SECTION 2A-8
VOICE, DATA, and VIDEO STRUCTURED CABLING SYSTEMS DESIGN CRITERIA

I. PROJECT DESIGN OVERVIEW

A. **This standard is drawn from the ANSI/TIA/EIA Structured Wiring Standards and is designed to support the goals of the District Technology Plan. Projects will vary depending on whether the project is new or retrofit design and construction.**

1. The base facilities required are to include communications equipment rooms (ER), telecommunications rooms (TR), distribution panels (DP), and cableways. Each site is to have one (1) ER per campus and at a minimum one (1) TR per building. The number of TRs will be determined by the requirement that all communication outlet horizontal wiring shall not exceed 250' cable length. Multiple story buildings will have a minimum of one (1) TR per floor.

2. Designated locations for workstation outlets should accommodate room rearrangements and future alternate uses whenever possible. The workstation outlets should be located so that they are as far away from windows, egress and water sources as possible.

3. Each instructional space shall be designed to include the media control units associated with the 21st Century Classroom described in Section XI of this design criteria document and detailed in the "Instructional Spaces – Typical Layout Detail".

4. Each instructional space shall be provided with laptop charging outlets located on the wall opposite to the teaching wall. There shall be two duplex outlets on dedicated circuit (royal blue in color) and one quad outlet (gray in color). The royal blue duplex outlets shall be for the connection of the charging carts (NIC) and the gray quad outlet is for the connection of a computer workstation (NIC). Refer to the "Instructional Spaces – Typical Layout Detail".

5. Unless fully enclosed in conduit, all communications wire shall be PLENUM rated Category 6 UTP #24 AWG, or better.

6. Any floor box location where enclosed conduit is used must be routed within the concrete slab and shall be designated a wet location. This mandates the use of cable specified for that purpose. If using gel-filled cable, a transition point will be acceptable when entering the plenum-rated space.

7. All workstation outlets and patch panels shall use ANSI/TIA/EIA T568B 8-pin modular jacks (RJ-45).

8. All cabling from workstation outlets must be home-run to each ER, TR, or DP and all wires terminated at each end on a one to one pin basis. Due to the high-density distribution within computer labs, a local TR or DP may

be created. The lab's TR would then be tied into the main horizontal wiring system via a fiber backbone connection.

9. Electrical wiring shall not be bundled in the same pathway as the communications wiring unless the pathway contains partitions for power and communications wiring UL listed for this purpose. Combination power and data outlet boxes (typically used in floor installations) shall contain no cross over wiring. I/O must maintain a straight throughway passage.

10. Fiber optic cabling is to be used between buildings for data distribution due to its transmission speed, bandwidth capability, elimination of inter-building grounding problems, and avoidance of lightning strike complications. Copper cabling is acceptable for telephone intra-building distribution, but lightning and surge protection, and proper grounding techniques must be used as required by all state, local, and district construction codes.

11. Fiber optic cabling is to be used for all intra-building distribution between ER, TR, and DP.

12. The rating of the wiring distribution system support apparatus (patch panels, communications jacks, etc.) shall be Category 6 or better and so certified.

13. Cabling connections for all wireless access points should be designed and installed in high locations to cover as much area as possible.

14. The cable tray, if applicable, shall be for the sole use of the Telecommunications and Energy management Department (EM and Security). Any HVAC equipment control wiring if not installed in the cable tray shall be installed in a separate conduit.

15. For new or replacement local exchange carrier entrance facilities, the consultant shall be required to provide to the Facilities Telecommunications Coordinator one 30”x42” copy of the Civil Site Survey and the electrical drawing sheet showing the Equipment Room (ER) where the cable will be terminated. The entrance cable and fiber shall be in two (2) -4” dedicated conduits from the ER back to the pick up point at the property entrance. The Facilities Telecommunications Coordinator will receive the location of pick up point from the local exchange carrier via the BIC package. PVC conduit is not allowed inside buildings, schedule 40 PVC may be used outdoors underground from pick up point at property line to a transition point inside the building.

16. For the Metro Ethernet service provide in the Equipment Room (ER) a 4’X8’, ¾” plywood backboard and one 120V-20A duplex of electrical power, fed from a computer panel, near the backboard for the sole use of the Local Exchange Carrier. A common power source ground bonded to the main distribution ground system (MDP) must be provided at the terminal location. Electrician to run a #6 insulated ground wire from the building electrical grounding electrode system (MDP) and terminated on bus bar at the base of plywood backboard inside the ER.

17. Provide 2 fiber strands from the main feeder cable and bring it (depending upon the distance, a 1” rigid metal conduit be needed to house the fiber strand) to a separate 4’x4’x ¾” plywood backboard in the ER to be designated for the Metro Ethernet. This backboard will house the WBT (fiber splice), the transceiver (must be within 6’ of a dedicated 120V duplex electrical outlet) and a network interface.

II. DESIGN CONSIDERATIONS

A. Equipment Room (ER) (Formerly referred to as CER)

1. This room is the entry point for incoming cables servicing the school and the origination point for all internal communications systems. Typically the ER houses the system equipment, provides service demarcation, and is connected to TRs for distribution to the end user. Designs and installations must provide a minimum of two (2) - 4" conduits for the main telephone service entrance facilities. Structured Wiring contractors or subcontractors must coordinate the termination points and connections at the street with the service providers. Inter-building and intra-building backbone horizontal wiring provide two (2) -2" conduits home run from the ER to each TR.

2. The ER shall include enough room to maintain and house the distribution equipment, server cabinetry and documentation for the system. Considerations in ER design include code requirements, 24 x 7 environmental conditioning, power, security and access by maintenance personnel, environmental conditioning, grounding and bonding. Minimum space required 15' by 15'. The ER (Equipment Room) shall be located within 50 feet of an exterior wall to allow for local exchange carrier termination.

