

# A military-related townscape: the case of Zuoying, Taiwan

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**Abstract.** *Morphological analysis similar to that employed by M. R. G. Conzen is used to examine the agents and agencies shaping the military city of Zuoying. The walled city and naval base underwent four phases of physical change. These were associated with functional changes that have reflected different military strategies and technologies. Seven morphological regions are recognized. Light is also shed on the urban historical context within which East Asian cities more widely have developed.*

*Keywords: military townscape, morphological region, building type, historical development*

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Conzen (2004a) stresses the importance of understanding *processes* of morphological change. In military-related cities, underlying military activities tend to be critical in the shaping of civilian space (Ó Tuathail and Dalby, 1998; Woodward, 2014).

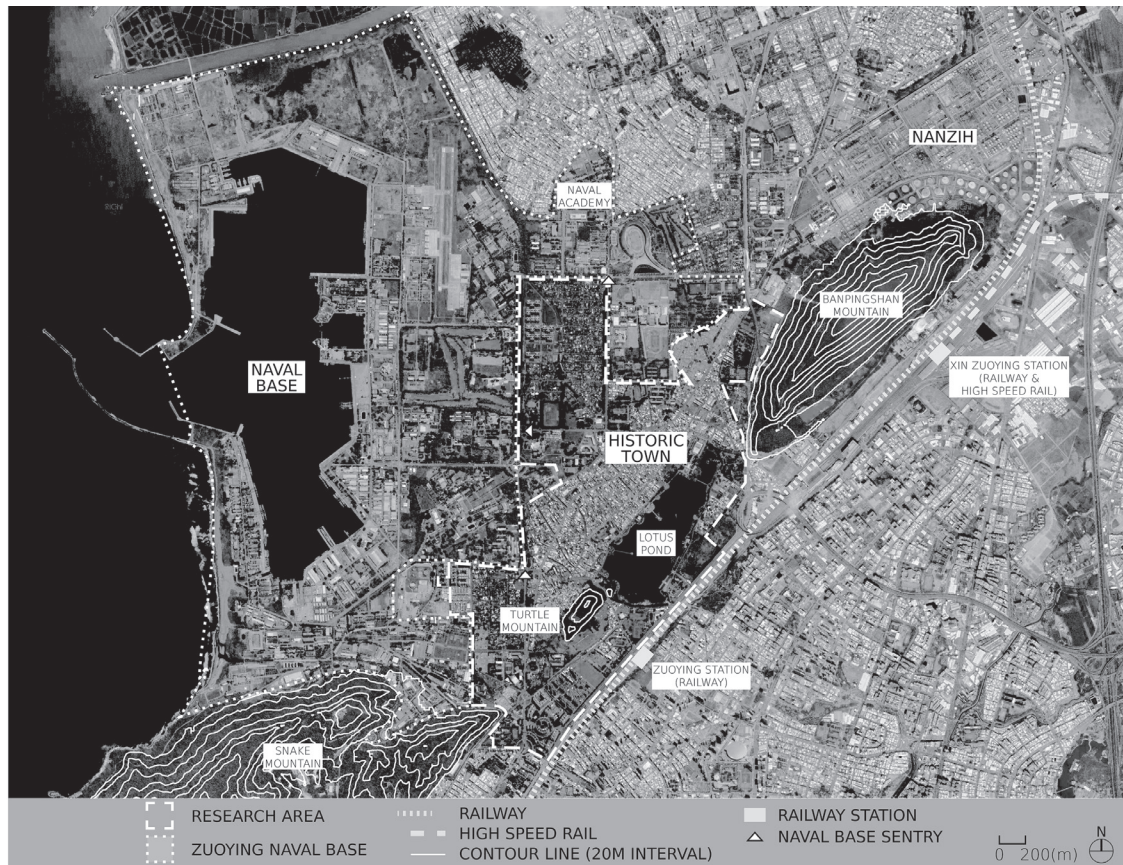
This study concentrates on the agents and processes at work in the formation of the military townscape in Zuoying, an important stronghold in the history of Taiwan and more broadly in the history of the islands of East and South-East Asia. In East Asia, the long and rich Chinese civilization and its turbulent history in modern times have accompanied major urban developments, but these have remained poorly understood in the West (Whitehand, 2011).

Located on the principal route along the coast of China, Formosa (Taiwan) was used over a long span of history for a wide variety of strategic purposes (Freeman, 1969). The strategic location made it an important base from which to control commerce and for the launching of attacks successively by the Spanish, Dutch, Koxinga, Qing dynasty of China, and Japanese. During the Second

World War, Taiwan was a major supply base and was described by Japanese officials as ‘the nation’s great plane carrier in the South’ (Barclay, 1954). The influence of new military technologies, regime shifts and changing conditions of strategic location are reflected in successive periods in Taiwan’s history.

Zuoying (Figure 1) has a long history of military activities in the Western Pacific (Water Resources Agency, 2013). It was the control centre of southern Taiwan and the largest and most important naval base on the island. A naval base usually includes the harbour, dockyards, warehouses, barracks and inland logistics systems, such as railways and oil refinery. It generally maintains a distance from nearby settlement and has controlled entrances.

The existing literature on military-related townscapes mainly focuses on those that surround battlefields, military installations and the remains of army bases (Gillem, 2007), for instance reconstructions of forts, roads and barracks (Anderson, 2010) or the preservation and adaptation of deserted military architecture (Strömberg, 2013). The influences of military actions and militarization



**Figure 1. The region of Zuoying city and the research area (adapted from Water Resources Agency, 2013).**

on such aspects of urban form as buildings, streets and plots, tend to be omitted from the discussion. In contrast, in this study questions concerning the *effects* military installations may have on the spatial linkages, locations and morphological structures of settlements, and *how* military activities play a part in the formative processes of the townscape are considered.

### Methodology

In exploring the morphological character of Zuoying, this study is grounded in the Conzenian approach and terminology (Conzen, 1960), focusing on the ground plan, building types and land and building utilization, and their combination to form morphological regions. It employs data collection,

pattern recognition, autonomous theories of change, and links to non-formal conditions such as agency or socio-economic conditions (Scheer, 2015, pp. 12–13) to elaborate systematically the spatial and functional interactions between military activities (and their installations) and the physical environment. Accordingly, the study is in two parts: first, focusing on the formative processes of Zuoying; and secondly, analysis of the resulting morphological regions.

The 1:500 cadastral map of 2008 and the topographical map of 2000 (1:1000), both produced by the Land Administration Bureau of Kaohsiung City Government, serve as the main research sources (cf. Conzen, 1988). They have been supplemented by field research, historical records and satellite images (Gu and Zhang, 2013; Raith, 2000; Water Resources Agency, 2013).

**Table 1. The morphological indicators: largely based on the Conzenian approach**

Elements of Zuoying townscape	Form complexes	Indicators (types of units)	Morphological units
Street types	Plan (plots and streets)	Ground plans	Morphological regions (including morphotopes)
Plot shapes and sizes			
Patterns of plot and building function (shophouse, traditional courtyard house, bungalow)	Building types  Land and building utilization	Building forms	

In the first part of the paper, the military installations, morphological processes, and predominant urban forms in each development phase are examined (Chen and Lin, 2014; Whitehand, 1987). In the second part, several morphological indicators (Table 1), essentially building form and ground plan (mainly street system and plots), provide the basis for recognizing various types of morphological units (Conzen, 1960).

