Benha University

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Benha University
Faculty of Engineering at Shoubra
Electrical Engineering Dept.

Ameeria Integrated
Technology Education Cluster

Undergraduate Course

Electric Installation Design

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Content

1. Introduction to Electric Installation Design.
2. Load Estimation.
3. Regulation and Standards.
4. Lighting Systems.
5. Distribution Boards and Panels.
6. Design of Emergency and Earthing Systems.
7. Energy Management Techniques.
8. Distribution Systems and Feeding Systems.
9. Household Appliances Troubleshooting and Maintenance.

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Lecture (1)

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Introduction

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What is Electricity?

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Electricity Meaning

- Electricity is a form of **Energy** that can be easily changed to other forms.

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Electricity Resources

Mainly 2 Sources

Non-Renewable resources

Renewable resources

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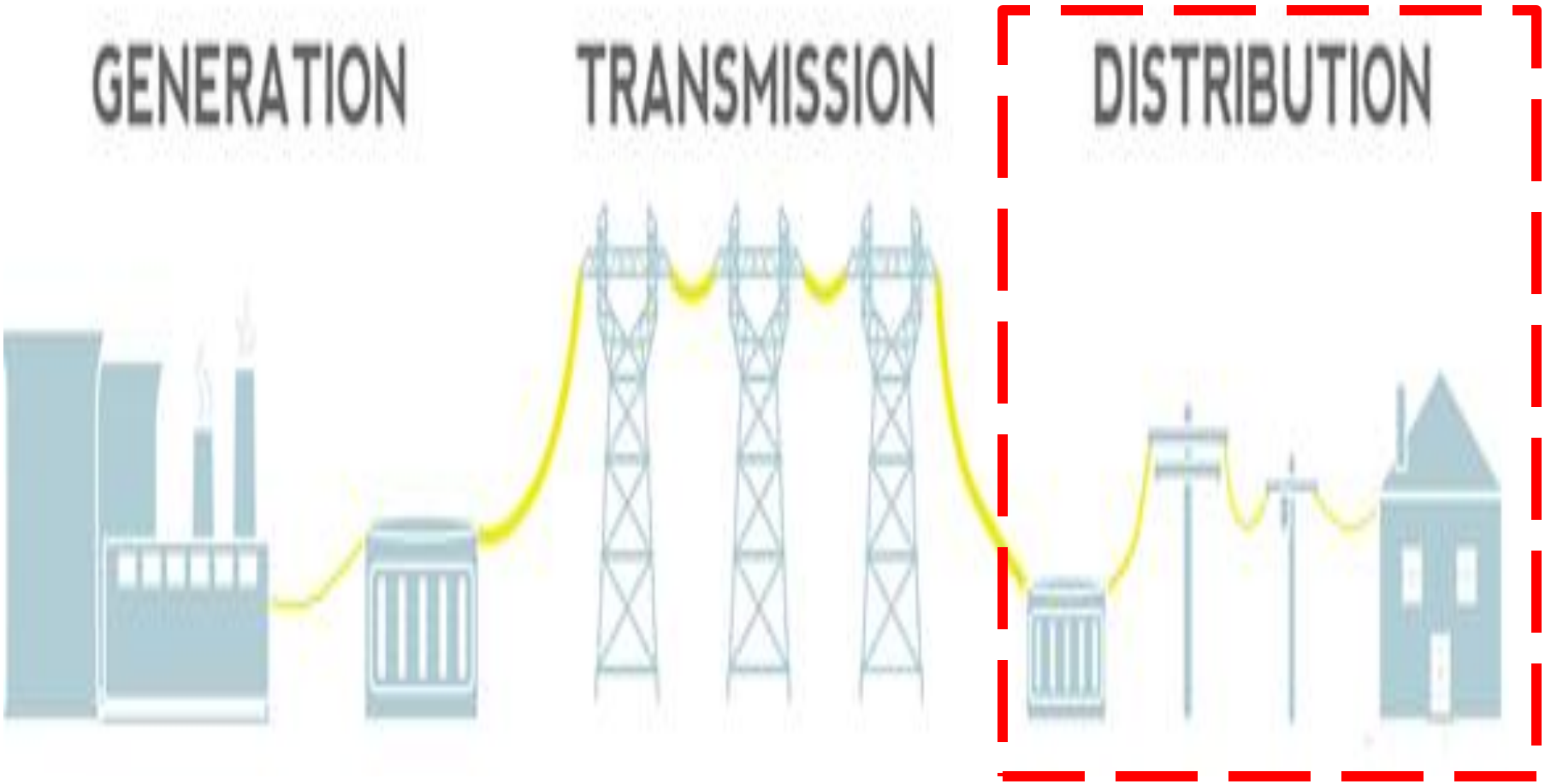
Electricity Delivery Stages



