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ASSET MAPPING FOR DECENTRILIZED PLANNING BY DESIGNING THE BYPASS ROAD USING QGIS.

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Abstract: *Designing a new road bypass alignment has become a crucial part of transportation planning and traffic management in order to reduce accidents, boost design speed, cut travel distances, and save fuel. This project is a case study of a comprehensive design process for a new road bypass routing that considers a number of factors, including the terrain, land use, and environmental consequences. A densely populated region of Budhgaon and Kavalapur with an inefficient and accident-prone road network serves as the study area for this investigation. Geographic information system (GIS) data, survey data, and satellite imagery are all used to design the proposed road bypass alignment. The alignment is improved to cut down on travel time, lessen the number of abrupt turns, and increase the road's design speed, by reducing the number of intersections, removing blind curves, and providing appropriate sight distance. The 5.820 km long proposed road bypass alignment is designed to improve design speed, shorten travel distances, conserve fuel, and reduction in accidents. The estimated 12% cut in travel distance will result in significant fuel savings. The new road bypass alignment is also intended to improve the local environment by lowering carbon emissions and noise pollution. Overall, this study provides an essential framework for creating a new road bypass alignment that can help lower accident rates, shorten travel times and conserve fuel. Along with this, Asset Mapping is to be done on this proposed road bypass alignment for public utilities and estimated cost of bypass road is found out.*

Key Words: **Geographic Information Systems.**

1. INTRODUCTION:

Decentralised planning is an approach of planning in which all local organisations and institutions will adopt, implement, and monitor the plan without the assistance of a centralised organisation. The Decentralized planning is the planning which is adopted at different levels. Using Q-GIS software for decentralised planning is an effective approach for making decisions and allocating resources that makes the most of contemporary geospatial technologies. Q-GIS is a free and open-source software which allows its users for geographic data creation, analysing, and visualising geospatial data. Making decisions about land use, natural resource management, disaster response, and other crucial topics may be done collaboratively using Q-GIS to analyse data, build and update maps, and make data-driven decisions, along with this it is commonly used for the designing the road alignment and for mapping the assets

Decentralized planning using Q-GIS software offers an exciting opportunity to promote more effective and equitable decision-making and to create sustainable systems that can adapt to the changing needs of communities over time. To have a proper decentralized planning it is very important to have good and safe means of connectivity to cities, towns and villages. If there is inappropriate connectivity to towns/cities/villages, the decentralized planning tends to fail. At the present if we focus on State Highway 75 of Maharashtra (SH75) it has a curtail importance to decentralized planning.

1.1 PROBLEM STATEMENT:

The region of Budhgaon-Kavalapur area is densely populated these days, these densely populated region is connected by the stretch of 6.200 km (Kilometers) of road which is Maharashtra State Highway 75. Along this existing road there are number of Assets located such as Industries, Institutions, Banks, Hospitals etc. this Assets contributes the huge amount of traffic to this existing road due to which the Traffic problems occurs which ultimately leads to number of accidents in this region. In the region of Budhgaon-Kavalapur area, road side encroachment has been increased, while which contains some of the Historic and Religious monuments, so due to these there is no scope for road widening.

The existing stretch of 6.200 km road contains the numbers of blind curve, some of them are truly sharp which has the angle of 90 degree, so it becomes difficult for driver of vehicle to pass the curve. For passing the curve one vehicle has to stop and let the other vehicle to pass and due to this Traffic problem may arises. So, there is need to deal with this Real-life problem of Budhgaon-Kavalapur area

1.2 Objectives:

- To design safe and efficient road alignment by using QGIS software.
- To reduce Accidents on road
- To Bypass the heavy traffic.
- Offer better transportation facilities.
- To locate necessary assets along proposed alignment.
- To enhance the connectivity of existing SH75.

