J. Adv. Res. Alternative Energy, Environment and Ecology
Volume 5, Issue 4 - 2018, Pg. No. 6-9
Peer Reviewed Journal

Research Article

Low Carbon Mobility: Appraisal of Case of Rajkot

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Abstract

Our cities are growing rapidly and so as the transport network. The land use planning and transport are interdependent and interlinked. But, eventually with this growth there is negative impact on the environment. Transportation contributes to 27% of carbon footprint and this is still growing with the growth of cities and its network system and the nature of societies. When even we talk about the planned strata the behavior of vehicles and tendency of user is the alarmed observation which can be noticed by increase in number of private vehicles. This contributes even to GHG Emissions which negatively impact the environment and human health and leads to the birth of chronic diseases.

Keywords: Low carbon mobility, Planning, Transportation, Urban areas

Introduction

A low-carbon mobility approach requires clear and innovative thinking about city futures in terms of the reality (what is already there), desirability (what we would like to see), and the role that transport can (and should) play in achieving inclusive sustainable cities. The increasing dependency on motorized vehicles and higher risks to non-motorized and public transport users is restricting the safe mobility and accessibility of all urban residents and specifically people from the lower income group. This is threatening the urban environment and contributing to growing emissions of CO_2 and other greenhouse gases. There is a need for planning that can ensure safe mobility and accessibility for people irrespective of their socio-economic background in a way that does not compromise the environment. India, in its National Action Plan on Climate Change (NAPCC) (2008), has identified sustainable urban planning as one of the levers for reducing emissions. Ongoing initiatives at the city-level that support such planning efforts are the Comprehensive Mobility Plans (CMPs), which are being made a prerequisite for support under the Jawaharlal Nehru National Urban Renewal Mission (JnNURM).

The proposed LCMP methodology, incorporated into the revised CMP (Ministry of Urban Development, 2014) amends the existing approach and methodology of preparing the CMP. The LCMP adds the additional indicators of inclusiveness and measurements of carbon emissions from transport to the existing methodology of CMP prepared by the MoUD to make urban transport inclusive and low-carbon, and thus truly sustainable.

An LCMP provides vision for urban transport in the city. This vision encompasses an approach that addresses both climate change and development benefits through an integrated transport and land-use planning process (relates to relationship between available mobility (means and choices available to move) and the individual's desire to move).

An Introduction to Rajkot

Rajkot, the fourth-largest city in the state of Gujarat, has experienced significant growth in recent years. In the last two decades, the urban population has more than doubled to around 1.4 million in 2011 and is expected to reach about 3 million in 2031. Since over half the city's population is in the productive age category, the city is expected to continue to grow rapidly in the future.

The city is divided into 23 wards with an average density of 12,735 people/km^2. Densities in the inner city are much higher than the rest of the city. The central portions of the city are dense and have mixed land uses, and the majority of residents live in the central area of the city. The residences in the central portion of the city comprise of row houses and low-rise apartments, packed closely in a

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How to cite this article: Chetna, Sharma VK. Low Carbon Mobility: Appraisal of Case of Rajkot. *J Adv Res Alt Energ Env Eco* 2018; 5(4): 6-9.

fine-grain urban fabric. The newer developments are typical of high-rise apartments, being loosely packed alongside wider roads. The major commercial area remains in the old city, and along the major radial and connecting radial in the outer parts of the city. Industries are located in the Bhaktinagar Industrial Estate and Aji Industrial Estate, which were developed by the Gujarat Industrial Development Corporation (GIDC), while the Sorathiawadi plot area was developed at a later stage.

Present Travel Infrastructure and Travel Patterns

The total road network length in the study area is approximately 2291 km, of which the RMC area accounts for 1799 km and the RUDA area 492 km. The road network in the RMC area is very dense, particularly in the old city area, where the network does not follow a particular pattern like the regular grid networks in the newer developments. The city roads form a ring-radial pattern, with six radials and one major ring. Most of the city roads have an intense ribbon development of commercial activities, forming a mixed use type of development along the arterials as well as some sub-arterials. Roads are narrow in certain places with varying widths, and the presence of bottlenecks constrains the free flow of motorized vehicles. Most city roads (97 per cent) have a right-of-way (ROW) of up to 30 m. The average speed of all modes in the city is 16 km/hr, and is much lower in the old city area due to delays from narrow streets and people walking on the streets. Most arterial roads have average speeds higher than 20 km/hr. The local streets have an average speed of 10 km/hr due to a number of intersections after every kilometer, which makes them more pedestrian and bicycle-friendly. Footpaths are present on all major roads in the city, but in most areas the width is less than 1.5 m and is encroached upon by street furniture, telephone boxes, trees, make-shift shops etc.

