Evaluation of Pedestrian Level of Service at Selected Intersection of Rajkot City

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Abstract— Pedestrian walking is a major mode of transportation in Indian cities and also effective mode of transportation for short trips. In this study pedestrian Cross walk data was collected from two locations in Rajkot city, India. The data was collected at R.M.C chowk and Mavdi chowk. These data were analyzed for finding pedestrian characteristics like speed, flow and density. Pedestrian characteristic is depending on gender of the pedestrian, age of pedestrian and type of facilities. Capacity and level of service for about two sections was do in this study and compare the current level of service and facilities for pedestrian. Important to evaluate the quality of service of such crossing facilities with respect to under mixed traffic conditions. Road crossing difficulty as well as safety considered as primary factors along with pedestrian individual factors (gender and age), land-use type and roadway geometry. The inferences of these results highlight the importance of land use planning in designing a new set of pedestrian access facilities for unprotected crosswalks under mixed traffic conditions. Also, the study results would be useful for evaluating pedestrian accessibility taking into account different planning required degree of segregation with vehicular movement at unprotected mid-block crosswalk locations.

Key words: Level of Service, Pedestrian, Road User, Speed, Flow, Density

I. INTRODUCTION

Transportation Pedestrian walking is a mode of travel to a given destination on foot. In transportation this type of mode is effectively used for short trips. Walking is a major mode of transportation in middle and low-class cities. In transportation many trips are originated and ended walking only. Developing country like India pedestrian walking is a major mode of transportation. The urban population in India was increased year by year; in 2001 the urban population was 27.81% after 10 years in 2011 this population reached to 31.16% because better facilities for pedestrians have been provided by us. One study told that Tiruchirappalli city 64.7% of the total trips are made on foot. Another study conducted in Mumbai they can told that all persons walk in a day irrespective of their income (Montgomery, 2006).Because better facilities have been provided for pedestrians are important criteria in urban areas. Now a day the local authorities are interested to provide good pedestrian facilities to encourage walking.

According to modal split study conducted in Mumbai in India told that out of nearly 2.85 million trips, 52.4% trips are walking trips (MMRDA 2008). African cities have more walking trips comparatively Asian and Latin-American cities. The average walking trips percentage of Africa, Asia and Latin-America cities are 57, 37and 22% respectively (Montgomery 2006).

HCM (2010) designates six level of service from "A" to "F" for pedestrian facility, with LOS "A" representing the best operating conditions and LOS "F" the worst. It used distinct average pedestrian space values as boundaries for the various LOS. According to HCM 2000 pedestrian facilities can be of two types that are uninterrupted and interrupted. When pedestrian facilities are not affected by any motorized modes of travel then the facility is known as the uninterrupted pedestrian facility or off-street pedestrian facilities and vice versa. Several studies have been performed relating to the analysis of PLOS of pedestrian facilities. As PLOS is not well defined for highly heterogeneous traffic flow condition on urban corridors in India, an attempt has been made in this regard to define pedestrian level of service criteria in this study. In this study two important intersection, R.M.C. chowk and Mavadi chowk of Gujarat state, India are taken as the study area. By using video data collection procedure all the field data like speed of pedestrian, effective walkway width and pedestrian hourly volume are collected. For the determination of different level of service (LOS) categories parameters like flow rate, pedestrian space and volume by capacity ratio are calculated. Then with the help of Affinity Propagation clustering methods six different ranges of PLOS categories that are from "A" to "F" are determined.

II. OBJECTIVES OF STUDY

- To assess the pedestrian movement at selected intersection.
- To find the pedestrian capacity and level of service study for providing better facilities for Pedestrian.

III. LITERATURE REVIEW

A. Archana. G, Reshma. E.K Analysis of Pedestrian Level of Service for Crosswalk at Intersections for Urban Condition (2013) IJRET Vol 1 (06), October – December 2013, ISSN 2321-2543, pg 604-609

These paper is on estimation of pedestrian level of service (LOS) is the most common approach to assess quality of operations of pedestrian facilities. Intersections, by their very nature, are locations where there is considerable potential for conflict between different traffic streams and different users. At busy intersections motorists, cyclists, and pedestrians often have to deal with complex situations and be aware of the position, movement and intent of other users. Mixed traffic of motor vehicles and pedestrians are common in urban intersections. Their study explains a method for the estimation of pedestrian LOS at intersections and also identifies the factors affecting pedestrian level-of service LOS at intersections.

