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Analysis & Design of Traffic Signals at Mudal Titta Road Junction

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ABSTRACT: A four-way intersection or crossroads, usually involves a crossing over of two streets or roads. At the intersections there are thorough turning and crossing traffic. And these traffic movements may be handled in different ways depending on the type of intersection and its design. The operating efficiency of a highway and the safety, therefore depend on the number and types of intersections en-route and the efficiency of the design of these intersections. This report presents a complete inspection and Design of Traffic Signals For Mudal Titta as per IRC-93(1985). A series of data based on traffic study and accident study has been collected and analyzed and then it was found that there is requirement of traffic signal design at the intersection. This detailed project report is focused on traffic signal design at the Mudal Titta to improve the intersection with the help of traffic studies, accident study. Provision of traffic signals at this location will not only ensure smooth traffic flow also safety of pedestrians.

KEYWORDS: Optimized signal cycle time, Signal Timing Optimization, Traffic signal coordination, Traffic Flow Prediction, Traffic Simulation.

I. INTRODUCTION

An intersection is where two or more roads join or cross. The intersection considered in this project is Mudal Titta, Tal Bhuydargad, Kolhapur, Maharashtra. It is the circle constructed on the intersection of Kolhapur Gargoti road (north & south), Radhanagari Road and Adamapur Road. There is very high traffic volume at the intersection because of which there is very much interruption of continuous traffic flow, high accident probability and difficulty in crossing the road by the pedestrian and vehicles. So the efficiency, safety, and speed is very low at the intersection and therefore cost of operation increases and capacity of road decreases. Hence, for the purpose of the fulfillment of all the above factors and for safe and comfort movement, we took this project as for the improvement of the intersection and its estimation which will provide much help to the engineers and will also give the idea while the execution of the project realistically.

Requirements of traffic signal:

The existing intersection is rotary. The rotary intersection is an enlarged road intersection where all converging vehicles are forced to move round a large central island in one direction before they can weave out of traffic flow into their respective directions radiating from the central island. In India, clockwise direction of flow around the island is followed. The main objective of providing a rotary are to eliminate the necessity of stopping even for crossing streams of vehicles and to reduce the area of conflict. It is useful when the size of rotary is significantly large for the existing traffic volume.

PROBLEM DEFINITION

The Mudal Titta Road Junction is experiencing significant traffic congestion, delays, and safety issues due to unregulated vehicular movement and inefficient traffic management. The lack of a well-structured traffic signal system results in disorganized flow, leading to longer travel times, increased risk of accidents, and difficulties for pedestrians crossing the junction.

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To address these challenges, a systematic approach is required to analyze traffic patterns, determine optimal signal timings, and design an efficient traffic signal system. The goal is to ensure smooth traffic movement, enhance road safety, and improve the overall efficiency of the junction

II. LITERATURE REVIEW

1. Rao, R.S., & Kalyani, M. (2018). The study analyzes traffic signal design at urban intersections using traffic volume counts and peak hour factors. The authors emphasize the importance of cycle length optimization for minimizing delays and queue lengths. Their methodology incorporates Webster's method and simulation modeling using VISSIM. Findings highlight that proper signal phasing reduces congestion and increases safety. The study is directly applicable to road junctions with complex traffic movement like Mudal Titta.

2. Sharma, S., & Jain, M. (2016). This paper focuses on saturation flow estimation and its role in designing efficient traffic signals. Using field data from Indian intersections, they adapt standard formulas to suit local conditions. The study provides insight into the variability of vehicle headways, which affects green time allocation. It's particularly relevant to junctions like Mudal Titta where heterogeneous traffic exists.

3. Patil, A. R., & Thorat, P. (2019). A comprehensive study using SIDRA Intersection software for signal design optimization. The authors evaluated delays, queue lengths, and level of service before and after signal implementation. Their findings show measurable improvements in vehicle throughput and pedestrian safety. Similar modeling could benefit Mudal Titta's junction planning.

4. Gupta, P., & Yadav, V. (2020). The research highlights the integration of traffic signal design with GIS-based tools. It explores spatial data mapping for understanding traffic patterns and signal timing requirements. The approach allows for visualizing congestion hotspots and tailoring signal phases accordingly. GIS mapping could provide valuable insights for Mudal Titta Junction.

III. FUTURE SCOPE

1. Integration with Smart Cities

IoT-Enabled Traffic Signals: Traffic signals equipped with Internet of Things (IoT) sensors for real-time data collection and decision-making. Connectivity with other urban infrastructure to provide seamless traffic management. **Centralized Traffic Control:** Integration with centralized traffic management systems for adaptive signal control. Coordination of signals city-wide to optimize traffic flow and reduce delays.

2. Advanced Technologies Artificial Intelligence (AI): AI-powered systems to predict and manage traffic patterns dynamically. Real-time adjustment of signal timings based on congestion levels.

Machine Learning: Continuous learning from historical and live traffic data to improve efficiency.

