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International Experience on the Success and Failures of Bus Rapid Transit System

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A global view of BRT

Belo Horizonte
Bogota
Campinas
Curitiba
Goiania
Lima
Porto Alegre
Quito
Recife
Sao Paulo

Europe

Claremont Ferrand
Eindhoven
Essen
Ipswich
Leeds
Nancy
Rouen

North America

Honolulu
Los Angeles
Miami
Ottawa
Pittsburgh
Vancouver

Asia

Akita
Fukuoka
Gifu
Kanazuwa
Kunming
Miyazaki
Nagaoka
Nagoya
Nigata
Taipie

Oceana

Adelaideide
Brisbane

Systems in operation

Cities shown in red
> 5million
population

Source: Embarq

Systems at the planning or construction stages

Latin America
Barranquilla
Bogota (expansion)
Cartagena
Cuenca
Guatemala City
Guayaquil
Lima
Mexico City
Panama City
Pereira
Quito (expansion)
San Juan
San Salvador

Asia
Beijing
Jakarta

North America
Albany
Alameda and Contra Costa
Boston
Charlotte
Chicago
Cleveland
Dulles Corridor
Eugene
Hartford
Las Vegas
Louisville
Montomery County
San Francisco
Seattle
Toronto

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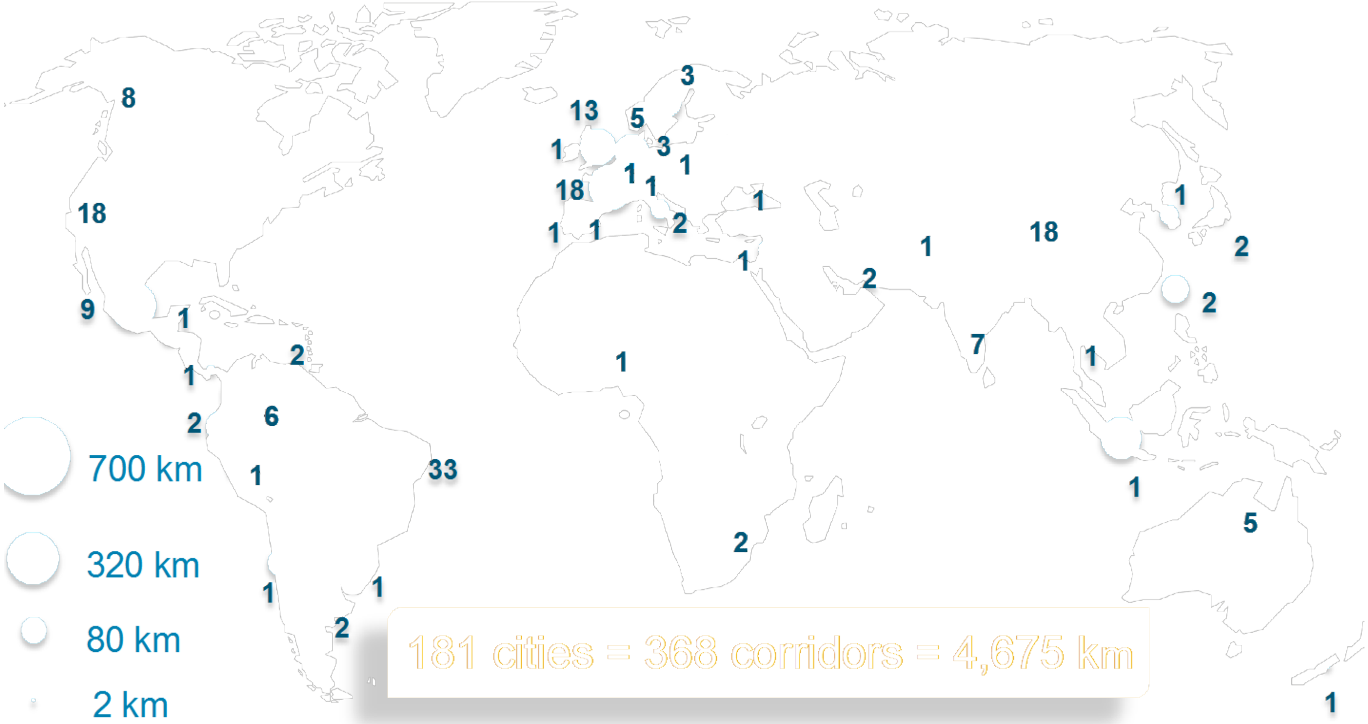
Bus priority systems in the world