B. Singh K., Jain P.K. Methods of Assessing Pedestrian Level of Service (2011) Journal of Engineering Research and Studies E-ISSN 0976-7916

The aim of this paper is to improve the pedestrian level of services in existing facilities. Such a measure of walking conditions would be helpful in roadway cross- sectional design. It would also help evaluating the needs of existing roadways for sidewalk construction. Estimation of pedestrian level of service (LOS) is the most common approach to assess quality of operations of pedestrian facilities. The focus of this study is to review current Methods of assessing pedestrian level of service (PLOS) and discussing some new concepts which have been proposed by the researchers to evaluate pedestrian environment in a batter way

C. B Raghuram Kadali, P. Vedagiri Evaluation of Pedestrian Crosswalk Level of Service (LOS) In Perspective of Type of Land -Use (2015) Transportation Research Part A 73 (2015) 113–124

In India pedestrians usually cross the road at mid-block crosswalks due to ease of access to their destination or the development of adjacent land use types such as shopping, business areas, school and residential areas. The behavior of pedestrian will change with respect to different land use type and this change in behavior of pedestrian further reflects change in perceived level of service (LOS). So, it is important to evaluate the quality of service of such crossing facilities with respect to different land-use type under mixed traffic conditions. In this framework, pedestrian perceived LOS were collected with respect to different land-use type such as shopping, residential and business areas. The ordered probity (OP) model was developed by using NLOGIT software package, with number of vehicles encountered, road crossing difficulty as well as safety considered as primary factors along with pedestrian individual factors (gender and age), land-use type and roadway geometry. From the model results, it has been concluded that perceived safety, crossing difficulty, land-use condition, number of vehicles encountered, median width and number of lanes have significant effect on pedestrian perceived LOS at unprotected (un-signalized) mid-block crosswalks in mixed traffic scenario. The inferences of these results highlight the importance of land use planning in designing a new set of pedestrian access facilities for unprotected mid-block crosswalks under mixed traffic conditions. Also, the study results would be useful for evaluating pedestrian accessibility taking into account different land-use type and planning required degree of segregation with vehicular movement at unprotected mid-block crosswalk locations.

IV. STUDY AREA

Study Area: In these research study there are two areas is considered in Rajkot city 1st location is R.M.C chowk and 2nd location is Mavdi chowk. Both intersection have BRTS path and at BRTS bus station. Both the intersection having crowded and almost traffics for student as well as daily workers and market.

V. DATA COLLECTION

Data was collected at two Intersection for determination of Level of service. Pedestrian interview classified volume count and Pedestrian volume count and speed of pedestrian data was collected. Videography method is adopted for CVC & Pedestrian count and find Speed at intersection. Data was collected at fifteen-minute interval for cvc and pedestrian count one-minute interval is considered. With volume of pedestrian and with average speed of pedestrian data density and flow of pedestrian found.

