MoDOT, St. Charles County, MoDNR, FEMA, and adjoining municipalities. Approvals from other regulating agencies are required prior to improvement plan approval by the City of St. Charles. Include copies of the permits acquired and/or permit forms for permits required by the contractor in the specifications.

_____ Provide proof of approval of improvements by the City of St. Charles Fire Department. *

_____ Provide proof of approval of improvements by the Historic Landmarks Preservation and Architectural Review Board (HLPARB).

_____ Provide proof of approval of building permits and flood elevation certificates issued by the City of St. Charles Community Development Department.

DESIGN PLANS

TITLE SHEET

_____ Plans shall be submitted on 22" x 34" sheets *

_____ All plan sheets shall be signed and sealed by a MO registered professional engineer. *

_____ Provide a location map of the site with north indicated. *

_____ Indicate the benchmark used for all survey data. All survey data shall directly relate to MO State Plane East Coordinates NAVD88 Datum (with projection). *

_____ Show a north arrow on all plan sheets. North should never face the bottom of the page. *

_____ List the City of St. Charles General Notes on the cover sheet. *

1. All improvements constructed herein shall comply with the Code of Ordinances of the City of St. Charles.
2. If property is greater than 1 acre, a Land Disturbance permit from the Missouri Department of Natural Resources is required prior to commencing any demolition, clearing or construction on site. Provide copy of approval from the Department of Natural Resources to the Public Works Department. (Permit #_____)
3. Siltation control shall be the responsibility of the contractor and shall be in accordance with the SWPPP plan. Additional siltation control may be required as directed by the City Engineer. (Code Section 510.090.B)
4. When grading operations are completed or suspended for more than 30 days, permanent grass must be established to control erosion. (Code Section 510.090.D.1)
5. All mud and debris from construction site to be kept off of City maintained streets. Streets shall be swept twice daily. (Code Section 510.090.E)

6. Handicap spaces cannot have a grade in excess of 2% in any direction. (Code Section 400.705.B.4)
7. Handicap accessible routes and ramps cannot have a cross slope in excess of 2%.(Code Section 400.705.B.4)
8. All water main construction including valves, sleeves, meters, hydrants and fittings must conform to City of St. Charles Water Specifications.
9. When a sanitary sewer lateral crosses over a water line, a minimum vertical clearance of 18" shall be provided. If this clearance is not possible, then both the water line and the sewer line will be encased in concrete until there is a 10' horizontal clearance between the two lines.
10. All sanitary sewer construction must conform to the latest version of the Metropolitan St. Louis Sewer District's standards and specifications.
11. All street and sidewalk construction is to be per the latest St. Charles City standards.
12. Flowable fill backfill shall be used for all backfill on sewer trenches that are under City streets, from the top of the bedding material (6 inches above the pipe) to the surface, or to within one foot of grade in landscaped areas. (Code Section 510.280.D.1.a)
13. Earth backfill (meeting MSD standards) may be used outside of paved areas, from the top of the bedding material to the surface. Earth backfill should be placed in a maximum 8-inch loose lifts and shall be mechanically compacted to a minimum density of 85% maximum density as determined by the Modified AASHTO T-180 Compaction Test or 90% of maximum density as determined by the Standard Proctor Test AASHTO T-99.
14. All storm sewer design is to conform to the City of St. Charles design requirements. (Code Section 510.290)
15. All storm sewer construction is to be per the Latest Edition of the Metropolitan St. Louis Sewer District (MSD) Standard Construction Specifications for Sewers and Drainage Facilities. (Code Section 510.280)
16. For New Subdivisions Only:
 - i. All jetting shall be performed with a probe route on not greater than 7.5-foot centers with the jetting probe centered over and parallel with the direction of the pipe. Trench widths greater than 10 feet will require multiple probes every 7.5-foot centers. Trench backfill depths less than 8 feet in depth shall be probed to a depth extending to half of the trench backfill, but not less than 3 feet. Trench backfill greater than 8 feet in depth shall be probed to half the depth of the trench backfill but not greater than 8 feet. Jetting shall be performed from the low surface topographic point and proceed toward the high point, and from the bottom of the trench backfill towards the surface. The flooding of each jetting probe shall

be started slowly allowing slow saturation of the soil. Water is not to be allowed to flow away from the ditch without first saturating the trench. Contractor shall identify the locations of surface bridging (the tendency for the upper backfill crust to arch over the trench rather than collapse and consolidate during the jetting process). The contractor shall break down the bridged areas using an appropriate method such as the wheels or bucket of a backhoe. When the surface crust is collapsed, the void shall be backfilled with the same material within the sunken/jetted area shall be compacted such that no further surface subsidence occurs. (Code Section 510.280)