B. Telecommunications Room (TR) (Formerly referred to as CC)

1. The TR is an interconnection point between the wiring backbone and the horizontal wiring to the workstations within a building. TRs concentrate horizontal wiring from user areas and distribute the signal back to the ER equipment. The TR is to contain only equipment related to data, voice, and video services.

2. The TR shall include enough room to maintain and house the distribution equipment and documentation for the system. Considerations in TR design include adherence to code requirements, 24 hour seven days a week environmental conditioning (AC), power, security, grounding and bonding, and access by maintenance personnel.

C. Distribution Panel for Retrofits

1. There may not be space for designated rooms when retrofitting a building. In these cases sufficient cabinet space is to be designed to house the TR's and DP's requirements. This panel shall consist of either a floor standing or wall mounted cabinet. This cabinet shall be secured, vented, grounded, enclosed, and provide access to all its interior. All cabinets within the same campus shall be keyed alike. All cable terminations, equipment mounting, and necessary power outlets shall be contained within the cabinet. Hinged doors should be used unless approved by BCPS Education Technology Services Department in writing.

2. Non secure rooms must use cabinets whether new or retrofit construction.

D. Distribution Pathway System

1. A conduit system is the preferred method for protection of the wiring system. This is required for use in all grade or below grade level concrete slabs and for inter-building distribution. All wiring between the ER and TRs must be run in metal conduit and make accommodations for the use of fiber optic cabling such as minimum bend radius with a minimum number of bends in compliance with BICSI Standards. Where suspended ceilings are available, the design of the horizontal distribution cable system from the TR to workstations may use a cable tray to support the main length of the cables. Refer to Section 16114 for preferred cable tray type. The wire from wall stub-ups to the tray would then be installed using conduit, J-hooks, and/or cable tray attached at a maximum of every 5 feet for support.

E. General ER/TR Requirements

All minimum requirements are based solely on the needs of the Voice, Data, Video systems. Additional space, electrical, etc. requirements may be needed as other low voltage systems are added to the rooms.

1. The ER / TR are interconnection points between the wiring backbone and the horizontal wiring to the workstations within a building. The ER is the origination point for all TR wiring backbone termination points. The ER/TR is to contain only equipment related to data, voice, and video distribution and/or other low voltage wiring systems.

2. The ER/TR's are not to serve as storage or janitorial rooms. Water pipes and mechanical rooms/areas are not to be used as ER / TR facilities. Security should be provided for the ER/TR through the use of locking hardware and/or door contacts.

F. Room Size and Locations

1. The ER should be located with consideration for service entrances and campus distribution. The ER/TR shall be sized to accommodate all necessary cabling and equipment for the area to be serviced. A minimum size of 15 x 15 feet should be allowed for the ER inside room dimensions. TR room size will vary depending on the number of racks required for the area being served. Communication Closet (CC or TR) shall be a minimum of 8 x 8 feet when housing 1 – 2 rack, 10 x 10 feet when housing 3 racks and at least 15 x 15 feet for over 3 racks. Locate room so that NO properly installed cable run to the workstation outlets exceed 250 feet. (150' is preferred.) Coordinate with the project RCDD and BCPS Education Technology Services Department for the actual size requirements.

2. All backbone interconnections between ERs/TRs, DPs, Portable TRs, etc. shall be hard piped using appropriately sized conduit.

3. Design Drawings must indicate the associated ER/TR/DP for each CO (communication outlets) (include FISH number in label).

G. Room Finishes

1. Floor: The floor of the ER/TR shall be smooth and free of cracks, crevices and dust and capable of supporting a 250 pound per square foot load. VCT anti-static flooring is to be used and carpet is not acceptable.

2. Walls: All walls shall be covered using 8' x 4' x 3/4" fire retardant marine grade plywood backboards installed on end, from near floor to near

ceiling. Plywood shall be painted light gray using fire retardant paint. Leave all plywood grade stamps exposed.

3. Ceilings: DROP CEILINGS shall be installed in any ER/TR. Finished ceilings are required. A 9'-0" or higher ceiling is desirable. There shall be NO roof penetrations or water pipes above the ER/TR.

4. Windows: No windows, louvers, or access panels are to be in the ER/TR.

5. Doors: A 3'-0" x 6'-8" minimum door is required. Doors should be metal or solid core wood with lockable hardware and meet ADA requirements.

H. ER/TR Electrical

1. Provide standard convenience outlets as required by code. Double duplex outlets shall be installed on the lower left quadrant of each systems individual backboard. Each ER should also be equipped with 2-120V outlets (NEMA L5-30R receptacle) behind each server cabinet and 1-120V outlet (NEMA L5-30R receptacle) behind each rack each on a dedicated circuit. Each TR should have 1-120V outlets and 1-120V outlet (NEMA L5-30R receptacle) behind each rack on a dedicated circuit. All other receptacles in these rooms shall be 120 volt, 20 ampere outlets NEMA 5-20R. Each double duplex receptacle should be on its own 20 Amp breaker. Refer to Section 2A-7 Electrical Design Criteria for emergency power requirements. Each server cabinet shall have 2 dedicated 30 Amp circuits with a NEMA L5-30R receptacle. All outlets in the ER should be on emergency power from the generator. Two quad outlets in the TR should be on emergency power from the generator.

I. Grounding

1. See Specification Section 16060 on Grounding

J. ER/TR Room Temperature and Humidity

1. The HVAC system shall be designed to ensure that the room ambient temperature shall be maintained 24hrs x 7days (24x7) between 55^0 F and 78^0 F. Relative humidity shall not exceed 40 percent. Any required cooling shall accommodate an internal 50 watt minimum per square foot heat load generated within the ER/TR. Provide a thermostat for each room.

