
BRT PLANNING AND OPERATION
BRT
PLANNING AND OPERATION
快速公交系统
规划与运营
Paulo Sergio Custodio
November 2004


BRT PLANNING AND OPERATION
We need to know what we are looking for…
我们要清楚自己的目标…
• Transportation is only part of the problem
• Transportation may be a solution or a bigger problem
• A car oriented policy only leads to congestion, air pollution and a worse living city
• 交通只是问题之一
• 交通可以促进城市的发展，但是也可能成为城市快速发展的阻碍。
• 以小汽车为导向的政策只能导致堵塞、空气污染、城市生存条件恶化

A better use of space needs priorities
更好的空间利用需要排出优先顺序

This means integrating

- Pedestrians
- Bicycles
- Public Transportation
- Cars

需要综合规划

- 行人
- 自行车
- 公共交通
- 小汽车

It is necessary a transportation policy towards mobility
公交政策应该提高机动性

- Integration of transportation modes
  - Trunk modes
  - Feeding Modes
  - Auxiliary modes
  - Complementary modes
  - Access modes
- Fare policy

- 综合各种交通方式
  - 干线
  - 支线
  - 辅助的交通方式
  - 补充交通方式
  - 到达主要交通干线的基础设施
- 票务政策

Inadequate planning may conduct to bad answers…

规划不周可能导致很糟糕的结果…

- We need to know demand and have transportation policies to avoid situations in where we spend a big amount of money for results like:
  - Guadalajara (Mexico) Metro: takes 40% of cities budget to carry 120 thousand passengers per day (needs help of state and nation). Feasibility studies predicted 400 thousand
  - Mexico city Line B: Carries 80 thousand passengers per day. Feasibility studies predicted 350 thousand.

- **我们应该确定交通需求，避免交通政策造成以下灾难：**
  - **墨西哥瓜达拉哈拉市地铁：花费了该市 40% 的预算，每天只运载 12 万乘客。可行性研究预测运载 40 万人。**
  - **墨西哥城地铁 B 线：每天运载 8 万人，可行性研究预测运载 35 万人。**

- São Paulo Metro Line 5: cost of 700 million US$ of a 9 km line to carry 32 thousand passengers per day. Feasibility studies predicted 350 thousand.
- Brasilia Metro: cost of 1,200 million US$ to carry 10 thousand passengers per day
- Delhi Metro Line 1: 9 km at a cost of 1.8 billion US$ to carry 12 thousand passengers per day. Feasibility studies predicted 400 thousand.

- **圣保罗市地铁 5 号线：9 公里的地铁线成本花去 7 亿美元，每天运载 3.2 万人，可行性研究预测运载 35 万人。**
- **巴西利亚地铁：付出 12 亿美元的成本，每天运载 1 万人。**
- **德里市地铁 1 号线：9 公里的成本高达 18 亿美元，每天运载 1.2 万人，可行性研究预测运载 40 万人。**

Or end up with some low efficiency BRTs solutions
一些低效率的 BRT 解决方案也是如此

- Jakarta - Indonesia
- Lima – Peru
- Bogotá before Transmilenio
- São Paulo - Brasil

- **雅加达 – 印度尼西亚**
- **利马 – 秘鲁**
- **新世纪干线运营之前的波哥大**
- **圣保罗 – 巴西**

Jakarta – Indonesia BRT
雅加达 – 印度尼西亚 BRT

- Jakarta (opened Feb, 2004)
  - Small stations
  - Small buses
  - Inadequate transfer terminal

- **雅加达 (2004 年 2 月开通)**
  - **车站小**
  - **车辆小**
  - **换乘站不足**

BRT – Lima – Peru

BRT – 利马 – 秘鲁

- Only infrastructure
- Bad operation
- No management
- **只有基础设施**
- **运营很差**
- **缺乏有效管理**

BRT – São Paulo – Brazil

BRT – 圣保罗 – 巴西

- Insufficient infrastructure
- Good control
- Good management
- Small buses for the demand
- **基础设施不足**
- **控制良好**
- **管理良好**
- **相对需求来说车辆太小**

Taipei - Taiwán

Causes of unsuccessful or inefficient BRT systems
BRT 系统失败或低效的原因

- Systems were built where there was space but no demand at all (Campinas LRT, São Paulo Metro Line 5, Delhi Metro Line 1)
- Systems were not good enough to face other modes competition -Brasilia (Brazil), Guadalajara (Mexico) and Medellin (Colombia) Metro Lines
- Low investment systems (São Paulo, Jakarta, Delhi)

- **系统线路虽然有空间条件，但是没有需求 (巴西 Campinas 市的轻轨, 圣保罗地铁 5 号线, 德里市地铁 1 号线)**
- **系统不够完善，无法应对其它交通方式的竞争——巴西利亚 (巴西), 瓜达拉哈拉 (墨西哥) 和 麦德林 (哥伦比亚) 的地铁线**
- **系统投资低 (圣保罗、雅加达、德里)**

To have the best result we need good planning…
为获得最佳效果， 我们需要精心规划…

- Good demand estimations
  - Origin-destination matrices
  - Trip generation models
  - Network data
  - User behavior
- Good modeling practices

- **精确估算需求量**
  - **起点终点矩阵**
  - **出行发生量模型**
  - **网络数据**
  - **使用者行为**
- **良好的建模实践**

But first we need to develop some general concept for a BRT System
但是首先我们需要明确 BRT 系统的一些基本概念

Infrastructure
- •Exclusive bus lanes
- •Transfer terminals
- •Conventional Stations

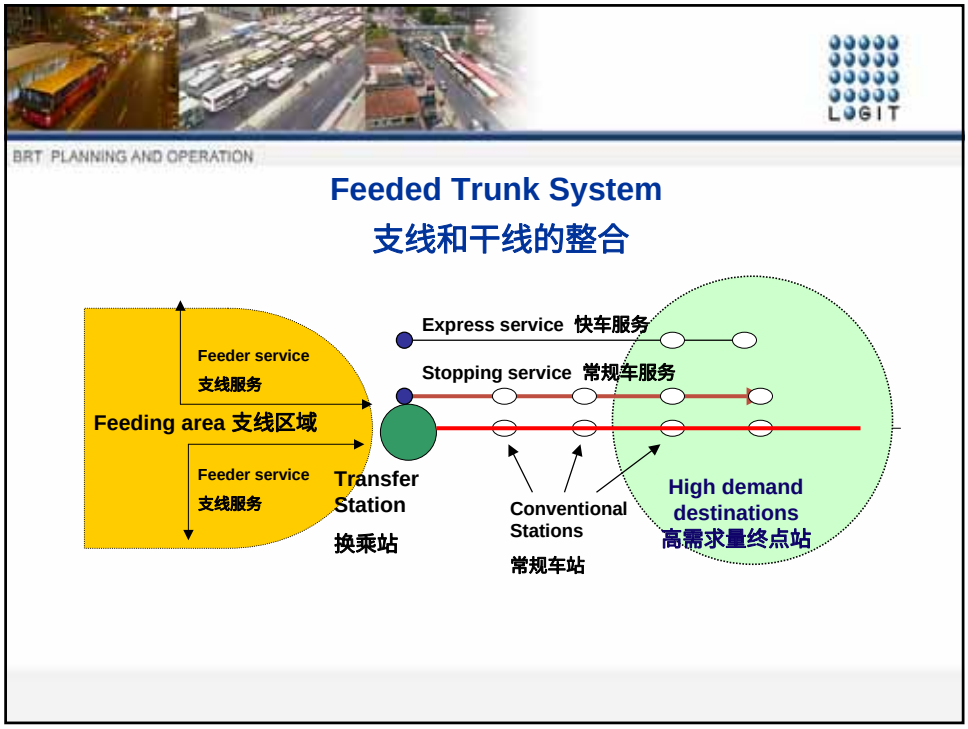
基础设施
- •公交专用道
- •换乘站
- •常规车站

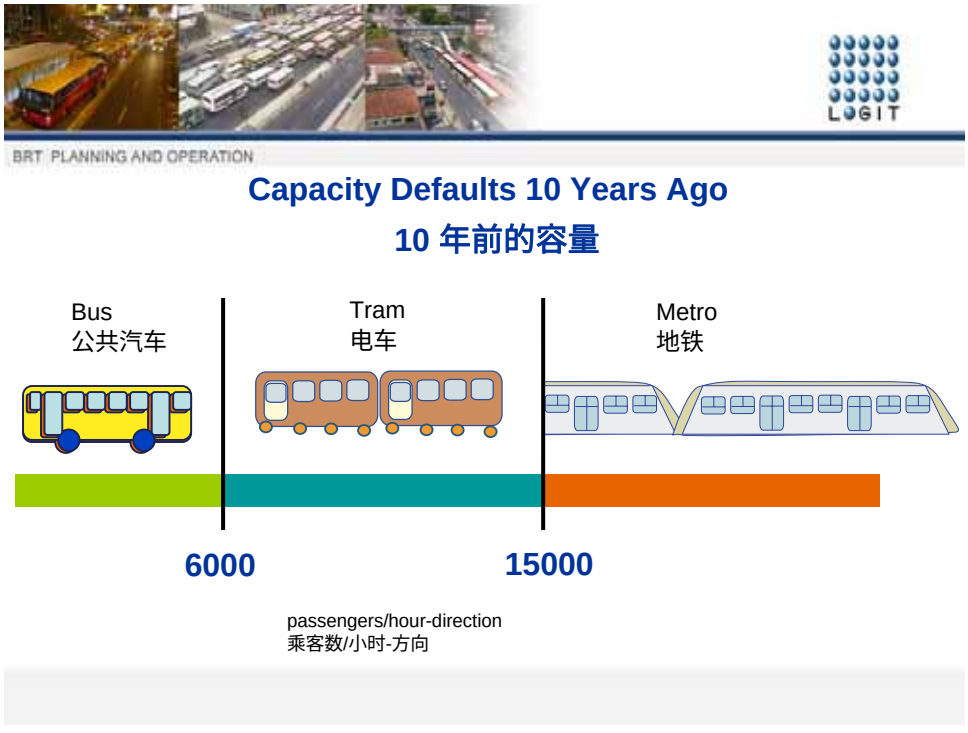
Services
- •Trunk Services
  - stopping
  - express
- •Feeding services

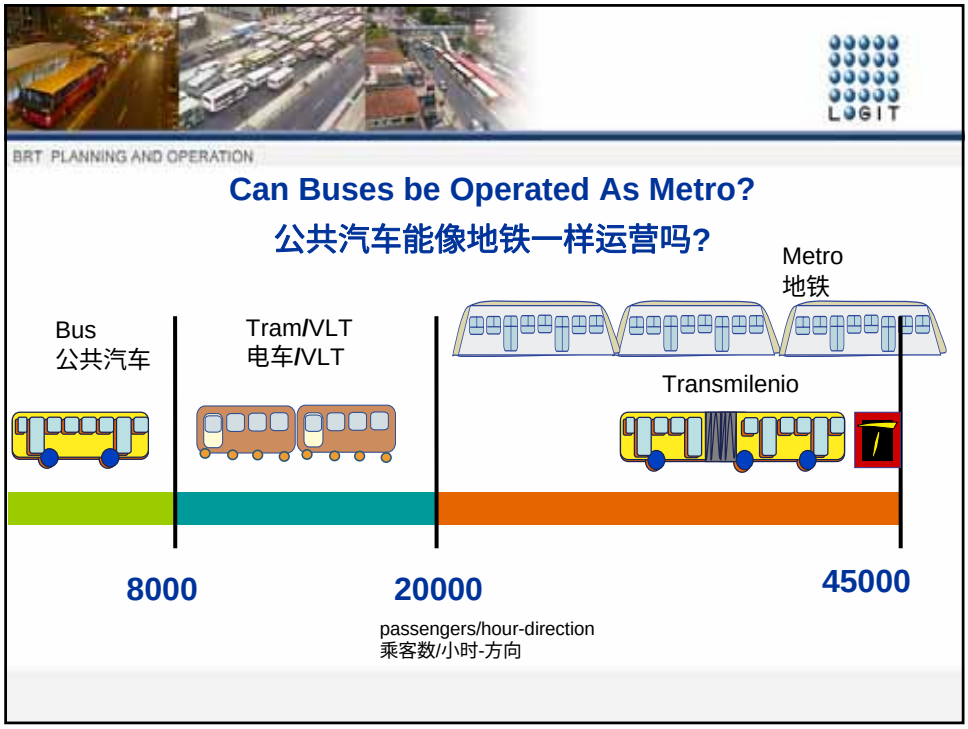
服务
- •干线服务
  - 常规车
  - 快车
- •支线服务

Institutional and operations management
- • Technical management
- • Efficient high capacity operating system
- • Commercial speeds over 20 km/h
- • Electronic fare collection system
- • Control system
- • New modern buses

制度与运营管理
- • 技术管理
- • 高效、高容量运营系统
- • 运营时速超过 20 公里/小时
- • 电子检票系统
- • 控制系统
- • 新的现代公共汽车


BRT PLANNING AND OPERATION
LOGIT
Feeded Trunk System
支线和干线的整合
Feeder service
支线服务
Feeding area 支线区域
Feeder service
支线服务
Transfer
Station
换乘站
Express service 快车服务
Stopping service 常规车服务
Conventional
Stations
常规车站
High demand
destinations
高需求量终点站


BRT PLANNING AND OPERATION
LOGIT
Capacity Defaults 10 Years Ago
10 年前的容量
Bus
公共汽车
Tram
电车
Metro
地铁
6000
15000
passengers/hour-direction
乘客数/小时-方向


BRT PLANNING AND OPERATION
LOGIT
Can Buses be Operated As Metro?
公共汽车能像地铁一样运营吗?
Metro
地铁
Bus
公共汽车
Tram/VLT
电车/VLT
Transmilenio
8000
20000
45000
passengers/hour-direction
乘客数/小时-方向


BRT PLANNING AND OPERATION
LOGIT
Buses can be operated better than metros…
公共汽车可以比地铁表现更好…
• High capacity – for most of the demands generated in most of the cities
• High speed – Transmilenio has an average speed of 26.6 km/h that can be considered very good as compared with São Paulo Metro that has an average speed of 30 km/h
• More flexibility to attend demand
• Much lower costs (investment and operational)
• It is sustainable over time with no subsidy on operations
• 容量高 – 能满足大多数城市的大部分需求
• 速度快 – Transmilenio 公共汽车的平均速度为 26.6 公里/小时，与圣保罗地铁的 30 公里/小时相比确实不慢
• 在满足需求方面更加灵活
• 成本低得多 (投资成本与运营成本)
• 无需补贴靠自身运营实现可持续发展

A BRT needs good standards…

BRT 需要较高标准…

- Speeds – over 22 km/h
- Capacity – up to 48,000 passengers per hour per direction
- Reliability – operation control
- Safety – closed stations and operation control
- Comfort – stations, terminals and vehicles
- Sustainability

- **速度 – 高于 22 公里/小时**
- **容量 – 单向每小时高达 4.8 万乘客**
- **可靠性 – 运营控制**
- **安全性 – 封闭型车站与运营控制**
- **舒适性 – 车站、换乘站、车辆**
- **可持续性**

BRT has many versions

BRT可以有各种模式

- Some with capacity but low performance
- Some with high performance but low capacity
- The challenge is to have high capacity with high performance

- **容量大，但运行状况不佳**
- **运行状况良好，但容量不够**
- **如何建成容量大且运行状况良好的BRT系统是一个挑战**

To get a successful BRT
获得一个成功的 BRT

- Planning, infrastructure, management and operational design must be integrated
- Infrastructure and operational design must be made at the same time
- Managers and operators need to be trained before starting operations of the system

- 必须整合规划、基础设施、管理、运营方案设计
- 基础设施与运营方案设计应同时进行
- 系统投入运营前需培训管理方与运营商

The bottleneck of a BRT system is stations and terminals design
车站和换乘站是 BRT 系统的瓶颈

- The capacity of the system is calculated at the station
- The station also has a capacity in terms of passengers that is related to its internal space
- Terminals also needs to be efficient in the way they do not produce delays to the operation
- Another problem is the location of the garages to avoid “dead km” to the system.

