

Fig. 1 - Fraction of geotechnical profile with soil resistance values under the cone of the probe (MPax10)

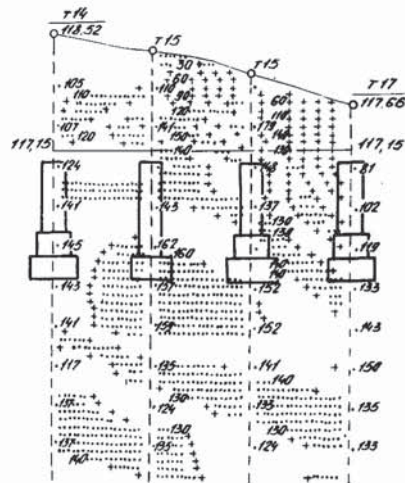


Fig. 2 - Numerical model of soil massive with characteristics of modulus of deformation E (MPax10)

CAD in NTT Architectural and Building Engineering Field

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KEYWORDS

CAD, Architectural General Drawing, Structural Drawing, Equipment Drawing, Quantity Survey, Building Maintenance, Database Management

ABSTRACT

NTT Building Engineering Department is responsible for planning, designing, supervision of construction work, and additional maintenance and remodeling work at NTT buildings. This paper describes the present situation of the computer utilization and CAD system in the building engineering department of NTT. First, we will describe the outline of the systems, which have been put into practical use within the in-house system and public data communication service. Then, we will also describe some problems of present state of NTT building work and reasons for the development of the CAD system, and finally, the outline such as, its basic concept, system configuration, and the function of NTT's CAD system. This system is expected to occupy the center of the systems in the architectural and building engineering field.

La Conception Informatisée dans le Domaine de la Conception
d'architecture et de la Technique du Bâtiment à la NTT

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MOTS CLEFS:

Conception Informatisée, Informatique Graphique, Dessin General
d'Architecture, Dessin de Structure, Dessin des Installations,
Revision Quantitative, Entretien du Bâtiment, Gestion de Base de
Données

Sommaire:

La Direction des Bâtiments de la NTT s'occupe des Etudes des
projets, de la Conception, de la Surveillance des Travaux et de
l'Entretien et la Renovation pour des bâtiments à la NTT.
Cet article expose la situation actuelle de l'utilisation des
ordinateurs et de la Conception Informatisée dans la Direction
des Bâtiments de la NTT. Premièrement, les grandes lignes des
Systèmes qui sont actuellement utilisés dans le bureau et au
service public de la Télé-informatique; deuxièmement, quelques
problèmes sur la situation actuelle des travaux de la Direction
des Bâtiments de la NTT et les motifs pour le développement du
système de la Conception informatisée; finalement, les grandes
lignes du Système de la Conception informatisée de la NTT qui
deviendra le noyau des systèmes à la NTT dans le domaine de la
technique du bâtiment, tel que la conception fondamentale, la
configuration et la fonction du Système; sont présentés.

1. Present State of Computer Utilization in NTT Building Work

1.1 The Office System and DEMOS

In the initial stage, a program for building construction unit
cost, computing material and labour, was developed. This was the
first application program for the computer, which NTT installed
in 1963. Since that time, several design activities for building
engineering and construction work, such as structural analysis
and structural design, budget management, air-conditioning heat
load calculation, construction cost estimation, and excavation
and shoring planning, have been computerized and many programs
have been developed.

On the other hand, since 1971, the appearance of NTT's Scientific
and Engineering Public Data Communication Service, DEMOS (Denden
Multi-access On-line System), made possible rapid development of
computer utilization in the building engineering field. As a
result of the appearance of DEMOS, NTT building engineers
developed a close relationship with DEMOS. Some building
engineering programs, which were developed for the system in the
office, were placed into public use as library programs. The
computer utilization method was drastically changed and became
more convenient for engineers.

There are now two ways of computer utilization in the building
engineering field in NTT, as shown in Figure 1. One is the
utilization of a computer system in the office, which is mainly
processed in batch mode, and the other is the utilization of
DEMOS.

