Utilities

NOTE: This is a new section, which includes content from previous sections of the KU Design Standards, along with appropriate revisions and updates. Significant revisions or additions to the previous standards are highlighted in italics.

GENERAL
Designers shall verify that all applicable portions of these standards are incorporated into the project’s design, drawings, specifications and final construction. Requests for variances from these standards shall be submitted in writing to the DCM Project Manager, using the KU Standards Variance Request Form found in Appendix A1.1, for review and written approval or rejection as indicated on the form.

RELATED DOCUMENTS & REQUIREMENTS
Refer to the following for requirements that also apply to work of this section. Designers shall coordinate the requirements of the following related sections of the KU Design Standards with this section and with each project’s specs/drawings.

- **Division 1 - General Requirements**: refer to sections regarding construction testing and field quality control requirements. Also contains additional information re: information that KU can furnish and the consultant’s obligations to field-verify existing conditions.
  - Unless directed otherwise, the Owner shall separately contract for quality control testing during construction, not the Contractor. Verify with DCM for each project.
  - Quality Control Testing of Sewer Lines: Video scans of sewer systems may be arranged for by the Owner, if appropriate.

- **Campus Landscape Master Plan**: All projects shall be designed and constructed to be consistent with the Campus Landscape Master Plan.
  - Current editions of this document can be viewed at the KU-DCM website: [http://www.ku.edu/home/fmku/](http://www.ku.edu/home/fmku/)

- **Division 3 – Concrete**: These requirements are also applicable for concrete work related to utility systems.

- **Division 5 – Metals**: Contains requirements for handrails, guardrails and miscellaneous metals, including hot-dip galvanizing of all exterior steel components, that may be related to utilities work.

- **Division 22 – Plumbing**: Contains additional information applicable to site utilities and piping insulation for utility lines.
  - Section 221113 – Facility Water Distribution Piping, includes domestic and fire water service distribution lines outside buildings.
  - Section 221313 – Facility Sanitary Sewers

- **Division 23 – Mechanical**: Contains additional information applicable to site utilities.
Division 26 – Electrical: Contains information on the campus electrical distribution system, medium voltage cabling and ductbanks, site lighting and site utilities.

Division 27 – Telecommunication Systems: Contains information on site infrastructure related to telecommunications systems, and may be pertinent if telecommunication systems are located within utility tunnels.

Appendix A33.1 - Standard Bike-Pedestrian Curb Inlet Detail

UTILITY TUNNELS – DESIGN GUIDELINES

General: Each new building or addition shall be required to extend the campus utility tunnel system as necessary to convey appropriate site utilities to it, as part of its scope of work and unless other funding has been identified specifically for this purpose, each project’s budget shall cover the necessary costs to extend utility tunnels and site utilities to serve each new facility.

In some cases, the University may determine that the location or character of the building or addition does not require utility tunnel extensions.

Identification System: KU has developed a system for identifying utility tunnel components, which shall be used on all projects. The University can provide site plans of existing tunnel designations, and shall assign appropriate designations to all new tunnel components. Designers shall show the designations for pertinent tunnel components, both existing and new, on drawings.

Design: Each new utility tunnel shall be designed to accommodate current and future utility needs those parts of the campus served by it, as determined by the University.

Designers shall consult with DCM, FS and KU-IT to determine the best location for tunnels. KU’s planning staff shall also be consulted to identify future proposed building or infrastructure locations, which shall be shown on proposed tunnel site plans, to verify that the needs of both have been coordinated.

Construction documents shall include dimensioned site plans to clearly locate all tunnel segments, cross-sections and appropriate details. Drawings shall also include vertical and horizontal profiles of each tunnel segment, showing all existing structures and utility lines crossing or abutting tunnel segments.

Minimum Interior Dimensions: Tunnels shall be designed to be a walk-through system, and shall typically have a 7’ clear interior height. Tunnels shall be not less than 7’ wide. This width is intended to accommodate not less than a 4’ interior clear walkway width between the anticipated utility lines and their support systems. This assumes a 2’ width along one side for wet piping, and a 1’ width along the opposite side for dry piping/conduits. If light fixtures are ceiling-mounted, the 7’ clear height is from their bottom surface.

Profile: Tunnels are typically rectilinear, but other profiles will be considered on a per-project basis.

