

DRAFT

SPECIAL SYSTEMS DESIGN GUIDE

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**DEPARTMENT OF DEFENSE EDUCATION ACTIVITY**

DOMESTIC DEPENDENT ELEMENTARY AND SECONDARY SCHOOLS (DDESS)

**US ARMY CORPS OF ENGINEERS**

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**ABOUT THIS GUIDE**

THIS DESIGN GUIDE HAS BEEN PREPARED TO PROVIDE THE A/E COMMUNITY WITH THE NECESSARY CRITERIA TO ASSIST IN THE DESIGN OF THE SPECIAL SYSTEMS THAT ARE TYPICALLY FOUND IN AN EDUCATIONAL FACILITY. WHILE CERTAIN FEATURES OF THE SYSTEM DESIGN WILL VARY FROM PROJECT TO PROJECT, THE REQUIREMENTS REFLECTED IN THIS GUIDE ARE INTENDED TO PROVIDE THE MINIMUM REQUIREMENTS REQUIRED BY DODEA/DDESS. THIS DOCUMENT REPRESENTS **PHASE[1]** OF THE DESIGN GUIDE DELIVERABLES. **PHASE[2]** WILL ACCOMPANY THIS DOCUMENT AND WILL INCLUDE STANDARDS FOR ADDITIONAL SPECIAL SYSTEMS.

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## [1] DATA/TELECOMMUNICATION SYSTEMS

### [1.1] SUMMARY

This chapter describes the Data/Telecommunication system design and installation/testing requirements.

The design requirements are intended to provide uniformity between design firms of symbols, equipment layouts, cabling methods, pathways, drawing submittal requirements, and specification requirements.

Every facility shall have wired and wireless data system installed and tested by a qualified firm experienced in network installations. All designs shall be in accordance with Building Industry Consulting Service International (BICSI). The network system shall be designed by a Registered Communication Distribution Designer (RCDD) and installed in accordance with the Telecommunications Industry Association (TIA) and Electronic Industry Alliance (EIA) General Guidelines, and the National Electrical Code (NEC). The design professional shall include in the design analysis of all projects a list of active components and a pull schedule as indicated in this guide to be furnished to appropriate DDESS staff to facilitate planning. These guidelines will be coordinated with the Education Specifications (EdSpecs) and will be a supplement. This active equipment shall be furnished and installed by the Government, however, the schedule shall be developed by the design team. Government furnished and installed equipment is noted in the Design Guide.

The following list indicates the minimum requirements for deliverables to be included in the construction drawings. These are representative examples. (Refer to 1.3 DOCUMENTATION REQUIREMENTS):

- [1] Zone Map
- [2] Neighborhood Plan
- [3] Equipment Schedules

The system shall consist of the following:

- [1] Incoming fiber optic and copper cables from the community telecommunication demarcation building to the Main Telecommunications Room 1 (TR1)
- [2] TR1 housing the main network equipment rack
- [3] Additional telecommunication rooms (TR2, TR3, etc.) housing network distribution equipment racks as needed
- [4] Fiber optic and copper distribution cables from TR1 to each additional telecommunication room
- [5] Cable trays, conduits, and supporting devices for fiber optic and copper work area cables
- [6] CAT 6 copper cables from the distribution rack patch panels to individual work area outlets
- [7] Work area outlets consisting of work area connectors, faceplates, room identification, patch panel, and port serving each connector

### Standards:

The design and installation of the network shall comply with the following Standards unless modified by this document:

- ANSI/TIA/EIA-568-B, Commercial Building Telecommunications Cabling Standard
- ANSI/TIA/EIA-569-A, Commercial Building Standards for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-569-B, Commercial Building Standard for telecommunication Pathways and Spaces
- ANSI/TIA/EIA-606, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA/EIA 526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- ANSI/TIA/EIA 526-14, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- NFPA 70, National Electrical Code
- NFPA 101, Life Safety Code
- ANSI/IEEE C2-2007, National Electrical Safety Code
- ANSI-J-STD-607-A-2002, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunication Cabling
- TIA Technical Committee TR-42, Technical Service Bulletin 162, Telecommunications Cabling Guidelines for Wireless Access Points
- 13A - For Outside Plant Cables (OSP)

### (A) Outside Plant Cables (OSP):

At the onset of the project, the telecommunications design team must communicate with installation community responsible for the telecommunication facilities, network infrastructure and distribution system. In particular, this discussion shall identify the location and capacity of the existing available fiber optic and copper cables in the proximity of the project. The design intent is to provide a dedicated 12 strands of single mode fiber optic cable and a 50 pair copper cable from the installation's demarcation point to the new school. The connection points and routing path shall be clearly identified in the facility construction documents. All OSP cables and raceways shall be compliant with Installation Information Infrastructure Architecture (I3A).

The construction documents to be prepared by the A/E shall include detail drawings of all the requirements, governed by the military community telecommunication standards, for the OSP. These shall include but, are not limited to, the number and type of conduits, cable vaults, pedestals, any innerduct, maintenance holes, minimum burial depths and details that depict how the OSP shall enter into the building.

The OSP, including both fiber and copper cables, will enter underground into the main telecommunication room, Telecommunications Room 1 (TR1). Refer to the TR1 floor plan drawing **[Diagram 1]** for the configuration of the room and cable entrance locations.

The incoming copper cables will be terminated in a protected entrance terminal (PET) enclosure and routed in cable tray to 110 type punch down blocks located on the telephone backboard wall as indicated. The copper cables will be routed in overhead ladder trays to the equipment racks located in TR1.

## [1.2] SYSTEM REQUIREMENTS

### (A) Main Telecommunication Room (TR1):

The A/E shall provide detailed plan drawings of TR spaces that indicate proposed layout interconnections and key clearances. Each facility shall contain one main TR1 for network equipment. The main telecommunications room shall meet the following requirements:

[1] The room shall be a minimum of approximately 160 SF with dimensions in each orientation of 10' x 16' with a 9' minimum ceiling height. The room shall have one door, minimum of 36" wide. The door shall have a key-pad lock to control access. The room shall have no windows. All walls shall be covered with 4' x 8' x 3/4" painted, plywood from 6" AFF. The plywood shall be mounted in a vertical position, adjoined to minimize seams, contain not knots, and have "A" grade exposed face. The A/E shall determine if fire-retardant-treated (FRT) plywood is required for compliance with applicable building codes. Refer to **Diagrams 2-6** for additional information.

[2] In order to mitigate the potential conflict of electromagnetic interference (EMI), TR1 shall not be located adjacent to any electrical room and the racks within TR1 shall maintain a minimum separation of 4' from any electrical equipment.

[3] The room shall have a dedicated cooling system independent from the mechanical system serving the rest of the building. This room shall have its own thermostat. The room shall be provided with positive pressure to minimize dust intrusion. The size of the cooling system shall be determined by the heat load produced by the communications equipment. Designer shall provide heat load estimates based on equipment systems that will be installed in the TR1 to support building systems.

[4] Any equipment unrelated to TR1 shall not be installed in or routed through this room.

[5] This room shall be dedicated to systems described herein.

[6] The room shall contain a minimum of four, two-post equipment racks, secured at the top and bottom, with planned expansion of at least one rack. Refer to **Diagrams 1-6** for additional information.

[7] TR1 shall have a standard telephone communication system.

[8] Rack-1 shall be dedicated to horizontal data cabling for data drops located in the proximity of TR1. Switches and patch panels as described below shall be installed in Rack-1 to a maximum of 240 cables. Refer to **Diagram 6** for additional information.

[9] Rack-2 shall be used for termination of all voice and wireless distribution cabling. Refer to **Diagram 6** for additional information.

[10] Rack-3 shall be used to support video distribution/ CATV and any requirements for public address intercom and clock systems. Refer to **Diagram 6** for additional information.

[11] Rack-4 shall contain the fiber optic termination and distribution equipment in the top-most part of the rack. The site incoming fiber shall terminate in this rack. The outgoing fiber to each additional Telecommunication Room and/or adjacent racks shall originate in the top of this rack. Refer to **Diagram 6** for additional information.

