APPENDIX D—INFRASTRUCTURE

FORMAT

1. Technical Specifications content and numbering system shall be based on CSI Master Format 2004 version.

BASIS OF DESIGN

1. The BGSU Design standards shall not replace fully developed, project specific technical specifications. Associate shall utilize the Standards as a minimum guide for design and execution in the field. Exceptions to these standards are allowed provided they are approved by the University.

2. In instances where fewer than 3 manufacturers are indicated, the Associate shall insert "or approved equal" in the Products section of the technical specifications.

3. All submitted substitute products shall be brought to the attention of Design & Construction, prior to approval.

RELATED SECTIONS

22—PLUMBING
23—MECHANICAL
26—ELECTRICAL

TUNNELS

1. Minimum inside clear dimensions for new tunnels shall be 7'-0" wide by 7'-0" high.

2. Excavate an additional 3-5 feet on either side of the tunnel as well as 12 inches below tunnel to allow for installation of future direct buried utilities adjacent to the tunnel and/or to pass underneath tunnel.

3. All tunnel tops shall be constructed for AASHTO H-20 wheel loading.

4. Sidewalks shall be separate from the tunnel top by minimum of 6-inches of compacted fill for all new tunnels.

5. Provide non-slip texture on tunnel floor.

6. Water-proof exterior walls and tunnel top. Apply Hydrotech 30 or other approved protection.

7. Full depth expansion/construction joints to be DSM impregnated foam by Emseal or approved equal.

8. Natural gas, sewer and water lines shall not be routed through the tunnels.

9. During major tunnel renovations:
   a. Existing natural gas lines shall be removed from tunnels and direct buried.
   b. Tunnels containing natural gas lines include the Library, Overman and Psychology Tunnels.
   c. Remove all water lines from the tunnels and install direct buried. All new water mains shall be a minimum 8-inch diameter and shall be designed in a looped configured so that they can be backfed. A branch
water line may cross the tunnel if installed near the floor level of the tunnel.

d. Remove all abandoned or obsolete communication cables per National Electrical Code (NFPA70 - 800).

10. Junctions:
   a. A junction is defined as the intersection of two or more tunnels.
   b. Piping, cable and cable trays shall be installed with offsets to maximize clearance to allow maintenance personnel to readily cross junctions.

11. Hatches
   a. Utilize Bilco Aluminum hatches (Model J-AL & JD-AL) reinforced for AASHTO H-20 wheel loading with integral drain channel. Standard size shall be 3’-0” x 5’-10”.
   b. Provide tunnel access hatch every 250 feet or on either side of where an obstruction makes a section of tunnel impassable.
   c. Install aluminum ships ladders at each hatch for access.

12. Receptacles
   a. Receptacles shall be GFCI protected and have a weatherproof cover.
   b. Provide a receptacle at a maximum of 100 feet apart.
   c. Branch circuit conduits shall not be mounted to tunnel ceiling.

13. Lighting
   a. Light fixtures shall be wet location listed, suitable for high heat and corrosive environments and provided with a wire guard.
   b. Provide red 3-way and 4-way toggle switches with weatherproof covers at each entrance to tunnel.
   c. Lamps shall be Fluorescent T8 (3500k, >80 CRI) or LED (>80 CRI).
   d. Lighting levels shall be maintained at a minimum of 1 average footcandle at the tunnel floor.
   e. All Tunnel lighting shall be connected to an emergency power source.
   f. Branch circuit conduits shall not be mounted to tunnel ceiling.

14. Ventilation
   a. Ventilation kiosks shall be utilized for intake and exhaust air. Location, style and color shall be coordinated with the University for aesthetics, allow for maintenance and sidewalk snow removal.
   b. Ventilation systems shall be designed to provide a minimum of 6 air changes per hour.

15. Sump Pumps - Electric
   c. Impeller: Bronze.
   e. Lower Bearing: Graphite.
   f. Legs: Galvanized.
   g. Floor Plate: Galvanized.
h. Switch Type: High-temperature, stainless steel, pedestal-mounted float switch with float rods and rod buttons.

i. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).

j. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

k. Control-Interface Features:
   i. Remote Alarm Contacts: For remote alarm interface.
   iii. Controls for interface to building automation system and capable of providing on-off status of pump and alarm status. Interface with existing Habitec alarm system currently used campus-wide.

