

# **BRT – Bus Rapid Transit Experience in Latin America**

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# Bus – problems with image

Any man who rides a bus to work after the age of 30 can count himself a failure in life

*Margareth Thatcher*

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# BRTs are in fashion



~50



Systems in Operation



~100

Planned Systems

- Curitiba, Brazil
  - BRT basics in the 70s
- Recently, BRTs have transformed public transport in many cities



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# Pereira, Colombia Cra. 8a. before



Photo: Megabus S.A.  
Courtesy of Ramón Muñoz

# Pereira, Colombia

## Cra. 8a. with Megabús



Photo: Megabús S.A.  
Courtesy of Ramón Muñoz

# What is a BRT (1)?

- Is a **flexible**, rubber-tired form of rapid transit that combines **stations**, **vehicles**, **services**, **running ways** and **ITS** elements into an integrated system with strong **identity**

*TRCP Report 90 – Bus Rapid Transit – Volume 2: Implementation Guidelines. TRB, 2003.*

## What is a BRT (2)?

- Is a **high-quality** bus-based system that delivers **fast**, **comfortable**, and **cost-effective** urban mobility through the provision of segregated right-of-way infrastructure, **rapid** and **frequent** operations, and excellence in marketing and **customer** service

*Bus Rapid Transit: Planning Guide. ITDP, 2007.*

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# Elements of BRT

- Running ways
- Stations/stops/terminals
- Fare collection
- Vehicles
- Service and Operating Plans
- ITS – Intelligent Transport Systems
- Branding and User Education
- Institutions and Regulation

# Elements of BRT

- Running ways
  - dedicated lanes/carriageways
  - curbside or median
  - 1 or 2 lanes per direction
  - at grade
    - different degrees of physical separation
  - “underground”
  - elevated
  - guidance (mechanical)

At grade,  
1+1 lane,  
no physical  
separation



At grade,  
1+1 lane,  
with physical  
separation



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At grade,  
1+1 lane,  
with physical  
separation  
(ma non troppo)



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# Underground, 1+1 lane running way



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Elevated, 1+1 lane



# Take a ride...



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# Surface, 2+2 lanes, physical separation



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# Quito Historic District



# Pereira, Colombia



# Bogota Eje Ambiental



Is it really a problem with road space?



# Elements of BRT

- Running ways
- Stations/stops
- Fare collection
- Vehicles
- Service and Operating Plans
- ITS – Intelligent Transport Systems
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# Elements of BRT

- Stations/stops
  - number of platforms
  - with or without passing lane
  - with or without level access
- Terminals



## Number of platforms





## Passing lane at stop



# Flexibility: different stops in each direction



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Level boarding,  
automatic doors

Level boarding,  
platform opening



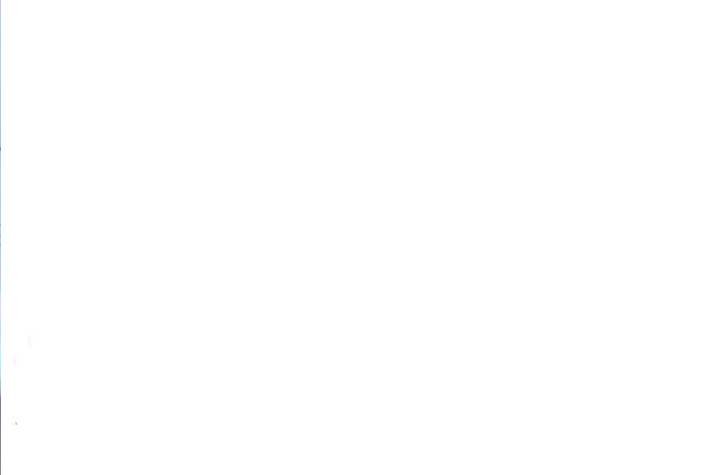


# “Tube” station, autom. doors, bus ramps





**Elevated  
stations**



... and their  
consequences

# Terminals



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# Terminals



# Elements of BRT

- Running ways
- Stations/stops
- Fare collection
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# Elements of BRT

- Fare collection
  - transaction media
    - manual or electronic
  - on-board or pre-payment
  - fare structure
    - flat or zonal
    - integrated or not
  - third-party financial services providers
    - equipment
    - commercialization of cards
    - electronic financial transactions



Combined media:  
money and  
smart card

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# Fare prepayment



Curitiba



Mexico City

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# Elements of BRT

- Running ways
- Stations/stops
- Fare collection
- **Vehicles**
- **Service and Operating Plans**
- **ITS – Intelligent Transport Systems**
- **Branding and User Education**
- **Institutions and Regulation**

# Elements of BRT

- Vehicles
  - capacity
    - conventional
    - articulated
    - bi-articulated
  - low floor/entry x elevated
  - number (and width) of doors
  - doors on both sides
    - requirement for flexible operation

## Las Vegas, Max



## Curitiba, Expresso

Low entry  
(on the left side)



“No entry”  
(on the right side)

# Elements of BRT

- Vehicles (and the environment)
  - propulsion
    - Diesel (not always low-sulphur)
    - CNG
    - biodiesel
    - ethanol
    - trolleybuses
    - hybrid (diesel/electric)
    - fuel cells

# Trolleybus



# Elements of BRT

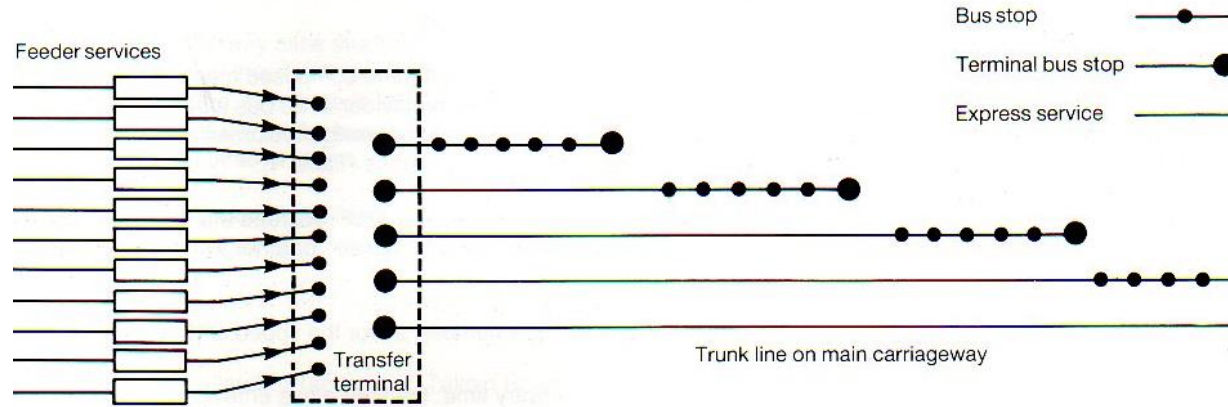
- Running ways
- Stations/stops
- Fare collection
- Vehicles
- **Service and Operating Plans**
- **ITS – Intelligent Transport Systems**
- **Branding and User Education**
- **Institutions and Regulation**



