High Level Bus Rapid Transit Systems (HBRT): an option to consider even at high demand levels

Dario Hidalgo, PhD
hidalgo_dario@ne.bah.com

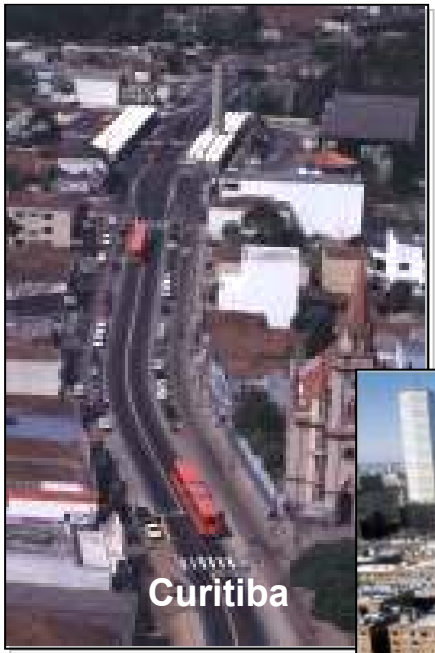
5th International Bus Conference UITP
Bogotá, Colombia, February 14-16 2007

High Level Bus Rapid Transit (HBRT) is not adequately reflected in traditional classifications of transit modes

- Longitudinally or totally segregated running ways
- Stations with prepayment; level access
- Large buses
- Electronic ticketing
- Central control (AVL)
- High frequency, several services (local, express, integrated feeder)
- Distinctive Image

Foto: TransMilenio Calle 80, Bogotá, Colombia, DHG Jun-2006

There are several applications of heavy rail transit (metro), light rail transit, and busways/bus priority schemes – but few HBRT examples


