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978-0-521-46773-5 - The Shorter Science and Civilisation in China: An Abridgement of Joseph Needham's Original Text, Volume 5

Colin A. Ronan

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Roads

No ancient country in the world did more in civil engineering, both as to scale and skill, than China, and this is particularly so when it comes to hydraulic engineering in all its aspects. Yet the Chinese did not neglect roads, and the system they developed compares not unfavourably with that of the Roman Empire when we consider it as only part of their system of communications. After all, as Adam Smith wrote in AD 1776, 'Good roads, canals and navigable rivers by diminishing the expense of carriage, put the remote parts of a country more nearly upon a level with those in the neighbourhood of the town. They are upon that account the greatest of improvements.' When one remembers that the Chinese Empire covered an area of almost 4 million square kilometres (some 1.5 million square miles), it becomes clear that a total of over 35 400 kilometres (22 000 miles) of specially made roads by AD 190 during the Later Han dynasty was no mean achievement.

The mode of construction of Roman roads is clearly shown in remains that still exist, and it is also well documented. In a ditch some 1.5 to 1.8 metres deep, a bed of stones was laid, then a layer of rubble and chippings, followed by sand, or gravel, or broken pottery and bricks locked in place by a lime cement. Flat stone slabs made up the final surface. Kerbs were often provided. Sometimes, the lower layers were extended sideways, with a ditch on either side, and on occasions the road was accompanied by a drainage channel of substantial size, while retaining walls might be built along the sides of steep slopes. The Romans also used graded earth tracks and side-roads with a gravelled surface.

It has often been said that roads in the Roman style resembled, to some extent, a series of walls lying horizontally, and these have often been highly praised. Yet, as the historian Lefebvre des Noëttes pointed out, they were, in truth, primitive and ill-suited to their purpose. Allowing nothing for expansion and contraction due to temperature, frost fissures and unequal drainage, they depended on thickness and rigidity. Yet the more successful

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methods of later times, culminating in the second decade of the nineteenth century with the compacted chips of John McAdam, and their subsequent developments, all depend on thinness and elasticity. These appear to be medieval in origin, but Chinese roads of similar light and elastic type long preceded them, as we shall see.

NATURE AND EXPANSION OF THE NETWORK

Gazing down on the Old World during the few centuries before and after the turn of our era, one could have seen, as in a slow-motion video, the appearance and radiation of two branching systems of highway communications: one springing from the western coast of the ancient Italian peninsula, the other near the great bend of the Yellow River where it swings round the Shanxi mountains to flow eastwards to the Yellow Sea. Should the Romans have ever succeeded in conquering the Parthians and Persians, the two road systems might have met, perhaps somewhere west of Xinjiang, but this was not to be. The octopus-like arms expanded independently, each in a world of its own, their builders troubled only occasionally by the vaguest rumours of another system too far away to matter.

There is a curious parallel between the Roman and Chinese systems in that both, after the third century AD, fell into a long period of decay, but while Europe became parcelled out into feudal kingdoms and domains with poor communications except by sea, the role of the Chinese highways passed over to an immense system of navigable rivers and artificial waterways, leaving only the mountain roads to continue their age-old function. For, as always to be expected in a feudal-bureaucratic society, the central government concerned itself with the construction and maintenance of the most satisfactory routes of communication.

This may be illustrated by some of the oldest records of road building in the Chinese culture-area which have come down to us. A verse in the *Shi Jing* (Book of Odes) expresses admiration of the roads in the neighbourhood of the capital of the Zhou State:

The roads of Zhou are (smooth) as a whetstone,
Straight as an arrow('s flight);
Ways where the lords and officials pass,
Ways where the common people look on.

This folk-song is considered rather ancient, perhaps of the ninth century BC, in the Western Zhou period. When we come to the *Zhou Li* (Record of Institutions (lit. Rites) of the Zhou Dynasty), that second century BC compilation of the ideal structure of the feudal-bureaucratic State, we have much more detailed information on the technical terms for roads. Interestingly, the Record seems to incorporate two distinct traditions, probably from

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different earlier feudal States. In the entry for the Si Xian (Director of Communications), we read:

He studies the maps of the nine provinces in order to obtain a perfect knowledge of the mountains, forests, lakes, rivers and marshes, and to understand the (natural) routes of communication.

