URBAN DESIGN MANUAL
FOR NON-MOTORIZED TRANSPORT FRIENDLY NEIGHBORHOODS
Table of Contents

I  Introduction

II  Urban Design Concepts for NMT Friendly Neighborhoods

  2.1 Mixed Land Use Neighborhoods
  2.2 NMT Supportive Street Design
  2.3 Dense NMT Network
  2.4 High Quality Pedestrian Experience
  2.5 Safe and Convenient Bicycle Facilities
  2.6 Provision of High Quality Public Transport Services
  2.7 Rationalized Car Use

III  Wuhan Case Study

IV  Executive Summary
I. INTRODUCTION
China is already the world’s largest emitter of greenhouse gases, and transport is the fastest-growing source of these emissions. The International Energy Agency estimates that CO2 emissions from China’s light-duty transport fleet will rise from 65 megatonnes (MT) in 2005 to nearly 300 MT in 2020, an increase of 290 percent. In addition to contributing to global climate change, the rapid adoption of motor vehicles in China is also causing growing urban congestion and air pollution.

For the past 20 years, most cities’ response to rapid population, income and car ownership growth has been to invest massively in roads. However, it is now recognized, at both the national and city levels, that this is not a sustainable urban development strategy. Indeed, national level policy makers have begun to shift directions towards promoting public transport and providing safe environments for walking and cycling as way to improve urban accessibility and address local, national and global environmental concerns. Yet, despite this shift at the national level, many municipalities lack the tools, knowledge, and resources to effectively address these issues.

This publication aims to bridge that knowledge gap by providing a guide on how to improve non-motorized transport (NMT), i.e. walking and cycling, at the neighborhood scale. The neighborhood is the basic unit of urban development, and as such, in aggregate, neighborhoods’ spatial arrangements and physical forms have a high impact on citywide transport practices. The publication centers on explaining a series of basic urban design concepts and features that make NMT-friendly neighborhoods, and therefore can help improve accessibility, and reduce CO2 emissions and pollution. In a first section, seven basic concepts that make up a NMT-friendly neighborhood are described in a concise manner, and images of how they have been implemented all around the world are provided as examples. On a second section, a case study of applying those concepts on a real neighborhood development project is presented, to showcase the contrast of traditional neighborhood development practices in China and NMT-friendly, low carbon neighborhood development.

The intended audience of the publication includes municipal government agencies involved in urban planning, as well as private real-estate developers. Its purpose is to familiarize those directly involved with neighborhood development with concepts pertaining their practice that are not in the mainstream at a time when Chinese cities are expanding at such a fast pace. Ideally, this publication will start a conversation on re-conceiving Chinese neighborhood development in the coming decades towards more sustainable practices.

Acknowledgements:

This report was prepared for and under the guidance of the World Bank Senior Urban Transport Specialist, Mr. Ke Fang, by ITDP China, the China office of the Institute for Transportation and Development Policy and World Bank Task Team.
Purpose of the Guidelines

Key elements of a successful NMT-friendly neighborhood.

Purpose

The purpose of the guidelines is to:

1) Clearly communicate the NMT-friendly neighborhood concept including objectives, components, and the role of the neighborhood in the region.

2) Provide guidance and inspiration on developing NMT-friendly neighborhood plans and incorporating the NMT-friendly objectives into other planning activities (e.g., official plans, secondary plans, residential development urban design).

3) Become a tool and resource for local government, real estate developers, planners, designers, consultants, community organizations, and other public or private agencies.

4) Serve as a key source of direction for real estate developers when undertaking residential development efforts or when renovating existing neighborhoods, or for public agencies when reviewing third party plans and proposals for community development.

Even though the scale and context of this material is focused on neighborhoods, this document can also be used beyond the planning and implementation of NMT-friendly neighborhoods, in planning for other areas in a NMT-friendly manner.

Intended Audience

The primary audience for these guidelines includes government staff, municipal land use and transportation planners, major community institutions, consultants, designers, and other agencies that engage in land use and transportation planning activities. The guidelines are also intended to serve as a guide for private developers who are planning, developing, and investing in any of the neighborhoods.

