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**To:** [REDACTED]

**Fr:** [REDACTED]

**Re:** **A-0004, Ghazi Boys High School Electrical Service**

**Dt:** 16 January 2010<<Date>>

On January 14, 2010, from 10:00AM to noon I met with International Relief and Development (IRD) electrical Engineer [REDACTED] and Engineer [REDACTED] at the IRD offices in Wazir Akbar Khan. We worked on a plan to have electric power delivered to the Ghazi Boys High School, currently nearing the end of construction, in Karte Char. The building has been designed by United Nations Office for Project Services, Afghanistan Operations Center (UNOPS).

We made remarkable progress. First we agreed that the structures planned for the site should be treated as four buildings; Block One to the northwest, Block Two to the east, the future Block Three to the southwest and the Link (Building 4) stretching north-south connecting the blocks.

Load Study: At first we did not see load study on the UNOPS documents. We estimated a quick load study. We estimated that lighting would require 15-VA/m<sup>2</sup>; convenience power 15-VA/m<sup>2</sup>, heating 15-VA/m<sup>2</sup> and circulation fans 5-VA/m<sup>2</sup>. We considered this to be a low estimate of the peak power demand. The demand totaled 50-VA/m<sup>2</sup>. We also estimated the building areas. The load study is summarized in the table:

Building	Area m <sup>2</sup>	Peak load density (VA/m <sup>2</sup> )	Estimated Peak Load (kVA)	Peak Demand Current at 400Y/230-V (A)
Block 1	2,000	50	100	145
Block 2	2,000	50	100	145
Block 3 (Future)	2,000	50	100	145
Link 4	1,500	50	75	72
	7,500		375	

UNOPS load study: These values turned out to be similar to the load study which is presented on the design drawings one line diagrams. As an example, for Block 1, the connected load at DP-100 is 42.231-kW; at DP101, 42.12-kW and DP-102, 41.70-kW. An 80% demand factor is taken at each panel-board and another 80% demand factor at the service distribution panel-board, "MDP-1". So the total connected load is 126.051-

kW and the estimated peak demand load is 64% of the connected load or 80.7-kW. Assuming a 0.90-PF that is 89.6-kVA estimated peak load compared to 100-kVA from the table above.

Service sizing: The service disconnect over-current device is rated 250-A. From the table above the smallest size that we would have recommended was  $145\text{-A} \times 120\% = 174\text{-A}$  rounded up to the next standard size is 200-A. The 250-A is still a good choice and we recommend no changes.

Link Building Service Disconnect: Our group did find one aspect of the existing design objectionable. The design does not treat the Link (Building 4) as a separate building. Branch circuits from at least two of the blocks enter this building. Therefore this building does not have a service disconnecting means and no single building service disconnect is available to cut off power to the building. We recommend that a 100-A service panel-board be added to the Link Building. For convenience the building can be sub-fed from MDP-1 in Block 1. No power should enter the Link Building from Block 2 or in the future from Block 3. Only the service cables should enter the Link from Block 1.

TVSS: Another aspect of the current design should also be reviewed. There is no surge protection specified in any of the buildings. We recommend a TVSS device be added at the service panel-board in each of the four buildings.

The UNOPS design is incomplete. The site electrical work to bring power to the buildings is not included. We propose the following design:

MEW in the public way: We will request the local electric power utility, The Ministry of Energy & Water (MEW), to extend the existing 20-kV feeder from the vicinity of the Tapi Salaam Mosque in Karte Char to the Ghazi BHS site to the north of the center of the Block 1 building. The MEW 20-kV line would terminate as close to the northern boundary of the site as practical. MEW would run this line in the public way.

Primary metering: We will request a primary metering cubicle for purchasing electric power from MEW.

Secondary Unit Substation (USS): We propose furnishing and installing a Secondary USS at the terminus of the MEW 20-kV line with a primary surge arrester, primary air switch and metering chamber; a 400-kVA, 4%-Z, oil-filled, 20-kV delta primary to 400Y/230-V, 3-P, Wye secondary transformer; and a secondary distribution section with three (3) 200-A, 3-P, 20-kAIC circuit breakers. A preliminary one-line sketch of the USS is attached.

Electrical Site Plan: The UNOPS design did not include an electrical site plan. We recommend UNOPS draft this drawing. A site plan is necessary for each utility to coordinate all utility work.

Site electrical work: The Secondary USS would be located on the electrical site plan. An underground direct buried duct for the service lateral from the Secondary USS directly south toward the Block 1 electric service stub out should be located. Another direct buried duct for the service lateral from the Secondary USS to Block 2 should be shown first headed directly east to a pulling hand-hole and then directly north to Block 2 electric service stub out. The route of the proposed third service lateral buried duct from the Secondary USS, around Block 1 and, eventually, through a series of hand-holes, to Block 3 should be shown. A preliminary diagrammatic sketch of the site power routing is attached.

