

## City-like settlement to industrial city: A case of urban transformation in Huwei township

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**Abstract.** *City-like Settlement (German: Teilweise Stadtähnliche Siedlungen) (Schwarz, 1989; Sorre, 1952) plays an important role in the course of civilization, especially the development of industrial cities. Accordingly, this study utilizes ground plan (Conzen, 1960) to deconstruct the relationships between industrialization and settlement formation in order to illustrate the common origin of cities in Taiwan as a result of the emerging economy at the turn of the 20th century. The industrial city of Huwei, known as the “sugar city” with largest yields of cane sugar in Taiwan, had the largest-scale sugar refinery in pre-war East Asia (Williams, 1980). The city has grown and transformed with the factory during the four phases of morphological periods, which began at the establishment of the sugar refinery and worker housing in the middle of the fertile flooding plain in western Taiwan. The spatial arrangement was directed to operational and management efficiency, characterized by the simple grids and hierarchy of layout along the riverside. As the industry enlarged, the new urban core was planned to support the original settlement with shophouses accumulated in the small grids. Followed by postwar modernism (Schinz, 1989), the urban planning again extended the city boundary with larger and polygonal blocks. In the fourth phase, however, the sugar refinery downsized, leading to the conversion of the worker housing and the merging of the factory and the city that slowly brought to its present shape. The morphological process results in the concentric structure from the sugar refinery, providing valuable references for the preservation of the sugar industry townscape, and unveils the influence of industrialization as well as the special urban development pattern in Taiwan.*

*Keywords: Industrial City, City-like Settlement, Morphological Process, Town-Plan Analysis, Sugar Refinery*

### Introduction

On the convergent boundary of Eurasian Plate and Philippine Plate along the East and Southeast Asia island arcs is where Taiwan lies. The small and mountainous island is the outcome of the plate movement between the East China Sea and the South China Sea, which has one of the highest population densities in the world in some 36,000 square kilometer land. The majority of the people live in the western flooding plain, where hundreds of cities and towns were established along coastal areas or agglomerated in the middle of the fields. The extensive Jianan Plain is where the crops are

grown to sustain the whole island. With its sub-tropical climate, the plain was used to grow sugar cane since the early 17th century as one of the major export goods besides rice. After the Second Opium War in 1860, Taiwan was forced to open trade with western merchants according to the Convention of Peking, which resulted in the bloom of the sugar industry. The sugar production increased significantly in the late 19th century with trading partners from around the world, especially Japan and Hong Kong. The early development of sugar production played the major role in the economic activities in the 19th century Taiwan. The traditional sugar factories were small,

primitive mills with traditional machinery and facilities that temporarily constructed at the sides of the sugarcane fields and mainly relied on ox carts for the transport (Chang, 2015). However, it was not until the industrialization of sugar factories at the turn of the 20th century that brought to complete breakthrough of the industry as well as new urban forms in Taiwan. The sugar, as the “sweetener” in Taiwan’s development (Williams, 1980), has since been indispensable to the island’s economy and the important element in the landscape.

In 1895, Taiwan was annexed to the Japanese Empire as a result of the First Sino-Japanese War. The colonial government deemed the sugar as the important economic sources and thus began the modernization and industrialization of the sugar industry. The measures included the replacement of the traditional sugar factory with modern sugar manufacturing plants, the use of steam power or oil power, the construction of sugar railways, and the setting of the system of cane supply region. After the upgrading of the sugar refinery at the turn of the 20th century, the scale of sugar production had expanded as ever before and allowed Taiwan to become the major sugar supplier of the Japanese Empire. In 1939, more than 1.4 million tons of sugar were produced in more than one fifth of the agricultural land. In the meanwhile, the construction of the modern sugar refineries had also brought to the emergence of City-like Settlements (German: Teilweise Stadtähnliche Siedlungen) (Schwarz, 1989; Sorre, 1952) in many parts of Taiwan, leading to dramatic changes of the urban landscape in the Jianan plain.

