


Urban Sustainability

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# Urban Redevelopment and Traffic Congestion Management Strategies

# Urban Sustainability

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Yanli Wang · Bing Wu · Linbo Li

# Urban Redevelopment and Traffic Congestion Management Strategies

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# Preface

The industrial revolution originated in Britain first led to the urbanization of developed countries, and then promoted the urbanization process of the world.

According to the experience of urbanization development in various countries, following the process of urbanization, on the one hand, a large amount of non-urban population becomes urban population, and a large amount of non-urban land becomes urban land. On the other hand, the existing facilities in the city are updated and the land is re-developed.

At present, urbanization in developing countries is developing rapidly. However, due to the weak foundation of urban construction, there is a great demand for upgrading and functional improvement of existing facilities in cities in the process of urban expansion. It can be said that urban expansion and urban renewal are carried out simultaneously, which is a very different aspect of urbanization development between developing countries and developed countries.

Therefore, in the process of urbanization in developing countries, attention should be paid to both urban expansion and urban renewal. In the process of urban renewal, land redevelopment is a very important way. Land redevelopment will inevitably break the balance of traffic supply and demand of the land and its surroundings because it changes the original land use pattern. What happens to transport when that balance is broken? It is worth studying how to make a good plan to guide the development before the balance is broken.

Since 2001, our team did a lot of various types of traffic impact analysis project, including residential facilities, office facilities, residential-office mixing facilities, commercial facilities, commercial-residential mixing facilities, sports facilities, industrial facilities, and transportation facilities, etc. The development and construction of these facilities are mostly the redevelopment of urban land use. From the point of each project in isolation, they have very limited impact on urban traffic, or just have a local impact. From the city as a whole, however, especially from the perspective of urban renewal in the process of urbanization, using the current traffic impact assessment standard to analyze traffic problems that are caused by the development projects is far from enough. Therefore, in 2008, our research team submitted an application to the Ministry of Education for the Doctoral Fund project *Research on*

*Traffic Congestion under the Condition of Urban Land Redevelopment* and obtained the funding. In 2017, we further submitted an *Integrated Traffic Impact Analysis Method for Urban Renewal* project to the National Natural Science Foundation and obtained funding.

The main content of this book comes from a part of the research results of the Doctoral Fund project and the Nature Fund project. Hereby, I would like to express my sincere gratitude to the Doctoral Program Foundation of the Ministry of Education and the National Natural Science Foundation.

Much of the research in this book has benefited from the relevant research of the postgraduate students in our research team. Their innovative ideas and research results have enriched the content of this book. I would like to express my sincere thanks to Hong Pan, Feifei Zhang, Lin Xiao, Junwei Yi, Xiaoting Zhang, Sicheng Hao, Yuning Jin, etc.

This book references many researchers' research results in the process of writing. These research results are listed in the book's reference list. Here, I also express my heartfelt thanks to the authors of the cited researches. And special thanks to the support of National Center for Smart Growth Research & Education at the University of Maryland. Thanks to Frederick W. Ducca, Gerrit Knaap, Xin Ye, Sabya Mashra, and others for their constructive suggestions.

In addition, some graduate students in our team also participated in the proof-reading of the paper, including Tianshuang Gao, Yan Yan, Xue Luo, Wenxuan Wang, Mengfei Cao, Hao Sun, Chenxi Wang, etc. In particular, Yuning Jin did the full-text proofreading, image processing, and typesetting. Many thanks to them for their hard work in bringing this book to fruition.

Due to the author's limited level and time, this book is bound to have many flaws. Please do not hesitate to criticize and correct.

Shanghai, China  
Winter 2021

Yanli Wang

# Contents

<b>1 Introduction</b> .....	1
1.1 Urban Renewal and Urban Land Redevelopment .....	1
1.1.1 Urban Land Redevelopment .....	5
1.2 Development of Urban Land Redevelopment .....	7
1.2.1 Related Theories and Practice in Developed Countries .....	7
1.2.2 Research and Practice in China .....	11
1.3 Urban Land Redevelopment and Transportation Problems .....	14
1.3.1 Classic Case of Urban Land Redevelopment and Traffic Problems .....	14
1.3.2 The Duality of the Impact of Urban Land Redevelopment on Traffic .....	25
1.4 The Content and Structure of the Book .....	26
References .....	28
<b>2 Traffic Congestion Mechanism Under Land Redevelopment</b> .....	33
2.1 Review of Traffic Congestion Mechanism .....	33
2.1.1 Traffic Flow and Transportation System Aspect .....	34
2.1.2 Relationship Between Transportation and Land Use Aspect .....	36
2.2 The Connotation of Land Redevelopment .....	40
2.2.1 Motivation for Land Redevelopment .....	40
2.2.2 Characteristics of Land Redevelopment .....	46
2.2.3 Land Redevelopment Process in China .....	51
2.3 Coordination of Land Redevelopment and Transportation System .....	53
2.3.1 Factor Connection Between Urban Land and Transportation System .....	53
2.3.2 Interaction Between Land Use Change and Transportation System .....	61
2.3.3 Influencing Factors of Land Redevelopment on Transportation System .....	66

