

# A Study of Construction Sequence and Traffic Management During Construction of Integrated Structure At Chandani Chowk Junction on NH-4, Pune

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**Abstract-** Chandani Chowk is one of the busiest and most important road junctions in Pune city. Despite several attempts by the civic and police authorities to resolve the traffic issues, the spot is constantly beset by traffic snarls and accidents, owing to the lack of planning and management. This constant flow of traffic at the Chowk is because it is the intersection where many important roads meet, including the heavy and high-speed traffic of the Pune-Bengaluru Bypass. Also, at the location NDA Road, Bavdhan, Paud/ Mulashi, Kothrud, VedBhavan service road and the bypass from Mumbai and Katraj intersects. The Detailed Project Report (DPR) for construction of integrated structure is prepared by NHAI recently to resolve the traffic issue at the location. The improvement proposal includes construction of road networks and flyovers/underpasses etc. The present study includes the construction planning and sequence for completing the work within estimated budget and Specified time Traffic study and management to ensure safety during construction.

**Keywords-** Contraction Planning & Sequence, Traffic Management.

## I. INTRODUCTION

Chandani Chowk is one of the busiest and most important road junctions in Pune city. There is constant flow of traffic at the junction. It is the western entry gate of Pune city. Chandani Chow junction interconnects four local roads with NH-4. Due to lack of planning and proper traffic management, the junction location is constantly beset by traffic snarls and accidents. At this junction, road coming from NDA side, Bavdhan side, Paud side, Kothrud side, VedBhavan service road and the bypass road (NH-4) from Mumbai -Katraj intersects.

On an average, about 1,50,000 vehicles, converge and diverse daily at the junction from six different directions. The traffic consists of two-wheelers, cars, buses and trucks.

The stretch also comprises a narrow bridge and a narrow service road (LHS). The never-ending traffic flow, the flagrant flouting of traffic rules and poor infrastructure are the prime reasons for ensuing chaos at the spot.

Efficient planning and management of traffic are the burning needs to resolve the issues at Chandani Chowk. Adequate and capable policing is sorely needed, along with the curbing of lawlessness by road-users.

## II. IMPROVEMENT PROPOSAL BY NHAI

### 2.1 Background

The main objective of the study by NHAI is to establish the technical, economical and financial viability of the project and prepare a report for “Road Improvement network of NH-4 at Chandani Chowk at Pune, Maharashtra with development of Service Roads, as per the best practices for Urban roads, meeting the City requirements for the roads”.

### 2.2 Proposed structures and road works by NHAI

#### Proposed road works

- i. NH-4: Widening of Main Carriageway (3 Lanes each) and development of Service Roads on LHS and RHS as well as Outer Service roads on LHS and RHS within PMC D P land.
- ii. NDA- Mulashi Road section of NH 743F.

a)NDA Junction to Mulashi Toll Plaza Location

b)Mulashiroad old Toll Plaza to Mulashi Road

c)Ramp-1: Mulashi towards Satara.

d)Ramp-2: Mulashi towards Mumbai.

e)Ramp-3: Mulashi towards Pashan.

f)Ramp-4: From Outer Service road towardsMulashi.

g)Ramp-5: Pashan/NDA towards Mumbai.

- h) Ramp-6: Pashan towards Satara.
- i) Ramp-7: Satara/Kothrud towards Pashan.
- j) Ramp-8: NH-4 Exit towards Outer Service roads.
  - iii. NDA to Pashan Road.
  - iv. Pashan Connector Road (24m DP road).
  - v. Ved-Vihar towards NDA Junction Road.
  - vi. Pashan towards PMC Water supply Road.
  - vii. Existing VUP towards Kothrud Road.
  - viii. VUP-1 towards Kothrud Road.
  - ix. Rotary at Pashan.
  - x. Rotary at NDA.

#### List of proposed structures to be constructed across NH-4:

- i. VUP-1: New Vehicular underpass.
- ii. NDA-Pashan VOP: Replacement of Existing NDA-Pashan VOP.
- iii. Ramp-1: Flyover from Mulshi towards Satara.
- iv. Ramp-3 & Ramp-7: Vehicular Underpass on Mulshi to Pashan and Satara/Kothrud to Pashan road.
- v. Ramp-5: Vehicular Underpass on Pashan towards Mumbai road.
- vi. Ramp-6: Flyover from Pashan towards Satara.

