A CHINESE DIGITAL MAPPING SYSTEM WITH PHOTOGRAMMETRIC METHOD

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ABSTRACT:

Many digital maps of large scale are being produced with photogrammetric method in Taiwan for highway construction and city planning. Some problems had to be solved in producing digital maps with Chinese annotations and informations. For instance, the Chinese characters do not consist of the alphabets and there are thousands Chinese characters frequently used. The way to display the Chinese annotations on the map and the data structure for Chinese informations are quite different than the alphabetized languages.

This paper presents a digital mapping system which produces Chinese annotations and informations besides other objects of a normal digital map suitable for the Chinese GIS. The methods and procedures of stereo plotting and editing the Chinese digital maps in Taiwan are also discussed.

KEY WORDS: Digital Mapping, System, Photogrammetry, Chinese

1. INTRODUCTION

Many governmental and private organizations in Taiwan now request maps in digital form for designing and planning. The digital maps on the magnetic media are used as the input source to their civil engineering software or the GIS systems directly. The conventional maps on the paper are no more acceptable. The companies which produced the conventional maps with photogrammetric method are therefore switched to produce the digital maps. But some problems had to be solved first. Especially the Chinese characters and informations should be stored in a suitable format for transfering to other systems and should be able to be reproduced or queried properly. This paper introduces a Chinese digital mapping system with photogrammetric method which is producing large scale digital maps for highway construction and city planning in Taiwan. The Chinese system on computers is explained first. Then the digital mapping system is presented with some results.

2. THE CHINESE SYSTEM

2.1 Overview

Chinese characters are not alphabetized as the most languages are. They are rather hieroglyphics like the old Egyptian. There are thousands Chinese characters frequently used. For data processing on computer systems, at least three problems had to be solved: (1) An easy way to key-in Chinese characters from normal "QWERT" keyboard. (2) The codes to represent the Chinese characters. (3) The fonts (patterns) to display or to print the Chinese characters.

These problems have already been solved in Taiwan, and the solutions became some standards among the computer systems. Now the input, processing and output of Chinese in "text mode" can almost be done on every computer in Taiwan. But the Chinese systems for computer graphics are still in developing.

2.2 The Input Methods

More than ten key-in methods of Chinese characters exist. Here only two of them will be mentioned: (1) The Tsang-Chieh Method: The radicals of Chinese characters are divided into 26 groups and represented by the 26 alphabetical keys on the keyboard. For instance, the Chinese character "light" 明 consists of two radicals "sun" 日 (A key) and "moon" 月 (B key). So just press A and B keys under Tsang-Chieh mode, and you get the character "light" 明 . (2) The Phonetic Symbols Method: There are 37 phonetic symbols and 5 tones for Chinese language, and they are represented by 42 keys on the keyboard. The character "light" 明 , for example, is pronounced as "MING", 2nd tone (ㄇㄧㄥˊ). But there are 19 Chinese character pronounced as "ㄇㄧㄥˊ". Press the keys ㄇ, ㄧ, ㄥ and ˊ (usually represented by the A, U, / and ˆ keys), the 19 characters with this same pronunciation will be displayed at the bottom of the screen, and you have to select one from them.

2.3 The BIG-5 Codes

There are a couple of code systems for storing Chinese on the text files. The most popular one is the BIG-5 Codes. Every Chinese character is represented by two bytes (two ASCII codes). The first byte is always greater than 127. For instance, the Chinese character "light" 明 is represented by ASCII codes 169(⌐) and 250(·), the "sun" 日 164 (ñ) and 233(θ), and the "moon" 月 164(ñ) and 235(δ). So if you see "日月明 " on a file under Chinese mode, you will see "ñθñδ⌐·" under English mode. In this way, any Chinese text can be saved as normal English text. The Chinese data can be sorted according to the order of radicals and strokes, too.

2.4 The Patterns

The strokes of each Chinese character can be seem as vectors or as a dot matrix pattern and can be defined on a pattern file. The Chinese system then reads the pattern of each character from the pattern file using the BIG-5 code as index and displays the pattern on the screen or prints it on the paper. There are several fonts of Chinese characters just like Gothic, roman, italic, etc. in English. Figure 1 shows some Chinese fonts printed by dot printer. The size of a pattern file for each font is about 1 mega bytes.

