ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

(A Unit of Alva's Education Foundation ®,Moodbidri)
Affiliated to Visvesvaraya Technological University, Belagavi
Approved by AICTE, New Delhi & Recognised by Government of Karnataka
Accredited by NAAC with A+ Grade and NBA (CSE & ECE)

To,

The Project Director
NHAI, Honnavar Division

From,

Dr. H Ajith Hebbar
Professor and HOD, Civil Engineering
Alva's Institute of Engg and Tech, Moodbidri, DK

Respected sir,

As per our previous email communication with NHAI Mangalore office and the telephonic conversation with NHAI Engineer, Honnavar PIU office, here is the list of **5th sem students** who are participating in the Internship in NHAI, Honnavar PIU division. **The proposed date of Internship is 30th October 2023 to November 30th, 2023** (30 Days Including Sundays or as per NHAI regulations). Further we may recall here, an MOU between **NHAI** (Mangalore Division) & AIET was signed on 12.10.2021 for Adoption of NHs by Engineering Colleges for **the Stretch** of 4/6 Laning of Goa Karnataka Border – Kundapura section of NH-66 from Ch 208.000 to Ch **280.940.** & Mangalore city Bypass. Hence I request you to do needful in this regard.

The Student Information is as follows,

S.No.	Student Name	USN	Male / Female	Mob	Email
1	A. DHANUSH	4AL21CV001	MALE	9148066595	4al21cv001@gmail.com
2	D S CHAITHRESH	4AL21CV003	MALE	9482696885	4al21cv003dschaithresh@gmail.com
3	S V VINAYAKA BHANDARKAR	4AL21CV011	MALE	8861149017	bhandarka543@gmail.com
Internal Guide / Contact Point				**Prof Shankargiri, Mob : 8073232168 , giricivil@aiet.org.in**	

Academic Performance

S.No.	Student Name	USN	% of Marks Scored in Semester Exam		
			1st Sem	2nd Sem	3rd Sem
1	A. DHANUSH	4AL21CV001	73.4	73.5	78.4
2	D S CHAITHRESH	4AL21CV003	71	77.33	77.8
3	S V VINAYAKA BHANDARKAR	4AL21CV011	74.2	71.8	80.5

Thanks and Regards,

Dr. H Ajith Hebbar

AIET, 30/10/2023

H.O.D.
Dept. of Civil Engineering
Alva's Institute of Engg. & Technology
Mijar, Moodbidri - 574 225

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

(सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार)

National Highways Authority of India

(Ministry of Road Transport & Highways, Government of India)

परियोजना कार्यान्वयन इकाई-होन्नावर/Project Implementation Unit - Honnavar

2nd Floor, Part 1, Vasudeva Business Park, Adjacent To HDFC Bank,
Mastikatte, Honnavar - 581 334

Email : piunhaihonnavar@gmail.com Email : piuhonnavar@nhai.org

No.NHAI/PIU-HNVR/GKBK/2023-24/349 31st October 2023

To

The Project Manager,
M/s. IRB West Coast Tollway Pvt. Ltd.,
Kadekodi Village,
Kumta

Sub: Four laning of Goa-Karnataka Border to Kundapur section of NH-66 (formerly NH-17) from Km. 93.700 to Km. 283.300 in the State of Karnataka to be executed as BOT Project on DBFOT Pattern under NHDP-IV: Internship Program in NHAI-reg

Ref: 1. Representation received from Alva's Institute of Engineering & Technology Moodbidri dated 27.10.2023
2. Memorandum signed between NHAI and Alva's Institute of Engineering & Technology, dated 12.10.2021.

Sir,

Please find enclosed herewith a copy of letter received from Dr. H Arjith Hebbar, Professor and Head, Department of Civil Engineering, Alva's Institute of Engineering & Technology Moodbidri, wherein they have requested for the internship program in NHAI at least for 3-4 students as per the Memorandum signed between NHAI and Alva's Institute of Engineering & Technology, dated 12.10.2021. The proposed date of internship is 27.10.2023 to 25.11.2023. Accordingly, RO-NHAI Bengaluru vide e-mail dated 19.02.2021, informed that to appoint students as interns in NHAI Project and as per terms and condition of MOU with the respective clause.

The Information is as Folllows:

S No.	Student name	USN	Male/Female	Mob	Email
1	A Dhanush	4AL21CV001	Male	9148066595	4al21cv001@gmail.com
2	D S Chaithresh	4AL21CV003	Male	9482696885	4al21cv003dschaitresh@gmail.com
3	S V Vinayaka Bhandarkar	4AL21CV011	Male	8861149017	Bhandarkar543@gmail.com
Internal Guide/Contact Point				Prof Shankargiri,Mob: 8073232168 giricivil@aiet.org.in	

Academic Performance:

S No.	Student name	USN	% of Marks Scored in Semester Exam		
			1st Sem	2nd Sem	3rd Sem
1	A Dhanush	4AL21CV001	73.4	73.5	78.4
2	D S Chaithresh	4AL21CV003	71	77.33	77.8
3	S V Vinayaka Bhandarkar	4AL21CV011	74.2	71.8	80.5

2. In the view of above you are requested to appoint the above students as interns as per terms and condition of MOU (Copy Enclosed).

Yours faithfully,

Encl.: As Above

(N. Harikrishna)
DGM(T) & Project Director

CC: 1. RO Office Bangalore· for your information
2. M/s. Theme Eng. Services Pvt. Ltd., Goodluck Road, Hindu Colony Bhatkal,Uattar Kannada, Karnataka · for your information.
3. Dr. H Arjith Hebbar, Professor and Head, Department of Civil Engineering, Alva's Institute of Engineering & Technology Moodbidri· for your information

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama" Belagavi – 590010

REPORT ON INTERNSHIP AT

"National Highway Authority of India, Honnavar Division, Karnataka"

Submitted By

A DHANUSH	**USN: 4AL21CV001**
D S CHAITHRESH	**USN: 4AL21CV003**
S V VINAYAKA BHANDARKAR	**USN: 4AL21CV011**

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF ENGINEERING

In

CIVIL ENGINEERING

Under the guidance of

Mr. Shankargiri K S

Assistant Professor, Department of Civil Engineering, AIET, Mijar

and

Shri. N. Harikrishna –DGM(T) & PD

Er. Amar Manipal- Site Engineer

NHAI, Honnavara Division

ALVA'S

Education Foundation

DEPARTMENT OF CIVIL ENGINEERING

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

MOODBIDRI – 574 225

2023-24

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CERTIFICATE

This is to certify that **A Dhanush (4AL21CV001), DS Chaithresh (4AL21CV003) ,S V Vinayaka Bhandarkar (4AL21CV011)** submitted internship report for V Semester B.E. in Civil Engineering during the academic year 2023-24.The internship report has been approved as it satisfies the academic requirements in respect of internship Work prescribed for the Bachelor of Engineering Degree. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The report has been approved as it satisfies the academic requirements in respect of **21INT68-INTERNSHIP** prescribed for the Bachelor of Engineering Degree.

Prof. Shankargiri K S
Internal Guide

Prof. ANUSHA B RAO
Internship Coordinator

PROF. DURGAPRASAD BALIGA
Head of the Department

H.O.D.
Dept. of Civil Engineering
Alva's Institute of Engg. & Technology
Mijar, Moodbidri - 574 225

ACKNOWLEDGEMENT

I express my sincere gratitude and indebtedness to **"National Highways Authority of India, Honnavara Division"** for their guidance, keen interest and advice rendered during the training period.

I express my sincere gratitude and indebtedness to **Dr. Peter Fernandes**, Principal of Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

I express my sincere gratitude and indebtedness to **Prof. DurgaPrasad Baliga** HOD, Department of Civil Engineering, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work

I am thankful to my guide, **Prof. Shankargiri K S, Assistant Professor, Department of Civil Engineering**, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

I express my sincere gratitude to my guide **Shri. N.Harikrishna –DGM(T) &PD and Er Amar Manipal – Site Engineer** for their constant guidance and support throughout this work.

I am also thankful to the Internship Coordinator, **Prof. Anusha B Rao, Assistant Professor, Department of Civil Engineering**, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

A DHANUSH	**USN: 4AL21CV001**
D S CHAITHRESH	**USN: 4AL21CV003**
S V VINAYAKA BHANDARKAR	**USN: 4AL21CV011**

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CHAPTER 1

INTRODUCTION

1.1 Background

National Highways Authority of India (NHAI) was constituted by an Act of Parliament in 1988 under the administrative control of the Ministry of Road Transport and Highways NHAI has been set up as a Central Authority to develop, maintain and manage the National Highways entrusted to it by the Government of India. The authority, however, became operational in February, 1995. The Authority consists of a full time Chairman, and not more than five full time Members and four part time Members who are appointed by the Central Government. The part time Members are the Secretary (RT&H), Secretary (Expenditure), Secretary (Planning) Administrative and VigilanceWings at its Headquarters. Project implementation Units (PIUs) headed by a Project Director and supported by various technical and accounts officers have been set up at various sites to oversee timely completion of the projects.

1.2 Project Details

The National Highways Authority of India (NHAI) has awarded IRB Infrastructure Developers Ltd. the contract for widening the 189-km stretch on the National Highway 66 from Kundapur to the Goa border, according to sources in the NHAI. IRB awarded for widening of NH 66 from Kundapur to the Goa border.

The NHAI had proposed to widen the stretch of the highway into four lanes under phase IV of the National Highways Development Project (NHDP).

The cost of the project would be approximately Rs. 2,400 crore. The construction period would be 910 days. The company has sought Rs. 536.22 crore as viability gap funding from the NHAI.

14 major bridges, 41 minor bridges, six road-over-bridges (RoBs), and three road-under-bridges (RuBs) would be built.

