Traffic Circulation, Diversion, and Management Plan for Ahmedabad-Mumbai High Speed Rail Corridor Package C-7

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ABSTRACT

Package C-7 of Mumbai- Ahmadabad High Speed Rail Corridor includes stretch of 18.133 Km and has two upcoming stations i.e., Ahmadabad and Sabarmati Station. This High-Speed Corridor will begin from Mumbai in Maharashtra and terminate at Sabarmati in Gujrat. The length of this High-Speed Rail (HSR) Corridor is 508.17 km of which Elevated: 468 km, underground: 27 km (2 km under sea at Thane Creek) At-Grade: 13 km and consists of 12 Stations. This Ahmedabad-Mumbai High Speed Rail (AMHSR) line envisages use of public transport system between financial capitals of Maharashtra and Gujarat and shall cater the present and future travel demand of the catchment area. This line shall also reduce load from road-based transport system of the corridor. During the construction phase of any Transportation Infrastructure running along the Right of Way (ROW) of existing roadway system, Traffic diversion and management plan implementation becomes absolute mandatory to reduce congestion, conflicts increase level of safety and ease construction process. Similarly, for package C-7 of High-Speed Rail Corridor, there is need of preparing an implementing Traffic Circulation, Diversion and Management plan to create a synergy amongst construction activities, traffic flow, safety of pedestrian and construction worker with minimal impact on surrounding catchment. This study shall provide Traffic circulation, diversion and management plan which will help to cater the existing traffic and stir them in a smooth and non-congested flow with the help of signage's, road markings, etc.

1. INTRODUCTION

Traffic management is a process of compiling and analyzing information on the impacts that a specific development proposal is likely to have on the operation of roads and transport networks & also control of both stationary and moving traffic, including pedestrians, bicyclists, and all types of vehicles. The management is not only including general impacts relating to transport management (road efficiency and safety) but should also consider specific impacts on all road users, including on-road public transport, pedestrians, cyclists, and heavy vehicles. Every land use generates home and non-home-based trips over the period of day which ply on the access roads and main arterial roads connecting the proposed / planned development. Also, as any infrastructure construction activity shall reduce the available capacity of transport network which will affect the level of service. These roads have specific capacity in terms of number of vehicle (PCU) handling in peak hour as per IRC 106-1990. To provide satisfactory riding quality on this rods, specific level of service shall be maintained by maintaining volume and ease of flow with proper diversion and management plans for the traffic plying on these roads.

It is necessary to maintain both quality and quantity of road infrastructure continuously to maintaining good Level of Service and safety on roads. Most importantly when it comes to Tier 1 & 2 cities where, percentage trip generation every year is increasing due to urban migration, transportation infrastructure facilities become the backbone of the city. However, due to lack of Mass Transit / Transit Oriented Developments and improper transportation planning, commuters must face major traffic issues during peak hour. For any infrastructure project, a proper traffic diversion and management plan is also mandatory to cater the needs, ease the movement and managing a good safety level during execution.

2. OBJECTIVES OF STUDY

The primary objective of this study is to prepare Traffic Circulation & Diversion plan for construction vehicle with the help of Primary and Secondary data collected for the corridor (C-7) and the catchment area so that congestion, conflicts can be ignored to the maximum extent with increase in safety of pedestrians and workers along with improved workability at site.

To achieve the above objectives, following scope is prepared which includes:

a) Reconnaissance survey to understand the existing traffic scenario, proposed construction plan (phasing if any) and bottlenecks in the traffic flow of study area.

b) Reconnaissance survey will be followed by collection primary data from the site which willinclude but not limited to:

i. *Classified Traffic Volume Count at Mid-blocks (Between intersection)*
ii. *Turning Movement Survey at Intersections (All intersection in study area)*
iii. *Spot-Speed Survey (at midblock of study area)*
iv. *Origin-Destination Survey (Strategic location around study area)*

c) Along with primary survey data collection, available data required for the study will be collected from the client.

d) Detailed traffic analysis will be done based on the data collected, rectified, and scrutinized. This traffic analysis will provide results like current LOS of study area, potential routes for traffic diversion, travel characteristics of road users, bottlenecks on the road network, LOS ofroad network considering proposed diversion plan.

