ABSTRACT

Let us assume that in order to project a toll network with alternate routing of traffic it is necessary to establish the traffic (given in Erlang for the mean busy hour) offered all the point to point relations, ascribed to the year in which the system will be put into service. Normally sets of historical data are provided which have been measured up to the year $t$ when the work of traffic prediction and the project for the network to be put into effect in the year $t + \Delta t$ ($\Delta t$ is the prediction interval, for example two years or more) are made.

Usually, data for traffic measured on existing trunk groups are provided and the coefficients for the destination of traffic which passes through the switching points offered all the point to point relations, ascribed to the year $t$ when the work of traffic prediction and the project for the network to be put into effect in the year $t + \Delta t$ ($\Delta t$ is the prediction interval, for example two years or more) are made.

Since machines equipped to measure traffic are already in use which give out data in usable form to be automatically elaborated and since the project for the network also by now is drawn up with the aid of a computer, only the automation of the procedure of preparation of the matrices for predicted traffic remains in order to make the handling of the traffic data completely automatic for the purpose of programming the system. In this regard, at the SIP recently a program of automatic calculation was completed which was written in Fortran II and also in PL/1 language, suitable for calculations either in batch or in time-sharing through terminals peripherally located and connected to a central computer.

The single parts which make up the entire program were carried out in successive phases and had already been operating individually: they have now been utilized as subroutines in a single elaborative procedure.

The various steps and programs which make up the computation procedure are illustrated in a particular way in the paper, making clear the main difficulties which have been overcome.

INTRODUCTION

The utilization of traffic data, measured on the telephone network in operation, has a double aim, insofar as the Operating Company, on the basis of the collected data, can value first of all the quality of the service given to the user and secondly it is able to program periodically the necessary plant additions and to determine more generally the future evolution of the network.

Figure n. 1 synthetizes in a schematic way the different stages existing for the said aims in the utilization of measured traffic data. These stages are based on operative procedures, now entirely automatic thanks to the use of electronic Centers for the processing of data.

The first automatic stage, in order of time, concerns the collection and the processing of measured data through quite simple procedures since the main difficulty depends on the great volume of data to be dealt with.

The problem concerning the network planning is completely different since the calculation procedure is considerably more complicated, though it is operating on a smaller number of data (traffic data, cost elements, installation restraints, etc.) this stage too has been recently brought to a computer, as it is stated by several articles published in specialized magazines of many countries, among which the special numbers of November and December 1971 of ITU Telecommunication Journal where the calculation procedure developed at SIP for planning of long-distance Italian network is also illustrated.

The preparation of forecasting traffic data, necessary to plan the future network, is a problem which is placed in an intermediate position between the two problems mentioned above, both regarding its temporal stage and its complexity, and it is interconnected and subordinated to them in the methodology of processing data since it depends on the data available as input and on that required as output.

The different aspects of this problem will be thoroughly examined later, firstly through a description in quite general words, successively by illustrating the automatic procedure employed at SIP for the Italian automatic toll network.

In Figure n. 1 there is also the scheme of the processing stage developed collaterally with the forecasting one: this processing stage operates on traffic data measured with the purpose of estimating the degree of utilization of the network in operation and of obtaining indications on the quality of the service. To this indications obtained as output from the Center which processes the data, will be added other information of immediate character existing at the exchanges, thus offering a more complete
picture. The forecasting, on the contrary, is fully defined within the limits of the following part of this paper.

It may be pointed out, at this moment, that the development during the years of the measured traffic and parallelly of the network presents many points of discontinuity so it is not generally advisable to extrapolate for the future the collected traffic data: it is enough to say, just to give an example, that with the setting up of a new high-usage trunk-group (according to the convenience in the development of traffic of a particular relation or necessary owing to the installation system and its restraints) the traffic carried on it is withdrawn suddenly from other previous trunk-groups in which it flew previously.

On the contrary, forecasts in traffic development are to be made on historical series of data the continuity and reliability in time of which must not consider the evolution of the telephone network, and the eventual anomalies of tendency in the traffic streams must be motivated only by external events like the sudden touristic and commercial development of certain regions, variations of tariffs, automation of the telephone service, etc.