VI. DATA ANALYSIS

A. Road Inventory Drawing

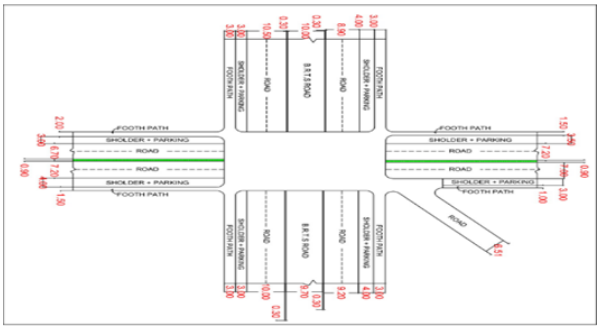

Fig. 1: road inventory drawing of mavdi chowk

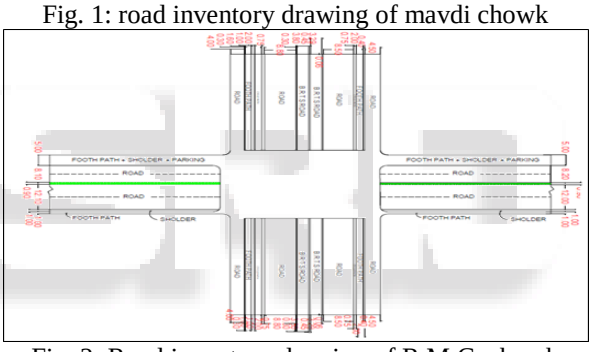

Fig. 2: Road inventory drawing of R.M.C. chowk

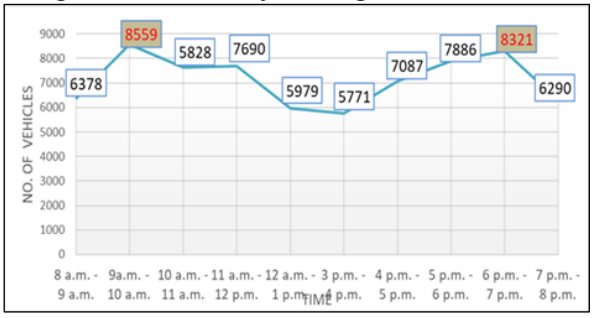

Fig. 3: Vehicular composition at mavdi chowk

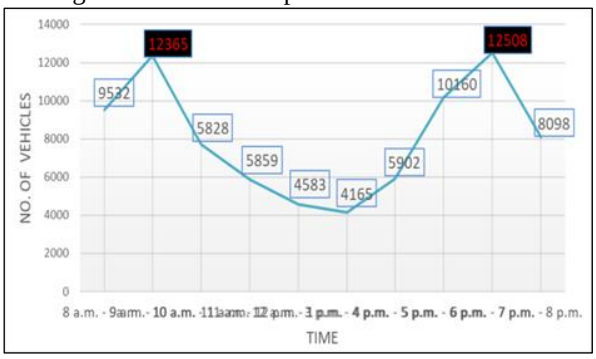

Fig. 4: Vehicular composition at R.M.C chowk

B. Pedestrian Volume Count Survey;

Pedestrian volume count was taken at that legs where is movement of pedestrian is high particular cross walk of these both intersection. This survey was carried out in morning at time 9 a.m. to 1 p.m. and in the evening at time 5 p.m. to 9 p.m. pedestrian volume is mainly calculated as a video graphic survey.

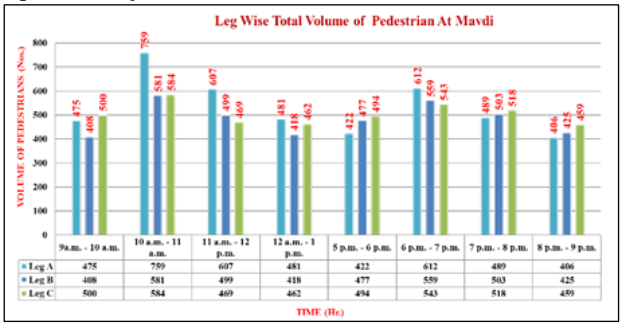

Fig. 5: volume of pedestrian at Mavdi Chowk

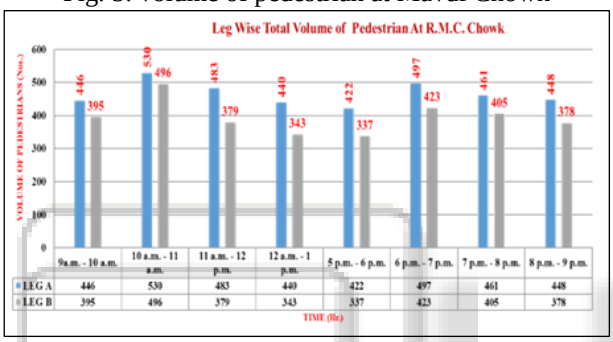

Fig. 6: Volume of pedestrian at R.M.C. Chowk

C. Fundamental relations

The speed(u)-density(k), flow(q)-density(k), speed(u)-flow(q) curves will be plotted data obtaining from above locations

1) Leg A of Mavdi Chowk:

