PART 2

CASE STUDIES & DESIGN PRINCIPLES
CHAPTER 1:
HONG KONG CASE STUDIES

As pointed out in the literature review earlier, Hong Kong is one of the most successful examples of implementing TOD strategies. In this chapter the TOD concept in Hong Kong will be examined. First by an introduction to Hong Kong’s mass rapid transit system, the MRT. Then by examining case studies made by researchers, and finally by making live case studies in some chosen Hong Kong developments which according to the researchers represent successful examples of TOD implementation.

INTRODUCTION TO THE HONG KONG MASS RAPID TRANSIT SYSTEM AND ITS TOD STRATEGIES

Hong Kong is one of the most transit oriented cities in the world. 43% of the housing units in Hong Kong are located within 500 meters of a MTR station, 20% are located within 200 meters. The mode share of public transport is as high as 90%. (Tang et al, 2004). Hong Kong’s mass transit system, the MTR (Mass Transit Railway), started its operation in 1979. Today it is one of the busiest mass transit systems in the world, with more than 1.3 billion riders per year. The system consists of 211.6 km of rail and 155 stations, of which 86 are railway stations and 69 light rail stops (MTR corporation, 2011).

The MTR is owned and operated by the MTR Corporation. The Hong Kong government owns the majority of the shares. Hong Kong’s MTR system is one of the few in the world that is actually profitable, which means it does not need subsidizing from the government. It not only gains profit from the MTR system itself, the company also engages in real estate development. (Tang et al, 2004).

HONG KONG’S RAIL+PROPERTY DEVELOPMENT MODEL

Hong Kong is famous for its Rail+Property development model, also referred to as the R+P model. R+P. It is cooperation between public and private interests using the TOD concept to concentrate development around a new MTR stop. The government hands out development rights around the station to the railway company, who in turn develops the land and can gain profit from the rising property values. By using this strategy the huge investments in new rail lines can be returned by profits from property development. The process works as following: First the MTRC, together with the government, plans the location of new rail lines and MTR stations. Then opportunities for developments around the new station are discussed, followed by the government granting development land rights around the station to the MTRC. The MTRC then draws up master plans and conceptual proposals for the area, making sure to give attention to public interests and especially planning for a built environment that promotes transit use. Great attention is given to concentrating high population densities around the station, and also to the design of the pedestrian environment. The plans are given to private developers by public tenders (inviting the private sector in a fair and free competition for receiving government construction projects), who then outlines detailed plans and handles the construction of the developments. The private developers are in charge of all construction costs, marketing costs as well as selling and leasing the properties. The MTRC are responsible for constructing all civil works such as roads and technical infrastructure. When the developments are finished, the MTRC and property developers share the profits gained from selling and leasing properties. The advantages of this model are many. With regards to TOD, the most important one is that the integration of transit and property development is overseen by one entity, ensuring that all factors are accounted for. The MTRC aims to fully take advantage of the positive benefits of the TOD concept, and the R+P model is an important tool to achieve these goals. (Tang et al, 2004)

CASE STUDIES FROM PREVIOUS RESEARCH ON TOD IN HONG KONG

Zhang and Lin (2011) make a case study of TOD in Hong Kong. They cite several sources, stating that Hong Kong is one of the best transit-oriented cities in the world. Their study concludes that the basic three Ds of the TOD concept, density, diversity and design are used extensively and successfully in Hong Kong. This, according to the authors, shows that the three Ds are also applicable in the context of Hong Kong.

A study comparing rail-based TOD in New York and Hong Kong found that the characteristics of the built environment around transit stations greatly promoted transit ridership over automobile travel, even when accounting for socioeconomic factors. This, the authors conclude, shows the value of TOD strategies when designing new developments in both Hong Kong and New York (Looa, Chenb, & Chan, 2010).

In another study, Cervero and Murakami (2009) examine Hong Kong’s public private partnerships and TOD. The study showed that the more integrated the station
was with its surrounding areas in terms of pedestrian friendly environments, higher properties values and higher level transit ridership was gained. They state that Hong Kong’s R+P development strategy has a high potential in mainland China.

One of the most extensive studies of TOD in Hong Kong was made by Tang et al. (2004). The main aims of the study was to examine factors that promotes rail-transit ridership in Hong Kong, and how to successfully implement Hong Kong’s Rail + Property Development model in other cities, specifically in cities in mainland China. The study reached several interesting conclusions. They found that a compact environment with high building density, mixed-use and lively street activities promoted transit ridership. With regards to density, both high population density and employment density concentrated around a transit station were important factors. The authors does however conclude that these factors are not enough to on their own provide the positive benefits of TOD. It is pointed out that some stations have a much higher proportion of transit ridership than other stations of similar or even much greater population densities and dwelling units within the catchment area. This, the authors conclude, is due to certain urban design features of the areas surrounding the station. Since the vast majority of MRT passengers walk to the station, ease of accessibility, walking distances, and the design of the pedestrian environment are underlined as very important planning and urban design features. Case studies made by the authors showed that long walking distances or unattractive and inconvenient pedestrian environment were significant factors for choosing other transport modes, such as the automobile. On the other hand, short walking distances and/or attractive and convenient pedestrian environments were shown to positively influence transit ridership. Several neighborhoods are pointed out by the authors as examples that have successfully implemented the above factors, not only density and mixed-use, but also a carefully designed pedestrian environment that provides safe, pleasant and convenient access to the MTR station and also with other destinations in the local neighborhood. Two examples of this is Chai Wan on the Island line and Po Lam on the Tseu Kwan O line. Another development that is discussed by the authors is Heng Fa Chuen. However, it is not as successful in attracting transit passengers as Chai Wan and Po Lam. They argue that, although the area has efficient and well designed pedestrian connections between the MTR station and its surroundings, as well as short walking distances, the fact the area has a single-use character may have a negative impact on transit use. The area has for example very few work places. A negative example is also brought up, namely the new R+P development Tseung Kwan O, two stations from Po Lam. According to the authors the lack of well designed connections between the MTR station and its surroundings have the effect of attracting fewer riders in Tseung Kwan O. There is a lack of footbridges and there are also large plots of undeveloped land close to the MTR station. The authors does however point out that these will be developed in the future, possibly fixing the problems. The new developments will be connected via footbridges.

The study did not go into any detail about the specific urban design aspects of the case studies, it is difficult to read from the study how these features look in reality. Therefore more detailed case studies of the urban design features of the five D’s, Density, Diversity, Design, Distance to Transit and Destination Accessibility will be made of these areas. The areas of Chai Wan, Heng Fa Chuen and Po Lam are chosen as case studies for this thesis. Smaller case studies are made of the other developments along the Tseung Kwan O line, namely Tiu Keng Leng, Tsing Kwan O and Hau Hang. The case studies will form the basis for outlining the design principles to be used in the design of the Nanjing proposal.
INTRODUCTION TO THE CASES

ISLAND LINE (BLUE): CHAI WAN & HENG FA CHUEN

Chai Wan and Heng Fa Chuen are located on the Island line (blue), which runs the length of Hong Kong Island. Chai Wan is the terminal station. The Island line started operation in 1985. Like many other developments in Hong Kong, Chai Wan and Heng Fa Chuen are built on reclaimed land. Chai Wan has a mix of private commodity housing and low income public housing estates. Several of the developments were built before the opening of the MTR station. Heng Fa Chuen consists of privately owned residential estates and was developed by the MTR corporation. The buildings heights in Heng Fa Chuen were limited due to the proximity to the old international airport.