- # of cities and length (km) per country

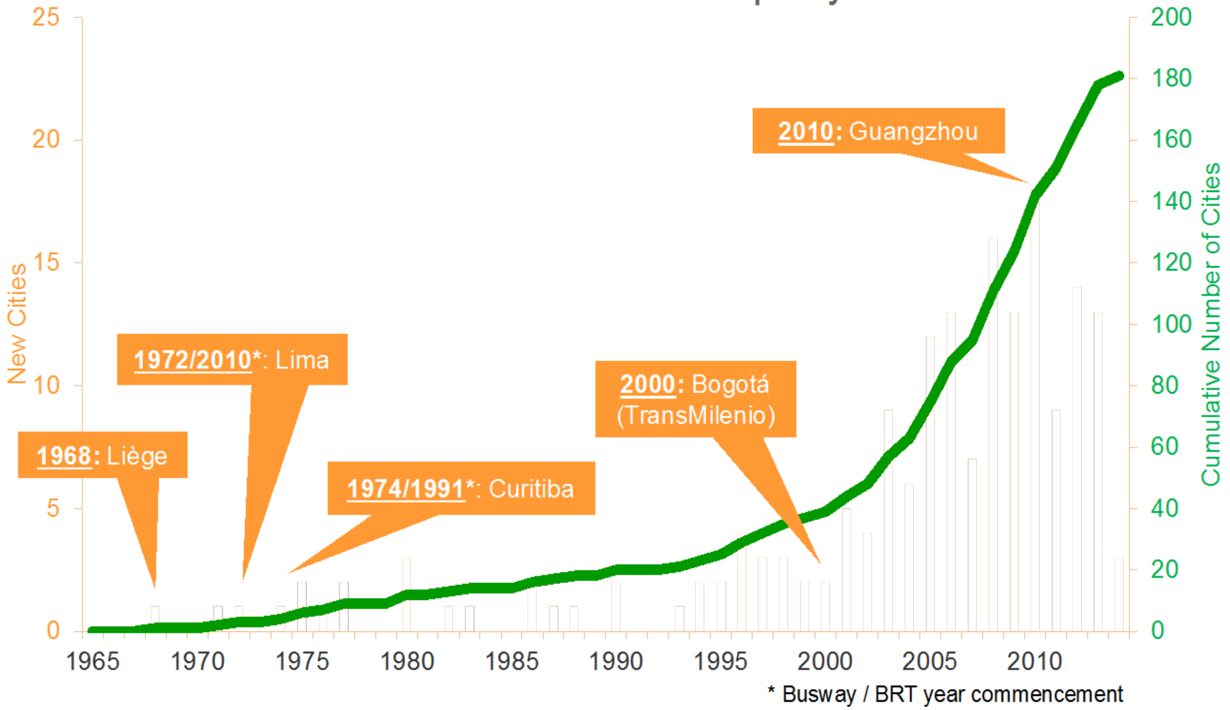


BUS RAPID TRANSIT ACROSS LATITUDES AND CULTURES · EMBARQ · EMBARQ Brasil · iea · SIBRT

source: BRTdata.org, August 2014

Bus priority systems in the world

Evolution of the number of cities per year



source: BRTdata.org, August 2014

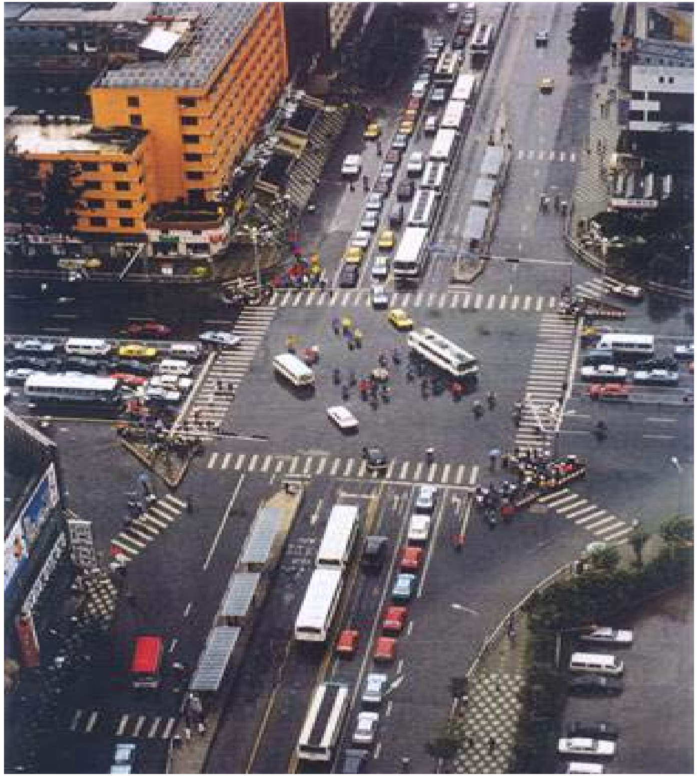
PEOPLE FLOW CAPACITIES

Mode	Persons per lane (3m) per hour
Metro	10,000 -- 50,000
Bus (dedicated lane)	5,000 – 40,000
Walking	9,000
Bicycle	5,000
Car	3,000

- 15,000 in exceptional cases

10,000 – 15,000 more common

- Equitable allocation of road space with people, rather than vehicles
- Greater use of public transport and non-motorized modes
- Reserving lanes and corridors exclusively for public transport and non-motorized modes of travel



□ Establishment of Bus Support System (SEOUL)

Expanding Exclusive Median Bus Lanes

■ **Expansion Plan (in 2005 and thereafter: 10 lines/172㎞)**

※ Status of Existing Bus Lanes

▷**Exclusive median bus lanes: 7 lines/ 84㎞**

▷**Curbside bus lanes: 293.6㎞**

New exclusive median bus lane (1st, July 2004)

- Kangnam-Daero
  - Queues in the bus lane
  - Some one-door bus generated long dwelling time at bus stops
    - ▷Control of numbers of bus in the lane (About 250 buses/h)

New exclusive median bus lane (now)

- Increase of speed for both bus and p-car
