BRTS Corridor, Delhi

Infrastructure Details and Performance Evaluation

Sandeep Gandhi

Principles and Key Features

Principles	Key Features
Provide for all road functions in an equitable manner	Entire ROW is redesigned, to improve efficiency and safety
Minimize travel time and distance for bus commuters	Open system - Central segregated bus lanes, release buses from congestion
	Junction shelters reduce walking distance
Cater to current and future bus demand	Parallel platforms staggered on both sides of junction provide a capacity of 200 buses/hr.
Ensure safety of all users	Segregated cycle tracks – traffic calmed and signalized crossings for ped. and NMV
Cater to current road usage – formal and informal	Integrated spaces for hawkers, Auto parking and cycle parking as per demand

BRTS Infrastructure Details

Bus Lane – Entry Exit

- Dedicated signals for bus lanes
- Bus lane segregation starts 30m after junction
- Special signs and marking to demarcate bus lane

Bus Lane – Entry/ Exit

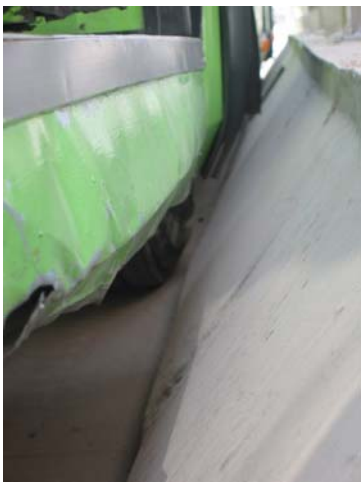
Bus Lane Median

- Rumble strips allow overtaking in case of breakdown
- Discourage over speeding
- Curb between bus and MV lane have gentle slope from bus lane side.

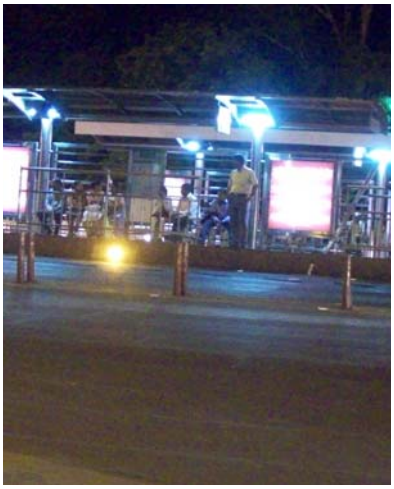
Bus Shelter Entry

- Shelters accessed directly from signalized pedestrian crossing
- Controlled access allow entry/exist only from junction side

Bus Shelter Level Boarding



Bus Shelter Lighting



Bus Shelter Signage

Bus Shelter Signage

- Route maps specific to bus routes at each shelter provided.
- Benches to seat 6 passengers provided in each shelter

Lighting and Drainage

Cycle Tracks

- Continuous Concrete Tracks
- Adjacent to MV lanes
- Raised by 75 to 100mm above road level
- Physically segregated from MV lanes and pedestrian path
- Tree belt provide shade

Cycle Track

- Entry aligned to natural path of cyclists
- Segregation starts 30m after junction to allow easy access

Cycle Track

- Raised crossing established cyclist and pedestrian priority at un-signalized junctions
- Textured ramps for vehicles – different surface treatment at crossing

Cycle Track

- Pedestrian path edge designed to prevent pedal hitting
- Raised pedestrian crossings

Cycle Track

- Information signs used for tracks – tracks projected as a friendly option, not enforcement
- Regulatory signs for cars – cycle tracks defined no entry for cars

Cycle Crossing at Junction

Pedestrian Path

- Wide shaded pedestrian paths

Pedestrian Path

- Raised crossing for pedestrians provide safe, convenient and barrier free crossing across unsignalized junctions
- Wide – differently textured crossing

Pedestrian Crossing at Intersections

TSR and Cycle Parking

- TSR and cycle parking are located near bus shelters – outside the carriageway
- Barrier free access to TSR parking is provided

Hawker Spaces and Landscaping

- Hawker spaces defined by benches and bollards located outside pedestrian path and cycle track

Intersection Landscaping

- Wide shaded pedestrian plazas provided for pedestrian and cycle refuge
- Each corner of junction has designated hawker spaces and at least 1 public toilet

Private Car Parking and Service Lane

- Access function catered by service lane which includes parking
- Limited access to/from service lane reduces friction on MV lanes

Signals

- Combination of near and far side signals for greater visibility

Barrier Free Infrastructure

As per disability act of 1999

Footpaths

Direct and Comfortable

Even surface

Continuous tactile pavers on entire 14.8km for visually impaired

Footpaths
Continuous at crossings

No level changes on footpath makes it convenient for people with reduced mobility

Raised crossing type design slows crossing vehicles, making it safer for use and establishing right of way for pedestrians.