2. Any HVAC unit used to maintain the above requirements shall either be a split air unit installed above the door of the TR or preferably outside the ER/TR itself and ducted into the room to provide the required environment.

K. ER/TR Fire Stopping and Extinguishers

1. All entry paths into the ER/TR shall be properly firestopped allowing for addition and subtraction of cables to be made without removal of the existing system. If 4" conduit is used then an approved UL system must be used.

2. A portable carbon dioxide fire extinguisher shall be provided and maintained within the ER/TR or as close as practical to the entry or exit. Avoid water based fire suppression intrusion.

L. Cable Raceway (cable tray) and Racks

1. Cable tray raceway to comply with SBBC Specification Section 16114 shall be installed around the perimeter of the ER/TR. Cable tray is to be installed as high as possible to make maximum use of the backboard and to coordinate with conduits entering the ER/TR. The tray is to be used to distribute cables from point of entry to the designated termination points. Install all necessary manufacturer sweeps to maintain proper bend radii. If tray is greater than 9" from the cableway connections, install tray to floor rack to act as a support. Use plastic innerduct to protect all fiber cable within the room. Cable tray shall comply with Specification Section 16114. Racks are to be installed in the ER/TR to support the communications patch panels and equipment. Open rack systems are to be 19’ wide industry standard by 7’ high. Allow a minimum of 16 sq. ft. for each rack in a 2' x 8' configuration (Racks use a minimum 2' x 2' area plus there must be 4 feet of clear work area in both the front and back of installed electronics to meet code requirements). Equipment is to be mounted in racks. All cable trays and rack systems must be properly grounded. Rack systems must have all necessary vertical and horizontal wire management components installed.

M. Patch Panel Layouts

1. Patch panel layouts are important in that they determine the amount and quantity of racks required for an ER/TR. Quantity of racks directly affects the size of any ER/TR. Patch panel designs need to be sized to accommodate a 20% growth factor. Patch panels for all horizontal wiring are to be arranged by color - Blue, Green, Purple, Yellow. Each communication outlet will be terminated in a series of four patch panels each of which has only one color. This schema will allow for the termination of cabling from a single four-port communication outlet into the same port number across the series of four patch panels. This will facilitate a port identification plan under which each CO will be identified with a single port number, and individual jack outlets will be identified by color (Blue, Green, Purple, Yellow). Color port identification must be done using color icons.

2. One rack should be designed to accommodate the voice patch panel at the top of the rack.

3. Horizontal wiring patch panels shall be equally distributed on the remaining racks beginning on the top of the racks.

4. Designers need to include Patch Panel Schedules on the drawings. Contractors need to verify schedules and update if there are any additions or subtractions during the project. Updates need to be approved by BCPS Education Technology Services Department.

N. Rack Configuration

1. Quantity:

To calculate the number of Horizontal Station Wiring Racks that are required in a TR, contractors are required to use following quad-jack to rack ratios:

39 - 78 Quad Jacks require 1 rack with four 96 port patch panels (see schema below)
1 - 38 quad jacks require 1 rack with four 48 port patch panels (see schema below)

Contractors are required to install the 96 port panels in every instance possible, and only install the 48 port panels when the quantity of quad jacks being supported falls below 38. If, for example, a TR supports the termination of 100 quad jacks, the contractor would need to install one rack with 96 port patch panels and one rack with 48 port patch panels.

This same formula applies to installing racks in the ER. However, the ER also required one Chatsworth Server Cabinet (as specified elsewhere in the design documents), and one extra rack designed to contain head-end voice systems, WAN equipment, etc.

2. Rack Location:

   Rack placement in ER or TR communications closets must be done so that at least 4' of open space exists between the back of the racks and the wall behind them. There must also be at least 36 inches of space around either of the two (or both) ends of the rack array to allow access to the area behind the racks. Racks also must be positioned at least three feet from any door opening.

3. Rack Layout:

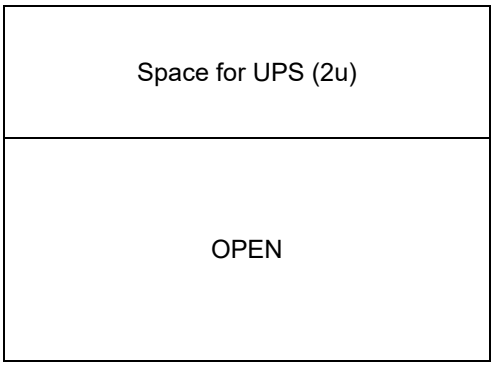
   Each 7 foot TR or ER Horizontal Station Wiring Rack should be set up according to the layout schema below when the number of quad jacks falls between 39 and 78:

Wire management (2u)
96 Count High Density Blue Patch Panel (4u)
Wire management (2u)
96 Count High Density Green Patch Panel (4u)
Wire management (2u)
96 Count High Density Purple Patch Panel (4u)
Wire management (2u)
96 Count High Density Yellow Patch Panel (4u)
Wire management (2u)
Remote (2u)
Fiber WIC (2u)

Space for Network Electronics (4u)
Space for UPS (2u)
OPEN

Each 7 foot TR or ER Horizontal Station Wiring Rack should be set up according to the layout schema below when the number of quad jacks falls between 1 and 38:

Wire management (2u)
48 Count High Density Blue Patch Panel (2u)
Wire management (2u)
48 Count High Density Green Patch Panel (2u)
Wire management (2u)
48 Count High Density Purple Patch Panel (2u)
Wire management (2u)
48 Count High Density Yellow Patch Panel (2u)
Wire management (2u)
Remote (2u)
Fiber WIC (2u)
Space for Network Electronics (4u)


Space for UPS (2u)
OPEN

O. Cableway Connections

1. The ER shall be connected to the cableway for routing of communications from other TR rooms and the user outlets. All backbone cabling must be enclosed in conduit. Horizontal cableway connection into the ER/TR may be provided by cable raceway or conduit nipple through the ER/TR wall toward the ceiling raceway system

2. One 4" conduit nipple shall be provided for every 25 CO (4 ports per CO) served. A minimum of two 2” conduit nipples shall be provided for every TR located on the same floor as the ER and for every TR located on other floors or buildings that will be interconnected with this ER.

