Transport Infrastructure in Indian Urban Environment

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Roy B C, born in 1944, holds a Ph. D in engineering. In a career of over 40 years, Dr. Roy has dealt with many multi-disciplinary projects; experience ranging from concept plan to execution and is known for his innovative designs. He has worked in MRTS, LRTS and BRTS projects. He is the Vice President and a Member of Technical Committee of IABSE.

1. Introduction

The objectives of urban transport infrastructure are to enhance mobility & safety, make public transport a dominant mode, improve non-motorized traffic and environment. This paper discusses urban transport characteristics and initiatives in this context in India, with case studies.

2. Urban Scenario & Transport Characteristics in India

Cities sport a highly mixed traffic. The major requirement of a successful transport system is to meet the demand for safe, convenient, clean and affordable modes of transport that can provide door-to-door service, through seamless multi-modal transfers – a spider webbed network, in short. Optimization across all modes and forms through detailed understanding and innovative solutions is the need.

3. Initiatives

The effects of grade separators are highly localized and may indeed worsen the situation. Instead the road may be taken elevated for long stretches with appropriate entry and exit points, for example as in the city of Jammu. Mumbai and Kolkata are following suit at much larger scales. Segregating motorized, non-motorized and pedestrian traffic improves carrying capacity of available road area. Pedestrianizing the ground level and taking traffic underground in multiple levels as needed is a solution, as being planned for BBD Bag area and Esplanade of Kolkata. Bus Rapid Transit Systems (BRTS) for corridors up to 15,000 persons per hour per direction (PPHPD) contributes to modal shift to public transport. However, to further augment capacity light and metro rail systems with multiomodal integration are also being increasingly adopted.

3.1 Bus Rapid Transport System (BRTS)

The ideal cross section of the roadway with the BRTS depends on segregation of distinct modes of traffic. ROW width of 45 m can comfortably accommodate three lanes of regular traffic and a BRTS lane per carriageway. However, lane widths may be compromised to certain extent to effect a 30-32 m RoW as available in some Delhi and Jaipur where BRTS corridor is planned. Safety aspect has to be looked into. BRTS can be taken elevated (Fig. 1) at low additional cost vis-à-vis at grade within the available ROW. Segmental construction or prefabricated systems can be adopted not only to save time on execution but also to reduce construction activites at congested sites, an environmental benefit.

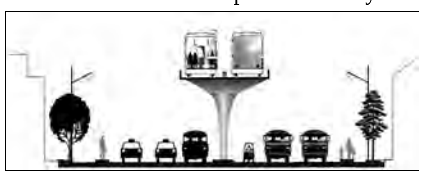

Fig. 1: Elevated BRT Corridor with other traffic at grade

3.2 Rail Based Transit System

For higher travel demands the solution lies in rail based mass rapid transit system. Reflecting its capital-intensive nature, MRTS is typically planned in phases. The metro systems in Kolkata and Delhi are effective public transport systems that have partly relieved the pressure on roads along

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the corridors. A spider webbed system with multimodal integration will enhance the effectiveness of the system.

3.3 Multi modal transport integration

Multimodal systems with coordinated service delivery and other systemics including organizational have become imperative. Efforts are on to achieve meaningful integration, including fares, of the Rail and the road based systems in Delhi. However, along corridors lacking an rail based MRTS, the bus system will continue to be the primary mode of public transport.

In Kolkata public transport system is both road and rail based. However whatever integration is present, it is haphazard. Plans are to integrate suburban station within the city with metro, LRTS and the road based systems.

4. Select Case Studies

The first effort in India, Kolkata metro, executed in the 1970s and nearly16.5 km long, runs mostly underground. It incorporated the then cutting-edge technologies, including and innovations in many areas such as soft soil with high water table conditions and heavily built-up areas. The underground structures comprised open excavation and tunneling in part, and ‘cut and cover' technique predominantly using of a diaphragm wall technique in mass scale.

The initial conception and design as independent transit box with the strutted diaphragm wall needed an area not generally available. A semi-integrated system was adopted in which the diaphragm walls shared the load with the RCC Box in addition to the earth pressure during construction. The design developed was a semi-integrated one. The next evolutionary step was integrated design wherein the diaphragm wall made part of the box. Special methods were introduced in the design of diaphragm wall to address site-specific problems. Special types of diaphragm wall techniques were adopted at railway yard and under an existing bridge. Top-down construction technique on a limited scale was adopted to help in traffic diversion.

Fig 2: 4 level grade separator

Fig 3: Tunneling with concrete lining

Top-down construction was adapted for a 4-level grade separator in Delhi (Fig. 2) for vehicular underpass and a pedestrian subway. Similar methodology was adopted in metro, Delhi.

For shield tunnel section cast iron (CI) lining was substituted by concrete lining (Fig. 3) from cost considerations. Tunneling operations were carried out in Kolkata using compressed air for better stability as the excavation had to be done in silty clay with high hydrostatic pressure.

5. Conclusion

Finding space to route transport corridors in Indian cities is becoming a daunting task. It is under this back drop new initiatives like BRTS and LRTS/MRTS with a major concentration on public transport through multimodal integration is discussed and some cases studied. Innovations using local materials and how those still carry relevance in the changed circumstances are discussed.