Curitiba


Goainia, Brazil


Quito, Ecuador


León, México


Boston


Bogotá, Colombia


Yakarta, Indonesia


Brisbane

Ottawa

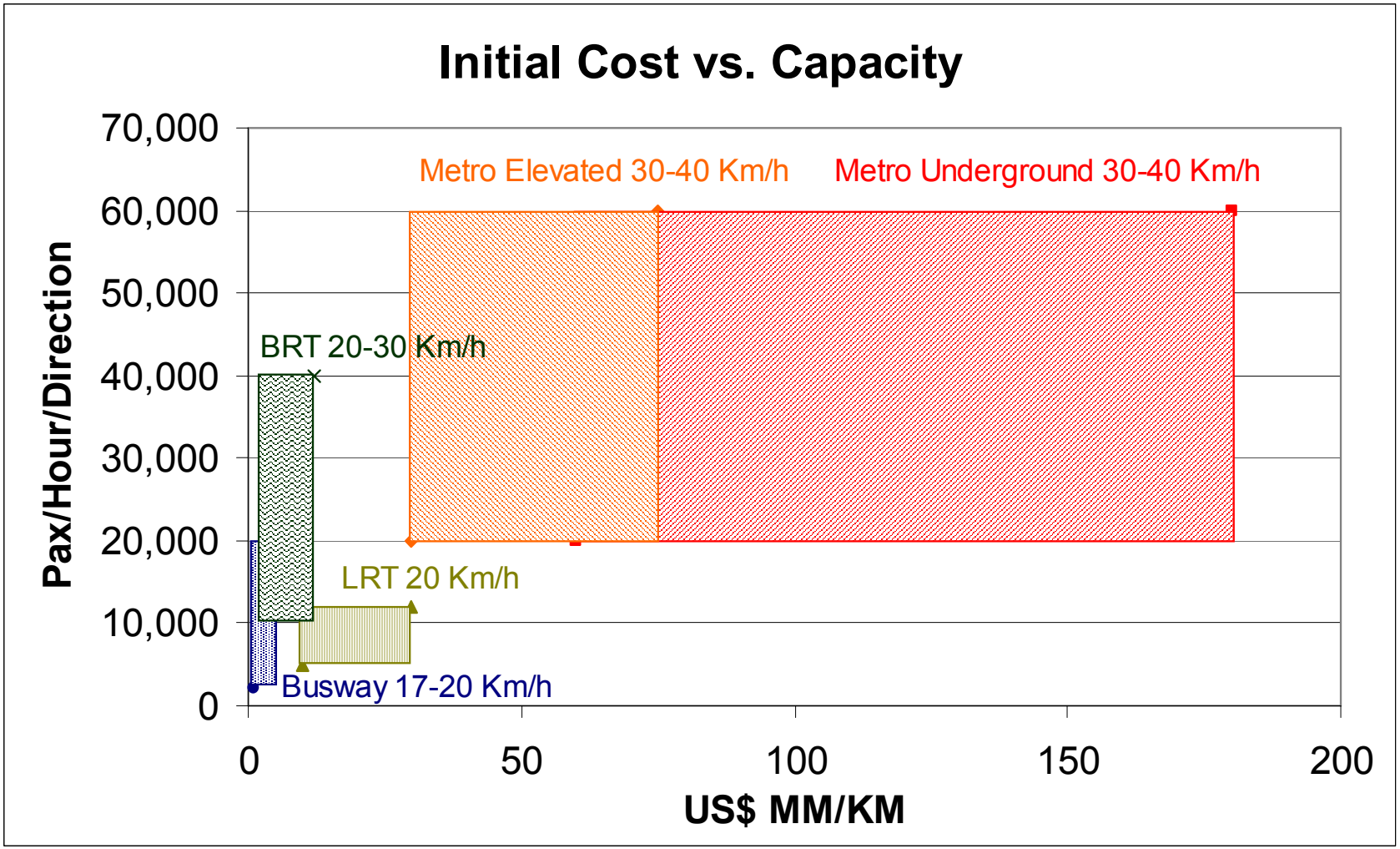

México City

No single option dominates the other transit alternatives in all aspects

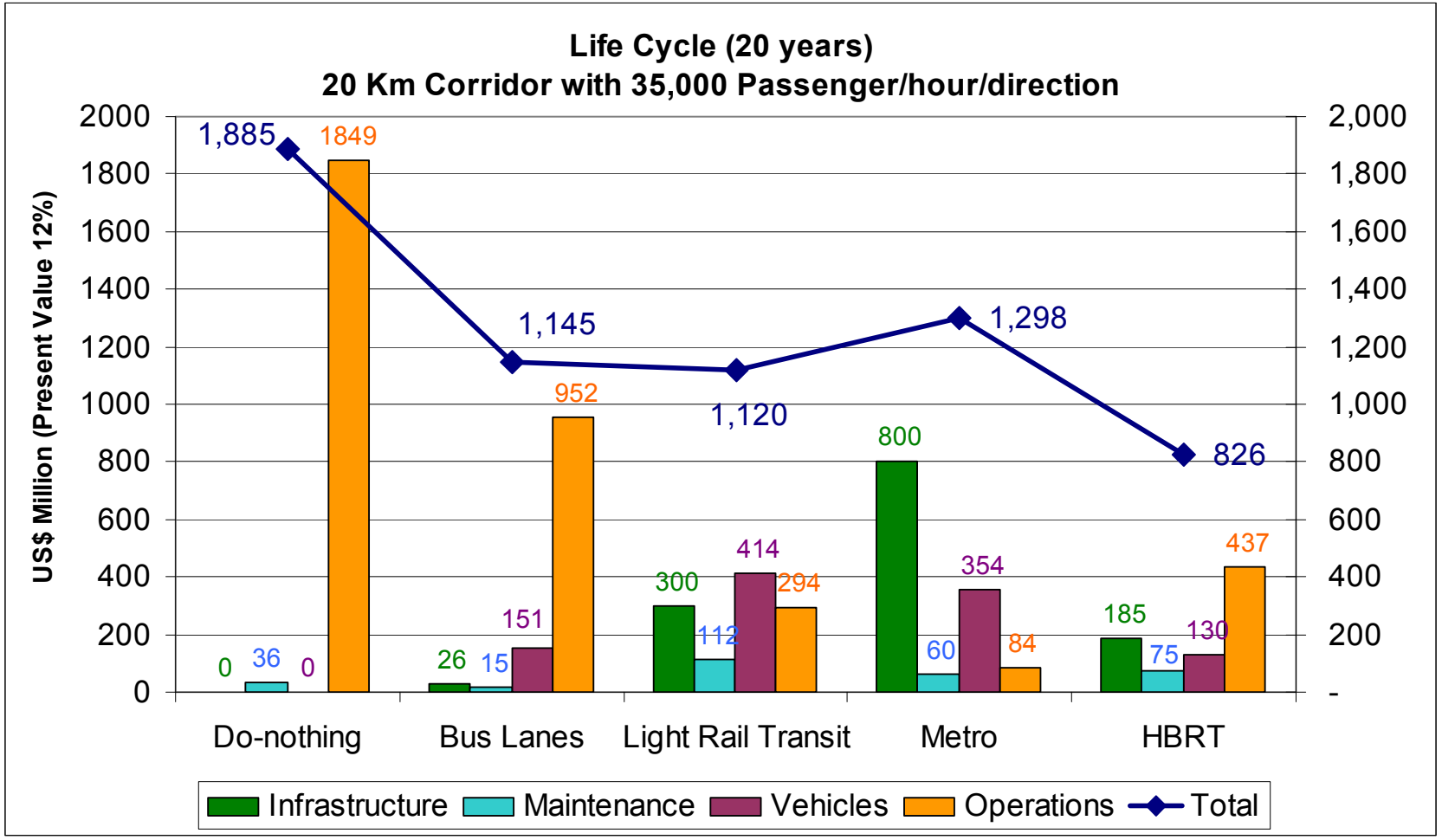
Attribute	Buslanes/ Busways	Light Rail Transit/ Trams	Heavy Rail Transit/ Metro	High Level Bus Rapid Transit HBRT
Required Space	2-4 lanes Existing ROW	2-3 lanes Existing ROW	Low impact/ new ROW	2-4 lanes Existing Row
Flexibility	High	Limited	Low	High
Traffic Impacts	Variable	Variable	Reduced Congestion(?)	Variable
Integration with feeder routes	Easy	Difficult	Difficult	Easy
LOS (frequency and occupation)	Fair	Good	Very Good (dense corridor)	Good
Safety	Fair	Good	Very Good	Good
Emissions	High	Low	Low	High Medium
Reliability	Low	Low (bunching)	High	Medium