P. Distribution Panels

1. The backbone cable raceway and grounding requirements also apply to DP wall mount cabinets.

2. If wall mount cabinets (DPs) are used in lieu of a TR then all equipment mounting and cable terminations will be accomplished within the cabinet. Cabinet is to be installed to a 8’ by 4’ by ¾” marine grade plywood backboard finished in light grey flame retardant paint.

3. Wall mount cabinets (DPs) used in lieu of a TR, shall have the grounding system connected to the cabinet frame.

4. Doors on wall mount cabinets (DPs) used in lieu of TRs shall provide access to all internal equipment and cable terminations. Door access for the DP shall be hinged, locking type to provide full access to the interior of the cabinet and its components.

5. Double duplex outlets shall be installed on the lower left quadrant of the backboard of the DP. All receptacles should be 120 volt, 20 ampere outlets NEMA 5-20R. Each double duplex receptacle should be on its own 20 Amp circuit.

Q. Cabling Distribution Requirements

1. Inter-building Backbone Wiring

a) Two 2 inch conduits home run from the ER to each TR

b) Multimode fiber optic cable with a minimum of 12 50/125 micron fibers (Data)

c) 12 pair Black Gel-filled voice grade cable to each TR. Terminate, protect and ground on 66 type blocks, then a tie should be made to the rack patch panel(s). Terminate 1 or 2 pairs per jack depending on the phone system requirements. *Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet.*

Note: All copper cabling requires grounded lightning protection devices at both ends of each pair of wires.

2. Intrabuilding Backbone Horizontal Wiring

a) Two 2 inch conduits home run from the ER to each TR

b) Multimode fiber optic cable with a minimum of 12 50/125 micron fibers (Data)

c) 12 pair Black Gel-filled voice grade cable to each TR. Terminate, protect and ground on 66 type blocks, then a tie should be made to the rack patch panel(s). Terminate 1 or 2 pairs per jack depending on the phone system requirements. Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet.

Note: All copper cabling requires grounded lightning protection devices at both ends of each pair of wires.

3. Intra building Horizontal Wiring

a) 6 (minimum) Four Pair, 24 AWG, Category 6 data grade UTP cables (Data, Voice) per classroom separated out to two drop locations.

b) 2 (minimum) Four Pair, 24 AWG, Category 6 data grade UTP cables (WAP/ Projector) per classroom and other locations as specified.

c) 4 (minimum) Four Pair, 24 AWG, Category 6 data grade UTP cables (Data, Voice) per office outlet location.

d) Refer to Division 17 for detailed specifications.

III. CABLE REQUIREMENTS

A. General

1. Plenum cable shall be required whether or not the suspended space is return air plenum, except where the installation uses fully enclosed conduit systems.

2. The wiring systems specified in these guidelines are based on the requirements of ANSI/TIA/EIA 568-B, as reflected by the BICSI design manuals for horizontal premise wiring. All products must be UL listed and meet applicable local and State codes.

B. Fiber Optic Cable

1. Fiber optic cable must be used for the data system inter building and intra building backbone wiring. This includes all ER to TR/DP wiring. All fiber optic cabling must be Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube with Extended Bandwidth 10 Gigabit Laser Optimized 50/125 Optical Fibers, unless specifically approved by BCPS Education Technology Services Department. A minimum of 12 strands shall be used for all backbone cables. All fibers must be terminated and contain no breaks. Cables that provide additional fibers to replace defective fibers are not permitted.

C. Copper Cable

1. The horizontal wiring from the ER, TR, and/or DP to the workstation outlets is to be 24 AWG four (4) pair unshielded twisted pair (UTP). The

UTP cable used must be certified ANSI/TIA/EIA Category 6 or better. The UTP cable used must meet NFPA 262-1985 and UL 910 standards and be marked CMP or Plenum (UL).

IV. Patch Panels

A. Patch Panels will be used in the ER, TR and DP to terminate all horizontal wiring. The panels used to administer the system shall be RJ-45 modular in the front to IDC (110) in the back. The panels shall perform to Category 6 standards and be wired per ANSI/TIA/EIA 568B.

V. Communications Outlet

A. Outlets shall be provided in configurations of one, two, or four modular jacks installed as required. All faceplates shall be completed with the appropriate number of jacks and blanks. The quad outlet in each instructional area shall be located by the teacher's work station. The dual outlet in each instructional area shall be located in the student computer area. The other dual outlet in each instructional area shall be mounted on the wall above the ceiling above the teacher's work area.

B. When used for data, all wall outlet boxes, baseboard raceways and modular office partition feeds shall at least be stubbed into the ceiling with 1-inch minimum conduit, which has been reamed and bushed.

C. (Retrofits) - The CO (communications outlet) should be recessed into the wall whenever possible. When this is not possible surface mounting may be done. The CO should then be installed in surface mounted raceway or directly into modular furniture.

D. Communications Power Outlets

1. Panel Surge Protector: Conform under provisions of Section 16415 – Transient Voltage Surge Suppressors. Surge protection must be provided at branch circuit computer panels or any panel where a computer circuit is being fed from.

2. Outlets: 20A-125V-3W, where surge protection cannot be provided at the panel listed above, provide a dedicated/surge suppression duplex receptacle. Outlet covers for all computer receptacles must be gray in color and specification grade. The laptop charging cart outlet covers shall royal blue in color and specification grade.