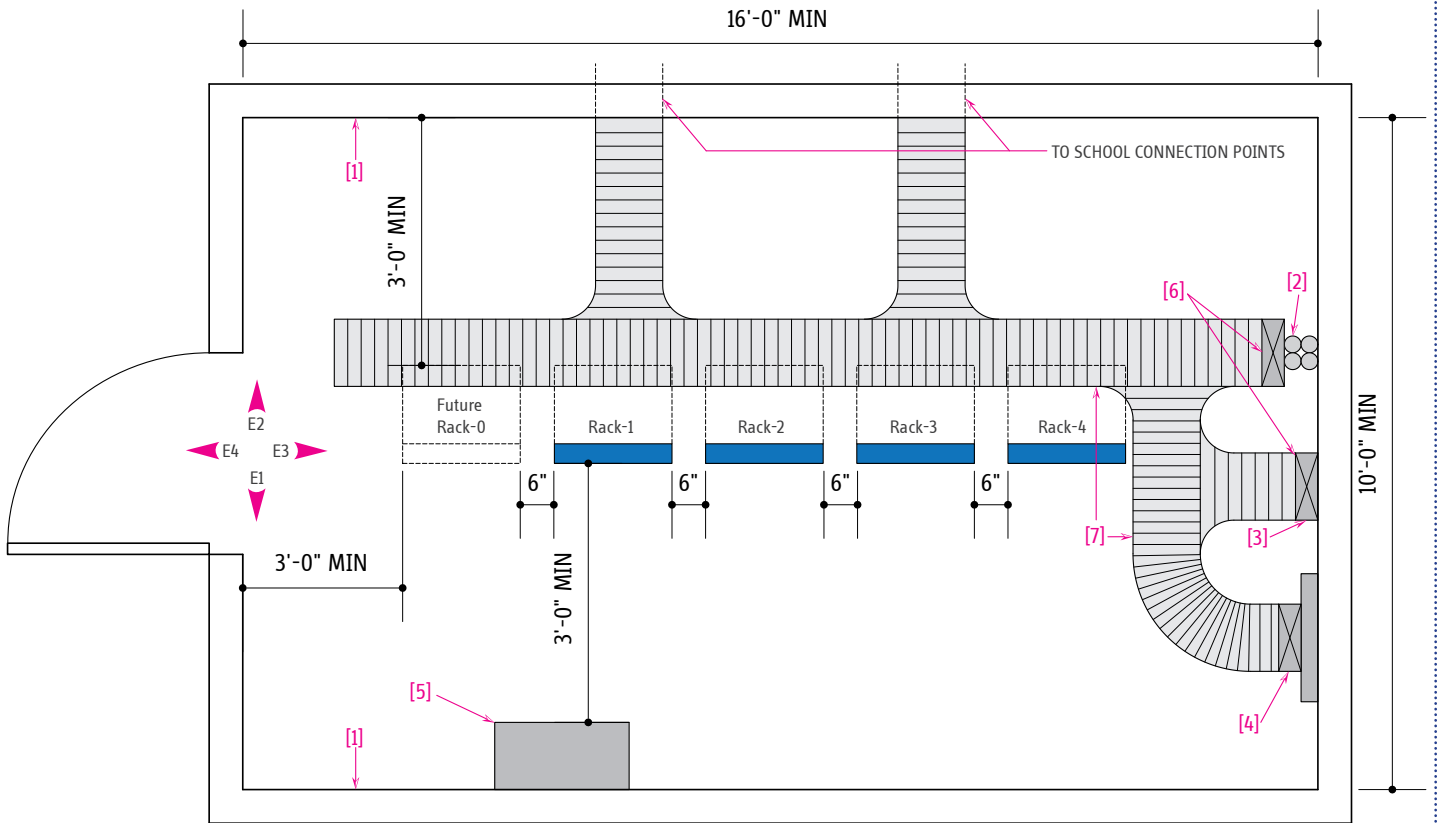
[12] The rack configuration for TR1 shall include physical parameters to mount a fifth rack to accommodate any future expansion. All racks shall have a minimum clearance of 3'-0" from any face of the equipment, including sides of end racks, to any wall or wall-mounted equipment.

[13] Provide a telecommunication master ground bar (TMGB) in TR1 for grounding the equipment racks and cable trays. The bar shall be a minimum of 12" long, 1/4" thick copper and attached to the wall with two insulators at 7'-0" AFF. The TMGB shall be connected to the electrical system main grounding electrode with a conductor sized in accordance with ANSI-607. The electrode grounding system shall be designed to provide a maximum resistance to earth of 5 ohms or less.

[14] TR1 shall be illuminated to an average of 50 foot-candles at 36" AFF using fluorescent luminaires located in front and rear of the racks to avoid shadows on the primary rack surface planes.

[15] The A/E shall install 20A, 120V duplex receptacles on the perimeter walls at approximately 6' O.C. Provide receptacles along the perimeter of the rooms 6'-0" OC and circuit every three receptacles to a dedicated circuit. The quantity of receptacles per circuit shall not exceed three. In addition, provide a dedicated 20A, 120 volt circuit that terminates in a twistlock receptacle mounted on the top or bottom of each rack for connection to remotely manageable power distribution units (PDUs) with ammeter mounted within the racks (one per rack).

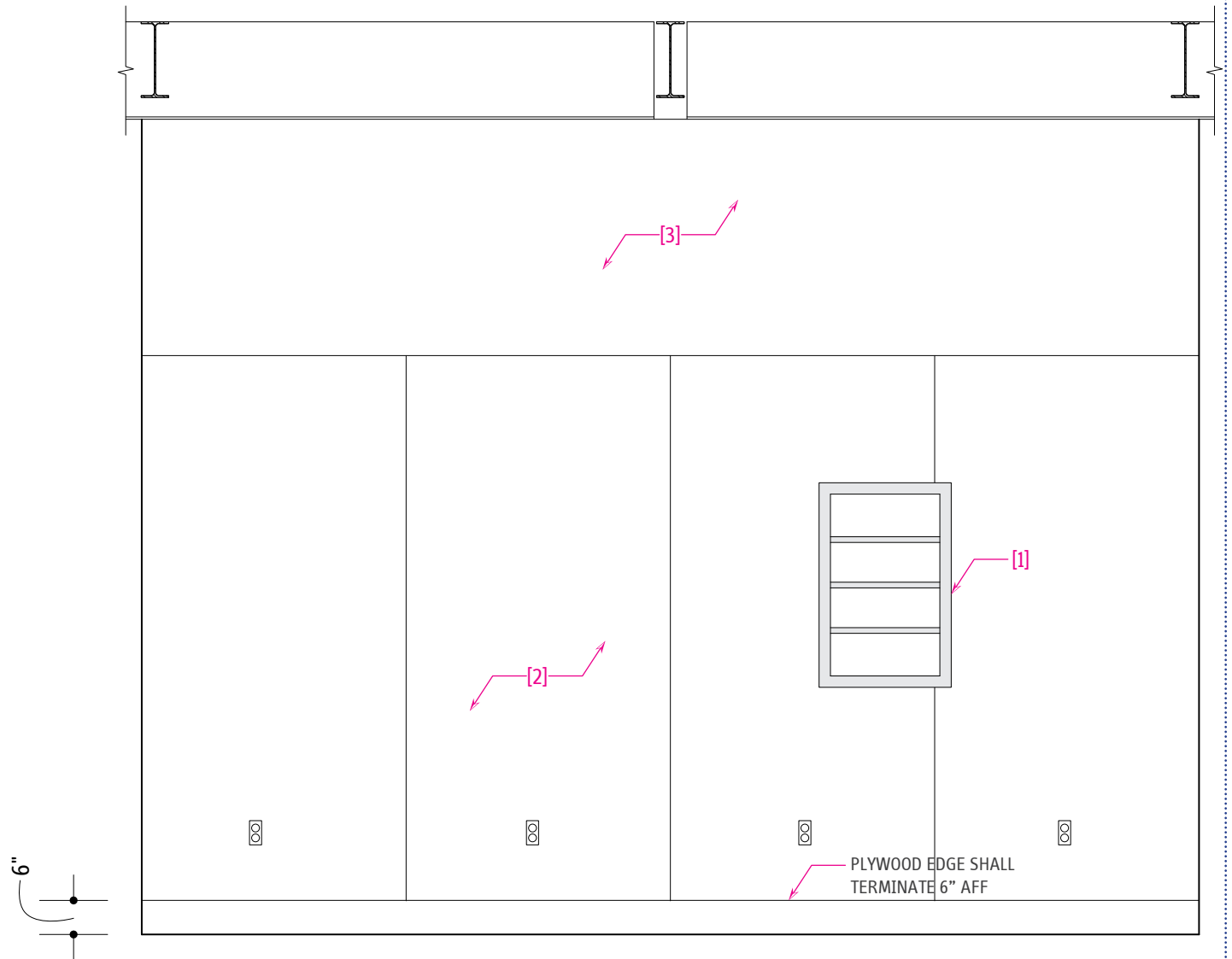
[16] **PDU Management:** The power distribution units at each of the racks shall incorporate switching technology to provide a manageable system for remote control, alarms, current monitoring and power delays. The system shall be Web based and will allow the user to access, configure and manage the units from remote locations.