Moreover, the forecasting traffic data at output must have the form and the degree of detail to allow a plan of the future network sufficiently optimized from economic point of view having also taken into account the existing or foreseeable installation restraints. In the most general case, this result is obtainable by making a forecasting "matrix" of the traffic (Erlang) offered, point-to-point, from every elementary area of departure towards every elementary area of arrival at the busy hour at the time \( t + \Delta t \) \( (\Delta t \) is obviously the interval of time elapsing between the date of the last traffic measurement, thus obtaining the last point of the historical series, and the year to which the network plan is referred). The points of elementary areas of departure and arrival and also the busy hour of traffic on which the network plan is based, are tightly connected to the structure of the network: in the most common case of a hierarchical network based on various switching levels, where also high-usage trunk-groups with overflow are admitted these data (that is: areas and busy-hours taken in account will vary considerably in order to utilize, for every portion of network overflowing upon the same final link, always the traffic of its own busy-hour. It is therefore necessary, besides the construction of the general traffic "matrix" utilizable, strictly speaking, only for the planning of the network portion which constitutes the highest hierarchical level, also the processing of variants for the single portion of matrix of the lower hierarchical levels, in order to complete also for them the plan of a network able to carry the traffic of the busy-hour which can be in different time according to the different areas and switching centers.

From what was said above it follows that the processing procedure takes place through a logical succession of main operative stages that may be synthetized as follows (see also the scheme of Figure 2):

1) - Starting from the traffic (Erlang) measured at the time \( t \) on the single trunk-groups coming from every toll centre of departure, it is possible to obtain the correspondent traffic offered, during the busy-hour, to the same trunk-groups in the first choice (that is: without the overflow traffic coming from other trunk-groups of previous choice) by using the well-known formulas of traffic theory, which are valid for networks with alternate routing.

Of course the computer must also know the network
consistence and structure and the routing rules. Therefore, it is possible to know the total offered toll traffic which originates from every area of departure.

2) - Through the data obtained at the point 1), eventually integrated with other traffic data (for example: the one handled through operators), by applying to them some coefficients of destination, it is possible to obtain the aliquots of traffic starting from every area of departure towards the other elementary areas of destination, or towards groups of these areas which dispose at their arrival of a common switching center of transit in order to work on rather consistent values statistically reliable: we shall call these data, conventionally, "main traffic data" and they represent the basis of the traffic "matrix", not bound any more to the traffic measures on the existing trunk-groups (whose historical series may present some discontinuities, as we have already said). Thus some historical series of "main traffic data" are created little by little, and in the stage 2) it has been reached the most recent point.

3) - At this point it is possible to extrapolate the historical series of the "main traffic data" by utilizing the mathematical pattern that suits better to each historical series and to the time interval \( \Delta t \) considered in the forecasts.

4) - We proceed then to the readjustment of the traffic data obtained in the stage 3), in order to get the congruence of these data to one another: this readjustment is made according to a priority order which depends on the (known) reliability of the data themselves.

In some cases the values thus obtained are rectified further on, through manual interventions, in order to consider possible discontinuities in the increase rates of traffic depending on external factors of any kind.

5) - By the main traffic data extrapolated at the year \( t + \Delta t \) it is possible to obtain the aliquots of traffic offered to all relations between departure and arrival areas. In the case of the national Italian toll automatic network, they constitute a matrix of 231 lines and as many numbers of columns (as the toll centres of departure and arrival) plus 21 lines and columns of partial sums as many as the transit centres of level higher than that of toll centres of departure and arrival.

![Fig. 2](image)

**Fig. 2**

Processing stages for determining the traffic matrix

![Fig. 3](image)

**Fig. 3**

Basic routing principle of the Italian toll network

In the following paragraph the processing procedure for the traffic matrices for the Italian toll network will be described. This network is based on three commutation levels:
- District Centres (CD) of which there are 231
- Compartment Centres (CC) of which there are 21
- National Centres (CN) of which there are 2

In this order the CD represent the points in which the traffic offered to the network originates and terminates while the CC and, at an even higher level, the 2 CN rep
represent the transit centres exclusively.

The network is made up of a fundamentally star-shaped structure in which the CDs are connected in both directions by trunk-groups of final choice, to their own CC and these, in turn, to one or both the CN, in relation to their geographical position. Finally the two CNs are connected to each other by final trunk-groups.

