

## DESIGN OF ELEVATED ROUNDABOUT IN PUNE CITY - PHASE 1

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### ABSTRACT

Urban transportation infrastructure plays a pivotal role in the economic and social development of a city. As urban centres like Pune experience rapid population growth and increased vehicular traffic, the need for innovative and efficient traffic management solutions becomes paramount. This project aims to address this challenge by proposing the design and cost estimation of an elevated roundabout in Pune City.

The proposed elevated roundabout serves as a novel solution to alleviate traffic congestion and enhance traffic flow efficiency at a key intersection in Pune (Vishrantwadi Chowk). The elevated design not only maximizes the utilization of available space but also provides an aesthetically pleasing urban landmark. The project encompasses comprehensive planning, design, and cost estimation phases to ensure a holistic approach to urban transportation infrastructure development.

The design phase involves a thorough analysis of the existing traffic patterns, road geometry, and topography of the proposed site. Utilizing advanced traffic simulation software like SIDRA, 3D Civil and Civil Engineering software such as Autocad and Revit. The project team optimizes the roundabout's layout to accommodate diverse types of vehicles and ensure seamless traffic movement. Safety considerations, including pedestrian pathways and adequate signage, are integrated into the design to prioritize the well-being of all road users.

The elevated structure incorporates modern engineering principles and materials to ensure structural integrity, longevity, and minimal environmental impact. The project also explores sustainable features, such as energy-efficient lighting and green landscaping, to align with contemporary urban development standards.

The outcomes of this project are expected to contribute significantly to urban planning and transportation management strategies in Pune City. By providing a detailed design and cost estimation for an elevated roundabout, the project aims to offer a blueprint for similar infrastructure projects in other urban centres facing similar traffic challenges. The findings may also serve as a reference for policymakers, urban planners, and engineers seeking innovative solutions to enhance urban mobility and quality of life in rapidly growing cities.

**Keywords:** Elevated Roundabouts, Urban Transportation, Traffic Flow Efficiency, Infrastructure Development, Green Landscaping.

### I. INTRODUCTION

The growth rate of vehicles is increasing in most metropolitan areas, and as a result, traffic congestion is also increasing, particularly at intersections. Traffic congestion is one of the major problems faced by most of the developing countries despite the measures taken to mitigate and reduce it. In order to overcome traffic congestion, especially in four-way intersections with increasing growth rate of vehicles, roundabout design is a popular traffic management solution in urban areas. In most countries, roundabouts have been widely adopted as an alternative to signalized intersections due to their ease of operation with fewer conflict points.

The city of Pune, India, has been experiencing rapid urbanization and increased traffic congestion in recent years at multiple junctions. To address these issues and improve traffic flow, this project aims to design an elevated roundabout at a strategically important locations in Pune (Vishrantwadi Chowk). The proposed sites for this project already had a normal roundabout in past however since it wasn't enough to tackle traffic congestion problem due to which traffic signals were introduced at these junctions. However it was seen that traffic signals were also not enough for proper and efficient flow of traffic, hence we aim to implement an

elevated roundabout at this junction along with traffic signals to deploy collaborative efforts to ensure non stop flow of traffic to ease the traffic congestion problem.

### **Types of Roundabout**

Roundabouts come in various types, each designed to accommodate specific traffic conditions and improve traffic flow. Here are some common types of roundabouts:

#### **1. Single-Lane Roundabouts:**

- Mini-Roundabouts: These are small roundabouts designed for low-traffic intersections. They often have a painted circle and a simple center island.
- Conventional Roundabouts: Standard roundabouts with a single circular lane for traffic. Vehicles circulate around a central island.

#### **2. Multi-Lane Roundabouts:**

- Double-Lane Roundabouts: These roundabouts have two concentric circles of traffic, with each circle having its own lane.
- Triple-Lane Roundabouts: Similar to double-lane roundabouts but with three concentric circles.

#### **3. Turbo Roundabouts:**

- This type of roundabout has a spiral or corkscrew shape for the circulating lane. It is designed to improve traffic flow by allowing higher speeds and smoother entry and exit maneuvers.

#### **4. Signalized Roundabouts:**

- Roundabouts with traffic signals at entry and exit points. Signals are used to control the flow of traffic into and out of the roundabout, especially during peak hours.

#### **5. Elevated Roundabouts:**

- Some roundabouts are constructed with an elevated center island or flyover to separate conflicting traffic movements.

We are selecting elevated Roundabouts for our Project.



**Fig 1:** Elevated Roundabout

## **II. METHODOLOGY**

This project will be executed in a 2- phase methodology.

### **1. Site Selection**

Identify a suitable location within Pune where a roundabout would be most beneficial, considering factors such as traffic volume, safety, and accessibility. Various junctions of Pune City were inspected and surveyed, based on final results Vishrantwadi Chowk was finalized.