- [1] 4'X8'X3/4" PAINTED PLYWOOD SHEETS MOUNTED VERTICALLY (ALL WALLS)
- [2] INCOMING OUTSIDE PLANT CABLE (FIBER OPTIC AND COPPER CABLES) - TRANSITION FROM UNDERGROUND CONDUITS TO BASKET CABLE TRAY SYSTEM
- [3] NETWORK PROTECTORS FOR INCOMING COPPER LINES
- [4] TYPE 110 PUNCH DOWN BLOCKS FOR INCOMING COPPER LINES
- [5] PUBLIC ADDRESS / PROGRAM SYSTEM CABINET
- [6] VERTICAL CABLE TRAY TRANSITION
- [7] 18" LADDER TRAY SYSTEM

**NOTES:**

(A) THIS ILLUSTRATION AS WELL AS THE FOLLOWING ARE NOT TO SCALE, ARE INTENDED TO BE CONCEPTUAL AND DEMONSTRATE INTENT. THE ROOM DOES NOT NEED TO BE EXACT DIMENSIONS, PROPORTIONS OR ORIENTATIONS. DESIGN SHALL DEMONSTRATE, OR "PROVE" DESIGNER'S SPECIFIC LAYOUT THROUGH USE OF A SIMILAR DRAWING OR DRAWINGS IN THE SPECIAL SYSTEMS SHEETS.



[1] PUBLIC ADDRESS / PROGRAM SYSTEM CABINET

[2] 4'X8'X3/4" PAINTED PLYWOOD SHEETS MOUNTED VERTICALLY - TYPICAL FOR ALL WALLS

[3] DRYWALL EXTENDS TO STRUCTURE BEYOND 9'-0" AFF

[4] COORDINATE PLACEMENTS OF RECEPTACLES WITH PLYWOOD

**[17] Power Panel:** In TR1, provide a 100 amp, 120/208 volt, three phase power panelboard located on the wall of the TR1 to provide easy access to the power circuit so that they can be de-energized and such that available power is in the room to accommodate any additional circuits that may be needed in the future.

**(B) Additional Telecommunication Rooms (TR2, TR3, etc.):**

Additional Telecommunication Rooms (TR2, TR3, etc.) shall be located where required to limit the total length of the CAT6 copper cable from the patch panel, to the furthest outlet to 275' or less as measured through the cable tray pathways and in-room routing to include vertical rises and drops. The 275' limit provides for sag and unexpected downturns of pathway as well as patch cables at the wall end outlets. Each level of a multi-story facility will contain a minimum of one TR. These telecommunication room(s) shall meet the same requirements as TR1 except as indicated by the following requirements:

**[1]** The room shall be a minimum size of 10' x 10' with a 9' minimum ceiling height. The room shall have one door, minimum of 36" wide. The door shall have a key-pad lock to control access. The room shall have no windows if located on exterior walls. All walls shall be covered with 4' x 8' x 3/4" painted, plywood from 6" AFF. The plywood shall be mounted in a vertical position, adjoined to minimize seams, contain not knots, and have "A" grade exposed face. The A/E shall determine if fire-retardant-treated (FRT) plywood is required for compliance with applicable building codes.

**[2]** This room shall be dedicated to LAN equipment. This TR shall be used to distribute or terminate fiber optic and copper cables to any location other than TR1. Refer to **Diagram 7** for additional information.

**[3]** The room shall contain at least one free-standing equipment rack, secured at the top and bottom, and associated cable management system. The room layout should indicate planned space for a future rack.

**[4]** The incoming fiber optic cable from the TR1 room shall terminate in the upper-most part of the rack.

**[5]** CAT6 patch panels for the horizontal cables shall be located below the fiber optic patch panel leaving a minimum of 4U space between FOPP and the first CAT6 patch panel. This allows space for the enclosed cable management system.

**[6]** Install additional racks (and cable management system) as needed for the quantity of horizontal cables to be terminated.

**[7]** Provide space in the data racks for the active equipment that will be furnished and installed by DDESS.

**[8]** The rack configuration for TR2, TR3, etc, shall include physical parameters to mount an additional rack to accommodate any future expansion. All racks shall have a minimum clearance of 3'-0" from the face of the equipment, including sides of end racks, to any wall or wall-mounted equipment. Refer to **Diagram 7** for additional information.

**(C) Video Distribution:**

**[1]** As noted above, the video distribution shall originate in Rack-2 located in TR1 and will be routed through the respective secondary TR if needed.

**[2]** The video distribution in the teaching spaces is preferred to be provided through the Interactive White Board (IWB). Each IWB shall have a cart-mounted unit that connects to the wall outlet through via an attachment umbilical with strain relief provided. Refer to **Diagram 8** for additional information.

**[3]** The IWB cart assembly will connect to a wall outlet that has a network connection to the TR and three additional CAT 6 cables that extend to the wall mounted IWB/projector.

**[4]** The location of the IWB's shall be coordinated with the entire design team and user group to ensure that it is located in the optimum locations. IWBs may also be portable and connected with an umbilical.

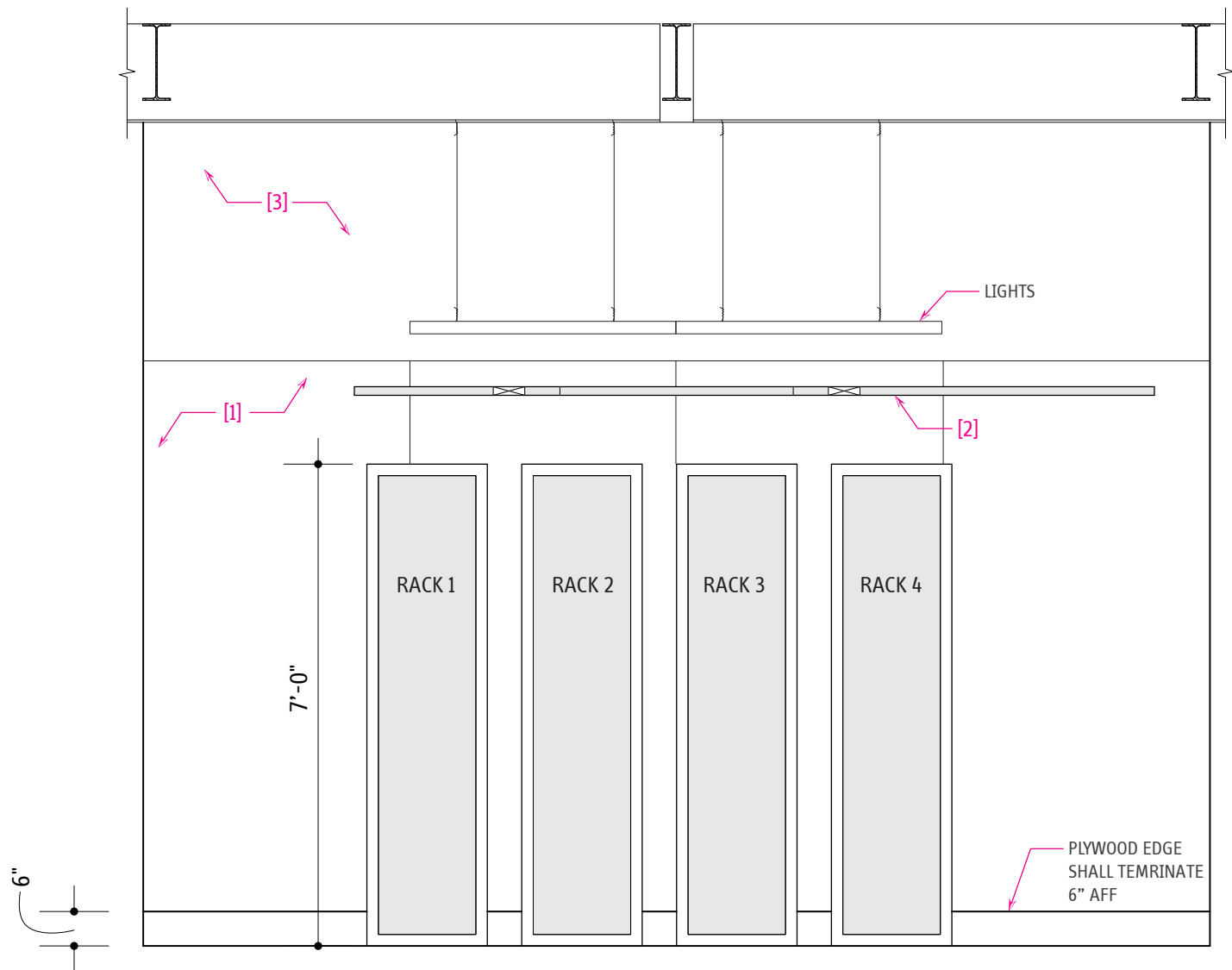
**(D) Wireless Connectivity:**

**[1]** The A/E shall designate the location of the wireless access point outlets to provide full and optimal coverage relative to the actual design conditions of the project, including room layout, heights, and building materials utilized. The density of the wireless usage is expected to increase over time. The quantity and location of the wireless data points, included in the original design, shall be based on the total student population and shall assume laptop operation by every student and staff member. Each instructional area of the learning environment may have up to 120 students and/or wireless network devices. All wireless devices will be powered-over-ethernet (POE).

