

STUDY OF TRAFFIC PROBLEMS AND SUGGESTED SOLUTIONS OF THOKAR NIAZ BAIG INTERSECTION

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ABSTRACT

The Thokar Niaz Baig intersection is a very busy junction in the South-West side of Lahore. It connects Johar town, Raiwind, Campus, Chuburji, and Lahore-Islamabad Motorway through Shahpur interchange. Vehicular jam, long queues, long delays, and sometime accidents during peak hours are frequent at this junction. The rise in the average temperature of atmospheric and noise pollution was observed at this junction due to heavy traffic. For smooth and rapid flow of traffic through this junction, geometric and traffic improvements are of savior importance. To come up with an appropriate solution for the junction, a methodology was devised which includes traffic studies, topographic survey & development of practical alternatives. Traffic studies included a manual classified count, delay, travel time, congestion, and queues. Topographic survey involves establishment of horizontal and vertical control and pulling in the junction in AutoCAD. Two practical alternatives are presented, out of which Option No.1 is recommended to take away. The study revealed that only the grade-separated arrangement at the junction is feasible. Entirely the same, if a link road between Mohlnwal road and Multan road is provided to decrease the number of intersecting legs, the effect would be more feasible. Other traffic engineering solutions like proper bus stops, road signs, and pavement marking can also be implemented to increase the efficiency of the junction.

1. INTRODUCTION

Lahore is the provincial capital and Punjab's main cultural, historical, administrative, and economic center. It is the second largest metropolitan city in Pakistan. The Thokar Niaz Baig intersection is located at South-West side of the Lahore division. It connects Raiwind, Chuburji, Johar Town, University of Punjab New Campus, and Lahore-Islamabad motorway through Shahpur interchange, as shown in the Figure 1. If we see the area near the intersection, the Population growth, universities, schools, colleges, hospitals, commercial areas i.e. Metro store and industries on Raiwind side, all are passing and are connected to the entire city through this intersection. There are twenty five housing societies and hundreds of industrial units from Thokar Niaz Baig to Mohlnwal Bridge [1]. The traffic volumes on all the major roads of Lahore city are estimated up to eight thousand vehicles per lane [2]. Keeping in view all the traffic problems due to development of the area, including the effect on the average increase in temperature due to traffic congestion and a lot of fuel consumption, it is necessary to carry out deep studies on this junction.

The Thokar Niaz Baig Chowk is typically five-legged, grade-separated intersection. In June 2005, before the construction of the flyover, 79350 motorized vehicles passed per day through this intersection [3]. At present, the increase in population, educational facilities, economy of the area, VIPs movements, and heavy pedestrians have put tremendous effect on this junction. At present (year 2014), 121785 motorized vehicles per day passed through this junction [4]. The intersection having two twin bridges (S-curved) with At Grade Signalized intersection. The Bridges having 2766 feet length, 575 feet level portion, 19.5 feet vertical clearance, 3 lanes each side, 46 piers, 4 abutments, and 36 inch diameter of pier piles etc.

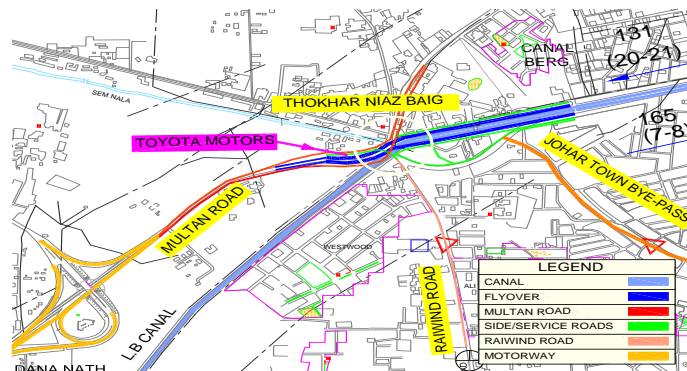


Figure 1: Location Plan Of Thokar Niaz Baig Intersection

Due to long delay, queues, problem for pedestrians crossing the intersection, accidents, and vehicle jam during peak hours, Traffic Engineering and Transportation Planning Agency, Lahore decided to remodel the intersection. A circulatory improvement has been made to overcome the existing problems. All the traffic is circulating in one direction (Clock wise), meeting the yield of each leg [5]. Concrete barriers are used to develop islands inside the intersection's functional area.

