OPTIMIZED SOLUTIONS FOR RESOLVING TRAFFIC CONGESTION AT UNIVERSITY CIRCLE

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ABSTRACT

In today’s world, due to globalization, transportation becomes one of the essential need of human being. In developing countries like India, where the population is going on increasing which leads to the serious traffic issues. In city, Pune which would be the metro-city in next some days, is facing a huge traffic problems. Hence it is necessary to do a traffic study of the city to provide designed, planned and cost effective road transportation system. In this paper, traffic data is counted and analysis of data is done with the help of software PTV VISTRO for signal optimization. Also, the other improvements are suggested. The main factors influencing the traffic problem are type of traffic, seasons, population accumulated in the area, direction of flow, parking, foot path availability, the width of the road, connectivity to the different locations and value of area etc. The aim of this paper is to identify the problems creating the traffic and providing solutions for effective transportation through the city.

Key words: Effective Transportation, Factors Affecting Traffic, PTV VISTRO, Traffic


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1. INTRODUCTION

Pune is a city of knowledge. Pune is well known for its industrial, political, geographical background. Hence population is increasing day by day in the city. Increased population increasing the traffic congestion in the city rapidly. That’s why proper redeemable measures should be implemented to overcome through this traffic. Nearly 14 lac vehicles have been added to the city’s vehicle population in the last ten years. According to the Pune RTO’s statistics, till February 2016 end, the vehicle population of Pune including Pimpri Chinchwad was 34, 90, 569. Out of the total vehicle population, Pune city has a total of 24,53,717 vehicles while Pimpri Chinchwad has a population of 10,36,852. Considering the university junction in the past, as traffic was very less, so there was a beautiful fountain in the middle of the junction. As time goes on, traffic increases resulting in construction of the flyover. But now at present condition, the flyover is also not enough to carry current traffic demand. Hence this flyover itself is disturbance to traffic.

2. PROBLEM STATEMENT

University circle is one of the most congested junctions in the Pune city. It is an entry for the other parts of the city like Pashan, Baner, Waked, Balewadi, Aundh to the core city. The shape of the junction is similar to hand of the human body. Six roads are coming at university junction. As there is no chance to widen the roads, due to land limit, creating huge traffic congestion at all time of the day. While designing flyovers at a junction, future population was not taken into account, resulting failure of the purpose of these flyovers. As there is no option of widening of the road because of the private property side by of the road. This problem causes huge traffic in the peak hours and it is impacting vastly on the traffic carriage capacity of the road. Following are the major problems seen at the junction:

2.1. Advance Technology

In India, there is always a lack of precision advance technology while data collection. While designing of transportation systems, latest technology has not been used for traffic counts. In Pune, unlike western countries, heterogeneous traffic is seen which is difficult to count and control.

2.2. Time Loss

There is a huge traffic at the junction, creating large queuing of vehicles around 500m -750m. Due to traffic congestion, a person have to stand around half an hour to pass the junction. Improper bike riding affects to the flow of traffic.

2.3. Lighting

Some areas at University junction are poorly lighted due to non-functional/missing street lights. Installation of functional streetlights is expected to improve the illumination of the junction and overall safety of the junction.

2.4. Signage

University Circle junction is a complex 5-legged junction. Inadequate signage results in inconvenience to unfamiliar commuters and deteriorates traffic operations due to improper lane usage and frequent stops to request for direction. Installation of adequate signage consistent with IRC 67-2012 is recommended.
2.5. Roadway Marking
Lane markings consistent with observed lane usage would encourage motorists and two-wheelers to follow lane discipline. Installation of compact lanes (2.8m–3.0m) consistent with IRC 35-1997 is recommended.

3. DATA COLLECTION
Before coming to any conclusion only by doing field observation, it was necessary to conduct a data collection of running vehicles through the junction. Data collection is done manually. [Sanjay Kumar Sigh (2012)]. From data analysis, it is observed that the peak hours are 09.45-10.45 in the morning and 18.00-19.00 for the evening.