1.3 Existing Road (Maharashtra State Highway 75) connectivity & Importance:

Sangli-Tasgaon-Vita-Mayani Road (SH75)

This highway start from Sangli, runs towards the north-east up to Kakadwadi and then towards the north up to the district border. After passing Miraj, Tasgaon and Khanapur talukas it enters Satara district.

This road route has opened for traffic the rich and fertile agricultural tracts in the district. It traverses through the entire length and breadth of the district. It also serves as a link between Madhavnagar Railway Station and Sangli.

It touches the following places in its stretch: —

(1) Madhavnagar.	(2) Budhgaon.
(3) Kavalapur.	(4) Kakadwadi.
(5) Tasgaon.	(6) Shirgaon.
(7) Borgaon.	(8) Limb.
(9) Alte.	(10) Karve.
(11) Vita.	(12) Gardi.
(13) Nagewadi.	(14) Mahuli.

Going from south to north, the following roads either cross it or take off from it.

Place of junction	***Name of road***
Kakadwadi:	(1) Kakadwadi-Miraj (M. D. R) (Major District Road).
	(2) Kakadwadi-Kuchi (M. D. R)
Tasgaon:	(1) Karad-Tasgaon (M. D. R).
	(2) Tasgaon-Islampur (M.D.R.).
	(3) Tasgaon-Kundalpur-Kerewadi (M. D. R.).
	(4) Tasgaon-Khanapur (M. D. R.).
Shirgaon:	Shirgaon-Dhamani Khurd (O. D. R.) (Other District Road).
Vita:	(1) Guhagar-Chiplun-Karad-Jath-Bijapur (S. H.) (State Highway).
	(2) Vita-Kherada-Pusesavali (M. D. R.).
	(3) Islampur-Kundal-Vita (M. D. R.).

Above the roads contributes the traffic on this highway.

1.4 Importance of Highway for economic development of the Sangli District:

Maharashtra is a western state of India, which has the Sangli district. The district's economy is based mostly on agriculture, with more than half of the people working in the agricultural sector and most of them has the agriculture as prime occupation. From the other crops, the region is well-known for the cultivation of grapes, sugar cane, and turmeric. The district's most significant crop is grapes, and it is also the greatest grower of grapes in Maharashtra. The grape cultivation is concentrated in the Tasgaon and Khanapur talukas of the district. Sangli district produces high-quality grapes, particularly the Thompson seedless variety, which is in high demand both in the domestic and international markets. Grapes are mainly grown for table consumption, but the district also produces wine and raisins.

Sugar cane is another important crop in Sangli district. The district has a large number of sugar factories, which process the sugar cane into sugar and molasses. Sugar cane is grown in the Karad and Walwa talukas of the district. Turmeric is another important crop in Sangli district, particularly in the Jath and Atpadi talukas. The district produces high-quality turmeric that is highly sought for on both the domestic and international markets. Other crops grown in the district include wheat, jowar, bajra, and legumes. Another significant crop farmed in the area is pomegranates. Pomegranates are primarily farmed in the district's north, particularly in the talukas of Atpadi and Kavathemahankal. Grapes, sugar cane, and turmeric are the three most prominent agricultural products in the Sangli area. The district's agricultural output makes a substantial contribution to the regional economy, creating jobs and encouraging the expansion of the economy. For cities and villages to develop and to grow, there must be effective road connectivity. For economic development and expansion, roads provide a means of transit for people, products, services, and agricultural sectors, which is very important for economic development of Sangli district.

2. LITERATURE REVIEW:

Prof. S.V. Sabale and Piyush S. Hokarne, et al (2021) [1]

Presented paper aims on the application of GIS (Geographical Information System) and its usage of the open-source software in various field. This user-friendly software which is Quantum Geographic Information Systems (QGIS) is most popular, leading and user-friendly open-source GIS

software. It is very easy to use, extensible, and has a constantly growing community and user base. More and more Private users and organizations choose QGIS as their mainstream GIS software.