- 2.4 Influence Path of Land Redevelopment on Transportation System ..... 70
  - 2.4.1 In Traffic Generation Stage ..... 72
  - 2.4.2 In Traffic Distribution Stage ..... 74
  - 2.4.3 In Traffic Mode Choice Stage ..... 82
  - 2.4.4 In Route Selection Stage ..... 90
- 2.5 The Impact of Land Redevelopment on the Transportation System ..... 91
  - 2.5.1 Impact on Trip Characteristics ..... 91
  - 2.5.2 Impact on Traffic Condition ..... 92
  - 2.5.3 Impact on Traffic Congestion ..... 99
- 2.6 The Cause of Traffic Congestion Under Land Redevelopment ..... 100
  - 2.6.1 Relationship Between Traffic Supply and Demand ..... 100
  - 2.6.2 Rationality of Land Redevelopment Scheme ..... 101
  - 2.6.3 Planning and Management Mechanism ..... 105
- References ..... 111
- 3 Traffic Congestion Management and Control Strategy for Land Redevelopment ..... 115**
  - 3.1 Review of Traffic Congestion Management Strategy ..... 115
  - 3.2 Target and Contents of Traffic Congestion Management Under Land Redevelopment ..... 119
    - 3.2.1 Target of Traffic Congestion Management Under Land Redevelopment ..... 119
    - 3.2.2 Contents of Traffic Congestion Management Under Land Redevelopment ..... 120
  - 3.3 Land Redevelopment Planning and Management Considering Transportation Development ..... 123
    - 3.3.1 Strategies for Integrative Planning of Land Use and Transportation ..... 123
    - 3.3.2 Land Redevelopment Planning Management Strategy ..... 130
  - 3.4 Transportation Supply and Demand Balance Control Under Land Redevelopment ..... 135
    - 3.4.1 Traffic Supply Management and Control Strategy ..... 135
    - 3.4.2 Traffic Demand Management and Control Strategy ..... 137
  - 3.5 Framework of Traffic Congestion Management System for Land Redevelopment ..... 138
    - 3.5.1 Management System Objectives and Elements ..... 138
    - 3.5.2 Management System Framework and Process ..... 140
  - References ..... 143

- 4 Traffic Demand Analysis Model for Land Redevelopment** ..... 147
  - 4.1 Review of Existing Traffic Demand Analysis Models ..... 147
    - 4.1.1 The Characteristics of Traffic Demand Forecasting and Analysis Under Land Redevelopment ..... 147
    - 4.1.2 Existing Traffic Demand Analysis Model and Their Problems ..... 148
  - 4.2 Integrated Land Use and Transportation Model Framework ..... 151
    - 4.2.1 Review of Integrated Land Use and Transportation Models ..... 151
    - 4.2.2 Framework of the Integrated Model Based on Land Redevelopment ..... 155
    - 4.2.3 Composition of Multi-Layer Transportation Module ..... 156
  - 4.3 Selection and Improvement of Passenger Transportation Model ..... 157
    - 4.3.1 Overview of Passenger Transportation Model Overview ..... 157
    - 4.3.2 Regional Passenger Transportation Model ..... 158
    - 4.3.3 Urban Passenger Transportation Model ..... 159
  - 4.4 Construction and Improvement of Freight Transportation Model ..... 169
    - 4.4.1 Freight Transportation Model Overview ..... 169
    - 4.4.2 Regional Freight Transportation Model ..... 171
    - 4.4.3 Urban Freight Transportation Model ..... 173
  - 4.5 Handling of Spatial–Temporal Traffic Assignment Models ..... 174
    - 4.5.1 Temporal Assignment Method ..... 175
    - 4.5.2 Spatial Assignment Method ..... 176
  - 4.6 Association and Development Between Models ..... 178
    - 4.6.1 Association Between Models ..... 178
    - 4.6.2 Model Development ..... 179
  - References ..... 184
- 5 Pre-exam of Traffic Congestion Under Planning Stage of Land Redevelopment** ..... 187
  - 5.1 Pre-exam Method of Traffic Congestion ..... 187
    - 5.1.1 Purpose and Significance ..... 187
    - 5.1.2 Basic Process ..... 188
    - 5.1.3 Key Technologies ..... 192
  - 5.2 Traffic Status and Congestion Analysis Indexes ..... 194
    - 5.2.1 Selection of Basic Indexes ..... 194
    - 5.2.2 Determination of Main Indexes ..... 201
    - 5.2.3 Auxiliary Indexes Construction ..... 203
    - 5.2.4 Index Calculation Method ..... 203
  - 5.3 Assessment Indexes of the Impact on Traffic Status and Congestion ..... 206
    - 5.3.1 Overview of Assessment Indexes ..... 206

5.3.2	Comprehensive Index Construction .....	211
5.4	Threshold of Land Redevelopment Traffic Rationality Analysis .....	213
5.4.1	Assessment Index Grading Threshold .....	213
5.4.2	Rationality Judgment Standard .....	214
References	.....	217
<b>6</b>	<b>Traffic Impact Analysis in the Implementation Stage of Land Redevelopment</b> .....	<b>219</b>
6.1	Existing Traffic Impact Analysis and Its Problems .....	219
6.1.1	Origin of Traffic Impact Analysis Method and Its Development in China .....	219
6.1.2	Main Problems .....	221
6.2	The Characteristics of Traffic Impact Analysis and Process Reengineering .....	223
6.2.1	Characteristics and Requirements .....	223
6.2.2	Process Reengineering .....	226
6.2.3	The Threshold .....	228
6.3	Preparation Technology For Land Redevelopment .....	231
6.3.1	Determination Method of Study Area .....	231
6.3.2	Traffic Demand Forecasting Method .....	234
6.3.3	Land Use Transportation System Evaluation .....	236
6.3.4	Other Technical Treatment Methods .....	238
6.4	Impact Analysis for Land Redevelopment .....	240
6.4.1	Impact Analysis .....	240
6.4.2	Impact Analysis Indicators .....	242
6.4.3	Determination of Impact Degree .....	244
6.5	Traffic Improvement and Suggestions for Land Redevelopment .....	246
6.5.1	Traffic Improvement and Suggestions in the Location Stage .....	247
6.5.2	Traffic Improvement and Suggestions in the Construction Stage .....	247
References	.....	250
<b>7</b>	<b>The Application of Land Redevelopment and Traffic Congestion Control Strategy</b> .....	<b>253</b>
7.1	Background of Case Study .....	253
7.2	Introduction of Land Use and Transportation Integrated Model (MSTM) .....	255
7.2.1	Model Structure .....	255
7.2.2	Network and Data .....	257
7.2.3	Model Validation .....	258
7.3	Redevelopment Schemes Design .....	261
7.3.1	Redevelopment Area and Data .....	261
7.3.2	Different Redevelopment Schemes .....	264

7.4	Traffic Impact Analysis .....	270
7.4.1	Analysis of the Impact on Overall Trip Characteristics .....	270
7.4.2	Analysis of the Impact on Overall Traffic Condition .....	277
7.4.3	Analysis of the Impact on Traffic Congestion Status .....	278
7.5	Traffic Reasonability Evaluation .....	281
7.5.1	Traffic Impact Assessment .....	281
7.5.2	Judge Traffic Reasonability .....	282
7.5.3	Analysis Results and Discussion .....	283
7.6	Implementation Management of the Scheme .....	283
	Reference .....	284

