



**CROSS/
ROADS**
LINKING MOBILITY SOLUTIONS



**IRF WORLD ROAD
MEETING 2017**

/ 14-17 NOVEMBER / DELHI / INDIA /

Accessibility Network Development for TOD along Proposed BRT Corridor in Dhaka, Bangladesh

Dr. P K Sikdar & Mr. Swarup Mukherjee
President CGM
Intercontinental Consultants & Technocrats Pvt. Ltd.
psikdar@ictonline.com;
swarup.mukherjee@ictonline.com

Content

- Transit Oriented Development (TOD) Background
- BRT Corridor Study in Dhaka
- Accessibility Audit Survey and Analysis
- Improvements for Accessibility Network
- Parking Strategies
- Land use control and regulations
- Redevelopment of Commercial/Residential Spaces
- Enforcement Strategies
- Conclusion

TOD Background

“a mixed use community that encourages people to live near transit services and to decrease their dependence on driving” - *Peter Calthorpe*

Transit Oriented Development (TOD)



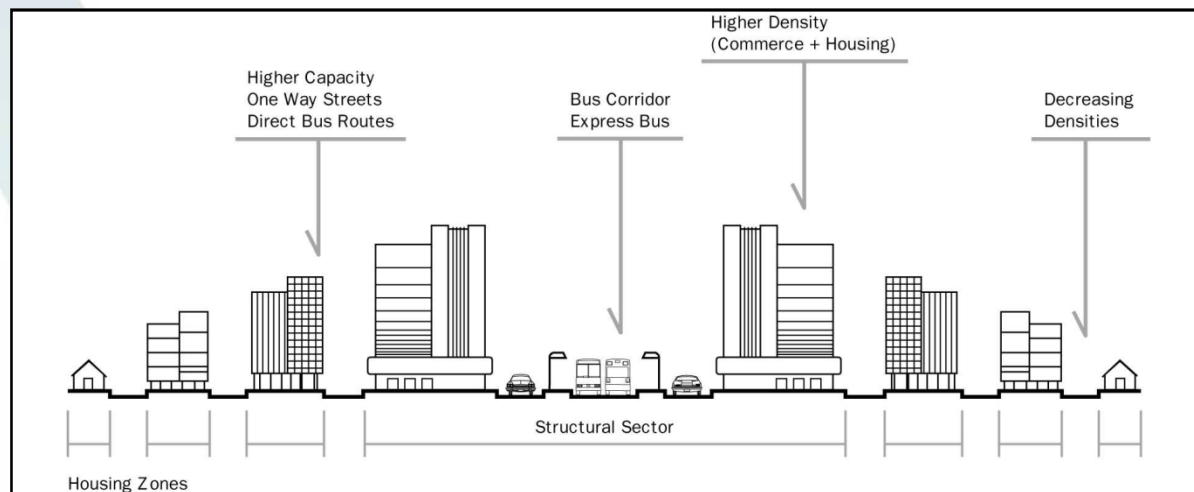
Alternative City Development Strategies
focusing on
use of **Public Transport**

TOD Background

Curitiba Master Plan -

guided the city development for 30 years

- linear urban city growth
- Integration of public transport
- Road network development and land use along key “structural axes”

