

# Extending the compass of plan analysis: a Chinese exploration

**J. W. R. Whitehand**

School of Geography, Earth and Environmental Sciences,  
University of Birmingham, Birmingham B15 2TT, UK.

E-mail: J.W.R.Whitehand@bham.ac.uk

and

**Kai Gu**

School of Architecture and Planning, University of Auckland,  
Private Bag 92019, Auckland, New Zealand.

E-mail: k.gu@auckland.ac.nz

*Revised version received 27 June 2007*

---

**Abstract.** *Research on Chinese urban form has hitherto been descriptive rather than analytical and it is handicapped by the lack of major sources of information used in the West. This paper explores M. R. G. Conzen's method of plan analysis, as developed by him largely in Europe, in the very different cultural conditions existing in China. Components and stages in the genesis of the layout of the ancient city of Pingyao are established or inferred using Conzen's method and concepts. Most components in the street plan of Pingyao and many of those in its plot pattern are products of a series of planned schemes. The historico-geographical structure of the city's plan can be understood in terms of fixation lines (mainly lines of former and extant city fortifications), consequent and occupation streets, fringe belts, present and former axial streets, the recurrence of an ancient street-grid module, rectilinear street systems in areas created since the fourteenth century, the influence of fengshui (especially on plot orientations), varying degrees of plot metamorphosis and repletion, and the incidence of communal residential work units. Because of the limited historical record, especially in the form of true plans, some findings are more tentative than those of comparable studies in Europe. However, the successful application of the method in an environment so different from that of its previous, largely Euro-American, testing grounds justifies confidence in its worldwide applicability, with major implications for urban landscape management.*

*Key Words:* Conzen, plan analysis, fixation lines, plot patterns,  
street patterns, Pingyao, China

---

Some of the most fruitful contributions to understanding the historical development of the form of towns and cities have come from plan analysis. It has not only provided an important method for the reconstruction of a fundamental aspect of urban landscapes but also contributed to underpinning a method for

their regionalization and management (M. R. G. Conzen, 1975). Its usage, however, has largely been limited to a small number of urban morphologists, and long after its first appearance in the geographical literature it is still necessary to make clear what it is that is being analysed in plan analysis and how 'plan'

relates to the other principal facets of the urban landscape that are susceptible to direct observation.

According to Conzen (1960, pp. 4-5), who led the development of research on plan analysis in the second half of the twentieth century, the definition of plan in this context is the 'topographical arrangement of an urban built-up area in all its man-made features', comprising three complexes of plan elements, namely streets, plots and the block plans of buildings. Conzen argued that the plan forms 'the framework for the other man-made features' (M. R. G. Conzen, 1960, p. 4), among which are the land-use pattern and buildings viewed three-dimensionally. Since there are other usages of the word 'plan' in relation to the built environment, it is worth drawing attention to the distinction between this view of plan and two other widespread usages: first, to describe the cartographic *representation* of such a topographical arrangement in, for example, a 1:2500 Ordnance Survey plan, and secondly, to denote a design or scheme.

Prima facie, the method of plan analysis as developed by Conzen is applicable to any settlement in any culture area. Its most effective use hitherto, however, has been in conjunction with fieldwork, documentary records, more recently archaeology, and, above all, during much of its existence, historical series of ground plans that include – in addition to streets – plot boundaries and the block plans of buildings (see, for example, Baker and Slater, 1992; M. P. Conzen, 1990; M. R. G. Conzen, 1960, 1962; Lilley *et al.*, 2005; Scrase, 1989; Slater, 1989). But there are large areas of the world for which neither urban archaeological records nor series of true ground plans exist, and where historical documentation is at best very fragmentary. One such area is the greater part of China. With what success can the sort of plan analysis inspired by Conzen be applied in such an area and to what extent are the concepts derived from plan analysis elsewhere applicable? The answers to these questions are only now beginning to be sought, and this paper describes the results of an investigation that is

part of that search.

### Chinese urban morphology

China has an urban history extending over some 3500 years (Dong, 1989, p. 7; He, 1996, p. 4). It needs morphological analysis, but the study of urban form in that major part of the world has hitherto been largely descriptive, despite its lengthy existence as a field of interest among researchers in archaeology, architectural history, geography and planning (Whitehand and Gu, 2006). Part of the explanation for the weakness of analytical, especially genetic, urban morphology in China is to be found in Chinese culture and, inseparable from this, the nature of Chinese historical records. Apart from the limited parts of cities mapped by Western surveyors from the mid-nineteenth century onward, cartographic records, so important in research on the historical development of urban form in the West, generally contain little planimetric information. Historical maps of Chinese urban areas generally show little more than street patterns and landmark structures, such as city walls, administrative buildings, palaces, temples and parks. Cartographic endeavours in China in the past have been particularly devoted to symbolization, especially pictorial symbols, and the visual effectiveness of map design as an art: the design of maps has been intimately linked to ideological purposes (Chang, 1974, p. 1). Such proclivities accord with Confucian principles and customs based on cosmology and the art of siting man-made forms auspiciously. They stem from studies of ancient Chinese civilization and philosophy, which have dominated research on urban form (Wang, 1997; Wheatley, 1971; Wright, 1977; Yang, 2003).

The present state of Chinese urban morphology should also be seen in relation to a number of other considerations. One of these is the minor role that fieldwork has played as a source of information in comparison with other historical and geographical sources. Another is the destruction of numerous ancient buildings and historical



**Figure 1. Part of the northern fringe of the walled city of Pingyao in the early twenty-first century. Reproduced from Zhu (2006) with the permission of Haihu Zhu.**

records, such as legal records of property transfers, during the Cultural Revolution, between 1966 and 1976. But in some ways most frustrating for the present generation of urban morphologists is the difficulty of gaining access to many of the records that do exist: though large-scale plans, for instance, at the scale of 1:500, showing streets and the block plans of buildings, were prepared for major Chinese cities after the early 1950s, they remained confidential documents and it is only in recent years that researchers have obtained access to them, and then only with difficulty.

### **Pingyao and its records**

Knowledge of the historical development of the physical form of Chinese cities at the scale of streets and buildings, as distinct from broad characteristics such as city shape and size, is too limited to allow much to be claimed about the representativeness of a particular city chosen for detailed plan analysis. This paper

examines Pingyao, a city notable for the survival of its traditional form (Ruan, 1998). Like nearly all Chinese cities, Pingyao has very limited documentary records of its historico-morphological development. An old-established administrative centre of a county (currently the administrative level below province and city), it is centrally located within Shanxi province in northern China, about 90 km south-west of the provincial capital of Taiyuan and nearly 500 km south-west of Beijing. The roughly square, walled city, of which part of the northern edge is shown in Figure 1, is sited on the gently sloping plain between the River Huiji and the River Liugen. Though it is not large by the standards of traditional Chinese cities, the area within its fourteenth-century wall being some 2.25 km<sup>2</sup>, by the standards of medieval European cities it is very large, only a handful of cities in that continent having had longer medieval walls. The walled historical core had a population of approximately 35 000 in 2001 (Zhang, 2001, p. 274). Most importantly for

plan analysis, a ground plan of Pingyao, showing streets, plots and the block plans of buildings, has recently been completed by Shanxi Research Institute of Urban and Rural Planning and Design. In Figure 2, the plot boundaries and the outlines of the block plans of the buildings have been based upon this unpublished plan which, unless otherwise indicated, provided the dimensions from which the maps and plans that comprise Figures 2-3 and 5-13 were constructed. It also provided the base plan for the fieldwork undertaken by the authors in 2004/7.

The principal historical records and the only significant repositories of old maps of Pingyao are a number of local gazetteers and geographical encyclopaedias (Hsu, 1978, p. 59). The earliest, *Pingyao Tujing (Cartographical Records of Pingyao)* was apparently prepared in the Jin dynasty (1115 - 1234) but no copy survives (Lai, 1999, p. 1). It is mentioned in *Shanyou shike congbian* (Hu, 1988), which was first published in the early twentieth century. Gazetteers were also compiled in 1618 (the Ming edition), 1674 (the early Kangxi edition), 1707 (the Kangxi edition), 1883 (the Guangxu edition), and 1999. In addition to a small number of maps and sketches of landmarks and scenic areas, such as important temples, street gates, the town hall, bridges and major public spaces, the gazetteers include historical accounts of Pingyao. The information they contain relates largely to the period since the fourteenth century.

