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AUTOMATION IN DEVELOPING TECHNICAL DOCUMENTATION OF TELECOMMUNICATION NETWORKS

ABSTRACT

During the last decade of the 20th century, intensive development of telecommunication infrastructure set high requirements regarding technical documentation that started to have problems in following the changes in the network. In the last several years HT made a great shift regarding automation and presentation of technical documentation, that is introduction of GIS (Geographic Information System), as precondition for the introduction of DIS (Documentation Information System), thus realising the necessary preconditions to use the gathered and organised spatial and attribute data, for higher quality of analysis, processing and repair of interference in the telecommunication network. The aim of this paper is to inform about the segments and computer programs used for the development of technical documentation.

KEY WORDS

technical documentation, AutoCAD, DIS – Documentation Information System

1. INTRODUCTION

The developed and advanced telecommunication infrastructure is the precondition for the overall social and economic development of any modern country. Reaching this goal is a responsible and difficult task that can be realised only through a long-term process of continuous development of the telecommunication network and high investments into their development.

Croatia today has one of the most developed and advanced telecommunication networks in Europe. The main optic cables have been laid throughout the country, and the networks in all the capital cities have been greatly reconstructed. Such intensive development of telecommunication infrastructure represented a great problem and a new challenge to the technical documentation personnel, which could not follow such fast changes in the network, so that it was necessary to start developing the technical documentation using computers.

The program tools within HT were unified, such as AutoCAD, the symbols used in drawings were defined, as well as the use of GIS tools and WWW technologies. This reduced significantly the time needed for the development and modification of documentation rendering it more updated and of higher quality.

An important requirement in building the system is also the reliability of the system against unauthorised usage of data. The basis for a security system is the NT server which performs all the activities regarding authorisation of access. A total of four levels of data protection have been introduced allowing for almost 100% reliability against unauthorised access by unknown persons.

1. every PC is protected by the password at the start,
2. system can be accessed only by the stations that have authorised IP addresses on the server,
3. every user has their Intranet access password,
4. sites containing confidential data are additionally protected by a password.

In the majority of cases the first three levels are used, and the fourth one only in exceptional cases in order to simplify user's work and handling.

2. BASIC CHARACTERISTICS OF TECHNICAL DOCUMENTATION

The technical documentation is written in two interconnected parts, and by further processing they are combined into a single unit which results in the final

form of the technical documentation. These two parts are:

- technical part,
- geodetic part.

2.1. Technical part

- Collecting data;
- Processing of data;
- Writing of technical documentation.

The technical part consists of collecting the data from the field that are subsequently sorted and processed into an adaptable form out of which some parts are combined with the geodetic part, and together they form the final technical documentation of a certain cable route i. e. of a certain exchange. The processing as well as the data presentation are performed in the computer programs Word and AutoCAD which allow easier keeping of records, input and printing of certain documents.

The Word 2000 program is used to show all the data necessary for everyday use of technical documentation in the spreadsheet form, with all the data listed accurately and in detail and described emphasising the cable route in question. In order to fill in the necessary data, default forms – "templates" are used, and they contain certain data for certain required information such as: length, type of cable, type of cable terminals, capacities and locations of certain wire pairs, etc. All these templates are separate, but they are interconnected and the aim is to acquire the necessary information as fast and as easy as possible. In this case the necessary data refer to the telecommunication cable routes.

For the maintenance requirements of cable networks and cable transmission systems, the technical documentation of the newly constructed systems must be developed very fast.

The technical documentation service personnel fill the obtained or recorded situations of telecommunication networks and intercity TC cables with graphical and data elements that precisely describe the structure and details of the system.

The personnel also participate in the activities of recording the realised condition of the position of cable routes, shafts, pipes, extensions, etc.

2.2. Geodetic part

- Collecting data;
- Processing of data;
- Writing of technical documentation.

The geodetic part is performed by geodetic groups, and it consists of gathering data in the field by geodetic recording and subsequent computer processing in the office.

Prior to geodetic recording it is necessary to carry out the preparation activities:

1. gathering of the existing geodetic maps,
2. gathering of coordinates of the existing trigonometric points (points known for coordinates x and y) and levelling points (points known for the coordinate z),
3. gathering of data about the realised TC capacities.