In Zuoying, there are eleven main building types (Whitehand *et al.*, 2014), namely shophouses, other commercial buildings (including, for example, hotels, restaurants and theatres), markets, traditional courtyard houses, row houses, condominiums, bungalows, bunkhouses, temporary constructions, temples, and public buildings (for example, government agencies, schools, and military buildings). Shophouses, commercial buildings, and markets constitute the main service providers within the city centre. Temples and public buildings tend to have more peripheral locations.

The streets in Zuoying can be grouped into several types, relating to phases of development. The primary streets are in many cases influenced by the location and entrances of military installations.

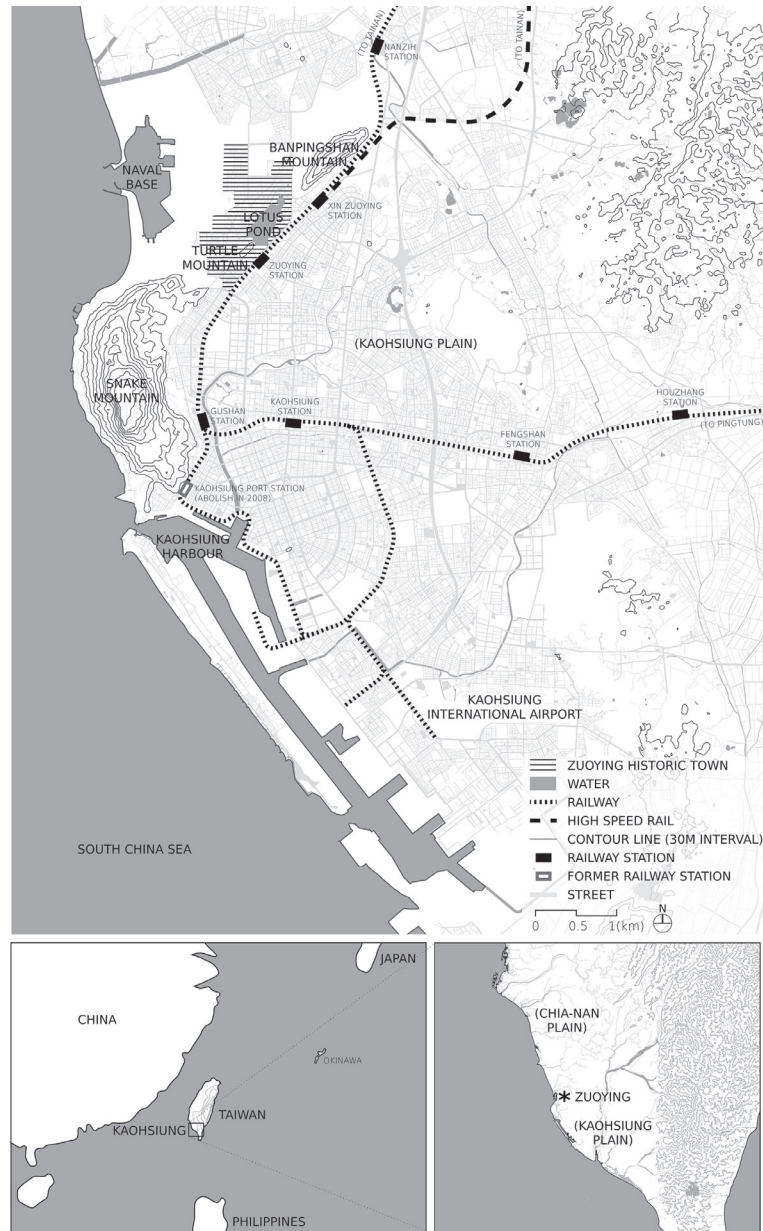
Plots serve as an important historical record of the spatial development of Zuoying. Their shapes and sizes are highly relevant to understanding property and building changes. Plot patterns and their relationships with streets may also indicate the development process in

the area (Sanders and Woodward, 2015). For example, when a planned route breaks through the frontage of existing houses (Caniggia and Maffei, 2001, pp. 135–7), the buildings and their plots may change their orientation according to the new route. This phenomenon is particularly evident in the primary streets related to military installations. In combination these various indicators provide a basis for the recognition of separate morphological units. The present morphological units in Zuoying are a result of series of morphological changes.

### Urban formative processes and military installations

With its hills marking the boundary between Chia-Nan Plain and Kaohsiung Plain, Zuoying is the only elevated area in the open terrain in south-western Taiwan (Figure 2). The series of hills and an inlet along the coastline provide barriers that serve as the first line of defence. The strategic location of Zuoying has contributed to it being one of the earliest developed areas in Kaohsiung (Wu, 2010). Since the eighteenth century Zuoying had been a walled county town. It used to accommodate mostly government office buildings and defence agencies inside the wall. The majority of housing was outside the wall. Unlike most walled Chinese cities, the spatial structure of Zuoying makes it a *castle-like city*.

According to historical records, four phases of large-scale transformation of the urban



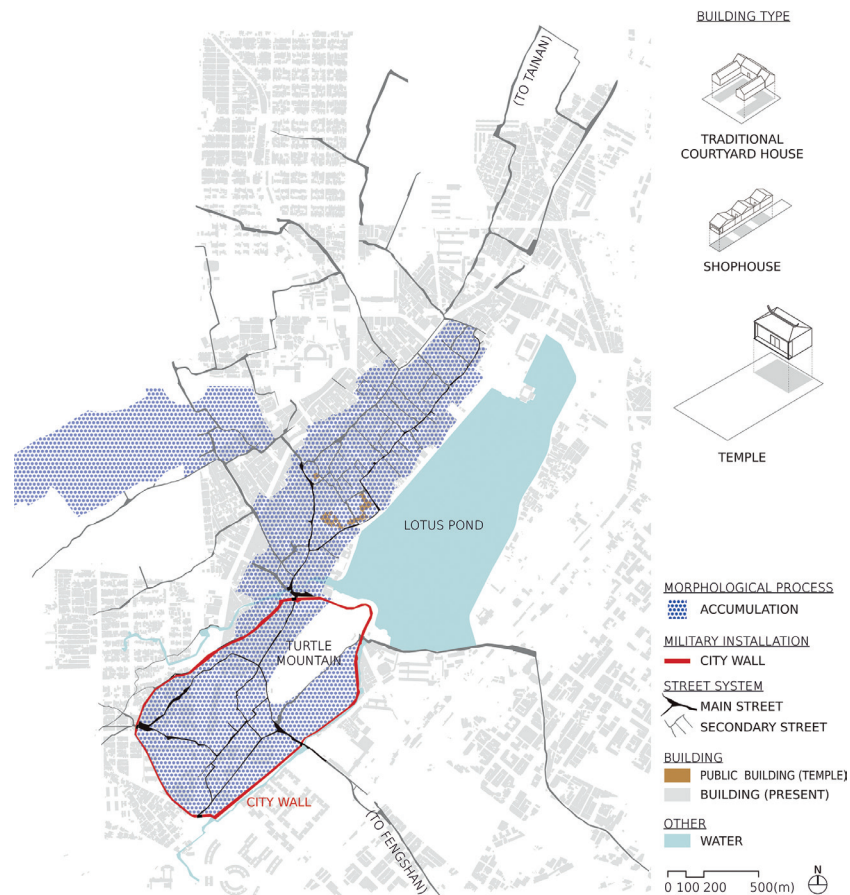
**Figure 2. Location of Zuoying, Kaohsiung City, and Taiwan.**

structure have occurred as the result of military activities. These relate to changes in military activities or policies, rather than regime shifts.