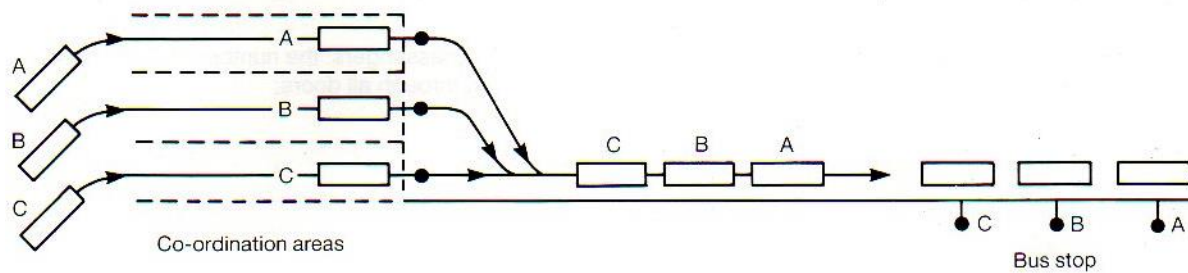
# Elements of BRT

- System and corridor planning
  - one corridor x few corridors x network
  - integration with existing systems
  - route structure
    - feeder-trunk
    - closed x open systems
  - express, limited stop, all-stop services
    - remember: buses make turns – less transfers
  - convoy operation

(i) Trunk and feeder service



(ii) 'Comonor' bus convoy



**Fig. A1 Options for High Capacity Busway Operations**

*(from Roads and Transport in Urban Areas, IHT/HMSO 1987)*

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Feeder terminal

Express service



# Elements of BRT

- Running ways
- Stations/stops
- Fare collection
- Vehicles
- Service and Operating Plans
- **ITS – Intelligent Transport Systems**
- **Branding and User Education**
- **Institutions and Regulation**

# Elements of BRT

- ITS components
  - vehicle prioritization
  - passenger information
  - fare collection
  - scheduling and dispatch systems
  - automated vehicle control
    - guidance (electronic)
    - docking
  - automatic passenger counters
  - security on board and at stations

## Control Center Transmilenio



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# Passenger information São Paulo



# Signal coordination Curitiba

# Docking: ITS?



Mexico City,  
Metrobús

León, Optibús





# Elements of BRT

- Running ways
- Stations/stops
- Fare collection
- Vehicles
- Service and Operating Plans
- ITS – Intelligent Transport Systems
- **Branding and User Education**
- **Institutions and Regulation**

# Branding – creating a strong identity



Guadalajara, Macrobus



Bogota

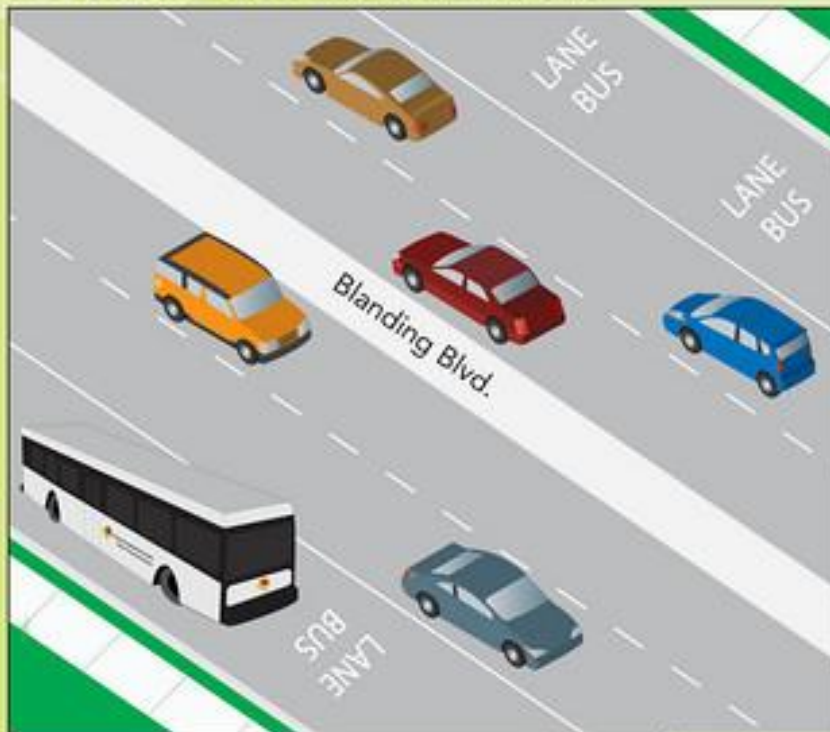
San Antonio

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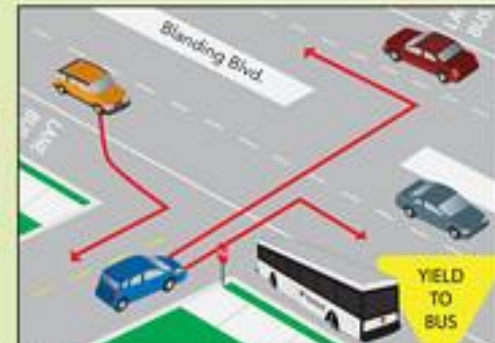
# User – and NON-user - education

**Bus lanes** are found throughout the country and are instrumental in helping mass transit vehicles move more efficiently. Jacksonville has its first bus lane on Blanding Boulevard between Morse Avenue and 103rd Street. Since this concept is new to the area, below are a few tips for using bus lanes.

## How to Use a Bus Lane



On Blanding between Morse Avenue and 103rd Street the far right lane is for buses only. Cars should not travel in this lane.



If the orange car needs to make a right hand turn at the intersection, it may enter the bus lane, yielding to buses, just prior to the **intersection**. It must turn right at that intersection. Buses and emergency vehicles may travel straight through without turning. All other vehicles must turn. If the blue car enters Blanding from a side street, it must be aware that the buses may travel straight through the intersection. It must also enter the travel lane, not the bus lane, even though the bus lane may be closer to the blue car.



If the green car is entering a **business** along Blanding, it will enter the travel lane by crossing the bus lane to the business. When it leaves, it will cross the bus lane and enter the travel lane. Be sure to yield to buses at all times when crossing the bus lane.



JACKSONVILLE TRANSPORTATION AUTHORITY  
Regional Transportation Solutions

Bus lanes operate 24 hours a day, seven days a week.

For more information, visit [www.jtafla.com](http://www.jtafla.com) or call customer service at 904-630-3100.