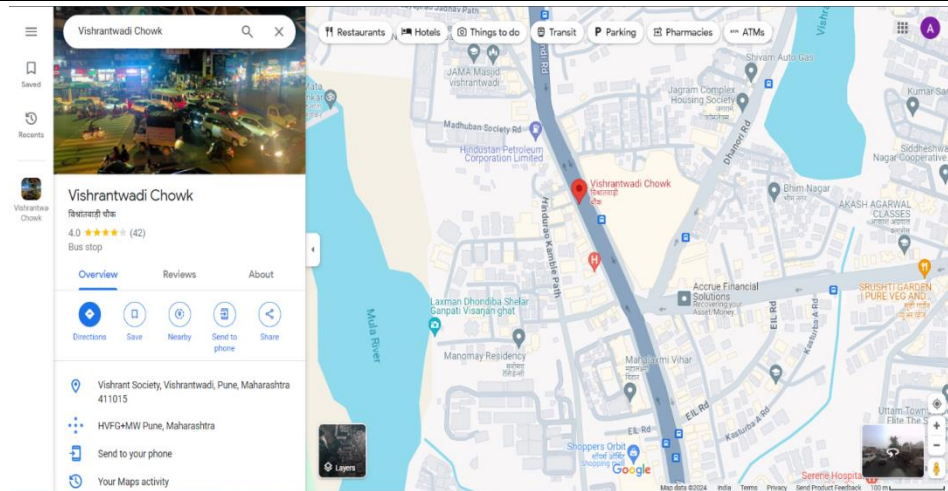


Figure 2: Selected Site (Vishrantwadi Chowk)

## 2. Traffic Analysis at Selected Junction

Conduct a comprehensive traffic survey to determine the current traffic flow, peak hours, and vehicle types. Guidelines and specifications to carry out all required surveys are provided in IRC:65-2017

In this step an hourly traffic volume survey is to be done for different types of vehicles passing through different directions of the junction at peak hours. Once these values are found out they are to be converted into passenger car unit values. The provision of conversion of normal traffic volume to passenger car units for roundabout is done in IRC : 65-2017.

Table 1: Roundabouts as an Intersections Type in Various Types of Roads

| Intersecting Road with Traffic Volume | Arterial/Rural Highway (3600 PCU/hr) | Sub-Arterial/Rural Road (2900 PCU/hr) | Collector Road (1800 PCU/hr) | Local Road |
|---------------------------------------|--------------------------------------|---------------------------------------|------------------------------|------------|
| Carriageway (1200 PCU/hr)             | D                                    | E                                     | E                            | E          |
| Arterial/Rural Highway (3600 PCU/hr)  | B                                    | B                                     | C                            | C          |
| Sub-Arterial/Rural Road (2900 PCU/hr) | -                                    | B                                     | B                            | C          |
| Collector Road (1800 PCU/hr)          | -                                    | -                                     | A                            | B          |
| Local Road                            | -                                    | -                                     | -                            | A          |

Notation:

- A. Likely to be an appropriate choice
- B. May be an appropriate choice
- C. Not likely to be an appropriate choice
- D. Not appropriate on at-grade
- E. Not likely to have a roundabout between carriageway and this road type

Table 2: Passenger car units for Roundabout

| Diameter, D (m) | Cycle | Motorized Two Wheeler | Motorized Three Wheeler | Small Car | Big Car | Light Commercial Vehicle | Heavy Vehicle | Cycle Rickshaw | Hand Cart | Buffalo Cart | Horse Cart |
|-----------------|-------|-----------------------|-------------------------|-----------|---------|--------------------------|---------------|----------------|-----------|--------------|------------|
|                 |       |                       |                         |           |         |                          |               |                |           |              |            |
| 20<D≤30         | 0.18  | 0.32                  | 0.83                    | 1.00      | 1.40    | 1.88                     | 3.65          | 1.12           | 2         | 4            | 3          |
| 30<D≤40         | 0.21  |                       |                         |           |         | 1.65                     | 3.45          | 1.31           |           |              |            |
| 40<D≤50         | 0.25  |                       |                         |           |         | 1.53                     | 3.20          | 1.56           |           |              |            |
| 50<D≤70         | 0.28  |                       |                         |           |         | 1.46                     | 3.05          | 1.74           |           |              |            |

[Source: CRR (2017) "Indian Highway Capacity Manual (INDO-HCM)"]

### 3. Design Of Elevated Roundabout

Select the appropriate type of roundabout (e.g., single-lane, multi-lane) based on traffic analysis.

Determine the roundabout's dimensions, including the central island, entry and exit radii, and lane widths.

Design 2D & 3D Plan using softwares. (To be executed in Phase 2) . Design will be followed as per IRC : 65 Guidelines.

### III. RESULTS

Vishrantwadi Chowk is intersection of 4 junction which are:

Mental Corner Road

Dighi – Alandi Road

Tingre Nagar Road

Lohegoan – Dhanori Road.