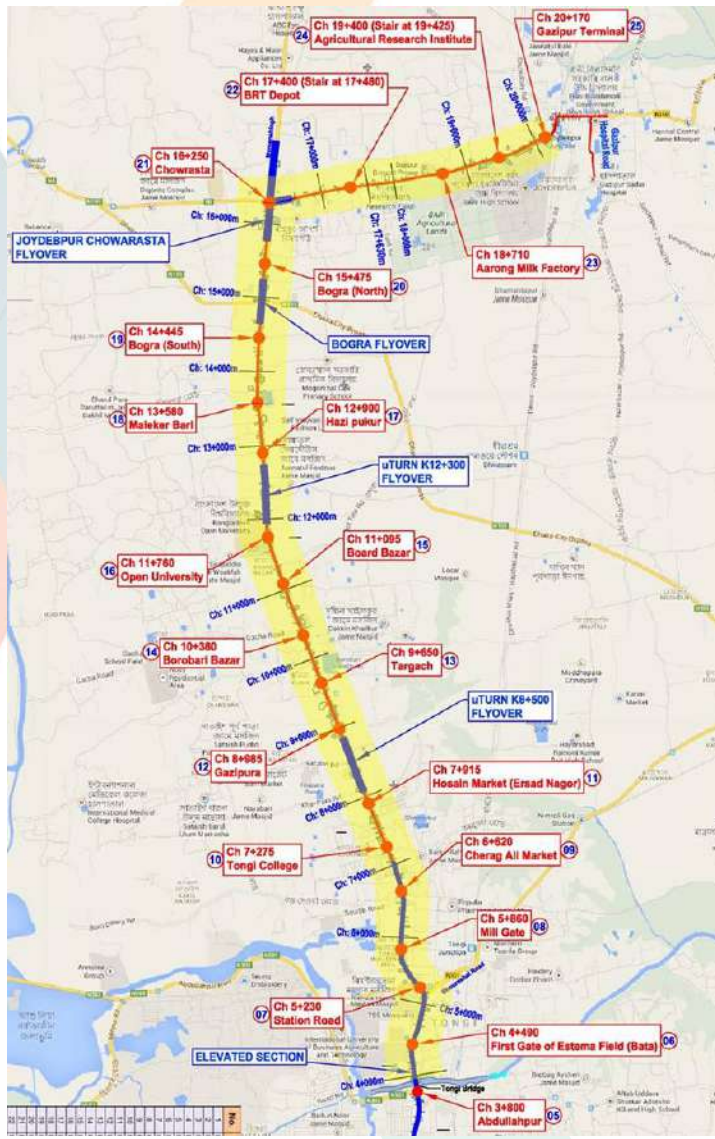


TOD Background

Delhi Development Authority (UTTIPPEC wing) developed TOD guidelines for Delhi Metro Railway Corporation (DMRC)

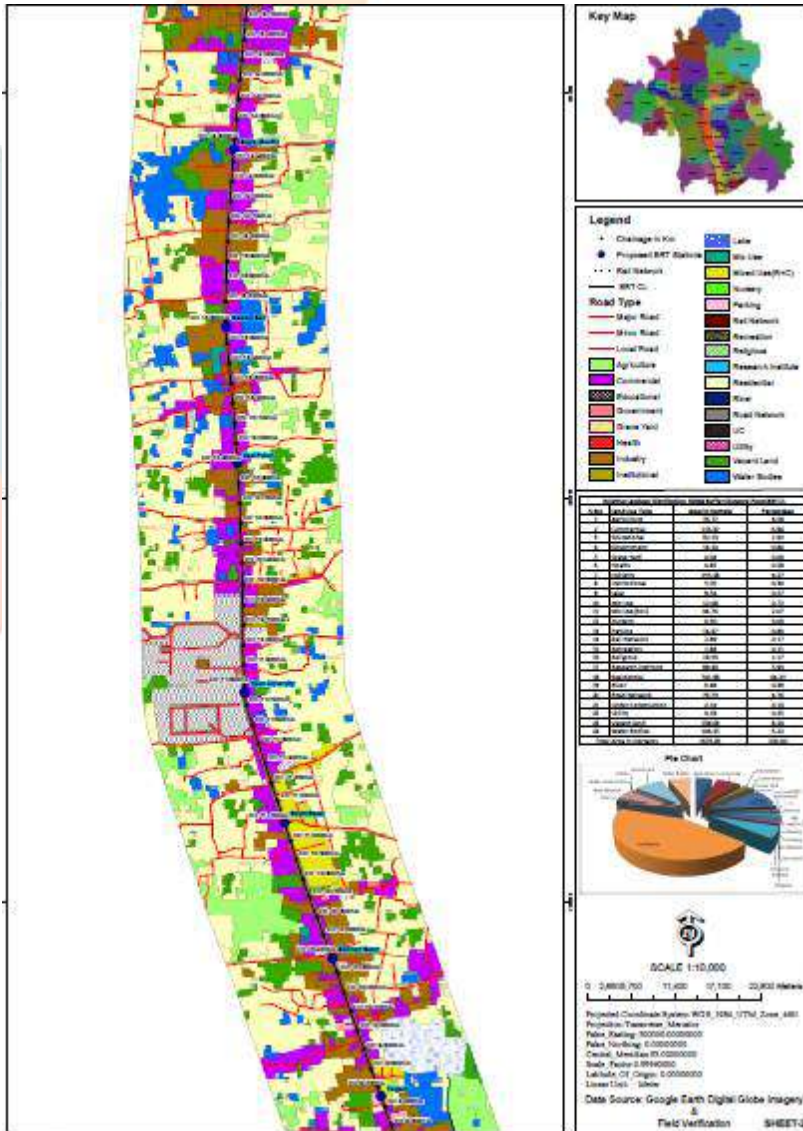
- “Variety of high-density, mixed use, mixed income buildings, within a short distance of a **Rapid Public Transport** network”
- Pre-specified zones near **Transit Stations**
- More people to use Public Transport and limit urban sprawl

BRT Corridor Study in Dhaka



- 500 M on both sides of BRT corridor were studied
- Stretching north of Dhaka Airport to Gazipur Terminal
- Approximate length 16 Km
- 15 At-grade BRT Stations
- 5 Elevated BRT Stations

