TRAFFIC CONGESTION ANALYSIS; REMEDIAL MEASURES FOR NARHE REGION

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Abstract: *Traffic congestion is a condition on transport networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. While congestion is a probability for any mode of transportation this article will focus on automobile congestion on public roads and its remedies.*

Keywords : *traffic density, pcu , nodal points, speed performance index.*

I. INTRODUCTION

Urbanization refers to the population shift from rural to urban areas. This has led to congestion in the developing areas. It is predominantly the process by which towns and cities are formed and become larger and more people begin living and working in central areas. The United Nations has predicted that half of the world's population would live in urban areas at end of 2008. It is predicted that by 2050 about 64% of developing world and 86% of developed world will be urbanised.

Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available street capacity; this this point is commonly street termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length.

II. CURRENT SCENARIO

Pune is second largest city in Maharashtra and 9th most populous city in country. Also, with the city area the suburban regions in Pune has started developing. Narhe is one of the suburban areas in Pune having a potential growth. The population of this region is increasing rapidly as the growth of industrial sector has increased employability. According to 2011 Census the population of Narhe was 16,846. On date the population has increased up to 1,50,000. Narhe region comprises of 5 colleges and more than 18 schools. Also, there are more than 100 registered small and medium scale industries. Along with the growth of population the congestion has increased and resulted in critical traffic issues. Industrial sector, college students' and local vehicles on road have increased. Proper traffic analysis and management is required for the decongestion of roads. Number of motorized vehicles on road have increased. Thus, proper public transportation system should be made more flexible.

III. SCOPE

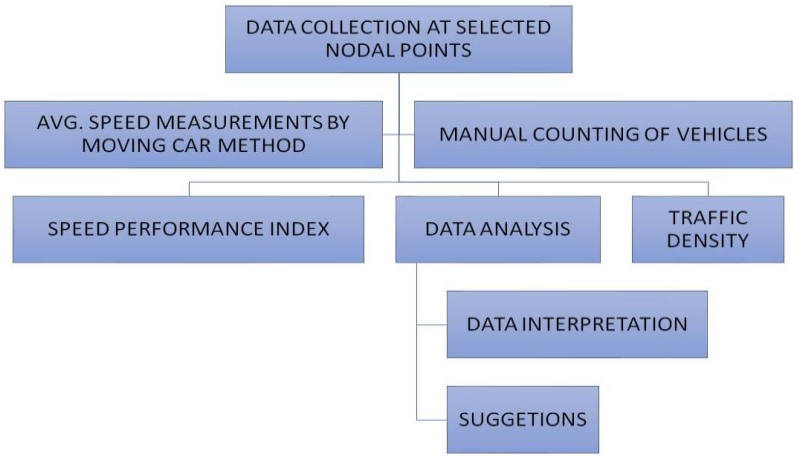
Active traffic management improves vehicle throughout and generates incident warnings for added safety on the road. Innovation technologies have helped to achieve this goal.

- Whole route will be thoroughly studied for challenges and bottlenecks that hinder the smooth traffic system.
- The actual public views will be taken under considerations.
- The passenger activity hotspots high mobility junctions and important stops along the route will be given importance in the development plan.
- Adjoining land use patterns will be studied and road-oriented development will be proposed.
- To find out all possible causes and solutions for traffic jams in Narhe.