Vehicle counts and pedestrian counts were conducted at University Junction and also at the adjacent SB road junction. In addition to the traffic counts, opinion of the local traffic police as well as traffic experts was interviewed.

![Figure 1 Position of counters](image)

The procedure followed for the study of university junction is as follows:

**Flow Chart 1 Flow diagram of Study**
Heterogeneous traffic flow volumes were converted into equivalent homogeneous traffic flow volumes [IRC 64-1990]. The morning peak hour (0945-1045) experienced 15,290 PCUs while the evening peak hour (1800-1900) experienced 14,616 PCUs. Pie Chart 1 below illustrates the morning and evening passenger car units entering a University junction in the morning and evening peak hour.

The composition of vehicular traffic entering University junction was observed to be similar during the morning peak hour and evening peak hour.

For pedestrian data collection, total 2840 pedestrian crossed the junction in the morning pedestrian peak hour (11.15-00.15) and for the evening pedestrian peak hour (1600-1700), the count was 2461.

The pedestrian counts for the morning period (0945-1245) and the evening period (1700-2000) for University junction are illustrated in Graph 1 below.

From data collection, it is observed that the phasing splits present at the junction is as follows:

**Figure 2** Existing Phasing Splits
4. DATA ANALYSIS

4.1. Signal Operations

Intersection operations for University junction were analysed using PTV Vistro. [Amudapuram Mohan Rao, Kalaga Ramachandra Rao (22 August 2012)]. PTV Vistro offers robust signal optimization algorithms to achieve best cycle lengths and splits for a single junction as well as an entire network. Figure 3 below illustrates the optimized PM peak hour timing plan.

<table>
<thead>
<tr>
<th>Existing phasing splits</th>
<th>Proposed phasing splits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHASE-I: Pedestrian-16sec</td>
<td>PHASE-I: Pedestrian-25sec</td>
</tr>
<tr>
<td>PHASE-II: University-18sec</td>
<td>PHASE-II: Pashan-72sec</td>
</tr>
<tr>
<td>PHASE-III(A): Aundh to Shivajinagar-64sec</td>
<td>PHASE-III(A): University-42sec</td>
</tr>
<tr>
<td>PHASE-III(B): Shivajinagar to Aundh-83sec</td>
<td>PHASE-III(B): University-10sec</td>
</tr>
<tr>
<td>PHASE-IV: Baner-57sec</td>
<td>PHASE-IV: Aundh-43sec</td>
</tr>
<tr>
<td>PHASE-V: Pashan-40sec</td>
<td>PHASE-V: Baner-139sec</td>
</tr>
</tbody>
</table>

![Figure 3 Proposed Phasing Splits](image)

Figure 3 Proposed Phasing Splits

Figure 4 illustrates the sequence of proposed signal phasing.

![Figure 4 Proposed Phasing](image)

Figure 4 Proposed Phasing

Table 1 below illustrates the yearly savings expected based on the travel time savings as a result of the optimized signal timing plan for the PM peak hour operations at University junction.
Optimized Solutions For Resolving Traffic congestion At University Circle

<table>
<thead>
<tr>
<th>ALTERNATIVE SOLUTION</th>
<th>VOT: Bus</th>
<th>VOT: Car</th>
<th>VOT: Two Wheelers</th>
<th>VOT: Three Wheelers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Rate (Rs/min)*</td>
<td>0.3</td>
<td>0.72</td>
<td>0.42</td>
<td>0.43</td>
</tr>
<tr>
<td>Updated Rate (Rs/min)</td>
<td>0.32</td>
<td>0.78</td>
<td>0.45</td>
<td>0.47</td>
</tr>
<tr>
<td>Number of Vehicles**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Volume (vph)</td>
<td>16750</td>
<td>4596</td>
<td>11050</td>
<td></td>
</tr>
<tr>
<td>Weighted Avg Rate (Rs/sec/vph)</td>
<td>0.0090</td>
<td>0.0007</td>
<td>0.0008</td>
<td></td>
</tr>
<tr>
<td>Time saved (sec)***</td>
<td>47.02</td>
<td>45.96</td>
<td>110.50</td>
<td></td>
</tr>
<tr>
<td>Total Daily PM Peak Hour Savings (Rs)</td>
<td>7,117.43</td>
<td>4596</td>
<td>11050</td>
<td></td>
</tr>
<tr>
<td>Total Yearly PM Peak Hour Savings (Rs)</td>
<td>25,978,61</td>
<td>4596</td>
<td>11050</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Annual PM Peak Saving