*Phase 1 (1719–1920): establishment of the city wall*

Taiwan was annexed to the Chinese Qing Dynasty in the late-seventeenth century.

During early Qing rule, the lack of plans to develop the island had led to the stagnation of urban development. Early in 1719, the government began to recognize the strategic location of Zuoying as a defence against aborigines and pirates (Liao, 2012). Therefore, a stretch of city wall was constructed in the mountain pass between the Turtle Mountain and the Snake Mountain. Originally constructed of clay, the wall underwent several modifications, including the addition of



**Figure 3. Morphological processes and building types of Zuoying in Phase 1.**

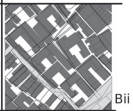
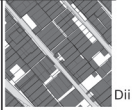
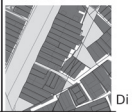
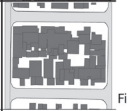
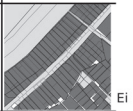



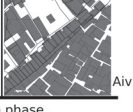
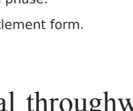
thorny bamboo to strengthen the foundations in 1734, and the construction of four forts to defend the city gates in 1760 (cf. Chen and Thwaites, 2013). According to historical documents, the establishment of the city wall was a key factor in stimulating initial settlement formation outside Zuoying city (Li, 1987).

Despite the strengthening of the city wall, it provided insufficient defence against civil unrest, and the city was invaded in 1786 (Liu, 2008). Following 40 years of abandonment, in c. 1826 a new wall – this time of brick – was constructed. To control the high ground, the walled area was extended to incorporate Turtle Mountain within the city (Figure 3). Streets were constructed within the new walled area to connect the government offices and official residences (Draeger, 2001; Liao, 2008). The narrow, winding streets passed through the north gate, meandered down to

major temples outside the city and continued northward to reach the supreme administrative centre (Tainan Prefecture).

During this time, primary accumulations of urban forms (cf. Conzen, 2004a) occurred on the northern side of the settlement, especially near Lotus Pond and the main streets. The limited space inside the city meant that most development was outside the city wall. It mainly comprised traditional courtyard houses (*San-Ge-Yuan*) and shophouses. The former were characteristic of South-East Asia. In Zuoying, however, the wide extent of *San-Ge-Yuan* was inseparable from the ‘tuntian system’ as a way of providing food for the army. Each *San-Ge-Yuan* unit was independent, but all faced Lotus Pond in the east in accord with *Feng Shui* and the requirements of ventilation (see ground plan of Bii in Table 2). The shophouses were

**Table 2. Phases of settlement formation, morphological process, and types of plan unit in Zuoying**

Phases	Settlement Formation		Morphological Process	Plan Unit	Ground Plan <sup>3</sup> (selected)
	Military Installation	Morphological Region			
Phase 1	City wall	Zuoying City, Northern Old Town, Southern Old Town	Primary accumulation	Bi, Bii, Ci, Cii	
		Fringe Belt	Accretion	Gv	
Phase 2	Breaking of city wall	-	-	-	-
	Zuoying Avenue	First Expansion Area	Accretion	Dii	
	Northern Old Town, Southern Old Town (along Zuoying Avenue)	Replacement	Di		
Phase 3	Naval Base	Town-Naval Base Interface	Accretion	Fi, Fii	
	Nanghai Ditch Military railway	Zuoying City (incl. city wall)	Replacement	Aiii	
Phase 4	Adaptation of Naval Base	Town-Naval Base Interface	Adaptation, Repletion	Fiii, Fv, Fvi	
		Second Expansion Area	Repletion	Ei, Eii	
		First Expansion Area	Repletion	Diii	
	Filling of Nanghai Ditch	Southern Old Town	Repletion	Ciii, Civ, Cv	
	Abandonment of military railway	Fringe Belt	Repletion	Giv	
	Military dependents' village	Fringe Belt	Accretion	Gi, Gii, Giii	
	Abandonment of city wall	Zuoying City (along city wall)	Repletion, Adaptation	Ai, Aii, Aiv, Av	
		Town-Naval Base Interface	Repletion	Fiv	

Note <sup>1</sup> Military installations (2nd column) act as driving factors (→) of the morphological regions (3rd column) in each phase.

<sup>2</sup> The arrows (→) show the remaining (cross-phase) influence of military installations in subsequent phases.

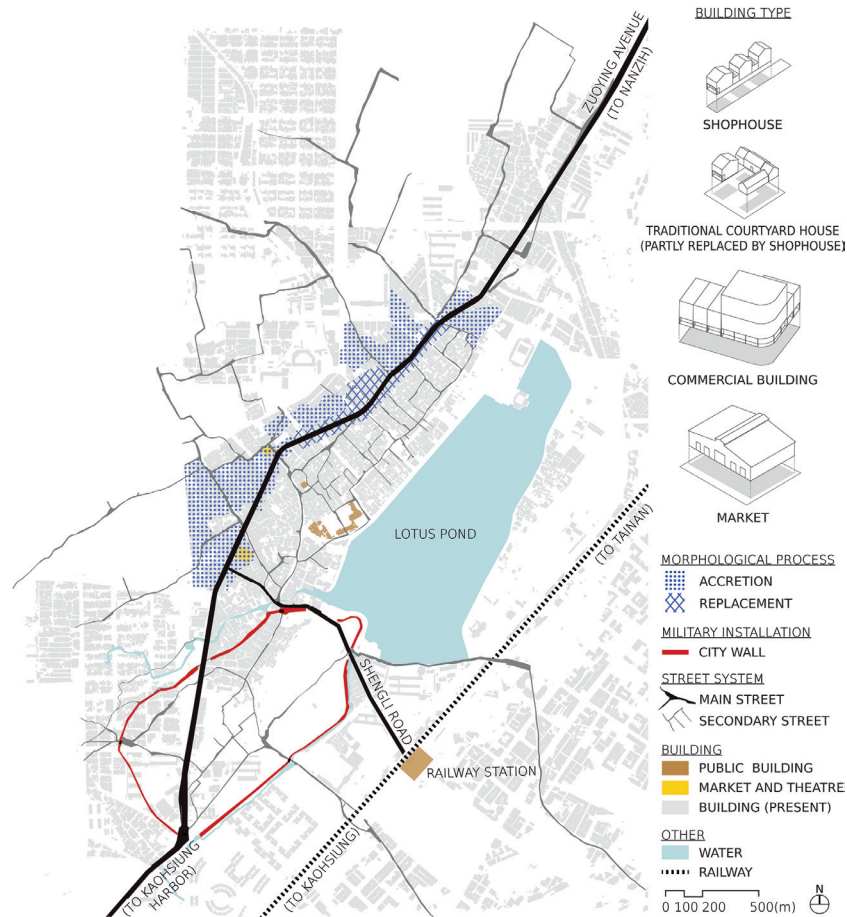
<sup>3</sup> Ground plans of selected plan units are shown at the same scale which represent the characteristics of the settlement form.

clustered outside the north gate. Their plots were long and narrow, unlike the more circular irregular ones of the *San-Ge-Yuan*.