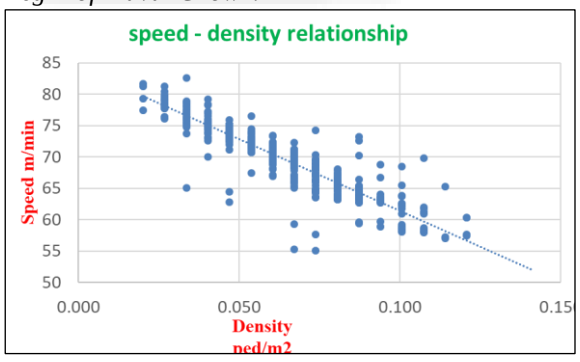

Fig. 7: Speed-density relationship

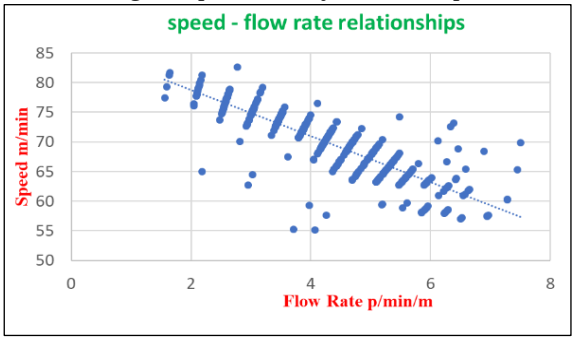

Fig. 8: Speed –flow rate relationship

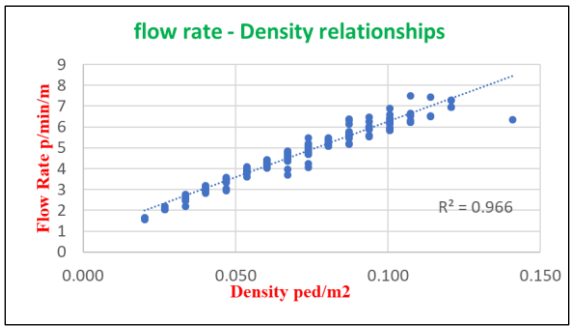

Fig. 9: Density-Flow rate relationship

2) Leg B of Mavdi Chowk:

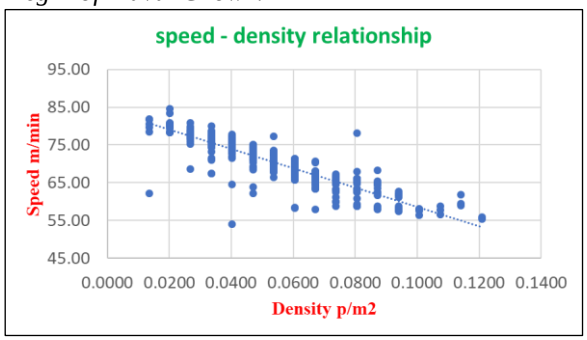

Fig. 10: Speed-density relationship

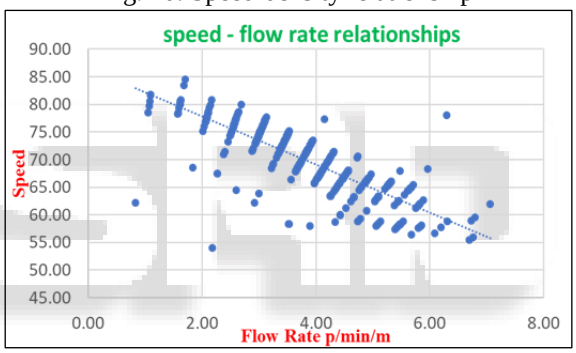

Fig. 11: Speed –flow rate relationship

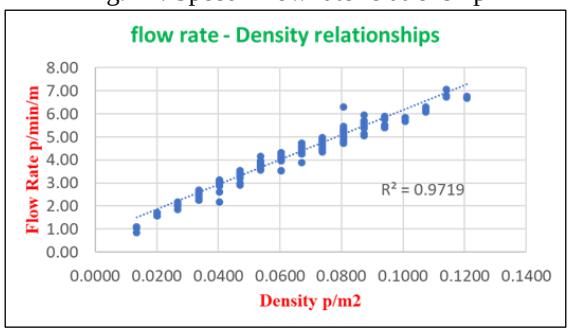

Fig. 12: Speed –flow rate relationship

3) Leg D Mavdi Chowk:

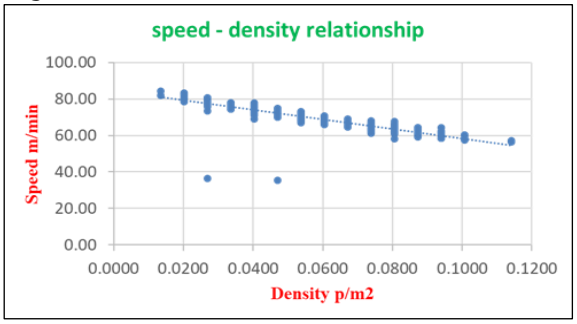

Fig. 13: Speed-density relationship

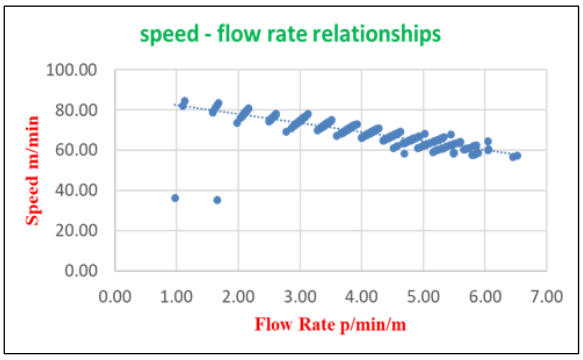

Fig. 14: Speed –flow rate relationship

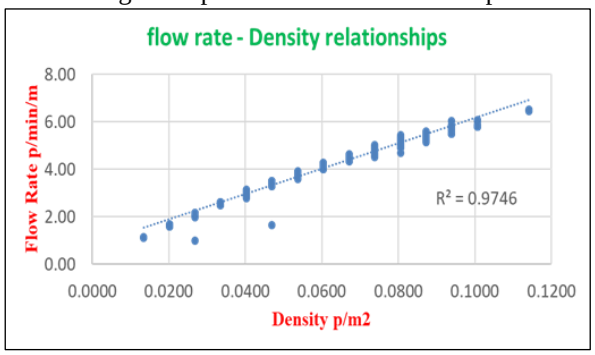

Fig. 15: Speed –flow rate relationship

4) Leg A of R.M.C Chowk:

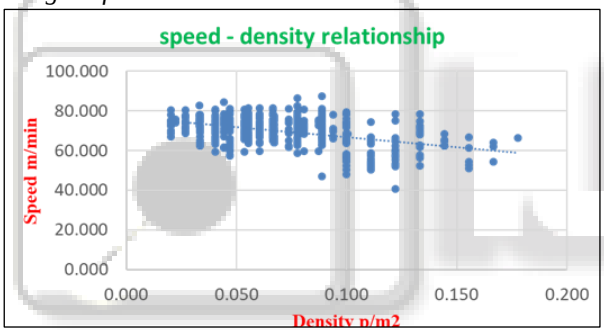

Fig. 16: Speed-density relationship

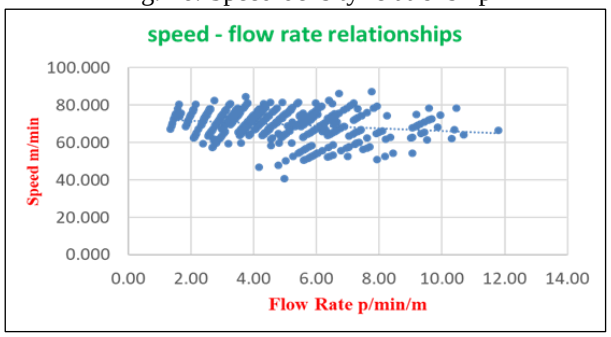

Fig. 17: Speed –flow rate relationship

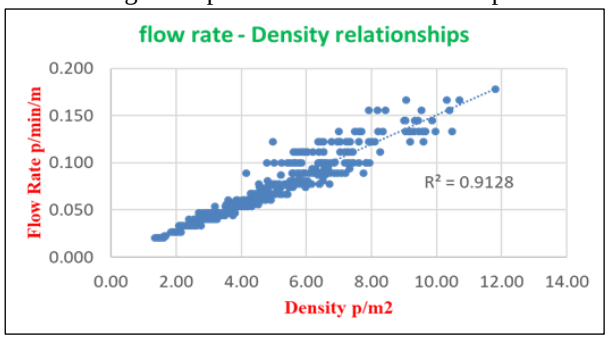

Fig. 18: Density –flow rate relationship

5) Leg D of R.M.C Chowk:

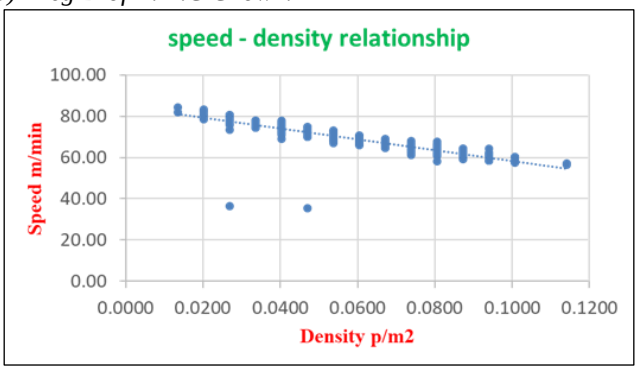

Fig. 19: Speed-density relationship

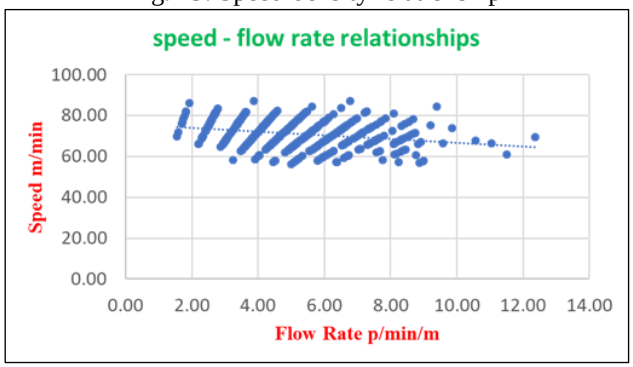

Fig. 20: Speed –flow rate relationship

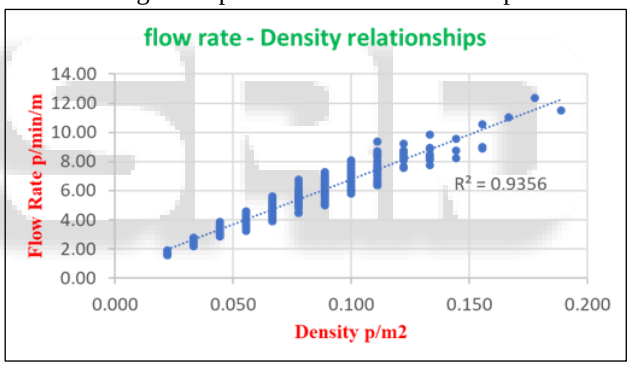

Fig. 21: Density –flow rate relationship

VII. LEVEL OF SERVICE AT STUDY AREA

Leg	Sample size	Average speed (ft/s)	LOS
A	4251	3.63	E
B	3870	3.86	D
D	4029	3.81	D

Table 1: level of service for average speed of pedestrian at Mavdi chowk

Leg	Sample size	Flow q (ped/min/ft)	LOS
A	4251	12.96	D
B	3870	12.14	D
D	4029	12.60	D

Table 2: level of service for flow of pedestrian at Mavdi chowk

Leg	Sample size	Average space (ft2/ped)	LOS
A	4251	55.60	B
B	3870	60.75	A
D	4029	58.58	B

Table 3: level of service for average speed of pedestrian at R.M.C Chowk

Leg	Sample size	Flow q (ped/min/ft)	LOS
A	4251	16	E
B	3870	17	E

Table 4: level of service for flow of pedestrian at R.M.C Chowk

VIII. CONCLUSION

Pedestrian capacity and level of service have been explained by using above fundamental diagram. From the flow verses density diagram have been used to find capacity of pedestrian flow in these Leg of intersection represented above.

- Capacity of pedestrians at Mavdi chowk Leg A (K.K.V Road) is 4 ped/min. maximum density at location is 0.059ped/m.
- Capacity of pedestrians at Mavdi chowk Leg B (Aanand bangallo Road) is 4 ped/min. maximum density at location is 0.054ped/m.
- Capacity of pedestrians at Mavdi chowk Leg B (Mavadi Road) is 4 ped/min. maximum density at location is 0.056ped/m.
- From these study result Flow rate of pedestrians is high at R.M.C chowk compare to r.m.c chowk
- Identified LOS of pedestrian at two intersections and provide recommendation to improve LOS.
- Mavdi chowk is a major intersecting points, where Rajkot city traffic and through vehicular traffic is intersecting. Huge number of Vehicular movements has observed from the traffic volume count so that there is more intersection of pedestrian while crossing the intersection.

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