BANGLADESH RURAL ELECTRIFICATION BOARD

PBS INSTRUCTION 100-23

SYSTEM PLANS AND CONSTRUCTION WORK PLANS FOR ELECTRIC NETWORK SYSTEMS

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Approval Date: 07/03/1979
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SUBJECT: SYSTEM PLANS AND CONSTRUCTION WORK PLANS FOR ELECTRIC NETWORK SYSTEMS

I. PURPOSE

To provide guidance to BREB engineers and PBS on the preparation, use and approval of construction work plans for electric network systems by PBS own fund, specially, which are not included in running and upcoming projects.

II. GENERAL

A. Construction work plans are the action phase of system planning. Each plan should provide system management with a coordinated construction program for the coming one or two years, as well as basic data for use in preparation of that part of the annual budget pertaining to capital expenditures for utility plant. A work plan is a convenient means of informing BREB of plans for construction in the immediate future and for obtaining BREB approval of such plans. After obtaining approval of plan prepared under this instruction from BREB, will be implemented following PBS Instruction 100-41 and 100-42.

B. Electrical network system is developing in a PBS through one or more project. Apart from this round the year one or more projects are running in each PBS. But some necessary and urgent works may not be included in these projects. As a result those works can not be done instantaneously under running project. To do this type of works, new plans are required. This type of plan can be divided into three categories- (a) Short-range

(Md. Mozibur Rahman) Consultant TAPP BREB
(Md. Duhidul Islam) Consultant TAPP BREB
(Md. Mozammel Huq) Consultant, TAPP, BREB
(Md. Abdul Khaleque) Consultant TAPP BREB

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(Md. Ahsanul Haque) Consultant,TAPP, BREB
(Debasish Chakraborty) PD,TAPP, BREB
(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB

plan, (b) Medium-range plan and (c) Long-range plan.

In electric network system, technology and load pattern are changing rapidly. More over within short time total electrification will be completed. That results long-range plan are not valid in most cases. Under short-range plan system up-gradation, system improvement, small extension, equipment change etc. can be done by PBS financing, where as, more financial support is required for implementing medium-range plan. In most cases PBS can't provide huge amount of financial support to implement medium-range plan. Medium-range plan can be implemented by BREB under GOB and/or development partner's financing project.

For this purpose, PBS will sent proposal for Short-range plan to Program Planning Directorate through PBS Monitoring and Management Operation Directorate. Before sending proposal a meeting will be conducted for finalizing proposal between Sr. GM/GM of PBS, Executive Engineer of BREB, RE/PE of consultant. Program Planning Directorate of BREB will develop DPP in normal process upon request of PBS(s). Short-range plan will be approved by BREB with the recommendation of sub-committee. Obtaining approval from BREB, short-range plan will be implemented by PBS with it's own fund, but PBS can request zonal Superintending Engineer to implement short-range plan, specially for difficult works, utilizing PBS own fund.

C. PBS Instruction 100-21, "Engineering and Staking Manual for Electric Distribution Systems", provides technical information which will be helpful in preparing the proposed Plan. Along with this proposed plan provisional budget for capital expenditure for utility plant and services for improvement of existing system and extension/expansion, taking into consideration inflation and contingency figures to be prepared by the PBS. Such Propose Plan and Budget prepared well in advance will provide BREB strong support in securing fund from GOB, Donors and Development Partners.

(Md. Mozibur Rahman) Consultant, TAPP, BREB

(Md. Duhidul Islam) Consultant, TAPP, BREB

(Md. Mozammel Hug) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant TAPP, BREB

(Md. Ahsanul Haque) Consultant,TAPP, BREB

(Debasish Chakraborty) PD,TAPP, BREB

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(Kamrul Ahsan Mollik) Asst. Secy. (Board)

III. THE PROPOSED WORK PLAN REPORT

Each construction work plan should be a separate engineering report. Exhibit-I is a suggested table of contents. Detailed calculations and engineering analysis need not be included in the report. They should be retained by the PBS/Consultant and made available upon request as required.

