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# On the Implementation of Accessible Transport System in Urban Villages

-- A case study of Shenzhen Futian District

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## Abstract:

Urban village is a type of living space in rapid urbanized area within P. R. China, the main spatial features of which are highly the assembling buildings and the principal dwelling space for transient population and poor foreigners. Considering the fact that these urban villages may stay for long time, the implementation of accessible transportation may help reduce social exclusion issues. The major difficulties to implement the Accessible Transport System (ATS) there lie in the exceedingly compacted internal and external spaces.

By analyzing the "barrier" and "favorable" aspects of urban villages to the ATS, this study proposes a "full realization approach" and a "partial realization approach" in the external and internal spaces of the urban villages. Through in-depth case study of Futian district in Shenzhen, the effectiveness of these approaches will be verified, and the key technical aspects of following research proposals be put forward.

**Keywords:** Urban Village, Accessible Transport System, China, Shenzhen

## Introduction

Urban village is a common type of living space in the rapid urbanized area in China for inhabiting transient population and the foreign residents who are the disadvantaged with low-income. Take Shenzhen for example, urban villages occupy half of its residential units, housing a population of 5.2 million among which 4.9 million are transient population (Zhang, 2009). Considering the fact that these urban villages may stay for long time as the principal dwelling space for the disadvantaged, the implementation of accessible transportation may help reduce social exclusion issues. An integrated accessible system rather than piece-meal solutions would be ideal (Ling & Mitchell, 1998a; John I. et al., 1990).

Accessible Transport System (ATS) encompasses public transport services at various geographical scales, the linkages between them, and personal vehicles and the pedestrian infrastructure (Wilson, 2003). It is about 'universal design' to provide 'access for all', so as to make the elderly and disabled people feel free in urban environment. The goal of being free in urban environments is actually made possible as a result of a combination of housing and transportation design modifications and creative housing programs (John I. et al., 1990).

Due to various historical reasons in the urban land management in Chinese cities, urban villages were out of urban administration for a long time. Absence of urban planning and municipal facility construction has led to highly assembling buildings and the exceedingly compacted internal and external spaces which have added to the difficulties of exploring successful approaches for ATS. Besides the spatial barriers, urban villages also have distinguished features which may be seen as advantages over the ordinary urban residential areas to implement ATS.

Urban villages are primary space for urban renewal, facing opportunities to reconstruct. Exploring "full realization" and "partial realization" approach of accessible transport system can give some references to current planning.

In section 1 and section 2 the distinguish features of urban villages in relation to the ATS planning are analyzed. In section 3 and section 4, the content and realization approach framework of ATS proposed. In-depth case study is presented in section 5 to verify the effectiveness of the two operational approaches. In section 6, future research directions are discussed.

## **1. The Barrier Characteristic of Urban Villages for ATS**

Compared with ordinary residences, urban villages were constructed spontaneously by local villagers without planning and municipal infrastructure. The pursuit of possible large building areas of private dwellings leads to inadequate road space, weak space identification and chaotic traffic organization.

The gradient and width of the roads are two decisive physical factors to accessible pedestrian system (Zhang, 2003). Space identification affects door to door transport services such as taxi. Although the main street in most urban villages is about 10-15 meters wide, most paths and tracks are much narrower, irregular and impossible for any motorized vehicular movement. As a result, we see not only shops and restaurants being concentrated along side of the main street in every urban village, but also the flea markets and cars that occupy the space of main streets in front of those shops and restaurants, which make them as narrow as other streets and paths. The spatial characteristics and usage of the roads add to challenges to accessible transport facilities for the disabled and elderly persons.

## **2. The Favorable Characteristic of Urban Villages for ATS**

### **2.1 Walking Safe Community**

Urban villages are generally small-scaled, with a public activity space in the center which coverage the residences in an acceptable walking distance. Many compact roads in urban villages have inadequate width for vehicles. These walking roads can afford safety for the disabled and elderly persons.

### **2.2 High Ratio of Dwellings for Rent**

The dwellings in urban villages are generally for rent, as the private houses of the

original villagers can not be traded in the real estate market. Except for self residence, 90% of the dwellings are rent to the transient population. These provide a strong mobility to exchange dwelling space, so the accessible dwellings can be centralized, the accessible transport system can be set enclose to the partial of dwellings.