Footpath
Resting Facility every 200m

40 to 45 cm high bollards with rounded edges are provided at shaded resting spaces every 200m.

These spaces also include space for hawkers

Footpath Lighting

Special white lighting at average 40 lux for footpaths

Maintains colour contrast from road

Ensures colour contrast of tactile pavers visible at night

Crossing and Intersections Crossing Cycle Track

Corridor provides regular spaces for parking of 3 wheelers

These facilities include level crossing for wheelchairs

Tactile warning for visually impaired

Boarding space for wheelchairs

Crossings and Intersections Negotiating Free Left Turns

- At grade crossing (no level change)
- Vehicles slow down
- Bollards with to direct vehicles and clear gap of 1.2m
- Tactile pavers to warn visually impaired before entering the junction
- 1:12 slope ramp access to zebra crossing

Intersection Signals

Audible signals which beep when light is green

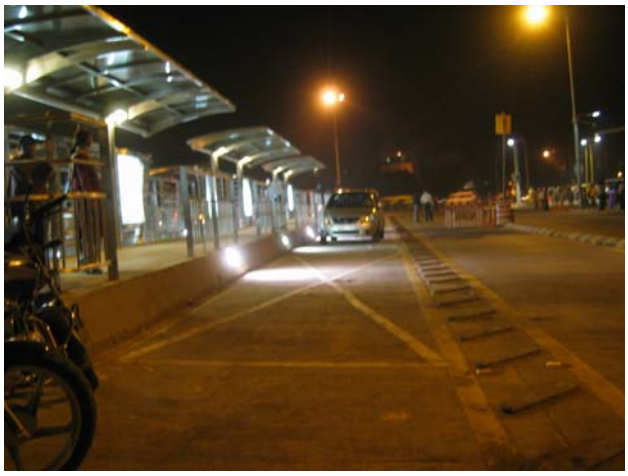
Bus Stations
Access to the Bus

- Defined boarding gates with warning tiles

Bus Stations
Lighting

Lighting levels of average 40 lux inside bus shelters.

White light ensure colour contrast for visually impaired at night



Buses
Access from regular roads

- Folding ramp inside each bus allows access to wheelchairs on regular roads

Buses
Inside the Bus

- Space to park wheelchairs with provision of special belt to secure during journey

Sign Boards

Station and Route Information at Footpath

Space for Braille signage and Audible messages at 1.4 to 1.6m above ground level.

Direction aid through tactile pavers

Wide space for wheelchairs

Sign Boards

Route Information at Bus Stations

- Space for Information in Braille

Operations and Performance Evaluation

Corridor Operations and Maintenance

Corridor Operations Team Responsibilities

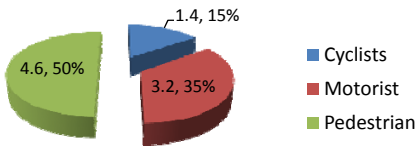
- Record Speeding incidents by buses
- Violation of bus and cycle tracks by MVs
- Monitoring no. of challans issued
- Traffic management
- Cleaning and maintenance of the corridor
- Handling breakdown of vehicles
- Handling incidents such as accidents
- Recording all types of accidents
- Monitoring monthly trends
- Co-ordinating repairs, upgrades etc.