# List of Figures

Fig. 1.1 The development of urbanization in Britain and the United States. **a** The development of urbanization in Britain. **b** The development of urbanization in the United States ..... 2

Fig. 1.2 The development of urbanization in China from 1949 to 2013 [7] ..... 3

Fig. 1.3 Paris redevelopment. **a** Paris before redevelopment by Haussmann. **b** Paris after redevelopment by Haussmann. **c** The Left Bank Area before the redevelopment. **d** The Left Bank Area after the redevelopment ..... 16

Fig. 1.4 Redevelopment of Baltimore port. **a** Map of Baltimore port before redevelopment. **b** Map of Baltimore port after redeveloped. **c** Photos of port Baltimore before redevelopment. **d** Photos of port Baltimore after redevelopment ..... 17

Fig. 1.5 London Wharf redevelopment. **a** Wharf before redevelopment. **b** Canary Wharf after redevelopment. **c** Overall layout of Canary Wharf. **d** Metro and light rail stations and their pedestrian bridges after redevelopment ..... 19

Fig. 1.6 Twice redevelopment of Cheongyecheon. **a** The Cheongyecheon before redevelopment. **b** The Cheongyecheon after the first redevelopment. **c** The Cheongyecheon after the second redevelopment ..... 20

Fig. 1.7 Redevelopment of Shenzhen Luohu Port. **a** Luohu Port, completed in 1985. **b** Customs clearance boom in the 1990s. **c** Shenzhen Luohu Port in 2010. **d** Shenzhen railway station in 2010 ..... 22

Fig. 1.8 Redevelopment of Shanghai Wujiaochang area. **a** Wujiaochang area in the 1980s. **b** Wujiaochang area in the reform of the 1990s. **c** Wujiaochang area in 2010. **d** Traffic situation of Wujiaochang area in the early twentieth century . . . . . 23

Fig. 1.9 The redevelopment of Zhongguancun. **a** Old appearance of Haidian Town. **b** Haidian Town after the redevelopment . . . . . 24

Fig. 2.1 Redevelopment changes of Xujiahui area in Shanghai, China. **a** Xujiahui area in the 1980s (before redevelopment). **b** Xujiahui area in the twentieth century (after redevelopment) . . . . . 41

Fig. 2.2 Redevelopment changes in Shanghai Lujiazui area, China. **a** Lujiazui District Area in 1990s (before redevelopment). **b** Lujiazui District Area in 2012 (after redevelopment) . . . . . 42

Fig. 2.3 Redevelopment changes in Shanghai Shipyard area. **a** Shanghai Shipyard Area (before redevelopment). **b** World Expo Park in 2010 (after redevelopment) . . . . . 43

Fig. 2.4 Redevelopment changes in Meilong District, Shanghai. **a** Meilong area in 1986 (before redevelopment). **b** Meilong area in 2004 (after redevelopment) . . . . . 45

Fig. 2.5 Schematic diagram of land development and redevelopment in urban development stage. **a** Stage I. **b** Stage II. **c** Stage III . . . 47

Fig. 2.6 Temporal and spatial distribution diagram of urban development and redevelopment . . . . . 50

Fig. 2.7 Current land redevelopment process and its impact . . . . . 52

Fig. 2.8 Interactive cyclical relationship between land use and transportation system . . . . . 59

Fig. 2.9 Elements of land use and transportation system . . . . . 61

Fig. 2.10 The relationship between land use change and transportation system . . . . . 62

Fig. 2.11 Land use in 2 km buffer zone along Shanghai Line 1 rail transit in 1989 and 2005 . . . . . 65

Fig. 2.12 Interaction diagram between urban land redevelopment and transportation system . . . . . 66

Fig. 2.13 Changes of road facilities around a plot within the inner ring of Shanghai before and after redevelopment. **a** Before redevelopment. **b** After redevelopment . . . . . 71

Fig. 2.14 Impact path of urban land redevelopment on transportation system . . . . . 72

Fig. 2.15 Distribution of departure time at different starting points . . . . . 77

Fig. 2.16 Distribution of home-based departure time . . . . . 77

Fig. 2.17 Distribution of company-based travel time . . . . . 78

Fig. 2.18 Population density distribution in Guangzhou at different time . . . . . 79

Fig. 2.19	Distribution of passenger flow in and out downtown by rail transit in Shanghai in work day morning peak hour	80
Fig. 2.20	Spatio-temporal path of residents' daily activities in Guangzhou	81
Fig. 2.21	Schematic diagram of OD expectation line before and after redevelopment of a block. <b>a</b> Before redevelopment of a block. <b>b</b> After redevelopment of a block	81
Fig. 2.22	Factors influencing the choice of transportation modes	82
Fig. 2.23	Selection ratio of traffic modes with different travel distances	84
Fig. 2.24	Internal traffic design schemes under different concepts in the same plot. <b>a</b> Traffic design based on cars. <b>b</b> Traffic design based on slow traffic	88
Fig. 2.25	Composition of travel modes of various land use in Shanghai	89
Fig. 2.26	Schematic diagram of traffic facility service state changes under redevelopment	94
Fig. 2.27	V/C changes of a plot with or without land redevelopment (has no significant adverse impact). <b>a</b> V/C without land redevelopment. <b>b</b> V/C with land redevelopment	95
Fig. 2.28	V/C changes of a plot with or without land redevelopment (has significant adverse impact). <b>a</b> V/C without land redevelopment. <b>b</b> V/C with land redevelopment	97
Fig. 2.29	Comparison of regional traffic conditions under different land redevelopment scenarios. <b>a</b> No land redevelopment scenario. <b>b</b> Land redevelopment scenario I. <b>c</b> Land redevelopment scenario II. <b>d</b> Land redevelopment scenario III	98
Fig. 2.30	Schematic diagram of traffic congestion formation under redevelopment. <b>a</b> No change of facilities after redevelopment. <b>b</b> Improvement of facilities after redevelopment	101
Fig. 2.31	Map of Pengpu area before and after redevelopment. <b>a</b> Before redevelopment. <b>b</b> After redevelopment	102
Fig. 2.32	Serious traffic congestion of Tianmu middle road in Shanghai (2009)	104
Fig. 2.33	Relationship between urban planning and urban traffic planning	107
Fig. 3.1	Commonly used measures to increase road network capacity	116
Fig. 3.2	Commonly used measures to improve management level	116
Fig. 3.3	Strategic framework for integrated planning of land use and transportation	121
Fig. 3.4	Strategic framework for management of planning implement	122
Fig. 3.5	Traffic classification system of urban land use	126