Site grounding: The UNOPS design did include grounding plans for each building. The design however lacks a site grounding plan that shows all of the buildings and the interconnected grounding electrode systems. We recommend that UNOPS produce this drawing.

Standby power: Ghazi BHS may want to make provisions for a standby electric power system if the MEW supply proves to be unreliable. For now, a manual transfer switch would have to be supplied. It is shown in the one-line diagram. Space for a future standby diesel generator and diesel fuel tank should be reserved on the electrical site plan.

Conclusion: If the recommendations proposed are acceptable, OIEE-AESP, Tetra Tech proposes to present our concept for electric power service for the Ghazi BHS to the MEW so that they can comment, modify and hopefully, eventually, agree (Inshallah) to provided service. UNOPS will be tasked with drawing a site electric power plan, a site grounding plan, a Link (Building 4) one-line diagram and a new one-line diagram describing the Secondary USS. Some minor modifications to the existing design drawings will be required. Ghazi BHS should evaluate the desirability of making provisions for the standby power system.

Attachments:

1. Photograph, From the roof of Block 2 looking north toward the Tapi Salaam Mosque, Karte Char, Kabul, Afghanistan, January 12, 2009.
2. Preliminary one-line sketch.
3. Preliminary diagrammatic sketch of the site power routing.

From the roof of Block 2 looking north toward the Tapi Salaam Mosque, Karte Char, Kabul, Afghanistan, January 12, 2009.