**[2]** Each primary teaching space shall have a minimum of one ceiling mounted wireless access point outlet.

**[3]** The wireless shall be powered-over-ethernet (POE) and be centrally located for optimal coverage. Facility mapping of wireless zones coverage and capacity must be considered.





[1] 4'X8'X3/4" PAINTED PLYWOOD SHEETS MOUNTED VERTICALLY - TYPICAL FOR ALL WALLS

[2] OVERHEAD LADDER TRAY FOR COPPER CABLES

[3] DRYWALL EXTENDS TO STRUCTURE BEYOND 9'-0" AFF

**(E) Telephone Systems:**

[1] The telephone system requirements shall be coordinated with the military community telecommunications authority to ensure that all new equipment is compatible. The intent is to design a voice system that is compatible for use with VoIP systems where available. All cabling, routing and limitations as indicated in this Design Guide also apply to the voice cabling.

[2] Telephone handsets shall be distributed throughout the building for use by teaching and Administration staff.

**(F) Equipment Racks:**

Equipment racks shall meet the following requirements:

[1] Equipment racks shall be free-standing standard EIA 19" racks with 84" overall height secured at the top and bottom (45 units). Racks shall be furnished with 6" vertical cable management system mounted on both sides of each rack or between adjacent racks. Racks shall contain the cable patch panels, neat-patch organizers, switches, fiber optic patch panels and other Government-furnished equipment.

[2] A minimum allocation of 25% spare capacity shall be included in the bottom most part of all racks as illustrated in **Diagram 6**, the TR1 rack elevation. The racks shall be subsequently populated with the data cabling beginning from the top left of the rack and ending near the bottom right of the rack, followed by the indicated 25% spare capacity below. Additional patch panels shall be installed in the rack to achieve the number of spare ports needed to achieve 25% spare allocation.

[3] Position the racks near the center of the room to ensure full perimeter access. Refer to **Diagram 3**.

[4] Provide rack elevation drawings for TR1 and for each TR room. The elevation shall clearly show the number and configuration of each rack. Detailed information including the number of switches, patch panels neat panels, wire management, and PDU's shall be included in the drawings. The number of terminated cables and the total number of available ports shall be illustrated. Refer to **Diagrams 6-7** for additional information.

[5] Plan TR spaces for an additional future rack location. Refer to **Diagrams 6-7** for additional information.

**(G) Patch Panels:**

Patch panels shall be 48-port CAT 6.

[1] Each port shall be sequentially numbered from left to right 1 through 24 on top and 25 through 48 on the bottom. Install a Neat Patch (2U) horizontal wire manager below the 24-port (single-unit, single-row) or below the 48-port (double-unit, double-row) panels then leave a 2U open space below for customer provided switches. Triple-row panels are not allowed. Below the switch, install an additional Neat Patch (2U) horizontal wire manager. Repeat this step for the quantity of patch panels provided Refer to **Diagrams 6-7** for additional information.

[2] Terminate cables by color and function using T568B configuration in the following order:

- Blue - Data leaving a minimum of 10% of open ports for future use
- Red - Video Distribution leaving 4-6 open ports for future use
- Orange - Wireless leaving 4-6 ports open for future use
- Yellow - Voice leaving 10% open ports for future use
- Green - Network printing devices leaving 4-6 open ports for future use and will utilize a standard work area outlet.

**(H) CAT 6 Copper Cables:**

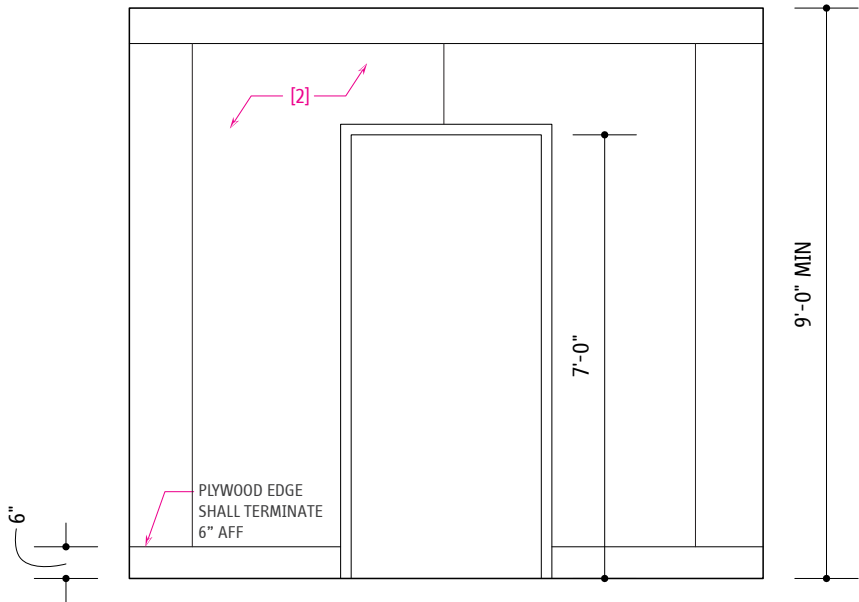
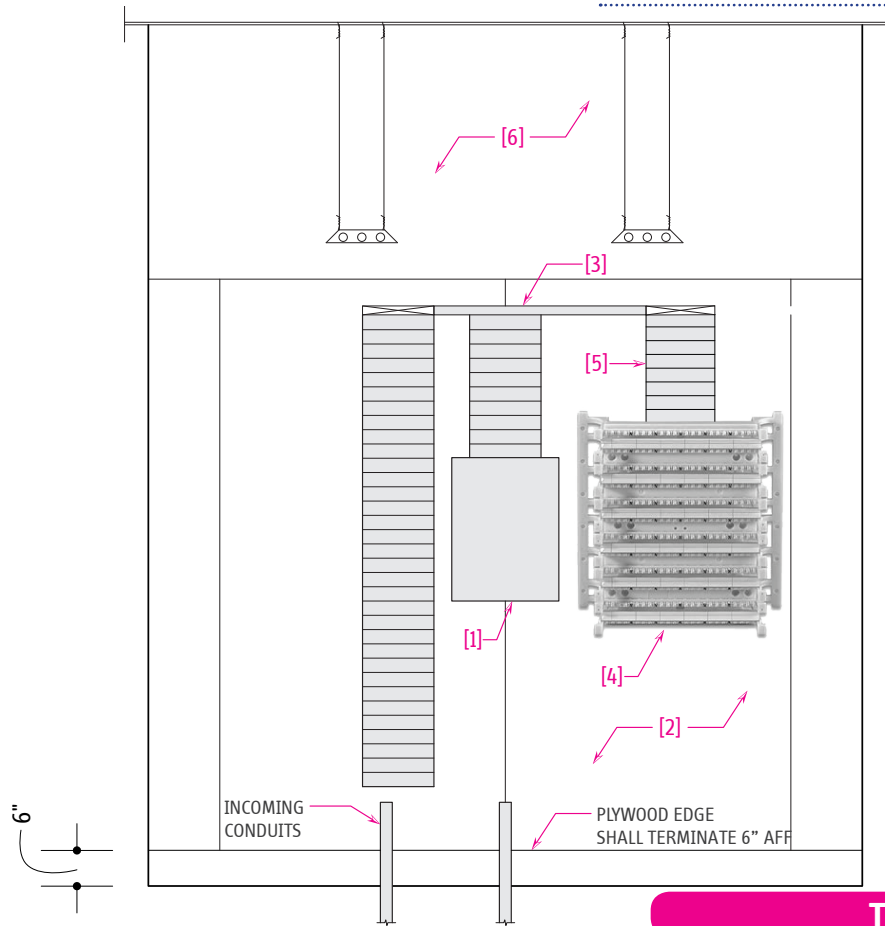
[1] Cables shall be CAT 6, UTP. The outer jacket shall be:

- BLUE for Data
- RED for Video
- ORANGE for Wireless
- YELLOW for Voice
- GREEN for Network Printing Device

