# AN AUTOMATED MAP PRODUCTION SYSTEM FOR THE ITALIAN STATE OWNED TELEPHONE COMPANY

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## ABSTRACT

The Italian state-owned telephone company-SIP- decided one year ago to start a project to automatize the production of its cartographic documentation, including networks, schematic maps and inventories.

The scope of the project was to automatize the production of their maps and to create a data base for easy up-dating. At the present time, SIP has to deal with a very large amount of drawings, which need continuos updating.

Labour and costs for updating maps is constantly increasing thus SIP has decided to test the Kongsberg System. They have evaluated time savings and total benefits and hence purchased a complete system for Rome, including one automatic digitizer and an interactive graphic system. The result of the project after a test period of six months is that the ratio between manual and traditional method of map production and the computer assisted method is 5:1.

In addition to that, SIP has at its disposal an easy and flexible data base for updating their work.

It is interesting to point out that SIP was the first European telephone Company to start production of a computer assisted process for its utility maps.

## INTRODUCTION

SIP-Italian Telephone Company, has decided to start with the process of automatization of the representative documentation of its telephone network.

For this reason they have organized a task-force of experts that have defined the specifications for the automatic drawing and for numeration of the telephone networks.

This paper is intended as a reference manual by which it is possible to set up the creation of the digital file.

After more than six months of work on the system, and having set up user oriented procedures and the other programs needed to satisfy specific requirements, the General Direction of SIP has decided to start the operative phase, providing a system not only for the Rome's office but also for Milan and Neaples.

SIP foresees to have the system operational by September'82.

## SIP AND ITS CARTOGRAPHY

The cartographic documentation of the telephone network on which the system has been used, consists of:

- Planimetry map of the principal network of distribution and junction. This map, in scale 1:2000 or 1:1000 relates to the distribution network between the exchanger and the departements as well as the junction cables

- Planimetry map of the principal network
  At the same scale and same size as the map mentioned above. This map relates to the part of network distribution and network terminals

- Schematic map of pipe-lines sections
  This map relates schematically, to the characteristics of the work, the size and position of the cables installed

- Schematic map of the exchanger
  This map shows, for every station, the correspondence between the position of the going-out cables at the exchanger and at the opposite terminals

- Schematic map of the shared-lines cabinet
  With format A4, the map shows, for every cabinet, the corrispondence between the coming-in cables and their position in the exchanger. It visualizes the details of the junctions in the cabinet. Also included is a list of the distances between elements of the network

The maps referring to the first and second point are represented on the cartographic planimetric basis. These maps are up to date and in very good conditions presenting only the geometrical elements strictly necessary, hence making a good base for a digital data base structured in levels.

## WHY SIP HAS DECIDED FOR THE AUTOMATIZATION?

The reasons that have induced the Company to start using the automatized systems, can be evaluated in terms of better efficiency during the course of the activities, and particulary with:

- Reduction of the on-call repair times due to cables damages, being able to intervene always with updated cartography

- The easy control of the inventory of the laid network for the certification of the reports of the contractor

- More precise determination of the network inventory

As far as the updating work and the production of the maps is concerned, the objectives of the company can be synthe-

tize as follows:

- better operational simplicity

- less production time

## DESCRIPTION OF THE OPERATIVE PROCEDURES

The operative procedure used by SIP is articulated, essentialy in the followings points:

- Acquisition of basic planimetries:
  a- the original map is read automatically with a scanner (Kartoscan)

  b- The scanned data is converted by a program into a vector form. The result is a digital representation of the original map. Fig. 1

- Acquisition and updating of telephone maps, schematic maps and selected data
  a- the maps are digitized manually into the system
  Fig. 2 - Fig. 3

The configuration of the system allows the symultaneous activity of multiple work stations, each consisting of one graphic screen for visualization and one digitizing table for coordinate surveying of the significative points on a draft (vertices, circles centers, etc.).

For the interactive work several tools can be used: lightpen, trackball, functional and alphanumeric keys, allowing easy access to macro-interactive functions, supplied with the basic system.

- Automatic drawing on the precision drafting table
  The drawing is carried out automatically on a precision drafting table, controlled directly from the computer.
  The drafting table is equipped with a head holding several interchangable pens, these can be ball-pen or ink type, with possibility of several colours and thiknesses.
  The speed of the table can be adjusted, depending on the type of ink used, until a maximum of 1 meter per second.

- The major functions of the interactive application software are:
  a- structuring of all elements in a multilevel data structure (planimetry, principal network, terminal network, etc.). These elements are graphically defined via their essential contents (coordinates, symbols, algorithms) which can be logically connected together.

  b- organization and merging of files is obtained via the automatic reading system (SIP uses this method only for the basis planimetry acquisition)

c- powerful interactive editing of all elements

## OPERATIVE RESULTS

As mentioned before, SIP aimed from the operative point of view,to achieve the best operative simplicity and the quickest production. Concerning production SIP has undertaken a time study of the activities related to traditional and automatic methods.

Obviously the ratio between the two times varies depending on the kind of documentation produced. The weithed mean has given the result of 1:5 (time for automatic drafting/time for manual drafting).

To produce all necessary maps related to a certain area of Roma, SIP found that it took 300 men hours using the computerized system, against 1500 men hours needed by the traditional manual method.

## BENEFITS EXPECTED BY SIP FROM AUTOMATIZATION

To evaluate the return of the investment necessary for the realization of the centers for urban networks, we can refer to:

a- the quality of the product supplied by the system

b- the benefits that such kind of product may have on some operative activities

c- the costs for the automatized solution compared to the traditional one (1)

While the benefits deriving form a- and b- are hardly evaluable in terms of money, on the other hand point c- shows clearly that a return can be realized, not only in general terms of efficiency but also in terms of money.