Land Use of BRT Corridor



Population - 287,191 (15% of GCC)

Pop Density - 17,224 persons per sq.km

Land Use

Residential 44%

Industrial 9%

Vacant 8%

Commercial 7%

Water bodies 6%

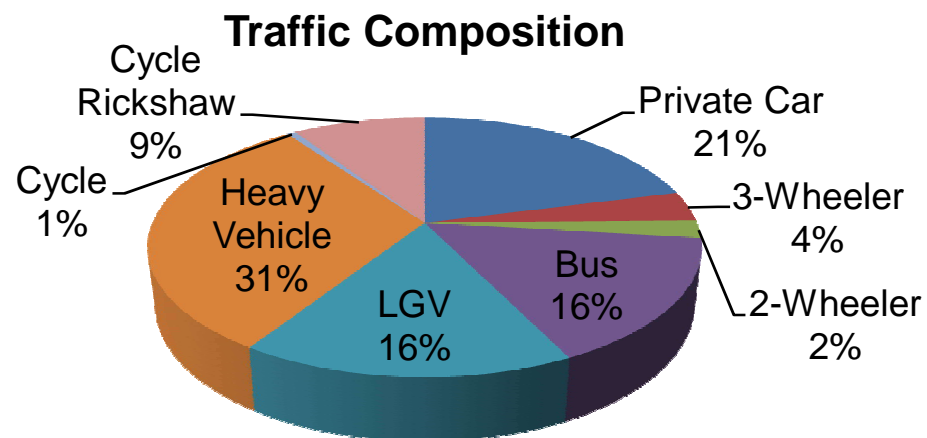
Institutional 6%

Road 5%

Agricultural 5%

Traffic & Travel Characteristics

Dhaka-Mymensingh Road (BRT Corridor) - 60,000 PCU/day

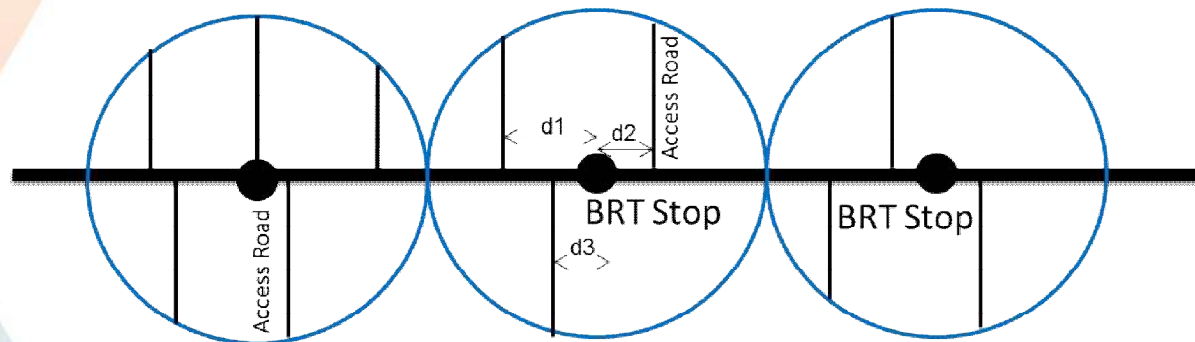


60% of daily trips are walk trips in Dhaka

Average Household Income (BDT/month)	Walk Trips	Trips by other Transport Mode
<2,000	84.0%	16.0%
2,000-9,999	67.0%	33.0%
10,000-29,000	40.0%	60.0%

Accessibility Audit

Out of 170 feeder roads exists along the BRT Corridor
84 Access Roads were audited which falls within 500 M of radius



Accessibility Parameter

- Road Width
- Availability of separate footpath
- Road Surface Condition
- Drainage Condition
- Street Lighting
- Walking/NMT Obstruction
- Availability of NMT parking space
- Presence of Garment Factory

Accessibility Audit Analysis Results

42% access roads are located within 100m from a BRT station

43% of access roads have road width less than 5 metre

44% of access roads have road widths from 5 to 10 metre

Only 3% of access roads are having sufficient space for pedestrians (more than 18 metre road width)

45% of access roads are in very bad condition

- 90% of the road surface is damaged
- no drainage facility
- no pedestrian facility
- no/insufficient street light

