

城市形态对绿色交通的影响

上海四个街区的调查

Influence of Urban Form on Travel Behavior in Four Neighborhoods of Shanghai

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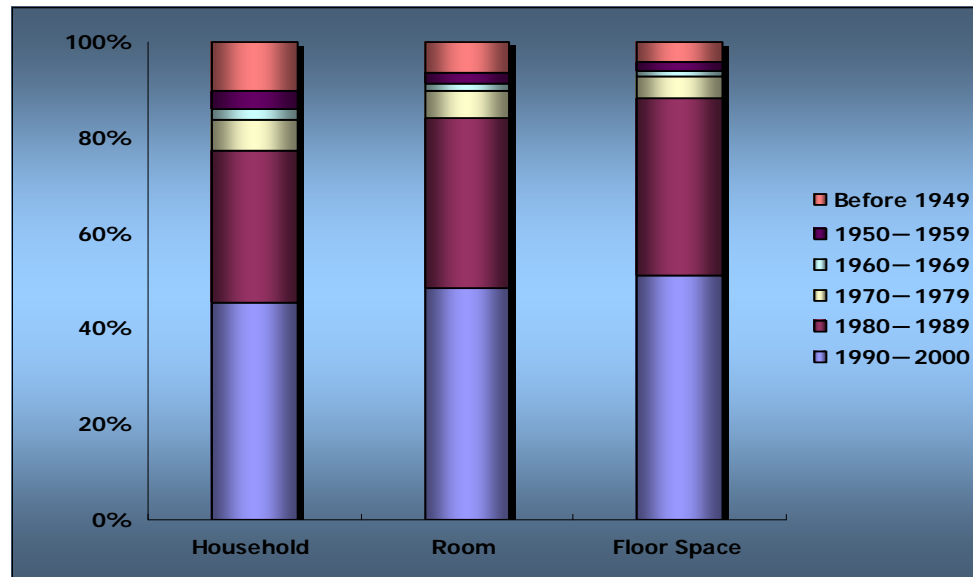
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引言 INTRODUCTION

中国城市在快速扩展

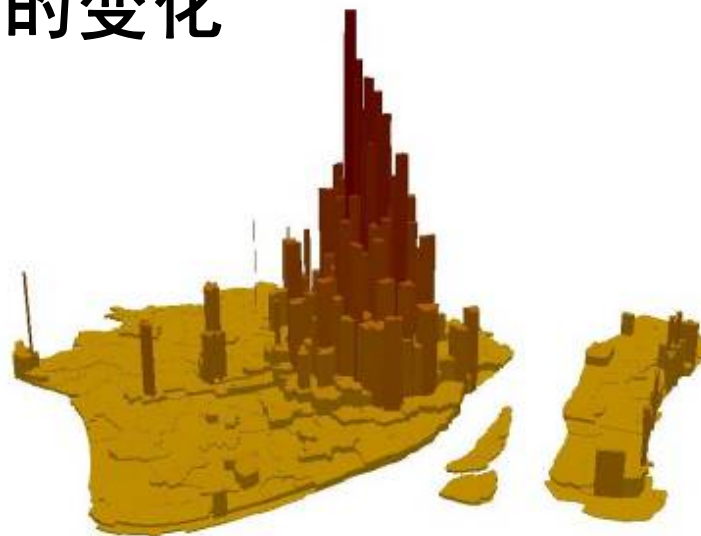
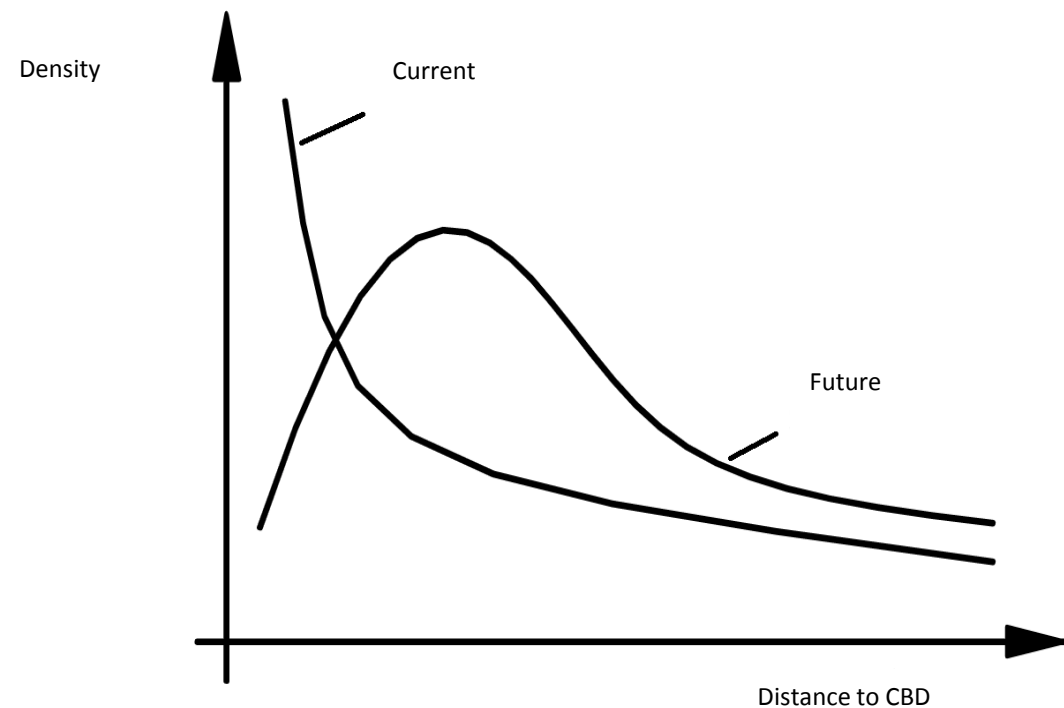
China Cities Expanded Tremendously Recently