Prof. A.K. Patil and M.Y. Patil, et al (2019) [2]

Carryout the case study of road accidents on Tasgaon-Sangli road which mainly caused due to Carelessness and lack of awareness of driver, consist of numbers of steep curves along with this there are a lot of pot holes present on this road i.e., the condition of road is terrible. This case study also gives data of accident caused on this road. According to this case study in the year 2016 there are total 803 numbers of accidents occur on this road, in which 376 caused to death and 791 got seriously injured.

Joseph Rei Mark (2019) [3]

Summarizes the designing of road alignment using the GIS for safe and convenient traffic operations. This paper helps in designing the road alignment as per economic, environment, social considerations using the GIS tool. It also focuses on the classification of roads in Philippines and problem of road alignment which is analyzed using GIS.

Pallavi Sonsale and Mayur Chaudhary, et al (2021) [4]

Had outlined the process for creating GIS-based asset mapping, utility infrastructure mapping, consumer mapping, and topographic mapping and final analysis are all done together. Initial work on this project is done for MIDC's Millennium Business Park in Mahape. This paper provides an important information regarding the various types of Mapping including the Asset Mapping using the GIS.

3. METHODOLOGY:

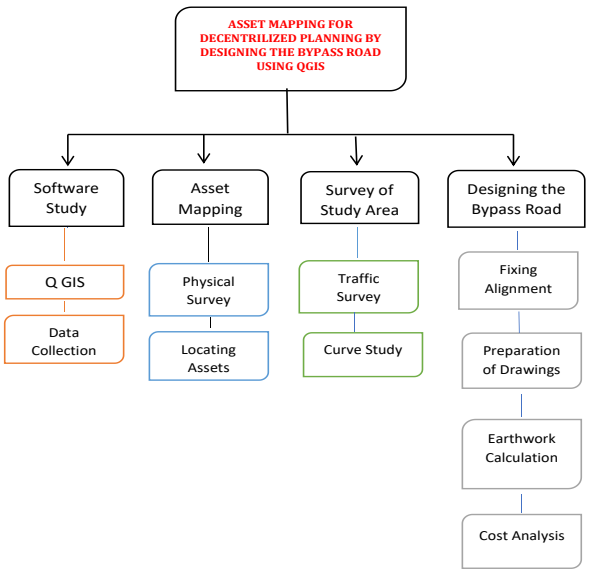


Fig -1: Tree diagram of Methodology.

3.1 Software study and Data collection:

In this phase the software named as Q-GIS is thoroughly studied and needful data such as DEM (Digital Elevation Model) file is to obtained from the Bhuvan Government of India website.

3.2 Asset Mapping along the existing Road:

In this phase the present status of Assets such as Industries, Institutions etc. along the existing road which contributes its user's traffic to this existing road is to be found out. It is determined by carrying out a physical survey in the study area and collecting the information from the assets and then Mapping the Assets by using the Q-GIS software.

3.3 Survey of Study Area:

It includes various types of Surveys such as

3.3.1 Traffic Survey:

In this survey the Traffic Capacity ratio and Traffic Analysis of Study Area is done at peak hours and non-peak hours. From this Survey it is concluded that the existing road has Traffic Volume Capacity Ratio is more than 0.7 and thus this road falls under the Sub- Arterial Road. But at present it cannot sustain the present Traffic volume, so this Sub- Arterial Road is need to be widened which is not possible at current scenario of encroachment and religious monuments. So, there is need to Design the Bypass Road.

3.3.2 Curve Study Survey:

In this Survey the Curves which are present on the existing road are critically examined and studied and their degree of bend is to found out. On these existing roads there are total 12 numbers of curve out of which 4 are the Compound curve, 5 are the Simple curve,1 is Reverse curve and 2 are the 90 degrees sharp curve. So, from this Curve study it is concluded that at given study Area of Budhgaon-Kavalapur the Existing Road contain the sharp curves which ultimately leads to Accidents so there is need to design and construct the Bypass Road.

