

## NUMERICAL MAPPING

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### ABSTRACT

Using computer to make maps and map data, it has become to put a lot of additional values. However it is not economical to make maps and map data by computer management, and needs 1.5 times to 2 times of expense than ordinary mapping when numerical map compilation is done completely using computer function at present, as the result the productivity has decreased.

That is to say manufacture technology of maps and map data have completed, but practical technology is still on the way. Thereat we reconstructed working process to improve efficiently manufacture technology.

key words: Mapping, AM, Cartgraphic

### 1 INTRODUCTION

In 1987, we made Tuchiura Urban Planning Map (1/2,500) by numerical mapping procedure in accordance with a draft for the standard of the digital mapping prepared by The Geographical Survey Institute of the Ministry of Construction JAPAN, and presented in ISPRS Kyoto. Since the numerical mapping is forecasted to increase rapidly, however it is still limited mainly on big cities' government actually because of economical problem, behind in to develop GIS to control numerical map data and so on.

The other side, at facility mapping field as electricity, gas, water service and others is being increased to make map data from existing maps, and then decreased value to make numerical map data by photogrammetric method.

However we continue to develop the numerical mapping method, because of we can not avoid the new technology and we think next renewal time of city planning maps owned each city governments will adopt the numerical mapping method. So there are many worths to use as digital map files are possible to use for facility map system, the map in future will be able to be made by continual revision of only changed regions because of data quality dose not come off unlikely map manuscripts, and so on.

As follow we report developed technology of numerical mapping after Tuchiura Urban Planning Map.

### 2 NUMERICAL PLOTTING

Numerical plotting demands to give layer numbers to elements and to acquire elements in duplicate to keep layer structure, and then volume of work decreased at numerical plotting as compared with ordinary plotting. Further more recently according to introducing analytical plotters and CAMSs with compilation function without plotting table that can do synchronously not some numerical compilation either digital data acquisition, as a

is desirable to produce from a digital map file directory only by batch processing, however the form of data dose not become the manuscript exactly since the manuscript demand beauty on sight. Furthermore there is a possibility to kill diagrams each other when duplicated elements on different layers are outputted. Therefore when manuscripts are made from digital map file, working processes are need as follow.

- 1) disguisement of contours or so in roads, houses and rivers
- 2) elimination of lines under texts
- 3) priority display of duplicated elements or rearrangement

It is not economical to compile numerical data only for a map manuscript separately from a digital data file, and there is possibility to get out of control when errors are found in original data. Therefore digital map files and manuscripts have encouraged to make directly from same working files.

## 5 CONTOUR

Contour lines have factor that dose not satisfy ordinary processing as line string, since contour have big number of coordinates, irregular factor by complex terrain future and artificial structures. As the result it is better to process contour at different flow. We examined three different method as follow.

Digital Mapping method : uses numerical data acquired by plotter

Map Digitize method : makes numerical data by scanner after manual compilation

Digital Terrain Model method : generates from spot heights DTM acquired

Following defects are found form each method.

DM method dose not have determined algorithm for batch processing, and it is difficult to compile huge coordinates conversationally on a display.

MD method demands to reinput contour heights.

DTM method can not use commonly since it is valid only natural terrain.

Basic thinking it is an ideal to compile numerical data acquired by plotting instruments, and some algorithm are tried. However one which is possible to use under settled condition became impossible by characteristic terrains and artificial structures, so that stable result could not get, totally unused is became their conclusion. Compare with this, it is possible to make numerical data stabile by MD method, and possible to give contour heights scanner data on batch process by giving same introducing heights.

## 6 CONCLUSION

Numerical plotting is better to determine only data acquisition at present. Also it is better legends which appear seldom are gave "else code", then give correct code on numerical compilation. And as last edge of house make by program automatically, house coded elements which acquires less than three coordinates are judged partition lines of the ridge, and so on, data acquisition have to reduce.

At numerical compilation, it is better to divide in small parts and makes those process simple, and develops as possible to unite skillful engineers and unskill labors.

result this has made volume of work more decreasing.

TABLE 1. approximately plotting volume per one day at 1/2500

ordinary	numerical with table	numerical with display
17	32	42

[hour/km<sup>2</sup>]

Plotting with layer adding makes working volume down widely is easily understood from this data. There is a limit to register legends in one registration menu sheet, all legends including which appear seldom are also registered on sheets that increased time to research. This is caused.

The reason that decreased working volume by numerical plotting with numerical compilation equipment is expected as follow.

- 1) time increasing to display data
- 2) displaying form lacked flexibility
- 3) time increasing to inspect data
- 4) increased possibility to destroy data on wrong operation and accident
- 5) data management
- 6) lack of suitable positioning for symbols and spot heights

Also avoiding of crossing between material features and between material and immaterial features were done synchronously, it is not efficient at totally conclusion too. Because of working concentration is being made low, and more complex operation of compilation have to use.