#### *Phase 2 (1920–1939): the breaking of the city wall and the construction of Zuoying Avenue*

In 1895, Taiwan was ceded to the Empire of Japan and remained under Japanese control until 1945. The colonial government

constructed a longitudinal throughway along the west coast to control local rebellions. This included Zuoying Avenue (c. 1921), which cut through the city wall (Zeng, 2006). Zuoying Avenue connected Nanzih (which later became the oil refinery for Zuoying naval base) to the north and Kaohsiung harbour to the south. This broad, straight road was a fillip to urban expansion on the west side of the original settlement. Later, Shengli Road was constructed to connect the naval base and the



**Figure 4. Morphological processes and building types of Zuoying in Phase 2.**

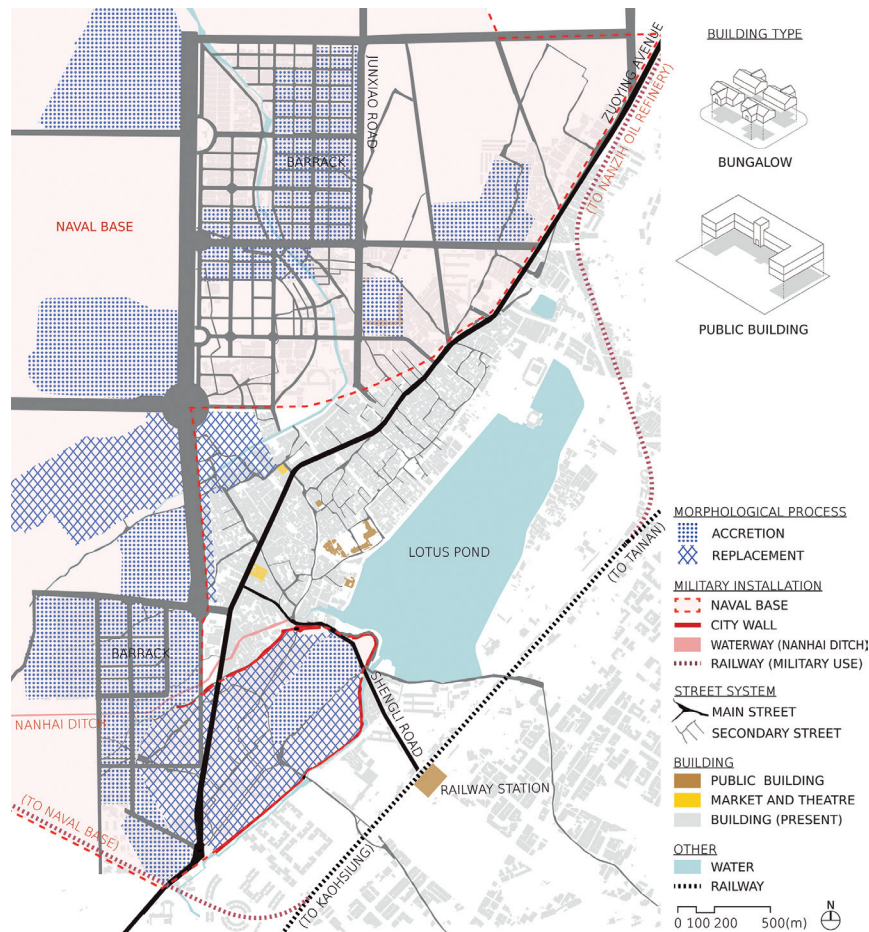
settlement to Zuoying railway station (Figure 4), acting as the important link between Zuoying and the railway network in western Taiwan.

The morphological structure has a close relationship to changing locations and changes to the access system. Accretions of *San-Ge-Yuan*, shophouses and commercial buildings occurred on the eastern periphery of the old town. Commercial buildings in this period took on a distinct form from housing, with larger plots and buildings. The intersection of the two new roads became an important node where the public market, theatres and shophouses were built. The area of expansion to the west of the original settlement had access roads stretching in a fish-bone pattern from Zuoying Avenue. Besides accretions, replacements occurred along Zuoying Avenue

and Shengli Road where shophouses replaced *San-Ge-Yuan* to provide more intensive commercial development (see ground plan of Di in Table 2). Thus the city wall that had once dominated urban development was greatly reduced in its importance in this phase, and Zuoying Avenue rapidly became the centre of Zuoying.

#### *Phase 3 (1940–1949): construction of the naval base*

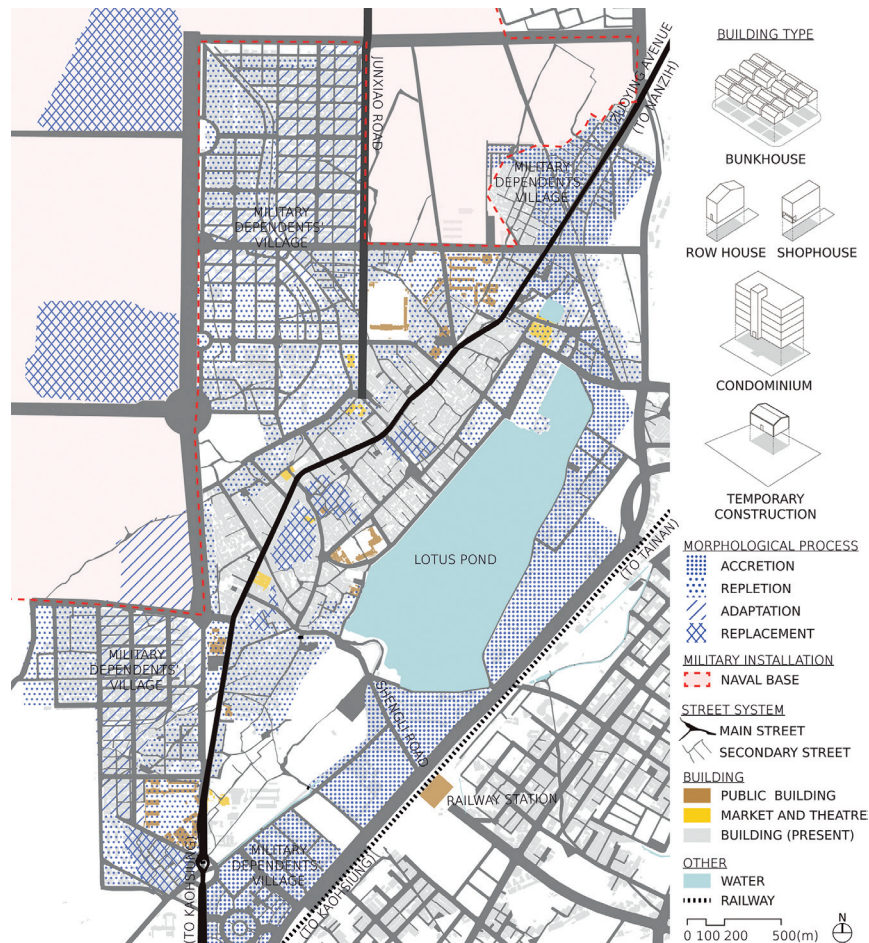
During the Pacific War (1941–1945), Kaohsiung, which was the largest city in southern Taiwan and had a natural harbour and commercial port, was fortified to be the base for the Southern Expansion Scheme (Freeman, 1969). In the coastal area of Zuoying, the naval



**Figure 5. Morphological processes and building types of Zuoying in Phase 3.**

base (Figure 5) was constructed in *c.* 1940, replacing the seaside fishing villages with a dockyard, hospital, warehouse, and barracks (Zeng, 2006). The entire walled city became part of the military area controlling the high ground of Turtle Mountain where bunkers, tunnels, fortresses and barracks were created as part of the defence system. Meanwhile, in order to strengthen links to the oil refinery in Nanzih, railway feeders were added to the north of Lotus Pond and south of Zuoying city. Zuoying railway station thus became the control node for movement of personnel and materials, protected by the naval base. When the war in South-East Asia worsened, a waterway (Nanhai Ditch) was constructed from the existing channel for *shinyo* suicide boats (Liao, 2014).