### Historical geography of Pingyao

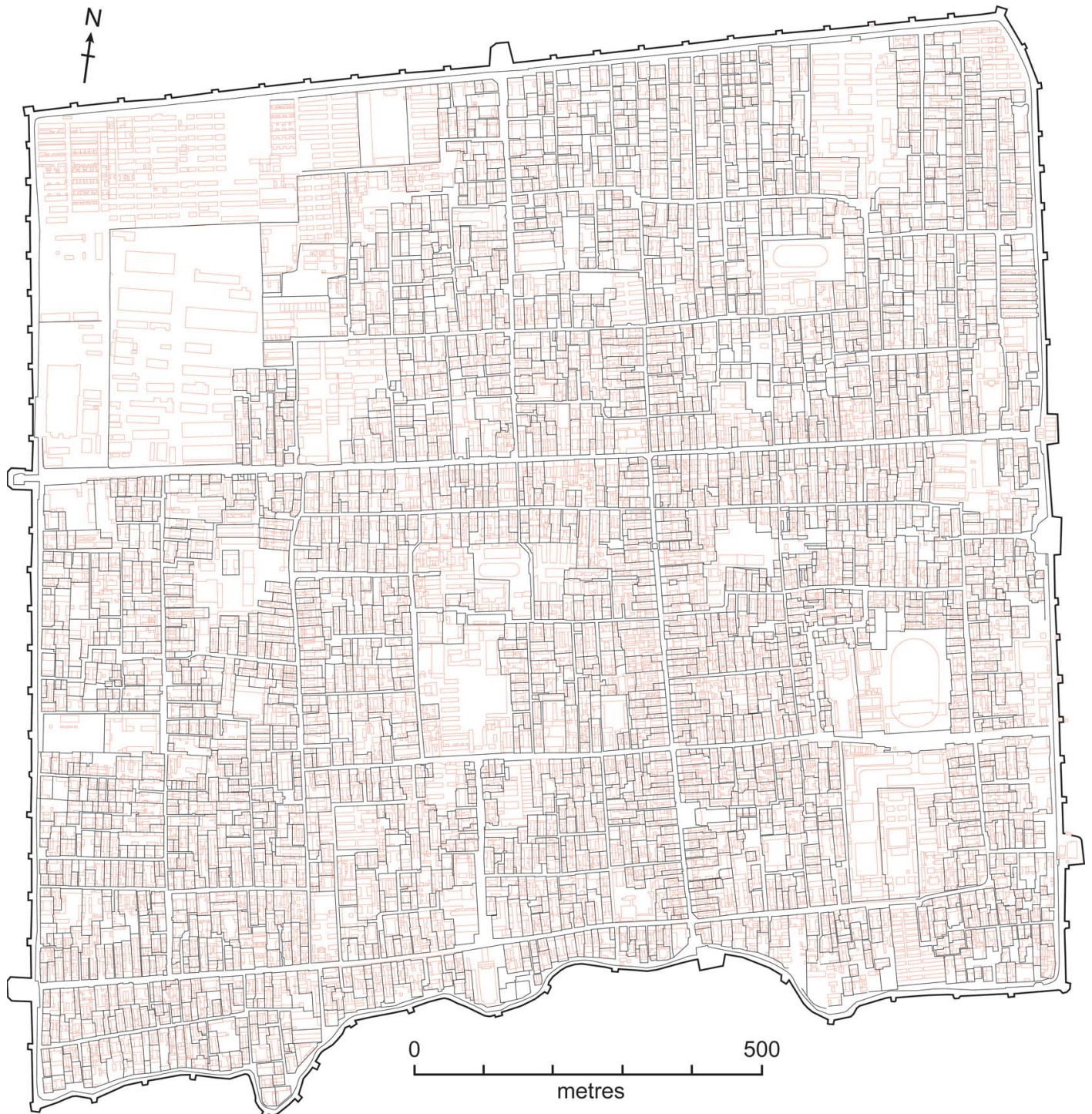
The origins of Pingyao, unlike those of practically all the various capital cities that China has had, are uncertain, but long pre-date any surviving historical records. It is possible that a settlement existed here as long ago as the Wudi period (c. 2600 - c. 2100 BC) (*Pingyao Xianzhi*, 1883, Guangxu edn; Compiling Committee for Pingyao Gazetteer, 1999, p. 2). However, General Yin Jifu is regarded as having founded a settlement here during the Xuanwang period (827 - 781 BC) in

the Zhou dynasty (c. 1100 - 256 BC). The Yingong Temple inside the present city wall, a tomb outside it and a military training and ceremonial platform (*dianjiangtai*) on it were built to commemorate this event.

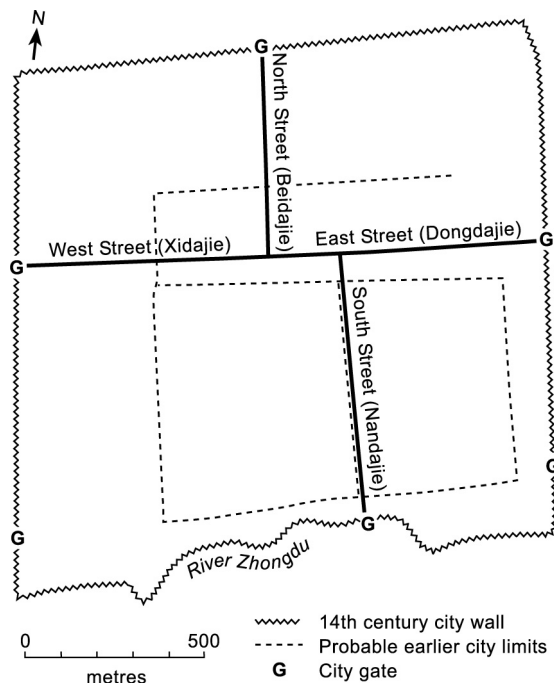
The city became the capital of the County of Pingyao in the fifth century AD (the Taiwudi period in the Beiwei dynasty) (Compiling Committee for Pingyao Gazetteer, 1999, p. 67) and has had a long history as an important administrative and market centre within its region. It has also benefited from its location on an ancient routeway, a major trade route since the seventh century AD, linking Beijing with Shanxi, Sichuan and Gansu, important provinces in the western part of China (Compiling Committee for Pingyao Gazetteer, 1999, p. 339; Du, 2002, p. 174).

'The original mud ramparts were narrow and low on both the eastern and western sides of the city' (*Pingyao Xianzhi*, 1883, Guangxu edn). It is not clear whether 'the stretches of wall built by Yin Jifu on the northern and western sides' of the city (*Pingyao Xianzhi*, 1883, Guangxu edn) were rebuildings of an existing structure. There are neither written references to, nor is there archaeological evidence of, any further city wall building until the fourteenth century, early in the Ming dynasty (1368 - 1644), when the existing wall was given a brick facing and further extended, mainly, if not exclusively, towards the north and west. Despite an increase in wall length of nearly 50 per cent, the number of gates remained the same: one in each of the northern and southern stretches of the wall and two in each of the eastern and western stretches (Du, 2002, pp. 38-43) (Figure 3).

The southern stretch of the fourteenth-century wall follows the course of the River Zhongdu, which was subsequently realigned and renamed the River Luigen. The stretches on the other three sides are straight, except in the north-east corner. The wall is just over 10 m high, 8 to 12 m wide at its base and 3 to 6 m wide at its top. It is protected by a moat (Compiling Committee for Pingyao Gazetteer, 1999, pp. 750-1). It has undergone a number of partial reconstructions but its entire length is extant. However, an extension constructed



**Figure 2. Plot boundaries and outlines of the block plans of the buildings: central Pingyao, c. 2000. Plot boundaries are shown in black. Building outlines are shown in red (in black where they coincide with a plot boundary). Based upon an unpublished plan prepared by Shanxi Research Institute of Urban and Rural Planning and Design.**



**Figure 3. Pingyao in the late-fourteenth century.**

in 1509 outside the more northerly of the eastern gates (Qinhan gate) no longer survives (Du, 2002, p. 43).

Following the opening of the first *piaohao* (an early type of bank) in 1823 (Du, 2002, pp. 198-229), Pingyao developed into a major financial centre, but it remained almost entirely within its fourteenth-century wall. Many of the buildings existing today within that wall were constructed during the period between the mid-nineteenth century and the early twentieth century (Figure 4). Like many other Chinese cities, after the Communist Party came to power in 1949 Pingyao was greatly affected by the policy of transforming commercial cities into industrial ones (Sit, 1995, p. 147). State-owned residential work units (*danweis*), also generally comprising housing and community buildings, were created not only as extensions to the city beyond its walls, but within the walled city, where a number of sites previously occupied by courtyard housing or institutions were redeveloped.

