**ENGINEERING PROFESSIONAL CAREER EPISODE 3**

**3.0** **INTRODUCTION**

This career episode describes my engineering activity during my career progression as a senior Engineer as an employee at the Federal Capital Development Authority (FCDA). I worked on the rehabilitation of streetlight on Ring Road 1 (RR1) in Abuja. I worked in the capacity as an electrical site supervising Engineer. I was involved in the design and construction of the project.

**3.1 CHRONOLOGY**

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| PROJECT TITLE | RING ROAD 1 STREETLIGHT REHABILITATION PROJECT |
| DATES OF PROJECT | JULY 2016- MAY 2017 |
| DURATION | 1 YEAR |
| NAME OF ORGANISATION | FEDERAL CAPITAL DEVELOPMENT AUTHORITY |
| LOCATION | ABUJA, FCT NIGERIA |
| MY ROLE | SENIOR ENGINEER (ELECTRICAL ENGINEER) |

**3.2 BACKGROUND**

The Federal Government of Nigeria, mandated the Federal Capital Development Authority (FCDA) to build the Federal Capital City of Abuja. The decree establishing the organization was done in the year 1976. For several years, the organization has been developing and building the Federal Capital City. They are involved in the planning, design, and construction of infrastructural projects in the capital city. The engineering department, which I am designated, does the design and development. The electrical division does the electrical part of the design and construction. And takes its yearly budget from the Federal Appropriation bill. The organization has over 3,000 employees in its payroll.

**3.3** The primary purpose of this project was to rehabilitate the streetlight of the road connecting two central districts (phase 1 and phase 2). The road is a 4KM road with four interchanges and eight connecting roads. The streetlight infrastructure was badly vandalized and was in a deplorable state

The contract for the rehabilitation design and construction was assigned to my division. The actual road design was a dual carriage express highway.

The electrical network was earlier designed to take its source from two injection substations; the national hospital 33/11KV injection substation and the Utako 33/11KV injection substation. And they were all connected with an underground cable.

The electrical aspect of the project involves the provision of streetlights to the whole stretch of the road and also provides telecom ducts across the road at intervals.

**3.4** The responsibility which I carried out as a senior Engineer during the projects include:

* Reviewing the design that was earlier done.
* Making recommendations and corrections in the plan submitted
* Supervision of HV cable trenching and connections from the injection substation to the 500KVA, 11/0.415 KV package substation.
* Supervision of LV cable routes trenching between poles and road crossing.
* Liaising with civil Engineers on-site to get proper road alignments.
* Organize monthly site meetings with the Head Electrical Engineer to keep everybody abreast of the progress of work
* Ensure quality assurance and quality control in line with FCDA, NEMSA specifications.

**3.5** The figure below shows the organogram, and my position is clearly highlighted in bold blue letters:

*Fig: Organizational chart*

**PERSONAL ENGINEERING ACTIVITY**

**3.6** The project was big enough to have a series of technical issues, but the electrical team applied a lot of electrical skills to curtail whatever issues that came up. Issue regarding the rating of package substation was crucial since it didn’t met the design specification. I personally enumerated the numbers of poles (load) with their individual ratings In order to come up with the appropriate sizes of the package substation. I discovered that the former rating was small (300kVA) compared to the enormous load which was added to it. To correct this issue, I recommended a higher rating package substation (transformer) 500kVA should be installed.

**3.7** In this project, because of the length of the road, the package substation had to be placed at several positions to enable them carry equal or almost equal amount of load. Hence the enablement of proper load balancing by sharing the amount of load evenly among the three phases of electricity. The load balancing was crucial factor in this project. If the load weren’t equally balance in all the phases then instability could occur in the system which even may lead to unnecessary faulty condition. So, I did the loading balancing of the system by equally dividing the loads in all the phases.

**3.8** During the project, I did the calculations for the total load demand, the rating of the lumen (light bulbs), the pole spacing, and the height of poles. The purpose was to give the street proper illumination at night to aid in the security architecture along with providing aesthetics to the roads and streets. For the calculation, I did researched on different methods like watts per square meter methods, lumen method. I realized that lumen method was more appropriate for outdoor lighting system. So, I adopted this method for the calculation. I calculated the number of poles required in the street. I determined the required illuminance level from the standard values of illuminance.

By so doing, the width of the streets was gotten from the civil engineers to get the proper specifications by using the formula.

**S= (LL) (CU) (LLF)**

**Ear W**

Where s= spacing to be determined

LL = lumen output of the utilization

LLF =Light loss factor or maintenance factor

W = Curb to curb street width

CU= coefficient of utilization

I choose the appropriate lumen output of lamp by analyzing the standard values. I also determined the coefficient of utilization. Similarly I also evaluated the light loss factor by considering depreciation factor. Moreover, I also did the calculation for determining the required staggered spacing. Then by solving above mentioned equation, I determined the spacing of the poles. I also determined the aiming angle for proper positioning of the lamp at poles.

