

Solution to Rapid Motorization and High Density of Population

--- A Case Study of Longgang District of Shenzhen, China

Solution de Motorisation Rapide et de Haute Densité de Population

---Recherches sur le Cas de l'Arrondissement Longgang de la Ville de Shenzhen de Chine

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Abstract

Longgang District, with a population of 1.7 million, is a part of Shenzhen Municipality, located beyond the second port line of Shenzhen Special Economic Zone (SEZ). It is going through a fast urbanization process and faces the same rapid motorization and related transport problems as SEZ. Through many years' practice, the planners have tried to define a step-by-step approach to meet these challenges. Some strategies have worked, some still have many difficulties to overcome, and some have already failed. This article summarizes the previous experience and the lessons drawn in trying to forecast the growth of the population and private cars; plan public transport systems, especially rapid transit modes; develop a basic road network and a toll-road network; modify the spatial distribution of traffic, and --generally-- harmonize urban planning and economic development and mold people's new life style.

Résumé:

L'Arrondissement Longgang est un quartier de la Ville de Shenzhen qui, avec une population de 1,7 millions d'habitants et une superficie de 844 km², est situé à l'extérieur de la Zone économique spéciale de Shenzhen (ZES). Un processus d'urbanisation de la ville est juste en cours. Longgang affronte les mêmes problèmes de circulation urbaine que ZES. Depuis des années, nous nous efforçons par tous les moyens de trouver graduellement une solution convenable. Certaines stratégies mises en oeuvre sont praticables et visiblement efficaces, mais il reste encore bien des difficultés à vaincre. Cet article essaie de faire le bilan de l'expérience acquise et des leçons tirées de la pratique de planification de transport, y compris: comment résoudre le dilemme entre l'augmentation des voitures privées et l'accroissement de la population; comment accorder une priorité aux transports urbains en commun, spécialement à ceux qui sont massifs; comment ajuster la distribution de l'espace de trafic par un planning de réseau routier et un système de péage raisonnables pour s'adapter à l'urbanisme actuel, au développement économique et à la formation de nouveau mode de vie du peuple.

1 INTRODUCTION

1.1 *The background*

Shenzhen Municipality was founded in 1979 with a total area of 2020 km². It composed of Shenzhen Special Economic Zone (hereinafter SEZ), Longgang District (L.D.) and Baoan District (B.D.). After 24 years of construction, the SEZ has changed from a small town into a modern city and regional center with 3 million people. Shenzhen was among the four cities to be awarded a prize for the best built environment, set up by the Construction Ministry of China in 2001.

As a model city, Shenzhen has well-structured and designed road and public transport networks. Transport facilities are in good condition and function well. The city authorities actively promoted the policy of public transport priority (bus-only lanes along main roads and facilities for bus-first traffic signals at intersections), set up effective regulation

and management of urban passenger transport operations, and a monitoring system to ensure high service quality and safety. A rapid public transport network covering whole city has been formed. Bus ownership is 11 vehicles per 10,000 residents. The non-motorized transport modes were discouraged and private cars are taking advantage of booming.

The L.D. was established in 1993, together with the B.D.. It is located beyond the second port line of the SEZ. It covers an area of 844 km² and has 1.7 million population (5th national census in 2001). The climate of L.D. is typical of Southern Chinese coastal region. The whole year is characterized by long sunshine hours and high temperature.

1.2 *Urban Development*

Before 1993, this was basically a rural area with about 250,000 farmers and more than 1 million non-native labors from inland provinces. Its economy was mainly based on simple manufacture

and processing materials supplied by the external customers, mainly Hongkong bosses.

Since 1993, L.D. has made full use of all possible opportunity to urbanize rapidly, with many unprecedented experiences. The process had two main dimensions, speeding up the construction of urban infrastructure and moving the rural collective land ownership into state's ownership.

In the space of 10 years, the L.D. invested more than 10 billion RMB yuan to build road network, especially expressways and other primary roads. This was done to create a better environment for investors. As a newly arisen, export-oriented, manufacturing base for hi-tech enterprises, regional logistical center and sea-side tourist resort, L.D. is becoming one of the most active economic regions in China.