After having collected the necessary data, the polygon network is developed from which the detailed recording of the terrain is to be carried out.

The recording of the terrain is related to the existing geodetic points, and refers to the collecting of the measuring data necessary for horizontal and vertical presentation of the terrain with the names and characteristics of the terrain.

The zone of the terrain along the TC cable route is recorded by the polar method with polygon points. The recording is done by means of autoreduction tachometers or total measuring stations. The relative polar coordinates of single target points are determined in relation to the location of the instruments, and these are:

1. horizontal angle measured from the direction to the known point,
2. horizontal length between the target and ground zero,
3. altitude difference between the target and ground zero.

In order to present accurately the condition on the terrain, the measuring outline is kept, and all the details that need to be presented in the geodetic map are entered into it manually by means of cartographic symbols.

The outline drawings are formed as required, depending on the location and development of the TC network, also including the names of places, streets, house numbers.

All the characteristic and crucial points on the TC cable route are recorded, as well as the shaft positions, connectors, cable terminal cabinets, details regarding crossings of traffic routes and waterways.

The data are saved in the instrument memory in files of textual format.

The data are subsequently transferred in the office from the measuring instrument into the computer and they are converted into the form suitable for drawing in the AutoCAD program (DWG file).

The detailed plans in the scale of 1:1000 are then drawn in AutoCAD from these data and using the outline drawings of the terrain.

The drawings are supplemented by scanning and digitising of the existing geodetic plans. The obtained drawings are finally plotted by means of a plotter. Being developed is also GIS (Geographic Information

System), which is to combine the data in the form of a drawing and the telephone network database.

3. INFORMATION SOFTWARE USED IN DEVELOPING TECHNICAL DOCUMENTATION

The following program tools are used for the development of technical documentation (geodetic and telecommunication part).

1. GEOCALC or G8 – programs used for processing of the recorded geodetic points in the field.
2. AutoCAD – the most dominant program for developing technical documentation. After having processed the geodetic data in the GEOCALC, the files in DXF format are loaded into AutoCAD, and based on the sketch design of the terrain, a drawing is made, i. e. the physical position of the TC cable. AutoCAD is also used to make the connecting schemes that describe the telecommunication characteristics of TC cables and other elements of the technical documentation presented in the form of a drawing.
3. WORD or EXCEL – programs in which the alphanumeric data are processed and which produce spreadsheet presentation, vehicles inspection, graphical list, inventory list, final list.
4. CAD OVERLAY – program package for the vectorisation of the scanned cadastre plans.
5. AutoCAD Map – allows connecting of the physical data saved in the drawing and the attribute data saved in the external databases, as well as the work with geographic maps.

3.1. AutoCAD drawing and improvement of the automation in producing technical documentation

The exploitation aim of every telecom operator is to achieve the best quality analysis, processing and repair of interference in the telecommunication network. In the processing of the interferences, the key element that defines the efficiency of solving the problem is accurate and always available technical documentation of the TC network. This allows the teams in the field who are responsible for eliminating the interferences, to find the location and the cause of interference fast and then to eliminate it. Handling of documentation in paper form requires big and adequately equipped premises, whereas continuous exchange of documentation between the storage and staff in the field results in the fact that the frequently necessary documentation is not readily available which causes problems in the efficient operation of all the services. New method in developing the documentation using computers has resulted in the possibility of distributing the information in the original form, which means in AutoCAD drawings and the accompanying alpha-numeric data via computer networks and modem communication.

AutoCAD was created so that it makes possible certain interventions which could automate the activities and adapt AutoCAD to one's own needs.

AutoCAD enables the drawing to be divided into layers, so that certain objects of the TC network that are interconnected can be set on precisely determined layers. In this way the drawing can be organised according to proper needs, and the presentation and the colour of the drawing elements can be regulated on the display and the printer. AutoCAD allows harmonisation in real time in order to keep the data contained in the technical documentation seamlessly updated.

4. DIS DATABASE AND DIGITISATION OF CABLE TERMINALS

Technical documentation provides the service to the majority of departments by combining the information into a unique system for tracking the condition in the telecommunication network.