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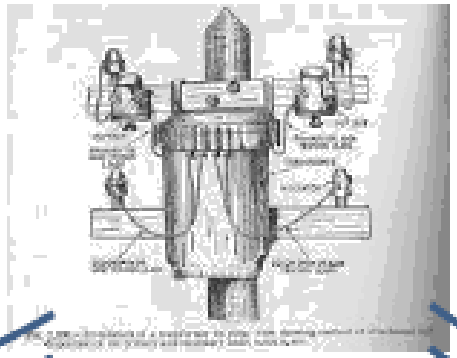
History of Electricity Distribution

- In 1880, Thomas Edison built the first electricity distribution system in the U.S.
- This system carried power from his Pearl Street Station to a few customers in the immediate area.
- Given the generator's proximity to the people using power, distributing the electricity from Pearl Street was a small operation.
- By the late 1882, Edison's distribution systems were vulnerable to competition from a more flexible and affordable option designed by Nikola Tesla, George Westinghouse, and others.
- Edison's electricity systems used direct current (DC), while Tesla and others promoted the adoption of alternating current (AC) systems, in direct competition with Edison.

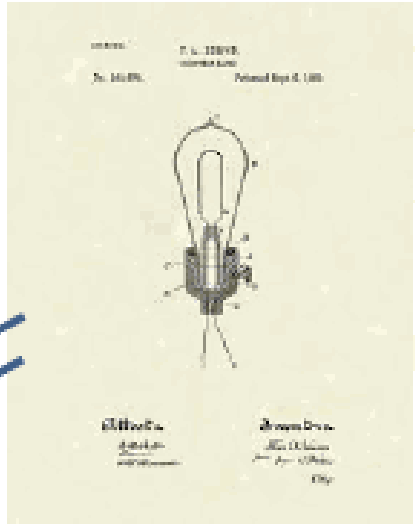
- By the late 1890's, AC distribution advantages ultimately allowed it to displace DC as the standard for electricity distribution.
- DC distribution systems are incredibly rare in the U.S. today, but many applications for DC power still exist.

