



e-ISSN:2582-7219



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 7, July 2023



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.54



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Analyzing Efficiency, Benefits and Applications of Providing a Roundabout / Rotaries: A Literature Review

Shubham Shrinivas Wani¹, Apeksha Choudhary²

P.G. Student, M. Tech Transportation Engineering, Department of Civil Engineering G H Raisoni University, Amravati, Maharashtra, India¹

Associate Professor, Department of Civil Engineering, G H Raisoni University, Amravati, Maharashtra, India².

ABSTRACT: Roundabouts, also known as rotaries or traffic circles, are a type of intersection that has been gaining popularity in recent years. They are seen as a safer and more efficient alternative to traditional intersections with traffic lights. There is a growing body of evidence that roundabouts can reduce traffic accidents and fatalities. A study by the Insurance Institute for Highway Safety (IIHS) found that roundabouts can reduce fatal crashes by up to 80%. Other studies have shown that roundabouts can also reduce the number of non-fatal crashes by 30-40%. Roundabouts can also improve traffic flow. A study by the Federal Highway Administration (FHWA) found that roundabouts can increase traffic capacity by up to 30%. This is because roundabouts allow vehicles to flow more smoothly and efficiently than traditional intersections with traffic lights. In addition to safety and efficiency, roundabouts can also improve the safety and comfort of pedestrians and cyclists. The circular design of roundabouts forces drivers to slow down, which makes it safer for pedestrians and cyclists to cross the intersection. There are a few factors that need to be considered when deciding whether or not to install a roundabout. The size of the intersection, the volume of traffic, and the presence of pedestrians and cyclists are all important factors to consider. Overall, the evidence suggests that roundabouts can be a safe and efficient alternative to traditional intersections. They can reduce traffic accidents and fatalities, improve traffic flow, and improve the safety and comfort of pedestrians and cyclists.

KEYWORDS: Traffic, roundabout, rotary capacity, design, rotary intersection

I. INTRODUCTION

Roundabouts are a type of intersection that has become popular in recent years. They are seen as a safer and more efficient alternative to traditional intersections with traffic lights. The first roundabout was built in 1905 in New York City. However, it was not safe or efficient, so a new type of roundabout was developed in the United Kingdom in the 1960s. This new roundabout was designed for lower speeds and had a smaller radius, and it quickly became popular. Today, roundabouts are used all over the world, and they are particularly popular in Europe. In the United States, there are now over 10,000 roundabouts. Roundabouts have many benefits. They are safer than traditional intersections with traffic lights, they improve traffic flow, and they are more environmentally friendly. Roundabouts are much safer than traditional intersections with traffic lights. A study by the Insurance Institute for Highway Safety (IIHS) found that roundabouts can reduce fatal crashes by up to 80%. Other studies have shown that roundabouts can also reduce the number of non-fatal crashes by 30-40%. Roundabouts also improve traffic flow. A study by the Federal Highway Administration (FHWA) found that roundabouts can increase traffic capacity by up to 30%. This is because roundabouts allow vehicles to flow more smoothly and efficiently than traditional intersections with traffic lights. Roundabouts are also more environmentally friendly than traditional intersections with traffic lights. This is because roundabouts reduce emissions from idling vehicles. A study by the University of North Carolina found that roundabouts can reduce emissions by up to 30%. Overall, roundabouts are a safe, efficient, and environmentally friendly alternative to traditional intersections with traffic lights. They are becoming increasingly popular all over the world, and there are now over 10,000 roundabouts in the United States.



II. ROUNDABOUT DEFINED

Roundabouts and traffic circles are both types of circular intersections, but they have distinct characteristics that distinguish them. Roundabouts have a significantly lower perimeter than traffic circles, which forces vehicles to decelerate more when entering a roundabout. This enhances safety and results in operating speeds of approximately 15 mph in roundabouts, while traffic circles may be designed for speeds of roughly 25 to 40 mph. Additionally, roundabouts are typically designed with a single lane of traffic, while traffic circles may have multiple lanes. Roundabouts are generally considered to be safer and more efficient than traffic circles, and they are becoming increasingly popular in the United States

III. OBJECTIVES

1. To assemble information about roundabout capacity analysis that is currently available through literature review.
2. Conducting a literature analysis to determine the effectiveness of existing roundabouts around the globe
3. To evaluate public sentiment for installing roundabouts at busy intersections.
4. To evaluate the advantages and disadvantages of a roundabout vs signals.

IV. LITERATURE REVIEW

Ishanya P. et.al. [1] Presented research paper on “A study on rotary intersection at Mangaluru”. The study investigated the behaviour of traffic at the Nanthur crossroads in Mangaluru. They used a video camera to count the number of vehicles and determine the peak traffic flow. Due to the high volume of traffic, an attempt was made to install traffic signals according to IRC guidelines, but this failed due to the high volume of traffic. The current traffic rotary was then successfully redesigned, and a modified roundabout design feature was suggested.

S. vasantha kumar et al. [2] presented a paper on “Design of a rotary for an uncontrolled multileg intersection in Chennai”. A video graphic survey was conducted for eight hours during the day to determine the traffic volume at the intersection and the capacity of the intersection. The practical capacity of the rotary was found to be 3,020 pcu, which was significantly higher than the reported traffic flow of 2,665 pcu.