Sources: Adapted by the author from Halcrow Fox, 2000), L. Wright and K. Fjellstrom, 2003, and V. Vuchic, 1992

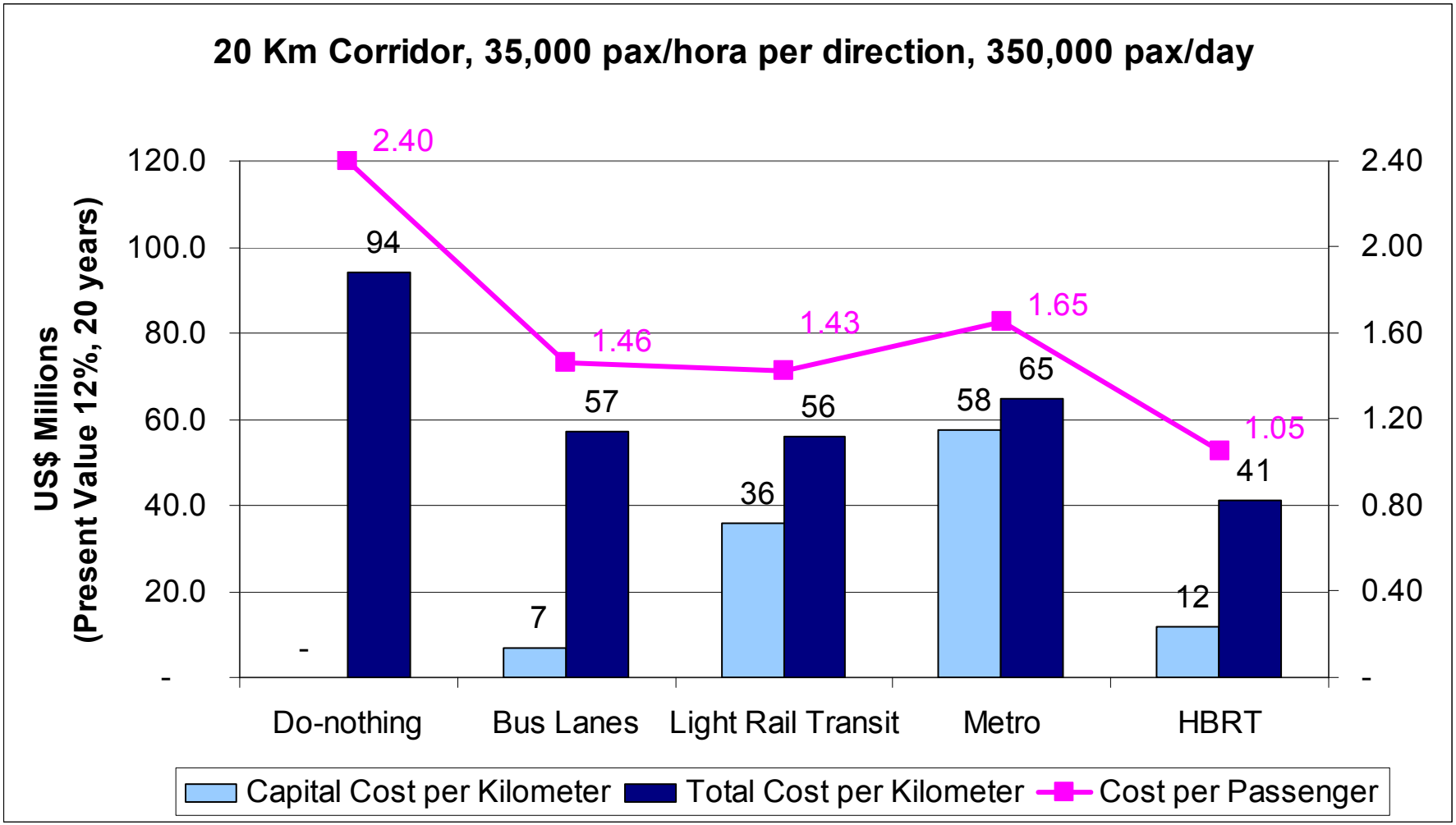
HBRT is able to provide similar capacity than Metro at a fraction of their cost -20,000 to 40,000 pphpd, 20-30 Km/h, for 5-20 MM/Km