1.2 CAD System Programs in NTT Building Work

In the field of architectural planning, computer application has
lagged behind other fields, because of the difficulties in
planning out and setting up a logical procedure. However, in
1969, at the time of the EXPO in Japan, the simulation technique
was applied to computer analysis of the viewers' flow at the NTT
pavilion. This application provided excellent assistance to
architects.

In 1978, based on the progress of LSI technology and graphic
techniques, the architectural schematic design system CAST
(Computer-aided Architectural Scheme-design Tool), applying to
distributed graphic processing, was developed. This system is
used, as a simulation system, in the course of schematic design.

In the structural design field, DEMOS library program service
using drawing building structure DRAW-BS was started. This
program is based on the subscriber's request for computer
utilization in a drawing in addition to structural calculation,
and the condition enabling the service to use the highly

efficient large sized XY plotter.

2. Reasons for development of the CAD system at NTT

NTT, which is aiming at the construction of an information network system, requires the Building Engineering department to fulfill the necessary tasks, accompanying improvement of its accuracy and efficiency. Concretely speaking, it is required for telecommunications buildings, which accommodate the telecommunications facility, to be constructed and maintained more perfectly and efficiently.

At present, with regard to the executing of the construction, extension, repair work and modernization of buildings, almost every task involving the development of various kinds and numbers of architectural, structural and equipment drawings and the following quantity take-off for cost estimation, on the basis of drawings, are done manually.

In the drawings, general drawings, which express the basic building shape, measurement and its location, or, a block plan, a plan, an elevation and a section are commonly used from a schematic design stage to a building maintenance stage. However, due to the partial deference of the scale and the contents expressed in a drawing, the same kind of drawings are made by hand with a great deal of effort at each stage. Under these circumstances, it is urgent to improve this situation and execute an efficient system of developing drawings and quantity take-off.

In order to maintain the existing telecommunication buildings which have a total floor area of about 13 million square meters, the architectural general drawings which have a function of recording the present condition, are used. However, now it has become impossible to maintain the buildings adequately due to the increasing number of drawings, accompanying building construction. Therefore, it is necessary to plan an effective and efficient way of drawings maintenance, so the building maintenance will be performed efficiently.

Other serious subjects for computer utilization in NTT's building engineering section are the development from file systems to data-base systems, from simple building engineering systems to integrated CAD systems and improvements in man-machine interface suitable for architects and engineers.

On the other hand, rapid progress has recently been made in the branch of graphic processing technique. Furthermore, the performance of main frames and peripheral units have been improved and their costs have been reduced. Under the circumstances, aiming at labour reduction, rapid data processing, improvement of accuracy, the CAD system has become feasible in

the design and drafting fields. Accordingly, NTT has decided to direct the development of the CAD system to make architectural general drawings, structural drawings and equipment drawings, through each stage. That is, from the schematic design, to the building maintenance and management stage, as a target for NTT buildings.

3. Outline of the CAD system (DREAMS) under development at the NTT Building Engineering Department

3.1 Basic Concept

(1) The scope of the system

This system, DREAMS (DRAwing system for Engineering and Architectural practice including Maintenance Service), deals with the following tasks;

- a) Develop and correct the drawing elements on the architectural drawings, structural drawings and equipment drawings for telecommunication buildings, at each step such as schematic design, design development, detailed design, and building maintenance. This system focuses the drawings on such particular subject areas as large numbers of frequently repeated figures and symbols, and a large number of drawings of each type. This increases the effectiveness of automation.
- b) Sum up the quantity of building element quantity from the structural drawings and the equipment drawings
- c) Using database management and maintenance on architectural general drawings, structural drawings, and equipment drawings

(2) Approach to database

From the viewpoint of the system scope, reduction of input labour and effective usage of the database, the most realistic method, or two dimensional element model, is basically adopted. However, with respect to carrying out the various kinds of engineering calculation and quantity take-off, not only the two dimensional values but three dimensional values, also involving the measurement of height, are required. According to these demands, a three dimensional element model is adopted. This system adopts the local database method, or, a department managing each building has its own distributed local database, from the viewpoint of the kind and quantity of data items, function of processing, and data transmission time.

