Fare Collection for Bus Systems

Dario Hidalgo, PhD
Senior Transport Engineer
EMBARQ
The WRI Center for Sustainable Transport
Delhi, India, December 4, 2009

EMBARQ®
The WRI Center for Sustainable Transport

Bus systems are fundamental in sustainable transport

- Reduce travel time and cost, improve convenience to transit commuters
- Reduce the quantity and severity of accidents (fatalities, injuries, property losses)
- Reduce energy consumption and harmful emissions
- Increase physical activity

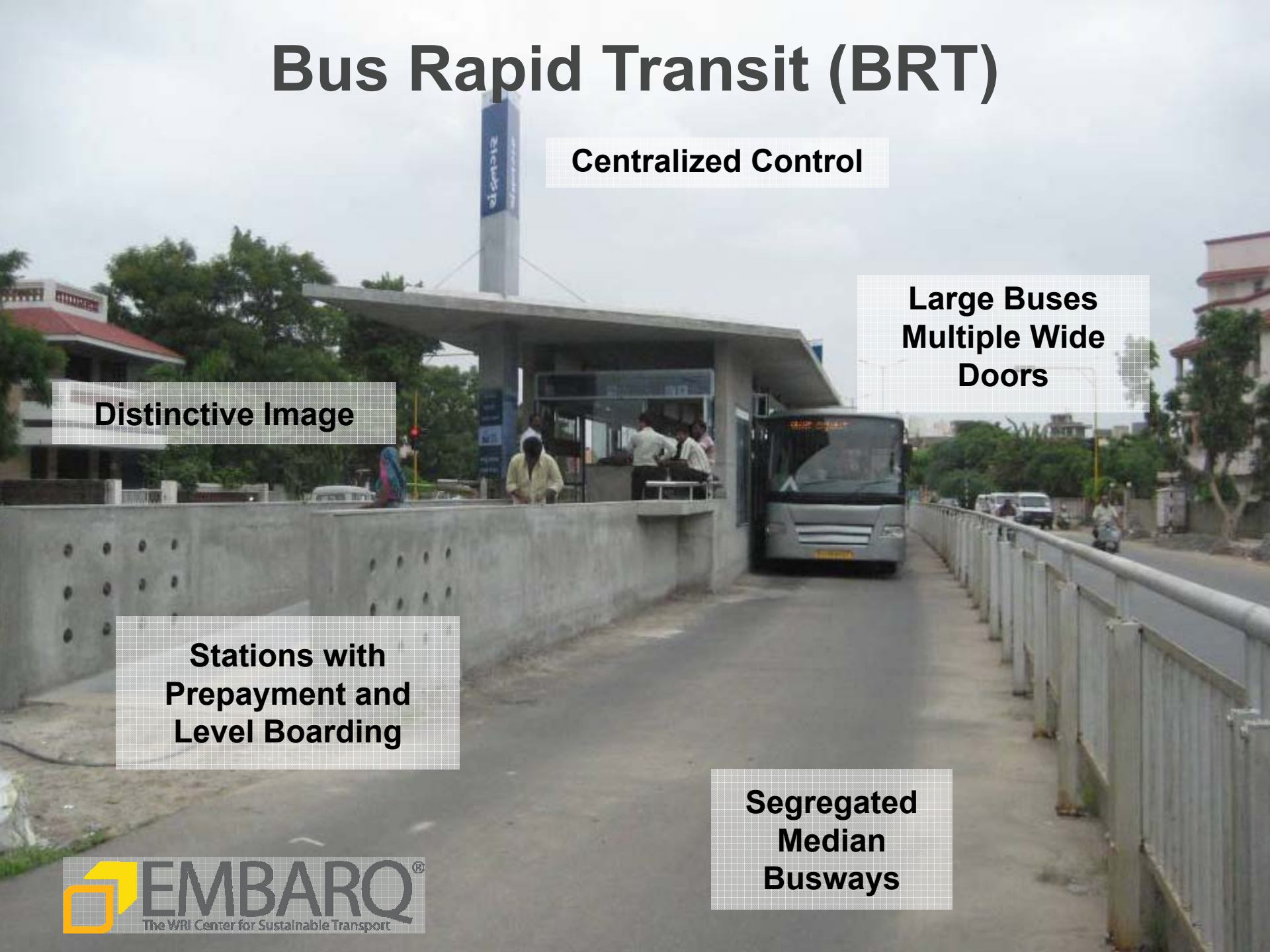
EMBARQ®
The WRI Center for Sustainable Transport