17. All pipe joints and joints on new structures shall use City approved rubber compression type joints. Water stops are required at all points of connection not using rubber compression type joints such as connections to existing structures. (Code Section 510.280.F)
18. Concrete covers on structures will not be allowed. Only cast iron covers are permitted. (Code Section 510.280.E)
19. Brick storm and sanitary structures will not be allowed.
20. It shall be the responsibility of the contractor/developer to provide traffic control per the latest edition of the Manual of Uniform Traffic Control Devices.
21. All utilities shall be located underground.
22. All filled places under proposed storm and sanitary sewer and/or paved areas shall be compacted to 90% of maximum density as determined by the Modified AASHTO T-180 Compaction Test or 95% of maximum density as determined by the Standard Proctor Test AASHTO T-99.
23. All filled places in proposed roads shall be compacted from the bottom of the fill up to 90% maximum density as determined by the Modified AASHTO T-180 Compaction Test or 95% of maximum density as determined by the Standard Proctor Test AASHTO T-99. All tests shall be verified by a soils engineer concurrent with grading and backfilling operations.
24. Grades cannot exceed a 3:1 slope. (Code Section 510.090.A)
25. Construction activities shall abide by the noise restrictions as outlines in Code Section 230.

_____ List all utility companies serving the project *

_____ Indicate how the project will be served by electric *

_____ Indicate on the plans any permits that have already been approved for this project *

- _____ Design Roadway Designation Information (ADT, DHV, D, T, Speeds, Functional Classification) *
- _____ Index of Sheets listing all plan sheets *
- _____ Length of Project *
- _____ Township and Range location *
- _____ Project scope description (Roadway Reconstruction, Sanitary Sewer Construction, etc.) *
- _____ Signature line for Director of Public Works
- _____ List the Design Standards utilized in the development of the plans. *

Typical Section Sheet

- _____ Typical Section Sheet x of x labeled *
- _____ Post the asphalt materials application rates on the first typical section sheet. Display the entire mix description.
- _____ Note Rumble Strip Location and type. *
- _____ Show base rock under all sidewalks. *
- _____ Show composition and thickness of existing pavements and bases. Pavement history with dates and thicknesses. *
- _____ Show the location of full and partial depth sawcuts. *
- _____ Show the station limits for each typical section. Station Limits include the entire project limits. *
- _____ Bypass typical section. *
- _____ Show the paylimits for materials.
- _____ Label the centerline or baseline and show the location of the profile grade. *
- _____ Provide a joint layout with bar locations for non typical areas.

- _____ Show lane and shoulder widths, cross slope, and superelevation max for each typical. *
- _____ Show typical fill and cut slopes. *
- _____ Show proper jointing plan for pavement. *
- _____ Label the type of curb and gutter. *
- _____ Show typical right of way limits. *

Summary of Quantities Sheets

- _____ Quantity sheets to be numbered 2.
- _____ Sheet x of x posted on each sheet.
- _____ Summary of Quantities sheet (2A) matches the bid item sheets.
- _____ Summary of Quantities sheets (2A) list the bid item number.
- _____ Quantities should be 3 dimensional calculations where applicable.
- _____ Check all quantities against items shown on the plan sheets. Show enough detail on the summary quantities to verify quantities, ie – Station, Location, Length, and Average Widths. Note locations of items for easy reference.
- _____ Refrain from putting pay item numbers on the quantity sheets.
- _____ Removal of Improvements = 1 LS. Show enough detail including amounts and locations of all removals. List all full depth sawcut for removal locations within the detail.
- _____ Make sure to list Mobilization = 1 LS.
- _____ Earthwork, show tabular results of the cut and fill for the project. List all shrink and swell factors used in the calculation of earthwork.
- _____ Embankment in Place includes compaction.
- _____ Compaction paid for in the cut areas.

- _____ Erosion control items listed. Add 10% contingency to erosion control devices.
- _____ Temporary seeding should be incidental to the project unless there is specific phasing that requires temporary seeding.
- _____ Pavement Repairs – Detail length, width, and location of repaired slabs. Tie bars are incidental to the pavement cost
- _____ Pay for reestablishing right-of-way markers that will be removed for new right-of-way projects.
- _____ Round all quantities to the pay item level of accuracy.
- _____ Split out quantities by stages if the project is occurring in more than one phase.
- _____ Add Contractor Furnished Surveying and Staking. Make sure to include a JSP that a registered land surveyor is required to do any and all layout.
- _____ Include Clearing and Grubbing by Lump Sum.
- _____ Culvert Cleanout – pipe diameter, length, location, per each.
- _____ Temporary Shoring – incidental to the project.
- _____ Pay item units and quantities match the bid form and estimate units and quantities.
- _____ Show the type of pavement marking used on the project
- _____ Note any items that are incidental to the pay items. i.e. – excavation, backfill, dewatering and compaction for pipe installation.