A. SYSTEM ANALYSIS

The analysis of the performance of the existing system will be a key indicator, where system improvements are needed and is an important part of the report. This section should summarize and discuss the performance of the system in respect to the following:

1. System, substation, and circuit capacity and loading.
2. Voltage conditions.
3. System loss.
4. Service reliability.
5. Adequacy of line sectionalizing.
6. Other factors substantially influencing the quality of service or the cost of providing service.

The use of tables, graphs, diagrams and sketches to show the performance of the existing system and trends, along with the necessary discussion, should be included.

B. CONSTRUCTION PROGRAM

1. The construction work plan should contain year wise tabulation of the system's construction requirements of the following:
   (a) New consumer installations.
   (b) Line extension plan.

(Md. Mozibur Rahman) Consultant, TAPP, BREB

(Md. Duhidul Islam) Consultant, TAPP, BREB

(Md. Mozammel Huq) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant TAPP, BREB

(Md. Ahsanul Haque) Consultant, TAPP, BREB

(Debasish Chakraborty) PD, TAPP, BREB.

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(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB

(c) Facilities to serve new large power loads.

(d) System up-gradation/improvement:

(1) Tie lines & feeder bifurcation.

(2) Conversion of lines in respect to voltage level.

(3) Reconductoring of lines and removal of related lines sections.

(4) Increased capacity of existing distribution transformers and services.

(5) Substations & switching stations capacity enhancement & augmentation.

(6) Addition/ Relocation/ Up-gradation of sectionalizes.

(7) Other additions or changes to the system not included elsewhere.

(e) Conversion of substation and switching station.

(f) Voltage drop calculations.

(g) Circuit loading and projections.

(h) Circuit Diagram including existing and planned system.

(i) Key Maps and Detail Maps.

(j) Cost Estimates and Bill of Materials.

This tabulation should give a brief description, the location (reference to circuit diagram), and the estimated cost of each major item. Any major construction, conversion or line changes to be performed on energized facilities should be identified by the engineer. Facilities that are to be installed underground should also be identified. A brief description and cost estimate should also be included for each group of the minor items that are not easily identified by a reference to a circuit diagram, such as the costs for increasing the capacity of existing transformer installations and services.

2. To facilitate use of the construction work plan for loans support, a summary of the

(Md. Mozibur Rahman) Consultant, TAPP, BREB

(Md. Duhidul Islam) Consultant, TAPP, BREB

(Md. Mozammel Huq) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant TAPP, BREB

(Md. Ahsanul Haque) Consultant, TAPP, BREB

(Debasish Chakraborty) PD, TAPP, BREB

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(Rashid Ahsan Mollik) Asst. Secy. (Board), BREB

proposed construction should be included in the report.

C. DISCUSSION OF CONSTRUCTION PROGRAM

A discussion on the need and justification of major improvement items and groups of other items should be included in the construction work plan. Quality of service, including service reliability and adequate voltage, should be discussed. Recommendations on scheduling of the proposed construction should be included.

D. EXHIBITS

1. Each construction work plan report should include a circuit diagram. The circuit diagram should show:
   (a) Present electric network system and proposed network facilities.
   (b) The results of measured voltage and current investigations, especially when direct comparison may be made with the voltage drops calculated in the previous construction work plan (if any).
   (c) The facilities proposed for construction within the work plan period, again by color coding, bold lines, or notes. The diagram should show calculated voltage drops resulting from the projected loads being applied to the system before the facilities proposed are constructed and after they are constructed. It may be appropriate that this information be shown on a second circuit diagram, especially if the proposed facilities involve new substations, consolidation of metering points, etc., in the course of changing existing substation or metering point circuits and areas. The boundaries of the area served by each substation or metering point should also be shown.
   (d) The transmission lines, existing and proposed, of the power supplier in or near the system's service area. The voltage level of each transmission line should be indicated.

