Combination of Various Digital Data to Establish a Land Information System

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Abstract

The connection of digital data from analytical plotters,digitizers and geodetic instruments with an interactive graphics workstation to establish a Land Information System is shown.By example of the project Neustadt,the effective usage of the different components is described.

1.Introduction

All data we use for a Land Information System are stored to-day on different mediums,mostly on maps.Some of the desireable data is not yet available from either maps or data-banks.Thus we have the situation,that the data input for the establishment of a complex Land Information System -here the project Neustadt-needs all tools of modern digital data acquisition.In our case ,we use analytical plotters,digitizers and electronic surveying instruments with memory unit.The various digital data is supervised and combined in an interactive graphics system to a Land Information System(LIS).

2.Data Acquisition for a Land Information System,the project Neustadt

For the project Neustadt we have cadastral maps as base of the LIS and the bundle block adjustment of aerial photographs for the geometric accuracy.(see Leonhardt et al.;Stampa-Weßel).Cadastral maps,utility-system maps are digitized with the Kern GSD-2 digitizing table,visible information (see Stampa-Weßel)from photographs are measured with the analytical plotter Kern DSR-1.Some data are measured with the terrestrial surveys with the electronic theodolite Kern E1 with distancemeter DM 502 and recording unit R48,they are calculated by the program systems GEO 100,KOGO provided by Kern. The data acquisition with the digitizer and the analytical plotter is done with the MAPS 200 program.The digitizer works also on-line to the interactive graphical screen IMLAC with the program MAPS 300.
All recorded data is revised on the interactive graphical workstation, Kern MAPS 300.

3.Description of the utilized Interactive Graphics Station

All supervision,revision and combination of the differrent data files-produced either with the analytical plotter,the digitizer or geodetic measurements-is done on the interactive graphics station MAPS 300.

The hardware components are - a PDP 11/23 computer of the Digital Equipment Corporation(DEC),it has a RT-11 operating system and 256 Kbyte memory; programs and data are stored on a 20 Mbyte Winchester disk,for data transfer a floppy disk unit is used;
- a graphics display,a 19 inch diagonal IMLAC screen,with 2048 x 2048 screen addressable points,92 key key-board light pen;bit-sliced display processor,8086 central terminal processor,64(optional 192)k bytes of RAM,64k bytes EPROM.

The MAPS 300 program is a program for editing graphical data in a data base. The system is menu driven and supports 999 layers(levels),so that the user can divide easily data into logical groups,which is very useful when editing a large data-base or to work with only part of the entire data. The layers can be switched on and off as required for editing. The software provides routines for :

- creating files
- combining of files or layers
- displaying single layers
- editing points,lines,attributes
- place alphanumeric annotation
- making lines and features parallel
- squaring buildings
- cross-hatching of polygons
- window zoom for fine editing.

The program is able to read all data which is complying with the international accepted Graphics Kernel Standard(GKS).The data from the MAPS 200 created files is converted to the MAPS 300 format.The entire interactive graphics system is ,because of the menu driven programs,user-friendly and easy to handle .(see also Klaver).

4.Combination of Data with MAPS 300 - System

First the files with the recorded data from data acquisition are separately displayed on the interactive graphical screen for supervision.The data from the DSR-1 are classified and assigned to the related levels,as normally it is not possible to assign all data to the correct level during measurements(see Stampa-Weßel).Digitizer data is reviewed to completeness,logical correlation of lines and symbols.After this supervision files of different origin are combined in the system.We use the DSR-1 data as base data and superimpose the utility data files.So the differences between the photogrammetric-measured data,which has a high accuracy and is based on the cadastral survey points,and the information from the utility maps can be seen.Now it is possible to measure the position of the point in both files and then to decide either to move the point in the utility file to the correct position as shown by the photogrammetric measurements or to improve it by check field survey.If we still have terrestrial surveys (coordinated points)we load these measurements into the system and adjust the data to these values.For all these operations it is useful that the program provides the possibility to load selected levels,edit data from these levels and then work with other data on different levels.

The program gives the ability to see parts of the data closer ,whenever desired,by the window zoom function.The window can also be moved , and therefore it is possible to edit a part of a file in sections,e.g.with the length of one parcel or house if editing a road.After adjusting of all data to the accurate ground coordinate system the data is revised to verify connection of lines,positions of the different utilities to each other, and correct distribution to the levels.
After final editing the data is stored in the data base.We have the different utilities,the cadastral information and other information on different files for more flexibility.If we want a combination of data for special requirements,we create a new file with the system(combination of files or layers) and we can plot this file,if wanted.In this step we are able to remove or add data to the original files,that can be,for instance,some topographic data to an utility map data which is combined with border lines and houses.Thus we have full flexibility to the content of an output,which will be in most cases a plot.

