28. CIVIL ENGINEERING

(*a*) INTRODUCTION

No ancient country in the world did more in civil engineering, both as to scale and skill, than China, yet very little has been done towards making known the history of it. Perhaps this is the less surprising when we reflect that competence in civil, preferably hydraulic, engineering is rarely combined with sinological knowledge and a good understanding of Chinese historical literature, nor much more often with the opportunity of travelling over the country to study the vestiges of the great engineering works of former times. However, a beginning has been made, and in the present Section we shall try to sketch some of their most important features, beginning with roads and walls, going on to bridges, and then devoting the major part of our space to the great public works of hydraulic engineering in which the Chinese excelled.

There seems to be no general history of Chinese civil engineering (*thu mu kung chhêng*[1]) in the vernacular, and even well-balanced accounts of the development of the science in the West, essential for comparative purposes, are not too easy to find.[a] Chinese literature does of course embody a wealth of notable books on water conservancy and control, but few which treat of the history of the techniques concerned in a modern manner, the authors preferring to discuss the geographical and economic aspects of the great works. Again, there was almost no coherent treatment of bridge-building until the Society for the History of Chinese Architecture took up the matter during the past thirty years, and published a number of important studies in its journal. All helpful sources will be mentioned in detailed reference as we proceed.

(*b*) ROADS

'Good roads, canals and navigable rivers', wrote Adam Smith in + 1776, '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 all improvements.'[b] His opinion is none the less just if we recognise, as is unavoidable, that the greatest highway systems of the ancient and medieval worlds were planned and constructed with strategic intent. Of the engineering techniques, as well as the geographical pattern, of the famous Roman roads, much is known, since besides the numerous remains which it has been possible to excavate, there are detailed literary descriptions of theory and practice.[c] We know how the largest stones were laid

[a] For antiquity see Merckel (1) and, better, Leger (1); for the Renaissance there is Parsons (2). The only modern general survey is that of Straub (1), unfortunately too short. Pannell's illustrated history (1), confined to occidental material, appeared too late to be of assistance to us. So also the collected articles of Merdinger (1).

[b] (1), p. 62. For a history of road engineering in general see Schreiber (1).

[c] The classical description of the Roman road system, and still the most complete, is that of Bergier (1), but it has long been out-dated by the results of modern archaeology, as in Leger (1), especially p. 157.

[1] 土木工程

at the bottom to form the *statumen*, rubble and chips of different sizes laid above for the *ruderatio*, then the nucleus of sand or gravel, or of broken pottery and bricks cemented with lime,[a] the whole being topped with flat stone slabs to form the *summa crusta* or *summum dorsum*. Kerbs were often provided. The body of the Roman road thus occupied an excavated trough as deep as five or six feet, some three times the depth required for a modern road. Sometimes the lower layers extended widely beyond the breadth of the actual road itself, with a ditch on each side, sometimes the road was accompanied by a drainage canal of substantial size, sometimes it ran on embankments or through cuttings, and elsewhere it might have retaining-walls along the sides of steep slopes. Such were the *viae munitae*, but besides these fully paved roads the Romans also used graded earth tracks (*viae terrenae*) and gravelled-surface side-roads (*viae glareatae*).

It has often been observed that roads in the Roman style resembled to some extent a series of walls lying horizontally. The methods of their engineers were for long the object of great admiration on the part of archaeologists, but, as des Noëttes (1, 9) pointed out,[b] 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,[c] while the more successful modern methods, culminating in the compacted chips of McAdam,[d] and all their asphalted and other developments, depend on thinness and elasticity. These appear to be medieval in origin,[e] but Chinese roads of similar light and elastic type long preceded them, as we shall see.

Although we can trace the origin of highways back to prehistoric tracks, bronze-age ridgeways and the like,[f] impressive and complex systems do not develop until the rise of strong and centralised government. Hence the Persian Royal Road of the early – 5th century from Susa (the capital in the mountains north of Basra) to Sardis (the most westerly city in the Iranian empire, near the port of Ephesus in Asia Minor), a distance of some 1,400 miles; and another road which led eastwards, about as far, to Sogdiana.[g] Hence also the remarkable road-system, at least as large, and covering much more difficult terrain in the Andes, built by the Inca State and its predecessors.[h]

and pl. III; Gregory (1); Forbes (6), (11), pp. 126 ff., (22); Merckel (1); Birk (1). Among specific papers those of Birk (2) and Hertwig (1) may be mentioned. There are recent maps of parts of the system in van der Heyden & Scullard (1), charts 53, 60, cf. figs. 289, 290, 291, 293, 294, 443; Bengtson & Milojčić (1), charts 30, 31.