- 系统的容量基于车站计算
- 车站的容量也与其内部空间能容纳的乘客量有关
- 换乘站也需高效，不能造成系统运营的延误
- 另一个问题是停车场的地点，要避免系统的“死亡段”

To get speed and capacity a BRT needs
实现快速公交系统所需的速度和容量

- To minimize delays at stations and terminals
- To use express services
- To avoid saturation of stations

- 将车站和换乘站的延迟降到最低
- 使用快车服务
- 避免车站饱和

We tried before several solutions
我们曾尝试多种方案

- Use the right lane
- Use central lanes with stations on the right hand side
- Use central lane with central stations with buses with doors on the left side
- And we got some conclusions:

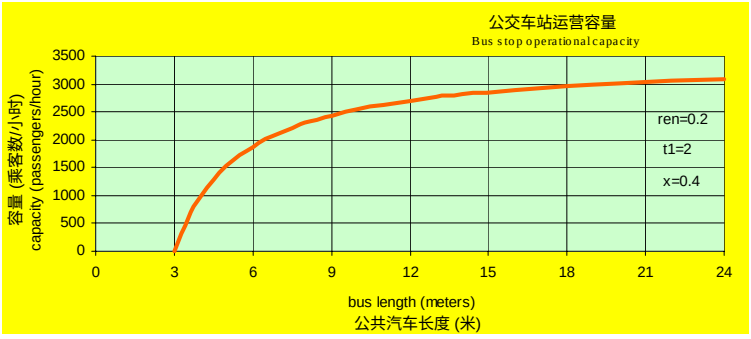
- 使用右侧车道
- 使用中间车道，车站建在右侧
- 使用中间车道，中央车站，车辆左开门
- 我们的结论：

- Central stations with buses with left side doors is the best solution
- Station design needs to meet capacity with hign performance
- **中央车站、左开门是最好的方案。**
- **车站的设计既要考虑到容量需求，有要保证良好的运行。**

BRT PLANNING AND OPERATION

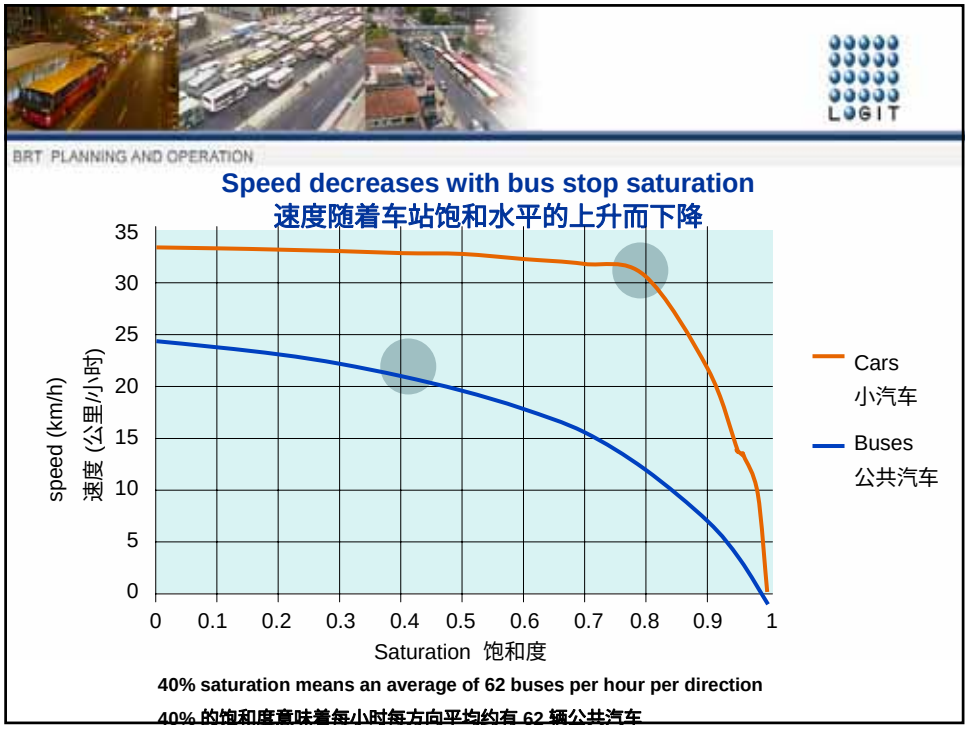
A normal bus has low capacity if you keep low delays at stations

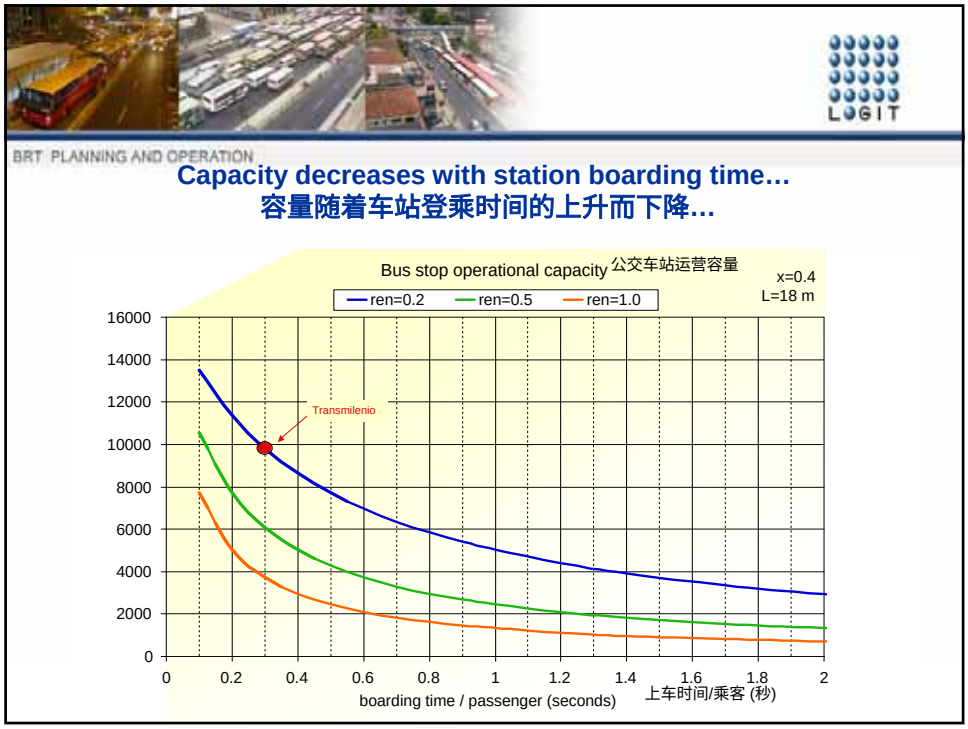
如果在车站的延迟时间较短，正常情况下公共汽车的载客量就低



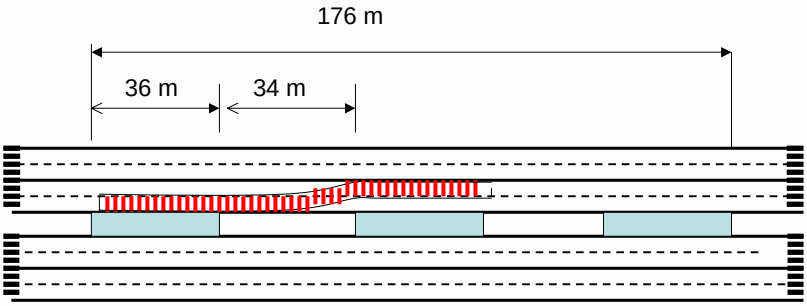
ren = renovation index 更新指数 **t1** = boarding time 上车时间

x = saturation index 饱和指数


BRT PLANNING AND OPERATION
LOGIT
Speed decreases with bus stop saturation
速度随着车站饱和水平的上升而下降
speed (km/h)
速度 (公里/小时)
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Saturation 饱和度
Cars
小汽车
Buses
公共汽车
40% saturation means an average of 62 buses per hour per direction
40% 的饱和度意味着每小时每方向平均约有 62 辆公共汽车


BRT PLANNING AND OPERATION
LOGIT
Capacity decreases with station boarding time…
容量随着车站登乘时间的上升而下降…
Bus stop operational capacity 公交车站运营容量
x=0.4
L=18 m
ren=0.2
ren=0.5
ren=1.0
16000
14000
12000
10000
8000
6000
4000
2000
0
Transmilenio
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
boarding time / passenger (seconds)
上车时间/乘客 (秒)

For higher demand we need stations with sub stops
在更高需求情况下，我们的车站需设多个站台



Single bus stop can have a maximum capacity of 9 thousand passengers per hour per direction using articulated buses.

使用铰接车，每个站台可以实现每小时单方向运力达到９千人。

Sub stops need overtaking lane at the stations

车站外需设超车道

Outside fare collection improves boarding time…
站外检票可缩短上车时间


BRT PLANNING AND OPERATION
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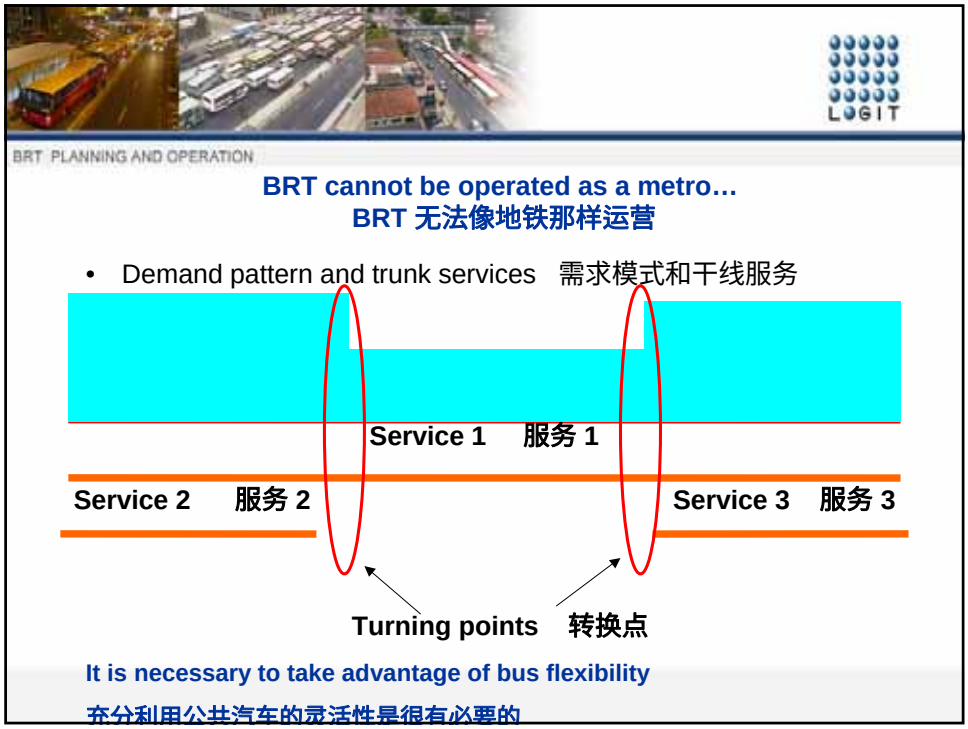
Transmilenio uses sub stops and overtaking lane...
Transmilenio 使用了多站台和超车道


BRT PLANNING AND OPERATION
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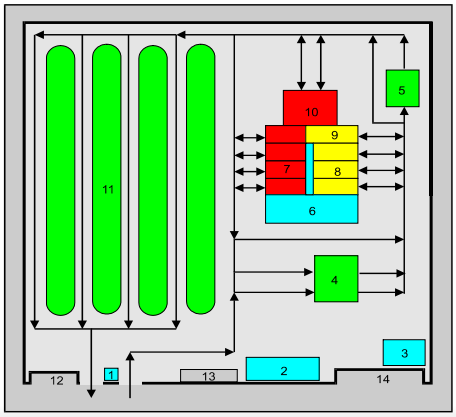
BRT cannot be operated as a metro…
BRT 无法像地铁那样运营
• Demand pattern and trunk services 需求模式和干线服务
Service 1 服务 1
Service 2 服务 2
Service 3 服务 3
Turning points 转换点
It is necessary to take advantage of bus flexibility
充分利用公共汽车的灵活性是很有必要的

Speed and capacity can be improved with express services
可利用快车服务改善速度和容量

Bus depot also needs to be efficient
车库同样需要保持高效

1- Entrance Gate
2- Administration
3- Social Area
4- Fuelling Area
5- Cleaning area
6- Spare parts supply area
7- Corrective maintenance
8- Preventive maintenance
9- Lubrication, body repair and painting
11- Parking lot
12- Private parking
14 Parking area



1- 入口
2- 管理区
3- 公共区域
4- 加燃料区
5- 清洁区
6- 零配件供应区
7- 故障检修
8- 预防性维护
9- 润滑、车身修理和上漆
11- 停车场
12- 私人停车区
14 停车区

You may have a wide variety of solutions…
您可以有多种解决方案…

Improvement 改进	Capacity 容量	Boarding time 上车时间	Sub-stops 附属站点	Express lines% 快线%	Lanes 车道
		t1	Nsp	Dir	
original 原始	3,000	2	1	0	1
level platform 水平登乘	5,000	1	1	0	1
outside collecting 车外检票	9,400	0.33	1	0	1
bus convoys 编组运营	16,000	0.33	4	0	1
sub-stops 多　站台	28,200	0.33	3	0	2
express lines 快线	36,700	0.33	3	40%	2
express lines 快线	43,000	0.33	3	60%	2
express lines 快线	52,000	0.33	3	80%	2

It is necessary to think on all details
有必要考虑所有细节

- Infrastructure and operational design
- Management
- Operations
- Keep good standards over time