Onto the series of stars which forms the fundamental backbone of the network, a highly efficient mesh of connections overlaps, determined on the basis of valuations of an economical nature.

The traffic originating from any CD is carried by the network according to dynamics of the subsequent choices which, as results from the diagram shown in figure 3, sets in the most complex case, seven alternatives which follow on in the hierarchical order indicated.

DESCRIPTION OF THE AUTOMATIC PROCEDURE CARRIED OUT BY THE SIP FOR THE ITALIAN TOLL NETWORK

A particularly delicate problem is the choice of the busy hour period, of both month and hour, in which the measured data on all the trunk-groups outgoing from the CDs of a CC area are taken into consideration.

For every hierarchical switching level in use, there exists a busy hour on the base of which the traffic to put on the matrix (measured at time t or for a time Δt) would be determined. In the specific case of the Italian toll network, which is referred to, there is:

a) a busy hour for the network outgoing from the area which relates to a CN: on the base of the corresponding traffic, it is possible to calculate correctly the loss for the outgoing part, whereas it is possible that the internal part in such an area (concerning the trunk-groups within a CC area, the ones between different CCs and those CC — CN);

b) a busy hour for the network outgoing from every CC, on the base of which it is possible to calculate correctly the loss for each of such areas, while it is possible that the internal part of the CC area is underestimated; it can be observed that a traffic matrix, constructed on the base of single busy hours in the CCS tends, on the other hand, to overestimate the total traffic heading to wards the area attracted to the other CN;

c) a busy hour for the network outgoing from the area of every CD, on the base of which it is possible to calculate correctly the loss for the network coming out of such areas; summing up the traffic determined in this way, one tends, however, to overestimate the total traffic, in a dimension all the more relevant as the hierarchy of the network increases.

Practically speaking, it has been decided, for simplicity's sake, to form one traffic matrix only based on the hypothesis (b), choosing the data to be measured correspondently, and accepting the prudential criterium of bearing a slight increase in the forecasted traffic exchanged between the areas attracted to the different CNs.

On the contrary, as far as the correct valuation of the loss within the CC area (which is conveyed into the future network project) is concerned, for every CD the relationship existing between the outgoing traffic at its own busy hour and in that resultant for the corresponding CC of which the traffic matrix is constructed, is valued: these relationships are memorized and utilized at the right moment.

That being stated, the various stages of the computing procedure are now described:

Stage 1) The research of the traffic offered in the first choice to the trunk-groups of the network is arranged by CC area of departure, continuing in orderly sequence towards all the other CCs of arrival, including itself, and completely exhausting each CC–CC relationship before continuing on to the next.

The input data are organized according to a series of matrices each of which contains all the data measured (traffic carried, consistency and accessibility) relative to the trunk-groups existing in the relationship taken into consideration.

The number of rows P in the matrices of a given CC area of departure is constant and equal to the number of the CDs of the CC of departure, while the number of columns Q varies from matrix to matrix being equal to the number of the CDs of the CC of arrival which have at least one trunk-group with one of the centres (CDs and CC) of departure.

For every matrix exist a marginal row (P + 1) which represents the relationship between the CC of departure and the number of the CDs of the CC of departure, while the number of columns Q varies from matrix to matrix being equal to the number of the CDs of the CC of arrival which have at least one trunk-group with one of the centres (CDs and CC) of departure.

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In the input, three types of data are set: traffic carried (Y), consistency of the trunk-group (N) and accessibility (K). The matrix is not complete in all its points as only the elements Yij, Nij, Kij are introduced, relative to the following coordinate points:

1) if the trunk-group CD1 — CD2 exists
2) if the trunk-group CD1 — CC2 exists, or simply to distinguish the last row when at least one type (a) data exists
3) if the trunk-group CC1 — CD2 exists
4) if the trunk-group CC1 — CD1 exists
5) if the trunk-group CC1 — CC2 exists
6) if the trunk-group CC1 — CC2 always, as it represents the indication of the end of the matrix which is necessary to continue on to the following matrix.

From the moment in which the matrix is incomplete, the input data are introduced into the computer preceded by the relative coordinates. For every CC, a file is formed in which the above mentioned data relative to the matrices are stored in the following order:

- the number P of the CDs of departure
- the P + 1 codes relative to the CDs and to the CC of departure.