3.4 Designing the Bypass Road:

3.4.1 Fixing the Alignment:

In this phase the proposed Bypass Road alignment is fixed. During fixing the proposed Bypass Road alignment various points are taken into consideration some of them are follows:

- **Ecofriendly**: The proposed Bypass Road alignment should be passed from such area, such that there should be no cutting of trees and thus this alignment should be ecofriendly.
- **Easy and Straight**: The proposed Bypass Road alignment should be easy and straight with No sharp curves.
- **Cost**: The alignment should be selected in such a way that it minimizes the cost of construction, so that the proposed alignment should be economical in terms of cost.
- **Traffic Divergence**: The proposed alignment should be selected in such a way that it diverts the traffic flow from existing road and provides an efficient and safe route for transportation.

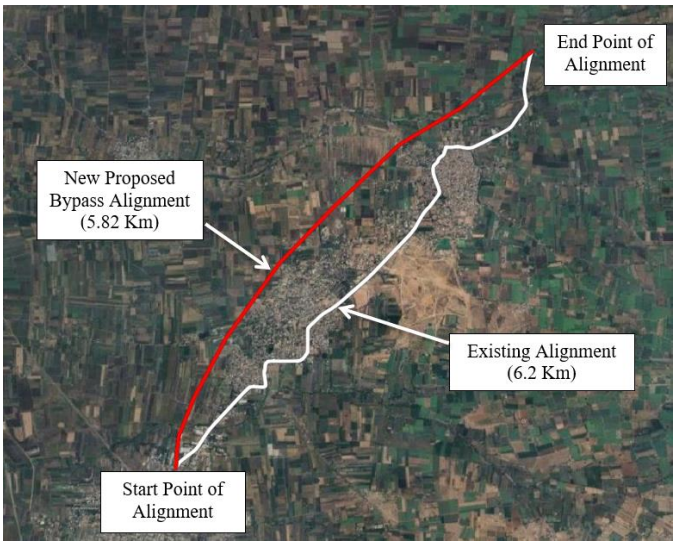


Fig -2: Key Map of Existing & Proposed Alignment.

3.4.2 Preparation of Drawings:

In this phase the detailed Design and Drawings of proposed Bypass Road are prepared.

Design Characteristics of New proposed Bypass Road:

- **Road type**: SH75(State highway 75) Bypass Road, Flexible pavement road, Double Lane Two-way traffic.
- **Roadway width:** 30m(meter).
- **Carriage way width:** 14m (7m each lane).
- **Formation width:** 19m.
- **Side slopes:** In embankment 1in 2, In Cutting 1 in 1.5.
- **Shoulders:** 2.5m wide.
- **Other:** Unlined side drains, Berms, Boundary stones, Street light and guard rails.

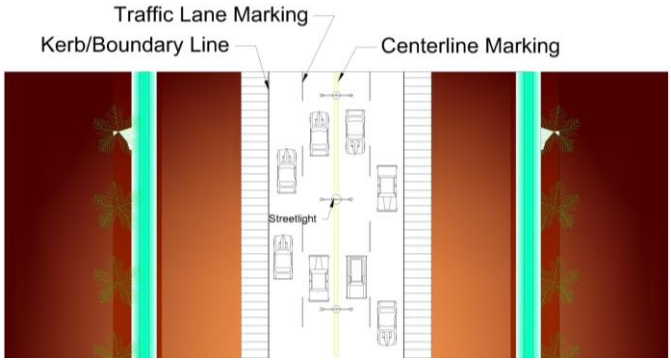


Fig -3: Top view of Proposed Bypass Road.