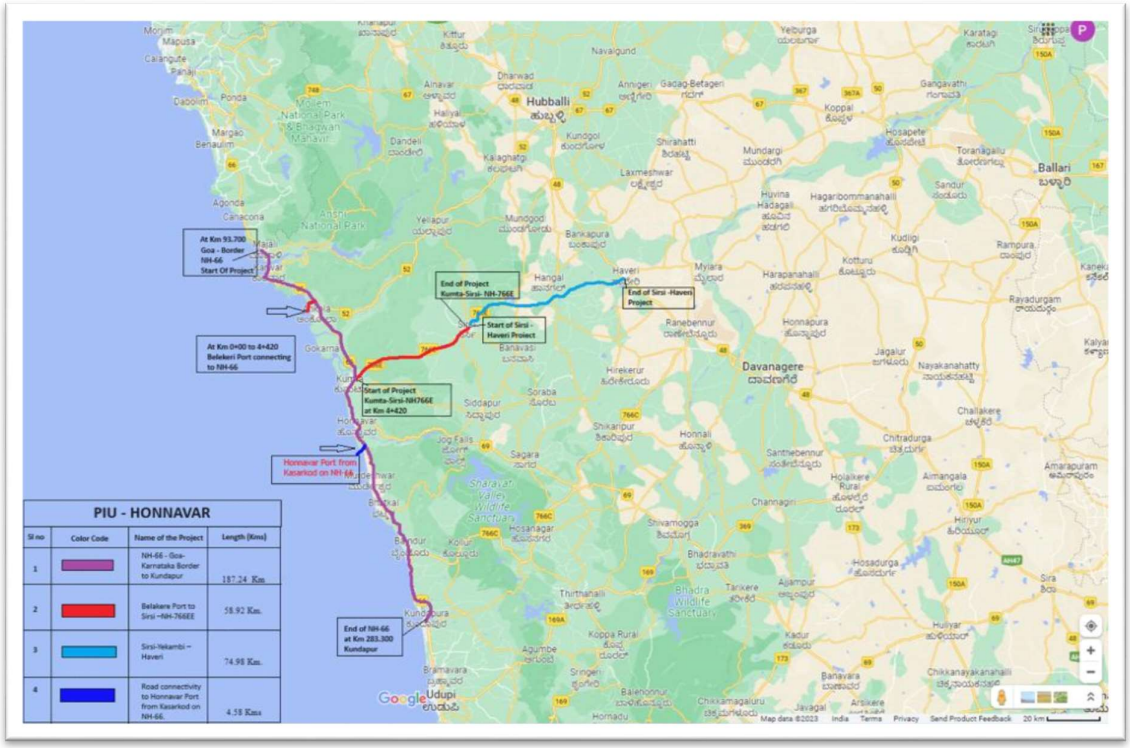

Fig 1.1 Ongoing Project location map

A main feature of the project was an elevated highway of 350-metre length and 12-metre width which would come up at Maravanthe, a tourist spot, where the existing highway passed through a narrow stretch between the sea and the river. The highway would be built along the river at about a metre height from the existing highway.

14 major bridges, 41 minor bridges, six road-over-bridges (RoBs), and three road-under-bridges (RuBs) would be built.

Four tunnels and an equal number of flyovers would be built. There would be 53 bus bays and four truck bays.

The Government would have to acquire 260 hectares of private land in 66 villages and 122 hectares of forestland for completing the project.

1.3 Objectives of Internship

- Understand bridge and culvert structures, including design, construction, and maintenance principles.
- Explore key highway elements like pavements, embankments, guardrails, and traffic systems.
- Study materials crucial in highway construction such as asphalt, concrete, and aggregates.
- Gain practical field experience through site visits and hands-on activities.
- Develop professional skills in civil engineering and project management.

CHAPTER 2

STUDY ON BRIDGES, CULVERTS AND HIGHWAYS

2.1 Project -1 Study On Components Of Bridges And Culverts

2.1.1 Bridge Bearings

The primary purpose of bridge bearings is to provide flexibility and support to bridges, allowing them to adjust to various external factors such as temperature changes, traffic loads, and seismic activity. They transfer the load from the superstructure (deck) to the substructure or piers, while also allowing for the movement and rotation of the bridge deck.

2.1.2 Types of Bridge Bearings

Bridge Bearings are typically made of steel, elastomeric materials, or a combination of both. They allow the bridge parts to move freely, while helping to reduce the stresses that can build up within the structure.

Fig: 2.1.1 Bearing

The type of bridge bearing used will depend on several factors, including the expected load weights, the span length, and the available space for accessing the bearing. The types most often used in modern bridges include elastomeric bearings, pot bearings, spherical bearings, rocker bearings, roller bearings, and sliding bearings.

2.1.3 Aspects of Bridge Bearing Maintenance

To ensure longevity and performance, bridge bearings need regular maintenance. The key steps involved in maintaining bridge bearings include:

Monitoring: Bearing performance should be monitored regularly to detect changes or problems. This can be done using various methods, such as measuring displacement or strain, or observing any unusual movements or vibrations.

Cleaning: Bearing pads should be cleaned to remove any dirt, debris, or other contaminants that may cause damage or reduce their effectiveness.

Lubrication: Proper lubrication is crucial to ensure smooth movement of the bearing pads. This should be performed using a suitable lubricant, such as silicone or mineral oil, and usually with the deck raised by a very small amount. Raising the deck is done using hydraulic cyclinders which allows lubricant to be pumped into the aperture.

Replacement: Over time, bridge bearing pads may wear out or become damaged, and they will therefore need to be replaced. Reasons for this include:

• Leaking bridge deck joints – allowing corrosive water and debris to reach the bearings.
• Inadequate visibility that prevents inspection.
• Extreme environmental conditions caused by cold, wet, or industrial pollution.
• Improper bearing specification and orientation.
• Inadequate multi-directional movement.
• Bearing defects caused in production.
• Wear and fatigue due to overload.

Replacement of bearings should be done according to the manufacturer's specifications, and by a qualified engineer or contractor.

Fig: 2.1.2 Hydraulic Jack

2.1.4 How to Maintain Bridge Bearings

Replacement of bearings is often done using hydraulic equipment such as cylinders (jacks or rams). While connected to a single or multiple hydraulic pump, these raise the deck beams by a small amount – just enough to free the bearings for replacement or resetting. Precise control of the jacks is needed to avoid damage to the structure. This can be achieved using split flow pumps or more advanced synchronous lifting pumps such as an Enerpac EVO Pump.

Depending upon the type of bridge structure and the nature of the project, the bearings may be replaced individually or as a group. The impact of traffic closures can be significant, so a quick turnaround is essential.

When using hydraulic jacks, these typically support the bridge beams next to the bearing being replaced. The hydraulic flow is activated, extending the cylinder plungers by a very small amount. The load is then secured mechanically using the locknut mechanism on each cylinder.

Next, the bearing is removed, which sometimes can require the top of the supporting pedestal or mortar pad to be partially demolished. The area is then reconstructed or cleaned, before the new bearings are installed. Finally, the locknuts are deactivated and the is cylinder retracted until the new bearing takes the load.

Fig: 2.1.3 Hydraulic Equipment Used For Bearing Replacement

2.1.5 Prestressed Cable:

PC Strand, or prestressed concrete steel strand, is a twisted steel cable composed of 2, 3, 7 or 19 high strength steel wires and is stress-relieved (stabilized) for prestressed concrete or similar purposes.

Fig: 2.1.4 Prestressed Cable

2.1.6 Expansion Joint:

Bridge expansion joints are designed to adjust its length accommodating movement or deformation by external loads, shrinkage, or temperature variations, and allow for continuous traffic between bridge structures and interconnecting structures (another bridge or abutment).

Fig 2.1.5 Expansion Joint

2.1.7 Retaining walls:

Retaining walls for bridge abutments and wing walls provide lateral support to the embankment fill, carrying the full bridge deck load. Here, the bridge abutment wall can also act as the substructure at either end of the bridge span to provide vertical and lateral support for the superstructure.

2.1.8 Culvert Types:

The types of culverts that are generally used in construction are as follows:-

Pipe Culvert (Single or Multiple)

Pipe culverts are rounded culverts that are widely used. Pipe Culverts can be single or multiple in number. When using a single pipe culvert, a larger diameter culvert is installed. If the channel width is greater, we will use multiple pipe culverts. They are well suited to larger flows. Pipe culverts have diameters ranging from 1 metre to 6 metres. These are made of concrete, steel, and other materials.

Fig.2.1.6 Pipe Culvert

Pipe Arch Culvert (Single or Multiple)

Pipe arch culverts mean nothing, but they resemble half circle culverts. Pipe arch culverts can handle higher water flows, but the flow must be stable. Fishes or sewage in the drainage are easily carried to the outlet due to the arch shape, as there is no stocking at the inlet or bottom of the channel. This type of culvert can also be supplied in a variety of sizes depending on the need. They also contribute to a beautiful appearance.

Fig.2.1.7 Pipe Arch Culvert

Box Culvert (Single or Multiple)

Box culverts are rectangular in shape and are typically made of concrete. The box culvert design also includes reinforcement. These are used to get rid of rainwater. As a result, they are ineffective during the dry season. They can also be used as passageways for animals to cross the rail or roadway during dry periods. Because of the sharp corners, these are not suitable for higher velocities. Box culverts are also available in a variety of sizes.

Fig.2.1.8 Box Culvert

Arch Culvert

Arch culverts are similar to pipe arch culverts, but an artificial floor is provided beneath the arch in this case. It is commonly used in narrow passages. The artificial floor is constructed of concrete, as is the arch. Steel arch culverts are also available, but they are quite costly.

Fig.2.1.9 Arch Culvert

Bridge Culvert

Bridge culverts are provided on canals or rivers and are also used as vehicle road bridges. A foundation is laid beneath the ground surface for these culverts. A series of culverts is laid, and then a pavement surface is laid on top of the culverts. These are generally rectangular shaped culverts that can be used in place of box culverts if an artificial floor is not needed.

Fig: 2.1.10 Bridge culvert

2.1.9 Bridges:

Minor Bridge: A minor bridge is a bridge having a total length of from 6 m to 60 m.

Major bridge: A major bridge is a bridge having a total length of above 60 m.

