A Study on Re- Appropriation of Intersections in Bhopal City

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Abstract

It is observed that well over half of the fatal and serious road accidents occur at intersections. The intersections in these roads are the bottleneck for them because the efficiency, safety, speed, cost of operation and capacity of the facility depends on the intersection design to a great extent. Each intersection involves through- or cross- traffic movements on one or more of the highways and may involve turning movements between these highways. Such movements can be facilitated by various geometric designs and traffic controls, depending on the type of intersection. Hence there is an urgent need for the proper designing of the various important intersections on the basis of current real time information as well as future predictions and also satisfying various codal provisions setup by IRC. The intersection is defined as encompassing all alterations (for example, turning lanes) to the otherwise typical cross sections of the intersecting streets. Intersections are a key feature of any street design in four aspects: focus of activity, conflicting movements, traffic control, and capacity. The scope of this study is limited to re- appropriation of five intersections of Bhopal city which are chosen according to the variance in their traffic and their situation in the Bhopal area, viz. Mangalwara Junction is located in old Bhopal city, where there are large number of pedestrians as well as 2- wheelers, and also heavy commercial vehicles due to transport business nearby, while on the other hand, Jyoti Talkies Intersection is situated in New Bhopal city in commercial area of M P Nagar which has a huge number of 2- wheelers as well cars and small buses of city transport. The Piplani Junction and J.K. Road Junction
are having large numbers of heavy commercial vehicles like trucks and dumpers flowing through them, MANIT Intersection has large number of 2-wheelers due to its connection with MANIT college, and also it has huge traffic flowing from the Kolar road to New Market and Nehru Nagar and vice-versa.

Keywords: Intersections, Rotarized Intersections, Channelizing Islands

Introduction

An intersection is the area where two or more streets join or cross at-grade. The intersection includes not only the pavement area, but typically the adjacent sidewalks and pedestrian ramps. Intersections are a key feature of street design in four aspects: focus of activity, conflicting movements, traffic control and capacity. All roadway users are affected by intersection design such as pedestrians, bicyclists, motor vehicles in transit. In addition to the users of the street and intersections, owners and users of adjacent land often have a direct interest in intersection design. The primary concerns include maintenance of vehicular access to private property, turn restrictions, consumption of private property for right-of-way, and provision of safe, convenient pedestrian access. The major street is typically the intersecting street with greater traffic volume, larger cross section, and higher functional class, and the opposite is true for minor street. Sidewalks, crosswalks, and wheelchair ramps are considered to be within the intersection. The pavement corner is the curve connecting the edges of pavement of the intersecting streets. Auxiliary lanes are lanes of traffic added at the intersection. Channelizing islands may be added to an intersection, to help delineate the area in which vehicles can operate. Islands can also provide for pedestrian refuge. Intersection legs are the segments of roadway adjacent to the intersection. The side of the leg used by traffic approaching the intersection is the approach leg, or simply approach, and the side used by traffic leaving is referenced to as the departure leg. Intersections can be categorized into four major types, depending on their basic configuration: Simple Intersections, Flared Intersections, Channelized Intersections, and Roundabouts.

Objectives of the study

The objectives of the study are as follows:

(i) Study of the existing scenario of the intersections in Bhopal City.
(i) Re-appropriation of intersections in Bhopal City.

**Literature Review**

NCHRP Report 650 (2010), describes common safety issues at median intersections on rural divided highways and presents innovative geometric and operational treatments for addressing those issues. It includes recommendations for modifications to the AASHTO- A Policy on Geometric Design of Highways and Streets (Green Book) and the Manual on Uniform Traffic Control Devices (MUTCD). Kent J. Fugal et al. (2008), [7] emphasized on the Design for Single-Lane to Dual-Lane Roundabout Expandability. This article explores the characteristics of a good expandable roundabout design, including basic procedures that should be followed. Ragnhild Davidse (2007) is concerned with the possibilities offered by road designs and driver assistance systems to improve older adults’ safe and independent mobility by compensating for their age-related functional limitations. Kay Fitzpatrick et al. (2002), [8] emphasized on the issues to be considered in developing an Intersection design guide. He throws light on the fact that safe and efficient operation of an intersection is directly related to its design, and decisions made during the design of an intersection occur after examining a series of tradeoffs. Synthesis of Highway Practice 264 (1998) [1], provided information on current practices with respect to the planning, design, and operation of modern roundabouts in the United States. In an effort to correct this situation, a continuing NCHRP project, is being carried out by the Transportation Research Board as the research agency. Bruce Hellinga et al. [2] has given Signalized Intersection Analysis and Design and its implications of day-to-day variability in Peak, which explores the number of days for which intersection approach volumes should be counted in order to establish intersection delay within a desired level of confidence. IRC-SP-41, ‘Guidelines for the Design of At-grade Intersection in Rural and Urban Areas’ and IRC-SP-65, ‘Recommended Practice for Traffic Rotaries’ have been reviewed in this regard.

**Methodology**

**Selection of Study Area**

- The study area includes old and new Bhopal, considering the heterogeneity of the traffic as different conditions prevail in different junctions.
• Following are the junctions that are taken under the scope of this study:
  
  i. J.K. road Intersection
  
  ii. Piplani Intersection
  
  iii. Jyoti Talkies Intersection
  
  iv. MANIT Intersection
  
  v. Mangalwara Intersection

Conducting Surveys

• Total Station survey of the Intersections.

• Traffic volume survey at all legs of the Intersections.

Analysis of the surveyed data and design of intersections

After the completion of the surveys, the analysis of the surveyed data is done in order to design the junction on the basis of the real time data and in accordance with the relevant IRC codal provisions.