[a] Cf. Vol. 4, pt. 2, p. 219.

[b] Since supported by Forbes (6) and others.

[c] When a paved road breaks to pieces, and the slabs become up-ended in all directions, it becomes much worse than no road at all. A Chinese example, near the Salween River, is shown in Gregory (1), fig. 12, a striking photograph. The upkeep cost of paved roads is also of course relatively high.

[d] See Gregory (1), pp. 220 ff. McAdam's achievement was to show that the foundation of the road may be the subsoil and need not be stone, if the sole above it consists of pieces of stone of the right kind and size, with a self-cementing carpet above. For modern practice see, e.g., Spielmann & Elford (1).

[e] On medieval European land communications see Lopez (2); Forbes (22).

[f] On the prehistoric north–south trade routes of amber across Europe cf. de Navarro (1); Gregory (1), pp. 28 ff.

[g] Cf. Calder (1); Forbes (11), pp. 130 ff. See chart 23 in van der Heyden & Scullard (1), and charts 11*b*, 12*c*, 17 in Bengtson & Milojčić (1).

[h] Cf. von Hagen (2, 3); Saville (1).

Comparable road-building work, perhaps not so extensive, was also carried on in Maurya India, judging from indications in the *Arthaśāstra*.[a]

(1) Nature and Expansion of the Network

Gazing down upon the Old World during the few centuries before and after the turn of the era, some demiurge might have seen, as in a slow-motion film, the appearance and radiation of two dendritic systems of highway communication springing from two different centres, one near the western coast about the middle of the Italic peninsula, the other near the great bend of the Yellow River where it swings round the Shansi mountains to flow eastwards to the Yellow Sea. The vision would have resembled somewhat the radiation of blood-vessels from the body of the foetal bird to make their ramifying way all over its yolk-store of food—and the bio-sociological analogy is not invalid altogether, for the tax-goods coming in would pass the legions on their outward ways. Could the Romans have ever succeeded in conquering the Parthians and Persians the two road systems might have met, perhaps, anastomosing somewhere west of Sinkiang, 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 the Chinese systems in that both, after the + 3rd century, 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 canals, leaving only the mountain roads to continue their age-old function. As the chief sources of knowledge about the ancient Chinese network and its growth the dynastic histories take first place, together with the abundant remains of the historical geographers, a numerous tribe among the Chinese literati.[b] And always, as would be expected in a feudal-bureaucratic society, the central government concerned itself with the construction and maintenance of the principal routes of communication.

> In China [wrote Adam Smith], and in several other governments of Asia, the executive power charges itself both with the reparation of the high-roads and with the maintenance of the navigable canals. In the instructions which are given to the governor of each province, these objects, it is said, are constantly recommended to him, and the judgment which the court forms of his conduct is very much regulated by the attention which he appears to have paid to this part of his instructions. This branch of public policy, accordingly, is said to be very much attended to in all those countries, but particularly in China, where the high-roads,

[a] Shamasastry tr., pp. 46, 48, 194, 334, and below, p. 5. According to Strabo, xv, 1, xi, a road 10,000 stadia long ran from the north-west frontier to the capital. With the stadion at 0·11 mile, this means some 1,100 miles. Cf. Anon. (82).

[b] Valuable modern monographs on the history of communications are not wanting: e.g. Lao Kan (*2*); Pai Shou-I (*1*) and Lo Jung-Pang (6). The history of ancient travel has been discussed by Chiang Shao-Yuan (*1*, 1), and the post-station system, at which we shall take a more particular look below, by Lou Tsu-I in various writings, especially (*1*). Unfortunately no one has studied ancient Chinese road engineering specifically from the technological point of view.

and still more the navigable canals, it is pretended, exceed very much everything of the same kind which is known in Europe.[a]

These features 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 *Shih Ching* (Book of Odes) expresses admiration of the roads in the neighbourhood of the Chou capital:[b]

> The roads of Chou 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.