[Commentary. When mountains and forests present obstacles, he cuts through them. When rivers and lakes offer impediment, he bridges them.]

He lays out the five kinds of canal and the five kinds of road, planting trees and hedges along them for defence. All (special points, passes and junctions) have guard-posts, and he knows the ways and roads that lead to them.

[Commentary. The five kinds of canal are *sui* (ditches), *kou* [*khou*] (conduits), *xue* [*hsüeh*] or *xu* [*hsü*] (small canals), *gui* [*kuei*] or *guai* [*kuai*] (medium canals), and *chuan* [*chhuan*] (great canals). The five kinds of road (*tu* [*thu*]) are *jing* [*ching*] (paths or ways), *zhen* [*chen*] (larger, paved ways), *tu* [*thu*] (one-width roads), *dao* [*tao*] (two-width roads), and *lu* (three-width roads).]

If there is alarm in the empire he fortifies the roads and difficult points, halts wanderers, and guards the positions with his men, letting past the barriers only those with the imperial seal.

The systematisation of the capacities of roads and canals, doubtless largely schematic, appears in the passages devoted to the Sui Ren (Grand Extensioner, or Minister of Agriculture):

This is how he organises the countryside. Between each farm there is a ditch (*sui*) with a path (*jing* [*ching*]) along it. Past every ten farms there runs a conduit (*gou* [*kou*]) with a way (*zhen* [*chen*]) alongside. Past every hundred farms there runs a small canal (*xue* [*hsüeh*]) with a one-width road (*tu* [*thu*]) accompanying it. Past every thousand farms there runs a medium-sized canal (*gui* [*kuei*]) with a two-width road (*dao* [*tao*]) along its bank. Past every ten thousand farms there runs a large canal (*chuan* [*chhuan*]) with a three-width road (*lu*) at its side. Such are the communications in the imperial domains.

[Commentary. The five grades of roads are all to connect the country and the capital for carriages and pedestrians. (Apart from men) paths will take only horses and oxen, the wider (paved) ways will take large hand-carts, a one-width road will take a single chariot, a two-width road will take two abreast, and a three-width road will take three abreast. One may make the country roads the same width as the ring-roads of cities.]

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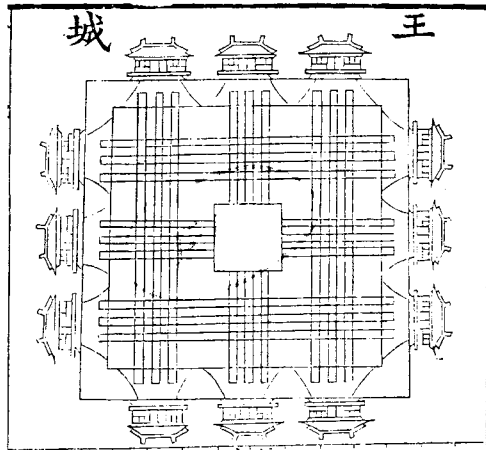
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Fig. 389. Diagram of an idealised imperial or princely city, with its thoroughfares. From the *San Li Tu* (Illustrations (diagrams) of the Three Rituals).

Now we know what was meant by a 'two-width road'. But another text in the same book has more spacious ideas. Under the heading of Jiang Ren (Master-Builders) we find that in the capital the main streets (*jing tu* [*ching thu*]) are to carry nine chariots abreast, the ring-roads (*huan tu* [*huan thu*]) are to carry seven, and the country roads (presumably imperial highways, *ye tu* [*yeh thu*]) are to carry five (Fig. 389). Furthermore, capitals of feudal princes are to have their main streets of the seven-width grade, their ring-roads five-width, and their approach roads three-width. Other cities must not exceed the five-width grade for their broadest streets, with all their other roads at the three-width level. Perhaps there is no discrepancy if the grandeur of the Zhou (or Han) capital is at issue only in this second text.