### 3 NUMERICAL COMPILATION

We had thought making digital map files are how numerical compilation would be changed to batch process at the beginning to start of numerical mapping technology developing. So that we obtained some result, but it is so far to automated mapping, and manual compilation is claimed at every turn.

Also we thought it would be possible to compile by unskilled labors, so that the computer assists sufficiently those labors. However we understood to compile on the display missing fixed scale is demanded more skillful technique than ever before. Therefore we started to educate photogrammetrists information processing technique. But it is difficult to make good result on short term too, and according to increasing demand of digital map files number of engineers have been lacked absolutely at present.

TABLE 2. approximately compilation volume per one day at 1/2500

ordinary	numerical
17	58

[hour/Km<sup>2</sup>]

### 4 DATA and MANUSCRIPT

At present map manuscripts are made with digital map files, since the GIS is not spread sufficiently. Making a map manuscript

At output of map manuscripts, it is efficient code disguise, elimination, rearrangement and so on necessary for compilation of manuscript data, and avoid difference between a digital map file and a map manuscript.

At contour process, DM method on a flat field, MD method on a hill field should be employed, it is efficient to use together.

From the above mentioned result shows the working flow, the file composition, and parted process in small which we structured manufacture technology of numerical mapping system.

Hence to make these technique practical technology, we continue verification.

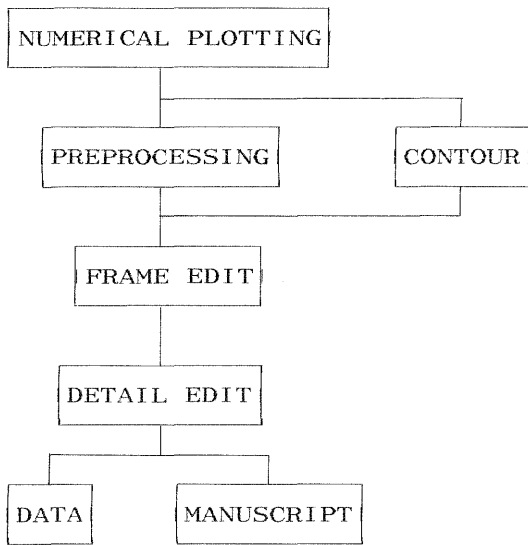


Figure 1. working flow

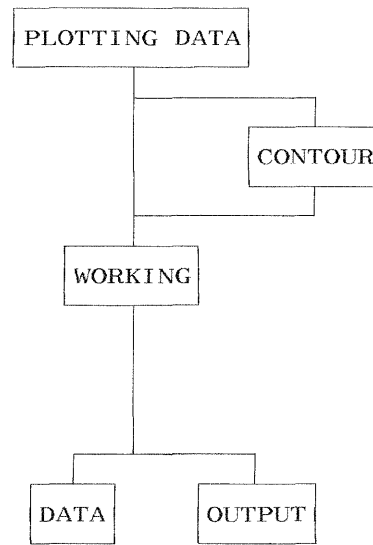


Figure 2. file composition

Table 3. detail flow

1. Preparation
  - .. administration of the tables
  - .. makes the frame in the working files
2. Data input
  - .. modifies error at data acquisition
  - .. makes ground control points' files
  - .. inputs data in the working files
  - .. modifies data conventionally on the files
3. Clip
  - .. clips to the working file per sheet
4. Preprocessing
  - .. gives symbology to data
  - .. patterns data
  - .. deletes or searches error data
5. Frame edit
  - .. nodes frame elements
  - .. displays width of roads, rivers and bridges
  - .. compiles width and form
  - .. nodes houses
  - .. codes partitions and so on
  - .. rectangle of houses
  - .. others
6. Detail edit
  - .. nodes between detail elements
  - .. nodes detail elements to frame elements
  - .. develops symbol on suitable position
  - .. examines validity of contour heights
  - .. nestles contours to material features
  - .. develops contour numbers
  - .. examines validity of contours and spot heights
  - .. searches crossing between houses, houses and contours
  - .. searches crossing between contours
  - .. clears away crossings
  - .. makes polygon for disguisement
  - .. parts contours in material features
  - .. codes disguised elements
  - .. codes elements to rearrange
  - .. others
  - .. inputs texts
  - .. digitizes boundaries
7. Contour
  - .. edits manually
  - .. scans and converts analog digital
  - .. converts to real coordinates
  - .. thin out coordinates
  - .. gives attribute area
  - .. puts information heights
  - .. gives heights
  - .. divides layers according of heights
  - .. merges digital mapping and map digitized elements
8. Tie
  - .. ties to frame and working boundary
  - .. ties to neighbor sheet files
9. Inspection
10. Digital map file creation
  - .. creates as connecting each layer
  - .. puts sheet record and index record
  - .. registers to magnetic tapes or so
11. Output file
  - .. patterns for manuscript
  - .. eliminates under symbols and texts
  - .. outputs

#### REFERENCE

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