

**DESIGNING, PERMITTING, AND BUILDING PROCESSES
FOR A CONSTRUCTION PROJECT**

Prepared by

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DESIGNING, PERMITTING, AND BUILDING POCESSSES FOR A CONSTRUCTION PROJECT

I. INTRODUCTION

This paper discusses the progress of a land development and/or construction project, which consists of engineering, permitting, and building processes. The owner of the project recruits proposals (RFP) or quotations (RFQ) for a new construction or remodeling work that usually contain some engineering concepts and permitting requirements. In the case of a more complicated case, an agency or entity sends out a request for qualifications (RFQS) in engineering or architecture for implementing a structural system. The architect and/or engineer being selected prepare plans and report, going through a permitting process for approval. When approved, it is ready for building. Then this entity or its representative distributes an invitation for bid (IFB) on the construction or a building process.

A land development project may be considered as an engineering or construction-related work. An engineering project, however, may be a design or planning process, which does not include the process of building or construction. This paper identifies the detailed processes of a construction-related project. It is one of a series of technical and procurement studies published for minority contractors. The purpose of this paper is for the contractors to understand the detailed contents of a project in order for them to better bid on and conduct the project. This paper covers the contents of engineering, permitting, and building processes for a construction or remodeling project. Previously, Asian Contractor Association (ACA) presented a study in “construction process” (Reference 1, ACA), which provides a description of the construction process for a specific structure, i.e., a building of home or office.

II. TERMINOLOGY USED IN THIS STUDY

Engineering: Engineering is the application of science and practical knowledge for building an object or developing a project. In this study, it refers to a design process for developing concept is always necessary no matter whether a report and/or plans are required.

Permitting: Permitting is a process designated to grant a permission or license for conducting an activity. In this study, it refers to the process of granting a permit by an authority or government entity for the implementation or construction of a structural system. A construction permit is generally required by the authority for a new construction, or for a remodeling or alteration project that may impact the life span of the structure. There are several types of construction permits (reference 2, City of Austin), including but not limited to those of demolition, development, building, and contractor and trade. “Development permit” is for a site plan. “Building permit” refers to the construction of structures and MPE systems (i.e., mechanical, electrical, and plumbing systems). “Contractor and Trade Permits” are related to the MEP work and the registration or qualification of the MEP contractors.

Building Process: Building process is a procedure to construct an object or implement a plan. In this study, it refers to the process of constructing a structural and related system. Following the issuance of a building permit by the authority, this process shall proceed in accordance with the drawings and specifications of the construction plan. It also has to follow a time schedule specified by the project management.

Contractors: Contractors are those businesses or individuals who bid and obtain a contract to perform work of one or more projects. In this study, contractors refer to engineers, architects, constructors, or any other construction-related personnel or businesses.

Plan(s): Plan is a sketch or proposal for achieving something. In this study, plan(s) refers to a set of engineering or architectural drawings for building or implementing a structural system. Engineering/architectural contractors respond to the “request for qualifications” for a construction project. If being selected for the project, they prepare the plan or a set of drawings, which clearly show the details and specifications for the construction of the structural system. It’s identified as the construction plan(s).

Scale: Scales are equipment or methods for measurement of an object. In this study, scales refer to the ruler and its reading for measuring the dimensions of a structure on a construction plan. There are two types of scales, i.e., architect’s and engineer’s scales. While the architect’s scale mostly used for measurements of interior equipment or structure, the engineer’s scale is usually applied to the field or outdoor project. The architect’s scale uses a 16-scale (Reference 3, Earle) format, i.e., an inch on the ruler is divided into sixteenths for measuring. For example, $1/4 = 1'$, means a quarter-inch on the scale represents one-foot length of an actual object. For the engineer’s scale, each unit on the scale is divided into multiples of 10. For example, $1 = 20'$, means one unit on the scale represents 20-feet on the field or 20-feet length of an actual object.

Engineering Report: Engineering report is a technical description of an engineering-related project. In this study, it refers to the information of a project, which is associated with the engineering design and construction. The report identifies the purpose, scope, requirements, and specifications of the project. This report, in connection with a set of construction plans, is available for bidders and other related personnel. A simple project may not have a report and/or the construction plans. But a description of the construction of the project is generally necessary.