According to National Land Law, the rural land belongs to rural collectives, i.e. to village administrations. In fact, over the last 20 years or more, the villagers of L.D. no longer worked on farmland but still retained a nominal identity as peasants. They rented their fields to external investors or constructed village-owned plants and factory buildings, as well as rental units. They grew "houses" now instead of growing grains, while disregarding urban planning and land-use regulations. All these deeds had serious consequences for the urbanization process. However, under the urbanization policy decree issued by Government of Shenzhen Municipality in October, 2003, this situation will be changed completely. By 2005, all villagers will be re-classified as urban residents and all land ownership will pass to the state.

1.3 Rapid Motorization

After China entered the WTO in 1999, the national car industry got an opportunity to boom. Car production in 2005 will reach the number of 2.5 million. At the same time, after the liberalization of imports, purchases of foreign-made cars are also booming.

In Shenzhen, the average annual income of permanent residents in year 2000 reached 21,600 RMB yuan (about 2,600 USD) and the predicted average annual income of permanent residents in year 2005 will be 4,000 USD. In L.D. the average annual income of town residents was 22,000 and peasants 9,000 RMB yuan respectively in 2001. That means many families can afford to buy one or even two private cars. More than 46% of them intend to buy a car within coming three years according to a market investigation carried out in 2002. In fact, a newest data released by the Traffic Management Bureau shows that, by the end of September 2003, there were 549,175 registered autos, twice the number reported in year 2000. Newly purchased vehicles (mainly cars) were 89,370, thus exceeding in 9 months the number for the whole last year.

This kind of fast motorization places the urban and transport planners into a dilemma. The pace of the economic and population growth in L.D. is so fast that it is very difficult to make forecast of auto-traffic growth even for the next 5-year period. One saying is very popular here: changeable planning can never catch up with the fast-changing circumstances. L.D. completed a transport plan in 1998 and its constituent municipalities did their urban plans, but a new satellite town planning project started in 2001, requiring new transport plans. This is not the end because a new round of planning process has begun in 2003 called "group town planning" requiring a new comprehensive transport plan.

Rapid motorization also forced the Government to speed up urban road construction under pressure of car owners. Little attention was paid to its vicious results: the more cars purchased, the more land was lost, pollution and noise increased, etc.. In 1990, the total length of roads in Shenzhen was only 800 km, but it has already reached 2,260.5 km. Among them are more than 1,500 km primary roads, of which 167.5 km are motorways. In coming 10 years (to year 2012), the planned investment of 20 billion RMB yuan will be put into construction of new roads in total length of 270 km to realize so-called "One Horizontal and Eight Vertical" expressway network. That means today we shall build roads for tomorrow to meet the rapid traffic growth.

2 TRANSPORT IN L.D.

Since establishment of L.D., the economy has boomed as has the population, especially flow-in workers. The relevant urban and transport infrastructure followed in suit. In effect, the basic highway network has been formed, and public transport ability and service level greatly improved.

At present there are 603 km of main highways, among them 98 km of motorways. The highway network density is 0.64 km/km², and 98% of villages are connected by bus lines. There are 51 bus lines with total length 2074.8 km and 1443 vehicles, 44 minibus lines with total length 893.2 km and 804 vehicles. Outside-SEZ, there are still taxi service (green taxi) with 1200 vehicles. For residential travel, the share of public transport modes increased from 8.43% in 2001 to 10.02% today.

The existing problems owing to historical reasons and infrastructure limits are mainly as follows:

2.1 Heavy Traffic Jams

According to the recent statistic data, there are 550,000 registered local autos, 83,000 are registered in other cities but permanently driven in Shenzhen. Passing-by Hongkong-owned vehicles (mainly big cargo containers) are 34,000 and flow-in ones are

about 50,000. Many of them are used continuously within L.D. or pass through the area every day. Evidently, in a few years, L.D. has jumped from a rural district into an urban auto society. No matter how many roads were built, the network is still not up to the traffic load. Just like in SEZ, the motor vehicle speed on L.D. road network has continuously fallen and the number of traffic jam points increased. In 1999, only ¼ of the roads had average peak hour speeds of less than 18 km/h and 45% intersections were saturated. Since last year (2002), 1/2 of all roads had speeds under 18 km/h and 60% intersections were saturated.

