



# Project Management

Project management is a soft skill which will appear in parts of your NICET certification exam. There will be project management questions on your NICET Level 3 and 4 tests. We recommend the following reference texts to help you learn more about project management:

*NASCLA Contractor's Guide to Business, Law and Project Management, BASIC EDITION*

[www.nascla.org](http://www.nascla.org)

*PMBOK Project Management Body of Knowledge*

[www.pmi.org](http://www.pmi.org)

Studying these references prior to your NICET exam will provide you with the knowledge you need to successfully navigate those sections of the test which may contain project management questions. Many of the questions which may relate to project management are common sense questions which can be answered correctly without significant study for most fire alarm technicians. Some of the questions may be related to specific calculations for profit margin, costs, budgeting and other essential project management mathematics. For these questions, expect a story problem type question. Knowledge of how to do these calculations is required and you may need to study to obtain this information. Other questions may relate to specific terminology used in business, law and contracting. If you are not familiar with this language, study of the above references will get you prepared.

## **Bidding and Estimating**

Project management is a temporary endeavor having a defined beginning and end. Bidding and estimating has to be based on the requirements of the project. The Scope of Work (SOW) is a key factor in establishing a bid. Some of the components of the SOW include:

1. Timeline for the project
2. Location of work
3. Period of work
4. Work to be performed
5. Milestones
6. Reports
7. Special requirements
8. Deliverables (completion of part of a project)
9. End products

There are several stages of a project and they can be categorized as follows:

1. Initiation
2. Planning
3. Execution
4. Completion

Typical bid documents include:

1. Invitation to bid. Brief overview of the project, deadlines and general requirements.
2. Bid Instructions. Specifics of how the bid should be completed and submitted.
3. Bid Forms. These include but are not limited to the following:
  - a. Bid Sheet
  - b. Bid Schedule
  - c. Bidder's questionnaire on experience
  - d. Financial responsibility and capability
  - e. Copy of the contract
  - f. Supplements

**Planning an Estimate.** Once the decision to bid has been made, planning your estimate is the next step. Planning is important to ensure that your estimate is as accurate as possible. A review of project documents is important. The documents include but are not limited to the following:

1. Architectural drawings
2. Specifications. Key things to know about specifications:
  - a. They are part of the legal contract
  - b. Includes General Clauses
  - c. Includes Technical Instructions
  - d. Includes Acceptance of the System requirements
3. Contract
4. Bond requirements

**Estimating Framework.** Estimating should be systematic. This systematic process may include the following:

1. Defining the phases of the project
  - a. Preconstruction
  - b. Construction
  - c. Post construction
2. Listing of each task and materials needed for each phase. This process may commence in this manner and continue through each phase:
  - a. Phase 1
    - i. Task 1, Materials, Labor
    - ii. Task 2, Materials, Labor
    - iii. Task 3, Materials, Labor
  - b. Phase 2
    - i. Task 1, Materials, Labor
    - ii. Task 2, Materials, Labor
    - iii. Task 3, Materials, Labor
  - c. Phase 3
    - i. Task 1, Materials, Labor
    - ii. Task 2, Materials, Labor
    - iii. Task 3, Materials, Labor

3. Estimating Checklist. The Construction Specifications Institute publishes a classification system called the Master Format. This groups activities to help in more accurately estimating costs. The Master Format is a tool which helps to ensure that you have accounted for all aspects of materials and labor.