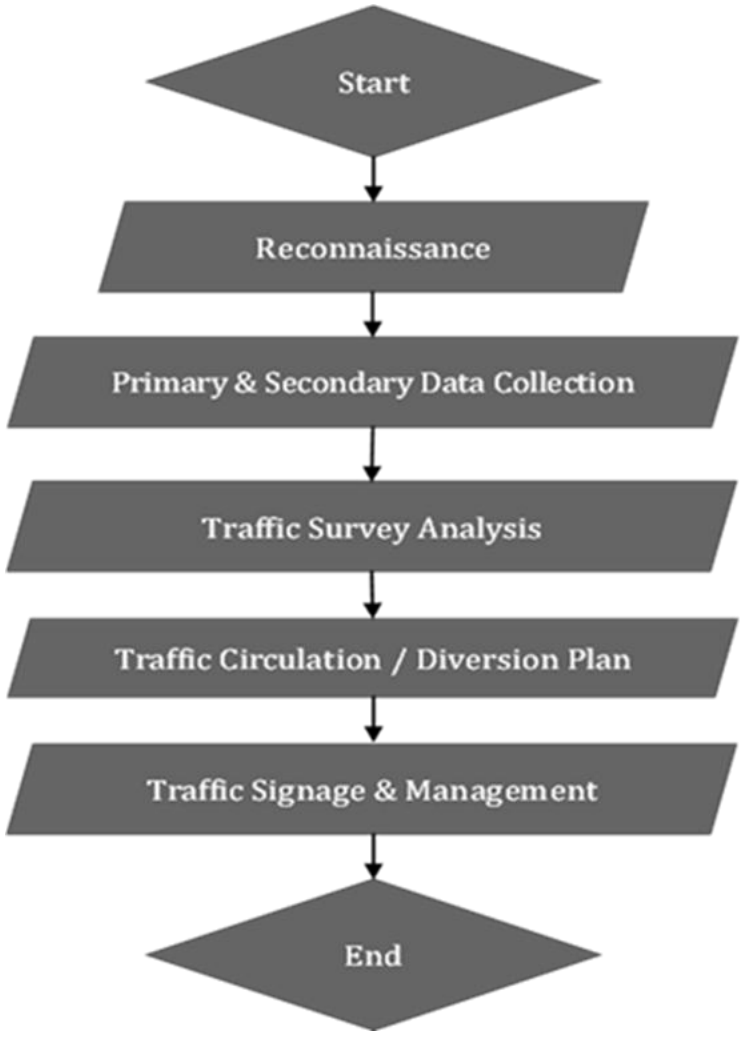
e) Taking in account the required space for construction of AMHSR corridor, traffic circulation plan for construction vehicles will be prepared with detailing like ROW required with adequate turning radius, signage plan etc.

f) Conceptual temporary signage plan for diverted route is prepared.

g) Traffic issues in the study corridor will be identified and their solution will be provided.

3. APPROACH & METHODOLOGY

In line with the scope of work methodology for preparing diversion plan for package C- 7 has been prepared and approached accordingly. Reconnaissance survey was conducted to understand the existing traffic scenario, proposed construction plan (phasing if any) and bottlenecks in the traffic flow of study area followed by primary data collection from site through various traffic surveys as mentioned in the scope. Along with primary survey data collection, available data required and available for the study like Topographical survey of the corridor and GFC for stations are collected from the client. Traffic survey was done based on the primary data collected and the results and observations are provided in the subsequent chapters. After acceptance of the Traffic survey analysis report, traffic diversion plan for the junction will be prepared in detail. Signage plan for diverted route shall also be prepared at this stage of the study. Study approach and methodology is shown in the following flow chart to understand the chronology of work.