  - 10 km/h to over 20 km/h
- More carriage of passenger
  - 6 times more passengers than other lanes
- Less travel time variation
  - 5 times less than other bus lanes

Bus lanes allow smooth passage for ambulances, fire trucks and police vehicles

Sao Paulo, Brazil

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Quito. Ecuador

Porto Allegre, Brazil

Nagoya, Japan

Taipei, Taiwan

Dedicated bus lanes needed when car lanes congested

Taipei, Taiwan

Nice, France

Nice, France

Bogota, Columbia

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Curitiba, Brazil

Curitiba, Brazil

Pune, India

Bus only, Quito, Ecuador

Tehran, Iran

Tehran, Iran

Pedestrian/bicycle tracks, BRT Delhi

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2 parallel bus stops, Delhi

Counter flow bus lane, Bangkok

Paris : CAR 1 WAY, BUS ONE WAY ROW ~ 15 m

Pedestrian path	2 m x 2
Bus lane	3.3 - 3.5 m
Car lane	3.0 m
Bicycle lane	2 m

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Paris : CAR 1 WAY 2 LANES, BUS ONE WAY ROW ~ 18 m

Pedestrian path	3 m x 2m
Bus lane	3.3 - 3.5 m
Car lane	3.0 m X 2
Bicycle lane	None

Paris : CAR 1 WAY, BUS ONE WAY ROW ~ 10 m

Pedestrian path	2 m
Bus lane	3.3 - 3.5 m
Car lane	3.0 m
Bicycle lane	None

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Paris : CAR 1 WAY 2 LANES, BUS TWO WAY ROW ~ 30 - 35 m