**Determining Estimated Costs.** One way to estimate costs is a method referred to as the “Quantity Take-Off Method”. When this method is used, estimates are based on individual units of materials and labor for each task in the estimating framework. There are 10 segments of the Quantity Take-Off Method as follows:

1. Determine labor cost for each task. (Required Labor Hours x Labor Rate = Labor Cost per Task)
2. Add Labor Burden. Labor Burden = Employer expenses for employees (approximately 30%)
3. Determine Materials Costs. This is based on each task in your estimating framework. The job materials list should include the quantity of required devices.
4. Determine Project Equipment Costs. These include:
  - a. Rental equipment costs
  - b. Wear and tear on your equipment costs
  - c. Maintenance and operating costs
  - d. Taxes and fees
  - e. Labor to operate the equipment
  - f. Licensing and training costs
  - g. Insurance costs
5. Add Subcontractor Fees.
6. Add Allowances. Includes items which are not specified in project plans (finish materials).
7. Add Contingencies. Typically a percentage for unanticipated conditions which may arise (2% is typical)
8. Add Project Overhead. Typically 5% - 10%. Items which are required to complete the job but are not directly accounted for in other places. Examples include:
  - a. Bonds
  - b. Temporary storage
  - c. Temporary office
  - d. Security guards
  - e. Utilities
  - f. Dumpster
  - g. Portable toilets
9. Add Company Overhead. Typically average 5%-10%.
  - a. Overhead percentage is divided into the direct costs of the project
  - b. Example
    - i. Direct costs = \$10,000
    - ii. Overhead % = 20%
    - iii. Direct costs % is then = 80% of total bid price
    - iv. Now divide direct costs by direct costs % to get to the total bid price
    - v.  $\$10,000 \div 0.8 = \$12,500$
10. Markup Definition. Difference between actual cost and selling price. Typically 15% is the standard industry markup. In this case Markup = Cost X (100% + 15%) = Cost X 115%. Example:
  - a. Consider direct costs of \$12,500 and a Markup of 15%.
  - b. Use the formula: Cost X (100% + 15%)
  - c. Markup =  $\$12,500 \times 115\% = \$14,375$

11. **Margin Definition.** Difference between selling price and profit. Let's use a 15% margin. The formula is  $\text{Cost} \div (100\% - \text{Margin}\%)$ . Example:
  - a. Consider direct costs of \$12,500 and a margin of 15%.
  - b. Use the formula:  $\text{Cost} \div (100\% - 15\%)$
  - c.  $\text{Margin} = \$12,500 \div 0.85 = \$14,705.88$

**Estimating Pitfalls.** Getting the pricing right on a project is so important that it should not be done in a frivolous manner. Make sure to go through the process and get your price right the first time. Here are some things to beware of:

1. **Don't Guess.** Your pricing determines the success of your business. Be sure to get it right.
2. **Preliminary Estimates.** Don't let your customer pressure you into giving them a preliminary estimate. They will hold you to it even if it is verbal. Be precise and get it right.
3. **Inaccurate Estimates.** Check and re-check your work. Look for errors in these areas:
  - a. Mathematical errors
  - b. Omissions in labor
  - c. Omissions in materials
  - d. Non-standard abbreviations
  - e. Units of measure

**Submitting Your Bid.** It is important to follow all instructions in the bid package. This typically includes:

1. Meeting submission deadlines
2. All requested documentation
3. The exact information in the bid package

The submission process typically is 30-90 days. So it will typically take this long to find out if your bid was accepted or rejected.

**Job Cost Recording System.** A formal job cost recording system is beneficial for the following reasons:

1. Current projects are monitored more closely and cost overruns are identified so corrective action can be taken
2. Helps with future estimates by creating more accurate unit costs
3. Reporting capability

**Technology in Estimating and Bidding.** There are many software products which are specifically designed for estimating. Based on your specific industry and needs, search out the product which best meets your needs.

## Contract Management

Contracts are legally binding agreements. The main purpose of contracts is agreement between those who sign them and prevent disputes. Contracts clarify agreements and provide protections for all sides.

**Required Contract Elements.** Here are the key elements of contracts

1. Offer and Acceptance. Specifically outlines the work to be done and the compensation for doing the work.
2. Consideration. Both parties must give up something of value. For example, payment for materials and expertise. Not just limited to money though. All payment terms should be clearly detailed in the contract.
3. Competent Parties. The parties in agreement are required to have the legal capacity to enter into a contract. This goes to mental competency.
4. Legal Purpose. Contracts must be possible to perform, not intended to harm anyone, and cannot require any illegal activity.