随之而来的问题是在数量扩张的同时如何保持城市的质量
How to Maintain the Quality With the Increasing in Quantity

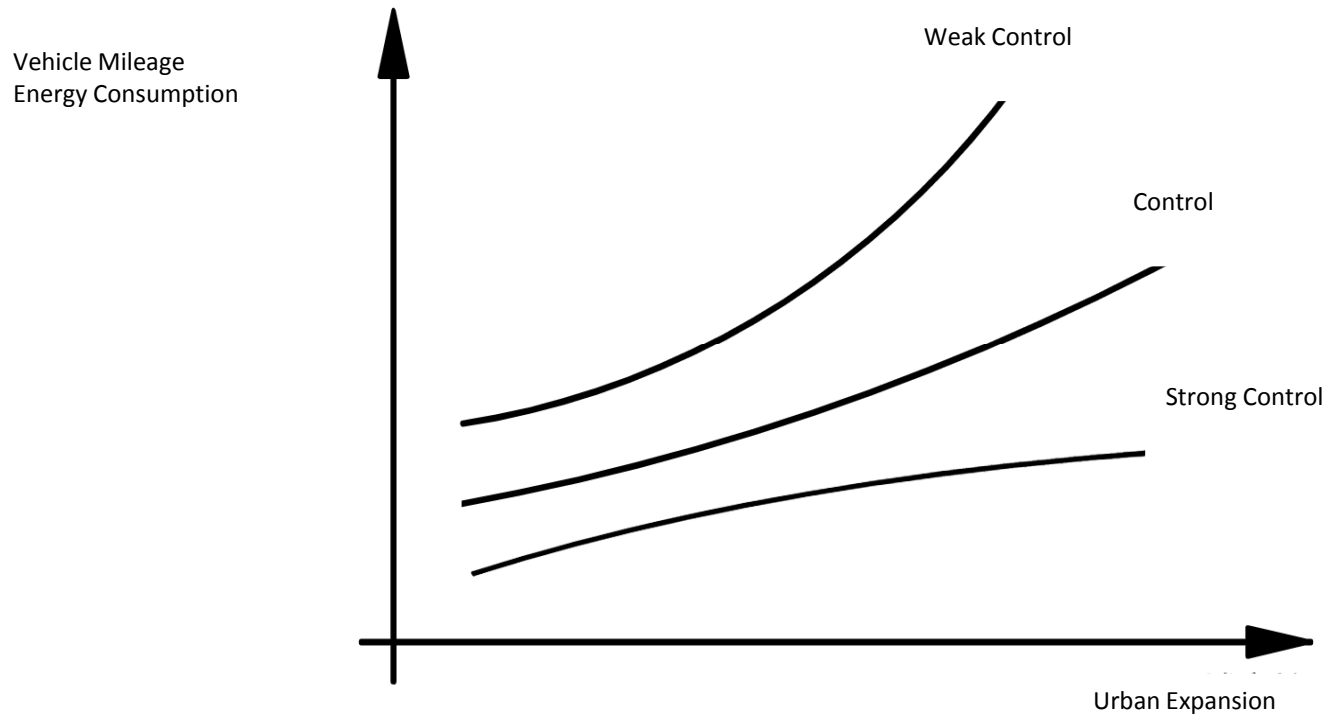


上海住房的增长(%)

城市密度曲线→空间结构的变化



Density Curve and Decentralization



城市扩展，规划控制和能源的消耗

Urban Expansion, Planning Control and Energy Consumption

Not so many countries like China , Planning can regulates both land use and transport but with competition between cities
 如何通过交通和土地使用的控制实现锁定作用-→绿色交通
 We still have the possibility to apply suitable control during urban expansion to realize the lock-in effects

新开发的批判 Criticizing the New Developments

小汽车导向式的开发 Automobile-Oriented

- 缺少 Lacking
 - 人性化的尺度空间
Human-scale public spaces
 - 社会的分异
Socially coherent
 - 社区场所特性
Place-based communities



➤ 有别于传统中国城市的肌理

Departed From The Traditional Chinese Cities

- 高密度 **High density**
- 面向步行和自行车交通的城市形态

Pedestrian and Bicycle Oriented Urban Form

Much Green, But in the Place of No Where

但是: 这些新开发对人们出行行为,绿色交通的影响如何?