Since the economic reforms initiated by the central government of China in 1978, Pingyao has been affected by the rapid rise of privately-

owned enterprises and the recognition of its tourist potential (Dong and Ruan, 1999; Ruan, 2003, pp. 17-27). In 1986 it was added to the List of Precious Chinese Historico-Cultural Cities (*lishi wenshua mingcheng*), and in 1997 it was designated as a World Heritage Site by UNESCO, triggering a dramatic growth of tourism (Zhang, 2001, p. 286) and associated changes to the urban landscape. In addition to improvements to the city's infrastructure, many restorations and reconstructions of historical buildings have taken place (Du, 2002, pp. 387-402).

### Previous research and the way forward

Despite Pingyao's exceptional state of preservation, its plan has been the subject of little previous investigation. The growth of tourism in the city in the past two decades has, however, created an environment much more congenial to historical research: important roles have been played by Pingyao Research Institute of Precious Historico-Cultural Cities, Pingyao Association of Cultural Heritage and Pingyao Association of Antique Collectors (Du, 2002, p. 326). Publications about Pingyao during that period have dealt with tourism and historical conservation (Liu, 2003; Zhang, 1999, 2001), urban history and culture (Du, 2002; Pei and Gong, 2003; Ruan, 1998) and traditional courtyard houses (including those in the surrounding region) (Ji, 2006; Song, 2000; Wang, 2002). But analytical approaches have been entirely absent. Like practically all Chinese cities, Pingyao lacks analyses of the processes of physical change to which it has been subject. Mapping of the historico-geographical development of the configuration of the city is needed. A diagrammatic representation of the city's growth phases prepared by Shanxi Research Institute of Urban and Rural Planning and Design (2005) is the nearest to this that there has been. Recognition of the tourist potential of Pingyao has created interest in the city's historical significance and led to pressures for redevelopment, but has not been paralleled by systematic attempts to identify how the varied



**Figure 4. The core area of central Pingyao, looking north over Nandajie in the late 1990s. The junction of Nandajie with Xidajie and Dongdajie is in the middle distance. Reproduced from Compiling Committee for Pingyao Gazetteer (1999) with the permission of the Committee.**

forms that make up the city have developed and, most importantly, how they fit together. It is in this regard that urban morphology, particularly plan analysis, as pursued by Conzen and his followers would seem to have an important part to play. By applying this type of plan analysis to Pingyao it is hoped that a contribution can be made that will both help in the task of tracing the historical development of China's cities and provide foundations on which those managing the

urban landscapes of those cities in the future can build (M. R. G. Conzen, 1966, 1975). Accordingly, the concepts and terms employed in the plan analysis undertaken here are for the most part those developed in Conzen's pioneering work (see, especially, M. R. G. Conzen, 1969, pp. 123-31).

Approached through plan analysis, components and stages in the creation and transformation of the layout of Pingyao can be established or inferred with varying degrees of

confidence. Limiting attention here to the walled city, key morphogenetic features can be brought together in the form of a map-cum-cartogram (Figure 5), though the limited historical record, especially in the form of true plans, and minimal archaeological evidence, have meant that this is necessarily more reliant on hypothesis than the nearest equivalent of Conzen's maps. However, although plan units – the end products of Conzen's more historically-informed plan analyses (M. R. G. Conzen, 1969, p.128) – have not been delimited, Figure 5 contains a major part of the groundwork for the recognition of such units. It is not only analytical and descriptive: the combinations of symbols and colours go some way towards synthesizing the characteristics of streets and plots that are the basis of plan units. One of the most important omissions is any systematic consideration of the block plans of buildings: this subject is touched on later in this paper, but its more detailed consideration is the topic of continuing work.

### Principal characteristics of the plan

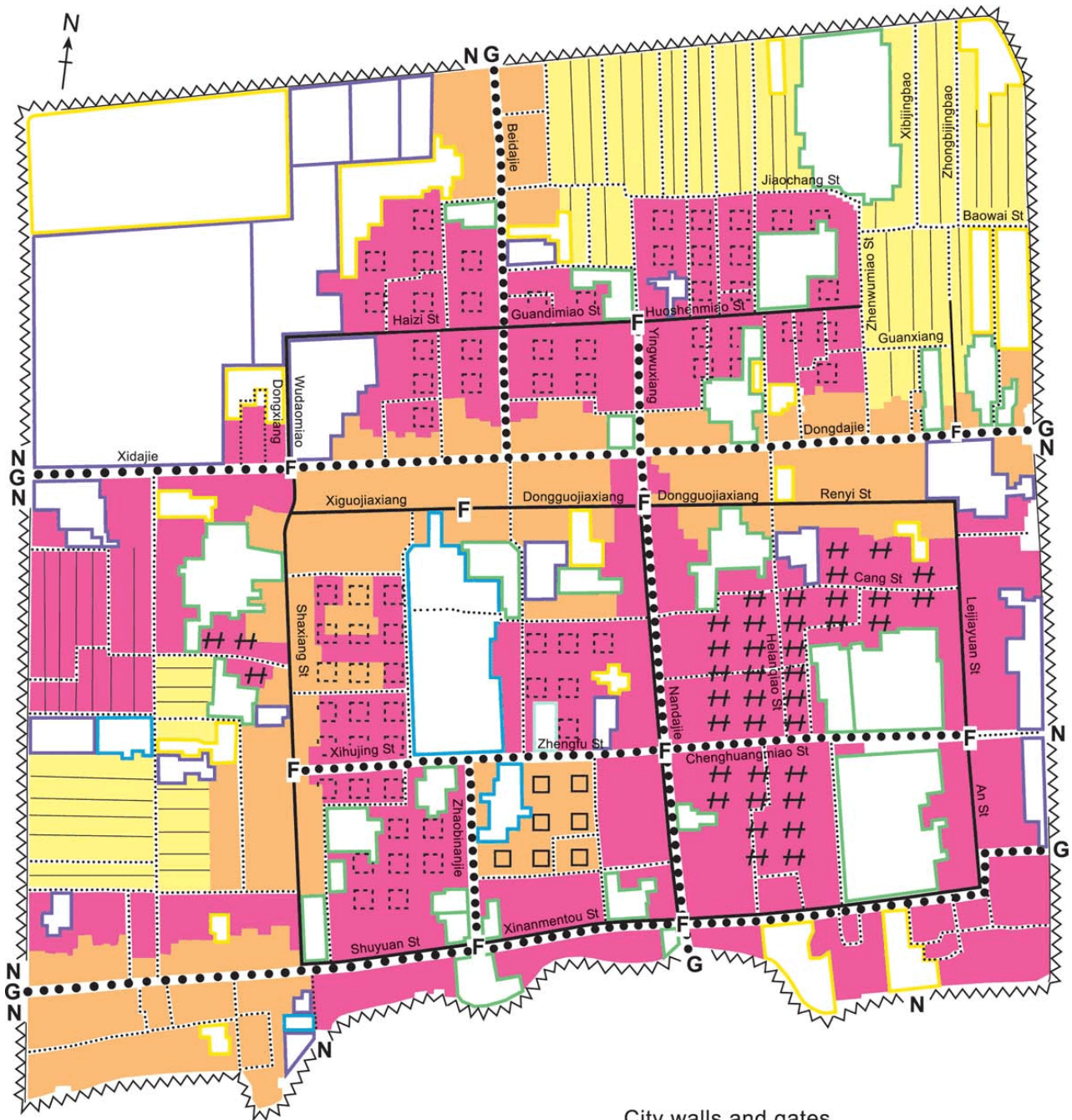
Practically all the main components in the street plan of Pingyao and many of those in the plot pattern are direct products of, or have developed out of, a series of planned schemes. Most of the larger of these schemes, including the ancient core, contained axial or spinal streets (shown by bold, black dotted lines in Figure 5). The main axial streets of the ancient core (Xihujing Street – Zhengfu Street and Zhaobinanjie) meet immediately south of the centrally-located administrative offices (*xianya*): a type of layout noted by Chang (1970, p. 78) as one of the four most common street patterns in Chinese cities. This broadly accords with the planning principles of mainly national and regional capital cities described in *Kaogongji* (the Artificers' Record), probably prepared during 206 BC - 220 AD (He, 1996, pp. 204-9). However, Pingyao was of minor significance compared with such major cities, and there is no historical record of the earliest part of its layout. A hypothesized former north gate of this initial ancient settlement is

shown in Figure 5, although Chang (1978, p. 78) points out that there was often no north gate in cities having this type of plan.