Contract Provisions include:

1. Contract Price and Payment Terms. Should specify how the contract price is calculated, whether lump sum, unit price or cost plus methodology is used. Should include all fees the customer is expected to pay. Payment terms should be very specific and include who is issuing payment, amount of the payments, form of payments, and when the payments will be issued.
  - a. Progress payments. Partial payments made after specific phases of construction are complete. The two functions of the progress payments are to protect the owner by holding the contractor responsible for the planned schedule, and to allow the contractor to for labor and material expenses as they occur.
  - b. Retainage. Used by the owner to ensure completion of the construction project and provide protection against liens, claims and defaults. Calculated as a percentage, typically 10%.
  - c. Final Payment. Once the structure can be used for its intended purpose, the architect issues a certificate of substantial completion. The building inspector issues a certificate of occupancy. Final payment is generally due when all punch list items are complete as agreed by the owner and contractor.
2. Obligations of the Parties. Should be clearly outlined for the contractor and the owner. Examples of what should be includes are:
  - a. Contractor obligations
    - i. Having proper licensing
    - ii. Securing building permits
    - iii. Ordering all materials and supplies and coordinating for site delivery
    - iv. Furnishing all labor
    - v. Completing all work in compliance with codes
    - vi. Scheduling inspections on a timely basis
    - vii. Completing all work according to plans and specifications
    - viii. Keeping the construction site clean and removing all debris during and upon completion of construction

- b. Owner's obligations
  - i. Ensuring prompt approval of all plans and specifications
  - ii. Ensuring project meets zoning specifications
  - iii. Issuing payments according to the specified progress payment schedule
  - iv. Paying for all required permits, assessments, and charges required by public agencies and utilities
  - v. Furnishing all surveys and recording plats and a legal description of the property
  - vi. Providing access to the construction site in a timely manner
- c. Supplemental conditions. Modify the general conditions of the contract and are often prepared in a separate document. They may outline such things as specific insurance requirements, project procedures and local law requirements.
- d. Breach of contract. Occurs when one of the parties involved fails to perform in accordance with any of the terms and conditions of the contract. A material breach of the contract is a serious violation. Liquidated damages are typically written into the contract. So if a breach occurs the injured party receives a predetermined compensation for the breach. This may occur if the contractor refuses to perform or complete a job or if the owner refuses to pay for completed work. A material breach will most likely end up in litigation.
  - i. Refuses to perform the contract
  - ii. Performs an act prohibited by the contract
  - iii. Prevents the other party from performing its obligations

**Boilerplate Provisions.** Standard language or clauses used in a legal contract. Sometimes they are referred to "miscellaneous" clauses. They generally appear at the end of the contract and their purpose is to protect the business in the event of a lawsuit. Examples of boilerplate provisions include attorney's fees, arbitration, consent to jurisdiction.

**Provisions to Limit Risk.** Examples of allocation of risk provisions are:

1. Force majeure addresses acts of god and other external events such as war and labor strikes
2. Indemnification (hold harmless) absolves the party from any payment for losses and damages incurred by a third party
3. Differing site conditions provisions allocate responsibility for extra costs due to unexpected site conditions
4. Warranties or guarantees define the contractor's responsibility for the repair of defects to the project after the completion of work
5. Delays and extensions of time provide contingencies in the event the completion deadline is not met
6. Schedule acceleration provides assignment of costs incurred to complete the project ahead of schedule if required by the owner
7. Artistic changes clauses address changes made for creative purposes

**Recitals** are language at the beginning of the contract that provide background, such as the parties entering into the contract, reasons for the contract, contract contents. Recitals are not always enforceable so it is important the elements of the contract be detailed.