In addition, these guidelines will serve as a key source of direction for real estate developers when undertaking residential development efforts or when renovating existing neighborhoods. They will also serve as a tool for public agencies (both municipalities and community) when reviewing third party plans and proposals for NMT-friendly neighborhoods. The ultimate goal is that all planning activities and residential development projects will help realize the direction of NMT-friendly to develop sustainable and livable communities.
II. URBAN DESIGN CONCEPTS FOR NMT FRIENDLY NEIGHBORHOODS

2.1 Mixed Land Use Neighborhoods

2.2 NMT Supportive Street Design

2.3 Dense NMT Network

2.4 High Quality Pedestrian Experience

2.5 Safe and Convenient Bicycle Facilities

2.6 Provision of High Quality Public Transport Services

2.7 Rationalized Car Use
2.1 Mixed Land Use Neighborhoods

**CURRENT ISSUES:**
Most neighborhoods in China still tend to be single-use only for residential, especially new development.

**DESIGN CONCEPTS:**
- Mixed land use and compact neighborhoods help reduce travel distance to jobs, services, and entertainment, thus facilitating travel by walking or cycling, and minimizing dependency on motorized travel.
- Restaurants, shops, and other public amenities within a neighborhood generate a vibrant local street life, making NMT travel more attractive and safer.
- “Horizontally”, continuous active frontages should be created along interior and exterior main streets whenever possible, offering a wide variety of functions and amenities.
- “Vertically”, land use mix is achieved by combining commercial functions at the ground level, and office and residential uses in the higher levels.
Mixed land use is a prominent feature of Jiangnan Xincun neighborhood in Guangzhou. Ground floors are open to mixed use, such as retails, healthcare facilities, restaurants, community service, etc.

source: ITDP
2.2 NMT Supportive Street Design

**DESIGN CONCEPTS:**

- Neighborhood streets should provide specialized high quality facilities for pedestrians and cyclists.
- Cross sections should effectively separate motor vehicle lanes, from bicycle lanes and sidewalks. Additional elements, like raised curbs or bollards, to protect NMT facilities from invasion of motor vehicle traffic, are encouraged.
- NMT facilities should allow for continuity and ease of movement.
- Setting speed limits for motorized traffic will ensure safe walking and cycling environments. Suggested speed limits for main streets are 20-30 km/h and for interior streets 10 km/h.
- At intersections, turning radius should be reduced to slow motorized traffic. Clearly marked crossings for pedestrians and cyclists, with refuge islands in the middle, are important elements.
Streets in New York City offer specialized facilities for NMT.

source: ITDP
2.3 Dense NMT Network

**DESIGN CONCEPTS:**

- A dense NMT network comprised by high quality NMT facilities along neighborhood streets, bicycle and pedestrian paths, alleyways and other shortcuts, allows for high NMT accessibility.
- Smaller blocks of only 80 to 100 m in frontage should be encouraged.
- Specialized NMT facilities providing shortcuts through buildings, shopping areas and public spaces, are encouraged.
- Safe NMT crossings of streets should be provided every 50 to 100 meters.
Spain-Barcelona-Grid Block

Barcelona offers a dense network of streets and alleys that promotes NMT.
2.4 High Quality Pedestrian Experience

**DESIGN CONCEPTS:**

- A high quality pedestrian experience is the hallmark of a truly NMT friendly neighborhood.
- A dense network of generous sidewalks and additional pedestrian paths should provide for efficient, safe and comfortable walking. The pedestrian experience should be enhanced with landscaping, street furniture and any necessary special provisions (e.g. to deal with weather conditions).
- In addition, public spaces of varying sizes and types, ranging from small plazas and pockets of greenery, to large squares, parks and greenways, should be strategically located through the neighborhood.

**CURRENT ISSUES:**

Pedestrians are not given enough priorities in the mixed traffic flow in China.
High quality pedestrian amenities make Singapore a walkable city.
CURRENT ISSUES:
Bicycle lanes are not well designed. There is a lack of bicycle facilities and adequate management.

