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A. SUSTAINABLE TRANSPORT AND INFRASTRUCTURE FOR THE GROWTH OF INDIAN CITIES
By Prof. T. G. Sitharam, Fagun Rajkotia and Radha Chanchani.

A sustainable transport system is a well balanced system which makes a positive contribution to the development of the community it serves; in terms of environmental, social and economical aspects. According to the European Union Council of Ministers of Transport, a sustainable transportation system is the one which allows safe and convenient access to basic needs of all groups of people of society. The system supports the development of its society which is consistent with the ecosystem and promotes equity between successive generations. It should be affordable and efficiently operational. Sustainable transportation system is one which provides a choice of transport modes for all sections of the public. The system should be environmentally sustainable along with a provision for utilizing renewable resources, limiting emissions and reducing the generation of noise. It should minimize the impact on the use of land with a plan for well balanced regional development.

The transport sector is considered as a significant component of economic development and human welfare. An efficient transport system enhances economic and social opportunities to its community by providing better accessibility to markets, employment and additional investments. Indian cities are experiencing economic growth, rapid urbanization and along with it ever-increasing transportation activity. In such a situation the provision of easy accessibility to education, work places, entertainment, and other activities becomes more important than ever. The challenge is to provide low cost and sustainable accessibility that is affordable even for low income groups.

Sustainable transport system means an environment friendly system that minimizes the use of energy and produce less CO2 and methane. Today, transport activity is considered as one of the major global consumers of energy; currently it represents about 1/4th of aggregate energy consumption and CO2 emissions. The environmental impacts due to the transport activities can be reduced by providing safe and easy accessibility of multiple modes of transport such as walking, cycling, para- transit (three wheelers), public transportation (like bus, metro rail, commuter rail, etc), and by enhancing the role of public transport. In addition, the impact can be reduced by developing fuel-efficient vehicles with bio fuels or renewable energy. The society can contribute to reduce the impact by making smart choice such as car-pooling, etc. Among the different modes of transport, walking and bicycling are the most sustainable. Recently, these modes are gaining world wide acceptance and attention. The next most sustainable mode is public transport. Apart from a good city bus service, Bangalore is implementing rail-based transport options like the metro and considering 10 developing a commuter rail system which connects the main city with its suburban areas and nearby towns.

Several countries including South Korea, USA and France are tearing down expressways after 50 years of the greatest road building activities in the world's history. According to Walter Kulash, a traffic engineer from Orlando, Florida, "widening roads to solve traffic congestion is like loosening your belt to cure obesity". Across the world, many city authorities are re- evaluating post-World War II federal urban policies and its destructive effects on cities. For example, when the 1989 earthquake damaged the

Embarcadero Freeway in San Francisco the city decided not to rebuild it as it was blocking views of the Bay and lowered property values. Another world famous example is that of Seoul, Korea where Lee Myung-bak, the city's mayor had proposed to remove a major freeway which was passing over Cheonggyecheon Creek and introduced a Bus Rapid Transit (BRT) system to accommodate the displaced traffic which would reduce the automobile usage in the city by half. Under his guidance, in 2003, the city has opened a 14.5 km BRT corridor and at the same time the freeway was closed. Today, the stream is restored and the revitalized surrounding area has become a famous tourist spot. The city continues to promote public transportation by adding more BRT routes.

Unfortunately, we have been engaged in similar road building exercises in our cities while overlooking the mistakes committed earlier. The Bangalore city authority is investing in road widening project to reduce traffic congestion on its roads. Before implementing we need to remember and learn from history and best practices from around the world. Instead of road widening, wouldn't it be a good idea to strengthen our road network by connecting arterial and sub-arterial roads? One should provide travelers with many options. We should really be investing in improving streetscapes, sidewalks, bike paths and transit, instead of devoting almost all of its tax money to huge, highly engineered expressways.

- Sustainable Transportation and TDM; Planning That Balances Economic, Social and Ecological Objectives.