4. TRAFFIC SURVEYS ANALYSIS

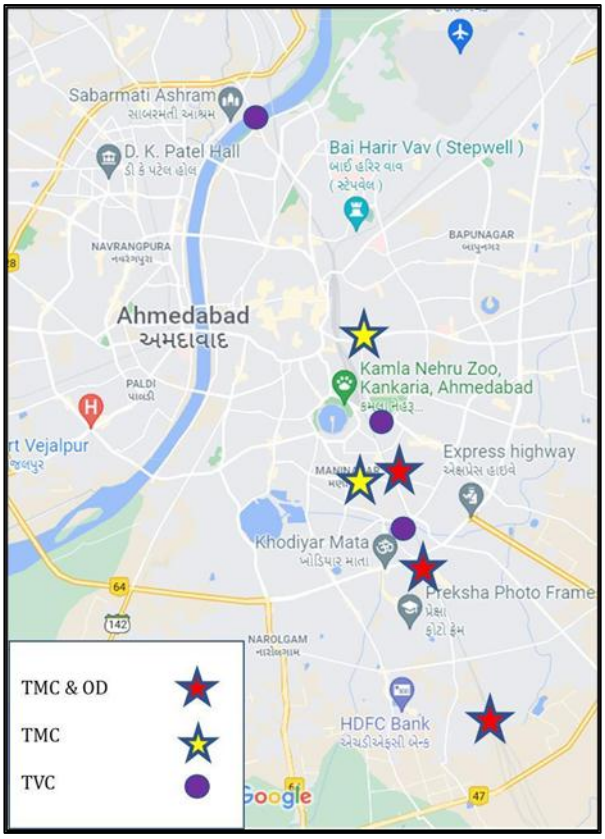
In order to arrive at the present traffic scenario and appreciate the travel characteristics of the road users in this area, primary studies were organized and conducted. The observations from the field studies have been presented below.

A. Methodology adopted for the Traffic Study

To measure the impact of C-7 Package construction work on road network, the current traffic characteristics need to be assessed. Package C-7 of Ahmedabad Mumbai High Speed Rial Corridor starts near Vatva and ends at Sabarmati where Sabarmati Rolling Stock Depot is being constructed. Sabarmati maintenance depot will be the largest depot among three depots planned for MAHSR corridor. Other depots will be at Surat (Gujarat) and Thane (Maharashtra). To get a better and clear understanding of the existing traffic conditions, the flow of traffic, utilization of road ROW and some other technical details of the road Primary traffic survey were planned and conducted.

These surveys include.

1 Traffic Volume count – 3 Locations
2 Turning movement Survey – 5 Locations
3 Origin and Destination survey – 3 Locations
4 Spot Speed survey – 3 Locations



B. Traffic Volume Count (TVC)

Traffic Volume Count is counting of the number of vehicles passing through a road over a period. It is defined as the procedure to determine mainly volume of traffic moving on the roads at a particular section during a particular time. Traffic volume count was conducted Traffic Volume count was conducted on 3 locations:

1 Mani Nagar Bridge
2 Cadilla Road
3 Subhash Bridge

As per the data collected at the location, it can be clearly seen that the road is dominated by the movement of Two Wheelers followed by auto rickshaw and then cars. Also, the peak hour of the Mid-block is from 11.00 to 12.00 in the Morning, 18.00 to 19.00 in the evening and 10.00 to 11.00 in the morning.

C. Turning Movement Count

Turning Movement Count or most popularly known as Intersection count is used to count vehicles which are moving inward and outward of an intersection in number of directions. The main purpose is to gather the vehicle data to determine the traffic flow in particular direction. Traffic Movement count was done at 5 Junctions to determine the directional flow in peak hours which will be helpful to decide the diverted route required for the study area. The survey was conducted 4 hours in the morning peak and 4 hours in the evening peak. Turning movement count was conducted at following locations:

i. Vatva Railway Crossing

Turning Movement count conducted at Vatva Railway Crossing again shows that the alignment stretch is dominated by two wheelers followed by Bicycles. Also, the morning peak i.e.,9.00 to 10.00 is at 709 PCUs/hr. and evening peak hour i.e., 19.00 to 00 is around 861 PCUs/hr.

ii. Cadilla Railway Crossing

The Turning Movement count conducted at Cadilla Railway Crossing shows that the alignment stretch is dominated by two wheelers followed by auto rickshaw Also, the morning peak i.e., 10.00 to 11.00 is at 2496 PCUs/hr. and evening peak hour i.e., 18.00 to 19.00 is around 2593 PCUs/hr.