2. OBJECTIVES

- To provide safety for the users of the intersection
- Congestion and jam less flow of traffic
- Reduce environmental problems caused due to heat emission when vehicular congestion occurs
- Increase driver confidence, crossing the intersection
- Less fuel consumption
- To facilitate the future development in the project area with Minimum delay

3. SITE STUDIES

The speedy growth of vehicles in Lahore division has put a terrible impact on the capacity of the intersection. In order to come up with the best possible solution, it needed to conduct a comprehensive study on site.

3.1. Topographic Survey

Topography is actually concerned with local details in general. We conducted the Topographic survey with the help of a Total Station and distance measuring Tape. A temporary Bench mark is used to find the Coordinates and Elevations of Different Points. The control points are shown on the topographic map of the intersection. All the points are identified as T1, T2, T3, ---up to T13. The alphabet 'T' is used to indicate the Thokar Niaz Baig intersection and Numeric 1, 2, 3---up to 13 represent point numbers as shown in the Table 1.

Table 1: Details of Survey Control Points

| | East | Northing (ft.) | Elevation (ft.) |
|-----|------|----------------|-----------------|
| 1 | 2 | 3 | 4 |
| T1 | 500 | 5000 | 500 |
| T2 | 467 | 4744.79 | 498.42 |
| T3 | 515 | 4611.80 | 499.63 |
| T4 | 525 | 4089.94 | 496.96 |
| T5 | 544 | 4608.72 | 501.47 |
| T6 | 536 | 5076.66 | 501.25 |
| T7 | 559 | 5370.18 | 501.68 |
| T8 | 502 | 5312.67 | 499.72 |
| T9 | 508 | 5697.20 | 498.28 |
| T10 | 455 | 4940.75 | 499.64 |
| T11 | 482 | 4917.71 | 494.30 |
| T12 | 506 | 5089.20 | 497.44 |
| T13 | 527 | 5170.88 | 497.92 |

After measuring co-ordinates and reduce levels of different point, using AutoCAD we plotted that points in AutoCAD to produce a final drawing with different survey control points and different physical features of the area.

3.2. Traffic Volume

We conducted a traffic survey at each leg of the intersection with the help of six to eight observers. Mobile camera is used to count vehicles where the counting was difficult. On each leg, during am & pm peak hours, we counted each direction vehicles for each quarter. The vehicles passing through the intersection are classified into different categories to cover Motorcycles/Scooters, Rickshaws/Motorcycle Rickshaws, Cars/Taxis/Pickups, Wagons (Toyota Hiace), Transit passenger vehicles with 12-18 seats), Busses/Coaches with 45-55 seats, Coasters/Flying Coaches/Mini Busses (24 seats), School Busses, Loader Pickups, Trucks 2-Axles, 3-Axles, 4-Axles, 5 Axles and above, Tractors with and without Trolleys, and Non-Motorized (cycles and animal drawn vehicles). After the completion of traffic survey,

we know about the peak hour traffic flow of each direction. We observed peak hour traffic at site from 8:00 am to 9:00 am and from 5:00 pm to 6:00 pm. From the known data of traffic during am and pm peak periods, the higher number of traffic was selected as peak hour traffic volume for the year 2014. According to AASHTO and some other agencies, the Peak Hour Traffic is 10-15 % of Average Daily Traffic (ADT) [6]. Considering these researches, the Average Daily Traffic at this intersection was calculated to an average value of 121785 vehicles/day.

3.3. Traffic Growth

Traffic growth in Lahore division is adopted to come up with a better vehicle growth rate. Doing so, the data of registered vehicles in the Lahore division is collected from Bureau of Statistics, Punjab, Pakistan. The average growth rates are then calculated by taking the arithmetic mean of past five years growth rates of registered vehicles in the Lahore division. It is observed that the traffic in the surrounding area will increase 14 to 20 percent per year. The greatest contribution of traffic growth in the project area is of Pickups/ Vans, because their growth rate is very high. This study shows us that an alternative is required to fulfill the requirements of the area in future.