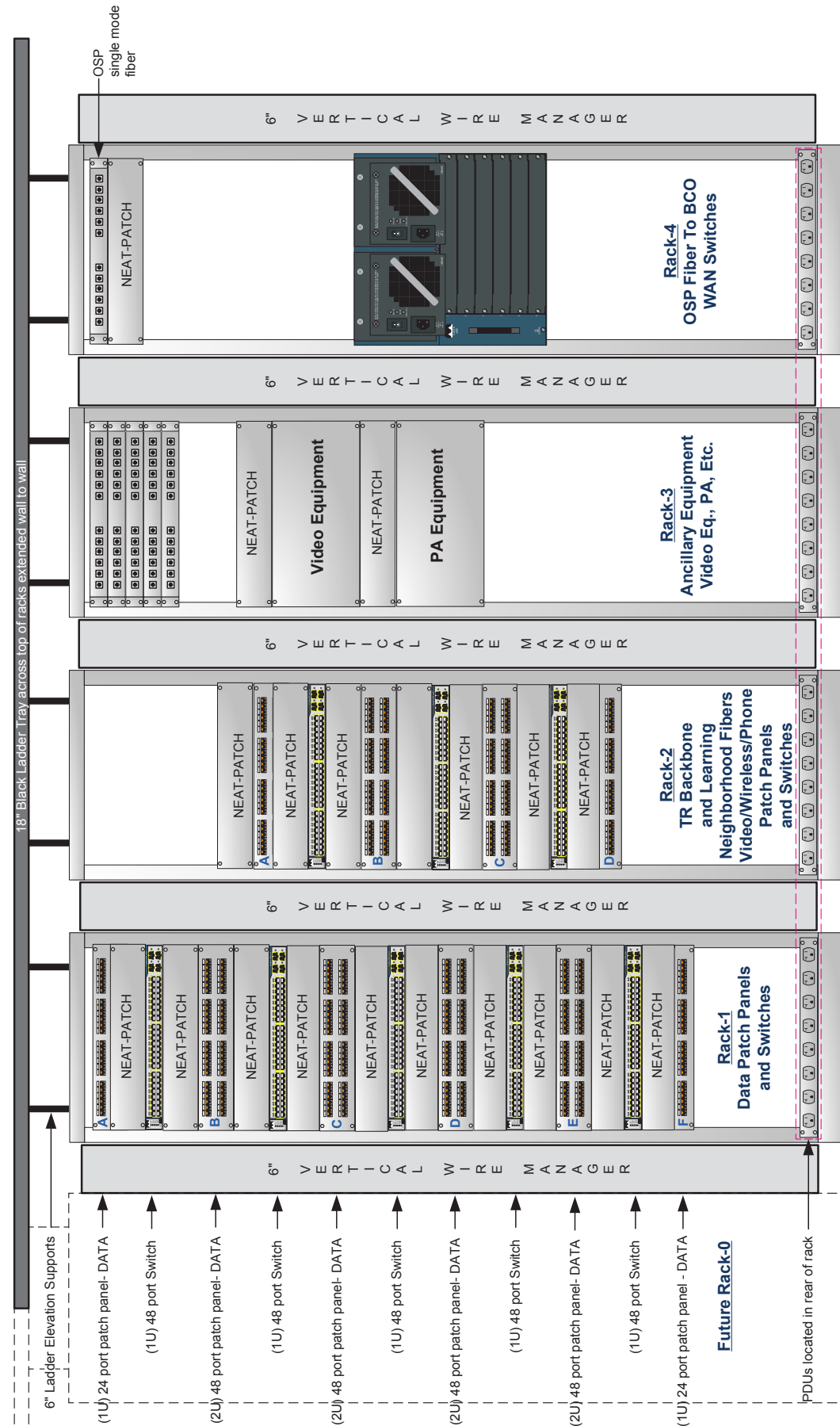
[2] No horizontal cable shall exceed 275 feet in length. In addition, any horizontal cable length in excess of 250 feet shall be specifically identified in the design documents. The telecommunications designer shall evaluate each cable run along its intended path of travel, including elevation changes, to verify the length restrictions are in compliance. All cables shall have passed the UL LAN certification program and be labeled with the UL marking. In above ceiling applications, utilize plenum-rated cable for air plenums.

[3] Cables shall not be installed within 12" of luminaires, motors, or other sources of interference.

[4] Splices within cable runs are not allowed. Cables in horizontal runs shall be bundled together neatly and untangled with hook-and-loop Velcro fastener straps. The installer must adhere to the manufacturer's requirements for bend radius and pulling tensions for all CAT6 runs.

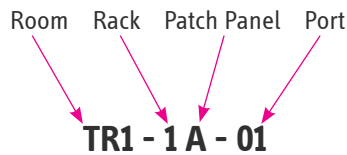


- [1] PROTECTED ENTRANCE TERMINAL FOR INCOMING COPPER LINES
- [2] 4'X8'X3/4" PAINTED PLYWOOD SHEETS MOUNTED VERTICALLY FLOOR TO CEILING - TYPICAL FOR ALL WALLS
- [3] OVERHEAD LADDER TRAY FOR COPPER CABLES
- [4] TYPE 110 PUNCH DOWN BLOCKS FOR TERMINATION OF COPPER LINES
- [5] VERTICAL LADDER TRAY TO SUPPORT VOICE CABLES
- [6] DRYWALL EXTENDS TO STRUCTURE BEYOND 9'-0" AFF



[5] Label all cables on both ends with computer generated, self-laminating, adhesive, wraparound labels with the telecommunications room number (TR1, TR2...), rack number, patch panel identifier, and port number. Place label 4-6" from the termination point. Work area outlet faceplate label shall be behind a protective clear identifying window.

Example:



[6] Patch panel label shall also be behind a protective clear identifying window.

[7] Provide cable pull charts as indicated in **Diagram 11** to identify all cables.

**(I) Fiber Optic Cables:**

[1] Terminate all fiber strands unless otherwise directed with SC type connectors.

[2] Install (1) each interlocking armored Single mode (SM) 12-strand and 50-Micron Multimode (MM) 12-strand cables to each Telecommunication Room from TR1. The manufacturer's recommended bend radius must be adhered to at all times. Terminate the SM in ports 1-12 of the fiber patch panel and the MM in ports 13-24 in the 1U patch panel installed at the top of Rack-3.

[3] Terminating points shall be clearly marked on the exterior of the fiber shelf indicating where each strand pair terminates at the opposite end (source and destination). A legend shall be provided at each fiber patch panel indicating the terminating end points.

**(I) Patch cords:**

Specify that contractor provides the following CAT 6 patch cords to support the LAN connectivity:

- Blue - 10' for the workstation. Quantity to equal 85% of all work area outlets plus 10%
- Blue - 15' for the workstations. Quantity to equal 15% of all work area outlets plus 10%
- Blue - 2' for the patch panels. Quantity to equal total blue work area outlets, plus 10%
- Green - 2' for patch panels. Quantity to equal total printer work area outlets plus 10%.
- Red - 2' for patch panels. Quantity to equal total red work area outlets plus 10%
- Orange - 2' for patch panels. Quantity to equal total orange work area outlets plus 10%

**(K) Cable Pathways:**

[1] All cables shall be adequately supported and protected with materials specifically designed for this purpose. Cables shall not lie on top of ceilings, piping, or mechanical equipment.

[2] Pathways for CAT6 copper cables shall not be installed immediately adjacent to electrical distribution busduct or feeder conduits. Where the cables run parallel to such services, maintain a minimum 6" separation. 90 degree crossings are allowed with a minimum 12" separation.

**(L) Cable Trays:**

[1] The following services are permitted to be installed in cable trays. No other wiring shall be installed in the trays:

- LAN cables
- Telephone cables
- Video cables
- Projector and IWB data cables
- Intercom cables (Data only, not power)
- Fiber optic cables
- Wireless access point data cable

[2] Cable trays shall be installed above accessible ceilings to serve as the primary pathway between telecommunication rooms, and for the horizontal cables. The A/E is responsible for defining and indicating the pathway desired.

[3] Cable trays outside of TR1 may be wire mesh type tray 4" in depth and width as required for the quantity of cables to be supported. Trays shall be filled to a maximum of 40% NEC. The wire mesh shall be hot-dipped galvanized unless a special coating is required. Each section of tray shall be furnished with a grounding lug attached to the tray and bonded together.

[4] Cable trays shall be continuous the entire length. Horizontal or vertical changes in direction shall be made of components by the same tray manufacturer to function as an integrated complete system.

[5] Cable trays shall be installed according to NEMA Standard VE2-2006. Position the trays below any piping or ductwork above the ceiling to provide ease of future access. Maintain a minimum of 12" clear above the top of the tray for installation of the cables, and maintain a minimum of 6" clear below the bottom on the tray and ceiling to allow removal of the ceiling tiles. Position the trays to allow access to items above the ceiling requiring routine maintenance such as filters, valves, VAV boxes, etc.



[6] Cable trays shall be supported from the structure according to the methods described in NEMA Standard VE2 using wall brackets or trapeze hangers. Select all supporting hardware for the weight of the tray and cables contained therein. All cable tray mounting details shall incorporate the appropriate level of restraint as required by the seismic zoning for the application.

