TRANSMILENIO AND TRANSANTIAGO

Public Transport planning in cities around the world

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Putting Theory into Practice in Latin America

Using models to support creativity and design
The need for quality in emerging countries

Growth → Urban population → Income growth

Split

Car available households → Priority → Public Transport in line with quality & lifestyle expectations

Car not available household → Priority → Public Transport that is affordable, accessible and reliable

Priority

Expectations
Bogotá, Colombia
Bogotá’s transport system 1990’s

✓ 7 million inhabitants

✓ 1 million cars

✓ 30,000 buses, de-regulated, different varieties

✓ Bus commercial speed (Peak) = 10 Km/hr.

✓ Average time per day on bus = 140 mins/traveller

✓ Infrastructure mostly car oriented
Chaotic public transport system pre-Transmilenio

- Some bus corridors carried over 30,000 pax/hr/dir
Transmilenio in Bogotá, Colombia

Infrastructure built by Government, ~US$5.3 million/km
Integrated fare of US$0.40 covers operating costs + buses
Pay on station, high platform; level boarding to speed up operations
Modelling for Bogotá: Transmilenio
Extensive data collection and model calibration

- Walk: 31%
- Work Bus: 1%
- Bus: 44%
- School Bus: 4%
- Other: 2%
- Taxi: 4%
- Car driver: 10%
- Car passenger: 4%
Extensive data collection and model calibration
Identification of demand groups and their requirements

Weights for:
- Walking
- Waiting
- In-vehicle times,
- Transfers &
- willingness to pay

Segmented by type of user
Passenger capacity and vehicle type

- Bi-artic H Plat pay off-bus
- Artic H Plat pay off-bus
- Bi-artic High Platform
- Artic + High Platform
- Bi articulated + cond.
- Articulated + conductor
- Standard bus
- Minibus
- Van

Capacity of Bus Based Systems

- Passenger capacity and vehicle type
Seven corridors planned and designed in 1999
Pay off-bus, speed up boarding
Sation configuration
Bike parking
Bicycle lanes in Bogotá as feeder mode
Results from the implementation of the first 3 corridors

Commercial Speeds of ~26 Km/hr

✓ Time savings of 32% per user (speed, reliability and interchange)
✓ 37% of users say “spend more time with family”
✓ +300% reduction in accidents
✓ 20% reduction in emissions
✓ Popular recognition of change in the quality of life in Bogotá
Santiago
Santiago

- Some 5.5 million people, 1.2 million cars
- Some 8,000 buses and a similar number of less formal shared taxis, etc.
- Most PT services were end-to-end with very long routes
- High frequency, poor quality buses, aggressive driving
- Flat fare of ~US$ 0.45, no subsidies
Santiago Metro

Moved 1.3 million passengers per day in 2006
TranSantiago

- A multi-modal Transport Plan
- Part of this plan is the introduction of a new Public Transport system
- Inspired in Transmilenio and Curitiba, based on a trunk-feeder system; it also uses Metro as a trunk system
- More ambitious than Bogotá:
  - The whole network: Cleverly Optimised
  - Only smartcards for payment
  - Not much infrastructure: technology will solve the problems
Objectives

- Improve service quality to all users.
- An economic, social and environmentally sustainable PT system.
- Maintain and improve PT share of trips in Santiago.
Three groups of concessions + Metro + Infrastructure?
Trunk routes
2007: Reality disappoints

Extreme crowding, especially in the Metro, frustration, low quality of service: a high political cost

Buses

Metro, carries over 2 million passengers per day
DEMONSTRATIONS, OFFICIAL INQUESTS

What went wrong?
What went wrong?

- Some basic design issues
- A case of extreme optimism
- The use of strategic model of 700 zones to undertake a tactical PT design
  - Zones generally too large to design PT routes and services
  - Zones near the periphery too large to locate bus stops
  - It could have been adapted and moderated using on-the-ground experience
- The abuse of spreadsheet financial model to achieve “objective” of no subsidy
- Rejection of experience (not invented here) and negative views
The design problem

Design a system that:

- Offers new buses, professional operators and new labour contracts with drivers; *this was the Improvement in the Level of Service*
- **Minimises operating costs without subsidies**
- Satisfy known demand
- Implicitly: without major investment in infrastructure

This led to a system that:

- A trunk-feeder structure and feeds metro too
- Low floor buses and high load factors
- Adjust supply very closely to known demand
- Integrated fare using smartcard “BIP”

- Reduces frequencies
- Requires transfers
- Increases, or at most retain, travel times
**Design of new services: how to satisfy user requirements**

\[
GenCost = a_1 t_{access} + a_2 t_{wait} + a_3 t_{in\ bus} + a_4 Fare + n \tau_{transf} + \delta
\]

- **Access Time**
  - Number & location of stops
  - Route Coverage

- **Waiting Time**
  - Frequency
  - Fleet size
  - Operational design

- **In-vehicle Time**
  - Infrastructure & priority
  - Delays at stops: pay on/off bus
  - Operational design

- **Fare**
  - Risk allocation
  - Commercial speed
  - Cost recovery ratios

- **Transfer Time**
  - Infrastructure
  - Integration
  - Operational design

**In practice, transfers were undervalued and the reduction of travel times was not seen as a key indicator of performance**
The overall business model

Fare and Financial Model

Network and Optimised Services Model

Concession design & Fleet Specifications

Revenues

Costs

Payments

Reduction of fleet

No government subsidies
No major infrastructure improvements
Use of modern technology (GPS, SmartCards)
In February 2007 the system is implemented in a “one-day big bang”

- **Service coverage and comfort**: despite the new buses, these were overloaded, offer fewer seats, sometimes passengers cannot board them and this increases delay: fragility of the new system
- **Walking and Travel times**: these have increased although a few people with trips along a trunk route now have somewhat faster services
- **Transfers**: more transfers than before thus increasing travel time and uncertainty
- “**One-Day Big Bang**”, a very risky strategy that nobody has got right yet
- **SmartCard**: initially a significant problem; seems to work OK now
High performance is not the same as trunk-feeder services
Trunk-feeder structure will only improve services if the infrastructure and operation design permit significant saving on the trunk section to compensate for transfers
All elements in a BRT system are interrelated: lanes, platform, payment, alignment, car restraint, revenue, enforcement, etc.
If major protected bus infrastructure and “pay off bus” is not possible it is better to think about open rather than closed systems
Public Transport systems are much more vulnerable to errors and overloads than road traffic; they require redundancy and spare capacity
Lessons

Modelling without experience and judgement is a dangerous combination

NEVER TRY TO IMPLEMENT A COMPREHENSIVE NEW ROUTE SYSTEM IN ONE DAY

• There is a lot to be learn from pilot studies and gradual change
• Users need time to adapt to new systems, but they need to go to work every day
• The resources required for good implementation are easily underestimated at a significant political cost

Be very careful with the data you collect and the models you develop

Use appropriate Key Performance Indicators

Involve stakeholders as co-planners (rather than challengers) from the start
THANK YOU