(Md. Abdur Rahman) Consultant, TAPP, BREB
(Md. Dunidul Islam) Consultant, TAPP, BREB
(Md. Mozammel Huq) Consultant, TAPP, BREB
(Md. Abdul Khaleque) Consultant TAPP BREB
(Md. Ahsanul Haque) Consultant TAPP BREB
(Debasish Chakraborty) PD, TAPP, BREB
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(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB

2. A current Key Map of the system should be included in the construction work plan.
3. Sample calculations should be included in the report to illustrate methods used in adjusting the results of voltage measurements, adjusting data used for voltage drop calculations to reflect actual conditions, and making economic conductor analysis. Such sample calculations could be in the form of photo copies of a portion of the engineer's working papers.
4. It is desirable to include a summary of outage data in the propose plan. The summary should show a break-down by calendar years of the total number of outages, total consumer hours outages, and the average hours outage per consumer. These data should be broken down into several categories, such as, source, planned, unplanned and total. If a disaster occurred, its effect upon the outage data should be noted.
5. Based on the propose plan, specially for re-conductoring, line extension/expansion a planned outage schedule will be prepared by the PBS along with the work plan which will be facilitate timely completion of work to a great extent.

IV. DEVELOPING THE PROPOSED WORK PLAN

The following sections outline the data and factors that should be considered in developing the propose construction work plan:

A. DATA FOR DEVELOPING THE PROPOSED PLAN

1. Most of the data necessary for preparing work plans is being maintained by the PBS for other purposes. The following items should be made available to the engineer and considered in preparing the proposed construction work plan:

(Md. Mozibur Rahman) Consultant, TAPP, BREB
(Md. Dulidul Islam) Consultant, TAPP, BREB
(Md. Mozammel Huq) Consultant, TAPP, BREB
(Md. Abdul Khaleque) Consultant TAPP BREB
(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB.
(Md. Ahsanul Haque) Consultant TAPP BREB
(Debasish Chakraborty) PD, TAPP, BREB
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০

(a) Up-to-date system planning report.

(b) System maps and an up-to-date circuit diagram.

(c) Operating records, including outage reports, consumer service complaints or other service reliability indicators, load growth by areas or feeders, load factors by areas and feeders, new consumers to be added, substation demands, wholesale power bills and contract terms, data on large power loads and special loads both existing and definitely scheduled for connection in the next two years.

(d) Results of operation and maintenance surveys and related O&M activities.

(e) Results of voltage and current investigations.

(f) Sectionalizing studies and records.

(g) System energy losses for the system and, if available, by areas or feeders.

(h) Other available data influencing the construction plan.

2. PBS will maintain up-to-date data to influence proposed plan.

3. Where data processing equipment is used for consumer billing, the billing information can be processed to give data that will provide closer correlation of projected load patterns, peaking factors, load growth trends, load factors, etc., with actual system conditions as they develop.

B. ANALYSIS OF EXISTING SYSTEM

1. How well the system has been performing, as determined by analysis of the system data, (A) above, should indicate what parts of the system are adequate and what parts need improvement during the next short-range and medium range period. In most cases, the results of voltage and current investigations and voltage drop calculations will determine where improvements are needed. (See PBS Instruction 100-24, "Voltage and Current Investigations", 100-21, "Engineering and Staking Manual for Electric Distribution System") Outage

(Md. Mozibur Rahman) Consultant, TAPP, BREB

(Md. Duruddul Islam) Consultant, TAPP, BREB

(Md. Mozammel Huq) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant, TAPP, BREB

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(Md. Ahsanul Haque) Consultant, TAPP, BREB

(Debasish Chakraborty) PD, TAPP, BREB

(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB

records and management objectives on improvement in the quality of service are also important in determining what parts of the system need improvement.

2. On new systems where there is a predominance of new line construction and operating data is limited, calculated values of voltage drop and loads for the existing system is the general practice for determining the need for immediate system improvements. However, as systems become more mature, the practice is to install indicating and recording meters at locations designated in work plans. As a result, actual data should be available in most cases from which the need for increased capacity of existing facilities can be determined. This procedure is more accurate and is preferable to the use of calculated loads and voltages. Obviously, it is necessary to make calculations in forecasting system conditions for the projected loads.
3. Since voltage and current investigations provide much of the basic data from which plans for required system improvements are developed, it is important that measurements and the analyses of the results be accurate. To minimize errors, competent system personnel should take the readings and record the data. Measurements should be taken at the time of the system annual peak load. If it is not practical to take them during the peak load period, the engineer should adjust the readings to coincide with the peak period.
4. Measured voltage and current checks should be made at least annually. PBS shall also monitor and review the voltage and current level on the system after new facilities are added. A comparison of the measured values of voltage drops with the calculated values in construction work plans will serve to test the validity of the assumptions made in connection with the establishment of peaking factors and load factors used in the calculations. A comparison will also serve to test the validity and lead to refinement of the method used to calculate the voltage drops. As a result of such refinements, engineering projections will more closely