### **2.3 Public Transport as Main Mode of Trip Making**

The majority of dwellers in urban villages use public transport as main mode of trip making. Except for the original villagers or with a career of car driver, almost none transient people have private cars. As urban villages are situated in the central area of the city where there is good external transportation accessibility, arrangement of some fixed routes of accessible bus can greatly enhance the disabled poor's ability to get more services, social contact, and better jobs (Roberts&Babinard, 2005).

### **2.4 Chance to Renovate**

Urban villages face the chances to be renovated. Renovation would take place either completely, or partially. Either way will lead to environment improvement and provide opportunities to upgrade transport systems with AST standard.

## **3. Principal Elements of Accessible Transport System in Urban Villages**

### **3.1 External Accessible Transport System of Urban Village (EATS)**

The external accessible transport of urban village (EATS) is a part of ATS which is deemed to improve the living condition of disabled poor greatly (Thomas, 2001). It can provide accessibility from urban village to other urban function area such as shopping centers, work centers, city parks, special schools and comprehensive hospitals.

The content of EATS plan includes routes planning, accessible vehicles, accessible facilities in bus/subway station and other instruction facilities.

### **3.2 Internal Accessible Transport System of Urban Village (IATS)**

The internal accessible transport of urban village (IAST) is a crucial linkage from home to public transportation nodes like bus/subway station as well as working place and public activity space. It bears the destiny to link the public activity space as to improve the living hoods of disabled and elderly persons with more social contact and community activities.

The content of IATS plan includes: pedestrian routes planning, accessible entrance, and sidewalk for the blind, ramp for wheelchair and instruction facilities (Fig 1).

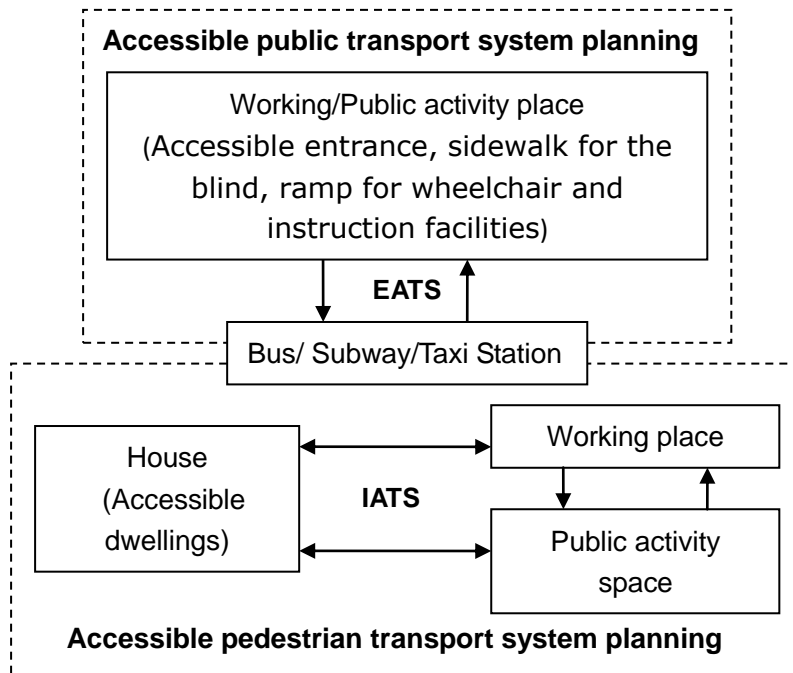


Fig 1 Principle elements of Accessible Transport System in Urban Village

#### 4. Implementation of ATS in the Urban Villages

Implementation of ATS consists of routes plan and facilities construction. The realization of EATS relies on the accessible public transport system. As a first step, selected fixed routes ought to run via frequently visited destinations such as hospitals, special schools, shopping centers and city parks. A possible option is the Dial-a-Ride system that provides door to door accessible service with special equipped taxis or buses.

The implementation of EATS does not have to be in full scale. A progressive partial solution may be recommended and used according to the various “barrier” and “favorable” aspects identified in each individual village. Key factors are scale, the gradient and width of roads, service distance of the bus stations and public facilities in urban villages, chance and modes of renovation (Fig2).