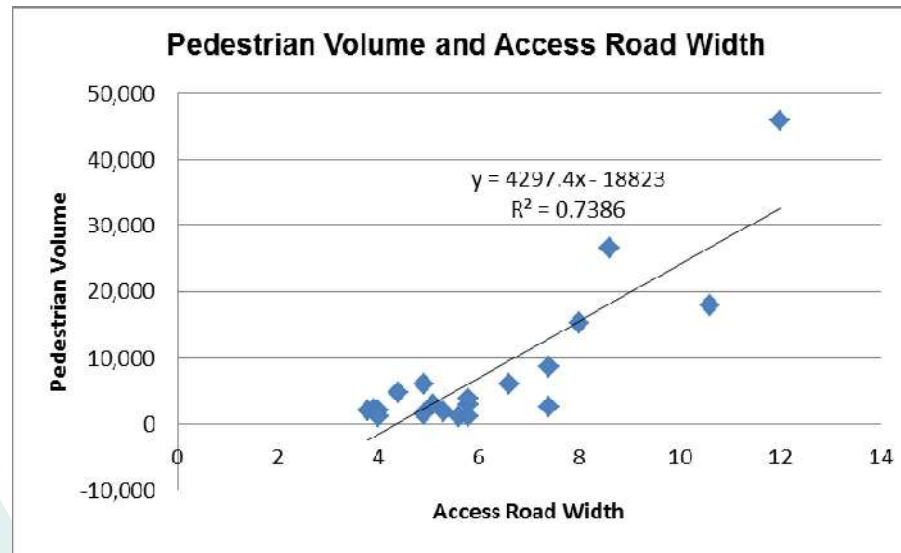
30% of the access roads are in good

- road surface is paved
- less than 5% obstruction in pedestrian and NMT movement

Accessibility Audit Analysis Results

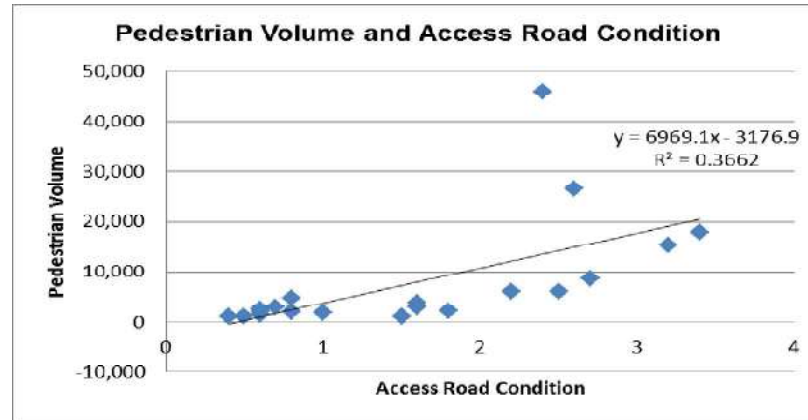
Pedestrian volume near to proposed BRT stations are regressed with observed data for each parameter to find out explainable relationship

$y = \text{Pedestrian Volume near to proposed BRT station}$
 $x = \text{Width of Access Road}$

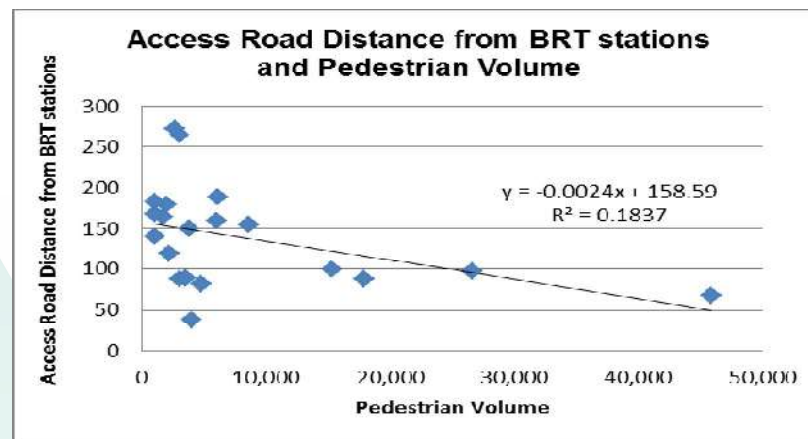


Accessibility Audit Analysis Results

$y = \text{Pedestrian Volume near to proposed BRT station}$
 $x = \text{Access Road Condition}$



$y = \text{Pedestrian Volume near to proposed BRT station}$
 $x = \text{Access Road Distance from BRT station}$



Prioritization of potential access road

- To take up in-situ development work immediately
- To achieve maximum accessibility benefit

Attributes of accessibility, field data were converted to a 5 point scale

Weightage Table

Pedestrian Volume	30%
Access Road Width	35%
Road Condition	10%
Availability of NMT Parking space	15%
Distance from BRT station	10%