2.1.10 Quantity Surveying:

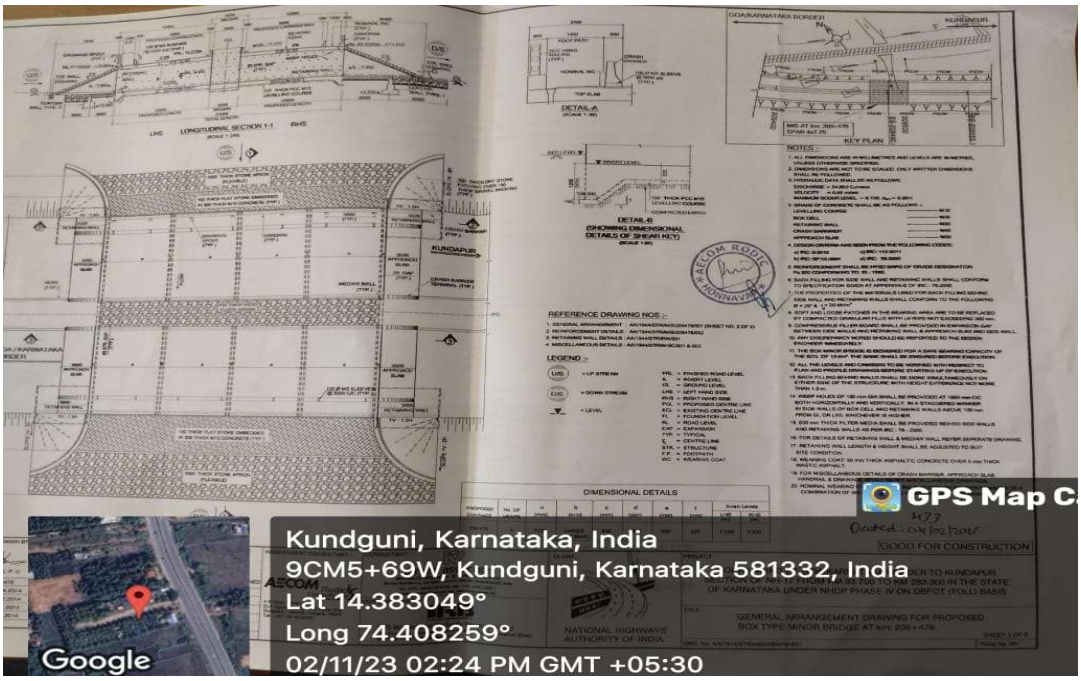

Fig: 2.1.11 Plan

2.1.11 BBS:

A bar bending schedule (BBS) is a tabular breakdown of reinforcing bars that includes details such as bar type, total length, weight, and a drawing of the desired bending shape. Generally speaking, a bar bending schedule is developed for every different kind of RCC operation.

FOUR LANNING OF GOA/KARNATAKA BORDER TO KUNDAPUR SECTION OF NH-17 FROM KM;-93+700 TO KM;-283+300 IN THE STATE OF KARNATAKA

Bar Bending Schedule for Syphon

Location- CH-166+100 BHS

STRUCTURE - Syphon

Date -

Sr No	Bar Mark	Shape of Bar	Dia of Bar (mm)	Spacing (mm)	No	Cutting length (m)	Total length (m)	Unit wt.	Wt in Kg	Total wt. in MT	Remarks
7	BS2	28.599	8	300	9	28.599	257.391	0.395	101.669		
8	BS3	200 \ 2350 / 200	12	180	160	2.702 -2.66	425.6	0.888	377.932		
9	BS4	~~28.599~~	8	300	9	28.599	257.391	0.395	101.669		
10	BS5	200 707 200	10	180	~~2X~~ 160	1.087 ~~1.1907~~	190.544	0.617	117.56		
11	SW1	2380 200 200	12	~~2X~~ 180	2X 160	2.732	437.12	0.888	388.167		
12	SW2	300 130 900 2380	12	180	2X 160	2.938	470.08	0.888	417.431		

p. Pmc Rep. IE'S Rep.

Fig: 2.1.12 BBS

2.1.12 Geogrid mesh:

Geogrids primarily provide a stabilisation or reinforcement function, to enhance the performance of soils. They also provide separation between soil and aggregate layers and are used widely in civil engineering applications.

Fig: 2.1.13 Geogrid Mesh

2.1.13 STRUCTURE COMPONENT OF BRIDGE

Types of Pile foundation:

- Sheet Piles.
- Load Bearing Piles.
- End bearing Piles.
- Friction Piles.
- Soil Compactor Piles.
- Based on Materials and Construction Method.
- Timber Piles.
- Concrete Piles.

Fig 2.1.14 Pile Boring Machine

Raft and PCC:

PCC is Plain Cement Concrete which is an item used in construction of Foundations like Raft Foundation and that also not as a key item. A PCC layer is laid as levelling course below the raft foundation.

PIER:

According to the definition, The Piers, are the vertical support structures of bridges. They are the intermediate supports, whose function is to transmit the forces they receive from the load-bearing elements to the foundations.

Fig 2.1.15 Bridge Pier

Girder:

The term "girder" is typically used to refer to a steel beam. In a beam or girder bridge, the beams themselves are the primary support for the deck, and are responsible for transferring the load down to the foundation.

Slab:

Slab bridges are monolithic, flat concrete beams (slabs) with twisted or roughened reinforcing steel rods concentrated in the lower portion and at either end of the slab, where tensile forces and sheer are the greatest. The amount of steel and depth of the slab are based on its length and live-load capacity.

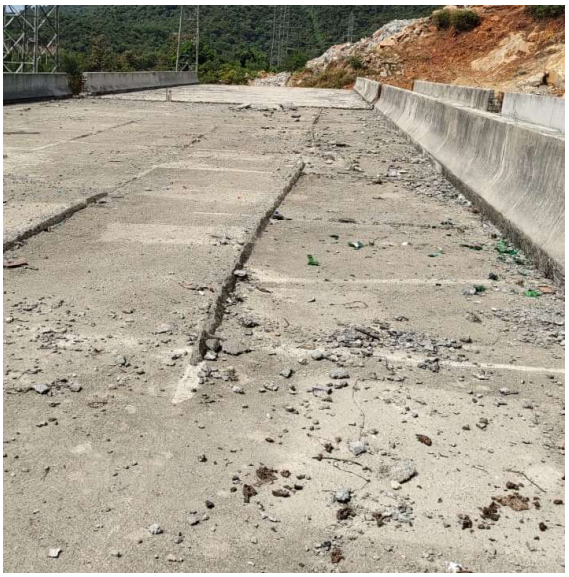

Fig 2.1.16 Slab

2.1.14 Observation

Devgi bridge for structural details.

Various aspects of bridge was explained.

Fig 2.1.17 Bridge structures

PCC layer for Bridge Foundation

Fig 2.1.18 PCC laying

2.2 PROJECT 2 STUDY ON HIGHWAY ELEMENTS

2.2.1 Cross section of Highway:

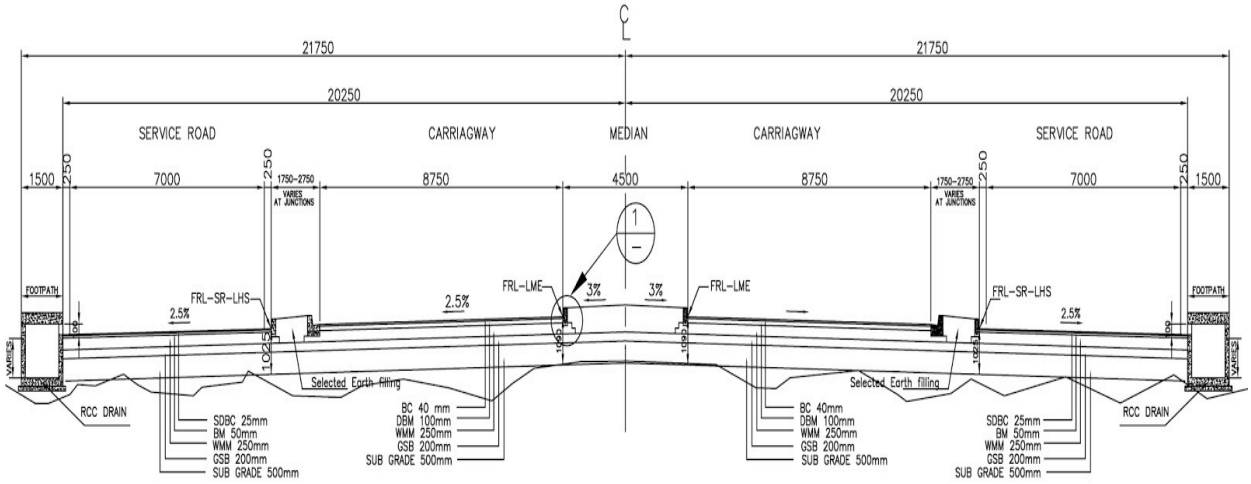

Fig 2.2.1 Design of typical hghway section

2.2.2 Layer details:

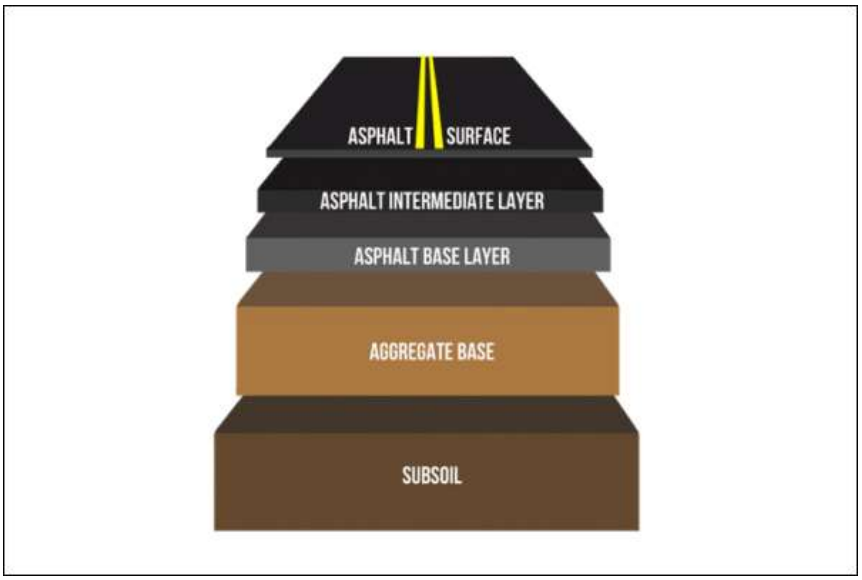

Fig 2.2.2 Highway layer

Fig 2.2.3 Layer details

2.2.3 Kerb:

The kerb is the raised edge of a pavement which separates it from the road.