As this folk-song is considered rather ancient, perhaps of the −9th century, in the Western Chou period, it may refer either to the Wei Valley, Kuan-chung[1] ('within the passes') as it was later called, or to the eastern capital and domains of the High King near the later site of Lo-yang.[c] The route between Chhang-an (1) and Lo-yang (6) must certainly be one of the most ancient tracks in all China.[d] When we come to the *Chou Li* (Record of Institutions (lit. Rites) of the Chou Dynasty), that −2nd-century compilation of the ideal structure of the feudal-bureaucratic State, we have much more detailed information on the technical terms for roads, though it seems to incorporate two distinct traditions, probably from different earlier feudal States. In the entry for the Ssu Hsien[2] (Director of Communications) we read:[e]

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.

[Comm. 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.

[Comm. The five kinds of canal (*kou*[3]) are *sui*[4] (ditches), *kou*[3] (conduits), *hsüeh*[5] (or *hsü*,[5] small canals), *kuei*[6] (or *kuai*,[6] medium canals), and *chhuan*[7] (great canals). The five kinds of road (*thu*[8]) are *ching*[9] (paths or ways), *chen*[10] (larger, paved, ways), *thu*[8] (one-width roads), *tao*[11] (two-width roads), and *lu*[12] (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.

[a] (1), p. 305. He goes on to minimise the civil engineering works of China, regarding the accounts of them as the exaggerations of 'weak and wondering travellers' or 'stupid and lying missionaries', but his reaction from Chinoiserie led him into error. We shall quote later on from some of the missionaries, who were no more than truthful (pp. 22, 33, 135, 142, 205, 208, 211, 363, 379).

[b] Mao, no. 203, tr. auct. adjuv. Legge (8), vol. 2, p. 353; Waley (1), p. 318; Karlgren (14), p. 154. The poem was quoted by Mencius (*Mêng Tzu*, v (2), vii, 8, tr. Legge (3), p. 267). Another folk-song also refers to the roads of Chou, but whether as 'winding and tedious' or 'flat and even' is not clear from the archaic language used; cf. Mao, no. 162, tr. Legge (8), vol. 2, p. 247; Waley (1), p. 151; Karlgren (14), p. 105.

[c] Cf. Yetts (17).

[d] Here the numbers in brackets refer to the Map in Fig. 711 and its accompanying tables, where the characters for all the place-names will also be found.

[e] Ch. 7, p. 26*a* (ch. 30), tr. auct. adjuv. Biot (1), vol. 2, pp. 198 ff.

[1] 關中 [2] 司險 [3] 溝 [4] 遂 [5] 洫 [6] 澮 [7] 川
[8] 涂 [9] 徑 [10] 畛 [11] 道 [12] 路

The systematisation of the capacities of roads and canals, doubtless largely schematic, appears in the passages devoted to the Sui Jen[1] (Grand Extensioner, or Minister of Agriculture).[a]

This is how he organises the countryside. Between each farm there is a ditch (*sui*[2]) with a path (*ching*[3]) along it. Past every ten farms there runs a conduit (*kou*[4]) with a way (*chen*[5]) alongside. Past every hundred farms there runs a small canal (*hsüeh*[6]) with a one-width road (*thu*[7]) accompanying it. Past every thousand farms there runs a medium-sized canal (*kuei*[8]) with a two-width road (*tao*[9]) along its bank. Past every ten thousand farms there runs a large canal (*chhuan*[10]) with a three-width road (*lu*[11]) at its side. Such are the communications in the imperial domains.

[Comm. 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.]