Pearl Street Station

electric pole

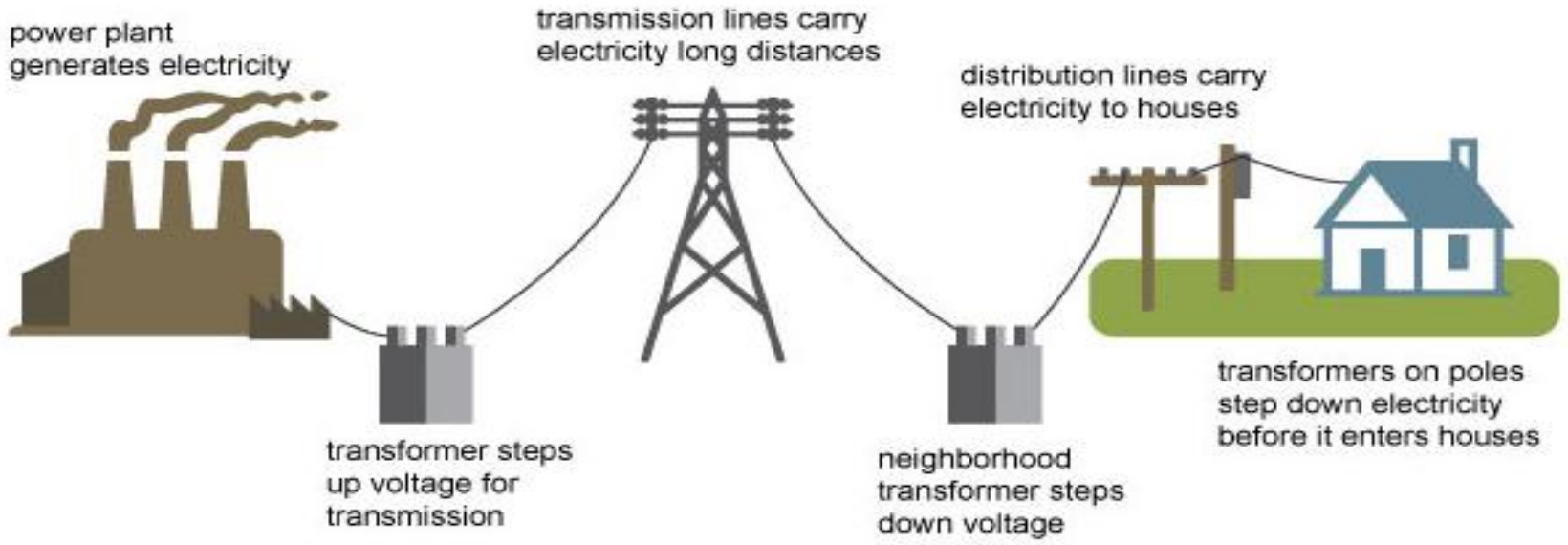


electric light

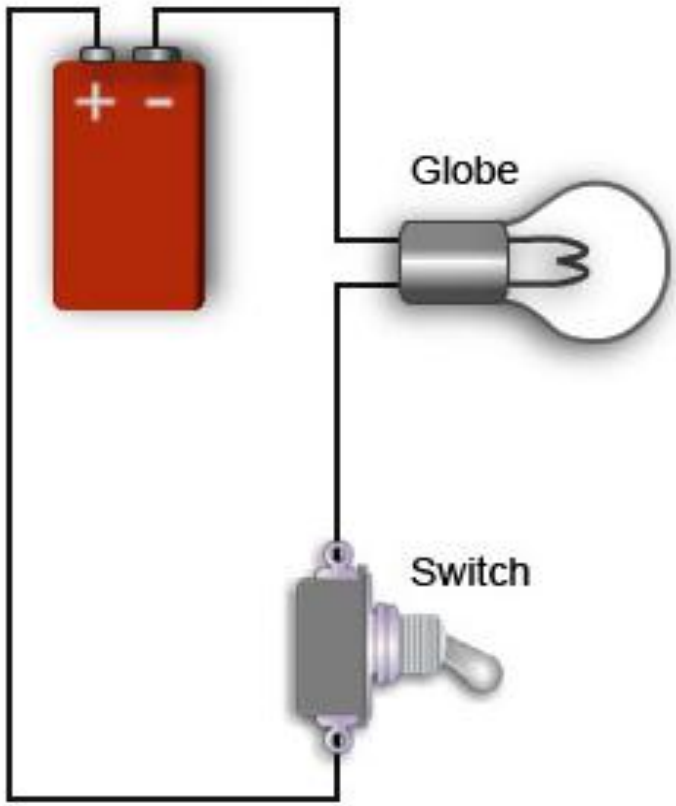


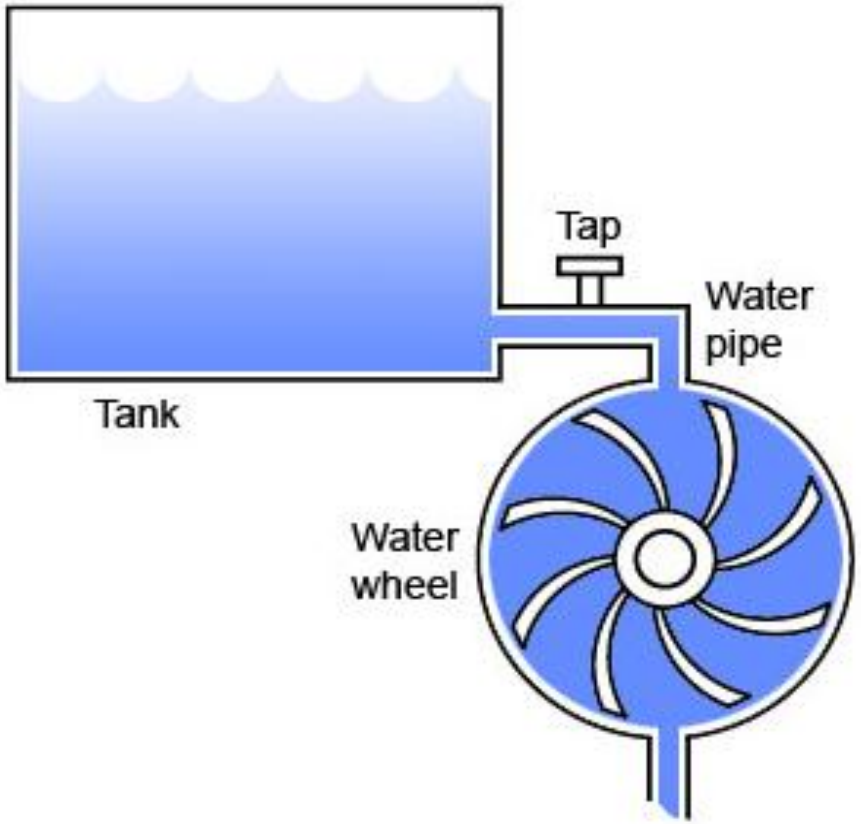
Electricity Distribution

- After electricity is generated and moved along the high-voltage transmission system, it comes off the transmission grid at local distribution substations.
- The voltage is reduced by special equipment called **Transformers**.



Analogy between Electricity & Water





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What do you know about Electrical Installation Design?

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Electrical Installation

- An electrician works on commercial, residential, agricultural and industrial projects.
- Electrical installation is closely associated with other parts of the construction industry, and with the many products that support it, normally for commercial purposes.
- Electric Installations require necessary designs, planning taking into consideration the whole requirement of the activities to be carried out in the building.