The boundary streets of this early settlement (Xiguojiaxiang – Domgguojiaxiang, Nandajie, Shuyuan Street – Xinanmentou Street, and Shaxiang Street) are *consequent* streets in Conzen's terminology, having been developed along a fixation line (M. R. G. Conzen, 1969, pp. 124-5) – in this case almost certainly a line of fortification at the edge of the settlement. In Figure 5, these streets, like others of similar origin associated with the city's subsequent fortifications, are shown by a thick black line. They are referred to as hypothesized consequent streets since their derivation has been inferred rather than based on documentary or archaeological evidence. In the course of subsequent city extensions, some consequent streets have become axial streets. This evidently occurred, for example, when a major extension eastward from the original core meant that Nandajie became the new central north-south axis of a greatly enlarged city, of which the line of Leijayuan Street – An Street appears, from the street pattern, to have been at, or closely aligned with, the eastern edge, although there is no documentary record of this.

Several axial streets have become reduced in significance as extensions to the city have brought into existence new axial streets. This is most notable in the case of Yingwuxiang. Extending north from the junction of today's two main axial streets (Xidajie – Dongdajie and Nandajie), this street no longer has much significance even within the most local pattern of vehicular movement. It has long ceased to lead to a gate in the north wall of the city. The present north and south gates are not connected by a single straight axial street. The asymmetry in the street plan associated with this is another common feature in Chinese cities (Chang, 1970, p. 78).

A recurrent feature in most of the central part of the city is a spacing between main streets of approximately 184 m. It is particularly evident in the case of streets aligned north-south (Figure 6). In the ancient core, south of Xiguojiaxiang, and for a distance of

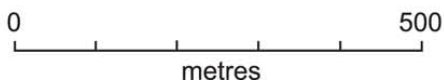


**Principal Streets**

- Axial street (present or former)
- Hypothesized consequent street
- ⋯⋯⋯ Other through street

**Street-plan types**

- □ Square grid
- □ Residual square grid
- ||| Rectilinear, north-south aligned
- === Rectilinear, east-west aligned
- ## ## Irregular rectilinear



**City walls and gates**

- ⚡ 14<sup>th</sup> century wall and discontinuous occupation road
- G** Extant historical gate
- F** Hypothesized former gate
- N** Post-1949 gate

**Courtyard plots (mainly residential)**

- Yellow Orthomorphic
- Orange Hypometamorphic
- Pink Metamorphic

**Other residential plots**

- Yellow outline: Mainly post-1949 terrace houses, often in communal plots

**Large plots with specialized buildings**

- Blue outline: Government
- Green outline: Institution
- Purple outline: Industry, storage and utilities
- Cyan outline: Bank/insurance

**Figure 5. Principal plan components of central Pingyao, 2006.**

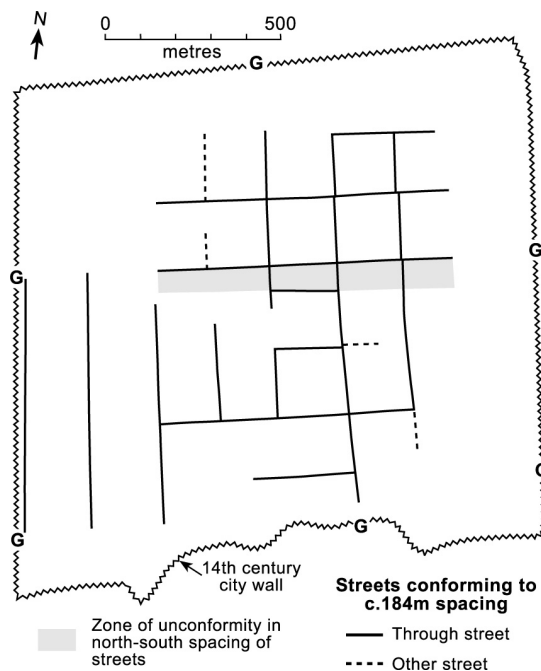


Figure 6. Regularities in street spacing in central Pingyao.

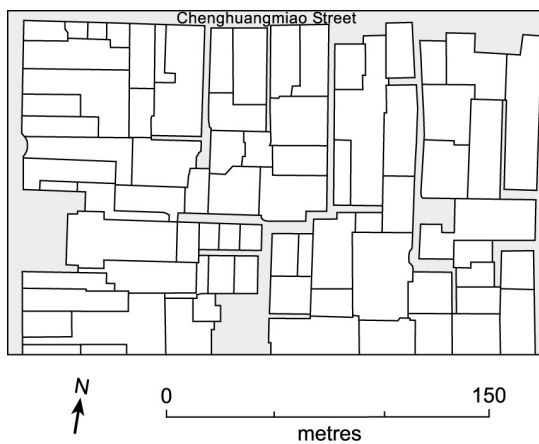
two street blocks north of Xidajie – Dongdajie, a grid of 184 m by 184 m street blocks (with a variation in street spacing of up to 14 m) is still evident in a number of places. These square, or almost square, street blocks may well have been *lis* or *fangs* until the Qing dynasty (1636 - 1912), the *fang* having been the basic administrative unit in the walled area of Pingyao up to that time (Compiling Committee for Pingyao Gazetteer, 1999, p. 69). Whether the street blocks were at one time walled, as was the case in many Chinese cities until early in the Song dynasty (907 - 979) (He, 1996, pp. 600-2), is not known. Square street blocks are absent in the presumed early fortification zone now occupied by Xiguojiaxiang, Dongguojiaxiang and Renyi Street and the plots between these streets and Xidajie – Dongdajie.

Deviations from straight street lines are few, although at least one – on an east-west street in the relatively old east-central part of the city (Cang Street – Figure 5) – is sufficiently pronounced to be very clear even at the small scale at which Figure 2 has been drawn. Such irregularities may reflect the layouts of earlier, rural settlements whose sites were incor-

porated within Pingyao (cf. M. R. G. Conzen, 1988, pp. 263-4), but there is no evidence to substantiate this speculation.

The line of the city wall that preceded the present, fourteenth-century wall is based largely on inference. There is a documentary reference to its length being 9 li 18 bu (*Pingyao Xianzhi*, 1883, Guangxu edn). In the early Ming period this was the equivalent of 4312 m (Fu, 2001, p. 7). However, measurements of wall lines that plan analysis indicates would be plausible do not yield any that correspond closely to this length. The wall may have marked a northward extension from the previous city limits to the line of Haizi Street, Guandimiao Street and Huoshenmiao Street, which is a hypothesized consequent street in Figure 5. That the wall continued to follow the existing Shaxiang Street wall line in the west is supported by a documentary reference in 1349 to the fact that the area west of Shaxiang Street was still outside the wall (Du, 2002, pp. 40-1). The suggested northern line is the only continuous line of streets between the presumed previous city limits and the present wall, but there is no evidence in the layout of either streets or plots at its eastern end of how it might have joined up with the eastern wall. It is therefore more tentative.

Most of the area in the north-eastern corner of the present walled area has been developed very differently from the oldest parts of the city. It is unlikely that this reflects redevelopment with little or no reference to a previous layout. In view of the longevity of major street alignments elsewhere in the city, which accords with the striking ‘conservatism’ of street lines noted by plan analysts in Europe (see, for example, M. R. G. Conzen, 1988, p. 255), it is much more likely that this area remained largely or entirely undeveloped until well after it was encompassed by the fourteenth-century wall. It has an essentially regular rectilinear street plan, in contrast to the older parts of the city, whose street plans are predominantly either square grids or quasi-rectilinear (‘irregular rectilinear’ in Figure 5). It has similarities to substantial parts of the area west of Shaxiang Street, although the alignment of most of its streets is north-south



**Figure 7. Metamorphic plots and pseudo-street system in the southern part of central Pingyao.**

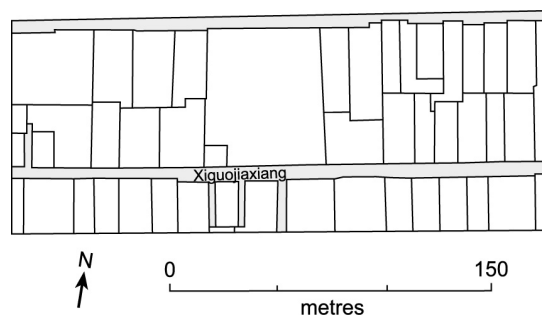
whereas west of Shaxiang Street there are strong east-west alignments (Figure 5).

Plots may be distinguished according to the varying extent to which they depart from an essentially regular rectilinear form. It is a reasonable presumption that such departures are to a large extent a function of modifications to the boundaries of plots since they were originally laid out. Following Conzen (1969, p. 127; 1962, pp. 402-10), three categories of change have been recognized in Figure 5, ranging from the essentially intact or orthomorphic to the hypometamorphic and metamorphic. The categorization of plots was not always clear-cut owing to the variety of types of change to which plot boundaries have been subject. Like Conzen, we have not quantified the limits to categories, and there was an element of subjectivity in assigning plots that lay on the margin between categories.