**BUT: What's Impact on People's Travel Behavior
of The New Development?**

城市形态对交通可持续发展的重要性

Importance of Urban Form on Sustainable Transport

- 探索新的发展路径 Exploring the New Paths
- 面临高速机动化的压力 Fast-paced Motorization
- 日益严重的环境和社会问题的挑战
Associated Environmental and Social Challenges

城市规划策略应对

Urban Planning Strategies:

鼓励非机动化出行，或“绿色交通”

Encourage Non-Motorized Travel, or “Green Transportation”

城市形态和交通的已有知识

Knowledge We Have – Urban Form/Transport

学界的高度兴趣 Considerable Scholarly Interest

大量的研究论文 Large Literature on This Subject

但大多研究针对工业化国家，几乎没有国内的研究

BUT most based on industrialized countries, not for China

研究假设 Hypotheses:

高密度小街坊的传统街区设计将使人们

Traditional Neighborhood with High Densities and Small
Street Blocks Will

出行距离更短

Shorter Trip Distance

更多采用步行和自行车交通

More Walk or Bike Travel

文献综述 REVIEW OF LITERATURE

交通：城市经济和社会发展的发动机，但是也同时带来全球性的能源和环境问题

Transportation: Powerful Driver for Economic Growth, But, Also a Major Contributor to the World's Energy and Environmental Problems

交通出行是人们必须克服空间的障碍以参与社会经济活动，交通出行本身并非是最最终的目的。因此，通过土地使用规划可以改变人们的交通出行的行为。

Travel for Overcoming the Spatial Barrier to Participation in Socio-Economic Activities, NOT an End Itself, and Therefore can be Effectively Modified Through Land Use Planning

文献综述 REVIEW OF LITERATURE

但是：城市建成环境与人们交通出行的行为之间的关联确
出奇地难以琢磨：

Giuliano, 1995; Boarnet and Sarmiento, 1998;
Crane, 2001; Krizek, 2003

非常明显：大都市地区的总体空间结构——
对人们的工作出行的行为有十分显著的影响

仍然不太清楚：城市街区的设计特征，土地使用如何影
响人们的出行行为

原因何在? Why

- 工业化国家城市建设环境的改善速度缓慢，规模小

In Industrialized Country Built Environment Usually Takes a Relatively Slow Pace, Small Scale

对城市整体建成环境改善的作用非常有限

Marginal Effect on the Overall Built Environment of the Metropolitan Area

过低的密度，基本的社会经济活动也非常依赖与小汽车

Very low Densities and Highly Dependent on the Automobile for very Basic Economic Functions

➤ 因此工业化国家对土地使用和交通相互关系的研究，也许并不适用于快速发展的国家

Empirical Studies of Land Use-Transportation Relationship in Industrialized Country therefore, may NOT be Applicable to Countries Undergoing Fast-paced Economic Growth and Urban Development

在快速发展的国家土地使用规划对城市建成环境有非常直接和显著的影响

In These Countries, Current Land Use Planning can Generate an Immediate and Significant Impact on the Built Environment at the Metropolitan Scale

研究方法 RESEARCH METHODOLOGY

城市选择——上海快速发展为我们提供了一个非常经典的案例

City Selection: Shanghai an Excellent Case

可持续发展已经成为城市的战略目标

Sustainable Development as a Key Component of its Strategic Goals

这里既有传统的邻里单元，也有新的开发

Traditional Neighborhoods, New Developments

机动车的迅速增长

Rapid Increase in the Number of Motor Vehicles

公交，自行车和步行出行的比例在下降

Mode Shares for Public Transportation, bicycle, and Walking Declining.

问题：规划如何能够鼓励传统的交通模式？

QUESTION: How to Encourage the Use of Traditional

Modes of Travel.