During the Warring States period, there was much road-building activity, both for military and commercial purposes. The State of Qin, however, as we shall now see, had been particularly busy, and the works achieved may well have been a great factor in its success. As soon as the whole empire was for the first time united under Qin Shi Huang Di in 221 BC, the new ruler embarked upon his celebrated policy of standardisation of measurements, and fixed, among other things, the gauge of chariot-wheels. In 220 BC, Qin Shi Huang Di made a tour of inspection in Gansu and Shaanxi, after which he ordered the construction of a vast set of arterial post-roads, 'speed-ways' (*chi dao* [*chih tao*]) or 'straight-ways' (*zhi dao* [*chih tao*]) radiating from the capital at Chang'an (near modern Xi'an), especially to the north, north-east, east and south-east.

Though contemporary descriptions are not available, it is worth giving one from only a few years afterwards. In about 178 BC, Jia Shan, one of

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Emperor Wen Di's counsellors, presented an essay analysing the causes of good government and civil confusion, particularly criticising Qin Shi Huang Di. After decrying the luxury of the palaces built at Xianyang, he continued:

He also ordered the building of post-roads all over the Empire . . . so that all was made accessible. These highways were 50 paces wide, and a tree was planted every 9 metres along them. The road was made very thick and firm at the edge, and tamped with metal rammers. The planting of the green pine-trees was what gave beauty to the roads. Yet all this was done (only) so that Qin Shi Huang Di's successors (on the throne) should not have to take circuitous routes.

Later commentators were a little puzzled by the statement about the structure of the roads, some thinking they were lined by walls on each side like raised causeways, others that the tamping referred simply to the consolidation of the edges, especially where there was an embankment. That little trace of these roads remained in later ages presumably implies that they were less massively built than the Roman roads. Yet if they consisted chiefly of rubble and gravel tamped down in the manner of *pisé* walls (see p. 26), they were more elastic and much more modern in conception. Such 'water-bound macadam' was in fact the traditional material of Chinese highways in all periods.

As for the width, it is generally agreed that the '50 paces' of the *Qian Han Shu* (History of the Former Han Dynasty), compiled from about AD 65 onwards, was a scribal error for '50 feet' (9 metres), so that the imperial highways would have been approximately nine-width roads equivalent to the broadest described in the *Record of the Institutions of the Zhou Dynasty*. They were thus larger than most of the Roman roads.

A few comments on the map of the imperial highways shown in Fig. 390 may now usefully be made. A more easterly centre, Sanchuan (6) in the neighbourhood of modern Luoyang (Henan province), was chosen as the hub of the system, the road from nearby Chang'an (1) negotiating the Hangu pass (12) much as the railway does today. It then splits, one arm going northwards to Ji (7) near modern Beijing, another north-east to Linzi or Qi (8), following the old course of the Yellow River for part of the way. The third and longest leads south-eastwards to Pei (10) (north of present Pei), from whence it wends its way gradually southwards over the Yangtze close to modern Nanjing and on to Wu (11), the capital of the former Wu State. Nearly as long as the south-eastern road is the southern one, which goes over the mountains by way of the Wu Pass (13), thence to Nanyang (14) and southwards, crossing the Han river and then the Yangtze near the Dongting Lake. From Changsha (16), it followed the Xiang River valley,