Fig. 3.6 The example of development intensity calculation ..... 128

Fig. 3.7 Flow chart of project development ..... 133

Fig. 3.8 Framework of traffic congestion management system  
for land redevelopment ..... 140

Fig. 3.9 Interrelation of subsystems ..... 141

Fig. 3.10 CMS operation flow chart ..... 142

Fig. 3.11 Key technologies of traffic congestion control strategy  
for land redevelopment ..... 143

Fig. 4.1 Compositions of the integrated model ..... 156

Fig. 4.2 The structural of the integrated model of large cities ..... 157

Fig. 4.3 Multiple cross-classification methods of family type. **a.**  
Multiple cross classification of family type of work-related  
trips. **b.** Multiple cross classification of family type  
of non-work related trips ..... 162

Fig. 4.4 Construction process of the destination choice model ..... 164

Fig. 4.5 Frequency distribution of travel distance for different trip  
purposes ..... 166

Fig. 4.6 Comparison of DC model and gravity model ..... 167

Fig. 4.7 Structure of mode choice ..... 169

Fig. 4.8 Flow chart of freight-based model ..... 172

Fig. 4.9 Input and output between models ..... 180

Fig. 5.1 Flow chart of traffic congestion pre-exam  
under redevelopment ..... 189

Fig. 5.2 Typical spatial distribution of traffic congestion on urban  
roads ..... 196

Fig. 5.3 Commonly defined indexes of traffic congestion ..... 197

Fig. 5.4 Relationship between density and congestion ..... 200

Fig. 5.5 Basic indicator set of traffic status and traffic congestion  
evaluation ..... 201

Fig. 5.6 Traffic status and congestion analysis index system ..... 204

Fig. 5.7 Assessment index set of redevelopment impact on traffic  
and congestion ..... 210

Fig. 5.8 Traffic state and congestion assessment index  
in pre-inspection ..... 211

Fig. 5.9 Traffic rationality judgment process for redevelopment ..... 215

Fig. 5.10 Judgment chart of traffic rationality for redevelopment ..... 217

Fig. 6.1 Stages of TIA ..... 226

Fig. 6.2. The TIA process in the stage of implementation ..... 227

Fig. 6.3 Method for determining the study area of traffic impact  
analysis ..... 232

Fig. 6.4 Interrelationships among aspects involved in dynamic  
traffic impact analysis ..... 242

Fig. 6.5 Indicators of impact analysis ..... 243

Fig. 7.1 Application process of strategy ..... 255

Fig. 7.2 Three-level model of MSTM ..... 256

Fig. 7.3	Comparison of car average travel length for each travel purpose obtained from MSTM and survey .....	259
Fig. 7.4	Comparison of travel mode structure for each travel purpose obtained from MSTM and survey .....	260
Fig. 7.5	Comparison of VMT for each county road obtained from MSTM and HPMS .....	260
Fig. 7.6	MSTM statewide coverage area and redevelopment area ( <i>Note</i> The area in black lines is the scope of redevelopment scenario) .....	262
Fig. 7.7	Distinct transit areas in redevelopment area .....	263
Fig. 7.8	Mode shares change under each TOD scheme .....	271
Fig. 7.9	Transit share changes of HBS, HBW and NHBW trips under TOD schemes .....	273
Fig. 7.10	Entire region average trip distance changes under TOD schemes .....	274
Fig. 7.11	VKT changes under TOD schemes compared to CLRP .....	277
Fig. 7.12	VHT changes under TOD schemes compared to CLRP .....	278
Fig. 7.13	VHD changes under TOD schemes compared to CLRP .....	279
Fig. 7.14	CLK changes under TOD schemes compared to CLRP .....	280
Fig. 7.15	VDI changes under TOD schemes compared to CLRP .....	280
Fig. 7.16	CLKR changes under TOD schemes compared to CLRP .....	281

# List of Tables

Table 2.1	Differences between development and redevelopment of urban land .....	50
Table 2.2	Land classification of code for classification of urban land use and planning standards of development land .....	55
Table 2.3	Shanghai travel attraction rate of different land use in 2004 ...	73
Table 2.4	Spatial-temporal characteristics of urban land use .....	75
Table 2.5	Peak hour coefficients of various types of land use in Downtown Shanghai .....	79
Table 2.6	The structure of travel modes for different purposes in Shanghai in 2009 (%) .....	83
Table 2.7	Distribution structure (%) of permanent residents in Shanghai in 2004 .....	84
Table 2.8	Composition of travel modes of different land use in Shanghai in 2004 .....	86
Table 2.9	The traffic volume and traffic status of adjacent road sections before redevelopment .....	92
Table 2.10	The traffic volume and traffic status of adjacent road sections after redevelopment .....	93
Table 4.1	List of variables considered for each transportation mode utility function .....	170
Table 4.2	The proportion of car trips in different periods obtained from the household trip survey in Maryland .....	175
Table 5.1	Commonly used traffic congestion evaluation indexes at home and abroad .....	198
Table 5.2	The relationship between network congestion rate and congestion degree .....	214
Table 5.3	NCC-based traffic congestion impact degree division .....	214
Table 5.4	Judgment table for the rationality of land redevelopment .....	216
Table 6.1	Status of China's TIA .....	221
Table 6.2	Starting threshold of traffic impact assessment for construction projects in Shanghai .....	230