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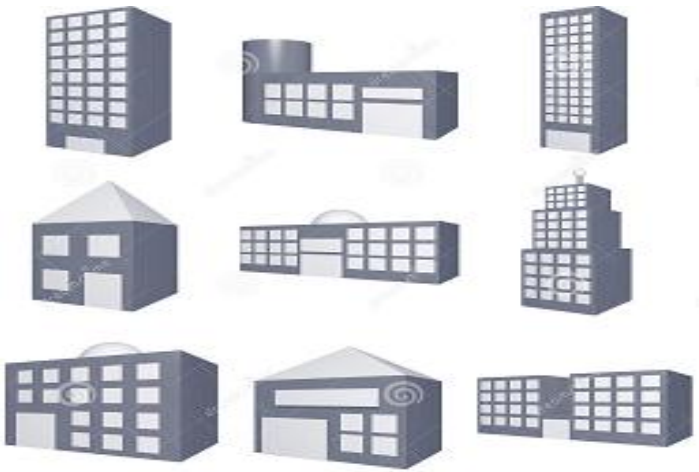
General Requirements for Electrical Installation

1. Architectural requirements

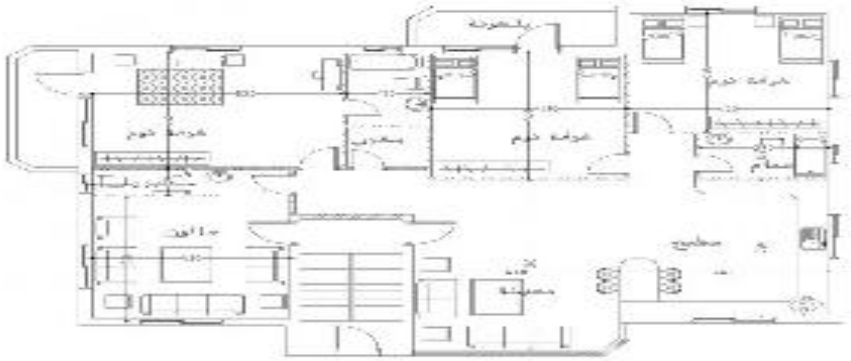
a) Building type

- Define the building type such as (commercial, residential, agricultural and industrial) to define electrical requirements.



b)Architectural plans

- To define the cables paths, and the locations of the different electrical equipment's, and to locate the main distribution boards in the buildings.



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2. Mechanical requirements

a) Define the mechanical loads

- Devices that include engines such as escalators, water pumps and fire fighting pumps in the building.

b) Heating ventilation & air conditions

- Information that needed by the designer to provide the feeding points in right locations

3. Electrical Requirements

a)Power loads

- Lighting
- Sockets
- Air conditions

b)Light current

. Fire alarm
. Data network
. Telephone
. Sound
- CCTV

c)Feeding system

. Single phase
. Three phase
. Transformer

Technical requirements

. Luminaires type
. Lux
. Sockets type

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Design Steps for Electrical Installation Project

1. Define general requirements for electrical installation project.
2. Classification of loads according to their nature (lighting-sockets-emergency).
3. Load estimation calculations, taking into account (demand factor and diversity factor).
4. Lighting system design.
5. Power works design for power loads such as (air conditions-escalators- water pumps).
6. Distribution circuits calculations.
7. Collect the distribution circuits into distribution panels.