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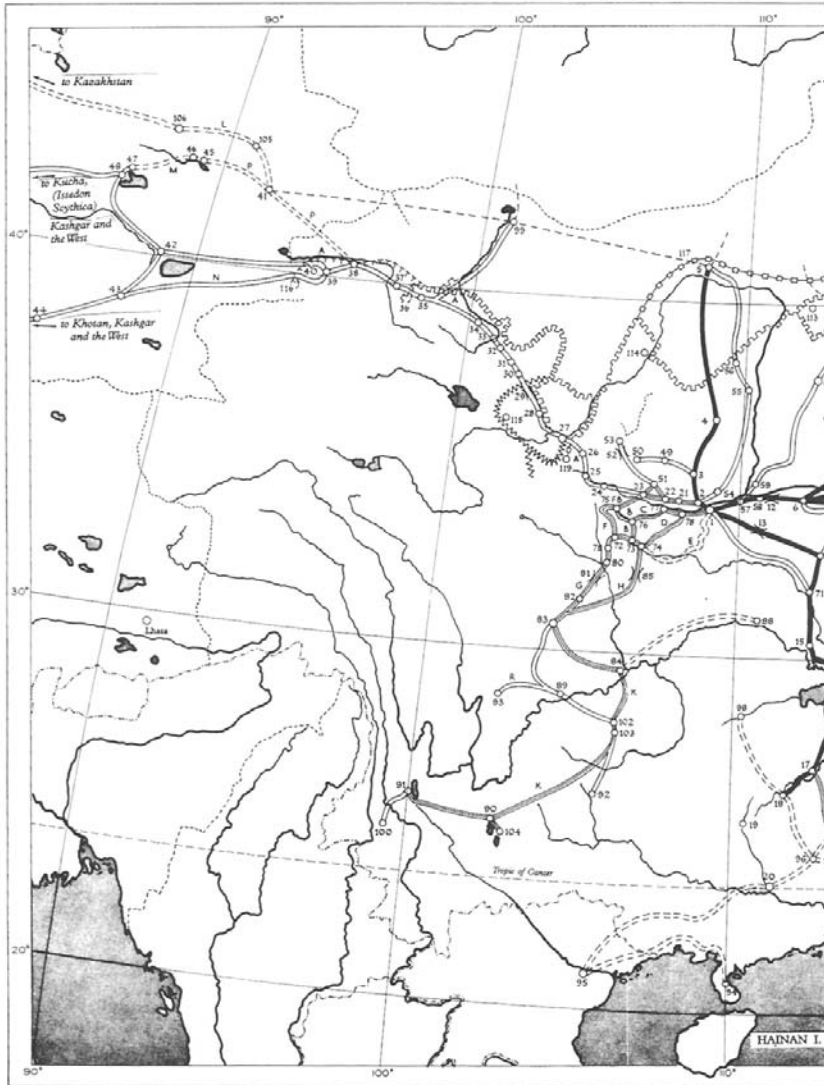
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ending its journey at Lingling (18). Though now bearing somewhat eastwards, this was no mistake, for, as we shall see in chapter 5, the upper waters of the Xiang were made in Qin times to connect with the upper waters of the West River of Guangdong, thus permitting the transport of arms and supplies for the conquest of the Cantonese State of Nan Yue.

Something must now be said of the Great North Road, the only road for

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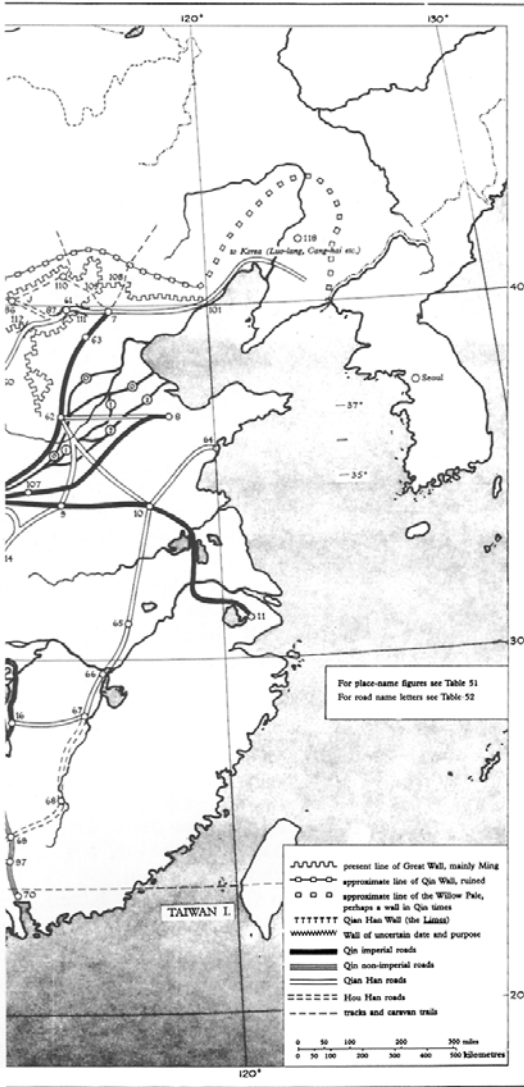


Fig. 390. Map of road communications in ancient China, and of the lines of the great defensive walls.

which we have any details concerning its construction. In 212 BC, Meng Tian, one of the Qin First Emperor's most important generals, whose name will always be connected with the Great Wall (see p. 41), was ordered to build a road from Xianyang (2), the imperial capital, up through the Ganquan districts (3, 4) and out through the Wall, striding across the Ordos Desert plateau of Inner Mongolia to the northernmost line of the Yellow River.

