Chapter 2
Telecommunications Design, Installation, and Implementation Project Management

Chapter 2 presents the reader with the fundamentals of information and communications technology (ICT) design, installation, and implementation of project management, including project closeout. The reader can utilize obtained knowledge and tools to deliver a successful ICT design project to clients.
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Design Project Management Support Tasks and Support Documentation

Introduction

The fundamental ICT project management tasks recommended to be performed, and specific support documentation recommended to be generated and maintained by a project manager (PM), are presented in this chapter. Typical ICT project phases will be listed, with specific project management tasks and support documentation presented within each project phase.

Design Project Management Phases and Tasks

The following is a list of phases integral to design project management and an outline of tasks that must be completed at each phase:

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Design Project Management Phases and Tasks, continued

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- **Checklist**—Based on the criteria for the project, a checklist should be developed and used to ensure that actual or potential issues are identified to the greatest extent possible. If issues are observed, they should be documented while on site (e.g., notes, pictures/video, sketches), so that solutions can be discussed and identified with applicable members of the team, and an agreement reached on corrective actions following the site visit. Any risks identified should be added to the risk management plan (see Risk Management Plan section). This can reduce the risk of issues being exacerbated as the project proceeds.

  NOTE: Refer to Chapter 4: Project Documentation for an example of the site survey checklist.

- **Tools**—To perform the work required for a thorough site survey, personal protective equipment (PPE [e.g., hard hat, safety glasses, reflective vest or high visibility shirt, leather gloves, steel toe leather boots, hearing protection]) may be required, particularly if construction activities are underway. Additional items that may prove useful are a ladder, flashlight, measuring wheel, voice recorder, digital camera or smart phone.

  NOTE: Certain environments may require specialized PPE and procedures to address or mitigate specific hazards and to meet regulatory or site requirements (e.g., Occupational Safety and Health Administration).

- **Contacts**—List of site contacts, telephone numbers, and e-mail addresses for access purposes.

A typical site survey includes the following steps:

- Evaluate work environment considerations.
- Interface with the client and contractors as needed.
- Ascertain hours of operation and determine building access (e.g., personnel related, code related). Verify parking requirements/limitations.
- Determine cabling pathway routes and equipment locations to ensure adequate space will be available for installation. Specific pathways and space considerations issues to be identified include:
  - Plenum and non-plenum areas.
  - Rated wall, ceiling, or floor barrier locations (fire or smoke).
  - Penetration locations and types.
- Define any additional support required and determine who is responsible for these additional services:
  - Access
  - Pathways
  - Electrical services
  - Heating, ventilation, and air-conditioning (HVAC)
Design Project Management Phases and Tasks, continued

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<tr>
<td>• Confirm location of telecommunications spaces.</td>
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<td>• Identify situations that will require special design considerations.</td>
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<td>• Determine the amount of support material required to complete the project, such as:</td>
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<tr>
<td>– Hangers.</td>
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<tr>
<td>– Cable tray.</td>
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<tr>
<td>– Surface raceway.</td>
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<tr>
<td>– Conduit.</td>
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<td>– Open top supports.</td>
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<td>– Cable routing assemblies.</td>
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<tr>
<td>– Access floors.</td>
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<tr>
<td>• Determine the location of work area outlets.</td>
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<tr>
<td>• Determine special situations where additional labor may be required for purposes of budget calculation:</td>
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<tr>
<td>– Ceiling height and ceiling type:</td>
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<tr>
<td>• Accessible acoustic tile versus inaccessible hard surface.</td>
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<tr>
<td>– Type of roof deck/floor slab construction:</td>
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<tr>
<td>• Pan deck</td>
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<tr>
<td>• Prestressed</td>
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<td>• Post-tension</td>
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<td>– Wall construction:</td>
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<tr>
<td>• Sheet rock.</td>
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<tr>
<td>• Stucco.</td>
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<tr>
<td>• Steel stud versus wood frame.</td>
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<tr>
<td>• Concrete masonry unit (CMU).</td>
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<tr>
<td>– Any structural components, duct work, or piping in possible conflict with cabling pathways installation.</td>
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<tr>
<td>– Any special equipment requirements.</td>
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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 questions are raised regarding the design.

