

Analysis of traffic congestion at Jai Stamb Chowk, Dhekha tiraha and Jhiria in Rewa City using SIDRA Software

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Abstract - One of the biggest issues at urban intersections is traffic congestion. The load on the current road and intersections is increasing due to the daily development in vehicle traffic; if suitable traffic design is not supplied, this increasing traffic will result in a jam situation for vehicle movement. We must properly establish intersections at crossroads and design the route with enough lane capacity in order to solve this issue. One of India's cities that is now growing quickly is Rewa. The road transportation infrastructure connects it from all sides. There is a lot of traffic in Rewa city because of this road transit system. One of the most efficient forms of traffic flow and adaptable active traffic control, traffic signals are widely used in many places throughout the world. The advantages of traffic signals include better traffic flow, more capacity at intersections, and the requirement for very minimal geometric design. Additionally, there are several important ways to improve network performance by controlling the flow of traffic lights at intersections. Due to the extremely high volume of traffic at Jai Stamb Chowk, Dhekha tiraha, and Jhiria, this study attempts to address the issue of traffic congestion and unexpected delays in traffic movement.

And this may be accomplished by using SIDRA intersection 8.1 software and the manual approach to install a four-phase traffic light with the rotary intersection.

Key Words: traffic congestion, traffic volume, traffic signal, SIDRA software, Rotary intersection.

1.INTRODUCTION

In metropolitan places, traffic congestion is a significant issue at intersections. Vehicle traffic is increasing daily, which puts more strain on the current road and intersections. If appropriate traffic design is not implemented, this increased traffic will result in a traffic jam that hinders vehicle movement. Issues including traffic jams, bottlenecks, and accidents have increased as a result of the growing number of cars on our crossings. In order to solve this issue, we must properly create intersections at crossroads and plan the road's lane capacity. Currently, the only way to address these issues is to provide effective traffic control at intersections, which can be done by installing traffic signal systems to allow for the efficient and continuous flow of vehicles through the intersections. Weaving traffic and entry volume serve as the foundation for the investigation. In this study, we concentrated on the rotary's ability to handle traffic and tried to address the issue that traveling vehicles encountered when crossing the rotary. The purpose of the study was to determine Rotary's performance and current state. By witnessing the traffic issues there, the traffic flow characteristics of circular intersections were studied at Jai Stamb Chowk Rewa, Dhekha tiraha, and Jhiria.

2. OBJECTIVES

- To research intersection traffic and the variables influencing intersection congestion density.
- To determine the Rotary intersection's traffic handling capability and the overall amount of traffic approaching the intersection.
- To use efficient, low-cost techniques to maximize traffic flow and reduce delays at crossings.
- Increase the capacity of the roads and lessen traffic in the side streets and Rotary area.
- To create a comparative analysis of the road performance metrics for intersections during morning and evening peak hours.
- The objective is to build a fixed-time traffic signal control system for the intersection by comparing manual and software methods.

3. LITERATURE REVIEW

Akcelik (2016), studied by comparing lane based and lane-group based models of signalized intersection network. Two paths utilize situations in the lane-based investigative system display, and the lane-group based system demonstrate path that prepares not consider path utilize are dissected utilizing the SIDRA INTERSECTION programming, and the subsequent signal unit appearances plus the delay and line length gauges are thought about utilizing a stunned T intersection organize illustration. It is demonstrated that noteworthy contrasts can come about between these models.

Xuanwu Chen & Ming S. Lee (2014), completed an investigation on, three remote programming bundles: RODEL discharge 1.9.9 from the U.K., SIDRA variant 3.2.2 from Australia, and VISSIM form 5.10 from Germany. For a client to create limit and delay gauges that imitate the field working conditions, these three programming bundles offer altogether different alignment capacities. RODEL does not give adjustment parameters. In any case, clients can lead some level of alignment through the alteration of the catch term of the resultant relapse condition. SIDRA variant 3.2.2 has two alignment parameters for roundabout execution investigation: ecological factor and passage/coursing flow change. VISSIM has various factors for alignment, which can be partitioned into two gatherings: driver's practices and need rules. Driver's conduct parameters incorporate vehicle following conduct, route change practices, et cetera. Need rules incorporate least gap time, least progress, et cetera.

Sandip Patil (2015) studied the real time traffic of pune city and implemented the work methodology for the effective control of traffic and concluded that design of traffic signal will help in advancing transportation network to provide ease & safety to

the using it. They will provide easy & efficient control over the movement of vehicles at Intersections. It will lead to minimum time delay resulting in saving in fuel & hence the cost of travelling will minimize achieving economy. Also there will be less pollution as vehicles have to wait for no such longer time than before. Traffic signals will also reduce the conflict points at intersections will minimize the accident. Thus resulting in overall efficiency & economy will assist the road user for better experienced.