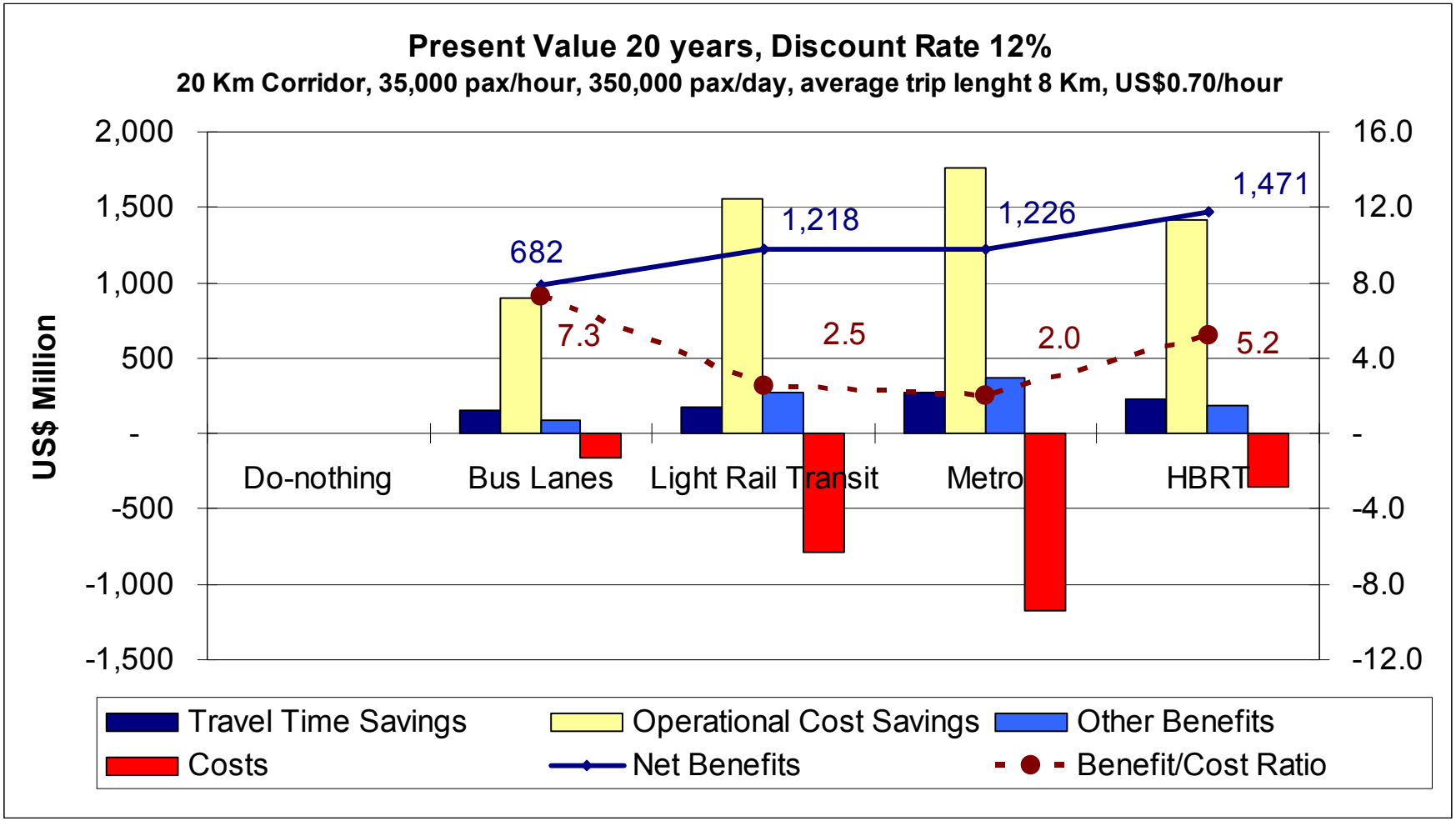
Despite its higher operation cost HBRT is able to provide the maximum value – lowest life cycle cost