3 Additional work tracking.

Receive and review any design update requests from the client, and perform an on-site survey to determine if an addendum to the design documents is required.
### Design Project Management Phases and Tasks, continued

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<tr>
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<td>Construction administration (CA).</td>
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<td>CA is the QC process during construction/installation/implementation to ensure compliance with design documents.</td>
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<td>During the CA process, the punch list walkthrough shall be conducted and results forwarded to the appropriate team members.</td>
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<td>Project closeout.</td>
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<td>Obtain any red line marked up drawings intended to be as-built drawings and provide them to the designers for official record drawing creation.</td>
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<td>Provide the official record drawings for inclusion in the project’s closeout documentation package.</td>
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<td>Schedule and moderate a design lessons learned debriefing.</td>
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Project Installation and Implementation

Overview

Just as a drawing provides a design for cable installation, a project plan is an essential design for the management and tracking of project goals. From the initial construction meeting to closeout activities, the plan helps to monitor and assess the progress of the project. This section defines the typical tasks included in a project plan and the methods used for implementing them.

Initial Construction Meeting

After completing the site survey and formulating a project implementation plan, the designated PM should hold an initial meeting with the entire ICT system installation team. At this meeting, the PM and the team leader should review the SoW and assign responsibilities to everyone involved. The project implementation plan can be reviewed and updated as necessary.

Milestones or checkpoints should be identified on the project plan by the PM to ensure the ICT team is meeting all of their SoW contractual requirements. Communication between all personnel involved in the project is critical to its success.

Updates to the project plan and minutes of all construction 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.

Pre-installation Meeting

After the initial construction meeting is held and the project implementation plan is updated, the PM should conduct a pre-installation meeting. This meeting should include the cabling installation team and appropriate contractors. All aspects related 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 that 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.
Change Control System

In the event that changes to the original SoW (e.g., additions to or removals of products or services) become necessary, a change control process should be put into place if the project has not already identified a change control system. Any change order or add service should be identified and the project plan updated accordingly. Figure 2.1 illustrates a change control process.

NOTE: Percentages shown will be project dependent.
Risk Management Plan

As part of the project planning and development, all risk should be identified and a mitigation or contingency plan to reduce or eliminate the risk should be agreed upon by all concerned parties. Any impact identified should be captured, reported, and the project plan updated accordingly.

Perform Site Survey

Site surveys are performed by the PM and contractor(s) and can include owner representatives in order to determine the variables involved to implement the project construction. Different types of projects may slightly vary regarding approach and tasks. Typical project types include:

• New construction.
• Modification or upgrades.
• Tenant improvement.
• Retrofit.

The site survey can include the following tasks:

• Verify current copies of all specifications, drawings, addendums, and SoW.
• Verify location of work area outlets.
• Perform visual inspection of the work site, if appropriate:
  – Inspect equipment locations to ensure adequate space.
  – Verify cabling and pathway locations to ensure adequate space.
• Verify location of main cross-connect (campus distributor), intermediate cross-connect (building distributor), and horizontal cross-connect (floor distributor) located equipment rooms, telecommunications rooms (TRs), and telecommunications enclosures to identify potential problem areas including:
  – Pathways and space issues.
  – Plenum and non-plenum areas for cabling.
  – Rated wall (e.g., fire, smoke) location and type.
  – Building access and parking problems.
  – Hours of operation and work environment considerations.
• Verify construction types and installation impact:
  – Ceiling height and ceiling type (e.g., accessible acoustic tile versus inaccessible drywall).
  – Type of roof deck (e.g., pan deck, prestressed, post-tension).
  – Type of floor deck (e.g., slab [topping or structural], pre-tension slab, post-tension slab, or access floor).
  – Wall construction (e.g., sheet rock, stucco, CMU, or shear wall and steel stud versus wood frame).
  – Seismic requirements.
Perform Site Survey, continued