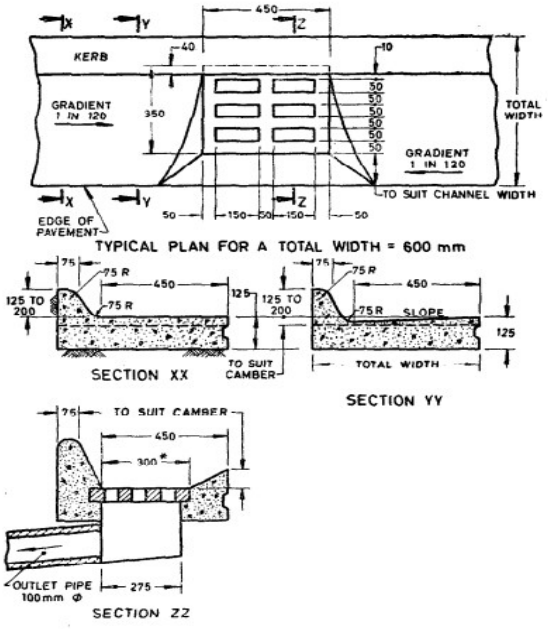

Fig 2.2.4 Plan of kerb

2.2.4 Types of stone:

1) Boundary stone (every 200m)
2) Hectometre stone (every 200m)
3) Km stone (every 1km)
4) Gantry (near tollgate)
5) 5km stone

2.2.5 Design of stone:

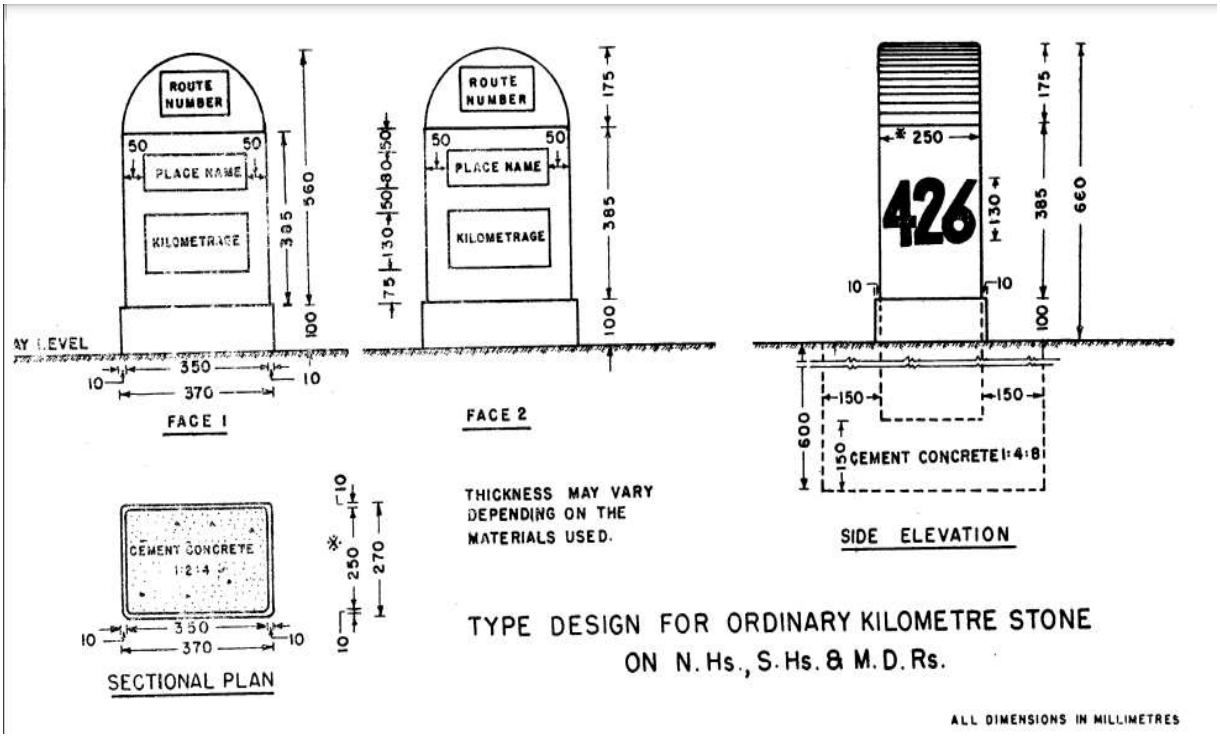

Fig 2.2.5 Type design for Ordinary Kilometre Stone

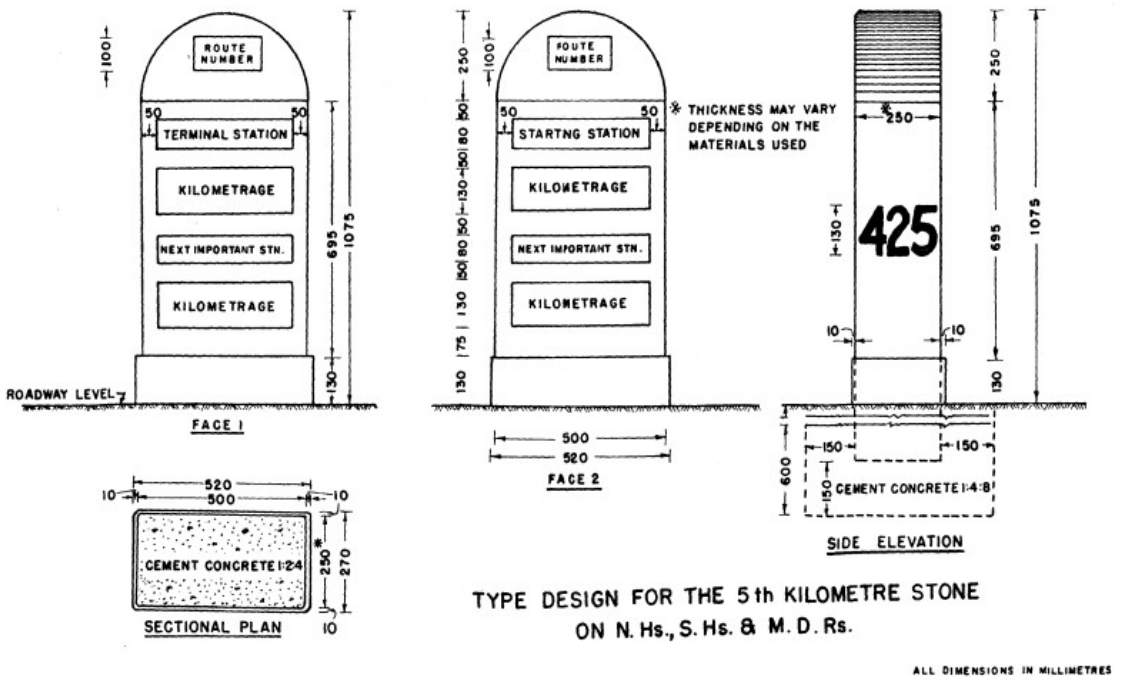

Fig 2.2.6 Type design for 5th Kilometre Stone

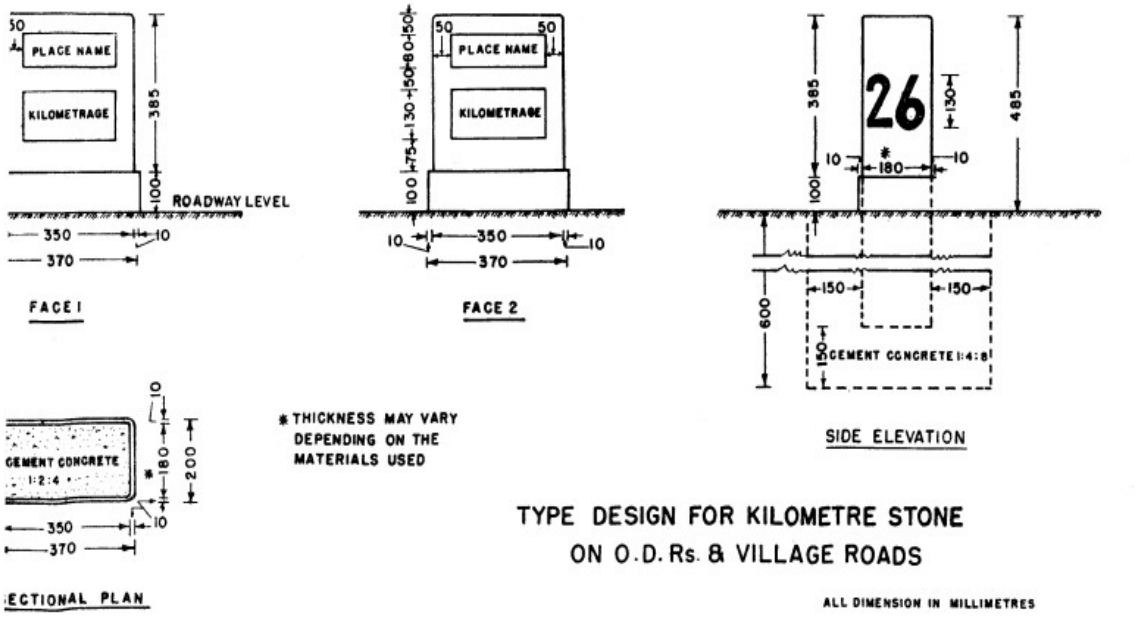

Fig 2.2.7 Type Design for Kilometre Stone

2.2.6 Observations

Hill cutting region near Dundakuli

Along with the cutting of slope along the edges of the highway the progress of steel bridge for water supply over the highway was in progress.

Fig. 2.2.8 Hill Cutting

Laying of BC layer

Fig.2.2.9 Laying BC layer with Paver

Highway cross section explanation in site.

Fig.2.2.10 Highway Details

CHAPTER 3

STUDY ON MATERIAL

3.1 SOIL TESTING:

A soil test commonly refers to the analysis of a soil sample to determine nutrient content, composition, and other characteristics such as the acidity or pH level.

Types of Soil Testing:

3.1.1 Natural Moisture Content (IS-2720 Part-2):

Soil moisture content (or water content) is the amount of water which can be removed when a soil sample is dried at the temperature of 105°C. Moisture content is usually expressed as a percentage of the dry mass. The natural moisture content of excavated soil is 32%.

3.1.2 Free swell index (IS-2720 Part-40):

10gm of oven dried passing through 425µm sieve is placed in 100ml of graduated measuring jar comprising distilled water to that in kerosene. After an equilibrium period of 24hrs the swell potential of the soil is calculated utilizing FSI. Max limit -50%

$$\text{Free swell index, percent} = \frac{V_d - V_k}{V_k} \times 100$$

where

V_d = the volume of soil specimen read from the graduated cylinder containing distilled water, and

V_k = the volume of soil specimen read from the graduated cylinder containing kerosene.