# Elements of BRT

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- **Institutions and Regulation**

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# Institutions and Regulation

- fragmented bus ownership
  - lack of route structure
  - lack of integration
  - lack of entrepreneurial expertise
- inadequate institutional setting
  - planning
  - management/supervision
  - operations
- stakeholders involvement
  - long and difficult negotiations
  - strong leadership required



Bogota, 1000s of owners/operators

Transmilenio, small number of bus companies



# Is the BRT world wonderful?

- problems with design
- problems with implementation
- problems with funding for maintenance
- problems with pavements
- problems with overcrowding
- other problems...



# Victims of poor design



Pune



São Paulo

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# Victims of poor design



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# Victims of their own success



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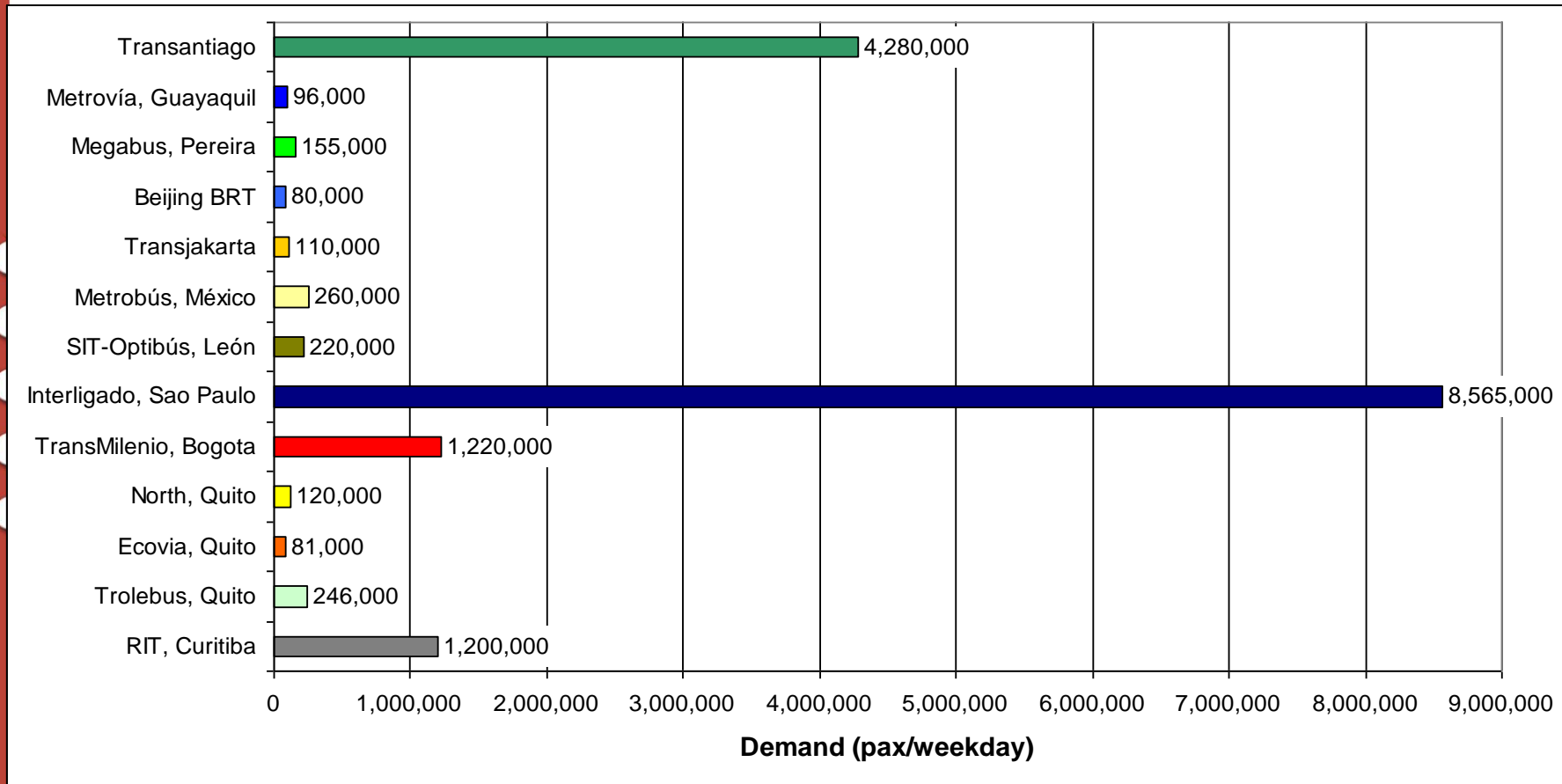
## Congested Transmilenio



# Flexible systems, flexible results

- What is the range of results in terms of
  - daily demand
  - peak loads
  - commercial speeds
  - boardings per km
  - passengers per bus per day
  - capital costs (infra+equipment) per km
  - fares