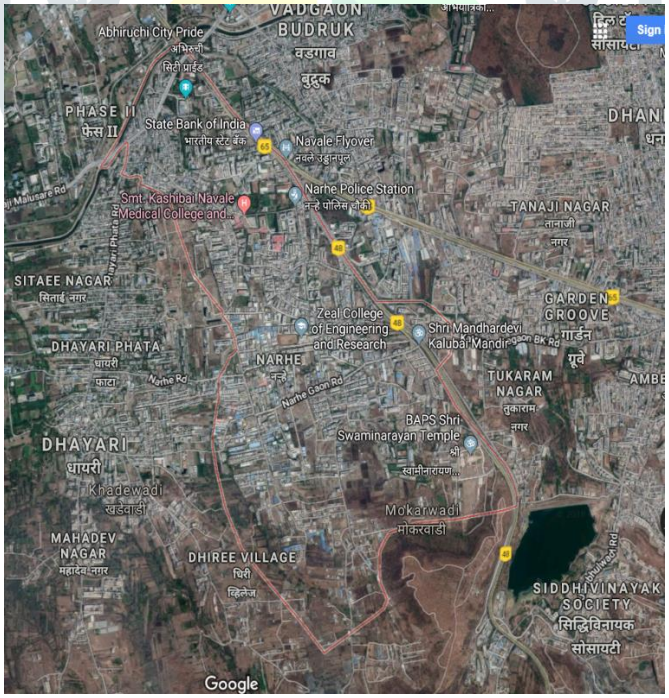
IV. LITERATURE REVIEW

- **Sourabh Jain, Sukhvir Singh Jain, Gaurav Jain** "Traffic Congestion Modelling Based on Origin and Destination " (**2017**)
- **Shekhar Rahane, U.R.Saharkar** "Traffic congestion –causes and solutions: A study of Talegaon Dab hade city" **(2014)**
- **P. J. Muhammad Ali & R. H. Faraj** "A traffic congestion problem and solutions: the road between Sawz Square and Shahidan Square in Koya city as a case study" **(2013)**
- **Sougata Maji** "Traffic Congestion and Possible Solutions A CASE STUDY OF ASANSOL" **(2017)**
- **Robaka Shamsher & Mohamamd Nayeem Abdullah** "Traffic Congestion in Bangladesh- Causes and Solutions: A study of Chittagong Metropolitan City" **(2013)**

V. RESEARCH METHODOLOGY



FlowChart



Territory of Narhe

Three road segments chosen are:

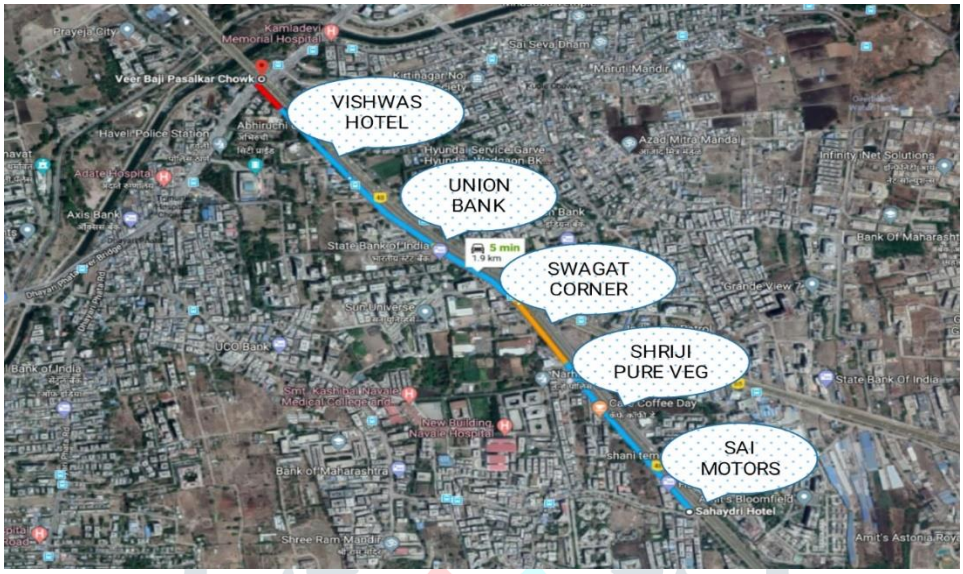
(A) Sai motors to Veer Baaji Pasalkar chowk(A) =2.53 KM

(B) Bhumkar chowk to Narhe road(B) =1.64 KM

(C) Sai motors to Veg gandharva hotel(C) =1.44 KM

SLOT ID	TRAFFIC TYPE	START	END
1	PEAK HRS - DAY	9:30 a.m.	11:00 a.m.
2	NON PEAK HRS - DAY	2:00 p.m.	3:30 p.m.
3	PEAK HRS - NIGHT	7:00 p.m.	8:30 p.m.
4	NON PEAK HRS - NIGHT	10:00 p.m.	11:30 p.m.