(3) Layer structure of drawing data

This system deals not only with architectural general drawings which are utilized from a schematic design stage to a building maintenance and management stage, but the structural drawings and the equipment drawings. In the above drawings, there exists a considerable number of common data items. At first, a classifi-

cation for each drawing element is carried out in each drawing, taking into consideration its commonness and individuality. Next, grouping by layer is performed to accumulate drawing elements, at each group or layer, in order to develop a drawing. As a result, data file management is unified without duplication. Also, required and sufficient information can be provided by a data file, according to demand.

Classifying the drawing elements on a drawing by layer brings the following advantages;

- a) Input of common information to the individual files is not required. In correcting the drawing data, it is also not required to carry out the same operation on the plural files.
- b) According to demand, the system is able to develop various kinds of drawings by combining information in many different ways.
- c) A compact database can be made, because the same information is not transferred to the plural directory on the drawing file.

3.2 Hardware Configuration

This system consists of three elements, data terminal equipment or a workstation, communication channel, and DEMOS center equipment. (Figure 2) A workstation has the main processing function which covers almost every usual task including developing, correcting and managing the drawings, and quantity take-off, on the basis of drawing data. Furthermore, DEMOS center also has a processing function of structural calculation and air-conditioning calculation.

The workstation used in the system has the following specifications. (Figure 3)

- a) CPU consisting of 32 bits and a UNIX-system with core memory up to 8MB
- b) Graphic 20inch colour display having high resolution and a function for processing figure data on a drawing
- c) Peripheral equipment which permits ease of input for figure data; digitizer tablet
- d) Magnetic disk storing on equivalent capacity of data files concerning the number of buildings treated; 40-280MB hard disk memory, 1MB flexible disk memory
- e) Large scale XY plotters having the function of temporary output of a drawing
- f) Communication device which connects to DEMOS center

3.3 Software Configuration

Application software consists of three programs for architectural general drawings, structural drawings, and equipment drawings. (Figure 4) Furthermore, each program is classified into a number of packages. Data transfer among packages is carried out through

data files, according to demand.

A package of developing drawings possesses three functions; an exclusive use, replacing symbols, and general use for architectural and building engineering drawings. These packages can be easily operated by architects and engineers, using the screen menu in Japanese on the CRT.

3.4 Effect of using the CAD system

The following improvements in effectiveness are expected through the use of the CAD system under development;

- a) Reducing labour for drafting through, what is called, a consistent drafting system, improving the accuracy of a drawing, and choosing an efficiency goal for the computer utilization of a quantity survey by using data files of architectural drawings
- b) Improvement in the coordination of items expressed by each kind of drawing, that is, architectural, structural and equipment drawings.
- c) Direct or indirect effects on design tasks by database management. Concretely speaking, space saving through a change of media. That is a shift from a lot of papers to a hard disk, and reduction of labour for drafting of building extension or repair work by using the existing datafiles.

4. Conclusion

In the conventional building management and maintenance job, it was the main purpose to maintain, what is called, the building performance or repair, maintenance and cleaning work. Recently, ambitious and positive activities such as improving building performance has become important at NTT, as well as designing a new building and planning a building extension. It is necessary to sufficiently grasp the existing situation in order to carry out adequate management and usage of the considerable number of buildings constructed since NTT's inauguration. Furthermore, in the area of increasing maintenance jobs, the design activity with this CAD system takes an important role. The CAD system under development at NTT is intended as not only a design system but a building maintenance system.

This system is planned to be utilized as an in-house system. At the same time, NTT regards this CAD system as being compatible with the DEMOS service and expects its utilization by many outside clients, because of its wide use functions.

