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PROMOTING LOW CARBON TRANSPORT IN INDIA

POLICY SUMMARY

Low-Carbon Mobility in India and the Challenges of Social Inclusion:

Bus Rapid Transit (BRT) Case Studies in India

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1. Executive Summary

This study assesses the current status and the progress of the Bus Rapid Transit (BRT) systems in five Indian cities, including Ahmedabad, where detailed study has been undertaken. The main purpose of this study is to understand how these cities in particular, and urban India in general, is transiting to the relatively low-cost and low-carbon transport such as the BRT. The BRT efforts in Pune, Delhi, Jaipur and Indore are discussed on the basis of the planning context, transport characteristics, users' opinions and assessment of the BRT project components like technical design, operations, safety and institutional framework. Broadly, it is found that Delhi and Pune have not been able to expand their initial 'pilot' BRT corridors given the lack of institutional initiatives, adversities and controversies created by the popular media and the urban middle-class. Jaipur is struggling between the metro rail aspirations and the lack of clarity in BRT implementation, whereas the BRT corridors in Indore are mired with land acquisition issues and confusion about whether to build open or closed BRT systems. The struggle to build the BRT systems in these Indian cities increases exponentially because of the lack of ownership of the BRT system by the planning and implementing agencies coupled with the reluctance of private vehicle owners to share the road space with public transport. Even after having support in the form of the national urban transport policy and financial support from the National Urban Renewal Mission, the Indian cities are struggling to plan or implement the BRT projects and this puts a grave question mark on the capacity and sincerity of the Indian cities in implementing the BRT system.

The Ahmedabad BRT system stands out amongst the Indian cities to have about 45 km of rapid transit network, which continues to expand even today. There is 'network' thinking involved in the planning of BRT systems and not 'corridor' thinking, which helps the sustainability of the project. With the expansion of the BRT system, the ridership is increasing (0.15 million) and the service is becoming increasingly popular amongst the people of the city. However, there is a lot of scope for improvement in its planning, design and implementation. The operational BRT corridors so far have been placed on roads of 30 meters or more in width, and maximum road space has been left for the mixed traffic, sometimes at the cost of cycle tracks and footpaths. In the entire BRT system the Non-Motorised Transport (NMT) infrastructure is not given its due attention as promised in the detailed project proposals. Furthermore, integrating the BRT system with the regular municipal bus service (Ahmedabad Municipal Transport Services) is another unaddressed concern, and in the public realm there are no official plans currently available for integration. Lastly, there are the social impacts of the project that have not been addressed, such as rehabilitation of the project-affected people on account of the corridor development. To develop nuanced understanding about these concerns, Ahmedabad BRT users were surveyed extensively, mainly to see how accessible the system is to everyone in the city and whether it has resulted in any modal shift away from high-carbon to low-carbon mobility.

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The survey of 1040 BRT system users in Ahmedabad showed that the sex ratio of the working population amongst the users was just 226, indicating that working women did not use this system much as compared to working men. The use of the BRT system by low-income groups is also not very significant. Of the total users, just 13.7 per cent belong to household with incomes of up to Rs. 5,000 (less than 100 US$). 62.2 per cent of users had monthly household incomes of more than Rs. 10,000 (about 200 US$). This is in spite of the fact that a large number of low-income group housing and slums fall within a 500 metre radius, or walking distance, from the BRT network. Many of the BRT users are captive public transport (PT) users who used public transport prior to the BRT project. After the project replaced their routes in the municipal bus service and shared auto rickshaws, some 47 per cent of PT users shifted to the BRT, and another 13 per cent of users shifted from the intermediate public transport (IPT) of shared or full-fare autorickshaw. Only 12 per cent of commuters have shifted from private motor vehicles. Only 42 per cent of the users were taking the BRT system for more than 21 days in a month, which means that the BRT is still to find sustained ridership in Ahmedabad. In all, the BRT is mainly serving the middle-income groups, most of which are the captive PT users commuting longer distances. The BRT has not been able to reach low-income groups despite such aspirations expressed in the detailed project proposal.

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Given the finding that the urban poor of Ahmedabad do not use formal public transport like the BRT, this study enquires more deeply into their mobility characteristics. On the whole, conveyance forms 6 to 7 per cent of total household expenditure in urban India. But, the bottom 40 per cent devotes just 3 per cent to travel costs. The urban poor still do not spend as much on transport, and urban poor women in particular spend very little on transport. In order to understand the actual expenditure and implications of a lack of affordable travel choices, a survey of 580 low-income households was carried out from the slums and informal settlements geographically distributed across the city. The survey shows that urban travels by the poor in Ahmedabad are generally fewer, take more time, travel less distance, and rely on NMTs or public modes more than the non-poor. 60 per cent of poor working women walk to work, whereas for men 30 per cent walk and 20 per cent cycle to work. In the absence of efficient and affordable public transport, 16 per cent of poor people use IPT. Only 0.4 per cent of the surveyed households used the BRT system. About 65 per cent of households preferred not to spend anything on transport. The over-dependence on NMT means shorter travelling distances, fewer out-of-home activities, less ability to search for and maintain employment, and lower capacity to seek higher quality goods at a lower price. The survey showed that 72 per cent of women and 51 per cent of men in these low-income households travelled less than 3 km. The average trip length for these women was 3.2 km lower than the city average, and for these men it was 5.3 km lower.