iii. Mani Nagar Railway Crossing

The Turning Movement count conducted at Mani Nagar Railway Crossing Junction again shows that the alignment stretch is dominated by two wheelers followed by auto rickshaw Also the morning peak i.e., 10.00 to 10.00 is at 2521 PCUs/hr. and evening peak hour i.e., 19.00 to 20.00 is around 2788 PCUs/hr.

iv. Bhairavnath Chowk

Turning Movement count conducted at Bhairavnath Chowk again shows that the alignment stretch is dominated by two wheelers followed by auto rickshaw Also, the morning peak i.e., 10.00 to 11.00 is at 3909 PCUs/hr. and evening peak hour i.e., 20.00 to 21.00 is around 4400 PCUs/hr.

v. Arham Circle

Turning Movement count conducted at Arham Chowk again shows that the alignment stretch is dominated by two wheelers followed by auto rickshaw. Also, the morning peak i.e., 09.00 to 10.00 is at 6346 PCUs/hr. and evening peak hour i.e., 19.00 to 20.00 is around 8322 PCUs/hr.

D. Origin and Destination Study

The Origin-Destination survey is carried out to study the travel pattern of passenger traffic along the study corridor. Origin and Destination Study was conducted at three locations:

1 Vatva Railway Crossing
2 Cadilla Railway Crossing
3 Mani Nagar Railway Crossing

The Information about Origin and Destination of trips, trip length, trip purpose, frequency of trips, travel cost, travel time was collected during the interviews.

a) Majority of Trips are dominated by work purpose and followed by business/education purpose.
b) Average trip length for business and education purpose varies from 2.0 to 8.0 km.
c) Average Travel time for the commuters varies from 10 minutes - 20 minutes.
d) Average travel cost varies from Rs.10 to Rs.20 depending upon the mode of travel

E. Spot Speed Survey

Spot speed studies are used to determine the speed distribution of a traffic stream at a specific location. Spot speed survey is carried out at mid-block locations with free-flowing traffic to determine the average speed of vehicle moving in peak hour. Spot speed survey data at these three (Mani Nagar Bridge, Cadilla Road, Subhash Bridge) locations suggests that the average speed of any vehicle is between 20-40 Km/Hr. Speed of Two-Wheeler is little higher than the other modes which is understood considering the driving conditions in the study area.

5. TRAFFIC CIRCULATION & DIVERSION PLAN

It is important to analyze the traffic congestion based on the data collected for the package C-7 corridor along with the diverted route as it will provide the present Level of Service of the corridor along with Level of Service available after traffic diversion on alternate routes. Level of Service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by drivers/passengers. Level of Service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Six levels of service are recognized commonly, designated from A to F, with Level of Service A representing the best operating condition (i.e., free flow) and Level of Service F the worst (i.e., forced or

break- down flows. On urban roads, the Level of Service is affected due to roadside commercial activities, construction activities, diverted traffic, pedestrian volumes etc.

A. Vatva Railway Colony

This is the location of 1st railway crossing on the study corridor and important to analyze as level of service of this road not just depends upon the volume of traffic but queuing of vehicles due to railway crossing. As shown in the table below the peak hour traffic in morning on north south corridor (Dibiyapur – Vatva Railway Colony playground) is about 146 PCU. Considering this road as a collector street because of road condition and punctures, the capacity of the two-lane two-way road is about 1300 PCU (900 DSV). Therefore, the Volume / Capacity ratio of the road is 0.12. However, during railway crossing halt this scenario may change and there is a requirement of clear path for construction vehicles.