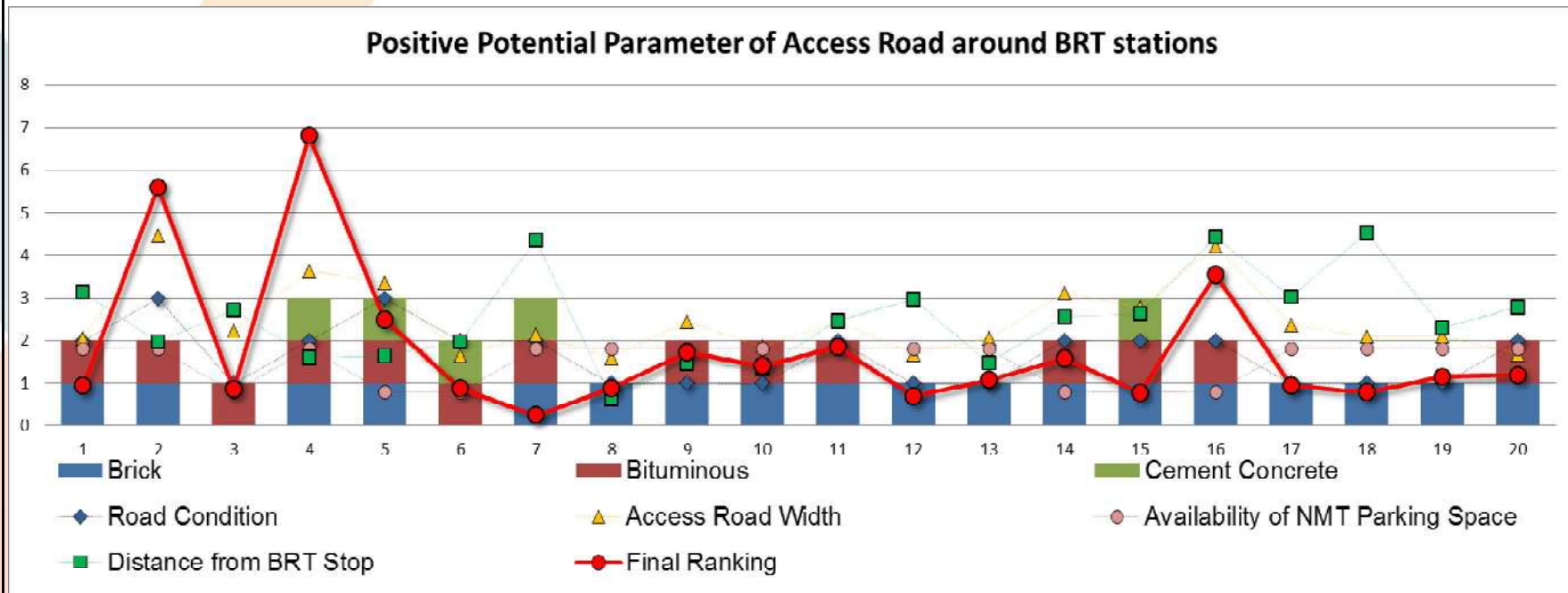
Ridership pull factor for passengers to come to BRT stations is derived based on relationships of studied attributes of accessibility

$$\begin{aligned} & \textit{Final Score} \\ & = [(Wt \textit{ Ave Pedestrian volume}) \\ & * (Wt \textit{ Ave Access Road Width}) \\ & * (Wt \textit{ Ave Road Condition}) \\ & * (Wt \textit{ Ave Availability of NMT Parking Space})] \\ & / [(Wt \textit{ Ave Distance from BRT station})^2] \end{aligned}$$

Weighted Average Final Score and Ranking

BRT St No.	Weighted Average Scores for BRT Station					Final Score	Ranking
	Road Condition	Access Road Width	Availability of NMT Parking space	Pedestrian Volume	Distance of Access Roads from BRT station		
1	0.200	0.722	0.270	0.235	0.313	0.938	12
2	0.300	1.563	0.270	0.687	0.197	5.608	2
3	0.100	0.781	0.120	0.067	0.271	0.857	16
4	0.200	1.268	0.270	1.025	0.160	6.814	1
5	0.300	1.179	0.120	0.589	0.174	2.487	4
6	0.200	0.575	0.120	0.083	0.197	0.884	14
7	0.200	0.752	0.270	0.115	0.437	0.246	20
8	0.100	0.560	0.270	0.077	0.163	0.878	15
9	0.100	0.855	0.270	0.115	0.176	1.729	6
10	0.100	0.649	0.270	0.184	0.186	1.405	8
11	0.200	0.855	0.270	0.146	0.248	1.857	5
12	0.100	0.590	0.270	0.077	0.298	0.691	19
13	0.100	0.722	0.270	0.058	0.177	1.075	11
14	0.200	1.091	0.120	0.331	0.256	1.582	7
15	0.200	0.973	0.120	0.231	0.263	0.779	18
16	0.200	1.474	0.120	1.500	0.212	3.555	3
17	0.100	0.826	0.270	0.038	0.303	0.936	13
18	0.100	0.737	0.270	0.101	0.452	0.785	17
19	0.100	0.737	0.270	0.038	0.232	1.142	10
20	0.200	0.590	0.270	0.038	0.228	1.180	9