Plat or Plot: A plat or plot is a map or drawing of a parcel of land. In this study, a plat refers to a legally defined lot of a subdivision recorded in the county or other authority. A plot is somehow different from a plat. It shows a plat and the additional information of an existing or proposed use on the plat.

Code and Regulation: The definitions of code and regulation are similar in most cases. Code is a set of regulations governed by law and enforced by an executive authority. Regulations are ideas or rules on how to proceed. In this study, code and regulations refer to “local or government code” and “land development code.”

Standard and Specification: Standard is a document of criteria or requirements for the formation and use of an object or material. A specification may be referred as a technical standard. In this study, Standard and specification refer to the documents for land development or construction services. Standard is often referred to the requirements of engineering design. Specifications are generally documented in the engineering report and construction plans. There is usually a document of “Standard and Specifications” published by the local authority for the use in a land development or construction-related project.

III. DESIGN PROCESS

1. Engineering Design

For a land development project, an entity or the owner of the project selects architectural and/or engineering firms for engineering design, based on their qualifications. The engineering design procedure for the project can be demonstrated as follows:

- Define the project that specifies the purpose, scope, and outline of the project.
- Collect data, which may include maps, soil test, utility information, etc.
- Conduct research and find a best solution’ i.e., prepare draft report and conceptual plans.
- Finalize a set of construction plans; submitting plans for a permit.
- Go through a permitting or review process; the drawing and specifications must follow the code of local authority and its land development code.
- Revise plans and report upon discussions with the permitting authority.
- Complete report and submit final plans for permit approval.
- Distribute documents, including report and approved plans, to invite bids on construction.

2. Contents of Engineering Documents

The engineering documents consist of an engineering report and a set of construction plans. The report provides information concerning the land development project. It may specify the purpose, scope, and requirements of the project. The construction plans include, but not limited to the following subjects:

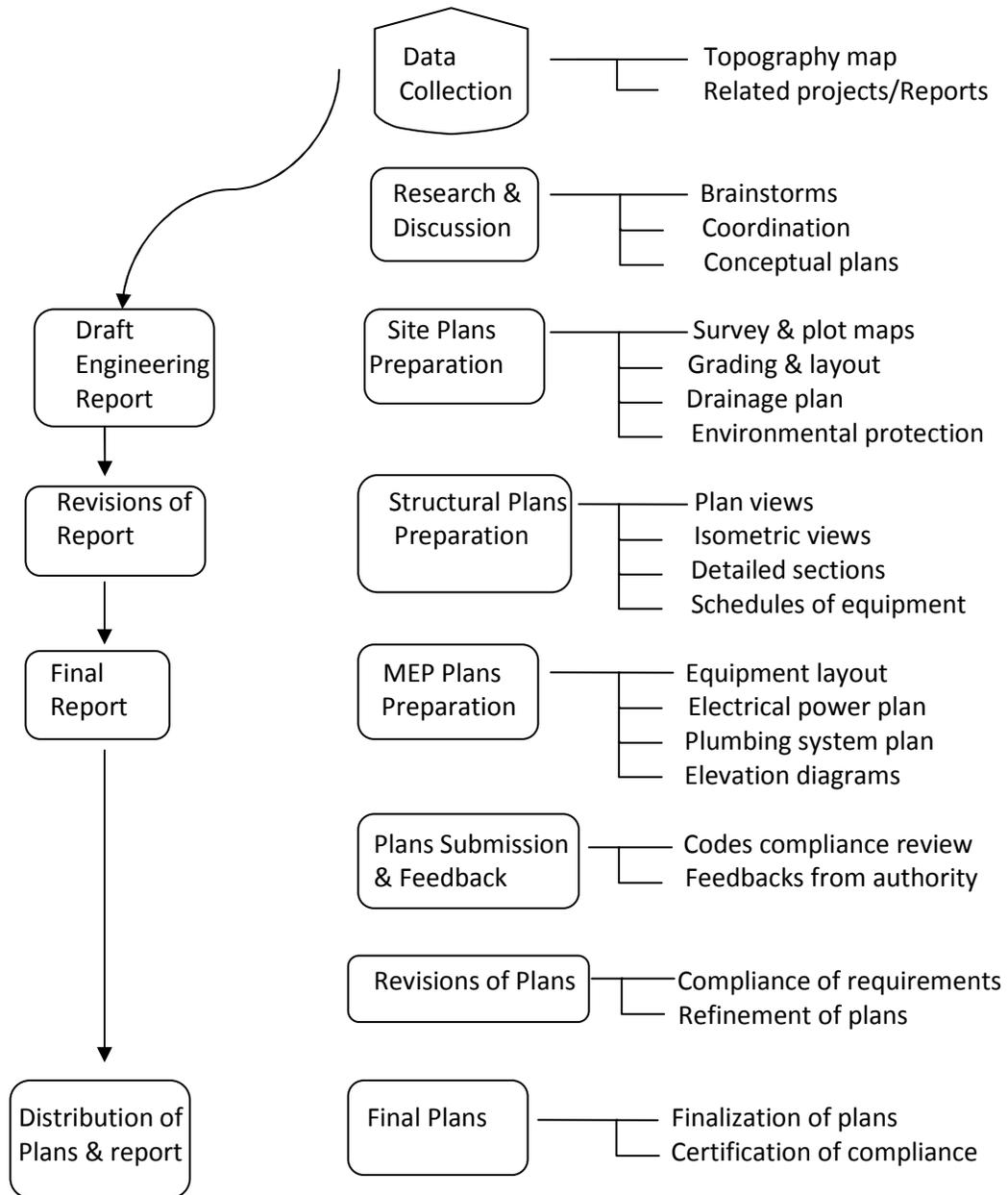
- The project location and a survey of a plat or tract of land to be developed.
- The existing conditions of the land such as its topography and the layout of various utilities and structures.
- A set of site plans, which may include a grading plan, a drainage plan, a structure and utility layout, and the environmental protection plan. The protection plan generally consists of landscaping, tree protection, and the erosion and sedimentation control measures.
- A set of structural plans, which provide the plan views of structures and its related objects. They may also show the isometric or three dimension pictorials of the structures. In this connection, the details of various cross sections for the structures should be drawn.