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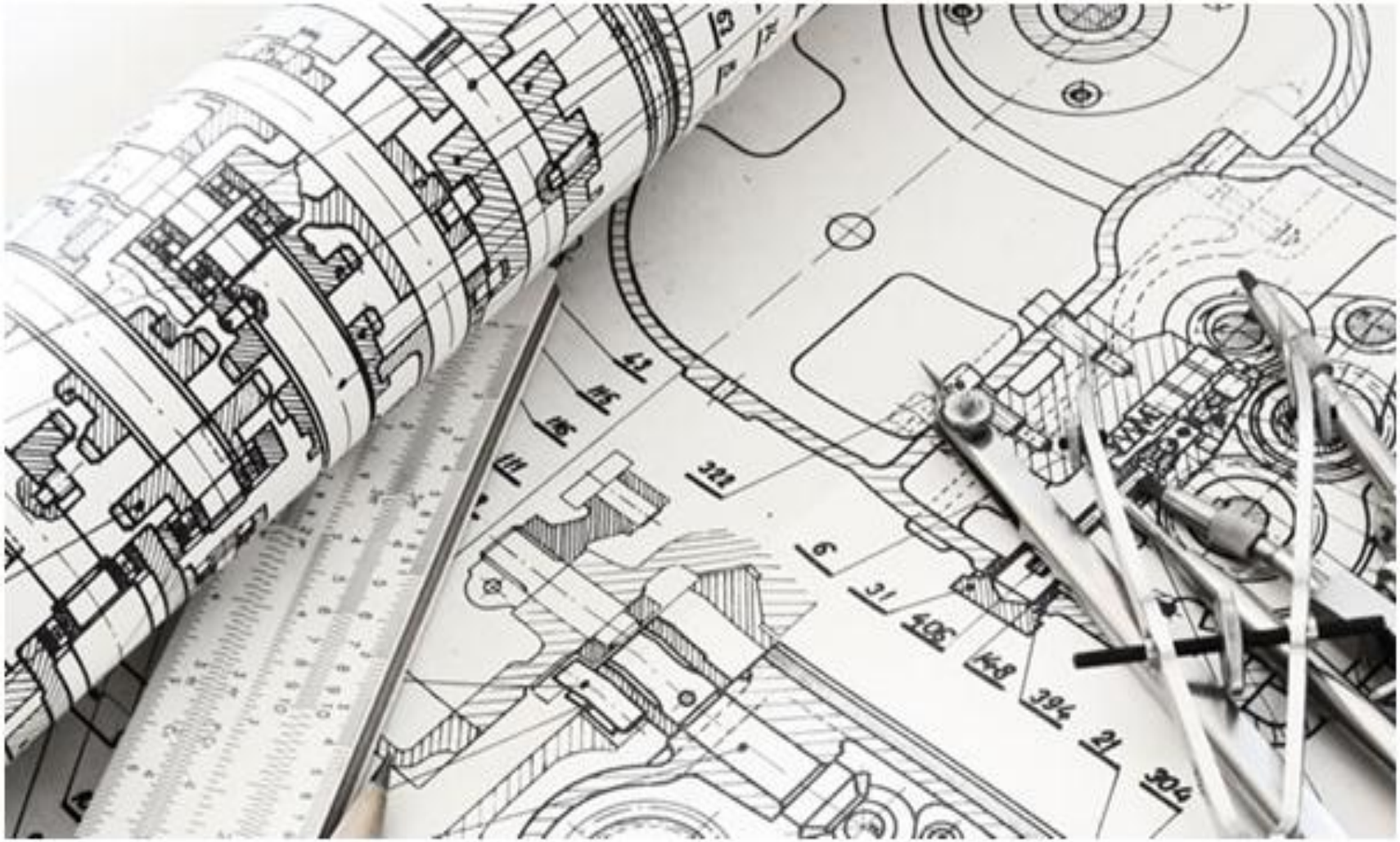
8. Design the main distribution boards.
9. Design the circuit breakers and feeders for the main distribution boards.
10. Review the short circuit study and voltage drop calculation.
11. Design the single line diagram and earthing system.
12. Design the low current system (telephone, data network, sound, fire fighting, and fire alarm).
13. Bills of quantities.

Engineering Documents for Electrical Installation project



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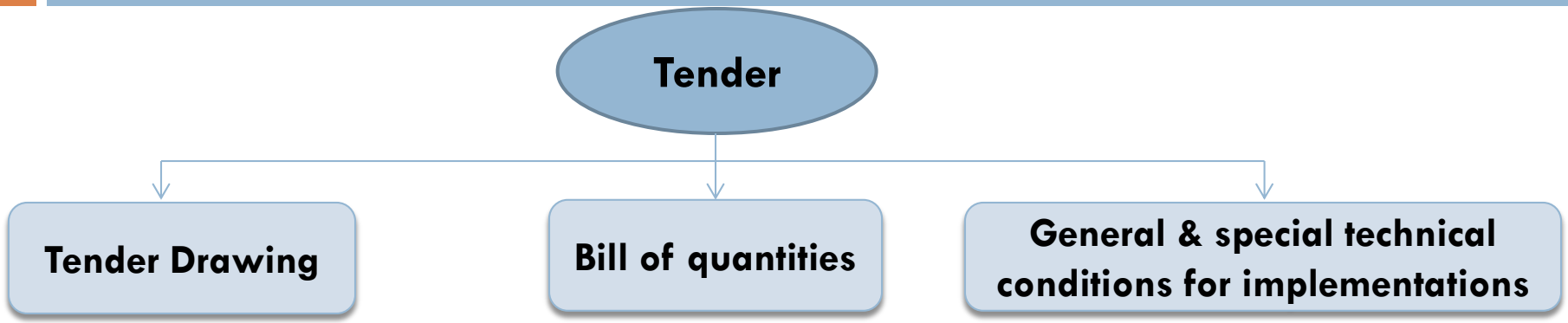
Project Documents