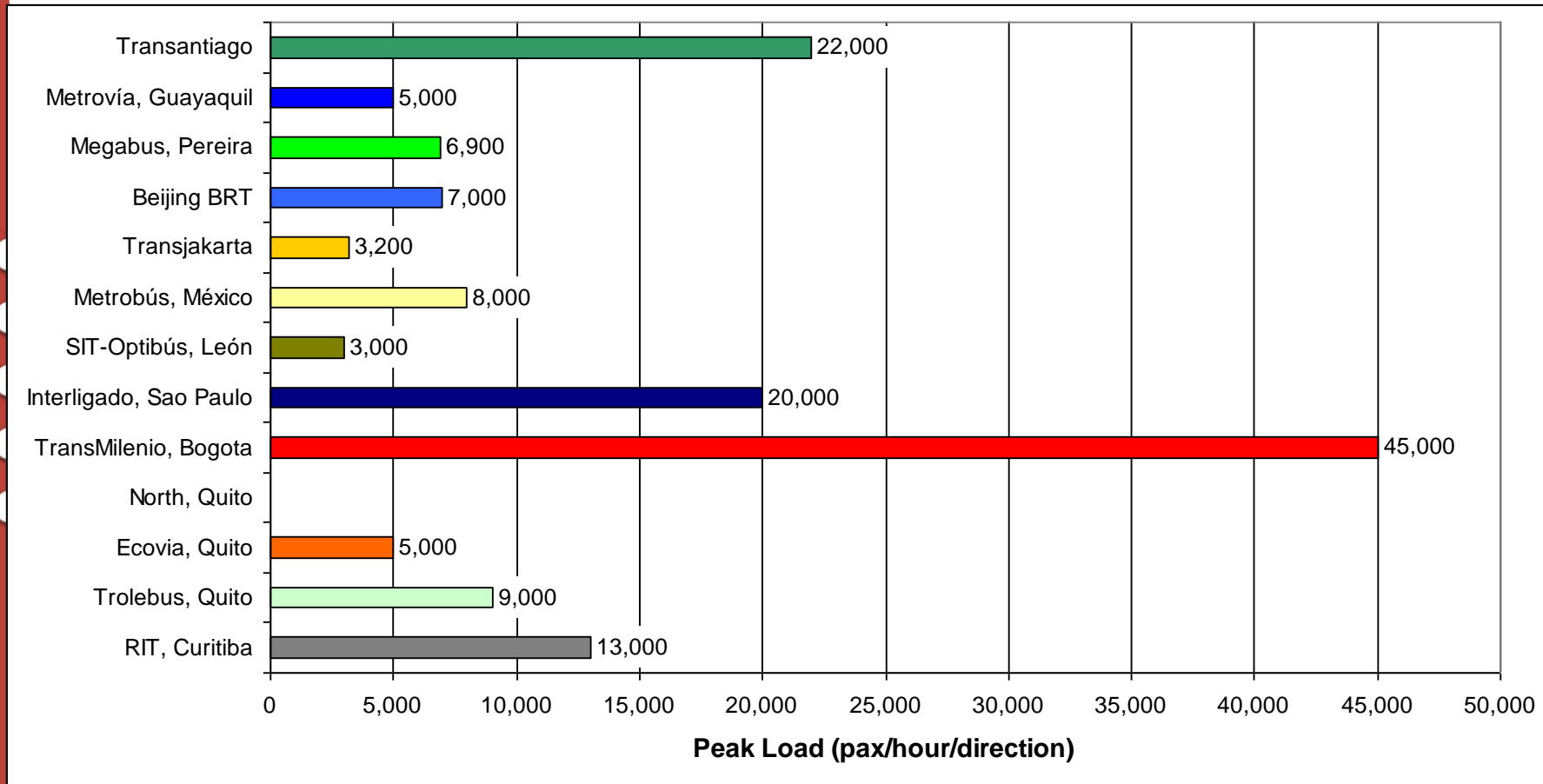
# The ridership is diverse; most systems between 100K–250K pax/day



Source: Hidalgo, Custodio & Grafiteaux (2007)

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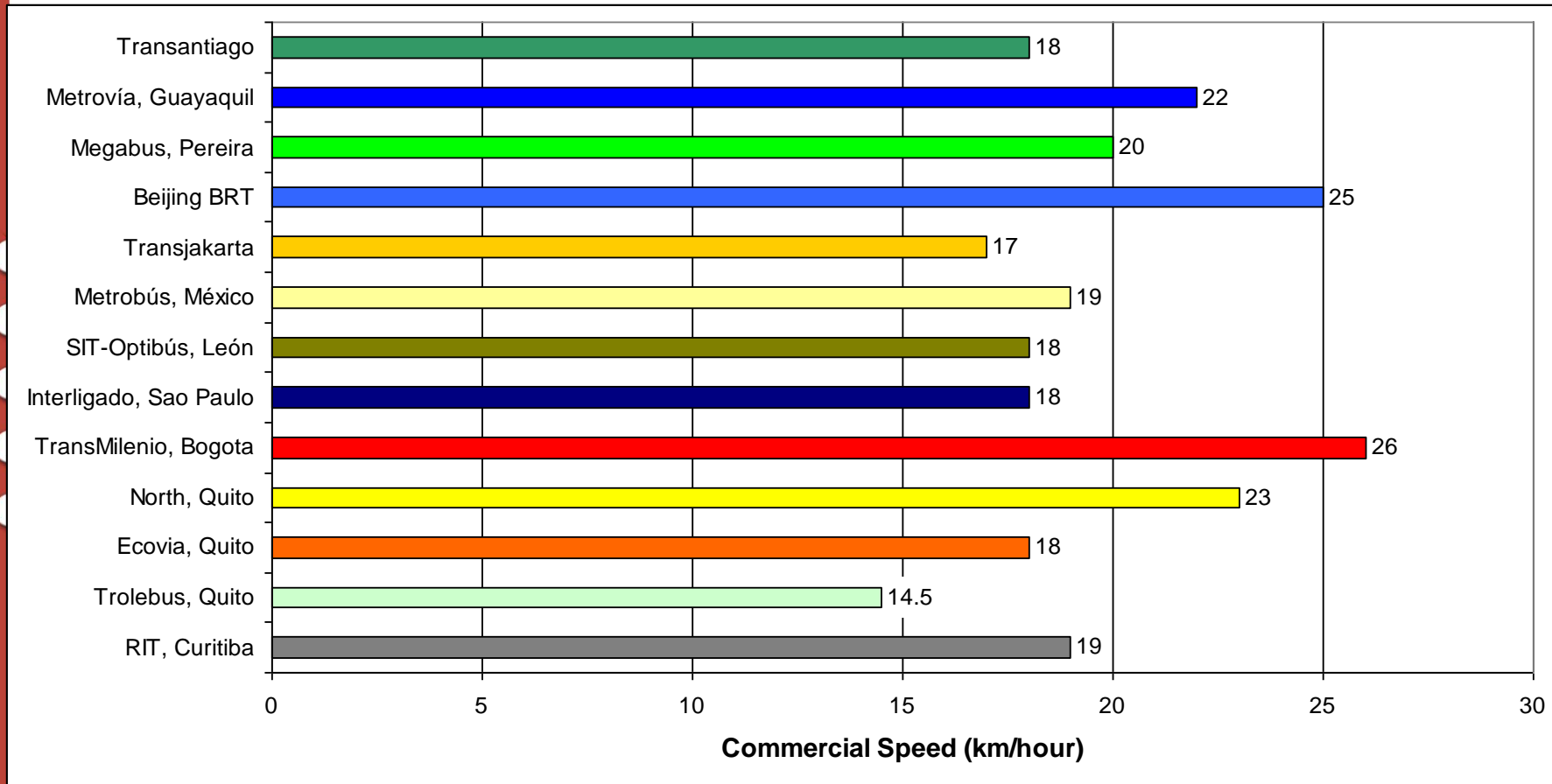
# Performance is contrasted: very high loads (20K+ pphpd), medium corridors (8K–13K), small corridors (3K–7K)



Source: Hidalgo, Custodio & Grafiteaux (2007)

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Top commercial speeds are over 25 km/h,  
with most systems operating between 14 km/h and 20 km/h