2.2 Road Safety Problems

In 2002 the traffic accidents in Shenzhen increased quickly compared with the same period of year 2001. The accidents were particularly frequent in Baoan and Longgang Districts. The main reasons are as follows: first, the drivers violate Traffic Regulations, especially driving at excessive speeds and driving drunk; second, the pedestrians lack the sense of traffic safety, crossing roads carelessly; third, the traffic signals and other control and management measures are insufficient. Fast speeds and driving without paying attention to road signals and marks were especially pronounced when a new road opened. Motorcycles posed an especially hazardous problem in this respect.

In recent years, education regarding Traffic Regulations and related laws has been strengthened for all citizens, especially for professional drivers and flow-in workers, but even for young children in primary schools. Our purpose is to let all residents and drivers know that a full-growth car society should be built on the basis of good driving behavior, i.e. abiding by the traffic regulations, treating each other courteously, and especially observing the “walkers first” policy to create a nice traffic environment. Of course to reach such an objective, there is still be a long way to go.

2.3 Highway Network Unsuitable to Urbanization

From a functional aspect, main highways and urban roads belong to two different categories. Highways mainly serve long distance and passing-through traffic, with higher speeds and fewer intersections. Urban roads meet the demand for shorter travel within urban area, with high access to adjacent activities and more intersections. However L.D. was typically developed along main highways. The density of these new residential and industrial areas made highways have the function of urban roads and streets. This reduced the speeds on one hand and impacted the accessibility and convenience on the other hand, causing jams and accidents. Shenghui Road is typical of such conflict of functions. Its

design capacity is only 30,000 veh/day, but it carries ordinarily more than 60,000 veh/day, even 80,000 on busy days.

2.4 Public Transport System

For historical reasons, the public transport system in L.D. is not as good as that in SEZ. Main bus lines are used to connect L.D. and SEZ on a few main roads. Owing to the incomplete road network, especially the shortage of secondary and minor roads, the bus lines have poor area coverage, requiring longer walking distance that discourage people to use them. The so-called private taxi-motor service has been banned since June 2003, but it is continuing illegally, being sought widely by local, short-distance passengers. Motorcycles, prohibited in SEZ area, are still widely used in L. D. causing traffic chaos and accidents owing to the drivers' lawless driving behavior.

In L.D. there are 13 bus enterprises. Most of them are small and can't afford high-level and on-time service. For pursuit of greatest profit, these buses stop do not stop only at bus stops but anywhere where they can collect passengers, operating like taxis. Traffic delays or even accidents accompany this type of operation. Bus maintenance of buses is not so good as needed, and break down often. This also produces many problems including road accidents, not to mention the passenger discomfort and inconvenience.

2.5 Lesson of Shui-Guan Motorway

Following good transport planning practices, Shui-Guan motorway should have been built as an urban expressway and play an important role for diverting heavy and pass-through traffic from Shenhui Highway. The latter already functions as an urban street because of the rapid urbanization along both sides of it. However, owing to shortage of funds, the L. D. Government adopted BOT (build-operation-transfer) to introduce about 500 million RMB yuan social capital from Huayi Company.

This was originally a good suggestion for fund raising, but not in line with the existing road development policy of China. Urban roads should be built by the Government, under control of Planning & Land Resource Bureau, and should be totally toll-free for all road users. Motorways, per contra, under the Communication Bureau and its subordinate Highway Bureau, may be built and managed as private public partnership schemes, where tolls are charged for paying back the bank loan and making profit.

Huayi Company invested money borrowed from banks to finish the construction of Shui-Guan Motorway, under a 25-year BOT contract with the L.

D. Government, which allowed it to charge tolls.

Two years passed since the opening of Shui-Guan Motorway. Its problems stand out clearly today:

First, the planned urban road network lost its balance. Many urban roads can't be connected to it and therefore a lot of traffic flow and volume is forced to concentrate on a few main roads causing traffic problems.

Second, the tolls discourage road users, who choose other toll-free roads thus causing negative changes in the spatial distribution of traffic. Some urban roads like Shenhui Road bear unnecessarily long-distance and pass-through traffic, especially the cargo containers. They get heavily jammed everyday.