Time Interval	Vatva Railway Crossing (PCU/ Hr.)
8:00 to 9:00	88
9:00 to 10:00	146
10:00 to 11:00	117
11:00 to 12:00	61
16:00 to 17:00	48
17:00 to 18:00	59
18:00 to 19:00	123
19:00 to 20:00	85

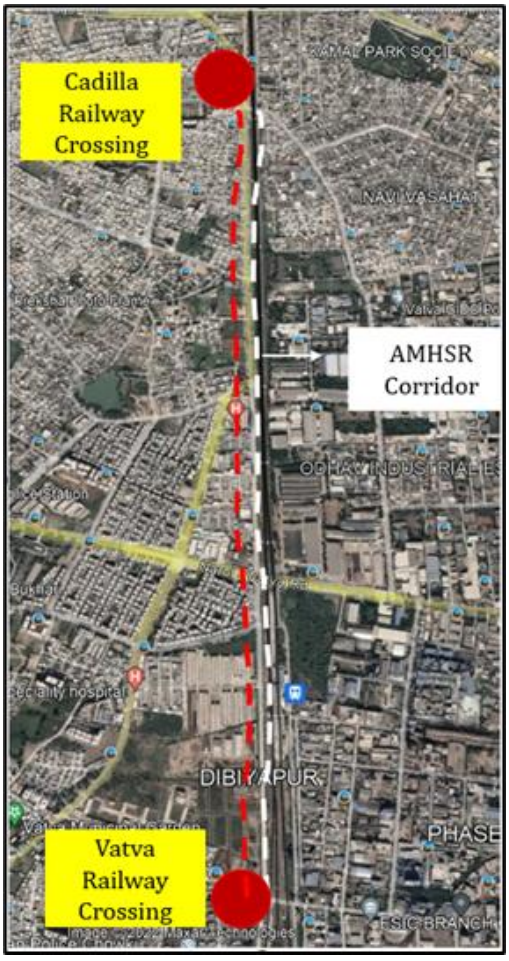
As shown in figure this section mostly lies in greenfield area parallel to existing railway line. A 6 m wide corridor which is 6 m away from the existing railway line and parallel to AMHSR proposed corridor is suggested for movement of construction vehicles. Vatva crossing is the first railway crossing on the proposed AMHSR corridor. One route for construction purpose is proposed parallel to the AMHSR corridor but an additional U Turn is provided at railway level crossing to provide access to the corridor where AMHSR & existing Railway corridor are their side from left to right and vice versa.

B. Cadilla Crossing

This is the location of 2nd railway crossing on the study corridor and important to analyze as level of service of this road not just depends upon the volume of traffic but queuing of vehicles due to railway crossing. As shown in the table below the peak hour traffic in evening on north south corridor (Mani Nagar - Dibiyapur) is about 1608 PCU. Considering this road as sub arterial road, the capacity of the two-lane two-way road is about 1714 PCU (1200 DSV). Therefore, the Volume / Capacity ratio of the road is 0.93 and Level of Service is E. This indicates saturated traffic situation in peak hour. This should be considered while preparing traffic circulation plan for construction vehicles.

Time Interval	Cadilla Crossing (PCU/ Hr.)
8:00 to 9:00	1340
9:00 to 10:00	1478
10:00 to 11:00	1504
11:00 to 12:00	1327
16:00 to 17:00	1496
17:00 to 18:00	1482
18:00 to 19:00	1608
19:00 to 20:00	1466

As shown in figure this section mostly lies in greenfield area parallel to existing railway line. A 6 m wide corridor which is 6 m away from the existing railway line and parallel to AMHSR proposed corridor is suggested for movement of construction vehicles.



The next section, which is starts after Cadilla Level Crossing, Similar to the trailing section a 6m wide corridor away from the existing railway line and parallel to AMHSR proposed corridor is suggested for movement of construction vehicles till Cadilla Bridge. Due to restriction in vertical clearance after Cadilla Bridge due to the flyover, we suggest a left turn at from Vatva Station Road towards Cadilla Road which gives a detour to the other side of Cadilla Bridge. Similarly due to Pier placement at Cadilla crossing the traffic at RHS shall be diverted to a parallel road on the right- hand side towards Jasoda Nagar Cross Road.

