Chapter 2
Planning and Project Management

This chapter has been renamed and updated with additional information regarding project management and project documentation. Contents include updated information on construction management issues, retrofit projects, coordination with other industry trades, and working with general contractors.

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Planning and Project Management

Introduction

Planning and project management are key to a successful information transport systems (ITS) cabling installation project. Taking the time to develop a well-defined plan before a project starts will help deliver a proper installation on time, within budget, and ensure that the job can be performed and meets all customer requirements.

Larger and more complex projects require more time to plan. It is difficult to manage loosely defined objectives and the efforts of a large project team over an extended period of time.

The purpose of a project plan is to provide:

- An understanding of the work to be done and how the cabling installation fits into the overall project.
- A list of project objectives.
- A list of specific tasks.
- A project schedule to track time and resources.
- Staffing assignments and project responsibilities.
- Identification of potential roadblocks and strategies for addressing them.
- Definition of the documentation forms and procedures used on the job.
- A tool for managing the project.
- A way to get commitment from the project team.

This chapter describes the components of a project plan and outlines how to use the plan to manage a project more effectively.

Developing a Project Plan

A cabling installation project plan must address all aspects of the installation.

Developing this plan involves a series of tasks, including:

- Gathering and reviewing customer documents, including drawings, specifications, material list, scope of work, and contract.
- Developing the project schedule.
- Developing project documentation, including a project log; acceptance plan; and forms for requests for information (RFIs), submittals, job change orders, and punch lists.
- Conducting a site survey to verify all gathered information.
- Reviewing and incorporating the company's safety plan. An understanding of cabling installation standards (structured wiring); national and local codes (safety issues); BICSI® manuals (design element); manufacturers' specifications (installation methods and product quality); voice, data, and video fundamentals; and a clear understanding of the customer's requirements will contribute to the success and effectiveness of the plan.

Gathering Information

Customer's Documents

When a cabling system installation is requested, the customer has several ways of soliciting bids—a request for proposal (RFP), a request for quote (RFQ), formal contract, purchase order (PO), or other document. These plans are transmitted to the cabling company.

The customer's plans typically contain drawings and specifications that identify the materials to be used, the standards by which they will be installed, and the individual installation locations. In addition to these plans, the customer's documents may include:

- The ITS distribution designer's drawings (cabling installation drawings).
- A list of materials.
- The scope of work.
- A contract that includes any other documents that dictate the progress or method of installation for the project.
- An overall project schedule.
- The customer safety plan.

For some projects, the cabling company or a member of the cabling installation team will be responsible for developing a set of installation drawings, list of materials, and the installation scope of work.

Gathering Information, continued

Customer's Drawings

Usually, the customer's drawings are scaled floor plans prepared by a licensed architect or registered professional engineer and will be accompanied by a document containing written specifications. The following can be used to determine which drawing set(s) are necessary:

- "A"—Architectural drawings, referred to as "A" drawings, show a plan (top) view of each floor in a building. Architectural drawings include all aspects of the physical construction of the building. They provide the detail for such items as walls, windows, ceilings, doors, flooring, cabinetry, and furnishings. If the architect employs an interior decorator, their work will be reflected on these drawings.
- "M"—Mechanical drawings, referred to as "M" series drawings, indicate the size and route of the heating, ventilating, and air conditioning (HVAC) and plumbing systems within the structures. In addition, the "M" series drawings may indicate potential obstructions to the installation of wires and cables inside the building. "M" series drawings indicate whether the main water pipe serving the building is metallic.
- "E"—Electrical drawings are very important to cabling installers. They indicate where the electrical services are installed inside the building and the pathways that will be installed by the electrical contractor for use by the cabling installation team. The drawings indicate the grounding system designed by the electrical engineer; the location of supporting structures installed by the general contractor (e.g., plywood backboards); and the layout of ceiling lights, called a reflected ceiling plan.
- "T"—With the approval of the new MasterFormat™, use of telecommunications drawings will increase throughout the building trades industries. When separate electrical and telecommunications drawings are provided, the telecommunications drawings will show the pathways, distribution room layouts, and media required for the project.

  Drawing packages provide the telecommunications pathways on "E" and/or "T" drawings and telecommunications outlet/connectors on a separate set of drawings. In large complex installations (e.g., school buildings and hospitals), there may be separate drawings for electrical, telephone, data, video, fire alarm, and intrusion detection systems.

  In most cases, pathways shown on design documents are schematic in nature. They do not reflect the actual route or path but, rather, indicate beginning and end points. The specific cable installation routes are left up to the cabling installers.

Gathering Information, continued

- "S"—Structural drawings are important because they indicate the location of all components of the building structure itself—the steel beams, concrete floors, exterior walls, and other components that make up the basic structure. The plans contain detailed sectionalized drawings that give both a plan (top) view and an elevation (side) view of the structures.

The following are types of drawings that can be found within each set:

- Site drawings can be provided by civil, landscape, or electrical engineers or by other members of the design team. These drawings indicate locations of exterior pathways that are being installed for use by the ITS contractor. The drawings indicate the size, quantity, and route of the pathways, as well as the service each will support. Site drawings usually identify service entrance pathways that will be used by the local service providers (SPs) in bringing service to the building from the public network.
- Cross-sectional drawings (riser diagrams) show the building profile and the floor-to-floor relationships within each building. This should show all pathways and spaces for ITS.
- Floor plans are an overhead view showing dimensional relationships on each individual floor that provides telecommunications rooms (TRs), work area outlets, and cabling or pathway routes.
- Room detail drawings provide an overhead view showing details of cable terminations, equipment locations, cross-connects, and electrical services within the room.
- The drawing package generally contains one or more sheets for general notes, legends, symbols, and abbreviations, as well as a drawing list. It is important to check this information to:
  - Identify all plans that impact cabling installation work.
  - Understand how the overall project is expected to come together.
  - Note any special requirements or limitations.
  - Understand who is responsible for installing the ITS pathways. Do not assume that others will be responsible.

Construction Specifications

Plans provide a pictorial representation of the project. The details required to accomplish such tasks (e.g., material ordering) are contained in the specifications. Specifications provide a written description of the work to be performed and the responsibilities and duties required of the architect, engineer, contractor, and owner. They identify the materials to be used, as well as applicable standards, performance criteria, and testing methods. Together with the drawings, the specifications form the basis of contractual requirements.

Gathering Information, continued

Designer's Drawings

A BICSI Registered Communications Distribution Designer (RCDD®) may be employed by the customer, the architect, the engineer, or the cabling installation company to develop the required telecommunications drawings and specifications. If not, a member of the ITS installation team may develop them. These drawings and documents indicate the size, quantity, description, and route of the cables to be installed, as well as the type of hardware used for supporting and terminating the cables. The drawings and documents should indicate the type of cable to be installed (e.g., performance rating, type of construction, and fire rating), the splicing sequences (if any), and the cables to be terminated in all TRs. In addition, the drawings should show the type of connecting hardware by size, quantity, and configuration, as well as the supporting structure required (e.g., cable tray, conduit, and hangers).

At times, separate drawings may be prepared for each type of ITS system to be installed. Separate drawings are prepared for copper cables, optical fiber cables, coaxial cables, and other low-voltage cables. However, there should be a schematic showing the placement of all the cables and sleeves so backbone routing can be determined. If the project is small enough, all of the information may be contained on a single drawing.

Elevation details of the TRs and the placement of various equipment items should be part of these drawings. A detail of each wall and rack in each TR, as well as a plan view of the floor-mounted hardware, should be included.

An example of a designer's drawing is provided in Example A at the end of this chapter.

Materials List

To submit an accurate proposal, a list of materials should be prepared during the bidding phase. This list should contain all of the items to be installed by:

- Description.
- Catalog number.
- Quantity.
- Unit price.
- Total price.

Gathering Information, continued

The list should have columns indicating the materials received and the materials dispensed. Field personnel can use these two columns to manage inventory during the actual installation work. Many contractors prepare similar lists for installation labor units, indicating the amount of time allocated for each portion of the installation. In addition, the list should contain labor hours allocated for the project by work process. Examples of these lists are shown in Examples B and C at the end of this chapter.

Scope of Work

A scope of work for the project covers the requirements for the cabling installation team. The scope of work document lists all of the elements of the installation. It is usually generated by the customer or the designer. However, the scope of work can be developed by the cabling installation company when bidding or responding to a customer's RFP or by the cabling installation team. The scope of work should indicate:

- People and firms involved in the project and their responsibilities.
- Work to be performed.
- Time frame for completing the work.
- Permits and/or licensing required and who is responsible for obtaining them.
- Materials to be installed.
- Methodology to be employed.
- Known limitations, restrictions, or potential problems with the job (notes and assumptions).
- Identification, labeling, and documentation systems to be employed on the project.
- Testing and test documentation methods to be employed.
- When and how the installation will be turned over to the customer.
- Clarifications or understandings that elaborate on the various items involved in the installation.

A sample scope of work is shown in Example H at the end of this chapter. This scope of work is an example only and is not intended to be all encompassing.

Contract

A project contract documents the understanding between the customer and the contractor. Some customers generate a PO that refers to other documents associated with the project (e.g., the scope of work or the materials list). If a contract is used, ensure that copies of the contract and any supplementary documents it lists are provided to the cabling installation team.

Gathering Information, continued

Contracts may list penalties associated with not completing the work correctly or delays in completion. Pay particular attention to liquidated damages. Performance bonds and insurance may be required as part of the contract. When a new or customer's contract is used, it is always a good idea to have an attorney review the document to determine whether the cabling installer's understanding is consistent with the actual legal issues involved.

Project Schedule

Once all of the items associated with planning a cabling installation have been identified, a project schedule needs to be developed. The schedule should list all project tasks, beginning with the award of the contract and ending with acceptance by the customer and collecting the final payment. The detail required for each task is directly proportional to its importance in completing items that precede or follow it. The project schedule should indicate the planned time required for each item, as well as provide space for inserting the actual time to perform the job task.