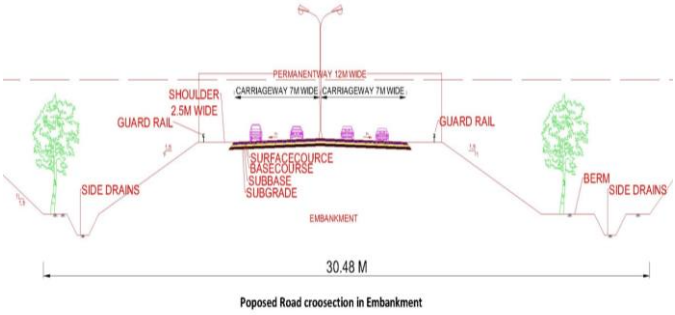
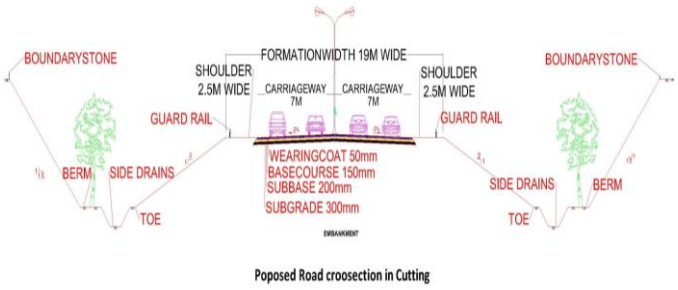


Fig -4: Cross section of Proposed Bypass Road in Embankment.



Poposed Road croosection in Cutting

Fig -5: Cross section of Proposed Bypass Road in Cutting.

3.4.3 Cost Analysis:

In this phase the overall project report i.e., DPR (Detailed Project Report) which includes the all the items of work and their detailed Quantities and the cost of individual quantities of item of work which is required for the construction of these Bypass Road is to be found out. It includes the Quantifying the item of work such as finding the quantity of Cutting and filling (Embankment) and different items of work, then abstracting to get the final cost of proposed Bypass Road.

Table -1: Quantity takeoff (Measurement sheet).

MEASUREMENT SHEET							
Name of Project : Byepass Road (L- 5.820 km)							
Sr. No.	**Description**	**No**	**Length**	**Breadth**	**Height**	**Quantity**	**Remark**
			Meter				
1	Road survey					L/S	
2	Cleaning of ground and removal of rubbish	1	5820	30.48		177393.6	sq.m
	Layoutof highways and chaining						
2	Earthwork						
a	Providing stacking filing murum for W.B.M. Road as per direction of engineer incharge including all taxes,transportation etc.completed					241368.233 cu.m	cu.m
b	Cutting ground for required depth and area as per the drawing, design including all taxes, transportation etc.					469717.991 cu.m	cu.m
c	compaction of murum		5820	30.48		177393.6 sq.m	Sq.m
3	Cuttings of Trees & Shrubs	50				50	no.
4	**Subgrade** Conveyingmaterialsobtainedfromroadcuttingincludingalllifts,layinginlayersof20cm.to30cm.breakingclods,dressingtotherequiredlines,curves,gradesandsection,wateringandcompactingtonotlessthan97%ofstandardproctordensityforaleadof300m.to500m.inclusive,fromthesiteofexcavationtothesiteofdeposition as directed.	1	5820	30.48	0.3	53218.08	cu.m
5	**SubBase course** Providing,laying,spreadingandcompactingstoneaggregatesofspecificsizestowaterbound macadamspecificationincludingspreadinginuniformthickness,handpackingtopropergradeandcamber,applyingandbroomingrequisitetypeofscreening/bindingMaterialstofillup theintersticesofcoarseaggregate,wateringandcompactingwithvibratoryrollertotherequireddensity.ByMechanicalMeans-Gradingl(Using Screening Type B (11.2 mm) Aggregate)	1	5820	14	0.3	24444	cu.m
6	**Base course** Providing,laying,spreadingandcompactingstoneaggregatesofspecificsizestowaterbound macadamspecificationincludingspreadinginuniformthickness,handpackingtopropergradeandcamber,applyingandbroomingrequisitetypeofscreening/bindingMaterialstofillup theintersticesofcoarseaggregate,wateringandcompactingwithvibratoryrollertotherequireddensity.ByMechanicalMeans-Gradingl(Using Screening Type B (11.2 mm) Aggregate)	1	5820	14	0.15	12222	cu.m
7	**SurfaceDressing--** Providingandlayingsurfacedressingaswearingcourseinsinglecoatusingcrushedstoneaggregatesofspecifiedsizeonalayerofbituminous binderlaidonpreparedsurfaceandrollingwith8-10tonne smooth wheeled steel roller. --c)10mmnominalchipplingsize(bitumen9.0kg/10Sq.M--Bitumenofspecifiedgrade(VG-30bulkbitumen rates are considered to arrive at rates)	1	5820	14	0.05	4074	cu.m
8	Exavation of Catch/Side drain gutters on both side of road	2	5820	0.9	0.9	4714.2	cu.m
9	Providing KM Stones on both the side 6 on each side.	12				12	no.
10	Providing 200m Stones on both the side	60				60	no.
11	Providing Mandatory and Regulatory sign boards on both side	20				20	No.
12	Plantation Of trees along both side of roads	500				500	No.
13	Marking the road lines of lanes 10 cm wide						
	1. Centre line	2	5820	0.1		1164	sq.m
	2.Side / kerb line on both side	2	5820	0.1		1164	sq.m
	3. diving lanes marks along road in right and left lane	1164	2	0.1		232.8	sq.m