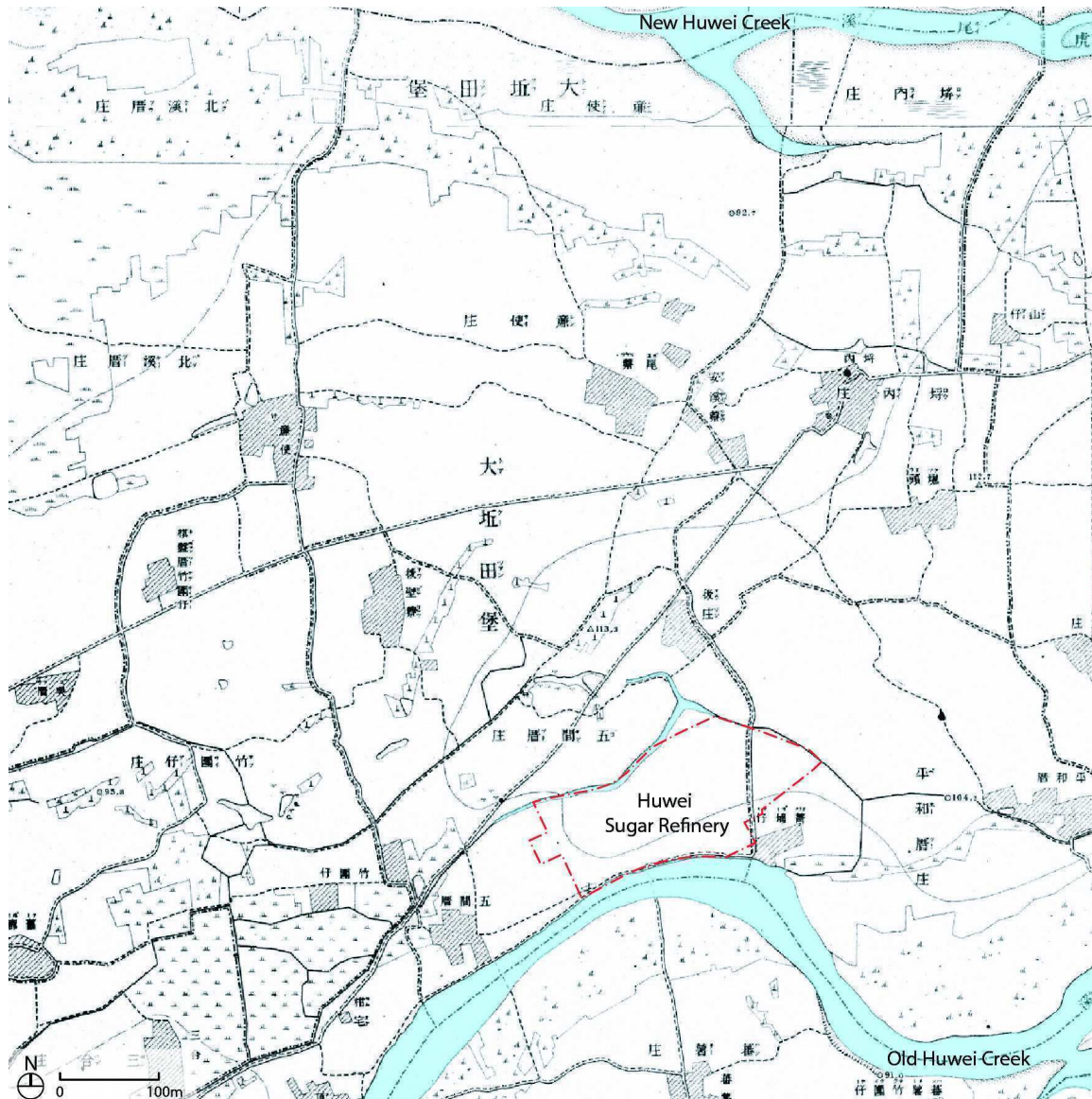
These City-like Settlements are industrial cities that grow with the modern sugar refineries. They are the settlement forms between rural settlements and cities, which does not largely depend on agriculture as the former nor are they able to provide various functions as the later. The City-like Settlements stemmed from the sugarcane field in a short time and operated as self-sufficient entities. Due to the distinctive background, the City-like Settlements does not share the same development processes with the surrounding small towns, but are the pure results of modern urban planning. The locations are conditioned by the transportation or material