(Md. Mozibur Rahman) Consultant, TAPP, BREB

(Md. Duhidul Islam) Consultant, TAPP, BREB

(Md. Mozammel Huq) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant, TAPP, BREB

(Md. Ahsanul Haque) Consultant, TAPP, BREB

(Debasish Chakraborty) PD, TAPP, BREB

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(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB

approach actual conditions as they evolve.

5. Metered data accumulated over a period of several years will enable the engineer to determine trends in primary line voltage drop. The rate at which voltage changes on a line is of more importance than the most recent metered value at any selected location. For example, the voltage at a particular location may have reached the minimum acceptable value over a period of several years. This situation indicates that additional capacity should not be added until the voltage drops below the minimum acceptable value as indicated by metered data. Without metered data, it is most probable that system improvements would be recommended in a propose construction work plan for immediate installation even though they might not be required within the period covered by the work plan. The use of metered data over a period of years will tend to increase the accuracy of the engineer's estimates concerning actual two-years financial requirements for system improvements. This will reduce premature installation of facilities and minimize capital expenditures.

C. DETERMINING SYSTEM IMPROVEMENTS TO BE INCLUDED IN THE PROPOSED PLAN

Having determined where improvements are needed, the next task is to specify what improvements are necessary in order to provide a good quality of service commensurate with that sought in the service reliability standard established by management. This involves using the system planning report to make sure that the work plan is in line with the actual requirement. It involves selecting the required portion of the long-range system to be installed during the next short-range period. As a part of determining what system improvements should be made the engineer should:

(Md. Mozibur Rahman) Consultant TAPP BREB

(Md. Mozammel Huq) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant TAPP BREB

(Md. Ahsanul Haque) Consultant,TAPP, BREB

(Debasish Chakraborty) PD,TAPP, BREB

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(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB.

1. Make voltage drop calculations for the parts of the system for which the results of the voltage and current investigations indicate might need improvements. As a means of showing where improvements will be needed, considering the projected loads applied to the existing system.
2. Determine or reevaluate the economic conductor sizes for the recommended line changes and new lines on the basis of latest data.
3. Make voltage drop calculations for the portions of the system where improvements have been specified to give an indication of the effect of the improvements and projected load growth upon the system.
4. Review and revise the sectionalizing study as required. System changes recommended in the construction work plan may require some modifications of the sectionalizing. Also, any sectionalizing problems should be investigated. (See PBS Instruction 100-21, "Engineering and Staking Manual for Electric Distribution Systems").
5. Determine the capacity and voltage of major equipment items that are required, such as substation transformers.
6. Review the power factor for each substation area and recommend the installation of capacitors if economically justified.

D. INCREASING CAPACITY OF DISTRIBUTION TRANSFORMERS AND SERVICES

On the basis of system records and pertinent information, the engineer should include an estimate of construction required to increase the capacity of existing transformers and services. It is also desirable that the engineer estimate the types, quantity and sizes of distribution transformers that should be purchased during the next short-range propose plan.

(Md. Moshiur Rahman)
Consultant TAPP BREB

(Md. Dulidul Islam)
Consultant TAPP, BREB

(Md. Mozammel Huq)
Consultant, TAPP, BREB

(Md. Abdul Khaleque)
Consultant TAPP BREB

(Md. Ahsanul Haque)
Consultant,TAPP, BREB

(Debasish Chakraborty)
PD,TAPP, BREB

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(Kamrul Ahsan Mollik)
Asst. Secy. (Board), BREB.

E. NEW ADDITIONS AND LINE EXTENSIONS

A determination should be made of the number of new consumer connections and their construction cost for the next short-range period. The system's records of the number and costs of new consumer connections during the past several years should be used as a basis in estimating this part of the propose construction work plan.