Table -2: Abstracting (Abstract sheet).

Abstract Sheet						
Nameof Project : Bypass Road (L=5.82 km)						
Sr. No.	**Description of Items**	**Qty.**	**Rate per unit**	**Unit**	**Amount in RS.**	**Remark**
1	Road Survey Using QGIS Software	5.82	3050	Km	17751	
2	Reconnaisance Survey of Road alignment in plain country including taking three dimensions of apexes,verification of type of land etc. alongwith the alignment etc. complete (With Chaining).	5.82	2011	Km	11704.02	SSR2021-22 SrNo.9,Item No.1.09
3	Clearing grass and removal of rubbish up to a distance of 50 metres outside the periphery of the area .	177394	4	Sq.m	709574.4	SSR2021-22 SrNo.85,Item No.2.07
4	Transfering and taking out design on coordinates of base line on ground using nails for exsisting road surface sand survey pegs for new alignment including taking out coordinates for horizontal curve satrequiredintervalof 50 meters etc. complete. (Extra line such as right of way median edges to toe line not included).	5.82	12408	Km	72214.56	SSR2021-22 SrNo.60,Item No.1.60
5	Cutting down branches of trees , bushes etc. stacking the material neatly as directed (For Motarable Road)	5.82	7648	Km	44511.36	SSR2021-22 SrNo.21,Item No.1.21
	Road Earthwork					
5	Excavation for roadway in earth, soil of all sorts, sand, gravel or soft murum including dressing sectiont other required grade,camber and side slopes and conveying the excavated materials with all lifts upto alead of 50m. and spreading for embankment or stacking as directed.	469718	104	Km	48850671.1	SSR2021-22 SrNo.87,Item No.2.10
6	**Subgrade Preparation** Conveyingmaterialsobtainedfromroadcuttingincludingalllifts,layinginlayersof20cm.to30cm.breakingclods,dressingtotherequiredlines,curves,gradesandsection,wateringandcompactingtonotlessthan97%ofstandardproctordensityforaleadof300m.to500m.inclusive,fromthesiteofexcavationtothesiteofdeposition as directed.	53218	359	cu.m	19105290.7	SSR2021-22 SrNo.99,Item No.2.26