Table 6.3	Classification of LOS of Non-motorized vehicle and pedestrian traffic	238
Table 6.4	Specific aspects of traffic impact analysis	241
Table 6.5	Analysis indicators of the internal traffic system of the plot	243
Table 6.6	Classification table of traffic impact	244
Table 6.7	Standards for judging the significant impact of the level of service of non-motor vehicle and pedestrian traffic	245
Table 7.1	Comparison of VMT for each road grade obtained from MSTM and observed values	261
Table 7.2	The number and growth of household units and jobs under CLRP	264
Table 7.3	Reallocation of household growth under household TOD scenarios compared to CLRP	266
Table 7.4	Reallocation of job growth under job TOD scenarios compared to CLRP	268
Table 7.5	Household units and jobs in the three geographic areas under TOD scenarios	269
Table 7.6	Job-housing balance (JHB) in the three geographic areas under TOD scenarios	270
Table 7.7	CLRP trip frequency and mode share by trip purpose	271
Table 7.8	Elasticity coefficient of transit share under “Res” and “Emp” schemes	272
Table 7.9	Trip frequency of different transit areas for different trip purposes under CLRP	273
Table 7.10	Elasticity coefficient of regional average trip distance under TOD schemes	275
Table 7.11	Average trip distance changes in PTA, OTA and NTA under TOD schemes	276
Table 7.12	The impact of the “Res45%” scheme on the traffic and congestion compared to CLRP	282

# Chapter 1

## Introduction



The sustainable development of cities and urbanization is inseparable with urban renewal, and one of the main ways of urban renewal is urban land redevelopment. Urban Land redevelopment, especially in the middle and late stages of urbanization, is an important way to maintain urban vitality and upgrade the energy level of city.

This chapter gives a brief introduction to the meaning of urban land redevelopment and its development situation at China and abroad, and then analyzes several international classical cases. Throughout the history of urban renewal and redevelopment, it is not difficult to find that the transportation system is an important aspect involved in redevelopment. The way to deal with the transportation system directly affects the traffic operation after land redevelopment. The land redevelopment can alleviate traffic congestion, and can also cause traffic problems and traffic congestion.

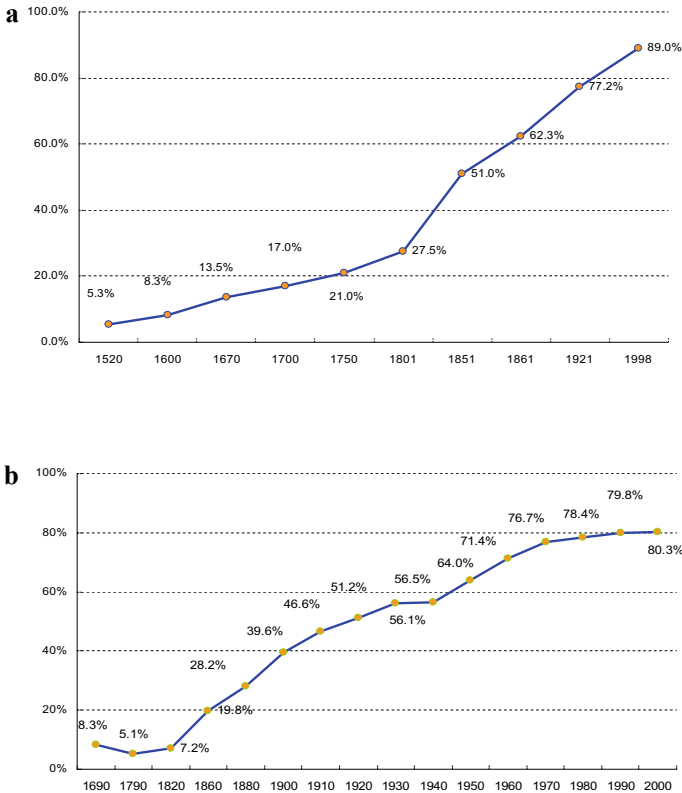
### 1.1 Urban Renewal and Urban Land Redevelopment

The development process of the city is a metabolic process that is continuously constructed and updated. In this process, there are two forms: new development and redevelopment of urban land. And the redevelopment of urban land is the main way of urban renewal.

Cities are the combination of “territory” and “bazaar”. Territory is mainly for defense and surrounded by walls. Bazaar refers to places where transactions take place. The most primitive “city” is formed by the exchange of goods and the gathering of people. Therefore, as early as the agricultural era, cities appeared. The emergence of cities is a symbol of human maturity and civilization. However, in the era of agricultural economy, the level of productivity is low and urban development is very slow. By the end of eighteenth century, the world’s urban population accounted for only 3% of the total population in the world [1].

In the nineteenth century, with the rise of the industrial revolution, the emergence of large-scale machine industry and socialized production, and the emergence and development of capitalist mode of production, many new industrial cities and commercial cities emerged. This led to a rapid growth of urban population, increased the proportion of urban population, and accelerated urbanization.

Britain is the origin of the Industrial Revolution and the country with earlier urban development. Its urbanization level was about 20% in the mid-eighteenth century before the beginning of the Industrial Revolution. After the beginning of the Industrial Revolution, the urbanization of Britain began to develop rapidly. London, the capital, was the only big city with a population of more than one million in the world in 1800. By 1851, the urbanization rate of Britain had reached 51% (as shown in Fig. 1.1 (a)). While, in the United States, the urbanization level was no more than 20% in 1860, before the formal beginning of the Industrial Revolution; But after the beginning of the Industrial Revolution, cities developed rapidly, and the urbanization rate had risen sharply to 51.2% by 1920 (as shown in Fig. 1.1 (b)) [2, 3].



**Fig. 1.1** The development of urbanization in Britain and the United States. **a** The development of urbanization in Britain. **b** The development of urbanization in the United States

From the process of urban development in developed countries, cities have experienced four stages: urbanization, suburbanization, Counter-urbanization and re-urbanization [4, 5]. In the stage of urbanization, urban development is mainly concentrated in the central area, where the population gathers and the urban population grows rapidly. During the period of suburbanization and counter-urbanization, the population spreads and migrates to the suburbs of the city, even to the countryside and small towns farther away from the city, and the population growth in the central area is slow or even reduced [6]. At this stage, the decay of central cities causes many problems, including empty central cities, land shortage, energy waste, traffic congestion, environmental pollution and so on. Therefore, European and American countries took the lead in launching a large-scale “urban renewal” campaign, and urban renewal as a proper term began to appear in the field of urban study. Through urban renewal, including rebuilding the central area and actively developing the declined areas of the urban center, the population can be attracted to the urban center again, and the city can enter the stage of re-urbanization.