HBRT is likely to be more economical in capital and lifecycle costs than Light Rail Transit and Metro - per-kilometer and per-passenger



HBRT makes it possible to obtain higher benefits than metro with a fraction of the lifecycle costs – Net Present Value 20% higher, Benefit/Cost 160% higher



After simulating different cost and benefit conditions, HBRT shows very high chances of being better than rail and softer bus improvements

Probability of Net Present Value being Higher (Results of a Montecarlo Simulation)

	Buslane/ Busway	Light Rail Transit	Heavy Rail Transit	High Level Bus Rapid Transit HBRT
Buslane/Busway	-	31.5%	47.2%	8.5%
Light Rail Transit	68.5%	-	60.5%	24.1%
Heavy Rail Transit	52.8%	39.5%	-	20.1%
High Level Bus Rapid Transit HBRT	91.5%	75.9%	79.9%	-

Note: - means not applicable. Read row header compared to column header. 20 Km Corridor, with 35,000 pax/hour

Other considerations are also favorable for HBRT in a developing city context

	Buslane/ Busway	Light Rail Transit	Heavy Rail Transit	High Level Bus Rapid Transit HBRT
Vehicles and operations covered with farebox revenues (does not require operational subsidies)	Yes	Few Times	Few Times	Yes
Possibility of being financed by the private sector (vehicle and operations)	Yes	Few Times	Few Times	Yes
Short implementation time	Yes	No	No	Yes
Makes use of local capacity (operators/industry)	Yes	No	No	Yes
Helps organizing citywide bus operations	No	Low Impact	Low Impact	Yes
Promotes cultural changes	No	Yes	Yes	Yes
Impacts Urban Development	Negative Impact	Low Positive Impact	High Positive Impact	Medium Positive Impact