Pedestrian path	4 m x 2
Bus lane	3.3 - 3.5 m x 2
Car lane	3.0 m x 2
Bicycle lane	2m x 2

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Paris : CAR 2 WAY 2 LANES, BUS TWO WAY ROW ~ 30 - 35 m

Pedestrian path	4 m x 2
Bus lane	3.3 - 3.5 m x 2
Car lane	3.0 m x 4
Bicycle lane	Mixed

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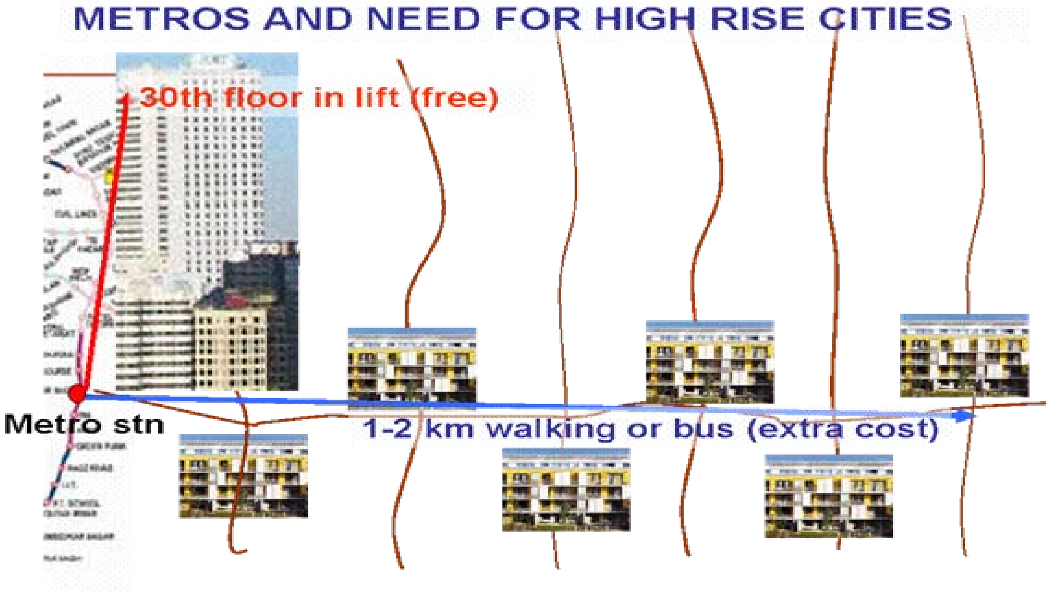
Elevated pedestrian access

Surface access, Taipei

High rise buildings, congestion necessary for Metro

- "Feeder trip" in lifts
- Only way large number close to destination
- Metros run empty in less dense cities



What kind of a city do we want ?