Overall, the top-down transportation planning approach has not really taken into account the needs of the urban poor in a city like Ahmedabad, which is considered the 'only successful running BRT in the country'. It seems that all the modes favourable to the poor (walking, cycling, shared autorickshaw, public bus) are either not being planned for or implemented properly. Other Indian cities are struggling even to develop adequate public bus systems, despite the fact that such systems represent very low benchmarks of success. It would only be fair to claim that several billion dollars of JnNURM funds for the transport projects have not facilitated the transport needs of the poor, and private motorised vehicle ownership is being promoted by the lack of public transport services. It is important for projects like BRT systems to be more socially inclusive, which can be achieved by recognising and including the urban poor. One way of doing this is through innovating the fare system. The sections of the population who are unable to 'access the city' are not only 'disadvantaged commuters', but are also 'disadvantaged citizens'. If an urban citizen is equipped by comprehensive policy support related to shelter and transport then they can build their capabilities to support their future generations. If the accessibility issues of a city were seen from a perspective of a poor working woman then the options would be amiable enough to take care of everyone in urban society. The foremost policy recommendation for Indian cities is to actively follow and implement the objectives of the National Urban Transport Policy (NUTP). The NUTP has clearly outlined the pathways for low-carbon mobility for Indian cities. The cities should be actively encouraged to take up BRT projects and public bus improvement projects along with plans for walking and cycling facilities. The on-street parking policies in India also have to play an important role of being demand management tools for use of urban space.

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2. Background – Sustainable Transport Paradigm

The term 'sustainable mobility' (prioritizing accessibility) covers all forms of transport that minimize fuel consumption and carbon emissions by reducing the need to travel itself (Knowflacher, 2007) (Banister, 2008)[1]. Knowflacher (2007) argues that the traditional hypothesis of urban transport planning, which emphasises the 'growth of mobility' and 'travel time saving by increasing speed', ends up creating more transport, environmental, and socio-economic problems all over the world[2]. It also creates higher mobility-oriented infrastructure and urban form, which makes it difficult for more sustainable modes to operate. There is a great danger of creating the situation of being stuck with automobile-dependent urban infrastructure. The transport interventions across the world are attempting to provide accessibility for all people, and to facilitate their reaching their desired destinations in a timely fashion, rather than just planning for the high speed mobility of a few. In the context of climate change, the notion of transport sustainability becomes more specifically a matter of reducing carbon emissions. Low-carbon mobility is prioritized – involving zero-carbon modes like walking and cycling or any other shared or public modes of transport.

In context of 'Equity', Vasconcellos (2001) argues that transport provision is not an end in itself[3]. The 'end' has to be the equitable appropriation of space and the corresponding access to social and economic life. There have been massive investments in the urban infrastructure in the developing cities and it is a timely debate in policy-making as to whether these investments are used for the betterment of everyone in society. Without equity, the sustainability would not be achieved in the true sense. The idea of equity is a paradigmatic approach to policy-making where everyone's share in the system is recognized and provided.

The practice of transport planning in general focuses on the link between transport and economic growth. In fact, transport does induce economic growth through investments in infrastructure, purchase of vehicles and employment generated through both. Neo-liberalism, which dominates economic policies in the developing world and in India, perceives 'growth of mobility' and 'freedom of modal choice' to be inseparable parts of economic growth and infrastructure building. Located in the neo-liberal approach, conventional transport planning assumes that infrastructure building and provision benefits everyone equally in the given transport system. However, such a growth-centred paradigm of transport does not necessarily address the human concerns of equitable development on one hand and environmental sustainability on the other.

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[1] Banister, D. (2008). The Sustainable Mobility Paradigm. *Transport Policy*, 15, 73-80.

[2] Knowflacher, H. (2007). Success and failures in urban transportation planning in Europe – Understanding the transport system. *Sadhana*, 32 (4), 293-307.

[3] Vasconcellos, E. A. (2001). *Urban transport, environment and equity – The Case of Developing Countries*. London and Sterling: Earthscan Publications.

Especially in societies experiencing high economic growth, there is a latent demand for PMT (private motorised transport) because of newly achieved prosperity. Because of this, there is pressure on the city governments to invest in infrastructure to facilitate the movement of private vehicles, which the city governments are complying with after a long lag. Cox (2010) demonstrates how there remains a bias towards prestigious mega-projects in market-based, top-down approaches to transport provision in multilateral projects[4]. Badami (2009) shows how this approach further facilitates motorization by not being proactive to achieve the goals of sustainability[5].