**Types of contracts** define things like who takes the risk that the work gets performed for the costs, who pays for cost overruns, who keeps the cost savings if the project is less than the estimate. Three common types are:

1. Lump Sum Contract. The contractor agrees to complete the project for a predetermined price. The contractor assumes all the risks. The contractor is responsible for the unforeseen. It is typically for the owner to require quality assurance program with this contract.
2. Unit Price Contract. Used when actual costs are difficult to accurately determine. Includes labor, materials, equipment and a markup fee.
3. Cost Plus Contract. The contractor is reimbursed for the actual cost of labor and materials and paid a markup fee for the overhead and profit.

#### **Contracting Methods:**

1. Single Prime. The traditional form of contracting. The project owner hires an architect to do the design. The contractor performs the work to the specifications and is responsible for completion.
2. Design / Build. The owner contracts with one company to take the project from design all the way through to completion.
3. Construction Management. The owner contracts with a professional construction manager to coordinate and manage the project
4. Turnkey. The turnkey method is similar to design/build with the addition of obtaining financing and land
5. Fast Track Construction. Construction begins before completion of the contract documents. A contract may be drawn up for each phase.
6. Multiple Prim Contracts. Typically used in large projects where different prime contractors can be used for different parts of the project
7. Partnering. Starts with setting common objectives and goals for a construction project. All parties involved such as the owner, designer, engineers and contractors work together to achieve the objectives. Partnering increases communication and trust reducing potential litigation and claims.

**Making changes to the contract.** Change orders are used for this purpose. Change orders are standard in the construction industry as a legal means for making changes to the contract. It is the responsibility of the project manager to ensure that written change orders are used. If changes are made to the original contract (even if there is no additional cost) a change order should be done. If the change order will affect the schedule, notification should be made to the project manager, project superintendent, and the subcontractor installing the equipment. Common reasons for change orders:

1. Change in scope of work
2. Customer directed changes
3. Unforeseen conditions
4. Errors or omissions in construction plans or specifications

Change orders are legally binding. Change orders should be written and should include:

1. Date of change order
2. Labor
3. Quantity of equipment
4. Specific details
5. Signatures from both parties

**Contract documents and Project manual.** The project manual is a central location for bid documents, contract provisions, technical specs and addenda. It is a useful tool easily referenced on the jobsite. Typical documents included in the project manual are:

1. Bid documents
2. Contract provisions
3. Supplemental forms
4. Technical specifications
5. Construction drawings

## Scheduling

Larger projects require a more formal scheduling method. Scheduling helps to organize required tasks and achieve job completion on time. Scheduling provides a central point of reference for all departments and the customer. Your bidding and estimating work is the basis of an accurate and complete schedule. The positions responsible for scheduling include the project manager, and the construction manager. There are many software options for project management scheduling available on the market today. They are industry specific. For fire alarm systems, there are several options available for estimating and scheduling programs. The primary scheduling methods are:

1. Calendar Scheduling. This is a simple scheduling method which uses a typical calendar and tasks are annotated by date. It makes it easy to identify tasks in relation to other important dates such as:
  - a. Dates of other projects
  - b. Delivery dates of materials
  - c. Payment schedules
  - d. Employee availability
2. Bar Chart (Gantt Chart) Scheduling. Shows the activity duration and sequence of tasks to be completed. It is easy to read showing a graphical depiction of the schedule in its entirety. One of the problems with this method, it does not show interdependency of activities.
3. Critical Path Method. CPM illustrates the interdependent relationship of tasks. It is necessary to determine the sequence of tasks and activity duration as you would with bar chart or calendar scheduling. CPM uses a flow chart to illustrate sequence of tasks and activities. In addition, you need to outline the following:
  - a. A list of all activities required to complete the project
  - b. Relationship and dependency between tasks
  - c. The duration for each activity
  - d. Simultaneous events
  - e. Critical path

**Project scheduling and cash management.** It is important to track incoming cash and expenditures during the project to ensure you have enough working capital to complete the job. Balancing incoming progress payments and outgoing expenditures is important to effective management and scheduling. A preliminary cash flow budget relating to the schedule should be prepared outlining the phases of the project and the payments / expenditures. Cash flow should be tracked through the duration of the project.