TSEUNG KWAN O LINE (PURPLE): PO LAM

The Tseung Kwan O line opened in 2002. It connects the Tseung Kwan O New Town developments with Hong Kong Island. Tseung Kwan O was pointed out as a site for new developments in the early 1980’s. Extensive land reclamation work was undertaken and several new developments have been built on the reclaimed land. Tseung Kwan O New Town consists of the districts Tsui Lam, Po Lam, Hang Hau, Town Centre, Tiu Keng Leng, Pak Shing Kok, Siu Chik Sha, Tai Chik Sha and Fat Tong O. The current population is 330,000, the plan is to increase that to more than 500,000 when the area is fully developed (Hong Kong Planning Department, 2012). Po Lam lies on the terminal station of the Tseung Kwan O line.
CHAI WAN & HENG FA CHUEN

The TOD strategies of Hong Kong can be clearly observed in developments along the Island line. To the right is a map showing the Shau Kei Wan, Heng Fa Chuen and Chai Wan MTR stations. The developments are tightly concentrated around the stations. There are very few developments in the areas outside the 500 meter radius of the stations. Sui Sai Wan is an example of a bus oriented development. Since there is no MTR station, development has been concentrated around a bus terminal, which serve as the terminal station for several bus lines.

EXPLANATION OF MAPS USED IN THE CASE STUDY

The Ds of Density and Distance to Transit are grouped together in one map. Population within a specified radius is chosen as the density unit to be used in this analysis. The purpose is to calculate the amount of people within a specified radius of the transit station. Tang et al. (2004) found that transit-use was the highest among residents living within 200 meters of a station. Residents within 500 meters also showed a high proportion of ridership. The ridership levels dropped more sharply with distances over 500 meters. Therefore the 500 meter and the 200 meter radius are chosen in this analysis. The population numbers of each building were fetched from the 2006 Hong Kong census. For better legibility, in this analysis the population numbers of each building has been added to show the total number of residents in each estate or building group.

Destination accessibility on the local neighbourhood scale measures accessibility to local functions such as shops, services and employment centres. For example the proportion of shops within 200 meters. Therefore the Ds of Diversity and Destination Accessibility on the local neighbourhood scale are grouped together. An example radius of 200 meters is used to show the amount of local destinations within easy reach.

The Design aspects are analysed through both studying the built environment and activity on site, such as the main pedestrian movement flows. Photos are also used to show important design aspects.
Residential towers built on top of shopping mall and podium.

Chai Wan Park

Residential towers on podiums. Parking & shops below.

MTR station + shopping mall. Development on top.
DENSITY & DISTANCE TO TRANSIT

The calculations show that Chai Wan is a very densely populated area. The majority of the residential estates are located within a 500 meter radius of a MTR station exit. The highest densities are found within the 200 meter radius and includes the residential developments of New Jade Gardens, which is located directly on top of the MTR station and its shopping mall. There is also a dense light industrial area with offices and workshops, including an office tower, directly northwest of the MTR station. This area provides many workplaces in close vicinity to the station. Another large workplace within the 500 meter radius is the Eastern Hospital in the north.

From the analysis of population density it is found that the emphasis on concentrating developments in a 200 meter radius around the transit station can clearly be seen in Chai Wan. In fact, nearly all developments are located within a 500 meter radius.

The high population density will put tremendous pressure on pedestrian connections as well as the road network. Judging from the high population concentration in the lower half of the area, Exit A and E should receive a huge amount of pedestrians, which requires great attention to the design of the pedestrian environment in this area. The fact that all the main roads of the area converge in a roundabout just south of the MTR station is in clear conflict with this. The design solutions to these problems will be shown in the coming pages.

Population within 500 metres: 82 287
Population within 200 metres: 33 666

*The whole population of an estate is included if its entrance is within the radius. The population numbers for each building that lie as base for this analyse were obtained from the Hong Kong Census (2006).
DIVERSITY & DESTINATION ACCESSIBILITY

The analysis shows high levels of diversity in Chai Wan. The largest shopping malls are concentrated around the MTR station, and smaller shopping malls and supermarkets are found within each estate. Besides the shopping malls, there are also plenty of smaller local shops selling everything from seafood to electrical appliances. There are also smaller workshops. Most of the industrial uses such as workshops and warehouses are concentrated in the area northwest of the MTR station. Here are also offices, most of them in a tall office tower. This area is very busy with delivery trucks which negatively affects the quality of the pedestrian environment. A large workplace, the Eastern hospital, is also located in the area. Schools are evenly scattered throughout the area. Most estates have several different levels of schools available within 100 meters. A youth community centre and school, Youth Centre, is located in the central part. This map only shows public parks and squares. A popular large park is located to the northeast of the MTR station, easily reachable from all the area. It is also possible to pass through it on the way to the MTR station. Scattered around the area are carefully designed pocket parks with plenty of sitting and relaxing opportunities. There are also several public sport fields in the area. The purple dashed lines show areas with many shops in the bottom floor of buildings, providing an interesting and active street life along the streets leading to the MTR station. Besides the shopping malls and Chai Wan park, these are the areas with the most vibrant activity.

An example radius of 200 meters can be seen on the map to the right. It shows that within a residential cluster a wide range of shops and services can be found within easy walking distance. Such as schools, grocery shops, shopping malls, barber shops, dentists, clinics, elder care, kindergartens, pocket parks, basketball courts etc. By using the same radius around the other estates, high levels of destination accessibility can be observed throughout Chai Wan.
DESIGN:
STREET NETWORK

**HIGHWAY**
Highway connecting Chai Wan to Central Hong Kong. Four lanes with no sidewalks. Separator in the middle with no trees. Only footbridge crossings. Very heavy traffic.

**ARTERIAL ROAD**
Four to six lane arterial road circling through the area. Separator in the middle with trees. No parking along the sides. Sidewalks on both sides with fences. Traffic lights at every crossing. Heavy traffic with loud double decker buses and trucks.

**LOCAL ROAD**
Two lane road with no parking on the sides. Sidewalks with traffic lights at every intersection, fences along both sides. Trees planted along the sides. Moderate traffic, mainly public light buses and cars.

**LOCAL STREET**
Small two lane street with parking along the sides. Shops, workshops and other services on the ground floor of buildings along the street. Small sidewalks with no fences. No Trees. No traffic lights at intersections. Light traffic, mainly cars and small delivery trucks.

**FOOTBRIDGE**
Footbridges pass over the most trafficked roads

**RESIDENTIAL AREA**
The residential areas have their own internal street networks with shared traffic space. The driving speeds are slow and focus is put on pedestrian connections. There are usually many entrances to each estate.
DESIGN: PEDESTRIAN NETWORK

This map shows the level of accessibility for pedestrians. The pedestrian network in Chai Wan is extensive and very accessible.

INTERSECTIONS
There are plenty of alternatives when choosing route. The potential conflicts between traffic and pedestrians in certain heavy trafficked areas has been solved by using traffic separation in the form of footbridges. In less trafficked areas a more shared space approach is used. The local streets have no traffic lights, low traffic, and are easy to pass. The larger streets have traffic lights, but these seldom need to be crossed because there are easier routes to choose. The most heavily trafficked roads are passed by footbridges.

BLOCK SIZES AND ENTRANCES
Block sizes are varying. Some are several hundred metres in length. The larger blocks and estates have several openings, allowing pedestrians to pass through. Some of the estates are however formed as gated communities, surrounded by fences and with security guards patrolling the area. Still, they offer several entrances for their residents, and visitors are allowed to pass through, although suspicious behaviour may get you expelled from the area. The more central estates handle the security issue at each building entrance.