Developing the Project Schedule

When developing a schedule for cabling installation work, the first schedule to obtain and refer to is the general contractor's construction schedule. It includes all of the trades working on the project and indicates their specific timeframes for accomplishing the project work. Of particular concern are the schedules for completion of the supporting structure inside the building. For example, installation of the backbone cables or the horizontal cables cannot be scheduled until the person or firm responsible has completed installation of the pathways and spaces used to house these cables.

With new building construction and many retrofit projects, it is necessary to identify the finishing schedules for other trades. For example, faceplates cannot be installed until the wall covering is completed. Racks may not be installed until the floor covering is installed. This can mean multiple trips to the job site for the cabling installation team.

The cabling project schedule should complement the general contractor's project schedule. Failure to coordinate the cabling project schedule with the general contractor's schedule may result in conflict between the two companies and could jeopardize timely completion of the project for both.

Project Schedule, continued

Companies use a variety of project management styles and software to develop project schedules and track installations. Some of the more prominent software packages in the marketplace are Microsoft® Project, MacProject Pro from Claris® Corporation, and Primavera®. Automated systems can reflect:

- Start and end times for specific tasks.
- Resources necessary to undertake specific tasks (some systems reflect people only, while others tie into materials lists).
- Interrelationship of tasks (e.g., what tasks must be completed before others; what tasks must wait until several other tasks are completed).

As actual project information is entered in an automated schedule, the system can display:

- Percentage of completion.
- Progress payment schedule.
- Materials or other resources expended.
- Time delays or advancements.
- "What if" analyses to review the impact of moving dates or resources.

Manually generated project schedules can be used, especially when the project is small and not complex. Copies of the completed schedule should be provided to all concerned parties.

Examples of two project schedule documents are shown in Examples D and E.

Developing the Project Documentation

All projects require documentation. Some documentation is required by the contract, and some is kept to make sure the project meets time and budget requirements. Documentation may vary by project, depending on its size and complexity. Most projects will include the following:

- Job log
- RFI and submittal forms and logs
- Job change orders
- Acceptance plan
- Punch list
- As-built drawings
- Test documentation
- Maintenance or equipment documentation

Developing the Project Documentation, continued

Job Log

If a standard form for tracking daily activities is not available, a job log should be developed. This log should reflect all work undertaken by day, whether it is complete, and the plans for the following day. It should provide a place to record detailed notes on any issues that arise, including:

- Date.
- Time.
- Who brought up or discussed any installation problems and the individual(s) involved.
- Description of the problem.
- Resolution.

The person in charge at the project site will use the job log to record all activities associated with the project. It is especially important to log occurrences that may result in scope changes that could have a financial impact on the cabling installation company. Sometimes, a contract requires copies of this log to be submitted to the customer and general contractor on a periodic basis.

Request for Information (RFI)

The contract documents cannot cover every detail about the materials, procedures, and testing requirements to be used on the project. RFIs are used to request clarification, supplemental information, or approval of materials substitution. They can provide direction when unforeseen circumstances arise. They are not intended to be used to request information on time-critical issues (e.g., gaining access to a work site).

The RFI form must provide a place to assign an identification tracking number to the RFI and to record the date and time, a description of the request, who is sending the request, and who will receive the request. This information must be entered in an RFI log, along with the date and time the response is received and the content of the response. This log provides a way to track when an RFI was sent, read, and acted upon.

An example of when to submit an RFI is as follows: The drawings indicate that all station cables are to be fished through existing office walls. However, the cabling installer finds the walls are constructed with multiple fire barriers, prohibiting a top to bottom pathway. An RFI should be prepared asking for direction from the owner or contractor. If surface raceway is installed without obtaining approval in writing, it may be difficult to receive compensation for the extra work and materials. In addition, the owner may state that surface raceway should not be used in such a situation, and the work may have to be redone.

Developing the Project Documentation, continued

Submittals

Submittals are a form of communication between the cabling installation team and the contractor or owner defining the specifics of how a job will be undertaken. In the construction industry, these most often fall into two categories: shop drawings and product cutsheet submittals.

Specialty contractors (e.g., HVAC, fire suppression, and audiovisual installers), most often provide shop drawings. They reflect the specific details of products to be used and the method of their installation within the new or renovated spaces. Shop drawings are often scaled drawings similar to the original construction blueprints showing the specific methods of interconnection, size of components, or individual routes that will be used when installing the product.

Product cutsheet submittals are used for documenting the specific items or product models that will be used on the job. These submittals note the product name or specification number and complete performance specifications.

Examples of submittals that might be required of the cabling installation team are:

- Products
  - Cable—each type and model
  - Outlet components (e.g., jacks, faceplates, and connectors)
  - Ladder racks
  - Equipment racks
  - Firestopping materials
- Shop drawings
  - Backboard layouts
  - Equipment rack placement and component layouts
  - Cable routing—horizontal and vertical
  - Cable suspension methods

Submittals that are a contractual requirement must be tracked to determine compliance with submittal methods and terms. This tracking can be a simple log defining when a specific submittal was made, when it was returned, and whether it was approved or requires resubmission.

Developing the Project Documentation, continued

Job Change Orders

Few projects are completed without changes to the original work plan. Even on small projects, changes occur. The changes may be insignificant, but they must be documented. When accounting for all materials and work operations at the completion of the project, unless the changes are documented and approved by duly authorized agents, compensation may not be received. A contractor should never perform additions, deletions, or material changes to the scope of work without written authorization.

When submitting a change order, keep the original and provide copies to the customer and any other interested parties. Be aware of the consequences of change orders prior to implementing them, especially their impact on the project schedule.

An example of a job change order form is provided in Example G. The cabling installation company may have forms prepared for this purpose. If not, and if the attached form is not used, copies of an approved American Institute of Architects (AIA) change order form may be used on the project. For many projects, this may be the only approved change order form.

Acceptance Plan

An acceptance plan outlines the tasks, tools, staff, and skills necessary to test and document the successful completion of a project. Many manufacturers and individual project plans provide copies of the documentation required to fulfill the contract needs but leave the logistics of how to conduct the tests up to the cabling installation contractor. To reduce the duplication of effort and provide an effective plan, the following items must be defined:

- When the testing will take place (once, several times, every day).
- Who will conduct the tests (how many people with what type of training).
- Who will witness the tests (if required).
- What tools, supplies, or other materials are required.
- Who needs to be notified or forewarned of the testing.
- How the tests will be documented.
- How the results will be transmitted to the contractor or owner.

Punch List

As with an acceptance plan, many firms use a specific form to document the work that remains to be completed. A punch list is simply a formal listing of items or issues needing resolution before the project is designated as complete. The punch list should be prepared during a joint inspection of the work site and should reflect the agreements reached between the owner or contractor, the cabling installation firm, and any impacted subcontractors.

Developing the Project Documentation, continued

A punch list is not simply a list of all the problems or mistakes at the job site. The punch list needs to define clearly and dispassionately the specific steps or work tasks that need to be completed. Rather than stating, "Faceplate crooked on station 342," the punch list should state, "Realign faceplate on station 342." A punch list should clearly define the person(s) or firm responsible for that work.

To be effective, the punch list must be in writing and must reflect the expected time for completion. Using this approach, the cabling installer not only knows exactly what needs to be done and when but has a document that defines when the work is finished. Once a punch list is completed and signed off, it becomes difficult for the owner or contractor to request additional improvements or changes without compensation.

Record Drawings (As-Built Drawings)

The format to be used for the as-built drawings must be agreed upon before beginning the project so information can be gathered in a proper fashion throughout the project. The most common type of as-built uses the original floor plans and reflects the actual placement of outlets, the configuration, and the station or jack numbers. Other information such as cable routing, backboard layouts and configuration, length of cables, and firestopping materials may be required as part of the original contract.

The cabling installer must keep in mind the need for this information and the format that will be used. It is generally a good idea to keep a set of drawings updated on a weekly or daily basis with completed work. Not only can these drawings be used for discussion purposes, but the form and content can be reviewed and approved by the general contractor or owner before a great deal of effort is expended.

As with any documentation required for submittal on a project, do not make assumptions (i.e., that the general contractor or the original designer will input all as-built information into electronic form). Some contracts require the cabling installation company to complete all computer-aided design (CAD) work and produce multiple sets of final drawings. The cost of this work must be taken into consideration before the job is submitted to the owner.

Maintenance and Equipment Documentation

An operation and maintenance (O&M) manual should contain the title of the project and the names and contact information for the architect or engineer, ITS system designer, and the installing contractor. Information for each product or system should be included identifying the specific products and components installed for the project. Each sheet should include the manufacturers' installation steps and any maintenance procedures, along with a list of replaceable parts. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation. Include a list of local suppliers from whom replacement parts may be obtained.

Developing the Project Documentation, continued

The cabling installers should retain all printed material that comes packed with the components installed for inclusion in the O&M manual. The format to be used for O&M manuals must be agreed upon before beginning the project so information can be gathered in a proper fashion throughout the project.

Test Documentation

Specific test documentation may be required under the terms of an agreement between a cabling installation company and a manufacturer's product warranty program. This should be discussed with the owner or contractor before the work begins to determine the documentation required. It may be necessary to negotiate with the owner, the general contractor, and the product manufacturer to develop an acceptable form of documentation.

The automated test sets used for documenting twisted-pair copper cable generally provide a simple and clear method of identifying and documenting station cable. It is necessary for the cabling installer to be aware of any additional procedural requirements that may be part of this testing (e.g., certifying the accuracy of the testing equipment and recalibrating the equipment). Some contracts require tests to be witnessed by the owner's representative. In these cases, it is important for the cabling installer to be aware that the witness has a specific contractual responsibility and is not simply looking over the cabling installer's shoulder. It is always best to discuss procedural issues before beginning work and to maintain a dialogue as testing continues.

Conducting a Site Survey

After all of the initial project documents are obtained and reviewed, a member (or members) of the cabling installation team will visit the installation site.

The purpose of the survey is to:

- Ensure local and national codes are met.
- Ensure all telecommunication standards are met.
- Compare design documents to existing conditions.
- Identify potential conflicts or concerns.
- Define any additional support required (e.g., access, pathways, and electrical services) and determine who is responsible for these additional services.
- Identify situations that will require special equipment or skills.
- Determine the amount of support material required to complete the project (e.g., hangers, cable ties, surface raceway).
- Determine the work-hour requirements, including the number and skill level of the cabling installation crew needed.
- Locate storage and staging area space.