4. METHODOLOGY

Stage-1:- Selection of study area: - In this study, at Jai Stumb Chowk Rewa, Dhekha tiraha and Jhiria are considered as study area because most of the time in a day this area faces heavy traffic jam and traffic congestion problem.

Stage-2:- Zoning of study area: - Three different zones were created to collect the data from study area.

Stage-3:- Data collection: - Peaks hour's data for 7 days were collected.

The following steps took for data collection:-

Volume count

Intersection volume count

Pedestrian count

Width intersection dimension

Data from different sources

Stage-4:- Data analysis and presentation: -Analyze the collected data and design the traffic signals by IRC guidelines using Webster method. Signal is again design using SIDRA intersection 8.1 software and results are compared.

Stage-5:- Conclusion and recommendation: - After analysis and presentation we conclude the best method.

5. BASIC PROPERTIES

In Rewa city, three intersections— Jai Stumb Chowk, Dhekha tiraha and Jhiria —was the subject of research. It also examines the different physical characteristics of the road, including the quantity of lanes, the width of the sidewalk, the width of the roadway, and the existence of channelizing islands.



Dhekha Tiraha satellite image



Jai Stambh Chowk satellite image



Jhiria Tiraha

6. TRAFFIC VOLUME COUNT

An electronic count or a person counting by the side of the road are two methods used to determine the amount of traffic on a given route. The local government can utilize traffic counts to determine which routes are most frequently traveled and to either enhance those roads or offer an alternate route in the event that traffic is too heavy. The most crucial information is produced using contemporary survey methods, such as counting the amount of traffic at various crossings and linkages. Carrying at peak hour counts at intersections allowed for the determination of the degree of traffic flow variance. The period of peak flows is evaluated by examining the traffic levels during peak hours.

Intersection 1

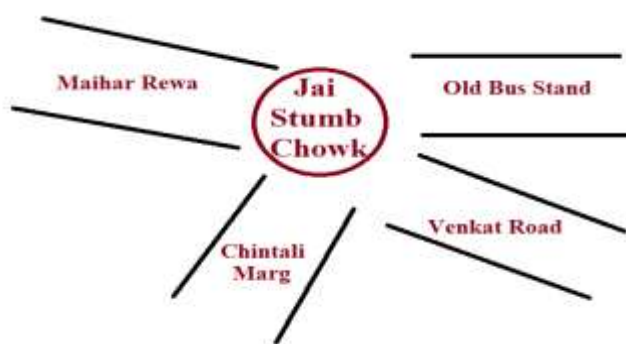


Table 5.5 Number of Vehicle Approaching at Jai Stumb Intersection from Different Direction (in PCU)

Approach	Left Turning	Straight	Right Turning	Total
Chintali Marg (S)	285	331	239	855
Venkat Road (E)	403	327	221	951
Old Bus Stand Road (N)	308	384	272	964
Maihar Rewa Road (W)	365	619	429	1413
Total	1361	1661	1161	4183

Intersection 2

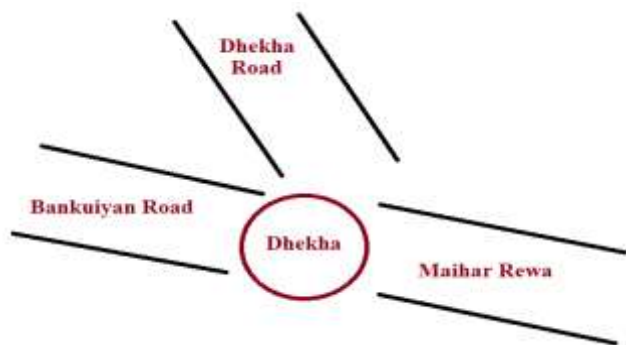
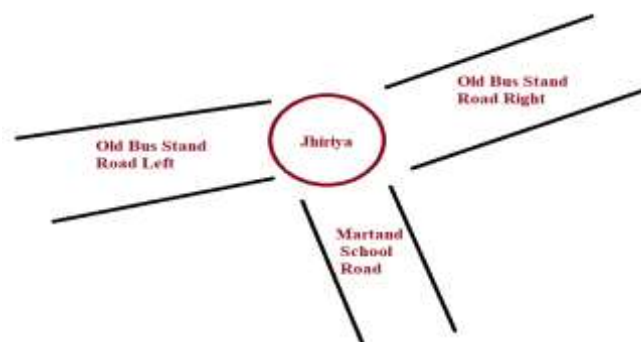