WEATHER PROTECTION
In the sub-tropical climate of Hong Kong, weather protection is important. In the central area around the MTR station, footbridges connect several shopping malls together, creating a weather protected pedestrian environment. The aim to focus on effective and pleasant pedestrian connections is evident. Roofs providing shelter are also placed over sidewalks in certain areas. The most common aspect is however the extensive use of trees that are planted along the streets and sidewalks, providing shade in the normally hot Hong Kong weather. There are also many pocket parks and squares along the main pedestrian routes, creating possibilities for sitting down and relaxing.
**DESIGN:**

**PEDESTRIAN FLOWS**

Due to the very high population density of Chai Wan, a lot of pressure is put on the pedestrian connections. A carefully designed pedestrian environment is essential to handling these movement flows. Visits to the area found the following main pedestrian flows. The map to the right shows the pedestrian flows between the residential estates and MTR station. The central area close to the MTR station has an extensive footbridge network which passes over the most heavily trafficked roads. These footbridges connect several shopping malls together, providing not only customers to the shops but also a weather protected environment for the pedestrians. Some estates have direct access to the MTR station. New Jade Gardens located directly on top of the station and shopping mall has entrances inside the mall, which is open 24 hours. Hing Wah Estate 1 and Wan Tsui Estate 1 and 2, have direct footbridge access to the station, passing through several malls. Further out from the area, pedestrians descend from the walkways and go out into street level, using the sidewalks. Comparing with the Diversity map, it is found that many of the main pedestrian flows move along streets with a clear mixed-use character, with small shops and services in the ground floors of buildings. This is especially the case for pedestrians walking from the eastern estates such as Yue Wan Estate, Lok Hin Terrace and Walton Estate to Exit A. Pedestrians from these estates use a combination of sidewalks and footbridges to reach the stations. Few busy intersections need to be crossed. Pedestrians from the estates to the northeast, use Exit D, passing through Chan Wai Park. Choosing to pass through the park is also an option for pedestrians coming from the east, such as Walton Estate or Yue Wan Estate, if they want a calmer walk with less shops.

Pedestrians from the estates to the northwest, such as Greenview Terrace, walk through the less pedestrian friendly industrial area to exit B. Walking from the estates to the west, such as Hing Wah Estate 1, pedestrians use a combination of footbridges and sidewalks, passing through two shopping malls going to exit E. An important find was the complete lack of bicycle paths and bicycle stands in the area. Another note is that while much emphasis was put on the connections to the MTR station, this has also provided an extensive network which makes walking to other destinations within the area convenient.
DESIGN:
A CLOSER STUDY OF ONE OF THE FLOWS
WALKING FROM YUE WAN ESTATE TO THE MTR STATION

This section will show a photographic documentation of a walk from one of the estates, Yue Wan, to the MTR station. These photographs will show different aspects of the pedestrian environment, such as pedestrian streets, footbridges, weather protected shopping malls and street activity. Comparing the Diversity map and pedestrian flow maps just shown, it is found that the path in question passes many different kinds of shops, services and activity centres, making it convenient to do for example grocery shopping on the way home from work. This is seen more clearly in the photos:

PHOTO # SEE NEXT PAGE FOR CORRESPONDING PHOTO

1. Start of the walk from the estate. The streets are small, low trafficked and easy to cross. The ground floors have small local shops and services, creating a vibrant urban street.

2. The building on the right, a part of Walton Estate, is built on a podium, with a private garden on top, making room for shops below.

3. Between photos three and seven runs a pedestrian street. In the beginning is a small market selling fruits, vegetables and seafood.

4. Small market stalls selling fresh seafood

5. A sports field and a park are next to the pedestrian street. There are ample sitting opportunities in the park.

6. The pedestrian street continues with more market stalls, selling clothes, accessories etc.

7. The entrance to the footbridge passing over the heavily trafficked roundabout. The footbridge also provides weather protection.

8. The footbridge leads to the shopping mall which is connected to the MTR station.

9. The shopping mall and the estate on top of it are connected to the MTR station. The station is above ground.
PHOTOGRAPHIC DOCUMENTATION
A CLOSER LOOK AT CHAI WAN

To make the description of Chai Wan more clear this section will show a photographic documentation showing the features discussed in the previous pages. Footbridges, podiums, streets and roads, parks, and street life can be seen in the photos. These photos are all taken in mid-day and it is clear that even outside of rush hour there is plenty of activity in the area. It is a mixed-use area with activity around the clock. But serenity can still be found in the parks.
Footbridge leading to Exit A. The slope creates easy access.

Footbridge leading to Chai Wan Park

Public transport interchange behind the MTR station.

Street life along the small streets

Some estates are built on podiums with a private garden on top. Parking garage and shops beneath.

Shopping mall and MTR station with the residential towers of Jade Garden on top.
Despite the footbridges, there still is an active streetlife.

Pedestrian street running below the elevated railway.

Small public place with benches.

Footbridge leading to Hing Wah Estate and shopping mall.

Pedestrian street between small park and shops. Easy walking access for elderly and disabled.

Walking through Chai Wan Park.
HENG FA CHUEN 杏花邨
Heng Fa Chuen is a less densely populated area than nearby Chai Wan. This is partly because Hong Kong’s old airport was nearby, imposing regulations on maximum buildings heights in Heng Fa Chuen. The area is predominantly medium-rise. Nevertheless, the area is still quite densely populated in a tight concentration around the MTR station. All of the residents live within 200 meters of it. This is also due to local natural conditions, the area is placed between the ocean to the east and a mountain to the west. The lower population density puts less pressure on pedestrian connections and other infrastructure compared to in Chai Wan.

The main difference between Heng Fa Chuen and Chai Wan is the diversity. Heng Fa Chuen has a clear single-use character. There has been no space arranged for small local shops or services in the bottom floors of buildings. It is likely that the perhaps overly large shopping mall next to the MTR was deemed enough for the area. The are far fewer options when it comes to local destination accessibility in Heng Fa Chuen. The options that exist, mainly schools and parks as well as the shopping mall, are however within a very easy walk. In sum, Heng Fa Chuen has much lower levels of both diversity and destination accessibility than Chai Wan. According to Tang et. al (2004), this fact has led to fewer passengers to the MTR station, since unless you are a resident there are few reasons for travelling to Heng Fa Chuen.
DESIGN:
STREET NETWORK

Heng Fa Chuen has very few roads and little traffic. The area has a shared traffic space character. The main traffic flow goes on the expressway Island Eastern Corridor that passes through the area.

HIGHWAY
Highway connecting Heng Fa Chuen to Central Hong Kong and Chai Wan. Four lanes with no sidewalks. Separator in the middle with no trees. Very heavy traffic.

ARTERIAL ROAD
There are no roads of this type in Heng Fa Chuen.

LOCAL ROAD
Two lane road circling the area, leading to the highway. Passed by footbridges and zebra crossings with no traffic lights. Low traffic volumes.

LOCAL STREET
Small two lane streets give access to the buildings. These streets have the character of shared traffic space with slow moving traffic.

FOOTBRIDGE
Footbridges lead out from the MTR connected shopping mall.

RESIDENTIAL AREA
There are no private gated residential areas in Heng Fa Chuen.
**DESIGN:**
**PEDESTRIAN NETWORK**

This map shows the level of accessibility for pedestrians. The pedestrian network in Heng Fa Chuen is very open and accessible. It shows a clear focus on providing easy and convenient access for pedestrians.

**INTERSECTIONS**
Given the low traffic volume in the area, there are few potential conflicts between motorized traffic and pedestrians. The main road leading to the MTR station and residential areas are crossed by a couple of footbridges which lead into the shopping mall and MTR station. There are no traffic lights in the area and crossing the streets is easy.