- The project will be finalized in the form of a **Tender.**

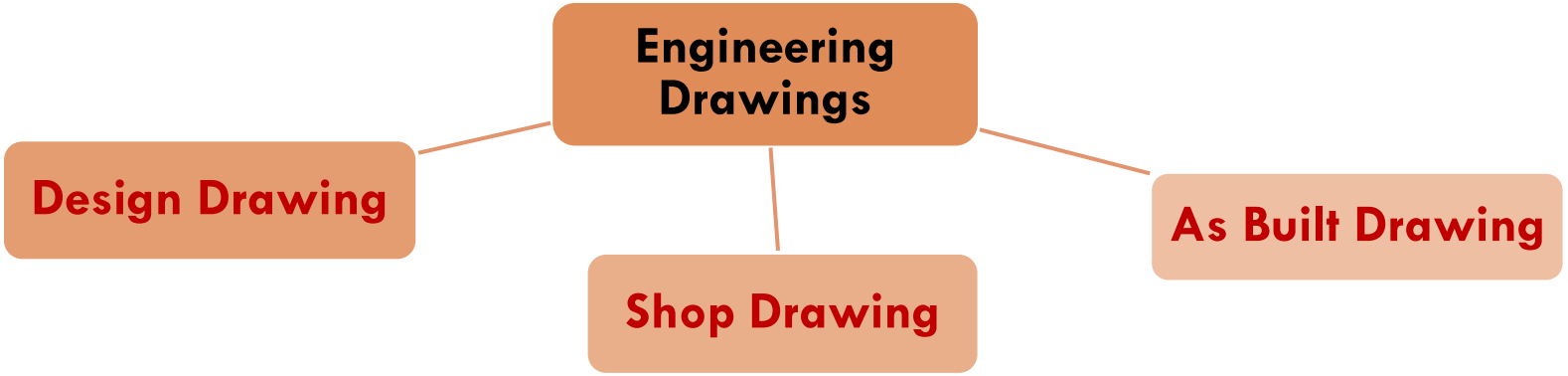
- **The Tender** shall be composed of a set of documents such as (drawings or plans, bill of quantities, and general technical conditions



- Sufficient Details are described.
- Use for estimating and pricing the cost.

- Tables that contains information for each element required in the Implementations of the project in terms of number and specs.

Engineering Drawing



Drawings that used to develop and communicate ideas about a developing design

Drawings shows how the building is originally designed, where the electrical wiring, plumbing, everything is supposed to go.

Drawings that reflect the as-constructed conditions of a project. The drawings are created by marking on the contract drawings any field built deviations from the contract documents.

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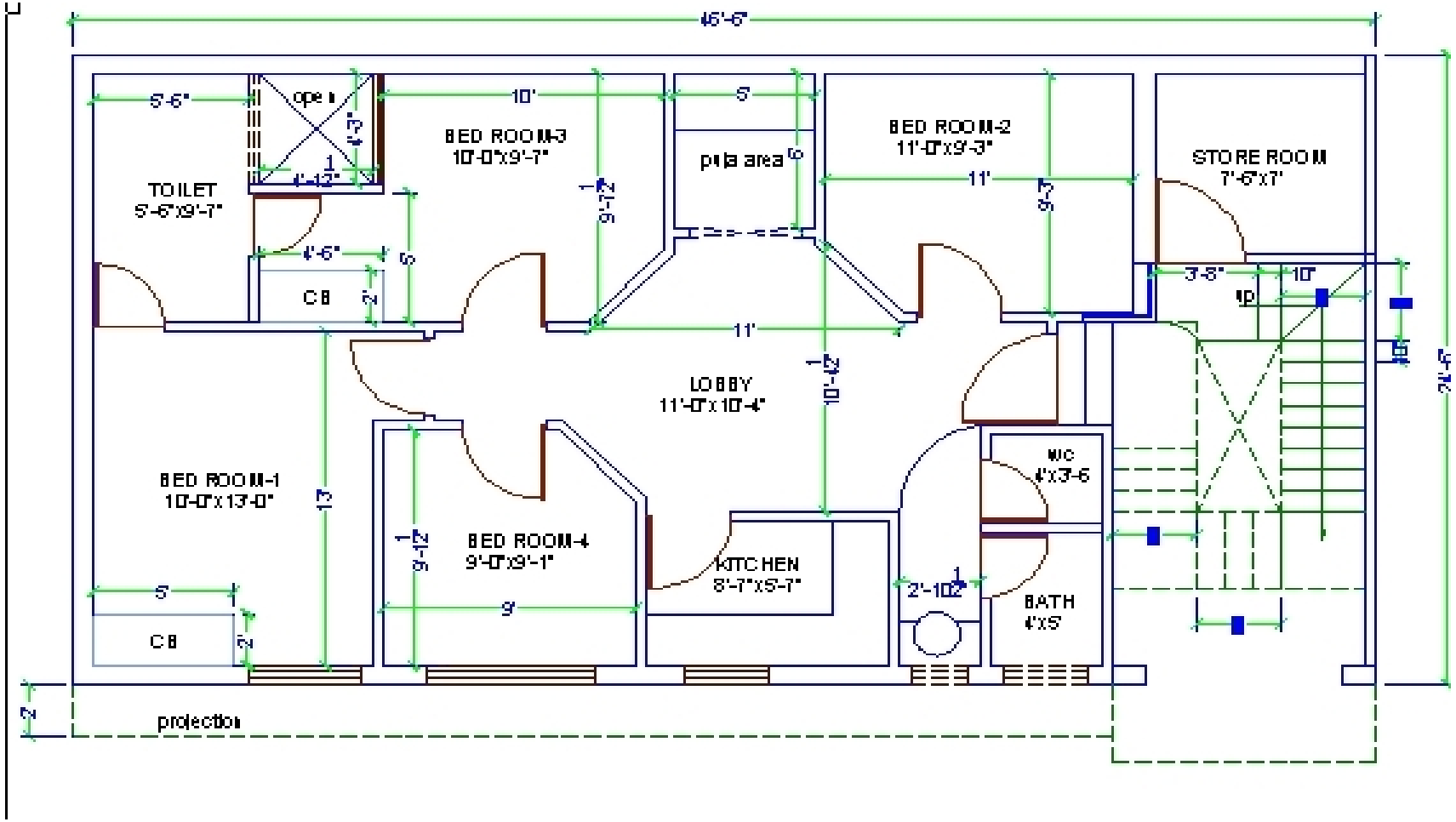
Design Drawings