#### 4.1 Full Realization Approach of Accessible Transport System

##### 4.1.1 Full Realization Approach of EATS

Accessible public transport system of the city sets the shape of EATS in the urban villages. As there are only scattered bus routes and equipped stations at present stage, implantation of a master plan to provide integrated inter-modal network (pedestrian routes, buses and subway) is essential.

##### 4.1.2 Full Realization Approach of IATS

Urban villages are communities with appropriate walking distance. A plan of pedestrian routes should be implemented. Inclusive design (level pathways of adequate width, curb ramps serving wheelchair users and all other pedestrians, ramps to public buildings, accessible bathrooms, etc) can be incorporated with pedestrian pathways and public buildings.

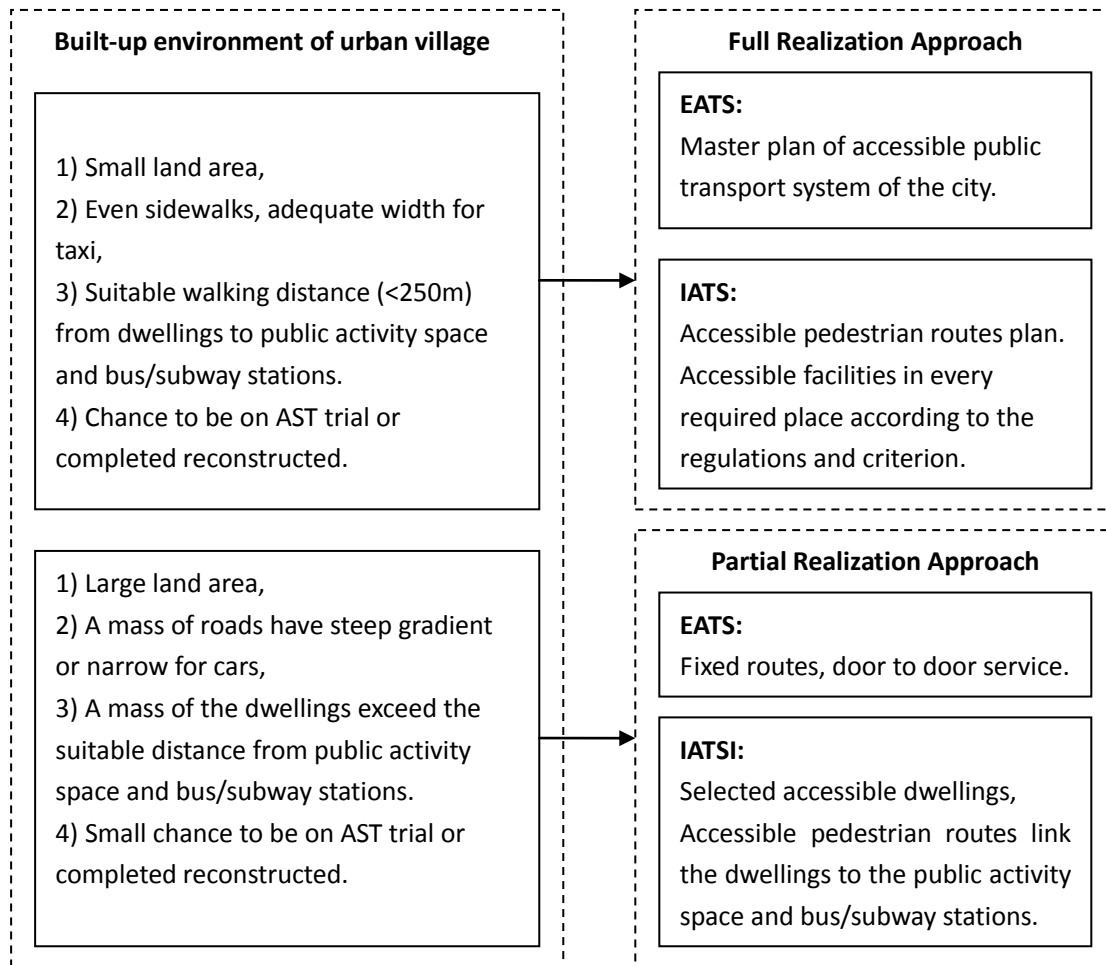


Fig 2 the Realization Approach of the Accessible Transport System

## 4.2 Partial Realization Approach of Accessible Transport System

### 4.2.1 Partial Realization Approach of EATS

When there is a budget constraint, the EATS tends to follow partial priority steps. For instance, some fixed routes of public transport via frequent visit places should be considered first and door-to-door taxi-hiring services could be implemented on a trial basis.