5.Presentation of Samples

The following pictures(Fig.1 - 6) should give an idea about the steps from data acquisition towards a complete content of the data base for the Land Information System.All pictures were taken from the screen,at the bottom you can see the menu as it is shown on Input Mode.Also the cursor is to be seen in all pictures.An explanation of the signs is given in Fig.6 .

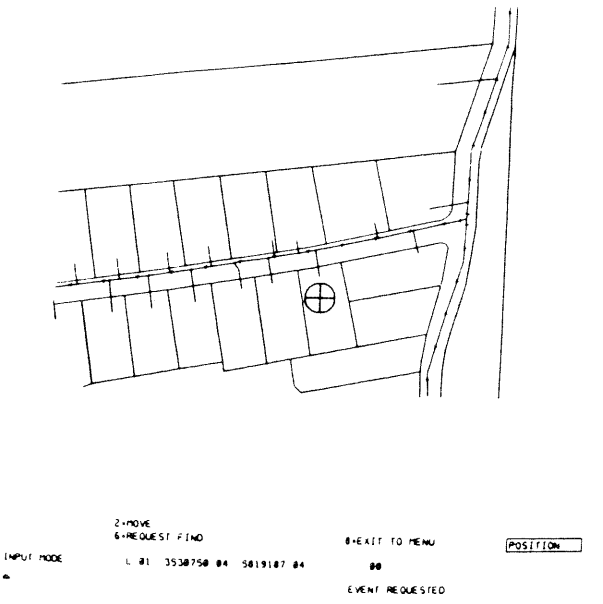

Fig.1
Digitized data of water-utility system,unrevised.

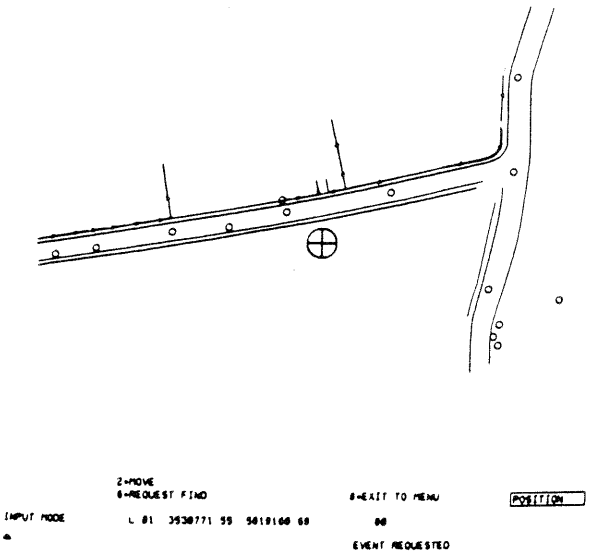

Fig.2

Original data measured with the analytical plotter,Kern DSR-1
Content:topography,streets,manholes of the sewerage-systems.

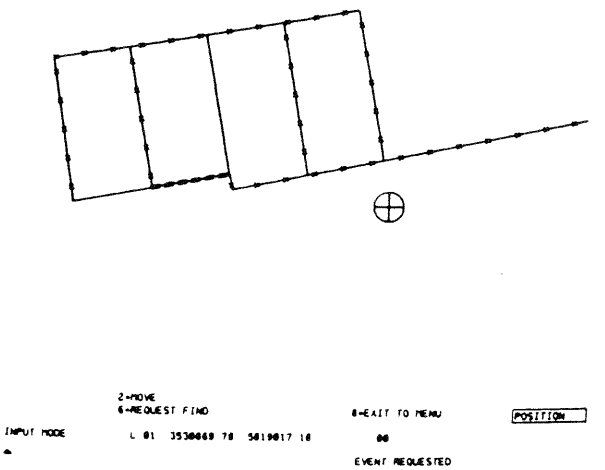

Fig.3

Coordinated points,terrestrial surveys - direct input

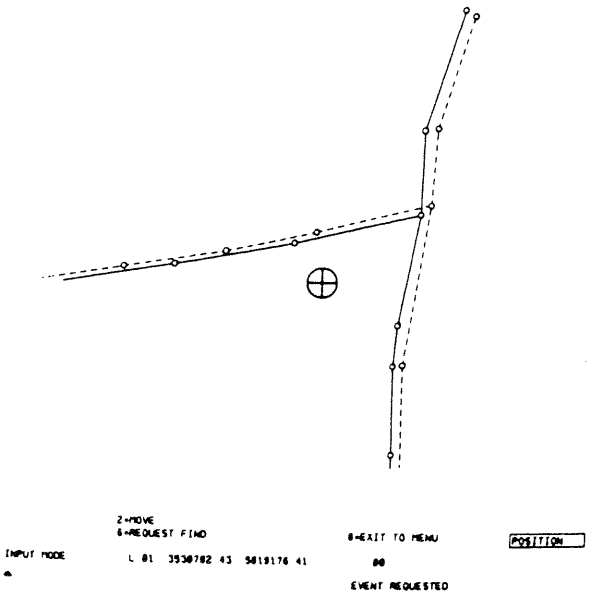

Fig.4

Revised utility data;sewerage system with manholes.