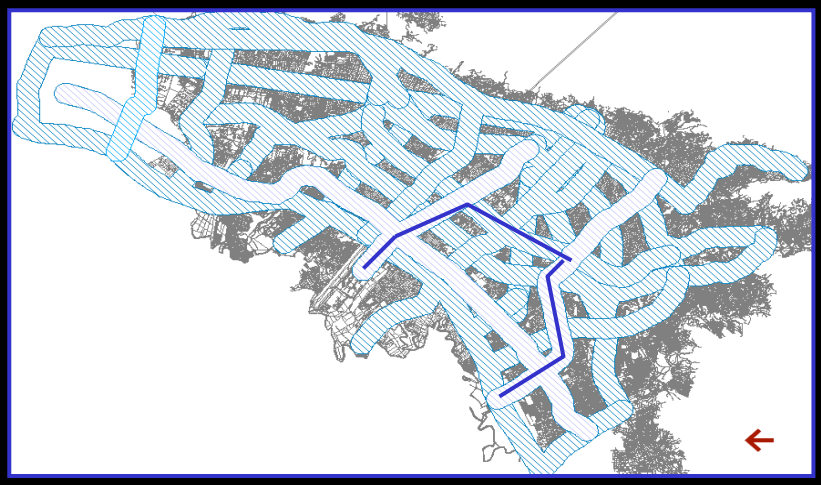
- 基础设施与运营设计
- 管理
- 运营
- 长期保持高标准


LOGIT
BRT PLANNING AND OPERATION
Thank You
谢谢您！

OPTIONS FOR FINANCING BUS RAPIDTRANSIT
快速公交系统融资方式

Walter Hook,
Kunming, China
中国昆明 2004 年11月
休利特基金会支持项目
Funded by the Hewlett Foundation

BRT is Much Cheaper than Metros
TransMilenio Versus the JICA-Proposed Metro: Same Cost
BRT 远比地铁省钱
TransMilenio 对比 JICA 地铁建议：相同的成本

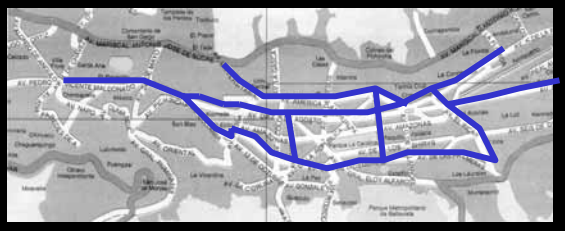


Operations Can and Should be Self Financing
运营能够也应该自负盈亏

Quito: two systems at the same cost:
基多：两种相同成本的系统

Rail system 铁路系统

Bus Rapid Transit system 公交快速通道系统



The Economics of Bus Rapid Transit
公交快速通道系统的经济性

Bus Rapid Transit
公交快速通道
$1-5 million / km
每公里 100-500 万美元

Metros and rail
地铁和铁度
$30-200 million / km
每公里 3000 万 – 2 亿美元

Steps One: Design the System from the Beginning with the following in Mind:

- Operations Should Be Financed From Fare Revenues
- Bus Procurement should be paid for by Private Bus Operators
- Ticketing system can be paid for by ticketing system operator
- Stations can be partially paid for by advertisers
- Spend Government Money on Creating the Conditions for Profitable Operation, NOT ON BUS PROCUREMENT
- Invest in sidewalks, trees, street furniture, bike parking, public space, comfortable stations, and other amenities to increase the profitability of the system.
- Don't skimp on quality of life.

步骤一：系统设计之初需要考虑以下因素：

- 运营资金应当取自车票收入
- 公交车辆的费用应当由私营公交运营商支付
- 售票系统的费用可以由售票系统运营商支付
- 部分车站建设费用可由广告商支付
- 将政府资金用于为可盈利运营创造条件，而不是用于公交车辆采购
- 对以下方面进行投资以增加系统的可盈利性：人行道、树木、街道设施、自行车停放、
  公共场所、舒适的站台以及其他便利设施
- 不要在生活品质上精打细算

TRANSMILENIO S.A.
Planning, Management and Control
规划、管理和控制

Infrastructure (Public)
- Corridors
- Stations
- Garages
- Complementary Infrastructure

基础设施（公共）
- 走廊
- 站台
- 车库
- 配套基础设施

Billeting (Private)
- Equipments
- Smart Cards
- Trust Fund

安排（私营）
- 设备
- 智能卡
- 信托基金

Operation (Private)
- Companies
- Buses
- Employees

运营（私营）
- 公司
- 公交车辆
- 员工

Division of Responsibility and Financing Between Public and Private Sectors
公、私部门间的责任、财务划分

Public Sector
公共部门

- Infrastructure construction (IDU)
- 基础设施建设
- Planning (City, TM)
- 规划
- Development; contracting service provision (TM)
- 开发，建立服务合同
- Control (TM)
- 控制

Contracts
合同

Private Sector
私人部门

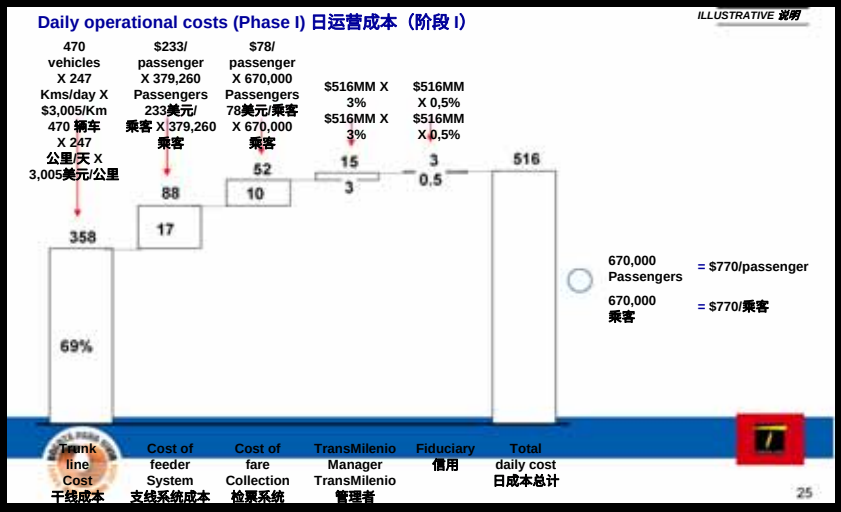
- Bus acquisition, operation and maintenance
- 车辆购置，运营和维护
- Fare collection system implementation and operation
- 收费系统运营
- Resources management (trust fund)
- 资源管理

Designing the System to be Self Financing
将系统设计为自负盈亏

- Do not try and save money on planning. BRT is performing Heart Surgery on your City. You should find the best surgeons you can, not the cheapest ones.
- Carefully estimate projected demand on the planned BRT Corridors. Requires traffic modeling
- Consider shifting from Direct bus routes to Trunk and Feeder routes.
- Consider banning competing bus services in the same corridor
- Set the technical specifications for the bus at a level that potential bus operators can afford.

- 不要打算在规划上省钱。BRT 是对“城市心脏进行手术”，应当尽可能找最好的“外科医生”，而不是最廉价的。
- 对所计划的 BRT 走廊的项目需求进行谨慎评估。 需建立交通模型。
- 考虑从直达公交线路向干线和支线的转移。
- 考虑禁止公交服务竞争对手在同一条走廊上运营
- 将公交车辆的技术规格设置在潜在公交运营商能够接受的水平。

INITIAL CALCULATIONS ESTABLISHED THAT THE INITIAL FARE FOR TRANSMILENIO SHOULD BE 40 CENTS PER PASSENGER
初步计算估计用于 TRANSMILENIO 的初始费用为每位乘客 40 美分



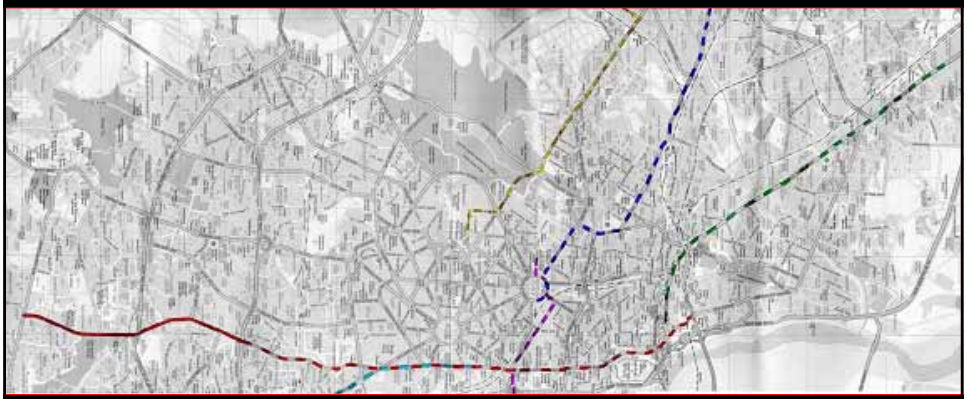
Financing Sources: System Planning
融资来源：系统规划

Local and national Sources 地方资源和国家资源
Bi-Lateral assistance agencies (e.g. GTZ, USAID) 双边协助机构（如 GTZ、USAID）
United Nations Development Programme (UNDP) 联合国开发计划署 (UNDP)
Grants from the Global Environment Facility (GEF) 全球环境基金的拨款 (GEF)
Loans from the World Bank and other Development Banks 世界银行和其他开发银行的贷款
Private foundations 私人基金会

TransMilenio Planning Costs
TransMilenio 规划成本

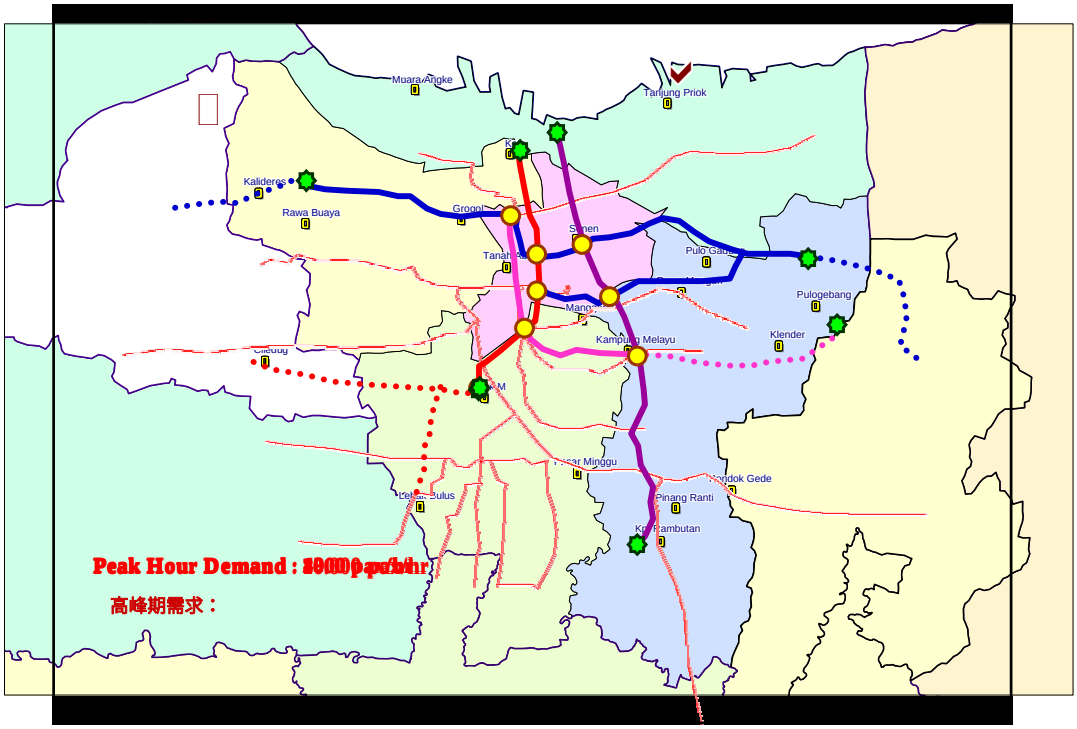
Firm Contracted	$ Amount	Paid By
McKinsey & Subcontractors	**3,569,231**	UNDP
Investment Bank	$192,308	Dept. of Transportation
Steer Davies Gleave	$1,384,615	Dept. of Transportation
Landscaping/ Architectural Designs	$115,385	Dept. of Transportation
Total	$5,261,538	
签约公司	金额（美元）	支付方
麦肯锡与分包商	**3,569,231**	UNDP
投资银行	$192,308	交通部
Steer Davies Gleave	$1,384,615	交通部
风景/建筑设计	$115,385	交通部
总计	$5,261,538	

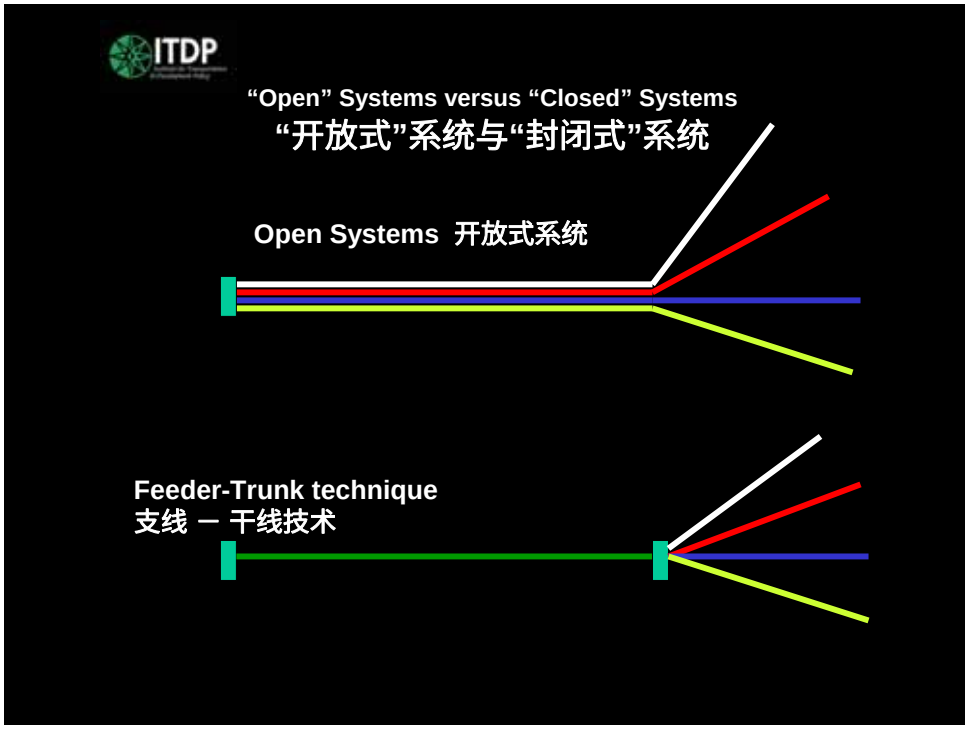
System Planning: Connecting BRT Corridors to Each Other and to other Mass Transit Options Can Dramatically increase Demand AND REVENUE
系统规划：使 BRT 走廊相互连接并与其他大批量运输方式相结合可以大大增加需求和财政收入



BRT Corridors in Delhi were selected for political purposes and do not connect. This hurts demand and REVENUES.