Furthermore, capital-intensive transport options, which are also energy-intensive, exclude and more often than not displace the low-income populations from the urban space. In such a context, issues of sustainability and equity are interwoven objectives of transport initiatives and not mutually exclusive entities, especially when what is sustainable is also equitable and vice versa. However, now there is an overwhelming consensus in the urban transport debates that accepts the need for more public transport and a reduced reliance on private transport. However, the debate is ongoing with regards to the type of public transport that is equitable. An increasing number of transport planners have started believing that a transport system that prioritizes walking, cycling, shared and public transport is equitable as well as low-carbon.

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[4] Cox, P. (2010). *Moving People-Sustainable Transport Development*. Zed Books.

[5] Badami, M. (2009). Urban Transport Policy as if People and the Environment Mattered: Pedestrian Accessibility the First Step. *Economic and Political Weekly, 44* (33), 43-51.

3. Introduction – The Bus Rapid Transit Debate

This summary report is based on a study of the assessment of the BRT systems in India. This study of the Bus Rapid Transit System (BRTS) in India is conducted based on the perspective of inclusiveness and modal shift towards public transport from Private Motorised Transport (PMT). Four cities namely, Delhi, Pune, Jaipur and Indore were selected to assess the macro-level issues with regards to BRTS in India. It was not feasible to study the impact of the BRTS in these cities as they still had short corridors and incomplete systems. These have therefore been discussed briefly as a context of assessment of BRTS. Ahmedabad BRTS, which has the largest network of all, was selected to assess its impact on the urban poor's mobility as well as the possibility of moving towards low-carbon transport. The research attempts to answer two key questions: (i) is the BRTS accessible to the urban poor and has it consequently improved the accessibility of the urban poor and (ii) has the BRTS led to a modal shift in favour of public transport that address climate change objectives? In Ahmedabad, after presenting the entire system and its overall assessment, a survey of 1040 BRTS users was carried out. This was backed with a survey of 580 urban poor households, identified as those living in slums or rehabilitated slums, which was carried out to understand the travel needs, pattern and affordability of the poor. Information was collected from all the members of the households to collect gender-disaggregated data.

In India, the National Urban Transport Policy (NUTP) emphasises public transport and the national government has made funds available for the same through the JnNURM

(Jawaharlal Nehru National Urban Renewal Mission). The NUTP aims to move away from 'roads for vehicles' to 'streets for people', and given the funding opportunities from the national government it seemed possible to build infrastructure favouring low-carbon or zero-carbon modes. Buses are the dominant public transport mode in Indian cities, (Wilbur Smith Associates and Ministry of Urban Development, 2008)[6], which face the shortcomings of escalating costs, poor maintenance, high labour costs, ageing bus fleets and erratic services (Badami, Tiwari, & Mohan, 2007) [7]. In such contexts, projects such as BRTSs provided new optimism for public transit.

The NUTP aims to move away from 'roads for vehicles' to 'streets for people'.

Public buses are more sustainable and offer low-carbon mobility, as it is an efficient mode in the usage of road space and engine capacity. The flexibility in routing and wide coverage makes it especially efficient in the urban context. Public buses are 'mass transit' as they carry millions of people around the globe in urban areas and elsewhere. The efficiency of public buses is compromised when increasing numbers of vehicles on the road slows them down. To make the 'mass transit' (buses) more 'rapid', the idea of a bus rapid transit evolved to give priority to the bus by creating dedicated lanes for it. In the words of Roberto Cervero, 'BRT is a key to absorb traffic displaced by road capacity losses'. Given the structure of most cities and budget constraints of the city governments, BRT emerges as the most cost-effective and wide ranging option for the mass rapid transit system. There have been many interesting examples from Latin American cities, where the BRT is often highly developed as a comprehensive and well-integrated system.

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The global literature suggests that transport systems are continuously evolving and transport planning is a continuous process. Cities that have committed to build comprehensive coverage of the BRT network along with good planning for integration with other modes have been successful in providing accessibility to its citizens. Here, the comprehensiveness of the BRT system includes a well-integrated network of walking and cycling facilities along the BRT system and effective parking policies. In some Latin American cities, BRTS has been seen and planned in conjunction with land use and housing policies, making the system efficient, sustainable and equitable. The crucial approach here has been to view BRTS projects as an exercise in appropriate road allocation for various uses other than just a road or traffic engineering project. There is a tendency, and hence possibility, for engineers to overlook the social planners in transport projects.

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[6] Wilbur Smith Associates and Ministry of Urban Development. (2008). *Study on Traffic and Transportation - Policies and Stategies in Urban Areas in India*.

[7] Badami, M., Tiwari, G., & Mohan, D. (2007). Access and Mobility for the urban poor in India. In A. E. Laquian (Ed.), *The inclusive city: Infrastructure and Public Services for the Urban Poor in Asia*. New Delhi: Woodrow Wilson Centre.

4. Key Results

The key results are presented separately for the national (macro) level and the city (micro or local) level. The key results also reflect on the implementation issues with regards to the BRTS in India.