Observation time slots



Sai motors to Veer Baaji Pasalkar chowk

SR. NO.	SOURCE	DESTINATION	DISTANCE	NOTATION
1	SAI MOTORS	SHRIJI PURE VEG	400	A1
2	SHRIJI PURE VEG	SWAGAT CORNER	220	A2
3	SWAGAT CORNER	UNION BANK	880	A3
4	UNION BANK	VISHWAS HOTEL	690	A4
5	VISHWAS HOTEL	V. B. P. CHOWK	320	A5

Nodal Points Distance

Data analysis:

Node and segment variables:

Speeds obtained by moving car method were averaged over the count period and then were converted to stream speed, the speed with which the average vehicle moves on that spot, equivalent to the PCU of traffic volume, using the following formula: $\boldsymbol{VS} = \sum_{n=1}^{N}(\mathbf{VI} * \mathbf{QI}) / \sum_{n=1}^{N}(\mathbf{QI})$

SEG	2 WHEELERS		4 WHEELERS		3WHEELERS		L.C.V.		H.C.V.	
A1	TOWARDS NARHE GAON	AWAY NARHE GAON	TOWARDS NARHE GAON	AWAY NARHE GAON	TOWARDS	AWAY	TOWARDS	AWAY	TOWARDS	AWAY
	160	350	27	39	34		15		9	
	510		66							
A2	TOWARDS NARHE GAON	AWAY NARHE GAON	TOWARDS NARHE GAON	AWAY NARHE GAON	TOWARDS	AWAY	TOWARDS	AWAY	TOWARDS	AWAY
	250	171	49	13	31		16		13	
	421		62							
A3	TOWARDS NARHE GAON	AWAY NARHE GAON	TOWARDS NARHE GAON	AWAY NARHE GAON	TOWARDS	AWAY	TOWARDS	AWAY	TOWARDS	AWAY
	503	380	61	27	64		36		15	
	883		88							
A4	ON WAY	WRONG WAY	ON WAY	WRONG WAY	TOWARDS	AWAY	TOWARDS	AWAY	TOWARDS	AWAY
	795	70	208	4	87		63		44	
	865		212							
A5	ON WAY	WRONG WAY	ON WAY	WRONG WAY	TOWARDS	AWAY	TOWARDS	AWAY	TOWARDS	AWAY
	444	7	95	0	59		26		16	
	451		95							
VEHICLES	2500		418		220		150		78	

Peak hour day

SR. NO.	2 WHEELERS	4 WHEELERS	3WHEELERS	L.C.V.	H.C.V.
A1	408	56	32	41	14
A2	280	57	21	17	11
A3	680	100	66	18	17
A4	695	229	63	71	55
A5	295	92	29	19	29
VEHICLES/HR	1886	420	168	132	100

Non-Peak hour day

SR. NO.	2 WHEELERS	4 WHEELERS	3WHEELERS	L.C.V.	H.C.V.
A1	544	80	22	18	8
A2	449	87	17	16	10
A3	110	119	61	13	13
A4	690	205	71	53	117
A5	528	152	41	14	24
VEHICLES/HR	2650	514	170	92	138

Peak hour night

SR. NO.	2 WHEELERS	4 WHEELERS	3WHEELERS	L.C.V.	H.C.V.
A1	101	32	21	22	20
A2	180	30	20	20	15
A3	148	89	44	16	10
A4	310	164	55	42	83
A5	88	88	20	18	14
VEHICLES/HR	661	322	128	95	114