Third, the value of land on both sides of the road has been greatly reduced because its motorway nature makes it a barrier to interaction between various land use activities. The investment environment has become worse. No real estate developers like to locate there owing to the noise, vibrations, pollution, etc..

All we can do now is to appeal the Government to countermand the BOT contract as soon as possible, pay compensation to Huayu Company, and turn Shenhui Road into a toll-free road.

3 COMPREHENSIVE TRANSPORT PLANNING

In L.D., the mandatory comprehensive transport planning has been carried out since July, 2003. According to the real situation in this district, the following four aspects are being emphasized: public transportation, road network, road toll system and parking. Special attention should be paid not only to planning itself, but also raising funds to realize the planned projects.

3.1. *Mass Rapid Transit Modes*

As in other regions of eastern China, high density of population and severe scarcity of useable land make the L.D. Government clearly understand that the only way-out from car traffic booming and for effective urban operation and improvement of investment environment lies in active development of rapid mass transit modes, especially metro lines. Early development of public transportation has already been adopted by the Government as a rigid policy since the mid of 1990s.

Mass rapid transit modes, mostly rail-based, are characterized by frequent, punctual, reliable and high-speed travel, all-day-and-weather service, energy and land saving, and less pollution. Such modes become an important symbol of modernization. It is expected to change totally the people's travel behavior and life style.

Line No.1 (21.4 km) is under construction and will be open by the middle of 2004, involving an investment of about 11 billion RMB yuan. By 2010,

Shenzhen will construct a total of 8 metro or LRT lines with total length of 238.5 km)], investing 52.5 billion RMB yuan. Lines No.1, 2, 3, 4 are metro (underground) and No. 6, 8, 11, 12 are urban rapid LRT. The plan is for all new towns to be connected to the center of SEZ within a 40 minutes ride.

3.2 *Underground Line No.3*

3.2.1 *Planning*

Underground Metro Line No.3 is a very important rail line both for public transport and economical development of L.D. with planned length of 30 km and 17 stations. The beginning station is Hongling Station and end station is Longxing station. It will have important interchange points with Line No.1, Buji railway station, Guangzhou Hongkong quasi-high-speed railway, the planned No.11 rapid urban railway, and the planned Zhu River Delta inter-city rapid rail transport system.

3.2.2 *Fund Raising*

According to the pre-feasibility studies, the construction of Line No.3 will cost 11.8 billion RMB yuan. Fund raising remains a huge problem. So far, the Municipal and L. D. two-level Governments promise to contribute 35% and 15%, respectively, of total investment. The remaining 50% will be lent by the National Development Bank at a low, long-term interest rate. Owing to the national and financial system in China, there is no precedent for a BOT or TOT, etc, in construction of a metro line. Some new channels for raising funds are being explored, such as making full use of the residents' bank deposits.

By the end of August 2003, the residents' deposit in banks of Shenzhen reached 203.5 billion RMB yuan. If a part of this amount could be activated to invest into the metro construction, this would greatly lessen the financial burden on the Government. The method would work as follows: the Government entrusts some Bank to raise funds at a higher profit rate than the National Debt, Treasury Bond or ordinary bank profit rate to absorb the resident deposit, then the Government borrows money from the Bank at lower long-term rate. The rates would be determined so as to have a positive-sum game for all three parties (the Government, the residents and the participating Bank). The reconstruction of Shenzhen Airport Project has set up a good example in raising funds of 200 million RMB yuan in June 2003 through entrusting Shenzhen Branch of the China Construction Bank. The Government of L. D. has contacted Hongkong Metro Company, Ltd, Guang-Shen Railway Company and Shenzhen Metro Company for possible participation in this scheme. One slogan is: the Government promises a profitable policy, and the enterprises are in charge of operation.

3.2.3 Social Effects and Economic Benefits

The Metro Line No.3 will bring forth great opportunity for the development of L.D even of the whole Shenzhen Municipality. According to relevant data in the construction cost of a rail line, the infrastructure part including civil engineering projects, rail system, vehicles, communication symbols, power supplies, etc, will take about 50% of total investment. This kind of investment is expected to increase the use of the idle production capacity of material and construction enterprises, creating new jobs. The overall economic growth will be pushed to a higher level. In addition, the project will also attract more investment in housing of the real estate along the rail lines including schools, hospitals, cultural resorts, etc.. This in turn will require basic infrastructure such as roads, electrical supply, water supply, gas pipes, and postal communications, all of which will promote further urban and economic growth.