The National-Level Issues

In spite of the NUTP, the debate on the best form of public transport continues in the Indian cities and the BRTS is compared and contrasted with the metro, the latter being more capital intensive than the former. According to rule-of-thumb calculations, metro rail systems would cost typically Rs. 1500 million per km (30 million US$) for above ground and Rs. 2500 million per km (50 million US$) for underground system whereas BRT system would cost no more than Rs. 100 million per km (2 million US$). Due to the lower once-off and lifetime costs, the BRTS should be preferred over the metro. Furthermore, the BRTS has more flexibility in expanding the transit network and widening the coverage. Given the structure of the Indian cities that have organically evolved as an urban form

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Table 1: Characteristics of the BRT systems of the selected cities

City	Stage of implementation	Construction started	Operation started	Planned network (Km)	Length of corridors approved by MoUD	Peak hour average speed (Km/hr.)	Frequency of buses (seconds / direction)	Existing Ridership (persons/ hour/ direction)	Planned ridership (persons/ hour/ direction)
Delhi	5.6 km operational	Oct-06	Apr-08	426	NA	16-19	30-45	9,000-10,000	20,000-24,001
Pune	17 km operational	2003	Dec-06	117	117.0	16-18	45-60	3,600	10,000-15,000
Jaipur	10 km operational	Sep-07	Partly started	138	42.0	25	120-300	500-1,700	–
Indore	11.5 km under construction	Oct-07	Not yet started	106	11.5	20 (expected)	150 (planned)	1,000-6,000	10,000-20,000
Ahmedabad	45 km operational	2007	Jul-09	200	88.8	22-25	180-300	1,500-2,000	15,000-20,000

around multi-nuclei economic centres, trips are distributed in multiple directions and it is difficult to find high ridership corridors to justify the metro rail system (i.e. 20,000 persons per hour per direction or more). Thus, bus rapid transit was positioned as more cost-effective and relevant option. However, many cities aspire to have metro rail systems coupled with high-end real estate development. Even in the cities where the full-fledged BRT operations and further expansions are planned, there are aspirations to build the metro system, as in the case of Ahmedabad, Pune and Jaipur. Sometimes, metro systems are proposed on the operational BRT corridors posing a direct threat to the system.

There is also an unsettled debate whether the BRTS should be an open system or a closed system. The closed system is very much an adaptation of the metro on roadways and hence preferred as a low-cost metro like system, as the buses run on the dedicated or 'exclusive BRT reserved' corridors. The closed corridors work in conjunction with the TOD (transit oriented development) option as in the metro. In contrast, the open system is more flexible as it is in essence a high capacity bus system, which is an upgrade of existing bus systems by providing them with a special corridor to take priority over PMT and other para-transit vehicles. Meanwhile, some of the city administrators and BRT planners have chosen closed over open systems, and wherever the BRT projects had begun as open systems they are being converted into closed systems. For example, the systems in Jaipur and Indore started as open systems and are now being converted into closed systems. Delhi's open system is under severe criticism, firstly from private vehicle users and now from the transport planners and road research institutes. Ahmedabad is a fully closed system. But, to get ridership for it, the cheaper public transport system provided by the local government is being closed down on the BRTS routes.

The JnNURM decided to fund BRT projects with comprehensive networks and with simultaneous non-motorized transport facilities. Some cities like Pune, interested in road projects, applied for the JnNURM funds meant for BRTS and then resurfaced the roads while not putting in the committed BRTS infrastructure. This city has not been able to come out of the older transport paradigm and has subverted the BRTS completely in the process.

The City-Level Issues

The major conflicts at the city-level are the conflicts related to road space use between the different users. Except Ahmedabad, all other BRT systems have been criticized in the local popular media for 'taking away the prime road space from regular traffic'. This clearly shows that the urban opinion-making is hijacked by the vocal elite classes who are also the owners of private vehicles and who resist more equitable distributions of road space.

Policy Issues

One of the major issues observed in the cities with regards to planning the BRT systems was the long-term commitment to the idea of BRTS. In some cases, the BRTS was threatened by proposals for metro rail, while in the other cities BRTS projects were threatened by a backlash in the media against the idea of this public transit mode. In the cases of Pune and Delhi, there was lack of clarity about the institutional 'ownership' of the BRT system, which resulted in operational inefficiencies. Except Ahmedabad, there were no visible attempts to expand the BRTS network or to engage in any proactive social marketing of the system. The Ahmedabad BRTS has claimed to 'connect busy places and to have avoided busy roads', but it can also be interpreted as 'building BRT on the wider roads only'. Ahmedabad is expanding its network and most of the roads have more widths than 30 meters.

There were no proactive attempts to integrate other modes with the BRTS in all cities studied. The Delhi BRTS has provided cycle-renting schemes in some locations, but besides that there was no attempt to link the bus corridor with other modes. In Pune, Delhi and Jaipur, the BRTS network was not comprehensive enough to plan any sort of integration with the other modes. In Ahmedabad, which is the only city where there is relatively extensive BRTS network, there was no attempt to integrate the BRTS with the existing municipal bus services, nor has there been any mention of such in the public domain. These two systems have been operating parallel to each other in terms of institutional mechanisms, fares and ticketing, and physical infrastructure.