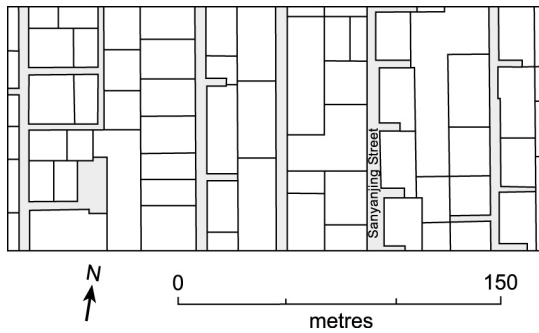
In the central and southern parts of the present walled city, plots are predominantly metamorphic (Figure 7), reflecting in part at least the very long time-span over which they have been exposed to forces for change. The main exception to this is the zone associated with former western and northern city limits in Shaxiang Street, Xiguojiaxiang – Renyi Street, and Xidajie – Dongdajie. Here hypometamorphism is characteristic: this reflects, it would seem, the still strong influence of the more recent laying out of planned series of

plots along and in the vicinity of consequent streets after the fortifications were demolished (Figure 8). In the vicinity of the northern and western stretches of the present wall, plots are predominantly orthomorphic and hypometamorphic, orthomorphism being particularly characteristic within a broad zone inside the eastern half of the northern stretch.

The greater regularity of the plots near the northern and western stretches of the wall, particularly in areas remote from gates in the wall, tends to correspond to greater regularity in the street system (Figure 9). Within the oldest parts of the city, in contrast, access to subdivisions of plots created in the interiors of street blocks by truncating plot tails has been achieved by the development of a labyrinth of alleys, including many culs-de-sac, forming what Conzen (1969, p. 129) terms a pseudo-street system (Figure 7). Over practically the entire city within the present walls, culs-de-sac are numerous. Initially they were probably mainly private alleyways but they have in most cases long since become public rights of way. At the end of a cul-de-sac, there is frequently either a stele bearing the inscription ‘*Taishanshi gandang*’ or a stone lion. This is a remedy for the inauspicious street end (Du, 2002, p. 57). Without such a feature, a dead end to a street is incompatible with *fengshui*: a system of good and evil influences in the natural surroundings considered when designing buildings and settlements – defined by Chatley (1917, p. 175) as ‘the art of adapting the residence of the living and the dead so as to co-operate and harmonize with



**Figure 8. Hypometamorphic plots associated with a hypothesized consequent street (Xiguojiaxiang) in central Pingyao.**



**Figure 9. Essentially orthomorphic plots and rectilinear street system in the northern part of central Pingyao.**

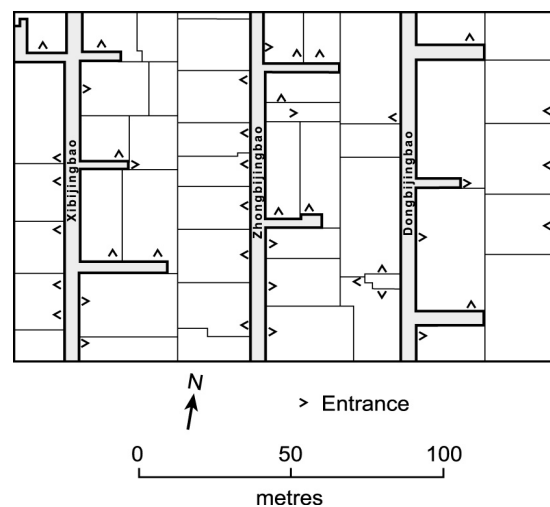
the local currents of the cosmic breath’.

With regard to building block plans, the traditional courtyard is by far the most common type. The main exceptions are a number of *danweis* that were created largely during the 3 decades after 1949. The creation of *danweis*, most of them industrial or institutional, has in many cases entailed the redevelopment of the sites of residential courtyards or temples. They constitute many of the ‘large plots with specialized buildings’ in Figure 5.

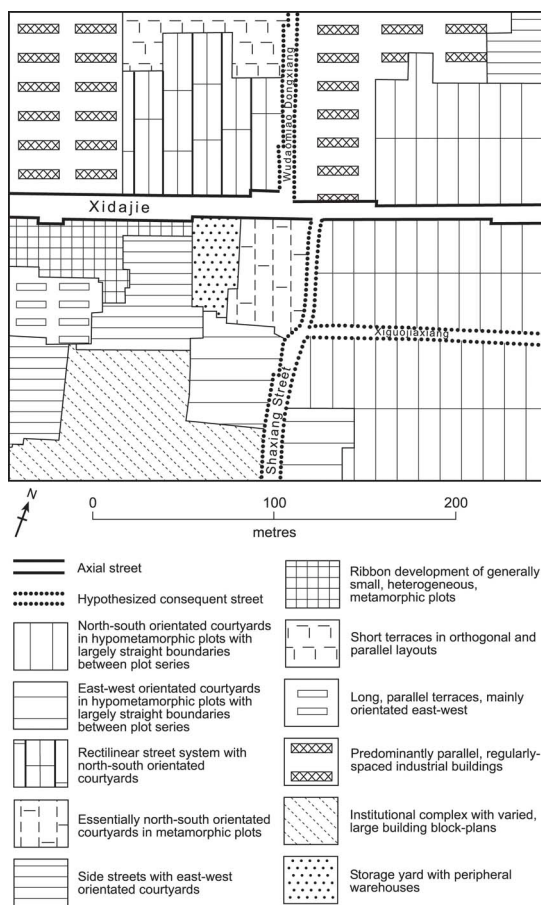
Institutions, many of them religious, tend to be located in the vicinity of former city limits, originally having been prominent components in a zone of spacious plots at the rural-urban fringe but later embedded in the growing urban area. Such fringe belts (cf. M. R. G. Conzen, 1960, pp. 56-65), often forming pronounced breaks between a city’s older and newer residential growth zones, have been researched in several Western countries (Whitehand and Morton, 2006). In the south and east of the present walled city, a number of large institutional sites associated with the presumed previous edge of the city are not clearly distinguished from the pronounced fringe belt associated with the present wall, which is in large part extramural and therefore not shown in Figure 5. Much of the glacis fringing the present wall survives as various kinds of open space. The intramural component of the fringe belt, consisting of a mixture of quasi-agricultural plots, institutions and factories, is much less continuous. Unlike in Western cities, in Pingyao substantial areas of

intramural agriculture existed well within living memory. They were particularly extensive in the north-west, but also significant in the north-east (C. Zhao, personal communication). Smaller areas of agriculture and the keeping of livestock were recorded at numerous other points just inside the present wall during the current research. By April 2007, the occupation road (M. R. G. Conzen, 1969, p. 127) just inside the wall (Figure 5) had become an almost continuous, paved ring road.

A south-facing orientation of plots and buildings is especially auspicious according to *fengshui*, being most in harmony with the ‘cosmic breath’. The large majority of plots, and hence the courtyards that occupy them, are orientated north-south. The majority of entrances are at the south end of the plot. On north-south orientated streets, it is not unusual for plots to have a long side to the street. In such cases, there is often a minor east-west orthogonal street, generally a cul-de-sac, giving access to a south-facing courtyard entrance. Since such culs-de-sac are predominantly on the east side of north-south streets, west-facing entrances are fewer than east-facing ones: this is mainly evident in the areas of rectilinear street systems located just inside the northern and western stretches of the present city wall (Figure 10). Among the



**Figure 10. Location of entrances to courtyards in the north-eastern part of central Pingyao.**



**Figure 11. Plan components of the north-western commercial fringe of central Pingyao.**

stretches of street where there are notable exceptions to the predominantly north-south orientation of plots are those in the three principal north-south hypothesized consequent streets (Shaxiang Street, Nandajie and Leijiayuan Street – An Street), where many courtyards are orientated east-west. In many of these cases, including practically every plot in Nandajie, commercial premises front the street. However, for the walled city as a whole, south-facing entrances are the most numerous, followed by east-facing, west-facing and north-facing entrances in decreasing order. Thus there is support for the view that *fengshui* is an influence on the city’s layout (Liu, 1995), but in a sizeable settlement, particularly one in which many plots contain shop fronts, there are practical difficulties in creating a layout that accords in its entirety with the principles of *fengshui*.