- The Geography of Transport System; http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/ch7c1en.html

- The Geography of Transport System; http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/ch7c1en.html

- Transport Technologies and Policy Scenarios to 2050; by World Energy Council 2007; http://www.worldenergy.org/documents/transportation_study_executive_summary_online.pdf

- Removing Freeways - Restoring Cities; http://www.preservenet.com/freeways/FreewaysTear.html http://cistup.iisc.ernet.in/events.html

B. MULTI-PRONGED STRATEGY T0 ACHIEVE 'SUSTAINABLE URBAN MOBILITY'
By Radha Chanchani and Fagun Rajkotia

'Accessibility' is understood as the ease of reaching a desired destination. 'Mobility' is movement required to achieve access, which can be by different modes. For long now cities have been designed for mobility, and that too usually focused on moving automobiles rather than people. However, mobility is secondary. Cities should first be designed for accessibility - the new paradigm for urban and transport planning!! This can only be achieved by the integration of land use and transport, which forms the crux of any good city plan and design.

1. Reduce Travel Demand, Bring Destinations Closer and Improve Accessibility

Plan and design urban areas so as to reduce the need to travel long distances to access education, work, recreation, shopping, basic goods and services; daily needs are met nearby. Employ the principles of Smart Growth and Transit-Oriented Development:

- The 5D's of Development - Diversity (appropriate mix of uses), Density, (urban) Design, Distance to Transit and Destination Accessibility. Create compact, relatively dense, mixed-use, mixed income and livable neighborhoods that are pedestrian and cycle friendly and support public transit.
- Enmeshed Hierarchies -integrate the planning and design of Road Networks with Public Transportation Systems and the distribution of Land Uses and Densities. Establish well- formed road network hierarchies based on functional characteristics.
- People's experience of the city is through mobility and the public realm. Improve public open spaces in conjunction with public transport systems to transform the quality of life and experience of the city; like in the successful world- class examples of Curitiba and Bogota in South America.

2. Improved Mobility of 'People' rather than 'Automobiles'

- Develop affordable and efficient integrated, multi-modal public transport systems. These are valuable for their economy of money and space, socially equitable and environmentally friendlier options. Low-cost, locally- relevant and development-oriented public transport systems should be implemented before exploring expensive options.
- Strengthen and promote the shift to sustainable, zero or low carbon mobility modes like non-motorized transport, para-transit and public transport options. Walk able and cycle-friendly streets create safer, more humane and livable environments.

  To make any city sustainable a well developed integrated multi modal public transportation system is vital Any mass rapid transit systems such as metro commuter rail or bus based transport can only be successful when these are seamlessly Integrated with last mile connectivity options like walking cycling or Intermediate para transit modes such auto rickshaws when the stops do not safely and conveniently connect with the origin or destination points of the trip ideally walking and cycling are most sustainable transportation modes but people them due to many reasons One of the reason is it may not be safe enough to bike or walk along the arterial or main roads due to high volumes of faster moving vehicular traffic and so it is essential to have sidewalks and segregated cycle lanes along such roads with easy access to the public transit stop and parking facilities Auto rickshaws and shared taxis should be used as feeders to connect poorly serviced interior areas with the public transit system. These aspects are critical in promoting the shift to public transport.

- In addition to its functional characteristics, the design of roads and streets needs to be context-sensitive (taking into account adjacent functions/ activities) and multi-modal. Equitable distribution of road space based on user groups.

3. Broad Policy Measures and Strategies

Employ push-pull factors to work together. Discourage private motorized vehicle use through transport demand management measures like parking policies, congestion charging, higher taxes and fuel costs, etc. Encourage car pooling, prioritize HOV (high-occupancy vehicle and bus) lanes and explore innovative means of incentivizing public transport like discounts and subsidies.

4. Use of Science and Technology for Improved Service Systems and Delivery

- Cleaner, greener, more efficient fuels, vehicle design and technology-with a focus on fuel efficiency leading to lower air pollution and GHG emissions, alternate less polluting fuels (gas/electricity) based on renewable resources.

- Use of ICT (information and communication technology) for efficient traffic management and operation services, passenger information systems, electronic payment services, road transport-related personal safety services, weather and environmental conditions monitoring services, disaster response management and co-ordination services, etc.

5. Public Education and Awareness Campaigns to ensure Participation