It was therefore necessary to develop a central database. The project DIS (Documentation Information System) has been developed, based on the Xpercom system of the US company Granite Systems, which is today the leading manufacturer of the network resources management systems. DIS – system, i. e. its key component Xpercom, is a multi-layer application based on the J2EE platform specified by Sun Microsystems.

The comparative analysis results in the conclusion that DIS includes many more data about the network than with the still existing TIS base (Telecommunication Information System). TIS is represented by the alphanumeric data about the respective switch, number of free pairs, number of occupied pairs, range of wire pairs, users and their addresses, whereas DIS is intended for the documentation of all the necessary data in the network and their connection with the GIS data.

DIS contains data of the access networks, commutation nodes capacities and their types, as well as data about the transmission equipment, and for the first time it includes the crossconnectors AXE and RSS.

For DIS to be accessible, flexible, and manageable, it has to meet the three crucial requirements:

1. it has to be web-based,
2. it has to have simple user interface,
3. it has to have open architecture.

Web-based application is designed so that it uses exclusively the Microsoft Internet Explorer. Such application is of no great problem in the training of the users, and the interface is mainly adapted for simple performance of complex enquiries which as a result can provide graphically whole parts of networks or sets of data that refer to a network element. DIS is visually and hierarchically organised so that navigation and use are maximally simplified.

In order to fill in the database it is necessary to gather all the data about individual telecommunication network documents, either their data about physical location or TIS data. For the area of the former TCC Split this means data for over 20,000 cable terminals. During digitisation of cable terminals it is desirable to use geodetic recordings of the cable routes (if they exist). The distribution of cable terminals in space or digitisation of cable terminals are carried out in AutoCAD by means of blocks. There are several types of blocks so that there is one block for every type of template. If there are no geodetic recordings of the cable routes a cable terminal can be inserted if its address is known, which is not desirable since it does not provide completely accurate data of the cable terminal coordinates.

Since there are still geodetic maps of certain sections of telecommunication routes which have not been updated, then it is possible to use ortophoto recordings of those regions. Subsequently the digitised templates are transferred into the Infoweb base. In Infoweb the templates are combined with the data from TIS and now they contain also other useful data: the respective switch, number of free wire pairs, number of occupied wire pairs, range of wire pairs, etc.

The processed data about the cable terminals are presented in Gisportal, closing the circle of digitisation, processing and presenting of data about the cable terminals. It is important to emphasise that thus processed data are presented on the Gisportal directly from the base which ensures that the data are updated.

DIS needs to be accessible anywhere and any time which represents significant assistance to services that detect and eliminate interferences every day.

The most important exploitation features of DIS application represent simply:

1. maintenance,
2. planning,
3. management and control of telecommunication network.