Non-Peak hour Night

vehicle	peak day		non-peak day		peak night		non-peak night		AVERAGE SPEED (VS)
	SPEED (P1)	DENSITY (Q1)	SPEED (P2)	DENSITY (Q2)	SPEED (P3)	DENSITY (Q3)	SPEED (P4)	DENSITY (Q4)	
2 WHEELERS	25	2500	55	1886	22	2650	60	661	34.32
4 WHEELERS	20	418	45	420	18	514	60	322	28.85
3 WHEELERS	28	220	40	168	25	170	50	128	28.8
L.C.V.	26	150	50	132	22	92	60	95	31
H.C.V.	18	78	45	100	18	138	60	114	22

Avg speed calculation

The manually collected data were digitized and a comprehensive table was obtained after removing visible noise (absurd values). Traffic volume was converted to PCU (Passenger Car Unit), the standard unit of vehicular traffic, using the given formula as suggested by HCM 2010: $Q_{PCU} = Q\ (V_C/V_I)/(A_C/A_I)$

Here Q is the observed volume (in vehicles per hour), V_I and A_I are the average speed and plan area of category vehicle and Vc and Ac are the corresponding avg. speed and plan area of cars, the standard design vehicle in traffic engineering.

TIME	VOLUME $\frac{VC}{VI}$	DENSITY $\frac{AC}{AI}$	DENSITY Q	DENSITY $Q.\frac{VC/VI}{AC/AI}$
2 WHEEL	0.97	4.467	6157	1337
4 WHEEL	1	1	1340	1340
3 WHEEL	0.97	1.196	686	556
L.C.V.	0.85	0.661	376	483
H.C.V	0.94	0.218	344	1483

Calculation of Q_{PCU}

Density = Volume / Speed

VEHICLE CATEGORY	TYPES OF VEHICLES	VEHICLES PER HOUR			
		DAY		NIGHT	
		PEAK	NON PEAK	PEAK	NON PEAK
1	2 WHEELERS	2500	1886	2650	661
2	4 WHEELERS	418	420	514	322
3	3 WHEELERS	220	168	170	128
4	L.C.V.	150	132	92	95
5	H.C.V.	78	100	170	114

Vehicles per hour at different traffic conditions

TIME	VOLUME $\frac{VEHICLE}{HOUR}$	DENSITY $\frac{VOLUME}{AVG.SPEED}$
PEAK HOUR DAY	2692	75.83
NON-PEAK HOUR DAY	2164	60.95
PEAK HOUR NIGHT	2851	80.4
NON-PEAK HOUR NIGHT	1056	29.75

Traffic density calculation

VEHICLE CATEGORY	TYPES OF VEHICLES	AVERAGE SPOT SPEED			
		DAY		NIGHT	
		PEAK	NON PEAK	PEAK	NON PEAK
1	2 WHEELERS	25	55	22	60
2	4 WHEELERS	20	45	18	60
3	3 WHEELERS	28	40	25	50
4	L.C.V.	26	50	22	60
5	H.C.V.	18	45	18	60

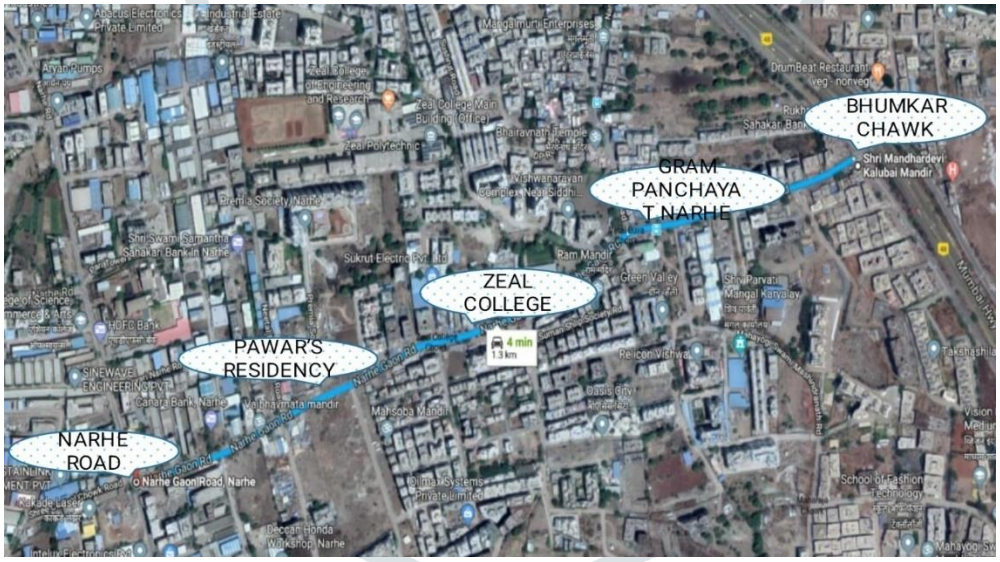
Avg speed calculation at different traffic conditions

