

# Architectural Design of Electric Transmission Substation - Challenges and Solutions

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**Abstract:** *This Article explains the challenges the Architect faces in the industrial field and how he/she can overcome them in a creative way. It emphasizes on the important role of the Architect in the design of Electric Transmission substation and how he acts as a pillar of the whole process by coordinating with different fields and ensuring that all disciplines are serving the function of the substation.*

**Keywords:** substation, architecture, engineering, industrial design, challenges, solutions, creative, fields, leading, process, electric, transmission, equipment, human, complexity, functional, form, practical

As an architect you spend an approximate of five academic years or more learning how to design an adequate space for people. You study their needs and requirements in order to design a place with purpose. You start your career trying to implement what you have learnt throughout these years, no matter where you have chosen to be, whether in a consultancy office, a housing organization, a real estate

developing company, or an industrial authority where the real challenge rises and strikes. You try to fit in your knowledge and experience in a technical type of a place, assuming that all of the creativity and innovation which were the base of your learning journey in college of architecture, won't be permissible.



However, you begin to shift your mindset to absorb the fact that your end user is an “Equipment” and not a human being anymore. In order for that to happen, you gradually widen your knowledge and take it to another analytical technical level, to understand what your equipment needs to properly fit inside the space you are creating, which purpose it is serving, how it will be operated and commissioned, how frequently it needs to be maintained and serviced, and here comes another end user, “people” who have their separate space requirements to be considered by the Architect. As complicated as it sounds, the Architect is the one who can creatively simplify the dilemma and create a simple & beautiful outcome “The Substation”, to serve different communities and developments all over Dubai.

Drifting away from complexity, the functionality and practicality of the substation is determined by the “plot” selection. The architect studies various aspects of the plot like dimensions & area, accessibility, available infrastructure, surroundings & electrical aspects, to ensure that the substation can effectively fit in the desired plot and all its technical requirements are met. As simple as it sounds, not all the mentioned data are available or meeting the substations’ requirements in the majority of the received plot verification requests, which makes it challenging for the architect to design the substation smoothly. Due to that, the architect shall coordinate with the related disciplines for the data collection and create a new conceptual layout for the substation design (if needed) in order to meet the equipment’s’ requirements. Once all the above are studied

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according to the plot verification guidelines, a clearance is given for the project to commence.

Beside the plot verification process, a very critical aspect is considered in the design of the substation, which is the list of equipment makes that need to be installed. The role of the architect is to study the size & requirement of each equipment, way of installation, loading and offloading, how it would be maintained & operated in the future in order to provide the needed space for maintenance and commissioning purposes & how equipments are electrically connected to each other in order to properly design the space for them to function.

All the data required for the project to commence as stated above, is gathered in a report called Project Parameter Report (PPR). It is the pillar of substation design, which all disciplines involved in the project rely on. Once it is released, the tender stage begins. It is where the bidders submit their proposals based on the provided tender drawings/documents which is prepared by the assigned architect and the technical specifications which contains all of the required technical data related to all disciplines, in order for them to submit their commercial and technical offers. Prior to the preparation of the tender drawings, the architect might need to visit the project's site to verify the adequacy of the site in terms of infrastructure and services and check the as built drawings if available. The assigned tender team smoothly handles the whole process and the architect assist whenever needed.

This was a summary of the architect's roles & responsibilities in the initiation stage, however it gets complicated when the project progresses taking the scope to another level where the architects lead the process in the engineering stage.

In engineering stage, the architect is key discipline who start pushing the project to execution phase by reviewing detailed engineering drawings, starting with the most important to the least. One of major challenge that face an architect in this stage is reviewing interfaced drawing. Interfaced drawing is drawing that contains all interfaced functional information of related systems such as: electrical, mechanical, civil, FPS & MEP that must meet at a common boundary. An architect is obliged to put an effort in coordination with other fields and areas in order to ensure that everything is designed properly and not affecting or clashing with other services provided by other disciplines. He/ She shall not only coordinate with internal interfaced fields, but also with contractors and consultant who are assigned to handle the project. There are lots of technical discussions might be required with external stakeholders of the project, to discuss comments, clarify ideas, disagree and agree on proposed design. To overcome this challenge, assigned team shall think how to reduce as much as possible disciplines' interface in the drawing by developing drawing checklist that includes disciplines' main points and standardizing some drawings. This will help interface disciplines to identify their main technical requirements and will limit their involvement in the drawings which will lead to reduced technical clashes between interfaced systems.

On the other hand, discrepancies between approved drawing and site work execution can be considered as another challenge as well. A design engineer can overcome this challenge by conducting site quality audits in order to monitor practical side of the project and trigger technical issues if any in an early stage, which will help in erecting them easily and quickly without affecting other services.

In such industrial building, where functionality of the building is more important than its form, compromising in some architectural and aesthetic elements will occur. This will limit the architect's creativity somehow. Most of architects might not prefer such type of projects to be involved in, yet they should always think out of the box and don't let these strict technical requirements limit their imagination, thinking and creativity. A good architect should always have a wide horizon and try his / her best to come up with outstanding outcomes from these limitations and challenges. For example, playing around with paint texture, colors, different direction of grooves can add some esthetic value on the building. Since it is industrial building, highlight metal elements with special unique color and add some aluminum cladding in studied certain pattern can emphasize building's industrial look.

Moving to control stage, where all technical documents related to project is either newly introduced or revised throughout project cycle. In this stage, several analyses may be conducted to ensure quality of design and based on these analyses gaps will be identified. In such transmission substation project following observations were identified: type of comments varies from one engineer to another, contractor is not complying with given comments in revised drawings and no consistency of submitting drawings from contractors for similar project. Mentioned observations are obstacles during execution stage that affect the timeline of the project. In order to run the project smoothly, a set of documents, procedures and guidelines to be developed in order to guide both sides of the project and ensure progress of the project as per scheduled time frame. This can be achieved by introducing drawing checklist, standardized some drawing, develop some template drawing (template drawing: partially standardized drawing where involvement of external stakeholders limited to certain details only.) In addition to introduce Drawing Document Control Monitoring Sheet which guide, classify, prioritize and monitor contractors' submission of drawings. Other solutions as well can be introduced based on identified gaps, and remember that there is always a room for enhancement and development.

In conclusion, the Architect is the Maestro of the project. Leading, guiding, instructing and monitoring the team directly or in - directly is his real game. Till the end of the project, the architect offers collaboration with concerned project's areas and assists them whenever required. His doors are always open for coordination & discussion to ensure getting the maximum benefit from all other services to not have them negatively affect the project progress. The Architect is a leader who thrives to prepare the concrete base for other departments to outstand.