Utility Lines in Tunnels: Tunnels are intended to accommodate the following utility lines:

- Steam supply and steam condensate
- Chilled water supply and return
- Primary electrical distribution lines.
- **Excluded Utilities**: Domestic water, irrigation water, sanitary sewers, storm sewers and natural gas lines are NOT to be routed within tunnels.

- Telecommunication Lines: Telecommunication lines are typically NOT to be routed within utility tunnels, as determined by KU-IT and DCM on a per-project basis.
  - The preferred alternative is to construct a concrete-encased conduit ductbank which is poured directly adjacent to the campus utility tunnels, and which terminates in pull boxes or telecommunication rooms that are adjacent to tunnel entry points. Refer to Division 17 for additional requirements.

- **Direct-Buried Utility Lines**:
  - *Steam lines shall NOT be direct-buried, at any time, and shall in all cases be contained within an approved tunnel system, when routed from building to building.*
  - *Chilled water lines may possibly be direct-buried, but only if approved by the Directors of DCM and FS, on a per-project basis, and only if other conditions don’t permit the construction of a utility tunnel to house them.*

- **Existing Utility Lines**: When new tunnels cross-over existing underground utility lines, the existing lines shall be relocated as required as part of the new tunnel's project, to accommodate the desired tunnel routing.
  - Existing or new cross-over utility lines shall not be penetrate tunnel walls, unless it is technically infeasible to relocate them. If cross-over lines are specifically approved by KU to penetrate tunnel walls, the Designer must detail their points of penetrations to be watertight, using sleeves, sealed fittings or other means.

- **Structural Loads**: Tunnels shall be designed to withstand vehicular traffic loading over the top of them, whether exposed on grade as a sidewalk, street or parking area, or fully buried below grade.

- **Maintenance Access & Egress**: Tunnels shall be accessible from standard swing doors to the greatest extent feasible. On-grade entrances with sloped hatches and sloping walkways are preferred. DCM or FS personnel can illustrate by some existing examples, such as the Mississippi Street tunnel entrance. Tunnel walking surfaces shall be level or uniformly sloped. Where changes in height occur abruptly or when access is from above or below, stairs shall be used in lieu of ladders or manholes to provide access.
  - *Tunnels shall NOT be accessed from man doors which pass from a building directly into a tunnel. Entry points to tunnels shall be outside of buildings. Tunnels shall abut the building foundation wall, with sleeved sealed penetrations for utility lines.*

- **Security**: All entry points for pedestrians or materials shall be secured, either by locks or mechanical fasteners. Locksets on doors into tunnels shall be locked on exterior at all times, but operable from the interior at any time (no interior keyed locks or deadbolts).

- **Tunnel Access Hatches**: Designers shall provide sidewalk-type access hatches into tunnel tops or manholes, for both maintenance personnel and piping material access.
  - *Bilco Type J, heavy-duty aluminum (300 PSF minimum load capacity), stainless steel hardware, counter-balanced hydraulic lift lid, with exterior key (keyed to KU Medeco maintenance key); or approved equivalent manufacturer/model. 36” wide x 72” size recommended.*
  - Standard manhole covers are discouraged for tunnel access and should not be used unless conditions prevent using a sidewalk hatch, and they are approved by KU.
Material Access: Tunnels and access points shall be designed to accommodate easy access of materials and equipment into any segment, for maintenance or new construction purposes. If 20' sections of piping cannot be carried into each tunnel segment through nearby pedestrian access points, piping access shall be provided into each tunnel segment by access ports, trench grates or similar means.

Safety: Utility tunnels shall be designed in compliance with OSHA standards regarding "confined spaces".

- Per KU-FS policy, contractors and consultants working within tunnels are advised that nobody is to enter the tunnels alone, and they are to wear hardhats and carry a flashlight and two-way radio or cell phone with them at all times (radios preferred, since cell phone coverage may be limited).
- Contact the KU Facility Services Safety Officer prior to initial tunnel access, to review KU’s tunnel access safety policy. Verify and complete any training, permits or documentation that may be required by FS before entering tunnels.

Drainage: Tunnels shall have a means of conveying intruded water to drains spaced at appropriate intervals that daylight onto grade or into storm sewers. If tunnel segments are below-grade, provide sumps and sump pumps which direct intruded water out onto grade or into storm sewers. Detail outlets so they will not be damaged by mowing equipment or vehicular traffic, and to exclude small animals from entering tunnel system.