Conducting a Site Survey, continued

Reviewing Gathered Information

When preparing for the site survey, include the following items:

- Designer's documents—Allow identification of specific locations related to the project and the work to be performed there. The drawings may indicate obstacles not visible from floor level.
- Checklist—Based on the criteria for the project, a checklist is used to ensure that everything is taken into consideration during the site survey and to double-check development of the project plan. If problems are found, plans can be formulated to overcome them while still on site, rather than having to return. Examples of checklists for new and retrofit construction are shown in Example F.
- Tools—To perform the work required for a thorough site survey, personal protective equipment (e.g., a hard hat, safety glasses, leather gloves, leather boots, and hearing protection) might be needed. Additional items that may prove useful are a ladder, a flashlight, a measuring wheel, a handheld tape recorder, a digital camera, or a video camera.
- Contacts – List of site contacts, telephone numbers, and e-mail addresses.

Reviewing Responsibilities with Team Members

The first stop at a job site should be at the general contractor's site office. While at the office:

- Introductions can be made.
- The work to be performed for the customer can be explained.
- Other contractors working for the general contractor can be identified, and the impact of their work can be discussed.
- A copy of the general contractor's construction progress schedule can be obtained.

  NOTE: This document can be used to determine how the installation schedule can be coordinated with other contractors working on the project site.

It is important to review responsibilities with the general contractor so that they understand the role the cabling installation company will play in the completion of the overall project. Remember, the general contractor owns a new building until the owner accepts it and has ultimate authority and responsibility for the project.

Verify who will construct the pathways and spaces. The customer's documents should state whether they will be provided by the general contractor or by others. In many cases, the pathways and spaces of a new building project are part of the responsibility of the general contractor or the electrical subcontractor. It is important to discuss the details of the pathways and spaces with the person or firm responsible. Do not assume they know the impact of their work on the installation of ITS cabling.

Conducting a Site Survey, continued

The contractor responsible for the pathways must determine how to install these pathways, observing what obstacles and obstructions must be overcome. Failure to make this determination might result in additional site surveys. The following are some of the obstacles that may be encountered:

- HVAC ducts and equipment
- Elevators
- Stairways
- Fire- or smoke-rated walls, floors, ceilings, and partitions
- Sprinkler systems
- Structural forms or beams
- Interstitial space

Examining the Site

While on site, be sure to observe all locations where the cabling installation work will be performed. Determine the physical location of all TRs; the size, type of construction, and configuration of utilities within TRs; and responsibilities required to interface with other trades.

Identify the location of pathways that have been constructed by the general contractor or the subcontractors, and determine the state of completion. Determine, at a minimum, the following:

- Have the subcontractors adhered to the architect's and designer's drawings and specifications?
- Are there any change orders that will affect the pathways and spaces? If so, how do they affect the project?
- How is the building and grounding infrastructure installed? Does it comply with ANSI-J-STD-607-A, *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*?
- Are commercial building grounding and bonding requirements known for telecommunications, and the *National Electrical Code*® (*NEC*®)?
- When will the telecommunications spaces be completed?
- When will the pathways be completed?
- When will the inspector or fire marshal be on site to perform interim inspections and the certificate of occupancy inspection?
- When will the project be turned over to the owner (tenant)?

Conducting a Site Survey, continued

If the project is a retrofit, identify all of the existing pathways and spaces used for ITS and their size, capacities, usability, congestion, and compliance with local codes and standards. Some questions to be answered are:

- Are any existing pathways vacant?
- Do any pathways have usable space?
- Are new pathways required?
- May existing facilities be used to assist in installing the new cable?
- How large are the existing TRs?
- How much space is available in them?
- Will the new hardware fit within the confines of their spaces?
- Does the TR layout allow ease of moves, adds, and changes?
- Are new TRs required?
- Are any additional spaces required?
- What, if any, are the requirements for making the transition from the existing to the new services?
- Does any existing cable, hardware, or equipment need to be removed?
- Do any hazards exist (e.g., inadequate or nonexistent firestops, asbestos, joint power/communication lines)?
- What will be the distances between work areas, TRs, equipment rooms (ERs), and entrance facilities (EFs)?
- Are there any sources of electromagnetic interference (EMI)/radio frequency interference (RFI)?
- Are there sufficient building services (e.g., electrical, HVAC) for the initial installation and for future growth?

Answers to many of these questions should come from the materials contained in the customer's and the designer's documents. However, do not leave anything to chance. Review all requirements of the project before concluding whether additional pathways, spaces, or building facilities are required. If they are, and they have not been included in the original plans and specifications, job change orders may be required. At the very least, these concerns need to be documented and discussed with the general contractor or the owner's representative.

All information gathered during the site survey should be carefully documented and placed in the project file. This information will become invaluable later, especially if new team members are assigned to the cabling installation after it starts.

Project Safety Plan

The safety of workers, the customer's personnel, and the subcontractors is of paramount importance. Workplace accidents can disrupt the best-planned job and cause costly delays.

Each company should have an occupational safety plan (in the United States it must be Occupational Safety and Health Act [OSHA] compliant). Before beginning any work operation, the contents of that safety plan should be reviewed with each employee working on the project. Each employee should fully understand how the rules of safety should be implemented as each cabling installation task is performed. Take the time to ensure that each employee is equipped with the proper safety equipment and has the knowledge to use the equipment safely. As a contractor or subcontractor, attending periodic safety meetings may be contractually required.

All employees should attend an initial safety meeting prior to commencing the work. All safety plans should be reviewed. Many general contractors and customers have safety orientation and drug screening programs that all employees must complete prior to beginning the project work. Only through knowledge, understanding, and on-the-job awareness can employees perform their work safely.

Project Implementation

Just as a drawing provides a blueprint for cable installation, a good project plan is a blueprint for managing and tracking the project. From the initial construction meeting to closeout activities, the plan helps assess the progress and monitor the project. This subsection defines the tasks and methods used for implementing the project plan.

Initial Construction Meeting

After completing the site survey and formulating the project plan, the cabling installation project manager (PM) should hold an initial meeting with the entire cabling installation team. At this meeting, the PM and the team leader should lay out the responsibilities of everyone involved. This ensures that everyone is on board and no one is kept in the dark regarding any aspect of the project. The project plan can be reviewed and updated as necessary. Questions can be asked and answered. Communication between all personnel involved in the project is critical to its success.

Updates to the project plan and minutes of all meetings should be maintained, and printed copies should be provided to each person attending and additional persons having a position of responsibility on the project. Meeting minutes must be prepared and distributed shortly after each meeting and must provide a mechanism to allow attendees to update or correct the material.

Preinstallation Meeting

After the initial construction meeting is held and the project plan is updated, the PM should conduct a preinstallation meeting. This meeting should include the cabling installation team and appropriate contractors. All aspects relating to the project should be addressed and discussed. If necessary, adjustments should be made to the project schedule based on the results of the meeting. To ensure the work is performed in a timely and professional manner, the project should be reviewed in detail so that team members can work in concert with each other and with the other contractors.

Progress Meetings

Periodic progress meetings should be held for every project. These meetings can occur as often as once a week or as necessary to ensure that everyone knows what is going on and what is expected of them. Work progress, as well as roadblocks and ways of overcoming them, should be discussed and agreed upon by all concerned parties. Each team can contribute to the success of the project by thoughtful participation in these meetings.

When a project involves several contractors, the general contractor and subcontractors should attend and participate in these meetings. The PM should attend the general contractor's construction meetings to ensure that all concerns are addressed. This facilitates proper coordination between the cabling installation team and other contractors working on the project.

Progress Meetings, continued

Meeting minutes must be prepared and distributed shortly after each meeting and must provide a mechanism to allow attendees to update or correct the material. If meeting minutes are not kept by the owner or general contractor, the PM should keep notes of the meeting and submit them as the PM's understanding of items discussed. This applies to all meetings.

Ordering Materials

The person responsible for ordering the materials should place the order as soon as possible after the project plan is accepted. Easily overlooked are items termed consumables. Consumables are normally shown as a lot on the materials list because they are too small to be detailed as a line item. Items could include tape, screws, tie wraps, and similar materials.

An order for materials is often placed using a PO. The PO should be in writing, and a copy of each material PO should be kept in the project file. These can be used to develop the inventory for the project and to check against materials received and stocked.

Receiving Materials

Receiving materials is one of the most important tasks on a project. It can affect the cost of the project just as much as the labor employed. Determining where to store the materials, how they will be dispensed, how to secure them from theft or damage, and how to dispose of unused materials is critical to the project's success.

As the materials arrive, the responsible team member must receive the materials, inventory them, and stage them in preparation for transportation to the job site. If the materials are delivered to the job site, a company representative should be there and should be responsible for receiving, documenting, and storing them in a secure location.

All received items should be inspected and inventoried upon receipt. Each package should be checked against the packing slip for quantity, identity, and condition. If the packaging is damaged in transit, the contents of the package may be damaged. Verify this with the delivering agent prior to signing for the package. This is especially true with large reels of copper and optical fiber cable. If damaged materials are kept, indicate the extent of damage on the packing slip and the shipper's manifest for future claims processing.

If there is visual indication that reels of cable are damaged, consider refusing to accept responsibility for them, or immediately notify the supervisor to determine the proper course of action. When optical fiber cables are received, check the cable even when no damage is visible, using an optical fiber flashlight, optical loss test set (OLTS), or some other type of testing device to determine the continuity of the strand end to end. Copper and coaxial cable may require testing with a time domain reflectometer (TDR) or other device to identify and document unseen damage.

Receiving Materials, continued

Check the project plan for specific methods to be used in accepting costly materials. It may be necessary to conduct and document physical tests on various types of cable prior to accepting them. For example, it is a common practice to conduct an optical time domain reflectometer (OTDR) test on optical fiber cable while it is on the reel.