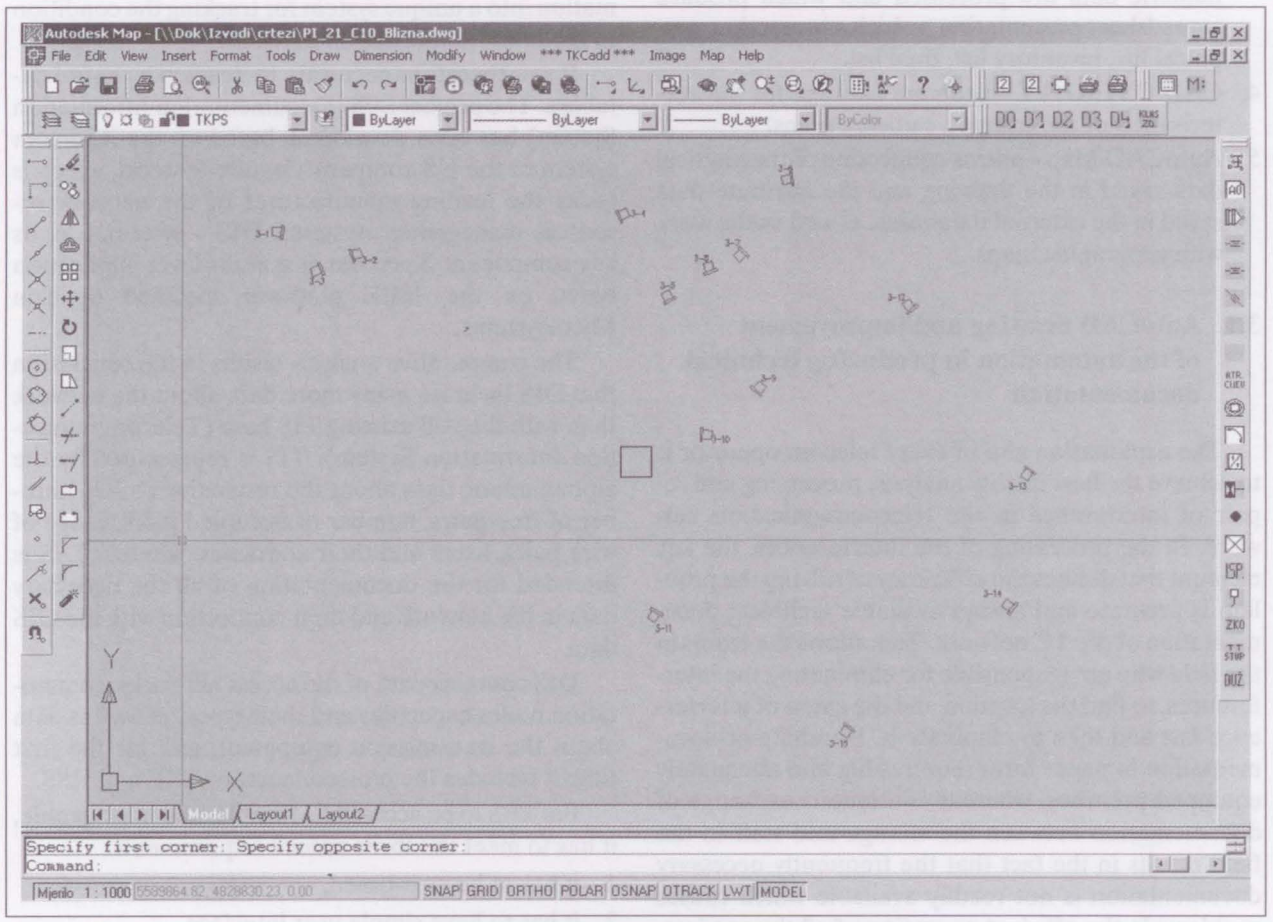

Figure 1 – Digitised cable terminals in AutoCAD

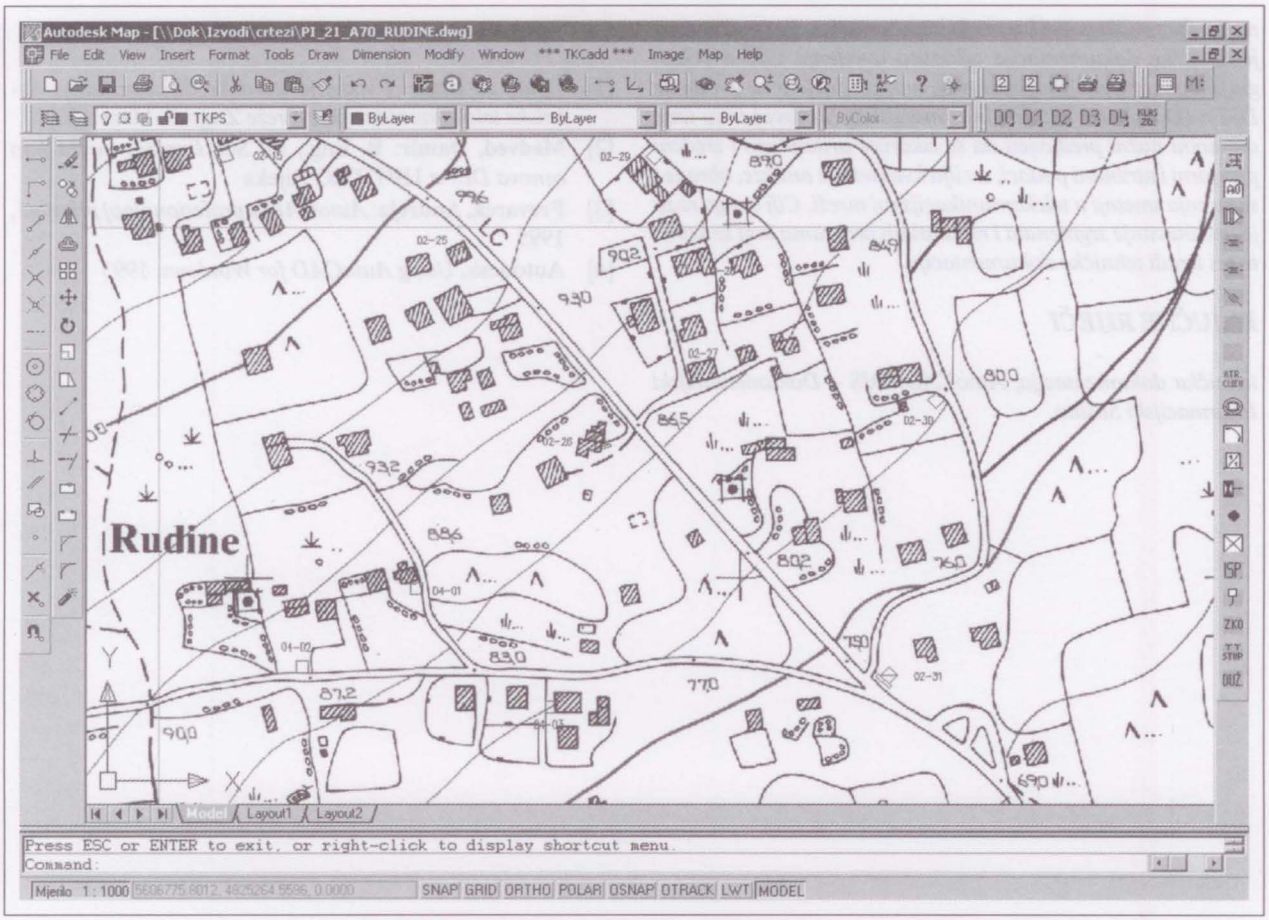

Figure 2 – Digitised cable terminals of Split RSS Rudine

5. CONCLUSION

In the public telecommunication network of the Republic of Croatia, the fixed telephone network is today still its backbone and the most widespread part whose development in the past years best represents the development and the achieved level of development of our telecommunications.

The technical documentation represents the basis of maintenance, planning, control and management of the fixed telecommunication networks. Interference in telecommunications is a constant problem in maintaining the TC network and it directly affects its availability. As every interference has also direct economic consequences (repair costs, lost traffic, etc.) their timely elimination, that is, prevention and repair of the causing factors are of special significance. Obviously, the crucial element in the process of treating the interference and the element which defines the efficiency of its solution is the accurate and always available technical documentation of the TC network. Without a well developed and updated technical documentation, no fast identification of the location and of the causes of interference are possible, neither is this the case with its subsequent elimination.