3. Power Back Up: Power back up for the communications equipment shall be provided via the school's main generator. Communications equipment includes, but is not limited to: communication's rack, main telephone system, network equipment and school's servers. Each one of these systems shall be provided with a UPS (not in contract) to support the equipment during power outages and allow for the transfer time to the main generator. The UPS will then serve as a filter for the generator power.

4. Electrical Outlet Requirements:

a) One (1) duplex outlet for each communication port, unless port is designed for voice use only.

b) One (1) duplex outlet for the printer (does not need to be surge suppressed).

5. Circuitry:

a) Provide one (1) dedicated electrical panel. Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-125V circuit for every two (2) quadruplex of power provided. Each circuit must consist of one (1) phase conductor, one (1) neutral and one (1) grounding conductor.

b) Connect the grounding conductor to the ground bar in the computer panel.

c) Computer circuits and non-computer circuits shall not occupy the same conduit.

6. Circuit Requirements:

a) Feed each circuit from a dedicated computer panel.

b) Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers.

c) Surge protect the panel, conform to SBBC Section 16415 – Transient Voltage Surge Suppressors.

7. General Classrooms

a) Two (2) duplex outlets on wall opposite to teaching wall with royal blue covers for the connecting of lap top charging carts. Refer to “Instructional Spaces – Typical Layout Detail” for location and type of outlets.

b) One (1) duplex outlet for the printer (does not need to be surge suppressed).

c) One quad outlet on wall opposite to teaching wall for connection of student computer.

d) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-125Vcircuit for every three (3) quadruplex of power provided. Each circuit must consist of one (1) phase conductor, one (1) neutral and one (1) grounding conductor. Refer to “Instructional Spaces – Typical Layout Detail” for classroom circuitry.

e) Connect the grounding conductor to the ground bar in the computer panel.

f) Computer circuits and non-computer circuits shall not occupy the same conduit.

g) One circuit per typical classroom for communication outlets. Refer to “Instructional Spaces – Typical Layout Detail” for the number of circuits and outlets required per typical classroom.

h) Feed each circuit from a dedicated computer panel.

i) Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers.

j) Provide one (1) duplex outlet in the ceiling location of the media projector as specified in Section XI (21st Century Classroom).

8. Media Center

Special Floor Outlets:

a) Provide one floor box for 4 (four) computers. Each floor box shall contain 4 duplex power receptacles, two dual voice/data outlets.

b) Refer to Standard Floor Box detail for installation, size and conduit routing.

c) Floor boxes are a 6 (six) gang floor box and be UL listed for the type of floor covering installed in the room.

d) One (1) duplex outlet for each communication port, unless port is designated for voice use only.

e) One (1) duplex outlet for the printer (does not need to be surge suppressed).

f) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-125Vcircuit for every two (2) quadruplex of power provided. Each circuit must consist of one (1) phase conductor, one (1) neutral and one (1) grounding conductor.

g) Connect the grounding conductor to the ground bar in the computer panel.

h) Computer circuits and non-computer circuits shall not occupy the same conduit.

i) Feed each circuit from a dedicated computer panel. Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers. Surge protect the panel, conform to SBBC Section 16415 – Transient Voltage Surge Suppressors.

j) Provide one (1) duplex outlet in the ceiling location of the media projector as specified in Section XI (21st Century Classroom).

9. Science Lab Classrooms and Specialty Classrooms

a) Teacher's Demo Table: Provide a quad of power and single gang outlet for voice/data connection. Locate outlets on the demo table side attached to the teacher's work table. Outlets shall be accessible to the teacher's work station 6" above the top of the work table.

b) Two (1) duplex outlets on wall opposite to teaching wall with royal blue covers for the connecting of lap top charging carts. Refer to "Instructional Spaces – Typical Layout Detail" for location and type of outlets.

c) One (1) duplex outlet for the printer (does not need to be surge suppressed).

d) One quad outlet on wall opposite to teaching wall for connection of student computer.

e) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-125V circuit for every three (3) quadruplex of power provided. Each circuit must consist of one (1) phase conductor, one (1) neutral and one (1) grounding conductor. Refer to "Instructional Spaces – Typical Layout Detail" for classroom circuitry.

f) Connect the grounding conductor to the ground bar in the computer panel.

g) Computer circuits and non-computer circuits shall not occupy the same conduit.

h) Feed each circuit from a dedicated computer panel.

i) Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers. Surge protect the panel; conform to SBBC Section 16415 – Transient Voltage Surge Suppressors.

j) Provide one (1) duplex outlet in the ceiling location of the media projector as specified in Section XI (21st Century Classroom).

10. Teacher Planning (NEW CONSTRUCTION AND REMODELING ONLY)

a) Provide one (1) duplex outlet for each communication duplex outlet.

b) Provide one (1) quadruplex of power for common area communication outlet. If the school is a wireless school, then laptop charging stations will be provided.

c) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-125Vcircuit for every three (3) quadruplex of power provided. Each circuit must consist of one (1) phase conductor, one (1) neutral and one (1) grounding conductor.

d) Connect the grounding conductor to the ground bar in the computer panel.

e) Computer circuits and non-computer circuits shall not occupy the same conduit.

f) Feed each circuit from a dedicated computer panel.

g) Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers. Surge protect the panel; conform to SBBC Section 16415 – Transient Voltage Surge Suppressors.

11. Kitchen Area

a) Provide one (1) quadruplex for communication quad outlet in cafeteria manager office.

b) In the kitchen serving area provide one 20A-120 volts duplex outlet per cash register.

c) Ensure cash registers are connected to the dedicated circuit. Receptacles shall be located 18" AFF when located in a pedestal and 36" AFF when wall/cabinetry mounted. For all pedestal mounted devices provide in-use WP covers.