7	**SubBase course** Providing,laying,spreadingandcompactingstoneaggregatesofspecificsizestowaterboundmacadampecificationincludingspreadinginuniformthickness,handpackingtopropergradeandcamber,applyingandbroomingrequisitetypeofscreening/bindingMat	16296	2043	cu.m	33292728	SSR2021-22 SrNo.129,Item No.3.19
8	**Base Course** Providing,laying,spreadingandcompactingstoneaggregatesofspecificsizestowaterboundmacadampecificationincludingspreadinginuniformthickness,handpackingtopropergradeandcamber,applyingandbroomingrequisitetypeofscreening/bindingMat	12222	2043	cu.m	24969546	SSR2021-22 SrNo.129,Item No.3.19
9	**Surface Dressing** Providingandlayingsurfacedressingaswearingcourseinsinglecoatusingcrushedstoneaggregatesofspecifiedsizeonalayerofbituminousbinderlaidonpreparedsurfaceandrollingwith8-10tonne smooth wheeled steel roller. -- d)6mmnominalchipplingsize(bitumen7.50kg/10Sq.M--Bitumenofspecifiedgrade(VG-30bulkbitumen rates are considered to arrive at rates)	4074	48	sq.m	195552	SSR2021-22 SrNo.165,Item No.4.07
10	Excavationforcatch/sidewatergutterinallsortsofsoilstothespecifiedsectionincludingstackingtheexcavated stuff in a regular bund and disposing of unsuitable or excess stuff as directed all sorts of soils.	4714.2	104	cu.m	490276.8	SSR2021-22 SrNo.92,Item No.2.18
11	Providingandfixing **KM** metre stones as perI.R.C. standardincludingfixinginstandardsize_____block including curing, painting lettering etc.	12	2970	no.	35640	SSR2021-22 SrNo.196,Item No.6.02b
12	Providingandfixing 200 metrestonesasperI.R.C.standardincludingfixinginstandardsize_____block including curing,	60	969	no.	58140	SSR2021-22 SrNo.196,Item No.6.02a
13	ProvidingandfixingMandatory/Regulatorysignboardsincircularshapeof_____mmdiamadeoutof____mmaluminumsheetbondedwithwhiteretroreflectivesheetingofClassB M25gradeconcreteblockofsize60cmX60cmX75cm includingtransportationetc;complete.ClassB(TypeIVHighintensitymicro-prismaticgradesheeting-HIP)shallhave7yearswrittenwarrantyfromthemanufacturerandauthoriseddistributor/convertorissuedforfieldperformanceincludingthescreenprinted areasandcut-outsheetingandcut-outdurabletransparentoverlayfilmandthiswarrantycertificateinoriginalshouldbesubmittedtotheEngineerinchargebythecontractor/suppl **600 mm dia made out of 3mm aluminum composite**	20	4740	no.	94800	SSR2021-22 SrNo.236,Item No.6.27b
14	Planting, Painting and numbering trees with white background and black lettering etc. complete.	500	52	no.	26000	SSR2021-22 SrNo.209,Item No.6.06
15	PaintingLine,Dashes,ArrowsetconRoadsintwocoatsonnewworkwithreadymixedroadmarkingpaintconfirmingtoI.S.164onBituminoussurfaceincluding cleaningthesurfaceofalldirt,dustandotherforeign matter, demarcation at site and traffic control (Over/Upto 10 cm wide) (MORTH-803) New Surface					
15	Centre line (Double line-overtake prohibited)	1164	323	sq.m	375972	SSR2021-22 SrNo.211,Item No.6.08a
15	Side/kerb/Boundry line on both side	1164	323	sq.m	375972	SSR2021-22 SrNo.211,Item No.6.08a
15	Lane Dividers	232.8	323	sq.m	75194.4	SSR2021-22 SrNo.211,Item No.6.08a
Total Cost					**128801538.3**	
Total cost in words					Twelve crore Eighty eight lakhs One thousand Five hundread and Thirty eight Ruppes only	

