

# DEVELOPMENT OF“DESIGN & ACCOUNT SYSTEM FOR DISTRIBUTION LINES CONSTRUCTION”

Hitoshi Furuya, Senior engineer  
Chouichirou Hori, Manager

System Management Group, Distribution Department, TOKYO ELECTRIC POWER COMPANY  
1-3 UCHISAIWAI-CHO-1-CHOME CHIYODA-KU TOKYO 100-0011 JAPAN

*Tokyo Electric Power Company is in charge of power supply for the area of 4000km including the Tokyo Metropolitan region with the maximum power demand of 60 million kW and 25 million customers. In order to this huge power, the company has 5.3 millions of electric poles and its total length of high voltage distribution lines is 410,000km. These facilities are managed by about 305,000 drawings. In addition, the annual number of construction works of distribution facilities has reached about 2 millions. Among them the construction works for the power supply are conducted within about one week in average following the standard target lead time from receipt of applications for electricity supply to completion and inspection of works. On the other hand, it takes huge manpower to conduct the design of distribution construction work and its adjustment. In this situation, the system based on the facilities drawing data has been developed and we are making efforts to economize manpower, reduce costs and lead time by the use of the automatic renewal of the facilities and drawings data. This system, which has been introduced to each of our company's offices, is called the Total Management System for Distribution Works. This paper describes the functions that this system provides and the effects that it can produce in distribution work management.*

## 1. INTRODUCTION

### 1-1. Objectives of the Total Management System for Distribution Works

The Total Management System for Distribution Works has the following objectives:

#### (1) To enhance the level of customer services

This system aims to realize a mechanism that enables our company to present definite answers to customer requests and make and keep promises about work deadlines. In order to perform operations with maximum efficiency, flexibility and speed, we have taken the following measures:

- \* Sharing of information managed by separate departments and facilities in our company to ensure speedy processing of inquiries. This includes information on distribution facilities and equipment, joint poles, pole locations, process information, etc.
- \* Verification of the conditions of drawings, facilities, and equipment controlled by each regional office in order to expedite the process of receiving inquiries, thereby increasing sales.
- \* Completely centralized processing of on-site surveys, design, work commitment, acceptance inspection, and account adjustment in order to reduce the time

necessary for completion of improvement works.

(2) To elevate the quality of operations in each workplace  
We will place more emphasis on the handling of exceptional events and operations requiring economic viewpoints and autonomous judgment. This shift from routine operations to more creative, sophisticated operations is enabled through thoroughgoing efficiency improvement, computerization, and labor saving in the routine administrative operations performed in large volume.

- \* Decreases in the volume of collation, totaling, and verification operations
- \* Selective implementation of evaluation and approval operations
- \* Decreases in the volume of statistics and report operations through the use of electronic data
- \* Decreases in the volume of large-volume routine operations through the use of digital map
- \* Minimization of control duplication and discontinuation of the control by master lists through systematization of the operations that are not yet computerized
- \* Promotion of paperless workplaces

(3) To maximize the benefits of overall efficiency, both within our organization and in associated companies

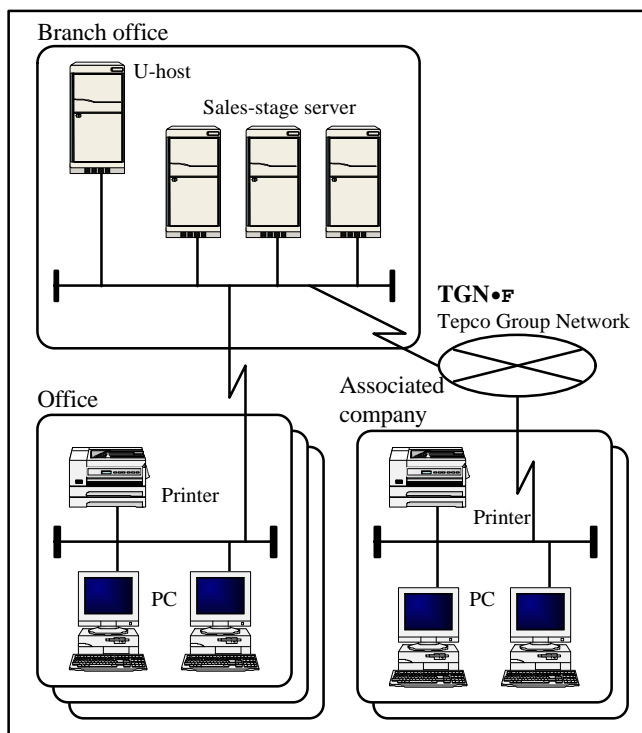
We will streamline operations and reduce costs through comprehensive computerization of information not only within our company, but also within companies entrusted to control drawings, work contractors, etc.

- \* Simplification of drawing correction operations
- \* Streamlining of the operations performed by contractors and subcontractors
- \* Independent management of materials control by adopting an onerous transfer system
- \* Simplification of operations by entering comprehensive commitment contracts with outside companies for maintenance operations such as patrol, inspection, etc.