**BLOCK SIZES AND ENTRANCES**
The are no blocks in the normal sense of the word in Heng Fa Chuen. Buildings are placed freely in a landscaped area. Small streets lead to the buildings. Pedestrians may freely walk around as they please, passing between individual buildings. The railway creates a barrier through the middle of the area, only passable by walking through the MTR station or by passing the tracks over footbridges to the north.
PHOTOGRAPHIC DOCUMENTATION
A CLOSER LOOK AT HENG FA CHUEN

Heng Fa Chuen has less character and street life than neighbouring Chai Wan. But the calmness does have its own qualities. The area is quite green and have plenty of walking and sitting opportunities. It is also much smaller, these few photos capture most aspects of the area.
TSEUNG KWAN O LINE: PO LAM 寶琳
In order to get a better sense of the density and character of the Tseung Kwan O area, of which Po Lam is part, a model of the developments along the Tseung Kwan O line was made. The area is built on reclaimed land from Junk Bay. The height of each building were obtained from the Hong Kong Housing Authority (2012). On top of every MTR station is a large shopping mall complex, with a public transport interchange on the ground floor. On top of the shopping malls are residential towers. It is a very high dense area with most residential towers being more than 40 floors high. For example, the residential towers on top of Tiu Keng Leng station are 52 floors. Those on top of Tseung Kwan O station are 39 floors, Hang Hai station has 49 floors high towers and finally Po Lam which has 38 floors high towers. Most of the developments in this model are finished. The exception is Tseung Kwan O station. Half of it is currently completed, the area to the right closer to the ocean is under construction, the model shows an approximation of the density when the development is finished.
PODIUM AND FOOTBRIDGE SYSTEM
TSEUNG KWAN O LINE: TIU KENG LENG & TSEUNG KWAN O

One of the key characters of Hong Kong TOD developments is the podium and footbridge system. On top of each station is a shopping mall, with a development on top. Surrounding the station are several additional shopping malls and residential podiums. The podium residential developments have their own private courtyard garden on top. The podiums closest to the station are all interconnected with footbridges, creating an extensive connected pedestrian circulation. The podiums further from the station does not contain shopping malls but does often have shops in the bottom floor. Each podium has its own parking garage within. According to research (Tang et al, 2004) (Cervero & Murakami, 2009), this strategy has proven to be an important factor for promoting transit use, as it creates ease of access and protection from weather. Hong Kong does have a warm, humid climate with plenty of rainfall. Another interesting aspect in this area is the green corridor, connecting Tseung Kwan O station with the ocean front.
PODIUM AND FOOTBRIDGE SYSTEM
TSEUNG KWAN O LINE: HANG HAU

Hang Hau is an extremely dense Transit-Oriented Development. All of the buildings are located within 200 meters of the MTR station. Most of the buildings are more than 50 floors high and each estate has its own private courtyard garden on top of its podium. The whole area is connected via an extensive footbridge system.

Vertical city. Two towers in Metro Town on top of MTR station. 67-69 floors high. Adapted from source: Michel Van Hove (2010)
Finally we come to Po Lam, the terminal station of the Tseung Kwan O line. The area is fully developed. The same features as in the rest of the Tseung Kwan O area can be found here. The area is located between two hills, which gives it a long, narrow shape. As in the previous described developments, the area around the MTR station is extremely dense, as can be seen in the model. The buildings are more than 40 floors high. In the following pages a more detailed case study will be made, showing density levels and specific urban design features.
POPULATION DENSITY & DISTANCE TO TRANSIT

Po Lam’s density will be studied more closely than in the other cases. Population density per area unit is added, as well as number of dwelling units and density. Po Lam’s floor to area ratio (FAR) is also studied.

Like Chai Wan, Po Lam is a very densely populated area. It is even more dense that Chai Wan within the 200 meter radius of the MTR station. 43702 people live within this radius, making Po Lam station a very busy one. As part of the extension of the Tseung Kwan O line to Po Lam, the MTRC built several shopping malls and residential developments around the station. Metro City phase one, two and three are all connected directly to the MTR station by footbridges. All of them have entrances directly into the shopping malls. More than 18000 people live in these developments. The shopping malls and surrounding streets are buzzing with activity all day. Another large residential cluster, King Lam Estate, is directly to the southeast of the MTR station. Far to the west is Tsui Lam Estate with its more than 22000 residents. These residents rely on buses and bicycles to take them to the MTR station in central Po Lam. This development is not officially part of Po Lam and is therefore not included in the density calculations.

Like in Chai Wan, it is found from the analysis of population density that the emphasis on concentrating developments in a 200 meter radius around the transit station can clearly be seen in Po Lam. The majority of residents live within just 200 meters of the MTR station.

**DENSITY STATISTICS:**

Population: 82732  
Population within 500 metres: 82732  
Population within 200 metres: 43702  
*The whole population of an estate is included if its entrance is within the radius. Tsui Lam Estate is not included as it is not part of the actual Po Lam project.

Population density: 111144 persons/km² or 1111 persons/hectar  
Total number of dwelling units: 22935  
Dwelling unit density: 308/hectar  

The population numbers for each building that lie as base for this analysis were obtained from the Hong Kong Census (2006). The area used for calculating population density is shown in the map on the next page.
DENSITY: FLOOR AREA RATIO

Floor Area Ratio (FAR) is a unit commonly used by planners and developers to describe the density of a development. Floor Area Ratio is used to compare the total built area with the area of the plot. The gross floor area of the buildings on the lot are divided by the plot area to give the floor to area ratio. The numbers found in this analysis may provide guidance when planning the design proposal for Nanjing.

FAR values in Hong Kong are generally very high. The maximum allowed FAR is 10 on Hong Kong island and 8 in Tseung Kwan O, which Po Lam is part of (Hong Kong Planning Department, 2012). The FAR values in Po Lam were calculated by adding the gross floor area of each building together, and then dividing by the plot area as shown in the map to the right. The total area of the site is 744362 m².

The FAR analysis shows that the central developments have the highest FAR values, with the metro station with its shopping mall and residential towers having the highest value.
Like in Chai Wan, diversity levels are also very high in Po Lam. The central area has a high concentration of commercial activity, with three different shopping malls all connected by footbridges and with the MTR station. Each residential cluster also have smaller shopping malls and small local shops and services. Along certain streets, the ones marked with the purple dashed line, lie plenty of small shops and services in the ground floor. Several levels of schools are located within each residential cluster. Two big parks with sports fields are located in the south and north part of the area. Tsui Lam Estate, located on the west edge of Po Lam outside the 500 meter radius, have its own shopping mall and services. There are no large workplaces in the area other than the shopping malls and schools. There are some offices in the towers on and around the MTR station.

Destination accessibility on the local scale is very high. Using the example 200 meter radius over each residential cluster, it is found that there is a large range of shops and services available within easy walking range. For example, Po Lam estate as shown in the radius in the map, has several schools, a shopping mall, small shops, a hospital, a park with sport fields, and a large food market within a 200 meter radius.
DESIGN:
STREET NETWORK

HIGHWAY
Tseing Kwan O bridge tunnel which goes under the mountain. Connecting Po Lam with Kowloon and the main Hong Kong Island.

ARTERIAL ROAD
Four lane arterial road circling through the area. Separator in the middle with trees. No parking along the sides. Sidewalks on both sides with fences. Traffic lights at every crossing. Heavy traffic with loud double decker buses and trucks.

LOCAL ROAD
Two lane road with no parking on the sides. Sidewalks with traffic lights at every intersection, fences along both sides. Trees planted along the sides. Moderate traffic, mainly public light buses and cars.

LOCAL STREET
Small two lane street with parking along the sides. Shops, workshops and other services on the ground floor of buildings along the street. Small sidewalks with no fences. No Trees. No traffic lights at intersections. Light traffic, mainly cars and small delivery trucks.

FOOTBRIDGE
Footbridges pass over the most trafficked roads

RESIDENTIAL AREA
While there are private residential areas in Po Lam, the traffic inside is mainly pedestrians. Usually only a few streets, the orange ones on the map, lead into the estate and its parking garages.
DESIGN:
PEDESTRIAN NETWORK

This map shows the level of accessibility for pedestrians. The pedestrian network in Po Lam is extensive and very accessible. Po Lam also has an extensive bicycle network.

BICYCLE NETWORK IN PO LAM

Intersections, block sized and entrances are very similar in Po Lam and Chai Wan. Therefore these are not described further. The main difference between Chai Wan and Po Lam is the presence of a bicycle network. The need for this was probably higher in Po Lam, since there are large residential areas located at some distance to the MTR station. A carefully designed bicycle network has been created. The red lines show the bicycle roads which allow for fast moving bicycles, intersections are designed so bicycles may pass quickly through them. Plenty of bicycle stands are available around the central shopping malls and MTR station.