For China, although the development speed of the city in the mid-20th century was faster than in any previous period due to the impact of the industrial revolution, the urbanization process was very slow compared with the developed countries due to factors of political and social system at that time. The proportion of urban population never exceeded 20%, until the reform and opening up in the late 1980s. From then, the city began to develop rapidly (Fig. 1.2). At present, China is in the stage of rapid urbanization. The suburbanization has begun to appear in some large cities. Many cities have or will carry out large-scale urban renewal projects such as old city reconstruction to ensure the rapid development of urbanization.

From the process of urban development, we can see that urban development and urban renewal are inseparable, urban renewal promotes the development of cities and urbanization, and urban development also needs continuous urban renewal. In fact, since human beings began to live in cities, there have been “urban renewal” activities. In the early stage, owing to the destruction of natural factors such as fire and aging, the cottage had to be rebuilt again and again with wood or clay, and then the house built with stone became a renewal trend; With the rapid development of urbanization after

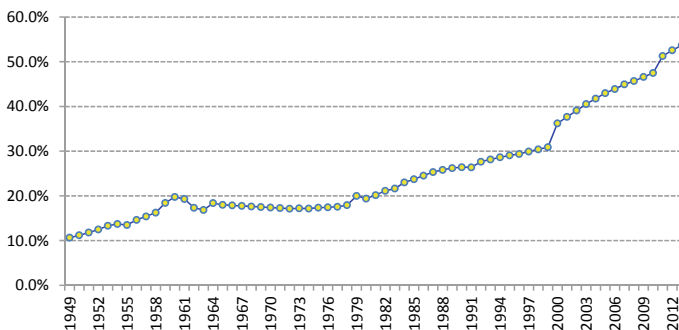


Fig. 1.2 The development of urbanization in China from 1949 to 2013 [7]

the Industrial Revolution, cities need to be expanded and renewed to accommodate the increasing population. In the mid-term of urbanization, especially the emergence of a large number of urban problems caused by suburbanization has triggered a large-scale urban renewal movement. The development of city itself is a metabolic process of constant construction and renewal.

Urban renewal is a kind of necessary and planned rebuilding activity for urban areas that are not suitable for modern urban life. Its goal is to take conscious intervention measures to solve the urban problems that affect or even hinder the urban development in the process of urban development, and to make the urban metabolism occur again. It is a social process of urban comprehensive essence from disintegration to transformation [8].

Urban renewal involves a lot of contents. The earlier and authoritative definition of urban renewal was elaborated at the first Research Conference on urban renewal held in The Hague, the Netherlands, in August 1958. That is, "People living in cities have different expectations and dissatisfaction with the buildings they live in, the surrounding environment or travel, shopping, entertainment and other life activities. And for the renovation of the houses they live in, the improvement of the environment such as streets, parks, green spaces and bad residential areas should be carried out as soon as possible, especially for the improvement of land use form or regional system and the implementation of large-scale urban planning undertakings, in order to form a comfortable living environment and beautiful city appearance, etc. Including all these related improvements, urban construction activities are urban renewal" [8].

Similar to urban renewal, there are many other expressions, such as urban reconstruction, urban transformation, urban recovery, urban renaissance, urban regeneration, urban redevelopment, old district reconstruction, old city renovation and so on. In essence, urban renewal refers to the demolition, transformation, investment and construction of a declining area in a city to make it develop and prosper again. Therefore, these concepts are either a manifestation of urban renewal or cover a specific aspect. The White Paper *Policy for the Inner City on Urban Renewal*, published in 1977 in Britain, clearly points out that urban renewal is a comprehensive way to solve urban problems, involving economic, social, cultural, political and material environment, etc. [9].

Thus, urban renewal includes not only the material renewal of objective entities (such as buildings and facilities), but also the non-material renewal, such as the renewal and continuation of various ecological environment, spatial environment, cultural environment, visual environment, recreational environment, as well as the continuation and renewal of neighborhood social network structure, psychological stereotype, emotional attachment and other environment or culture. Therefore, urban renewal includes the following aspects: (1) adjustment of urban industrial structure and selection of leading industries; (2) orientation of urban nature and function; (3) determination of the suitable size of urban population; (4) establishment of urban development intensity; (5) positioning of urban spatial image (including regional urban image and urban spatial image); (6) Urban land use layout and structural adjustment; (7) Renewal of road traffic system; (8) Renewal of urban culture; and

(9) Measures and suggestions for implementation of urban renewal and other related diversified objectives and countermeasures [8].

Urban renewal can be implemented in three ways: Redevelopment, Rehabilitation and Conservation [10].

**(1) Redevelopment or Reconstruction**

Redevelopment or reconstruction is to demolish buildings on urban land and make new and rational use of land in line with urban development. This is the most complete way of renewal, but this way may have a positive or negative impact on the urban space environment and landscape, social structure and changes in the social environment. At the same time, it is riskier in investment, so it can only be used when there is no feasible alternative.

**(2) Rehabilitation**

Renewal projects of rehabilitation mainly include improvement of fire-fighting facilities, infrastructure and public service facilities, improvement of street elevation, environmental renovation and energy-saving renovation of existing buildings, and they do not change the main structure and use function of buildings. It is to renovate or renew all or part of the building so that it can continue to use. The way of rehabilitation cost shorter time than reconstruction. It can also relieve the pressure of resettlement and it needs to invest less money. This way is suitable for areas or buildings that need to be renewed but can recover without reconstruction. The purpose of rehabilitation is not only to prevent their continued decay, but also to further improve the living environment of the area.

**(3) Conservation**

Conservation is the repair and protection of existing urban structures and entities. It is suitable for areas where buildings are fully maintained and in good condition. This way is the most relaxed and flexible, and the lowest cost method. It is a preventive measure for urban areas where social and economic activities are functioning normally.

Although the ways of urban renewal are divided into three categories, in the actual urban renewal work, it is often flexible to use in the specific engineering practice, according to the specific local conditions, which can adopt either a way or a mixed way.