Note: Mostly applicable to transit conditions in developing countries

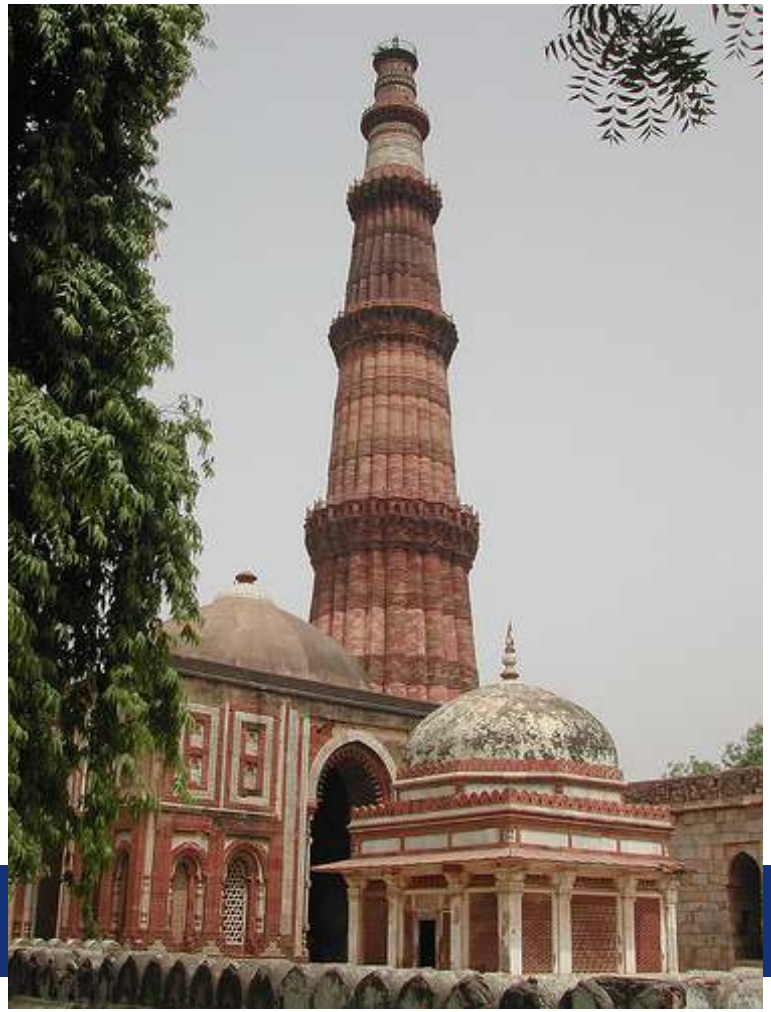
If HBRT exhibits such conditions, why decision makers are so inclined to rail transit? – potential reasons for developing cities

- Metros are usually funded with national transfers. Municipalities prefer Metros as they maximize disbursements to the local economy.
- HBRT requires reorganization of existing bus routes and operations (politically difficult). Most Metros are implemented without nuisance to existing bus operators.
- Metros have higher perception of modernity than buses.
- Countries with large rail industry actively promote Metros with subsidized long term loans and technical cooperation studies.
- Techniques associated with HBRT are not new, but there are few examples.
- Decision makers do not usually use transit in developing cities. When they visit cities with Metro they find them comfortable, reliable and noiseless (paradigmatic)
- Displacing transit from the surface ROW provides extra capacity for car users (decision makers)

Recent Examples – Two Capital Cities

Delhi – India

- 18 Million Inhabitants, 9,294/km2
- GDP per Cápita USD 3,100 (Country)



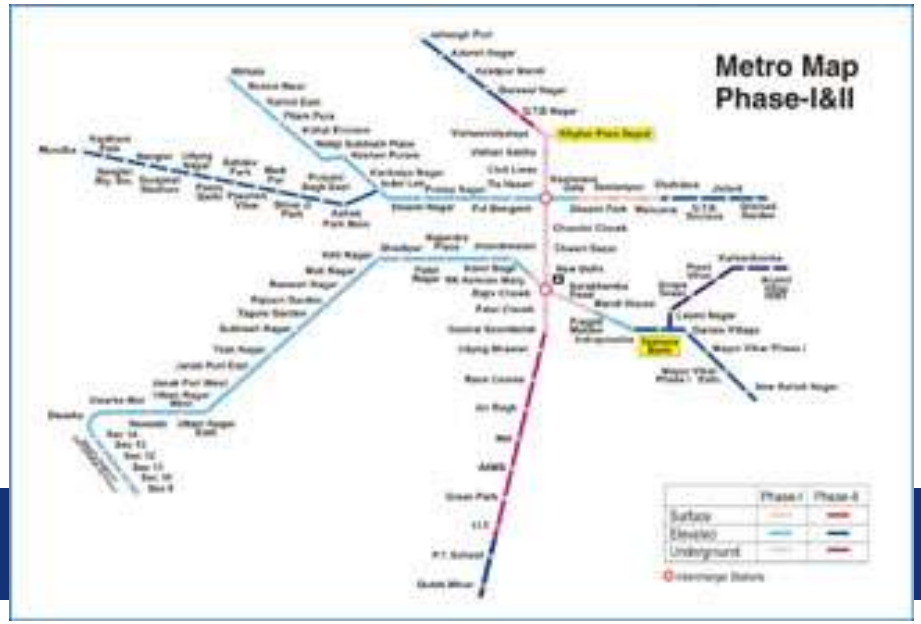
Bogotá – Colombia

- 8 Million Inhabitants, 4,528/km2
- GDP per Cápita USD 6,600 (País)