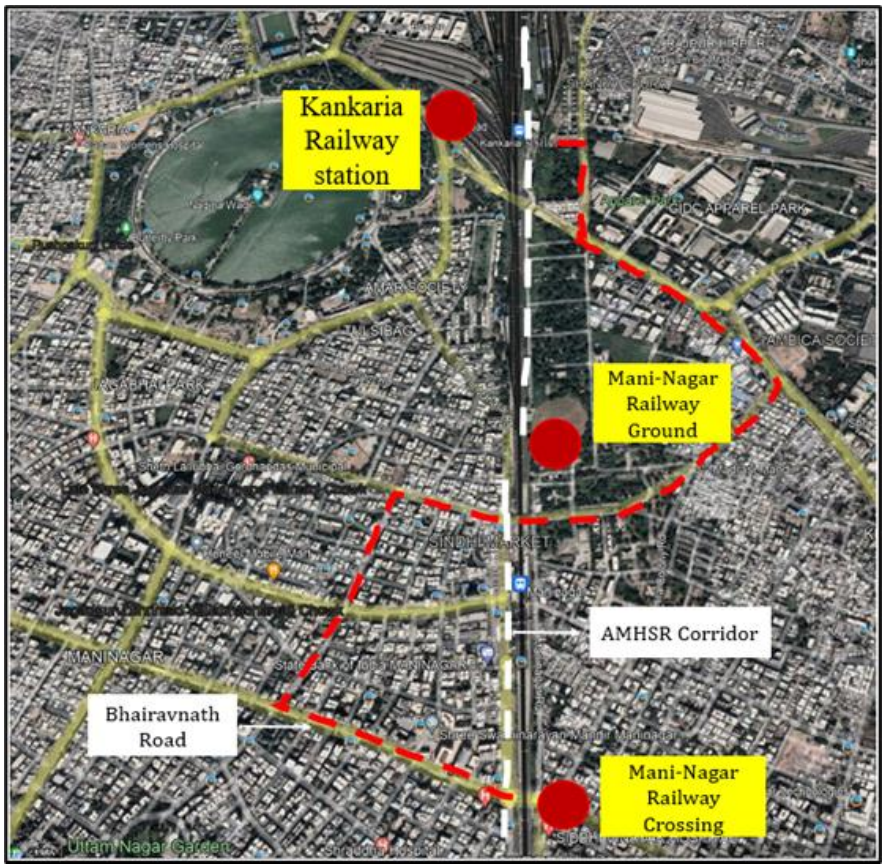
C. Mani Nagar Railway Crossing

This is the location of 3rd railway crossing on the study corridor and important to analyze as level of service of this road not just depends upon the volume of traffic but queuing of vehicles due to railway crossing. As shown in the table below the peak hour traffic in evening on north south corridor (Mani Nagar Railway Station - Dibiyapur) is about 1755 PCU. Considering this road as sub arterial road, the capacity of the four-lane two-way divided road is about 4100 PCU (2900 DSV). Therefore, the Volume / Capacity ratio of the road is 0.42 and Level of Service is B. This indicates theoretically free flow traffic situation in peak hour. However, due to level crossing, actual traffic situation is different and should be taken care while preparing construction vehicle traffic circulation plan.

Time Interval	Mani Nagar Railway Crossing (PCU/ Hr.)
8:00 to 9:00	1436
9:00 to 10:00	1594
10:00 to 11:00	1701
11:00 to 12:00	1304
16:00 to 17:00	1613
17:00 to 18:00	1755
18:00 to 19:00	1771
19:00 to 20:00	1431

As shown in figure this section mostly parallel to AMHSR corridor. A 6m wide corridor which is 6m away from the existing railway line and suggested for movement of construction vehicles. The Alignment shifts from Left to Right side

of the existing Railway Line at nearby Mani-Nagar Railway Ground and a portal is proposed at nearby Mani Nagar Railway Ground right side of the AMHSR corridor. To connect the ROW a left turn towards. Bhairavanth Road which connects the Mani Nagar Bridge and eventually connects to the AMHSR corridor nearby the Kankaria Railway station, which shall give an internal access till nearby Mani Nagar Railway Ground.