在德里，BRT 走廊被用作政治用途并且没有相互连接。这降低了需求也减少了财政收入。


Muara Angke
Tanjung Priok
Kalideres
Rawa Buaya
Grogol
Senen
Pulo Gadung
Pulogebang
Klender
Kampung Melayu
Pinang Ranti
Peak Hour Demand :
高峰期需求：


ITDP
"Open" Systems versus "Closed" Systems
"开放式"系统与"封闭式"系统
Open Systems 开放式系统
Feeder-Trunk technique
支线 – 干线技术

“Closed” BRT systems are more expensive but have much higher REVENUE
“封闭式”BRT 系统成本更高但收入也更高

“Quito’s Ecovia Line
基多的 Ecovia 线

“Open” BRT systems are much cheaper but less profitable
“开放式”BRT 系统相对经济但利润也相对较低

Taipei and Kunming’s “Open” BRT has cueing problems during peak hours, compromising capacity and profits

台北和昆明的“开放式”BRT 在高峰期存在潜在问题，导致客流量和利润降低。

ITDP

Bogota Before TransMilenio had an 'open' busway. It was not profitable.
波哥大在采用 TransMilenio 之前使用的是"开放式"公交车道，结果无利可图。

TransMilenio re-allocated the same 30,000 passengers per hour onto 1/3 as many buses: Profits per bus tripled.

TransMilenio 将同样每小时30,000 乘客进行重新分配，所用公交车数量为原来的 1/3：每辆公交车的利润增加两倍。

ITDP

Quito also cut the old bus lines and reallocated passengers onto 1/3 as many much larger buses, increasing profits.
基多还减少了旧的公交线路并重新分配乘客，采用大型公交车后车的数量减少了 2/3，从而增加了利润

Quito's Avenida 10 de Agosto, Before and After the HCBS System was Implemented.
多市的 Avenida 10 de Agosto 在采用 HCBS 系统之前和之后

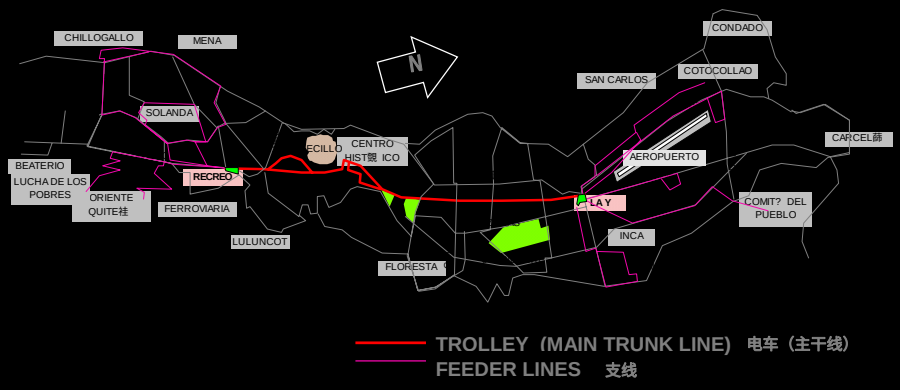
Jakarta built Asia's first 'closed' BRT system:
It just breaks even. Why?
雅加达修建了亚洲首个"封闭式"BRT 系统：
该系统仅仅达到收支平衡。原因何在？

TransJakarta did not cut parallel buses and does not have free transfers from feeder buses.
Only 5500 out of 12,000 passengers take the BRT. The rest are on normal buses.
雅加达交通部门没有削减并行公交车的数量并且
从支线公交车下车后没有免费转乘车
12,000位乘客中只有5500 位乘坐BRT。其余乘客仍然乘坐普通公交车。

ITDP

Quito, Bogota, Curitiba all have free transfer from Feeder Buses operated by the same authority

基多、波哥大和库里提巴的乘客从支线公交车下来后都可乘坐由同一机构运营的免费转乘车



ITDP

TransMilenio

60% of the demand comes from feeder buses

60% 的需求来自支线公交车

Closed Terminals Can Create Free Transfers for feeder buses even on open systems.
即使在开放式系统中，封闭式终点站也可以为支线公交车建立免费转乘站。

Sao Paulo圣保罗

Infrastructure Cost and Capacity Comparison of BRT systems
BRT 系统的基础设施成本与运载能力之比

Line 线路	Capital Cost/Km ($million) 资金成本/公里（百万美元）	Actual capacity (passengers / hour / direction) 实际运载能力（乘客/小时/单向）
Hong Kong Metro 香港地铁	$220	81,000
Bangkok Skytrain 曼谷空中列车	$74	25,000 – 50,000
Caracas Metro 加拉加斯地铁	$90	21,600-32,000
Mexico City Metro 墨西哥城地铁	$41	19,500 - 39,300
Kuala Lumpur LRT Putra 吉隆坡 LRT Putra	$50	10,000 – 30,000
Bogota TransMilenio 波哥大TransMilenio	$6	35,000 - 45,000
Sao Paulo Busways 圣保罗公交车道	$2	27,000 -35,000
Porto Alegre Busway 伯特阿勒格瑞公交车道	$2	28,000
Curitiba Busway 库里提巴公交车道	$2	15,000
Quito Bus Rapid Transit 基多公交车快速通道	$2	9,000-15,000
TransJakarta	$1	8,000

Comparative BRT System Costs
与之相比的 BRT 系统成本

City 城市	Type of system 系统类型	Kilometres of Segregated lines (km) 隔离线路公里数 （公里）	Cost per kilometre (US$million / km) 每公里成本 （百万美元/公里）
Taipei 台北	Bus rapid transit 公交快速通道	57	0.5
Porto Alegre 伯特阿勒格瑞	Bus rapid transit 公交快速通道	27	1.0
Quito (Eco-Via Line) 基多(Eco-Via线路)	Bus rapid transit 公交快速通道	10	1.2
Las Vegas (Max) 拉斯维加斯(Max)	Bus rapid transit 公交快速通道	11.2	1.7
Curitiba 库里提巴	Bus rapid transit 公交快速通道	57	2.5
Sao Paulo 圣保罗	Bus rapid transit 公交快速通道	114	3.0
Bogotá (Phase I) 波哥大（一期）	Bus rapid transit 公交快速通道	40	6.8

Cost Breakdown on Infrastructure Costs, Bogota, TransMilenio Phase II
波哥大 TransMilenio 二期基础设施建设成本明细

Component 目录	Total Cost US$ Million) 总成本（百万美元）	Cost/Km (US$ Million) 每公里成本（百万美元）
Studies and designs 研究和设计	4,01	0,09
Exclusive Ways 专用车道	36,69	0,87
General traffic lanes 一般交通车道	36,13	0,85
Public space[1] 公共场所	28,29	0,67
Stations[2] 站台	25,51	0,6
Pedestrian overpasses 步行天桥	16,57	0,39
Terminals 终点站	15,72	0,37
Parking and maintenance areas 停车和维护区域	17,16	0,40
Properties 设施	29,18	0,69
Network services 网络服务	18,57	0,44
Maintenance 维护	18,57	0,54
Roads for feeder buses 支线公交车道	15,28	0,36
Control Center 控制中心	3,33	0,08
Others[3] 其他	22,85	0,54
TOTAL TRUNK LINES 干线总计	292.2	6,89

Financing Sources: Infrastructure
融资来源：基础设施

- International Development Banks
- National Development Banks
- National Government Grants
- Provincial or Municipal General Revenue
- Petrol taxes
- Road pricing / congestion charging
- Parking fees
- Land value taxation
- Sales or leasing of commercial space near stations
- Commercial banks
- Municipal bonds
- Private Investors?

- 国际开发银行
- 国家开发银行
- 国家政府补贴
- 省级或市政总收入
- 汽油税
- 公路收费 / 堵塞收费
- 停车费
- 土地使用税收
- 出售或租赁站台附近的商业场所
- 商业银行
- 市政债券
- 私人投资者？

Sources of Financing, TransMilenio Phase I
TransMilenio 一期融资来源

Source	Percentage
Local Fuel Surcharge	46%
Power Company Privatization & Other Local Revenues	28%
Reprogrammed World Bank Credit	6%
National Government Funds	20%

来源	百分比
地方燃油附加费	46%
电力公司私有化和其他地方财政收入	28%
重新规划的世界银行贷款	6%
国家政府基金	20%

Investing more in Stations and High Quality Urban Design Can Increase the Status of the System and Win Political Support: New Design for La Paz, Bolivia
增加站台投资和高质量的城市设计可以提升系统的地位并赢得政府支持：玻利维亚拉巴斯的新设计

Leveraging Investment out of the Private Sector
利用私有部门的投资

- Government needs to know how profitable the BRT system being designed will be.
- Based on this profit estimate, the technical specification for the bus can be set as high as this profit margin will allow.
- Holding a competitive bid among private bus operators is key to reducing the bus procurement cost
- Competitive bidding process is also critical to reducing operating cost per kilometer.
- Fixed operating payment per kilometer gives operators an incentive to reduce operating costs.

- 政府需要了解将要设计的 BRT 系统的可盈利性。
- 根据这一利润评估，可以将公交车的技术规格设置为这一利利润允许的最高级别。
- 在私营公交车运营商中保持有竞争力的竞价是降低公交车辆采购成本的关键所在。
- 有竞争力的投标过程对降低每公里的运营成本也很关键。
- 每公里固定的运营收入促使运营商降低运营成本。

TransMilenio Bidding Criteria
TransMilenio投标条件

因素	说明	合格	最小点数	最大点数
合法性	法定注册	X	-	-
经济	足够的投资资金	X	-	-
运营	城市中的公交车运营商		30	150
运营	走廊中的公交车运营商		50	250
运营	国际		-	50
价格	服务价格？（美元/公里）			350
所有权	小型公交车所有者持有的股份		32	200
环境	排放物等			200
车辆来源	当地生产			50

Buses Should Be Selected Based on Financial Viability as well as other considerations.
选择公交车辆时应该考虑其成本可行性及其他因素

Propulsion technology 推进技术	Cost per vehicle (US$) 每辆车的成本（美元）
Diesel/Clean Diesel 柴油机/清洁型柴油机	30,000 – 100,000 100,000-250,000
CNG, LPG bus CNG、 LPG 公交车	150,000 – 350,000
Hybrid electric bus 混合电力公交车	200,000 – 400,000
Fuel cell bus 燃料电池公交车	1.0 – 1.5 Million（百万美元）
Metro rail car 地铁车辆	1.7 - 2.4 Million（百万美元）

BUS OPTIONS
公交车类型

REGULAR BUS
普通公交车

"Clean" Diesel
"清洁型"柴油车

Hybrid-electric vehicles
混合电力公交车

Fuel cell technology
采用燃料电池技术的公交车

Electric trolley
电车

Compressed Natural Gas (CNG)
Liquid Petroleum Gas (LPG)
压缩天然气 (CNG)
液化石油气 (LPG)

High Status Buses Can Elevate System Image but should not compromise financial viability.
高性能公交车可以提升系统的形象但不能兼顾成本可行性

New BRT Bus, Las Vegas, USA
美国拉斯维加斯的新型 BRT 公交车

New BRT Bus, Delhi
德里的新型 BRT 公交车

Sources of Financing: Buses, Ticketing Systems, Operations
融资来源：公交车、票务系统、运营

- Revenues from the Farebox
- Revenues from Advertising/ Merchandising
- Private Investment from bus operators and ticketing system operators
- Loans secured by bus manufacturers
- Bi-Lateral export banks
- International Finance Corporation
- National Development Banks
- Commercial banks

- 车票收入
- 广告/商品宣传收入
- 公交车运营商和票务系统运营商的专用投资
- 由公交车生产商作保的贷款
- 双边出口银行
- 国际金融组织
- 国家开发银行
- 商业银行

After Structure is Agreed and System is Designed, then consider:
达成框架协议并且设计出系统后，接下来需要考虑：

- How fast the money can be made available.
  Local and national sources are much faster
- How much local control can be retained over the BRT system
  Private financing often comes with conditions that compromise user needs and social objectives.
- The cost of capital from different sources
- The allocation of risk among stakeholders

- 资金何时到位
  地方和国家来源的资金到位要快得多
- 地方对 BRT 系统有多大的控制权
  私人融资常常附带影响用户需求和社会目标的条件
- 从其他来源获得的资金的成本
- 股东之间的风险分配

Private investment into the buses is not just about getting the money
私人对公交车的投资并不仅仅是为了赚钱

- Privately owned buses tend to be better maintained because they own the asset.
- Private operators are usually better able to negotiate a lower price and better service contracts for the buses from manufacturers
- Private operators are more likely to make a reasonable choice of bus technology not influenced by political considerations that may compromise service quality
- Procurement is the most typical source of government corruption.

- 私人所有的公交车能得到更好的维护，因为资产归他们所有
- 私人运营商通常能与生产商在公交车方面达成更低的价格和更好的服务合同
- 私人运营商在公交车技术方面更容易作出合理的选择，不会因政治因素的影响而牺牲服务质量
- 采购是最典型的政府腐败渠道。

Current Financing Situation in China
中国目前公交投资现状

- Little or No National Government Role in Municipal Public Transport
- No National or Local Gasoline Tax exept in Hainan.
- Municipalities have a lot of revenue from the sale of land to real estate developers.
- Some cities have a licensing fee to operate a motor vehicle inside the city. Guangzhou it is Y980/year and Y10/day. This fee can be increased.
- Some marginal parking revenues.

- 中央政府对地方公交项目基本没有投资
- 没有汽油税
- 地方政府通过向开发商销售土地获得很多资金。
- 一些地方收取车辆登记费用，广州目前的标准是980元/年，或者10元/天
- 有少量的停车费

Current Discussions on BRT Financing in China
中国目前BRT融资模式

- Metro and Highway Companies created “public-private partnerships”, corporate entities which can borrow money from state banks like the Bank of Construction, etc.
- Municipalities cannot borrow money directly from state banks.
- BRT is small enough that it does not require approval from the State Development Reform Committee
- Beijing BRT will be a “Public-Private Partnership” between state construction company, the municipal bus company, the municipality, and other interests.

- 地铁或者高速公路公司采用“公私合营”的模式，这种公司可以从国家银行取得贷款。
- 地方政府可以从国家银行直接获得贷款
- BRT 项目由于投资规模不大，可以不通过国家发改委的批准。
- 北京BRT 采用公私合营的方式，由国家建设公司，地方公交公司，地方政府和其他感兴趣的部门组成。

Concerns about “Public Private Partnership” for BRT Company
上述模式可能存在的问题

- A Construction Company Owner may inflate the construction costs.
- A Public Bus Company owner may have all the management problems of the public bus company. The city will have no recourse if the quality of service is poor or the bus maintenance is poor.
- A bus manufacturer owner will lock the bus operator into a monopoly bus supplier, inflating bus costs.
- If the BRT company has to pay off loans from the ticket sales, it may drive up ticket prices and complicate integration of the ticketing system with other modes.