WEATHER PROTECTION

In the central area around the MTR station, footbridges connect several shopping malls together, creating a weather protected pedestrian environment to an even further extent than in Chai Wan. The indoor areas were very busy at the time of visit. The aim to focus on effective and pleasant pedestrian connections is evident. There are trees that are planted along nearly all the streets and sidewalks, providing shade in the normally hot Hong Kong weather. There are fewer pocket parks and squares in Po Lam than in Chai Wan. Some walkways do however have sitting opportunities along them.
As in Chai Wan, the very high population density of Po Lam puts heavy pressure on the pedestrian connections. Visits to the area found the following main pedestrian flows. The map to the right shows the pedestrian flows between the residential estates and MTR station. The central area close to the MTR station has an extensive footbridge network which passes over the most heavily trafficked roads. These footbridges connect several shopping malls together, providing not only customers to the shops but also a weather protected environment for the pedestrians. The indoor pedestrian network is very extensive in Po Lam. Many estates also have direct access to the shopping malls and MTR station, being located on top of them with entrances being open 24 hours. Metro City one, two and three with their 18000 residents are living directly on top of these malls. They have private gardens on top with artificial lakes. Moving further out from the shopping malls, after passing the heavy trafficked roads pedestrians descend onto street level. Pedestrians from Po Lam Estate pass by several shopping malls and small shops and services on the way to the MTR station. They also can walk through a large market. On the pedestrian- and bicycle path leading to the southeast, many students are walking from the schools there. People can also walk between Po Lam and its nearby neighbour to the southeast. Residents of King Lam Estate have just a short walk to the entrance of the shopping mall and its connected MTR station. Generally, walking is quick, easy and convenient. And the many shops and activities along the most busy movement flows create a vibrant street life. Despite the fact that there are many footbridges in the area, there is still lots of activity on street level.
PHOTOGRAPHIC DOCUMENTATION
A CLOSER LOOK AT PO LAM

Po Lam is a densely populated area with almost excessively tall buildings, many over 50 stories. The scale can be seen from the pictures, it feels much more overwhelming than the scale of Chai Wan. But the plentiful green spaces and attention to details on street level help to bring down this feeling. The area is full of vibrant street life, even in mid-day. Students walk around in the area on their breaks and the elderly can be seen taking walks and sitting down in the parks and other open spaces.
Big local market next to Po Lam Estate

Crossing one of the smaller roads. No traffic lights needed.

Many bicycle stands can be found around the station.

A long bicycle- and pedestrian road runs from the MTR station and southeast through Po Lam

The other direction of the bicycle- and pedestrian road. The station is the building on the right.

Footbridge from station to Metro City Plaza II shopping mall. Exit D.
Carefully designed weather protected walkway on top of station, leading to the Pinnacle and King Lam Footbridge between Po Lam Estate with shopping mall and MTR station. Also lots of activity on street level.

Entrance to King Lam Estate is behind, a short and easy walk to the shopping mall and MTR station.

Metro City shopping mall on top of MTR station.

Footbridge between Po Lam Estate with shopping mall and MTR station. Also lots of activity on street level.

The busy entrance of King Lam Estate.

Entrance to King Lam Estate is behind, a short and easy walk to the shopping mall and MTR station.

Taxi and bus interchange next to MTR station and below shopping mall. Deliveries come here as well.
HANDLING OF SECURITY IN THE THREE CASES
GATED COMMUNITIES IN HONG KONG

New developments in mainland China usually take the form of gated communities. With guards posted at the entrances and security cameras placed around the area. This phenomenon is also apparent in Hong Kong. In the three studied cases above, the security issue is handled in several different ways.

GUARDED ENTRANCE TO COURTYARD. STREET LEVEL.

Nearly all estates have some form of monitored car entrance, usually with a small booth and raisable barrier. Below is a typical gated community in Chai Wan and Po Lam. The picture is from Greenview Terrace in Chai Wan. There are several entrances to the estate. Two for cars as well as pedestrians, which both have guard booths. There is one pedestrian only entrance on the south side of the estate, also with a guard. Pedestrians may enter freely, but are under the watchful eyes of several security guards patrolling the area. After taking a few pictures inside of the courtyard, I was asked to leave the premises. Most areas are generally quite relaxed on the security, freely allowing visitors to pass through.

RESIDENTIAL TOWERS ON PODIUM. ENTRANCE ON STREET LEVEL.

Estates in the central areas and closer to the MTR station are commonly placed on podiums. On top of the podium is a private courtyard garden, some of them even has lakes. Below the podium level is parking garage. The ground floor has commercial uses. Entrance is through guarded doors on street level.

ENTRANCE FROM PUBLIC AREA / STREET.

Some estates have the building entrances directly onto the street or a public courtyard or park. The security issue is handled within each building, with a guard inside each entrance.

RESIDENTIAL TOWERS ON TOP OF SHOPPING MALL AND MTR.

Estates which are placed on top of shopping malls and MTR stations have guarded entrances directly from the shopping mall. They also have a private courtyard garden on top of it.

FREELY ACCESSIBLE AREA, SOME GUARDS.

Found only in Heng Fa Chuen. There are no closed areas, you may walk freely around the buildings. There were however a few guard booths, indicating some presence of security.
LOCAL CASE: TYPICAL DISTRICT IN HEXI NEW TOWN, NANJING

河西新城
CHosen CASE STUDY AREA
HEXI NEW TOWN

The chosen study area is a typical residential district in Hexi New Town. While there is no metro station directly within the area, several stations are planned for the future. Other residential areas have adjacent metro stations, and would be better suited for a case study. However, they are still under construction and a full case study would not be possible. These areas are pointed out in the map to the right. They are nearing completion, and will be very similar to the already fully developed area in the northern-most red box. Therefore, the fully developed area is chosen as a reference case study, and the future metro stations that will be located within the area are included in the analysis. The findings are argued to be valid for all current developments in Hexi New Town. The case study uses the same structure as in the previous Hong Kong cases, sorted according to the five Ds. The findings of this case study will be used for comparison with the Hong Kong cases, and to help in synthesizing design principles appropriate for the area.


Functional zoning. The land use plan of the study area and its surroundings clearly show the paradigm of functional zoning.
BIRD VIEW MODEL

STUDY AREA

Commercial axis

Future metro station

Metro station

World Trade Center

Future metro station
BIRD VIEW MODELS
STUDY AREA

BIRD VIEW OF THE NORTH-WEST CORNER OF THE STUDY AREA

BIRD VIEW FROM SOUTH OF STUDY AREA

BIRD VIEW FROM EAST OF STUDY AREA AND NEARBY RESIDENTIAL AREA TO THE SOUTH
POpulation Density & Distance to Transit

As no official population numbers were available, they were in this case study calculated using what numbers were available. The only known aspects were the area of each of the building’s ground floor, and the number of floors. These were used to calculate the gross floor area of all buildings. No average apartment size numbers were available either, therefore an average apartment size of 90m² was used. The average household size was set to 2.77, found in Nanjing planning documents (Nanjing City Master Plan 2007-2030, 2007). The average household size in Hong Kong is 2.9, though in Po Lam it is as high as 3.6 (Hong Kong Census Department, 2012). The average apartment size in Hong Kong is 55m². While this results in some differences in total population numbers, the most interesting aspect is the proportion of residents living with a certain radius of a station.

A surprising find was the relatively high population density in the selected area. Visiting the area, there is the sense of an empty neighbourhood. There are very few people on and cars on the streets. Therefore a low population density was expected. The high population density may have to do with the fact that the study area is made up of nearly only residential buildings. Choosing a larger area, including the surrounding commercial areas, would have resulted in a far lower density. The greatest difference with Hong Kong, is the way the density is related to transit. Despite three nearby metro stations (1 existing, 2 planned), less than half the population lives within 500 metres. No one lives within 200 metres. This is in one way due to the location of the entrances to the compounds, but even if those change, only about a fifth of the residents would live within 200 metres of a metro station. This is not ideal from a TOD point of view. Instead, as will be shown in the following pages, the built environment is focused on providing ease of access for the car.

