Table II. 100% Elimination Parmetrics

	Daily load (kWh/m^2 day)	Difference (%)
Base case	0.44	--
No internal gain	0.7	67.2
No solar radiation through windows	1.15	164.3
No conduction through glazing	0.15	65.0
No conduction through walls	0.31	29.2
No air infiltration	-0.72	263.7

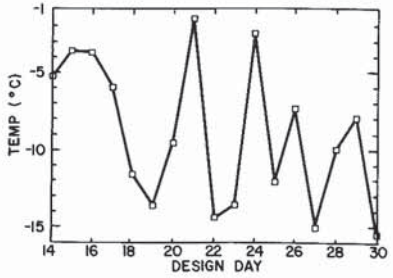

FIG. 1 Average outdoor temperature, Montreal, December 1979

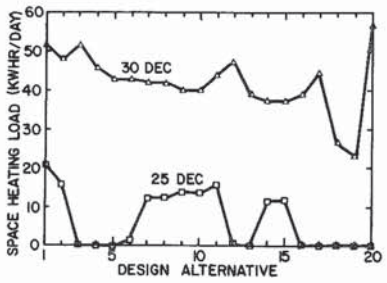

FIG. 2 Sensitivity of the design alternatives to weather conditions

Automatization of Calculation of Foundations on the Basis of Static Sounding Data

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KEY WORDS

Pile Foundation, Computer Programme, Shallow Foundation, Static Sounding, Modulus of Soil Deformation,Geotechnical Profile.

Computer programmes are proposed to calculate pile bearing capacity on the basis of static sounding data at every sounding point in a broad range of possible depths of driving. Apart from this it facilitates the choice of correct type of pile driving hammer and the definition of the necessary pile impact strength. Inaccuracy in calculations is compensated by correction coefficients established for each building site on the basis of control testing and results of previous experiences. The programme algorithm is based on the Bayesian formula.

Based on sounding data computer constructs geotechnical profiles which represent a system of isolines separating various zones in accordance to soil characteristics, with allowances for linear variation of basic indices.

For calculating foundations on natural bases dependences obtained experimentally are used which relate sounding data with permissible values of pressure on soil. Computers construct numerical models of a soil massive on the basis of calculated characteristics in the form of geotechnical profiles along the axes of a building and based on these models the dimensions of foundations at given loading are calculated.

The elaborated approach decreases the time necessary for soil investigation and design from 1,5 to 2 times.

Automatisation de calculs des fondations basée sur données du sondage statique.

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MOTS CLÉFS

Fondation des pieux, Programme calculatrice, Fondation superficielle, Sondage statique, Module de déformation, Profil géotechnique.

On propose des programmes facilitant les calculs de la force portante des pieux à base des données du sondage statique dans chaque point du sondage avec une large gamme de profondeur d'enfoncement.

Ces programmes facilitent la choix du mouton et la détermination de la resistance des pieux aux charges dynamiques. Une certain inexactitude dans les calculs est compensée par des coefficients de correction choisi pour chaque chantier à base des epreuves de contrôle et experiences anterieurs. L'algorithme de ce programme a comme base la formule de Bayes.

A base des données du sondage une calculatrice construit les profils géotechnique qui representent un système des isolignes separant les zones du sol aux caractéristiques différents, supposant toutefois un changement linéaire des indices basiques.

Pour calculer fondations sur base naturel on utilise les rapport d'essai relationant les données du sondage à la magnitude de pression admissible sur le sol. Une calculatrice construit un modèle numerique d'un massif du sol avec les caractéristiques calculatives en forme d'un profil géotechnique du sol et à base de ce modèle on calcul les dimensions des fondations sous charges predéterminées.

Cette approche réduit le temps des recherches géotechniques et des projets de 1,5 à 2 fois.

Constantly increasing rate of construction lays considerable importance on the problem of speeding up survey and design works. Great importance is attributed to high-speed methods of soil investigation in field conditions, which permit to obtain within short periods much information for the foundation designing and decrease investigation costs. These methods permit to determine the features of soil layers, to evaluate in numerical values its inhomogenious character and to describe its differing mechanical qualities in horizontal and vertical sense. This refers in the first place to static sounding of soils which has developed considerably in the USSR in the last two decades.

For projecting constructions by the Ministry of Industrial Building of the USSR sounding equipment C-832M is widely used, which has been constructed by the NIIpromstroi Scientific Research Institute.

At the same time high-speed construction methods are related to a complication of data processing methods and elaborate foundation calculations since the number of original data is increased. The most elaborate and lengthy in this respect are calculations of pile lengths based on sounding data, since pile resistance must be determined in many points of the site for broader range of driving depths. Mathematical operations in this case number several hundred and even thousand. If at the same time technological problems have to be solved (choice of pile driving hammers, evaluation of pile destruction during driving,etc.) the calculations become even more labour consuming.

Practice has shown that the only way of overcoming above-mentioned difficulties is a wide application of computers, as without them information processing becomes much more prolonged than field investigations.

The NIIpromstroi institute has worked out a number of applied programmes for the most labour consuming and unifiable stages of data processing and foundation calculations. The basic algorythms are connected with the methods of code practice or methods elaborated in the institute.

Software is composed on the basis of computer operation system ES (DOC ES) with the application of PL/I, FORTRAN and ASSEMBLER Version 2,1 languages.

As source of information static sounding data obtained by sounding equipment with a 36 mm Ø probe, with friction coupling 310 mm long are used.