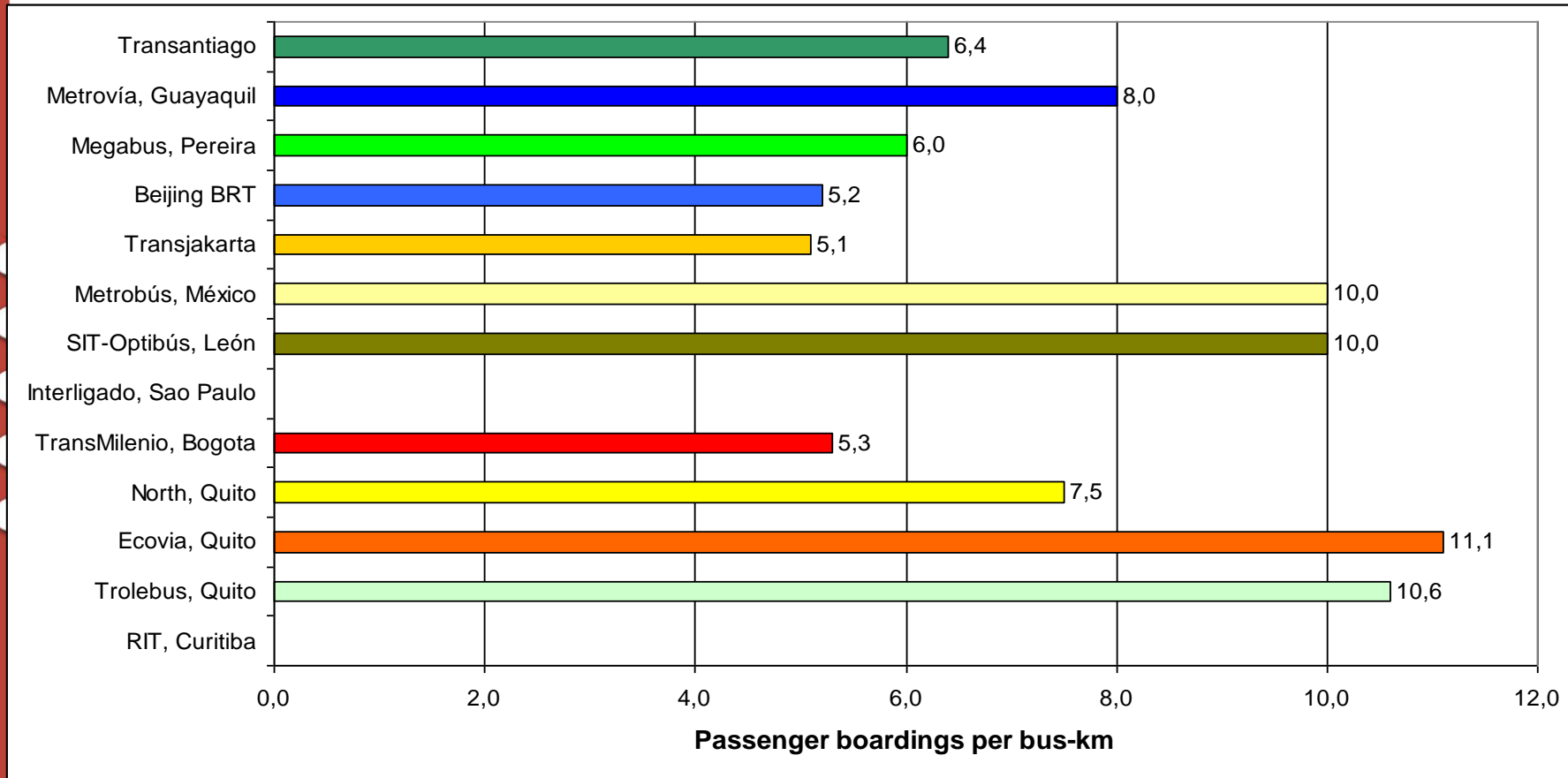


Source: Hidalgo, Custodio & Grafiteaux (2007)

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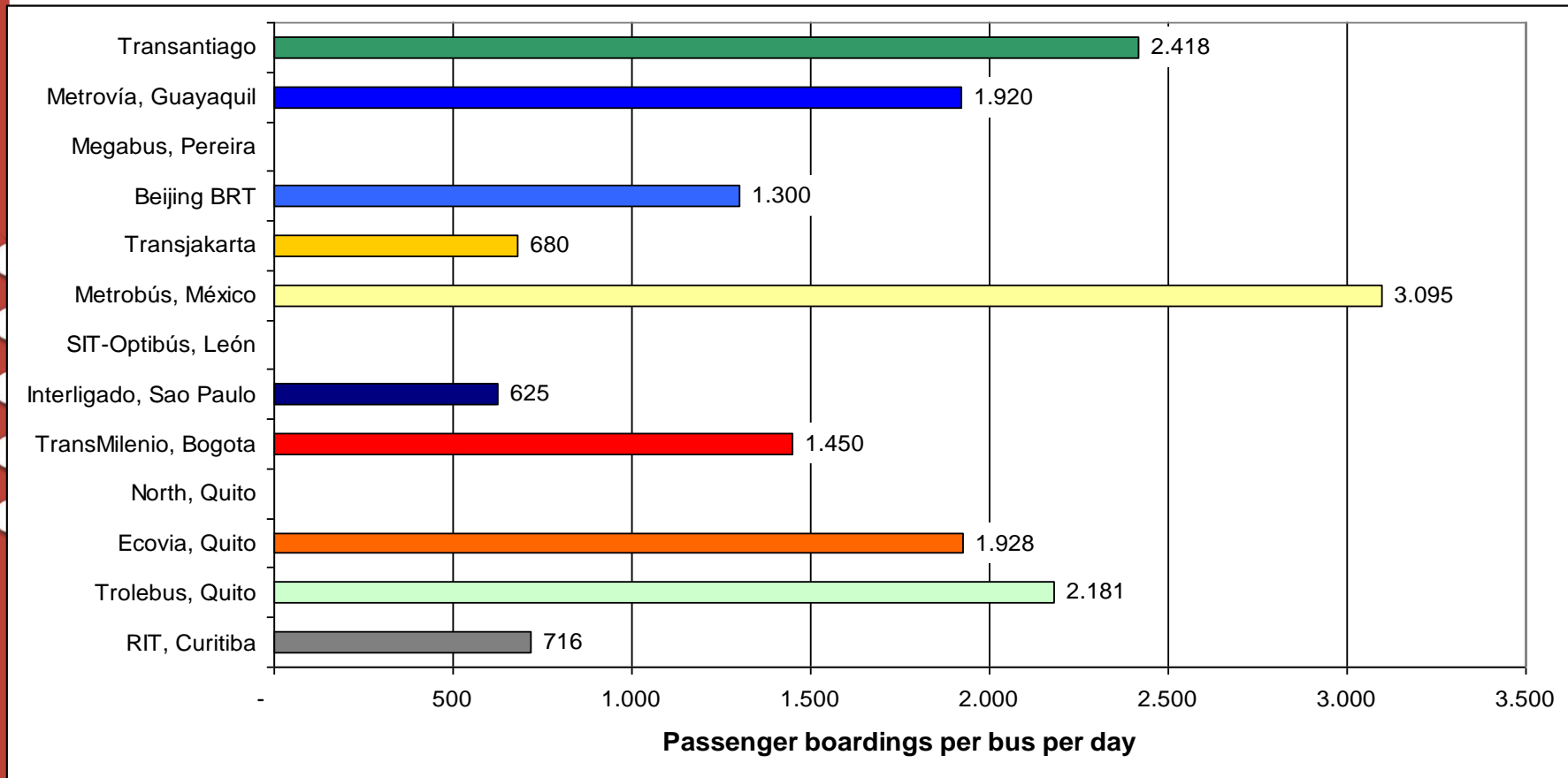
# Top operational productivity is over 10 boardings/bus-km with most systems between 5 and 8 boardings/bus-km