3.1.3 Grain Size Analysis (IS-2720 Part-4):

The portion of the soil passing 4*75-mm IS Sieve obtained as given the soil sample received from the field shall be prepared as specified in IS: 2720 (Part 1)-1983. The soil fractions retained on and passing 4'75-mm IS Sieve shai. be taken separately for the analysis. shall be oven-dried at 105 to 110°C. The oven-dried material shall then be riffled so that a fraction of convenient mass is obtained. Silt should not exceed 50%

3.1.4 The liquid limit plastic limit and plasticity index (IS-2720 Part-5):

Liquid Limit (LL) is the water content at which soil changes from a plastic to a liquid state when the soil specimen is just fluid enough for a groove to close when jarred in a specified manner. Plastic Limit (PL) is the water content at the change from a plastic to a semi-solid state. LL less than 20% and PL less than 6%.

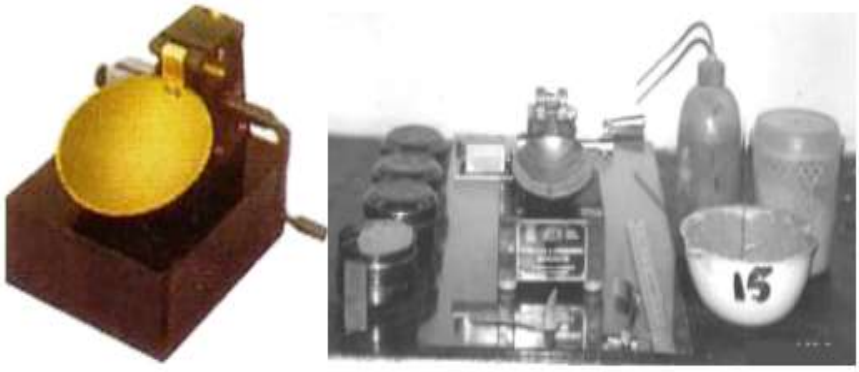

Fig 3.1 Liquid limit apparatus

3.1.5 Maximum Dry Density (IS-2720 Part-8):

To determine the required amount of water to be used when compacting the soil in the field and the resulting degree of denseness ,which can be expected from compaction at optimum moisture content.

3.1.6 California Bearing Ratio Test (IS-2720 Part-16):

CBR is the ratio expressed in percentage of force per unit area required to penetrate a soil mass with a standard circular plunger of 50 mm diameter at the rate of 1.25 mm/min to that required for corresponding penetration in a standard material. The ratio is usually determined for penetration of 2.5 and 5 mm . When the ratio at 5 mm is consistently higher than that at 2.5 mm, the ratio at 5 mm is used. The following table gives the standard loads adopted for different penetrations for the standard material with a C.B.R. value of 100%.

3.2 Aggregate Test:

An aggregate crushing test is conducted to ascertain the aggregate's structural soundness and crushing strength. The aggregate crushing value gives a comparative indication of the resistance to crushing under a crushing load that is applied gradually.

Types of Aggregate tests:

3.2.1 Aggregate Impact Value (IS-2386, Part-4):

The aggregates must pass through 12.5 mm sieve and retain on 10 mm IS sieve. Limits for AIV, ranging from 45% maximum to 25% maximum according to the concrete surface wear expectation.

Fig 3.2 Impact value Apparatus

3.2.2 Flakiness Index (IS-2386, Part-1):

The percentage (by mass) of stones in an aggregate having an ALD of less than 0.6 times their average dimension . Flaky aggregates tend to produce seals with less voids due to their tendency to pack more tightly than cubical aggregates consequently flaky particles require less binder.

Fig 3.3 Flakiness Index and Elongation Apparatus

3.2.3 Water Absorption (IS-2386, PART-3):

Water absorption gives an idea on the internal structure of aggregate. Aggregates having more absorption are more porous in nature and are generally considered unsuitable, unless found to be acceptable based on strength, impact and hardness tests.

Fig 3.4 Water Absorption Apparatus

3.3 Bitumen Quality Test

Various tests are conducted on bitumen to assess its consistency, gradation, viscosity, temperature susceptibility, and safety.

There are a number of tests to assess the properties of bituminous materials. The following tests are usually conducted to evaluate different properties of bituminous materials.

1. Penetration test
2. Ductility test
3. Softening point test
4. Specific gravity test
5. Viscosity test
6. Flash and Fire point test
7. Float test
8. Water content test
9. Loss on heating test

3.3.1 Penetration Test

It measures the hardness or softness of bitumen by measuring the depth in tenths of a millimeter to which a standard loaded needle will penetrate vertically in 5 seconds. BIS had standardized the equipment and test procedure.

The penetrometer consists of a needle assembly with a total weight of 100g and a device for releasing and locking in any position. The bitumen is softened to a pouring consistency, stirred thoroughly and poured into containers at a depth at least 15 mm in excess of the expected penetration. The test should be conducted at a specified temperature of 25^0C.

It may be noted that penetration value is largely influenced by any inaccuracy with regards to pouring temperature, size of the needle, weight placed on the needle and the test temperature.

In hot climates, a lower penetration grade is preferred. The Fig-1 shows a schematic Penetration Test setup.

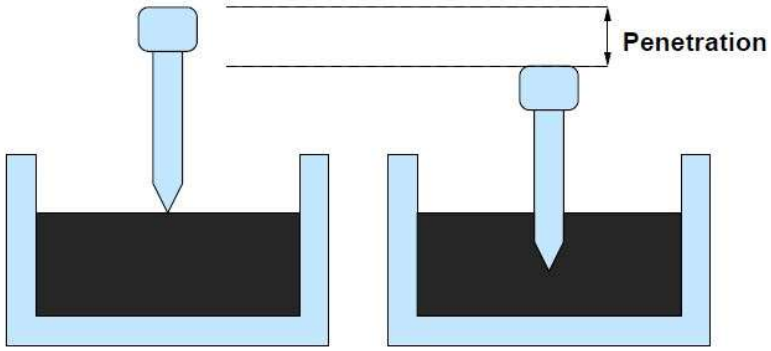

Fig 3.5 Penetration Test Setup

3.3.2 Ductility Test

Ductility is the property of bitumen that permits it to undergo great deformation or elongation. Ductility is defined as the distance in cm, to which a standard sample or briquette of the material will be elongated without breaking. Dimension of the briquette thus formed is exactly 1 cm square. The bitumen sample is heated and poured in the mould assembly placed on a plate. These samples with moulds are cooled in the air and then in water bath at 27^0C temperature. The excess bitumen is cut and the surface is leveled using a hot knife. Then the mould with assembly containing sample is kept in water bath of the ductility machine for about 90 minutes. The sides of the moulds are removed, the clips are hooked on the machine and the machine is operated. The distance up to the point of breaking of thread is the ductility value which is reported in cm.

The ductility value gets affected by factors such as pouring temperature, test temperature, rate of pulling etc.

A minimum ductility value of 75 cm has been specified by the BIS

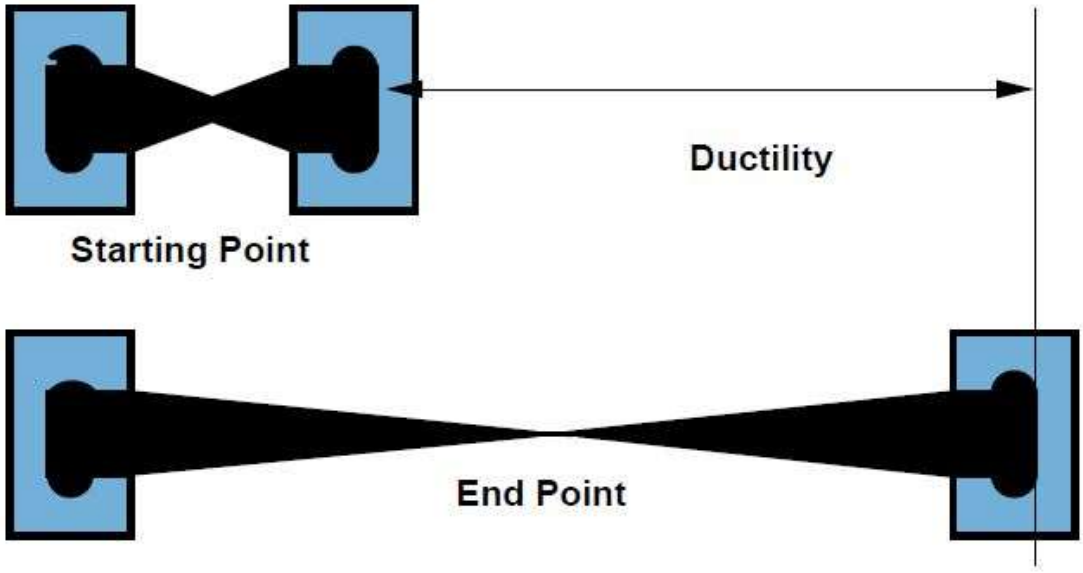

Fig- 3.6 Ductility Test

3.3.3 Softening Point Test

Softening point denotes the temperature at which the bitumen attains a particular degree of softening under the specified condition of test.

The test is conducted by using Ring and Ball apparatus. A brass ring containing test sample of bitumen is suspended in liquid like water or glycerin at a given temperature. A steel ball is placed upon the bitumen sample and the liquid medium is heated at a rate of 5^0C per minute. Temperature is noted when the softened bitumen touches the metal plate which is at a specified distance below.

Generally, higher softening point indicates lower temperature susceptibility and is preferred in hot climates.

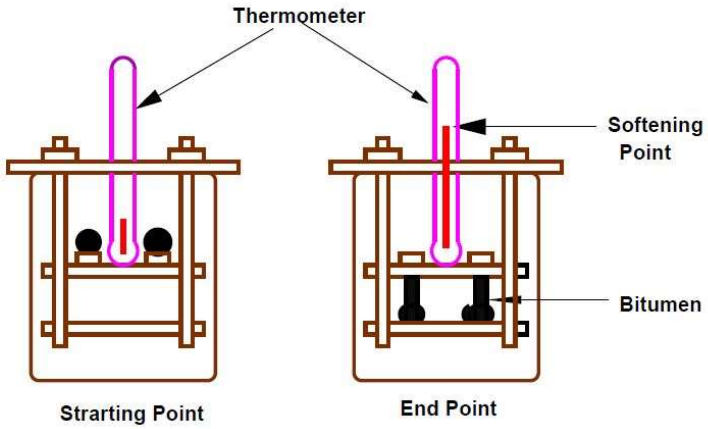

Fig- 3.7 Softening Point Test Setup

3.3.4 Specific Gravity Test

The specific gravity of bitumen is defined as the ratio of mass of given volume of bitumen of known content to the mass of equal volume of water at 27^0C. The specific gravity can be measured using either pycnometer or preparing a cube specimen of bitumen in semi solid or solid state.