- **Any city needs a good bus system**
  - Area wide coverage, integrated
  - Good match between supply and demand
  - Frequent, reliable
  - Adequate equipment
  - Supporting technologies
  - Adequate institutional setting and clear financial schemes

- **High demand corridors need Bus Rapid Transit – BRT as part of the city bus system**
  - Greatly improve performance and quality of service – fast, reliable, safe, clean

EMBARQ®
The WRI Center for Sustainable Transport

Bus Rapid Transit (BRT)



Component	"High End" BRT
Running Ways	• Longitudinal Segregation
Traffic Engineering	• Geometric Adjustments • 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;) • Design according to the service needs
ITS	• Automatic Vehicle Location/Centralized Control • Traffic Signal Priority • **Electronic Fare Collection/Fare Integration**

EMBARQ®
The WRI Center for Sustainable Transport


EMBARQ
The WRI Center for Sustainable Transport

Fare Collection System Components

- Hardware
  - Electronic Card
  - Sell/Recharge Terminal
  - Reader and Turnstile
  - Communications and Central Control
- Software
  - Mapping and Keys
  - Contol Center

EMBARQ®
The WRI Center for Sustainable Transport

Fare Collection System Components

EMBARQ®
The WRI Center for Sustainable Transport

Available Technologies

- Swipe cards (magnetic)
- Electronic chip

- Contactless Cards
  - Integrated logic circuit
  - Microprocessor

EMBARQ®
The WRI Center for Sustainable Transport

Contactless Cards Standards

- ISO 14443
- Two protocols:
  - Type A Mifare
  - Type B Calypso

EMBARQ®
The WRI Center for Sustainable Transport

- **Type A Mifare:**
  - Simple memory applications
  - Single chip Philips (Mifare 1, Mifare ProX, Mifare Desfire)
  - Multiple users: Londres (Oyster), Toronto, Sao Paulo, Bogota, Madrid, etc.

- **Type B (Calypso):**
  - Complex memory applications (microprocessor for "smartcard" applications)
  - Multiple chip providers (ASK, Fujitsu, NEC, Samsung, Sharp, Texas Instruments)
  - Open system (www.innovatron.fr)
  - Large scale applications: Paris, Lyón, Lisboa, Milano, Montreal, etc.

- **Other proprietary technologies: Sony, Cubic**

EMBARQ®
The WRI Center for Sustainable Transport

Multiple Uses

- Public transport
- Parking
- Toll Collection
- Personal Identification: insurance, social services
- Retail

EMBARQ®
The WRI Center for Sustainable Transport

Octopus, Hong Kong

- All public transit modes
  - Regional trains,
  - Matro
  - Light Rail
  - Buses
  - Ferry Boats.
- It is actually an electronic piggy bag with multiple uses
  - Public telephones
  - Parking
  - Retail
- 80% of the population uses Octopus daily

Source: Octopus, 2009

EMBARQ®
The WRI Center for Sustainable Transport

Some Fare Collection Systems in Brazil

EMBARQ®
The WRI Center for Sustainable Transport

Source: Sganzela, Roberto,
http://www.congresotransportesustentable.org/ponencias5

Región Metropolitana de São Paulo

Brasília - DF

Osasco - SP

Región Metropolitana de Belo Horizonte - MG

Ribeirão Preto - SP

Cachoiero de Itapemirim – Espírito Santo

EMBARQ®
The WRI Center for Sustainable Transport

Source: Sganzela, Roberto,
http://www.congresotransportesustentable.org/ponencias5

Nuevo Transporte de Guatemala

transurbano

Siga

Sistema Integrado Guatemalteco de Autobuses

EMBARQ®
The WRI Center for Sustainable Transport

Source: Sganzela, Roberto,
http://www.congresotransportesustentable.org/ponencias5