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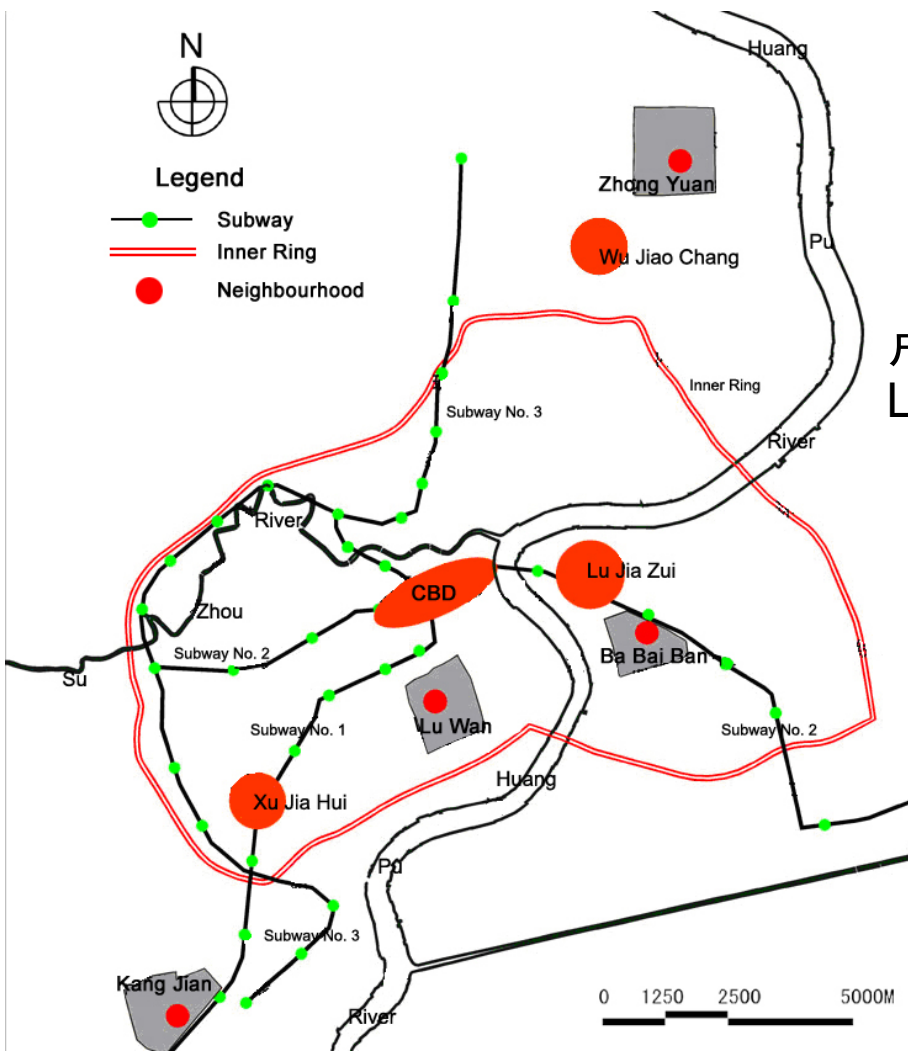
问题：规划如何能够鼓励传统的交通模式→绿色交通？

QUESTION: How to Encourage the Use of Traditional Modes of Travel.

- 选择几个城市设计特征非常不同的街区进行研究Select Several Neighborhoods with Contrasting Urban Form Characteristics for the Study.
- 问卷调查搜集交通出行行为的数据 Questionnaire Survey to Collect the Data on Travel Behavior of in the Selected Neighborhoods
- 通过回归模型确定影响城市形态与出行行为影响的显著性水平 Regression Models are to Identify the Statistical Significance and Substantive Importance of Urban Form Characteristics in Influencing People's Travel Behavior

所选的四个街区

The Four Selected Neighborhoods



区位 Location

卢湾和八百伴接近城市的中心
Lu Wan and Ba Bai Ban near the CBD

康健和中原接近城市的两个副中心，分别是徐家汇和五角场
Kang Jian and Zhong Yuan near the Edge of Central City Proximate to Two Major Sub-center