Table 5.5 Number of Vehicle Approaching at Dhekha Intersection from Different Direction

Approach	Left Turning	Straight	Right Turning	Total
Dhekha Rewa	268	370.5	251.5	890
Bankuiyan Road	315.8	413.6	285.6	1015
Maihar Rewa Road	301	389	295	985
Total	884.8	1173.1	832.1	2890

Intersection 3



Approach	Left Turning	Straight	Right Turning	Total
Martland School	402	480	347.5	1229.5
Old Bus Stand Road Right	466.5	463.5	686.5	1616.5
Old Bus Stand Road Left	413.6	723.2	483.8	1620.6
Total	1282.1	1666.7	1517.8	4467.0

The Jai Stumb Chowk's rotating capacity is 843 PCU per hour. The rotary can't manage traffic on its own if this volume is higher. This volume of traffic (4183 PCUs per hour) is too high for the rotor to handle. Likewise, Dhekha Tiraha's capacity is estimated to be 785 PCU per hour, whereas Jhiriya Tiraha's is 792 PCU per hour. Therefore, signalized rotary can be offered in all situations, as this study suggests.

7. DESIGN OF TRAFFIC SIGNAL

Overview of the Sidra Software

Currently, there are several traffic modeling tools / software's available on the market. The single leading is collection of software concerns traffic flow operations. The software tools used for traffic procedures have a wide-ranging of applications. Some part of the software provides an alternate to the standard usage of commonly utilized highway capacity analysis methods. While other parts use simulation for assessment of the effect of altering traffic designs, geometric patterns, and control approaches. Similarly, some apparatuses have surrounded optimization abilities to permit the improvement of the best control devices. Among the variety of these soft wares are SIDRA, TRANSYT-7F, PASSER IV, PASSER IV, HCS2000, etc.

The Signalized and Un signalized Intersection Design, and Research Aid (SIDRA) is a software bundle utilized as assistance meant for design as well as the valuation of system capacity, timing, level of service and execution analysis of individual intersections and networks of intersections. SIDRA is an influential analytical package for intersection under signal control; two-way stops, and or all way stop-signal controlled and roundabouts which may have up to eight legs. Besides, improving the phase systems, separations, and cycle lengths, SIDRA contains a good graphic display of geometric features of

the intersection, comprising the sum of the lanes, turning lanes and networking.

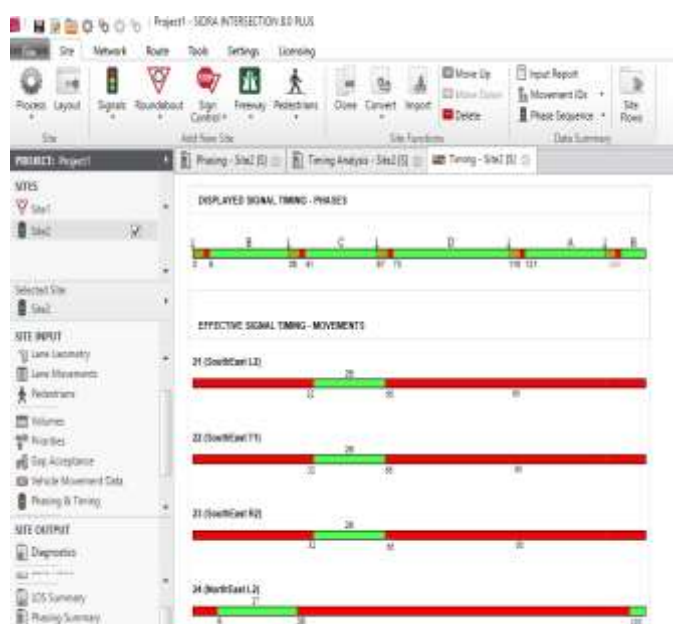
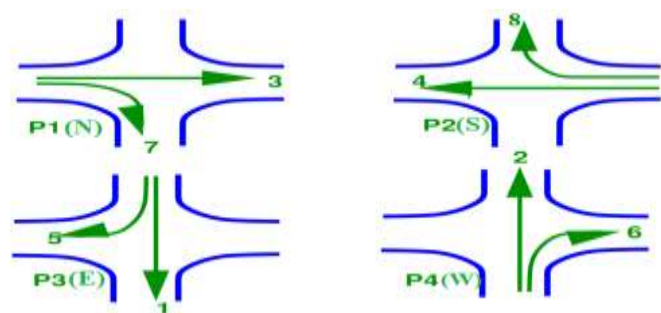