2.5 Safe and Convenient Bicycle Facilities

DESIGN CONCEPTS:
- Bicycle facilities are comprised by bicycle lanes, bicycle paths and parking, that act together to ensure accessibility by bicycle of the whole neighborhood.
- Special attention must be given to protecting the safety of bicyclists in potential points of conflict with motorized vehicle traffic.
- A shared bicycle system, with docking stations within 500 meter or less from any point in the neighborhood, is also suggested to promote bicycle travel.
II. URBAN DESIGN GUIDELINES

Denmark-Copenhagen-Bike City

Copenhagen is one of the most bicycle-friendly cities in the world.
II. URBAN DESIGNGUIDELINES

CURRENT ISSUES:

Newly-developed residential neighborhoods are often under-served by public transport. Existing bus lines are sometimes too crowded and have a low quality of service.

DESIGN CONCEPTS:

2.6 Provision of High Quality Public Transport Services

• Public transport services should be the primary source of motorized mobility for neighborhood residents and those visiting. The neighborhood should be serviced by a mass transit system (metro or BRT) providing efficient access to other areas of the city. Local buses will service motorized travel demand within the neighborhood.

• All points in the neighborhood should be within 500 meters or less of a bus stop or a mass transit station. Services will be frequent, reliable, and available from very early in the morning until very late at night. Information platforms are encouraged.

• NMT facilities should lead in a seamless way into bus stops or mass transit stations. Sufficient parking facilities for bicycles will be available at these locations.
The widespread availability of high quality public transport throughout Portland allows for NMT-friendly neighborhoods.
2.7 Rationalized Car Use

**CURRENT ISSUES:**
Traffic volume in China is still growing at a fast pace due to the lack of car ownership and parking control. Parking is sometimes disruptive for NMT.

**DESIGN CONCEPTS:**
- An NMT friendly neighborhood promotes a more rational use of the cars, i.e. more sustainable modes of transport like NMT and public transport are promoted to fulfill most travel needs, but it is also understood that cars are best suited for certain travel demands.
- Parking supply is limited-vis-à-vis traditional neighborhoods-and rationalized via pricing mechanisms that, at minimum, reflect the full cost of their provision.
- Setback parking and on street parking are discouraged. Instead, parking is provided primarily in strategically located parking lots and in perimeter areas.
- Car share systems are an efficient way to make car mobility available for residents, while rendering car ownership less necessary.
UK-London-Parking Control

London’s parking control policy has greatly reduced street traffic and congestion.
III. WUHAN CASE STUDY

3.1 Project Background

3.2 Current Situation Overview

3.3 NMT-Friendly Community Design

3.4 Outcomes and Impacts
3.1 Project Background

This section presents the results of a study commissioned by the World Bank China Office, with funds from a Swiss Embassy grant to China in support of low carbon development in Chinese cities. The study was carried out by a team of consultants from the China Office of the Institute for Transportation and Development Policy. It looks at current plans for the development of the Zhongyang Huacheng neighborhood, in Wuhan, Hubei Province, to then provide strategic advice on how to build an NMT friendly and low carbon neighborhood. Overall, it is a case study of how the concepts described in the previous section can be incorporated into a specific neighborhood development project in China.

DESIGN PRINCIPLES

1. Mixed Land Use Neighborhoods

2. NMT Supportive Street Design

3. Dense NMT Network

4. High Quality Pedestrian Experience

5. Safe and Convenient Bicycle Facilities

6. Provision of High Quality Public Transport Services

7. Rationalized Car Use
3.2 Current Situation Overview

Zhongyang Huacheng is located in Wuhan Houhu New Town area and borders with Jinqiao Avenue (on the east), Jinnan Avenue (on the south), Tazi Hu East road (on the west) and Jinnan San Road (on the north). The land is currently not developed, but mostly ready for construction. Construction on the western part of the area, which will be the first construction in Zhongyang Huacheng, will start soon.
### Zhongyang Huacheng