### 1-2. Configuration of the Total Management System for Distribution Works

Fig. 1 shows the configuration of the Total Management System for Distribution Works. In the system currently used, each office is directly connected to a host computer. In the new system, however, a client/server configuration is adopted; servers perform main operations and a host computer monitors the backup system. Associated companies are connected online via TGN (TEPCO Group Network).

<Fig.1 SYSTEM CONFIGURATION>



## 2. DIGITIZATION

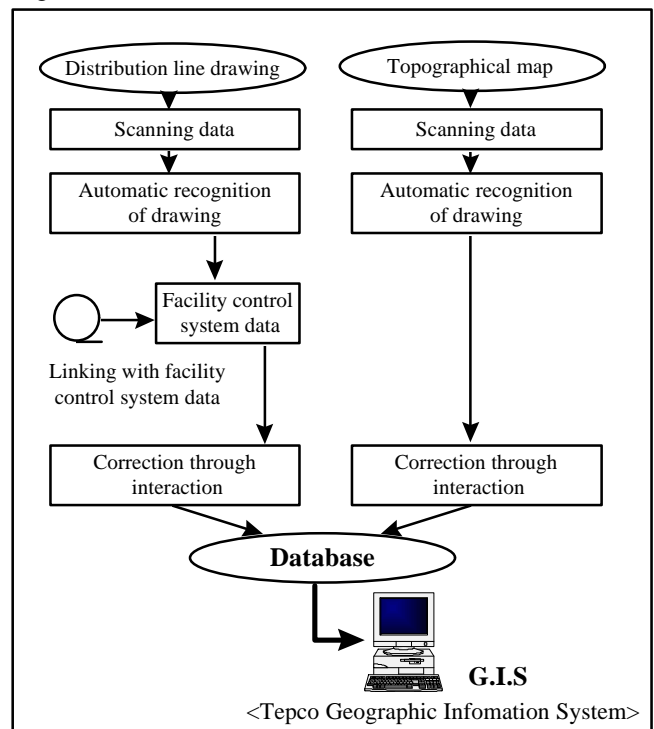
If design, account adjustment, facilities, equipment, and drawings are to be controlled based on information provided by topographical maps, the maps and distribution facility drawings must be digitized. This section describes the digitization process.

Once digitized, topographical maps and distribution facility drawings can be displayed and controlled electronically, replacing the conventional method of control in paper form. Fig. 2 illustrates the digitization process.

This digitization process includes the following steps:

- \* Scanning topographical maps and distribution facility drawings which so far have been controlled in paper form so that the information can be read automatically and organized into an image database.
- \* Automatically transforming scanned image data into vector quantities and classifying topographical information (i.e., information on roads, houses, printed text, etc.) and information on facilities and equipment (i.e., information on main poles, equipment, electric wires, etc.) into separate categories.
- \* Collating information on facilities and equipment with corresponding conventional information on facilities/equipment to verify the appropriateness of the acquired information.
- \* Conducting on-site surveys to elucidate data that could not be recognized or ended up erroneous, and making corrections through interaction.
- \* Compiling a database by incorporating respective information in layers according to respective categories, i.e., topographical information (roads, houses, printed text, etc.) and information on facilities and equipment (main poles, equipment, electrical wires, etc.).

<Fig.2 OUTLINE OF DIGITIZATION>



Easy-to-operate centralized information processing can be realized based on this electronic map, and information output from this electronic map can be distributed to our company and associated companies in the form of electronic data.