Source: Hidalgo, Custodio & Grafiteaux (2007)

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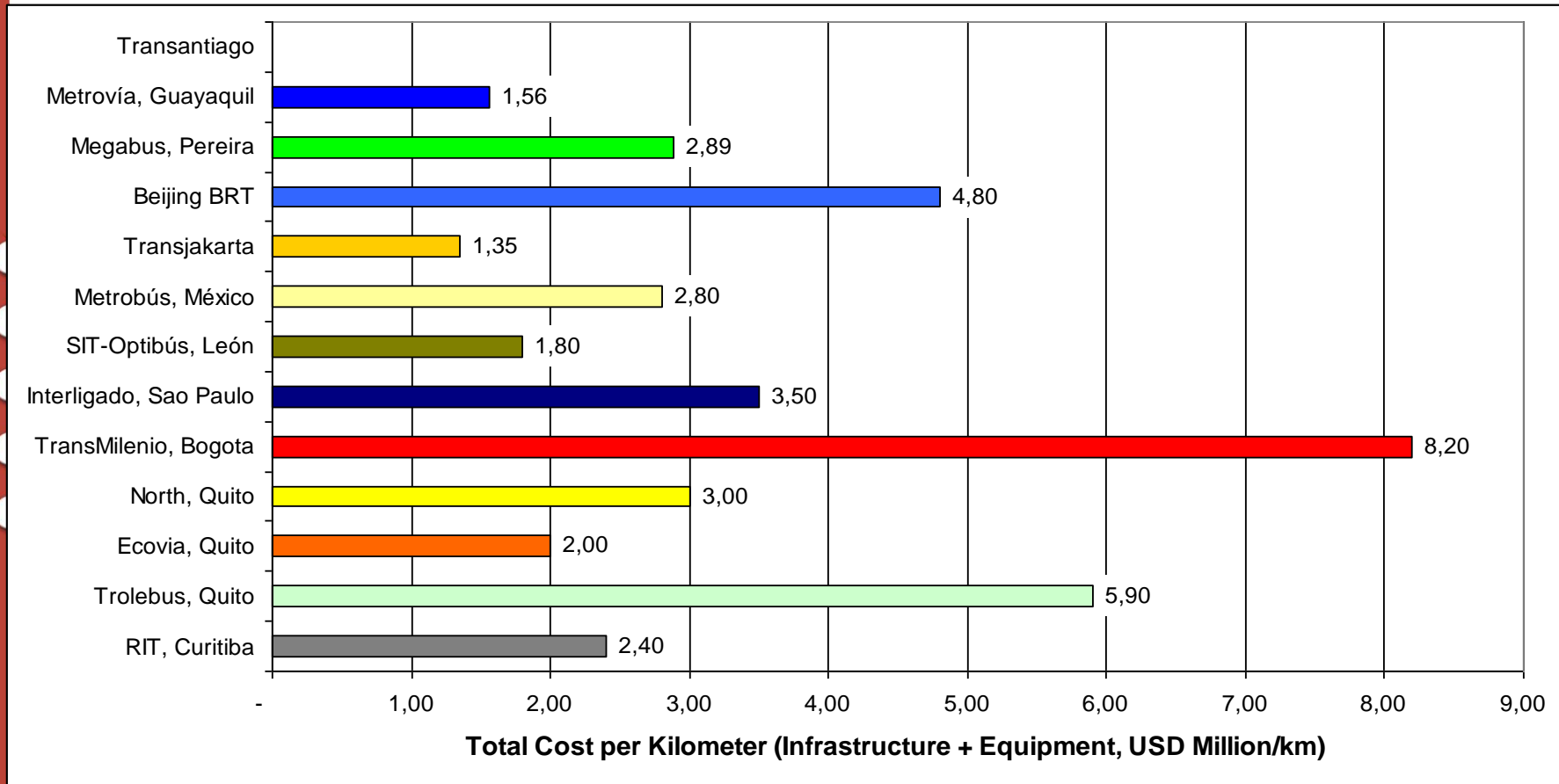
Capital productivity very high in some systems (2–3K+ pax/bus/day); others between 0.6K and 1.5K pax/bus/day



Source: Hidalgo, Custodio & Grafiteaux (2007)