Now we know what was meant by a 'two-width road'.[b] But another text in the same book has more spacious ideas. Under the heading of Chiang Jen[12] (Master-Builders) we find[c] that in the capital the main streets (*ching thu*[13]) are to carry nine chariots abreast, the ring-roads (*huan thu*[14]) are to carry seven, and the country roads (presumably imperial highways, *yeh thu*[15]) are to carry five (Fig. 712). 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 Chou (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 but the details are still unclear. The State of Chhin, however, as we shall 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 Chhin Shih Huang Ti in −221, he embarked upon his celebrated policy of metrological standardisation and fixed, among other things, the gauge of chariot-wheels.[d] In −220 he made a tour of inspection in Kansu and Shensi, after which

[a] Ch. 4, pp. 24*b*, 25*a* (ch. 15), tr. auct. adjuv. Biot (1), vol. 1, p. 341. Note the decimal progression, with regard to Vol. 3, pp. 82 ff., 89.

[b] An interesting Indian parallel of a few centuries later occurs in the *Arthaśāstra* (Shamasastry tr. p. 53). Roads to military stations are to be 48 ft. wide, royal chariot roads in the countryside 24 ft., elephant forest roads 12 ft., ordinary chariot roads 7½ ft., cattle ways 6 ft. and paths for men 3 ft. Inca data from Peru range from 75 ft. (processional) through 45 ft. and 24 ft. ('regulation') to 15 ft. (quite frequent). Widths of 12 ft. and 6 ft. only occur in the communications of the subsidiary cultures (von Hagen, 3).

[c] Ch. 12, pp. 17*b*, 18*a*, 20*a* (ch. 43), tr. Biot (1), vol. 2, pp. 564 ff.

[d] *Shih Chi*, ch. 6, pp. 12*a*, 13*b*, tr. Chavannes (1), vol. 2, pp. 130, 135. The text says that the Chhin double-pace (*pu*) was fixed at 6 ft., and that the chariot gauge was uniformised throughout the empire. The gauge has always been taken as one double-pace, and indeed the *Chou Li* (*Khao Kung Chi*) says that 'the distance between the wheels is 6 ft.' (ch. 12, p. 24*a*, tr. Biot (1), vol. 2, p. 580). But what this means

[1] 遂人 [2] 遂 [3] 徑 [4] 溝 [5] 畛 [6] 洫
[7] 涂 [8] 澮 [9] 道 [10] 川 [11] 路 [12] 匠人
[13] 經涂 [14] 環涂 [15] 野涂

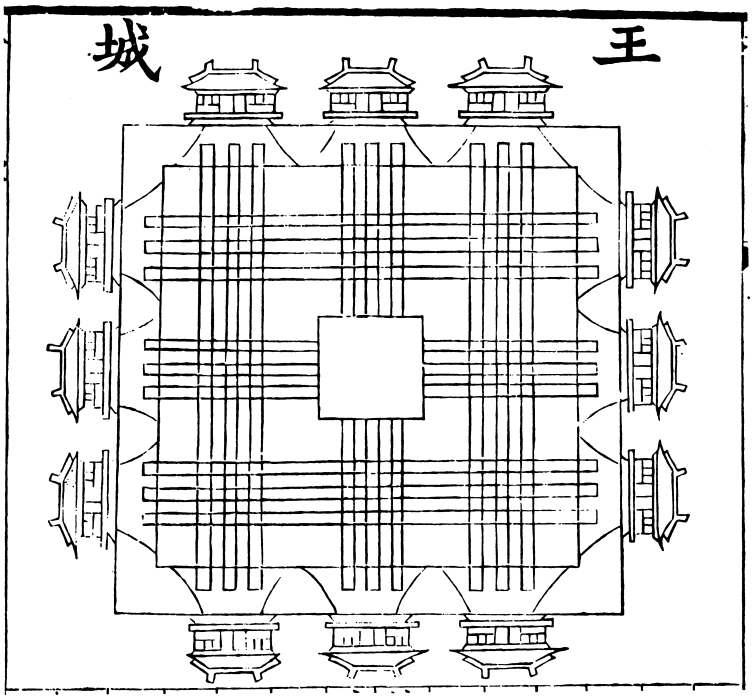

Fig. 712. Diagram of an idealised imperial or princely city, with its thoroughfares, showing the traditional decumane-cardinal plan. From *San Li Thu*, ch. 4, p. 2*b* (cf. pp. 73, 80ff.).