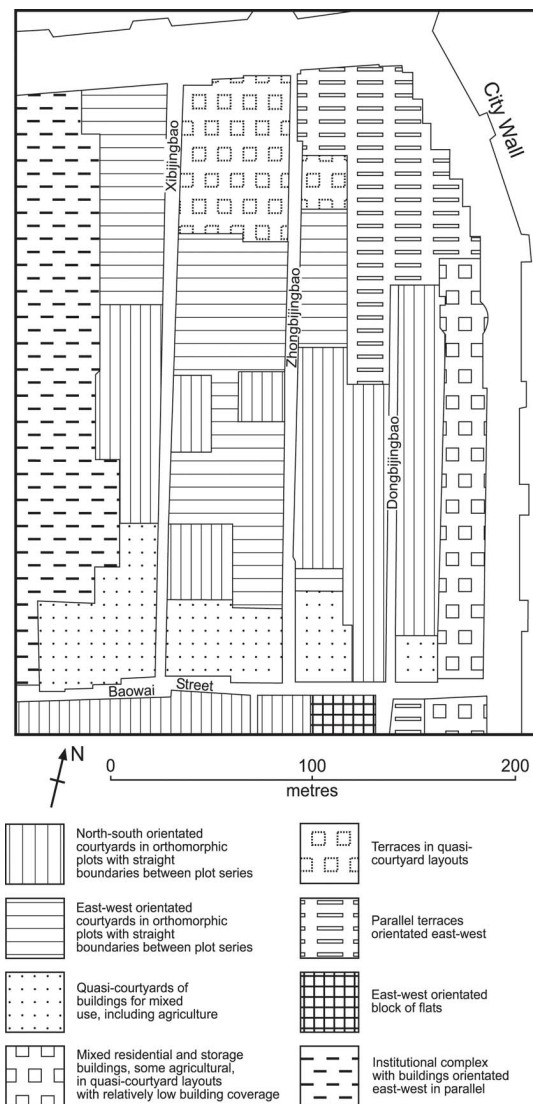
Within the part of the city developed before the fourteenth-century wall was constructed, straight boundaries between series of plots that back on to one another are rare, practically the only exceptions being where plots have been laid out along hypothesized consequent streets (Figure 8). In contrast, straight boundaries between plot series occur frequently within those parts of the city that were developed between the mid-fourteenth century and the late-nineteenth century (Figure 9) (Compiling Committee for Pingyao Gazetteer, 1999, pp. 74-7). The high degree of irregularity of plot boundaries in the oldest areas of the city is likely to reflect the susceptibility of the large square street blocks in this area to a great variety of types of plot subdivision, as well as the very lengthy period during which processes of change have been at work here.

### The meso-scale

Examination of two contrasting, relatively small parts of the walled city, the north-western commercial fringe (Figure 11) and the Bijingbao area (Figure 12) reveals some of the variety of plan types.

The north-western commercial fringe, surrounding the junction of Xidajie, Shaxiang Street and Wudaomiao Dongxiang is highly differentiated internally (Figure 11). This reflects its location astride what was, for a lengthy period until the fourteenth century, the fringe of the city. It lost this location when the fourteenth-century city wall was constructed farther out. The old fortifications were demolished and the space thus created was occupied by a planned layout of streets and plots. This gave rise to a contrast between the former fortification zone – the more easterly part of the area – and the area lying outside it, the more westerly part.

The more easterly part retains much of its regularity today, although part of the area north of Xidajie has been redeveloped since 1949 and is occupied by industrial buildings. The more westerly part is more heterogeneous. This reflects a number of differences in its historical development. These include the



**Figure 12. Plan components of the Bijingbao area of central Pingyao.**

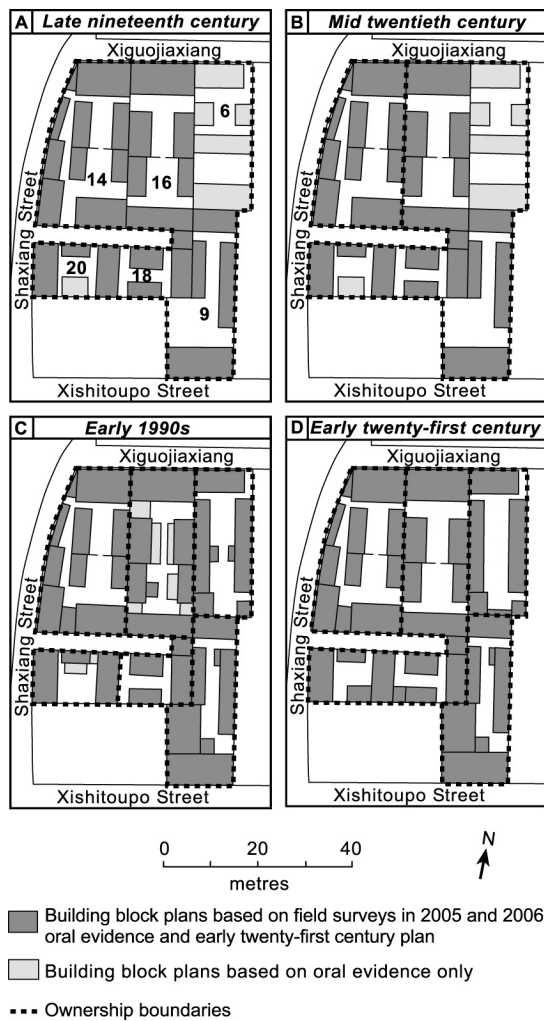
relatively unplanned development of this part of Xidajie as a previously extramural street leading out of the city; the variety of piecemeal additions as the city expanded to fill out the space within the new wall; and a number of redevelopments, taking several different forms, since 1949. Though this part of Xidajie was substantially widened in 1981 (Ruan, 2003, p. 20), it retains the character of a commercial ribbon developed piecemeal, especially on its south side.

The Bijingbao area, lying in the north-east corner of the present walled city, is much less internally differentiated (Figure 12). It was

one of a number of schemes of development that were gradually implemented in the large amount of additional intramural space that became available following the major extension of the city wall in the fourteenth century. It consists essentially of three parallel north-south streets (Xibijingbao, Zhongbijingbao and Dongbijingbao) that join a single east-west street (Baowai Street) at their southern ends. The north-south streets were originally gated at their ends (Song, 2000, p. 25). This arrangement was characteristic of agricultural villages in the vicinity (Song, 2000; Zhang and Song, 1996), of which Liang, 6 km south-east of Pingyao, is an ancient surviving example. Indeed the Bijingbao area still contains plots in agricultural use and the former primarily agricultural function of the area is apparent in the building fabric, notably the arched courtyard entrances for horse-drawn carts. The parallel street plan is complemented almost throughout by straight boundaries between plot series. Nearly all the east-west orientated plots have either west- or east-facing entrances. In the case of the north-south orientated plots, which are on average larger, in a number of cases side alleys allow a south-facing entrance. This is wasteful of land, but facilitates conformity to *fengshui*. North-facing entrances, which are not favoured by *fengshui*, are very rare in this area.

### Plots and building block plans

The plan analyses undertaken by Conzen and his followers in the West have been especially effective at the scale of the individual plot, linking analysis at this level to the way in which larger areas of towns and cities have been transformed over time. In China, the dearth of large-scale plans and individual property records means that greater reliance in plot analysis must be placed on the fragmentary information that in a minority of cases is in the possession of the present occupiers of plots. One such instance in Pingyao relates to a very small area of what is currently several plots at the junction of Shaxiang Street and Xiguojiaxiang – referred



**Figure 13. Changes of ownership boundaries and building block plans in Hou's courtyards, central Pingyao, between the late-nineteenth century and the early twenty-first century.**  
 Sources: Du (2002), pp. 123-4; Compiling Committee for Pingyao Gazetteer (1999), pp. 756-7; personal communications with G. Cheng, C. Li, L. Song and C. Zhao.

to collectively as Hou's courtyards (Figure 13). Though the representativeness of the histories of these plots is unknown, reconstruction of some of the physical changes that they have undergone can be related to developments more widely in recent times, not only in Pingyao but also in other Chinese cities.

The area lies on the edge of the ancient core, much of it, probably all of it, having been part of the zone of city fortifications around that core until the city's limits were extended

in the fourteenth century. Courtyard houses were apparently built in the area between 1736 and 1795 (Compiling Committee for Pingyao Gazetteer, 1999, pp. 756-7), but it seems unlikely, considering the increasingly favourable location of this part of the city as the built-up area expanded, that these were the first such houses to have existed here.

Wangbin Hou (1820-96), the owner of one of the banks, Piaohao Tianchengxiang, purchased all of the area, comprising essentially six courtyards (Figure 13A), in the second half of the nineteenth century and undertook major rebuilding (Du, 2002, pp. 123-4), although the existing building block plans apparently remained essentially unchanged. The courtyards consisted of an outer courtyard (14 Shaxiang Street), an inner courtyard (16 Shaxiang Street), a courtyard used for reading (*shufang*, 18 Shaxiang Street), a courtyard for horse-drawn carts (20 Shaxiang Street), a garden (6 Xiguojiaxiang) and an ancestor hall (9 Xishitoupo Street). Four of the courtyards were linked by an alleyway.