Table 6.10 Traffic signal Phase timing as per SIDRA Software for Jai Stumb Chowk

Street	Red	Initial Amber	Green	Clearance Amber	Red	Cycle length
Maihar to Venkat	-	3	26	3	98	130
Venkat to Maihar	32	3	26	3	66	130
Old Bus Stand to Chintali	64	3	27	3	33	130
Chintali to Old Bus Stand	97	3	27	3	-	130

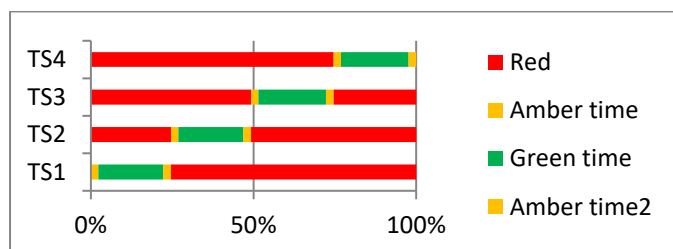
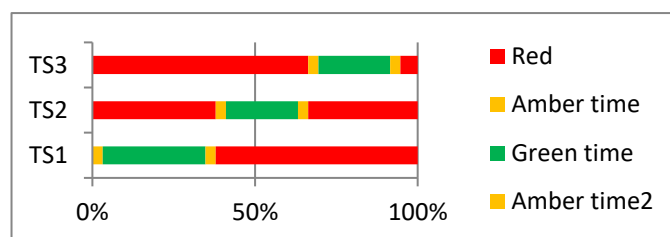


Fig 6.16 Phase diagram of traffic signal

Similarly by using SIDRA intersection software the traffic signal phase timing for Dhekha Tiraha is calculated below:-

Traffic signal Phase timing

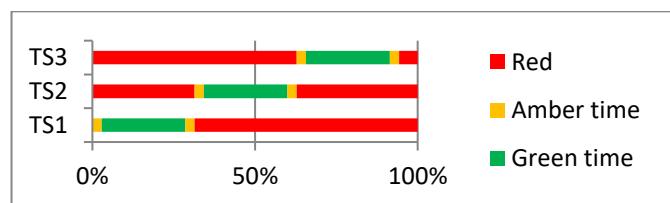
Street	Red	Initial Amber	Green	Clearance Amber	Red	Cycle length
Bankuiyan to Maihar	-	3	30	3	59	95
Maihar to Bankuiyan	36	3	21	3	32	95
Dhekha to bankuiyan	63	3	21	3	5	95



By using SIDRA intersection software the traffic signal phase timing for Jhiria is calculated below:-

Traffic signal Phase timing

Street	Red	Initial Amber	Green	Clearance Amber	Red	Cycle length
Old Bus Stand Right	-	3	27	3	72	105
Old Bus Stand Left to Right	33	3	27	3	39	105
Martand School to Old Bus Right	66	3	27	3	6	105



Phase diagram of traffic signal

7. CONCLUSIONS

i. For a week, traffic volumes were gathered during morning and evening peak hours. Working days were taken into account in order to obtain accurate data. The Highway Capacity Manual HCM standard, the passenger car unit (PCU), was used to transform the traffic data gathered for the various vehicle classifications.

ii. The current system is unable to manage the volume of traffic at the intersection. Its capacity must therefore be increased.

However, the intersection has already reached its maximum capacity. Additionally, because of the position, it is not possible to raise the intersection's parameter. Then, using any method necessary to reduce traffic is the answer.

iii. Dividing vehicles approaching the intersection area is the honorable method of reducing traffic. Traffic lights can be used to separate traffic. Consequently, installing a signal is advised.

iv. In study the signal time of a four-phase signal is computed. We used the g SIDRA Intersection 8.1 software to create the traffic signal. The minimum cycle time, according to SIDRA Intersection 8.1 software, is 130 seconds for Jai Stamb, 95 seconds for Dhekha Tiraha, and 105 seconds for Jhiriya.

v. We may use the traffic cycle time of this approach since, according to our analysis, the signal design using SIDRA software takes into account Flow Scale, Design Life, and Sensitivity analysis with level of service (LOS) factor that is appropriate for the traffic flow.

vi. Ultimately, an ideal solution was created for the suggested design that resulted in a significant reduction in average delay and queue length, which in turn lowered overall fuel consumption and gaseous emissions, while also increasing flow capacity and quality.

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