**Site:** Zhongyang Huacheng, current site

**Figures on Zhongyang Huacheng are shown below**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of development</td>
<td>0.9931 km²</td>
</tr>
<tr>
<td>Built surface</td>
<td>1,508,600 m²</td>
</tr>
<tr>
<td>Floor Area Ratio (FAR)</td>
<td>2.23</td>
</tr>
<tr>
<td>Number of residential units</td>
<td>8,576</td>
</tr>
<tr>
<td>Future population</td>
<td>35,000</td>
</tr>
<tr>
<td>Residential density</td>
<td>352 people/hectare</td>
</tr>
<tr>
<td>Parking spaces</td>
<td>9,500 according to World Bank</td>
</tr>
<tr>
<td></td>
<td>21,627 according to Hongda developer</td>
</tr>
<tr>
<td>Distance to city center</td>
<td>7 km</td>
</tr>
<tr>
<td>Start of construction</td>
<td>2011</td>
</tr>
<tr>
<td>Completion of development</td>
<td>2019-2021</td>
</tr>
</tbody>
</table>

**Distance to city center:** 7 km

**Start of construction:** 2011

**Completion of development:** 2019-2021
### INITIAL ASSESSMENT OF PROJECT PLAN

The following table presents the main features of Zhongyang Huacheng’s design and the project’s team assessment of the way in which they would impact building an NMT friendly and low carbon neighborhood after an initial visit. Further elaboration on these concepts was carried out as the project went along and is presented in subsequent chapters.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>CALCULATION, COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy target</td>
<td>65% of traditional development</td>
<td>need to understand where this rates, and is it possible?</td>
</tr>
<tr>
<td>Time frame</td>
<td>8-10 years</td>
<td></td>
</tr>
<tr>
<td>Residents</td>
<td>35,000 households</td>
<td></td>
</tr>
</tbody>
</table>
| Size | land area is 100 ha = 1 km² = 1,000,000 m²  
- 16 ha building  
- 84 ha street and open space  
building area is 1,500,000 m² | 1,500,000 m² in 16 ha roughly equals a series of 10 storey buildings  
need to evaluate building percentage, as 16% might leave a lot of blank areas |
| Dimensions | roughly 600 x 2500m | a linear shape is good for transit |
| Super block size | 200 x 300 m-300x500m private streets within | size is better than other area (could be smaller)  
need to understand through NMT traffic & midblock crosswalks |
| Land use | quantity fixed by WPB. land uses within 200m² blocks open, except for schools, hospitals, etc.  
ground floor land use (important to activate street life) is up to developers | need to assess vis-à-vis transit, walking routes, cycling routes  
need to get in contact with developers on the land use plans for ground floor space |
| Street network | red lines of road fixed by WPB | In general this is OK, but we might need additional bike/pedestrian paths to connect to transit. |

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>CALCULATION, COMMENT</th>
</tr>
</thead>
</table>
| Cross-sections | roads forming perimeter of superblocks  
- 20m ROW  
- 30m ROW  
- 40m ROW  
setback 15m – used for landscaping, parking, exercise, etc.  
There are also 60m ROW roads, but these are away from site. | ROW size is OK; however we need to understand and perhaps attempt to reduce the required setback of 15m. Not only does this double the width of the “enclosure”, but its use and regulation. We also want to ensure that the setback area would not be used for parking at some later date.  
In some designs bike lanes should be moved from the sidewalk to the road |
| Intersections | designs were shown, though not much detail was provided | the designs seem to be the usual. Attention needs to be paid to narrowing the curb radii, providing refuge islands and putting in bike lanes.  
Also there are some non-rectilinear junctions which are problematic |
| Speed limits | 30 km/h on 20m ROW  
- 30 km/h on 30m ROW  
- 50 km/h on 40m ROW | Generally OK. Perhaps the speed limits should vary by building & land use context, see below.  
Traffic calming measures need to be included to ensure these speeds, especially on the smaller roads. |
| Crosswalks | every 350m – national standard (non-binding guideline) | crossings should be more on the order of every 50-150m. Current designs include too few crosswalks. |
| Parking | 11,300 spaces – fixed by WPB  
mostly underground, so they must be constructed first  
pricing fixed by WPB | 11300/8576 = 1.3 spaces per household. This is far too much.  
construction is of concern as people are more likely to drive if parking is available  
need to understand pricing |
| Metro | 2 lines (line 3 and line 8) nearby site, 1 being built | need to ensure that residents can access the metro easily and conveniently, not by car. Because distances are not long, a public bike system is also a good option |
| Bus | 1 depot adjacent to site, 2 depots nearby site. Bus companies will not begin service until demand is shown. | need to ensure that bus service is provided when the first residents move in |
3.3 NMT-Friendly Community Design

1. Densify the walking and cycling network

Roads should be designed to carry a large number of trips, not a large number of car trips. By adding small roads through the blocks, the capacity and convenience of the road network is increased, benefiting pedestrians, cyclists, car drivers and passengers on public transport.