[7] Where cable trays pass through walls that extend to the deck, install a framed opening in the wall the same dimensions as the outside dimensions of the tray and penetrate the wall through the framed opening. Where cable trays are shown to pass through fire-rated walls, install a minimum of two 4" conduit sleeves with fire caulk on the outside and fire caulk in the inside once the cable sleeves are pulled.

**(M) Conduits:**

[1] Conduits shall be installed in walls for the vertical drops from the ceiling to the outlet box containing the LAN jack. Minimum size of the conduit shall be 1". Install a bushing on the conduit at the termination above the ceiling to protect the cable during installation. Every conduit installed for LAN cables shall contain a nylon pull string.

[2] Where hard ceilings are encountered, extend the conduits completely across the hard ceiling area and terminate at the cable tray or above an accessible ceiling.

[3] Floor outlets are not DDESS preference. However, where LAN jacks are installed in floor boxes, install conduits under the floor from the box to the nearest wall, run vertically up the wall and terminate above the ceiling. The minimum quantity and size conduits to a floor box shall be two 1" conduits for LAN cables.

[4] Where LAN jacks are installed in modular furniture partitions having internal raceways for LAN cables, install a furniture connection box at the location recommended by the partition supplier. The conduit sizing for service to the modular furniture shall be intentionally oversized to aid in future expansion. Install a minimum of 1.25" conduit from the box to above the accessible ceiling.

**(N) Open Cables:**

[1] Cables may be run without conduit above accessible ceilings from the LAN outlet stub-up to the cable tray. A pathway for such cables shall be established during design and indicated on the design drawings. Bundle cables above the ceiling and support with J-hook or center spline type suspended racks hardware specifically designed for this purpose.

[2] All cables supplying LAN jacks in a room shall enter the room at one location. Where the wall extends to deck, install a conduit sleeve in the wall for installation of the cables. At firewall penetrations, seal around the outside of the sleeve with approved fire caulk. After installation of the cables, seal the interior of the sleeve with approved fire caulk material.

[3] All cables not in trays shall be properly supported with j-hooks installed at a minimum of 5' increments. Position the supports such that the sag at the mid-point between supports is no more than 12". Use additional supports if necessary. Cables cannot lie on the structural steel or "red-iron" of the facility. J-hooks should be installed at all conduit entrances and above all workstation locations to allow for a 3' service loop in the cable.

[4] Neatly bundle conductors into logical bundles and secure with Velcro straps between J-hooks and in all telecommunication rooms.

**(O) Work Area Outlets:**

[1] LAN outlets shall consist of an outlet box with faceplate containing the LAN jacks Refer to the **Diagrams on the next page** for additional information.

[2] Recessed wall outlet boxes shall be galvanized steel boxes, 4-11/16" square with a minimum depth of 2-1/8" where 1" and 3/4" conduits are attached.

[3] Box faceplate shall contain the LAN jacks. Faceplates may contain 1 to 6 jacks on a single gang plate. LAN jacks shall be TIA/EIA Cat 6, 8P8C terminated using a T568B configuration. Refer to the **Diagrams on the next page** for additional information.

**(P) Testing - CAT 6 Cables:**

[1] All cable runs shall be certified. Each cable run shall contain a data report with the following information:

- Circuit ID as labeled at the patch panel and jack.
- Length of cable run
- Date of test
- Cable Type
- Type of scanner used
- Overall test result of cable (i.e. PASS). **NOTE:** Marginal tests are not acceptable.

[2] Wiring shall be tested and reported as complying to the following individual tests:

- Wire Map - Show the wiring is straight through with no open, crossed, reversed, or split pairs.
- Resistance - Measured in ohms, limit, and PASS/FAIL
- Length - Measured length of each cable pair
- Propagation Delay - Measured in nanoseconds, each pair
- Impedance - Determine if anomalies exist on cables longer than 16 feet, measured for each pair.
- Attenuation - Measure the loss of signal over the length of the cable. Attenuation for each pair (dB), frequency for 100 Mhz.
- Measure the near-end crosstalk of a cable and verify the cable has adequate immunity from the next pairs.

[3] Submit the test results in spreadsheet format as directed by the contract specifications. Specifications shall be edited such that DDESS receives a copy.

**(Q) Testing - Fiber Optic Cables:**

[1] Perform continuity test on all fiber and connections.

[2] All installed fibers shall be certified via the use of an OTDR.

[3] Certification of fiber shall report the loss ratio of each fiber.

[4] A printed report of each fiber segment tested shall be supplied.

[5] A summary of all fiber tests, including dB loss for each fiber segment shall be supplied in printed and spreadsheet format.

[6] Provide approximate length of each cable run.

**[1.3] DOCUMENTATION REQUIREMENTS**

**(A) Zone Map:**

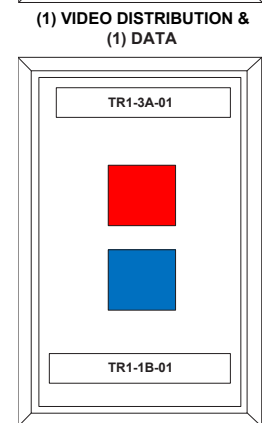
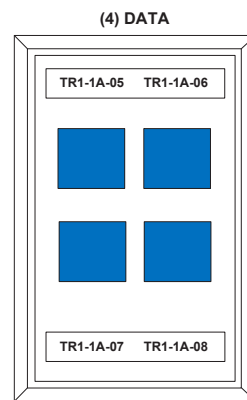
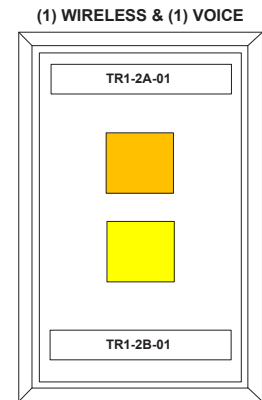
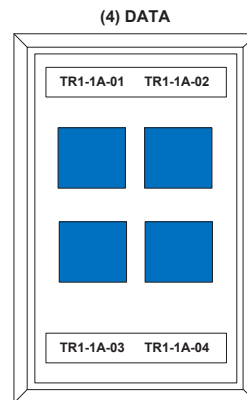
[1]

**(B) Neighborhood Plan:**

[1] The learning neighborhood floor plan is included to illustrate a general depiction of communication outlet locations and their relationship to teaching spaces. As unique conditions exist with an individual project, the actual locations of the outlets, respective to the project, shall be coordinated with the floor plan.