Weighted Average Final Score and Ranking

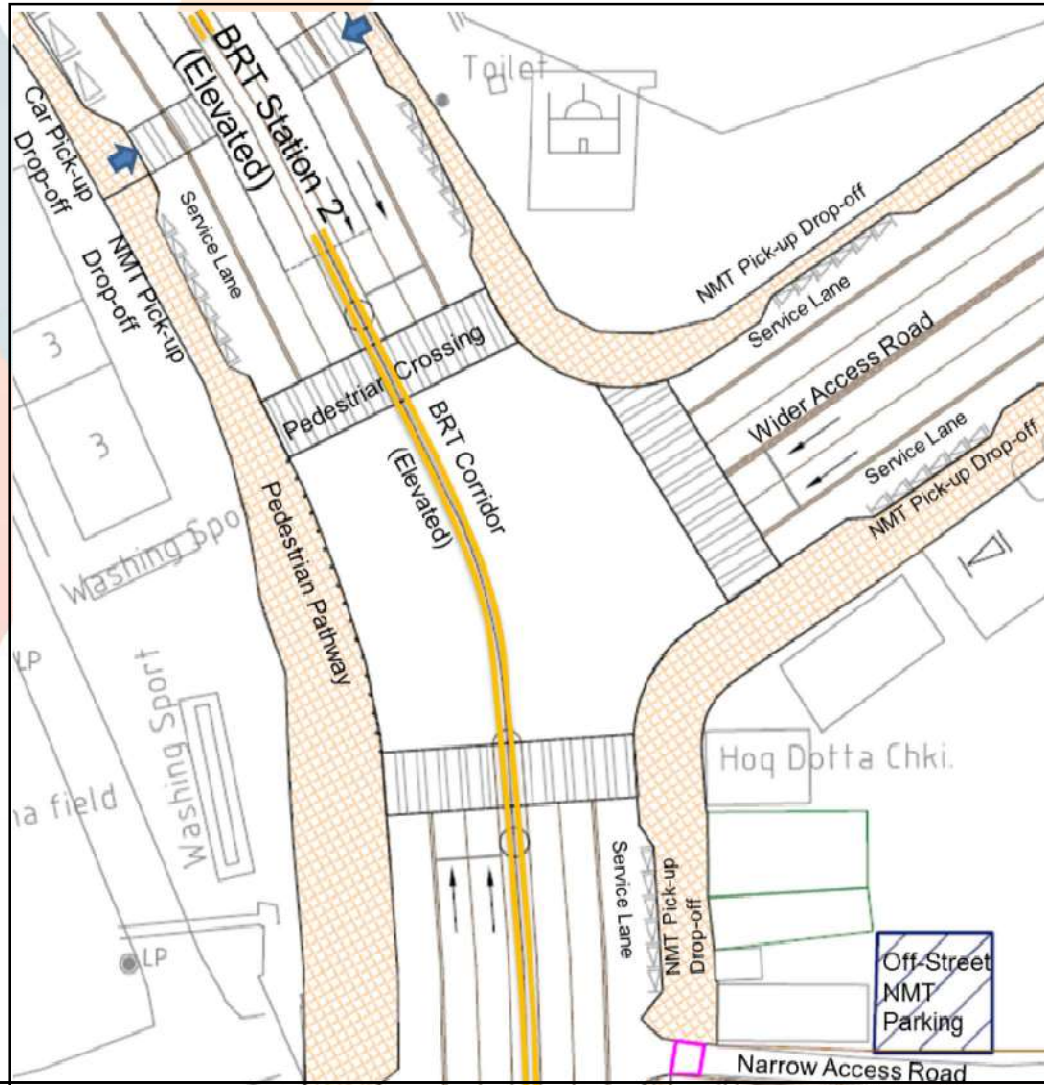


BRT station 2, 4, 5 and 16 are candidate stations for immediate development work

- Accessibility network around these stations have positive attributes
- Access road widths are 8-15 metre with shoulder spaces
- Pedestrian and NMT facilities in the Access roads can be developed with minimum alternations