所选的四个街区 **The Four Selected Neighborhoods**

卢湾是上世纪三、四十年代建设的传统里弄街区

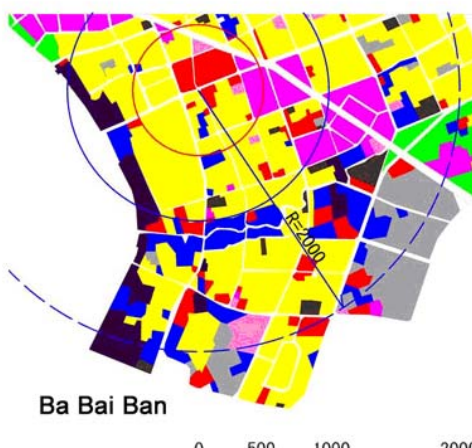
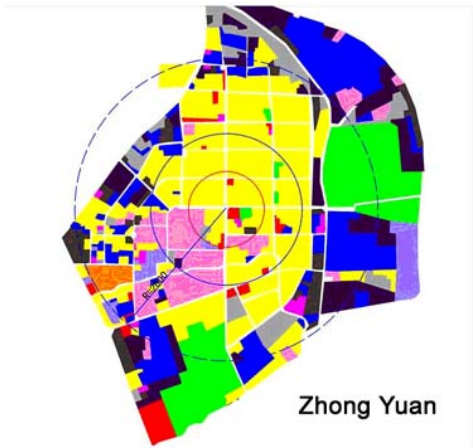
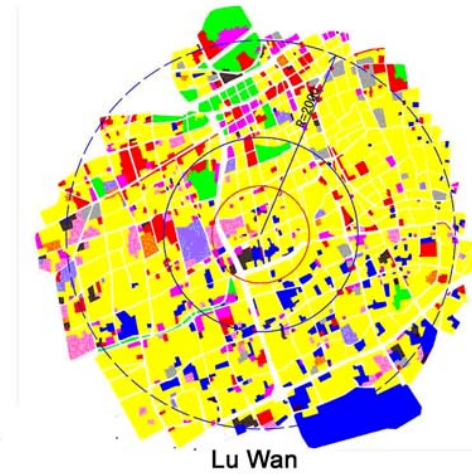
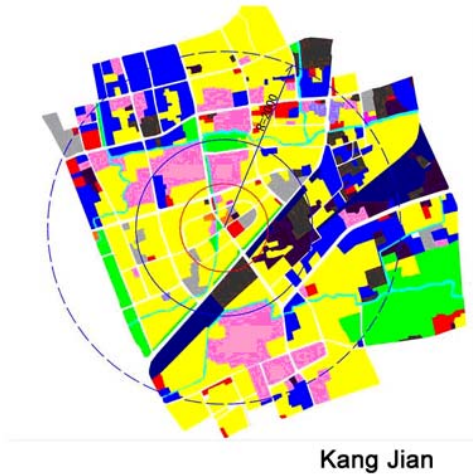
Lu Wan is an Old-styled Neighborhood Built in the
1930s and 1940s

其余的几个地区都是在1980~1990年代建设

Other Three New Residential Areas Developed in the 1980s
and 1990s.

土地使用和路网结构特点

Urban Form Characteristics in the Land Use Configurations and Street Network



Legend

- Residence
- Commercial
- Bussiness
- Educational
- Hospital
- Entertainment
- Manufacture
- Warehouse
- Unused Land
- Utilities
- Green Space

0 500 1000 2000M

四个街区的土地使用

Summary of Land Use in Four Selected Neighborhoods

	康健 Kang Jian	卢湾 Lu Wan	中原 Zhong Yuan	八百伴 Ba Bai Ban
	(%)	(%)	(%)	(%)
Residential 居住	38.87%	54.16%	30.03%	43.95%
Commercial 商业	2.53%	5.69%	2.15%	6.79%
Office 办公	0.09%	3.15%	0.92%	8.32%
Education 教育	11.25%	2.93%	7.36%	1.61%
Entertainment 文娱	0.21%	0.50%	0.95%	0.26%
Medical 医疗	0.41%	1.72%	2.81%	0.29%
Manufacture 工业	11.84%	7.95%	17.31%	9.04%
Warehouse 仓储	3.05%	0.18%	9.59%	6.11%
Roads 道路	10.22%	16.87%	6.05%	9.05%
Utilities 市政设施	8.37%	1.22%	5.34%	1.92%
Open space 绿地	8.17%	3.97%	12.74%	3.18%
Vacant 空地	2.63%	1.65%	4.75%	8.76%
Water/River 水域	2.35%	0	0	0.73%
TOTAL 总计	100.00%	100.00%	100.00%	100.00%

卢湾 Lu Wan

主要以居住用地为主，典型的传统街区，高密度，土地混合使用和人性化的街区尺度

Primarily a Residential Neighborhood , Typical Traditional, Mixed Use, Human-scale Neighborhood

中原 Zhong Yuan

圈城状土地使用，中心是居住用地，周边是工业、仓储和市政设施用地

Ring-shaped Land Use Pattern, Residential at the Center
Surrounded by Industrial, Warehouse, and Utilities

- 土地使用功能划分非常明确

Different Land Uses Clearly Separated

- 商业和服务业用地缺乏

Lack of Commercial Services

- 道路面积有限

Limited Road Surface.