The development of information technology, new fast networks and the user-friendlier interfaces have enabled a much faster development of technical documentation which is capable today of following the intense development of telecommunication systems and of providing applicable solutions which are to be actually used in exploitation.

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SAŽETAK

AUTOMATIZACIJA IZRADE TEHNIČKE DOKUMENTACIJE TELEKOMUNIKACIJSKIH MREŽA

U posljednjem desetljeću XX. stoljeća intenzivan razvoj telekomunikacijske infrastrukture postavio je velike zahtjeve prema tehničkoj dokumentaciji, koja je sve teže mogla pratiti promjene u mreži. U posljednjih je nekoliko godina u HT-u

napravljen veliki pomak u pogledu automatizacije i prezentacije tehničke dokumentacije odnosno uvođenja GIS-a (Geografskog informacijskog sustava), kao preduvjeta za uvođenje DIS-a (Dokumentacijskog Informacijskog Sustava) te su time ostvareni nužni preduvjeti da se iskoriste prikupljeni i sređeni prostorni i atributni podaci, u cilju kvalitetnije analize, obrade i saniranja smetnji u telekomunikacijskoj mreži. Cilj ovoga rada je upoznavanje segmenata i računalnih programa koji se koriste pri izradi tehničke dokumentacije.

KLJUČNE RIJEČI

tehnička dokumentacija, AutoCAD, DIS – Dokumentacijski Informacijski Sustav

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