Bus Rapid Transit (BRT) Systems

Dedicated Corridor Rapid Transit (DCRT) System

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BUS RAPID TRANSIT
ACROSS LATITUDES AND CULTURES

ITLS

What is a Bus Rapid Transit System?

This or (and) this?

Photos: CTS Brasil

BRT Systems: Paris, Guangzhou, Bogota, Beijing

What is a Bus Rapid Transit System?

“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”

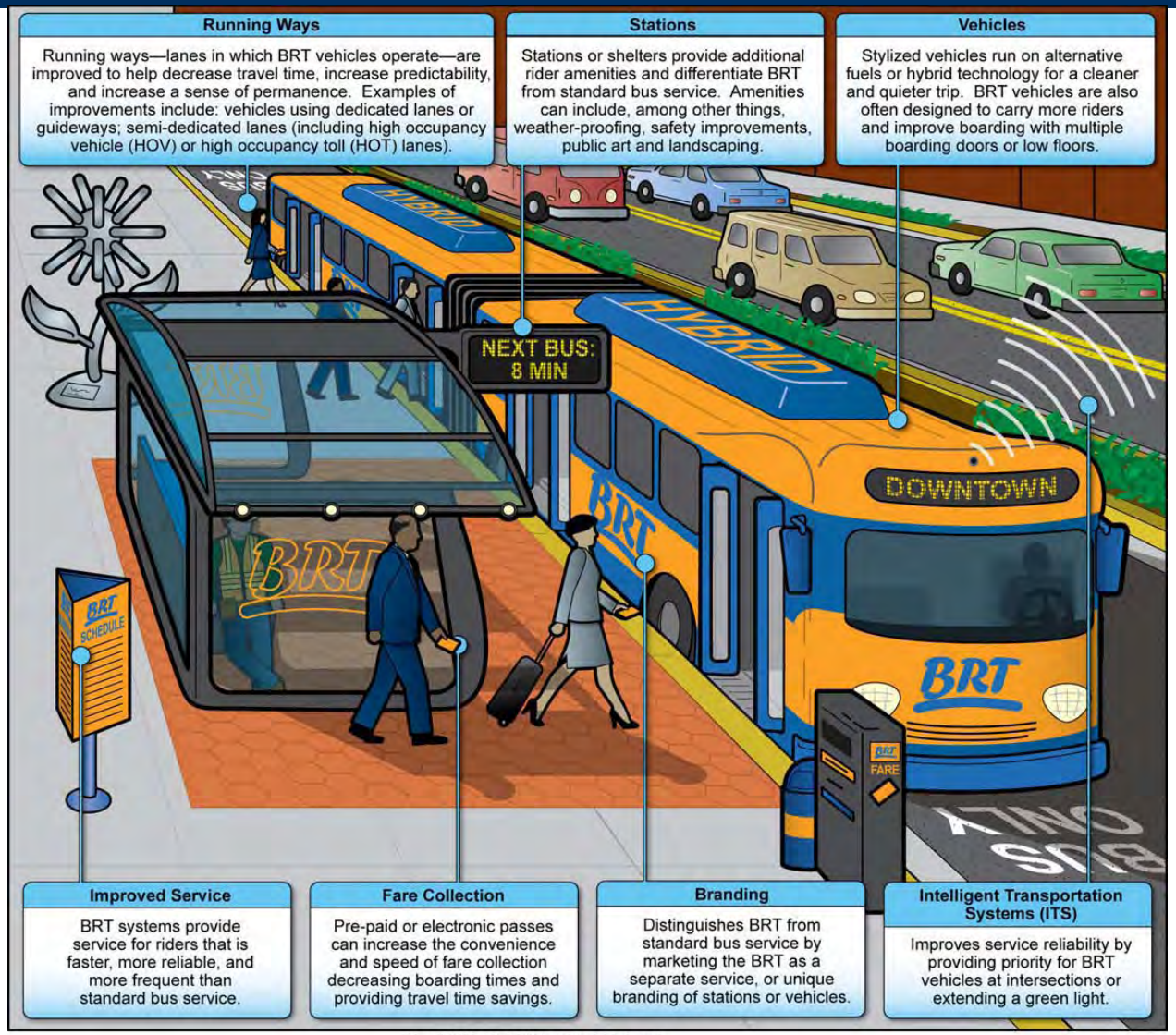
TCRP Report 90 – Bus Rapid Transit – Volume 2: Implementation Guidelines 2003

“It is a high quality public transport system, oriented to the user that offers fast, comfortable and low cost urban mobility”

BRT Planning Guide – ITDP, 2007

Photo: Karl Fjelstrom - ITDP

Characteristics of Bus Rapid Transit



Source: GAO analysis of bus rapid transit research.