2.5 Chinese System for CAD Software

The Chinese systems for CAD software systems use the same theories and methods metioned above. The operator enters the Chinese characters with one of the input methods, the system draws the pattern by reading the pattern file, and saves the code, coordinates, height, rotation and other attributes onto the data base. Some software companies in Taiwan have developed some Chinese systems for CAD systems e.g. AutoCAD, MicroStation, ARC/INFO etc. Figure

2 shows some Chinese fonts plotted by a Chinese CAD system.

3. DIGITAL MAPPING SYSTEM IN TAIWAN

3.1 Digital Mapping System with Photogrammetric Method

There are two major ways to produce digital maps in Taiwan: (1) Using analytical stereo plotter with digital mapping software(Chen 1986,Chen 1988, Seile 1989, Menke 1991). (2) Using analog stereo plotter aided by computer. The analog plotter has to be installed with encoder and converter, and connected to a personal computer via interface hardware and interface software for the CAD systems (DAT/EM 1991). In both ways, the interactive graphics commands are always too complex and time consuming for the operators, even using the pull-down menus or windows. Therefore we had to design some menus which can be simply touched by finger on a keypad or pointed by cursor on a tablet. Figure 3 shows an example of such menu.

3.3 The Symbols

The Ministry of Interior is going to promulgate a standard of the symbols on maps. Figure 4 shows a part of this standard. It includes (from left to right) symbol names, short codes, elements, symbols, sizes, classes, line types, colors, measuring methods, long codes and remarks (Wang 1992). Before the operator can simply draw these symbols by one touch, a symbol library should be designed, such as the Blocks, ACAD.LIN and ACAD.PAT in AutoCAD, or the Cell Libaraies in MicroStation. Sometimes you need to write programs using a special programming language, e.g. AutoLISP, for more complex symbols.

3.4 The Chinese Annotations

The standard of Chinese annotations on maps will be also promulgated. Figure 5 shows a part of this standard. It includes classes, Chinese fonts, English fonts and line types (Wang 1992).

3.5 The Exchange Format

Different mapping systems produce different output formats of digital maps, e.g. the DXF format, the DGN format, the SIF format, etc. The Ministry of Interior is going to promulgate a Standard Exchange Format (SEF) which can be used to transfer digital map files containing Chinese information between different systems. There are 20 types of record in the SEF format: (1)Volume Header, (2)Volume termination, (3)Section Header, (4)Point, (5)Line, (6) Polygon, (7)Node, (8)Annotation, (9)Annotation Parameter, (10)Curved Annotation Parameter, (11)Attribute Definition, (12)Attribute Combined, (13)Attribute Description, (14)Node-line Linkage, (15)Polygon-line Linkage, (16)Line Topology, (17)Two-dimensional geometry, (18)Three-dimensional geometry, (19)Continuation, and (20)Comment (Wang 1992).

4. RESULTS

Figure 6 and Figure 7 show two parts of 1:1000 map plotted from 2 digital maps produced by the method descripted in this paper.

5. CONCLUSION

The Digital Mapping Systems with Photogrammetric Method are working successfully in Taiwan. The problems of Chinese information have been solved.

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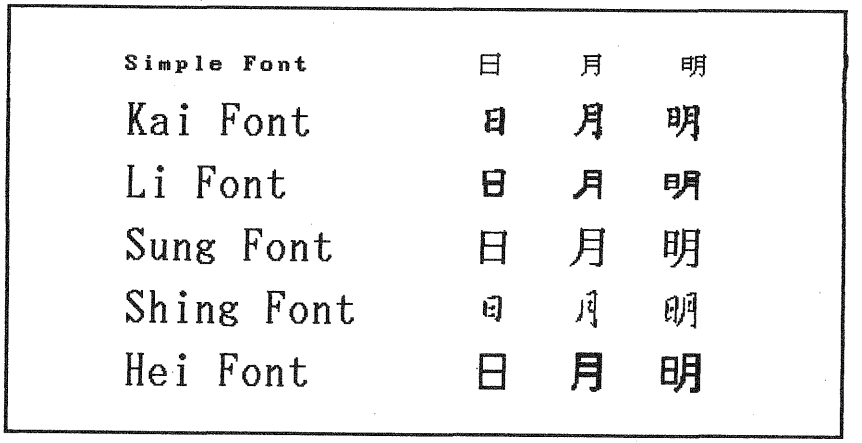