The suggested extra pedestrian/cycling paths in the figure below should be open for anyone to use, not only the residents in that block.

Apart from bike lanes on the planned roads, four types of connections for public NMT access are essential:

- Efficient routes through ‘public green’ or open spaces, that are currently not planned
- Passages through buildings into block interiors
- Mid-block street crossings
- Paths along water edges

These are especially critical when they shorten the route to transit stations. Suggested NMT paths, not open to motorized traffic, are shown in the figure below on the left. Combined with bike lanes on the normal roads, the suggested NMT-network for Zhongyang Huacheng is presented in the figure below on the right.
Cross-section design

In the current cross-section designs for Zhongyang Huacheng car traffic, bicycles and pedestrians are not separated well. Especially on the larger roads, where traffic volumes and speeds are high, this is essential to ensure safe and convenient walking and cycling. Good separation can be achieved by adding trees, plants, curbs or bollards between the different modes of traffic. It is recommended to change the cross-section design to deal with this issue before construction of these roads starts.

Below some suggested road-section improvements are presented.

Intersection and crossing designs

When properly designed, the NMT network will be heavily used. At intersections it is important to reduce the turning radius for mixed traffic (which slows down traffic). Moreover clearly marked crossings for pedestrians and cyclists, with refuge islands in the middle, are necessary at intersections. One example is the use of bike boxes to increase safety for cyclists at intersections.

The project team could not obtain the planned drawings for the intersections, because local agencies and design institutes refused to provide them. The team therefore could only work with pictures taken during presentations of the design institutes. Based on this intersection planning, the project team provided recommendations for different types of intersections. These include large roads intersecting, large and small roads intersecting and small roads intersecting. One example is shown in the drawing below, explaining the details of the design.
The Zhongyang Huacheng area is rich in green space and waterways. In the current plans, the small canals are often disconnected by roads and buildings. Because of its natural beauty, it is recommended to construct continuous greenways along these waterways. It is important for these greenways to block intrusions by motorized traffic, and to ensure connectivity, especially through intersections. A good connection with normal roads and residential and commercial areas is also necessary in order to form a usable network.

Below is an overview of the proposed greenways. Jinnan road and the canals in Zhongyang Huacheng form the backbone of this network. The greenway can be implemented simultaneously with the construction of the roads and canals.

Wuhan has developed a greenway network planning. Connecting the greenways in Zhongyang Huacheng with the greenways in the rest of the city will ensure a better connection between Zhongyang Huacheng and the citywide network.
Mixed land use

It is recommended that the Wuhan Urban Investment Bureau develops mixed-use areas near transit stations (especially metro and BRT) and commercial areas. Suggested locations are shown in yellow in the picture below. Both interior and exterior main streets should also have continuous active frontages wherever possible. This will help ensure both mixed use and sufficient vitality to attract people to walk rather than drive. 'Dead' uses such as banks and offices should not be permitted to take up major portions of the streetfront.

The built surface requirements are set by Wuhan's Planning Bureau. The land use within the blocks is not set though and can be decided by the developer. It is recommended to develop these into mixed use areas. Commercial functions (shops, cafes, restaurants) on the ground-floor increases the livability of the area. A vibrant community can be created in which people fill the streets at any time of the day and people’s need to travel long distances is lower.
High quality public transport is necessary to build Zhongyang Huacheng into a low-carbon district. The area is close to two metro stations. Zhongyang Huacheng currently has 10 bus routes in the vicinity of the development. Unfortunately large parts of the city are not accessible from these bus routes. More routes need to be added before the opening of Zhongyang Huacheng in order to improve accessibility by bus to more of the major destinations in the city. An overview of the current bus lines is shown in the figure below.