八百伴 Ba Bai Ban

- 位于浦东，90年代以后发展起来
Located in Pudong, Newly Developed in the 1990s.
- 土地使用划分功能明确
Different types of land use spatially separated,
- 道路面积占到9%的比例，但道路很宽
9% of the Land is for Roads, But Wide

康健 Kang Jian

- 附近有相当大的工业和教育用地
Relatively Large Areas for Industrial and Educational Uses,
- 商业用地的比例较小
Small Land Allocation for Commercial Services
- 土地使用混合的程度较低
The level of Mixture of Different Uses is also Quite Low

街道布局 Street Network Layout

卢湾街道密集，具有高度的可达性和连通性

Lu Wan densest and most accessible street network

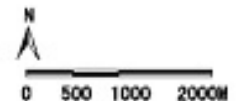
新开发地区，大街坊，道路设计着重考虑机动车辆的快速通过

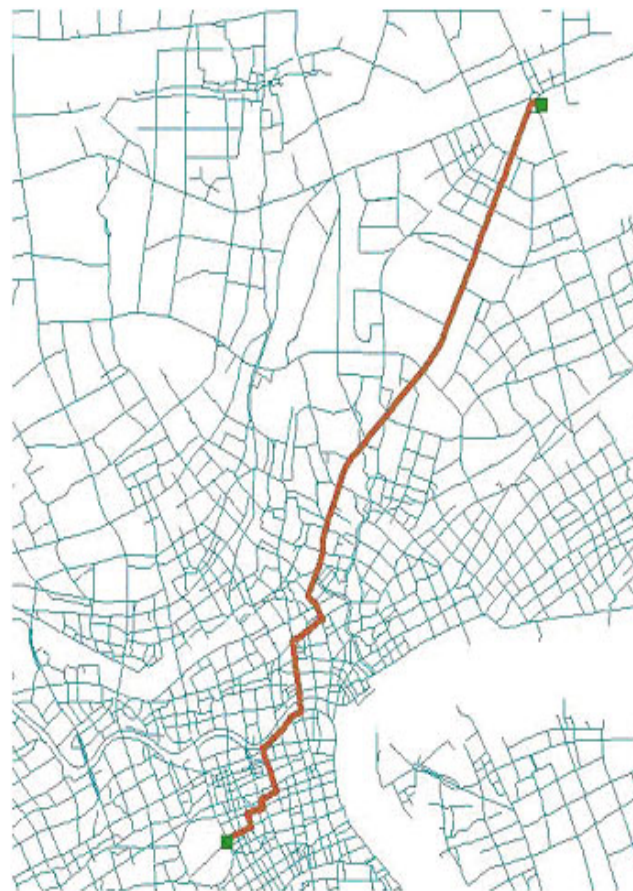
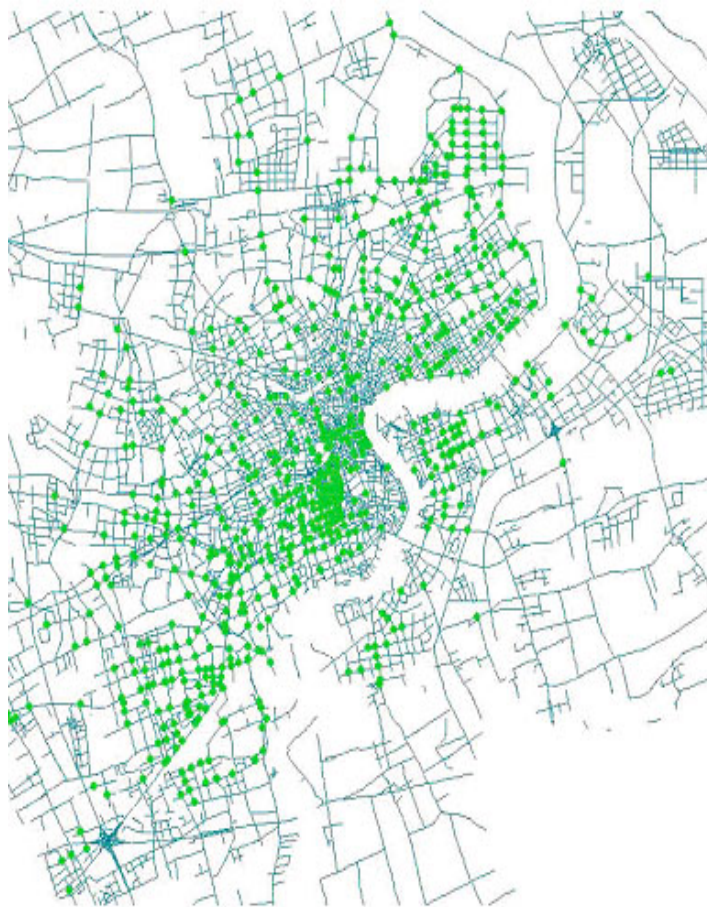
Newer Developments :
Large-sized Street Blocks,
Focusing on the Travel
Speed of Motorized
Vehicles