If materials delivered to a job site are visibly damaged upon arrival, they should be refused and the delivery service instructed to return them to the distributor or manufacturer. If materials are accepted and then found to be defective, they should be stored separately from other materials and returned to the appropriate source via prearranged instructions from that distributor or manufacturer. If it is not possible to identify the defect and document it, enclose a copy of the documentation with the materials to aid the distributor or manufacturer in properly replacing it and correcting the problem that caused the defect.

Storing Materials

There are three basic locations for storing materials for a project: the job site, a company-controlled location, and the distributor from which the materials were purchased. Each has its advantages and disadvantages.

These storage options should be of prime concern when considering how to plan for materials distribution and use on a job. Depending on the size of the project, the best alternative may be a combination of all options.

Job Site

The job site offers immediate availability of materials. However, there are risks associated with storing materials at a job site. Is a secure space inside the building available? Is an exterior space (e.g., trailer or other building) available and secure? Will only authorized persons have access to the space? Most of the time, the security of materials is the first concern. Until the materials are installed and accepted by the customer, they are the property and the responsibility of the contractor installing them.

Some customers may make space available for storing job materials, but few, if any, will agree to accept liability for loss or damage until the materials are installed and accepted. Risk of loss insurance may be needed to protect against loss of both materials and tools. Although this insurance will cover the loss, delays in obtaining replacement materials may make it undesirable to store them on the job site unless significant security can be assured.

Storing Materials, continued

If space is not available for storage inside the building, a jobsite trailer might be needed. In most locations, a permit is required prior to locating a job trailer on a construction site. If the trailer will be used only for materials and tool storage, temporary utilities will not normally be required. Office trailers requiring temporary electrical power, telephones, and sanitation utilities may require additional permits or coordination with the local utility companies providing these services. In most cases, local telephone and power companies will bill the contractor requesting the temporary service for the actual cost of constructing the facilities. The contractor's company may be required to sign a contract for a minimum period of time that the service will be used.

If large cable reels are to be used on the project, a security fence may be required. Fencing can be rented, and the rental company will usually install the fencing. The degree of security associated with jobsite fencing will depend on what is stored inside the fence and the social environment associated with the jobsite location. In most locations, chain link fencing will be adequate. In other locations, concertina wire may be needed for maximum security. In some cases, private security might have to be hired during nonworking hours.

Company Location

If the project is in the same city as the cabling installation contractor's office and adequate space is available, materials can be stored at the company location and sent to the job on a daily basis. Security may be less of a concern at the contractor's home location. Break-ins, however, occur even at the most secure locations. The cabling installation company should have insurance to protect against losses when materials are stolen or lost.

Distributor

Most distributors are in the business of stocking materials. Most distributors will deliver materials to a job site or to a company location on demand. Distributors use a process called assemble and hold, which allows companies to order materials for a specific project and stage them at the distributor's closest branch location until picked up or delivered.

Security is not an issue for the contractor in this situation because the materials are the property of the distributor until they are picked up or delivered. In addition, distributors generally have adequate space to hold materials for specific jobs and can deliver them in bulk or by partial order. Normally, the contractor is not billed for the materials, regardless of how long they stay in the staging area, until they are picked up or delivered.

Distributing Materials on Site

Control of the access to job materials will determine who is allowed to distribute them to the cabling installer. Only designated persons should be allowed to distribute materials on the job site or receive them at the end of the workday. Allowing full access to the job materials by the entire work crew invites abuse and loss of materials.

When materials are distributed, some record of accountability should be made to track where the materials are used. Excess materials should always be accounted for at the end of each workday and stored for use later on the job or returned to the company storage area for use on another project. They may eventually be returned to the distributor or manufacturer for credit after the project is completed and accepted. In addition, the records of the distributed materials must be returned to the company PM to ensure proper accounting.

Plan for a distribution area on site regardless of where the bulk of the materials and tools are being staged. The cabling installers will always know where to get their materials, and accounting and control are easier from a single location.

Managing the Project Schedule

Once the project has started, the original project schedule should be compared with the other construction schedules, and the various schedules should be updated at least weekly for accuracy.

The cabling installation schedule should be updated daily, indicating the progress of the day's work and whether the project is on schedule, ahead of schedule, or behind schedule. Any supporting documentation that will lend credibility to delays encountered in the project should be referenced in the project schedule updates.

Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

The project schedule should include all materials and services required from the sources that are not under the cabling contractor's direct control to include actions required by the owner. The PM should describe any dependencies upon the owner and third parties, as well as all project assumptions, expediting methods, active system interfacing requirements, and other management-related issues critical to the timely and successful completion of this project. The plan should describe the manpower and mobilization requirements in terms of functional responsibility, level, and head count.

Maintaining the Project Log

A person on site should keep a project log during all work operations. This log should begin on the first day of activity on the project site and continue until the company vacates the site. All activities relevant to the work should be logged on a daily basis, including the work completed and any problems encountered.

Contractual obligations that are affected by the work of others should be logged and accompanied by detailed notes. This document could prove valuable when others have caused delays. Accuracy and timeliness are, therefore, critical to the credibility of the log.

It is good practice for the PM to document certain elements of the project on a weekly basis and to record the following information concerning events at the site:

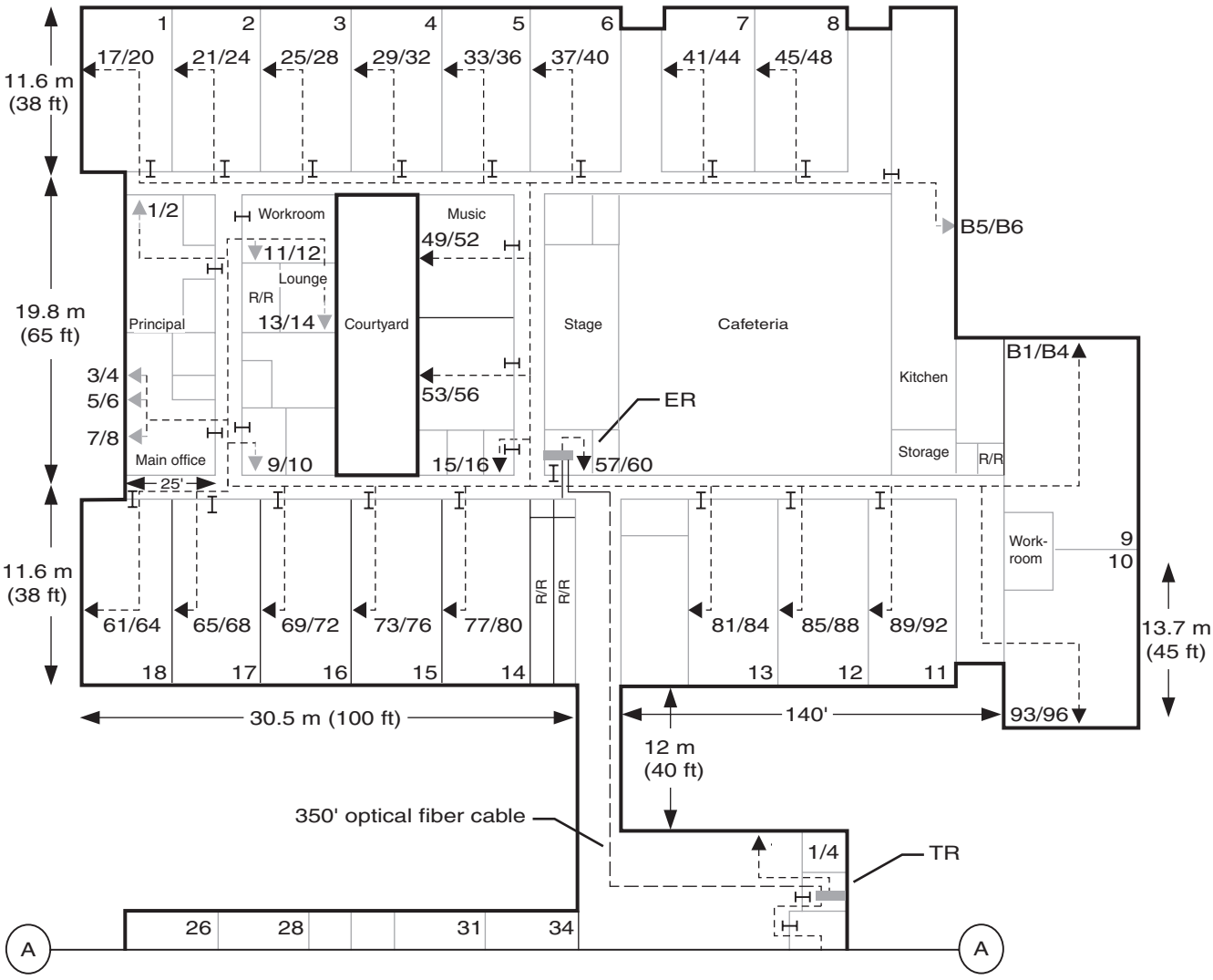
- List of subcontractors at the site
- Approximate count of personnel at the site
- Accidents and unusual events
- Meetings and significant decisions
- Stoppages, delays, shortages, and losses
- Emergency procedures
- Change orders received, implemented, and in process
- Services connected and disconnected
- Equipment or system tests and start-ups
- Status of material orders
- As-built documentation status report
- Punch list status
- Weather conditions
- Timesheets
- Daily job reports

Summary

A good project plan is essential for the successful completion of the work. The plan should reflect each aspect of the work and the company's effort to ensure this work will be performed in a timely, safe, and efficient manner. It should include:

- Customer documents.
- Documentation to be submitted to the general contractor and customer.
- Job requirements.
- Security and safety plan.
- Acceptance plan.
- Materials list.
- Tools list.
- Task list and description.
- Labor estimates.
- Overall job schedule.
- Cabling installation schedule.
- Scheduled meetings.
- Inspection schedules.
- Resources required for compliance with the schedules.
- Materials staging.
- Coordination with other trades on the project.