3.4. Delay And Travel Time Studies

Delay and Travel time is observed and counted at site. For this purpose a Stopwatch is used. In a moving vehicle, we actually traveled at each direction during peak hours. The maximum delay and travel time direction is Mohlnwal to Raiwind road, having an average 43 and 63 sec, delay and travel time, respectively.

3.5. Existing Problems

The Traffic Engineering and Transportation Planning Agency Lahore, at the start of year 2014, revised the traffic movement system at the intersection. We observed different problems, visiting the site during peak and off peak hours. We also gain information from traffic wardens on site. All the traffic difficulties are discussed below.

3.5.1. Pedestrians

If we see the intersection in plan, the intersection is wider at all directions. We observed that normally vehicular speed at the intersection during off peak hours is higher. The pedestrians crossing the intersection during off peak hours enforce vehicles to reduce speed. Pedestrians crossing the intersection from Chuburji to Raiwind direction are more problematic because the waving vehicles get a lengthy and wider road to move fast. This phenomenon could increase the possibility of accidents. The pedestrians crossing the intersection are shown in the Figure 2.

3.5.2. Vehicular jam

As we carried out traffic survey, we noticed the traffic condition. A very huge traffic is generated from the surrounding area, sometimes causing a vehicular jam during peak hours. We observed that there are total three locations where vehicles cross each other very difficultly. The vehicles yielding from Mohlnwal road cross the vehicles which are passing to Multan road. These vehicles are higher in number and thus during peak hours due to vehicular congestion, long queues are formed at the yield of the Mohlnwal road. At the yield of Chuburji road the situation is same. A very huge traffic of Canal road is crossing the vehicles of Chuburji to New Campus, Raiwind, Mohlnwal, and Multan road. The area where the crossing occurs is very small, so during peak and sometime during off peak hours the vehicles are queued and cause vehicular jam. Sometime vehicles queue extended up to the yield of Multan road as shown in the Figure 3.



Figure 2: Pedestrians Crossing The Intersection During Off Peak Hours



Figure 3: Traffic Congestion And Queues At Yield Of Chuburji Road

Traffic from Canal road and Nazria-e-Pakistan Avenue is very heavy. When they are passing to Mohlnwal, Multan, and Chuburji, they cross vehicles of Raiwind road. Vehicles cross each other at a high speed which could cause accidents. On the other hand, long queues are formed at Raiwind road during peak hours due to the bottleneck at Raiwind road and improper bus stops. Photograph taken at this bottleneck during site study is shown in the Figure 4.



Figure 4: Long Queues At Raiwind Road (Both Directions)

3.5.3. Unused area

We see that there is a large area at the center of intersection, which is not in use after the circulation improvement made by TEPA. The best use of this area would be very helpful for the solution of existing problems.

3.5.4. Delay and travel time

For each direction delay and travel time is different. We observed that during peak hour congestions and queues are frequent. As we see the drawing, the total length of path from Multan to Mohlnwal road is 2700 feet, from Chuburji to Mohlnwal road is 2200 feet, and from Canal and New Campus Road to Chuburji road is 2200 feet. Because of heavy traffic and lengthy path, these vehicles face longer travel time and delay. All the above directions are facing very longer travel time and delay as compared to other intersections in Lahore.

4. DEVELOPMENT OF PRACTICAL ALTERNATIVES

Based on the data gained during site studies and concerning the economy of the area, following two options are suggested. One of the following three may be selected to implement.