Plan Sheets

- _____ First Plan Sheet number is number 3. *
- _____ Section, Township and Range is shown for all projects where new property rights have been acquired. *
- _____ North arrow and scale on all plan sheets. Plan sheets shall be drawn to a standard scale that shows enough detail to be easily read. Plan sheets should be a standard scale (1:20 suggested) and should be uniform. The north arrow should never point to the bottom of the page. *

- _____ Apply appropriate notes labeling all work outside what is shown is incidental to the construction of the project. Add a note describing the limits of the right of way. *
- _____ Note stating all utility information is shown for information only and the contractor will be required to determine the location of all utilities prior to commencing work. *
- _____ Legend for any shaded or hatched areas. Make sure hatches/shading is unique and easily distinguished. *
- _____ Label beginning and end of the project limits. *
- _____ Avoid unnecessary lines on the plan sheets. Do not show contours unless necessary. *
- _____ All new features should be solid, heavier, and dark and easily recognizable. Existing features should be dashed and lighter. *
- _____ Label slope cut lines as SLC, and slope fill limits as SLF. *
- _____ Show all crossroad centerline skews and intersections. *
- _____ Note all field located property corners. *
- _____ Show existing and new locations of mailboxes. *
- _____ Items to be removed and relocated need to show the new installed locations. *
- _____ Show all existing and new right of way dimensions and labels. *
- _____ Relocated utilities shown with symbols on the title sheet legend. *
- _____ Horizontal Curve info – include PIs, PCs, PTs. Check design speed and superelevation tables. Provide a table for any superelevated curves. If too busy create a special geometrics sheet. *
- _____ Horizontal Alignment ties match points and coordinates listed on the coordinate point sheet. Reference Points match reference points sheet.
- _____ Show all crossing drainage structures. Label all overtopping flood frequencies and discharge for all crossroad structures. *
- _____ Entrance notes include: Station, Width, Grade, Type, Pipe info, Surfacing, Skew angle. Notes match cross section and profile sheets. *

- _____ Label sideroad and major connection radii. A warping plan should be included to show all side roads and intersections or irregular areas. *
- _____ Drainage structures labeled and stationed. (Size, Type, Skew, Class) *
- _____ Underdrains at all new areas of low pavement.
- _____ Match line stations match the next sheets station. Match lines should reference the adjoining sheet number. *
- _____ Bridge and retaining wall notes. (stations, design high water, storm frequency, flow lines, removal notes)
- _____ Drain basins at bridges and walls. *
- _____ Show signals and lighting (including conduits) on plan sheets. *
- _____ Dimension all non-typical features. *
- _____ Sidewalks meet ADA standards. *
- _____ Guardrails placed with sufficient lateral clearance and meet standard plans and type of guardrail is appropriate for the guardrail location. *
- _____ Note the flood hazard zone from the FIRM map with the panel number and date. *
- _____ Indicate the floodway and floodplain limits on the plan sheets. *
- _____ If constructed in the floodplain, label the 100 yr flood elevation, low floor elevation and low sill elevation. The low floor elevation and low sill elevation must be 1.5 feet above the floodplain elevation. *
- _____ Obtain a floodplain development permit and provide approval from the City of St. Charles Community Development for any work within a floodway or floodplain. *
- _____ Linework for structures and piping reflect the physical dimensions of the improvements. *
- _____ Show the existing and proposed grades on structures that are labeled as ATG.
- _____ Structures labeled as ATG requiring more than adding a riser ring will be a separate bid item.

Profile Sheets

- _____ Begin and End Project notes on all profiles. All equations, and exceptions shown in the plan and profile. *
- _____ Label max superelevation rates with station range, crown section, and transition in the profile view. *
- _____ Show all crossroad drainage structures with flowline elevations and utility crossings. *
- _____ Label all vertical curve info show VPIs, VPCs, VPTs, Ks and SSDs. *
- _____ Earthwork balance point shown on the profile along with volumes, borrow, and excess.
- _____ Show benchmark information *

Reference Points

- _____ Show survey ties with coordinates. At least 3 ties are required.
- _____ Type of reference point is specifically identified.

Missouri Coordinate Sheet

- _____ Coordinates for Beginning and End of Project points.
- _____ Coordinates for intersection points.
- _____ Coordinates for curve data (PC, PI, PT)
- _____ Grid Factor and Convergence (Must show MO State Plane Coordinates, Not Modified State Plane Coordinates)

Work Zone Traffic Management Plan Sheets

- _____ Changeable message signs should generally be contractor furnished/city retained.
- _____ Sign alternative pedestrian routes.
- _____ Address signal location staging.
- _____ Note pavement edge treatment where needed.
- _____ Check detour directional signage.
- _____ Use Directional Indicator Barricades through limits of tapers in which traffic is merging together, do not use them for lane shifts. Use DIBs with lights for nighttime work (Arterials and Collectors).
- _____ Reduce Speed Ahead signs used only where speed is being reduced by 15 mph or more.
- _____ Label all buffer spaces, taper lengths, device spacing, barrier stationing.
- _____ Label all signs UIP, RELOC, or COVER after the first usage.
- _____ Specify barrier taper length and attenuator barrels setup. Add 10% for barrel replacement to the attenuators.
- _____ Any detour specified will carry the traffic loading?
- _____ Staging plan shows temporary / permanent lane closures as well as any existing pavement marking to be obliterated and temporary pavement markings (include removal of temporary pavement markings if necessary).
- _____ Check if temporary traffic signals are needed at intersections.
- _____ Check if remaining pavement space outside of closures/removals is sufficient and/or whether temporary striping is needed for the proposed traffic flow (two-way, one-way, # lanes, etc.).
- _____ Time or duration restrictions.

Erosion Control Plan Sheets

- _____ Erosion control is shown on separate plan sheets.
- _____ Legend depicts the typical erosion control devices.