Rajkot has a dedicated cycle lane on one stretch along the Bus Rapid Transport (BRT) corridor, but it is difficult to use bicycles on most city roads. City buses previously operated by RMC and a private operator (VTCOS) failed, and therefore the majority of public transport requirements are met through auto-rickshaws. The Bus Rapid Transit (BRT) system is under construction using JnNURM funding; however only a 10.7 km stretch is currently operational.

An average individual residing in Rajkot makes 1.3 trips per day, and when walk trips are excluded, it comes down to 0.81 trips/day. The average trip length for the city is approximately 3.8 km, inclusive of walk trips. Walking and two-wheelers account for a little over one-third each of all trips, followed by auto-rickshaws (11 per cent), bicycles (10 per cent), buses (3 per cent), cars (2 per cent) and others (1 per cent). Non-motorized trips account for nearly half of all trips (48 per cent). A little over half (53 per cent) of all trips are work trips, while educational trips account for 26 per cent, followed by shopping (16 per cent), religious (4 per cent) and other trips (1 per cent). Over 25 per cent of road accidents reported in Rajkot over the past five years involved people using NMT.

Figure 1.Location of Rajkot

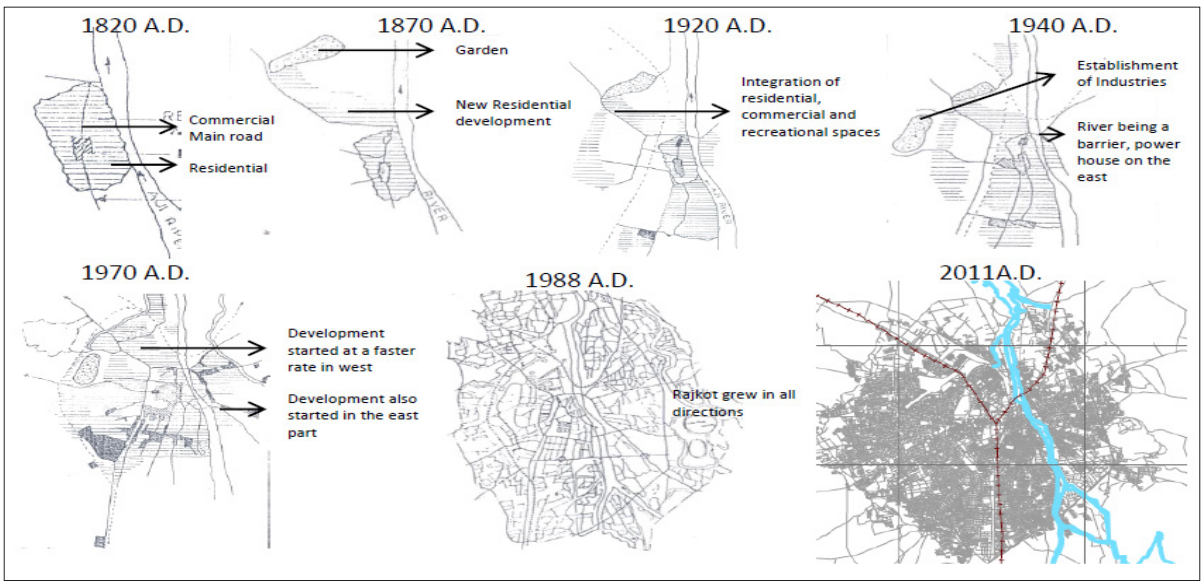

Figure 2.Growth of rajkot on the banks of aji river (rajkot urban development authority, 2011)

ISSN: 2455-3093

Low-carbon Scenario

The Low-carbon Scenario (LCS) aims to lower carbon emissions by shifting to non-motorized modes of transport and changing land use patterns, and thereby improving accessibility to destinations. The types of interventions or strategies this study considers are land use, NMT, PT and technological interventions. In the LCS, 'stated preference' surveys were conducted alongside household surveys to understand people's demand. This provided insight into the mode that would be used if the current mode were not available, and the preferred mode for each purpose if walk, cycle and bus infrastructure were in place. A short question was also asked, giving scenarios for improvements of infrastructure. This resulted in new mode choice probabilities, which were assigned to routes. This exercise resulted in estimating the demand for transport infrastructure on the city's network. The high-demand routes were selected as the corridors of infrastructure development in the city.