4.1. An Underpass Between Raiwind Road And Chuburji Road With At-Grade 4-Legged Roundabout

In this option an underpass is suggested between Raiwind road and Chuburji road. The piers of the flyover are named as P1, P2, P3, up to P18 as shown in Figure 5.2. The underpass from Raiwind to Chuburji road may be passed through the clear distance between piles of P7, P8, and P9, P10. The clear distances between these piles, where the underpass would be passed is approximately 73-feet. The horizontal distance between these piles is sufficient to provide an underpass from one direction. If we provide three, 12-foot lanes in this direction then the safe distance remaining on each side of the underpass to the piles is 18.5-feet. If we provide 4-foot footpath for maintenance purpose or for pedestrians then the safe horizontal distance remaining is 16.5-feet. The horizontal distance remaining on each side is safe for the construction of underpass. On the other hand the underpass for vehicles from Chuburji to Raiwind road can also be facilitated with an underpass. In this case the underpass will be passed between piles of P5, P6, and P7, P8. The horizontal clear distance is 62-feet approximately, for the provision of the underpass. Three, 12-foot lanes with 4-foot footpath may also be provided. The safe distance between the piles and underpass on each side is 11-feet, which is safe for the construction of underpass or it may be satisfied against safety by providing a retaining wall. If we talk about vertical alignment of the underpass, according to the drawing provided by C&W, Lahore, there are six piles under each pier with a five feet thick pile cap. They are driven into a hard strata up to 80-110 feet. There is a canal flowing at the center of flyover up to the area where the underpass is proposed. The canal bed level in this area varies from 498 to 493 feet approximately. The total vertical distance between canal bed and pile end is approximately 85-feet, which is safe to provide an underpass with a 20-foot vertical clearance. To avoid the bottleneck on Raiwind road, some area is needed to provide ramps. The alternative discussed is shown in Figure 5.

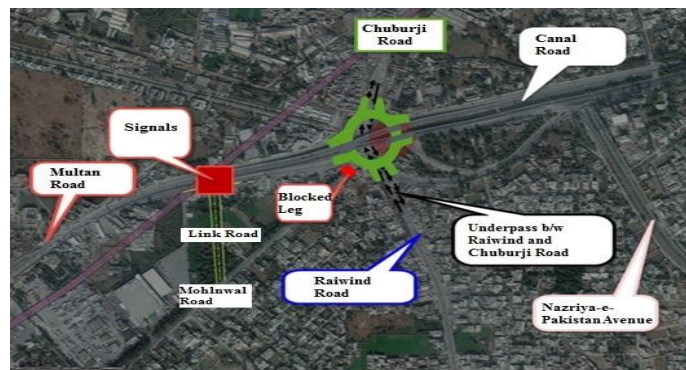


Figure 5: Alternative/ Option No.1

To decrease the number of intersecting legs, it is proposed to connect the Mohlnwal road with Multan road, far from the intersection. The residents of Westwood Colony and nearby area will not pass through the intersection, directly through Mohlnwal road, but will follow the Multan road through this link road. Some signal arrangement would be needed on the Multan road to avoid the possibility of accident. In this alternative some extra land would be required for the link road connecting Mohlnwal road to Multan road. If we see the AutoCAD drawing of the intersection, the clear distance between P5, P6, and P7, P8, is

minimum 73-feet and between P 9, P10, and P12 is 61.5-feet. A four-legged roundabout is proposed keeping in view the available distance between the piers. The roundabout may be provided with external diameter of 446-feet and internal diameter of 144-feet. To do so P3, P4, and P16 will be outside the roundabout and P5, P6, up to P15 will be inside the roundabout. In this proposal, no extra land is required because the roundabout is small and the area is already available. This arrangement is shown in the Figure 6.