3.2.4 Urban Reconstruction

Metro Line No.3 will stimulate urban renewal along its corridor. Unplanned houses and plants along both sides of Shenhui Road are historical remains, and the old towns can't meet the demand of urban modernization. A detailed plan is in the making, its main idea being to redevelop the vicinity of metro stations, each covering about 0.8 to 1.0 km² area. A high-intensity development will be encouraged to full use the advantage of Metro Line No.3. That means the planned building/land ratio may be permitted to reach 5.0 or even 6.0. High-rise apartment houses around the metro stations may adopt Hongkong's new-town pattern to provide more passengers for metro traffic, change people's car-driving life style, and leave more land space for green areas. The Government may also make more profit through land market auction to help out with the metro investment and promote the construction of public facilities and infrastructure. Based on initial estimates, the land value gains in those regions around metro stations may be counted up to 6.7 billion RMB yuan.

3.3 Building an Integrated Transport System

There still a long way to go to realize a full-size and integrated transport system in L.D.. In near future, special attention will be given to the construction of transport hubs, large social parking lots, bicycle and pedestrian walking system including the non-obstructed walkways for the old and disabled people.

3.3.1 Transport Hubs

The transport hubs to be built in L.D. will make possible an effective transfer of passengers between all kinds of transport modes. For example, accompanying the reconstruction of Buji Railway Station, long distance railway passengers will start their journey from Buji instead from the Railway Station of Lohu Port in SEZ. The latter has been the biggest land port in China for several decades and has been under tremendous transport demand pressure. The planned Metro Line No.3 will connect with the Buji Railway Station to rapidly pick up and deliver passengers. Interchanges with the city bus service, long distance intercity bus lines, taxi, cars and walking system should also be incorporated. Here the parking lots, especially park-and-ride facilities should become the key points for Buji as a huge transport hub. Four or five hubs will be built in the next 3-5 years in L.D.

3.3.2 Car Parking

Like in all car-traffic booming urban regions, parking problems are a bad headache for Shenzhen. In previous years the Government didn't pay much attention to car parking, but it rapid motorization made it change its attitude completely. New urban planning standards reflect such a change. The norm for parking spaces in planned residential neighborhoods was raised from 0.5 before 1998 to 1.0 parking space per household now. In addition, other parking standards and regulations, for on-street and off-street parking, and employment parking, are also being revised. With the implementation of national policy encouraging motorization, more and more well-to-do families can afford to purchase a car and this trend is getting stronger year by year. What we can do in facing this reality is to make out a series of policies to restrain the car use i.e. limited car spaces in Central Town and high parking charges, etc.. Here a lot of experience may be absorbed from abroad.

3.3.3 Bicycling

China is a bicycle kingdom, but in L.D. as well as in SEZ bicycle traffic volume is getting smaller and smaller year by year because of hot weather, theft, etc.. An important aspect is that bicycling seems to have become a symbol of poverty. However, bicycle traffic is a popular, non-polluting ("green") transport mode, good for health and convenient for short distance travel. It should be protected and encouraged. Since the interaction between autos and bicycles on same road lowers the road efficiency and threatens traffic safety, the bicycle lanes preferably should be located next to sidewalks, separated from the auto lanes, just as seen in some western countries.

4 THE ROAD SYSTEM

4.1 *Rebuilding Road Network*

According to Shenzhen Master Plan (1996-2010), the urban layout and structure should be planned as “three axial lines, three circle layers, three urban centers and nine functional groups.” L.D. is located at the Eastern axial line, in the Second and Third circle layers. It is one of the three urban centers and includes three functional groups. However compared with SEZ and Baoan District, the social and economical development of L.D. is rather backward because it failed to construct a good system of rapid roads. At present only one first-level highway (Shenhui road) is connecting all towns at the Eastern axial line. This has created a “bottle-neck” effect and limits the development of the Big Industrial Area, Pinghu logistical base and Longgang town center. It is therefore necessary to strengthen the Eastern transport corridor. Shenhui road will be reconstructed as an urban avenue specially for public transport with the road red-line width of 120 m and the Metro Line No.3 elevated on the road median green belt.