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[More information](#)Table 51. *Place names for the maps of road communications (Fig. 390) and civil engineering works (Fig. 464) in ancient China.*

1	Chang'an [Chang-an] 長安 = Xi'an [Hsi-an (Sian)] 西安	24	Tianshui [Thien-shui] 天水
2	Xianyang [Hsien-yang] 咸陽 = Weicheng [Wei-chhêng] 渭城	25	Longxi [Lung-hsi] 隴西
3	Ganquan Shan [Kan-chhüan Shan] 甘泉山 = Shunhua [Shun-hua] 善化 = Yunyang [Yün-yang] 雲陽	26	Dingxi [Ting-hsi] 定西
4	Ganquan [Kan-chhüan] 甘泉	27	Jincheng [Chin-chhêng] 金城 = Lanzhou [Lan-chou] (Lanchow) 蘭州 = Gaolan [Kao-lan] 皋
5	Jiuyuan [Chiu-yuan] 九原 = Wuyuan [Wu-yuan]	28	Yongdeng [Yung-têng] 永登
6	Luoyang [Lo-yang] 洛陽 = Sanchuan [San-chhuan] 三川	29	Wushao Ling [Wu-shao Ling] 烏鞘嶺 (pass)
7	Yan [Yen] 燕 = Ji [Chi] 薊 = Beijing 北京	30	Liangzhou [Liang-chou] (Liangchow) 涼州 = Wuwei [Wu-wei] 武威 = Sera Metropolis (by mistake for Chang'an)
8	Linzi [Lin-tzu] 臨淄 = Qi [Chhi] 齊	31	Yongchang [Yung-chhang] in Gansu province 永昌
9	Kaifeng [Khai-fêng] = Chenliu [Chhen-liu] 陳留 = Daliang [Ta-liang] 大梁 = Bianjing [Pien-ching] 汴京	32	Shandan [Shan-tan] 山丹
10	Pei [Phei] 沛 = Peixian [Phei-hsien] 沛縣	33	Ganzhou [Kan-chou] (Kanchow) 甘州 = Zhangye [Chang-yeh] 張掖
11	Suzhou [Su-chou] (Suchow) 蘇州 = Wu [Wu] 吳 = Huiji [Hui-chi] 會稽	34	Gaotai [Kao-thai] 高臺
12	Hangu Guan [Han-ku Kuan] 函谷關 (pass)	35	Jiuquan [Chiu-chhüan] 酒泉 = Suzhou [Su-chou (Suchow)] 肅州
13	Wu Guan [Wu Kuan] 武關 (pass)	36	Jiayu Guan [Chia-yü Kuan] 嘉峪關 (Western Gate of the Great Wall)
14	Nanyang [Nan-yang] 南陽 = Wan [Wan] 宛	37	Yumen [Yü-mên] 玉門
15	Nan [Nan] 南 = Nanjun [Nan-chün] 南郡 = Jiangling [Chiangling] 江陵 = Ying [Ying] 郢 = Linjiang [Lin-chiang] 臨江 = Jingzhou [Ching-chou] 荊州	38	Anxi [An-hsi] 安西 = Guazhou [Kua-chou] 瓜州
16	Changsha [Chhang-sha] 長沙	39	Dunhuang [Tun-huang] 敦煌 = Shazhou [Sha-chou] 沙州
17	Hengyang [Hêng-yang] 衡陽 = Hengshan [Hêng-shan] 衡山	40	Yumen Guan [Yü-mên Kuan] 玉門關 (Jade Gate)
18	Lingling [Ling-ling] 零陵	41	Yiwu [I-wu] 伊吾 = Hami [Hami] 哈密
19	Guilin [Kuei-lin] 桂林	42	Loulan [Lou-lan] 樓蘭
20	Xiang [Hsiang] 象 = Cangwu [Tshang-wu] 蒼梧 = Wuzhou [Wu-chou] 梧州	43	Yuni [Yü-ni] 竊匿 = Shanshan [Shan-shan] 鄯善 = Erqiang [Erh-chhiang] 塔羌 = Charlik
21	Wugong [Wu-kung] 武功	44	Qiemo [Chhieh-mo] 且末 = Cherchen
22	Fufeng [Fu-fêng] 扶風	45	Gaochang [Kao-chhang] 高昌 = Shanshan [Shan-shan] 鄯善 = Karakhoja = Turfan
23	Baoji [Pao-chi] 寶雞 = Chencang [Chhen-tshang] 陳倉	46	Jiaohe [Chiao-ho] 交河 = Piala = Yarkhoto

Table 51. (cont.)