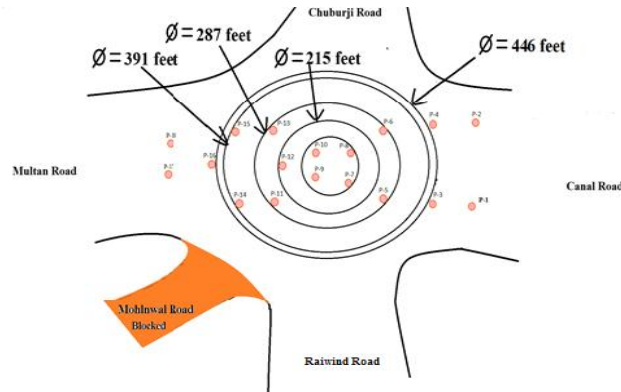


Figure 6: Lane Arrangement Between Piers

4.2. An Underpass Between Raiwind Road And Multan Road With At-Grade 4-Legged Roundabout

In this proposal an underpass between Raiwind and Multan road is suggested which will form a curve. The underpass will be provided separately for both directions. From Multan road to Raiwind road, the underpass will pass between piles of P16, P11 and P15, P12. The clear distance available between the piles of these piers is 48-feet. If we provide two lanes each 15-feet, then there will be a safe distance of 7-feet on each side. For the vehicles of Raiwind to Multan road, the underpass may be provided safely because it will not pass between the piers. After the provision of underpass, it is also suggested to provide a four-legged roundabout as discussed in the first option, to insure continues flow of vehicles.

5. CONCLUSIONS AND RECOMMENDATIONS

The Thokar Niaz Baig Chowk is one of the busiest intersections in Lahore. It connects Raiwind, Johar town, University of Punjab New Campus, Chuburji and Lahore-Islamabad Motorway through Shahpur interchange. Huge traffic is generated from these areas and high percentage of traffic volume is passed through this intersection. Sometime during peak hours, long queues, accidents, and time delays are frequent at this intersection. For smooth and rapid traffic flow at this intersection, geometric and traffic improvement is imperative. In order to come up with an appropriate solution, both options were studied.

5.1. Conclusions

- Before the implementation of the circulation improvement, there were long queues, time delay, and vehicular jam at the intersection
- At present time, with the help of the circulation improvement, the traffic is regulated, but during peak hours the Raiwind road is queued and sometimes causes traffic jam

- During peak hours on the left side of the flyover towards Chuburji side, inside the intersection, long queues and traffic jam is observed during peak hours
- There is no short term solution possible for the intersection as the maximum area of the intersection is already under the use of traffic
- No further improvement in signal timing can reduce delay as the signals were manually operate during peak hours, before the circulation improvement
- Provision of the underpass is the only option that can increase the intersection capacity, reduce time delay and long queues, at present as well as in future
- Provision of an alternate route between Mohlnwal and Multan road would reduce the number of intersecting legs and hence reduce the complexity of the intersection
- Roundabouts can safely slow traffic flow and enhance traffic flow because the traffic flow is continuous
- Considering a Roundabouts, the environmental pollution and noise can be reduced

5.2. Recommendations

It is always better to open new corridors rather than spending huge money on the widening of existing corridor. Therefore, as a first priority, it will be more beneficial and cost effective to provide a free way to the legs of heavy traffic.

We recommend to implement Option No.1. In this option the vehicles passing through the intersection between Raiwind and Chuburji road would be having an underpass of 3-12 feet lanes in each direction. In this option, during the construction of underpass, stability operations for the flyover are not required. The underpass would be somewhat deep as compared to other underpasses in Lahore. The steep slopes can be avoided by the provision of long ramps on each side. A four-legged roundabout having an external diameter of 419-feet is also recommended. The roundabout proposed over there would thus take the area which is blocked and unusable at present traffic circulation pattern. For the pedestrians to cross the intersection, foot bridges of steel could be provided, so that they do not cross the vehicles at grade. The vehicles from Mohlnwal road will not pass through the intersection directly, but they will have to use a link road connecting Multan and Mohlnwal road. An extra land is needed to provide this alternate route. A Minor adjustment in geometric design like provision of pavement marking, channelization, exclusive buss lanes, road signs etc will enhance the capacity of the intersection.

6. REFERENCES

- [1] Naseem ur Shah., (2011), EPD Director, “Conference with The News on the development of Thokar Niaz Baig”
- [2] Traffic Engineering and Transportation Planning Agency, Punjab Pakistan. (2013), Transportation planning for Lahore.
- [3] Communications and Works Department, Punjab, (2005) "Thokar Niaz Baig Traffic Planning", Intersection Improvement Presentation,
- [4] Based on our study of Traffic Volume
- [5] The Express Tribune, “Remodeled Thokar Niaz Baig intersection”, Newspaper, December 23rd, 2013
- [6] American Association of State Highway and Officials, “Green Book”, 2004, Chapter 2nd