### 4.2.2 Partial Realization Approach of IATS

The partial implementation of IATS is based on the condition of the existing

dwelling and roads. When there is no huge demand of ATS and the build-up environment is poor, the realization approach would be only a partial solution. They include the selection of accessible housing and the corresponding pedestrian routes that connect public activity space inside the urban villages and bus/subway stations nearby.

The accessible dwellings refer to those having an appropriate land scale, even road gradient, adequate road width and suitable distance to public space and bus stops. Considering the acceptable distance of disabled, and the service radius of a bus stop, 250 meters will be the maximal limits (Fig 2).

## **5. The Case of Futian District in Shenzhen**

Futian district is the center core of Shenzhen where the CBD located within. There are 15 urban villages in Futian and 2 of them have been totally dismantled and reconstructed, leaving a normal urban built-up environment. The following discussion concerns about the rest 13 urban villages, especially the private dwelling area.

There are common features of urban villages in Futian. They include extremely high density of population and buildings, inadequate width and sharp gradient of village roads, flea markets and parking obstacles on or along the road, weak space identification, and high rental ratio. Although former few features make door-to-door accessible vehicle service almost impossible, they provide also a unique situation to make a good spatial possibility to concentrate accessible housing related facilities somewhere close to the village center. Through such an arrangement, the overall reduction of travel distance of the disabled and elderly to various necessities are equally effective as raising their mobility. Indeed, the specific reconstruction to equip wheelchair lavatory, accessible bathroom, and ramp at the entrance of the house can be put forwards.

### **5.1 Distinguish of the “Full” and “Partial” Realization Approach**

As mentioned previously, key factors are scale, the gradient and width of roads, service distance of the bus stations and public facilities in urban villages, and the chance and mode of renovation (Fig2). Simple classification of realization approach can be brought out by analyzing the dominant factors of urban villages in Futian, such as number of private house (represented the scale of poor conditioned dwellings); proportion of houses inaccessible for taxi (those roads in front with adequate width for cars); proportion of houses with suitable walking distance to bus stations and public space (with a walking distance no more than 250m); chance to complete dismantling and reconstruction.

Chance to complete dismantling and reconstructing is the determinant factor for implementing full-scale ATS in urban villages as it means new built-up environment with relatively restrictive planning standard. Meanwhile, it's much cheaper to implement “design for all” or “inclusive design” in new construction than reconstruction (Peter&Julie, 2005). According to the local government's plan (Government of Futian, 2005), four urban villages (Xiameilin, Xinzhou, Shisha, Gangxia) located near the center core will be totally dismantled and reconstructed (marked the chance as “High”). Another four will be partly dismantled and

reconstructed (marked the chance as “Mid”). The rest will face environment upgrading (marked the chance as “Low”). Village Tianmian with the smallest scale has being retrofitted before thus the distance from dwellings to public space becomes accessible and all the roads now have adequate width for taxi or wheelchairs. These make Tianmian suitable to implement a full realization approach (Table 1).

Those suitable for partial realization approach have different features, scale, width, and gradient, respectively. Further action should be put forward according to the specific situation of each village.

**Table1 Classification of Realization Approach of Urban Villages in Futian District**

No	Name	Number of private houses	Percentage of houses accessible for taxi	Percentage of houses with suitable walking distance to bus station and public space	Chance to complete dismantling and reconstruction	Realization approach
1	Xameilin	636	90%	60%	high	full
2	Shangmeilin	448	80%	70%	Mid	partial
3	Xiasha	673	70%	40%	low	partial
4	Shangsha	970	90%	50%	low	partial
5	Shawei	397	100%	65%	low	partial
6	Shazui	510	70%	70%	low	partial
7	Xinzhou	466	80%	75%	high	full
8	Shisha	504	40%	90%	high	full
9	Shuiwei	335	80%	80%	Mid	partial
10	Gangxia	425	35%	100%	high	full
11	Tianmian	48	100%	100%	low	full
12	Futian	859	90%	70%	Mid	partial
13	Shangbu	787	90%	60%	Mid	partial