Post Construction Evaluation and Interventions

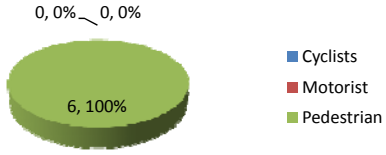
- Speed data was analysed by DIMTS operations team through GPS fixed in buses
- Overspeeding by buses was blamed for pedestrian fatalities
- Rumble strips installed in bus lanes

Accidents

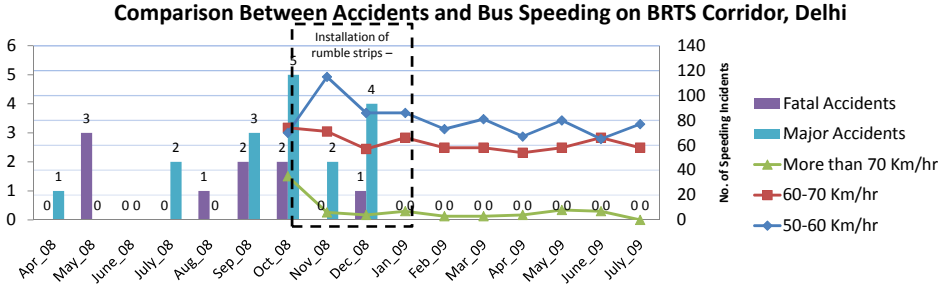
Yearly Average Fatalities Before Construction on 5.8km Stretch of BRT Corridor, Delhi



Yearly Average Fatalities After Construction on 5.8km Stretch of BRT Corridor, Delhi



Comparison Between Accidents and Bus Speeding on BRTS Corridor, Delhi

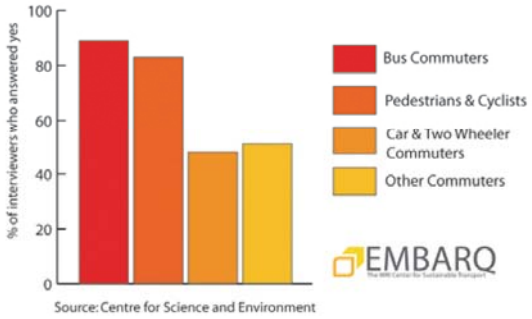


No. of Accidents post installation of rumble strips in bus lane – **"ZERO"**

Delhi Bus Corridor Performance Qualitative Rating

Component	Rating
User Acceptance **High**	• **High 88%** (Bus Commuters, CSE, Jun 08; weighted average **69%**)

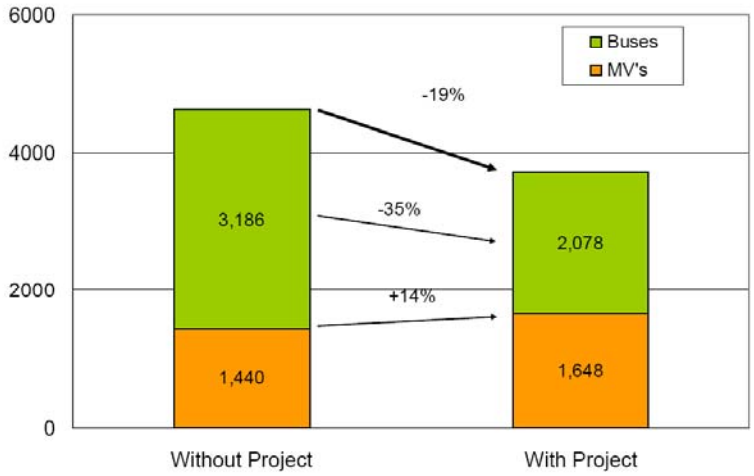
Are you happy with the BRT and dedicated bus lane system?