16. Identification: Label tunnels walls at each junction and at every access hatch.

HIGH PRESSURE STEAM (HPS – GREATER THAN 35 PSIG)

1. A steam main is defined as a steam line that serves a total building gross floor area greater than 150,000 gsf and is longer than 100 feet or back feeds another steam line that serves 150,000 gsf and is longer than 100 feet. All other steam lines shall be classified as steam branch lines.

2. All steam mains shall be installed in utility tunnels or inside of a mechanical equipment room, direct buried to be approved by owner.

3. All steam branch lines longer than 100 feet shall be a minimum of 8-inch and shall be valved and capped at the end of the branch for future extension.

4. All steam mains West of Centrex should be at least 12-inch and all steam mains East of Centrex should be at least 10-inch.

5. Isolation Valves shall be installed in the main loops at a minimum of every 300 feet and at every junction with another steam main to allow for isolation of a section of a failed steam main while back feeding the rest of the system.

6. Criteria:
   a. Normal Operating Pressure: 100 psig
   b. Normal Operating Temperature: 338ºF
   c. Maximum Steam Velocity: 100 fps
   d. Minimum Thermal Expansion Safety Factor: 1.50

7. Refer to Mechanical Section for Pipe, Valve and Fitting Schedule.

8. Insulation: per ASHRAE 90.1

9. Jacketing: Aluminum 0.02-inch thick, smooth no vapor barrier

10. Steam main drip traps shall be sized with a 2 times safety factor at full differential pressure and shall be provided every 200 feet or less.

11. Label: HPS every 50 feet.
PUMPED CONDENSATE (CPCR & PCR)
1. Criteria:
   a. Normal Operating Pressure: 25 psig
   b. Normal Operating Temperature: 307°F
   c. Maximum Velocity: 6 fps
   d. Minimum Thermal Expansion Safety Factor: 1.50
2. Refer to Mechanical Section for Pipe, Valve and Fitting Schedule.
3. Insulation: per ASHRAE 90.1
4. Jacketing: Aluminum 0.02-inch thick, smooth no vapor barrier
5. Identification: PCR / CPCR / GCR every 50 feet.
6. Refer to Mechanical Section for Steam Powered Condensate Pumps

HIGH PRESSURE STEAM CONDENSATE PIPING
1. Criteria:
   a. Normal Operating Pressure: 100 psig
   b. Normal Operating Temperature: 338°F
2. Refer to Mechanical Section for Pipe, Valve and Fitting Schedule.
3. Insulation: per ASHRAE 90.1
4. Jacketing: Aluminum 0.02-inch thick, smooth no vapor barrier
5. Identification: HPC every 50 feet.

COMPRESSED AIR PIPING
1. Piping: Carbon Steel ASTM A53, Grade A, Schedule 40, Butt Weld
2. Fittings: Butt Weld, ASTM A234, forged steel Class 300, for 2 ½ inch and larger.
3. ASTM A234, Grade WPB ANSI/ASTM B16.3, malleable iron Class 250 for 2 inch and smaller,
4. Joints: Threaded for 2 inch and smaller, welded ANSI/AWS D1.1, for 2 ½ inch and larger.
5. Flanges: Class 300 for steam forged steel slip-on flanges or weld – neck flanges for carbon steel.
6. Valves: Full Port Ball Valve, Carbon Steel Body, TFE Seat, Carbon Steel Ball with
7. Chrome Plated Hand Lever 300#
6. Identification: CA every 50 feet.

SITE HIGH VOLTAGE ELECTRICAL
Refer to BGSU Electrical Standards for “MEDIUM –VOLTAGE VOLTAGE CONDUCTORS” and “MEDIUM VOLTAGE PAD MOUNTED SWITCHGEAR.”
1. Cable Trays: 4-inch high x 12-inch wide, flange out. Tray shall be NEMA Class12B aluminum ladder style with 12” rung spacing and 3” loading depth.
   a. Cables shall be installed in a single layer in accordance with the N.E.C.
   b. Support spacing shall not exceed 12 feet.
2. Conduit: minimum 4", type EPC, schedule 40 PVC, per NEMA TC2. For ductbank installations, conduits shall be supported on duct separators (4 per 20ft of duct) and secured with nonmetallic straps. Conduits shall be completely encased in concrete for the entire length of the ductbank with a warning tape placed 12" above the concrete envelope.

End of Section