Recent examples – two capital cities

Delhi Metro – India

- Construction started in 1998
- Operation
  - December 2002 (Initial 8.5 Km Line 1)
  - June 2006 (65 Km,3 Lines, 59 Stations)
- USD 2,327 million (USD 36 million/Km)



TransMilenio BRT Bogotá – Colombia

- Construction started 1998
- Operation
  - December 2000 (Initial 14 Km)
  - May 2006 (84 Km, 6 trunkways, 114 Stations)
- USD 524 Million transit only (USD 6 millones/Km)

  + USD471 Mixed traffic lanes and Public Spaces

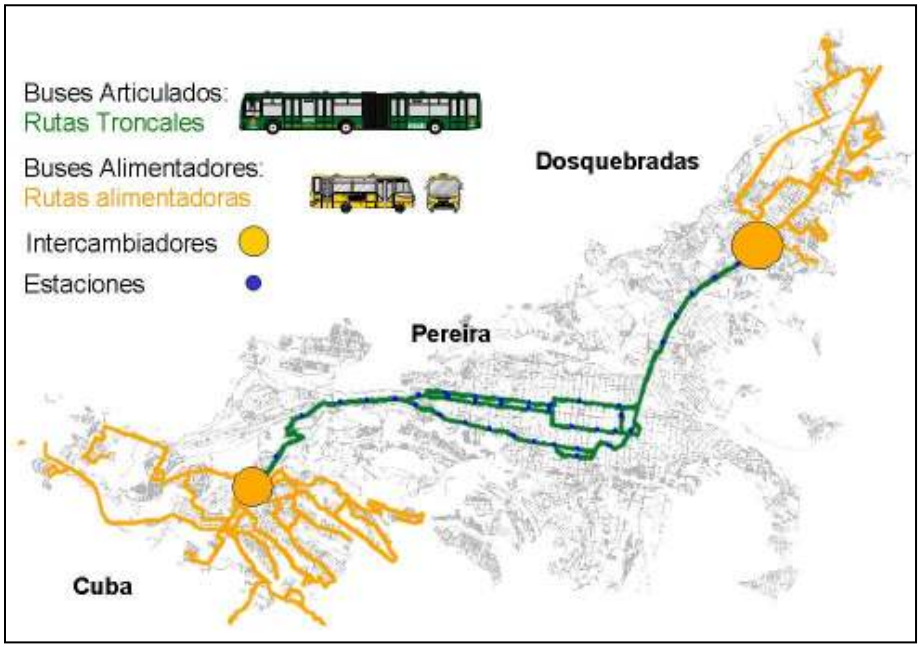
Delhi Metro– India

- 475,000 pax/day (33% of estimated value)
- Capital Investment per Pax/day USD 4,421
- Fare without integration USD 0.13-0.48 (Average 0.31)
  - With integration USD 0.24-0.59 (Average 0.42)
  - Fare/daily income 3.7%-4.9%

TransMilenio de Bogotá – Colombia

- 1,260,000 pax/day (89% of estimated value)
- Investment per Pax/day USD 430
- Integrated Fare USD 0.55 (Flat)
  - Fare/daily income 3.0%

One of the most recent BRTs – Megabús, Pereira, Colombia



- Trunkways 27 Km, 38 Stations, 2 Interchange Facilities (90% finished and in operation)
- 51 Articulated Buses, 81 Small Feeder Buses, Advanced Fare collection and Control Systems
- 155,000 passengers/day (expected)
- USD 22 Million in Infrastructure, USD 21 Million in Buses and Fare Collection Equipment
- Total cost USD 1.6 Million/Km; 277 USD/Pax/day

Conclusions

- Recent developments in the developing world, show that the combination of high level BRT features result in very high capacity at a fraction of the costs of rail transit alternatives.
- For the conditions reviewed in this study (35,000 pphpd, 20 Km corridor), High Level Bus Rapid Transit (HBRT) has the greatest chances of providing the best socio-economic indicators.
- As a result, it is recommended that HBRT be considered as an option for transit improvements even at high demand levels (10,000-40,000 pphpd).
- Introduction of bus lanes without transforming operations, is not enough. It seems imperative to transform the operational conditions with combined services (express, local), centralized control, off-board ticketing and level access.
- Introduction of Rail transit (LRT and Metro) may be beneficial, but may have less impact per dollar. The worst alternative is maintaining the status quo.

¡GRACIAS!