Improvements of Accessibility Network

For Access Roads 8-15 metre wide

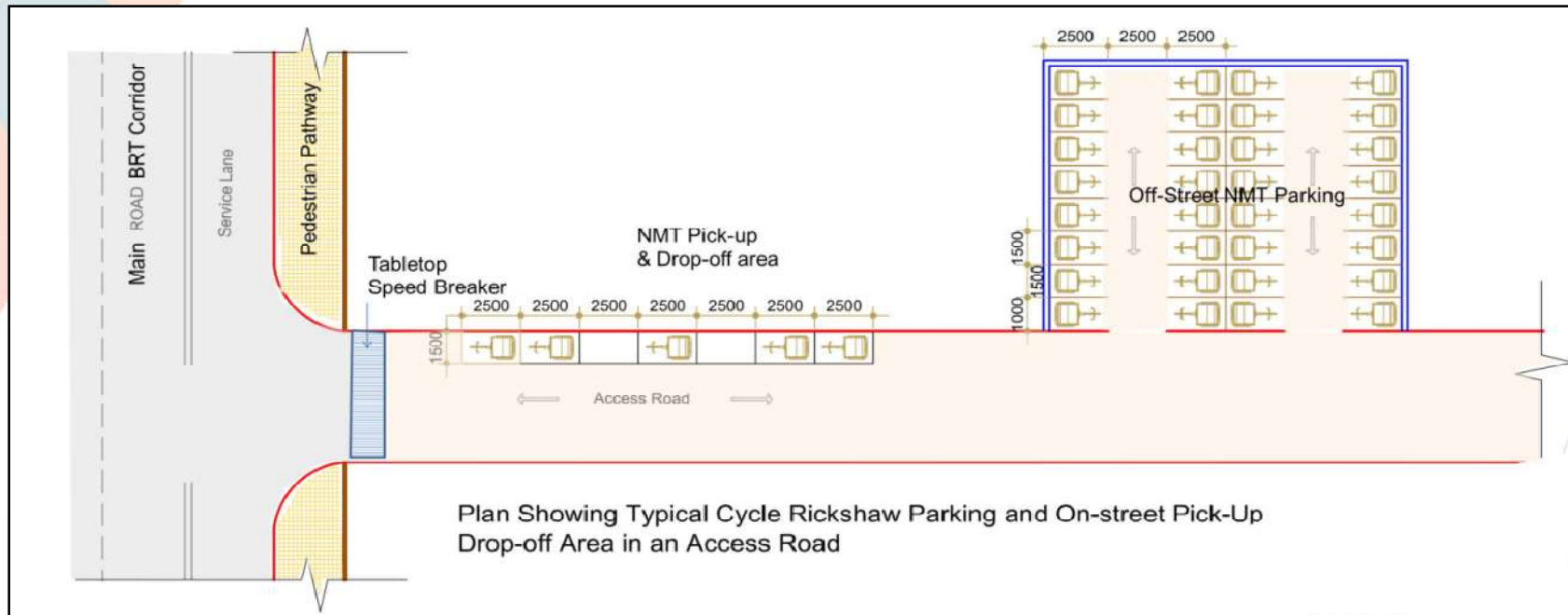


- Redesign of intersections
- Shoulders can be reconstructed with paver blocks
- Guard rails will be installed along the edge of footpath to channelize pedestrian movement
- NMT pick-up drop-off bays, off-street NMT parking arrangements