- A set of MEP plans. The letters of “MEP” stand for “mechanical, electrical, and plumbing.” The mechanical plan specifies the locations, connections, and elevations of all mechanical equipment such as air conditioning, heating, and ventilation equipment. The electrical plan shows the locations, connections, and elevations for the power source and all electrical equipment. An electrical load calculation (Reference 4, ACA) is associated with the electrical plan. The plumbing plan presents plans of piping and its related equipment. A drawing of piping elevations has to be accompanied with the plan of the plumbing system.
- On each sheet of the construction plan, there may be instructions concerning the details, symbols, and specifications for its drawing.

3. Flow Chart of the Design Process

Figure 1 provides a step-by-step diagram for the design process. Each step consists of some work items as specified in the diagram.

Figure 1. Flow Chart of Engineering Design Process for a Construction Project



IV. PERMITTING PROCESS

1. Plan Submission and Review Process

A development permit is generally required for a land development project. The owner of the project, or its representative such as an engineering firm, submits a set of construction plans for permit reviews and approval by the local authority, for example, a city or county government. It may take some time for the approval, depending on the review backlog and the complexity of the plans. The following description demonstrates the contents of a permitting review:

- Refer to Section III, Item 1, permit review, the owner or a representative of the project shall fill out an application form to apply for a general construction permit to the “development service” of the local authority. Other types of permits may be necessary in connection with the construction permit.
- Associated with the applications it should include a map of plot and a set of construction plans. The plans demonstrate a new construction, an alteration, or a remodeling work, either for residential or commercial/industrial use. A commercial/industrial project generally requires a permit, no matter how minor the project is.
- The construction plan has to be a complete set, i.e., it consists of all required documents, such as any combination of plans of map, site, structure, and MEP systems.
- The development service of the local authority reviews plans and check if the drawings and specifications of the plans comply with the rules of the local authority and whether they are according with the land development code of the authority.
- Corrections of plans are mostly necessary during the review process. Plans are successively revised in accordance with the requirements of all rules and codes.
- A general construction permit, a contractor and trade permit, and possibly other permits shall be issued following the final revisions of the plan. Together with the permit, there may be a notice indicating the required inspections during each stage of the construction.

2. Permitting and Inspection Process for a Simple Case

A simple case refers to the remodeling or alteration of a portion of a house or a commercial space. In this case, submission of partial plans instead of a complete set of plans may be sufficient. For example, a combination of a plot map, a plan view of the structure, and a portion of MEP plans may be sufficient for a permitting process. The following description specifies the inspection and permitting process for the simple case:

- A plot map indicates the existing condition and the layout of alterations shall be submitted for review. Additional structural and/or MEP plans are generally necessary in obtaining a construction permit.
- A pre-construction discussion is a good start; but an inspection before the construction may not be necessary.
- Inspections for “new structures” and any related “foundation work” is required before and after their constructions.