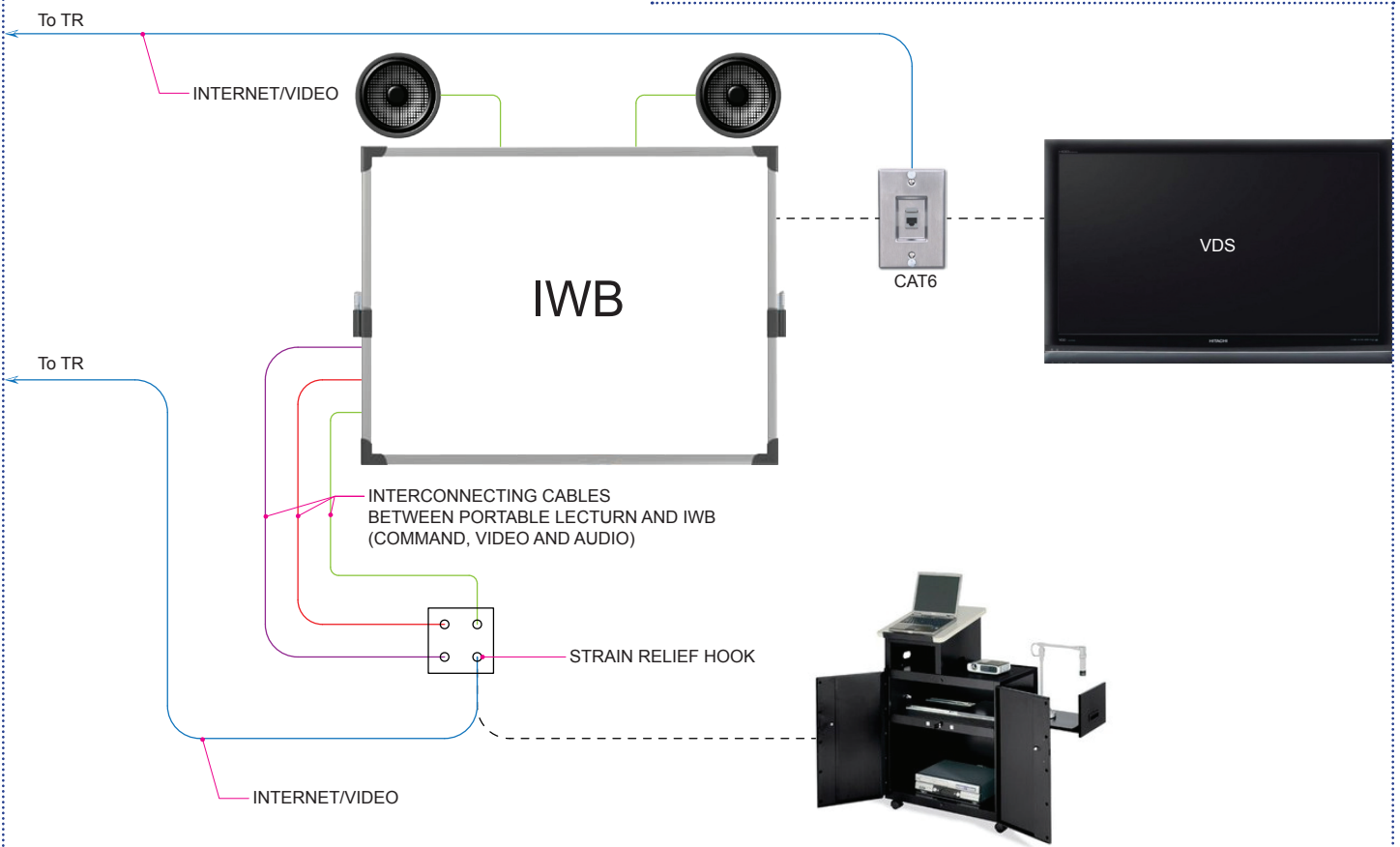
**(C) Equipment Schedules:**

[1] The A/E shall be responsible for the design and consideration of all active and passive components of the communication system which shall include the scheduling of the quantity and type of all applicable equipment. The scheduling shall be organized in a concise table format and provided to the Government for coordination. Active components shall be Government Furnished/Government Installed.

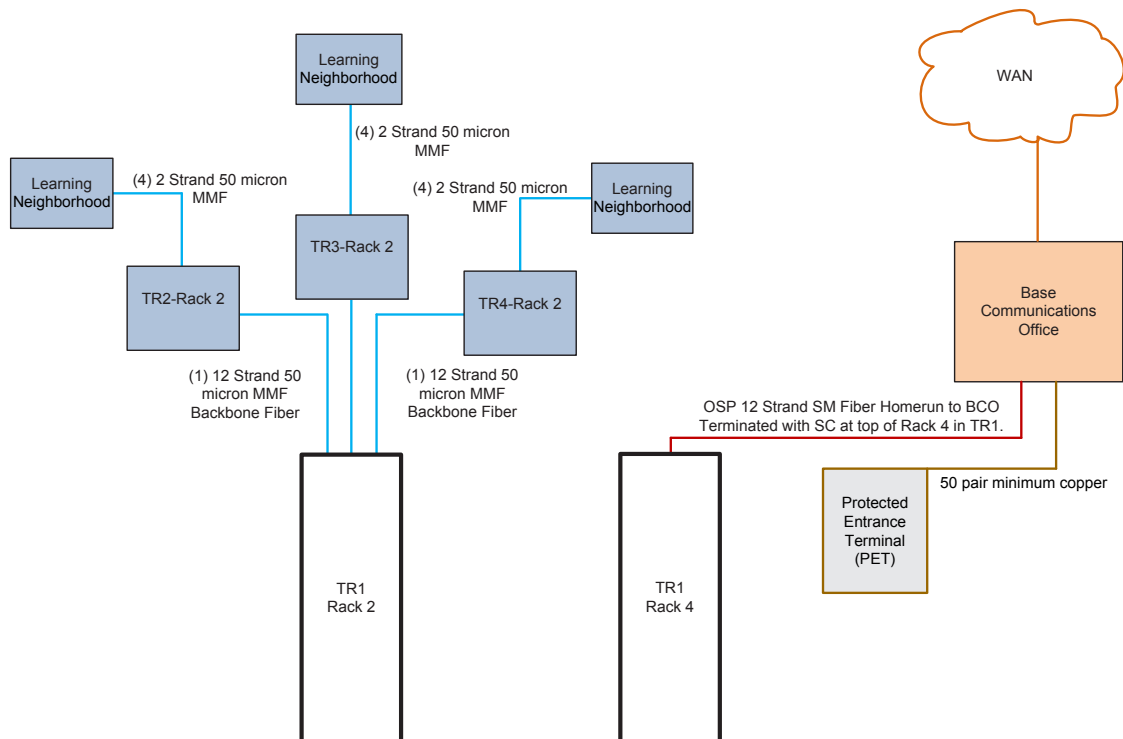




## INTERACTIVE WHITE BOARD [DIAGRAM 8]

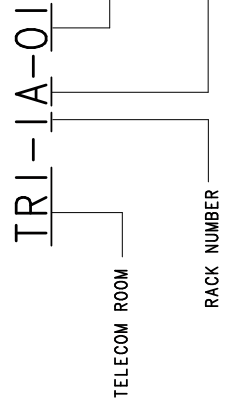


## DDESS FIBER/COPPER DISTRIBUTION SYSTEM [DIAGRAM 9]



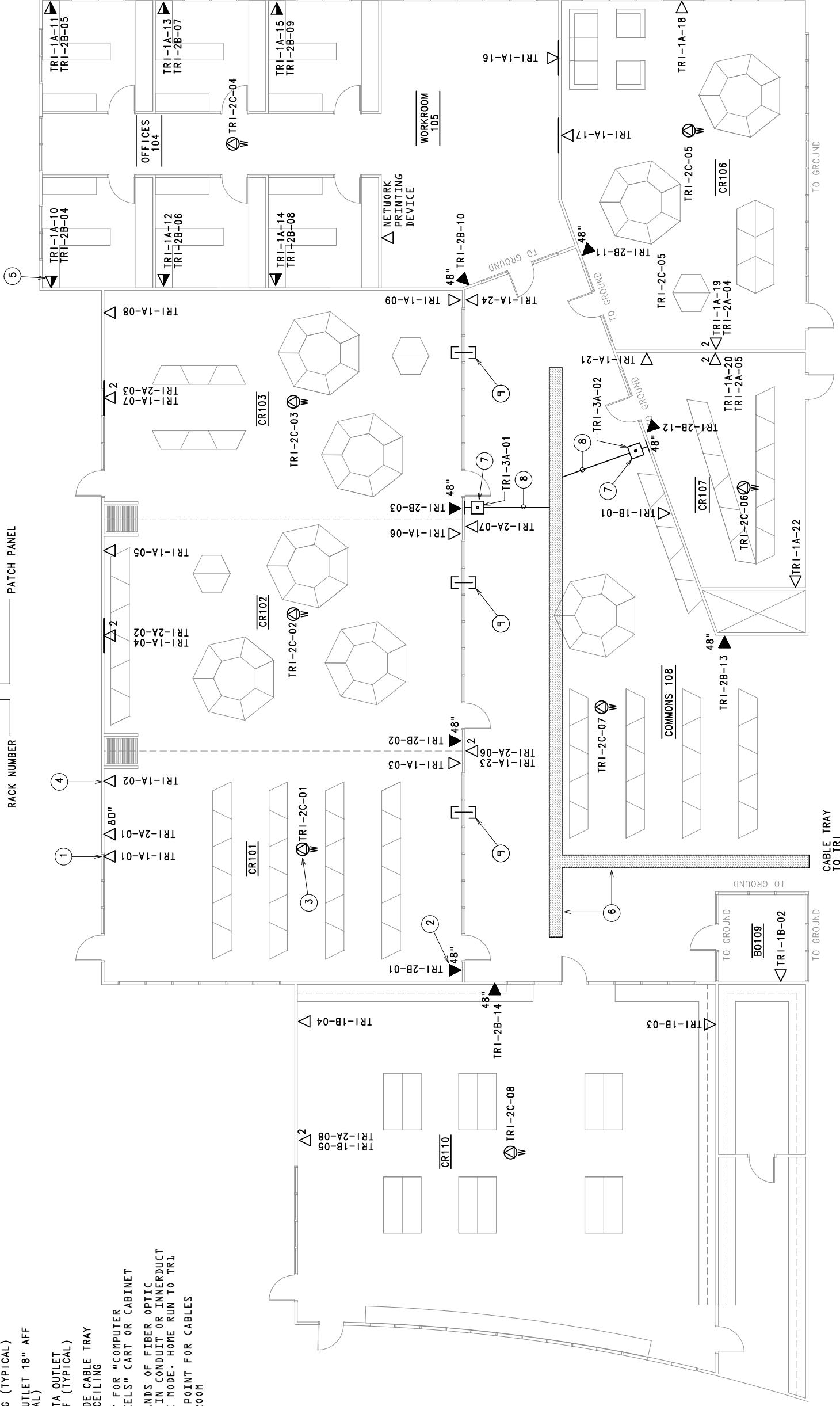
CABLE PULL SCHEDULE									
Telecom Room	Rack Designation	Patch Panel	Port Number	Room	Application Type	Cable Color	Cable Length (<250 Ft)	POE	Remarks
TR1	1	A	1	CR 101	Data	Blue			White Board
TR1	1	A	2	CR101	Data	Blue			
TR1	1	A	3	CR101	Data	Blue			
TR1	1	A	4	CR 102	Data	Blue			White Board
TR1	1	A	5	CR 102	Data	Blue			
TR1	1	A	6	CR102	Data	Blue			
TR1	1	A	7	CR 103	Data	Blue			White Board
TR1	1	A	8	CR 103	Data	Blue			
TR1	1	A	9	CR 103	Data	Blue			
TR1	1	A	10	Offices 104	Data	Blue			
TR1	1	A	11	Offices 104	Data	Blue			
TR1	1	A	12	Offices 104	Data	Blue			
TR1	1	A	13	Offices 104	Data	Blue			
TR1	1	A	14	Offices 104	Data	Blue			
TR1	1	A	15	Offices 104	Data	Blue			
TR1	1	A	16	Workrm 105	Data	Blue			
TR1	1	A	17	CR 106	Data	Blue			
TR1	1	A	18	CR 106	Data	Blue			
TR1	1	A	19	CR 106	Data	Blue			White Board
TR1	1	A	20	CR 107	Data	Blue			White Board
TR1	1	A	21	CR 107	Data	Blue			
TR1	1	A	22	CR 107	Data	Blue			
TR1	1	A	23	Commons 108	Data	Blue			White Board
TR1	1	A	24	Commons 108	Data	Blue			
TR1	1	B	1	Commons 108	Data	Blue			
TR1	1	B	2	Breakout 109	Data	Blue			
TR1	1	B	3	CR 110	Data	Blue			
TR1	1	B	4	CR 110	Data	Blue			
TR1	1	B	5	CR 110	Data	Blue			White Board
TR1	2	A	1	CR 101	Video	Red			White Board
TR1	2	A	2	CR 102	Video	Red			White Board
TR1	2	A	3	CR 103	Video	Red			White Board
TR1	2	A	4	CR106	Video	Red			White Board
TR1	2	A	5	CR 107	Video	Red			White Board
TR1	2	A	6	Commons 108	Video	Red			White Board
TR1	2	A	7	Commons 108	Video	Red			White Board
TR1	2	A	8	CR 110	Video	Red			Wall mounted flat screen
TR1	2	B	1	CR 101	Phone	Yellow			
TR1	2	B	2	CR 102	Phone	Yellow			
TR1	2	B	3	CR 103	Phone	Yellow			
TR1	2	B	4	Offices 104	Phone	Yellow			
TR1	2	B	5	Offices 104	Phone	Yellow			
TR1	2	B	6	Offices 104	Phone	Yellow			
TR1	2	B	7	Offices 104	Phone	Yellow			
TR1	2	B	8	Offices 104	Phone	Yellow			
TR1	2	B	9	Offices 104	Phone	Yellow			
TR1	2	B	10	Workrm 105	Phone	Yellow			
TR1	2	B	11	CR 106	Phone	Yellow			
TR1	2	B	12	CR 107	Phone	Yellow			
TR1	2	B	13	Commons 108	Phone	Yellow			
TR1	2	B	14	CR 110	Phone	Yellow			
TR1	2	C	1	CR 101	Wireless	Orange		●	
TR1	2	C	2	CR 102	Wireless	Orange		●	
TR1	2	C	3	CR 103	Wireless	Orange		●	
TR1	2	C	4	Offices 104	Wireless	Orange		●	
TR1	2	C	5	CR 106	Wireless	Orange		●	
TR1	2	C	6	CR 107	Wireless	Orange		●	
TR1	2	C	7	Commons 108	Wireless	Orange		●	
TR1	2	C	8	CR 110	Wireless	Orange		●	