### ***1.1.1 Urban Land Redevelopment***

From the way of urban renewal, we can see that redevelopment is a main way of urban renewal. The so-called urban land redevelopment, also known as urban land reuse, is the secondary development of local land by changing or not changing the nature of land use on the basis of existing urban land use [11].

The concept of redevelopment is actually relative to new development in terms of development object. New development is the transformation of land from non-urban use (such as agricultural use) to urban use. While redevelopment is based on the new development of urban land, replacing and upgrading the original land type, structure and spatial layout because of the requirements of social and economic development, for example, the transformation and reconstruction of the declining areas in urban built-up areas. Its typical form is old city regeneration, but it is not limited to the transformation of old districts [12].

New development is the expansion of the city, the engine of urban development, and the construction of the initial urban spatial layout. As the main way of the initial and medium-term urbanization, it directly affects the shape and scale of the city. And redevelopment is the renewal process of urban built environment, which also has an important impact on urban economic development and spatial evolution. Especially when the urban development enters the middle and late stages of rapid urbanization, due to the restriction of land resources, which means the expansion of land use scale and the development of new towns are restricted, the central urban areas begin to decline because of its original low land use efficiency and the appearance of suburbanization. Therefore, urban land redevelopment has become an important way of urban development and an accelerator of urbanization. Through repeated reconstruction of urban space, urban development is promoted in the changing process. Only through rational redevelopment, urbanization can be guaranteed to steadily and healthily enter the later stage of development or the stage of re-urbanization.

According to the difference of redevelopment area and object, there are many classification methods for urban land redevelopment. In terms of functional districts, it can be divided into redevelopment of central area, redevelopment of industrial area, redevelopment of waterfront area, redevelopment of large-scale project base and so on. Specific to a site, according to the nature of the original land, it can be divided into residential redevelopment, industrial redevelopment, commercial redevelopment and so on. In practice, there may be multiple types of land redevelopment, that is, comprehensive redevelopment. Different types of redevelopment have different emphases and concepts, and the main period and contents of redevelopment are also different.

As the main way of urban renewal, urban land redevelopment also involves many aspects, mainly including adjustments and changes in one or more of the following areas: (1) the industry carried by the land; (2) the spatial image of the area; (3) the layout and structure of the urban land; (4) the road traffic system; (5) the nature and function of the land; (6) the intensity of land development; (7) the resident population and employment carried by the land; and (8) the urban culture carried by the land; and so on.

## 1.2 Development of Urban Land Redevelopment

As the main way of urban renewal, urban land redevelopment is also one of the main ways of urban development, which can also be regarded as a major measure to improve the city environment. It is important to urban planning and embodies in every stage of urban development.

### 1.2.1 *Related Theories and Practice in Developed Countries*

As early as before the Industrial Revolution, various countries had different scales of renewal, mainly aimed at the natural renewal process of the serious material aging existing in cities. In this period, the size of city is generally small. Functions of cities are relatively simple and their development is relatively slow. In the nineteenth century, with the rise of the industrial revolution and the development of urbanization, urban problems began to emerge, and urban land redevelopment began to attract attention. Since then a lot of exploration has been made on the theory and practice of redevelopment.

#### (1) **Development of Theories**

The theory of urban land redevelopment originates from the research on the improvement measures of urban problems, including the exploration of urban form. As early as the first half of the nineteenth century, some utopian socialists put forward various ideas about redevelopment, of which improving housing and urban planning was taken as one of the measures to cure urban social diseases. At the turn of the nineteenth and twentieth centuries, due to the congestion in big cities, E. Howard put forward the idea of “garden city” from a spatial perspective, and designed a convenient transportation system as a support. The idea of “garden city” provides a references for urban redevelopment and it is also the beginning of modern urban planning [13]. At the same time, to solve the overcrowding in big cities after the Industrial Revolution, researchers put forward many other measures. For example, P. Geddes’ comprehensive studied on the evolution of urban development from a cultural perspective, and pointed out that redevelopment needs to be incorporated into urban planning and should retain the unique historical characteristics of cities [14]. While C. Sitte recognized the differences between old and new cities from an artistic perspective, and mentioned the difference between new construction and reconstruction in handling transport facilities, which is widely used in urban reconstruction [15] in later period.

After World War I, aiming at the problems of urban development and reconstruction, some new theories of urban space began to form, such as Concentric circle mode and subsequent sector mode and multi-core mode and so on. In addition, there are theory of determinant spatial city which emphasizes spatial concentration (also known as “contemporary city”) and the theory of Broadacre city which

emphasizes dispersion against spatial concentration. These explorations of urban space provide a reference for the later urban renewal and reconstruction. During this period, the Athens Charter drafted in 1933, outlined the problems faced by modern cities, including traffic problems. It also pointed out the causes of traffic congestion and proposed measures to be taken and the tasks of urban planning, taking improving society as the urban planning goal. The Athens Charter is a milestone in the development of modern urban planning theory as well as redevelopment [16].

After World War II, starting with T. Sharp's book *A Planning for Rebuilding*, more urban planning theories about urban reconstruction emerged. Many scholars such as J. Goodman and L. Keeble have studied the post-war urban planning [17, 18], and J. Jacobs criticized the urban reconstruction and renewal from a special angle, contributing to better urban redevelopment [15]. The Machu Picchu Charter drafted in 1977, further elaborated on the content and objectives of urban planning on the basis of the Athens Charter, emphasizing comprehensive and dynamic planning, and corrected the car-oriented urban development concept of the Athens Charter, clearly pointing out the importance of public transportation and urban reconstruction. It has an important impact on the future development of cities and transportation [19].