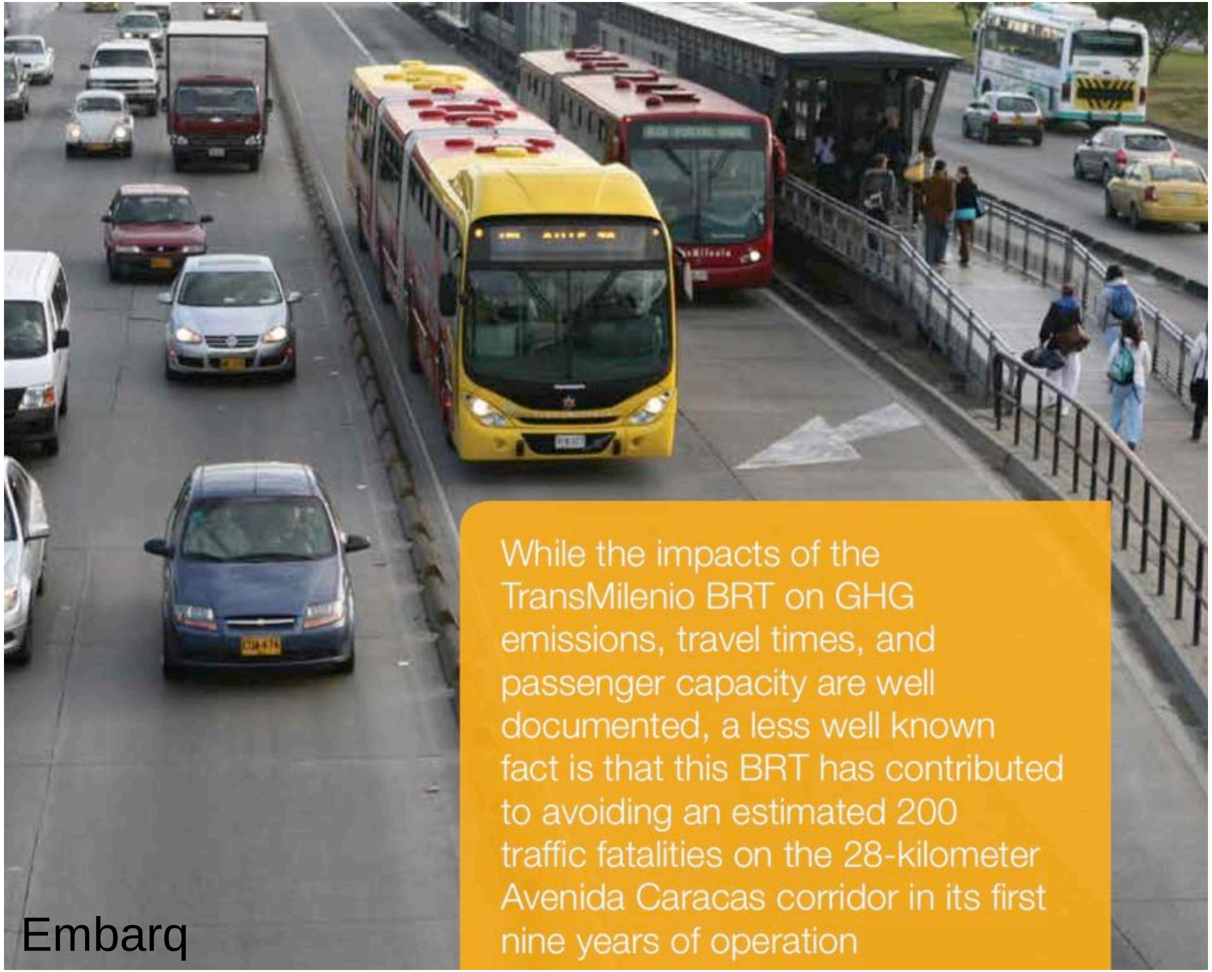
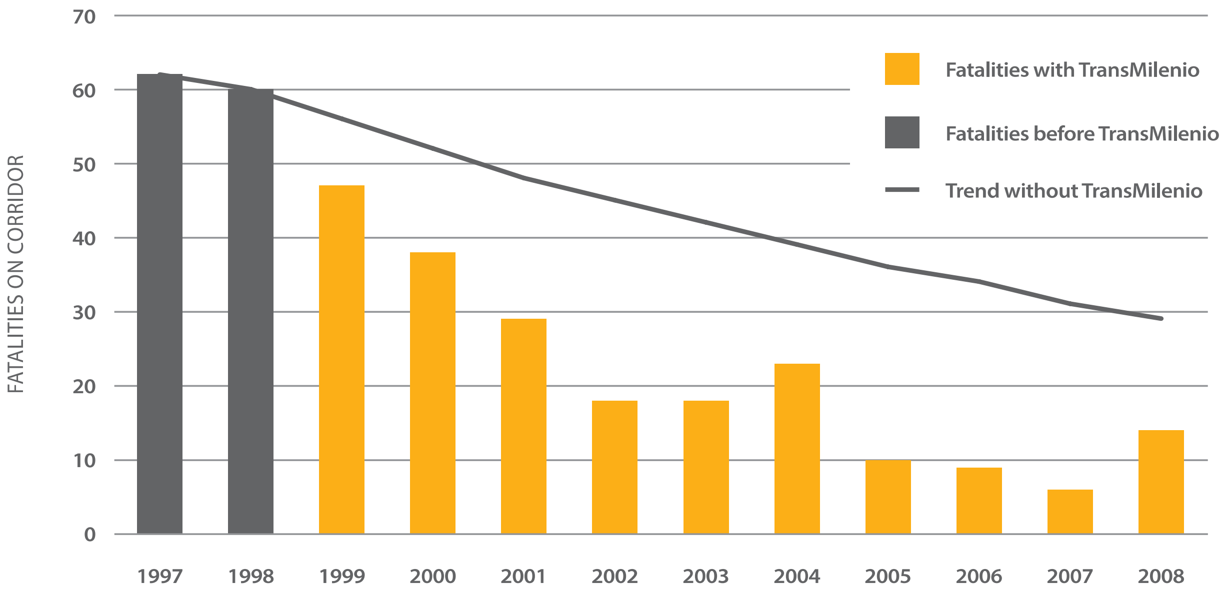