needs, which are the planned development on large pieces of available land serving for the particular function. Because of the high demand of workers in the factory, there are usually equipped with dormitories as well as sufficient amenities and recreation services for the workers and their families. They represent the classical industrial settlement in the 20th century in their intimate relationship between the spatial arrangement and the functions, the emphasis on efficiency in the simple grid layout, the limitation of construction techniques of the time, and the clear hierarchy in the forms of dormitories.

One of the most prominent case is Huwei, also known as the “sugar city” with the largest yields of cane sugar in Taiwan and had the largest-scale sugar refinery in pre-war East Asia. The industrial city came into existence shortly after the construction of Huwei Sugar Refinery and the worker housing, which transformed into a commercial city with the development of the new urban core in the 1920s. In the postwar era, the urban plan extended the city boundaries and brought to the restructuring of the industrial city. In the 1980s, the reduction of the sugar production in the refinery again led to the merging of the factory and the city that contributed to its present shape. Today, the traces of the City-like Settlement still embodied in the town plan that show its origin as the sugar factory, which is the interrelationship between the industrial development and the urban landscape. Accordingly, the purpose of this study sets in the revelation of the transformation of the sugar industry in Huwei and its influence on the formation of the industrial city in order to understand the common origins of cities in Taiwan since the 20th century.

### Study methods

A study on the ground plans of Huwei was conducted following the systematic analysis of the town plan proposed by Conzen (1960) to identify the characteristics of the City-like Settlement and its transformations throughout the subsequent phases. The empirical study utilized the 1:5000 Digital topographic map produced by Yunlin County Government



**Figure 1.**  
**Huwei and surrounding small towns before the establishment of Huwei Sugar Refinery in 1898**  
 (Center for GIS, RCHSS, Academia Sinica, 1898)

in 2015 as the main source alongside the historic maps and the urban plans from each development phase. A comparison between the ground plans throughout the formative processes of Huwei industrial city provided the important basis for understanding the shaping of the City-like Settlement as well as the planning intervention that gave it its specific industrial characteristic. The emphasis was put the street systems and their spatial configuration, the important infrastructure and land uses to build up the comprehensive image of the townscape of the industrial city. In closer scrutiny, the study took the streets, building

types and their arrangements in the blocks, as well as the plot agglomerations to reveal the interactions between the sugar refinery and the city as a result of the transformation of the sugar industry since the last century.

### Case study in Huwei industrial city

The northwestern part of Jianan Plain where the downstream of Zhuoshui River, the longest river in Taiwan, runs through is the extensive flooding plain that nurtured the sugar cane fields in Huwei. There used to be several



small villages in the middle of the fields that connected to each other and relied heavily on the surrounding small towns and the land (Figure 1). Many small towns were formed along the winding streets where the traffic ran through and services were provided (Tomita, 1943). Because of the fertile land and the sub-tropical climate for the sugar cane, many modern sugar refineries were constructed in the nearby regions since 1906, including Huwei, Douliu, Beigang, and Longyan Sugar Refineries successively. The abrupt development of City-like Settlements that came with them had brought to the reshaping of the original landscape that was in no way similar to the existing forms. Huwei, as one of the biggest node in the northwestern part of the plain, had since emerged from the broad and flat sugar cane fields and slowly grown into an industrial city.