## Project Management

The project manager plans and coordinates all activities as required by the project manual. If the project manager assigns work or makes an agreement with subcontractors it should be done in writing. Responsibilities include but are not limited to the following:

1. Prepare budgets, work within budget constraints
2. Review shop drawings to determine appropriate methods
3. Determine labor requirements
4. Preparing schedules
5. Monitoring overall progress
6. Monitoring compliance with codes
7. Ensuring proper handling of change orders
8. Regularly meeting with stake holders
9. Work to resolve conflicts

The lifecycle of a project can be divided into the following categories:

1. Contract award
2. Pre construction phase
3. Construction phase
4. Job completion and closeout

There are several aspects to tracking the progress of the project. Here are some ways many projects are tracked:

1. Daily reports or logs are done daily and consist of the following
  - a. Project name and location
  - b. Date
  - c. Weather conditions
  - d. Personnel on the job
  - e. Description of work
  - f. Hours worked on each task
  - g. Change orders
  - h. Progress on the job
  - i. Other relevant information
2. Status reports summarize project highlights addressing items completed in progress and outstanding.
3. Tracking the schedule is important to ensure the project is on deadline. A good project manager makes sure to communicate with anyone impacted by the schedule.

**Budget and Cost Controls.** Project management is working within budget constraints. This means controlling costs and making sure the project comes in on time and on budget. Important aspects of this include:

1. Just In Time delivery of materials. Keeping inventory is an expense. Making sure materials arrive on time, but not too early helps to control costs. Material that arrives late is always bad and should be avoided. Some project management teams use an expediter. The responsibility of the expediter is
2. Use Purchase Orders. The purchase orders are controlled and require approval. This is an important way to help control costs.
3. Receiving. It is important to properly receive materials. This can help insure all materials are delivered and in appropriate condition. If equipment delivery issues arise, the purchase order and the packing list for the material will be important.
4. Budget Tracking. This starts with your cost estimate and job cost system. There are many software options available to contractors to put this in place.

**Quality Assurance.** A quality assurance program can help to ensure that the customer receives a quality and effective end product. Contractors who have an effective quality assurance program tend to do better work, and reduce their exposure to litigation. Some important considerations are:

1. Accurate and detailed specifications and plans
2. Detailed shop drawings
3. A formal quality assurance program
4. Customer satisfaction surveys

**Value Engineering.** This is a specific project management approach. The intent of this approach is to look at the project from the owner's perspective and control costs while providing a high quality product. It is a methodology used to meet a building owner's objective for cost, quality and time.

## Managing Risk

Managing risk is important for contractors. Contractors can manage foreseeable risk by ensuring they comply with licensing requirements, they are technically competent, they follow code requirements and follow industry best practices.

Managing risk for those areas which are not so easy to identify requires insurance and bonds.

As a contractor, you are responsible for paying for insurance protection. Some common types of insurance are:

1. Property insurance
2. Liability insurance
  - a. Protect against 3<sup>rd</sup> party claims
  - b. Protect against negligence that results in bodily injury or property damage
3. Business Owner's Policies
4. Automobile insurance
5. Burglary and theft insurance
6. Key man life insurance

7. Worker's Compensation Insurance
8. Unemployment Insurance
9. Inland Marine Insurance. Tools and equipment, material in transit.