The current bus routes reach the perimeters of Zhongyang Huacheng, but convenient access to and from the center of the area is not provided by these routes (see graph below). The Zhongyang Huacheng center area is at least 1km in walking distance to bus stops from most current bus routes. Further analysis is needed, but it can be seen that relatively minor route modifications could bring several bus routes onto the interior roads of Zhongyang Huacheng, providing more convenient transit access for these residents.
Even with bus routes closer to the development, though, most residents will still need to walk at least 300m to reach a bus stop, and more to reach metro stations. For this reason, a supplementary bike sharing system is needed, with stations at the bus stops (and future metro and BRT stations), and at distances of 300m-400m away. The public bike system is described further below.

For Jinnan road a future Bus Rapid Transit corridor is suggested. This BRT can be a high-quality, high speed bus system with bus-only lanes and bus stations in the median of the road. This BRT corridor can be extended into the city, to provide high-quality and fast public transport access to other parts of Wuhan. The existing electricity pylons on Jinnan road then need to be moved underground.

An initial possibility with stations of this BRT is shown in the figure below. Much more analysis on the planning of this BRT system needs to be done in follow-up studies.
Bike parking

Throughout Zhongyang Huacheng bike parking needs to be provided. Safe bike parking is needed to encourage people to use a bicycle. Bike parking should especially be provided at residential buildings, commercial areas and transit stations, and the size needs to be dimensioned based on the demand of those locations. The graph below shows suggested bike parking locations.

Suggested bike parking locations
As shown earlier, metro stations and many bus routes run along the perimeter of Zhongyang Huacheng, resulting in poor access for some residents in the central parts of the development. A public bike system can help provide access to and from the metro stations and bus stops, and other main points around the development. The public bike stations need to be located at origins and destinations, including bus stops, metro stations, commercial, residential areas and recreational facilities. The public bike stations can be combined with private bike parking stations. The distance between public bike stations should be around 400 meters. A map of proposed public bike stations (green dots) is shown below.
The stated low-carbon goals of Zhongyang Huacheng are contradicted by the excessive supply of parking places. The existing regulations require the developer to build 21,627 off-street parking places; a figure which does not even include setback parking. Given the projection of 8576 households in the area, this means an average of 2.5 parking spaces per household. This is very high, by any standard and unless this is changed it will be impossible for Zhongyang Huacheng to meet any low carbon development goals. And note that this does not even include setback parking, which the Planning Bureau said is actively encouraged in Wuhan.

Off-street parking

This exceptionally high number of parking places will have numerous negative effects. When parking is provided everywhere, probably at no or very little cost, this will make driving easy and convenient relative to walking, cycling and public transport, and will ensure high car use and a high car mode share. The oversupply of parking spaces is also very expensive for the developer, who in turn will need to charge these extra costs to future residents. This will make the development unnecessarily expensive and less attractive to potential buyers of apartments. The developer and the Planning Bureau need to work together to lower the required parking number (for Zhongyang Huacheng, but also the rest of Wuhan) and to set a maximum, rather than a minimum number of parking places for their developments.

Another important issue to address is setback parking. The current Wuhan setback regulations, laid down in the Wuhan City Building Planning and Management Regulations, state that developers need to reserve between 3 and 15 meters of setback. The use of setbacks is not specified and is up to the developer. Currently in other parts of Wuhan, setbacks are used for parking. During meetings the Wuhan’s Planning Bureau told the project team it actively encourages developers to use setbacks for parking. Setback parking has a corrosive effect on the pedestrian environment. To reach setback parking, cars cross the sidewalk and make walking unsafe and inconvenient. Often setback parking effectively completely blocks the sidewalk. Moreover the shopping environment degrades, since shops become less accessible and less visible, and streets and public spaces become car parking lots.
In some Chinese cities, like Guangzhou, the Planning Bureau has specified allowable uses for setbacks. The uses are restricted to walking space, public space or public green (trees, plants, flowers) and parking is no longer allowed. The project team recommends the same policy for Zhongyang Huacheng (and Wuhan in general).