- Comply with building access requirements (e.g., personnel related, code related).
- Use predefined pulling techniques per Telecommunications Industry Association (TIA) standards and manufacturer specifications.
- Comply with material storage plan.
- Determine scheduling requirements for populated buildings.
- Determine acoustics limitations.
- Discern PPE requirements.
- Determine powder-actuated tool certification required, usage limitations, and hours.
- Determine daily cleaning and equipment protection.
- Determine waste disposal requirements.
- Document pre-existing conditions (e.g., fire stopping considerations).
- Assess availability and limitations of existing pathways and raceways.
- Assess building addition alignment with old construction.
- Determine conduit location and size.
- Determine hazards such as asbestos-related and lead paint considerations.
- Determine cable removal requirements.
- Determine ceiling height and ladder or personnel lift or scaffold requirements.
- Assess rated wall (e.g., smoke, fire) penetration requirements.
- Verify furniture outlets and faceplates.
- Obtain customer safety and security requirements.
- Assess construction access requirements.
- Determine equipment delivery methods and access.
- Determine access or moving requirements.
- Determine material staging considerations.
- Determine accessibility with limited TRs.
- X-ray floor for core drilling with structural engineers.
- Assess environmental limitations (e.g., cable temperature, adequate lighting, air circulation).
- Determine power, HVAC, and lighting considerations.
- Determine substandard electrical upgrade requirements.
- Verify bonding (earthing) infrastructure.
Retrofit Additional Survey Tasks

During a retrofit installation project, additional tasks and activities may be required. These activities require surveying active circuits, their wiring blocks, and possible equipment and their ports. This survey requires communication with the end user. Scheduling after hours activities should be considered to reduce end user impact.

In addition to the previous list, this type of survey may also include:

- Requesting and checking existing circuit documentation.
- Verifying the existing documentation for changes.
- Looking for and verifying cable, wiring block, and equipment identification labels or tags.
- Verifying terminations and jumpers with visual and hand tracing.
- Using the appropriate test set to verify the active service.
- Using a toner and probe set to verify spare copper cable pairs.
- Using a light source and probe for optical strand identification.
- Labeling both cable ends, wiring blocks, optical jumpers, and equipment ports.
- Updating the existing records.

Progress Meetings

Periodic progress meetings should be held for every project. These meetings may occur daily, weekly, monthly, quarterly, or as necessary to ensure that team members know the status of the project and what is expected of them. Work progress as well as issues and risks and ways of overcoming them should be discussed and agreed upon by all concerned parties. Each team member can contribute to the success of the project by thoughtful participation in these meetings.

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

If the owner or construction manager does not keep meeting minutes, 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 and submittals are approved. Easily overlooked are items termed consumables, which typically include tape, screws, cable ties, hook and loop straps, and similar materials.

An order for materials is often placed using a purchase order (PO).

NOTE: From a financial, accounting, and accountability viewpoint, a good practice is for one person to obtain quotes, generate POs, and place material and equipment orders with suppliers. Another individual may be designated to receive, inspect, stock, maintain inventory of, and issue the materials and equipment for installation.
Receiving Materials

Receiving materials is one of the most important tasks on a project. 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.

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. Identifying responsibility and distribution of material should be done by the PM and responsible contractor. Material management is to be conducted and agreed upon by contractor and general contractor, owner or owner representative.

As the materials arrive, the responsible team member must receive the job supplies and materials, inventory them, and stage them in preparation for transportation to the work site. If the materials are delivered to the work 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 and purchase order for accuracy, 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 a 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, or some other type of testing device to determine the continuity of the strand end to end.

For example, as part of a risk management plan, it is a common practice to conduct an optical time domain reflectometer test on optical fiber cable while it is on the reel. Copper and coaxial cable may require testing with a time domain reflectometer or other device to identify and document unseen damage.

If materials delivered to a work site are visibly damaged upon arrival, the materials 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. Confirm that the materials received are sufficient to accomplish the SoW.
Storing Materials

Three basic locations for storing materials for a project are the:

- Work site.
- Company-controlled location.
- 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.