For achieving low-carbon emissions through lower mobility and higher accessibility, it is important to integrate land use and transportation. The identification of high demand travel routes led to the selection of nodes and corridors of development for controlling the sprawl of the city. The strategy behind this is to plan the densities and diversities of land use, supporting lower mobility and, in turn, lower carbon emissions. Concentrating developments in these nodes and corridors can help control urban sprawl and bring opportunities closer to people. Thus, travel behavior can be changed by running the land use simulation and allotting new commercial and residential densities, as well as determining a job-housing mix to concentrate development near the centre. Combining the improvement in the road infrastructure and the land use interventions gives the integrated land use transport plan. However, for lowering carbon emissions, it is important to suggest changes in the type of fuel and vehicles to reduce overall transport emissions. All these four strategies (named land use strategy, NMT strategy, PT strategy and technology strategy) are modelled to discover the best strategy for the Low-carbon Comprehensive Mobility Plan.

Land Use Strategy

Analyzing the relationship between land use and the manner in which individuals travel in Rajkot, it was found that accessibility to jobs, polycentric development and a balanced job-housing ratio encourage individuals to travel and use NMT and PT modes. Thus, a strategy is proposed that ensures increased accessibility to jobs and polycentric development with major and minor nodes. The major nodes would have a Floor Space Index (FSI) of 4 and minor nodes an FSI of 2.5. These nodes will have a good land use mix, ensuring a balanced job-housing ratio. As a result of this strategy, it was projected that the share of the public transport mode would increase to 22 per cent, and the estimated average trip length would drop to 3.9km from the 6.0 km of the BAU, resulting in 36 per cent lower CO_2 emissions.

Non-motorized Transport Strategy

In the NMT strategy, it was proposed that on all major roads, and on roads where demand for walking is high, footpaths greater than 2 m wide will be provided. By doing so, it is estimated that the NMT share will hold its current share of 48 per cent going into 2031, rather than decrease to 29 per cent as under the BAU scenario. Potential dedicated bicycle routes were identified in areas along all major roads where individuals stated they would prefer using bicycles if dedicated corridors were provided. As a consequence, the bicycle share in LCS is projected to increase from the current five per cent to 12 per cent. Overall, it was found that a significant number of trips (including all short trips, educational trips and some of the work trips) would shift to NMT, thus decreasing vehicle use and in turn, reducing CO_2 emissions by 41 per cent in comparison to the BAU scenario.

Public Transport Strategy

A three-stage approach was adopted for the public transport strategy. This included the use of lower-capacity buses on routes that have low public transport demand, city buses on roads with sufficient demand, and BRT on corridors where the city bus service is unable to cater to demand even if it is run at a higher frequency. But adopting this strategy, it was projected that the combined trip share of public transport, including BRT would be 29 per cent, and the motorized mode would significantly decrease to 27 per cent. This strategy results in a 47 per cent drop in CO_2 emissions in comparison to the BAU scenario.

Low-carbon Comprehensive Mobility Plan

The Low-carbon Comprehensive Mobility Plan aims to achieve improved air quality, fewer accidents, improved accessibility and lower carbon emissions from the transport sector. This will be achieved by promoting greater use of non-motorized transport and the public transport system. The LCMP proposes to modify the General Development Control Regulations (GDCR) and Development Plan (DP) for higher residential and commercial densities and higher job-housing ratios at identified major nodes and corridors. Design elements include: higher intersection density; commercial or retail on the ground floor and first floor with residential on the upper floors to make streets active and safer; and designs of bus stations for all, including low income groups and the disabled. A pedestrian plan consisting of a 180 km-long network, a bicycle network and a public transport network has also been identified through the use of a demand-based model.

In the short term (i.e. by 2016), the priority will be NMT infrastructure projects such as footpaths and cycle lanes, followed by PT investments. Investments in 2016 are

estimated to cost INR 4,474 million, of which NMT and PT account for 23 per cent and 63 per cent respectively. In the medium term (i.e. by 2021), emphasis will be on developing BRT, as well as other investments such as footpaths, junction improvements, etc. These investments are expected to cost INR 3,809 million, of which PT would account for 83 per cent. Long-term projects (i.e. for 2031) include significant spending on developing new roads and BRT, as well as other infrastructure. This phase is expected to cost INR 11,274 million, of which road works and PT would account for 33 per cent and 63 per cent respectively.

Features

- **Integration:** Integrate the mobility plan with urban growth, structure and urban form, and use this understanding in setting up the envelope of possibilities in travel decision-making.
- **Equity:** Provide accessibility and safety for different socioeconomic groups and genders.
- **Mode Shift:** Prioritize sustainable modes of transport – i.e. public transport, and non-motorized transport.
- **Environment:** Reduce impacts of transport on local air quality and CO2 emissions.

Key Outcomes

- Improved mobility for all socio-economic groups and genders.
- Improved access to opportunities and activities.
- Improved safety and security for all, especially pedestrians and cyclists.
- Reduced energy use, air pollutants and CO_2 emissions.

Conflict of Interest: None

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Date of Submission: 2018-09-07
Date of Acceptance: 2018-11-14

ISSN: 2455-3093