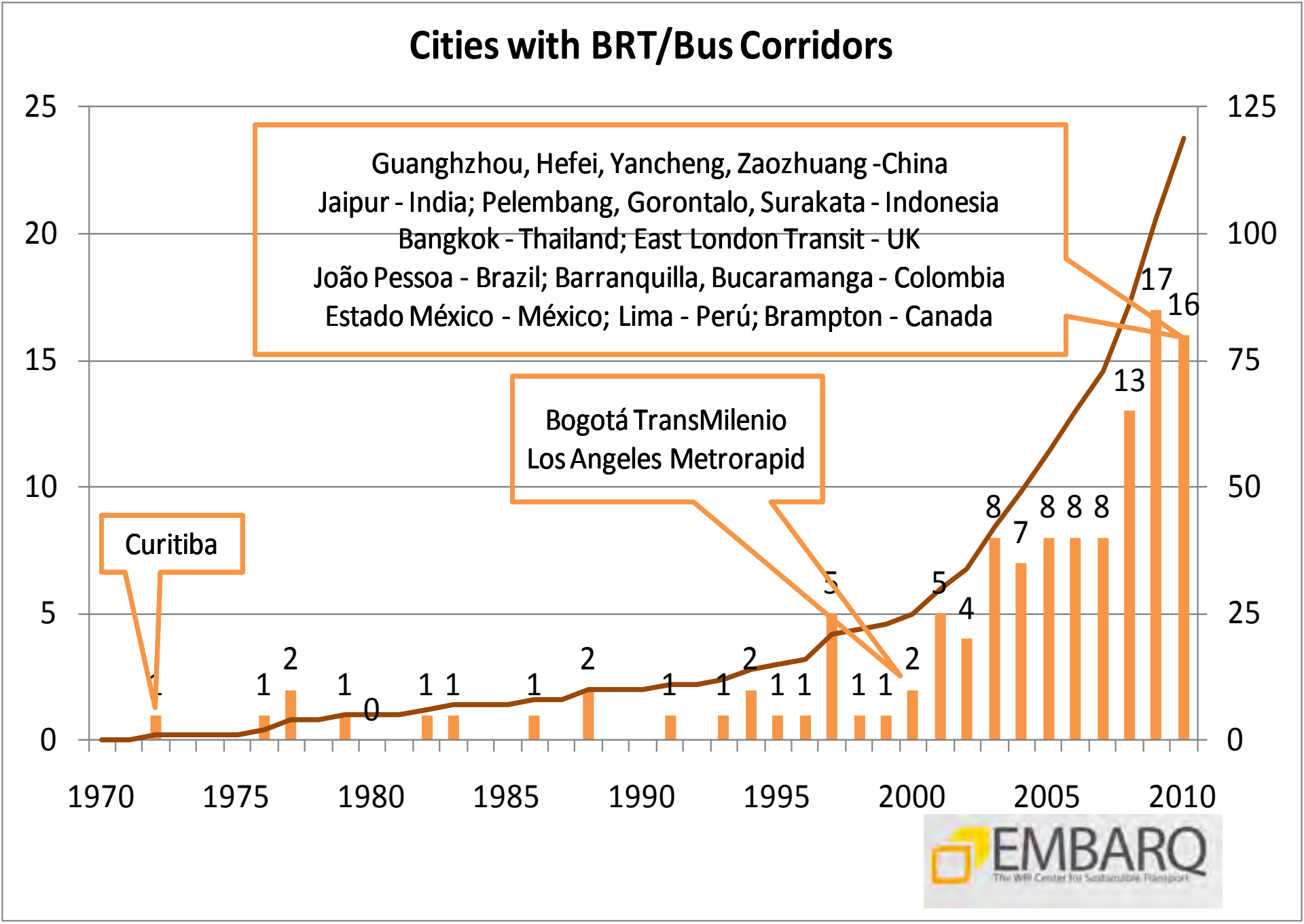
BRT in numbers 2010

- 120 cities with BRT Systems and Bus Corridors
- 280 corridors
- 4,335 km
- 6,683 stations
- 30,000 buses
- 26.8 million passengers per weekday
  - 1% of the world´s urban population (2010)
  - 1.4 times the combined population of New York and Newark (2010)