SPEED PERFORMANCE INDEX	TRAFFIC STATE LEVEL	DESCRIPTION OF ROAD TRAFFIC
(0,25)	HEAVY CONGESTION	POOR
(25,50)	MILD CONGESTION	BIT WEAK
(50, 75)	SMOOTH	BETTER
(75,99)	VERY SMOOTH	GOOD

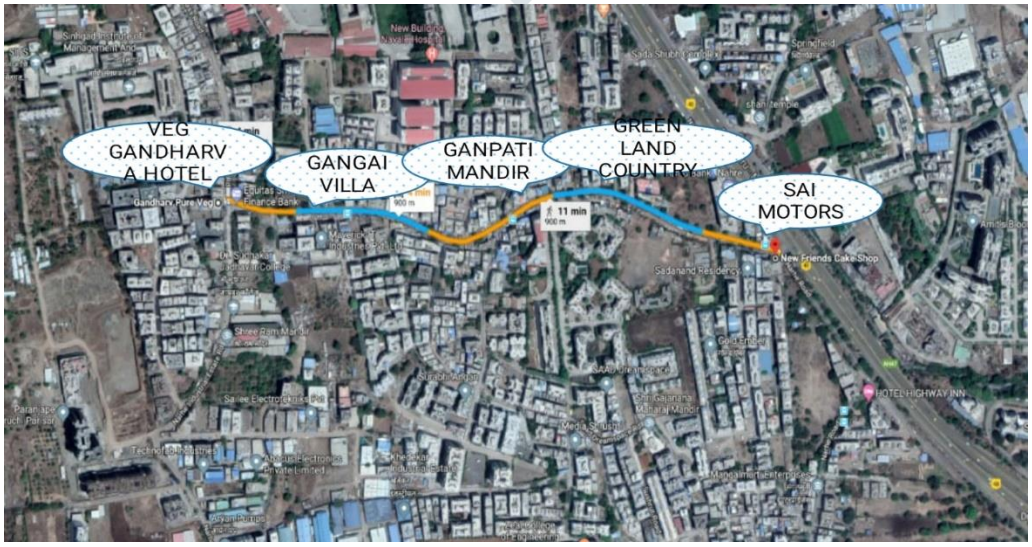
The evaluation criterion of speed performance index

VEHICLE CATEGORY	V	V MAX	RV (S.PI)	$\overline{RV}$ AVG (S.PI)
2 WHEELERS	34.32	65	57.2	48.3
4 WHEELERS	28.85	60	48.13	
3 WHEELERS	28.88	60	48.13	
L.C.V.	31	60	51.66	
H.C.V.	22	60	36.66	