Tarjeta inteligente

SISTEMA DE PEAJE

Completamente automatizado

Source: Metrobus, Ciudad de Mexico

Source: Metrobus, Ciudad de Mexico

PEAJE

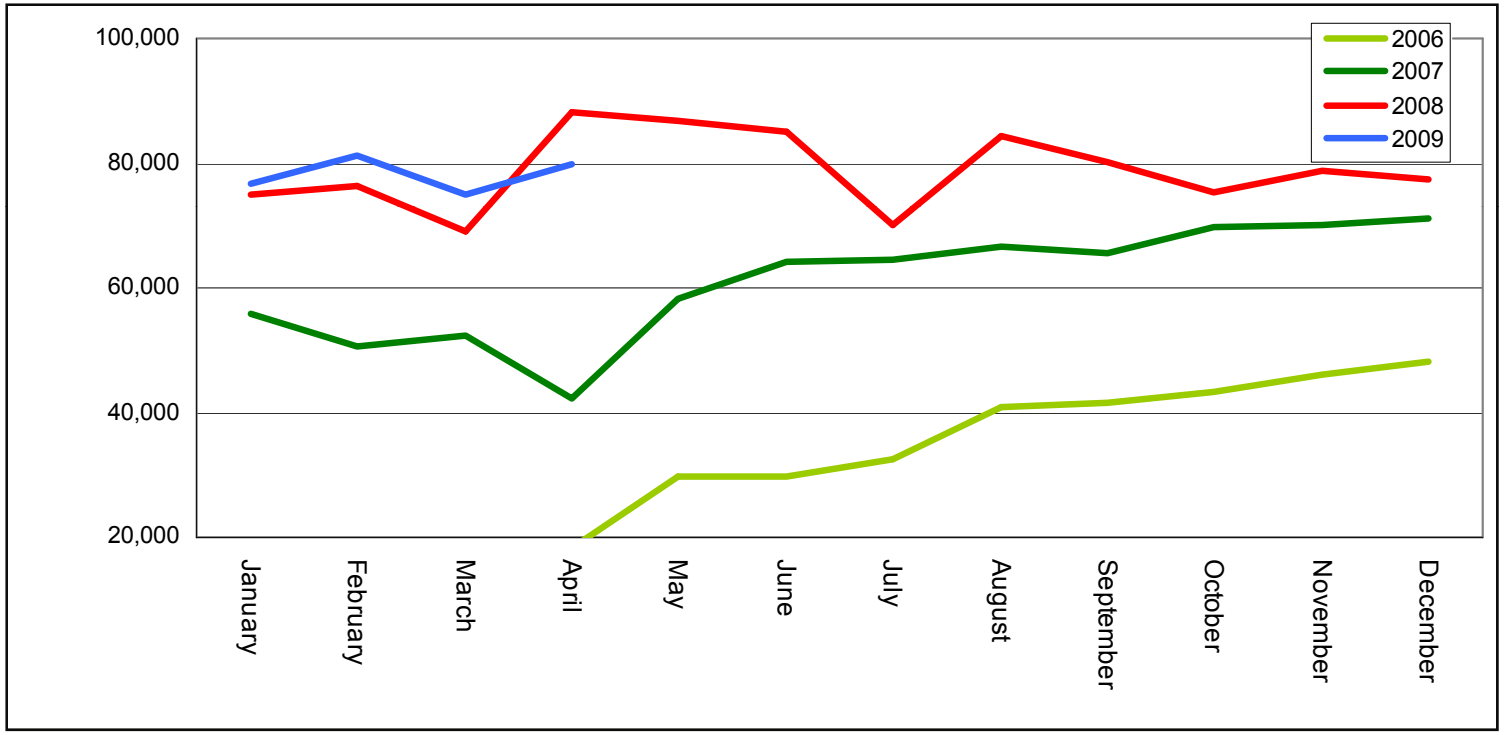
Sistema universal

Indore

Atal Indore City Transport Services Limited (AICTSL)

EMBARQ®
The WRI Center for Sustainable Transport

Patronage : Passengers per Month since Inception



EMBARQ®
The WRI Center for Sustainable Transport

kms	fare	tkts	amt	% tkts	% amt	pax-kms
3	4	528	2112	39%	24%	1584
7	6	371	2226	27%	26%	2597
10	8	285	2280	21%	26%	2850
13	11	134	1474	10%	17%	1742
14	13	42	546	3%	6%	588
		1360	8638			9361
		0.92	revenue per pax km			
		6.88	average trip length			