**On-street parking**

It is important to control on-street parking in Zhongyang Huacheng in order to keep sidewalks, bike lanes and streets orderly, safe and convenient to use. Parking should preferably be done off-street, in parking lots in perimeter areas, so streets stay free and attractive for others to use. But on-street parking could be useful in commercial streets, for short term parking with a maximum of three hours. Prices for on-street parking should always be more expensive than off-street, in order to encourage drivers to park away from the street. The price should be set (and updated) based on 85% occupancy of the parking spaces. This way the price is fair and there is always a place to park. More details about the recommended on-street parking system are provided in the full report.

### Speed Limit

In order to have safe walking and cycling environments, the speed of motorized traffic needs to be limited. The right speed limit is related to the type of road: the recommended speed limits are shown in the table below (left: Wuhan Planning Bureau’s recommendations, right: project team’s recommendations).

<table>
<thead>
<tr>
<th>ROW</th>
<th>Speed Limit</th>
<th>Recommended Speed Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 m</td>
<td>50 km/h</td>
<td>40-60 km/h</td>
</tr>
<tr>
<td>30 m</td>
<td>30 km/h</td>
<td>30-40 km/h</td>
</tr>
<tr>
<td>20 m</td>
<td>30 km/h</td>
<td>20-30 km/h</td>
</tr>
</tbody>
</table>

International experience shows speed limits are not only related to the width of the road but also to the land use around these roads. Enforcement of the speed limit is not always easy. By constructing speed bumps, speed tables and narrow road sections, speeds can be enforced automatically and don’t need Traffic Police assistance.
3.4 Outcomes and Impacts

**CARBON IMPACT**

Zhongyang Huacheng is not yet developed, so traffic data are lacking. Instead, a comparative analysis was made to predict the future modal split in Zhongyang Huacheng. The CO2 emissions were calculated for different scenarios. Results are shown in the table below for (1) the original plan, (2) a scenario with a high mode shift from car to walking and cycling and (3) a scenario with a high mode shift from car to public transport. The CO2 savings presented in the second and third model are saving compared to the original plan. Because the real mode shift will partly happen to walking and cycling and partly to public transport, the actual carbon savings from this plan will be between 69% and 79%.

<table>
<thead>
<tr>
<th>Model</th>
<th>tCO2 emission/year</th>
<th>CO2 consumption / person/day kg</th>
<th>CO2 savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Original plan</td>
<td>30,098</td>
<td>2.356</td>
<td></td>
</tr>
<tr>
<td>2. high mode shift to walking/cycling</td>
<td>6,282</td>
<td>0.492</td>
<td>79%</td>
</tr>
<tr>
<td>3. high mode shift to public transport</td>
<td>9,402</td>
<td>0.736</td>
<td>69%</td>
</tr>
</tbody>
</table>
INVESTMENT IMPACT

Because nothing has been constructed yet in Zhongyang Huacheng, changing the existing plan will not incur extra costs. Reducing the parking standards by at least 5000 spaces will save 1.6 billion RMB (see full report for calculations). To improve NMT facilities some extra costs need to be made though. Based on Guangzhou’s data, these costs are minimal. The construction of the NMT and greenway network will increase costs by around 5 million RMB. A public bike system consisting of 1,000 bikes would cost roughly 8,000 RMB per bike to set up, or around 8 million RMB. This is based on the highest quality public bike system in China, provided by the Foshan Tianzhen company. It includes bikes, docks, and booking/information poles and associated technologies. There is an additional cost of 80 RMB per bike per year. This cost does not include replacement of the bikes, which have a 5 year warranty. Bike parking places cost another 800,000 RMB.
IV. EXECUTIVE SUMMARY

DESIGN PRINCIPLES:

1. Mixed Land Use Neighborhoods
2. NMT Supportive Street Design
3. Dense NMT Network
4. High Quality Pedestrian Experience
5. Safe and Convenient Bicycle Facilities
6. Provision of High Quality Public Transport Services
7. Rationalized Car Use
NON-MOTORIZED TRANSPORT FRIENDLY NEIGHBORHOODS