The Miller Act requires that performance and payment bonds be obtained for all government projects over \$100,000. Some common types of bonds are:

1. Bid Bond. Guarantees the contractor, if awarded the job, will do work at the submitted bid price, enter into a contract with the owner and furnish the required performance and payment bonds.
2. Surety Bond. Risk transfer mechanism between a surety bonding company, the contractor and the project owner.
3. Performance Bond. Guarantees the contractor will complete the contract within the time frame and conditions.
4. Payment Bond. Guarantees subcontractors and suppliers of labor, and materials they will be paid for work if they perform properly under contract.
5. Maintenance Bond. Guarantees for a stated period (typically 1 year) no defects in workmanship or material will appear.
6. Completion Bond. Provides assurance to project backers that the project will be completed on time.
7. Fidelity Bond. Covers business owners for losses due to dishonest acts by their employees.
8. Lien Bond. Guarantees that liens cannot be placed against the owner's property by contractors for payment of services.

In the event that the contractor who has the bond is unable to meet the contractual requirements, it is the bond issuer's responsibility to fulfill the requirements.

### **Additional Points of Consideration**

1. Form I-9 is used to show legal immigration status / legal to work
2. Fair Labor Standards Act (FLSA) prescribes minimum wage, overtime and work week requirements
3. Americans with Disabilities Act (ADA) prohibits discrimination based on disability
4. Davis Bacon Act requires payment of prevailing wage
5. Walsh-Healey Public Contracts Act requires payment of minimum wage and overtime pay on contracts that provide goods to the federal government
6. Service Contract Act requires payment of prevailing wage rates and benefits on contracts to provide services to the federal government
7. Contract Work Hours and Safety Standards Act sets overtime standards for service and construction contracts on federal projects
8. Wage Garnishment Law limits the amount of an individual's income that may be legally garnished and prohibits firing an employee whose pay is garnished for a single debt
9. Employee Polygraph Protection Act prohibits most employers from using any type of lie detector test
10. Family and Medical Leave Act entitles employees to take up to 12 weeks of unpaid leave each year

11. Title VII of the Civil Rights Act of 1964 prohibits discrimination on the basis of race, color, religion, national origin and sex
12. Equal Pay Act of 1963 prohibits employers from paying different wages to men and women who perform basically the same work
13. Age Discrimination in Employment Act prohibits discrimination against individuals who are age 40 or older
14. Worker Adjustment and Retraining Notification Act offers protection to workers by requiring 60 day notification of plant closings
15. Title III Consumer Credit Protection Act protects employees from being discharged by their employers because their wages have been garnished for any one debt and limits the amount of employee's earnings that may be garnished
16. Uniformed Services Employment and Reemployment Rights Act protects service members rights when returning from a period of service in the uniformed services
17. Numerous labor organizing, collective bargaining and dispute resolution acts give employees the right to organize
18. Right to work laws secure the right of employees to decide for themselves whether to join a union
19. At Will Employees means that either the employer or the employee may terminate employment at any time without notice or cause
20. Material Safety Data Sheets (MSDS) ensures chemical safety in the workplace and employers are required to have these readily available
21. Bookkeeping = accurate recording of all financial transactions
22. The Balance Sheet provides details on the growth and stability of the company. The basis of the balance sheet is  $Assets = Liabilities + Owner's Equity$ . The balance sheet provides information as of a specific date.
23. The Income Statement summarizes the company's revenues and expenses over a given period of time (also known as the profit and loss statement)
24. Statement of Cash Flows summarizes receipts and disbursements over a given period of time. Especially important for those companies using Accrual based accounting.
25. Cash Basis for Accounting = based on when cash is made, not when the sale is made
26. Accrual Basis for Accounting = based on when sale is made, not when cash is received. Used for larger companies and companies involved in assigning purchase orders by job.
27. Prompt Payment Act requires federal prime contractors to be paid within 14 days of submitting a progress payment invoice and subcontractors to be paid within 7 days after that
28. Activity Ratio =  $sales\ per\ day \div current\ receivables$ . This formula indicates how effectively a company manages its credit
29. Jobsite Safety requirements are listed in OSHA publications
30. MasterFormat is a classification system published by the Construction Specifications Institute that includes numbers and job tasks grouped by major construction activities (fire alarm systems falls under Division 16 Electrical)