Impact Factor (SJIF): 4.542

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444
Volume 4, Issue 3, March-2017

# DESIGNING EFFICIENT RAPID PUBLIC BUS TRANSPORT IN SURAT

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***Abstract-Introducing public bus transit system in Indian cities raises many challenging issues of different nature ranging from technical to operational. The present study examines the impact of a new public bus transit system by applying a binary logit analysis for assessing the possible variation in modal shift behavior. The case study of mode-choice was developed, calibrated, and validated using socio-economic data collected on six proposed corridors in the city of Surat, Gujarat, India. Traffic quality parameters, such as average speed, delay, congestion, travel time, and travel cost were modeled to investigate the impact of the new bus transit system.***

***The congestion at intersections in the case of open BRTS results in delay to both BRT buses and private traffic. The present study consists of the evaluation of traffic flow characteristics on a 1.8 Kilometers of BRTS corridor in Surat city, which includes four intersections. Very less literature is available on the evaluation of hybrid BRTS under Indian traffic conditions Bus Rapid Transit System (BRTS) is one of the most popular forms of semi-rapid public transit system with moderate capacities and more importantly minimal capital costs compared to other forms of public transportation system, which makes it favorable for developing nations such as India, China, Brazil, Indonesia, etc. (Hook (2005).***

***Public transportation is a key component of a sustainable transportation system, which improves mobility with lesser detrimental economic & environmental impacts on its neighborhood.***

## I. INTRODUCTION

Surat Municipal Corporation is spread over an area of 327 sq. km and has a population of about 4.6 million (Census 2011) which makes it the eighth largest city in India. This has exerted a huge pressure on its infrastructure including its housing and transport. It is to be seen that how the city's transportation infrastructure responds to the growing population. The literature studies were done for various documents that covered topics relevant to the scope like roads, Non- Motorized Transport (NMT), Public Transport, and Land Use Transport Integration (LUTI). Surveys were done for getting a better understanding of what affects a riders' choice while choosing public transport. These initial studies were essential for getting an overall idea about how transport infrastructure is closely related to citizens' everyday lives.

The main objective of this is to develop Urban Transport Infrastructure through BRTS in Surat 2021. Our roads infrastructure and our traffic management system has not been designed to cope with such a heavy vehicular load, leading to heavy traffic congestion at busy signal points in big cities as Surat. . In order to resolve the issue of less preferred BRTS, this paper presents the studies that were carried out to analyze the flaws of BRTS over the stretch and evaluating the deficiency between the planned and achieved objectives.

## II. METHODOLOGY

The methodology for obtaining actual routes, Existing road structures, and PTAL method is used for designing the new proposed BRTS routes in Surat city

1) Literature review
2) Pilot survey
3) Classification of Surat roads.
4) Creation of PTAL 2016 Map for BRTS, City Bus & IPT
5) Analysis

The methodology used to develop PTALs for the Ryde LGA should be based on the system developed by the London Borough of Hammersmith and Fulham.

As PTAL development is a relatively new concept in Australia any proposed changes or additions to the methodology will be welcome and will be discussed and decided on. An outline methodology is suggested below.

The PTAL will measure accessibility based on both the access distance to public transport services and the level of service provided. The following formula should be used to derive an accessibility index for any given location which takes into account these two factors:

**Accessibility index (EDF) = 30 ÷ access time**

Access time = walking time to the station or stop + average waiting time for the next service

Average waiting time = (K ÷ 2) x (60 ÷ scheduled frequency)

K refers to the reliability factor. The following values of K were used in the Hammersmith and Fulham example:

- rail – 1
- bus – 2

The application of this equation results in the Equivalent Doorstep Frequency (EDF) for a particular service. The EDF for individual services are then added together to yield the aggregate EDF for all services. This aggregate EDF is then used as the accessibility index for a particular point of origin or transport node.

Simplified Example:

A transport node which consists of a train station providing one service which stops 3 times in the hour has the following calculations:

Average waiting time = (1÷ 2) x (60 mins ÷ 3) K = 1, Scheduled frequency = 3
= 10 mins
Access time = 10 +10 Walk time = 10 mins
= 20 mins
EDF = 30 ÷ 20
= 1.5

The relevant accessibility index at this transport node is therefore 1.5. In the case that there is more than one service stopping at this node, the multiple EDFs would be added together to give the aggregate EDF.

The accessibility indices calculated for each transport node must be converted to accessibility levels to enable them to be mapped in a meaningful way. In the London Borough of Hammersmith and Fulham example accessibility levels from 1 – 6 have been calculated where as in the Parramatta example accessibility levels of 1 – 4 were used. Depending on the accessibility indices calculated for the Ryde LGA a meaningful group of accessibility levels should be developed in consultation with the City of Ryde.

*Mapping of Accessibility Levels*

The calculated accessibility levels should be overlaid onto a map of the LGA. A colour code for each accessibility level should be used. It is expected that some overlap of accessibility levels will occur. A darker colour could be used to represent higher transport accessibility levels in order to show priority on the mapping.