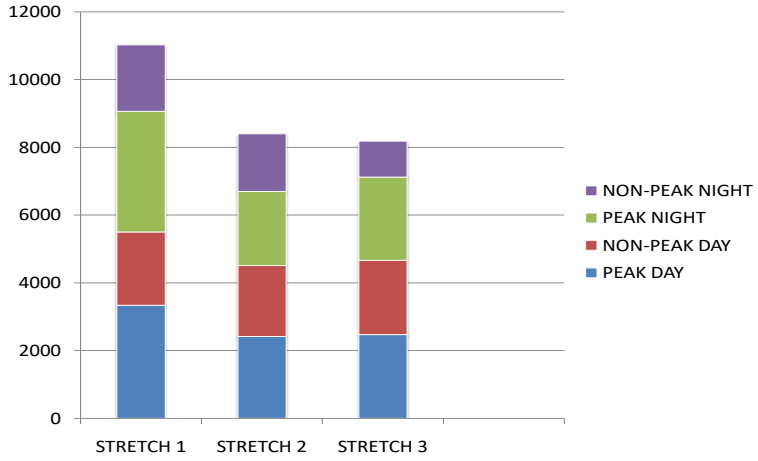
Same method is used for data collection and data analysis for remaining two stretches.



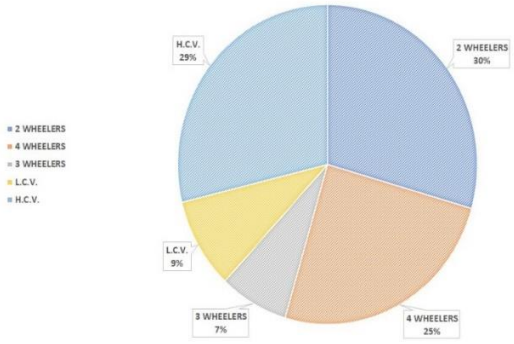
Bhumkar Chowk toNarhe road



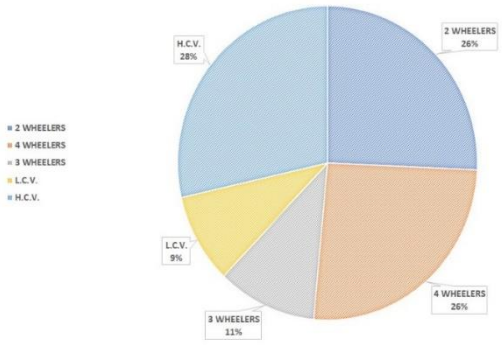
Sai motors to Veg Gandharva hotel



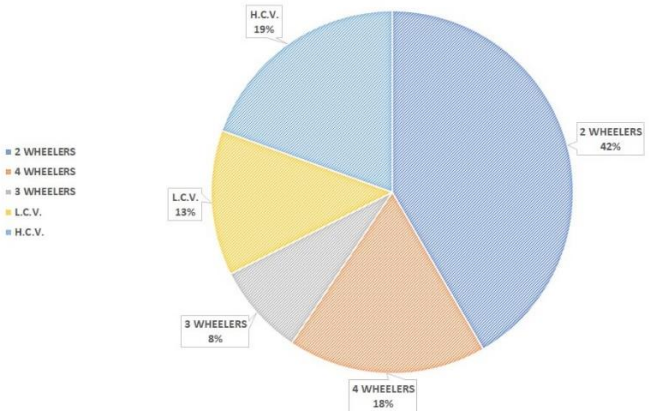
Graphical representation of no. of vehicles observed during survey work



Stretch A



Stretch B



Stretch C

VI. CAUSES

Narrow roads: Streets of Narhe gaon are not that wide spread, due to illegal possession on the road by the shop owners and road side vendors. The roads are not planned by the administration due to lack of vision, which has resulted into heavy traffic issues on daily basis. Due to improper positioning of bus stops, the traffic on the roads increases.

Frequency of HCV: Due to number of industries, the demand for HCV for raw material purpose and delivery purpose is more. Narhe is developing region, hence a lot of construction activities are going on, this leads to need of HCV. Due to lack of drainage and water supply system, large number of population in this area depends on water from water supply tankers for domestic purposes.

Increasing number of population : From year 2011 to 2018, the population of Narhe has jumped from 16,846 to 1,50,000. This is due to increase in number of colleges, schools, industries and comparatively lesser land rates.