Rapid growth of BRT Systems and Bus Corridors in 2010, specially in developing cities

- 16 cities started operations in 2010 (13% growth)
  - China (4), Indonesia (4), Colombia (2), India, Thailand, Mexico, Perú, UK, Canada
  - 21 corridors; 396 km; 464 stations; 2,047 buses
  - 1.4 million passengers per weekday (5% growth)
- 7 cities expanded corridors in 2010, 125 km
- 49 new cities with corridors under construction
- 16 cities expanding their corridors
- 31 new cities in planning stages

Cities with BRT/Bus Corridors



Source: EMBARQ BRT/Bus Corridors Database, January, 2011

Interesting developments 2010 plus

- Government Agencies – moving from corridors to integrated systems and collaborative efforts – SIBRT
- Growing Public Private Partnerships PPP for systems operation – Latin America, India, South Africa
- Increased support from the national level - programs in Mexico, Colombia, India, Indonesia, France, US
- Interest of manufacturers in BRT, new buses, alternative fuels from India, Indonesia and China - complement the high bus production of Brasil
- Fare collection, control, user information systems technologies consolidated

Salient issues

- Poor understanding on what is BRT
- Institutional and financial risks – poor contracting, institutional set ups and fare level definition mechanisms
- *"The bus industry needs a 'wake-up' call. The opportunities are extensive, but the industry is far too traditional (often complacent), often lacking lateral thinking and not pro-active enough."* Hensher D. "A bus-based transitway or light rail? Continuing the saga on choice versus blind commitment" Road & Transport Research, Vol 8 No 3 September 1999.
- Strong preference by decision makers for rail alternatives without adequate alternatives analyses
  - Hot debates in Curitiba, Bogotá, Quito, Lima, Sao Paulo, Delhi, Mumbai, Bangalore, Washington DC, Sydney…

Component	"High End" BRT – "Supply Side"
Running Ways	• Complete or at least Longitudinal Segregation
Traffic Engineering	• Geometric Adjustments (high speed and safety) • Left and Right Turn Controls • Traffic Signal Priorities for Buses • Modern Traffic Signal Technology
Stations	• Enclosed Facilities • Level Boarding and Prepayment • Passing Lanes (when required)
Vehicles	• Multiple doors • Easy Boarding/Alighting • Low Emissions
Services	• Mixed services (local, accelerated, express; short loops) • Designed according to the service needs
ITS	• Automatic Vehicle Location/Centralized Control • Traffic Signal Priority • Electronic Fare Collection/Fare Integration

Component	"High End" BRT – "Performance Side"
Quality of Service	• High User Acceptance
Travel Time	• Easily Accessible • Low waiting time • High commercial speed
Reliability	• Low variability (intervals, speeds) • Low breakdowns, incidents
Comfort	• Acceptable Occupancy Levels (buses, platforms) • Good user information • Seamless integration with other transport modes • Perception of safety and security
Cost	• Relative low capital and operational costs • High capital and operational productivity
Externalities	• Low level of accidents (fatalities, injuries) • Low emissions • Congestion relief (attraction of motor vehicle users) • Increased land values

ITLS

Thredbo 12: Types of Bus-based transit According to Transport Demand Needs and Urban Environment* They must be included in the mix of options (Juan C Munoz *et al*, 2012)

Type	Main Features	Throughput/ Performance	Application
Basic Bus Corridor	Median or curbside lanes, on board payment, conventional buses	500-5,000 pphpd 12-15 km/h	Low density corridors, suburbs
Bus of High Level of Service BHLS	Infrastructure, technology and advanced vehicles for enhanced service provision	500-2,500+ pphpd 15-35 km/h	Small urban areas, historic downtown, suburbs
Medium BRT	Single median lanes, off board payment, information technologies	5,000-15,000 pphpd 18-23 km/h	Medium density corridors, suburb/centre connections
High Capacity BRT	Dual median lanes physically separated, large stations with prepayment, large buses, information technologies, combined services	15,000-45,000 pphpd 20-40 km/h	High demand, dense, mixed use corridors, central city

* Variations apply, need to design according to local context; pphpd=passengers per hr per direction