Because of the geographical proximity to Hongkong, a lot of freight traffic passes across whole L.D., creating a very complex and heavy mixed traffic flow, causing traffic jams, traffic accidents and delays. The planned roads therefore will emphasize new through-corridors parallel to Shenhui Road along the Eastern axial line, so as to divert passing-by traffic from urban road network. This role will be played by two parallel roads called Shahe Road in south and Hongmian Road in north.

4.2 *Cancellation of Second Port-line Check Stations*

For L.D. there are only 4 check points along the more than 200 km second port-line connecting with SEZ, i.e. Beizhaijiao, Yantian, Shawan, Buji Check Stations. The Armed Police checks the passengers and vehicles entering SEZ. These checks also cause traffic delays. The extreme example happened at Buji Check Station where daily in-and-out autos and passengers have already reached about 100-120 thousand vehicle and nearly 200 thousand person passages per day, which is greatly beyond the capacity of the station. At evening rush hours, time delays of 2-3 hours per vehicle often happen. Now a proposal to remove the second port-line check stations has already put forward by the regional government but is still not permitted by the State. In the near future, when metro lines are in operation, these check stations will automatically end their historical missions.

4.3 *The Roads in the Hinterland of the Port*

As the sixth-ranked container port in the world, the handling capacity of Shenzhen Ports has already reached 8 million cargo containers per year. Among them, the Yantian Port saw a 33% increase rate a year, with an accompanying prosperity. The professional containers ownership is already 13,000, and at rush hours more than 10,000 containers move in and out of the port area everyday. Unfortunately, an inadequate road system in the port’s hinterland (mainly in L.D.) leads to heavy traffic jams everyday. For example, one container’s driver ordinarily should hand his cargo to the Port within one hour, but because of traffic jams, he may need up to 10 hours to finish his job. The Yantian Port authority has decided to invest 4.68 billion RMB yuan to construct seven huge roads, including Yanpai Motorway, Eastern Rapid Corridor, Second Yansha Expressway, etc.. By the end of 2005, an effective port-transport system will be in place.

5 TOLLS

In 1988, a road funding policy based on tolls had been adopted to speed up the highway construction. Highways would be built through loans, and tolls would be charged to repay debt. Since then, 12.95 billion yuan loans were collected and 511 km highways built up, occupying 32.8% of total highway length of Shenzhen. At the same time, 12 non-motorway toll stations were set up. The toll revenue in 2001 year was 0.74 billion yuan. The policy is now changing, the objective being to improve the environment for investors. The reform program approved by Shenzhen Government in 2002, the general target is set to realize “non-toll and non-stopping policy” in all city highways except motorways. By the end of year 2003, all of the 12 toll stations will be removed and new 9 one-direction toll stations set up along Shenzhen border line to release all toll-highways within Shenzhen area.

Owing to the nature of the present loan and investment system in China, it is very difficult to generate huge funds for highway and tunnel construction. A huge debt has already been accumulated, and the pressure of repaying loans is heavy. The Shenzhen government therefore has decided to set up a special Fund for Highway and Tunnel infrastructure, following the principle “who is benefiting and who will repay”. The Fund will be fed from contributions by the Municipal and District Governments, the land fund, the rebuilding fund, tolls fees and other road user charges. The proceeds will pay for road maintenance, repay debt, compensate for previous construction units’ losses, and fund new highway projects.

The Fund will be set up as a special account in the Financial Bureau of the Municipal Government. The

income and the expenditures will be managed separately. All the payments will be checked by the Highway Bureau and co-approved by the Communication Bureau and the Financial Bureau.

6. CONCLUSION

For a rapid urbanized and motorized urban region with high population density, such as the Zhujiang River and Changjiang River Delta regions of China, the experience and lessons of L.D. show that the local Government should pay special attention to striking a balance between traffic demands and the supply of road network and public transport modes, depending on its financial ability. Without claiming that Longgang's approach would be fully suitable for other regions, fund raising is a very important task for the Government in addition to its leading role in traditional aspects of network planning, traffic management and transport regulation.

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