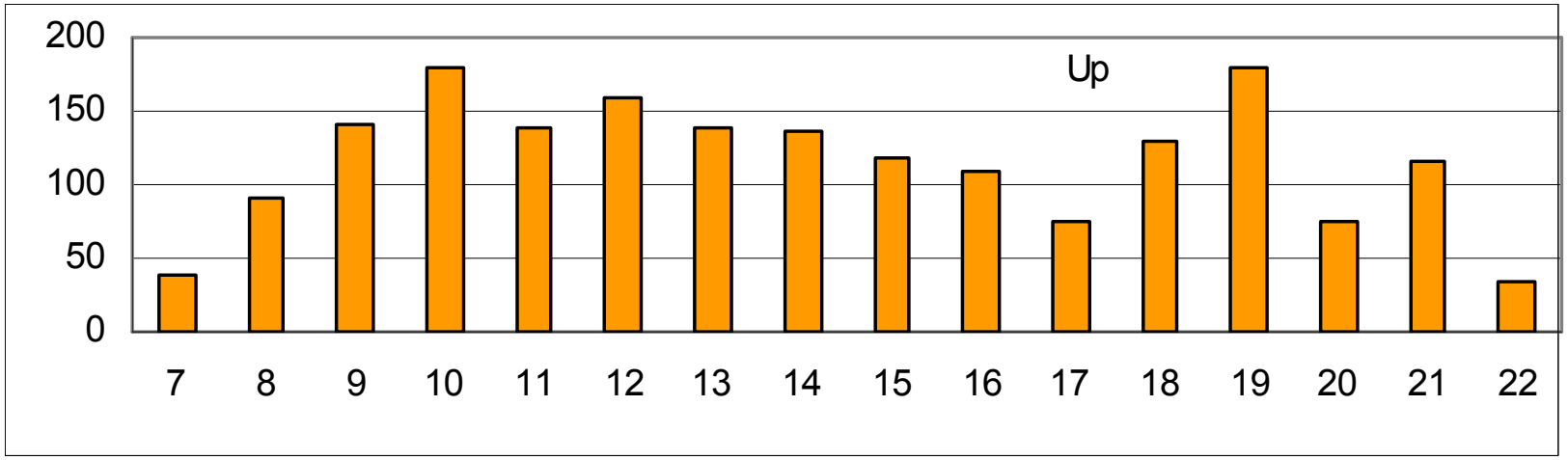
Average Trip Length by Route

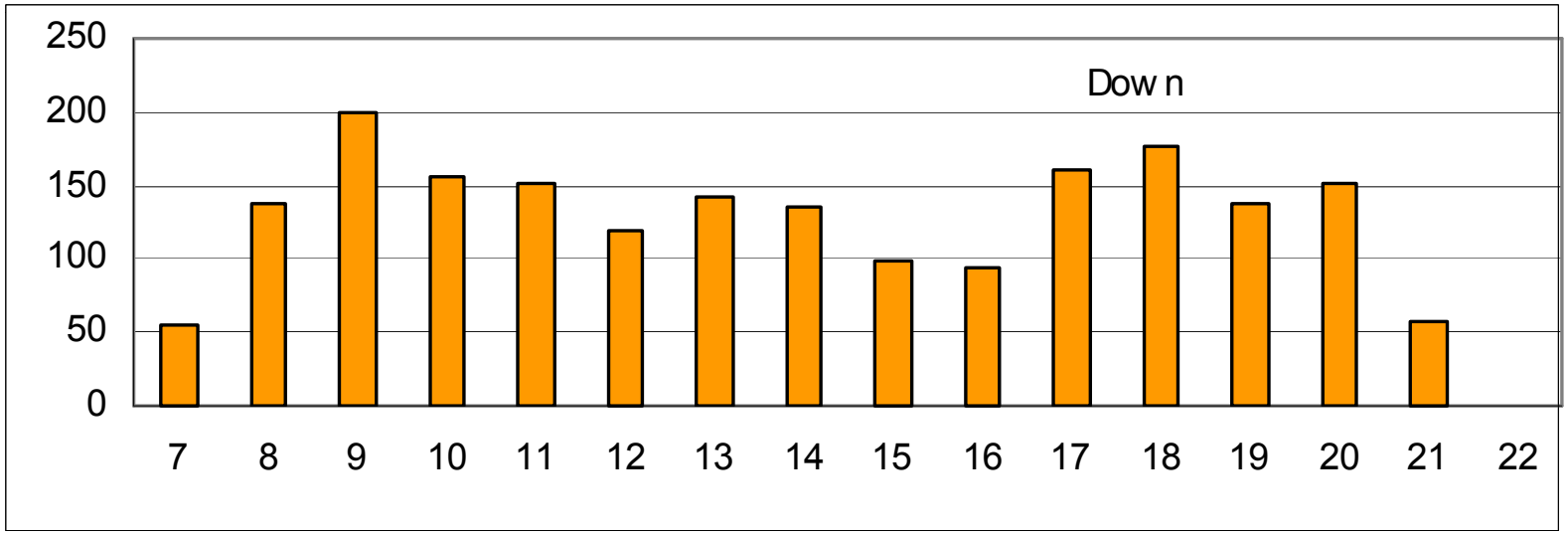
EMBARQ® The WRI Center for Sustainable Transport