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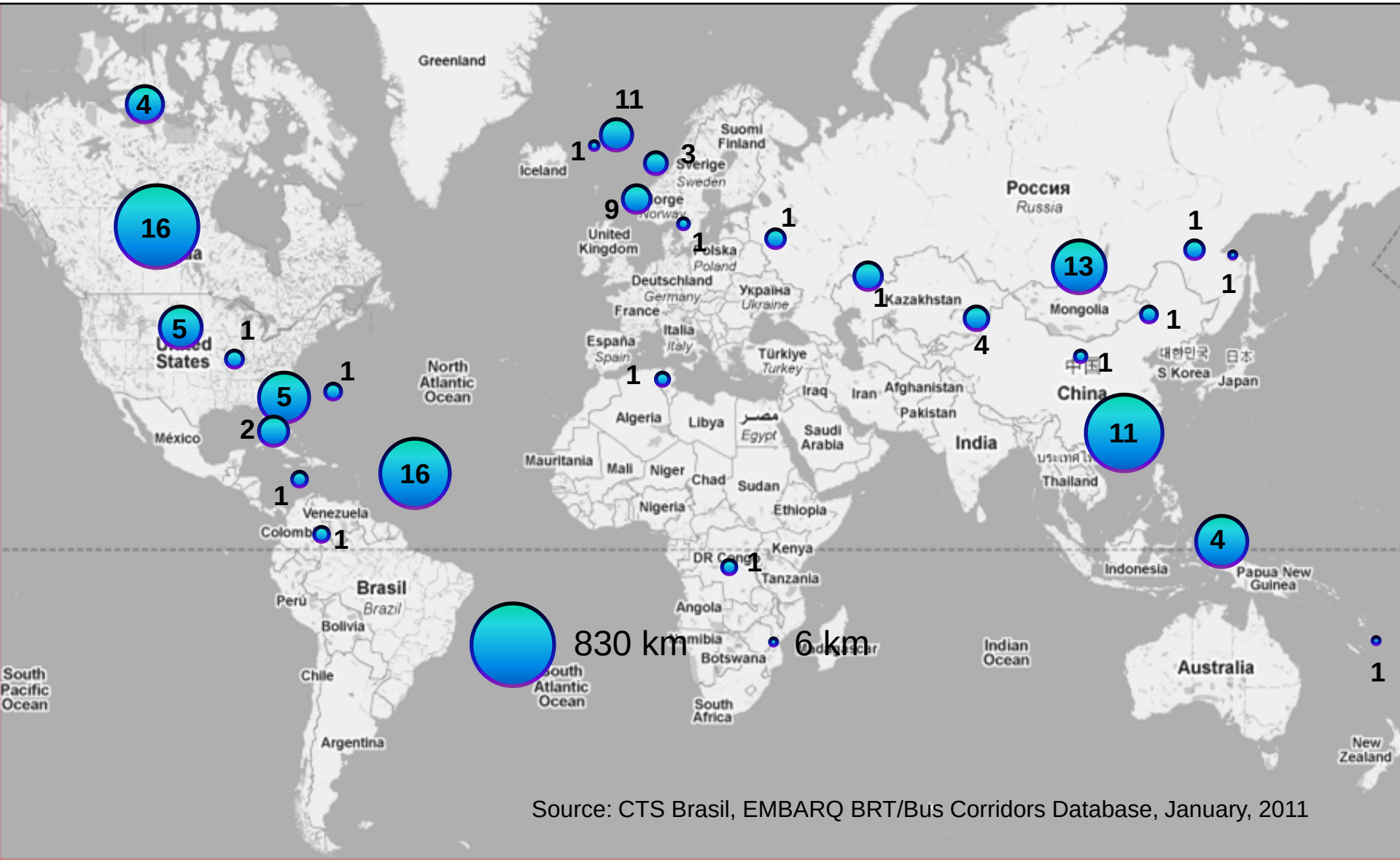
About 120 cities with BRT or bus corridors
4,335 km - 6,683 stations – 30,000 buses
26.8 million passengers per weekday



Source: CTS Brasil, EMBARQ BRT/Bus Corridors Database, January, 2011

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Cities with the most used BRT/Bus Corridors Networks 2010