Work Site

Work site storage offers immediate availability of materials. Some building owners/managers may make space available for storing job materials; however, few agree to accept liability for loss or damage until the materials are installed and accepted. Most of the time, security of material is the first concern in selecting a storage location. Until the materials are installed and accepted by the customer, they are the property and the responsibility of the contractor installing them.

If space is not available for storage inside the building, a work site container might be needed. If large cable reels are to be used on the project, a security fence may be required.

Some of the risks associated with storing materials at a work site include:

- Owner/construction manager may not have secure space inside the building available during duration of construction.
- Exterior space (e.g., trailer, other building) may not be secure.
- Unauthorized persons may have access to the space.
- Other trades may have to perform tasks in the secured space (e.g., wall finishing/painting, electrical trim, HVAC trim). Do not rely on the tradespersons or the general contractor to re-secure the space when those tasks have been completed. Monitor other trades activity in the space, and re-secure the space when tasks are completed for the day.
- Space may become wet or construction activities may damage materials.
Storing Materials, continued

**Company-Controlled Location**

When a project site is near the cabling installation contractor’s office/warehouse and adequate space is available, materials can be stored at the company location and sent to the job as needed. Otherwise, the cabling contractor may rent or lease secure dry space near the project.

Some of the risks associated with storing materials at a company-controlled location include:

- Unauthorized company personnel accessing company materials.
- Material used on incorrect projects.

**Distributor**

Distributors often will deliver materials to a work site or company location on demand.

Some distributors provide a preloaded enclosed delivery trailer on site or intermodal shipping container with the purchased materials and equipment.

Some of the risks associated with storing materials at the distributor location include:

- Hours of operation and availability.
- Delivery delays.
- Material sold to other customers.
- The distributor could have financial difficulties paying their vendors (manufacturers) and therefore may not deliver material on time.

**Distributing Materials on Site**

Control of the access to job materials will determine who is allowed to distribute them to the installer. Only designated persons should be allowed to distribute materials on the work 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. 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 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. On shorter timeline projects more frequent schedule updates may be required.

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.

The PM should identify the risk level of the delay and whether a contingency was put in place to correct or adjust the schedule.

The risk management plan will require verification and updates to the plan as required. The PM may revise the schedule after each meeting or activity where revisions have been recognized or made and issue the updated schedule with the report of each meeting. The project sponsor or stakeholders will have final authority to the changes made to the schedule.

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 the project. The plan should describe the manpower and mobilization requirements in terms of functional responsibility, skill level, certification level, and head count.
Project Closeout

The closeout phase of a project typically begins at the end of the testing and commissioning phase of a project and ends with the final acceptance of the project. Each project has unique requirements and the PM should create a checklist based on the project plan deliverables to ensure the ICT team has met all of their contractual agreements.

Typical closeout activities include:

- Reviewing and submitting test results; complying with appropriate naming convention per client requirements.
- Reviewing and submitting as-built drawings with labeling.
- When required, reviewing and submitting photographs of the final project.
- Documenting device addresses, identification codes, locations, serial numbers in Internet protocol (IP) addressable systems (e.g., security, wireless, IP cameras, building maintenance systems).
- Providing patching matrix.
- Obtaining transmittals for non-installed equipment and accessories:
  - Patch cables.
  - Spare parts and equipment.
  - Equipment cords.
- Reviewing original SoW and developing punch item list (clean up items), including missing items, removing material from site, recording missing documentation, and missed test results.
- Training end users as required.
- Finalizing and submitting operations and maintenance manual package.
- Delivering warranties, guarantees, and service level agreements.
- Performing final walk through with owner representative.
- Finalizing the invoice.

The general contractor, owner, or owner's representative may require a post-installation review meeting to cover lessons learned. This provides the ICT team and the PM the opportunity to identify any gaps, assumptions, resource allocation, and other items miscalculated or not captured during the early stages of the planning phase of the project.

The project closeout ends any further obligations or responsibility by the ICT team, PM, and contractors.

All documents relating to the project need to be archived for future reference requirements. There may be legal requirements for minimum retention.