Data Sources:

- 1) Number of private house (Government of Futian, 2004).
- 2) Percentage of accessible houses is estimated through buffering with the topographic map
- 3) Chance of reconstruction (Government of Futian, 2005)

## 5.2 Realization Approach of EATS in Futian

### 5.2.1 A Master Plan of Accessible Public Transportation Routes

In general, a master plan of accessible public transportation routes should be brought out. The routes ought to link urban villages to fundamental urban functional space using accessible bus, subway and taxi. Second, an integrated inter-modal network of buses, subway, pedestrian routes should be included.



As the basic transport mode of urban villagers is bus, priority should be given to bus network structure and location choice of bus stops within the villages. Also, the links of the buses to public activity sites and space over the city may also offer social inclusion to the urban villagers. Although subway transit has much better equipped facilities and more feasible linkage between platforms to vehicles for the disabled, only one village (Gangxia) is in appropriate walking distance to subway station. Thus, bus routes ought to integrate subway routes with pedestrian routes station by station.

### **5.2.2 Construction of Accessible Public Transport Facilities**

Accessible public transport facilities refer to the vehicles, the stations and instruction system.

In order to add mobility to the fixed routes accessible bus, dial-to-ride accessible taxi and unfixed route bus are essential. Sidewalk for blind, ramp and elevator for wheelchairs should also be provided for inter-modal network station by station.

Detailed instruction facilities include illuminated and/or audible signals in the vehicles and on the stations. Information about the number, location, and tickets information of accessible transport should be through telephone or on web.

## **5.3 Realization Approach of IATS in Futian**

### **5.3.1 Accessible Dwellings**

Taken village Shangsha & Xiasha as an example, identifying accessible dwellings can help to reduce construction amount by centralizing the living space of disabled and elderly persons.

Shangsha and Xiasha are located together at the edge of Futian District. The land area of the two villages is 162.8 kilometers, with 1643 private houses and a transient population of 0,12million. (Futian District Old Town Redevelopment Bureau, 2004) .Although there are 9 bus stations on the periphery, many dwellings are beyond the 250-meter suitable walking distance. Road constrains lie in Inadequate width to Shangsha Village and large gradient to Xiasha village.

Potential accessible dwellings can be chosen considering follow conditions:

- (1) Those within the 250-meter suitable walking distance of both bus stations and public space (Fig 3).
- (2) Those linked with the bus station and public space with roads of adequate width(>2m) and even gradient(<1:20, according to the national standard" Codes for Design on Accessibility of Urban Roads and Buildings" )
- (3) Those have good construction quality, ventilation and lighting condition (Fig 4).
- (4) Exclude those alongside the main road as they are for commercial use and the stakeholder can hardly be persuaded to change them to much lower profiled usage.

Dwellings meet the conditions above are potential accessible dwellings (Fig 5). Implementation can be brought out to persuade the owners to reconstruct the dwellings with accessible facilities.

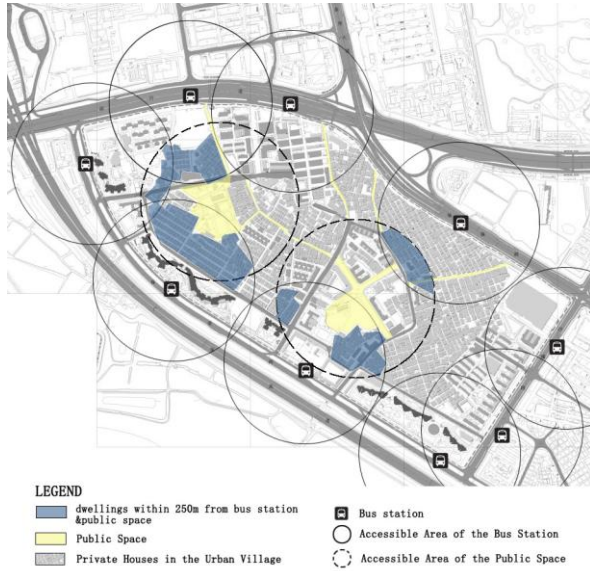


Fig 3 Potential area for accessible housing (With suitable distance to bus stops and public space)