The construction of the naval base represented the shift of ruling power from land to sea, resulting in the dramatic transformation of Zuoying city. Buildings near the camp and in the whole walled city were demolished and replaced by military facilities and warehouses. The south-west part of the city wall was replaced by orthogonal grids of the military camp. Inside the naval base, however, there was the construction of barracks on a major scale. The Japanese officers' dormitories were bungalows arranged linearly in a north-south direction. These navy-owned plots were not subdivided into smaller parcels and were much larger than the plots in the old town (Huang, 2007; Schenk, 2013) (see ground plan of Fi in Table 2). The new straight streets of the barracks contrasted with



**Figure 6. Morphological processes and building types of Zuoying in Phase 4.**

the winding ones of the adjoining traditional settlement and marked the western boundary of urban expansion. The two systems, the naval base and the pre-existing settlement, converged at the south- and north-west sides of Zuoying.

*Phase 4 (1950–2013): adaptation of the naval base and demolition of the city wall*

Control of Taiwan was transferred to the Republic of China at the end of the Second World War. The immigration of several million Chinese from mainland China ensued. The new authority regarded Zuoying as the best coastal defence zone and enlarged the naval port so that it accommodated the entire

naval force. Several military dependents' 'villages' were constructed by the government, together with the adaptation of original barracks to accommodate the influx of several thousand soldiers and their families (Wu and Xu, 2010). Owing to the development of military strategies and advances in technology, the former defence system employed by the Japanese colonial government became redundant. The walled city, the sites of military railways and Nanhai Ditch were slowly occupied by military dependents (Figure 6).

Morphological processes in this period were primarily the repletion of the Japanese barracks and peripheral accretions in the form of bunkhouses that served as accommodation for military dependents. They were typically connected to existing developments for the

purpose of sharing infrastructure. Outside the naval base, vacant lands in the urban fringe, the walled Zuoying city, and the areas along former waterways and military railways were also occupied by military dependents (see ground plans of Phase 4 in Table 2). In addition to the construction of military dependents' accommodation, partial filling-in occurred in the former fringe areas. After the establishment of the Naval Academy in the north of the barracks area, the transitional zone between the traditional settlement and the naval base was densely occupied by shophouses, row houses, and condominiums associated with the rising importance of Junxiao Road. Attracted by the railway station, new shophouses and row houses appeared near Shengli Road and the road that followed the former Nanhai Ditch. The transformation of the naval base and barracks led to the opening up of the western boundary of the settlement, the restructuring of Zuoying, the merging of the military dependents' areas and spontaneous growth of the traditional settlement.

Zuoying has over the years developed outside Kaohsiung metropolis, beyond the series of mountains, Lotus Pond and the 'villages' of the military dependents. Meanwhile Kaohsiung has expanded significantly and engulfed the surrounding areas. The military installations have, nevertheless, played an important role in the shaping of urban form. Even after they have lost their original function, these massive constructions retain a presence in the ground plan. The interrelationships between the military installations and the urban areas as a whole are summarized in Table 2.

### Morphological units of Zuoying

The chronological transformations in each development phase have brought about the current morphological structure of Zuoying. The frequent changes of military activities were key forces in urban development, creating period specific urban forms (cf. Conzen, 2004a) juxtaposed in the mosaic

of morphological units (Rowe and Koetter, 1978). The combination of eleven building types, four streets types, and two plot types reflects the development forces at work. The heterogeneity of the composition and configuration of the 42 different kinds of morphotopes is shown in Figure 7.

Seven morphological regions can be identified (Figure 8), namely Zuoying city, the northern old town, the southern old town, the first expansion region, the second expansion region, the town-naval base interface, and the fringe belt. Among them, Zuoying city, the northern old town, and the southern old town have grown since the earliest phases, which are followed by the first expansion region in the second phase and the second expansion region in the fourth phase. On the periphery, the town-naval base interface and the fringe belt have relatively short histories. They are mainly the Japanese barracks and military dependents' villages from the third and the fourth phases respectively.

### *Zuoying City (A)*

Zuoying city (morphological region A in Figure 8) has been through several functional changes and replacement processes. Many of the initial urban forms have been demolished. Nevertheless, the city wall, as a large-scale military installation in Phase 1, continues to have an important role in shaping the region's boundary. In the north-west, bunkhouses have been built at a high density along the secondary streets inside the former walled city. The remaining parts of the city wall, namely the north-west and north-east sections, have become parts of residential areas. Bunkhouses were laid out in a different orientation to integrate with the wall (see ground plan of Aiv in Table 2). The plan units concerned are Ai, Aii, Aiii, Aiv, and Av. The first three consist of building repletion inside the walled city during Phase 4, of which plan unit Ai was the military dependents' accommodation occupied by the influx of migrants (see d in Table 2). Plan unit Aiii was vacant land released from the Japanese Naval Base and used for