- 建设公司可能高估建设费用
- 公有的公交公司会存在一些问题，政府没有其他资源来维护系统，保证服务质量
- 公交制造商的投资方可能造成垄断，同时高估车辆的费用。
- 如果BRT公司需要通过车票收入环贷款，就可能增加票价，因而增加了同其他票制系统的整合。

Final Recommendations for Chinese cities
建议

- Infrastructure Investment funds should come from Municipality and Bank loans
- Bus financing should come from bus operating companies and private banks
- Create a public BRT Corporation that can borrow money from state banks.
- BRT Corporation should not be expected to pay for the infrastructure from ticket sales.

- 基础设施投资应该来自于政府和银行贷款。
- 车辆投资应该来自于运营商和私人银行。
- 建立公有快速公交公司，从而获得国家银行的贷款。
- BRT 公司不应该通过票款偿还基础设施建设。

Ensuring High Quality Service
保证高品质服务

- The BRT Corporation should not have private investment from bus manufacturers, construction companies, or bus operators in order to protect the interests of bus passengers.
- Bus operations should be contracted out to more than one private operator to ensure competition
- Contracts should include quality of service targets with rewards and penalties.

- BRT 公司不应该从车辆提供上，道路建设公司以及公交运营商方面获得投资，以保证乘客的利益。
- 公交运营应该同不同的私人运营商签订合同，以保证竞争。
- 合同应该包括服务质量目标，和相应的奖惩条款。

Thank You!

多谢

The Institute for Transportation and Development Policy

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Bus Rapid Transit
快速公交系统

A Sustainable Mobility Solution for Chinese Cities

中国城市可持续机动化解决方案

Breakthrough Technologies Institute

What is BRT?

- **BRT is a complete rapid transit system**
  - **Family of technologies**
    - **Advanced buses, off-vehicle fare collection, signal priority, passenger information systems, etc.**
  - **Rail-like operating structure**
    - **Frequent operation, limited stops and express service, etc.**
  - **Multimodal access**
    - **Pedestrian, bicycle, feeder services**

何谓 BRT？

- **BRT 是一套完整的快速交通系统**
  - **技术系列**
    - **先进的公共汽车、车外检票、优先通行信号、乘客信息系统等。**
  - **类似铁路的运行结构**
    - **高频次、有限停车站以及快车服务等。**
  - **多种服务方式**
    - **人行道、自行车道和支线服务**

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The Urban Bus – BRT Continuum
城市公共汽车 向 BRT 的转化过程

US BRT Initiatives

美国 BRT 的启动实施

- Strong Federal Government Commitment
  - US Secretary of Transportation Norm Minetta:
    - BRT is the most cost-effective transit investment available.
  - US Federal Transit Administrator
    - Government "vigorously supports" BRT
  - Legislation pending to make it easier to invest in BRT
  - Federal government created a consortium of cities interested in BRT

- 强大的联邦政府委员会
  - 美国交通部部长 Norm Minetta：
    - BRT 是最高效的交通投资。
  - 美国联邦交通管理人员
    - 政府"积极支持"BRT
  - 通过立法使得对 BRT 的投资更方便
  - 联邦政府建立了由对 BRT 感兴趣的城市组成的团体

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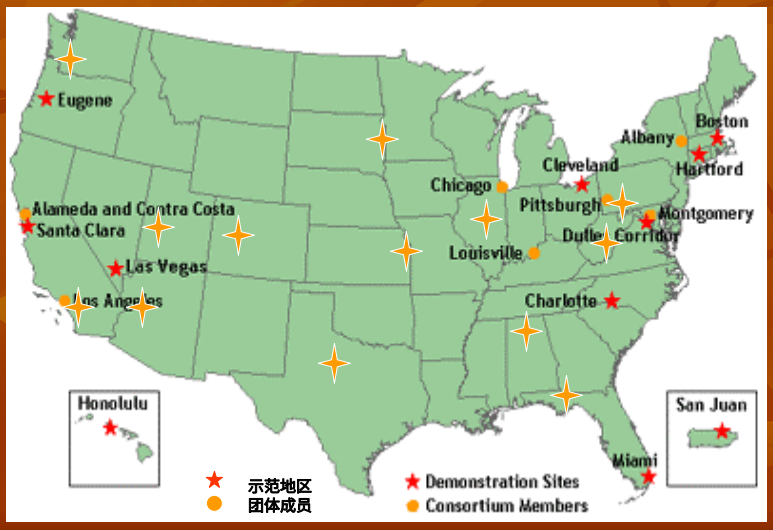
US BRT 美国 BRT



Why BRT? 为何选择 BRT？

- New roads do not solve congestion problems
  - Within 4 years, almost all new capacity is filled
  - New capacity increases operation and maintenance costs
    - In Virginia, growing O&M costs soon will constitute most of the road budget
- 新建道路无法解决交通拥堵问题
  - 4 年之内，几乎所有容量都已爆满
  - 新增容量将增加运营和维护成本
    - 在维吉尼亚，越来越多的运营和维护费用将很快占据大部分道路预算

Why BRT?

- BRT performs as well or better than rail – US Transportation Research Board, TCRP-90
  - Capital costs can be a small fraction of the cost of rail
  - In US, operating costs also appear to be lower
- Implications:
  - Can build more capacity for same investment
  - Leaves resources for other priorities

为何选择 BRT？

- BRT 的功能相当于甚至优于铁路系统 – 美国交通研究会，TCRP-90
  - 资本费用仅是铁路成本的一小部分
  - 在美国，运营成本似乎也较低
- 启示:
  - 同等投资可以创造更大容量
  - 节省资源让给其他需要优先解决的问题

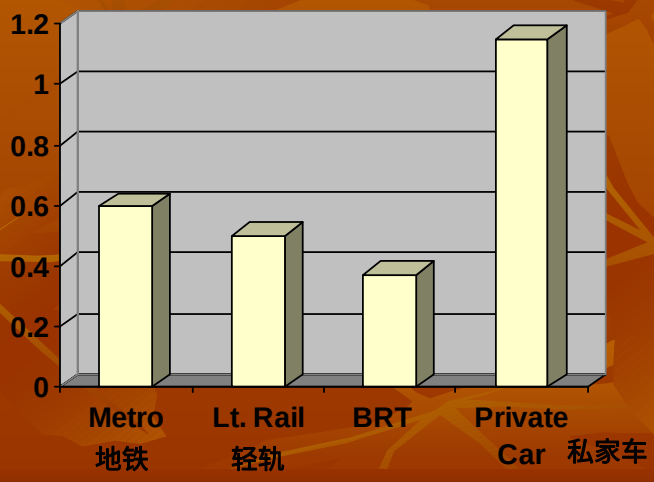
Why BRT?

- Significant air quality benefits
  - Lower NOx emissions than US cars
  - Significantly lower PM 2.5, greenhouse gas, and other emissions than electric rail based on coal

为何选择 BRT？

- 对改善空气质量极为有利
  - 氮氧化物排放量低于美国轿车的排放量
  - 同其他基于煤炭的电气化铁路相比，能明显降低 PM 2.5、温室气体及其他排放

NOx Emissions
氮氧化物排放
(Grams/Passenger Mile，Washington DC Scenario)
(克/乘客英里，华盛顿 DC 的状况)



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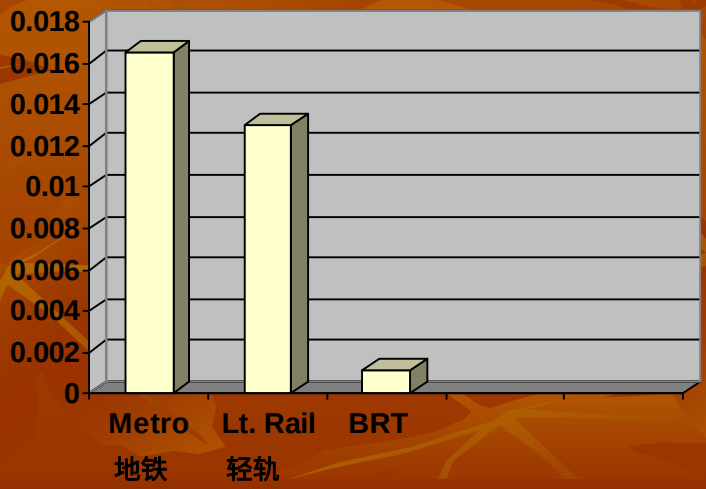
PM 2.5 Emissions
PM 2.5 排放
(Grams/Passenger Mile，Washington, DC Scenario)
(克/乘客英里，华盛顿 DC 的状况)



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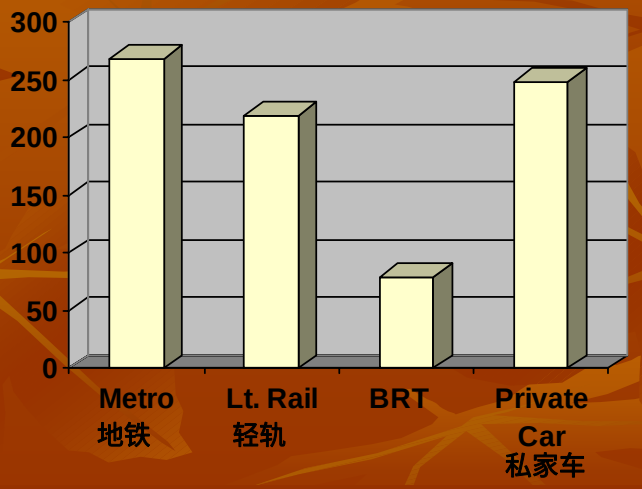
CO_2 Emissions
CO_2 排放

(Grams/Passenger Mile，Washington DC Scenario)
(克/乘客英里，华盛顿 DC 的状况)



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Why BRT?
Air Quality

- Results consistent with 2001 International Energy Agency study
  - Buses "offer the most …. environmentally-friendly mode of motorised travel on the planet."
    - Bus-dominated transport can cut CO2 emissions by 100% compared with car-dominated transport
    - Advanced diesel technologies can significantly reduce CO, PM, and HC emissions compared with standard buses

为何选择 BRT？
空气质量

- 结果同 2001 年国际能源机构的研究一致
  - 公共汽车"提供了地球上最有利于环境的运输模式"
    - 同以轿车为主的交通相比，以公共汽车为主的交通可减少 100% 的 CO2 排放
    - 同标准公共汽车相比，先进的柴油技术可显著减少 CO、PM 和 HC 的排放

Why BRT? Air Quality

- Bus air quality will continue to improve

为何选择 BRT？空气质量

- 公共汽车空气质量将继续得到改善

表 2：
美国与欧盟公共汽车氮氧化物与 PM 排放标准
(至 2010 年)

TABLE 2. BUS EMISSIONS STANDARDS FOR NOx AND PM THROUGH 2010, US AND EU (G/KWH)[11]

	NOx		PM	
Model Year	US	EU	US	EU
2000	5.8	5	0.075	0.1
2001	5.8	5	0.075	0.1
2002	5.8	5	0.075	0.1
2003	2.9	5	0.075	0.1
2004	2.9	5	0.075	0.1
2005	2.9	3.5	0.075	0.02
2006	2.9	3.5	0.075	0.02
2007	0.16	3.5	0.0075	0.02
2008	0.16	2	0.0075	0.02
2009	0.16	2	0.0075	0.02
2010	0.16	2	0.0075	0.02

Note: EU limits: Euro II from 2000, Euro III from 2005, Euro IV from 2008

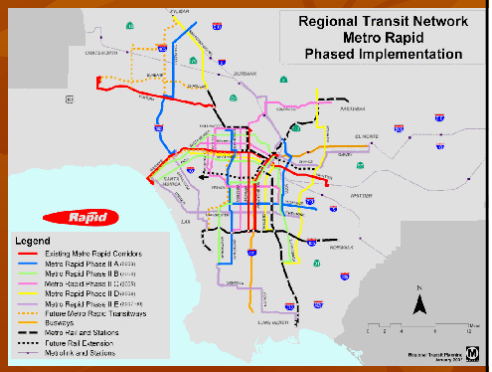
Source (资料来源): Fulton, Lew, *Sustainable Transport: New Insights from the IEA's Worldwide Transit Study* (2001)

4 Leading Projects
4 大领先项目

Los Angeles 洛杉矶

Key Facts:

- Population: 16 million (metro area)
- City prohibited spending local tax dollars on metro construction in 1998
- Mayor, City Council members went to Curitiba
- Committed to 2 phase implementation of BRT
  - Over 560 kilometers new service



主要事实:

- 人口：1600 万 (地铁覆盖区域)
- 1998 年，城市禁止将地方税收用于地铁建设
- 市长及市议会成员前往 Curitiba
- 决定分 2 阶段实施 BRT
  - 新增服务超过 560 公里

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Los Angeles

Phase 1 (Rapid bus, not yet BRT)

- Simple Route Layout
- Frequent Service
  - In some cases, 90 sec headways
- Less Frequent Stops
- Level Boarding
- Color-coded Buses and Stations
- Bus Signal Priority
- Passenger Information System

- 7 corridors currently open
  - No exclusive lanes

洛杉矶

第 1 阶段 (快速公交，尚不属于 BRT)

- 简单的线路布局
- 车次频繁
  - 在某些情况下，90 秒发车间隔
- 减少停车次数
- 水平方式上下车
- 带色彩代码的公共汽车和车站
- 公共汽车信号优先
- 乘客信息系统

- 目前，7 个走廊已经开通
  - 没有专用车道

Los Angeles 洛杉矶

Phase 2

- Exclusive Lanes
- Higher Capacity Buses
- Multiple Door Boarding
- Off-Vehicle Fare Collection
- Feeder Network
- Coordinated Land Use Planning

第 2 阶段

- 专用车道
- 更大容量的公共汽车
- 多门上车
- 车外检票
- 支线网络
- 协调有序的地面使用规划

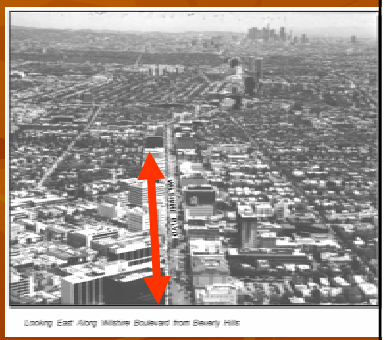
60 foot, articulated, BRT vehicle manufactured by NABI (Compressed Natural Gas).