While the impacts of the TransMilenio BRT on GHG emissions, travel times, and passenger capacity are well documented, a less well known fact is that this BRT has contributed to avoiding an estimated 200 traffic fatalities on the 28-kilometer Avenida Caracas corridor in its first nine years of operation
Embarq

Figure 2 Reported traffic fatalities on Avenida Caracas (first TransMilenio BRT corridor) in Bogotá, before and after the implementation of the BRT



SOURCE: EMBARQ Analysis, based on data provided by TRANSMILENIO S.A.

BRTS Corridor Delhi – Safety Features

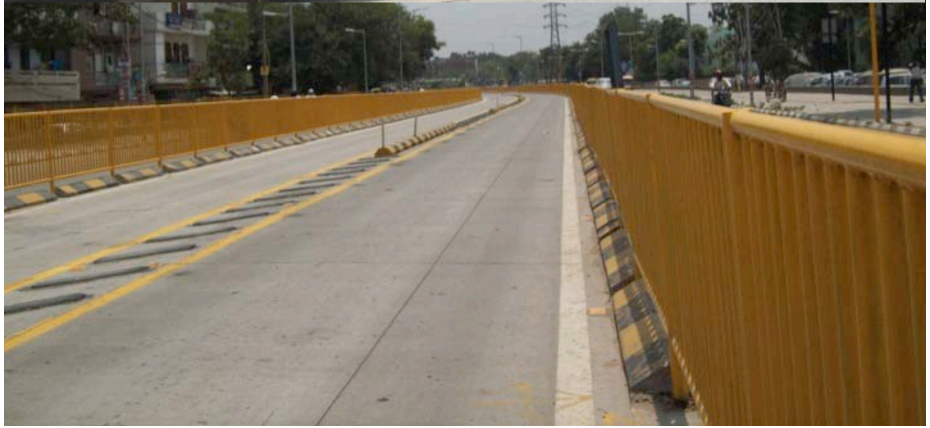
BRTS Corridor Delhi – Safety Interventions