#### Phase 1: establishment of Huwei Sugar Refinery in 1906

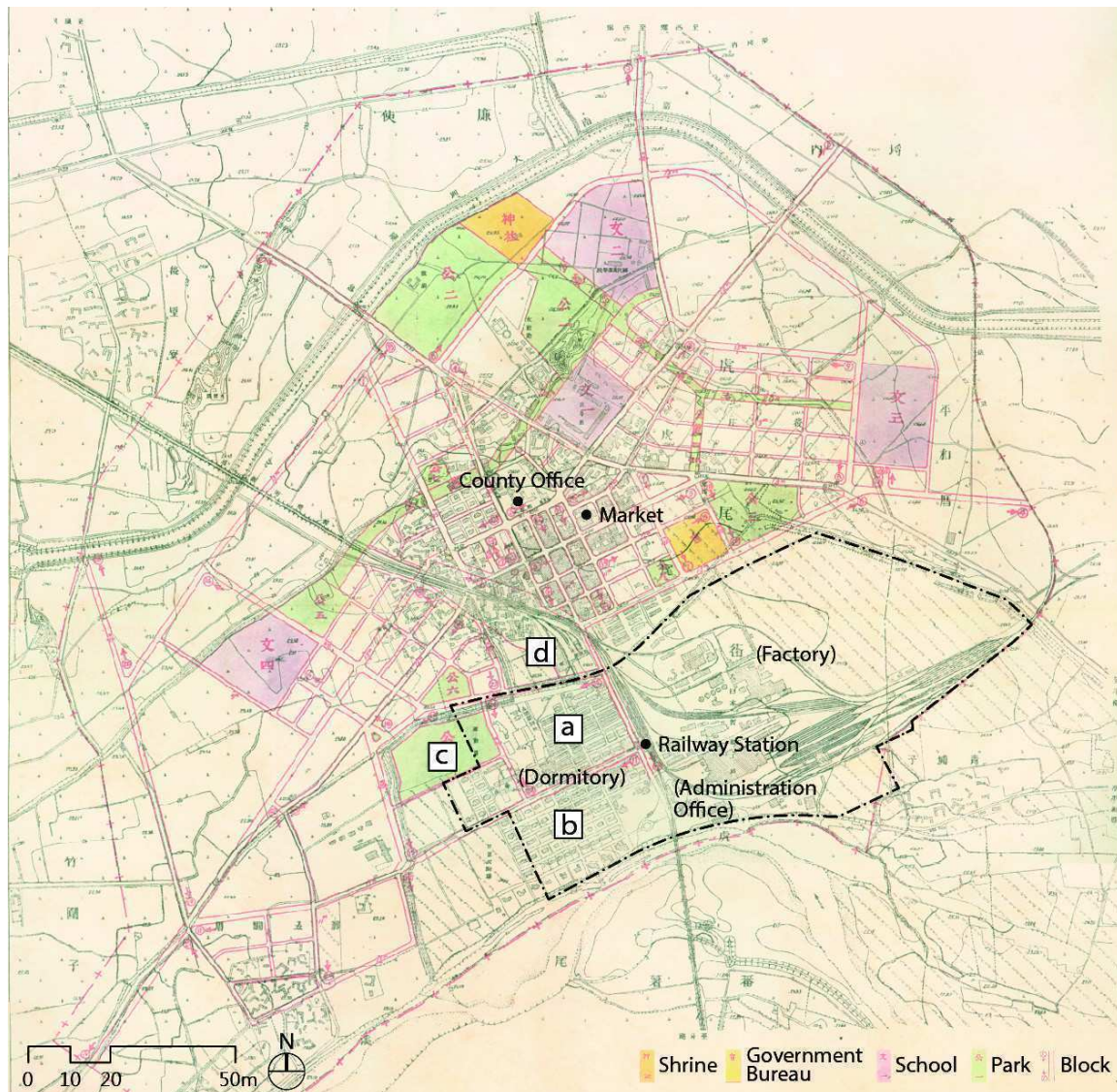
Huwei Sugar Refinery (Figure 2) was constructed at the carefully chosen site in the middle of the fertile sugar cane fields in Yunlin County, where sugar cane can be transported to the factory within twenty-four hours. Because of the large amount of water required during the sugar refining process, for example, generating steam power, boiling, cooling, and cleaning