After the 1980s, the development of urban planning theory was diversified, and more theoretical research on urban space development emerged and developed, such as the compact city, the multi-center city, and the sprawling city, which provided a theoretical basis for reshaping and redevelopment of urban space [15]. Among them, the compact city, advocating and emphasizing urban redevelopment, are considered to be the most effective urban spatial structure patterns [20–22]. At the same time, the theory of new urbanism and smart growth came into being. New urbanism advocates the creation and reconstruction of a diverse, walkable, compact, mixed-use community. And its two cores are the traditional neighborhood development theory (TND) and the transit-oriented development theory (TOD). Smart growth advocates making full use of urban stock space, emphasizing the reconstruction of existing communities, increasing residential density, emphasizing the use of buses, and redeveloping abandoned and polluted industrial land, reducing the running cost of infrastructure facilities, housing construction [23–25]. In addition, ecological planning and sustainable development have also attracted the attention of scholars, providing new vitality for the theory of redevelopment. Transportation has been taken seriously in this era, and even guided the reshaping of urban space. Regardless of the urban spatial development pattern, it involves and requires a corresponding transportation system as a support.

At the same time, many scholars have carried out a series of studies on specific issues of urban land redevelopment. For example, Savoie did an analysis on suburban redevelopment [26]; Desfor and William discussed port redevelopment [27, 28]; Horridge and Sears put forward some targeted strategies for brownfield redevelopment [29, 30]. In these specific issues, they all involved dealing with the transportation system during redevelopment.

## (2) Practice and Regulations

These theories of urban redevelopment planning are closely related to the development of cities. They originate from practice, transcend practice, and in turn guide practice. Therefore, with the development of theories, the practice, related laws and policies are constantly improving.

In early practice of urban redevelopment, the most influential one was the Paris Planning run by Osman, a French officer, in the nineteenth century. Since 1853, the 17-year urban renewal of Paris has basically completed the transformation from an old Paris to a new Paris [31]. In the reconstruction of Paris, comprehensive arrangements have been made for roads, housing, municipal construction and land management. Some traffic measures, including the reconstruction and expansion of railway stations, the construction of a railway network around the city, and the reconstruction and expansion of roads leading to urban areas, have saved the transportation system of Paris which is all most paralyzed [32]. The renovation of Paris has made a useful exploration for urban renovation, and the cities such as Cologne and Vienna have followed.

From the end of the nineteenth century to the middle of the twentieth century, there were cases of redevelopment in big cities, but most of them were small size with little influence. After World War II, the redevelopment of big cities in various countries became more and more active, and the relevant laws and regulations began to improve day by day.

After World War II, major cities in Europe have undergone urban renewal and renovation. Paris was once again undergoing large-scale urban renewal and transformation. In the first 20 years after war, urban renewal and transformation was mainly busy with the transformation of dilapidated urban areas and improvement of public facilities. But transformation of this stage is too pursuing modernization to ignore the urban texture, and it faced re-renovation or even reconstruction 30 years later. At the end of 1967, France promulgated *the Land Planning Act*, which made significant adjustments to the urban renewal policy. After the 1970s, it began to implement the agreed development zone system. It adopted the market operation mode of government-led and public-private cooperation, and coordinated the interests of all parties. It integrated the urban landscape, land and transportation, and was taken as an important tool for urban renewal and transformation [33]. In the late 1970s, urban renewal was regarded as the primary content of urban policy and, Paris launched large-scale renovation in the 1980s followed by a series of space renovation plans to welcome the arrival of the new millennium in the late 1990s. Traffic problems in these renovation plans have once again been put in the first place, but unlike the renovation in the 1950s and 1960s, this time they refused cars, vigorously developed public transport, and solved traffic problems through a complete subway and public transport system. In short, in the middle and late twentieth century, the large-scale urban renewal and transformation in Paris was based on long-term planning research, using the agreed development zone system as a tool; and it was rational under the guidance of space development theory, which had a far-reaching impact on the urban development of Paris [34].

In addition, the redevelopment experience of industrial zones in Birmingham-Manchester of England, Alsace-Lorraine of France, France and Ruhr of Germany, have been well known in the world [35]. Among them, the British government also published a white paper on urban regeneration policy in 1977, aiming at social, economic and cultural renewal of the city, which transformed a declined city that has become a burden of society into a social asset [36]. In order to solve the recession and achieve the revival of the inner city, the United Kingdom established the urban development corporations. A development company corresponded to a specific urban area, which is responsible for attracting private investment and building the inner city area. Since the 1980s, British cities have made considerable achievements through urban renewal. For example, Cardiff and South Wales have completed their economic restructuring and gotten out of the dilemma [37] after suffering from the decline of heavy and polluting industries such as coal and steel. Remarkable results of renewal have been achieved in London's Docklands and the Thames basin.

At the same time, urban redevelopment in the United States originated from the slum-clearance movement to revitalize the urban economy after the first world economic crisis. From the end of the nineteenth century, it mainly experienced the following stages. (1) From the end of the nineteenth century to the early 1930s, the main manifestation is the beautification movement of the city. The United States Congress passed the *Urban Reconstruction Act* in 1867 and New York promulgated the *Zoning Ordinance* to control land use and building height, which were amended into the zoning resolution in 1961 to adapt to the new situation [38]. (2) From the early 1930s to the early 1970s, there were large-scale urban renewal plans [39] during this period, the *Housing Act* was promulgated in 1937, and it was revised by the United States government in 1949 based on its practical experience. In 1954, the act was identified as a city renewal plan to eliminate degraded areas. Since then, the United States has launched a large-scale urban renewal and development plan [40]. (3) From the early 1970s to the end of the twentieth century, it was mainly urban replacement. Urban renewal plan was abolished by Congress in 1973, and then Community Development Project was adopted in 1974. And (4) From the end of the twentieth century to nowadays, it is mainly government-led urban regeneration under the concept of smart growth [12]. *Smart Growth* is a city growth strategy against urban sprawl [41, 42], which covers planning, land, transportation and other aspects. Filling development and redevelopment are two technical measures to improve land use intensity advocated in smart growth management. This strategy has been widely recognized and strongly advocated by many states of the United States. In 2000, the National Center for Smart Growth (NCSG) was established at the University of Maryland to study smart growth and related land and transportation issues and to conduct practical research on smart growth programs and regional growth programs in Maryland. In 2002, the American Planning Association (APA) developed a legislative guidance manual on smart growth [23, 43].

Apart from Europe and America, the urban redevelopment in East Asia is represented by Japan and Korea. At the end of the nineteenth century, there is rapid rise of industrialization and urbanization in Japan, but infrastructure cannot keep up with the pace of economy and population, which limits the further development of cities and