Name	Corridors	Km	Pax/day
Prioridade Transporte Colectivo, Sao Paulo, Brasil	10	301.3	6,843,664
Rede Integrada de Transporte, Curitiba, Brazil	6	72.0	2,260,000
TransMilenio, Boogta, Colombia	7	84.0	1,700,000
Busways, Taipei, China Taiwan	10	30.3	1,680,000
Tehran BRT, Iran	5	91.0	1,440,000
Prioridade Transporte Colectivo, Porto Alegre	10	57.2	1,170,000
Guangzhou BRT, China	1	22.5	800,000
Optibus, Leon, Mexico	4	31.0	700,000
Metrobus, Istanbul, Turkey	2	43.0	700,000
Metrorapid, Los Angeles, USA	21	390.2	464,600
Metrobus, Mexico City, Mexico	2	50.0	450,000
Metrobus-Q, Quito, Ecuador	3	42.2	440,000
Prioridade Transporte Colectivo, Belo Horizonte, Brazil	2	23.7	435,000

Dark color strong segregation, stations with prepayment

Source: EMBARQ BRT/Bus Corridors Database, January, 2011

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Cities with the Longest BRT/Bus Corridors Networks 2010

Name	Corridors	Km
Metrorapid, Los Angeles, California	21	390.2
Prioridade Transporte Colectivo, Sao Paulo, Brazil	10	301.3
SmartBus, Melbourne, Australia	4	233.0
MIO, Cali, Colombia	6	179.0
Trans Jakarta, Jakarta, Indonesia	10	172.2
LINK, Phoenix, USA	4	128.0
Metrobus, Monterrey, Mexico	3	101.0
Tehran BRT, Iran	5	91.0
Trans Hulonthanlangi, Indonesia	3	90.0
Trans Jogja, Indonesia	3	90.0
TransMilenio, Bogota, Colombia	7	84.0
TransMetro, Pekanbaru, Indonesia	2	74.0
Rede Integrada de Transporte, Curitiba, Brazil	6	72.0

Dark color strong segregation, stations with prepayment

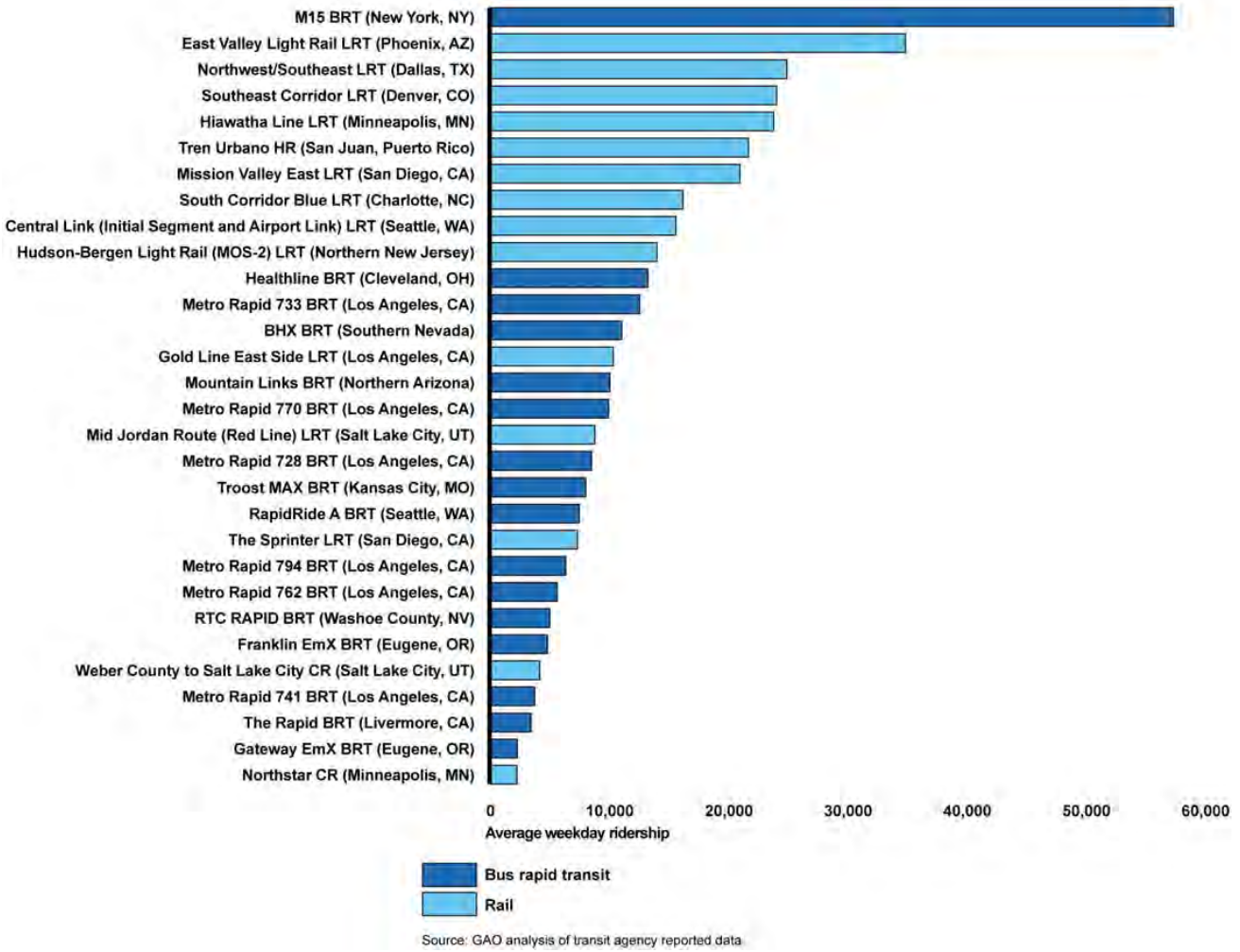
Source: EMBARQ BRT/Bus Corridors Database, January, 2011