12. Administration Suite

a) Electrical Outlet Requirements: One (1) quadruplex outlet for each communication quad outlet.

b) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-125Vcircuit for every three (3) quadruplex of power provided. Each circuit must consist of one (1) phase conductor, one (1) neutral and one (1) grounding conductor.

c) Connect the grounding conductor to the ground bar in the computer panel.

d) Computer circuits and non-computer circuits shall not occupy the same conduit.

e) Feed each computer circuit from a dedicated computer panel.

f) Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers. Surge protect the panel; conform to SBBC Section 16415 – Transient Voltage Surge Suppressors.

13. Elementary School Multipurpose Dining (Cafetorium)

a) Provide one (1) duplex outlet for each communication duplex outlet.

b) Provide one (1) quadruplex of power for common area communication outlet. If the school is a wireless school, then laptop charging stations will be provided.

c) Connect the grounding conductor to the ground bar in the computer panel.

d) Computer circuits and non-computer circuits shall not occupy the same conduit.

e) Feed each circuit from a dedicated computer panel.

f) Provide panel with required capacity to feed the actual computer requirements plus 20 percent additional spare capacity to serve future computers. Surge protect the panel; conform to SBBC Section 16415 – Transient Voltage Surge Suppressors.

g) Provide one (1) duplex outlet in the ceiling location in front of the stage area for a media projector as specified in Section XI (21st Century

Classroom). This media projector shall also have a media cabinet located in the stage area.

14. Remodeling Projects

Where providing a new feeder for the computer panel is not possible, the following will be permitted.

a) In the existing panel serving the area under consideration, provide 3-pole breaker and sub-feed a new panel.

b) Provide surge protection for the new panel as per SBBC Section 16415 – Transient Voltage Surge Suppressors. Engineer of Record: Prepare design documentation indicating all necessary load summary analysis feeder sizing and panel schedule of the existing and new panels.

c) All documents shall be reviewed by SBBC Design Services and SBBC Building Department.

15. Renovation Jobs

a) Connect the computer outlet circuits to a dedicated panel instead of connecting to the electrical panels, which may serve other loads.

b) If providing a new feeder for the computer panel becomes an impossibility, the following alternate could be considered:

(1) In the existing panel serving the area under consideration, provide a three (3)-pole breaker and sub-feed a new panel next to it. Provide surge protection for the new panel as per SBBC Section 16415 - Transient Voltage Surge Suppressors. Engineer of Record: Prepare design documents indicating all necessary load summary analysis feeder sizing and panel schedules of the existing and new panels.

(2) All documents shall be reviewed by SBBC Design Services and SBBC Building Department.

VI. Workstation Outlets Locations

A. The workstation outlet (WO) is the combination of the communications outlet (CO) and the power receptacles (PR). Connections are accomplished using communications jacks and electrical plugs.

B. Each workstation location shall have a WO within three feet.

C. Every user area shall include a minimum of one WO. When determining the location of outlets, alternate room arrangements that would meet instructional and/or office needs should also be considered during design. (Retrofit only: Long areas designated as workstation areas may be served using dual channel divided raceway (UL listed) with PR and CO located as needed.)

VII. Wireless Overlay Design - Basic WAP/21st Century Classroom (ceiling mounted projector) Design Guidelines

A. All wiring of wireless access point locations shall be done using a minimum of two (2) Cat6 cables terminated in a dual CO. All access point wiring shall

terminate in the TR on specially designated patch panels used for wireless cable termination exclusively.

B. All cabling for Access Points shall be done following all District standards. All identification of the cable shall be similar to labeling for standard outlets or floor boxes.

VIII. Cabling Design for WAP in New Construction

A. Since a site survey cannot be performed prior to construction the above cabling guidelines shall apply with the following changes. The designer shall design a grid cabling system for the building so as to allow the support cables to be installed during construction. When designing the cabling infrastructure for the Wireless Access Point (WAP) the base distance between terminations shall NOT exceed 250 ft from the point of origin in the ER or TR. The above distance is to allow for adjustments in the actual WAP locations to optimize the signal for the actual conditions. It also is to include the required maintenance loops required for any cabling. After construction is complete, a wireless site survey shall be performed to identify the actual WAP locations and cables to be used to provide the required wireless coverage.

IX. Telephone System

A. New Site

1. Wiring for the telephone system from the ER, TR or DP to the WO in the user areas is accomplished as part of the horizontal wiring. ER, TR or DP's are to be interconnected using a minimum 12 pair Category 3 or Gel-filled Black voice grade cable. Designs for telephone systems must include a dedicated 120V-20A circuit behind the voice systems rack in the ER.

B. Classroom/Administrative Addition

1. Wiring for the telephone system from the ER, TR or DP to the WO in the user areas is accomplished as part of the horizontal wiring. The RJ11 plugs of the telephone instruments will connect to the RJ45 type jack in the WO at the locations selected by the school. ER, TR or DP's are to be interconnected using a minimum 25 pair Category 3 or Gel-filled Black voice grade cable. Each TR interconnection shall be sized according to the minimum needs of one telephone line per classroom and one per administrative outlet.

X. PORTABLES/RELOCATABLE BUILDING

A. Interbuilding wiring distribution shall follow the design and installation standards. Fiber optics shall be used for data services. Lightning protection devices are required at each end of the cable where copper cabling is provided.

B. Provide one box 24"x24"x6" waterproof NEMA rated junction box next to the system boxes on the exterior of the relocatable to be used for technology with 2-2" and 1-3" conduit penetration into the relocatable to be terminated in a 12"x12"x4" junction box.

C. All wireways shall be installed the length of the portable, NOT across the division seam. Conduits which must cross the seam shall be installed so as to allow for easy disconnects at the seam locations.