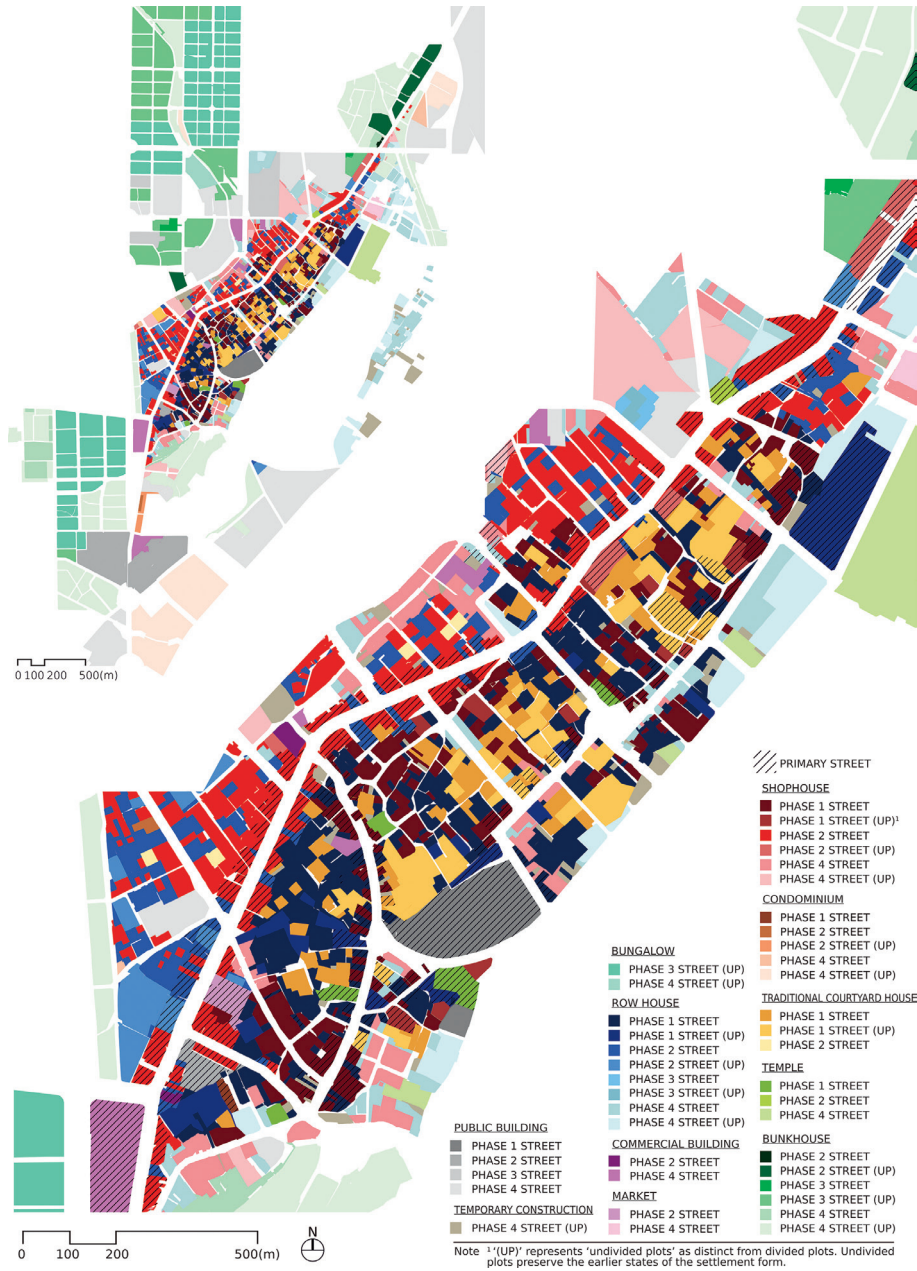


Figure 7. Morphotopes of Zuoying.

schools. The form of plan unit Aii was much influenced by the breaking of the city wall and the construction of Zuoying Avenue (see c in Table 2). Plan units Aiv and Av occupied the abandoned areas of the city wall that were once taken up by military dependents (see d in Table 2). The western part of Zuoying city (Figure 8, plan unit Fiv) is excluded from region A due to its divergent development process after the breaking of the city wall and

the construction of the naval base (see e in Table 2).

*The northern old town (B)*

In the northern old town (Figure 8, morphological region B), many traditional courtyard houses survive from the first morphological period (Phase 1). They have been partially

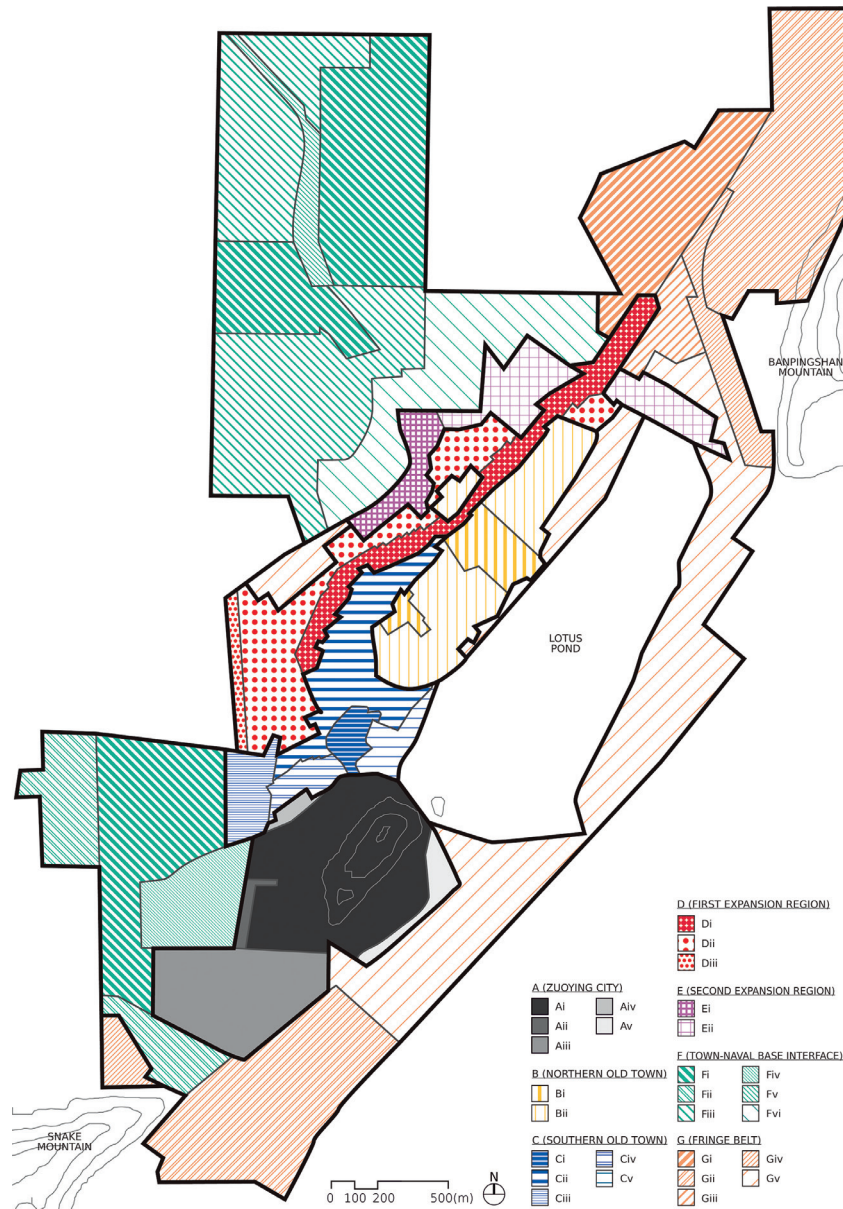


Figure 8. Morphological regions and plan units of Zuoying.

replaced along the new planned streets. However, the building alignments follow the street system of the first development phase. Even when the streets were widened in the last phase, new row houses and shop-houses were constructed in accord with the original fabric. The plan units concerned are Bi and Bii, the former having been through replacement processes associated with the construction of Zuoying Avenue and Junxiao Road: the original plots were subdivided for

occupation by row houses. However, plan unit Bii has preserved the initial character of the old town, with traditional courtyard houses surviving in their original plots. The influence of Zuoying Avenue is evident in the old town in the southern plan unit Bi. The creation of Junxiao Road brought about the transformation of the northern plan unit Bi with its direct access to Lotus Pond. Despite the attraction of Zuoying Avenue (Figure 8, plan unit Di), the region has on the whole maintained the

original spatial structure, reflecting the lack of development incentives owing to the changes in urban foci since the breaking of the city wall (Phase 2).