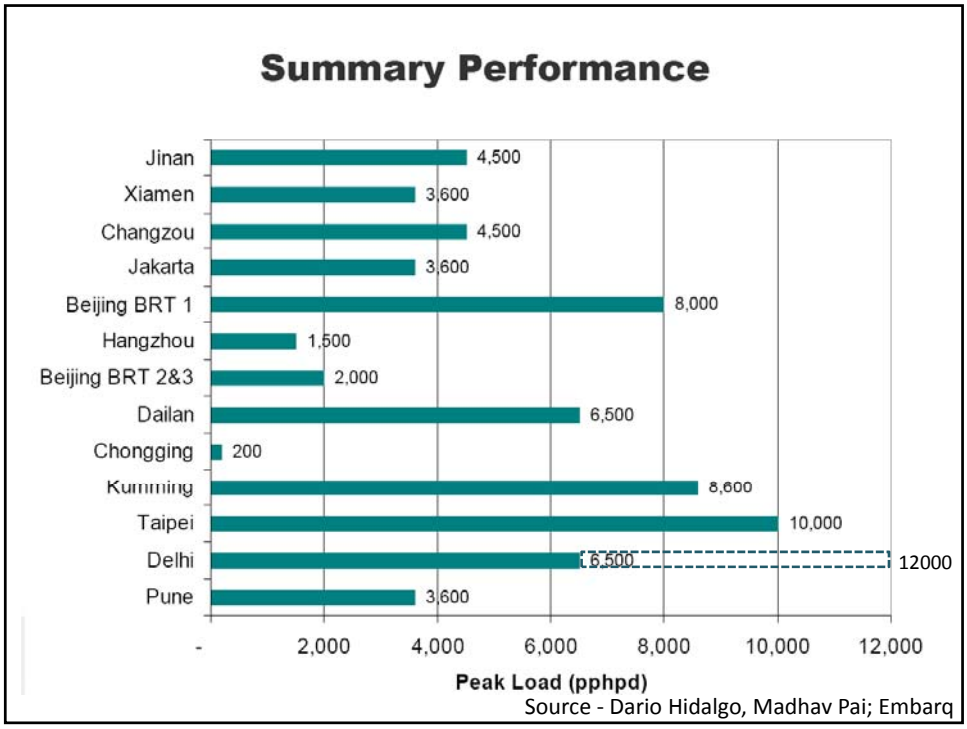
Source - Dario Hidalgo, Madhav Pai; Embarq

The Bus Corridor has reduced the average travel time

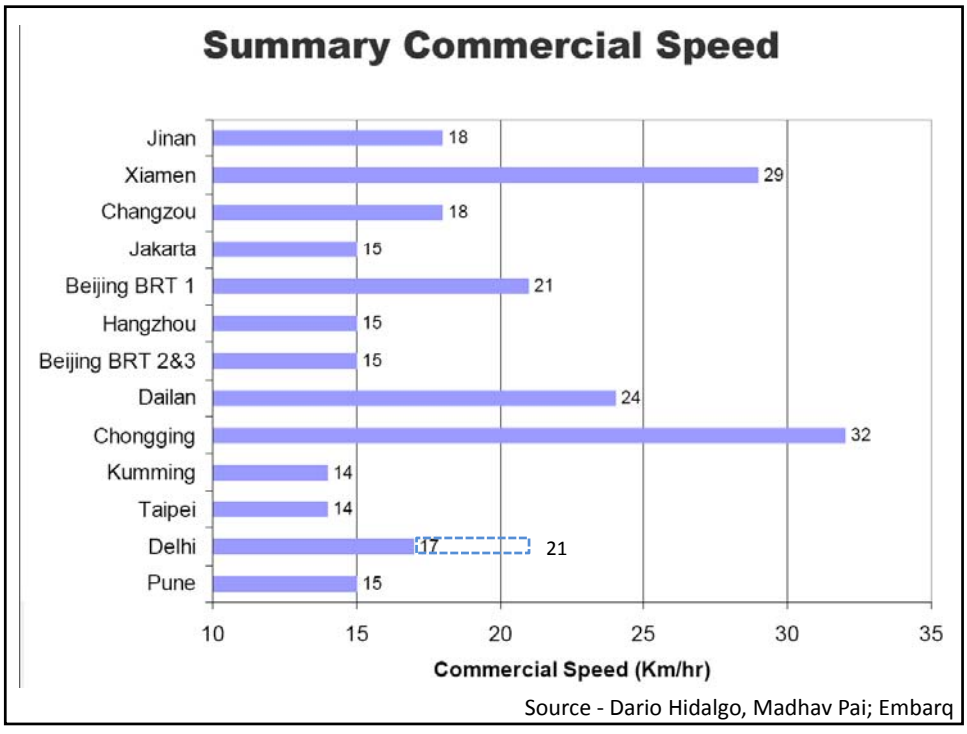
People Delay - Morning Peak Hour - In Hours



Source - Dario Hidalgo, Madhav Pai; Embarq



Source - Dario Hidalgo, Madhav Pai; Embarq



Source - Dario Hidalgo, Madhav Pai; Embarq