In the early-twentieth century, following Hou's death and related to the growing competition associated with the emergence of modern banking, the business that he had developed began to decline. In 1954, 14 Shaxiang Street was sold to the Chai family (C. Li and L. Song, personal communication) (Figure 13B). The courtyard houses largely retained their existing form until the 1960s. Thereafter they were taken over by the government, and four of them gradually became occupied by a number of families, mostly those of factory workers, none of them related to the Hou family. Six families occupied 16 Shaxiang Street, five occupied 9 Xishitoupo Street (the ancestor hall), three occupied 18 Shaxiang Street, and two-storey apartment buildings were constructed in the garden area (6 Xiguojiaxiang) which by the early 1990s was occupied by eight related families (G. Cheng, personal communication). Part of 14 Shaxiang Street was transformed into a community centre (*chengxi juweihui*). The new occupants of the courtyard houses attempted to remedy the woefully inadequate space within existing buildings by erecting

structures, mostly rudimentary, within the courtyards, for use as kitchens, small bedrooms and storage places. Such infill was generally unauthorized. Some of the remaining courtyard space became no more than alleyways (Figure 13C). Thus a process had occurred that was in its way reminiscent of what had taken place in the cores of many traditional British cities in the nineteenth century (M. R. G. Conzen, 1960, pp. 65-9; 1962, pp. 400-7), although in plan the outcomes were markedly different, reflecting in particular the major differences of building type.

The local Housing Management Authority (*fangguansuo*) took over ownership of the courtyards but neither it nor the occupiers had the funds to maintain them. Resolution of the problem began in the late 1990s with the city's economic recovery, stimulated by the rise of tourism. Three courtyards were purchased by a local resident, G. Cheng, who began to renovate the main buildings, clear the buildings that had been constructed in the courtyards by the previous occupants (Figure 13D), and use the premises as a hotel, 20 Shaxiang Street being used for services and storage, and 16 and 18 Shaxiang Street each providing a number of rooms for guests. Whereas site clearance frequently terminated the corresponding process of plot repletion in Europe, it did not occur in this instance owing to the recognition of the economic potential of the traditional courtyard buildings – though such clearance has occurred elsewhere in Pingyao and has been widespread in Chinese cities. The owner of 14 Shaxiang Street also renovated his courtyard buildings, and he too opened a hotel for tourists. Cheng is seeking to expand her hotel business by purchasing neighbouring courtyards.

The sequence of plan development that has been reconstructed in this small area is part of a much wider process within Pingyao and more generally within Chinese cities. In the case of Pingyao this includes, in the last decade, numerous cases of small-scale entrepreneurial activity by owner-occupiers instigating piecemeal changes within a few plots. There is also the immediate prospect of

much larger-scale interventions, affecting entire street blocks, by private developers and government planners based in Taiyuan (H. Wang, personal communication). The combined effects of these changes may well be as great as, or greater than, those associated with *danwei* creation and state induced multi-occupation of courtyards that accompanied the widespread (but not complete) state ownership during much of the second half of the twentieth century.

### Conclusion

The plan analysis described in this paper confirms the applicability of Conzenian method and concepts in a geographical area with a markedly different cultural history from the parts of the world in which they have previously been employed. In addition to breaking new ground geographically, the paper exemplifies the thinking, especially the types of inference, that can be employed to advantage when confronted with the different, generally less informative, sources available in China. However, this study lacks the depth of those in which Conzen refined the method and articulated the concepts: indeed, in light of the limitations of Chinese sources for this type of research, it is probably unrealistic to expect historico-morphological studies of traditional Chinese cities to match the standard set by Conzen. The main prospect of progressing beyond the inferences drawn here, for example concerning the lines of previous city fortifications, is through archaeological investigation – an approach that has hitherto on the whole been underutilized in the study of the historical development of Chinese cities.

Analysis of the present street system of Pingyao, in conjunction with early records of Chinese city planning principles, has allowed the extent of the ancient city core and a series of planned extensions within the present walled city to be inferred. The recognition of fixation lines and consequent streets played an important part in the process of inference. Square street blocks, largely in the older parts of the city, were probably administrative units

until the Qing dynasty. Within them a pseudo-street system and metamorphic plots tended to develop as the interiors of street blocks became subdivided. Hypometamorphic plots are more characteristic along and in the vicinity of a number of presumed consequent streets where our analysis suggests planned plot series were laid out in former fortification zones.

In large areas laid out since the fourteenth century just inside the northern and western stretches of the present wall, there are regular rectilinear street systems and predominantly orthomorphic and hypometamorphic plots. The originally gated parallel streets within the north-east corner of the present walled city have considerable similarities to agricultural villages in the vicinity of Pingyao, and there is still physical evidence of the original agricultural function of this part of the city and several other parts.

The large majority of plots, and hence the courtyards that occupy them, are orientated north-south, most entrances being south facing in accordance with the precepts of *fengshui*. On north-south orientated streets, other than those with commercial frontages, plots frequently have a long side to the street, with an east-west cul-de-sac giving access to a south-facing courtyard entrance. However, the practicalities of achieving an efficiently functioning arrangement of streets and plots militate against total conformity to the orientations favoured by *fengshui*.

In the 3 decades after 1949, the city was widely affected by the repletion of residential courtyards with illegal temporary constructions, associated with multi-occupation, and the redevelopment of traditional religious and other sites for residential work units. As tourism has replaced industry as the city's main economic driving force, this phase of repletion and redevelopment has been succeeded by widespread refurbishment of buildings on the main axial streets, particularly street-frontage buildings in the core of the commercial area. Much of this restoration has been undertaken by owner-occupiers and has generally involved the clearance of illegal building infill within courtyards but the

retention of the buildings surrounding the courtyards. A further phase of redevelopment that is now beginning has also been stimulated by the supplanting of industry by tourism. It is characterized by large-scale proposals by combinations of private developers from outside the city and the provincial government. This is bringing into sharp focus the need to reconcile economic boom with conservation of the historical urban form.

Though this study is essentially an investigation in plan analysis, it provides an important part of the basis for a comprehensive morphological analysis leading to the delimitation of morphological regions (M. R. G. Conzen, 1975). Conzen himself argued that analysis followed by regionalization should be not only fundamental to understanding urban form but also a basis for urban landscape management. This has been supported by more recent studies, including one in China (Whitehand and Gu, 2007). Such research takes on added importance, particularly in the case of a World Heritage Site such as Pingyao, in light of the important general policy changes being discussed by UNESCO's World Heritage Centre, involving a change in emphasis from a concern primarily with individual sites and monuments to a consideration of historic urban landscapes as ensembles (Bandarin, 2006). This sharpens the focus of attention on urban morphology in general, and Conzenian thinking in particular, and draws it further into a wider arena of concern for the built environment. Plan analysis, as a fundamental component of urban morphology, constitutes part of the basic groundwork for ensuring that conservation is undertaken on a sound basis. This paper strongly suggests that such work is as pertinent to parts of the world that have recently been undergoing rapid economic development and opening up to historico-geographical analysis as it is in its European homeland.

### Acknowledgments

The research on which this paper is based was funded by the Economic and Social Research Council, Award Reference RES-000-22-0730. The

authors are grateful for the assistance they received in Pingyao, particularly from Xiangguang Gao, Yingjie Hao, Taiping Ji, Jinsheng Li, Yinsheng Tian, Huaiyu Wang, Susan Whitehand and Changben Zhao, and for comments on a draft of the paper by Piper Gaubatz, Tony Scrase, Terry Slater and Wei Tao. The illustrations were prepared for publication by Anne Ankcorn and Kevin Burkhill.