Figure 1: The Chinese Fonts

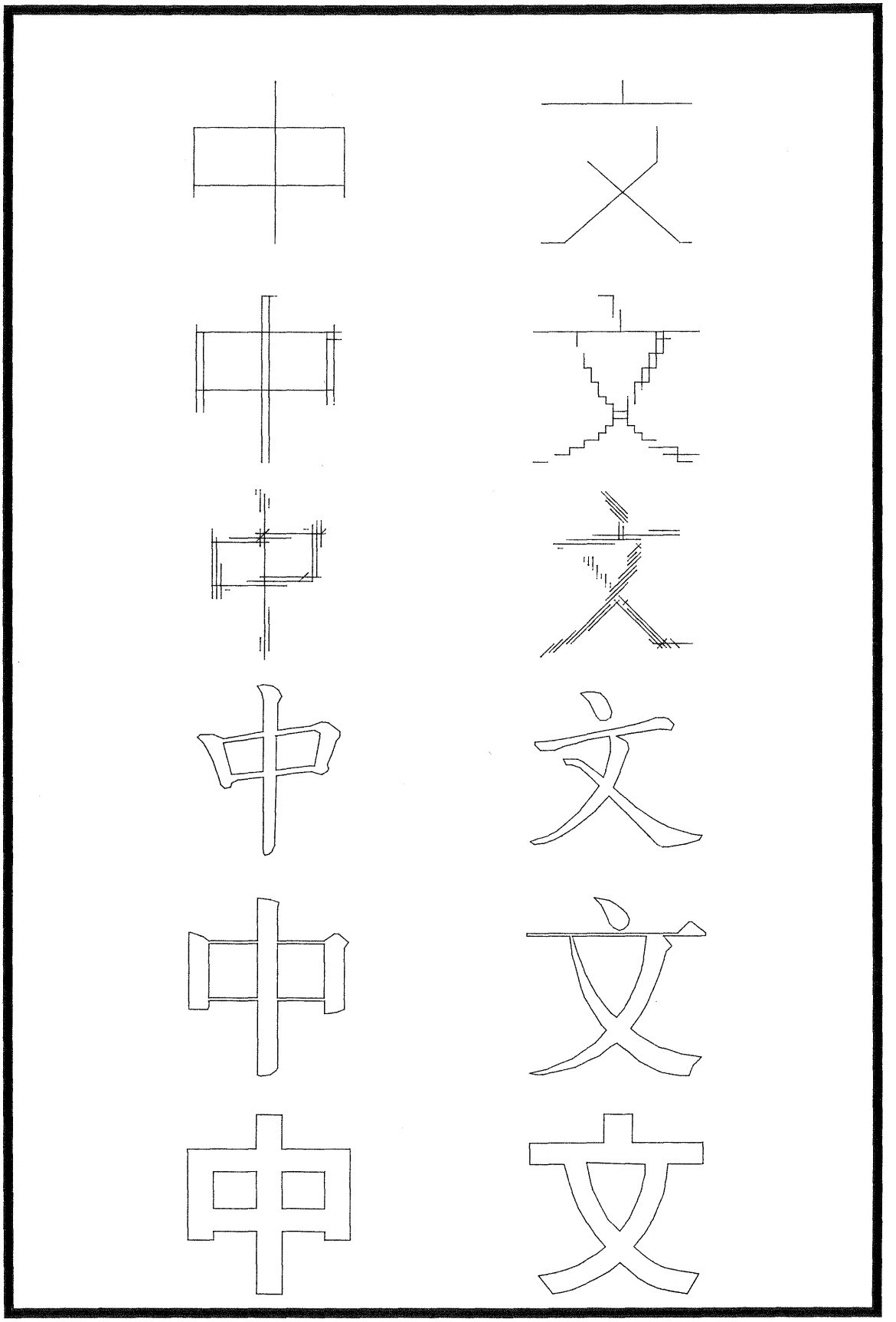


Figure 2: Plotted Chinese Fonts

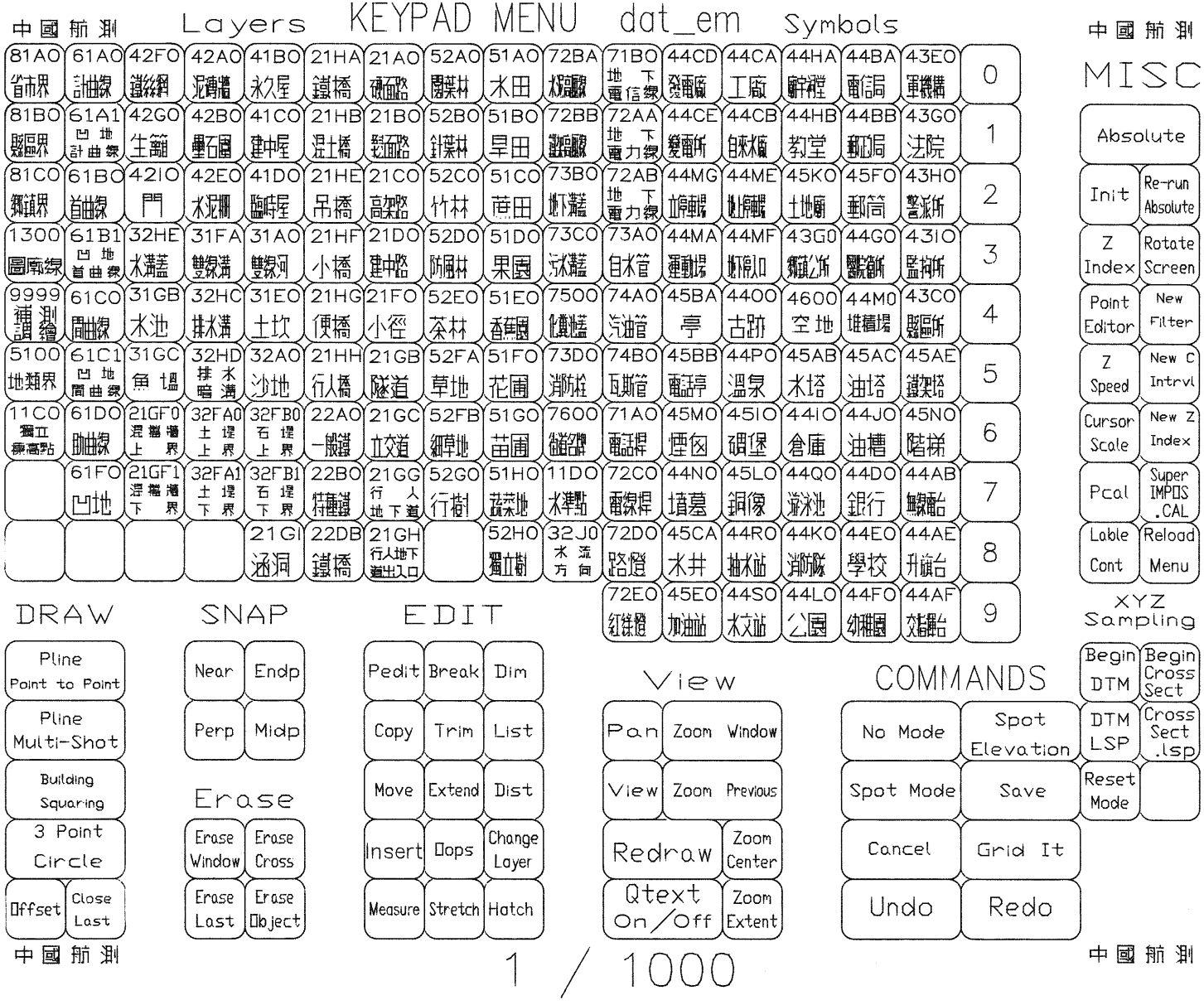


Figure 3: Menu for Chinese Mapping System

建　　物（其他特殊建築構造物及附屬於建築構造物之雜項工作物）

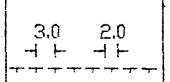
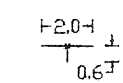
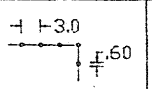
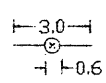
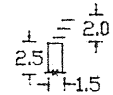
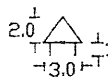
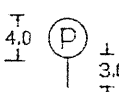
地形物資料名稱	地形物編碼	地形物圖元類別	使用之圖例	圖例尺寸及基點	圖例類別	圖例線號	圖上之顏色	量測使用圖元	原內政部編碼	備註
竹垣	414	2			4	2	7	5	E 403 010 090	
木柵	415	2			4	2	7	5	E 403 010 100	
門	416	2			1	2	7	2	E 403 010 000	
階梯	417	3			3	2	7	4	E 403 020 000	
煙囪	419	1			1	2	7	1	E 403 040 000	
棚屋／亭／架	420	3			5	2	7	5	E 403 050 000	
升旗台	422	3			2	2	7	5	E 403 060 010	
停車場	423	3			5	2	7	5	E 403 070 000	
立體停車場	424	3			5	2	7	5	E 403 070 010	