### 2.3 Objectives of the Study

The main objectives of the study are as follows-

- Effective Construction Planning for completing the work within estimated budget and Specified time.
- Traffic study and Traffic Management during the construction without disturbing existing NH-4 traffic.

## III. CONSTRUCTION SEQUENCE

### 3.1 Construction Sequence of Project

The project location is within Municipal limits of Pune. There is rapid development taking place on both sides of the road. Due to site constraints at the project location, it is necessary to decide the project construction sequence. The main objective of constructions sequence is minimum disturbance to the traffic movement on NH -4. To achieve this, project activities are divided into nine stages. Each stage is having four to five activities to complete. Also, traffic movement is shown in black arrow during construction. The detailed description of these stages is as follows-

**Stage- I:** In this stage construction of road works proposed are as below. These road works are not affecting the main carriageway traffic of NH-4. In this stage following roads are proposed:

- 1) Construction of LHS and RHS service roads from Chainage Km. 841.400 to Km. 842.160.
- 2) Construction of LHS and RHS outer service roads from Chainage Km. 841.400 to Km. 842.160.
- 3) Construction of LHS and RHS service roads from Chainage Km. 842.640 to Km. 843.600.
- 4) Construction of LHS and RHS outer service roads from Chainage Km. 842.640 to Km. 843.600.
- 5) Construction of Pashan Connector DP Road & Pashan Rotary.
- 6) Construction of new NDA - Mulshi Road.
- 7) Construction of Kothrud to VUP-1 Road.

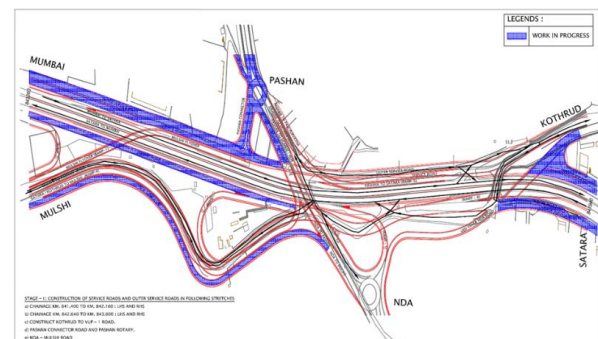


Fig. 1: Stage-I

**Stage- II:** After Completion of Stage – I, Construction of Stage – II can be started. Stage – II includes construction of following road works and Structures-

- 8) Construction of Ramp - 1: Mulshi to Satara road.
- 9) Construction of Mulshi Flyover.
- 10) Construction of Ramp - 2: Mulshi to Mumbai Road.
- 11) Construction of Ramp - 3: Mulshi to Pashan Road.
- 12) Construction of Ramp - 4: Satara/Kothrud to Mulshi Road.
- 13) Construction of VUP on Ramp – 3 and Ramp – 7.

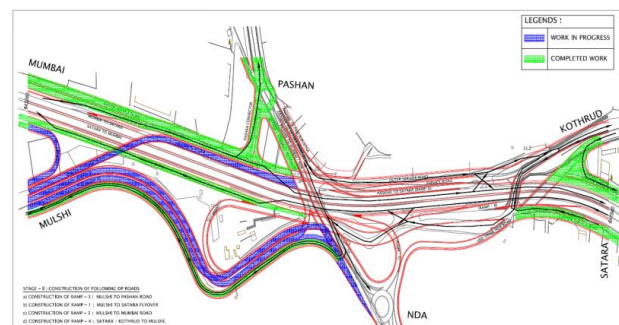


Fig. 2: Stage-II

**Stage-III:** After Completion of Stage – II, Construction of Stage – III can be started. For construction of Stage – III, it is necessary to reduce the traffic volume at Pashan VOP. In stage

- I and stage – II, traffic volumes have been reduced. Stage – III includes construction of following structure-

14) Construction of NDA - Pashan VOP (Part -1)

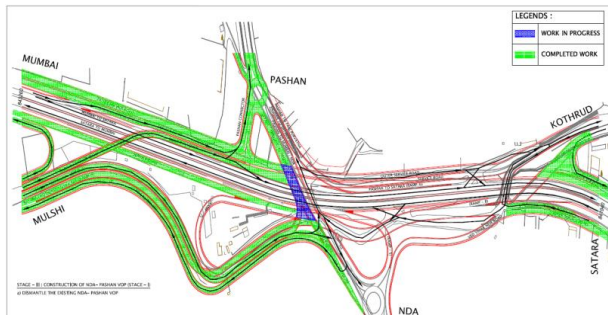


Fig. 3: Stage-III

**Stage-IV:** After Completion of Stage – III, Construction of Stage – IV can be started. Stage – IV includes construction of following road works and Structures-

- 15) Construction of RHS Service roads from Chainage Km. 842.250 to Km. 842.640.
- 16) Construction of RHS outer service roads from Chainage Km. 842.250 to Km. 842.640.
- 17) Construction of Ved-Vihar to NDA Road.
- 18) Construction of NDA Rotary.
- 19) PashanSatara VOP – Foundation work.