Example A: Designer's Drawings



← = (1) 41080-XAP faceplate equipped with (4) 41108-RX5 category 5e, T568A, modular jacks; academic locations

← = (1) 41080-XAP faceplate equipped with (2) 41108-RX5 category 5e, T568A, modular jacks; administrative locations

▬ = External building wall (masonry constructions)

▬ = Interior building wall (may or may not be fire/smoke rated)

⋯⋯ = Category 5e wire route (proposed)

– – – – = Optical fiber cable route (proposed)

▬ = (1) 55053-703 relay rack E/W (2) 11374-703 vertical management panels

17/20 = Data/voice

ER = Equipment room

R/R = Restroom

TR = Telecommunications room

Example B: Materials List

Project Number: XXXXXXXXXXXXX
Project Name: Anywhere Elementary School
Address: Anywhere, USA

Item	Material Description	Catalog Manufacturer	Catalog Number	Unit Each	Total Price	Price
1	Wire, 4 pair, 24 AWG, UTP, Cat 5e, CMR	Mfg. A	530141-TP	54000´	0	$0.00
2	Surface raceway, small	Mfg. B	MT1ABC5	350´	0	$0.00
3	Surface mount box, single gang	Mfg. C	WT12DB	56	0	$0.00
4	Cat 5e equipment rack E/W wire management	Mfg. D	55053-703	2	0	$0.00
5	Vertical wire management hardware	Mfg. E	11374-703	2	0	$0.00
6	Patch panel, 48 port, T568A	Mfg. F	49485-C96	8	0	$0.00
7	Patch panel, 24 port, T568A	Mfg. G	49485-C24	2	0	$0.00
8	Faceplate, single gang, dual port	Mfg. H	41080-2AP	9	0	$0.00
9	Faceplate, single gang, quad port	Mfg. I	41080-4AP	47	0	$0.00
10	Modular jack, Cat 5e, orange, T568A	Mfg. J	41108-RO5	208	0	$0.00
11	Horizontal wire management panel	Mfg. K	49253-BCM	16	0	$0.00
12	Rear cable bars	Mfg. L	49258-TWB	36	0	$0.00
13	Firestop compound	Mfg. M	AA529	10	0	$0.00
14	Electrical Metallic Tubing, 3/4"	Mfg. N	34EMT	150´	0	$0.00
15	Electrical Metallic Tubing, 2"	Mfg. O	2EMT	160´	0	$0.00
16	Cable, optical fiber, 6 str., OFNR	Mfg. P	PDRCB3510/15	300´	0	$0.00
17	Fiber distribution panel	Mfg. Q	4R130-OTA	2	0	$0.00
18	Connector panels	Mfg. R	4F100-6TM	2	0	$0.00
19	ST connectors	Mfg. S	95-100-01R	12	0	$0.00
20	10/100BASE-T 24-port switches	Mfg. T	AT3624TR-15	1	0	$0.00
21	10/100BASE-T 24-port switches	Mfg. U	AT3624TRS-15	3	0	$0.00
22	Chassis	Mfg. V	AT-36C3	2	0	$0.00
23	Optical fiber transceivers	Mfg. W	AT-MX26F-05	2	0	$0.00
24	Duplex, STST, 3 m F/O jumpers	Mfg. X	STST3M	2	0	$0.00
25	Data patch cords	Mfg. Y	42454-03O	104	0	$0.00
26	Data patch cords	Mfg. Z	42454-050	104	0	$0.00
27	Data line cords	Mfg. AA	42454-10O	208	0	$0.00
28						
29						
30						
31	Exempt materials	various	various	1 lot	NA	$0.00
32	Transportation					$0.00
Total Materials						**$0.00**

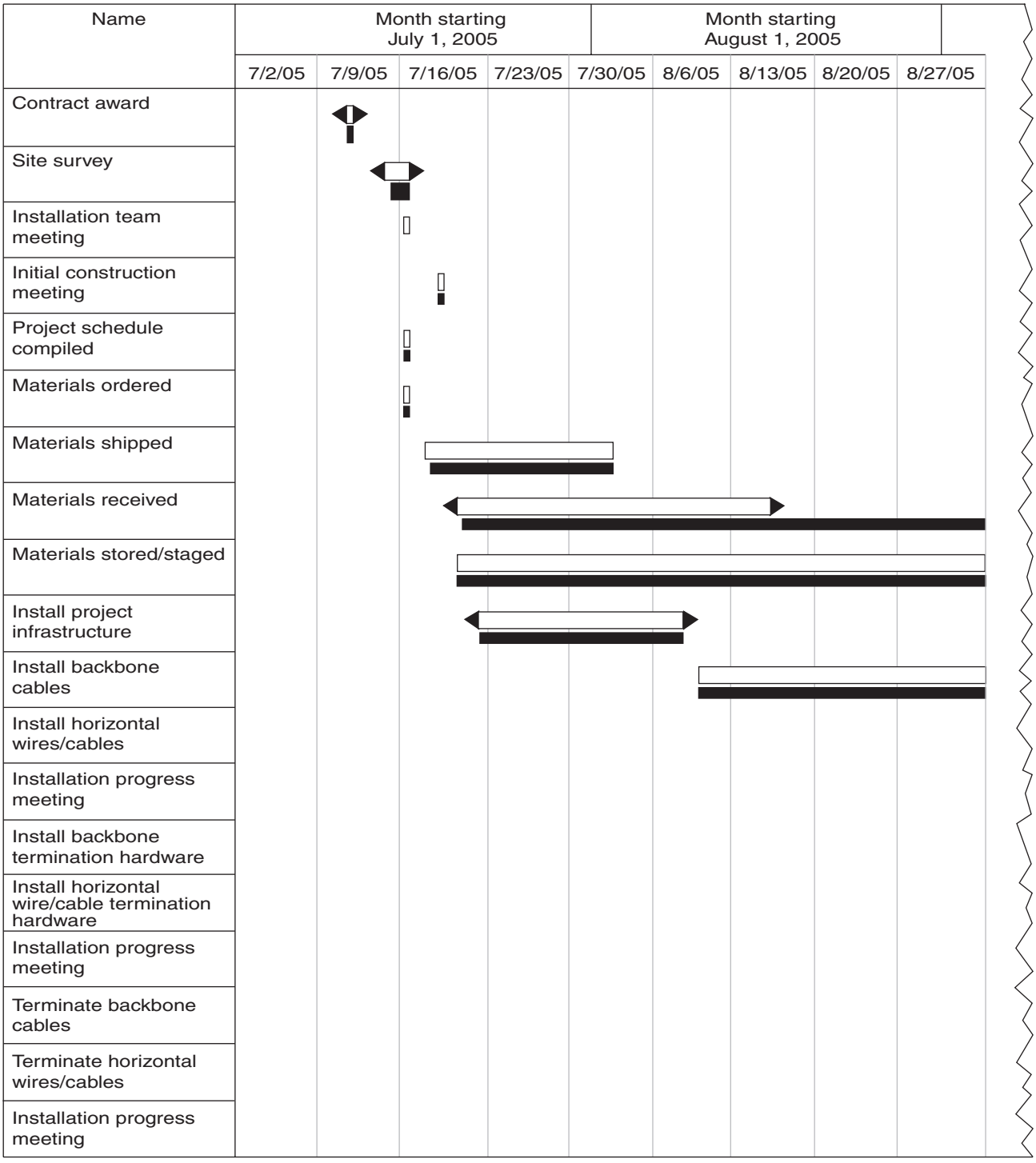
Example C: Labor List

Project Number: XXXXXXXXXXXX
Project Name: Anywhere Elementary School
Address: Anywhere, USA

Item	Material Description	Units/Quantity	Unit Rate	Total Price
1	Installing horizontal cables (2 per run)	9	0	$0.00
2	Installing horizontal cables (4 per run)	47	0	$0.00
3	Installing faceplates and jacks	208	0	$0.00
4	Installing equipment racks	2	0	$0.00
5	Installing patch panels	6	0	$0.00
6	Terminating cables at patch panels	208	0	$0.00
7	Certifying Cat 5e and Cat 6 wire	208	0	$0.00
8	Installing surface raceway	56	0	$0.00
9	Installing surface mount boxes	56	0	$0.00
10	Installing backbone optical fiber cables	300	0	$0.00
11	Installing F/O connecting hardware	4	0	$0.00
12	Terminating F/O cables	12	0	$0.00
13	Testing F/O cables	6	0	$0.00
14	Install fire-/smoke-rated partition penetrations	59	0	$0.00
15	Mount switches on relay racks	4	0	$0.00
16	Installing backbone conduit from main building to portables	120	0	$0.00
17	Installing horizontal conduit between backbone conduit and portables	48	0	$0.00
18				
19				
20				
Total Labor				**$0.00**

Total cost		**$0.00**
Materials markup	**50%**	**$0.00**
Labor markup	**50%**	**$0.00**
State sales tax on materials	**6%**	**$0.00**
Total price to customer		**$0.00**