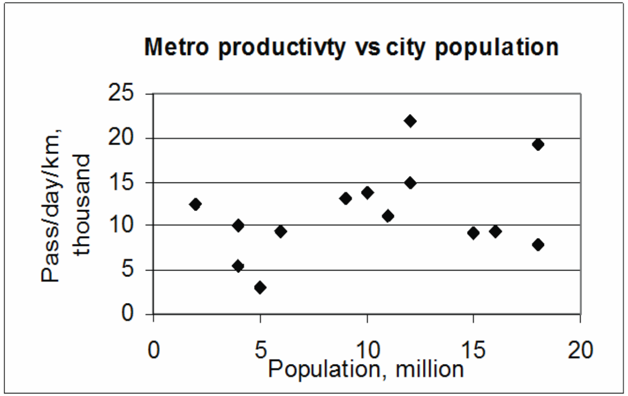
All crashes observed in bus lanes

Rumble Bars before stations approaches in bus lane

Signal cycle improved at one junction to reduce pedestrian delays

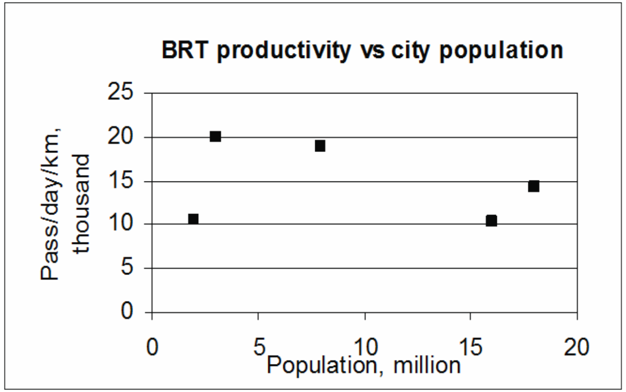
Railing extended in some Mid Block segments.





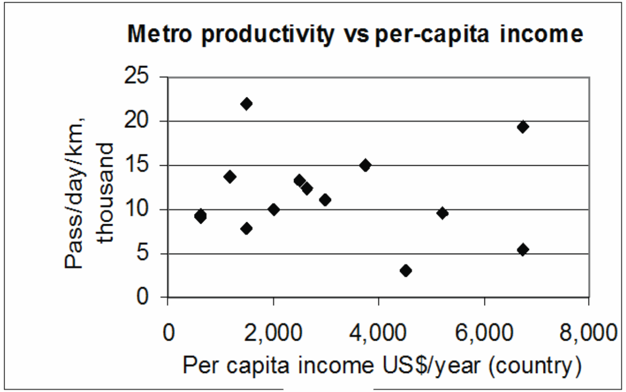
Metro productivty vs city population
Pass/day/km, thousand
25
20
15
10
5
0
0
5
10
15
20
Population, million

(a)



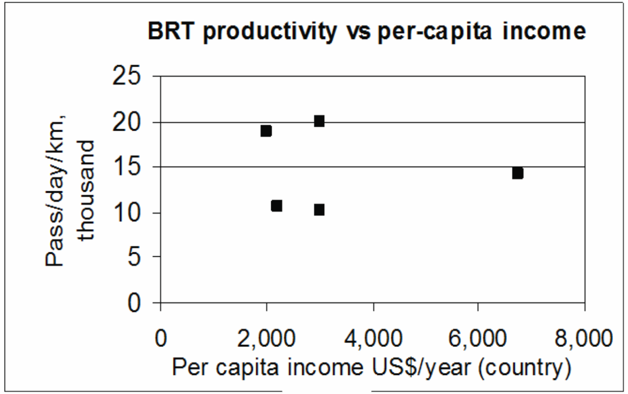
BRT productivity vs city population
Pass/day/km, thousand
25
20
15
10
5
0
0
5
10
15
20
Population, million

(b)



Metro productivity vs per-capita income
Pass/day/km, thousand
25
20
15
10
5
0
0
2,000
4,000
6,000
8,000
Per capita income US$/year (country)

(c)



BRT productivity vs per-capita income
Pass/day/km, thousand
25
20
15
10
5
0
0
2,000
4,000
6,000
8,000
Per capita income US$/year (country)

(d)