LEGEND	
	DATA OUTLET (UNO)
	TELEPHONE OUTLET
	TEL/DATA OUTLET
	WIRELESS OUTLET IN CEILING
	FIBER OPTIC OUTLET
	IUB



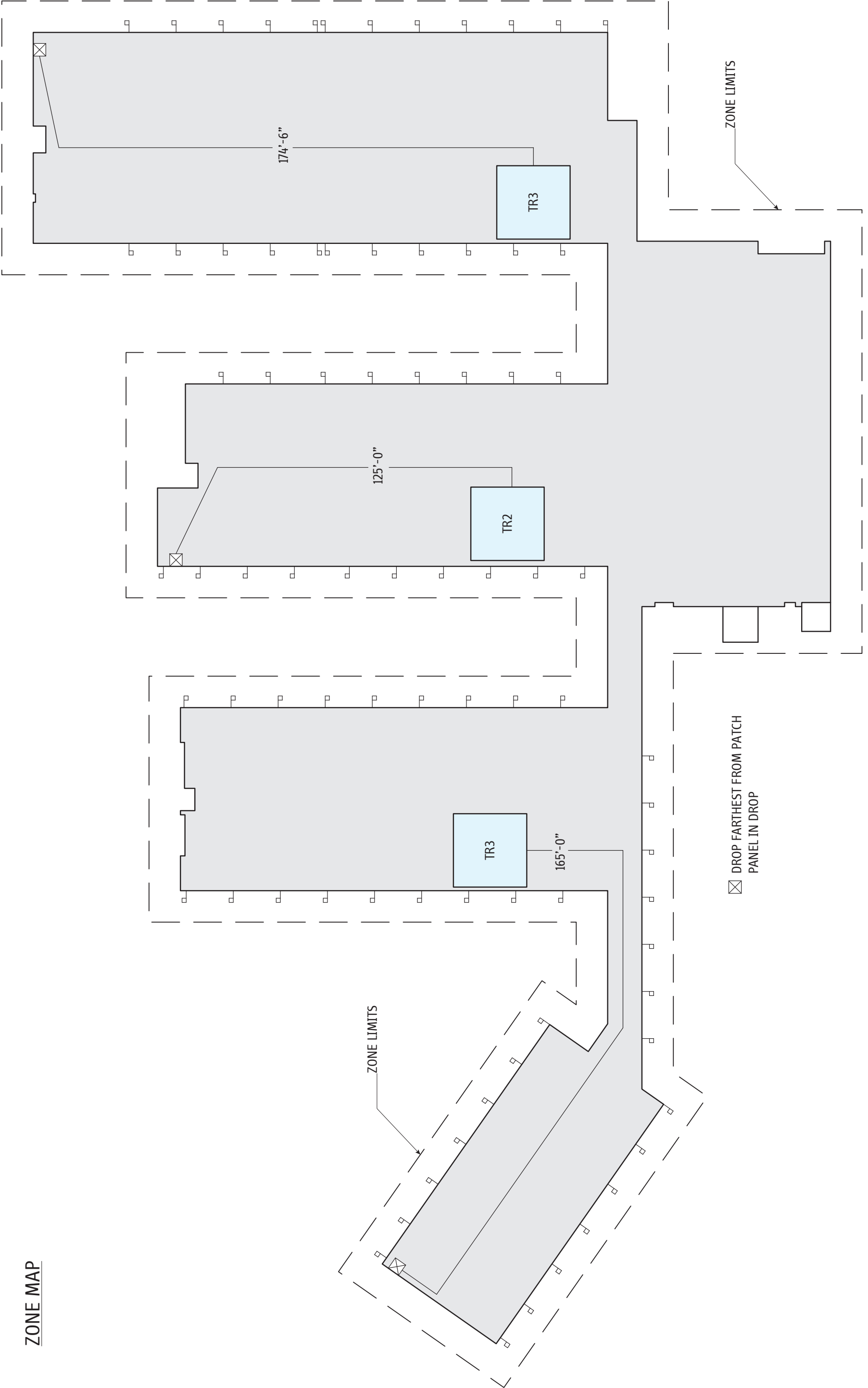
NOTES:

- 1 OUTLETS FOR SMART BOARD AND VIDEO (TYPICAL)
- 2 OUTLET FOR WALL PHONE 48" AFF (TYPICAL)
- 3 WIRELESS OUTLET IN CEILING (TYPICAL)
- 4 DATA OUTLET 18" AFF (TYPICAL)
- 5 TEL/DATA OUTLET 18" AFF (TYPICAL)
- 6 18" WIDE CABLE TRAY ABOVE CEILING
- 7 OUTLET FOR "COMPUTER ON WHEELS" CART OR CABINET
- 8 5 STRANDS OF FIBER OPTIC CABLE IN CONDUIT OR INNERDUCT SINGLE MODE. HOME RUN TO TRI-1A-01
- 9 ENTRY POINT FOR CABLES INTO ROOM



NEIGHBORHOOD PLAN - SPECIAL SYSTEMS

SCALE: 1/8" = 1'-0"



ZONE MAP