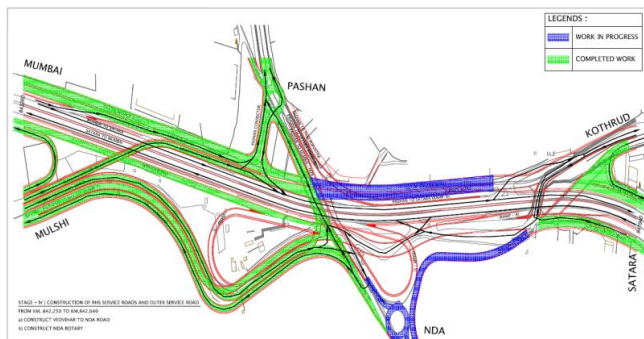


Fig. 4: Stage-IV

**Stage-V:** After Completion of Stage – IV, Construction of Stage – V can be started. Stage – V includes construction of following road works and Structures-

- 20) Construction of LHS Service roads from Chainage Km. 842.160 to Km. 842.640.
- 21) Construction of RHS outer service roads from Chainage Km. 842.160 to Km. 842.640.
- 22) Construction of Kothrud/Satara to Pashan Road (Ramp – 7)
- 23) VUP on Ramp – 5 – Foundation and abutment work.

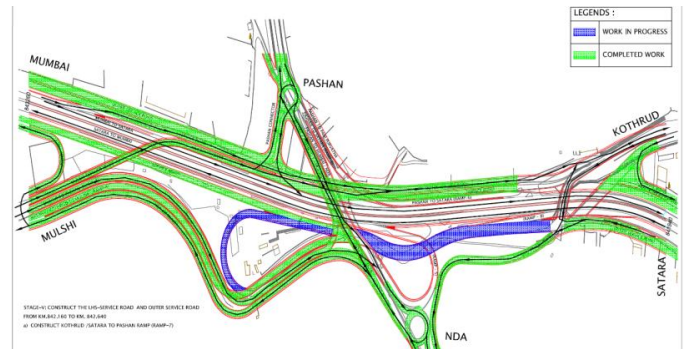


Fig. 5: Stage-V

**Stage-VI:** After Completion of Stage – V, Construction of Stage – VI can be started. Stage – VI includes construction of following road works and Structures.

24) Construction of VUP-1.



Fig. 6: Stage-VI

**Stage-VII:** After Completion of Stage – VI, Construction of Stage – VII can be started. Stage – VII includes construction of following road works and Structures.

- 25) Widening of Existing VUP.
- 26) Widening of NH-MCW from Chainage Km.841.400 to 842.160.
- 27) Construction of RHS Inner service road from Chainage Km. 842.250 to Km. 842.160.
- 28) Construction of Ramp – 8.

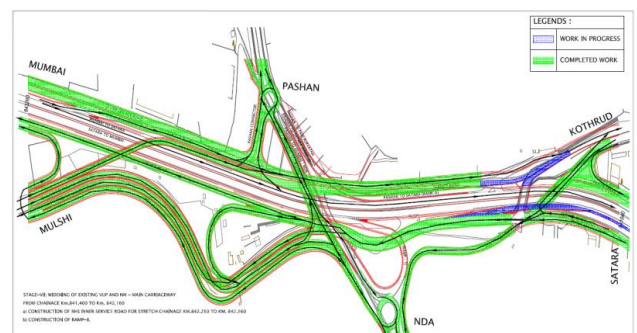


Fig. 7: Stage-VII



**Stage-VIII:** After Completion of Stage – VII, Construction of Stage – VIII can be started. Stage – VIII includes construction of following road works.

- 29) Construction of RHS - Outer service road from Km. 842.160 to Km. 842.640 up to final profile.