he ordered the construction of a vast set of arterial post-roads, 'speed-ways' (*chhih tao*[1]) or 'straight-ways' (*chih tao*[2]) radiating from the capital at Chhang-an, near modern Sian, especially to the north, north-east, east and south-east.[a]

in modern terms is a little uncertain. If Wu Chhêng-Lo's figure for the Chhin and Chhien Han foot is taken (27·65 cm.) it would be equivalent to 5·44 ft.; if the foot of Chhin State, followed by Hsin and Hou Han, is taken (23·1 cm.), it would be 4·54 ft. The *Chou Li* (*Khao Kung Chi*) says elsewhere that 'the widths of roads are measured with the chariot gauge as the unit' (ch. 12, p. 17*a*, tr. Biot (1), vol. 2, p. 562), and later commentators say, assuming a Chou date for the *Chou Li*, that this was 8 ft. But while the Chou double-pace had 8 ft., not 6 ft., the Chou foot (19·9 cm.) was so short that it gives a gauge very little different from the former of our two figures, 5·22 ft.

We can gain more assurance from archaeological excavations of vehicles (cf. Vol. 4, pt. 2, pp. 77 ff., 246 ff.). Chariot gauges in the Shang are as wide as 7·07 ft., in the early Chou they average about 6·55 ft., in late Chou 5·71 ft., and in the Warring States period 5·41 ft., ranging down to 4·59 ft. There was thus a continuing reduction in gauge. Recent excavations of the city gates of the Han capital at Chhang-an show four traffic lanes within a width of 19·7 ft., i.e. 4·92 ft. for each one. There is thus fair agreement between textual and archaeological evidence; leading us incidentally to the interesting conclusion that Chhin and Han chariot gauges were quite close to the standard railway gauge of modern times, 4·71 ft. (4 ft. 8½ in.). It follows further that the three-width roads of the *Chou Li* would have been of the order of 15 ft. broad, and the nine-width roads 45 to 50 ft. As for Western parallels, there seems to have been an opposite tendency, gauge gradually widening from the 3·77 ft. of early Roman vehicles to the characteristic Romano-British rut distances which vary from 4·50 to 4·83 ft. (Lee, 1)—again approximating to 'standard' gauge. I am much indebted to Dr Lo Jung-Pang for discussion in correspondence helping to establish this note. Cf. Vol. 2, pp. 210, 214, 553, Vol. 4, pt. 2, pp. 250, 253.

[a] *Shih Chi*, ch. 6, p. 14*b*, cf. Chavannes (1), vol. 2, p. 139 and *TH*, p. 211. It must be remembered that the capital was very much in the west of the united empire. Communications to the south and south-west presented great natural difficulties, to which we shall return (pp. 15, 19 below).

[1] 馳道 [2] 直道

Though contemporary descriptions are not available, it is worth giving one from only a few years afterwards. About −178 Chia Shan,[1] one of the emperor Wên Ti's counsellors, presented him with a hortatory essay, entitled *Chih Yen*[2] (Words to the Point), in which he analysed the causes of good government and civil confusion, particularly criticising Chhin Shih Huang Ti. After decrying the luxury of the palaces built at Hsien-yang, he continued:[a]

> He also ordered the building of the post-roads all over the Empire, east to the uttermost bounds of Chhi and Yen, south to the extremities of Wu and Chhu, around the lakes and rivers, and along the coasts of the sea; so that all was made accessible. These highways were 50 paces wide, and a tree was planted every 30 ft. along them. The road was made very thick and firm at the edge, and tamped with metal rammers (*chin chhui*[3]). The planting of the green pine-trees[b] was what gave beauty to the roads. Yet all this was done (only) so that (Chhin Shih Huang Ti'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 (*hou chu chhi wai*[4]), some thinking that they were lined by walls on each side, like raised causeways (*yung tao*[5]),[c] others that the tamping referred simply to the consolidation of the edges, especially where there was an embankment.[d] That little trace of these roads remained in later ages presumably implies that they were less massively built than the Roman roads.[e] Yet if they consisted chiefly of rubble and gravel tamped down in the manner of pisé walls (see on, p. 38), they were more elastic and therefore much more modern in conception. Such 'water-bound macadam' was in fact the traditional material of Chinese highways in all periods.[f]