Legend

- Railway
- Express road
- Two-way road
- One-way road
- River





通过ArcView 计算距离

Distance Calculated by ArcView

社会经济变量的描述性统计

Summary Statistics of the Socio-Economic Variables

Variable (变量)	Mean (均值)	Std. Dev. (方差)	Min. (最小)	Max. (最大)
Age (years) (年龄)	36.39	14.49	16	65
Gender (female=1) (性别, 女=1)	0.48	0.50	0	1
H.H. Size (# of persons) (家庭人口)	3.19	0.97	1	13
Personal Monthly Income (CNY) (月收入)	3057.39	2167.69	500	12000
Trip Time (minutes) (出行时间)	29.44	32.03	2	712
Trip Distance (meters) (出行距离)	5324.21	5375.39	37.30	31990.66
# of Bicycles in H.H. (自行车拥有)	1.32	0.96	0	7
# of Car in H.H. (小汽车拥有)	0.07	0.28	0	3
# of Mopeds in H.H. (助动车拥有)	0.26	0.50	0	4

N=1819

四街区的方式划分

Sample Modal Shares in Four Selected Neighborhoods

Mode (方式)	Kang Jian (康健)		Lu Wan (卢湾)		Zhong Yuan (中原)		Ba Bai Ban (八百伴)	
	Counts	%	Counts	%	Counts	%	Counts	%
Non-Motorized (非机动化)	166	36.97	399	71.51	344	53.17	69	42.33
Transit (公共交通)	225	50.11	121	21.68	265	40.96	74	45.40
Driving (开车)	58	12.92	38	6.81	38	5.87	20	12.27
Total (总计)	449	100	558	100	647	100	163	100

Non-Motorized Modes: Walk, Bicycle, E-Bike 非机动车包括: 步行, 自行车, 助动车

Transit: Bus, Metro 公交包括: 地面公交和轨道交通

Driving: Motorcycle, Taxi, Car 开车包括: 摩托, 出租车和小汽车

回归分析 Regression Analysis

出行距离 Trip Distance, 连续变量 Continuous Variable ,
一般最小二乘法 OLS Method

方式选择, 离散变量, 多元对分模型

Modal Choice, Discrete Variable: Multiple Logistic Regression

➤ 方式的特征

Modal Characteristics,

➤ 出行者的社会经济特征

Traveler Socio-Economic Characteristics

➤ 背景特征 Contextual Factors (哑元变量 Dummy Variable)

回归分析 Regression Analysis

对分模型 Logistic Regression Model

$$LN(P_{transit} / P_{NMM}) = \beta_{t0} + \beta_{t1}X_1 + \beta_{t2}X_2 + \dots$$

$$LN(P_{car} / P_{NMM}) = \beta_{c0} + \beta_{c1}X_1 + \beta_{c2}X_2 + \dots$$

$P_{transit}/P_{NMM}$ and P_{car}/P_{NMM} 分别表示选择公共交通，开车与非机动方式的发生比率

$P_{transit}/P_{NMM}$ and P_{car}/P_{NMM} give the odds ratios of choosing transit and car over choosing non-motorized modes, respectively

回归分析的结果

RESULTS OF REGRESSION ANALYSIS

出行距离 Trip Distance

高收入和车辆拥有者，长距离出行

Higher Income and Ownership of Car, Longer Travel Distance,

出行距离与年龄，性别和是否在卢湾与出行距离成反比关系

Age, Gender (female), and Residential Location (Lu Wan)

Variables Negatively Correlated

特别是卢湾地区区位因素影响最为显著

Home in Lu Wan is the Most Significant Variable for Explaining
Trip Distance.

出行距离的回归

Regression Results for Trip Distance

	Coef.	Std. Err.	T-Stat
Constant	7394.0	593.6	12.46
Personal Monthly Income (CNY)收入	236.5	117.8	2.01
Age (years)年龄	-433.7	83.0	-5.23
Gender (female=1)性别	-693.3	241.9	-2.87
H.H. Size (# of persons)家庭人口	-72.5	124.6	-0.58
# of Car in H.H.车辆数	1290.8	442.2	2.92
Home in Lu Wan (1: yes; 0: otherwise)在卢湾 (哑元变量 1:是, 2:其它)	-2835.8	262.5	-10.80