❖ Costing of Bypass Road Project

- Total cost of road construction: Rs. 12,88,01,538/-
- Contingency Charges (5%): Rs. 64,40,076/-
- Overhead charges (8%): Rs. 1,03,04,123/-
- Water charges (8%): Rs. 1,03,04,123/-

GRAND TOTAL COST OF CONSTRUCTION OF BYPASS ROAD: Rs. 15,58,49,860/-

4. RESULTS:

This paper, focuses on designing the Double Lane Two-way Traffic Bypass Road, having the length of 5.820 km which starts from the point [Pashchim Maharashtra Patra Depot, Sangli] N16^{0}53.648' E074^{0}35.344' and ends to point [Near Kavalapur Bridge, Sangli] N16^{0}56.042' E074^{0}37.246', which has the estimated cost of **Rs. 15,58,49,860/-** for the **5.820 km (Excluding Land Acquisition Cost)** which will be **Rs. 2,67,78,326/- Rs. per kilometer.**

Also, for better public utilities purposes, Asset Mapping is done along the proposed Bypass Road alignment with the Assets such as Bus stops, Fuel stations, for effective use of this utility on this proposed Bypass Road. This Assets are provided with the BUFFER ZONE (blue shaded area in figure 6) this buffer zone will serve the area covered under the zone and thus Decentralized Planning can be done in effective manner for this proposed Bypass Road. So, this Bypass Road will solve the Real-Life problem concerned with Budhgaon-Kavalapur area.

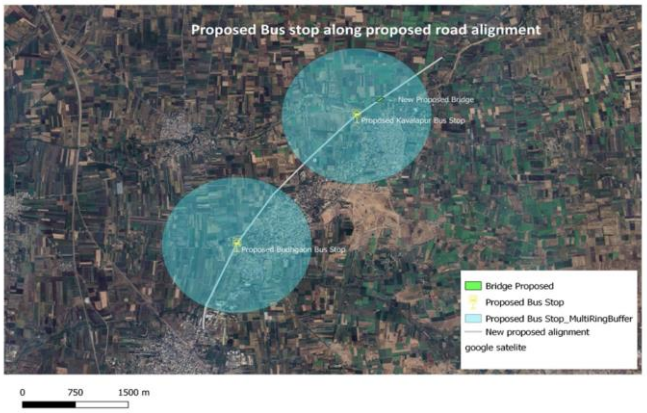


Fig -6: Asset Mapping of Bus stops along the Proposed Bypass Road with Buffer Zone.

Fig -7: Asset Mapping of Petrol Pumps along the Proposed Bypass Road.

5. CONCLUSION:

These Case study includes designing the Double Lane two-way traffic Bypass Road which starts from start point [Pashchim Maharashtra Patra Depot, Sangli] N16^{0}53.648' E074^{0}35.344' up to end point [Near Kavalapur Bridge] N16^{0}56.042' E074^{0}37.246' Along the existing state highway 75. This Bypass route will divert the heavy traffic from existing road alignment .The existing stretch of SH 75 highway having the length of 6.200 KM which passes through Kavalapur – Budhgaon villages, which makes the road alignment more tedious for the passengers because it consists of number of steep curves, encroachment along the road alignment which obstruct the eye view of passenger and thus reduces the visibility and road widening is not possible due to present of prime assets such as religious monument, public assets etc.

So this bypass road of having the stretch of 5.8 KM which eliminate the steep curves and the reduces the complication for widening of the road so due to this travel time will get reduce and thus ultimately save the fuel consumption and provide better visibility and resulting reduction in accident and along with this bypass road alignment, Asset Mapping is to be done for public utility purpose just by providing the Bus stops, Gas stations and other public utility wherever is needed along the stretch of these bypass road. The future scope of this Bypass Road can be utilized in the fields of Trade, Tourism, Governance, Education, Agriculture, Facility management etc which is very important to increase the GDP (Goss Domestic Product) of Sangli district.

6. REFERENCES

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