D. Typical Cable Routes To Portable From Permanent Building

1. Single Portable Installation

a) For a single portable installation where the communication outlets in the portable are located within 250 linear feet of the existing TR, a dedicated 2" PVC conduit from the ER to the portable networking junction box shall be required.

E. Multiple Portable Communications Closet Installation

a) If more than one portable is installed exceeding the 250-ft. limit, one of the portables will be designated as a telecommunications room (TR), distribution panels (DP). If portables are located in a cluster, the center portable is to be established as a TR. This TR will serve the additional portable classrooms within the 250-ft. limit of the TR. The TR portable shall have a 2"conduit home run back to the ER for communications wiring. The communications networking conduits from the TR portable to all of the associated cluster portables are to be home-run routed in a star topology configuration and not of a series design from portable to portable.

F. The standard maximum number of ports served from the portable TR/DP will be 48 quad communication outlets or 192 ports. For example, this can accommodate up to 12 standard classroom portables if the location of the communication outlets within the classroom portables does not exceed the 250-ft. limitation. The 250 foot limitation is defined as the total distance of the cable run from CO to the TR.

G. Type of Cable from ER to Portable TR/DP

1. The type of cable used for communications networking from ER to Portable TR shall be one (1) 12 strand 50/125 μm multimode optical fiber cable and appropriately sized black, gel filled category 3 voice grade cable. Cable and cable installation must meet all appropriate specifications of Electronic Industries Association / Telecommunications Industry Association (EIA/TIA) Commercial Building Telecommunications Cabling Standard 568 B and EIA/TIA TSB 40-A or newer standards as outlined in the BICSI (Building Industry Consulting Service International) standards manual.

H. Type of Cable from Portable TR to Other Portables

1. The type of cable used for communications networking from portable TR/DP to other portable shall be lightning and surged protected, gel filled, category 6 unshielded twisted pair (UTP) copper cable which meets the specifications as stated above.

I. Portable Installation

1. Portable Communication Equipment Room

a) If the portable does not have a permanent structure on site, then one of the portables will be designated as a ER. This portable will require additional space for the ER to accommodate the necessary communication racks for data and voice systems. The amount of space required for the ER will be determined in design.

2. Conduit Infrastructure

a) This portable will be the center of the star topology configuration for the communications infrastructure. All other TR/DP portable conduits will be home run to the ER portable. All manhole conduit ends and network junction boxes must be clearly marked with non-permeable paint for route designations and have protective bushings or bell ends.

3. Local Exchange Carrier Demarcation Conduit

a) All new portable sites will require coordination of Local Exchange Carrier entrance cable facilities. The coordination will be done by the Facilities Telecommunications Coordinator in accordance with the specifications detailed in Project Design Overview #15.

J. Typical Cable Routes and Typical Trench Detail for a Portable Site

1. Conduit sizes required for communications wiring

a) For a single portable or one TR portable, a 2” conduit is needed from permanent building ER to portable.

b) For three to four TR/DP portables, a 3” conduit is needed to a distribution manhole from the permanent building ER with individual 2” conduit to each TR portable from manhole location.

c) If more than four TR/DP portables are required, additional conduit will be necessary.

K. Typical Networking Infrastructure within Portable

1. General Modular and Recolatable Classrooms without Communications Closet

a) All conduits from TR/DP portable shall be home run, stubbed to an exterior mounted weatherproof 12” x 12” x 4” NEMA rated junction box.

b) Penetrating to the interior of the modular will be a 2” sleeve terminating in an interior 12” x 12” x4” metal networking junction box. This junction box will be located 6” above finished floor. A 1” conduit home-run from each CO to the 12x12 interior junction box.

c) In portable classrooms, for each designated communication outlet location, install 1 (one) 1” conduit stubbed out from top of interior networking junction box into the ceiling space or run below floor decking to a 4”x4”x2-1/4” junction box with single gang mudring.

2. General Portable Classroom or Lab with Communications Closet

a) All conduits from TR/DP portable shall be home run, stubbed to an exterior mounted weatherproof 24” x 24” x 6” networking junction box.

b) The TR/DP location requires a 4-ft. x 6-ft. floor space allocated for a communication equipment rack and backboard. Behind the rack location provide an electrical quadruplex outlet in a standard 1900 back box, one 20A-120V dedicated surge protected circuit. All conduits and rack shall be supplied with a bonded ground with a #6 dedicated ground wire run to the building’s electrical service ground and ground rod where supplied.

L. Portable Networking Guidelines

1. General Portable Classrooms

a) Electrical Outlet Requirements:

(1) One (1) quad outlet receptacle for each communication outlet.

(2) Circuitry:

(a) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-120V circuit for every two (2) quadraplex of power provided. Each computer circuit shall have one (1) dedicated hot conductor, one (1) dedicated neutral conductor and a common equipment ground.

(3) Circuit Requirements:

(a) One or more circuits per typical classroom for communication outlets.

(b) Surge protect the panel; conform to SBBC Section 16415 Transient Voltage Surge Suppressors.

(4) Typical Minimum Amperage Requirements:

(a) Computer workstation – 4 amps per workstation

(b) Laptop – 2 amps

(c) Printer – 6.5 amps

(d) Total amperage required determined by the total number of devices in portable.

b) Communication Outlets: Provide a minimum of three (3) 1-inch empty EMT conduits for general classroom. One (1) of the conduits must be located by the teacher workstation and one must be located for use with wireless access port. If conduits are unable to be recessed in wall, then conduits will be mounted externally and secured to wall. Conduit ends must be protected by nylon bushings and include pull strings. (Conduit denotes clear raceway with pull string). Conduits must be grounded per NEC.