As for the width, it is generally agreed that the '50 paces' of the *Chhien Han Shu* was a scribal error for 50 ft.[g] so that the imperial highways would have been approximately nine-width roads equivalent to the broadest described in the *Chou Li*. They were thus rather larger than most of the Roman roads.[h] The inner lanes of these nine-lane thoroughfares were apparently reserved for the equipages of the emperor himself and authorised members of the ruling house; messengers, officials and merchants using the outer ones.[i]

[a] *Chhien Han Shu*, ch. 51, p. 2*a*, tr. auct. adjuv. Lo Jung-Pang (6). See also Chhü Shou-Yo (*1*).
[b] Cf. Chhen Jung (*1*), pp. 21, 25.
[c] Fu Chhien (+2nd century).
[d] Yen Shih-Ku (+7th century).
[e] Interesting remains have however been recorded. The Chhin imperial highway uncovered near Ling-ling (18) in Hunan was as wide and flat as a dry river-bed (*Hu-nan Thung Chih*, ch. 33, p. 9*b*).
[f] Cf. Tan Pei-Ying (1). Here everything depends upon the choice of rock for the chips and the cementing material.
[g] I.e. 32·7 of our feet if the Chou foot is taken, or 45·8 and 37·8 ft. if the Chhien Han and Hou Han standards are taken respectively. Archaeological finds indicate a breadth around 40 ft. The Chinese pace was always a double pace; 6 ft. until the end of the Sui, 5 ft. from the beginning of the Thang onwards.
[h] Estimates for these vary; Leger (1) considered that they were rarely wider than 25 ft., but there is some evidence for occasional broader stretches.
[i] An incident of −47, told in *Chhien Han Shu*, ch. 10, p. 1*b* (cf. Dubs (2), vol. 2, p. 374), confirms something of this description, and other demonstrative passages may be found, but it is rather difficult to believe, with some, that the central imperial lanes were so sacred that the common people could never cross them except by over-bridges. Such an arrangement all over the empire would have been far too expensive. We suspect that the taboo petered out some distance away from the capital. But daring to travel on the central lane was a high misdemeanour, and in one case a marquis was executed for doing so.

[1] 賈山 [2] 至言 [3] 金椎 [4] 厚築其外 [5] 甬道

Let us look at the course of the imperial highways shown on the map (Fig. 711).[a] A more easterly centre, San-chhuan (6) in the neighbourhood of modern Loyang, was chosen as the hub of the system, the road from Chhang-an (1) negotiating the Han-ku Pass (12) much as the Lung-hai railway does today,[b] and traversing the smaller centres of Hua-yin (57) and Hung-nung (58)[c] in the Yellow River valley. Thence the Eastern road went straight to Lin-tzu (8) in Shantung, capital of the former State of Chhi, following the Chi[1] River and passing places not now exactly identifiable. Branching from San-chhuan, the North-eastern road went up diagonally through Hopei to Chi (7), near modern Peking, capital of the former State of Yen, probably passing through Han-tan (62) and Chung-shan (63), well-known cities of the Warring States period. This road followed for a long way the old course of the Yellow River (cf. pp. 240 ff. below) after crossing it not far from Loyang, and water transport probably proved useful for the conveyance of the road metal. The longest road was that which struck off south-east towards the mouth of the Yangtze. Skirting first the northern edge of the vast valley of the Huai[2] River, it came to Chhen-liu (9) and then to Phei (10) after which it turned south, crossed the Yangtze in the vicinity of modern Nanking [54][d] and made its way past the Chiangsu lakes to Kuei-chi (11) at or near Suchow, the capital of the former State of Wu. Nearly as long as the South-eastern road was the Southern one. This did not go through San-chhuan but over the Hsiung-erh Shan[3] by the Wu Pass (13) direct from Chhang-an to Wan (14),[e] after which it went southwards, crossing the Han[4] River near Hsiang-yang (71) and reaching Nan-chün (15),[f] i.e. Ying, the capital of the former State of Chhu. Chhin Shih Huang Ti's opening of the south did not stop there, however, for the road crossed the Yangtze somewhere near the debouchment of the Tung-thing Lake[5] after following the river's windings, and so came to Chhang-sha (16). It then proceeded up the Hsiang[6] River valley past Hêng-yang (17) to its terminus at Ling-ling (18). Although it was now going eastwards again this was no mistake, for as we shall see later on (pp. 299 ff.) the upper waters of the Hsiang were made to connect in Chhin times by a remarkable canal with the upper waters of the West River (Hsi Chiang[7]) of Kuangtung, thus permitting the transport of arms and supplies for the conquest of the Cantonese State of Nan Yüeh.[g] Such was the way in which the order was carried out to link the ancient countries of Chhi and Yen, Wu and Chhu, with the capital of the Chhin empire.