16 New Cities with BRT/Bus Corridors in 2010

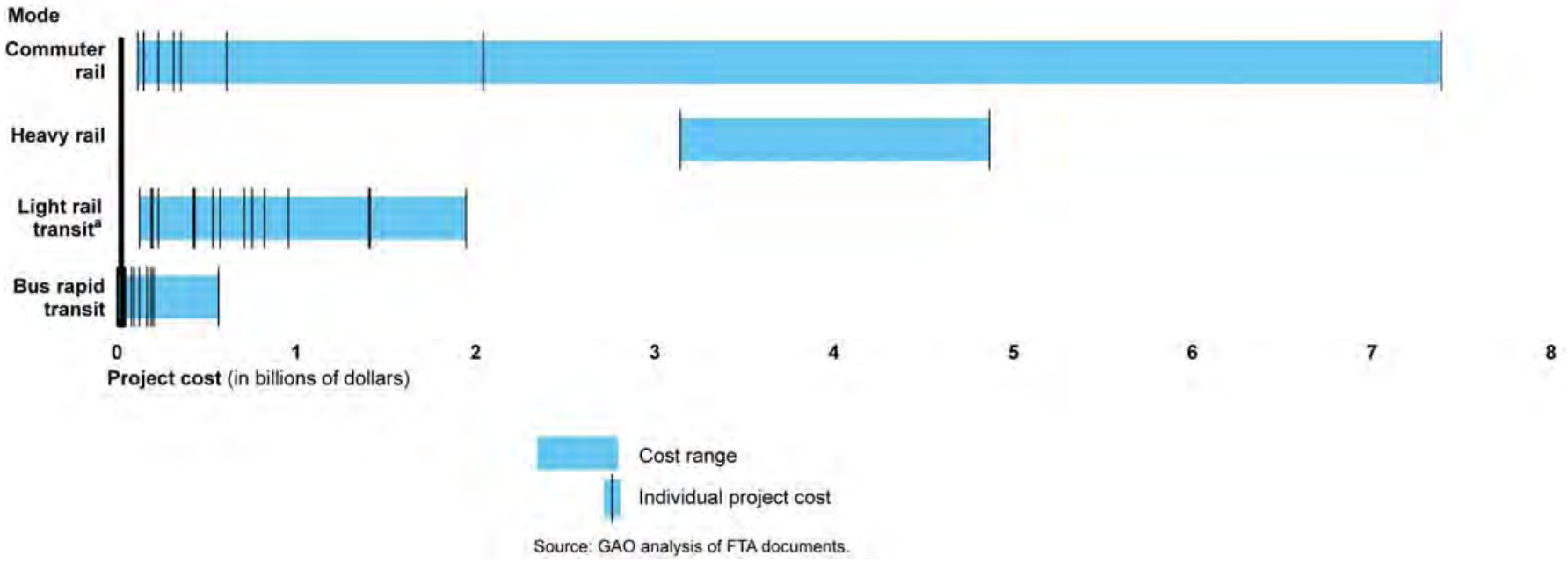
Name	Corridors	Km	Stations	Buses	Passengers/ Weekday
Guangzhou BRT, China	1	22.5	26	800	800,000
Hefei BRT, China	2	12.7	14	65	65,250
Yancheng BRT, China	1	8.0	21	20	20,000
Zaozhuang BRT, China	1	33.0	24	20	20,000
Jaipur Bus, India	1	7.1	10	20	6,200
Trans Hulonthanlangi, Indonesia	3	90.0	84	15	1,920
Tans Musim, Indonesia	2	60.0	69	15	1,920
Batik Solo Trans, Indonesia	1	30.0	35	15	1,920
Bangkok BRT, Thailand	1	15.9	12	20	10,000
East London Transit, UK	1	20.0	40	18	9,000
Corredor de Ônibus de João Pessoa, Brasil	1	2.5	5	111	100,000
Transmetro, Barranquilla, Colombia	1	13.4	15	92	32,000
Metrolinea, Bucaramanga, Colombia	1	8.9	24	131	75,000
Mexibus, Estado Mexico, Mexico	1	16.0	32	63	63,000
Metropolitano, Lima, Perú	2	27.0	35	627	160,000
Züm, Bradford, Canada	1	28.5	17	15	7,500