In paving jobs, to classify a binder, density property is of great use. In most cases bitumen is weighed, but when used with aggregates, the bitumen is converted to volume using density values.

The density of bitumen is greatly influenced by its chemical composition. Increase in aromatic type mineral impurities cause an increase in specific gravity.

The specific gravity of bitumen varies from 0.97 to 1.02.

3.3.5 Viscosity Test

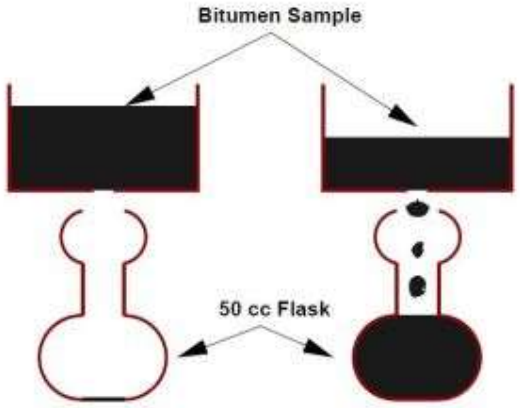

Fig- 3.8 Viscosity Test

Viscosity denotes the fluid property of bituminous material and it is a measure of resistance to flow. At the application temperature, this characteristic greatly influences the strength of resulting paving mixes.

Low or high viscosity during compaction or mixing has been observed to result in lower stability values. At high viscosity, it resists the compactive effort and thereby resulting mix is heterogeneous, hence low stability values. And at low viscosity instead of providing a uniform film over aggregates, it will lubricate the aggregate particles.

Orifice type viscometers are used to indirectly find the viscosity of liquid binders like cutbacks and emulsions.

The viscosity expressed in seconds is the time taken by the 50 ml bitumen material to pass through the orifice of a cup, under standard test conditions and specified temperature. Viscosity of a cutback can be measured with either 4.0 mm orifice at 25^0C or 10 mm orifice at 25 or 40^0C.

3.3.6 Flash and Fire Point Test

At high temperatures depending upon the grades of bitumen materials leave out volatiles. And these volatiles catch fire which is very hazardous and therefore it is essential to qualify this temperature for each bitumen grade. BIS defined the ash point as the temperature at which the vapour of bitumen momentarily catches fire in the form of ash under specified test conditions. The fire point is defined as the lowest temperature under specified test conditions at which the bituminous material gets ignited and burns.

3.3.7 Float Test

Normally the consistency of bituminous material can be measured either by penetration test or viscosity test. But for certain range of consistencies, these tests are not applicable and Float test is used.

The apparatus consists of an aluminum oat and a brass collar filled with bitumen to be tested. The specimen in the mould is cooled to a temperature of 5^0C and screwed in to oat. The total test assembly is floated in the water bath at 50^0C and the time required for water to pass its way through the specimen plug is noted in seconds and is expressed as the oat value.

3.3.8 Water Content Test

It is desirable that the bitumen contains minimum water content to prevent foaming of the bitumen when it is heated above the boiling point of water.

The water in bitumen is determined by mixing known weight of specimen in a pure petroleum distillate free from water, heating and distilling of the water. The weight of the water condensed and collected is expressed as percentage by weight of the original sample.

The allowable maximum water content should not be more than 0.2% by weight.

3.3.9 Loss on Heating Test

When the bitumen is heated it loses the volatility and gets hardened. About 50gm of the sample is weighed and heated to a temperature of 163^0C for 5 hours in a specified oven designed for

this test. The sample specimen is weighed again after the heating period and loss in weight is expressed as percentage by weight of the original sample.

Bitumen used in pavement mixes should not indicate more than 1% loss in weight, but for bitumen having penetration values 150-200 up to 2% loss in weight is allowed.

Table 1- List of IS Codes Related to Bitumen Testing.

Tests for Bitumen with IS codes	
Name of Test	**IS code Number**
Penetration Test	IS: 1203-1978
Ductility test	IS: 1208-1978
Softening Point test	IS: 1205-1978
Specific gravity test	IS: 1202-1978
Viscosity test	IS: 1206-1978
Flash and Fire Point test	IS: 1209-1978
Float Test	IS: 1210-1978
Determination of Water Content	IS: 1211-1978
Determination of Loss on Heating	IS:1212-1978

3.4 Cement Quality Test:

Quality Tests on cement are carried out to check the strength and quality of the cement used in construction. It helps to identify the usage of cement for different purposes based on its durability and performance.

The following tests are conducted on cement in the laboratory are as follows:

1. Fineness Test
2. Consistency Test
3. Setting Time Test
4. Strength Test
5. Soundness Test
6. Heat of Hydration Test
7. Tensile Strength Test
8. Chemical Composition Test

3.4.1 Fineness test on cement

The fineness of cement is responsible for the rate of hydration, rate of evolution of heat and the rate of gain of strength. Finer the grains more is the surface area and faster the development of strength.

The fineness of cement can be determined by Sieve Test or Air Permeability test.

Sieve Test: Air-set lumps are broken, and the cement is sieved continuously in a circular and vertical motion for a period of 15 minutes. The residue left on the sieve is weighed, and it should not exceed 10% for ordinary cement. This test is rarely used for fineness.

Fig 3.9 Blaine Apparatus

Air Permeability Test: Blaine's Air Permeability Test is used to find the specific surface, which is expressed as the total surface area in sq.cm/g. of cement. The surface area is more for finer particles.

3.4.2 Consistency test on cement

This test is conducted to find the setting times of cement using a standard consistency test apparatus, Vicat's apparatus.

Standard consistency of cement paste is defined as that water content which will permit a Vicat plunger of 10 mm diameter and 50 mm length to penetrate depths of 33-35 mm within 3-5 minutes of mixing.

Fig 3.10 Vicat Apparatus

The test has to undergo three times, each time the cement is mixed with water varying from 24 to 27% of the weight of cement.

This test should be conducted at a constant temperature of 25°C or 29°C and at a constant humidity of 20%.

3.4.3 Setting Time of cement

Vicat's apparatus is used to find the setting times of cement i.e., initial setting time and final setting time.

Initial Setting Time: For this test, a needle of 1 mm square size is used. The needle is allowed to penetrate into the paste (a mixture of water and cement as per the consistency test). The time taken to penetrate 33-35 mm depth is recorded as the initial setting time.

Final Setting Time: After the paste has attained hardness, the needle does not penetrate the paste more than 0.5 mm. The time at which the needle does not penetrate more than 0.5 mm is taken as the final setting time.

3.4.4 Strength test of cement

The strength of cement cannot be defined directly on the cement. Instead the strength of cement is indirectly defined on cement-mortar of 1:3. The compressive strength of this mortar is the strength of cement at a specific period.

3.4.5 Soundness test of cement

This test is conducted in Le Chatelier's apparatus to detect the presence of uncombined lime and magnesia in cement.

Fig 3.11 Le Chatliers Apparatus

3.4.6 Heat of Hydration Test

During the hydration of cement, heat is produced due to chemical reactions. This heat may raise the temperature of concrete to a high temperature of 50°C. To avoid these, in large scale constructions low-heat cement has to be used.

Fig 3.12 Calorimeter

This test is carried out using a calorimeter adopting the principle of determining heat gain. It is concluded that Low-heat cement should not generate 65 calories per gram of cement in 7 days and 75 calories per gram of cement in 28 days.

3.4.7 Tensile Strength of Cement

This test is carried out using a cement-mortar briquette in a tensile testing machine. A 1:3 cement-sand mortar with the water content of 8% is mixed and moulded into a briquette in the mould. This mixture is cured for 24 hours at a temperature of 25°C or 29°C and in an atmosphere at 90% relative humidity.The average strength for six briquettes tested after 3 and 7 days is recorded.

Fig 3.13 Tensile Testing Machine

3.4.8 Chemical Composition Test

Different tests are conducted to determine the amount of various constituents of cement. The requirements are based on IS: 269-1998, is as follows:

- The ratio of the percentage of alumina to that of iron oxide should not be less than 0.66.
- Lime Saturation Factor (LSF), i.e., the ratio of the percentage to that of alumina, iron oxide and silica should not be less than 0.66 and not be greater than 1.02.
- Total loss on ignition should not be greater than 4%.
- Total sulphur content should not be greater than 2.75%.
- Weight of insoluble residue should not be greater than 1.50%.
- Weight of magnesia should not be greater than 5%.

3.5 RMC Plant:

The ready mix concrete plant is used to manufacture ready-mix concrete which is used in all the construction projects. The ready-mix concrete is also known as RMC is a mixture of cement, water, sand and aggregates. It is manufactured in a batching plant as per the required specifications of a construction project.

Fig 3.14 Ready Mix Concrete Plant

3.6 Bituminous mixing Plant:

A bitumen mixing plant, also called asphalt mixing plant, is road surface paving material production equipment that is used to blend cold aggregate, liquid bitumen, and other admixture to form asphalt mix or blacktop, which is widely used for road construction.

Fig 3.15 Bituminous Mixing Plant

3.7 Stone Crushing Plant:

A crushing plant setup is a series of machines that are designed to take large pieces of concrete, asphalt or rock and break them into smaller pieces. The crushed material can then be used for construction, landscaping, and other purposes.

Fig 3.16 Crushing Plant

3.8 Observation

3.8.1 Ankola plant visit

Fig.3.17 Plant at Ankola

3.8.2 Explanation about Bituminous mixing Plant:

Fig.3.18 Bituminous mixing Plant

CHAPTER 4

STUDY ON BLACK SPOT ON VARIOUS LOCATION

4.1 Shirali (Ch:225+220):

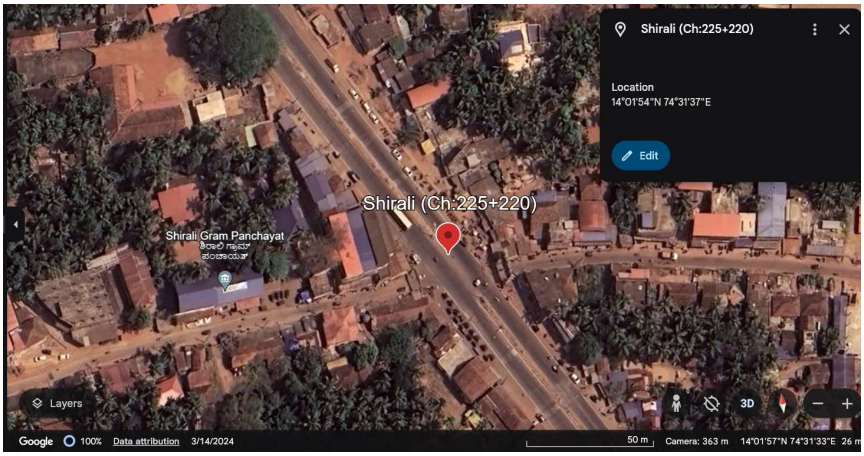

Fig 4.1: Shirali Junction map location

Observation at Shirali Junction:

1) Bus Bay Issues:

A proper bus bay is not provided. This causes buses to stop on the main road, obstructing traffic flow.