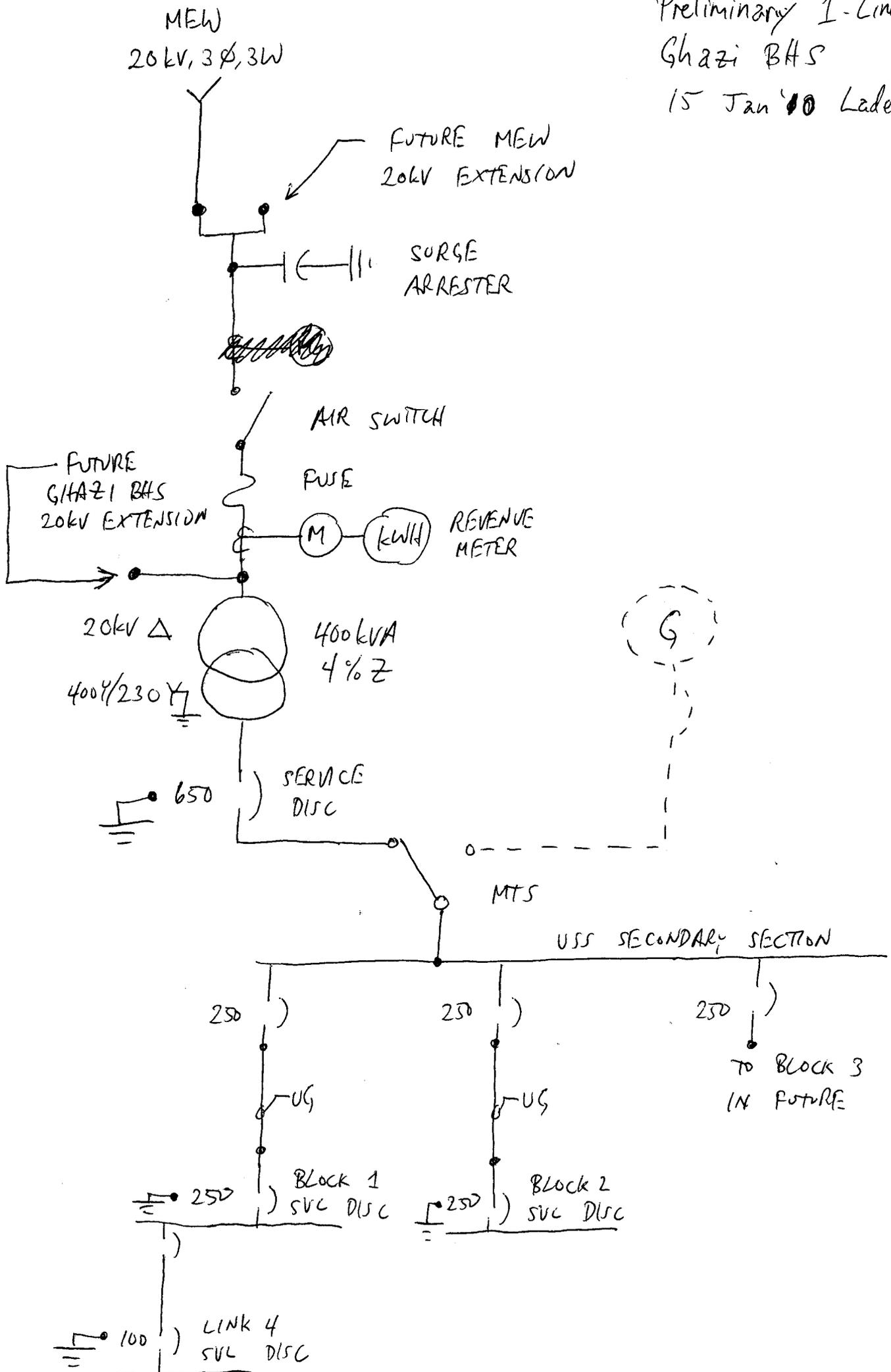


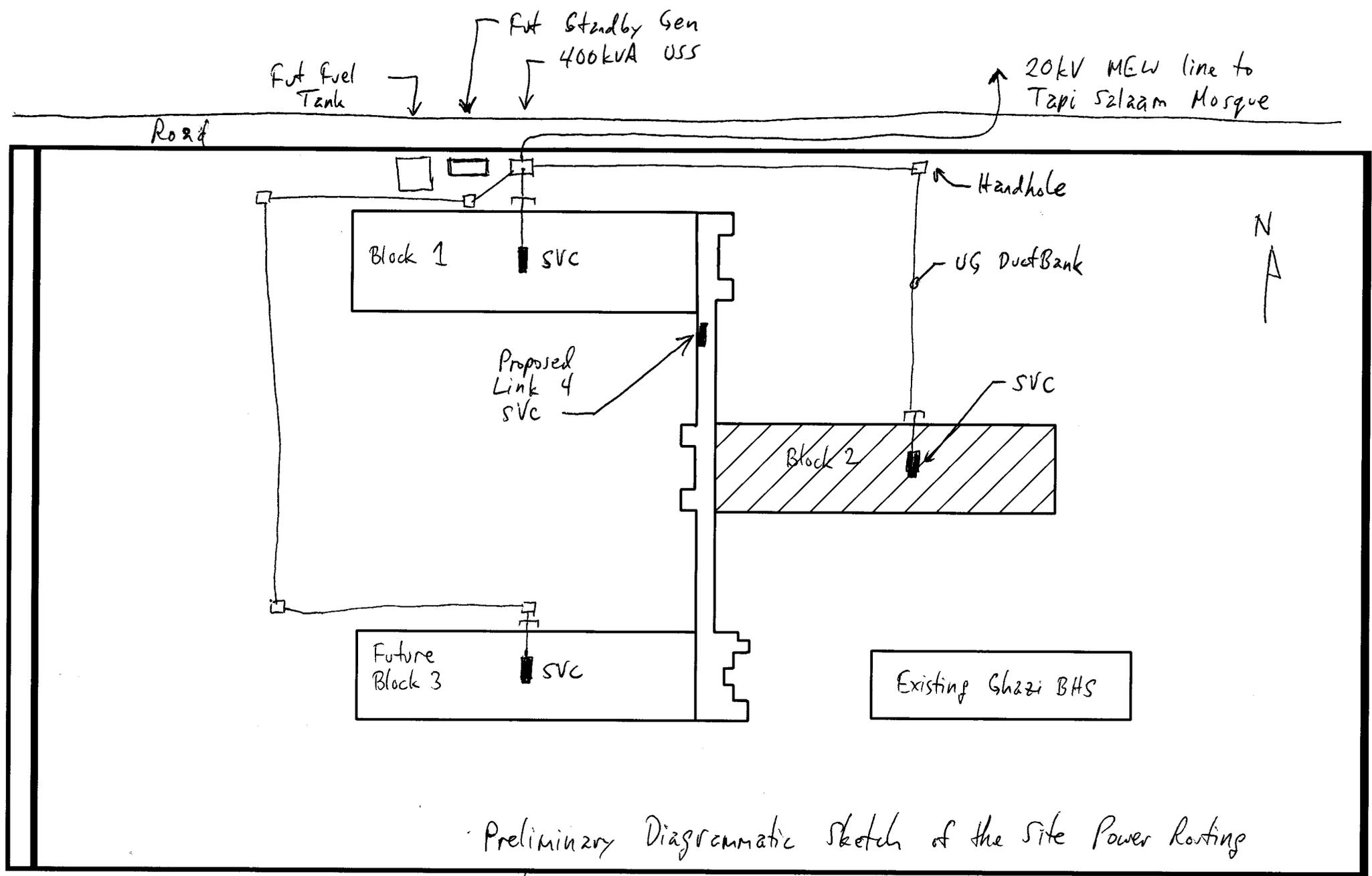
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Preliminary 1-Line Sketch

Ghazi BHS

15 Jan '00 Laderman





Preliminary Diagrammatic Sketch of the Site Power Routing

Ghazi BHS, 15 Jzn '10, Ladernzu

Main Road