All this I got with the assistance of the head Electrical engineer and consultation from the IEE Regulations. After evaluating the spacing between the poles, I determined the average lumen for evaluating the wattage of each lamp. After determining the required output power of lamp, I compared this lumen value with the standard table of lumen and power. Here I choose the nearest value of lumen for evaluation of lamp wattage. According to the selected wattage for lamp, I selected the appropriate rating of lamps. I also verified that is the selected lamp was able to provide adequate lighting or not. For this, I did the manual calculation for determining the actual illumination of selected lamp and found to be greater than the assumed illuminance. This confirms that the selected lamp could provide adequate lighting.

**3.9** I discovered most of the cables were burnt mainly due to small sizes of cables earlier used. So there was need for The LV cable size to be determined. For determining the size of cable, I considered two factor that affected the size. I considered the current carrying capacity and voltage drop in cables. I estimated the maximum load and also considered maximum cable length. According to IEE regulation, I considered the maximum permissible voltage to 2.5%. I had to calculate based on the rating of the lamps that were designed for the project. There were two types of poles, the 12m using 800 Watts and the 8m using 450 Watts, by using the formula,

**I = P**

**V COS**

I determined the amount of current flowing in the cable by using the output power of lamps, line to line voltage and power factor. I calculated the per phase current by dividing with. I also determined the effective resistance of the cable and as per the IEE regulation cables were selected. After getting the value of I in Amps and checking from the IEE regulations, a cable size of 25mm2 for the 12m and 16mm2 for 8m pole were procured because of their current carrying capacity. Further, I also prepared a design concept for the telecom duct by considering the nature of distribution. I included connection cabinets, junction boxes, duct and conduit and connection of concrete manhole in the design. I recommended to use UPVC duct for construction of underground duct system for making of connection of joint boxes and manholes.

**3.10** To avoid vandalism after project completion, I made sure power should always be available at night. There must be continuous supply of power at night at street. I ensured that the lights were also protected from any kinds of fault or failure and interruption of power was avoided. In so doing, I designed an installation of an auto re-closer on the11Kv side of the transformer so that faults could easily be spotted and separated. I installed auto re-closer for continuation of power supply to streetlight in case of any kinds of failure or fault. The re-closer automatically connects to power source if the fault clear up. And also lighting arrester in case of lighting strike during thunderstorms.

I incorporated Lighting controls which was specially built in the substation transformer (lighting kiosk). The automatic lighting ON-OFF actuation was executed by photocell (photoelectric relays).

**3.11** I faced a problem in the determining the required value of illuminance of the lamp used in street lighting system. I came to know about this issue while making verification of lamp, either it was capable of providing adequate lighting or not. The verification was done as per the comparison between the calculated and assumed value of illuminance. I had determined the wattage of lamp and selected the appropriate rated lamp. But while making comparison, I found that the calculated value of illuminance was less than assumed value of illuminance. This concluded that selected lamps were not suitable for adequate lighting. To tackle this issue, I decided to choose the lamp with higher illuminance level. For this, whole calculation process was started from beginning. I assumed higher value of illuminance and did the calculation to determine wattage of lamp. After this, I evaluated the actual illuminance level and compared with assumed value of illuminance. This time the actual illuminance was greater than assumed illuminance.

**3.12** To avoid cars frequently hitting the streetlight poles, I ask for a specially designed poles to be procured which was installed. The pole was the steel galvanized hexagonal shaped poles which cannot be easily brought down by reckless drivers.

**3.13** Executing the project, I followed all the safety rules and regulations according to the policy of my organization. I used to wear helmet, gloves, working suit and I also mandated workers to do the same

**3.14** In this project, I avoided overbilling and under billing, I made sure the BEME (Bill of Engineering Measurement and Evaluation) was followed to detail.

**3.15** Communication and information flow are very critical in project execution. I ensured there is a weekly project meeting with the Head Electrical Engineer In this project, I also did periodic invitation of the civil team whenever their attention are needed.

**3.16** During the project, I found out that earlier design didn’t make enough road crossings. I have to go along the entire stretch of the road to get road crossing at some specified intervals. I mandated that 150mm ducts should be used so as to provide space for future use.

**3.17** This project proved to be a new learning point of my experience career. I developed many interpersonal skills such as time management, cost value engineering, communication skills and advanced negotiation skills.

**3.18** After the construction of the project, I have to organize for the testing of the streetlights, cables and the package substations by the National Electrical testing body (NEMSA). To ascertain the quality of job done and for proper connection to National Grid. Also I had to come up with the as built drawing using AUTOCAD for easy maintenance of the infrastructure

**3.19** **SUMMARY**

The project provided an opportunity to get a good experience for me. I used my various skills and knowledge of engineering degrees to complete the project activities. I successfully managed to get the desired result. The project was delivered in due time and handed over to the maintenance department. The project is a complete success as the road is well illuminated at night.