- _____ Sediment removal calculated for erosion control items (1 cy / 100 lf of silt fence, 1 cy / ditch check).
- _____ All ditch checks should be type II.
- _____ Silt fence should not be used as an inlet protection.
- _____ Consider using more permanent erosion control versus temporary.
- _____ Plan depicts a 25 x 50 temporary gravel washdown area located near the construction entrance and water source.
- _____ All low places are graded to drain.
- _____ Show any interim or staged grading.
- _____ A SWPPP report has been prepared in accordance with MDNR regulations.

Lighting, Signal, ITS, Sound Wall, and Retaining Wall Plan Sheets

- _____ Power supply is the correct type for signals, lighting or signals and lighting and shown in the correct location. *
- _____ Battery backup included. *
- _____ Signals and lighting plan shows the existing signals and lighting equipment and all underground conduit. *
- _____ Signal heads are laid out in the correct location, with supplemental heads where needed. *
- _____ Signal post and base information is clearly labeled, including black mast arms and post requirement. *
- _____ Pull box locations are clearly labeled. *
- _____ Conduit is depicted as bored or open cut. Symbology matches the legend displayed on the plans. *
- _____ All detection zones are shown on the plans. *
- _____ Plans show all necessary signal signing. Signal signing matches the City's standard.
- _____ New signals are not blocking other heads during construction. *

- _____ Mast arms are standard lengths with a 55 ft maximum. Are existing mast arms adequate for any pavement widening projects. *
- _____ Signals plans include any pedestrian signals and push buttons. Pedestrian signals and buttons are ADA compliant. *
- _____ Signals and lighting plans show all existing utilities. Bases are not through utilities or posts are not within 10 feet of overhead power lines. *
- _____ Lighting provides consistent coverage and is either stand alone or signal mounted. *
- _____ Controller doors open away from traffic. *
- _____ Is advance detection needed. *
- _____ 2 conduits between controller and 1st pull box. *
- _____ Conduits are sized for the number of cables needed. *
- _____ Signal and Lighting quantity sheets show all the quantities from the plan sheets.
- _____ A wiring diagram is included for the signalized intersection. Diagram includes the street names and a north arrow.
- _____ Pull boxes sized for conductors. Class 1 – 22 or less. Class 2 23-69. Class 3 more than 69. *
- _____ Signal heads, visors, louvers, and backplates are all detailed Signal heads depict mast arm or upright location.
- _____ Conduit is 3 inch from source to power supply and power supply to controller. 2-3" from controller to 1st pull box. All conduit is a minimum of 3 inches. From pull boxes to loops 1" conduit is used. Conduit for fiber is 2". *
- _____ Conduit lengths include +4 ft at controller, +4 ft at power supply, +4 ft at type a signal base, +2 ft at type c or type f signal base, -1 ft at pull box.
- _____ Cable sized correctly. 2 AWG power source to supply. 8 AWG minimum power supply to controller.
- _____ Signal breakers are sized for the signal loading.

_____ 7c#16 for vehicular signal heads, 5c#16 for pedestrian signal heads, 2c#16 for pedestrian push buttons. 1c#14 in duct for detector. Video uses power and coaxial cable.

_____ Lighting is 2c#12 from controller to pull box. 1c#10 pull box to luminaire. Fiber is usually 24 strand single mode fiber.

_____ Cable lengths account for +35 at power source, +8 at power supply, +8 at controller, +6 at each pull box, +3 at each pull box for spliced cables, +13 for top or side mounted vehicular heads, +10 for pedestrian heads, +9 for push buttons, +21 for mast arm signals, +30 for bracket arm cameras or luminaires + length of bracket arm+length to turn up the post, +60 fiber at class 5 pull box near cabinet, +10 of fiber cable at intermediate pull boxes.

_____ Jumpers noted where two signals are together. Calculate the length to the furthest then jump back.

_____ Auxiliary breaker shown as 15 amp.

_____ Signal load switch assignments are shown.

_____ Signals Ring diagrams are shown.

_____ Controller type is detailed.

Retaining Wall / Sound Wall Sheets

_____ Retaining and sound wall profile shows the existing ground, footing, and top of wall elevation and proposed contours. *

_____ Retaining wall plan view is included on the retaining wall sheets. *

_____ Retaining walls over 4' from finish grade to top of wall require a building permit.*

_____ Retaining walls over 6' require a fence or protective barrier. *

_____ Retaining walls should be labeled with quantity (sf) and require a JSP noting that the exposed face of the wall is all that is measured for payment.*

Signing Plan Sheets

_____ Verify the signing quantities from the signing plans and estimate.

_____ Signs conform to the MUTCD standard. *

_____ Signing quantities include all appurtenances or clearly state the cost of all hardware is included in the cost of the sign. This should include mounting type for all signs (breakaway, standard, etc.).

_____ Signing plans shall clearly detail any electronic signs (speed limit, crosswalk, etc.) and should note on the detail which items are included in the cost of the sign.