Rakesh kumar chhalotre, , Dr. Y. P. Joshi. [3] presented paper on “An evolution of Rotary intersection on Prabhat Square Bhopal”. The researchers personally counted the traffic volume on the square for seven days and collected peak hour traffic statistics. They determined the rotary's capacity and offered design specifications. The capacity calculated from the traffic volume analysis was greater than the rotary's operational capability. As a result, a signalized intersection was included to keep the volume at the crossing under control.

Ms. Sonalika maurya, Mr. Ajeet Singh.[4] presented a paper on “Efficiency of rotary intersection at authority Chowk greater Noida”. The researchers manually counted and gathered traffic volume at the study intersection. They found that the roundabout's capacity had been exceeded due to the current traffic load. As a result, they proposed a signalized intersection to regulate the traffic entering the circle.

Dayananda H. S. t al.[5] presented paper on “capacity evaluation of rotary intersection at K. R. Hospital Junction Mysore” suggested redesigned parameters for the rotary. They measured traffic volume over seven days using a video camera mounted on a building near the intersection. After calculating all traffic volume data, they calculated the capacity of the rotary by adjusting the dimensions while maintaining the same weaving ratio as the previous capacity.

Veethika Gomatsa et al[6] presented paper on “Design and analysis of an intersection for improve traffic flow at Bhopal”. At Jyoti Talkies Square and Vallabh Bhawan, researchers attempted to recommend measures for improving and easing traffic flow. They conducted traffic volume surveys at two-hour intervals throughout the day on consecutive days of the week. Signal timing at Jyoti Talkies Square was changed to accommodate afternoon peak traffic. It was suggested that the road be widened. The capacity of the roundabout at Vallabh Bhavan was calculated, and it was found to be greater than its capacity. As a result, the roundabout was able to provide efficient traffic flow..

Sitesh kumar singh, Karan Prabhakar.[7] published a paper on “statistical analysis of rotary intersection on Dogra chowk Jammu. The researchers examined traffic volume on existing roundabouts and gathered data on the geometric features and operational status of the roundabouts. They found that the capacity of the existing roundabouts had



reached their limit. Based on the results of the rotary junction study and improvement, they made recommendations for geometric features that could boost the capacity of the roundabouts.

Parth M. Pande, Srinath Karli.[8] presented paper on “Design of Rotary Intersection as an alternative to four arm signalized intersection of urban area”. A traffic volume survey was conducted to determine the capacity of the rotary. The results showed that the current traffic flow at a signalized intersection was greater than the intersection's capacity. As a result, proposed design parameters were supplied to reduce delay and increase the capacity of the intersection rotary.

Tom v. Mathew et al.[9] published on traffic rotaries that provided all the theoretical knowledge about rotaries, including guidelines for selecting rotaries, traffic operation in rotaries, design elements, and the capacity of rotaries

V. EFFICIENCY

Many studies have shown that roundabouts can increase the efficiency of intersections in three ways:

- They can reduce delays. The Insurance Institute for Highway Safety (IIHS) found that roundabouts can reduce delays by 13-36%. The National Cooperative Highway Research Program found that roundabouts can reduce peak hour delays by 75%.
- They can lower operating costs. Roundabouts require less maintenance than signalized intersections, which can save money in the long run.
- They can reduce environmental impact. Roundabouts can reduce traffic emissions by 21-42% and fuel consumption by 30%.

The IIHS does not recommend roundabouts for all intersections, such as those with uneven traffic flow or where site constraints prevent the building of a well-planned roundabout. However, for intersections where roundabouts are a good fit, they can offer significant benefits in terms of efficiency, cost, and environmental impact.

Here are some specific examples of the benefits of roundabouts:

- A study of 11 Kansas intersections found that roundabouts reduced delays by 65% and vehicle stops by 52%.
- A study of 3 roundabouts in Poughkeepsie, New York found that they reduced delays by 54% and travel times by 70%.
- A study by the New York State Department of Transportation (NYDOT) found that roundabouts along Route 67 in Malta, New York reduced delays by 74%.

These are just a few examples of the many studies that have shown the benefits of roundabouts. If you are considering installing a roundabout at an intersection in your community, I encourage you to do your research and see if it is a good fit for your needs.

VI. CONCLUSION

Roundabouts have become increasingly popular in recent decades due to their proven ability to improve traffic flow and safety at intersections. Numerous studies have shown that roundabouts can reduce delays by up to 75%, accidents by up to 30%, and fatalities by up to 75%. They can also improve pedestrian safety and reduce environmental impact. While roundabouts are not suitable for all intersections, they are a safe and efficient way to manage traffic at many intersections. More research is needed on the benefits of roundabouts for bicyclists, but overall, roundabouts are a great way to improve the flow of traffic and make intersections safer for everyone.

In addition to the benefits mentioned above, roundabouts can also:

- Reduce fuel consumption and emissions. This is because they allow cars to travel at a more constant speed, which is more fuel-efficient.
- Improve air quality. This is because they reduce the number of stop-and-go traffic movements, which produce more emissions.
- Make intersections safer for pedestrians and cyclists. This is because they force drivers to slow down and yield to pedestrians and cyclists.

Roundabouts are a great way to improve traffic flow and safety at intersections, and they are more efficient and environmentally friendly than traffic signals.



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