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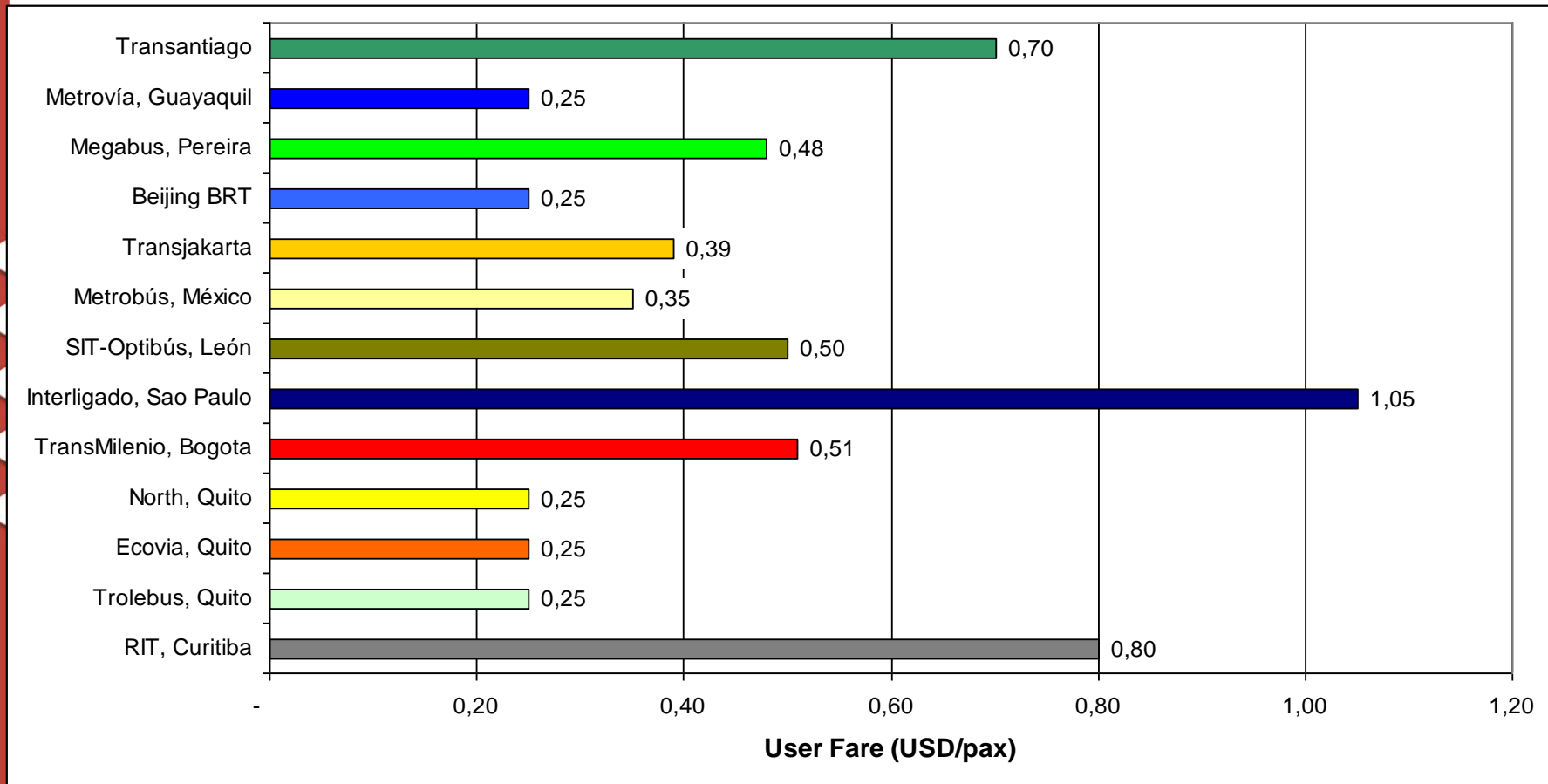
Total capital costs vary from 1.35 U\$ million/km (Jakarta) to 8.2 U\$ million/km (Bogotá, infrastructure and equipment only)



Source: Hidalgo, Custodio & Grafiteaux (2007)

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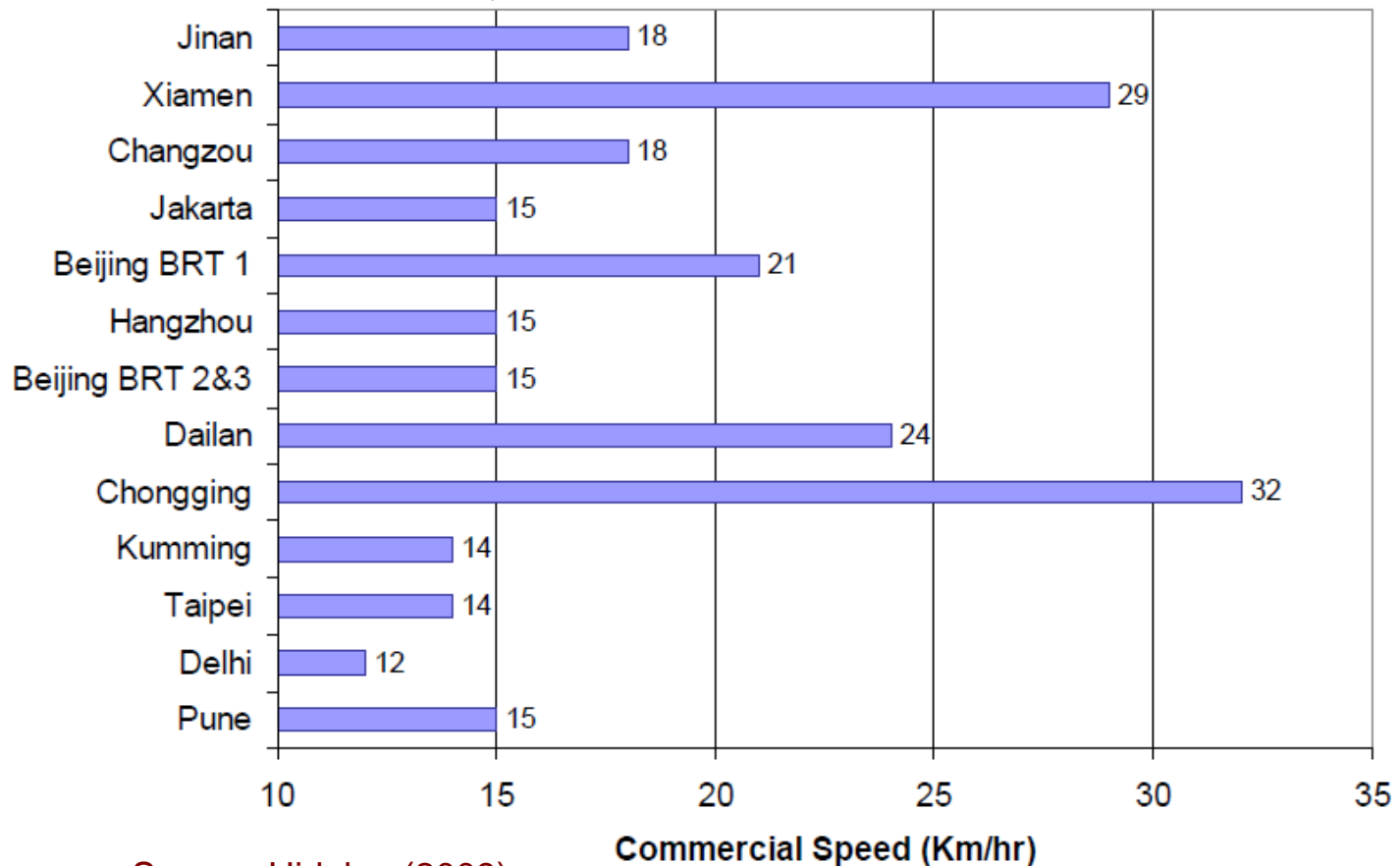
All fares below U\$1.05 per trip – most systems with fares below U\$0.40 are receiving subsidies or under financial stress



Source: Hidalgo, Custodio & Grafiteaux (2007)