- One option for internal drainage is to slope tunnel floor ¼" per foot to one side, and provide a 1-1/2" deep x 3-1/2" wide cast-in-place gutter along the low side of the tunnel floor, directing water to drains or sumps.

Ventilation: Provide by natural or mechanical means, as appropriate for conditions expected within each tunnel segment.

Lighting & Power: Provide general illumination throughout all sections of utility tunnels, operable by internally-illuminated light switches at each access point into tunnel.

- Light fixtures shall be corner-type, mounted above the "dry piping" side of the tunnel, with a polycarbonate lens and fluorescent bulbs. Space fixtures at intervals adequate for wayfinding and egress. Recommended lighting levels are 1 fc minimum, and 5 fc average. All lighting shall be fed from a circuit that has emergency backup power.
- Ground-fault duplex outlets shall be provided at 100' maximum intervals within tunnels, fed by 20 amp circuits that are independent of the lighting system. Install duplex outlets adjacent to light fixtures as much as possible.

Telephones: Provide campus-only telephones at major nodes and adjacent to equipment rooms, for use by maintenance personnel. Phones shall be secured in a waterproof box, with a lock keyed to KU's maintenance keys.

Construction: Utility tunnels shall be constructed of materials and configurations deemed appropriate for each application.

- Tunnels shall be constructed of either cast-in-place concrete, or precast concrete.
- Corrugated metal and metal deck framing materials are NOT allowed in new tunnels.
- Utility Support Systems: Support components and fasteners shall be of non-corrosive materials or of hot-dipped galvanized steel. Utility lines are not to be hung from tunnel ceilings, though light fixtures and duplex outlets may be ceiling-mounted.
Waterproofing: Tunnels shall have dampproofing applied on below-grade wall surfaces and, if below grade, on top surfaces. Tunnels in areas where the water table or groundwater is expected to consistently occur above the tunnel's floor elevation, or where a sidewalk is poured above the tunnel roof, shall receive waterproof membranes on all below-grade surfaces, including bottoms.

- ALL below-grade construction joints shall be detailed to have continuous waterstops (if cast-in-place concrete) or mastic seals (if precast concrete) applied within the joint, to limit groundwater or surface water intrusion.

Tunnel Terminations at Buildings: Designer shall detail terminations so that tunnels are separated from buildings with one-hour fire-rated construction. All penetrations through termination walls shall be fire-stopped. Provide sleeves through termination walls for future utility lines, as directed by DCM.

Steam and Condensate Piping Insulation in Tunnels: Designers shall specify preformed Mineral-Fiber (fiber glass) insulation per ASTM C547, Type I in thicknesses identified below. Install field-applied, 30-mil minimum, PVC fitting covers and insulation jacketing per ASTM D1784.

- Insulation thicknesses greater than 2-inches shall be built-up of multiple-layer installations, with each layer secured separately. Joints in multiple layer installations shall be staggered.

- Submittals and Quality Control sections of the specification should specifically include the "mockup" requirements identified within Masterspec Section 220719 – Plumbing Piping Insulation for Contractor demonstrations of quality of insulation applications and finishes, for review and approval by A/E and Owner.

- Other product and execution requirements shall be coordinated with and specified by the Designer in Masterspec Section 220719 – Plumbing Piping Insulation.

### Tables – Required Pipe Insulation Thicknesses:

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**SITE UTILITIES – DESIGN GUIDELINES**

**Construction Profile Drawings:** Designers shall include profile drawings in the construction documents for new water service, sanitary sewer and storm sewer piping systems.

- Profile drawings shall show new lines in vertical relationship to all other piping or underground structures that they cross, to scale and to correct elevation for each.
Profiles shall also show all thrust blocks required at vertical changes in direction in water service lines, and reference appropriate details.

Piping Trench Backfill: Refer to Division 31 - Earthwork for requirements, particularly Section 312000 – Earth Moving.

Flush-Grade Valve Boxes: All boxes or enclosures for accessing valves in underground utility piping shall be embedded in a 5-1/2” thick cast-in-place concrete collar, set flush to adjacent grades and extending not less than 6” on all sides around valve box (18” x 18” minimum concrete collar).