47	Yanqi [Yen-chhi] 焉耆 = Karashahr	77	Meixian [Mei-hsien] 郿縣
48	Weili [Wei-li] 尉犁 = Kalgaman	78	Zhouzhi [Chou-chih] 鹽池
49	Beidi [Pei-ti] 北地 = Ningxian [Ning-hsien] 寧縣	79	Ningqiang [Ning-chhiang] 寧羌 (or 強)
50	Anding [An-ting] 安定 = Pingliang [Phing-liang] 平涼	80	Zhaohua [Chao-hua] 昭化
51	Yong [Yung] 雍 = Fengxiang [Fêng-hsiang] 鳳翔	81	Jianmen Guan [Chien-mên Kuan] 劍門關 (Sword-gate Pass)
52	Xiao Guan [Hsiao Kuan] 蕭關 (Xiao pass)	82	Mianyang [Mien-yang] 綿陽
53	Huizhong Gong [Hui-chung Kung] 回中宮 = Guyuan [Ku-yuan] 固原	83	Shu [Shu] 蜀 = Chengdu [Chhêng-tu] 成都
54	Liyang [Li-yang] 隴 (or 櫟) 陽	84	Ba [Pa] 巴 = Chongqing [Chung-chhing] (Chungking) 重慶
55	Shangjun [Shang-chün] 上郡	85	Bayu Guan [Pa-yü Kuan] 巴峪關 (pass)
56	Yulin [Yü-lin] 榆林	86	Pingcheng [Phing-chhêng] 平城 = Datong [Ta-thung (Tatung)] 大同
57	Huayin [Hua-yin] 華陰	87	Feihu Kou [Fei-hu Khou] 飛狐口 (Flying-fox Pass)
58	Hongnong [Hung-nung] 弘 (or 宏) 農 = Guolüe [Kuo-lüeh] 詭略	88	Zigui [Tzu-kuei] 棣歸
59	Hedong [Ho-tung] 河東	89	Podao [Pho-tao] 樊道 = Yibin [I-pin] 宜賓
60	Jinyang [Chin-yang] 晉陽 = Taiyuan [Thai-yuan] 太原	90	Dian [Tien] 滇 = Dianchi [Tien-chhih] 滇池 = Kunming [Khun-ming] 昆明
61	Dai [Tai] 代 = Daijun [Tai-chün] 代郡	91	Yeyu [Yeh-yü] 葉 (or 櫟) 榆 = Dali [Ta-li] 大理
62	Handan [Han-tan] 邯鄲	92	Zangke [Tsang-kho] 莊 (or 祥) 柯 (or 柯 or 柯)
63	Zhongshan [Chung-shan] 中山	93	Yuesui [Yüeh-sui] (越蕩 or 蕩) = Qiongzhou [Chhiung-tu] 邛都
64	Langya [Lang-ya] 琅邪 = Langye [Lang-yeh] 琅琊 (the guantai [kuan-thai] 觀臺, observation terrace)	94	Hepu [Ho-phu] 合浦 = Leizhou [Lei-chou] 雷州 = Haikang [Hai-khang] 海康
65	Lujiang [Lu-chiang] 蘆江	95	Jiaozhou [Chiao-chou] 交州 = Hanoi
66	Jiujiang [Chiu-chiang] 九江	96	Hanguang [Han-kuang] 滄光 (or 沈)
67	Qingjiang [Chhing-chiang] 清江	97	Yingde [Ying-tê] 英德 = Zhenyang [Chên-yang] 鎮陽
68	Ganxian [Gan-(hsien)] 贛 (縣)	98	Guiyang [Old Kuei-yang] 桂陽 = Yuanling [Yuan-ling] 沅陵
69	Qujiang (Gugong) [Chhü-chiang (Kukong)] 曲江 = Shaoguan [Shao-kuan] 韶關 = Shaozhou [Shao-chou] 韶州	99	Juyan [Chü-yen] 居延 = Edsin (or Etsin) Gol
70	Nanghai [Nan-hai] 南海 = Guangzhou [Kuang-chou (Canton)] 廣州	100	Yongchang 永昌 (in Yunnan) = Baoshan [Pao-shan] 保山
71	Xiangyang [Hsiang-yang] 襄陽	101	Shanghai Guan [Shan-hai Kuan] 山海關 (Eastern Gate of the Great Wall)
72	Mianxian [Mien-hsien] 沔縣	102	Yelang [Yeh-lang] 夜郎 = Tongzi [Thung-tzu] 桐梓
73	Baocheng [Pao-chhêng] 褒城		
74	Hanzhong [Han-chung] 漢中 = Nanzheng [Nan-chêng] 南鄭		
75	Fengxian [Fêng-hsien] 鳳縣 = Shuangshipu [Shuang-shih- phu] 雙石鋪		
76	Liuba [Liu-pa] 留壩		