## III. DATA COLLECTION & DATA ANALYSIS

### 1. Data collection:-

Primary data was collected for the study from various sources like TARU, SMC Traffic Police etc. Data with different sources is as follows:

Table 1: Data Collected

| Category | Data Type | Source |
|---|---|---|
| BRTS | Route & Stops | BRTS-Transit Map (City-link), SMC, TARU |
| City Bus | Routes, Stops, Frequency, Fleet Size, Base Fare | SMC, Rainbow, TARU |
| IPT (Shared) | Routes & Stops | Auto Union, Auto Drivers, Traffic Police, SMC |

### 2. Roads network of Surat

The Roadway network of Surat within SMC is around 1915 Km. As per the Development Plan 2004, a total of 9.2 % of SUDA area is proposed under Transport and Communication. The street network in Surat is ring-radial form at city level and grid Iron pattern is observed on the smaller roads of the local level network. In terms of distribution of roads by ROW width, the city is well placed with about 32% of its width, exceeding 18 meters and above. The ROW distribution 68.55% of the total road length has a ROW below 18 m. Another 8.09% of roads have ROW equal to 18 m. The roads having available ROW of 24 m are 8.57% of the total road network. 4.19% of the total road network has an available ROW of 30 m., these include the roads like the Udhana Magdalla road and the Dumas road near airport. The roads having 45 m ROW form 4.34% of the road network these are the inner ring road and certain arterial roads leading to it. Another 2.68% of the roads have an ROW equal to 60 m, these are the major highways like Surat- Kamrej highway, Surat-Navsari highway and the upper portion of the Surat-Dumas road from Athwa gate to outer ring road

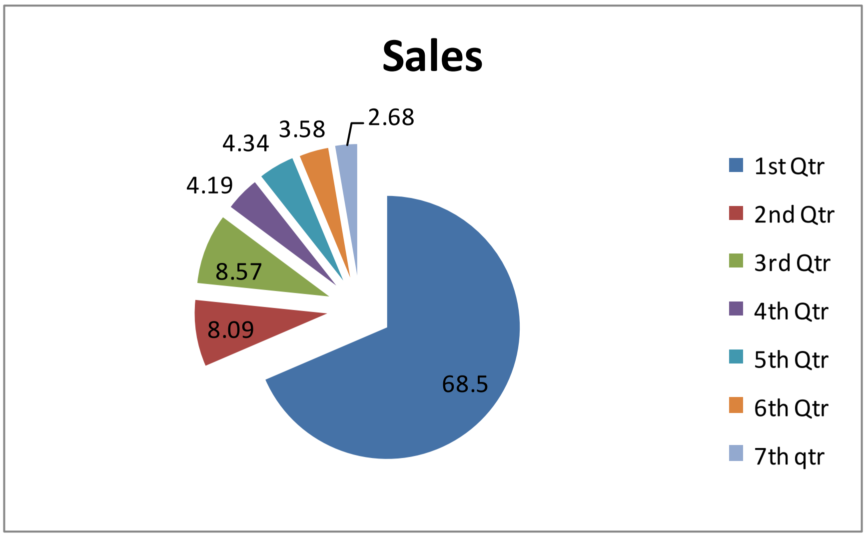


Figure 1: ROW distribution of SMC roads

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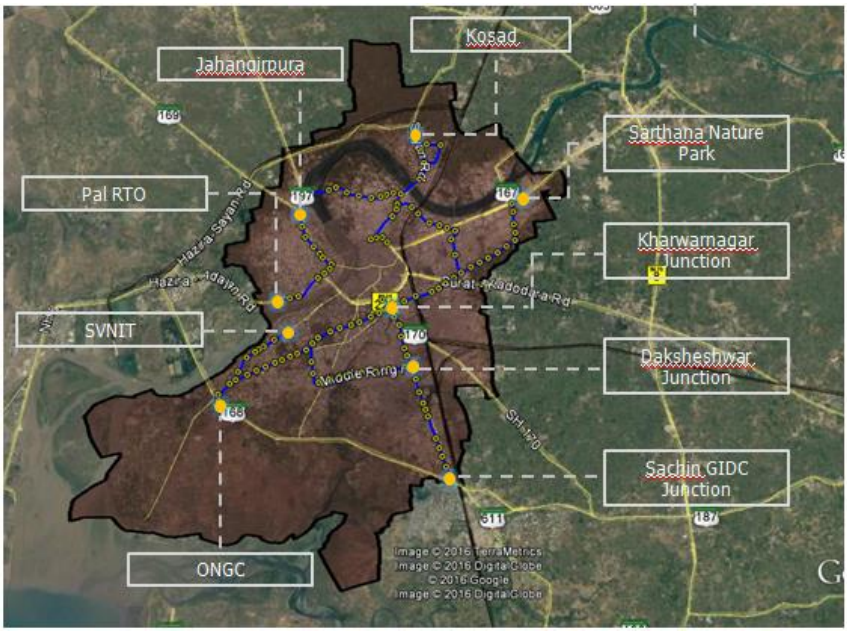
**3.BRTS PTAL CALCULATIONS - SURAT CITY**