_____ All signs are labeled with station and offset and note that the contractor shall install City supplied tags.

Pavement Marking Plan Sheets

_____ Intermittent striping calculated as station to station divided by 4.

_____ Include Pavement Marking Removal quantities where required.

_____ Pavement markings shall follow MUTCD standards.

_____ Provide details on reflective markers on raised islands. Reflective markers should be included on all raised islands.

_____ Stop bars, crosswalks, and arrows are type 2 preformed marking tape.

_____ Plans detail color and width of all markings. Provide dimensions/stations for all pavement markings.

Culvert / Storm Sewer Plan Sheets

_____ Show existing and proposed grade lines on profiles and sections. *

_____ Label the pipe size, length, slope, class, and material on the profile sheets. Pipe backfill should be incidental to the cost of the pipe. *

_____ Inlets and manholes are paid for by the depth of structure. *

_____ Box culverts labeled with skew, size, barrel width x height x length. Check the DHW is the same on the road profile as the culvert section. *

_____ Inlet details the type of inlet or grate to be used. *

_____ Rock lining or other permanent erosion control is installed at channel changes. It is required to have geotextile material under rock lining. *

Design meets MSD standards for construction. MoDOT standards only when on MoDOT right-of-way.*

Pipes do not decrease in size in the direction of flow.*

Sewers shall be aligned: *

1. To be in a straight line between structures, such as manholes, inlets, inlet manholes and junction chambers, for all pipe sewers thirty (30) inches in diameter and smaller.
2. To be parallel with or perpendicular to the centerlines of straight streets unless otherwise unavoidable. Deviations may be made only with approval of the City Engineer.
3. To avoid meandering, off-setting and unnecessary angular changes.
4. To make angular changes in alignment for sewers thirty (30) inches in diameter or smaller in a manhole located at the angle point, and for sewers thirty- six (36) inches in diameter or larger, by a uniform curve between two tangents. Curves shall have a minimum radius of ten times the pipe diameter.
5. To avoid angular changes in direction greater than necessary and any exceeding ninety (90) degrees. Structures should be designed to accommodate A-loks or Z-loks.
6. Avoid long runs underneath the pavement.

Storm sewers shall be located: *

1. To serve all property conveniently and to best advantage.
2. In public streets, roads, alleys, rights-of-way, or in sewer easements dedicated to the City.
3. On private property along property lines or immediately adjacent to public streets, avoiding diagonal crossings through the central areas of the property.
4. At a sufficient distance from existing and proposed buildings including footings, and underground utilities or other sewers to avoid encroachments and reduce construction hazards.
5. To avoid interference between other stormwater sewers and house connections to foulwater or sanitary sewers.
6. In unpaved or unimproved areas whenever possible.
7. To avoid, whenever possible, any locations known to be or probably to be beneath curbs, paving or other improvements particularly when laid parallel to centerlines.
8. Drainage to sinkholes is not permitted.
9. Crossing perpendicular to street, unless otherwise unavoidable.

The flowline of storm sewers shall meet the following requirements: *

1. The flowline shall be straight or without gradient change between the inner walls of connected structures; that is, from manhole to manhole, manhole to junction chamber, inlet to manhole, or inlet to inlet.
2. Gradient changes in successive reaches normally shall be consistent and regular. Gradient designations less than the nearest 0.001 foot per foot, except under special circumstances and for larger sewers, shall be avoided.
3. Sewer depths shall be determined primarily by the requirements of pipe or conduit size, utility obstructions, required connections, future extensions and adequate cover.
4. Stormwater pipes discharging into lakes shall have the discharge flowline a minimum of three (3) feet above the lake bottom at the discharge point or no higher than the normal water line.
5. A concrete cradle is required when the grade of a sewer is twenty (20) percent or greater. A special design and specification is required for grades exceeding fifty percent (50%).
6. For sewers with a design grade less than one percent (1%), field verification of the sewer grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements.
7. The City may require the submittal of revised hydraulic calculations for any sewer reach having an as-built grade flatter than the design grade by more than 0.1%. Based on a review of this hydraulic information, the City may require the removal and replacement of any portion of the sewer required to ensure sufficient hydraulic capacity of the system.
8. Drops greater than 5 feet require reinforced concrete bottoms.

Manholes shall be designed to: *

1. For sewers thirty (30) inches in diameter or smaller, manholes shall be located at changes in direction; changes in size of pipe; changes in flowline gradient of pipes, and at junction points with sewers and inlet lines. For sewers thirty-three (33) inches in diameter and larger, manholes shall be located on special structures at junction points with other sewers and at changes of size, alignment change and gradient. A manhole shall be located at one end of a short curve and at each end of a long curve.
2. Spacing of manholes shall not exceed four hundred (400) feet for pipe sewers thirty-six (36) inches in diameter and smaller; five hundred (500) feet for pipe sewers forty-two (42) inches in diameter and larger, except under special approved conditions. Spacing shall be approximately equal, whenever possible.
3. When large volumes of stormwater are permitted to drop into a manhole from lines twenty-one (21) inches or larger, the manhole bottom and walls below the top of such lines shall be of reinforced concrete. Special structural design may be required for large pipes and/or large drops.