Illegal parking: Illegal parking on the road has been creating congestion every day at Gandharv Hotel chowk and in front of Maharashtra Bank.

Higher purchasing power: Due to higher purchasing power of people in Narhe, the popularity of private transportation is increasing, but existing roads and highway are not supportive according to the increasing number of vehicles.

Improper planning: Narhe does not come under the PMC territory, there is no Development Plan. Hence illegal activities like land acquisition and road side vendors have increased.

Inadequacy of traffic police: Since Narhe does not come under PMC, volunteers are appointed by Gram Panchayat at Greenland County, Zeal college road and Shri Control chowk instead of traffic police. Hence there is no fear and discipline among the local people.

Improper lane Management: Lane management is an important factor in managing traffic situations. Roads of Narhe are mainly single and undivided. Many types of the vehicles try to over take the vehicle even in the single undivided road.

Quality of Roads: Due to poor road quality, the speed of vehicles running on the road is not uniform. The excavation work done for laying drainage lines haven't been closed properly resulting non uniform road surface.

Other reasons:

a. Lack of driving sense
b. Lack of awareness
c. No signalling system
d. Absence of mass traffic system
e. Tendency of overtaking
f. Different speed vehicles

VII. SOLUTIONS

Stretch A→ Veer BajiPasalkar to Sai Motors chowk

1.Provision of new road: A new road parallel to the road stretch from swagat corner to sai motors of approximately 700 metres length is proposed in this paper. This new proposed road should be made compulsory one way. Parallel to this road there is also another road from Barbeque misal to Greenland county. This road must complement each other.

2.Providing Signal: Traffic signals should be provided at swagat corner.

3.Road widening: Adequate road widening should be done.

4.Strict lane management: divider should be provided from sai motors to navale bridge.

5.Increasing Man Power: Traffic police or volunteers should be present at swagat corner and union bank.

6.Proper parking system: vehicles parked illegally near union bank should be fined.

Stretch B→Narhe road to Bhumkar Chowk

1.Providing Industrial Corridor

2.Improving Road Quality: The quality of road throughout is very poor. There in necessity of improvement of the road. The pits formed due to excavation purpose should be closed properly. A uniform road surface should be made.

3.Providing Signal: Signal should be provided at Shree control chowk, grampanchayat chowk and Bhumkar chowk.

4.Strict lane management: The divider should be provided from Bhumkar chowk to Shree control chowk to improper over taking tendency of vehicles.

5.Road widening: The road should be expanded by acquiring land in front of zeal college and vetal bua chowk.

6.Increasing Man Power: The traffic police or volunteers from gram panchayat should be appointed at Bhumkar chowk, in front of zeal college and Shree control chowk.

Stretch C→ Veg Gandharva Hotel to Sai Motors

1.Improving Road quality: The quality of road is extremely poor. The pits and depressions are formed thorough out the stretch. The excavation work done for drainage laying and water supply purpose haven't been closed properly forming undulations on road. The roads get water logged in rainy season due to poor drainage system, hence proper slope should be provided at cross section of roads to drain out water.

2.Strict Lane Management: Heavy traffic jam occurs daily at Greenland County junction, Ganpati Mandir and in front of veg Gandharv Hotel due to single and undivided roads. The dividers should be provided for proper lane management.

3.Providing Signals: signals should be provided at Ganpati mandir and Veg Gandharv Hotel.

4.Increasing man power: Traffic police or volunteers from Granpanchayat should be appointed at Ganpati Mandir and Veg Gandharv Hotel

5.Proper drainage system: During rainy season the water logging conditions are experienced in front of Meera medical. The condition is very severe and dangerous for driving especially for two wheelers. This is due to poor drainage system. The slope of 1:100 should be provided throughout the stretch with proper drainage system.

6.Proper parking system: Parking of vehicles from Axis Bank ATM to Bank of Maharashtra should be strictly prohibited. Alternate side parking method should be adopted.

7.Road Widening: All the illegal vendor shops should be removed and the road should be expanded by land acquisition throughout the stretch.

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