In Addition to the above-mentioned diversion, during Pier Placement it was observed that the 4 piers before the Mani Nagar Railway Crossing were obstructing the road movements. So, to overcome this reduction of the carriageway for the length of 3.5m it was suggested the traffic shall be diverted to a Sub arterial road connecting Jai Hind Char Rasta on Bhairavnath road along with the three marked connecting roads to displace the traffic before these pier obstructions. This shall increase travel distance of about 1 km, but as operating speed can be managed on this road it is suggested traffic shall be diverted on the marked route rather than plying on existing route during construction phase.

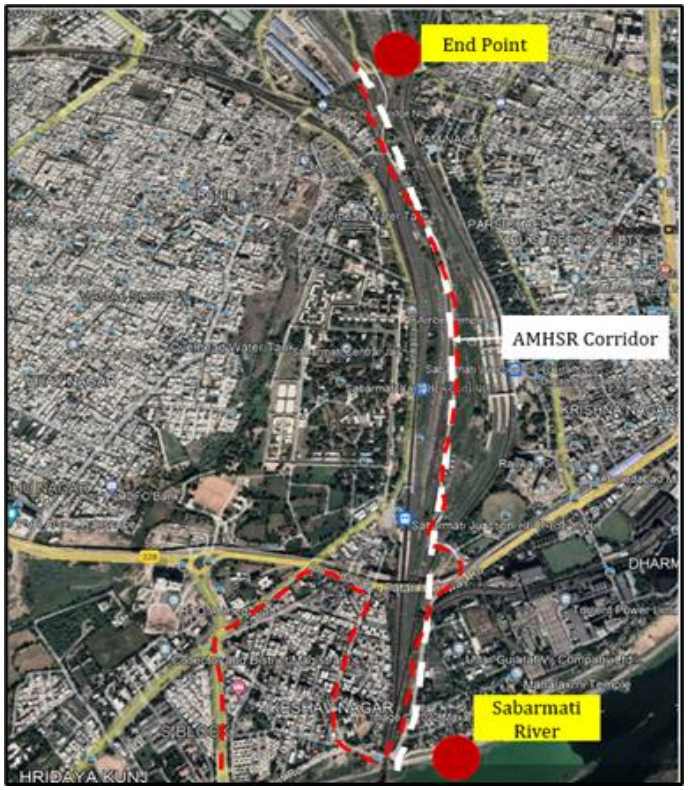
D. Subhash Bridge

This bridge lies on the Sabarmati River and connecting north and south parts of the Ahmedabad and important as construction vehicles shall ply on this road. As shown in the table below the peak hour traffic in evening on north south corridor (Gandhinagar -Ahmedabad) is about 4193 PCU. Considering this road as arterial road, the capacity of the four-lane two-way divided road is about 5142PCU (3600 DSV). Therefore, the Volume / Capacity ratio of the road is 0.8 and Level of Service is E. This indicates theoretically sub saturated traffic situation in peak hour. However, Subhash bridge relates to arterial 4 lane road from either side which makes decongestion of Subhash bridge easier.

Time Interval	Subhash Bridge (PCU/ Hr.)
8:00 to 9:00	3138
9:00 to 10:00	2910
10:00 to 11:00	3206
11:00 to 12:00	2383
16:00 to 17:00	4125
17:00 to 18:00	4193
18:00 to 19:00	3108
19:00 to 20:00	2933

As shown in figure below this stretch is uniform and continuous till Sabarmati River front. The entire stretch will be connected to various openings in between them, one such point is suggested adjacent to the Sardar Vallabhbhai Patel National Memorial which can be used to connect the Subhash Bridge to cross Sabarmati River. A muddy path will be constructed in Sabarmati River on the ROW to create access for the construction vehicles. Along with the muddy Path Subhash Bridge can also be used to access both the ends of the river.

As shown in figure below the remaining existing parallel road is available parallel to the AMHSR including a tunnel nearby Ahmedabad-Patan Highway flyover which has the required vertical clearance. After the tunnel the adequate land is available parallel to the ROW to create access points in between.



6. TRAFFIC MANAGEMENT IMPLEMENTATIONS

Construction zone is an integral part of any road construction system. The safety practices in construction will, therefore, be oriented towards reducing conditions, which lead to such hazards, and consequent stress whereby risk of accident increases. Different measures are aimed at avoiding hazardous conditions for different zones and sections where major construction activities are going on.