The programme of determining pile length is most widely used. It establishes limit pile resistance in every sounding point for various depths of driving (starting from 3 m till the

depth for which sounding was made, with 1 m interval in depth). For every depth of driving calculated load per pile is established considering the variability of particular values of limit resistance at this depth.

The programme permits an evaluation of pile driving to predetermined depth with this or that hammer. It is assumed that the driving is successful when refusal values in the section with maximum resistance are not lower than 0,5 cm and the piles themselves support the expected number of hammer blows without destruction.

The calculations related to this problem are simple but labour consuming and without computers such calculations are unrealistic in production conditions.

A special programme is worked out for the constructions of soil profiles on the basis of sounding data. It provides a pattern reflecting the changeability of this or that foundation parameter in a system of isolines. Point resistance under cone or side friction of the probe may be considered as starting data.

Fig.1 represents a section of the profile with information on soil resistance under the probe point. In the same way it is possible to construct profiles reflecting other variables. These may be: relation of point resistance to side friction, which is characteristic of the type of soil (sand,clay); pile resistance, lower points of these piles correspond to points on the profile, etc. The programme stipulates the use of computer without grapher. Isolines are marked only by dashed signs and are drawn by hand joining these signs together. Isoline outlines are established by means of a linear interpolation of "key" values in the same way as horizontal lines are drawn on the basis of geodesical measurements.

Computers facilitate correction of calculation results at a certain building site. Indices based on calculation results of sounding data or pile resistance will always contain errors which are compensated by special correction coefficients in calculation formulae. Such errors are characterised by certain statistical distributions, which may be established on the basis of analysis of former experience.

Our information indicates that distribution paramters of errors depend on the variety of soil types where investigations were conducted. If investigation conditions are limited to a certain site, statistical distribution of errors as a rule will have a displaced center and dispersion in comparison to a general case, embracing a wide range of soil conditions. This permits the entry of correction coefficients for definite sites to average indices and the establishing of lower "margins" without imperilling foundation safety.

For the completion of such an operation a programme is offered in which Bayes formula is used, which permits a revaluation of the probability of various hypotheses after the completion of an event. As "hypotheses" are offered various possible meanings of correction coefficient (based on the analysis of former experiences). An "event" on the basis of which a revaluation of probabilities of "hypotheses" is made is the result of comparison between approximate and "exact"values of the sought for index, obtained directly at the investigation site. If several exact tests are made on the site then definition is made in several stages: final probabilities (a posteriori) become initial (a priori) at the next stage and the new result of comparison between approximate and exact values becomes an "event".

Such tests as static pile loading, punch test etc. are considered as exact tests, while approximate values are the result of calculation of the same index on the basis of sounding.

The above-described approach allows the use of less exact empirical formulae, which correlate sounding data with sought for indices, since the defects of such formulae to a certain extent may be compensated by varying correction coefficients. The high productivity of our sounding equipment and the possibility of continuously obtaining information about soil characteristics with sufficient number of sounding holes allows the construction of numerical computer soil models.This offers the possibility of passing from the traditional methods of designing of shallow foundations on the basis of representative samples to designing foundations based on numerical models of soil massives. When designing foundations according to this method the following estimated soil characteristics are used: allowable soil pressure and modulus of soil deformation,which are obtained by static sounding.

Fig.2 represents a section of numerical model of soil massive based on the modulus of deformation E. The transition from sounding data to calculated characteristics is based on the results of field tests, which demonstrated a close correlation between calculated characterisitcs and the results of sounding tests. For calculating soil massives and establishing the size of a foundation and their unification computer programmes are worked out by the institute.

The practice of employment of sounding and above-mentioned programmes for calculating foundations cuts by 75% drilling costs during site investigation and shortens the time for processing investigation data and calculating of foundations 8-10 times, thus speeding up investigation and design process as a whole from 1,5 to 2 times.

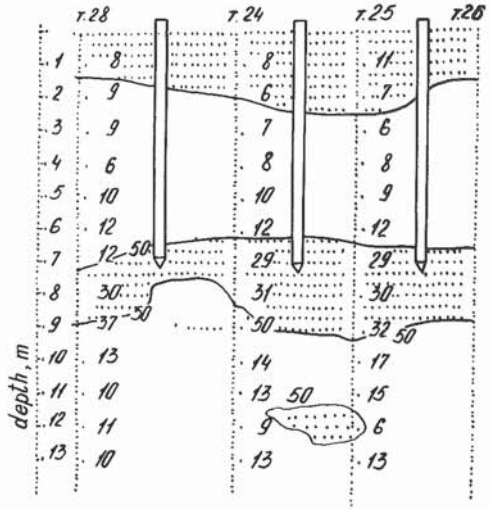

Fig. 1 - Fraction of geotechnical profile with soil resistance values under the cone of the probe (MPax10)

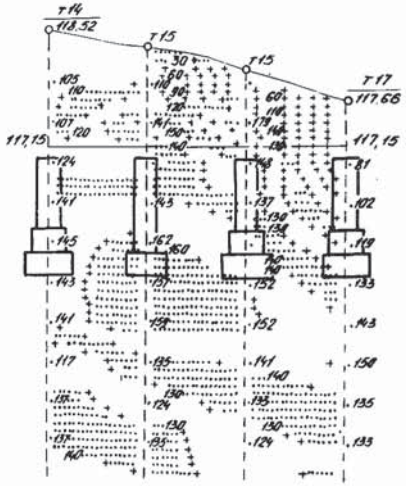

Fig.2 - Numerical model of soil massive with characteristics of modulus of deformation E (MPax10)

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.