Route	Route Length	Average Trip Length	Revenue Per Pax	Fare Per Pax
1	18.3			
2	18.4	5.71	0.97	5.51
3	21.7	6.88	0.92	6.35
4	19.3	5.91	0.97	5.74
5	25.5	7.65	0.89	6.81
6	13.1	5.96	0.94	5.58
7	18.3	5.39	0.99	5.35
8	14.1	5.17	1.00	5.16
9	14.7			
10	9.6			
11	24.5	6.17	0.96	5.90
12	8.6	4.75	1.03	4.89
13	6.6	4.93	1.02	5.01
14	14.8			
15	17.6			
16	11.4			
17	13.8	6.17	0.92	5.69
18	13.2	5.60	0.96	5.38
19	13.2			
22	18			
23	10			
24	11.5			

Average Trip Length by Route

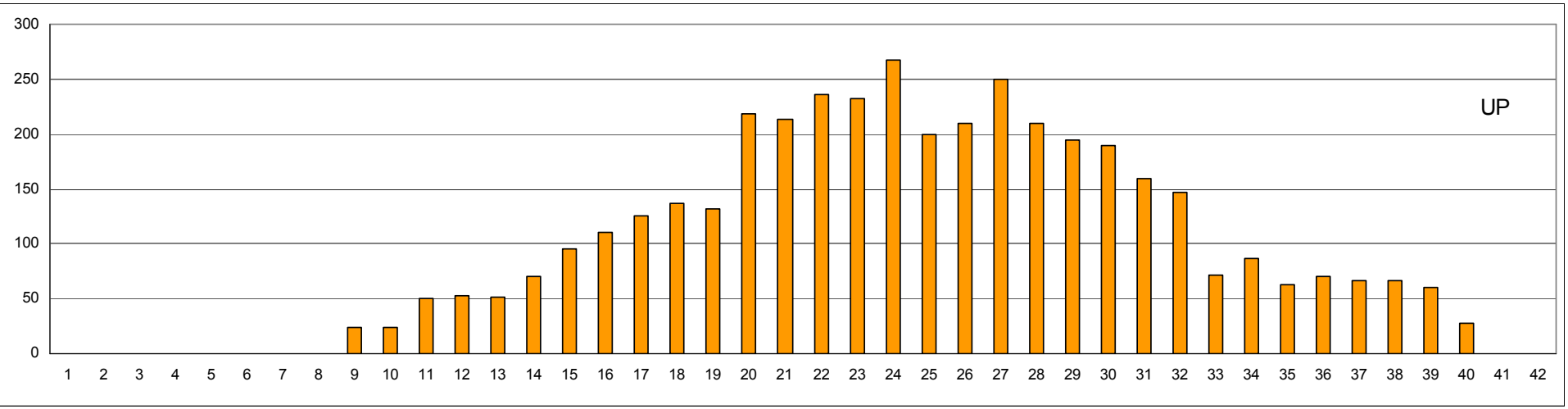
EMBARQ®
The WRI Center for Sustainable Transport