In principle tram same as BRT

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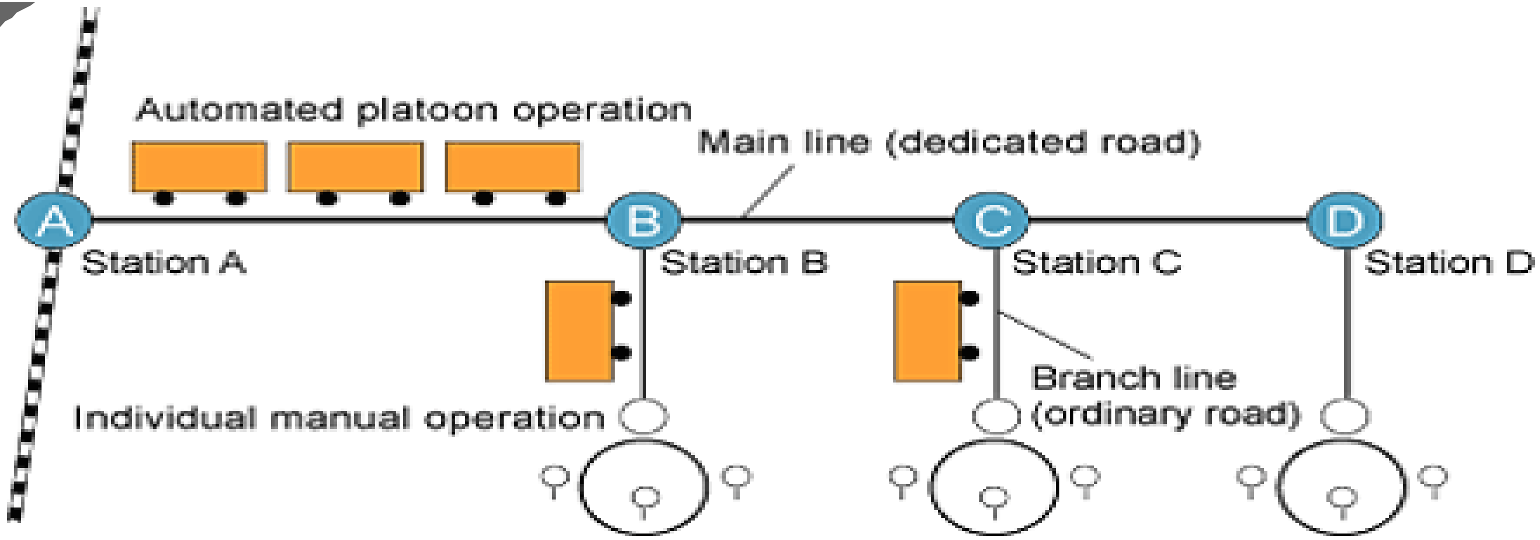
In principle tram same as BRT

Open system vs closed system

BRT must <u>not</u> imitate the METRO in all aspects. BRT must use all aspects that make it flexible

Toyota's new Intelligent Multimode Transit System (IMTS), driverless vehicles that move together automatically in a platoon formation on dedicated roads, as well as manual and independent operation as buses on ordinary roads. The system features the punctuality, high speed and large passenger capacity of conventional rail based systems and the economic efficiency and flexibility buses serving regular routes



This makes it possible to directly link central cities with outlying regions, without requiring the passengers to switch buses. The system can be operated flexibly and efficiently according to changes in transportation demand, and at the same time can dramatically reduce the high construction and maintenance costs associated with conventional track-based systems

Economic: Public transport on the ground in the form of buses and street cars is cheaper to build, maintain and to operate.

Efficiency: Public transport is one of the most efficient modes with respect to energy consumption, use of space and safety. Therefore, there is no reason to remove it from the road surface.

Accessibility: Elevated or underground public transport loses half or even two-thirds of potential customers compared to street level public transport modes. Further, if public transport is separated from the street level, it becomes necessary to build and operate escalators, lifts, etc. This enhances the costs for construction, maintenance and operation.

Security: The entire transport system on the street level is under public social control and is, therefore, much safer.

Urban economy: Street level public transport is good for urban economy. The experience of European cities show shows that replacing street level public transport by underground systems has a negative effect on local shops. Underground or grade separated public transport systems increase both disparities and the need for longer travel.

Structural: Public transport on street levels keep people moving without fundamental changes of urban structures and the system provides flexibility as land use changes.

Urban vision: It is crucial to integrate public transport also in the mental map of people and visitors. Public transport on the streets tells the people that it is a socially balanced city.

Environmental: Public transport on the street level serves as an indicator for an environment friendly transport policy of the city. To integrate public transport in the human society it is necessary to keep it on the road surface instead of the sky or underground.