## References

- Baker, N. J. and Slater, T. R. (1992) 'Morphological regions in English medieval towns', in Whitehand, J. W. R. and Larkham, P. J. (eds) *Urban landscapes: international perspectives* (Routledge, London) 43-68.
- Bandarin, F. (2006) 'Towards a new standard setting instrument for managing the historic urban landscape', in Patricio, T., van Balen, K. and de Jonge, K. (eds) *Conservation in changing societies: heritage and development* (Raymond Lemaire International Centre for Conservation, Katholieke Universiteit Leuven, Leuven) 27-36.
- Chang, S. (1970) 'Some observations on the morphology of Chinese walled cities', *Annals of the Association of American Geographers* 60, 63-91.
- Chang, S. (1974) 'Manuscript maps in late imperial China', *Canadian Cartographer* 11, 1-14.
- Chatley, H. (1917) 'Fêng Shui', in Couling, S. *The encyclopaedia Sinica* (Oxford University Press, London) 175.
- Compiling Committee for Pingyao Gazetteer (ed.) (1999) *Pingyao xianzhi (Gazetteer of Pingyao)* (Zhonghua Shuju, Beijing).
- Conzen, M. P. (1990) 'Town-plan analysis in an American setting: cadastral processes in Boston and Omaha, 1630-1930', in Slater, T. R. (ed.) *The built form of western cities* (Leicester University Press, Leicester) 142-70.
- Conzen, M. R. G. (1960) *Alnwick, Northumberland: a study in town-plan analysis* Institute of British Geographers Publication 27 (George Philip, London).
- Conzen, M. R. G. (1962) 'The plan analysis of an English city centre', in Norborg, K. (ed.) *Proceedings of the I. G. U. Symposium in Urban Geography Lund 1960* (Gleerup, Lund) 383-414.
- Conzen, M. R. G. (1966) 'Historical townscapes in Britain: a problem in applied geography', in House, J. W. (ed.) *Northern geographical essays in honour of G. H. J. Daysh* (University of Newcastle upon Tyne, Newcastle upon Tyne) 56-78.
- Conzen, M. R. G. (1969) *Alnwick, Northumberland: a study in town-plan analysis* Institute of British Geographers Special Publication 27 (Institute of British Geographers, London) revised edn.
- Conzen, M. R. G. (1975) 'Geography and townscape conservation', in Uhlig, H. and Lienau, C. (eds) *Anglo-German Symposium in Applied Geography, Giessen-Würzburg-München* (Lenz, Giessen) 95-102.
- Conzen, M. R. G. (1988) 'Morphogenesis, morphological regions and secular human agency in the historic townscape, as exemplified by Ludlow', in Denecke, D. and Shaw, G. (eds) *Urban historical geography: recent progress in Britain and Germany* (Cambridge University Press, Cambridge) 253-72.
- Dong, J. (ed.) (1989) *Zhongguo chengshi jianshe shi (History of Chinese urban construction)* 2nd edn (Zhongguo Jianzhu Gongye Press, Beijing).
- Dong, J. and Ruan, Y. (1999) 'Qingdai de piaohao zhongxin chengshi: Pingyao, Taigu' ('Central Piaohao cities in the Qing period: Pingyao and Taigu'), in Dong, J. (ed.) *Chengshi guihua lishi yu lilun yanjiu (Historical and theoretical research on urban planning)* (Tongji University Press, Shanghai) 28-31.
- Du, L. (ed.) (2002) *Pingyao gucheng zhi (History of the old city of Pingyao)* (Zhonghua Shuju, Shanghai).
- Fu, X. (2001) *Zhongguo gudai chengshi guihua jianzhuqun buju ji jianzhu sheji fangfa yanjiu (Research on ancient Chinese urban and site planning and architectural design methods)* (Zhongguo Jianzhu Gongye Press, Beijing).
- He, Y. (1996) *Zhongguo gudai chengshi guihua shi (History of Chinese urban planning)* (Zhongguo Jianzhu Gongye Press, Beijing).
- Hu, P. (1988) *Shanyou shike congbian (Shanyou collection of stone engravings)* Vol. 21 (Shanxi Renmin Press, Taiyuan), reprint of the Qing edn.
- Hsu, M. (1978) 'The Han maps and early Chinese cartography', *Annals of the Association of American Geographers* 68, 45-60.
- Ji, Y. (ed.) (2006) *Shanxi chuantong minju (Traditional houses in Shanxi)* (Zhongguo Jianzhu Gongye Press, Beijing).
- Kaogongji* (the Artificers' Record), in *Zhou li (Record of the rites of Zhou)*, compilers unknown; probably Western Han in date, but perhaps containing material from the Zhou period (reprinted 1980, Zhonghua Shuju, Beijing).

- Lai, X. (1999) 'Foreword 1', in Compiling Committee for Pingyao Gazetteer (ed.) *Pingyao xianzhi (Gazetteer of Pingyao)* (Zhonghua Shuju, Beijing) 1-3.
- Lilley, K., Lloyd, C., Trick, S. and Graham, C. (2005) 'Mapping and analysing medieval built form using GPS and GIS', *Urban Morphology* 9, 5-15.
- Liu, P. (1995) *Fengshui: zhongguoren de huanjingguan (Fengshui: a Chinese environmental perspective)* (Sanlian Shudian, Shanghai).
- Liu, Y. (2003) 'Luyou kaifa huanjing xia Pingyao gucheng de baohu' ('Urban conservation in the context of the development of tourism in Pingyao'), *Jianzhushi Lunwenji (Treatises on the history of architecture)* 19, 205-17.
- Pei, M. and Gong, Z. (2003) *Yunzhen yuyi: Pingyao guicheng baguajie (The metaphor of streets in the city of Pingyao)* (Jiefangjun Wenyi Press, Beijing).
- Ruan, Y. (1998) 'Dengshang shijie lishi wenhua yichan minglu de Pingyao gucheng' ('World Heritage city of Pingyao'), *Chengshi Guihua Huikan (Urban Forum)* 3, 51-3.
- Ruan, Y. (2003) *Hucheng jishi (Documenting urban conservation)* (Zhongguo Jianzhu Gongye Press, Beijing).
- Scrase, A. J. (1989) 'Development and change in burgh plots: the example of Wells', *Journal of Historical Geography* 15, 349-65.
- Shanxi Research Institute of Urban and Rural Planning and Design (2005) 'Pingyao gucheng baohu jianjie' ('A brief introduction to city conservation in Pingyao'), unpublished document.
- Sit, V. F. S. (1995) *Beijing: the nature and planning of a Chinese capital city* (Wiley, Chichester).
- Slater, T. R. (1989) 'Doncaster's town plan: an analysis', in Buckland, P. C., Magilton, J. R. and Hayfield, C. (eds) *The archaeology of Doncaster - 2. The medieval and later town* BAR British Series 202 (British Archaeological Reports, Oxford) 43-61.
- Song, K. (ed.) (2000) *Pingyao gucheng yu minju (The ancient city and local style houses in Pingyao)* (University of Tianjin Press, Tianjin).
- Wang, D. (1997) *Zhongguo gudai chengshi guihua wenhua sixiang (Cultural thinking on ancient Chinese cities)* (Zhongguo Chengshi Press, Beijing).
- Wang, X. (2002) *Jinzhong dayuan (Courtyard houses in central Shanxi)* (Sanlian Shudian, Beijing).
- Wheatley, P. (1971) *The pivot of the four quarters: a preliminary enquiry into the origins and character of the ancient Chinese city* (Aldine, Chicago).
- Whitehand, J. W. R. and Gu, K. (2006) 'Research on Chinese urban form: retrospect and prospect', *Progress in Human Geography* 30, 337-55.
- Whitehand, J. W. R. and Gu, K. (2007) 'Urban conservation in China: historical development, current practice and Conzenian approach', unpublished MS.
- Whitehand, J. W. R. and Morton, N. J. (2006) 'The fringe-belt phenomenon and socio-economic change', *Urban Studies* 43, 2047-66.
- Wright, A. F. (1977) 'The cosmology of the Chinese city', in Skinner, G. W. (ed.) *The city in late imperial China* (Stanford University Press, Palo Alto, CA) 33-75.
- Yang, K. (2003) *Zhongguo gudai ducheng zhidushi yanjiu (Research on planning regulations in ancient Chinese cities)* Renmin Press, Shanghai).
- Zhang, S. (1999) 'Lishi chengzhen baohu de mudi yu fangfa chutan: yi shijie wenhua yichan Pingyao gucheng weili' ('A preliminary exploration of objectives and methods for urban conservation: a case study of the World Heritage city of Pingyao'), *Chengshi Guihua (City Planning Review)* 23, 50-3.
- Zhang, S. (2001) *Lishi chengshi baohuxue daolun: wenhua yichan he lishi huanjing baohu de yizhong zhengtixing fangfa (An introduction to integrated conservation: a method for protection of cultural heritage and the historical environment)* (Shanghai Kexue Jishu Chubanshe, Shanghai).
- Zhang, Y. and Song, K. (1996) 'Shanxi de bao yu lifang zhidu tanxi' ('Analysis of bao in Shanxi and an exploration of lifang regulation'), *Jianzhu Xuebao (Architectural Journal)* 4, 50-4.
- Zhu, H. (2006) *Kongzhong kan Pingyao (Looking at Pingyao from the air)* (<http://zhuhaihu.blshe.com/post/29/741>) accessed 28 May 2007.