Number of obs. = 1819

F (6, 1812) = 31.97

Prob > F = 0.0000

R-squared = 0.0957

Adj R-squared = 0.0927

方式选择 Mode Choice

Part1 选择公共交通与步行自行车的比率

Part 1 odds ratio of choosing transit vs. walk/bike

Part 2 选择开车与步行和自行车的比率

Part 2, odds ratio of choosing driving vs. walk/bike

出行方式选择的多元对分回归分析

Multiple Logistic Regression of Travel Mode Choice

	Odds Ratio	Coef.	Std. Err.	z
<i>1. The odds of choosing transit as compared to walk or bike(公家与非机动车)</i>				
Trip Time(出行时间)	1.068	0.029	0.004	17.40
Personal Monthly Income (CNY)(收入)	1.156	0.063	0.070	2.39
Age (years)(年龄)	0.813	-0.090	0.035	-4.76
Gender (female=1)(性别)	1.205	0.081	0.148	1.52
H.H. Size (# of persons)(家庭人口)	0.872	-0.059	0.058	-2.04
# of Car in H.H.(车辆数)	0.828	-0.082	0.223	-0.70
Home in Lu Wan(是否在卢湾)	0.471	-0.327	0.067	-5.33

2. The odds of choosing driving mode as compared walk or bike(开车与非机动车)

Trip Time 出行时间	1.025	0.011	0.006	4.16
Personal Monthly Income (CNY) 收入	1.294	0.112	0.115	2.90
Age (years) 年龄	0.865	-	0.057	-2.21
Gender (female=1) 性别	0.540	-	0.106	-3.15
H.H. Size (# of persons) 家庭人口	0.786	-	0.085	-2.24
# of Car in H.H. 车辆数	6.133	0.788	1.474	7.55
Home in Lu Wan 是否在卢湾	0.609	-	0.128	-2.35

Number of obs. = 1817

LR chi2(14) = 783.10

Prob > chi2 = 0.0000

Log likelihood = -1262.5604

Pseudo R2 = 0.2367

两部分分析中出行时间的系数均为正

Trip Time has Positive Coefficients in Both Parts of the Model

这表明出行时间增加，人们更不会选择步行和自行车

Means: Longer Trips, Travelers are less likely to Choose Walk or Bike

出行者交通方式选择偏好的定量分析

Quantitative Assessment of the Travelers' Modal Preference

出行时间每增加一分钟

Every Minute Increase in Trip Time

选择公交是步行和自行车可能性的 1.068 倍

choosing transit is 1.068 times higher than walk or bike

选择开车的可能性是步行和自行车的1.025倍

choosing the driving mode is 1.025 times higher than walk or bike

进一部分分析我们可以发现

More Interesting

总体来看选择公共交通的可能性是小汽车的1.043倍

Choosing Transit against Car=1.043

也就是说公共交通依然比小汽车有一定的优势

It means that transit still keeps the relative advantage over Automobile

收入因素 Income Factor

理论：

随着收入的增加人们更愿意选择更加机动性, 更加舒适的交通方式

THEORY: When income increases, people tend to switch from travel modes with lower mobility and less comfort to ones with higher mobility and more comfort

收入每增加一元 Increasing in one Yuan

选择公交与非机动车的比率为1.156 Choosing transit-NMM=1.156

选择开车与非机动车的比率为 1.294 Choosing Driving-NMM= 1.294

也就是说随着人们收入的增加

When People Becoming Richer

选择开车是乘公交的1.119倍 Choosing: 1.119 Times More Prefer Car to Transit

年龄和家庭人口 Age, Family Size

老年人和大家庭更趋向于选择步行和自行车

Old People and Big Households more like to Chose Walking and Bike

性别和车辆拥有 Gender, Car Ownership

女性和车辆拥有者非常显著地趋向于选择开车

Significant in Choosing Transit or Driving

城市形态特征 Urban form Characteristics

在卢湾人们选择步行和自行车

With the Variable of in Lu Wan, Choosing Walk or Ride a Bike

是选择公共交通的 2.12倍

2.12 times ($1/0.471=2.12$) more to take transit

是选择开车的1.64倍

1.64 times ($1/0.609=1.64$) more to drive

结论 CONCLUSION

➤ 街区的城市形态的确对人们的出行行为有显著的影响
Neighborhood-scale Urban Form Does Matter in
Individuals' Transportation Decisions

➤ 在传统老街区人们的出行距离更加短, 更易于选择非机动化的出行方式, 因此也就是更加有利于可持续发展
Traditional Neighborhoods in China, is associated
with Substantially Shorter Trip Distance and Greater
Probability for Choosing NMM, Sustainable

结论 CONCLUSION

➤小街区，高密度，土地的混合使用和基本服务设施配置的土地使用规划，城市设计可以十分有效地促进”绿色交通”和可持续发展

Land Use Planning and Urban Design, by Promoting Small Street Blocks and High Density Street Network, Mixed Land Use, and Local Provision of Basic Commercial Services, can Effectively Facilitate “green transportation” and Sustainable Development.

➤城市的新区开发和旧区改造必须遵循上述原则，但不幸的是新的建设并非如此，因而必须有所创新

New Developments Need to follow the Principle, But Quite Unfortunate Now----Innovation Important

THANKS!