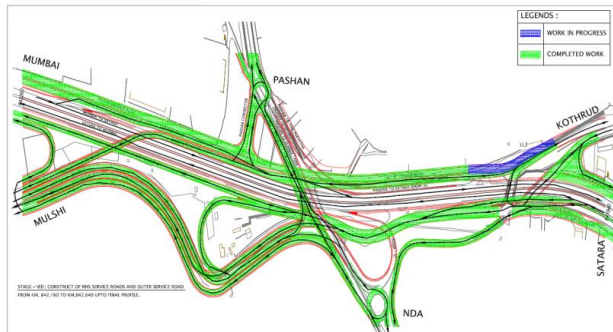


Fig. 8: Stage-VIII

**Stage-IX:** After Completion of Stage – VIII, Construction of Stage – IX can be started. Stage – IX includes construction of following road works-

- 30) Road NDA -Pashan VOP (Part - II)  
 31) Pashan - Mumbai Ramp (Ramp - 5) – Superstructure and approaches  
 32) Pashan - Satara Ramp (Ramp - 6) – Substructure, Superstructure and approaches  
 33) Pashan to Panipuravatha Road.

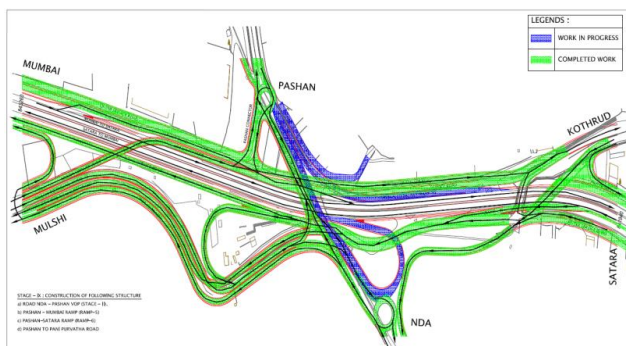


Fig. 9: Stage-IX

#### IV. TRAFFIC MANAGEMENT

It is necessary to prepare Traffic Management Plan (TMP) during construction for the project of Chandani Chowk. The main objective to prepare a Traffic Management Plan is to ensure that, there will be minimum disturbance to the existing traffic on NH-4. Due to bottleneck at Pashan VOP, the task is difficult. Earlier, stage-wise construction sequence is discussed. In the same line for regulation of traffic, a traffic management plan during construction is required to be prepared.

##### 4.1 Existing Traffic Movements

The existing traffic movements are from six directions viz. Mumbai, Satara, Kothrud, Pashan, NDA and Mulshi side. Mumbai - Satara traffic is going on NH-4, towards Kothrud- traffic takes a Kothrud road, towards Pashan/NDA/Mulshi it takes Kothrud road through VUP via Kothrud-NDA Jn. road over Pashan VOP to Pashan.

Satara towards Kothrud- traffic is to take a left for VedVihar road through VUP to Kothrud, towards NDA/Mulshi/Pashan take a left to Kothrud-NDA Jn. road from where it is going to respective directions.

Kothrud towards Mumbai/NDA/Mulshi traffic is going through VUP via Kothrud-NDA Jn. Road and from where it going to respective directions, towards Satara/Pashan traffic is going through VUP via Kothrud-NDA Jn. road over Pashan VOP from where it is going to respective directions.

Pashan towards Mumbai/NDA/Mulshi traffic is from Pashan-Kothrud road going through VUP via Kothrud-NDA Jn. Road and from where it going to respective directions, towards Satara/Kothrud traffic is going through Pashan-Kothrud road from where it going to respective directions.

Mulshi towards Mumbai traffic is from Mulshi to NDA Jn. Road over Pashan VOP via Pashan-Kothrud road going through VUP via Kothrud-NDA Jn. Road to Mumbai, towards Pashan/Satara/Kothrud traffic is from Mulshi to NDA Jn. Road over Pashan VOP from where it going to respective directions.

NDA towards Mumbai traffic is passing over Pashan VOP via Pashan-Kothrud road going through VUP via Kothrud-NDA Jn. Road to Mumbai, towards Pashan/Satara/Kothrud traffic is passing over Pashan VOP from where it going to respective directions, towards Mulshi traffic is from NDA-Mulshi road to Mulshi.

##### 4.2 Traffic Diversion for Stage – I

For the traffic diversion of stage –I refer the figure no. 1. For the construction of this stage traffic diversion is not required. The existing traffic at ChandaniChowk will remain as it is.