60 英尺长铰接式 BRT 公交车，NABI 制造 (使用压缩天然气)。

Los Angeles 洛杉矶

- Performance (Wilshire corridor rapid bus)
  - Corridor ridership increased 42% (to 90 thousand trips/day)
  - Operating speed increased 29%
  - Cost/passenger mile decreased 24%

- 性能 (威尔郡走廊快速公共汽车)
  - 走廊乘客增加了 42% (现在为 9 万人次/天)
  - 运行速度提高了 29%
  - 每乘客英里成本降低了 24%



Wilshire Metro Rapid

威尔郡走廊快速地下交通

Los Angeles 洛杉矶

- Cost
  - Roughly $120 thousand per kilometer
    - ½ stations
    - ½ signal priority
  - Phase I used existing bus fleet (CNG), so no additional costs for buses

- 成本
  - 大约 12 万美元/公里
    - ½ 的站点
    - ½ 优先通行信号
  - 第 1 阶段使用现有公共汽车 (CNG),所以无需为公共汽车支付额外费用

Los Angeles Comparison with Light Rail 洛杉机同轻轨比较

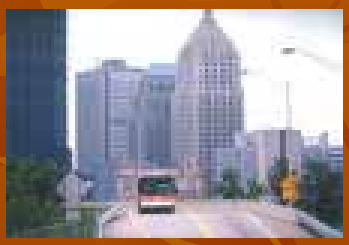
	Rapid Bus (Wilshire) 快速公共汽车 (威尔郡)	LRT (Gold Line) 轻轨快速交通 (金线)
Cost/km 成本/公里	$102, 000	$38, 000, 000
Weekday Boardings 工作日搭乘人次	50, 000	15, 000
Average speed 平均速度	22.5 – 48 km/h	37 km/h
Ridership 乘客数量	+42%	-60% (below projections) -60% (低于预测)

Pittsburgh 匹兹堡

- Key facts:
  - Population: 1.26 million
  - 4 busways (not full BRT)
    - 3 bus only; 1 allows private cars
  - 29.8 km bus only
  - Mountainous terrain
    - Requires significant tunneling
    - Increases costs
- 主要事实：
  - 人口：126 万
  - 4 条公共汽车道 (并非完全意义的 BRT)
    - 只有 3 条公交车道；另 1 条允许私家车通行
  - 只有 29.8 公里的公交专用道
  - 山地
    - 需要大量隧道
    - 增加成本

Pittsburgh 匹兹堡

East Busway
- Opened in 1983
- 14.6 km
- 9 stations
- Cost: $183 million
- 30,000 weekday boardings



东部公交专用道
- 1983 年开通
- 14.6 公里
- 9 个站点
- 费用：1.83 亿美元
- 3 万人次/工作日

Pittsburgh 匹兹堡

West Busway

- Opened in 2000
- 8 km
- 6 stations
- Cost: $258 million
- 10,000 weekday boardings

西部公交专用道

- 2000 年开通
- 8 公里
- 6 个站点
- 费用：2.58 亿美元
- 1 万人次/工作日

Pittsburgh 匹兹堡

South Busway

- Opened in 1977
- 7 km 7 公里
- 11 stops
- Cost: $27 million
- 11,000 weekday boardings

南部公交专用道

- 1997 年开通
- 7 公里
- 11 个站点
- 费用：2700 万美元
- 1.1 万人次/工作日

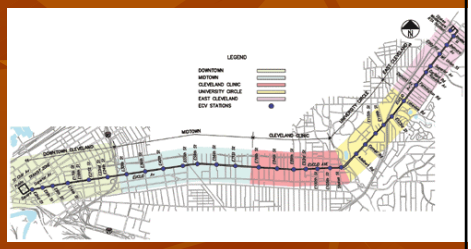
Pittsburgh Comparison with Light Rail

匹兹堡同轻轨比较

	Busways (3 exclusive) 公交专用道 (3 条)	LRT 轻轨快速交通
Length 长度	29.8 km	40.2 km
Total Cost 总成本	$468, 000, 000	$937, 000, 000
Cost/km 成本/公里	$15, 700, 000	$23, 300, 000 (reconstruction，重建)
Weekday Boardings 工作日搭乘人次	51, 000	24, 000

Cleveland 克利夫兰

- Key Facts:
  - Population: 2.25 million (metro region)
  - Will be first full-featured BRT in the US
  - Construction began October 2004
    - Completion Date: December 2008



- 主要事实：
  - 人口：225 万 (地铁覆盖区域)
  - 将成为美国第一个完全意义的 BRT
  - 建设工程于 2004 年 10 月启动
    - 完工时间：2008 年 12 月

Cleveland 克利夫兰

- Key facts:
  - 60 foot, diesel/electric hybrid vehicles
  - Left and right side boarding
  - Space for on-street parking and deliveries
  - Integrated bike lanes
  - Expanded sidewalk space to support retail and cafes

- 主要事实：
  - 60 英尺长柴油/电力混合动力汽车
  - 左、右侧上下车
  - 留有路旁停车和输送空间
  - 集成的自行车道
  - 扩展了人行道空间，供零售店和咖啡店使用

Cleveland 克利夫兰

- 39,000 daily riders (projected 2025)
  - Cleveland LRT currently carries about 10 thousand weekday riders
- 11.25 km
- $168 million (projected)
  - $15 million per km
  - Includes a complete reconstruction of the street and sidewalks, plus installation of new bike and pedestrian facilities
- 3.9 万人次/天 (2025 年预测)
  - 目前，克利夫兰 LRT 载客量为 1 万人次/工作日
- 11.25 公里
- 1.68 亿美元 (预测)
  - 150 万美元/公里
  - 包括对街道和人行道的彻底重建，并安装新的自行车和人行道设施

Boston 波士顿

- Population: 3 million
- BRT designed to be 5th line of Boston's rail system
- 3 stage project
  - Phase 1: Open
  - Phase 2: Expected 2004
  - Phase 3: Expected 2010
- Like Cleveland, will be full-featured BRT when complete

- 人口：300 万
- 波士顿轨道系统的第 5 条线路被设计为 BRT
- 3 阶段工程
  - 第 1 阶段：已开通
  - 第 2 阶段：预计 2004 年完工
  - 第 3 阶段：预计 2010 年完工
- 与克利夫兰一样，完工后将完全具备 BRT 功能

18 meter, articulated, CNG, 104 passenger capacity

18 米长，铰接式，CNG，载客量为 104 人

Boston 波士顿

- Phase 1
  - Dedicated bus lane on surface street
  - Connects south suburbs to downtown
  - Buses run every 5 minutes or less
  - Silver Line ridership increased 95% in one year
  - 90% of riders rate service as "good to excellent"
  - Cost: $40 million

- 第 1 阶段
  - 地面公交专用道
  - 连接南部郊区与市区
  - 公共汽车发车间隔为 5 分钟或更短
  - 一年内，银线乘客人数增加了 95%
  - 90% 乘客的服务评价为"很好，非常好"
  - 成本：4000 万美元

Boston 波士顿

- Phase 2
  - Initially will be a separate BRT line from Phase I
  - Tunnel connecting South Station (commuter rail) with Logan airport
- Phase 3
  - Tunnel connecting Phases I and II
- Projected to carry 60,000 riders per day when complete
  - Blue line rail has 56,000 daily boardings
- 第 2 阶段
  - 最初将在第 1 阶段基础上开辟一条独立的 BRT 线路
  - 连接南站 (往返轨道交通) 与 Logan 机场的隧道
- 第 3 阶段
  - 连接第 1 阶段和第 2 阶段的隧道
- 完工后，预计每天将承载 6 万人次
  - 蓝线轨道交通每天的载客量为 5.6 万人次

Challenges

- Public acceptance
  - Buses have a poor public image due to decades of under-investment
- Funding
  - Policies tend to favor more expensive rail investments, despite clear performance advantages of BRT
- Vehicle availability
  - Mostly standard buses
  - BRT product beginning to be introduced

挑战

- 公众接受
  - 由于数十年缺少投资，公共汽车给公众留下的印象很差
- 投资
  - 有关政策倾向于更为昂贵的轨道投资，尽管 BRT 具有明显的性能优势
- 可获得的交通工具
  - 绝大多数标准公共汽车
  - 开始引进 BRT 产品

Opportunities

- BRT as part of a broader project to revitalize key urban corridors
  - Cleveland
- BRT as part of new road infrastructure
  - Toll lanes
- BRT as an upgrade to existing, popular bus routes
  - Los Angeles

机遇

- BRT 是改造城市主要走廊更广义项目的一部分
  - 克利夫兰
- BRT 是新的道路基础设施的一部分
  - 收费线路
- BRT 是对现有主要公交线路的改进
  - 洛杉矶

More Information
更多信息

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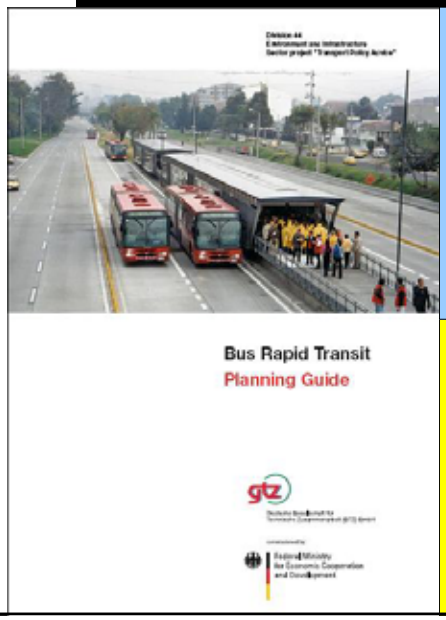
Breakthrough Technologies Institute

BRT Planning Guide
快速公交系统规划指南



GTZ's Sustainable Urban Transport Programme
德国技术合作公司可持续城市交通项目

www.sutp.org

Lloyd Wright
University College London

Lfwright@usa.net

Contents
内容

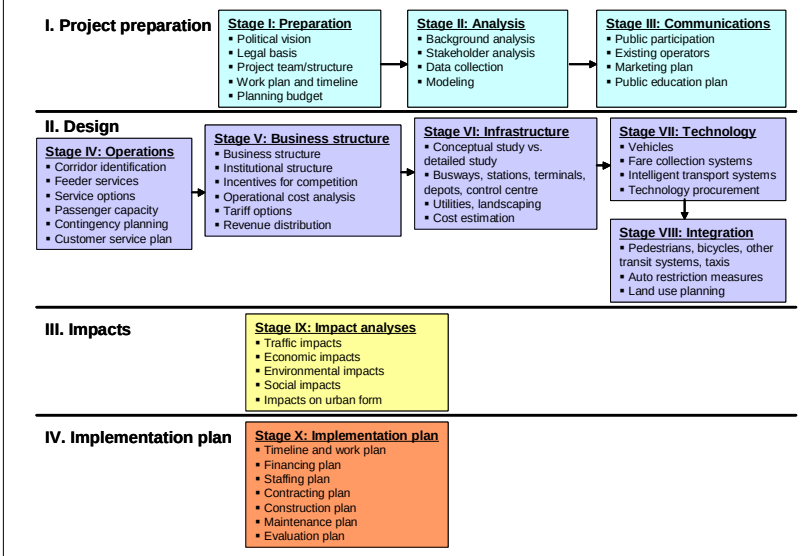
BRT planning resource

- ❑ Step-by-step review of BRT
- ❑ Extensive photos, graphics, and design examples
- ❑ List of BRT publications and web sites

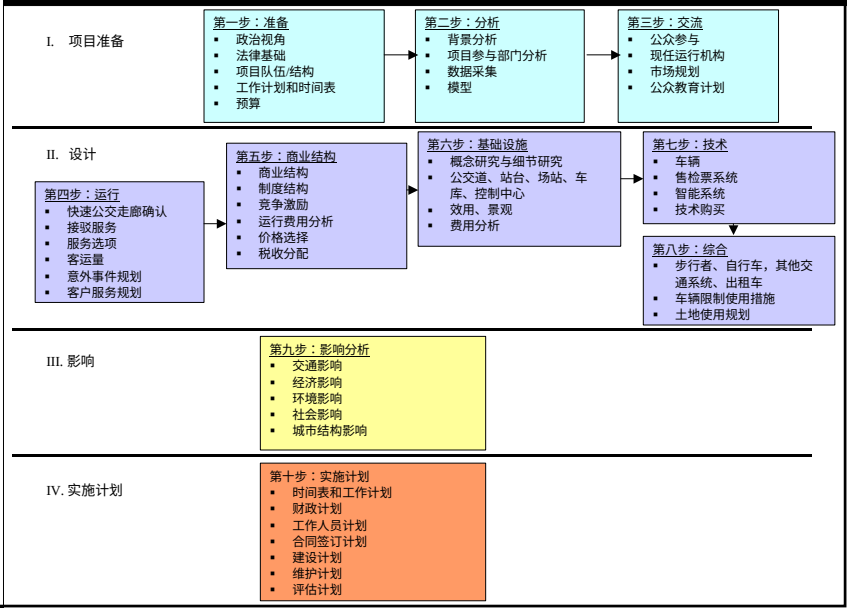
快速公交系统规划资源

- ❑ 快速公交系统逐项回顾
- ❑ 大量照片、图表和设计实例
- ❑ 快速公交系统出版物和网站列表

BRT planning process



快速公交系统规划步骤



Training packages
培训材料

Available December 2004

- Module 3a and 3b: Mass Transit Options and Bus Rapid Transit
- Module 3c: Bus Regulation and Planning – Bus Sector Reform
- Module 3d: Preserving and Expanding the Role of Non-Motorised Transport

2004 年12月发布

- 模块 3a 和 3b: 大容量公交及快速公共汽车交通系统
- 模块 3c: 公交管理及规划—公交部门改革
- 模块 3d: 推动非机动交通发展

GTZ Sourcebook
GTZ 资源总汇

English version can be ordered by contacting:

Transport@gtz.de

Full version of Sourcebook translated to Chinese, available in May 2005.

英文版本可以通过以下地址购买

Transport@gtz.de

中文版本将于2005年5月发布

BRT planning:快速公交系统规划：
The next phase下一阶段

A more detailed planning guide is on its way
一部更详细的规划指南正在制作当中

To be published in mid-2005
将于2005年年中发表

<u>Funding organisations</u>
- ❑ **Hewlett Foundation**
- ❑ **Global Environment Facility**

<u>赞助单位</u>
- ❑**休利特基金会**
- ❑**全球环境基金**

<u>Coordinating organisation</u>
- ❑ **Institute for Transportation & Development Policy (ITDP)**

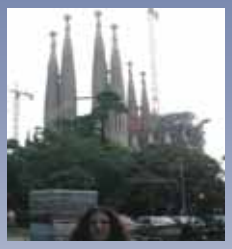
<u>协作单位</u>
- ❑**交通发展政策研究所**

Sustainable Urban Transport through BRT: Progress in Mexico City, Potentials for China
通过快速公交系统实现可持续城市交通: 墨西哥城的进展, 中国的潜力

Lee Schipper, *EMBARQ*
World Resources Institute
世界资源研究所
美国华盛顿特区
Washington, D.C.
www.embarq.wri.org

CITIES: Icons: Places, History, and Views
What Happens if Transport Breaks Down?
城市:特征: 地理、历史、以及景观如果交通瘫痪，这个城市会变成怎样?