#### *The southern old town (C)*

In the southern old town (Figure 8, region C), the region has been greatly influenced by the north gate of Zuoying city, the positioning of Shengli Road, and the filling of former Nanhai Ditch. This has resulted in major replacements of the traditional courtyard houses. In comparison with the northern old town, the number of traditional courtyard houses from the early phases preserved today is much fewer and they are located deep inside the street-blocks (plan unit Cii). In plan unit Ci, the existing streets leading out from the north gate that were once the primary streets in Phase 1 no longer have locational advantages, following the changes in Zuoying city in Phase 2. Plan unit Ci contrasts with plan unit Di in the first expansion area (Figure 8), manifesting its lack of attraction after the roads were widened for modern uses. The shophouses and row houses were not rebuilt in accordance with the new streets. In plan unit Ciii, the area developed shortly after the abandonment of Zuoying city in Phase 4, shophouses and commercial buildings were attracted to the location provided by Zuoying Avenue (see b in Table 2). In plan units Civ and Cv, the filling of Nanhai Ditch provided additional building land along Shengli Road and Lotus Pond that gradually brought about the building repletion of shophouses, row houses, and temples along the streets of Phase 4.

#### *The first expansion region (D)*

The first expansion region (Figure 8, region D) was rapidly occupied by shophouses, row houses and commercial buildings, reflecting the forces for development of the new urban centre brought about by the creation of Zuoying Avenue. In particular, the breaking of the city wall and the substitution of

Zuoying Avenue as the new main street have given plan unit Di its distinctive character. As a result of the attraction of the new commercial centre, the western part of the original old town has been replaced by shophouses. In the west, the former vacant land (plan unit Dii) has undergone rapid growth after the laying out of the new main street. Shophouses and row houses were arranged in simple, orderly, subdivided plots along the narrow secondary streets leading directly to Zuoying Avenue. On the western boundary of plan unit Diii, however, the strip of bunkhouses is distinct from the neighbouring plan units created along the access road to the naval base (see a in Table 2). Overall, the present shape of the region consists of the transformation of the military installations, which started with the creation of Zuoying Avenue but stopped with the construction of the naval base.

#### *The second expansion region (E)*

The dramatic military transformation during Phases 3 and 4 also led to changes to the urban core, notably the development of the second expansion region between the town-naval base interface and the old town (Figure 8, region E). Plan unit Ei is characterized by commercial buildings and shophouses, indicative of the rise of the new commercial centre with the creation of Junxiao Road as the new external access and entrance to the Naval Academy. In the small lanes near the southern end of Junxiao Road, rows of shophouses are neatly built in rectangular plots, providing daily retail services for the Naval Academy students. Although not so densely built as plan unit Ei, Eii acts as an important activity centre, with the public buildings and the market from Phase 3 and Phase 4 serving the surrounding neighbourhoods.

#### *The town-naval-base interface (F)*

The town-naval-base interface (Figure 8, region F) is characterized by the adaptation of Japanese officers' dormitories and the

construction of military dependents' accommodation exhibiting characteristic emergent urban forms in the military townscape. The building styles and street systems are distinct from those of the old town (Figure 8, regions B and C) and the expansion regions (Figure 8, regions D and E) which were mainly bungalows and bunkhouses in grid layouts (see ground plan of Fi in Table 2). Owing to the lack of full autonomy under military controls, the plot divisions have remained almost the same and are subject to changes in military decisions. Plan units Fi and Fii comprise the barracks of the Japanese naval base. The former is distinguished from the latter by the dormitories being for high-ranking officers. The separation of personnel not only affected the spatial arrangement of different building types in Phase 3 but continued to dominate the housing of high-ranking officers in Phase 4. Plan units Fiii, Fiv, and Fv are the simple-and-narrow military dependents' accommodation built during Phase 4. They utilized existing grids (Fiii), the abandoned Zuoying city (Fiv) (see f in Table 2), and the sites of former waterways (Fv). Closer to the settlement, the former military area (Fvi) is utilized by large public buildings, including schools and neighbourhood centres – common phenomena in urban fringe belts.

#### *The fringe belt (G)*

The fringe belt (Figure 8, region G), shows another distinguishing feature of military-related townscapes. The five plan units, Gi, Gii, Giii, Giv and Gv, almost surround the original settlement and Lotus Pond. Their shapes not only correspond with the topography but include traces of the former military installations created at the settlement fringe, including the north and south stretches of the military railways and the military dependents' accommodation. In particular, plan units Gi, Gii, and Giii were established near, but not immediately adjacent to, the settlement. Gi and Giii are composed of bunkhouses with large plots, while Gii consists of relatively large condominiums with lower building coverages than those in the original settlement

(see ground plan of Gii in Table 2). Plan unit Giv is also military dependents' bunkhouses. However, they are on the sites of former military railways, and the buildings are arranged in elongated plots dictated by the direction of the rails (see ground plan of Giv in Table 2). These four kinds of plan units are the outcome of dramatic changes in the planning of defence systems associated with different military strategies. However, in Gv between the settlement and the camp are mixtures of temporary constructions, temples, row houses, bunkhouses, and a few shophouses with large, undivided plots, randomly scattered along new roads.

#### **Conclusion**

Starting as an early walled city, Zuoying was gradually transformed into a naval base. It became the major supply base for launching attacks in South-East Asia during the Second World War. The processes of accretion, repletion, adaptation, and replacement in Zuoying were driven by developments in military knowledge, technology, and changes in political and military relationships in Eastern Asia. The establishment of the old town was closely linked to the setting of the city wall. The construction of Zuoying Avenue and adaptation of the naval base were important influences on the pattern of accretionary growth (Conzen, 2004b) and led to dramatic structural transformations. The military influences on the building cycle in Zuoying were of particular importance as the processes of development were dominated by the functional requirements of different military strategies, which reflected the evolution of modern military knowledge and associated activities in Eastern Asia.

The military installations, being large-scale facilities, were often constructed at the urban fringe. They in turn affected the settlement structure as the entrances to these installations became primary streets and led to the emergence of new urban foci. In the course of time, the military installations became embedded in the urban area. They continue to dominate the shapes and configurations of the morphological regions. The long oval shape of the early

urban area, its gradual merging with the barracks, and the military dependents' quarters in the fringe belts reflect topographical conditions and changing military activities. Studies of the ground plan and military installations of each development stage show that plan units and morphological regions in Zuoying have been influenced substantially by the military installations and their transformations.

In this military townscape, the regularity in the hierarchy of form complexes noted by Conzen (1988) is distinct from the principle of systematically differentiated persistence of forms to which he draws attention (Conzen, 2004a). Transformations of the military installations at the 'building fabric' level or the 'land and building utilization' level in some cases trigger much larger-scale morphological change. Serving as the *elementi primari* (Rossi, 1966), the military installations have influenced the formative processes of the townscape. The function and physical form of these installations respond to military activities, triggering a series of structural transformations and changes at various levels of form complex in the townscape (cf. Whitehand, 1994). In time the original function of the installation may be lost, but the influence of its physical form may last. In the long term, the relation between military installations and urban structure maintains a dynamic equilibrium.

This study of Zuoying has shown the responses of physical form to various military purposes over time. It has also touched on more general phenomena in East Asian coastal cities during the modern period. Urban development in Zuoying took a somewhat different path from European fortress cities that were established according to geometrical principles or theories of ballistics in the Middle Ages and Renaissance – for example bastides, Teutonic towns and the so-called 'ideal' cities such as Palmanova. The formative processes in Zuoying reflect governance strategies and advances in military technology in modern times. Nonetheless, in all these military-related cities, the large-scale and intensive influences of military practice and the fortification of cities have for long been dominant shapers of the urban form. Military

townscapes are much more than manifestations of military architecture. They are results of military strategies and functions. They also need to be understood in relation to surrounding settlements.