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Pune and Delhi could design and implement facilities for pedestrians and cyclists. Especially in Delhi, the cyclists extensively used the cycle tracks. In contrast, in Ahmedabad, in spite of building the biggest network with operational efficiency, there has been a total failure to design and implement facilities for walking and cycling. In fact, it was taken for granted that the new corridors would not have any cycle tracks[8].

Implementation Issues

Each city has its unique situation regarding the failures in implementation of the projects as planned. Various departments of the city governments are involved in implementation of the BRTS projects, such as planning, construction and operations etc. without any efficient coordinating mechanism.

The most difficult implementation issues are related to the sharing of the road space amongst all users. Even if the system is designed to give priority to the pedestrians and cyclists, it is often re-appropriated in favour of motorized vehicles. As in the case of Delhi,

[8] Times of India. (2011, August 7). BRTS cycle track discarded over space security concerns.

the traffic police control the signal cycles at junctions, which they have designed to favour mixed traffic more than the BRTS. The traffic police have also refused to check on the motorized two-wheelers encroaching the cycle tracks, and regulating this has been left to the private security guards. Sometimes, inappropriate design of infrastructure has led to the lack of usage. In other cases like Ahmedabad, the footpaths and cycle tracks are not designed and built on all corridors, compromising safety and access for the pedestrians and cyclists. Wherever built, the design is not sympathetic to the cyclists to use the lanes meant for them. It is also not clear whether they have plans to improve these facilities or not. In Ahmedabad, the NMT infrastructure has been given short shrift (Table 2). To assess, two stretches were fully surveyed. While only 26.2 per cent of the BRT route length had bicycle tracks, only 65.0 per cent of these tracks were unobstructed. In the case of footpaths, 83.7 per cent of the BRT track had footpaths, but only 52.5 per cent of these were unobstructed. In many instances, the pedestrians are seen walking on the mixed traffic lane on account of a lack of footpath along the BRT route (Figure 1).

Figure 1: BRTS known as 'Janmarg' in Ahmedabad city

Source: http://en.wikipedia.org/wiki/File: Ahmedabad_BRTS.jpg

Table 2: Status of NMT infrastructure in Ahmedabad BRT

	BRT length in km (L+R)	Bicycle track status (L + R)		Footpath provided (L+R)	
		Provided as % of BRT route	% obstructed of the total provided	Provided as % of BRT route	% obstructed of the total provided
R.T.O to Naroda	63	32.5	35.0	85.0	52.6
Danilimda C.R. to Kankaria T.E. (Loop)	15	0.0	–	78.0	52.0
Total	**78**	**26.2**	**35.0**	**83.7**	**52.5**

Figure 2: Pedestrians and cyclists in mixed traffic on the BRT corridors in Ahmedabad

Users and Non-users of the BRTS in Ahmedabad

Two important questions are: does the BRTS offer a low-cost and affordable transport option to low income groups (who are 'captive' users of public transport), and has it offered convenient public transport to ensure a modal shift from private two and four-wheelers to public transport? These two questions have been answered through this research with a detailed case study of Ahmedabad City. More often than not, in situations of latent demand for public transit, any system introduced will work. Table 3 below gives the profile of the BRT users in Ahmedabad and also indicates the impact of the BRTS in the city in terms of its inclusiveness as well as a shift towards low carbon transport.

The BRT system user group is dominated by males (72.5 per cent). Of the total users, just 13.7 per cent belong to households with incomes of up to Rs. 5,000. BRTS is being used by largely the middle-income groups, with monthly incomes between Rs. 10,000 and Rs. 40,000, within which half the users fall. The households with incomes of up to Rs. 5,000 per month are the bottom half of the urban spectrum and they do not use the BRTS in Ahmedabad to any great extent. Within this group, women use the BRTS even less than men; the sex ratio (females per thousand males) amongst all users is 244, and among those who are workers is 226. The sex ratio in the non-workers category using the BRTS is 770, indicating that women are using the BRTS to a great extent for other purposes than work. A very large proportion, about a quarter among the males and about two in every five among the females use the BRTS for social purposes. It is possible that many of such trips have been induced by a new mode of transport in the city. For example, the BRTS connects Western Ahmedabad to the recreational facilities located at the Kankaria Lake in the southeast of the city. In other words, the BRTS has made the long-distance recreational facilities more accessible for the middle-class from Western Ahmedabad and created new demand for transport. Only 42 per cent of the users were taking a BRTS for more than 21 days in a month, which means that the BRTS is still to find regular and sustained ridership in the city.