London's Big Ben, Westminster, and Wheel
伦敦的大本钟.西敏寺以及摩天轮



Barcelona's Sagrada Familia
巴塞罗那圣家族教堂

Berlin's Brandenburger Tor
柏林的勃兰登堡门

Shanghai's Bund
上海外滩

Mexico's Plaza Mayor
墨西哥城市长广场

Xian Bell Tower
西安塔楼

What Is A Sustainable City?
怎样才算是一个可持续发展的城市?

- **Leaving No Costs or Burdens for Future Generations**
  - Environment, Equity, Economic Sustainability (World Bank)
  - Caring for health and safety of present
- **Balancing Economic Opportunity, Environmental Responsibility for People**
  - A good environment costs less than a bad one
  - A good economy supports a clean environment
  - A good economy thrives on livability

- **为后代的发展不留负担**
  - 环境,平等,经济的可持续性 (世界银行的定义)
  - 关注当前的健康和安全
- **平衡经济发展与保护环境**
  - 良好的环境降低发展成本
  - 良性的经济有助于洁净的环境
  - 良性的经济离不开可居住性

EMBARQ

What Is A Sustainable City?
怎样才算是一个可持续发展的城市?

- **Steered by the Public, Private and Civil Society Sectors**
  - Governance depends on sustainable consensus, stakeholder involvement
  - All three sectors invest in a city, all three benefit
  - A city is sustained by its people
- **需要公众，私有部门，以及政府三方面的协助**
  - 政府管理需要达成可持续性的共识，各方利益人的参与
  - 三方共同投入，共同受益
  - 城市的可持续性离不开这个城市的公民

Transport must Serve, not Sever, Development of Sustainable Cities
交通必须支撑,而不是断割城市的可持续性发展

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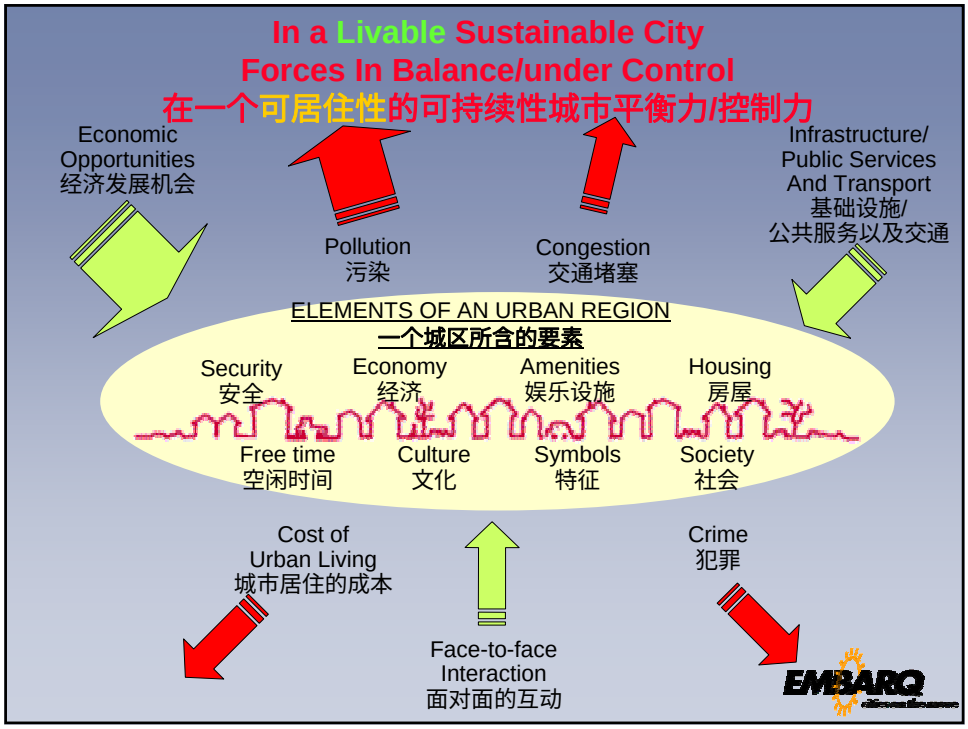
In a Livable Sustainable City
Forces In Balance/under Control
在一个可居住性的可持续性城市平衡力/控制力
Economic Opportunities
经济发展机会
Pollution
污染
Congestion
交通堵塞
Infrastructure/ Public Services And Transport
基础设施/公共服务以及交通
ELEMENTS OF AN URBAN REGION
一个城区所含的要素
Security
安全
Economy
经济
Amenities
娱乐设施
Housing
房屋
Free time
空闲时间
Culture
文化
Symbols
特征
Society
社会
Cost of Urban Living
城市居住的成本
Face-to-face Interaction
面对面的互动
Crime
犯罪
EMBARQ


Which Ones Support Sustainable Cities?
下面的那个交通有助于城市的可持续性发展？
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Sustainable Transport: From Vision to Policy
可持续性交通从概念形成到政策实施

1) City's Vision and future: How transport serves vision, advances development and livability, overcomes constraints

1) 城市的定位和远景: 交通如何有助其定位, 高速发展以及可居住性, 克服种种限制

2) Conceptualization: Inclusive definition of "sustainable transport"

2) 概念形成: 包括 "可持续性交通"的概念

3) Operationalization: Goals and challenges for clean air, Access, and safety/security

3) 运营的可行性: 为实现洁净空气，便利交通，以及安全所面临的目标以及挑战

4) Getting There: Policy Strategy, implementation, technologies

4) 具体实施: 政策策略, 实施, 技术支持

5) Monitoring, enforcement, evaluation accountability, and stakeholder process: governance Framework and hearts and minds5)

监督, 贯彻执行, 评估的可信性, 以及利益方的权益平衡: 管理手段，整体思路，人心所向

EMBARQ cities on the move

"Solutions" Exist But Are Politically Difficult
Everything Starts with People and Vision
"解决方案" 与政治性缺陷并存:
一切都需从人以及长远规划着手

Bogota: Transmilenio Bus Rapid Transit

哥伦比亚波哥大的新世纪交通系统运行的快速公交

Vienna. Almost car free Old city, LPG buses

维也纳. 城内几乎见不到私有车辆，公共汽车使用液化天然气

London: Congestion Charge

伦敦: 交通堵塞收费

"Solutions" Exist But Are Politically Difficult
Everything Starts with People and Vision
"解决方案" 与政治性缺陷并存:
一切都需从人以及长远规划着手

Below are ***EMBARQ*** Partner Cities
以下是 ***EMBARQ*** 合作城市

Shanghai – Buses Stuck In Traffic
上海 – 公共汽车堵在车流中

Xi'An – Buses lined up At the South Gate
西安 – 公共汽车在南门外受阻

Hanoi – and some Chinese cities balancing bikes and buses
河内– 情形类同于中国的其它城市自行车与公共汽车各得益彰

EMBARQ

Mexico City:
What the Aztecs Saw
墨西哥城:
阿兹迪克时代（公元1325-1521）
看到的景色

What we see today
我们今天看到的景色

EMBARQ

Mexico City
墨西哥城

- One of worlds three or four most polluted cities
- Massive congestion
- Hectic public transport carries 75% of all trips
- Small mini-buses carry more than 2/3 of “public”
- Metro carries most of rest
- Would you ride around in this?

- 世界上4大污染最严重的城市之一
- 严重的交通堵塞
- 繁忙的公共交通系统承担了 75% 出行
- 小型面包车承担了 2/3 公共交通乘客
- 地铁担负了余下的部分
- 你愿意在选用这样的公交吗?

- Unfortunately dozens of other mega-cities nearly as bad, a few worse
- 不幸的是，大部分其它超大城市的状况与此类似，甚至更加糟糕

Features of Mexican Traffic
墨西哥城未来的交通

Playing chicken with the bus in the counter flow lane

杂乱无序的交通

Bovine Rapid Transit

运“牛”交通系统

EMBARQ’s ROLE (w GEF/W Bank): DEVELOP CLEAN BRT FROM THIS CHAOS

EMBARQ（和世界银行全球环境基金）的角色就是在这种杂乱无序中建立快速交通系统

Bus Rapid Transit (BRT) is a Flexible, Low-Cost, Integrated Package of Components...More Than Just Lines On A Map
公共快速交通（BRT)是一个灵活，低成本，综合考虑了各方面因素的方式... 而不仅仅是地图上的那些干线

TECHNOLOGY技术

- Advanced Vehicles先进交通工具
- Low Emissions低排放量
- IT Control Systems
- 信息技术控制系统
- Fare Systems收费系统
- Passenger Information Systems
- 乘客量信息系统

CUSTOMER INTERFACE
乘客界面

OPERATING PLAN
运营规划

- Sound Management 良好的管理
- Network Structure网络结构
- Route Structure路线结构
- Service Frequency服务频率
- Service Span服务范围
- Station Spacing车站距离
- Integration with other Modes\
- 与其它交通的结合

- Fare Structure收费方式
- Marketing Strategy市场战略
- Safety and Security安全/保障
- Travel Information出行信息
- Physical Design实体设计
- Urban Design城市规划

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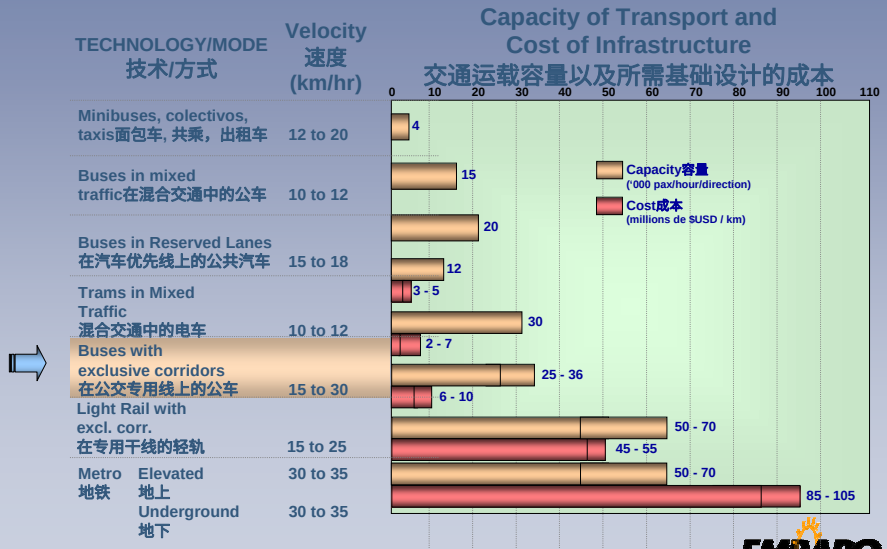
How Mexican Authorities (and others) Came to Embrace BRT—Costs
墨西哥政府和其他组织如何想到采用BRT-----成本



Adupted by SETRAVI from World Bank.- Armstrong W. Allan.- 1989.- World Bank.- Documento 52S

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Climbing The Bus Technology Ladder
Lessons from *EMBARQ*'s Mexico Program
公共汽车的技术阶梯
*EMBARQ*在墨西哥城，项目所获经验

- **Conventional Technology at Minimal Cost**
  - Clean diesel hauling up to 240 passengers in double articulated
  - Conventional size clean diesel or CNG, even LPG
  - Very Low Emissions available today (EMBARQ Tests in Mexico->)
- **Clean up Existing Vehicles (EMBARQ in Mexico City)**
  - Exhaust or engine retrofit of existing heavy vehicles; (->)
  - Careful testing to pick best and most cost effective solutions
  - Use cleanest diesel available (<15 PPM)
- **传统技术，最低成本**
  - 可容纳240名乘客的高载量汽车使用洁净柴油
  - 采用传统标准柴油或者压缩天然气,或者液化天然气
  - 现有的低排放量(*EMBARQ* 在墨西哥的测试)
- **清理现有的交通工具 (*EMBARQ* 在墨西哥城)**
  - 取消或者调换现有中型车辆的引擎
  - 细心测试，挑选最佳且有效的解决方案
  - 使用现有最洁净的柴油 (<15 ppm)

EMBARQ

Climbing The Bus Technology Ladder
Lessons from *EMBARQ*'s Mexico Program
公共汽车的技术阶梯
*EMBARQ*在墨西哥城，项目所获经验

- **Advanced Systems – Maybe Now, Maybe Later**
  - Hybrids worth testing now (EMBARQ in Mexico City)
  - Fuel cells? Feedstock and infrastructure main uncertainties
  - Real issue: Learn without starving other options

- **高级系统 – 或许现在，或许以后**
  - 混合动力值得测试 (EMBARQ 在墨西哥城)
  - 燃料电池? 但受到原料以及基础设施等主要不确定因素限制
  - 最终问题: 在学习中探索新的解决方案

BRT Makes Bus Systems Healthy Enough to Afford Wise Choices to Clean the Air

BRT能够保证公共交通是足够健康的明智方案，且带来洁净空气

EMBARQ

Key Lessons For Improving Urban Environment: Synergies
公共汽车的技术阶梯
*EMBARQ*在墨西哥城，项目所获经验

- **Sustainable Technologies**
  - Necessary for health and welfare
  - Supported by economic rules from institutions and good standards
  - Justified by good economic calculations/co-benefits etc
- **Sustainable Institutions**
  - Required for technology to be supported and used right
  - Necessary for making rules for economic sustainability of transport
  - Supported by leaders' visions of city's economic development
- **可持续性技术**
  - 对于健康和社会福利是必需的
  - 得到符合各种机制和良好标准的经济规则的支持
  - 得到良性经济计算/附带效益等等的证实
- **可持续性机制**
  - 技术需要机制的支持并且合理的利用
  - 有必要为制定交通规则，实现交通经济可持续性
  - 需要领导人对于城市经济发展的远见的支持

EMBARQ

Key Lessons For Improving Urban Environment: Synergies
公共汽车的技术阶梯
*EMBARQ*在墨西哥城，项目所获经验

- **Sustainable Behavior**
  - Strong economic signals to all actors (consumers, operators, etc)
  - Safety and security to encourage sustainable behavior
  - Solid indicators for measuring real changes and improvements
- **可持续性行为**
  - 对所有社会参与者发出强烈的经济信号
  - 利用安全以及保障手段来鼓励可持续性的行为
  - 完善的指标来测量确切的变化和改善

BRT ONE IMPORTANT PIECE OF A SUSTAINABLE CITY
BRT是一个可持续发展城市的重要组成部分

EMBARQ

Applying The Lessons: EMBARQ in Shanghai
经验的利用: *EMBARQ* 在上海

- **LONG RANGE VISION – A LEADER, NOT A FOLLOWER**
  - "World Class City"
  - Transportation White Paper
  - EXPO 2010
- **SUSTAINABLE TRANSPORT FOR SUSTAINABLE CITIES**
  - Development of BRT System to meet demands of Expo and beyond
  - Work with world's leading experts to develop world class system
- **远景目标 – 一个示范者,而不是一个跟随着**
  - "世界级城市"
  - 交通白皮书
  - 2010世博展
- **可持续性城市需要可持续性交通**
  - 发展 BRT 系统从而满足世博会以及今后发展的需求
  - 和世界权威专家一起合作，开发世界一流的交通系统