Fig 4 Potential area for accessible housing (With good construction quality, ventilation and lighting condition)

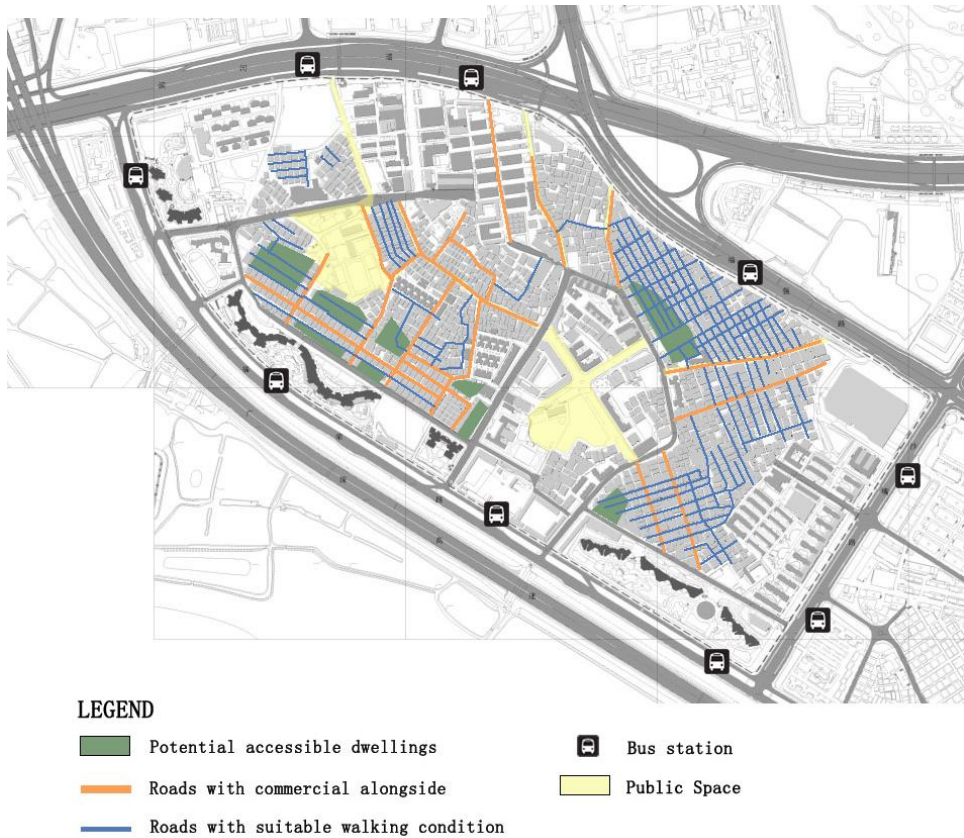


Fig 5 Potential Accessible Dwellings and Roads

Source: Detailed condition of gradient and usage of the roads depending on on-site investigation.

### 5.3.2 Accessible Roads

Accessible roads should guarantee the visual impairment and wheel chair users and the access for ambulance in emergency. Apart from the roads with adequate width and even gradient condition linking the potential dwellings to nearest bus station and public space, all the roads with suitable walking conditions should be considered to promote an accessible pedestrian system, not only for the elderly and disabled but also for those with luggage or children. If widening can't be void, imploding the path in front of the building with the platform can be an alternative.

## 6. Conclusions and Discussion

Implementation of ATS does not only help the disabled people to overcome physical barrier, it also provides more working opportunities and participation within the community they live, which in fact move the activity space towards the people in need. Current construction of accessible facilities can only solve limited hardware problem, a master plan of integrated inter-modal network of accessible transport should be carried out with policy safeguard mechanism.

Like other case studies, our case is limited to be representative to only circumstances that are similar to Futian district in Shenzhen. Realization approaches should coincide with the special conditions. The full and partial realization approaches remain the framework to lead the routes plan and facility construction. Detailed standard like the feasible walking distance and its relation with the land scale and cost call for more empirical studies. The sources of transportation funds for construction and suitable mechanism of government subsidy still needs exploring. The design of accessible transport routes and the validity of different trip modes remain further study issues.

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