After construction of the Stage – I, the Mumbai-Pashan traffic will be diverted to the Pashan connector road (24m wide) and Kothrud to Satara traffic will be diverted to the RHS Service road, which will reduce the traffic volume from Kothrud VUP and Pashan VOP. The reduced traffic volume at Kothrud VUP and Pashan VOP is beneficiary for the further diversion in lateral stages.

#### 4.3 Traffic Diversion for Stage – II

For the traffic diversion of stage –II, refer figure no. 2. For the construction of this stage traffic diversion is required. For the construction of Ramp – 3 (Mulshi to Pashan) and Ramp – 4 (Kothrud to Pashan), the existing NDA Junction towards Mulshi traffic will be diverted on newly constructed NDA-Mulshi road and for construction of Mulshi flyover, existing traffic on NH-4 will be locally diverted to the newly constructed LHS and RHS Service and outer service roads. The diversion is marked by arrow in the figure no. 2 above.

After construction of the Stage – II, Mulshi towards Mumbai traffic will be diverted to the Ramp -2 (Mulshi-Mumbai) and Mulshi towards Satara/Kothrud traffic will be diverted to the Ramp -1 (Mulshi-Satara). Mulshi towards Pashan traffic will be diverted from Ramp – 1 via Pashan connector road to Pashan. All Mulshi traffic going to all respective direction is diverted to newly constructed ramps. Therefore, the traffic at the Pashan VOP is further reduced.

#### 4.4 Traffic Diversion for Stage – III

For the traffic diversion of stage –III, refer the figure no. 3 above. For construction of this stage traffic diversion is not required. The traffic diverted up to stage -2 will remain the same for stage -III.

After construction of the Stage – III, all the existing traffic on Pashan VOP will be diverted on newly constructed NDA-Pashan VOP. After diverting the traffic, the existing Pashan VOP will have to be dismantled for the further widening of roads. The new NDA-Pashan VOP is longer, so now space is available for the excavation of structure.

#### 4.5 Traffic Diversion for Stage – IV

For the traffic diversion of stage –IV, refer the figure no. 4 above. For construction of this stage, traffic diversion is required. For the construction of RHS Service road and Outer Service road for the stretch from Km. 842+250 to Km. 842+640. Existing traffic from Pashan towards Satara/Kothrud will be diverted on Pashan connector via NH-4 to Kothrud road and then to Kothrud.

After construction of the Stage – IV, Mumbai/Mulshi/Pashan towards Kothrud traffic is diverted on newly constructed RHS outer service road.

#### 4.6 Traffic Diversion for Stage – V

For the traffic diversion of stage –V, refer the figure no. 5 above. For construction of this stage traffic diversion is required. For the construction of LHS Service road and Outer Service road for the stretch from Km. 842+160 to Km. 842+640. Existing traffic from Kothrud towards NDA/Mulshi/Mumbai will be diverted on Kothrud – NDA Junction road to NDA and then from NDA Junction via Mulshi Road to Mulshi and then from ramp -2 (Mulshi-Mumbai) to Mumbai respectively.

After construction of the Stage – V, Kothrud to Mumbai/Pashan/Mulshi traffic will be diverted to LHS Service road and from outer service road to Mumbai and then diverted on Ramp – 4 (Kothrud to Mulshi) to Mulshi and then from Ramp – 7 (Kothrud/Satara to Pashan) to Pashan respectively.

#### 4.7 Traffic Diversion for Stage – VI

For the traffic diversion of stage –VI, refer the figure no. 6 above. For construction of this stage, traffic diversion is required for the construction of New VUP-1 on NH-4. The VUP – 1 will be constructed in two parts i.e. LHS Carriageway & RHS Carriageway. For first part i.e. LHS Carriageway, existing traffic from Satara towards Mumbai will be diverted on LHS Service road and on outer service road. Mumbai towards Satara traffic will remain undisturbed. After construction of first part, Mumbai to Satara traffic will be locally diverted on LHS Carriage way and for construction of second Part of VUP i.e. RHS Carriageway will be constructed.

After construction of the Stage – VI, all existing traffic through Existing VUP will be diverted to newly constructed VUP – 1 for the widening of Existing VUP.

#### 4.8 Traffic Diversion for Stage – VII

For traffic diversion of stage –VII refer the figure no. 7 above. For the construction of this stage, traffic diversion is required for the widening of Existing VUP and road part on NH-4. The Existing VUP will widen in two parts i.e. widening of LHS carriageway & widening of RHS carriageway. For First part i.e. LHS carriageway widening, existing traffic from Satara towards Mumbai will be diverted on LHS service road and on outer service road. Mumbai towards Satara traffic will remain undisturbed. After construction of first part, Mumbai to Satara traffic will be locally diverted on LHS carriage way and second part i.e. widening of RHS carriageway will have to be constructed.