Therefore, for as many times as there are relationships to take into account, to exhaust the calculation relative to a CC area (in our case, as shown in the following, 24 times):

- the number Q of the CDs of the CC area of arrival, which is variable as already indicated
- the Q + 1 codes relative to the CDs and to the CC of arrival

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- the order of the five data, i, j, Y_{ij}, N_{ij}, K_{ij}, by which the matrix relative to the relationship of reference is orderly introduced by rows. The sequence finishes with the five numbers relative to the coordinate point (P + 1, Q + 1).

Of the 24 matrices introduced, the first 20 represent the relationship between the CC of departure and the remaining ones, the 21st is relative to the relationships within its own limits, the following two refer to the two CNs, and finally the 24th contains the data relative to the final trunk-groups outgoing from every CD (CD_i → CC_j).

As jumps of hierarchy are not allowed in the structure of the network, the matrices towards the two CNs are reduced to one point only (i, Q + 1), (i = 1, 2 ... P + 1).

The calculation to obtain from the traffic carried by every trunk-groups the relative traffic offered in the first choice, is carried out in the following order: within every CC → CC matrix, the data are explored row by row passing on by one by one to the following, up to the P row.

The following data are calculated and stored for every trunk-group:

a) total traffic offered to the trunk-group (average value and variance)
b) traffic offered to the trunk-group in the first choice
c) traffic overflowing from the trunk-group (average value and variance).

The values at point c) are necessary in order to be able to obtain from value a), pertaining to the trunk-groups of the successive choice, the value b) which is the point of arrival of the calculation.

At this point the traffic offered in the first choice to the trunk-groups CD_i → CD_j and CC_1 → CC_2 is obtained. Finally the data contained in the row (P + 1) are explored obtaining, in that manner, the traffic offered in the first choice to the trunk-groups CC_1 → CD_j and CC_1 → CC_2.

We go on therefore to the matrix of the following CC of arrival, up until the completion of the series of 21 matrices: only at the end can the same calculation for the trunk-groups CC_3 → CN_2, CC_4 → CN_1 and CD_j → CC_1 be executed, having provided for the memorizing of all the overflow data from the preceding choice which insist on these last ones.

Then, the total traffic departing from every CD offered in the first choice to all the existing trunk-groups has been derived and the same refers to the CC.

If necessary, the same calculation can be repeated identically using other input data, referring to the traffic measured in the busy hours of each CD, which may be different from that resulting from the entire CC area; such data are stored in suitable Files and only used to derive for every CD the connection between the traffic originating in the two different busy hours (the real one for the CD and the one resulting for the CC).

The same calculation programmes allow us to obtain the traffic offered to the trunk-groups outgoing from the CNs and for the final trunk-groups entering every CD_i.

Nevertheless, it is opportune to emphasize that all the data relative to the trunk-groups of the descending hierarchical type (CN → CC_i, CC_i → CD) could serve only as control points in the various processing stages as the traffic which flows on them has already been carried at least by another link in the series and that such control is no longer valid if the input data of the present processing procedure do not refer to all the values measured in the same busy hour.

The output of every CC is stored in suitable Files memorizing the following data for every trunk-group:
- code of the departure centre
- code of the arrival centre
- average value of the traffic offered in the first choice in the busy hour of the CC
- accessibility
- number of circuits
- ratio between traffic in the busy hour of the CD and the CC (if calculated).

The Files are arranged according to centres of origin in order that all the trunk-groups outgoing from the same centre are written up in sequence.

These Files whose data can also be printed, form part of the input of the processing programme which will be described later in stage 2.

The formulae used for the calculation are the following:
- Erlang formula, in the case of fully accessible trunk-groups and random traffic.
- Wilkinson's theory of the random equivalent for fully accessible trunk-groups and peak traffic.
- Palm-Jacobsen formula modified by Lotze, for limited accessibility trunk-groups and random traffic.
- General method of the random equivalent according to formulae developed by the SIP for limited accessibility trunk-groups and peak traffic.

Stage 2) To the total traffic offered as output from every CD, derived in stage 1 limitedly to that carried on teleselective network, in some cases it is necessary to add other traffic aliquots not included in the data measured (e.g. the traffic handled by operators on specialized circuits). These aliquots are put in manually until they amount to the data obtained in stage 1 corresponding to the centers and relationships in question.