the sugar, the sugar refinery was thus located between the new and old Huwei creek in the north and south respectively to ensure the supply of water resources (Lin and Su, 2009). In the meantime, a new transport system was set up to allow the easy access of ingredients from the sugar cane fields and transporting finished products to the seaports. Huwei Sugar Railways were constructed accordingly, which was a radial network with its center in Huwei Township as part of the whole Taiwan Sugar Railways system. Between the sugar factory and the sugar railway, as well as in the vicinity of the railway station, the main street, and the post office, the administration offices were erected in order to manage the factory operation.

On the other side of the sugar railway was the dormitory area, which was surrounded by parks, recreation facilities, the school, and the hospital. In order to sustain the daily needs of the factory workers, there were also the shrine, tennis courts, the canteen, the club, the library, and the barber shop in the dormitory area. In its simple (see Figure 3c) and repeating grids, however, a clear difference can be found in the building types of the dormitories that exhibited the ranks of the staffs. Bungalows with large gardens were built for the factory director in the southern end of the area (see also Figure 3b). The building density thus became higher northwards, which were duplexes and four-



**Figure 2.**  
1906 Plan of Huwei Sugar Refinery in the 1st phase ( Xu, 2011:40, fig. 3-7-1)



**Figure 3.**  
**1941 Plan of Huwei in the 2nd phase (Taiwan Sōtokufu, 1938)**

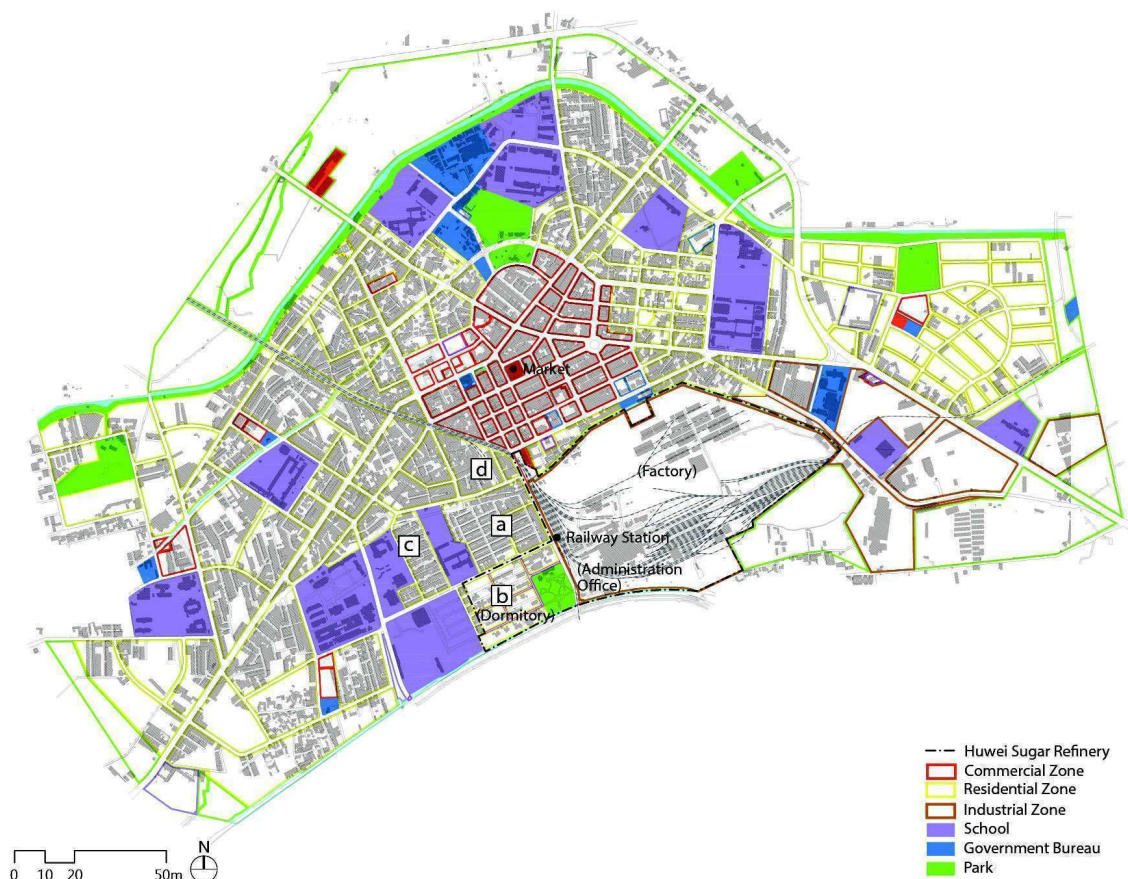
flat houses for lower-rank Japanese staffs (see Figure 3a). In its simple yet hierarchical layout, the establishment of Huwei Sugar Refinery marked the emergence of the City-like Settlement at the riverside in the middle of the sugar cane fields.