Table 3: Profile of BRT Users

Indicators	Male	Female	Sex ratio
Income groups of the users			
% among users with income less than Rs. 5,000 pm	14.4	11.5	244
% among users with income more than Rs. 40,000 pm	10.9	16.8	585
Age group			
% among users in age group 15-40 years	75.9	73.8	369
Employment			
% workers among BRT users	71.8	42.7	226
% among users who are casually employed	6.1	3.3	121
% among users regularly employed in public sector	8.1	18.0	500
% among users regularly employed in private sector	63.8	65.6	232
Trip purpose			
% using BRT for work	55.4	35.0	239
% using BRT for education	15.8	19.6	471
% using BRT for social, religious and recreational purposes	24.7	38.5	591
Distance to BRT stops			
% users Walking to BRT station from home	44.8	50.0	–
Median distance travelled to reach the BRT station from home	0.38 km		
Trip cost and lengths			
Average cost per BRT trip (Rs and USD)	Rs. 6.73/ USD 0.15		
Median cost per BRT trip (Rs and USD)	Rs. 5.00/ USD 0.11		
Average trip length by BRT (km)	12.92		
Median trip length by BRT (km)	10.84		
Modal Shift			
Modal shift from AMTS to BRTS (%)	46.8		
Modal shift from shared autorickshaw to BRTS (%)	12.9		
Modal shift from full-fare autorickshaw to BRTS (%)	13.1		
Modal shift from motorized two-wheeler to BRTS (%)	10.2		
Modal shift from motorized four-wheeler to BRTS (%)	1.5		

Note: Exchange rate assumed to be Rs. 45 = 1 US Dollar (USD)

46 per cent of the commuters access the BRTS by using other modes, and 50 per cent of commuters are located within 500 metres of a BRT stop. Furthermore, the BRTS is being used in Ahmedabad for an average travel of 8.7 km and half of the users are going up to 6.9 km on the system. This explains that the users are long-distance commuters given the average trip-length in the city, as stated in the AMC-CEPT study of 2006 (quoted in AMC et al 2008) is 5.5 km. The average total trip length, which includes trips by other modes for access-egress, is up to 10.84 km for the half of the BRTS users and 12.92 km for all the BRT users. The total expenditure incurred on transport by the low income households (under Rs. 5,000 pm), is about 12 per cent, whereas those in the higher income groups varies from 1.0 to 2.0 per cent, indicating that even the BRTS is an expensive option for the low income groups in Ahmedabad city.

Prior to the BRTS, a large proportion (47 per cent) of the current users, were taking the AMTS (municipal) bus and because these services were discontinued on the BRTS corridors they shifted to the BRTS. Another 13 per cent each have shifted from the intermediate public transports of shared and full-fare autorickshaw. In total 70 per cent of the BRTS commuters were regular users of public transport. Only 12 per cent of commuters have shifted from private motorized vehicles. The AMTS users have shifted to the BRTS because on certain routes the services of the former were discontinued. In that sense, the BRTS would not have impacted the carbon emission level as users have shifted from one public transport mode to another. The BRTS has also induced new trips, as 13 per cent of commuters were not making the trip before the BRTS. But the higher income groups experienced the enhanced mobility much more than the poor. And thus, it explains the new travel demand being created for purposes such as recreational, social and shopping trips. To conclude, BRT is mainly used by the middle-income groups and many of them have been the previous public transit users commuting longer distance.

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The Urban Poor and their Travel Demand

Since the urban poor in Ahmedabad do not really use the most important low-carbon mobility initiative in the city, namely the BRT system, the next question was how the

mobility of the urban poor is determined. In order to understand the actual expenditure and implications of a lack of affordability on travel choices and work and housing location choices, a survey of 580 low-income households was carried out. The samples were taken from the slums and informal housing settlements and were geographically distributed across the city to capture the issues emerging from the relocation of urban poor housing on the city's periphery.

The survey shows that the travels by the poor in Ahmedabad are mainly by walking or by the public or shared transport modes (Table 4). 60 per cent of the poor working women walk to work whereas in the case of men, 30 per cent walk and 20 per cent cycle. One major difference in the males and females is the use of cycling among the males whereas these trips are replaced by walking among the females. Women are culturally restrained in using cycles. In the absence of an extensive network of affordable public transport, 16 per cent among women and nearly the same percentage among men use IPT (largely shared autorickshaws). Ironically, only 0.4 per cent of the surveyed households used the BRTS. The poor people travel short distances and the most essential trip purpose is work or education. The urban poor make fewer trips per capita than the non-poor, and while the differences are not extreme it implies that the poor work closer to home than the non-poor. The survey showed that 72 per cent of women and 51 per cent of men travelled less than 3 km. The average trip length for women was 3.2 km and for men it was 5.3 km. About 65 per cent of households prefer not to spend anything on transport. The time and money costs of public transit are higher for the poor (with a great share from a monthly household budget) than for other income groups, which may indeed explain their short commutes or limited mobility. Many of the urban poor suffer constrained mobility and the consequences of this deficit mean fewer out-of-home activities, less ability to search for and maintain employment, lower capacity to seek higher quality goods at a lower price. There are number of concerns involved in various aspects related to the mobility of the urban poor. The modes used by the poor are mainly the non-motorized ones of walking and cycling, which makes them 'vulnerable road users' from the road-safety point of view (Wilbur Smith Associates and Ministry of Urban Development, 2008).