## References

- Anderson, C. J. (2010) 'Constructing the military landscape: the Board of Ordnance maps and plans of Scotland, 1689–1815', unpublished PhD thesis, University of Edinburgh, Edinburgh.
- Barclay, G. W. (1954) *Colonial development and population in Taiwan* (Princeton University Press, Princeton, NJ).
- Caniggia, G. and Maffei, G. L. (2001) *Architectural composition and building typology: interpreting basic building* (Alinea, Firenze).
- Chen, C. H. and Lin, W. S. (2014) 'Morphological process as an instrument for knowing chronological character: a case study in Tainan', paper presented to the Twenty-first International Seminar on Urban Form, Porto.
- Chen, F. and Thwaites, K. (2013) *Chinese urban design: the typomorphological approach* (Ashgate, London).
- 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. (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* (Cambridge University Press, Cambridge) 253–72.
- Conzen, M. R. G. (2004a) 'Morphogenesis and structure of the historic townscape in Britain', in Conzen, M. P. (ed.) *Thinking about urban form: papers on urban morphology, 1932–1988* (Peter Lang, Oxford) 60–77.
- Conzen, M. R. G. (2004b) 'Urban morphology: a geographical approach', in Conzen, M. P. (ed.) *Thinking about urban form: papers on urban morphology, 1932–1988* (Peter Lang, Oxford) 47–59.
- Draeger, H. J. (2001) *Die Torstraße: Häuser erzählen Geschichte* (Deutsche Stiftung Denkmalschutz, Bonn).
- Freeman, C. W. (1969) 'The strategic significance of Taiwan to the United States: an historical appreciation', in Freeman, C. W. (2013) *Interesting times: China, America, and the*

- shifting balance of prestige* (Just World Books, Charlottesville, VA).
- Gillem, M. L. (2007) *America town: building the outposts of empire* (University of Minnesota Press, Minneapolis, MN).
- Gu, K. and Zhang, J. (2013) 'Cartographic sources for urban morphological research in China', *Urban Morphology* 18, 5–21.
- Huang, W. S. (2007) 'Gāoxióng zuǒyíng juàncūn jùluò de fāzhǎn yǔ biànciān' ('The development and change of military dependent villages in Zuoying, Kaohsiung City'), unpublished MA thesis, National Kaohsiung Normal University, Kaohsiung.
- Gāoxióngshì zhèngfǔ dìzhèngjú (Land Administration Bureau Kaohsiung City Government (Cartographer)) (2000) *Gāoxióngshì dūshì jihuà shùzhí hángcè dìxíngtú* (*Digital topographical map of Kaohsiung City*) (Kaohsiung City Government, Kaohsiung).
- Gāoxióngshì zhèngfǔ dìzhèngjú (Land Administration Bureau Kaohsiung City Government (Cartographer)) (2008) *Zuǒyíngqū dìjìtú* (*Cadastral map of Zuoying District*) (Kaohsiung City Government, Kaohsiung).
- Li, C. L. (1987) *Fèngshānxiàn jiùchéng chéngqiáng diàochá yánjiū* (*A survey of the old castle of Fongshan county*) (Civil Affairs Bureau Kaohsiung City Government, Kaohsiung).
- Liao, T. T. (2008) 'Fèngshān shuāngchéng gǔdào tàchá' ('To search the ancient path of Fongshan Twin City', *Gāoshì wénxiàn* (*Kaohsiung Historiography*) 21(4), 282–95.
- Liao, T. T. (2012) 'Qīngdài fèngshānxiàn jiùchéng nèi simiào, guānshǔ yǔ jiēdào kōngjiān zhī kǎozhèng' ('A study of temple, bureau building and street space in the old castle of Fongshan county during the Qing Dynasty'), *Gāoxióng wénxiàn* (*Kaohsiung Historiography*) 2 (4), 100–34.
- Liao, T. T. (2014) *Zuǒyíng jiùchéng de rijūn zhènyàngduì shénshè jí yízhǐ tàchá* ('A survey of Japanese Shinyo, shrine and remains and Zuoying old city'), *Gāoxióng wénxiàn* (*Kaohsiung Historiography*) 4(3), 101–38.
- Liu, Y. C. (2008) *Lìshǐ de zuǒyíng jiǎobù: Cóng jiùchéng kǎogǔ tán qǐ* (*The path of history of Zuoying: an archaeological survey of the old castle*) (Bureau of Cultural Affairs, Kaohsiung City Government, Kaohsiung).
- Ó Tuathail, G. and Dalby, S. (1998) *Rethinking geopolitics* (Routledge, London).
- Raith, E. (2000) *Stadtmorphologie: Annäherungen, Umsetzungen, Aussichten* (Springer, Wien).
- Rossi, A. (1966) *L'architettura della città* (Marsilio, Padua).
- Rowe, C. and Koetter, F. (1978) *Collage city* (MIT Press, Boston, MA).
- Sanders, P. S. and Woodward, S. A. (2015) 'Morphogenetic analysis of architectural elements within the townscape', *Urban Morphology* 19, 5–24.
- Scheer, B. C. (2015) 'The epistemology of urban morphology', *Urban Morphology* 20, 5–17.
- Schenk, L. (2013) *Stadt entwerfen: Grundlagen, Prinzipien, Projekte* (Birkhäuser, Basel).
- Strömberg, P. (2013) 'Funky bunkers: the post-military landscape as a readymade space and a cultural playground', in Linehan, D. and Boyd, G. A. (eds) *Ordinance: war + architecture & space* (Routledge, London).
- Water Resources Agency (2013) *High resolution satellite image, Formosat-2, scale 1:1000* (Water Resources Agency, Taiwan) (<http://gic.wra.gov.tw/gic/GIS/JS/MainJs.aspx>) accessed 13 June 2017.
- Whitehand, J. W. R. (1987) *The changing face of cities: a study of development cycles and urban form* (Blackwell, Oxford).
- Whitehand, J. W. R. (1994) 'Development cycles and urban landscapes', *Geography* 79, 3–17.
- Whitehand, J. W. R. (2011) 'Issues in urban morphology', *Urban Morphology* 16, 55–65.
- Whitehand, J. W. R., Gu, K., Conzen, M. P. and Whitehand, S. M. (2014) 'The typological process and the morphological period: a cross-cultural assessment', *Environment and Planning B: Planning and Design* 41, 512–33.
- Woodward, R. (2014) 'Military landscapes: agendas and approaches for future research', *Progress in Human Geography* 38, 40–61.
- Wu, L. S. and Xu, Y. F. (2010) 'Zuǒyíng guānguāng yóuqì kōngjiān yǔ yóukè mǎnyìdù zhī yánjiū' ('A study on tourism leisure space and tourists' satisfaction in Zuoying'), *Gāoshì wénxiàn* (*Kaohsiung Historiography*) 23(3), 46–85.
- Wu, W. Y. (2010) 'Zuǒyíng dūshì jihuà yǔ dūshì fāzhǎn yángé' ('The urban planning and urban development history of Zuoying'), *Gāoshì wénxiàn* (*Kaohsiung Historiography*) 23(3), 4–45.
- Zeng, Z. G. (2006) *Gāoxióngshì zuǒyíng chuántǒng jùluò jí mǐnzhái zhī diàochá yánjiū* (*A survey of traditional settlement and houses in Zuoying, Kaohsiung City*) (Kaohsiung Old City Cultural Association, Kaohsiung).