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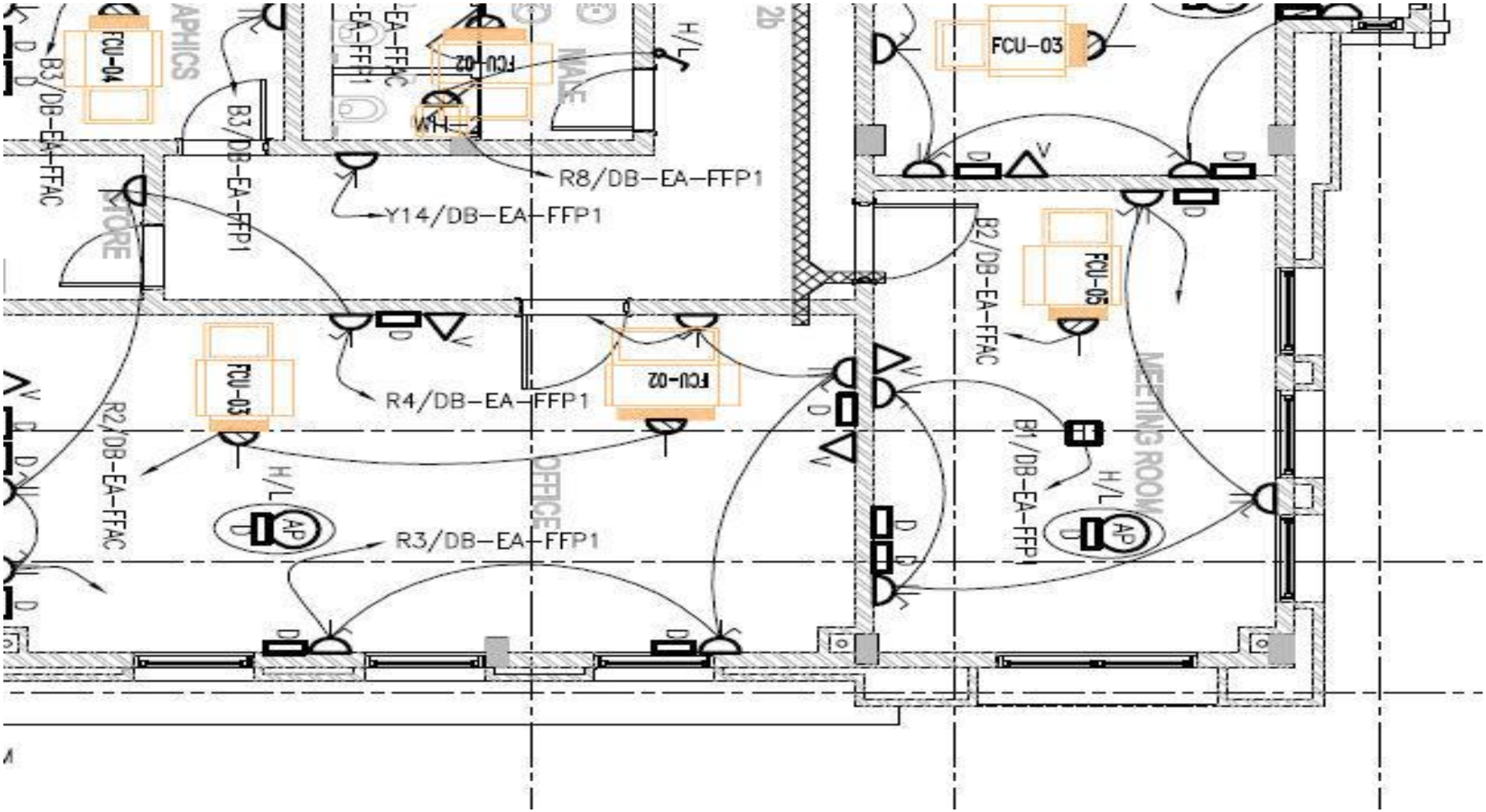
Shop Drawings