The programme sets the complete preparation of the matrix of traffic offered to all the relationships CD_i → CD_j of every pair of CGs.

The territorial subdivision of the Italian telephone network and the relative codes of all the CDs are permanently stored in the computer, which knows, therefore, the dimensions (rows and columns) of every matrix to be prepared. To this end, the programme takes out the traffic data, eventually integrated as shown above, prepared in stage 1 and it works on these with a series of successive elaborations to arrive at the final matrix.

In order to carry out these calculations, it is necessary to know the coefficients of interest for the traffic coming out of every CD which are stored (in the most recently measured version) in suitable Files. The calculations are carried out in the following manner:

2a) Remembering that in stage 1 there have been obtained for every CD of a CC area, the total outgoing traffic offered and various partial values of traffic directed towards other CDs (case of the existence of trunk-groups CD_i → CC_j), the first calculation will, therefore, consist of completing the matrix at P + 1.
rows and 22 columns (CDs - CC matrix) in which the 
(P + l) row is destined to contain the total traffic of the 
CC of departure towards all the other 20 and with itself, 
whilst the twenty second column contains the general to 
tals of traffic leaving every CD of the CC of departure.

In order to do this, the above quoted coefficients of in-
terest applied to the totals of the column 22 are exhaust-
ed controlling that the relative column totals coincide 
with the eventual totals already present in the row (P + 
1) obtained in stage 1. If not, various adjustment cy-
cles are carried out correcting the elements now de-
rived with the distribution of the total traffic coming 
out of every CD, being careful not to modify those al-
ready obtained from stage 1.

2b) We go on to the compilation of the matrix of all the 
CD-CD relationships for every pair of CCs. For each of 
these matrices various values have already been de-
termined for the CDj - CDj relationships where there 
exist direct trunk-groups and some column partial to-
taIs where there exist CCj → CDj trunk-groups (from 
stage 1) and all the row totals and the matrix totals 
(from stage 2a).

Going back again to the coefficient of interest applied 
to the row total – freed from traffic of the direct trunk-
groups - the matrix is completed.

Therefore, a control is carried out on the values ob-
tained, verifying if the partial sum of the columns 
equal to the traffic which in the first choice is offered 
to the trunk-group CCj → CDj - coincides with the 
partial totals eventually imposed (from stage 1) when 
this trunk-group exists; if not, various adjustment cy-
cles are carried out modifying the values obtained from 
distribution, with the exception of the values of the 
existing direct CDj → CDj trunk-groups and those which 
are on rows for which the trunk-group CDj → CCj ex-
ists. This is equivalent to giving more confidence to 
the data obtained from Erlangmetric measurement on 
eexisting trunk-groups, in respect to those obtained with 
the help of the coefficients of interest.

2c) At this point the matrix at time t is obtained. 
In order to effect the forecasts, nevertheless, one does 
not work distinctly on all the elements in the matrix, 
a large number of these is represented by low traffic 
values, affected by a very low statistical reliability. 
For example, for the toll traffic controlled by the SIP, 
in 51,798 point-to-point (CD - CD) relationships only 
5,130 are at least of 1 Erlang, 787 are at least of 10 
Erlang, 343 are at least of 20 Erlang, 65 are at least 
of 50 Erlang and only 23 are at least of 100 Erlang.

For these reasons the traffic forecasts are effected by 
extrapolating a limited number of historical series of 
data which answer to the double requirement of having 
a reliability statistically valid and not being attached to 
the existing structure of the network. In this regard,
from each of the matrices obtained at the termination 
of stage 2b) are extracted those which we call conven-
tional "main traffic data" represented by the values 
corresponding to:
- existing direct trunk-groups CDj → CDj
- all the row totals (from CD to CC)
- all the column totals (from CC to CD)
- total matrix

These values are permanently stored to contribute to 
add and up-date the corresponding historical series.

Stage 3) Now commences the processing phase, which 
works on the historical series of the above mentioned 
main data, in order to obtain the corresponding fore-
casting data on the desired time. The historical series 
can be comprised of one of more values per year and 
must have the same number of data for each year. 
The present procedure is used, essentially for short and 
medium term (2-5 years) forecasting and therefore it 
is considered sufficient to limit the storage of the his-
torical series to the data of the last five years.