It remains to speak of the Great North Road, the only one for which we have any details concerning its construction. In −212 Mêng Thien,[8] one of the First Emperor's

[a] For further explanations the reader may like to turn to the geographical introduction, with its maps, in Vol. 1, pp. 55 ff. In what follows, numbers in round brackets refer to the place-names given in the accompanying table, while those in square brackets refer to Table 4 and the map in Fig. 35 of Vol. 1.
[b] Cf. Anon. (57). [c] Cf. Vol. 2, p. 367.
[d] Ferries are of course implied; the Yangtze was not bridged anywhere below the gorges until our own time.
[e] This was the famous metallurgical centre of the Warring States and Han periods; cf. Vol. 5, Sect. 30*d*.
[f] Later Chiang-ling; cf. Vol. 2, p. 367. [g] Cf. p. 441 below.

[1] 濟 [2] 淮河 [3] 熊耳山 [4] 漢水 [5] 洞庭湖 [6] 湘江
[7] 西江 [8] 蒙恬

Table 60. *Place-names for the map of road communications in ancient China* (Fig. 711) *and for the map of civil engineering works* (Fig. 859)

Notes: (1) Roads west of An-hsi graded off for the most part into caravan tracks without sharp distinction.

(2) During the course of Chinese history a single place often bore as many as half-a-dozen different names. In the table the most ancient name comes first, generally speaking, the modern name last.

(3) The locations of the older and newer cities of different dynastic periods are often not quite identical; they may be a few miles apart. Here for convenience they are treated as synonymous.

(4) Numbers in square brackets are a cross-reference to Table 4 and the map in Fig. 35 of Vol. 1.

1 Chhang-an [9] 長安
= Hsi-an (Sian) 西安
Cf. Vol. 1, pp. 58, 103, 124, 181

2 Hsien-yang 咸陽
= Wei-chhêng 渭城
Cf. Vol. 1, p. 100
Vol. 4, pt. 2, p. 130

3 Kan-chhüan Shan 甘泉山
= Kan-chhüan Kung 甘泉宮
(the temple founded by Shao Ong)
= Shun-hua 淳化
= Yün-yang 雲陽
Cf. Vol. 1, p. 108
Vol. 4, pt. 1, pp. 122, 315
Vol. 5, Sect. 33

4 Kan-chhüan 甘泉

5 Chiu-yuan 九原
= Wu-yuan 五原

6 San-chhuan 三川
= Lo-yang [8] 洛陽

7 Yen 燕 (former capital of Yen State)
= Chi 薊 (near modern I-hsien 易縣)
= Pei-ching (Peking) [50] 北京
Cf. below, pp. 75 ff.
Vol. 1, pp. 139ff.

8 Lin-tzu 臨菑
= Chhi 齊
(former capital of Chhi State)

9 Chhen-liu 陳留
= Ta-liang 大梁
= Pien-ching 汴京
= Khai-fêng 開封

10 Phei 沛
= Phei-hsien 沛縣
(north of Hsüchow 徐州)

11 Wu 吳 (former capital of Wu State)
= Kuei-chi 會稽
= Su-chou (Suchow) 蘇州

12 Han-ku Kuan 函谷關 (Pass)

13 Wu Kuan 武關 (Pass)

14 Nan-yang 南陽
= Wan 宛
Cf. Vol. 5, Sects. 30, 36

15 Nan 南
= Nan-chün 南郡
= Ying 郢
(former capital of Chhu State)
= Chiang-ling 江陵
= Lin-chiang 臨江
= Ching-chou 荊州
Cf. Vol. 2, pp. 191, 197, 198