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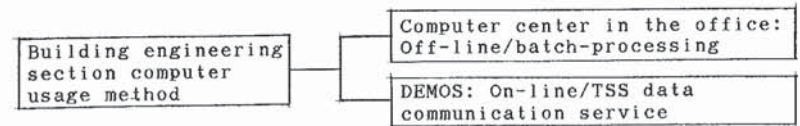


Figure 1. Building engineering section computer utilization

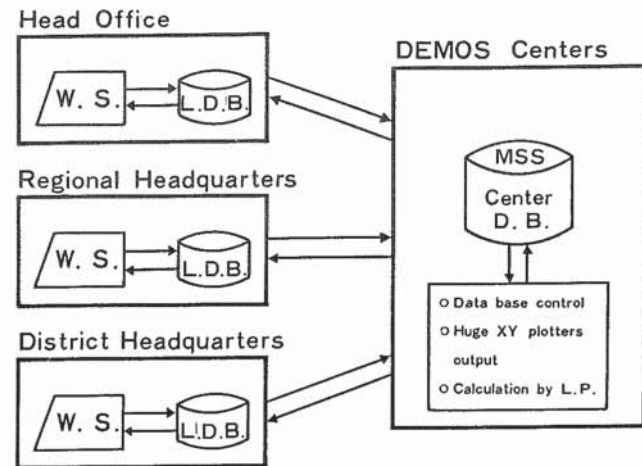


Figure 2. System Configuration

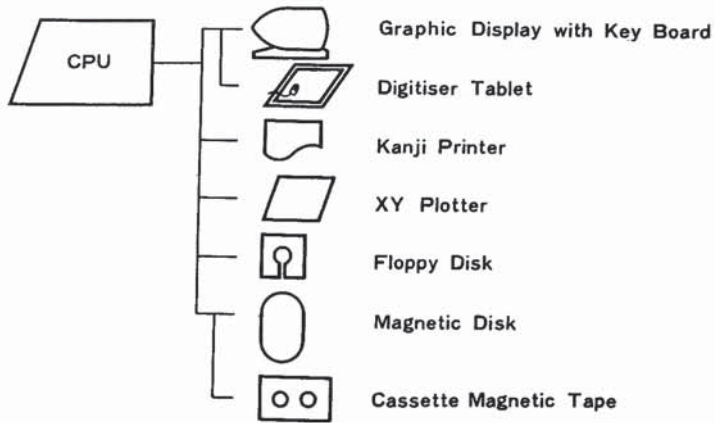


Figure 3. Workstation Configuration

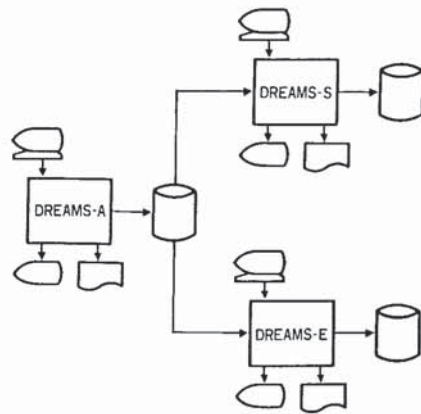


Figure 4. Software Configuration

Earthwork Analysis on Personal Computers

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KEYWORDS

Earthwork, microcomputers, simulation, linear programming, heavy construction.

ABSTRACT

The analysis of heavy earthwork operations at the project site level requires many considerations. Some factors involved are: 1) technology used; 2) uncertainty in the duration of construction activities; 3) resource configuration; 4) interaction between resources; 5) characteristics of each project. A description is presented of a system designed to analyze heavy construction operations on microcomputers. The structure of the system is presented. The system described was developed on a project sponsored by the National Science Foundation. The system addresses the following areas: 1) estimates of earthwork quantities; 2) resource definition; 3) productivity and unit cost estimates; 4) earthwork allocation. It is based on operation research techniques such as simulation, and linear programming. No knowledge of these techniques is required to run the programs. A user needs only to enter the required data in an interactive environment. It provides construction decision-makers with a quantitative tool for the analysis of earthwork operations.