- Rough works for MEP systems are usually started with the building process of new structures. Inspections for the rough work of MEP system are required. These inspections are separate from the structural inspections specified above.
- Final inspections take place when all work is complete. A code compliance certificate or certificate of occupancy (CO) shall be issued following the approval of all inspections.

3. Permitting and Inspection for a General Case

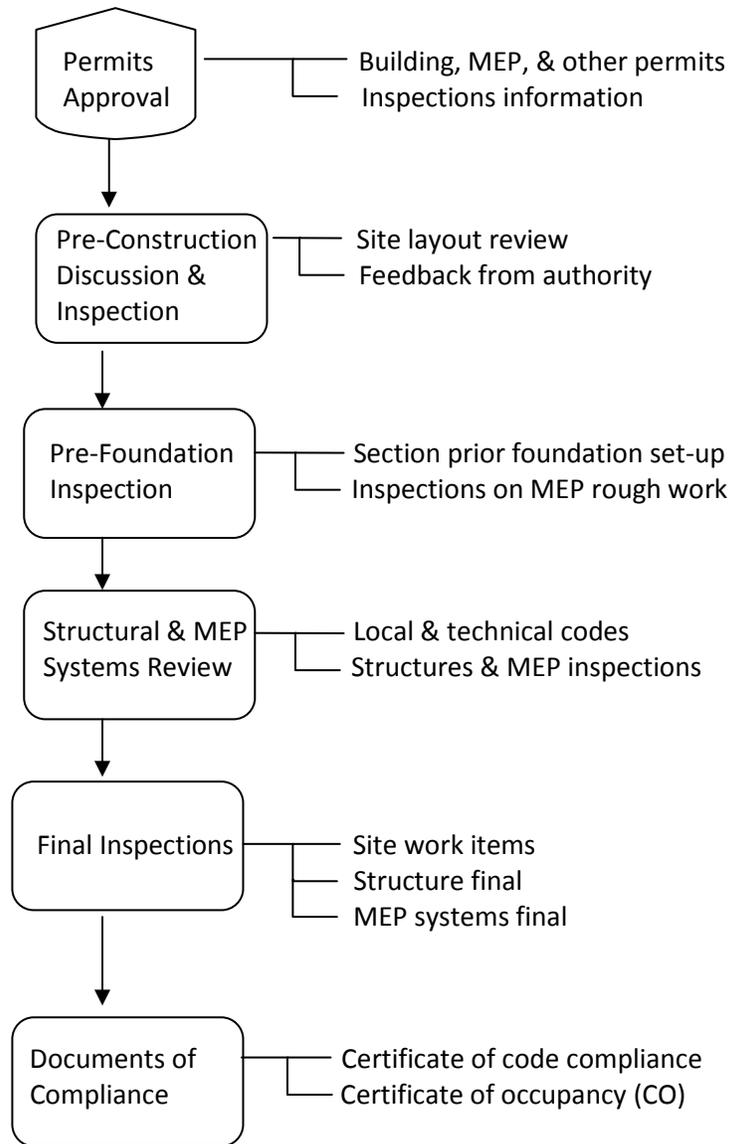
A general case refers to a new construction such as the implementation of a residential subdivision or a commercial/industrial development. Representative of the project has to submit a complete set of construction plans, which may include various sets of drawings such as site surveys, site plans, structural drawings, and MEP system plans. Inspections at several stages of constructions shall take place. The following description specifies the procedures of inspection and permitting for a general case.

- The owner or a representative of the project shall fill out a form to apply for a general or building permit. The trade or specialized contractors for the project shall apply for the MEP permits. Other permits such as those of demolition, right of way, etc. may also be necessary.
- A pre-construction discussion and inspection is generally necessary for the project
- Additional inspection takes place when the foundation is being set up. At the same time, site layout and any MPE rough work require inspections.
- The next reviews include inspections of structures such as framings, site items, etc. MEP works, during or near completion, are subject to further inspections.
- There are final inspections for all items related to the project. These items may include but not limited to buildings, site works, traffic control, and MEP systems.
- Certificate of occupancy or code compliance document shall be issued following the approval of the final inspection.