| Parameters | Values | Units | Formulas | |
|---|---|---|---|---|
| | | | WT | Distance / Average Walk Speed |
| Avg Walk speed | 60 | m/min | AWT | (0.5 * (60 / frequency)) + Reliability Factor |
| BRTS walk access time | 15 | minutes | TAT | WT + AWT |
| BRTS reliability (K) | 1 | minutes | EDF | 30 / TAT |
| BRTS bus Frequency (f) | 4 | Per Hour | AI | SUM (Weight * EDF) |
| Frequency Hour | 8:00 to 10:00 | AM | | |

| Point of Interest Number | Service Access Points (SAP) -BRTS Stops | Distance | Walk Time (WT) | Average Waiting Time (AWT) | Total Access Time (TAT) | Equivalent Door Frequency (EDF) | Accessibility Index (AI) |
|---|---|---|---|---|---|---|---|
| | | meters | minutes | minutes | minutes | | |
| 1 | | 0 | | | | | 0 |
| 2 | | 0 | | | | | 0 |
| 3 | Tadwadi | 862 | 14.366667 | 8.5 | 22.86666667 | 1.311953353 | 1.311953353 |
| 4 | Navyug college | 158 | 2.6333333 | 8.5 | 11.13333333 | 2.694610778 | 2.694610778 |
| 5 | SMC West zone | 278 | 4.6333333 | 8.5 | 13.13333333 | 2.284263959 | 2.284263959 |
| 6 | Tadwadi | 750 | 12.5 | 8.5 | 21 | 1.428571429 | 1.428571429 |
| 7 | | | | | | | **6.407446166** |
| 8 | | 0 | | | | | 0 |
| 9 | | 0 | | | | | 0 |
| 10 | Patel Wadi | 848 | 14.133333 | 8.5 | 22.63333333 | 1.325478645 | 1.325478645 |
| 11 | | 0 | | | | | 0 |
| 12 | | 0 | | | | | 0 |
| 13 | | 0 | | | | | 0 |
| 14 | Sitanagar | 396 | 6.6 | 8.5 | 15.1 | 1.986754967 | 1.986754967 |
| 15 | Puna Gam | 780 | 13 | 8.5 | 21.5 | 1.395348837 | 1.395348837 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 16 | Radha Park Society | 772 | 12.866667 | 8.5 | 21.36666667 | 1.404056162 | 1.404056162 |
| 17 | | | | | | | **2.799404999** |
| 18 | Pramukh Park Society | 674 | 11.233333 | 8.5 | 19.73333333 | 1.52027027 | 1.52027027 |
| 19 | Puna Gam | 662 | 11.033333 | 8.5 | 19.53333333 | 1.535836177 | 1.535836177 |
| 20 | Royal Park | 109 | 1.8166667 | 8.5 | 10.31666667 | 2.907915994 | 2.907915994 |
| 21 | | | | | | | **5.964022441** |
| 22 | | 0 | | | | | 0 |
| 23 | | 0 | | | | | 0 |
| 24 | Palanpur Patia | 67 | 1.1166667 | 8.5 | 9.616666667 | 3.119584055 | 3.119584055 |
| 25 | Ramnagar | 535 | 8.9166667 | 8.5 | 17.41666667 | 1.722488038 | 1.722488038 |
| 26 | Tadwadi | 710 | 11.833333 | 8.5 | 20.33333333 | 1.475409836 | 1.475409836 |
| 27 | | | | | | | **6.31748193** |
| 28 | | 0 | | | | | 0 |
| 29 | | 0 | | | | | 0 |
| 30 | Ved Darwaja | 656 | 10.933333 | 8.5 | 19.43333333 | 1.54373928 | 1.54373928 |
| 31 | Gotalvadi Circle | 111 | 1.85 | 8.5 | 10.35 | 2.898550725 | 2.898550725 |
| 32 | Katargam Darwaja | 354 | 5.9 | 8.5 | 14.4 | 2.083333333 | 2.083333333 |
| 33 | Patel Wadi | 475 | 7.9166667 | 8.5 | 16.41666667 | 1.827411168 | 1.827411168 |
| 34 | Ved Darwaja | 678 | 11.3 | 8.5 | 19.8 | 1.515151515 | 1.515151515 |
| 35 | | | | | | | **8.324446741** |

**5. Schematic Proposals for BRTS Routes**




## IV. CONCLUSION

BRTS stops fails to cover certain major access locations over the route where large passenger traffic is observed. We identified major transportation issues by observations and interviewing various stakeholders in the city. After identifying the issues, we took up issues pertaining to our topic, which was either Roads and NMT, Public transport.
The roads and NMT undertook designing of roads of various right of way based on their adjunct Land use. The public transport group did a Public Transport Accessibility Level mapping and found out the areas where there was a demand for public transport, but it was not available. Then, we proposed new public transport routes and bus stops for the unserved areas.

A certain stretch or area was finalized(kharvanagar road & anuvrat duar) as a Hot Spot and was designed according to surrounding Land use which would promote public transport and non-motorized transport usage.

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