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Having an 'inferior' mode is only part of the problem for the poor. Cities in the developing world have complex urban structures with varying costs of living and service access close to the workplace or close to the public transit lines. Many poor

Table 4: Modal Split by Sex, Surveyed households in Ahmedabad

Sex	Walking	Cycle	Hand cart/ paddle rickshaw	Public bus	Shared auto rickshaw	BRTS	Multiple modes	M2W	Auto rickshaw	Grand total
For main trip										
Female	58.9	1.8	0.7	8.7	16.3	0.2	9.9	0.8	2.6	100.0
Male	29.7	19.5	2.7	11.8	15.6	0.5	11.7	5.0	3.6	100.0
Overall	40.4	13.0	2.0	10.7	15.8	0.4	11.0	3.5	3.2	100.0
	Non-motorized modes = 55.4			Public/ shared modes = 26.9			Private modes = 6.7			100.0
After distributing multiple mode trips										
Female	65	2	1	10	18	0	–	1	3	100.0
Male	34	22	3	13	18	1	–	6	4	100.0
Overall	45	15	2	12	18	0	–	4	4	100.0
	Non-motorized modes = 62			Public modes = 30				Private modes = 8		100.0

Table 5: City-Level Modal Split, Ahmedabad

Mode share in earlier studies	Walking	Cycle	Public bus	Shared auto rickshaw	M2W	Auto rickshaw	Car-van	Others	Total
LB-IPTS study 2000[a]	37.6	17.6	8.4	5.7	25.3	2.5	2.5	0.3	100.0
AMC-CEPT 2006[b]	13.2	18.8	15.0	–	35.0	8.8*	3.1	5.8	100.0

Notes: * Shared auto rickshaw is assumed to be part of this as it is not mentioned separately.

[a] As quoted by AMC et al, 2007 (Detailed Project report for BRTS Phase -1)[9]

[b] As quoted by AMC et al 2008 (Detailed Project report for BRTS Phase -2)[10]

[9] AMC, AUDA and CEPT University (2007). *Bus Rapid Transit System Ahmedabad Detailed Project report Phase I.* Retrieved December 21, 2011, from http://www.ahmedabadbrts.com/images/Ahmedabad%20BRTS%20Phase-1%20DPR_Feb%202007.pdf

[10] AMC, AUDA and CEPT University (2008). *Bus Rapid Transit System Plan Phase II Detailed Project Report.* Retrieved September 12, 2011, from http://www.ahmedabadbrts.com/images/Ahmedabad%20BRTS%20Phase-2%20DPR_April%202008.pdf

workers take several part-time, low-paid jobs at different locations simply to maintain the very basic level of household income. Labour market imperfections and working in the informal sector increase their vulnerability. Especially when the poor households are displaced from their original location, they feel excluded from the city losing their livelihoods and education for their children. The problem of access becomes more acute because they are able to spend less than 5 per cent of their total household expenditure on transport. The burden of limited mobility is borne disproportionately by women and children. The women of lower-income households experience greater transport deprivations as compared to men.

It seems that all the modes favourable to the poor (walking, cycling, shared autorickshaw, public bus) are either not being planned for or are not being implemented properly. It would only be fair to claim that several billions of JnNURM funds for the transport projects have not facilitated the transport needs of the poor.

Overall, the top-down transportation planning approach has not really taken into account the needs of the urban poor in the city of Ahmedabad in spite of all the rhetoric about including the low-income groups in the detailed project proposals. It seems that all the modes favourable to the poor (walking, cycling, shared autorickshaw, public bus) are either not being planned for or are not being implemented properly. It would only be fair to claim that several billions of JnNURM funds for the transport projects have not facilitated the transport needs of the poor.


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5. Policy Recommendations and Overall Conclusions

The foremost policy recommendation for Indian cities is to actively follow and implement the objectives of the National Urban Transport Policy (NUTP). The NUTP has clearly outlined the pathways for low-carbon mobility for Indian cities. The cities should be actively encouraged to take up BRT projects and public bus improvement projects along with plans for walking and cycling facilities. The on-street parking policies in India also have to play an important role as demand management tools. Those not owning private motorized vehicles, such as the low-income group, should be supported in continuing their low-carbon mobility practices. The poor working women should be specifically encouraged to use public transport. Based on these broad recommendations, the following issues are specifically highlighted.

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Planning Issues

The MoUD India has been a key promoter of low-carbon mobility projects such as the BRT in various cities. Cities that have shown interest in building BRTS often lack the expertise and human resources in understanding the full implications of such a project. The cities need handholding and planning knowledge for projects as complex as BRTSs. There is a great need to develop planning guidelines for models of BRTS in the Indian context endorsed and commissioned by the MoUD. City officials and planners need to be systematically trained not only about the technical aspects of the BRTS but also about the social marketing of such projects. MoUD has conducted various training programmes and workshops with many bilateral and multilateral agencies. However, it has not resulted in expanding the dedicated team of experts at the central level or at the city level to deal with the complexities of the BRTS projects. Because of this, the early enthusiasm for the BRTS projects has not sustained in recent years.