Example D: Project Timeline



Example E: Project Schedule

Name	Start Constraint	Finish Constraint	Actual Start	Actual Finish	Percent Done
Contract awarded	›|‹ 7/11/05	›|‹ 7/11/05	›|‹ 7/11/05	›|‹ 7/11/05	100%
Site survey	›|‹ 7/13/05	›|‹ 7/16/05	›|‹ 7/14/05	›|‹ 7/16/05	100%
Installation team meeting	›|‹ 7/16/05	›|‹ 7/16/05	›|‹ 7/16/05	›|‹ 7/16/05	100%
Initial construction meeting	›|‹ 7/19/05	›|‹ 7/19/05	7/19/05	7/19/05	100%
Project schedule compiled	›|‹ 7/16/05	›|‹ 7/16/05	7/16/05	7/16/05	100%
Materials ordered	›|‹ 7/16/05	›|‹ 7/16/05	7/16/05	7/16/05	100%
Materials shipped	›|‹ 7/17/05	›|‹ 8/3/05	›|‹ 7/17/05	›|‹ 8/3/05	100%
Materials received	›|‹ 7/19/05	›|‹ 8/18/05	›|‹ 7/19/05	›|‹ 9/25/06	100%
Materials stored/staged	›|‹ 7/19/05	›|‹ 10/19/05	7/19/05	10/19/05	100%
Install project infrastructure	›|‹ 7/20/05	›|‹ 8/9/05	›|‹ 7/20/05	›|‹ 8/9/05	100%
Install backbone cables	›|‹ 8/10/05	›|‹ 9/8/06	8/10/05	9/8/06	100%
Install horizontal cables	›|‹ 9/10/05	›|‹ 12/22/06	9/10/05	12/22/06	100%
Installation progress meeting	›|‹ 9/10/05	›|‹ 9/10/05	9/10/05	9/10/05	100%
Install backbone connecting hardware	›|‹ 1/2/06	›|‹ 1/18/06	1/2/06	1/18/06	100%
Install horizontal cable connecting hardware	›|‹ 1/19/06	›|‹ 2/26/06	1/19/06	2/26/06	100%
Installation progress meeting	›|‹ 2/26/06	›|‹ 2/26/06	2/26/06	2/26/06	100%
Terminate backbone cables	›|‹ 1/19/06	›|‹ 2/9/06	1/19/06	2/9/06	100%
Terminate horizontal cables	›|‹ 2/27/06	›|‹ 3/29/06	2/27/06	3/29/06	100%
Installation progress meeting	›|‹ 3/29/06	›|‹ 3/29/06	3/29/06	3/29/06	100%
Label all facilities as per ANSI/TIA/EIA-606-A	›|‹ 3/22/06	›|‹ 4/5/06	3/22/06	4/5/06	100%
Test backbone cables	›|‹ 4/5/06	›|‹ 4/12/06	4/5/06	4/12/06	100%
Test horizontal cables	›|‹ 4/15/06	›|‹ 5/3/06	4/15/06	5/3/06	100%
Compile all test results	›|‹ 5/6/06	›|‹ 5/8/06	5/6/06	5/8/06	100%
Installation progress meeting	›|‹ 5/3/06	›|‹ 5/3/06	5/3/06	5/3/06	100%
Punch list	›|‹ 5/9/06	›|‹ 5/10/06	5/9/06	5/10/06	100%
Correct all items on punch list	›|‹ 5/16/06	›|‹ 5/17/06	›|‹ 5/16/06	›|‹ 5/17/06	100%
Final punch list	›|‹ 5/16/06	›|‹ 5/16/06	5/16/06	5/16/06	100%
Customer punch list	›|‹ 5/17/06	›|‹ 5/17/06	5/17/06	5/17/06	100%
Customer acceptance	›|‹ 5/20/06	›|‹ 5/20/06	5/20/06	5/20/06	100%
Prepare as-built package	›|‹ 5/20/06	›|‹ 5/24/06	5/20/06	5/24/06	100%
Provide all project documents to customer	›|‹ 5/27/06	›|‹ 5/27/06	5/27/06	5/27/06	100%
Return surplus materials to distributor for storage	›|‹ 5/20/06	›|‹ 5/22/06	5/20/06	5/22/06	100%
Complete billing to customer	›|‹ 5/28/06	›|‹ 5/28/06	5/28/06	5/28/06	100%
Review billing with customer	›|‹ 5/29/06	›|‹ 5/29/06	5/29/06	5/29/06	100%
Receive final payment	›|‹ 5/30/06	›|‹ 5/30/06	5/30/06	5/30/06	100%
Close project	›|‹ 5/31/06	›|‹ 5/31/06	5/31/06	5/31/06	100%
Clear punch list	›|‹ 5/10/06	›|‹ 5/13/06	5/10/06	›|‹ 5/13/06	100%
Clear customer punch list	›|‹ 5/17/06		5/17/06	›|‹ 5/20/06	100%

›|‹ indicates completion

Example F: Site Survey Checklists

Checklist for Site Survey—New Construction

Issue	Responsibility	Date Scheduled	Date Ready
1. Owner's telecommunications needs defined and documented			
2. Telecommunications design complete and up to standards			
3. Modifications (if required) submitted and approved			
4. Drawings and specifications distributed			
5. Building construction complete for:			
• Telecommunications spaces			
– Backboards			
– Lighting			
– Electrical			
– Grounding			
– HVAC			
– Fire suppression			
– Alarms and controls			
• Backbone pathways			
• Horizontal pathways			
• Work area spaces			
6. Secure storage identified			
7. Work site conditions defined			
• Safety plan posted			
• Permits approved			
• Safety equipment in place			
• Office and meeting area defined			
• Elevators available			
• Loading dock/access			
8. Cable placement needs defined			
9. Access to all floors for reels			
10. Secure anchor points identified			
11. Start work approval date			
12. Firestopping complete			
13. Inspection date			
14. Completion date			

Checklist for Site Survey—Retrofit Installations

Issue	Responsibility	Date Scheduled	Date Ready
1. Owner's telecommunications needs defined and documented			
2. Telecommunications design complete and up to standards			
3. Modifications (if required) submitted and approved			
4. Drawings and specifications distributed			
5. Plan defined for moving or working around building occupants			
6. Modifications to existing rooms or construction of new spaces complete for:			
• Telecommunications spaces			
– Backboards			
– Lighting			
– Electrical			
– Grounding			
– HVAC			
– Fire suppression			
– Alarms and controls			
• Backbone pathways			
• Horizontal pathways			
• Work area spaces			
7. Secure storage identified			
8. Work site conditions defined			
• Safety plan posted			
• Permits approved			
• Safety equipment in place			
• Office and meeting area defined			
• Elevators available			
• Loading dock/access			
9. Cable placement needs defined			
10. Access to all floors for reels			
11. Secure anchor points identified			
12. Start work approval date			
13. Firestopping complete			
14. Inspection date			
15. Cutover/transition date			
16. Completion date			

Example G: Job Change Order

Company Name
Company Address

Job Change Order
Project Name
Project Location
Project Number

Change Order No. _____

Initiated by: _____ Date: _____

Details of request or nature of change:

Labor $ _____ Materials $ _____ TOTAL $ _____

_____ _____
Verified by (Signature) Date

The undersigned hereby accepts the prices quoted on this Job Change Order and agrees to pay _____ the amount stipulated at the TOTAL above upon satisfactory delivery of the goods and services described above. Acceptance also authorizes the materials to be ordered and/or the work to be performed.

_____
Authorized signature

_____
Title

_____
Date

Date work completed: _____ Verified by: _____

Example H: Scope of Work

Anywhere School District One, Anywhere Elementary School

General

This project provides for the installation of a category 5e structured cabling system network at Anywhere Elementary School. The primary media is a four-pair category 5e (communications plenum) CMP horizontal cable and a six-strand optical fiber backbone cable between TRs. A TR will be located in the storage area adjacent to the stage. An equipment room will be located in the office of the media center. Each of these spaces will serve its respective areas as indicated by the zone division line.

Copper Horizontal Cable

The cable to be used on this project is manufactured by Manufacturer C and is four-pair, 24 AWG [0.51 mm (0.020 in)], twisted-pair, CMP-rated. It is available in 305 m (1000 ft) boxes. This cable meets or exceeds the ANSI/TIA/EIA-568-B1 requirements.

Patch Panels

Category 5e patch panels, wired to T568A, will be provided in each TR. Patch panels will be mounted on 483 mm (19.0 in) relay racks in each room, along with the switches and wire management panels. The patch panels will be provided in two sizes: 48-port and 24-port. In both TRs, four 48-port and two 24-port patch panels will be required.

Equipment Racks

Two 483 mm (19.0 in) x 2.1 m (7 ft) equipment racks will be installed as part of this project. One of the racks will be installed in the TR, and the second will be installed at the media center. Manufacturer A manufactures both racks, catalog number 55053-703. They are black in color. Both racks will be equipped with vertical and horizontal wire management systems to ensure orderly installation of patch cords between various components on the equipment rack. These racks provide enough rack space for all of the equipment to be mounted on them at their respective locations. They will be bolted to the floor, and a ladder rack will be provided for additional support and routing of cables. The equipment will then be mounted on the racks. Each rack will be grounded to its respective telecommunications main grounding busbar (TMGB) or telecommunications grounding busbar (TGB) with a 6 AWG [4.1 mm (0.16 in)], stranded, green insulated wire.

Faceplates and Modular Jacks

Faceplates will be provided in two port sizes. The dual-jack installation will be a two-port faceplate, while the classrooms will have four-port faceplates equipped with four modular jacks. The faceplates are manufactured by Manufacturer A, catalog number XXXX-XXX. They will be office white in color.

Anywhere School District One, Anywhere Elementary School, continued

Modular jacks will be provided at each location shown on the attached illustration. The modular jack will be category 5e, T568A pinout and will be one of four colors (i.e., orange, black, red, or yellow).

Raceways and Associated Equipment

Where wire or cable cannot be concealed within the walls at a device location, surface raceway will be installed. This raceway will be 19 mm (0.75 in) electrical metallic tubing (EMT) conduit. The conduit will originate above the suspended ceiling and continue down to a surface-mounted box. The surface-mounted box will house the faceplate and modular jack(s) and provide mechanical protection for the terminations.

Between the main building and the portable classroom buildings, a 50 mm (2 in) EMT conduit will be installed. Junction boxes will connect the 50 mm (2 in) conduit to the 19 mm (0.75 in) conduits that will be installed in each portable classroom building. These conduits will provide mechanical protection and support for installation of the wires to the portable classroom buildings.

Optical Fiber Backbone Cable

A six-strand optical fiber cable will be installed from the ER to the TR. Manufacturer C manufactures the cable listed by Underwriters Laboratories Inc.® (UL®) as optical fiber non-conductive riser (OFNR) to comply with all applicable building codes. The cable will be installed in the suspended ceiling area between the TR at the stage area and the media center.

Optical Fiber Connecting Hardware

Rack-mounted optical fiber distribution centers manufactured by Manufacturer A will be installed in each TR. They are catalog number XXXX-XXXX and are equipped with catalog number YYYYY-YYY connector panels.

The fiber distribution centers will be equipped with sufficient connecting hardware to accommodate all six strands of glass that originate or terminate at their respective locations. Subscriber connector (SC) type optical fiber connectors manufactured by Manufacturer B Corporation, catalog number ZZ-ZZZ-ZZZ, will be used to terminate the strands of glass.

Data Patch Cords

A category 5e data patch cord will be provided for equipment interconnection. Data patch cords will be installed in the length required to provide proper wire management between components installed on the relay racks. They are orange in color.