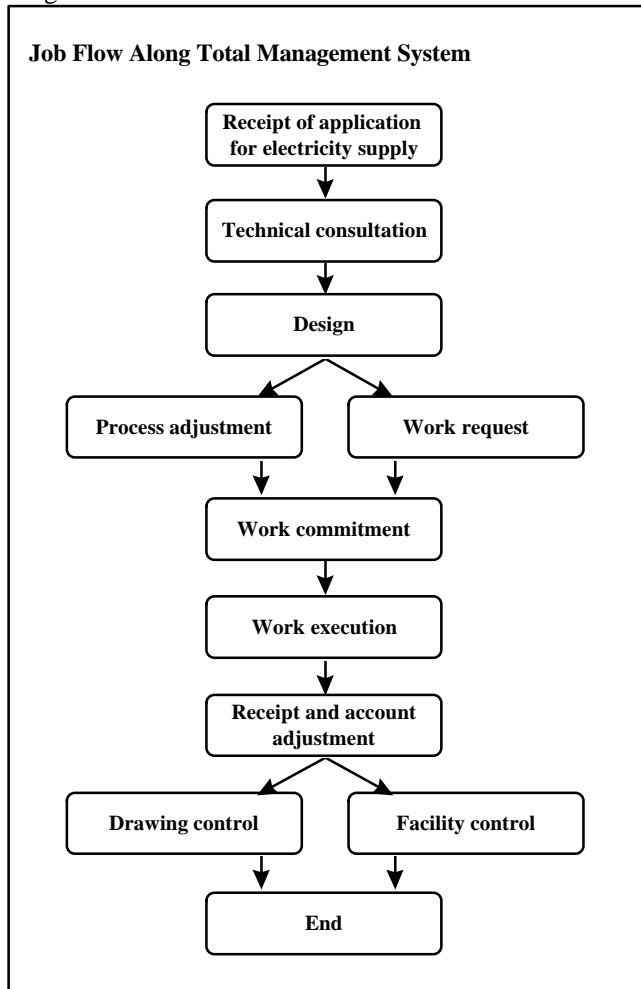
## 3. G.I.S DESIGN

This section describes the G.I.S design function — one of the core functions among the many functions provided in the Total Management System for Distribution Works.

Fig. 3 shows the operation flow,.

This system which is designated as Tepco Geographical Information System (hereafter G.I.S), supports a series of operations from handling of customer inquiries regarding electricity supply to design, work commitment, receipt and account adjustment, and drawings control.

<Fig.3 G.I.S DESIGN OPERATION FLOW>



(1) Receipt of applications for electricity supply and technical consultation

On receipt of an application for electricity supply from a customer, the location where the supply of electricity is needed and the energy demand are examined. Next, the person who received the application registers the name and address of the customer and the energy demand, and then checks the exact location and the point to which a drop wire is drawn.

(2) Design

Data on the received application is distributed to the terminal at the design facility via a company LAN, and the design drawing is electronically prepared on the receiving terminal. The following procedure is used to prepare the design drawing:

- \* A required map drawing can be retrieved by entry of an address, pole number, or map number at the terminal.
- \* A facility symbol is selected from the window and placed on the on-screen map.
- \* Attributes such as the lengths of poles, transformer capacities, etc., are entered on the facility input window.

After necessary attributes are entered, the computer identifies the category of standard works based on the data on the drawing and automatically calculates design data on materials, work costs, etc. The other design-support functions shown below can also be used using data on the design drawings:

- \* Display of data on attributes such as pole length, wire thickness, etc., by indicating facility/equipment symbols representing existing poles and electric wires
- \* Calculation of pole strength by automatically calculating spans, wire thickness, and other equipment data and line angles
- \* Prevention of design duplication and search for design drawings by indicating the works planned in the same area and the design drawings for ongoing works

(3) Commitment of work and completion report

Completed design drawings are electronically sent to a work contractor via the TGN circuit. The work contractor executes the work based on the design drawings, materials totaling table, and work cost account adjustment sheet. The results of the work done are reported to our company as electronic information.

(4) Receipt and account adjustment

The person in charge of account adjustment examines the report on the work submitted by the work contractor or conducts an on-site survey. Based on the result of this examination or survey, he performs the account adjustment procedure. On completion of this account adjustment, work costs, materials costs, etc., to be paid to the work contractor are automatically calculated and informed to the accounting system.

(5) Facilities/equipment control and drawings control

As the person in charge of account adjustment completes the account adjustment process, data on distribution facilities and equipment are automatically updated and stored in the system. A set of electronic drawings are also automatically corrected. This allows the latest information on on-site facilities and equipment to be continuously stored in the system.

The main benefits that this system can produce in distribution work management are as follows:

- \* Improved efficiency of design and account adjustment operations through centralized control of design drawings and documents.
- \* Improved accuracy of design data (fewer input omissions and erroneous design data)
- \* Substantial labor saving in the correction work done for overhead distribution line drawings
- \* Quick and precise response and handling of technical inquiries by customers to the technical service departments of our company

Table 1  
 DEVELOPMENT SCHEDULE FOR THE TOTAL MANAGEMENT SYSTEM FOR DISTRIBUTION WORKS

<b>DATE</b>	<b>DESCRIPTION OF THE DEVELOPMENT</b>
<b>Jul. 1997</b>	The sytem was experimentally introduced to eight offices.
<b>Jan. 1998</b>	First-stage introduction (15 offices, a total of 23 offices)
<b>Jul. 1998</b>	Second-stage introduction (52 offices, a total of 75 offices)
<b>Jan. 1999</b>	Third-stage introduction (51 offices, a total of 126 offices)
<b>Mar. 2000</b>	Next stage of development to commence

#### **4. FUTURE PROSPECTS**

Through the digitization of the Total Management System for Distribution Works, our company can now perform online operations in coordination with associated companies to accomplish tasks relating to the supply of electricity, from receipt of applications to account adjustment and drawings correction. This new system was experimentally introduced to 126 offices in Jan. 1999.

In the second stage of development for the distribution management system, other functions, including the high- and low-voltage system management, will be added. Overall completion of this development project for the Total Management System for Distribution Works is slated for March 2000.