Out of a total of 63 cities eligible for the national funds under JnNURM, only about 10 had shown interest in building a BRTS. Out of which only four cities, namely Ahmedabad, Delhi, Pune and Jaipur, have buses running on continuous dedicated corridors. Given the challenge of transport infrastructure in Indian cities, many other cities should be encouraged to come forward to upgrade their transport system. It is important that the national funds provide positive incentives for the cities to take up low-carbon mobility projects such as the BRT. And such incentives should become exemplary for other cities to take similar paths.

Instead of discussion and dispute around open or closed systems, the efficacy of the BRTS would depend a lot upon how meticulously the system is designed in terms of

level boarding, junction design, and operational planning. A system which allows easy and faster boarding-alighting (than regular buses), minimises the waiting time of the commuters and prioritises BRT buses at the junction is likely to get more support from commuters. It is possible to achieve these three crucial components of the BRT in both the systems provided it is planned and implemented for that purpose. From the urban governance point of view, building up a transit system like BRT requires a long-term vision and commitment of continuously investing in the system.

It is important to understand that no single PT system can cater to the needs of transit in any city. Furthermore, different existing and proposed transport systems need to be integrated with each other in terms of physical access, fares/ticketing, institutions and social marketing, as some of the successful examples in the world show us. The BRTS therefore should not be seen as one pre-fixed system and cities should be given a chance to adapt it according to their own needs and requirements. They should provide easy access to the commuters and should also remain affordable for the economically disadvantaged, as they are the most dedicated users of bus systems in cities. The BRTSs have to be developed as inclusive systems accommodating the concerns of the NMT users and informal sector, as that is the need of many cities in developing countries.

The BRTS should not be seen as one pre-fixed system and cities should be given a chance to adapt it according to their own needs and requirements.

Implementation Issues

The implementation of the BRT projects is mired by the lack of coordination amongst various government agencies, a lack of effective monitoring from the national

government and a lack of interest in the city administrations to implement such complex projects on a long-term basis. The most crucial implementation aspect is a clear institutional set-up that is fully responsible for all aspects of the transport system and has the ability to share its vision with other stakeholders (i.e., traffic police) and to take them along in the implementation process. The funding for the BRTS project should be linked with performance-based incentives. The cities opting for low-carbon mobility should be given priority over other infrastructure funds as well. National-level monitoring and handholding can also facilitate initiatives for local cooperation between other agencies. The national-level monitoring should also make sure that the goals of the NUTP are not compromised and all aspects of the project, such as infrastructure for walking and cycling, are also implemented with efficiency. The national-level monitoring should be linked with the disbursement of funds and performance-based incentives.

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One another conflict seen consistently across the cities is over on-street parking. The new facilities created, whether footpaths, cycle tracks or increased road width, were encroached by roadside parking. Parking is seen as a 'right' of the motorist instead of being seen as an act of privatizing the public space. Much of this parking on the BRT corridors is long-term parking and not short-term and dynamic parking. All the parking on the BRTS corridors continues to be free and this has become the major obstruction in efficient street management. This means that the BRTS plans should include parking policies as part of an overall integrated approach.

Overall Conclusion

Transport can facilitate mobility and access and thereby enhance the livelihoods of the poor. Public transport represents a particularly important physical common property resource for the urban poor. Good provision can enhance livelihood profiles and enable the poor to develop and broaden their asset base. For low-income people in many Indian cities, including Ahmedabad, public transport is either unaffordable or constitutes a substantial financial burden. It is important for projects like the BRTS to be more socially inclusive by expanding their reach to the urban poor. The urban poor can be the dedicated users of the BRTS system provided they are recognized and included in the system by innovating the fare system. The lost opportunity of building walking and cycling facilities along the BRT corridors would have facilitated the travel of the urban poor. There is a lot of scope for improvement in Ahmedabad's BRTS before it will achieve low-carbon mobility and equitable development.


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Information about the project:

UNEP Transport Unit (www.unep.org/transport) in Kenya, UNEP Risø Centre (www.uneprisoe.org) in Denmark and partners in India have embarked on a new initiative to support a low carbon transport pathway in India. The three-year 2.49 million Euro project is funded under the International Climate Initiative of the German Government, and is designed in line with India's National Action Plan on Climate Change (NAPCC). This project aims to address transportation growth, development agenda and climate change issues in an integrated manner by catalyzing the development of a Transport Action Plan at national level and Low Carbon Mobility plans at cities level.

Key local partners include the Indian Institute of Management, Ahmedabad, the Indian Institute of Technology, Delhi and CEPT University, Ahmedabad. The cooperation between the Government of India, Indian institutions, UNEP, and the Government of Germany will assist in the development of a low carbon transport system and showcase best practices within India, and for other developing countries.

Homepage : www.unep.org/transport/lowcarbon

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