A category 5e data line cord will be provided for each category 5e horizontal wire installed. These data line cords will be provided to Anywhere Elementary School for installation when the actual computer installation occurs. They are 3 m (10 ft) in length and orange in color.

Anywhere School District One, Anywhere Elementary School, continued

10/100BASE-Tx Hubs

We are providing pricing for Manufacturer D Ethernet 10/100BASE-Tx hubs to allow for the networking of each category 5e horizontal cable installed. As per your direction, we are sizing the hubs to facilitate a maximum of two devices in each classroom and the administrative area. The hubs will be equipped to allow connection to the optical fiber backbone as well as to each other. Each hub will be mounted in its respective relay rack. Patching from the hubs to the patch panels will be accomplished using the data patch cords and optical fiber patch cords provided.

Optical Fiber Patch Cords

Duplex SC/SC 3 m (10 ft) optical fiber jumpers will be provided to allow connection of all hubs.

Firestopping

In each classroom and firewall in the hallways, a horizontal penetration must be made to facilitate installation of the horizontal wires and optical fiber cables. Each penetration will be made and then the fire rating will be restored using approved materials and methods. Manufacturer E Model No. AAAAA firestop compound will be used to restore penetrations. Sleeves will be installed where required by code.

Installation Methodology

All work will be completed to conform to the:

- Manufacturers' specifications.
- Latest edition of the *National Electrical Code®*.
- Latest edition of the *National Electrical Safety Code®*.
- ANSI/TIA/EIA-568-B.1, *Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements*.
- TIA/EIA-569-B, *Commercial Building Standards for Telecommunications Pathways and Spaces*.
- ANSI/TIA/EIA-606-A, *Administration Standard for Commercial Telecommunications Infrastructure*.
- ANSI-J-STD-607-A *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*.
- Latest edition of the BICSI *Telecommunications Distribution Methods Manual.*
- Latest edition of the BICSI *Network Design Reference Manual.*
- Latest edition of the BICSI *Information Transport Systems Installation Manual*.
- All local codes and ordinances.

  NOTE: Where a conflict exists, local codes and ordinances will supersede all other requirements.

Anywhere School District One, Anywhere Elementary School, continued

Testing

Each horizontal cable will be tested for compliance with ANSI/TIA/EIA-568-B.1 requirements using a Manufacturer E tester. The tests will be conducted on the basic link configuration. A hard copy and an electronic media of choice as selected by the owner (e.g., compact disc [CD] or flash card) containing the test results will be provided to the District.

Each strand of the optical fiber cable will be tested using a Manufacturer B OLTS. The results will be recorded and provided to the District in hard copy and an electronic media of choice as selected by the owner (e.g., CD or flash card) upon completion of the project.

As-Built Package

Upon completion of the project, Datawireinstaller, Inc. will provide an as-built package to the District that will contain the following items:

- Updated floor plans
- Wire/cable routing schematic
- Facility assignment records
- Horizontal cable test results
- Optical fiber cable test results
- Photographs/videotape

Warranty

The project will be warranted for a period of fifteen (15) years from completion of installation.

Schedule

We anticipate this project will take approximately two weeks to complete. This is contingent upon the absence of unforeseen delays during installation. We plan to perform the work with minimum impact on the staff by working during the hours most advantageous to both the school and Datawireinstaller, Inc. This is contingent upon the school's providing access to the building at these times. If weekend work is required, we are prepared to perform the necessary work during these times. We would, however, prefer to work during normal working hours.

Most of the materials required for the project are available from our distributors as stock, and the other items have short intervals.

Anywhere School District One, Anywhere Elementary School, continued

Delays to Project

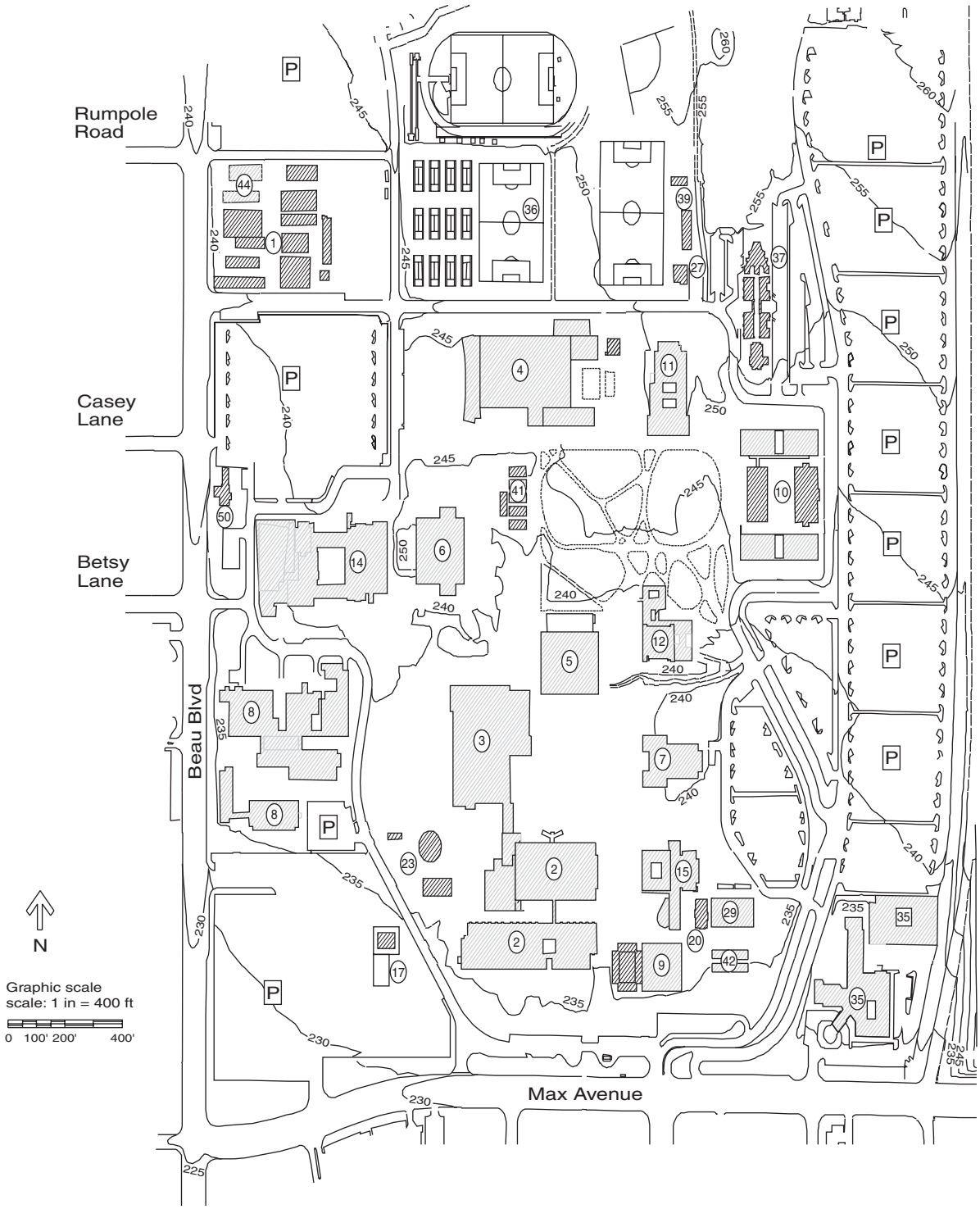
Delays caused by Anywhere School District One, their employees, students, agents, assignees, contractors, subcontractors, or any other person(s) not directly employed by Datawireinstaller, Inc. will result in proportional delays in the completion of the project. All costs incurred by Datawireinstaller, Inc. as a result of the said delay will be passed along to Anywhere School District One on a cost-plus basis.

Damage to Installed Physical Plant

Damage caused to physical plant installed by Datawireinstaller, Inc., by Anywhere School District One, their employees, students, agents, assignees, contractors, subcontractors, or any other person(s) not directly employed by Datawireinstaller, Inc. will be repaired or replaced at the District's option. All cost associated with the said repairs or replacement work will be passed along to Anywhere School District One on a cost-plus basis. Any delays caused by the said work will result in a proportional delay in the completion of the project.

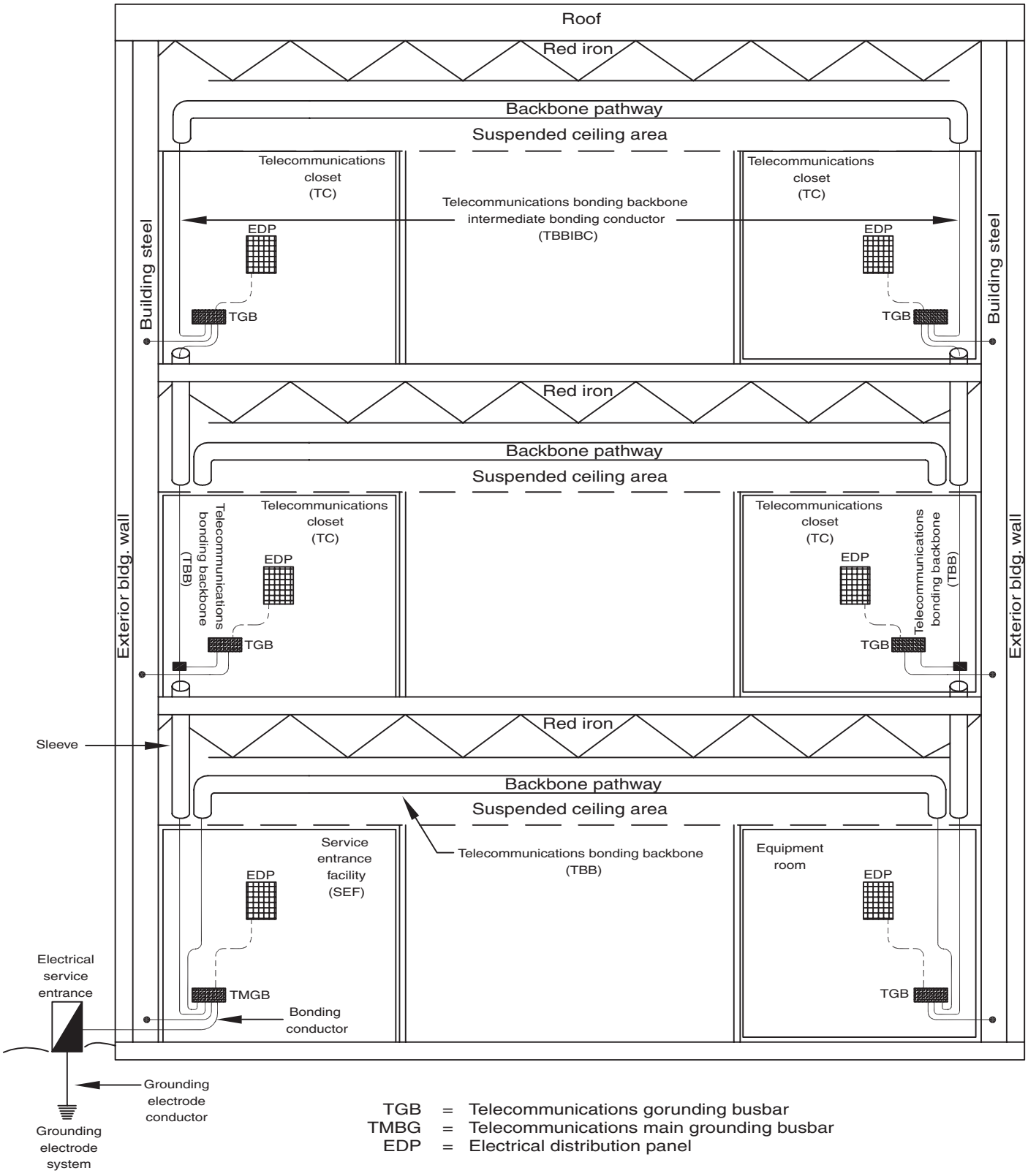
Anywhere School District One, Anywhere Elementary School, continued