2) Intersection Issues:

There are intersections on both sides of the bus stop. Proper turning lanes and traffic lights are not provided. This creates confusion and potential hazards for both drivers and pedestrians.

3) Proximity of Market Shops to Roads:

Market shops are very close to the roads which affect traffic flow. This proximity leads to congestion and increases the risk of accidents.

4) Passenger Safety Risks:

Inadequate provision for passenger safety, such as the absence of shelters, seating, and barriers can put passengers at risk while waiting for or boarding buses.

Proposed Corrective Measures for Shirali Junction

1) Planning and Construction of Bus Bay

a) Construction of designated bus bay off the main road to allow buses to pull over without obstructing traffic.

b) Ensure the bus bay is clearly marked and has adequate space for buses to safely enter and exit.

2) Enhancing Intersection Safety

a) Install traffic lights at the intersections to manage the flow of vehicles and pedestrians.

b) Create dedicated turning lanes to prevent traffic congestion and reduce the risk of accidents.

c) Implement clear signage to guide drivers and pedestrians.

3) Implementing Clear Boundaries

a) Establish clear boundaries between the market area and the roadway.

b) Use physical barriers or bollards to prevent pedestrians from spilling onto the road.

4) Creating Pedestrian Zones:

a) Designate specific areas for pedestrians that are safely away from the main traffic lanes.

b) Consider creating a pedestrian-only zone or market square where vehicular traffic is restricted.

5) Parking Management:

a) Designated parking areas to be provided away from the main road to reduce roadside parking congestion.

b) Implementation of strict no-parking zones near the market to keep the roads clear.

6) Public Awareness Campaigns:

a) Educate the public about the importance of keeping roads clear and safe near market areas.

b) Use signs, public announcements, and community meetings to raise awareness about traffic rules and pedestrian safety.

Fig 4.2: Shirali Junction

4.2 Railway cross Karki:

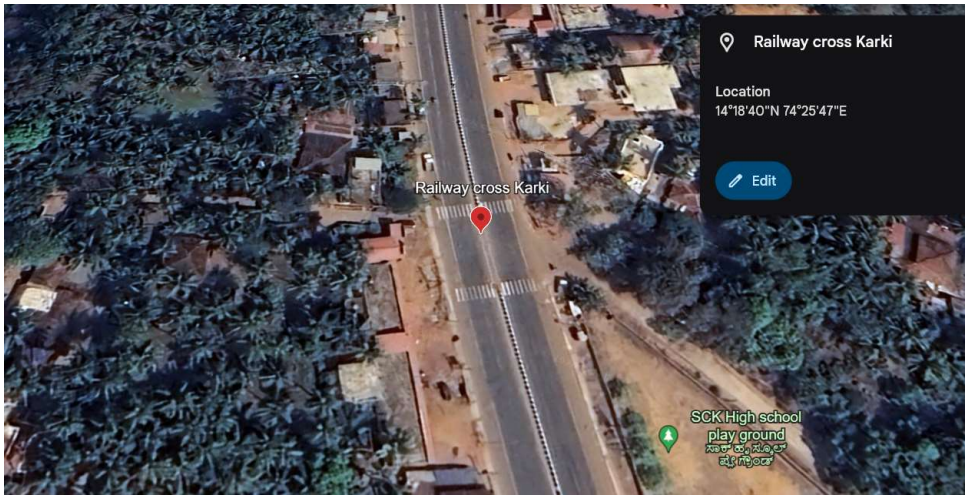

Fig 4.3: Railway cross Karki map location

Observation at Railway cross Karki :

1) **Insufficient Dimensions:**
   Bus bays may not have the required length and width to accommodate buses, leading to buses stopping partially in the traffic lane.
2) **Poor Location:**
   Bus bays might be situated too close to intersections or turning points, causing obstruction and confusion.
3) **Inadequate Entry and Exit Tapers:**
   Lack of proper entry and exit tapers can make it difficult for buses to smoothly enter and exit the bay, disrupting traffic flow.
4) **Lack of Clear Signage and Markings:**
   Absence of clear signage and road markings can result in drivers and pedestrians being unaware of the bus bay, increasing the risk of accidents.
5) **Safety Concerns for Passengers:**
   Insufficient passenger amenities and safety measures can lead to unsafe conditions for passengers waiting for or alighting from buses.
6) **Traffic Flow Disruptions:**
   Bus bays that are not properly designed can disrupt the flow of traffic, leading to congestion and increased travel time for other vehicles.

Proposed Corrective Measures for Railway cross Karki

1) **Adequate Dimensions:**
   a) **Length and Width:** Design bus bays with adequate length (30-50 meters) and width (3.5-4 meters) to fully accommodate buses without obstructing the main traffic lane.
   b) **Optimal Location:** Position bus bays away from intersections, major turning points, and pedestrian crossings to minimize traffic disruption and enhance safety.
   c) **Proper Entry and Exit Tapers:**
      i) **Entry Taper:** Provide a gentle entry taper with a 1:8 ratio to allow smooth ingress for buses.
      ii) **Exit Taper:** Provide an exit taper with a 1:6 ratio for smooth egress, ensuring buses can merge back into traffic without causing abrupt stops.
2) **Clear Signage and Road Markings:**
   a) Install prominent signage to indicate the presence of a bus bay ahead.

b) Mark the bus bay clearly on the road with appropriate road markings to guide buses into and out of the bay.

3) Passenger Safety and Amenities:

a) Provide well-lit, sheltered waiting areas with seating for passengers.

b) Ensure pedestrian crossings are available and safely accessible near bus bays.

c) Install barriers or railings to prevent passengers from stepping directly onto the road.

4) Traffic Management and Calming Measures:

a) Implement traffic calming measures such as speed bumps or raised crosswalks near bus bays to slow down traffic.

b) Coordinate bus bay design with traffic signals if near intersections to manage the flow effectively.

5) Regular Maintenance:

a) Conduct regular maintenance of bus bays to ensure they remain in good condition, free of potholes and other damage.

b) Periodically review the usage and condition of bus bays to make necessary adjustments and improvements.

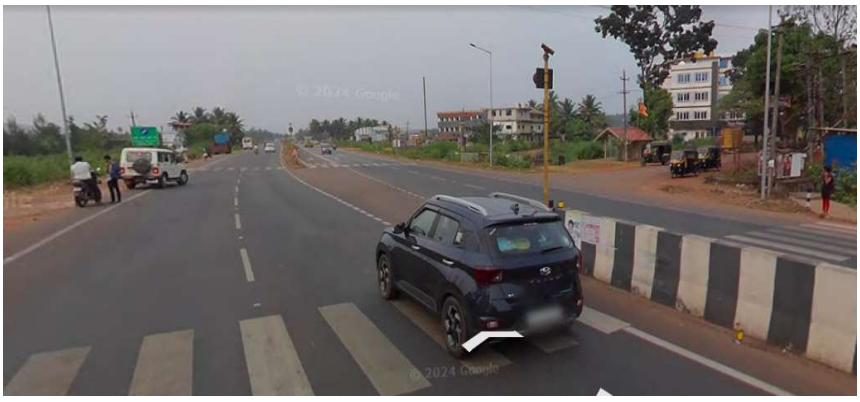

Fig 4.4: Railway Cross Karki

4.3 Venktapur Villege (Near Bridge) Bhatkal Taluk (226/300):

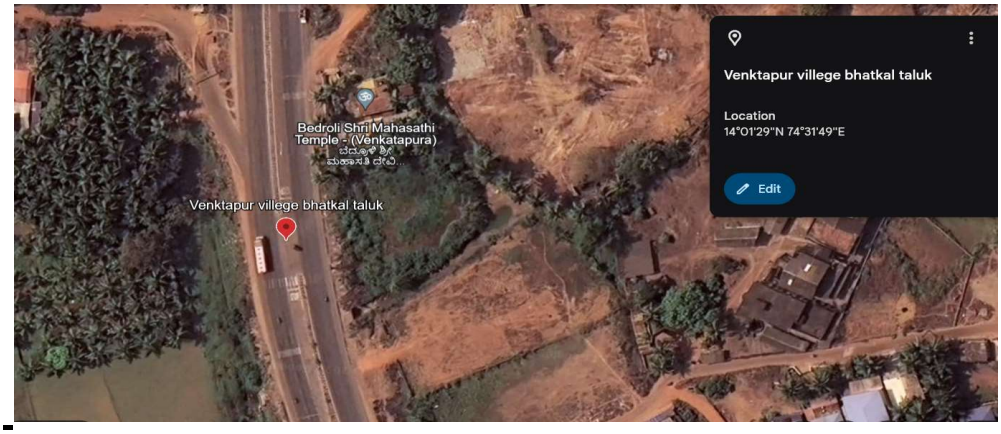

Fig 4.5 : Venktapur Villege Map Location

Observation at Venktapur Villege (Near Bridge) Bhatkal Taluk (226/300):

1) **Insufficient Pedestrian Crossings:**
   a) Lack of adequately marked pedestrian crossings, leading to unsafe crossing conditions for pedestrians.
   b) **Poorly Designed Footpaths:** Footpaths may be absent, too narrow, or obstructed, forcing pedestrians to walk on the road.
2) **Inadequate Signage and Road Markings:**
   a) Lack of clear signage and road markings to guide both pedestrians and drivers, increasing the risk of accidents.

3) **Improper Lighting:** Inadequate lighting at pedestrian crossings and footpaths, reducing visibility and increasing the risk of accidents, especially at night.
4) **Lack of Traffic Calming Measures:** Absence of traffic calming measures in areas with high pedestrian activity, leading to higher vehicle speeds and increased risk of accidents.
5) **Poor Maintenance:** Lack of maintenance of pedestrian infrastructure, leading to damaged footpaths, faded road markings, and malfunctioning pedestrian signals.