Phase 2: early development of the urban core in 1920

After the establishment of the Huwei Sugar Refinery, the area flourished with its rising importance as the regional administrative center and the transport node. In 1920, a new urban center (Figure 3) in the north of the refinery was planned to provide commercial

services for the staffs working in the factory. Apart from the usual Strassendorf, or the linear development along the main streets in most of the small towns in western Taiwan, the new town in Huwei did not rely on the surrounding countryside but was designed as a self-dependent urban center that focus primarily on the sugar refinery. Accordingly, the streets were not planned to conform the connecting streets to the surrounding towns, instead, they were laid in the simple grid layout with comparatively small sizes and shallow depths right next to the northern boundary of the sugar refinery. The new city area contained three parts. In the southern part, there were twelve rectangular blocks in sizes ranging





**Figure 4.**

**Plan of Huwei Sugar Refinery in the 3rd phase (Yunlin County Government, 2015b)**

from 50 meters by 40 meters to 80 meters by 50 meters that contained mainly shophouses for commercial activities. In the northern part, there were the county office, the market, and government bureaus (i.e. the police office and the fire station), standing at the opposite end of the axis and faced the entrance of the sugar refinery. In the southwestern part of the new urban center (see Figure 3d), the area was confined to the railways and a waterway and was used as the worker housing and the rail yard in the north of the dormitory area of the sugar refinery. As a result of the thriving sugar industry, Huwei quickly took its shape to become a small commercial city. The urban center acted as the service provider outside the refinery to supplement the daily necessities available in the refinery. In 1941, a revised plan was drawn to expand the city area however only a small portion was realized before it was replaced by the new urban plan in the 1970s.

Phase 3: postwar urban planning in 1940s

In the postwar era, the regime was shifted back to China, and Huwei Sugar Refinery was since managed by Taiwan Sugar Corporation (TSC). The sugar production in the factory had remained the systems and processes from the Japanese period on the whole, however the production had reduced annually due to the changing economic environment. On the other side, the city had extended its boundary to the east and southwest side during the 1940s from the original urban core (Figure 4). The new development areas featured larger and polygonal blocks that engulfed the sugar refinery and the worker housing. In contrast to the Japanese urban plan, the new city blocks were not the simple, small grids leading directly to the sugar refinery, instead they were influenced by the post-war modernism (Schinz, 1989) and designed in the more organic patterns. In other words, the new urban