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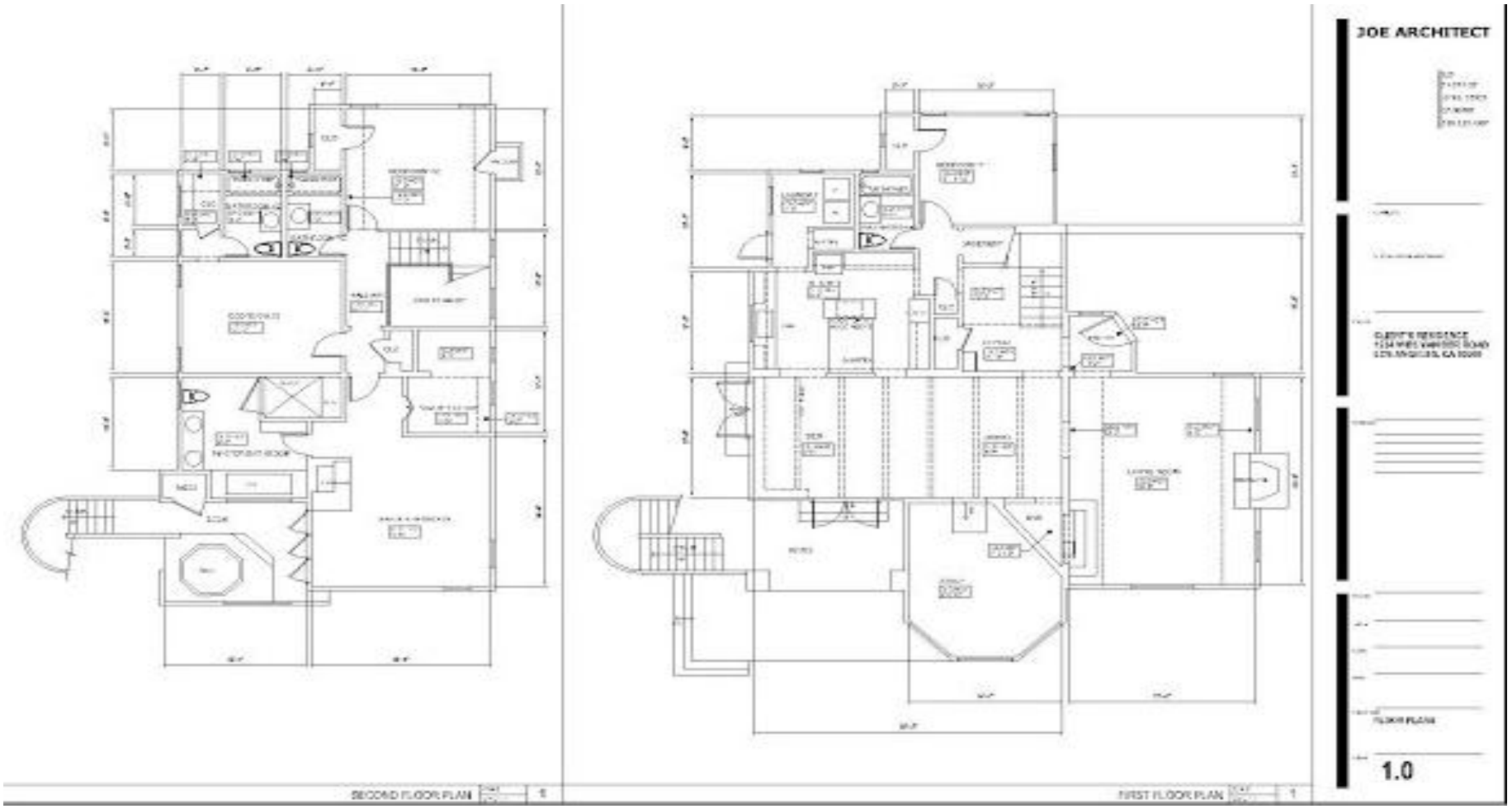
As Built Drawings



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Differences between Engineering Drawings

Engineering Drawings		
Design Drawing	**Shop Drawing (DWG)**	**As Built**
Main design	Executive drawing	contain all modifications that required in site
used to develop and communicate ideas about a developing design	we do it before construction of the project	needed after construction (if any item done in site, it should be surveyed and done in drawing)
	contain all details that help in the construction in the site and procurement phase	mostly we don`t need details, because we delivered in shop drawing.
	material in drawing should be as owner requirements and design	all material in drawing should be as execution

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Activity

What are the electric installation design regulations and standards?