Figure 4: The Standard of Symbols for 1:1000 Map

五千分之一地形圖註記字體

等級	中文字體(明體)	英文數字(標準字體)	線號
48	地形圖圖式	ABC123	4
44	地形圖圖式	ABC123	4
38	地形圖圖式	ABCD123	4
32	地形圖圖式	ABCD1234	3
28	地形圖圖式	ABCDE1234	3
24	地形圖圖式	ABCDEF12345	3
20	地形圖圖式	ABCDEFG12345	2
18	地形圖圖式	ABCDEFG123456	2
16	地形圖圖式	ABCDEFGH1234567	2

Figure 5: The Standard of Chinese Annotations

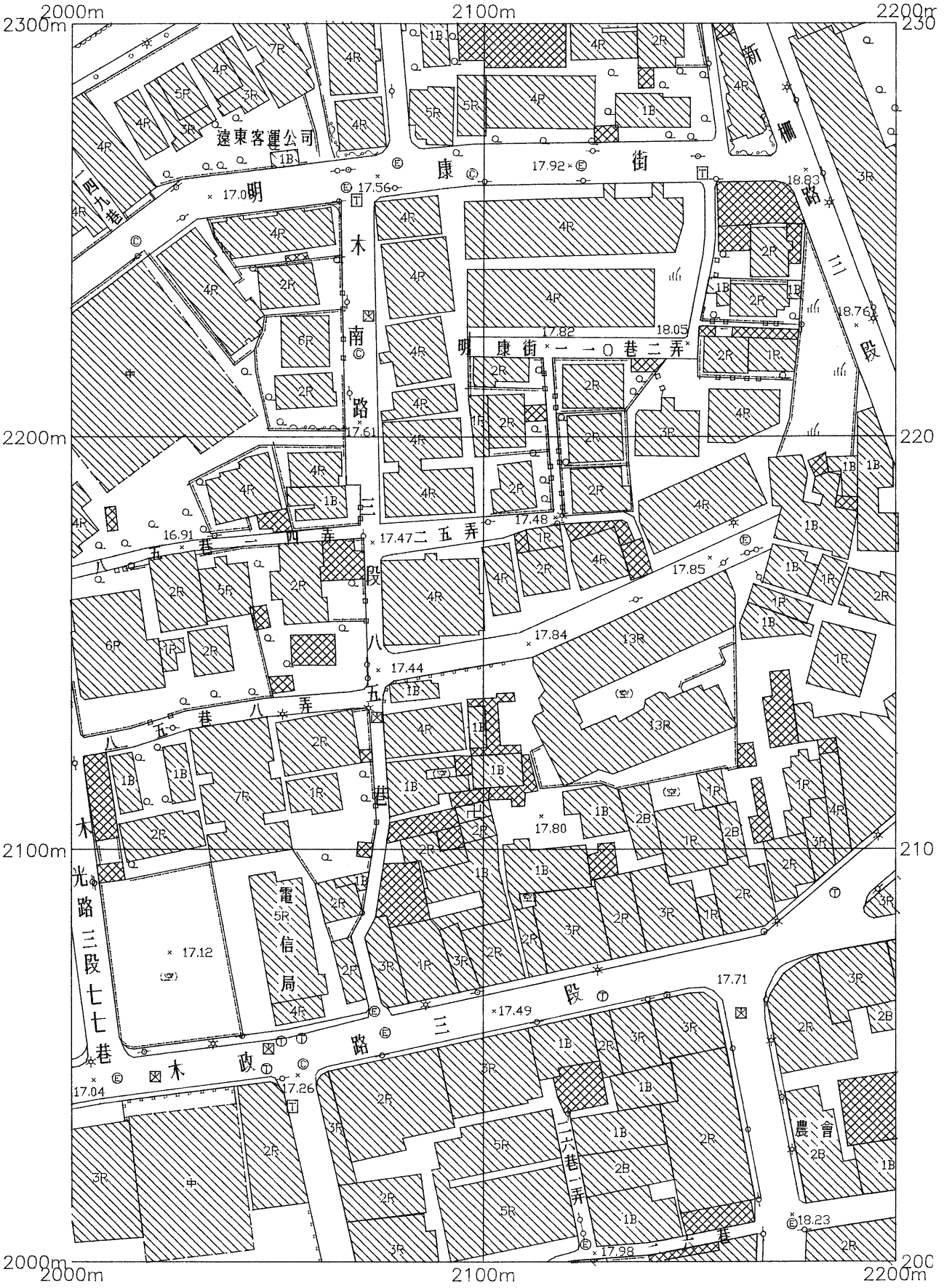


Figure 6: Output of a Chinese Digital Map (1)