**Figure 5.**  
**Changes of Huwei city from the 3rd phase to the 4th phase**  
**(Taiwan Sōtokufu, 1938; Yunlin County Government, 2015a)**

plan discarded the compact and centralized grid system of the 1941 plan (Figure 3) and established a more decentralized and diversified system with block sizes ranging 75 meters by 100 meters to some 100 meters by 150 meters, or even larger. Moreover, the new street system turned its center to the roundabout in the east side of the original urban core where several main streets converged, and thus brought to restructuring of the spatial linkages and the eastward expansion of the city area. In this phase, Huwei had completely transformed from a City-like Settlement to a planned city with sizable residential, commercial areas and the public infrastructure that provided various functions and services.

#### Phase 4: downsizing of Huwei Sugar Refinery and merging with the city in 1980s

Until 1980s, the sugar no longer held the economic importance in Taiwan, and Huwei Sugar Refinery had since downsized dramatically, including the demolition of the northern half of the Japanese dormitory, recreation facilities, and a rail yard. Consequently, these areas became parts of the city and blurred the boundary between the sugar refinery and the city. In closer scrutiny, the conversion of the former factory dormitory had resulted in the replacement of the worker housing with the row houses that were accumulated in the original street blocks and remained the similar urban landscape (Figure 5a). In the western boundary of the remaining dormitory area, the first layer of the Japanese bungalows was replaced with villas, however the traces of the former forms were still visible in their arrangement in the grid blocks (Figure 5b). The former tennis courts of the refinery were also turned into residential zones (Figure 5c) and part of the campus area for National Formosa University which mainly occupies the land of the former Sugar Cane Research Institute in the west of the dormitory area. In the southwestern part of the old urban core, the area had transformed dramatically due to the abandonment of the rail yard and the worker housing, resulting in the fractional and chaotic urban forms as a transition zone between the railways, the waterway, and different street systems, as well as between the city and the sugar refinery (Figure 5d).

In 2015, with the establishment of the high speed railway station in Huwei that brought to the change of location and regional connection and the modification of the former industrial and residential zone of the sugar refinery as the new „sugar industry specialized zone“, the once City-like Settlement has become the key cultural landscape site and thus the main focus of urban planning. The modified urban plan centers on the redevelopment of the sugar refinery as housing and recreation areas while preserving the sugar industry landscape, which is expected to reshape the relationship between the city and the factory once again.

#### Conclusion

The industrial city of Huwei develops with Huwei Sugar Refinery and shows the intimate relationship in the spatial arrangement between the city and the factory. Today, even though the sugar industry had long ceased in Taiwan, Huwei Sugar Refinery still maintains a small portion of sugar production in its cultural heritage site. Unlike most of the heritage sites, the focus of the modified urban plan is the industrial and residential zones of the refinery, while the original urban core in the north continues to grow at its own pace. The city, however, continues to develop under the influence of the sugar refinery from the earliest urban planning as an industrial city which embodies the uniform grids in the old urban core and the dormitory areas.

In summary, the emergent City-like Settlement and the large areas of worker housing contributed to the initial urban landscape in the middle of the sugar cane fields. Because of its development background, there are comparatively more public utilities and infrastructures in Huwei than the surrounding settlements. In purpose of supporting the factory, a small city area was planned to provide services to the factory staffs which was characterized by the simple grids, spatial hierarchy, and the function-oriented arrangement of facilities. As the sugar industry slowly declined, the city expanded and engulfed the factory, which was the less compact and more organic layout that extended the city to the



east and southwest. In the last phase, the sugar refinery dramatically downsized and resulted in the conversion and merging of the city and the factory. Nevertheless, the traces of the sugar refinery and the original layout continue to dominate the urban forms in these areas. The townscape of Huwei resonant with the sugar industry, which serves as a classic case of the outcome of industrialization and modernization in the 20th Taiwan. As “sweetener” in Taiwan’s development, the sugar industry not only acted as the important economic sources, but also the key influence to the shaping of industrial cities and their subsequent formative processes.

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