4. Manholes shall be avoided in driveways, crosswalks or sidewalks.
5. Connections to existing structures may require rehabilitation or reconstruction of the structure being utilized. This work will be considered part of the project being proposed.
6. When a project requires a manhole to be adjusted to grade a maximum of twelve (12) inches of rise is allowed if not previously adjusted. When adjustments to raise or lower a manhole is required, the method of adjustment must be stated on the project plans and approved by the City.

_____ The Hydraulic Grade Line shall be designed to: *

1. The hydraulic grade line at any inlet or storm manhole shall not be higher than two (2) feet below the inlet sill or top of manhole.
2. Storm sewers shall not flow with greater than three (3) feet of head.
3. The beginning point for the hydraulic grade line computations shall be the higher (i.e. more conservative) elevation as determined below:
 - a. For connection to existing pipe system:
 - (1) Top of pipe intrados of at least two reaches downstream of the connection point of the existing system; or
 - (2) The hydraulic grade line computed for the existing system.
 - b. For connection to channels or ditches:
 - (1) Top of pipe intrados of the proposed pipe, or
 - (2) The hydraulic grade line computed for the channel or ditch as approved by the City.
 - c. For upstream system pipe connection to dry and wet detention basins:
 - (1) The starting hydraulic grade line for all incoming pipes shall be the 100 year-24 hour blocked low flow water surface elevation, where City maintained streets are located adjacent to or upstream of the basins.
 - (2) The starting HGL for all other situations may be the 100 year – 24 hour unblocked low flow water surface elevation, unless the local road authority requires something higher.
4. When storm sewers are designed to convey 100 year flows, effusion at low lying inlets is not allowed, unless 100 year ponding easements are so delineated, granted, and recorded. Those associated temporary “ponding” easements however, should not be confused with 100 year overland flow paths, for which no conveyance area easements are presently required. Also, such intentional effusive designs may be prohibited for City maintained streets or highways.

_____ Structures are sequentially numbered in both the plan and profiles. *

_____ Show all utilities in storm sewer profiles. If SUE work was completed show accurate elevations on the profiles.

_____ Provide a typical pipe cross section view of the sewer, backfill and trench width. All pipes are to be bedded in MSD type 1 or 2 bedding unless otherwise directed by the engineer.

_____ Are all culvert end obstructions outside the clear zone or protected? *

Cross Section Sheets

_____ Show all utilities in cross sections. *

_____ Cross sections show the existing and proposed grades at least 10 feet beyond the improvements. *

_____ Note any abrupt or special sections. All driveways, intersections/side roads must have a section to at least 10 foot beyond improvements. *

_____ End areas labeled for cut and fill shown in square footages for each section.

_____ Volumes in cubic yards for cut and fill between each section labeled.

_____ Proposed and existing right-of-way and easements shown on cross sections *

_____ Dimension and label all non typical features. *

_____ Cut and fill slopes labeled, are the slopes recoverable, has protection been given to non-recoverable slopes. *

_____ Offset, slopes and elevations labeled for proposed improvements and grades. *

_____ Show the baseline/centerline of the street with elevation. *

Water Distribution Plan Sheets

_____ Show the location and size of the existing and proposed water lines. *

_____ Evaluate the need for fire hydrants at high points. *

_____ Provide a profile for all water line installations *

_____ Show and label all water appurtenances, valves, and meters. *

_____ Valving should be appropriate for future system control. *

_____ Provide the City standard plans for all waterline installation features.

_____ Evaluate Watermain material type with installation location.

- _____ Show waterline crossings of sanitary sewers, concrete encased where required.
- _____ Show thrust blocks on the plan and profile.
- _____ Label all bends. *
- _____ Where encasement is used, spacers are incidental to the cost.

Sanitary Sewer Plan / Profile Sheets

- _____ Show existing and proposed ground lines on profiles and sections. *
- _____ Label the pipe size, length, slope, class, and material on the profile. Also show the pipe size on the plan sheets. *
- _____ Inlets and manholes are paid for by the depth of structure. *
- _____ Evaluate H2S impacts during design. *
- _____ Show sanitary lateral connection locations. If necessary camera for locations. *
- _____ Design meets MSD standards for construction. *
- _____ The minimum diameters of pipe for sanitary sewers, eight (8) inches. Sewers shall not decrease in size in the direction of the flow. Circular pipe sewers shall be used for all sizes of sanitary sewers. *
- _____ Sanitary sewer alignments are normally limited by the available easements, which in turn should reflect proper alignment requirements. *
 Sanitary sewers shall be aligned:
 1. To be in a straight line between structures for all pipe sewers thirty inches (30) in diameter and smaller.
 2. To be parallel with or perpendicular to the centerlines of straight streets unless otherwise unavoidable. Deviations may be made only with approval of the City.
 3. To avoid meandering, off-setting and unnecessary angular changes.
 4. To make angular changes in alignment for sewers thirty (30) inches in diameter or smaller in a manhole located at an angle point and for sewers thirty-three (33) inches in diameter or larger, by a uniform curve between two tangents. Curves shall have a minimum radius of ten times the pipe diameter.
 5. To avoid angular changes in direction greater than necessary and any exceeding ninety (90) degrees.
- _____ Sanitary Sewers shall be located: *