5. ALTERNATIVE SOLUTIONS

After the traffic data collection and data analysis, we thought of some recommendations. But due to some technical reasons and due to the lack of area required for construction, we came to know that these options are at this stage are not possible.[Khaled Mahmud, Khonika Gope, Syed Mustafizur, Rehmam Chowdhury (May 24, 2012)]. The options are as follows-

5.1. Flyover from Aundh-Shivajinagar

This is one good option. As there is a direct way for people going from Aundh to Shivajinagar. But of the following limitations, it would not be acceptable:

Location of the piers will cause huge traffic congestion as it will be in the middle of the traffic flow.

The proper length of ramp from SB Road to Shivajinagar is not available.

The construction process will be too lengthy, causing regular traffic irritation.
5.2. Underground from Aundh-Shivajinagar

This alternative is possible. But of following limitations, it would not be acceptable:

- The proper length for ramp from SB Road towards Shivajinagar is not available.
- As per IRC, it is required to provide minimum two lane for underground, but it is not possible at the university junction.

5.3. Tunnel from SB Road-Pashan

This option is quite possible, as new road will reduce the traffic volume at university circle. But this option has following obligations:

- Since this route is environmentally sensitive, so will lead to oppose.
- Widening of road SB road will be quite a tough job.
- Noise pollution will increase at SB road. And this will not be acceptable as there are so many residential buildings.
5.4. Formation of one route for the people going to Baner and Aundh from Shivajinagar

Figure 5 Alternative IV

This could be one of the best options to forecast traffic at university junction. In this option, the alignment of the flyover from Shivajinagar to Baner can be shifted to left. Then the Aundh route cab be diverted to Baner. People going to Baner and Aundh will go to Baner and From Baner road, people who want to go Aundh will go to Aundh road through underground road from Baner to Aundh. But for making this option viable, land limitation should be overcome.

Underground bypass construction from Baner road to Aundh road is difficult as this land portion belongs to government property

5.5. Double flyover from Aundh-Baner-Pashan to Shivajinagar

Figure 5 Alternative V

The limitations of this alternative are as follows:
The proper length of ramp from Baner road towards Shivajinagar is not available.
Since three routes are going to intersect, traffic congestion at flyover is possible which is not acceptable.
Lane problem will occur.

5.6. Flyover from Shivajinagar to Pashan

Figure 5 Alternative VI

This will be better option for an alternative. But because of following limitations, it is not acceptable:

The volume of vehicles coming from Shivajinagar is less as compared to vehicles coming from SB road. So the efficiency of the flyover will be less.

Since the efficiency of the flyover is less, so the cost of the project will not match the efficiency.

6. IMPROVEMENTS

6.1 Short Term Improvements

The following improvements are recommended for the University Circle and SB Road Junctions.

- Signal Timing and Phasing Optimization:
  - Provide additional pedestrian signal poles and pedestrian signals
  - Update the existing signal phasing sequence and timings to incorporate more efficient and safe movement of vehicles and pedestrians alike.
  - Review location of existing traffic signal lights and provide additional traffic signals/ relocate existing traffic signals as necessary.
  - Investigate the implementation of video detection or a similar non-invasive actuation technology to provide a higher level of local optimization.
  - Update hardware of junction if the existing controller is inadequate to accommodate the proposed recommendations.

- Roadway Lighting:
  - Install adequate lighting at the Junction. Emphasis should be on illuminating all pedestrian crossings as well as sidewalks (footpaths).
  - In an effort to ensure adequate illumination at the junction, consultation with lighting engineers as per IRC: 103-2012 (Guidelines for Pedestrian Facilities) is recommended.