Density Statistics:
- Population: 29976
- Population within 500 metres: 14401
  (if entrances change: 22474)
- Population within 200 metres: 0
  (if entrances change: 5398)
- Population density: 31843 persons/km² or 318 persons/hectare
- Total number of dwelling units: 10822
- Dwelling unit density: 114/hectare

*The whole population of an estate is included if its entrance is within the radius.
DENSITY:
FLOOR AREA RATIO
& BLOCK SIZE

Area of the whole site:
0.82 km² / 82 ha
Total building plot area:
69.8 ha / 85% of total area
Total road surface area including green buffers, sidewalks and bicycle lanes:
12.2 ha / 15% of total area
Parks and other public places (not counting streets): 0.0 ha / 0% of total area
Total Floor Area Ratio:
1.3

While the population density was surprisingly high, the floor area ratios found in the area are more according to expectations. This shows that population density alone is not sufficient in determining the density of an area. Comparing with Po Lam, the floor area ratios are very low and confirms the feeling of a very low density when visiting the Hexi area, compared to the feeling of ultra-high density when visiting Hong Kong. The floor area ratio of the whole site is 1.3. In Po Lam it is 4.5, and that also includes two large public parks. Except for the roads, there are no public places in the area. The parks are instead in the form of private courtyard gardens located within the walls of each compound. The private courtyard gardens are however also found in Hong Kong. If this area would, have more public open places such as parks, as in Po Lam, the floor area ratio would be below 1.0.
DIVERSITY & DESTINATION ACCESSIBILITY

There is a clear use of function separation in Hexi New Town. To the west lies a commercial axis which runs the length of the new town. To the east lies Jinyue Science Park, a collection of companies, bus parking with maintenance garage, warehouses and light industries. The science park was under construction at the time of writing. The commercial axis is separated from the residential area by a wide eight lane road and a green buffer. The entrances to the commercial area are car access points blocked by gates and guard houses. The residential area is however self-sufficient when it comes to schools, which are distributed evenly throughout the area. Some commercial services can be spotted in the map along the streets in the residential area, but as can be seen from the pictures these buildings are set back from the street, with a parking lot in front, and no sidewalks. The main use of these shops are directed at car owners, such as repair shops and car washes. One large supermarket can be found in the area, it is located underground and main access is by car through the attached parking garage.
DESIGN:
STREET NETWORK

The street network in Hexi New Town is composed of a grid network of wide boulevards and streets. Wide green buffers run along the sides of the streets. There is little sense of enclosure, since the buildings are setback far from the streets. Several visits have been made to the area during varying times. However, regardless if it’s rush hour, weekend or during a midweek day the scene is the same. Although there are traffic, the over-dimensional street network makes the area feel empty with only a handful of cars. Pedestrians is a rare sight. This is despite the fact that there lives around 30000 people in this area, with a density of 31000 people per km² as shown earlier. There should be bustling activity on the streets. The large street network is clearly capable of easily swallowing up that large amount of people and their cars. Within each compound is a private internal street network with a more shared traffic space. As Monson (2008) pointed out, these streets often run alongside the larger streets, creating a double system, as can be seen in the map. The internal street network in the map is just one example, they are all similar in this area.
DESIGN:
PEDESTRIAN NETWORK

The pedestrian network in Hexi New Town made up of very large grids, normally more than 200x200 meters. The map shows one example grid where one side is 383 meters long. The map shows only public walking possibilities, since each block is private and closed off by walls and guarded gates. There are sidewalks and bicycle roads along all the streets, all planted with trees, but since there are very few shops and activities in the area walking is less attractive and interesting. The sidewalks usually run along long stretches of high walls, creating a nearly endless perspective to the horizon. Despite the high population density, the sidewalks are empty, with the occasional electric bike passing by. There are many nice sidewalks and bicycle roads in the area, it seems to at least have been the intention of planners to create a pleasant pedestrian environment, but nice sidewalks and bicycle roads are not enough to encourage people to walk and use the metro.

Plenty of nice sidewalks and bicycle roads. But that alone is not enough.

Entrance to a gated community, no non-residents allowed.

A sign showing the way to the metro somewhere in the distance.

Security cameras places around the perimeter. Parking on sidewalk.
The literature review described some common aspects of Chinese town planning. There are the walls, today in the form of gated communities. There’s also the southern orientation paradigm and lastly the private courtyard gardens. Can these aspects also be found in Hexi New Town? Yes. In fact this area is an exact image of the descriptions found in the literature. Each block is walled in, creating a gated community. Each compound have two exits, both with gates and manned with guards. Visitors are required to sign in. All of the residential buildings are, with only minor deviations, orientated to the south. All of the compounds have their own private centrally located courtyard garden with the mandatory artificial lake. It is clear that these ideals in Chinese residential developments still hold strong also in Nanjing, and should be considered when outlining the design principles.
CONCLUSIONS & DESIGN PRINCIPLES
The findings of the Hong Kong case are described below sorted according to the five Ds. A set of design principles has been outlined based on the findings of the case studies of Hong Kong and Nanjing. An own model of TOD more suitable for Nanjing is proposed.

**DENSITY & DISTANCE TO TRANSIT**

**Population**
Population densities in the case studies of Hong Kong are very high. This is especially the case for the Tseung Kwan O line. Po Lam has a density of 111144 people/km² or 1111 people/ha. This can be compared with the most densely populated district in Shanghai, which has 96200 people per km² (Urban Age Project, 2006). The most densely populated district in Nanjing is the Gulou district with 31,000 people per km² (Nanjing Population Development Report, 2012). However, in Nanjing population densities in smaller grids such as neighbourhoods or individual blocks can be more than 1000 persons per hectare. But these take up very small areas, the density in larger areas never come close to Hong kong levels (Yun & Yehua, 2005).

Due to Hong Kong's topography and limited land its density needs to be extremely high. The developments are often encircled by mountains or bordered by the ocean. While Nanjing also have high population pressure, it may not have the same need of the excessive density levels of Hong Kong. Introducing those extreme density levels would make the design proposal far more dense than any existing neighbourhood in Nanjing today. The density of the studied case in Hexi New Town actually shows quite high density levels, although that is also due to that it nearly only consists of residential buildings. If a larger area of Hexi New Town would be analysed, a lower population density would be found. Higher population density is suggested for the design proposal, however not as high as in Hong Kong.

**Floor Area Ratios**
However, population density is not enough on its own to understand the real density of an area. The issue of low density in Hexi New Town is much more clear when it comes to the floor area ratios. A typical block in Hexi New Town has a much lower floor area ratio not only compared to Hong Kong blocks, but also to European perimeter-blocks. Building with such low floor area ratios works against implementing an effective transit-oriented development. It would be difficult to reach a high population density while at the same time having plenty of public places, commercial uses and services in the area with such a low floor to area ratio. Building with higher floor area ratios would put more people close to the metro station and provide space for public places and commercial uses. Therefor a much higher floor area ratio is recommended for the design proposal.
Dwelling units
Dwelling density is another issue. While a typical block in Hong Kong has a dwelling unit density of more than 2000 units per hectare, it is only around 150-200 in Hexi New Town. Even compared to European perimeter-blocks, Hexi New Town blocks have a low dwelling unit density. This is in part due to the relatively large apartments in new developments in Nanjing, compared to Hong Kong. In Hong Kong the average apartment size is 55m². In Po Lam, most apartments range between 50 and 70m² (Hong Kong Housing Authority, 2012). Some official numbers were found regarding social housing projects in Nanjing. The social housing projects near the area of the design proposal has an average apartment size close to Hong Kong's average, around 65m² (You, Han & Wu, 2011). While there is no official number for average apartment size of commodity housing, when looking at real estate brochures for Hexi New Town, typical new developments often have an average apartment size of 150m², though this also includes the balconies. This is not ideal from a density point of view, it would have a negative effect on the amount of people living close to a metro station. Smaller apartment sizes would be beneficial not only from a transit-oriented point of view but also from an environmental view, since Chinese apartments rarely have any insulation and require much energy for its heating. A larger apartment size would increase the energy needed even further. In favour of these factors a smaller average apartment size is suggested. Though still much larger than the average Hong Kong apartment of 55m².