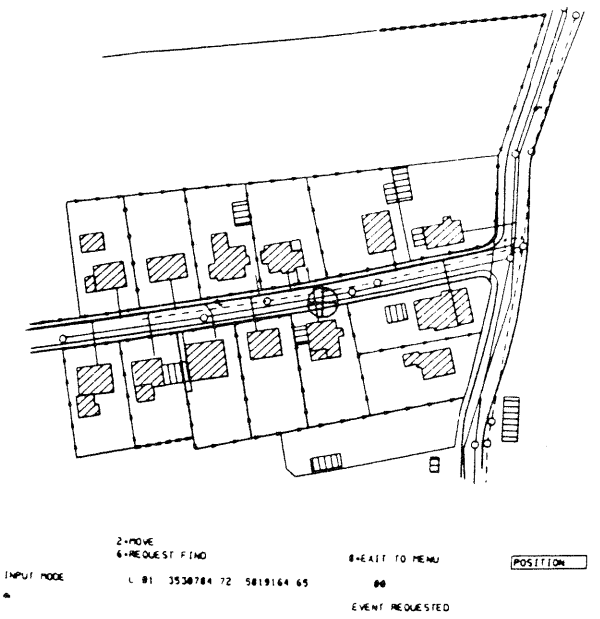

Fig.5

Revised data combination;cadastral,topographic,utilities(water and sewerage) information

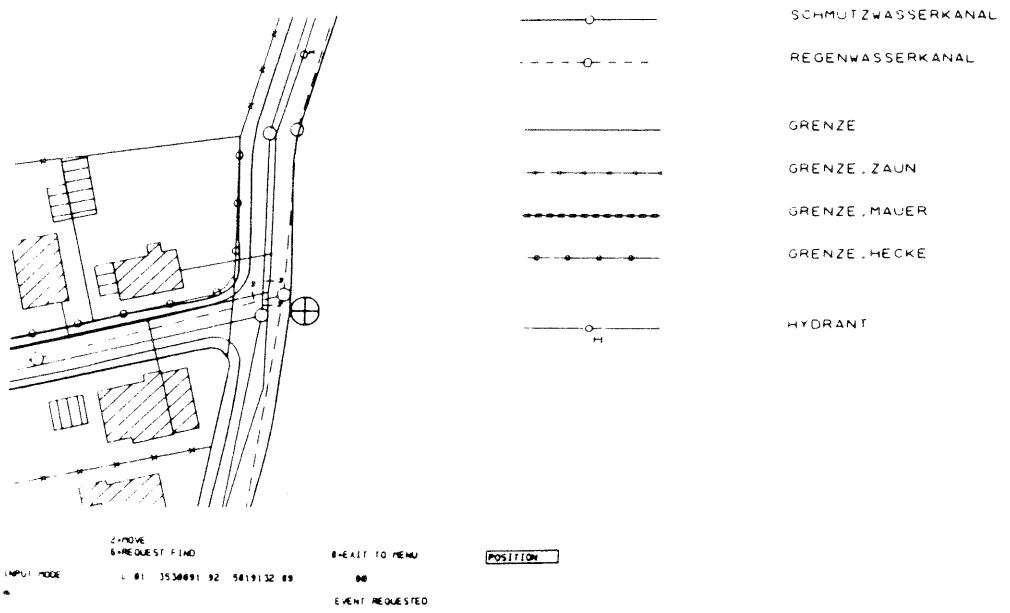

Fig.6

Enlarged section of Fig.5 with explanation of signs.

These data can also be drawn on a plotting table,e.g.Kern GP-1,with different colours for the utilities,which increase the resolution of the drawing(for an example see Leonhardt et al.)

6.Conclusion

Digital data of various origin can be revised and adjusted to one reference system with an interactive graphics system.The total free combination of data from a data-bank is possible with the Kern MAPS 300 system,so that the user defines the content of maps as an output at the time he needs it. The system is capable to perform the work for the establishment of a Land Information System,with the oppotunity to transfer the GKS-compatible data to any industry standard data base management system.

References

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