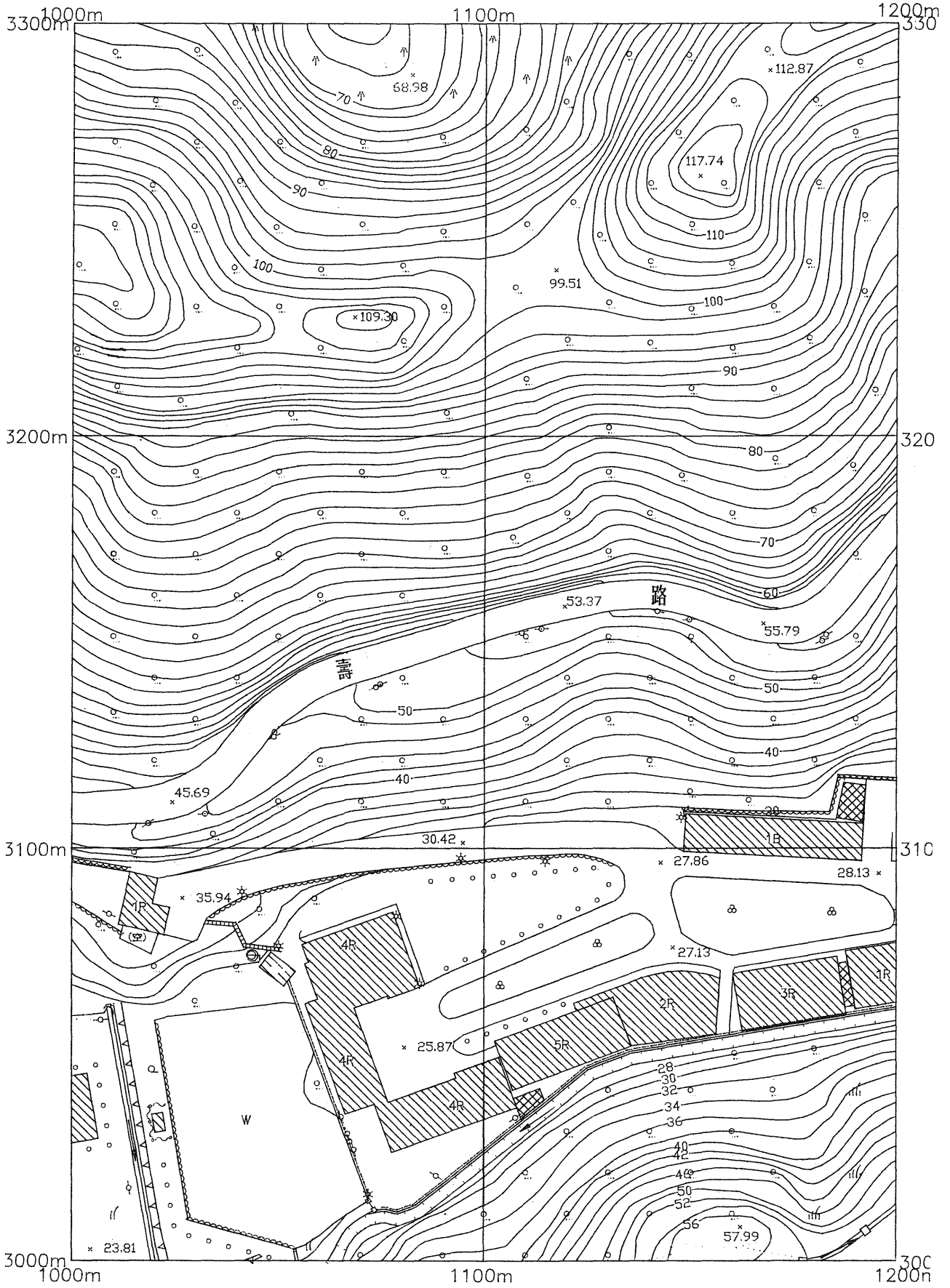


Figure 7: Output of a Chinese Digital Map (2)