Distance to transit
In all of the Hong Kong cases, nearly all of the population lives within 500 metres of the MTR station, with a large proportion of it being concentrated within a 200 metre radius. One of the main problems in Hexi New Town is where the high density areas are placed in relation to transit. Little regard has been taken to concentrating density around the metro stations. Areas with high population densities, like the area studied in the case study of Hexi New Town, are often located away from transit, while a lower density area may be located around a metro station instead. This is one of the areas where Hong Kong’s design principles can really be implemented fully. Hong Kong’s strategy of concentrating developments within 500 metres of transit stations should be used in the design proposal. With the highest concentration in a 200 metre radius around the station. Floor area ratios should be the highest in this 200 metre radius, and then decrease with distance to the station.

Reduce feeling of high density
In Hong Kong, green open areas counteract the feeling of density. In Tseung Kwan O for example, a green link runs from the ocean front to the MTR station. In Chai Wan, sight lines are opened up to the surrounding hills, and a large park is situated next to the station. In Heng Fa Chuen, an ‘eco’ walk has been created around the development, including an oceanfront promenade. In Po Lam, two large parks cut through the area. This could also be utilized in the design proposal in the form of a green link to the Yangtze riverfront.

SUGGESTED DENSITY LEVELS FOR DESIGN PROPOSAL:
Population density: 500 persons per hectare for the whole site, including public spaces such as parks. It is half of Po Lam’s density, but much higher than the rest of the Hexi New Town. A high proportion of the total population should be concentrated within 200 metres of the metro station.
Floor area ratios: Much higher than in Hexi New Town. Should be higher than European levels but not higher than Hong Kong, with the highest values in the 200 metre radius of the station
Dwelling units: Same as floor area ratios. Use an average apartment size of 90m².
DIVERSITY & DESTINATION ACCESSIBILITY

Problems in Hexi New Town

Chinese cities are traditionally mixed-use. Hexi New Town takes a different form. Plans for how new developments should be organized can be found in the Nanjing City Masterplan (2007). Although they depict a mixed-use concept, the various functions are located quite far from each other. A new neighbourhood is divided up into a grid network with a community centre in the middle and services provided in smaller grids around the centre of the neighbourhood. While it does seem logical in the planning stage, the actual implementation of this strategy is mostly car-oriented. Some of this strategy can be found in Hexi New Town. Schools are for example divided relatively evenly around the area. But few commercial activities exist, and the ones that do exist are not well integrated. Commercial areas are designed for car traffic. Nearly all commercial activities in Hexi New Town are placed along a main commercial axis, away from the residential area and separated from it by a wide road and green buffers. The result is low land use mix, and little integration with transit.

Lessons from Hong Kong

In Hong Kong, commercial areas are more evenly distributed. Each residential cluster has plenty of services and small local shops within a walking distance. These commercial activities and services are also located well in relation to transit. Along the path between the MTR station and residential areas lies many shops on the bottom floors, creating bustling street life and opportunities for doing for example grocery shopping on the way to and from the MTR. Several options also exists when choosing walking path. It’s possible to choose to walk through all the commercial areas, or to instead take a calmer walk through a park. It is also possible to enter the station both from ground level directly into the MTR station, or to use the footbridges and pass through the shopping malls on the way to it. In all of the cases studied in Hong Kong, the MTR station is connected with a shopping mall with residential towers on top, either placed on top of the station or directly next to it. In this way the different land uses are well integrated with transit.

Design Principles: Diversity

Distribute services within clusters: Provide schools and other services within each residential cluster, with short walking distances to them.

Place shops and services along main pedestrian flows: As shown in the maps to the right of Chai Wan and Po Lam, place commercial activities along the main pedestrian flows between the residential clusters and transit station.

Focus on pedestrian access to shops and services: Instead of today's focus on ease of access for cars in Hexi, focus should be shifted to providing ease of access for pedestrians.
**DESIGN PODIUMS & FOOTBRIDGES**

One of the most striking features of a Hong Kong transit-oriented development is the use of the podium and footbridge strategy. It is a key component in all of the case studies. Chai Wan, Po Lam and all of the developments along the Tseung Kwan O line use this strategy. It is also found in many other MTR station areas around Hong Kong. In all of the cases, a shopping mall is placed either directly on top of the station, or directly adjacent to it. The shopping malls are normally several floors high with a garage on the bottom floor. The garage sometimes contains a public transport interchange. There are also parking and a goods delivery area. The upper floors are shopping mall and more parking places for the residents of the estate on top. On top of the podium and shopping mall are tall residential towers. The residents have their own private garden on top of the podium. Land use is in this way highly integrated with transit. By building with podiums more residents, commercial uses and services can be located very near transit. It achieves a high concentration of functions and people around the station. The footbridge system creates an extensive interconnected system protected from weather and traffic. It provides easy and convenient access to the station. As noted in the introduction to Hong Kong transit-oriented development strategies, developments lacking an extensive footbridge and indoor walking network have lower levels of transit use (Tang et al. 2004).

**Section sketch.** This section sketch shows the arrangement of the different podium types. The central station podium are higher than the others and includes a parking garage and delivery area as well as a public transport interchange. On top of all the podiums are private gardens, a necessary component of new developments in China and Nanjing.

**Concept.** This model of Hang Hau can serve as a concept image for how the design proposal can be made. The central underground MTR station has a shopping mall on top and residential towers on top of that. The developments closest to the station are also podiums, containing parking garage and shops on the bottom floor. They are all interconnected with an extensive footbridge system.

**Chai Wan.** In Chai Wan, long sloped footbridges are used to connect the central MTR station and shopping mall with the surroundings. The sloped footbridges makes it easier for the elderly and disabled.

**Sloped footbridge in Chai Wan.**
Arguments for footbridges vs. underground walkways

A natural question is if underground walkways would not be better than footbridges, especially if the station is located underground. Why walk up several floors from the underground station, only to walk down again? It will be shortly discussed here, but it is a question begging further research. None of the studied areas in Hong Kong had underground walkways anywhere. Clearly the use of footbridges have some advantages in the eyes of Hong Kong planners. The station location varied. In Chai Wan, the station is on an elevated rail one floor above ground. In this case the use of footbridges is natural. In Po Lam, the station is on ground level, with only one exit to the street outside. Several escalators go up from the station to the above shopping mall and footbridge area on the second and third floors. Once on the second floor, you get access to an extensive indoor walking system with several connected shopping malls and podiums. The shopping mall has natural lighting and the footbridges are either glassed in or open to the outside. This could be one of the reasons for choosing a footbridge system over an underground walkway system. You get a better sense of the surrounding environment and can enjoy the natural lighting without feeling too enclosed. It is possible to walk along the footbridges to the surrounding estates without going down to ground level as the entrances to the estates are within or on top of the podiums. It is therefore not a question of a usual footbridge that only crosses one street. You go up on one side of the street and down on the other. It is an individual unit. The footbridges in Hong Kong are part of a larger system. Despite the fact that Po Lam’s station is on ground level, the majority of people still chose to go through the shopping mall and footbridges on the second floor. While no scientific method was used, the amount of people moving in the different areas could be clearly observed. Given time, a more scientific method could have been used to prove this. People walking from the estates further out, and that are not placed on podiums, still chose to use the footbridges to walk up one level and walk through the shopping mall and finally down to the station. The shopping malls were all full of people, even during the middle of a weekday. In Tiu Keng Leng, Tseung Kwan O and Hang Hau on the Tseung Kwan O line, all the stations are located underground, making an even stronger argument for using an underground walking system. Yet even here the sole strategy is a footbridge and podium network. While an underground walking system may very well be more efficient, the footbridge system is the chosen strategy in Hong Kong. We can imagine that an underground walkway system would’ve been implemented instead, how would it have looked? The MTR station, several shopping malls and the surrounding developments would all be connected through an underground walking system. So in order to pass from one shopping mall to the other, one would have to walk down underground to use the walkway connecting the two shopping malls. Same situation when passing from the shopping mall to the adjacent residential estate, which may be placed high up on a podium. One would have to get from several floors up in the shopping mall, down to the underground, in order to use the walkway. At the very least, one would have to go down to ground level to cross the street. A dual system could be used, utilizing both footbridge and underground walkways. But this would create three separate walking systems, one on footbridges, one on street level, and one underground. Dividing up the pedestrians that much could create problems for shops not being able to attract enough customers. It can be concluded that from a pure transit point of view, reaching the station would be most efficient with underground walkways. The footbridge system is more efficient when connecting podiums and shopping malls, to create ease of access between them. There are also other advantages like orientation and openness, being able to receive natural light and get an overview of the area.