1. To serve all property conveniently and to best advantage.
2. In public streets, roads, alleys, rights-of-way, or in sewer easements dedicated to the City.
3. In easements on private property only when unavoidable.
4. On private property along property lines or immediately adjacent to public streets, avoiding crossing through the property.
5. At a sufficient distance from existing and/or proposed buildings (including footings) and underground utilities or other sewers to avoid encroachment and reduce construction hazards.
6. To avoid interference between house connections to foul water or sanitary sewers and stormwater sewers.
7. In unpaved or unimproved areas whenever possible.
8. To avoid, whenever possible, any locations known to be or probably to be beneath curbs, paving or other improvements particularly when laid parallel to centerlines.
9. To avoid sinkholes and creeks.
10. No sanitary lateral clean outs or sampling tees shall be placed within the area of the stormwater overflow path.

The flowline of sanitary sewers shall meet the following requirements: *

1. The flowline shall be straight or without gradient change between the inner walls of connected structures.
2. Gradient changes in successive reaches normally shall be consistent and regular, with small or insignificant differences in successive reaches. Gradient designations less than the nearest 0.001 foot per foot, except under special circumstances and for larger sewers, shall be avoided.
3. For sanitary or combined sewers the hydraulic grade line shall not rise above the intrados of the pipe.
4. When the grade of a sewer is twenty percent (20%) or greater, a concrete cradle or collars is required. For grades exceeding fifty percent (50%) a special design and Project Specifications are required.

Manholes: *

1. Manholes shall be located at changes in direction, changes of pipe size, flowline gradient, and at junction points with connecting sewers. For sewers thirty-three (33) inches in diameter and larger, manholes shall be located on special structures at junction points with other sewers and at changes of size or gradient.
2. Spacing of manholes shall not exceed four hundred (400) feet for pipe sewers thirty-six (36) inches in diameter and smaller, five hundred (500) feet for pipe sewers forty-two (42) inches in diameter and larger, except under special approved conditions. Spacing shall be approximately equal, whenever possible.

In addition, street access manholes should be located at a spacing of not more than 1200 feet apart to facilitate sewer maintenance requirements. "Street access manholes" are those manholes in or adjacent to a paved street accessible to the City.

3. Manholes on sanitary sewers ten (10) inches through thirty-six (36) inches shall be a minimum of forty-eight (48) inches in diameter and/or have a square bottom section with sides of forty-eight (48) inches, depending on the sewer diameter. Manholes on sewers eight (8) inches in diameter shall have a minimum bottom section of forty-two (42) inches. Manholes on sewers greater than thirty-six (36) inches in diameter shall be built in accordance with the Standard Specifications.

4. At stream and channel crossings, manholes shall be located on both sides of the crossing at changes in pipe material. The manholes shall be a minimum of ten (10) feet from the top of the bank on both sides of the crossing.

5. All manholes on sanitary sewers that are built within the 100-year flood limits, the stormwater overflow path, or in other areas determined to be subject to flooding shall be provided with lock type watertight manhole covers.

6. Manholes for sanitary sewers shall be precast concrete or poured in place type and waterproofed on the exterior, as approved by the City.

7. Outside foul water drops are not permitted.

Gradients *

The following minimum slopes of sanitary pipe sewers are those giving at least three (3) feet per second velocities flowing full, based on Manning's formula using an "n" value of 0.013 unless otherwise directed by the City. Slopes greater than these minimums shall be used wherever possible.

For sewers with a design grade less than one percent (1%), field verification of the pipe grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements.

The City may require the submittal of revised hydraulic calculations for any sewer reach having an as-built grade flatter than the design grade by more than 0.1%. Based on a review of this hydraulic information, the City may require the removal and replacement of any portion of the sewer required to ensure sufficient hydraulic capacity and cleansing velocity of the system.

Pipe Size Minimum Slope in Ft.

per 100 Ft. (% Grade)

- 6 (house lateral)* 2.0
- 8 1.0
- 10 0.6
- 12 0.6
- 15 0.4
- 18 0.3

21 0.3

24 0.2

27 0.2

30 0.2

36 0.1

Pipes larger than thirty (36) inches in diameter shall maintain a cleansing velocity of three (3) feet per second.

Flow Design *

All lateral and sub-main or collecting sewers shall be designed on the basis of an average per capita use of not less than one hundred (100) gallons per day, and on that basis shall be designed with capacities of four hundred (400) gallons per capita per day at peak flow unless otherwise directed by the City. Sanitary flow from day schools with gymnasiums, showers and cafeterias shall be computed on the basis of thirty (30) gallons per capita per day discharged in eight (8) hours. On this basis the daily peak flow rate shall be 90 x 4 gallons per capita per day for the lateral sewers. Sanitary flow from tourist camps and trailer courts shall be computed on the basis of 2.5 persons per each unit for each twenty four (24) hour period at fifty (50) gallons per capita per day times a peak factor of four (4). Sanitary flow from apartments, boarding schools and condominiums and other smaller facilities shall be computed at the same rate as residential property. Sanitary flow from all other types of institutions, commercial property, industrial plants, etc., shall be separate and individual studies based on a conservative ultimate anticipated flow multiplied by the peak factors applicable to each case. In the case of industrial flow, when the rate and volume can be predetermined with a reasonable degree of accuracy, no dilutions or diminishing factor shall be applied against this flow in the outfall, sub-trunk or trunk sewers.