4. Flow Chart of the Permitting Process

Figure 2 provides a step-by-step diagram for the permitting process. Each step consists of some work items as specified in the diagram.

Figure 2. Flow Chart of Inspection and Permitting Process for a Construction Project



IV. The Building Process

1. Bidding for a Construction Project

Following the completion of engineering design and permits approval, the process of building or construction begins. For a smaller-scale project, the owner could have had simply chosen a contractor to build. In a general case, the owner or representative of the project announces an invitation for bid. The announced document may be presented in a different type of forms such as “Invitation for Bid,” “Request for Quotation,” or “Request for Proposal.” This document documents the specifications and requirements of the project to the bidders and requests the price and/or the price and value for the project. In the latter case, the selection chooses a bidder or contractor based on the amount of price and the quality of the construction that the bidder or contractor presents in its proposal for the project. A written contract for building between the owner and the contractor is necessary after the selection of a contractor.

The general contractor should have a team to build for the different phases of the project. In most cases, the general contractor recruits various subcontractors (subs) to participate in the project. Using subs has the advantage to ask the subs to purchase their individual bond and insurance, and in turn, save some costs or time in the process of building.

2. Plans Reading, Cost Estimates, and Value Engineering

Contractors associated with the building process should be able to read the construction plans, which have been approved and permitted by the local authority. In accordance with the plans, the contractors can assure the required quantity and quality of the structure for the project. There are many types of plans to be read, including but not limited to topography maps, site plans, structure details, traffic controls, and MEP systems. Another function for plan reading is for estimating the costs of the project. ACA presented a plan reading study (Reference 5, ACA).

Costs estimate plays an important role for the building process. On the construction plans, there are symbols, lines, areas, and volumes which identify an element of an object or structure. Through plan reading, these elements can be quantified. By quantifying these elements and finding the unit costs of the elements, the costs of various items and materials associated with the building process can be calculated. In addition, the labor and overhead costs have to be added to the calculation. Overhead costs may include, but not limited to bonding, insurance, work comp, and transportation. Also, the variations of costs associated with geographic areas and historical changes have to be considered.

Value engineering is closely related to the cost control for a building process. The definition of value engineering is to optimize the payment applications for the building process, subject to the requirement of the best quality in construction.

The construction management for the project should know how to control the cost of construction and at the same time maintain its quality requirements for the building process. The objective of the management is to achieve a maximum value in construction for its expenditure.