After construction of the Stage – VII, Kothrud to Mumbai/Mulshi/NDA/Pashan traffic will be diverted through VUP -1 and Satara and Satara/Ved-Vihar to Kothrud traffic will be diverted through the existing widened VUP.

#### 4.9 Traffic Diversion for Stage – VIII

For the traffic diversion of stage –VIII, refer the figure no. 8 above. For construction of this stage, traffic diversion is required. For construction of the RHS outer service road stretch from Km. 842+160 to Km. 842+250, Mumbai/Mulshi/Pashan towards Kothrud traffic will be diverted to RHS Inner Service Road.

After construction of the Stage – VIII, Mumbai/Mulshi/Pashan towards Kothrud traffic will have to be diverted to RHS service road and outer service road.

#### 4.10 Traffic Diversion for Stage – IX

For the traffic diversion of stage –IX, refer the figure no. 9 above. For construction of this stage, traffic diversion is required. For construction of NDA-Pashan VOP (Part-2) and Pashan Flyover, local traffic diversion is required.

After construction of Stage – IX, Pashan towards Satara traffic will be diverted through Pashan Flyover to Satara. Pashan/NDA towards Mumbai Traffic will be diverted through Ramp – 5 (Pashan/NDA-Mumbai) and for Pashan-Panipuravatha traffic on Pashan-Panipuravatha road. Pashan towards NDA traffic on NDA-PashanVOP (Part-2) to NDA.

#### 4.11 Final Traffic Movement

After construction of the of all the stages, Traffic from Mumbai towards Satara will take NH MCW to Satara, traffic towards Kothrud will be through RHS service roads to Kothrud, traffic towards Pashan will be through Pashan connector to Pashan, traffic towards NDA/Mulshi will be through Pashan connector via NDA-Pashan VOP to NDA and from NDA-Mulshi Road to Mulshi respectively.

Traffic from Satara towards Mumbai will take NH main carriageway to Mumbai, towards Kothrud will be through LHS Service roads through existing VUP to Kothrud, towards Pashan will be through Ramp -8 to Ramp -7 to Pashan, towards Mulshi will be through Ramp - 8 and Ramp - 4 to Mulshi, towards NDA from Ved-Vihar to NDA Road to NDA.

Traffic from Kothrud towards Mumbai through VUP -1 to LHS service road to Mumbai, towards Satara will be

through RHS Service roads to Satara, towards Pashan it will be through VUP -1 to Ramp -7 to Pashan, towards Mulshi it will be through VUP-1 and Ramp -4 to Mulshi, towards NDA through VUP -1 to Ved-Vihar to NDA Road to NDA.

Traffic from Pashan towards Mumbai through Ramp-5 to Mumbai, towards Satara it will be through Ramp-6 to Satara, towards Kothrud it will be through Pashan Connector road to RHS outer service road to Kothrud, towards Mulshi it will be through NDA-Pashan VOP and NDA-Mulshi road to Mulshi, towards NDA through NDA-Pashan VOP to NDA.

Traffic from Mulshi towards Mumbai through Ramp-2 to Mumbai, towards Satara it will be through Ramp-1 to Satara, towards Kothrud it will be through Ramp-1 to RHS outer service road to Kothrud, towards Pashan it will be through Ramp -3 to NDA-Pashan VOP to Pashan, towards NDA through Ramp -3 to NDA-Pashan VOP taking U-turn from Pashan rotary to NDA.

Traffic from NDA towards Mumbai through Ramp-5 to Mumbai, towards Satara will be through NDA-Pashan VOP to Ramp-6 to Satara, towards Kothrud will be through NDA-Pashan VOP to Pashan connector to RHS outer service road to Kothrud, towards Pashan will be through NDA-Pashan VOP to Pashan, towards Mulshi through NDA-Mulshi road to NDA.

## V. CONCLUSIONS

The improvement proposal of Chandani Chowk by NHAI and difficulties during the implementation of project are thoroughly studied, the construction sequence, traffic management study is given in this report. The conclusion of the study is as below:

- Construction Planning and Construction sequence is done for timely completion of work.
- Traffic study and Traffic Management plan is prepared during the construction of work for safe movement of traffic. It is observed that, traffic will be diverted safely during construction work towards different directions.

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