F. COORDINATION

1. PBS should coordinate the development of the propose construction work plan with

   system management. The BREB Deputy Director, Feasibility and Planning, should be kept informed and should attend coordination conferences whenever possible.
2. Each major change should be coordinated with other recommended changes. Substantial conversion on one circuit and switching some load from a neighboring circuit may postpone the need for improvements on the neighboring circuit.
3. All construction and operations and maintenance activities should be coordinated. For example, poles in a single-phase line that are to be replaced because of scheduled conversion to a three-phase line would not be ground line treated.
4. Any new points of power delivery to the system or required increased capacity at existing points of delivery should be coordinated with the power supplier to assure that such new delivery points or increased capacity will be made available when and where needed.

V. USE AND APPROVAL OF PROPOSED WORK PLANS

A. The propose construction work plan or any revision should be available to system

(Md. Mozibur Rahman)
Consultant, TAPP, BREB

(Md. Duhidul Islam)
Consultant, TAPP, BREB

(Md. Nozammel Huq)
Consultant, TAPP, BREB

(Md. Abdul Khaleque)
Consultant,TAPP, BREB

(Md. Ahsanul Haque)
Consultant,TAPP, BREB

(Debasish Chakraborty)
PD,TAPP, BREB

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(Kamrul Ahsan Mollik)
Asst. Secy. (Board), BREB.

management in time for use in preparing its annual budget and for loans support purposes. The propose work plan should be prepared sufficiently in advance to allow time for adequate coordination and for review by the BREB authority. Lines and substations those were included in the propose work plan should have technical approval of System Engineering and Design Directorate of BREB.

B. PBS will prepare the STPP (Standardized Project Proforma) in the approved or prescribed format collected from BREB and send it to concern PBS Monitoring and Management Operation Directorate with PBS Board proposal and copy to Chief Engineer(Project), Director, Program planning, Director, Finance, Director, MP&SS and Director, SE&D for opinion. Upon receiving the STPP all the said offices will send their

opinion/observation to concern PBS Monitoring and Management Operation Directorate within ten (10) working days. The concern PBS Monitoring and Management Operation Directorate will arrange a meeting of Sub-Committee for discussion and place it to the Steering Committee for recommendations by seven (7) working days. Finally concern PBS Monitoring and Management Operation Directorate will place it to BREB Board for approval. BREB has authority to change the preparation and approval process of the STPP for the interest of work.

Sub-Committee and Steering Committee are as follows:

01. Sub-Committee

(a)	Chief Engineer(Project)	- Convener
(b)	Director, Program planning	- Member
(c)	Director, Concern PBS Monitoring and Management Operation	- Member-Secretary
(d)	Director, Finance	- Member
(e)	Director, MP&SS	- Member

(Md. Mozibur Rahman)
Consultant TAPP, BREB

(Md. Duhidul Islam)
Consultant, TAPP, BREB

(Md. Mohammed Hug)
Consultant, TAPP, BREB

(Md. Abdul Khaleque)
Consultant TAPP, BREB

(Md. Ahsanul Haque)
Consultant TAPP, BREB

(Debasish Chakraborty)
PD, TAPP, BREB.

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(Kamrul Ahsan Mollik)
Asst. Secy. (Board), BREB.

(f) Director, SE&D - Member

(g) Sr. GM/GM of Concern PBS - Member

02. Steering Committee

(a) Member (Planning & Development) - Convener

(b) Chief Engineer(Project) - Member

(c) Executive Director - Member

(d) Director, Finance - Member

(e) Director, Program planning - Member

(f) Director, Concern PBS Monitoring and Management Operation - Member-Secretary

(g) Sr. GM/GM of Concern PBS - Member

(Md. Mozibur Rahman) Consultant TAPP BREB

(Md. Duhidul Islam) Consultant TAPP BREB

(Md. Mozammel Huq) Consultant, TAPP, BREB

(Md. Abdul Khaleque) Consultant TAPP BREB

৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০

(Md. Ansanul Haque) Consultant, TAPP, BREB

(Debasish Chakraborty) PD, TAPP, BREB.

(Kamrul Ahsan Mollik) Asst. Secy. (Board), BREB.