16 Chhang-sha [56] 長沙

17 Hêng-yang 衡陽
= Hêng-shan [53] 衡山

18 Ling-ling 零陵

19 Kuei-lin [61] 桂林

20 Hsiang 象
= Tshang-wu 蒼梧
= Wu-chou 梧州

21 Wu-kung 武功

22 Fu-fêng 扶風
Cf. Vol. 4, pt. 2, p. 39

23 Old Pao-chi 寶雞
= Chhen-tshang 陳倉

24 Thien-shui 天水

25 Lung-hsi 隴西

26 Ting-hsi 定西

27 Chin-chhêng 金城
= Kao-lan 皐蘭
= Lan-chou (Lanchow) [7] 蘭州

28 Yung-têng 永登

29 Wu-shao Ling 烏鞘嶺 (Pass)

30 Wu-wei 武威
= Liang-chou (Liangchow) 涼州
= Sera Metropolis (by mistake for Chhang-an)

Table 60 (*continued*)

31 Yung-chhang 永昌 (in Kansu)
Cf. Vol. 1, p. 237
32 Shan-tan 山丹
Cf. Vol. 4, pt. 2, p. 402
33 Chang-yeh 張掖
= Kan-chou (Kanchow) 甘州
34 Kao-thai 高臺
35 Chiu-chhüan 酒泉
= Su-chou (Suchow) 肅州
36 Chia-yü Kuan 嘉峪關
(Western Gate of the Great Wall)
Cf. Vol. 1, Fig. 14
37 Yü-mên 玉門
38 An-hsi 安西
= Kua-chou 瓜州
39 Tun-huang [45] 敦煌
= Sha-chou 沙州
40 Yü-mên Kuan 玉門關 (Jade Gate)
41 I-wu 伊吾
= Hami 哈密
= Qomul
42 Lou-lan 樓蘭
43 Yü-ni 寙匿
= Shan-shan 鄯善
= Erh-chhiang 婼羌
= Issedon Serica
= Charkliq
44 Chhieh-mo 且末
= Cherchen
45 Kao-chhang 高昌
= Shan-shan 鄯善
= Karakhoja (Qarākhoja)
= Turfan
46 Chiao-ho 交河
= Piala
= Yarkhoto
47 Yen-chhi 焉耆
= Karashahr (Qarāshahr)
48 Wei-li 尉犂
= Kalgaman
= Kurla
49 Pei-ti 北地
= Ning-hsien 寧縣
50 An-ting 安定
= Phing-liang 平涼
51 Yung 雍
(former capital of Chhin State)
= Fêng-hsiang 鳳翔
52 Hsiao Kuan 蕭關 (Hsiao Pass)
53 Hui-chung Kung 回中宮
= Ku-yuan 固原
54 Li-yang 櫟 (or 櫪) 陽
55 Shang-chün 上郡
56 Yü-lin [11] 榆林
57 Hua-yin 華陰
near Thung-kuan [5] 潼關
58 Hung-nung 弘 (or 宏) 農
= Kuo-lüeh 虢略
Cf. Vol. 1, p. 94
Vol. 2, p. 367
59 Ho-tung 河東
60 Chin-yang 晉陽
= Thai-yuan 太原
61 Tai 代
= Tai-chün 代郡
62 Han-tan 邯鄲
63 Chung-shan 中山
Cf. Vol. 5, Sect. 30
64 Lang-ya 琅邪
= Lang-yeh 琅琊
(the kuan-thai 觀臺, observation terrace)
Cf. Chavannes (1), vol. 2, p. 144
65 Lu-chiang 廬江
66 Chiu-chiang 九江
67 Chhing-chiang 清江
68 Gan(-hsien) 贛 (縣)
69 Chhü-chiang (Kukong) 曲江
= Shao-kuan 韶關
= Shao-chou 韶州
70 Nan-hai 南海
= Kuang-chou (Canton) [28] 廣州
71 Hsiang-yang 襄陽
Cf. Vol. 5, Sects. 30, 34
72 Mien-hsien 沔縣
73 Pao-chhêng 褒城
74 Han-chung [18] 漢中
= Nan-chêng 南鄭
75 Fêng-hsien 鳳縣
= Shuang-shih-phu 雙石舖