3. The Building Process for a Project

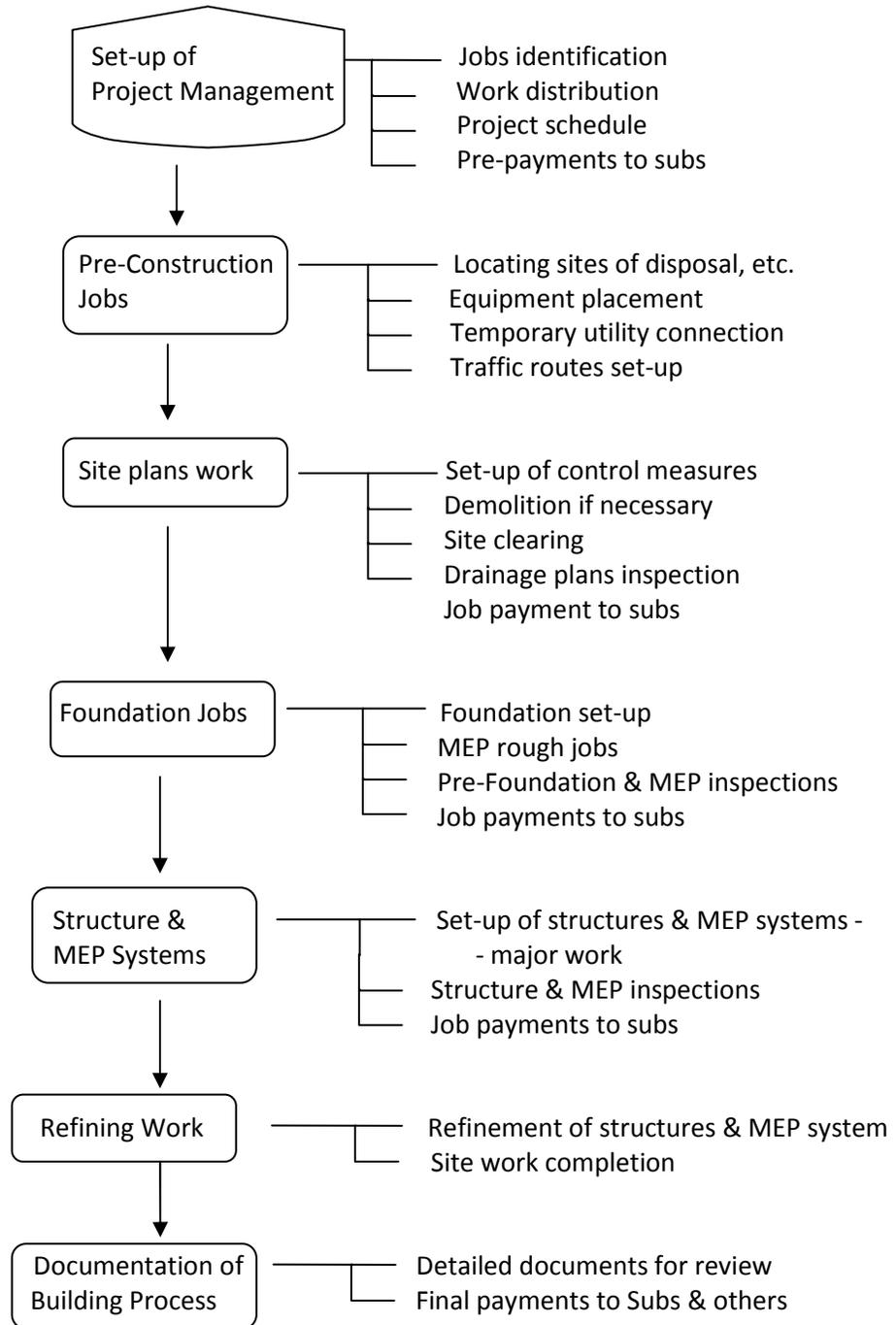
The building process varies depending on the types of construction. A remodeling or alteration process may be simpler than those of a new construction. Residential construction is different from that of a commercial project. Also, there are various forms of construction items such as buildings, utility facilities, or street improvements. Assuming a targeted site is feasible for construction as determined at the time of engineering design, the project management should establish a work plan which identifies, distributes, and schedules jobs for the project. In general, these jobs include, but not limited to the items listed below:

- Pinpoint existing utility lines. Identify and establish sites of disposal and equipment, and routes of transportation. Locate and place equipment such as toilets, temporary disposal, and other removable structures. Temporary use of electricity and water are generally necessary.
- Set up tree protection and erosion and sedimentation control measures, in accordance with the construction plan. Begin site clearing and demolish existing structures, if any.
- Conduct site excavations, cut and fill, in accordance with the layout and grading plans. Site drainage and its facilities are to be implemented.
- Following the implementation of site plans, the priority job is to establish a foundation for the planned structural system. In the meantime, the initial or rough work for the MEP systems should be completed.
- The major work for the construction is to build the structure and the associated MEP systems. This work has many portions and each portion contains detailed jobs. For example, the construction of a building has various portions such as framing, trusses, siding, roofing, and doors and windows. Each portion has several sections to be considered. For the same token, each of the MEP system has many equipment, and piping or wiring connections, which may involve some difficult jobs.
- The final jobs of the building process are the refinement work. The interior work is to conduct detailed jobs in order to comply with the construction plans and the requirements of the final inspections. The site work may consist of landscaping, traffic control, and site cleaning and restoration.
- The details of the above listed jobs have to be well documented to respond to reviews by all project-related parties.

4. Flow chart for the Building Process

Figure 3 provides a step-by-step diagram for the building process. Each step consists of some work items as specified in the diagram.

Figure 3. Flow Chart of the Building Process for a Construction Project



CONCLUSIONS

This paper describes the contents of an engineering and/or construction project. The description consists of the engineering, permitting, and building processes. It is to provide a basic guideline in obtaining, planning, and developing a construction project.

ACA has prepared a series of publications to serve its customers. This paper is one of the publications, which is particularly designated for the contractors such as engineers and constructors, and the owners of the project. This paper is also useful for people who plan to get into the field of the construction- related business.

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