Improvements of Accessibility Network

For Access Roads <5 metre wide

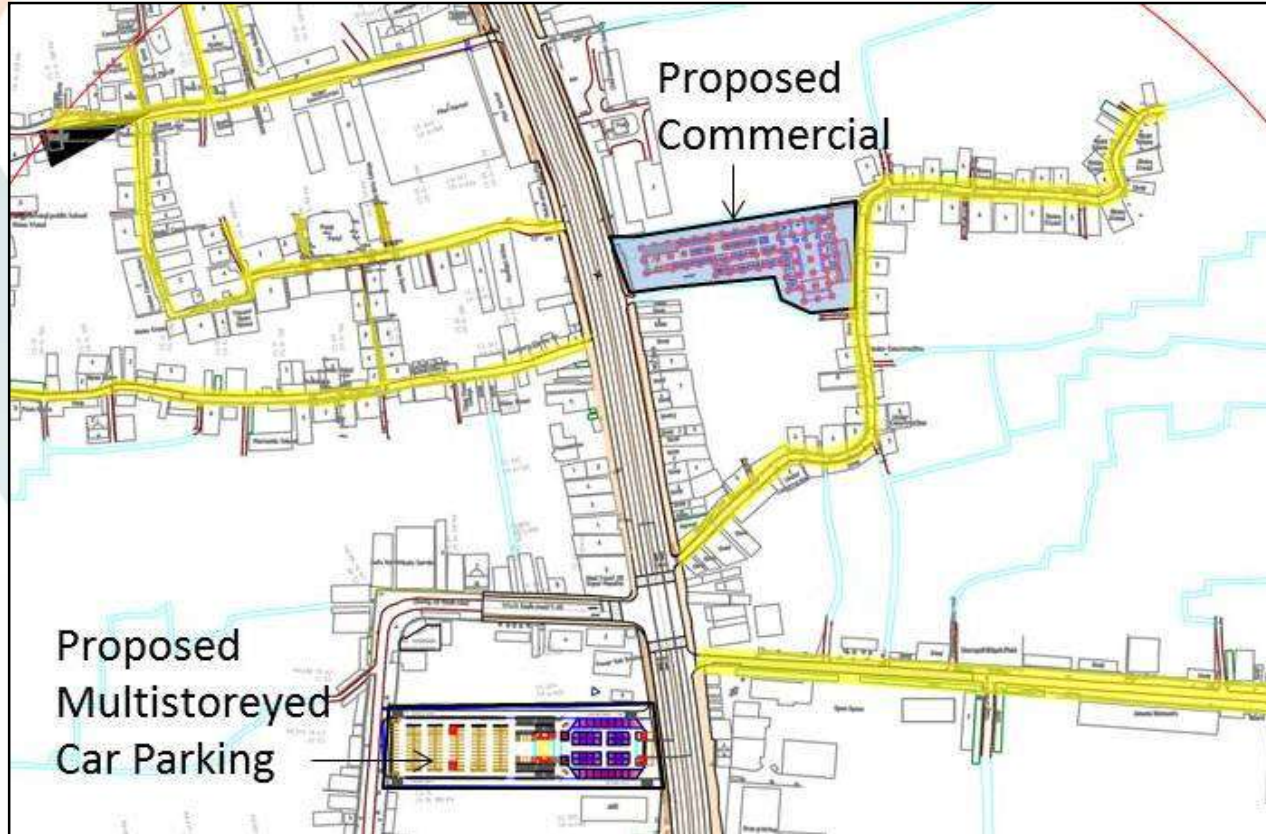
- Parallel Pick-up/ Drop-off spaces of cycle rickshaws along the access roads
- Off-street cycle rickshaw parking spaces are identified for each BRT station



Cycle Rickshaw is a widely used mode of transport in Bangladesh and essential component to support last minute connectivity – *Rob Gallagher*

Parking Strategies

- Parking spaces are to be provided for vehicular and NMT modes and at the same time on-street parking will be prohibited along the BRT corridor
- Pickup and drop-off spaces for NMT and vehicular modes are to be provided near the stations
- Multi-storeyed car park buildings (off-street parking) with commercial spaces at ground floor can be developed in PPP mode



Parking Strategies



Bus parking area of 5 hectare identified to accommodate 500 buses



Truck parking area of 15 hectare identified to accommodate 2000 trucks

Land use Control and Regulations

Land Use control Policies

- Notification of BRT Overlay Zone
- Incentivize Multi-storeyed Multi-family Apartment Housing
- Redevelopment: Land Assembly/Management
- Land Pooling
- Private Sector Participation

Proposed Development Control Regulation

- Proposed FAR and Road Width in BRT Overlay Zone
- Redevelopment Regulations
- Proposed Transit Oriented Development (TOD) Authority
- Financial and Fiscal Plan
- Capacity Development

Land use Control and Regulations

- Road Right of Way (ROW) can be identified and land owners of adjacent land parcels jointly develop the area



Redevelopment of Commercial/Residential Spaces

- Existing Commercial Clusters are identified for Redevelopment
- Proposed redevelopments are found to be viable with 12%, 24% and 25% IRR in PPP mode



Enforcement Strategies

Uninterrupted access to the BRT stations by all access modes will be possible through very strict enforcement along the BRT corridor

- Capacity building with traffic police
- Proposed improvements in enforcement rules

MVO 1983 need to be amended with,

- Parking management law
- Vehicle inspection rules
- Law to include use of New Technology
- Driver insurance law
- Fees and Fines law needs to be updated
- Impounded vehicle law need to be updated
- Private sector participation law needs to be updated

Conclusion

Components required to be implemented to achieve common TOD goal

- Improvements of accessibility network for easy reach to the stations are the most essential component of a successful Public Transport system
- Development Authorities/Metropolitan Transport Authorities need to adopt off-street parking proposals to accommodate the existing and future demands
- Land use policies and regulations to be implemented in the TOD influence area
- Incentives to be provided Commercial redevelopment, vendor cluster development projects
- Legal department is to amend/introduce traffic rules and regulations suiting to the needs of operations of proposed public transport system



THANK YOU