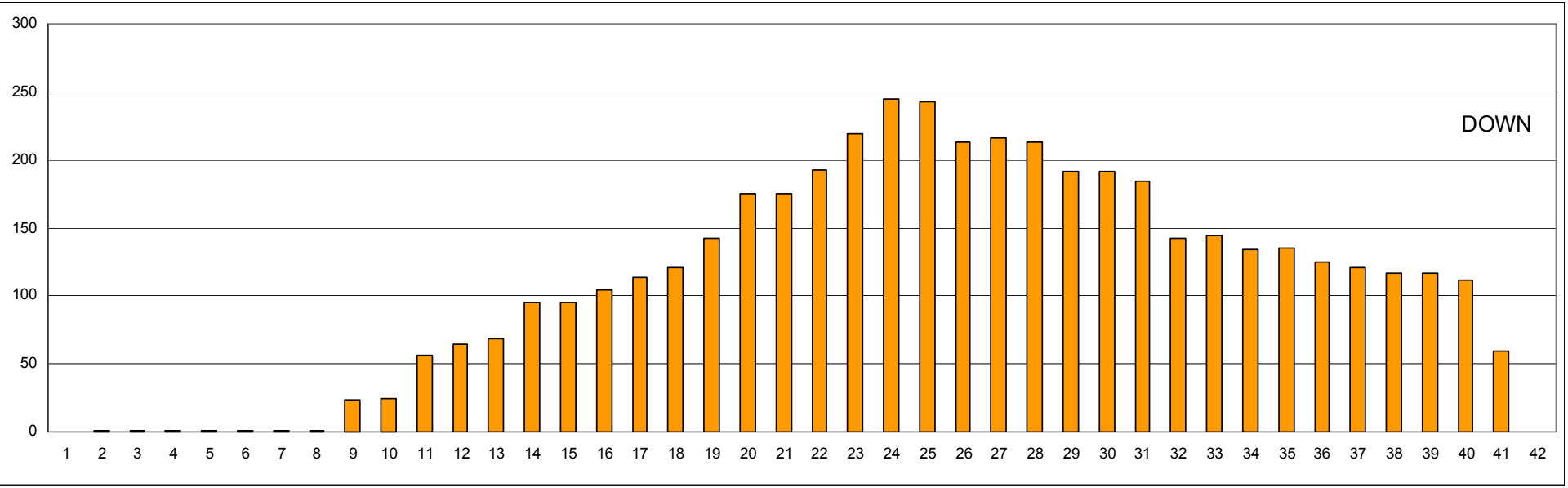




Variation By Time of Day on Route 2

EMBARQ®
The WRI Center for Sustainable Transport





EMBARQ®
The WRI Center for Sustainable Transport

AM Peak Hour Boarding's & Alighting's – Route 2

Results

Benefits

- Increased security and user protection
- Reliability and speed
- Data collection for better system planning
- Intermodal integration
- Multiple fares in a single card (zone, time based, day of the week, special users, volume discounts)
- Regional and even national integration possible

Difficulties

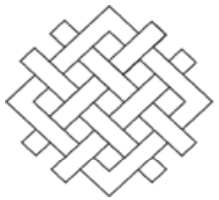
- High cost for sporadic user
- Many people still uses single trip payment
- Requires very strong and reliable “back office support”
- Most implementations have been incomplete for launch date

EMBARQ®
The WRI Center for Sustainable Transport

Component	"High End" BRT
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	• Low 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 • Increased land values • Congestion relief (attraction of automobile and motorcycle users)

EMBARQ®
The WRI Center for Sustainable Transport

Thank you!



WORLD RESOURCES INSTITUTE

Global Strategic Partners

SHELL FOUNDATION

CATERPILLAR FOUNDATION

India Program Partners

Godrej Industries

Sustainable Urban Mobility for Asia SUMA

ClimateWorks

The World Bank – Global Environmental Facility

The UK High Commission SPF

EMBARQ®
The WRI Center for Sustainable Transport

www.embarq.org