Development of Modified Intersections

Design of J.K. Road Intersection

The intersection considered is a three legged intersection. The two legs are of Raisen road and the third leg leads to JK Road. It is an uncontrolled intersection, as there are no pavement markings, physical dividers like median on through route, channelizing islands, traffic signals and no pedestrian crossing facilities. Therefore, to design the intersection for the safe and efficient functioning, peak hour traffic volume surveys at the intersection are carried out. The observations and recommendations for the intersection are as follows:-

• The traffic intensity at the intersection is very high for the safe operation of traffic at the intersection in its present situation.

• To provide traffic signals and to remove encroachment on all the three legs to enhance the capacity of the junction.

• To streamline the vehicular traffic and to provide refuge to the pedestrians crossing the road,
channelizing islands are proposed as shown in the drawing sheet.

- To enhance the visibility of the junction at night, it is recommended to provide High Mast light to lighten the junction area.

![Figure 1. Existing Details of J.K. Road Intersection](image1.png)

**Figure 1. Existing Details of J.K. Road Intersection**

![Figure 2. Details of Proposed J.K. Road Intersection](image2.png)

**Figure 2. Details of Proposed J.K. Road Intersection**

**Design of Piplani Intersection**

The peak hour traffic volume survey at the Piplani Petrol Pump intersection was carried out. The observations and recommendations for the intersection are as follows:

- The peak hour traffic volume at the first three legged Intersection Sonagiri side i.e. considering the three legs is 6000 PCU per hour.

- The intersection gets locked frequently because of high volume of crossing and turning traffic, especially during peak hours. The staggered junction has become completely incapacitated and present traffic management measures are inadequate to deal with such a high intensity traffic volume.

- The junction should be signalized with necessary widening on all the
legs of the intersection as shown in the drawing sheet.

- Encroachment on all the four legs should be removed to enhance the capacity of the junction.

- Traffic signal at the intersection needs to be designed based on real time data.

Figure 3. Details of Existing Piplani Intersection

Figure 4. Details of Proposed Piplani Intersection

Design of Jyoti Talkies Intersection

The Jyoti Talkies intersection is a four legged intersection. The Board office leg & leg towards Chetak Bridge are part of the major road. The intersection is a Rotary intersection and does not have pavement marking, channelizing islands, traffic signals, medians for through route and pedestrian crossing facilities. Therefore to design the intersection, peak hour traffic volume surveys at the intersection have been carried out. The observations and recommendations are as follows:

- The peak hour traffic volume of the four legged intersection is 5500 PCU/hour. The situation is not fulfilling the safe and efficient operation of traffic due to high intensity of traffic volume.

- The intersection gets locked frequently because of high volume of crossing and turning traffic.
especially during peak hours. The rotary junction has become completely incapacitated and present traffic management measures are inadequate to deal with such a high intensity traffic volume.

- The junction should be signalized with necessary widening on all the legs of the intersection as shown in the drawing sheet.
- Channelizing islands should be provided to streamline the vehicular traffic and refuge for pedestrians crossing the road according to drawings.

Design of MANIT Intersection

The intersection is a four legged intersection; one is towards Bittan Market, second is towards New Market, third is towards Nehru Nagar, and fourth is towards MANIT. The observations and recommendations for safe and efficient functioning of this intersection are as follows:

- The peak hour traffic volume of the four legged intersection is 4800 PCU/Hr.
- The existing Rotary diameter is inadequate so Rotary diameter should be minimized according to given drawing, to accommodate the heavy volume of traffic.
- The pavement marking & traffic signs should be provided at the
Design of Mangalwara Intersection

Mangalwara junction is a five legged intersection and all the legs have high volume of traffic intensity. The intersection is surrounded by dense commercial as well as residential establishments. Presently the intersection is an uncontrolled intersection and does not have channelizing islands, traffic signals, pedestrian crossing facilities, pavement markings, and high mask lights for proper night vision. Therefore to design the intersection for safe and efficient functioning, three days peak hour traffic volume survey at the intersection was conducted. The observations & recommendation for the intersection are as follows:

- The peak hour traffic volume of the five legged intersection is 6000 PCU/hour. This traffic intensity is very high for safe and efficient operation of traffic at the intersection.

- Existing bus stops should be removed and should be located 75 meter away from intersection, that too on the further side of the intersection.

- The high mask light should be provided at the junction area for better visibility at night.
• Signals should be provided at the intersection. This signalization should also have pedestrian timings (IRC: 93-1985).

• All the five legs should be widened according to the given drawings and channelizing islands should be provided to streamline the traffic and provide refuge for pedestrians crossing the road.

• High mask light should be provided at the junction area for better visibility at night.

Figure 9.Existing Details of Mangalwara Intersection

Figure 10.Proposed Details of Mangalwara Intersection

Conclusion

The increase in road accidents at intersections is one of the burning issues in the present situation. The number of fatalities and injuries as a result of accidents at intersection in Bhopal is serious enough to demand attention of responsible administrative authority. The intersection is the most important part of the roads and requires prime attention for their proper planning and designing. If the traffic volume exceeds the 10000 PCU per hour at an at-grade intersection, a grade separated intersection is suggested. The junction should be free from encroachment on all the legs to enhance the capacity and proper visibility. To provide refuge to the pedestrians, channelizing islands should be provided. Traffic signs, traffic signals and pavement markings need to be provided. A road safety audit at intersections must be carried out by road professionals to
compare existing characteristics of the intersections, that may be related to congestion and accidents (width of carriageway, obstacles at the intersection, signalized or not, design of signal, visibility, channelizing islands, quality of surfacing, traffic sign and marking etc) to standard characteristics meeting safety requirements.

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References