As regards the quality of the product, the main aspects are:

- the flexibility of the digital data organization (graphical and numerical) that allows the absolute indipendence from the different scales, also permitting a more flexible approach to the maps structured with appropriate levels.

- better legibility of the cartography, compared with the one manually produced and a better approach to the standardization of the drawings.

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(1) The comparison with the traditional solution has been done only as a theoretical example. The traditional method has never given, in spite of all efforts made during past years,the desired efficiency.

- the absolute corrispondence of the inventories and of the indexes of the data shown on the maps

Other benefits derived from the availability of an up to date cartography, can be found in the following activities:

- planning: immediate availability of the real situation of the laid networks

- maintenance: increased rapidity and certainty for on-call repairs

- management of the potential users: exact location of the network terminals

Also we can foresee the possibility of utilizing the information provided by the system as input for management procedures relating to finantial problems.

At last, with regard to balance of costs versus benefits derived from the introduction of the system, we think it may be useful to give some evaluations on the amount of labour involved in updating cartography with system compared with the traditional one.

The evaluation has been carried out assuming both procedures to be fully operational.

Times involved were taken at the "Agency of Rome", during a test period of 4 months.

During this period of time several samples have been taken leading to a result of 1:5 ratio between automatized and manual method.

It was osserved that a draftsman manually updates a map at roughly 0.04 Kmcable per hour which gives us an extimate of 70 Kmcable per year.

As in one year SIP implements networks for about 30,000 Km cable, the draftsmen necessary for the updating work is approximatly 450.

On the other hand using the system, the number of draftsmen required is approximatly 90 persons, hence savings about 360 persons. At the cost of ₰ 19,000/year per draftsman, SIP may save as much as 360 x 19 = ₰ 6,84 million/year.

The equipment for CAD with 90 working stations needs as investment approximatly of 115,000 x 90 = ₰ 10,5 million to which corresponds, with depreciation allowance of 10 year and interest rate of the 22,5% an yearly cost of about ₰ 2,7 million to which we have to add 0,83 million for maintenance; the total result is ₰ 3,53 million. Therefore, using the system, SIP should get savings for ₰ 3,31 million per year.

Finally we must consider that it had never possible for SIP to dedicate the right amount of resources in updating maps;

the consequence is that today there is a large amount of backlog maps.

Today, we have strong reasons to think that SIP could reach its objectives of exact and precise updating of the maps of its network at fully operational conditions.

Fig.1

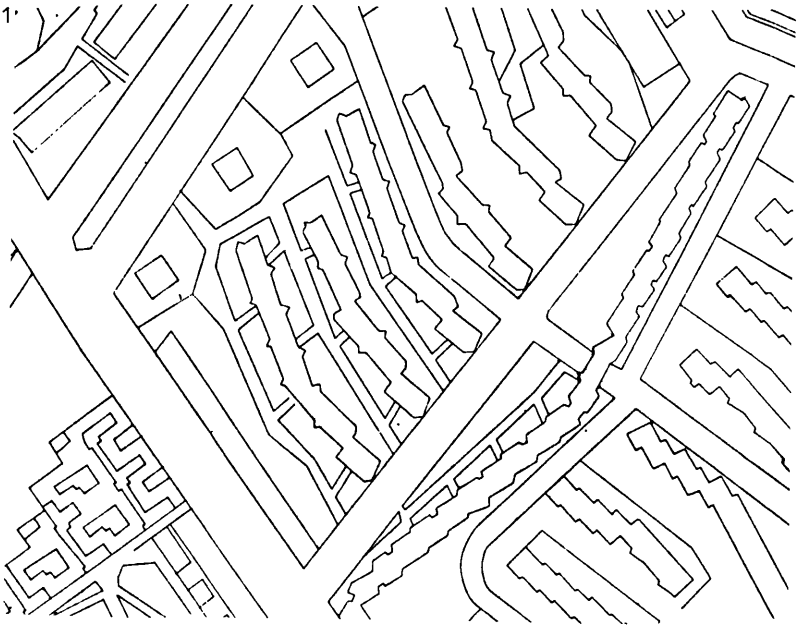

Fig.2

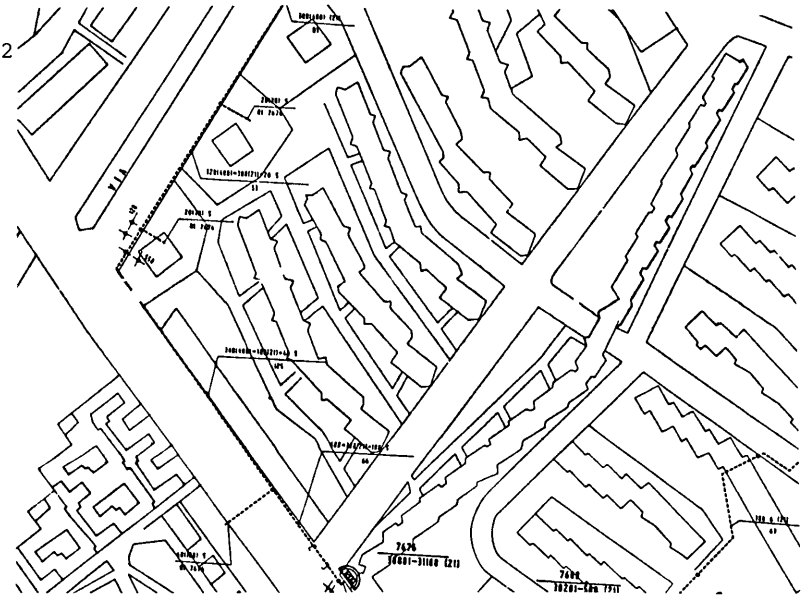

Fig.3