(1) Typical Classroom Equipment:

(a) One (1) laptop (Teacher)

(b) One (1) printer

(c) One (1) telephone

(d) One (1) Wireless Access point

2. Computer Lab Portable Classroom

a) Electrical Outlet Requirements:

(1) One (1) quad receptacle for each communication outlet

(2) Circuitry:

(a) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-120V circuit for every two (2) quadraplex of power provided. Each computer circuit shall have one (1) dedicated hot conductor, one (1) dedicated neutral conductor and a common equipment ground.

(3) Surge protect the panel; conform to SBBC Section 16415 Transient Voltage Surge Suppressors.

(4) Typical Minimum Amperage Requirements:

(a) Computer workstation – 4 amps per workstation

(b) Laptop – 2 amps

(c) Printer – 6.5 amps

(d) Total amperage required determined by the total number of devices in portable.

3. Administrative/Special Purpose Portable

a) Electrical Outlet Requirements:

(1) One (1) quad receptacle for each communication outlet.

(2) Circuitry:

(a) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-120V circuit for every two (2) quadraplex of power provided. Each computer circuit shall have one (1) dedicated hot conductor, one (1) dedicated neutral conductor and a common equipment ground.

(3) Circuit Requirements:

(4) Surge protect the panel; conform to SBBC Section 16415 Transient Voltage Surge Suppressors.

(5) Typical Minimum Amperage Requirements:

(a) Computer workstation – 4 amps

(b) Printer – 6.5 amps

(c) Total amperage required determined by the total number of devices in portable.

(6) Communication Outlets: Provide a minimum of one (1) 1-inch empty EMT conduits per staff member. Conduits shall extend from a 4”x4”x2-1/4” junction box with single gang mudring 18” above finished floor to TR/DP backboard or to internal networking junction box. If conduits are unable to be recessed in wall, then conduits will be mounted externally and secured to wall. Conduit ends must be protected by nylon bushings and include pull strings. (Conduit denotes clear raceway with pull string). Conduits must be grounded per NEC.

b) Typical Administrative Equipment:

(1) One (1) computer workstation per staff

(2) Printer – number of printers may vary in portable

(3) Telephones

4. Cafeteria/Dining Portable (Refer to Educational Specifications for Food Service)

a) Provide one (1) quadraplex for communication quad outlet in cafeteria manager office.

b) In the kitchen serving area provide one 20A-120 volts duplex outlet per cash register and provide one network port per cash register device.

c) Circuitry:

(1) Provide dedicated surge protector for the electrical panel. Provide one (1) 20A-120V circuit for every two (2) quadraplex of power provided. Each computer circuit shall have one (1) dedicated hot conductor, one (1) dedicated neutral conductor and a common equipment ground.

XI. 21ST CENTURY ENGAGED CLASSROOM (Refer to "Instructional Spaces – Typical Layout Detail.)

A. Each instructional space shall be provided with a Sound Field Classroom Sound Enhancement system. The system will require power connection and shall be located in the front of the classroom in the media cabinet. Refer to Instructional Spaces – Typical Layout Detail and Specification Section 16820 – Sound-Field Classroom Sound Enhancement.

B. Each instructional space shall be provided with laptop charging outlets located on the wall opposite to the teaching wall. There shall be two duplex outlets each on a separate circuit (royal blue in color) and one quad outlet (gray in color). The royal blue duplex outlets shall be for the connection of the charging carts (NIC) and the gray quad outlet is for the connection of a computer workstation (NIC). Refer to the "Instructional Spaces – Typical Layout Detail".

C. Each instructional space shall be provided with a projector (NIC) located as indicated in the "Instructional Spaces – Typical Layout Detail". The consultant shall coordinate the projector location with the luminaires. The row of luminaires where the projector is located shall be controlled by one of the light switches.

D. All conductors shall be pulled for rough-in inspection.

E. For the 21st Engaged Classroom infrastructure, refer to the schematic drawing for all junction boxes, conduits and room location/deployment arrangement. Associated cabling requirements are noted below:

Wall Plates				**Cable Type**			
Manufact	Part #	Device Qty	Description	Cable Qty	Manufact	Part #	Description
Hubbell	imf2ow	1	Double gang fplate	0	n/a	n/a	n/a
Hubbell	Imr1101ow	1	3RCA composite idc utp	1	Berktek	10032092	Lanmark 1000 cat6
Hubbell	Imsv351101ow	2	***	2	Berktek	10032092	Landmark 1000 cat6
Hubbell	im15st1ow	2	****	2	Liberty	Rgb5c-pin	*
Hubbell	imb1ow	1	Blank insert	0	N/A	N/A	N/A
Extron	MLC104IP	1	Media Controller				
Ceiling Plate				**Cable Type**			
Hubbell	imf2ow	1	Double gang fplate	0	N/A	N/A	N/A
Hubbell	9ST10	1	**	1	Berktek	10032092	Lanmark 1000 cat6
Hubbell	imr1101ow	1	3RCA composite idc utp	0	Berktek	10032092	Lanmark 1000 cat6
Hubbell	imsv351101ow	2	***	0	Berktek	10032092	Lanmark 1000 cat6
Hubbell	imbds1ow	1	15-pin blank	0	N/A	N/A	N/A
Hubbell	im15st1ow	2	****	0	Liberty	rgb5c-pin	*

- *5 conductor 26 awg stranded plenum RGB analog black
- **9 pin to screw type conn. Utp Extron plate terminates.
- ***S-video, 3.5mm combo idc utp
- ****15 pin f/screw svga terminal

F. Hubble Modular connector-plates should be used. Avoid use of pre-stamped connector plates as these are less flexible as future needs may change connector-plate functionality.

G. All infrastructures must be terminated from outlet to outlet so cables are not hanging out of, or hidden up in the ceiling, waiting for equipment to plug in to. The cords must be capable of being plugged into the ceiling plate from the equipment the same way they do at the wall plate(s).

END OF SECTION