Signage has been provided in such a way that the driver will get complete information about the road safety regulations ahead. With the help of this signage, driver can understand the characteristics of road section. The signage plan is therefore prepared for complete corridor. All signage proposed will be clearly understood. Reflective or illuminated signage is suggested for proper visibility. Signage needs to be placed at appropriate locations suggested in the signage drawing so that people have time to see and understand the signs and take appropriate action. It includes the following:

a) Ongoing Work Signs
b) Speed Limit
c) Advance "Traffic Diversion Ahead" Board
d) No-Parking Sign

Channelizing devices are used to warn vehicles of unusual condition created by constructions or maintenance activity in or near the travelled way and to guide vehicles safely pass the work area. It includes the following:

a) Traffic Cones
b) Tubular Markers
c) Delineators
d) Object Hazard Marker
e) Drums
f) Barricades

For safety of people at work, it is required to identify hazards, assess risk and consider means to control the risk exposure during the work. Therefore, the policies that should be considered are as follow:

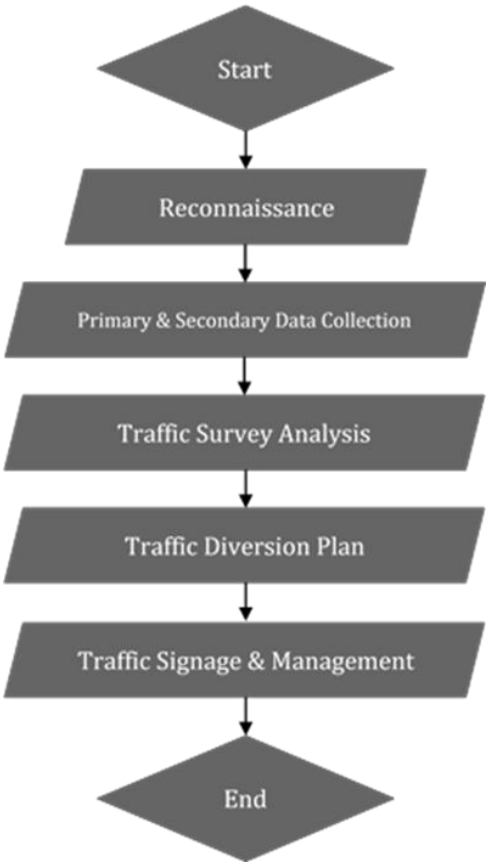
a) To ensure that traffic is delayed as little as possible by the construction operation.
b) Importance is given to traffic safety for pedestrians and to provide a safe working environment for the workmen.
c) Routine inspection of traffic control elements and traffic operation needs to be carried out to ensure that roadside safety is never slack during the progress of the project.

7. CONCLUSION

1. Package C-7 of Mumbai Ahmadabad High Speed Rail Corridor in Ahmadabad City includes a stretch of 18.133 Km and has two upcoming stations i.e., Ahmadabad and Sabarmati Station

2. There is need of preparing an implementing Traffic Diversion and Management plan for this package to create a synergy amongst construction activities, traffic flow, safety of pedestrian and construction worker with minimal impact on surrounding catchment. This study shall provide Traffic diversion and management plan which will help to cater the existing traffic and stir them in a smooth and non-congested flow with the help of signage's, road markings, etc. In line with the requirement of Traffic diversion and management plan for study corridor.

3. In line with the scope of work methodology for preparing diversion plan for package C-7 has been prepared and approached accordingly.



4. Reconnaissance survey was conducted to understand the existing traffic scenario, proposed construction plan (phasing if any) and bottlenecks in the traffic flow of study area followed by primary data collection from site through various traffic surveys as mentioned in the scope.

5. As per the data collected at the location, it can be clearly seen that the road is dominated by the movement of Two Wheelers followed by cars. Also, the peak hour of the Mid-block is from 10.00 to 11.00 in the morning.

6. While diverting the traffic for construction of the alignment, parking management and signage plan becomes mandatory as some portion of the road capacity is not utilized because of encroachment and illegal parking.

7. REFERENCES

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