Figure 2.1
Sample site plan



Anywhere School District One, Anywhere Elementary School, continued

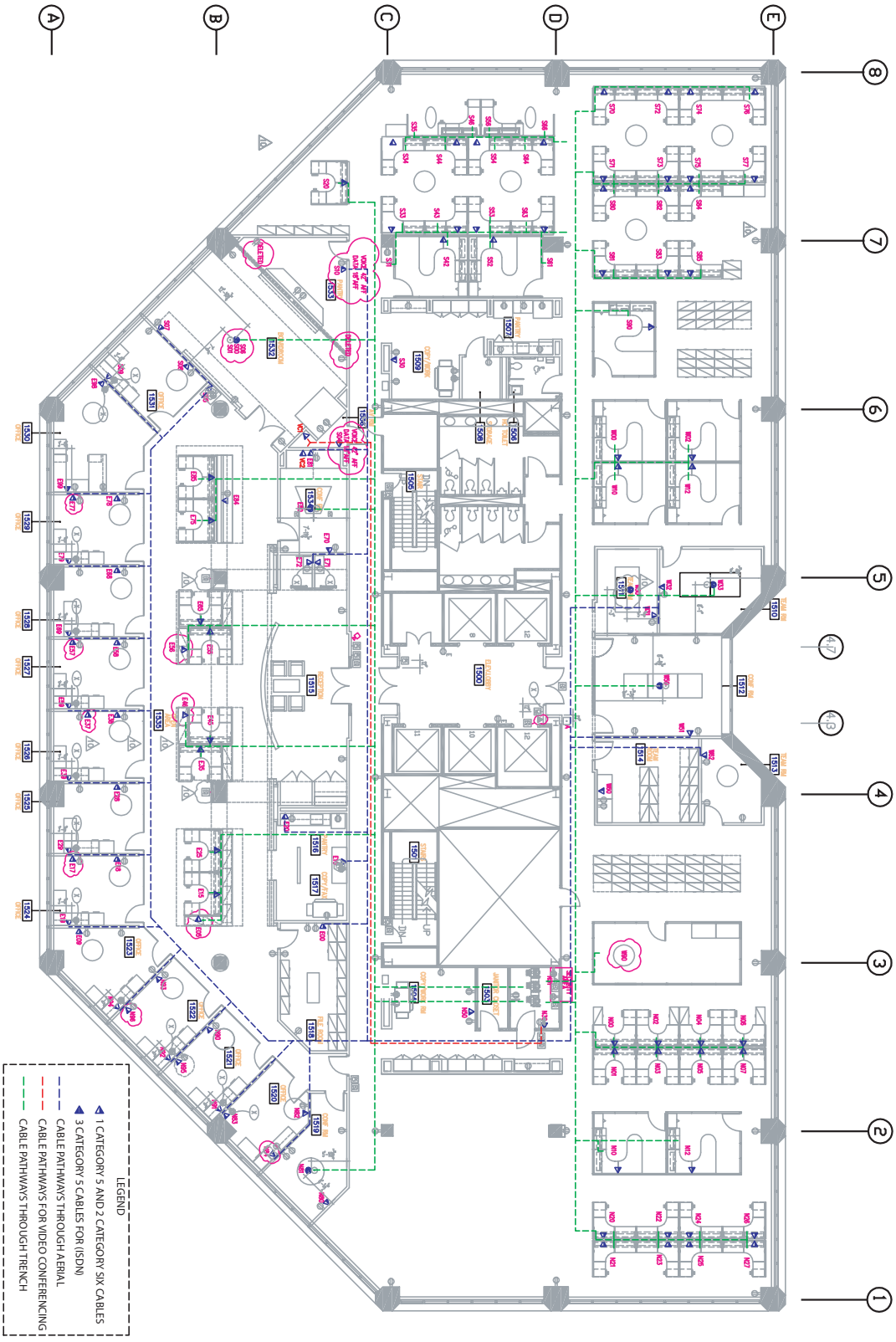
Figure 2.2
Sample cross-sectional diagram



TGB = Telecommunications gorunding busbar
TMBG = Telecommunications main grounding busbar
EDP = Electrical distribution panel

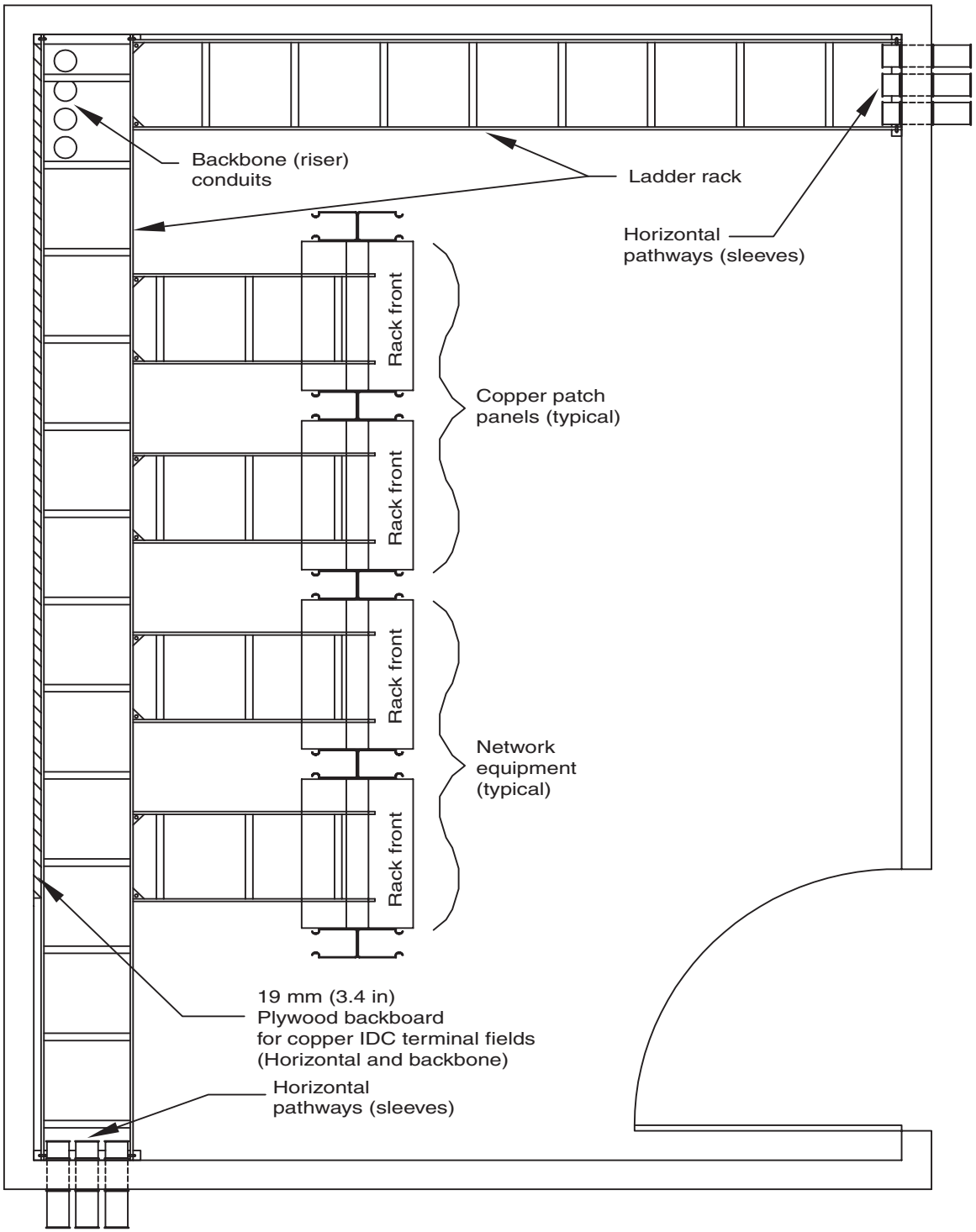
Anywhere School District One, Anywhere Elementary School, continued

Figure 2.3
Sample floor plan



Anywhere School District One, Anywhere Elementary School, continued

Figure 2.4
Sample room detail



IDC = Insulation displacement contact

NOTE: All measurements are in accordance with ANSI/TIA/EIA-568 B.1.