Manholes and Valve Boxes: Do NOT locate these structures in steps or sidewalks. If existing manholes or valve boxes are to occur in new steps or sidewalks, review optional locations with DCM and adjust as agreed upon.

Plastic Lines: All plastic utility lines, such as sanitary sewers, low-voltage electrical, irrigation systems and gas lines, shall be wrapped with trace wire.

Piping & Supports for Underground Utility Lines thru Exterior Walls:

All sanitary and storm sewers leaving the building shall be cast iron for a distance of at least 10 feet from the building, or for the full distance if in filled or unstable ground. Where cast iron pipe enters or leaves the building, a Link-Seal sleeve, or approved equivalent, shall be provided in the wall and gaskets or sealant shall be installed between the sleeve and pipe to allow for movement.

All services leaving the building which are laid on filled earth, including sanitary sewer, storm sewer and water main, shall be supported at each joint and elbow on reinforced concrete beams until the pipe rests on solid undisturbed soil.

Concrete beams shall bear on a ledge or pocket in the foundation wall and on at least five feet of solid undisturbed earth beyond the excavation. Construction of beams shall be the responsibility of the Mechanical Subcontractor. Ledges or pockets in foundation walls shall be provided by the contractor responsible for constructing those walls.

The Mechanical Subcontractor shall have complete responsibility for proper installation of all exterior underground piping installed by him, shall warranty these lines against breakage and shall be liable for all damages, repairs, and replacement caused by settling of pipe or backfill one year warranty period specified in the General Conditions.

FACILITY NATURAL GAS PIPING – 231123

General: The University is provided natural gas service by Black Hills Energy. All extensions of gas service lines from utility-owned gas mains shall be provided by the utility provider, to within immediate proximity of new building.

Designers shall meet with utility provider, confirm routing and termination points of lines provided by the utility company, and shall clearly note them and the extensions of those lines to be provided by the Contractor on the construction documents.

STEAM AND CONDENSATE HEATING PIPING – 232213

General: Direct-buried steam or condensate lines are NOT acceptable.
Expansion provisions shall be included by the Designer within each straight segment of steam line, with steam piping anchored on each side of an elbow at a change in direction.

Steam lines shall include provisions for drain-down to a limited number of locations, as approved by FS personnel who maintain those lines. Valves and system design features shall be included that allow FS personnel to easily conduct bi-annual steam shutdowns.

**STORM UTILITY DRAINAGE PIPING – 334100**

**General:** Runoff from new roofs shall be discharged through underground storm sewer systems, unless other drainage provisions are approved or requested by the University.

**Storm Water Detention:** The City of Lawrence Stormwater Ordinances shall be met on all projects, unless otherwise directed or approved by the University. Copies of those ordinances may be obtained by contacting the City Engineer of Lawrence.

**Materials:** Reinforced concrete pipe (RCP) or poly-vinyl chloride (PVC) piping may be used.

- Storm sewers shall be RCP for sizes 8” diameter and larger.
- Storm sewers smaller than 8” may be cast iron or, if the area is not rocky, PVC piping (Schedule 80, SDR 35 minimum).
- Vitreous clay piping (VCP) is NOT an acceptable material for storm drainage systems.
- Corrugated Metal Pipe (CMP) is discouraged, but may be permitted on a case-by-case basis, as approved by the DCM Director.

**Grates:** Designers shall carefully select all storm water structures and grates to avoid hazardous conditions within areas subject to pedestrian or bicycle traffic.

- Specify grates and structures that exclude bicycle tires, wheelchair tires and high heels in areas subject to that traffic.
- All grates and drains in areas of pedestrian traffic shall be ADA-compliant.
- Designers shall also consider pedestrian traffic and shall design curb inlets and other storm structures so that pedestrians walking to parked vehicles can't accidentally fall into throat of curb inlets, or lose their balance due to a storm structure which may not be visible beneath snow, leaves or accumulated debris.

- **KU’s Standard Bike-Pedestrian Curb Inlet Detail:** Project Designers shall utilize this curb inlet detail, which can be viewed in Appendix A33.1, in areas where bicycle and/or pedestrian traffic can be expected, such as on Jayhawk Boulevard and Memorial Drive, and within or near parking areas. The dropped-top inlet box (shown in the detail) shall only be used in planter beds. In other locations, a standard flat top shall be used, which aligns with the top of the adjacent curb.