Traffic volume survey for every junction was carried out between peak time of 5 pm to 7 pm.

PCU is calculated by multiplying total volume of specific vehicle by pcu unit given in table 2.

**Table 3:** Traffic Volume Survey of Mental Corner Road

| TIME   | CAR/JEEP | 2 WHEELER | 3 WHEELER | BUS | LCV | TRUCK | PCU/HR  |
|--------|----------|-----------|-----------|-----|-----|-------|---------|
| 5-6 pm | 248      | 336       | 107       | 56  | 63  | 66    | 1043.97 |
| 6-7 pm | 302      | 389       | 141       | 74  | 81  | 52    | 1208.69 |

**Table 4:** Traffic Volume Survey of Dighi – Alandi Road

| TIME   | CAR/JEEP | 2 WHEELER | 3 WHEELER | BUS | LCV | TRUCK | PCU/HR |
|--------|----------|-----------|-----------|-----|-----|-------|--------|
| 5-6 pm | 365      | 443       | 48        | 31  | 18  | 23    | 894.59 |
| 6-7 pm | 311      | 419       | 62        | 34  | 37  | 17    | 848.6  |

**Table 5:** Traffic Volume Survey of Tingre Nagar Road

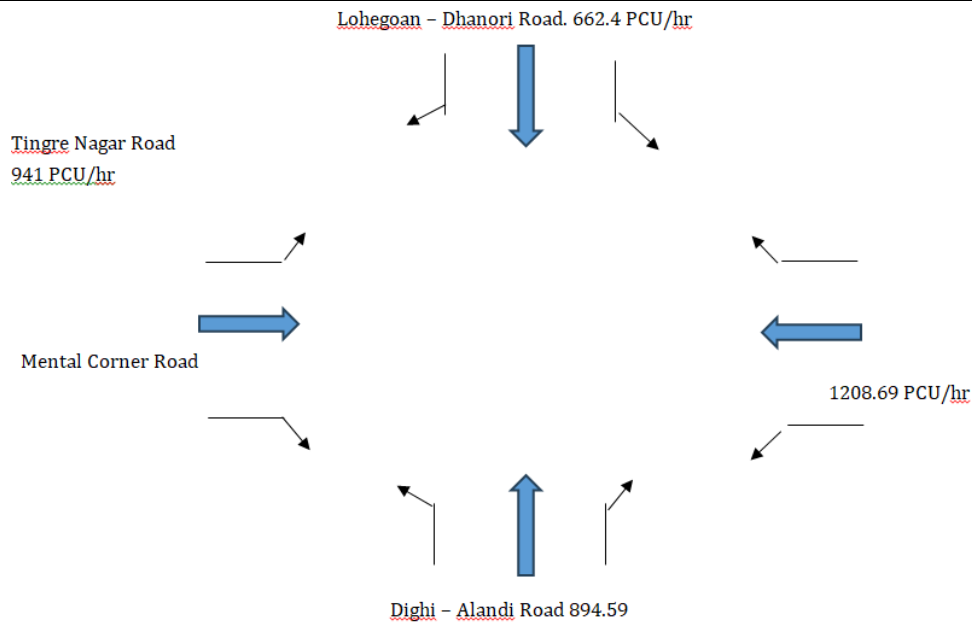
| TIME   | CAR/JEEP | 2 WHEELER | 3 WHEELER | BUS | LCV | TRUCK | PCU/HR |
|--------|----------|-----------|-----------|-----|-----|-------|--------|
| 5-6 pm | 360      | 511       | 137       | 33  | 22  | 26    | 941    |
| 6-7 pm | 354      | 496       | 125       | 31  | 29  | 24    | 907    |

**Table 6:** Traffic Volume Survey of Lohegoan – Dhanori Road.

| TIME   | CAR/JEEP | 2 WHEELER | 3 WHEELER | BUS | LCV | TRUCK | PCU/HR |
|--------|----------|-----------|-----------|-----|-----|-------|--------|
| 5-6 pm | 160      | 301       | 86        | 13  | 12  | 16    | 505.11 |
| 6-7 pm | 254      | 274       | 53        | 21  | 39  | 12    | 662.4  |

#### Result

Traffic Approach from all junctions were successfully surveyed and criteria for design of elevated roundabout is met (which will be executed in phase 2).



**Fig 3:** Approach of vehicle towards junction PCU/hr

#### IV. CONCLUSION

Study area is Vishrantwadi chowk of Pune having latitude 18.5742\* N and longitude 73.8773\* E . This junction is an intersection of 4 roads Alandi Road Mental Corner Dhanori Road Tingare Nagar

Here Traffic signal system exists but causes frequent stopping and starting of vehicles. To avoid this problem an elevated roundabout is to be designed.

After completing all the methodology for phase 1 it can be concluded that an elevated roundabout can be constructed at vishrantwadi chowk to ease the traffic congestion. Design of elevated roundabout will be executes in phase 2

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