Whatever the reasons may be, the sole use of the podium and footbridge system in the studied cases in Hong Kong has in research proven to be very effective in terms of creating successful transit-oriented developments (Tang et al, 2004). Therefore it is argued that this system should also be used in the design proposal for Nanjing.

Green connections. Some podium and footbridge areas are quite open, with plenty of greenery and sitting opportunities. The picture shows one of the footbridge areas between the Po Lam MTR station shopping mall and a podium.

Shopping mall. Also in Po Lam. Busy activity in the shopping mall, people move through the mall to reach the station. The station entrance can be seen in the back of the picture. One floor below are the train tracks.
DESIGN
PEDESTRIAN NETWORK, BLOCK SIZES & GATED COMMUNITIES

In Hexi New Town, the implementation of the common superblock practice have created very large blocks, usually around 6-7 hectares per block. Some areas in Hexi New Town have blocks as large as 17 hectares. In Hong Kong, the pedestrian network is much more fine-grained. This partly because the estates can be passed through by anyone. In Hexi New Town non-residents are not allowed to pass through the private compounds. Based on the findings of the literature review about Chinese planning practice, specifically the gated community, it is concluded that the residential compounds in the design proposal also needs to be private. It makes it more problematic to create the open kind of pedestrian network found in Hong Kong. It is not easy to create more entrances to each compound, as every entrance needs a guard, and residents are reluctant to pay for the extra guards. More gates also raises more concern regarding the overall security of the compound (Miao, 2003). However, it is believed that block sizes can be made smaller than in other parts of Hexi New Town by using a much higher floor to area ratio. A smaller block can still have the same number entrances as a large superblock, normally two entrances, because the number of residents sharing the cost is similar and security can still be maintained. The podium strategy also works very well with this. When it comes to the more centrally located podiums the solution is easier. In Hong Kong the podiums usually are totally private, non-residents are not allowed in. There are some podiums, especially in Chai Wan, that are open to the public. This is more the case for public housing projects placed on podiums, commodity housing podiums are normally private. The strategy of private podiums can be imported directly to the proposal in Hexi New Town. However, these decisions mean that the Nanjing planning law cannot be followed. This will be described more in detail later. A footbridge system should be used in the central part around the metro station. The most heavily pedestrian trafficked connections can be turned into pedestrian streets.

DESIGN PRINCIPLES: PEDESTRIAN NETWORK & BLOCK SIZES

Smaller block sizes closer to metro: Make small block sizes around the metro station, larger blocks further out.

Create indoor walking system with footbridges in the centre, around the metro:
Blocks can be passed through in the centre by indoor connections such as shopping malls, creating a fine-grained network of pedestrian connections in the centre.

Diagonal connections from outlying large blocks: Because the private estates cannot be passed through like in Hong Kong, create public diagonal connections from the outlying blocks to the centre. In order to make the walking distance as short as possible. The diagonal connections makes a good location for placing commercial activities and services.

Block size range: Between 1.5-4 hectares. Based on the concept sketch an average block size of 2.5 hectares is expected, making a total of 40 blocks per square kilometre.

Concept sketch. Smaller blocks close to metro that are passable indoors. Footbridges in the central area. Larger blocks further out with diagonal connections.

Comparison maps. All maps are in the same scale.
While Hong Kong developments put a great emphasis on a pedestrian-friendly environment, developments in Hexi New Town favour a much more car-friendly environment. A change of direction is suggested for the proposal in Hexi New Town. Following the design principles regarding the pedestrian network, a more fine-grained network is proposed, composed of much smaller streets. The heavy use of green buffers and building setbacks in Hexi New Town will be partly removed in the design proposal. Podiums and commercial buildings should have no setback. Sidewalks should run next to the building frontages, with commercial activities and services on the bottom floors. Parking takes place on the street outside the sidewalk, not on a lot in front of the building as is the case in Hexi today. Normal compounds without commercial activities and not on podiums can still be set back as before.

**DESIGN PRINCIPLES: STREET NETWORK**

**Streets instead of roads:** The design proposal should rely more heavily on small local streets rather than large artery roads.

**Ring road:** Ring road directing heavy traffic around the area. Motorists can drive around the ring road and enter the area where its closest to their homes, removing the need for driving through the area.

**Bicycle roads:** Many bicycle roads should pass through the area. The 4 lane main roads should have bicycle roads as well as several of the local streets. Bicycle stands should be located at the shopping mall entrances and by the metro station.

**Sidewalks, no building setbacks:** Sidewalks should be wide and run along the facades of the buildings, next to shops on bottom floors. Remove the building setback and green buffers.

- **8 lanes:** Main traffic connection with city centre
- **6 lanes:** Ring road around area
- **4 lanes:** Main roads within area, including bicycle road
- **2 lanes:** Local streets

**Concept sketch.** A grid network is utilized. An outer ring road circling around the area, as in Po Lam. Two four lane streets pass through the area. Smaller two lane pedestrian friendly local streets within the area. Cul-de-sacs for cars only. Pedestrians and bicycle roads will be a fully connected network without cul-de-sacs.
BUILDING TYPES AND ORIENTATION

Here the southern orientation paradigm and suggested building types will be discussed. Building types will only be shortly discussed since this is not a main question of the thesis. They are used more as reference to help in the design, to find out how many buildings each plot could have. Knowing the building types will make it possible to calculate more accurate floor area ratios and population densities of the proposal.

As described in the literature review, building orientation has been an important aspect throughout Chinese history. Residential buildings must be orientated to the south. Because of this, building in a European perimeter-block fashion would be very difficult. But the idea is not to build something totally new to the area, but adapt the existing structure to a more transit-oriented one. Existing building types and southern orientation will be used. The main building type used in the proposal should be the residential tower. Building types are based on existing buildings in Hexi New Town and in Hong Kong. In the central area, on top of the metro station and podiums, very tall residential towers can be used. Tall residential towers around 40 and up to 50 floors can be found in other parts of Hexi New Town. The design proposal should be made of a combination of components found in both Nanjing and in Hong Kong. The chosen building types are suitable for building tall and thereby achieving the wanted high floor area ratios. Most of the building types makes it possible for typical Chinese apartments, with one balcony located to the south and one to the north.

Nanjing planning regulations

Many of the chosen design principles would violate the rules of the Nanjing planning regulations. Some adaptations will be made, but the law will not be totally followed.

Sunshine levels

The regulations stipulate that buildings have to be placed a certain distance from each other depending on their height, due to sunshine requirements. Following this rule would make the proposal less dense than the wanted levels. Residential towers in Hong Kong are often placed only 10-15 metres from each other. Taking into the account the importance of sunshine levels in Nanjing, the buildings in the design proposal should not be placed as densely as in Hong Kong, yet more closer together than the Nanjing planning law requires.

Building setbacks

There is a requirement that all buildings should be setback at least 15 metres from the street kerb, and be separated by a green buffer zone. Taller buildings require further setback. Following this regulation would make many of the design principles invalid. Podiums would have to be set back 15 metres from the street. The shops on the bottom floors would be placed far from the street, with either a green buffer or a large parking place in between. As a result, the whole pedestrian environment would be negatively affected.

Chinese and Nanjing planning law makes implementing Hong Kong design principles very difficult. They are not in agreement with each other. Therefor the design proposal will neglect these regulations in the Nanjing planning law, in favour of achieving a true transit-oriented development concept. The advantages of a transit-oriented developments is argued to outweigh the apparent importance of sunshine and open space around roads.