Applying The Lessons: EMBARQ in Shanghai
经验的利用: *EMBARQ* 在上海

- **INDICATORS OF SUSTAINABLE TRANSPORT**
  - Measure health of transport (and health of people)
  - Clean air/emissions inventory measurements begun
  - Access/congestion next indicator set
- **可持续性交通的指标**
  - 测量交通的健康性 (以及人类的健康)
  - 洁净空气/排放量指标的测量已经开始
  - 下一步工作是进行出行通畅/交通堵塞指标的测量

BRT A KEY ELEMENT OF EMBARQ's PARTNERSHIP WITH THE SHANGHAI GOVERNMENT
BRT是EMBARQ与上海市政府合作的一个关键组成部分

By 2015 there will be 23 mega-cities, and nearly 300 cities in the developing world are already 1 million strong

到 2015 年前，全球将有 23 个超大城市。在发展中国家中，已有近300个城市的人口达到了100万

EMBARQ

- Created at WRI by Shell Foundation
  由壳牌基金会设立，依附于世界资源研究所
- Mission is to work closely with empowered forces in urban areas to solve transport/environment problems
  其宗旨是和城区利益群体一起合作，解决交通/环境问题
- Working in Mexico City and Shanghai
  与墨西哥城，上海市的合作初见成效
- Now in Xi'an, Pune and Hanoi Visit us at
  在西安,普那以及河内的项目正在进行中
  访问我们的网址
  http://www.embarq.wri.org/en/index.htm

EMBARQ

BRT Development In China
- Challenges and Opportunities
中国快速公交系统发展
面临的挑战与机遇

Kangming Xu –International Consultant
徐康明 城市交通咨询顾问

The Challenges
中国城市交通面临的挑战

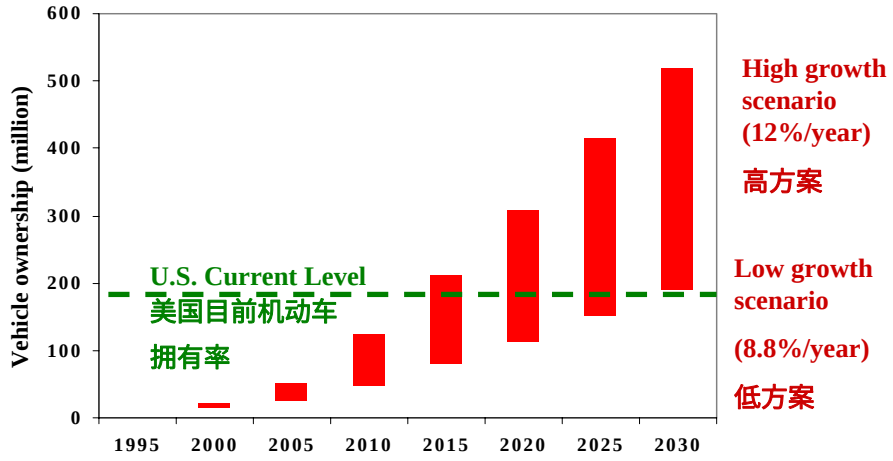
Urban Transport Programs in 80's
中国80年代的城市交通问题

Urban Transport Programs in 90's
中国90年代以来的城市交通问题

Vehicle Ownership in Beijing
北京机动车拥有量

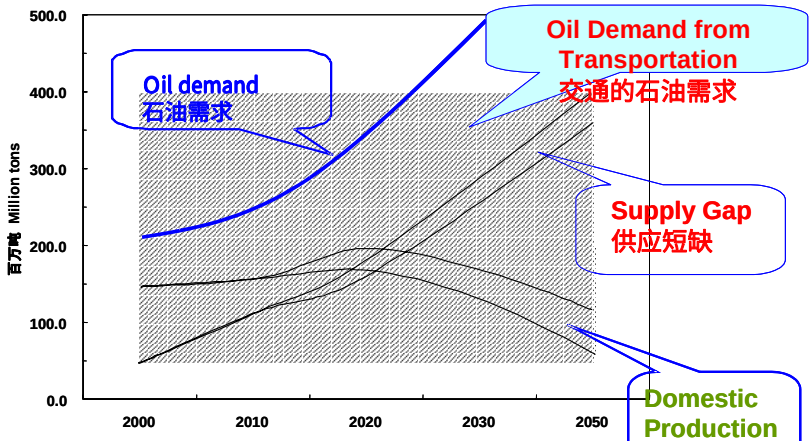
From 从	To 至	Years 年
0	1,000,000	48
10,000	100,000	20
1,000,000	2,000,000	6

Growth Trend of Vehicle Ownership
中国机动车拥有率预测



Source: Tsinghua University, State Council DRC

Energy Issue 能源安全



Source: IEA

Energy Issue 能源安全

Oil	Daily (millions barrels) 日均值 (百万桶)
Consumption 消耗量	5.3
Production 国内产量	3.5
Import 进口量	1.8

- If crude oil price increase $10 Dollars per barrel, it will cost China 7 Billion US dollars extra for importing oil every year.
- Second largest oil consumption nation after the United States.
- 国际原油价格每增加10美元，中国每年需多化70亿美元的外汇来进口石油。
- 中国成为仅次于美国的第二大石油消费国家。

Environmental Impacts
环境影响

- Vehicle emissions contribute 60% of air pollution in large cities
- 机动车排放的污染物对城市大气污染指标的贡献率已高达60%

Elder Population On the Rise
老龄人口的逐渐增加

- Elder population (age 60+) exceeds 130 million and counts for 20% of the elder population in the World.
- 中国60岁以上的老龄人口已经达到1.3亿，老龄人口已占世界老年人口的20%。

Potential Impacts of Traffic Congestion
交通拥堵的潜在影响

Population 人口	No. of Cities 城市数目
> 2,000,000	13
>1,000,000	42
>500,000	270
In 2002, the GDP from cities accounted for 60% of the national GDP 2002年城市的GDP占全国GDP的60%	

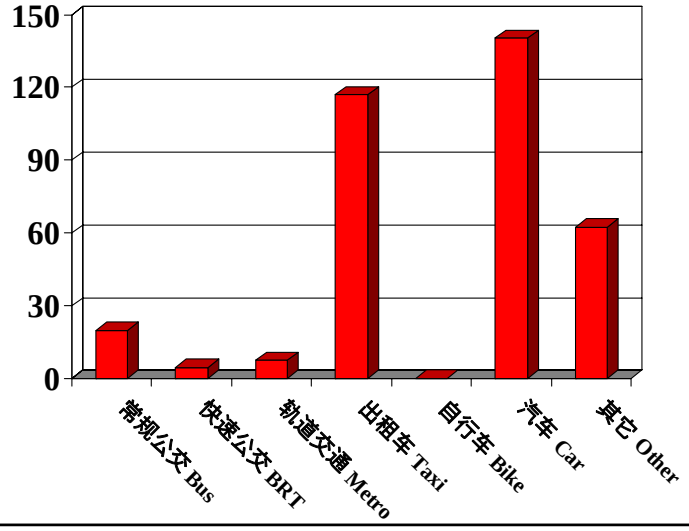
Better Use of Road Space
对道路资源的有效利用

Need a Wise Strategy to Address Urban Mobility。

需要一个正确的战略来解决城市交通问题。

Clean Air – CO_2 Emission

运送单位人公里不同交通模式的CO_2排放量(克)



Reducing Oil Consumption – Energy Security

减少石油需求，提高国家能源安全性

Need A New Solution
一个新的方法

Urban Transport Development Strategies
改善城市交通的战略举挫

不要从“堵”字做文章,

从“通”字做文章

Find A Way Out!

Urban Transport Development Strategies

改善城市交通的战略举挫

从“通”字做文章

公共交通交通的“通”

自行车交通的“通”

行人交通的“通”

货物流通的“通”

Let’s focus on moving people and goods, rather than cars.

Let buses running fast,

Keep bicycles on most streets,

Provide a safe environmental for pedestrians,

Move goods more effectively.

Urban Transport Development Strategies

改善城市交通的战略举挫

从“堵”字做文章

教训:“恶性循环”

教训:“死胡同”

教训:“缓解而不是解决”

If focus on dealing with traffic jams & gridlock,

You get a “Vicious cycle”, or a “Dead End”

Philosophy
思路

- Excessive car use is a PROBLEM;
- Priority must be given to moving people;
- Public Transport is the best solution;
- BRT is quick and cheaper solution.

- 过度地使用私人汽车是交通问题的根源;
- 优先考虑运输人而不是车;
- 发展公共交通是解决城市交通的重要手段;
- 发展快速公交系统是一种投资低见效快的手段。

Bus Rapid Transit
快速公交系统

Development Strategies
发展战略

BRT Development Strategies
快速公交发展战略

- 与城市发展方向的紧密结合;
- 与城市主要公交客流走廊的紧密结合;
- 与城市其它城市公共交通方式的紧密结合;
- 与城市近期建设项目的紧密结合。

- **Integration with Urban Development;**
- **Integration with Major Transit Demands;**
- **Integration with Other Public Transport Modes;**
- **Integration with Short-term Infrastructure Improvements.**

Integration with Urban Development
与城市发展方向的紧密结合

- 在连接新城与母城的城市放射线道路上实施快速公交项目;
- 在城市的环路上实施快速公交系统；

- Implement BRT corridors to connect suburban new towns and city core;
- Implement BRT corridors on Ring Road systems。

Integration with Urban Development
与城市发展方向的紧密结合

First True BRT Corridor in China
第一条快速公交系统

Develop BRT on Ring Roads

在环线上实施快速公交

Previous Recommendation:
28km Proposed Elevated Roadway
以前的推荐方案：
28公里的城市高架道路

Adopted Recommendation:
BRT Boulevard on the Middle Ring Road
最终采纳的建议：
在二环路上实施快速公交系统林荫大道

Integrate with Major Transit Demands

与城市主要公交客流走廊的紧密结合

- 在现有公交客流走廊上实施快速公交系统，以保障更多的公交乘客可以享受快速、便捷的公交服务。
- Implement BRT on high demand corridors to provide fast and reliable transit services for more passengers.

Integration with Other Public Transport Modes
与城市其它城市公共交通方式的紧密结合

- 与轨道交通的紧密结合：
  - 作为轨道交通的补充
  - 作为轨道交通的延伸
  - 作为轨道交通的过渡
  - 作为轨道交通的替代
- Integration with Metro
  - Supplement
  - Extension
  - Transition
  - Replacement

Integration with Other Public Transport Modes
与城市其它城市公共交通方式的紧密结合

- 与常规公交的紧密结合：
  - 常规公交作为支线
  - 与常规公交的换乘
- Integration with Bus
  - Trunk and Feed
  - Transfer and Integration

Integration with Short-term Infrastructure Improvement Projects

与城市近期建设项目的紧密结合

- 准备近期道路建设项目时，考虑实施快速公交系统的可能性。
- Consider BRT options for roadway improvement projects.

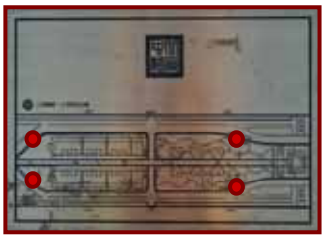




Integration with Short-term Infrastructure Improvement Projects

与城市近期建设项目的紧密结合

Beijing Nanzhongzhou BRT Corridor


北京南中轴快速公交系统的部分路段

Convert Busway to BRT
将公交专用道向快速公交转化

Program Tasks:
- **More effective busway**
- **Bus Route Optimazation**
- **Bus Fare Reforms**
- **Better Buses**

项目内容
- **完善公交专用道的设施**
- **公交线路优化**
- **公交票价体制的改革**
- **改良公交车辆**

Resources
外部条件

National Policy
国家的相关政策

•温家宝总理对公共交通的意见："优先发展城市公共交通，是符合中国实际的城市发展和交通发展的正确战略思想。"

•建设部38号："关于优先发展城市公共交通的意见"

•国务院93年决策参考520"加快发展城市快速公共汽车交通系统的建设"

•Premier Wen's endorsement: "Giving public transport priority is a right strategy for urban and transport development in China."

•Ministry of Construction Policy 38 "Public Transport Development Policy"

•State Council Policy 520 "Promote BRT Development in Chinese Cities"

Domestic Experiences
国内的有关经验

•网络规划的经验：

  •北京、上海、成都、西安、重庆、杭州等。

•走廊规划：

  •北京、成都、上海、重庆、沈阳、杭州等。

•实施经验：

  •北京

•BRT Network Planning Experience

  •Beijing, Shanghai, Chengdu, Xi'an, Chongqing, Hangzhou.

•BRT Corridor Planning Experience:

  •Beijing, Chengdu, Shanghai, Chongqing, Shengyan, Hongzhou.

• Implementation Experience：

  • Beijing

Domestic Technical Resources
国内的有关技术资源

- 能源基金会的中国快速公交系统项目：赠款和技术专家
- 快速公交网站 http://www.brtchina.org
- 快速公交技术中心（威廉与佛洛拉·休利特基金会的慷慨资助，筹办阶段）

- The Energy Foundation BRT Program： Provide research grants and technical supports
- BRTChina web site: http://www.brtchina.org
- BRT Technical Center (early development stage funded by the Hewlett Foundation)

International Resources
国际上的一些资源

- 国际组织：
  - 如：世界银行, 国际环境组织
- 私人或公司基金会
  - 大卫与露西·派克德基金会
  - 威廉,佛洛拉·休利特基金,壳牌等
- 非政府研究机构：
  - 德国GTZ，IDTP，等

- International Organization
  - The World Bank, GEF and etc.
- Private and Company Foundations
  - Hewlett Foundation, Packard Foundation, Shell, Volvo and etc.
- Non-government organizations
  - GTZ, IDTP etc.

Development Trend
发展趋势

BRT Development Trend
近期计划实施快速公交系统的城市

Suggestions

实施快速公交的建议

•国家：

- •快速公交的发展政策
- •快速公交的投资政策
- •快速公交的相关技术研究

•城市：

- •快速公交的发展政策
- •城市规划的结合
- •资金筹措
- •管理运营体系
- •交通管理
- •城市综合交通

•National Level：

- •Development Policy
- •Investment Policy
- •Technical Research

•City Level：

- •Development Policy
- •City Planning
- •Investment Policy
- •BRT Management Structure
- •Traffic Management
- •Comprehensive Transport

Why Do We Need BRT？

推广快速公交的意义

It benefits everyone！

为老百姓谋福利！
为城市谋福利！
为国家谋福利！
为全球谋福利！



Beijing BRT Photos
北京快速公交系统

The BRT Bus
快速公交的车辆

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Before
从前

Beijing BRT Photos
北京快速公交系统

Before
从前

Beijing BRT Photos
北京快速公交系统

After
现在

Beijing BRT Photos
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After
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Beijing BRT Photos
北京快速公交系统

BRT Northern Terminal
快速公交北端终点

Thank You !

谢谢!