Source: EMBARQ BRT/Bus Corridors Database, January, 2011

USA: Reported Average Weekday Ridership Data for First Year of Operation, by Mode



Range and Individual Capital Costs for BRT and Rail Transit Projects Receiving a Grant Agreement from Fiscal Year 2005 through February 2012



Source: GAO analysis of FTA documents.

What are Desirable Features of a Good BRT System: Drivers of Patronage

Hensher, Mulley and Li (2012)	Hensher and Golob (2008)	Hensher and Li (2012)
Maximum fare	Average fare per trip	Average fare per trip
Service frequency	Peak headway	Headway
Car mode share	Trunk vehicle capacity	Average distance between stations divided by population density
Number of BRT stations interacted with extension of segregated with-flow lanes	Number of stations	Number of existing trunk corridors
Pre-board fare collection		Pre-board fare collection and fare verification
Doorways for passengers on left and right sides of bus		Doorways located on median and curbside
Longitudinal location of with-flow bus lanes on sides		Existence of an integrated network of routes and corridors
		Modal integration at stations
		Total length of BRT corridor
		Opening year relative to 2011
		Quality control oversight from an independent entity/agency
		Latin America (Location of BRT)

Hensher, D.A. and Golob, T.F. (2008) Bus rapid transit systems – A comparative assessment. *Transportation* 35 (4), 501-518.

Hensher, D.A. and Li, Z. (2012) Ridership Drivers of Bus Rapid Transit Systems, *Transportation*, online 26 February 2012, DOI: 10.1007/s11116-012-9392-y.

Hensher, D.A., Mulley, C., and Li, Z. ***(2012)*** Drivers of Bus Rapid Transit Systems –Influences on Ridership and Service Frequency

The Dilemma with the B word (Bus)

"Anyone who lives in Sydney's fast growing north west knows what a short-sighted idea it is to suggest buses should replace the rail link," O'Farrell (Premier of New South Wales) says (June 2012).

"The idea of putting more buses onto an already crowded road system just beggars belief."

It is time for a radical move – a name change for BRT.

Dedicated Corridor Transit (DCT) (Or **Dedicated Corridor Rapid Transit –DCRT)**.

DCT or DCRT

Dedicated Corridor Transit (DCT) (Or **Dedicated Corridor Rapid Transit –DCRT)**.

This places the matter fairly and squarely where it belongs:

- the corridor delivering transit services,
- with transit defined as all candidate public transport modes, OR
- as defined online as “public transportation system for moving passengers”.

That is the big sell, and not whether it is steel track or bitumen.

Common Problems and Challenges

- **Rushed implementation – several components incomplete**
- **Very tight financial planning – non technical user fares, some systems at risk**
- **Very high occupancy levels (160 pax/bus standard for articulated buses is not accepted by the users)**
- **Early deterioration of infrastructure (lack of road surface reinforcement or problems in design/construction)**
- **Implementation of fare collection systems requires longer time tables and very tight supervision**
- **Insufficient user education**

The VREF BRT Team in Durban at Thredbo 12 September 2012