Population Factors

Family population factors for the various areas in the City are to be determined from the latest United States Census Tracts. An acceptable figure is 3.7 persons per household unit.

Sanitary Flow Table

Population Unit Cu. Ft./Sec.

One Person @ 400 G/D 0.00062

One Household Unit @ 3.7 Persons 0.00229

@ 400 G/C/D

Where G/C/D = Gallons per Capita per Day

Basic Formula:

Flow in Cu. Ft./Sec. = Population x Flow(in G/C/D) / 646,317

Hydraulic Grade Line *

1. Hydraulic Grade Line Limits

The hydraulic grade line for sanitary and combined sewers shall not rise above the pipe intrados.

The beginning point for the hydraulic grade line computations shall be the higher (i.e. more conservative) elevation as determined below:

For connection to existing pipe systems

a. Top of pipe intrados at least two reaches downstream of the connection point to the existing system; or

b. The hydraulic grade line computed for the existing system, especially where the downstream system has suspected or known lack of capacity issues.

Field verified structure and flowline elevations, pipe sizes and characteristics shall be used.

_____ Pipes having a cover of less than three (3) feet shall be encased in concrete, or a stronger pipe be used, unless otherwise directed by the City. *

_____ Structures are sequentially numbered in both the plan and profiles. *

_____ Show all utilities in sanitary sewer profiles. *

_____ Provide a typical pipe cross section view of the sewer, backfill and trench width. All pipes are to be bedded in MSD type 1 or 2 bedding unless otherwise directed by the engineer.

_____ Show the proposed daily sanitary flow and provide average daily sanitary flow, peak flow and velocities within the proposed sanitary sewer. *

_____ Provide a copy of the sanitary approval letter from MoDNR.

_____ Note the anticipated groundwater elevation.

_____ All sanitary items are quantified and match the bid book, and estimate.

DESIGN SPECIFICATIONS AND BID BOOK

_____ Table of Contents included.

_____ Bid package follows the City of St. Charles Boilerplate available on ProjectManager.com. Bid # and bid opening date is correctly written and contains the drexeltech wording.

_____ Insurance requirements reviewed and adjusted accordingly.

_____ Bid package follows the MoDOT LPA Boilerplate with supplemental information from the City of St. Charles Boilerplate(I/A).

- _____ JSPs for all bid items not listed on the Standard Bid Item List on ProjectManager.com. JSPs for non standard bid items describe the work, method, measurement, payment and materials to be used and specifically call out any incidental work to be done.
- _____ JSP Table of Contents reflects all the JSPs used on the project. Include page numbers for the JSPs in the table of contents.
- _____ Project Manual cover sheet signed and sealed by a professional engineer.
- _____ Work Zone Traffic Management Plan is specific to the project and covers the work to be done.
- _____ Contains emergency provisions and incident management specification
- _____ Contains project contact for questions provision. Specification states that all questions to be submitted in writing by a given deadline one week prior to the bid opening.
- _____ Contains project cooperation with other contractors if necessary to coordinate with other contractors in the area.
- _____ If the project contains seeding, use the City's seeding and sodding specification.
- _____ Disposition of salvaged materials JSP.
- _____ Utility service leads or lateral JSP. Identify who is responsible (Disconnect, Relocate, Protect, Etc.)
- _____ Utility JSP is specific to the project and includes the scope and timeframe for all utility relocations on the project. Time and coordination with dependent relocations shall be incidental to the contract.
- _____ Prevailing Wage Rate information included.
- _____ Alternate Bid specification included describing how the bid will be awarded.
- _____ City Water Specifications included (if applicable).
- _____ Any permits acquired / blank copies of necessary permits.
- _____ City specialty sign detail included (if applicable).
- _____ County Road Board sign detail included (if applicable).

- _____ Current ADA specifications and LPA checklist included (if applicable).
- _____ Current City paver or retaining wall specification utilized, including the paver color to be used (if applicable).

ENGINEER'S ESTIMATE

- _____ Pay items match the 2B and Bid book items and quantities.
- _____ Estimate has project name, project number, project limits and the seal of the engineer of record. *
- _____ Estimate contains mobilization = 1 lump sum. *
- _____ All signals and lighting quantities are included. *
- _____ Resetting property corners is listed when right of way has been purchased.
- _____ All signal signs are included.
- _____ Optional Items are included for Optional pieces of work. Options to be selected are detailed in the JSPs.
- _____ Alternate bid items are grouped together so it is clear that it is either / or.
- _____ As built plans included in design estimate.
- _____ Contractor furnished surveying and staking is included.
- _____ Consider the use of High Early Concrete for special areas where access is an issue.
- _____ Include Right-of-way Estimate. *

DESIGN PLANS, SPECIFICATIONS AND ESTIMATE REVIEWED BY:

Project Manager: _____

Construction Inspector: _____

Water Division: _____

Signals/Lighting: _____

Other: _____