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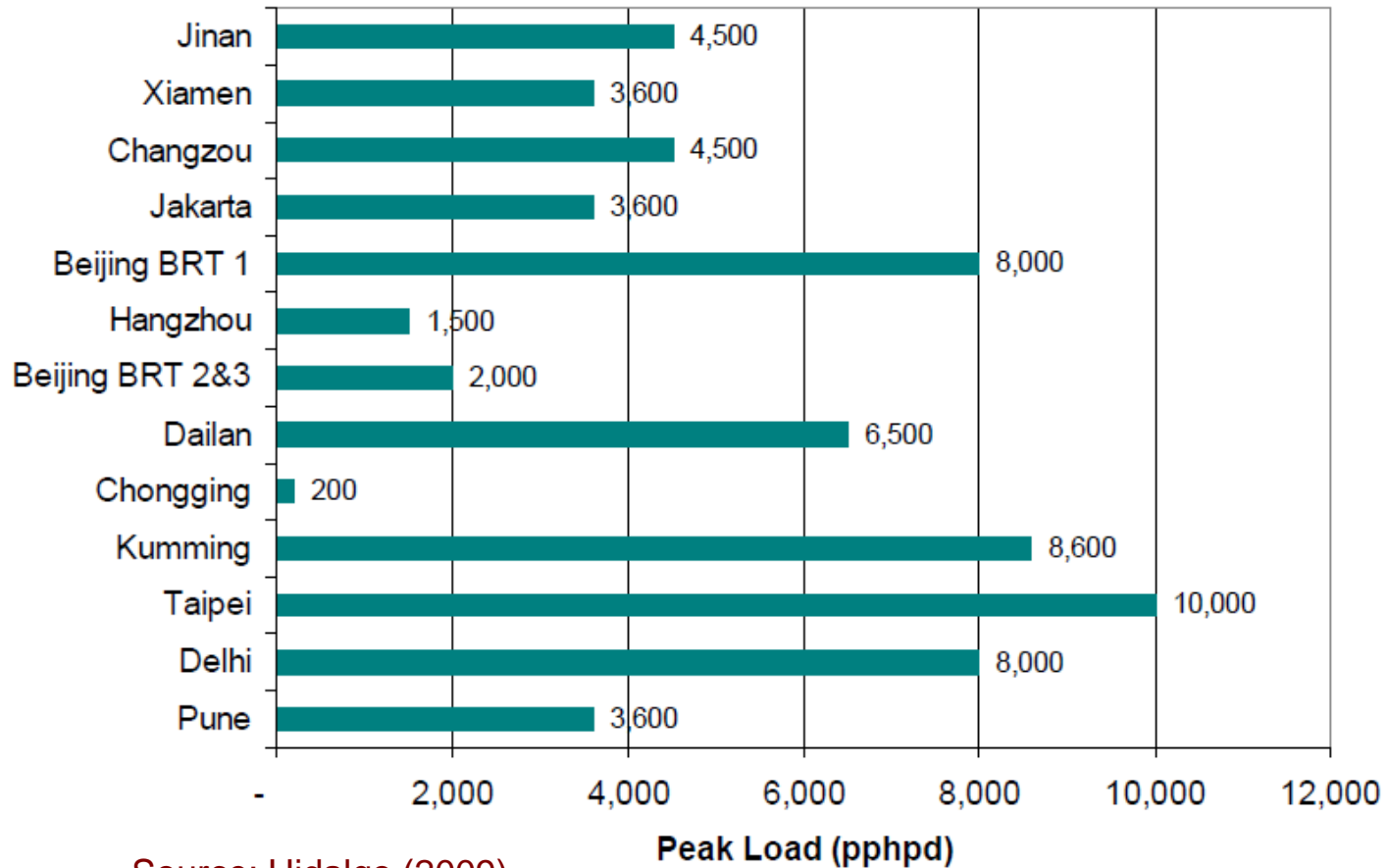
# Are BRTs in Asia doing better?



Source: Hidalgo (2009)

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# Demand is not high in Asian cities



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# BRT and Urban Development

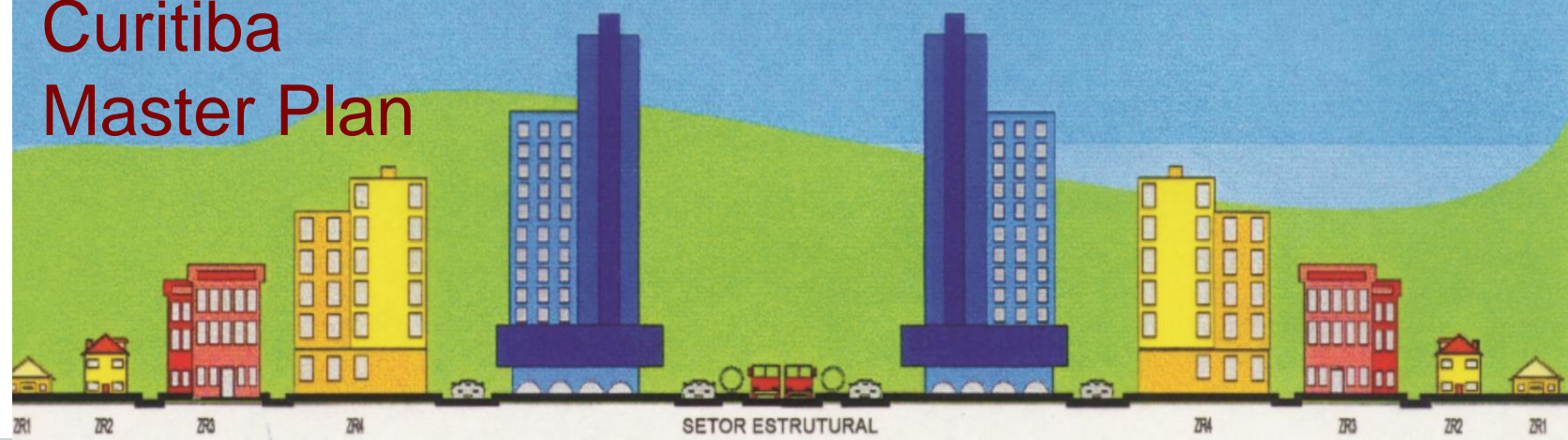
- Need to transform cities in developing countries
  - growing interest in TOD –  
Transit-Oriented Development
- Rail modes traditionally seen as more advantageous (fixity)
- Can BRT help?

# BRT and Urban Development

- Bogotá
  - every 5 min of additional walking time to BRT station decreases rental price 7 to 9%
- Curitiba Green Line
  - real estate prices tripled after city law enabled densification along BRT corridor
- Curitiba RIT – since 1974
  - the pictures speak for themselves



# Curitiba Master Plan







South corridor

West corridor

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## BRT Eye-catchers

Low capital costs

Short implementation times

Not a magical solution,  
but important alternative in  
transport planners' toolkit



Lima



Cidade do México



Paris



Brisbane

Istambul



Johannesburg



Guadalajara



Changzhou, China



# VREF – Volvo Foundations Center of Excellence for BRT

- Catholic University Santiago, Chile
- IST – Lisbon Technical University
- MIT
- University of Sydney
- EMBARQ/World Resources Institute



You can be happy on a bus





# Thank you

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