- Roadway Signage:
Optimized Solutions For Resolving Traffic congestion At University Circle

- Install guide signs, warning signs and regulatory signs at appropriate locations to assist motorists travel towards their destination effortlessly and safely.
- Colour, size and location of signs (height, offset, spacing) should be in conformance with IRC: 67-2012 (Code of Practice for Road Signs).
- Special attention should be given for the appropriate signage at the directional island proposed at the SB Road intersection.

**Roadway Markings:**

- Install lane striping with compact 2.8m-3.0m lanes. On approaches where the right-of-way varies provide inner lanes (lanes starting from the right side) with a constant width (2.8m – 3.0m) and allow only the left most lane to vary in width based on effective residual space. (IRC SP41:1994, Page 73, Section 7.4.3)
- Install good quality lane striping as per IRC: 35-2015 (Code of Practice for Road Markings) on all approaches at least 100m before and after the junction.
- Provide retroreflective raised pavement markers (cat eyes) for all lane markings approximately 75m before and after the junction.
- Provide Stop Bars and Pedestrian Crossing markings at locations as per the proposed improvement plan.
- Provide guidance lane markings for turning vehicles through the junction.
- Special attention should be given for installation of appropriate advance roadway markings to help motorists manoeuvre the directional island proposed at the SB Road intersection.

**Pedestrian Infrastructure:**

- Install pedestrian guardrails on all approaches of the junction to direct pedestrian traffic to the dedicated pedestrian crossing locations.
- Install pedestrian guardrails along the median for the Shivajinagar approach (where the Pashan Off-Ramp becomes at-grade) to prevent unauthorized pedestrians crossing the travel way.
- Resurface the existing footpaths and bicycle track to provide a good quality even surface.
- Install ramps and appropriate bollards to accommodate access by people with disabilities while at the same time preventing the unauthorised use of the pedestrian facilities by motorized two/three/four wheelers.
- All pedestrian infrastructure to be installed/relocated in compliance with IRC: 103-2012 (Guidelines for Pedestrian Facilities).

**Geometric Improvements :**

**A. University Circle**

- Relocate existing central median (divider) to provide a new travel lane. Accordingly demolish the central channelizing island to incorporate this new lane.
- Relocate all pedestrian signal and traffic signal infrastructure, surveillance equipment, location of Stop Bar as well as location of Pedestrian crossings, consistent with the revised junction geometry.
- Channelize existing Aundh approach with the use of barricade (temporary) or extending the footpath (permanently) to provide a constant width for the carriage way to prevent drastic lane change manoeuvres at mouth of the junction at this leg.
• Extend existing footpath (traveling towards the junction) to accommodate the surplus unused space (illegally used by auto-rickshaw and buses to park).
• Extend existing landscape island under the flyover to the proposed pedestrian crossing.
• Channelize the existing Shivajinagar approach road (towards the junction) from Pashan Road ramp with the use of lane markings (temporary) and subsequently replacing them with barricades (temporary) and eventually extending the landscape island (permanently) to provide a constant width for the carriage way to prevent drastic lane change manoeuvres at mouth of the junction at this leg.

**B. SB Road Junction**

• Install dividers to prevent motorists from making right turn manoeuvres in between the existing flyover piers. Opening for the right turn lane under the flyover to be provided upstream of this junction.
• Install a channelizing central island to separate right turning traffic and through traffic. It is recommended that this island be created with the help of temporary barricades and subsequently be made into a permanent pedestrian refuge island once the general public has had an opportunity to get accustomed to it.
• Replace existing channelizing island with a new channelling island to accommodate a better turning radius for traffic making a left from SB Road towards University junction.

### 6.2. Long Term Improvements

• Consistent with the smart city initiative for Pune city a sustainable solution promoting public transit was proposed for University junction. A BRTS corridor through University junction was recommended as a long term solution for this junction.
• Considerring voluminous pedestrian count, provision of underpass for pedestrian can be done as long term improvement from pedestrian safety point of view.

**REFERENCES**

Optimized Solutions For Resolving Traffic congestion At University Circle