Connected Vehicle Technology: Vehicle-to-Infrastructure (V2I) communication allowing signals to interact directly with vehicles. Improved safety through advanced warnings about signal changes.

IV. OBJECTIVES

- 1. To study the traffic volume & signals.
- 2. To study the various method of counting the traffic.
- 3. To select the best alternative method for traffic volume
- 4. To give recommendation for improving the traffic at MUDAL TITTA (SH-178) road junction.



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V. METHODOLOGY



STUDY AREA

Mudal Titta junction is one of the fastest growing suburbs of Kolhapur, India. From the junction, the South Road leads to Gargoti, and the North Road leads to Kolhapur, and the East Road leads to Adamapur and West Road leads to Radhanagari Cross Skewed-Junction



VI. DATA

AVERAGE PEEK HOURLY VOLUME

Road Direction	PCU/Hour
Gargoti Road to Titta Road :	575
Titta Road to GargotiRoad :	527
Total Leg -1 (<u>Gargoti</u> Road PCU):	1102
Kolhapur Road to aTittaRoad :	703
Titta Road to Kolhapur Road :	742
Total Leg -2 (Kolhapur Road PCU):	1445
Radhanagari Road to Titta Road :	183
Titta Road to Radhanagari Road	139
Total Leg- 3 (<u>Radhanagari</u> Road PCU):	322
Muragud Road to aTitta Road	355
Titta Road to Muragud Road	353
Total Leg - 4 (Muragud Road PCU):	708



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VII. SIGNAL DESIGN AND RESULT

SIGNAL DESIGN

Four phase signals

In four flow from each approach is put into a single phase avoiding all conflicts. This type of phase plan is ideally suited in urban areas where the turning movements are comparable with through movements and when through traffic and turning traffic need to share same lane. his phase plan could be very inefficient when turning movements are relatively low.

WEBSTER METHOD

After Analysis of all method we use Webster method for signal design

1. In excepbonal ...

STEP 1

- Approach volume on road(q)
- Approach volume on road 1 (q) = 1102 (Gargoti to Titta)
- Approach volume on road 2 (q) = 1445 (Kolhapur to Titta)
- Approach volume on road 3 (q) = 322 (Radhanagari to titta)
- Approach volume on road 4 (q) = 708 (Murgud to titta)

STEP 2

- Width of road
- 1. Width of road -1 = 10m
- 2. Width of road -2 = 10m
- 3. Width of road -3 = 10m
- 4. Width of road -4 = 10m

STEP 3

- Saturation flow(s)
- 1. Saturation flow on road 1 (S1) = 525 x W1 = 525 x 10 = 5250 PCU/hour
- 2. Saturation flow on road 2 (S2) = 525 x W2 = 525 x 10 = 5250 PCU/hour
- 3. Saturation flow on road 3 (S3) = 525 x W3 = 525 x 10 = 5250 PCU/hour
- 4. Saturation flow on road 4 (S4) = 525 x W4 = 525 x 10 = 5250 PCU/hour

STEP 4

Critical flow ration (Y) (Y) = $\frac{\text{VOLUME}}{\text{SATURATION FLOW}}$

$$(Y1) = \frac{Q1}{S1} = \frac{1102}{5250} = 0.209$$
$$(Y2) = \frac{Q2}{S2} = \frac{1445}{5250} = 0.275$$

$$(Y3) = \frac{Q3}{S3} = \frac{322}{5250} = 0.061$$

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 $(Y2) = \frac{Q4}{S4} = \frac{708}{5250} = 0.134$ STEP 5 • Optimal signal cycle (Co) Co = $\frac{1.5x1+5}{1-Y}$ L = Total lost time per second = 2N+R L = (2 X 4 + 12) L = 20 Sec Y = (Y1 + Y2 + Y3 + Y4) = (0.209 + 0.275 + 0.061 + 0.134) Y = 0.679 Co = 1.5 x 20 + 5 1 - (0.679) = 109.034 \approx 110 sec

STEP 6

• Green Time Total cycle time (G) = 110 Sec $G1 = \frac{Y1}{Y}(Co - L)$ $= \frac{0.209}{0.679}(110 - 20)$ G1 = 28 Sec $= \frac{0.275}{0.679}(110 - 20)$ G2 = 36 Sec $= \frac{0.061}{0.679}(110 - 20)$ G3 = 9 Sec $= \frac{0.134}{0.679}(110 - 20)$ G3 = 18 Sec

• Green Time

G1 = 28 Sec G2 = 36 Sec G3 = 9 Sec G4 = 18 Sec







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VIII. PHOTO VIEW

PHOTO VIEW





XI. CONCLUSION

Roadway intersections are a crucial part of the system and frequently act as a bottleneck for traffic. The most recent data demonstrates both site limits and an increase in traffic. The engineer must create criteria and procedures based on the fundamental relationships between capacities, traffic flow, geometry design, and safety that allow users to move directly from suggested geometry to actual operating condition estimates.

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