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Table 51. (*cont.*)

103	Langzhou [Lang-chou] 郎州 = Zunyi [Tsun-l] 遵義	111	Zijing Guan [Tzu-ching Kuan] 紫荊關 (pass)
104	Yizhou [I-chou] 益州 = Chengjiang [Chhêng-chiang] 涪江	112	Pingxing Guan [Phing-hsing Kuan] 平型關 (pass)
105	Jumi [Chü-mi] 且彌 = Zhenxi [Chen-hsi] 鎮西 = Balikun [Pa-li-khun] 巴理坤 = Barkol	113	Yanmen [Yen-mên] 雁門 = Youyu [Yu-yü] 右玉
106	Yizhi [I-chih] 移支 = Dihua [Ti-hua] 迪化 = Urumchi	114	Ningxia [Ning-hsia] 寧夏 = Yinchuan [Yin-chhuan] 銀川
107	Rongyang [Jung-yang] 榮陽 = Zhengzhou [Chêng-chou (Chêngchow)] 鄭州	115	Xining [Hsi-ning] 西寧
108	Gubeikou [Ku-pei-khou] 古北口	116	Yang Guan [Yang Kuan] 陽關 (gate)
109	Nankou [Nan-khou] 南口 = Juyong Guan [Chü-yung Kuan] 居庸關 (gate)	117	Gaoque [Kao-chhüeh] 高闕
110	Zhangjiakou [Chang-chia-khou] 張家口 = Wanquan [Wan-chhüan] 萬全 = Kalgan	118	Shenyang [Shen-yang] 瀋陽 = Mukden
		119	Lintao [Lin-thao] 臨洮 = Minzhou [Min-chou] 岷州
		120	Suzhou [Su-chou (Suchow)] 宿州
		121	Shexian [Shê-hsien] 葉縣
		122	Shouzhou [Shou-chou] 壽州
		123	Daming [Ta-ming] 大名
		124	Linqing [Lin-chhing] 臨清
Anding, 50		Dianchi, 90	
Anxi, 38		Dihua, 106	
Ba, 84		Dingxi, 26	
Balkun, 105		Dunhuang, 39	
Baocheng, 73		Edsin Gol, 99	
Baoji, 23		Erqiang, 43	
Baoshan, 100		Feihu Kou, 87	
Barkol, 105		Fengxian, 75	
Bayu Guan, 85		Fengxiang, 51	
Beidi, 49		Fufeng, 22	
Beijing, 7		Ganquan, 4	
Bianjing, 9		Ganquan Shan, 3	
Cangwu, 20		Ganxian [Gan-hsien], 68	
Chang'an, 1		Ganzhou (Kanchow), 33	
Changsha, 16		Gaochang, 45	
Charlik, 43		Gaolan, 27	
Chencang, 23		Gaoque, 117	
Chengdu, 83		Gaotai, 34	
Chengjiang, 104		Guangzhou (Canton), 70	
Chenliu, 9		Guazhou, 38	
Cherchen, 44		Gubeikou, 108	
Chongqing (Chungking), 84		Guilin, 19	
Dai, 61		Guiyang, 98	
Daijun, 61		Guolüe, 58	
Dailing, 8		Guyuan, 53	
Dali, 91		Haikang, 94	
Daming, 123		Hami, 41	
Datong (Tatung), 86		Handan, 62	
Dian, 90		Hangu Guan, 12	