Various forecasting models are used, all able to extra-
polate apart from the trend also the periodical compo-
ments of the historical series (seasonal factors) choosing 
the most adapted to the circumstances.

It is considered that it is not necessary, at this stage, 
to initiate a discussion of the forecasting models, as 
this subject occupies in its own right an important place 
in international literature and the use of a particular 
interpolating curve instead of another does not condition 
in the slightest the processing procedure described 
herein.

Stage 4) Whatever the method adopted for the extrapola-
tion of the historical series of the main traffic data, it 
is necessary that in the construction of the forecasting 
data priority is given to the historical series of the great-
est weight. The results obtained for such series are 
then analysed critically, carrying out then, if necessary, 
corrections in order to take into account eventual exter-
nal discontinuity factors.

Successively, one can go on to the extrapolation of the 
remaining historical series, the forecasting results of 
which must be in agreement with the first ones, even 
though respecting, within certain limits the character-
istic course relating to the single traffic streams.

The criterium shown, nears the principle that at equal 
statistical affidability, more relevant confidence interval 
for the small traffic aliquots can take place.

In our case, it came about in the following manner:
a) firstly, the forecasting data relative only to the totals 
in the CC-CC matrix is obtained, determining the corre-
sponding increment rate for the considered interval 
\( \Delta t \).
b) In relation to the absolute value of the traffic offered 
to the other historical series, referring to the same ma-
trix of which at point a) the increment rate has been 
fixed, a confidence interval is established within which 
the increment rates which will be determined in the 
extrapolation of this series are considered acceptable, 
bringing than to the closest confidence limit the eventual 
data differing (not motivated by the factors of an exter-
nal origin).
c) At the conclusion of this calculation on the base of 
the row and column totals, and on the values of the 
relationships served by direct trunk-groups, a matrix 
total is recalculated and a correction coefficient is 
applied to the partial values obtained, in order to bring 
this total to the value fixed beforehand.

Stage 5) Specified, in this way, the main traffic data at 
time \( t + \Delta t \), one goes on to the compilation of the com-
plete forecasting matrix. The completion of the matrix 
is that of the most probable distribu-
tion in which:

\[
A(i,j) = \frac{R(i) \cdot C(j)}{M}
\]
where \( R(i) \) is the row total, \( C(j) \) is the column total and \( M \) the matrix total, previously freed from the values \( C_D - C_D_j \) already obtained by extrapolation of historical series corresponding to the existing trunk-groups.

**OUTLINING SCHEME OF COMPUTING PROGRAMME FOR THE RESEARCH OF THE TRAFFIC OFFERED IN THE FIRST CHOICE TO THE TRUNK-GROUPS OF THE TOLL NETWORK**

**START**

READ NUMBER \( P \) OF THE \( C_D \) OF THE ORIGINATING CC

ADVANCEMENT INDEX \( N_C + 1 \)

READ NUMBER \( Q \) OF THE \( C_D \) OF THE TERMINATING CC

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE FINAL TRUNK-GROUP \( C_D_i - C_D_q \)

\( N_C = N_C + 1 \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE FINAL TRUNK-GROUP \( C_D_i + C_D_q \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_r - C_D_h \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_y - C_D_l \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_o - C_D_v \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_r - C_D_h \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_y - C_D_l \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_o - C_D_v \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_r - C_D_h \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_y - C_D_l \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_o - C_D_v \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_r - C_D_h \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_y - C_D_l \)

DETERMINE AND MEMORIZE THE TRAFFIC OFFERED TO THE TRUNK-GROUP \( C_D_o - C_D_v \)

IN RELATION TO THE GEOGRAPHICAL POSITION OF THE ORIGINATING \( C_D_i \) AND TERMINATING \( C_D_q \) IN TELSTATION, THE OVERFLOWING TRAFFIC OF \( C_D_i + C_D_q \) AND \( C_D_i - C_D_q \)

PREPARE THE OVERFLOW DATA FOR THE TRUNK-GROUPS OF SUBSEQUENT CHOICE

PRINT - OUTF

CHANGE THE ORIGINATING CC

GO BACK TO START

Fig. 4
OUTLINING SCHEME OF THE PROGRAMME FOR COMPILATION OF THE TRAFFIC MATRIX

Fig. 5