Proposed corrective Measures for Venktapur Villege (Near Bridge) Bhatkal Taluk (226/300):

1) **Adequate Pedestrian Crossings:**

a) Install well-marked pedestrian crossings at regular intervals, especially near schools, markets, and other high pedestrian traffic areas.
b) Use zebra crossings, pelican crossings, and pedestrian signals to ensure safe crossing.

2) **Properly Designed Footpaths:**

a) Construct wide and continuous footpaths on both sides of the road, free from obstructions.
b) Ensure footpaths are accessible for all, including persons with disabilities, by providing ramps and tactile paving.

3) **Clear Signage and Road Markings:**

a) Install prominent signage to indicate pedestrian crossings and footpaths.
b) Use clear and reflective road markings to guide both pedestrians and drivers.

4) **Adequate Lighting:**

a) Install sufficient street lighting at pedestrian crossings and along footpaths to improve visibility and safety at night.
b) Use solar-powered lights or energy-efficient LEDs to ensure consistent illumination.

5) **Traffic Calming Measures:**

a) Implement traffic calming measures such as speed bumps, raised crosswalks, and rumble strips in areas with high pedestrian activity.
b) Use road narrowing, chicanes, and other physical measures to reduce vehicle speeds.

6) Regular Maintenance:

a) Conduct regular inspections and maintenance of pedestrian infrastructure to ensure it remains in good condition.

b) Repaint road markings and repair any damage to footpaths promptly.

c) Ensure pedestrian signals are functioning correctly and are synchronized with traffic lighs.

Fig 4.6 : Venktapur Villege

4.4 Haldipura:

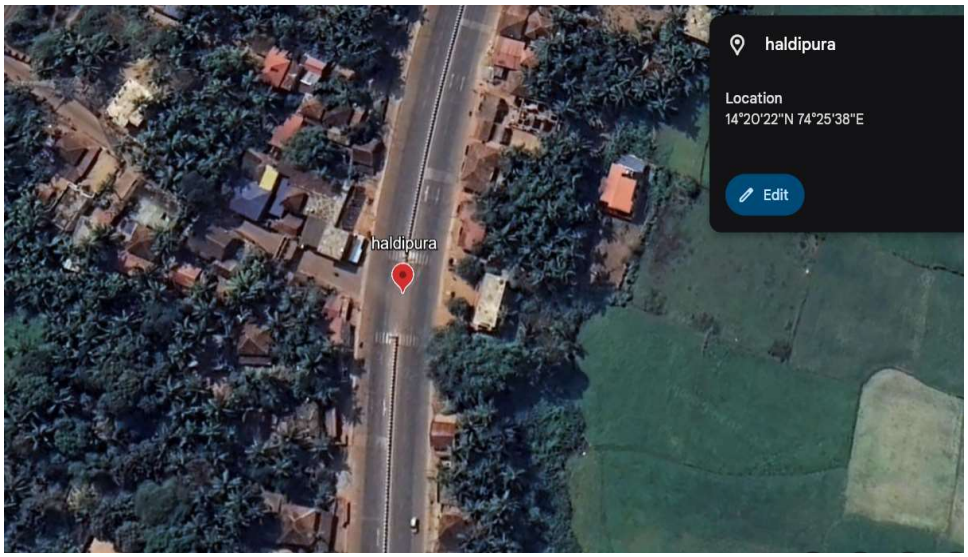

Fig 4.7: Haldipura map location

Observation at Haldipura:

1) **Bus Bay Issues:**
   a) A proper bus bay is not provided.
   b) This causes buses to stop on the main road, obstructing traffic flow.

2) **Intersection Issues:**
   a) There are intersections on both sides of the bus stop.
   b) Proper turning lanes and traffic lights are not provided.
   c) This creates confusion and potential hazards for both drivers and pedestrians.

3) **Proximity of Market Shops to Roads:**
   a) Market shops are very close to the roads, affecting traffic flow.
   b) This proximity leads to congestion and increases the risk of accidents.

4) **Passenger Safety Risks:** Inadequate provision for passenger safety, such as the absence of shelters, seating, and barriers, can put passengers at risk while waiting for or boarding buses.

5) **Lack of Safety Measures:**

a) Absence of barriers or railings to guide pedestrians and prevent them from stepping directly onto the road.
b) Lack of traffic calming measures near pedestrian crossings to slow down vehicular traffic.

Corrective Measures Suggested for Haldipura

1) Parking Management:

a) Create designated parking areas away from the main road to reduce roadside parking congestion.

c) Implement strict no-parking zones near the market to keep the roads clear.

2) Improving the Bus Bay:

a) Construct a designated bus bay off the main road to allow buses to pull over without obstructing traffic.
b) Ensure the bus bay is clearly marked and has adequate space for buses to safely enter and exit.

3) Enhancing Intersection Safety:

a) Install traffic lights at the intersections to manage the flow of vehicles and pedestrians.
b) Create dedicated turning lanes to prevent traffic congestion and reduce the risk of accidents.
c) Implement clear signage to guide drivers and pedestrians.

4) Properly Designed and Continuous Footpaths:

a) Width and Accessibility: Ensure footpaths are wide enough to accommodate pedestrian traffic (minimum width of 1.5 meters recommended) and are continuous along both sides of the road. Ensure footpaths are free from obstacles and are accessible for all, including persons with disabilities, by providing ramps and tactile paving.
b) Maintenance: Regularly inspect and maintain footpaths to keep them in good condition

Fig 4.8 : Haldipura Location

4.5 Alvekodi, Kumta taluk:

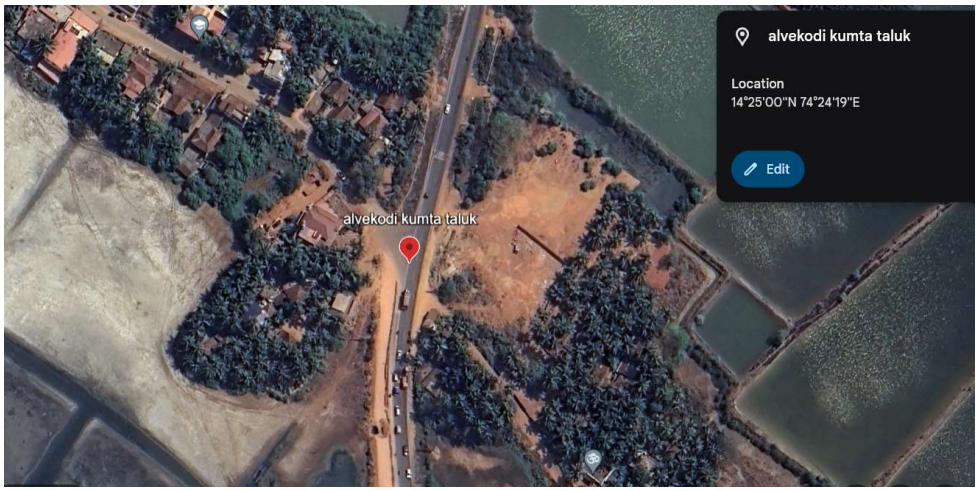

Fig 4.9: Alvekodi map location

Observation at Alvekodi location:

1) **Inadequate Road Furniture:** Lack of essential road furniture such as guardrails, barriers, median strips, and bollards, which are crucial for road safety.
2) **Poorly Designed and Maintained Road Signs:** Road signs may be poorly designed, placed incorrectly, or not maintained, leading to reduced visibility and effectiveness.
3) **Insufficient Traffic Calming Measures:** Absence of or ineffective traffic calming measures in areas requiring speed reduction, such as near schools, residential areas, and intersections.
4) **Lack of Road Markings:** Absence or fading of road markings, such as lane dividers, pedestrian crossings, and directional arrows, which are essential for guiding traffic and ensuring safety.
5) **Inadequate Lighting:** Poor lighting on roads, especially at critical points like intersections, pedestrian crossings, and sharp curves, increasing the risk of accidents.
6) **Improper Drainage Systems:** Ineffective or clogged drainage systems leading to waterlogging on roads, which can cause vehicle skidding and damage to road surfaces.
7) **Bus Bay Issues:**
   a) A proper bus bay is not provided.
   b) This causes buses to stop on the main road, obstructing traffic flow.
8) **Intersection Issues:**
   a) There are intersections on both sides of the bus stop.

b) Proper turning lanes and traffic lights are not provided.
c) This creates confusion and potential hazards for both drivers and pedestrians.

Corrective Measures for Alvekodi location

1) **Adequate and Properly Designed Road Furniture:**
   a) **Guardrails and Barriers:** Install guardrails and barriers at critical locations such as sharp curves, bridges, and steep embankments to prevent vehicles from veering off the road.
   b) **Median Strips and Bollards:** Use median strips and bollards to separate opposing traffic flows and protect pedestrian areas.

2) **Well-Designed and Maintained Road Signs:**
   a) **Design and Placement:** Ensure road signs are designed according to MoRTH standards and placed at appropriate locations to provide clear guidance to road users.
   b) **Maintenance:** Regularly inspect and maintain road signs to ensure they are visible and in good condition.

3) **Effective Traffic Calming Measures:**
   a) **Speed Bumps and Rumble Strips:** Install speed bumps and rumble strips in areas requiring speed reduction, such as near schools, residential areas, and intersections.
   b) **Chicanes and Road Narrowing:** Use chicanes and road narrowing techniques to slow down traffic in specific areas.

4) **Clear and Durable Road Markings:**
   a) **Lane Dividers and Crossings:** Ensure road markings such as lane dividers, pedestrian crossings, and directional arrows are clearly visible and maintained.
   b) **Reflective Markings:** Use reflective materials for road markings to enhance visibility at night and during adverse weather conditions.

5) **Adequate Road Lighting:**
   a) **Street Lighting:** Install sufficient street lighting, especially at critical points like intersections, pedestrian crossings, and sharp curves, to improve visibility and safety at night.

b) **Energy-Efficient Lighting:** Use energy-efficient lighting solutions such as LEDs to ensure consistent illumination and reduce energy costs.

6) Effective Drainage Systems:

a) **Design and Maintenance:** Ensure drainage systems are properly designed to handle heavy rainfall and regularly maintained to prevent clogging and waterlogging on roads.

b) **Surface Drainage:** Implement surface drainage solutions such as curbs and gutters to channel water away from the road surface.

7) Improving the Bus Bay:

a) Construct a designated bus bay off the main road to allow buses to pull over without obstructing traffic.

b) Ensure the bus bay is clearly marked and has adequate space for buses to safely enter and exit.

Fig 4.10: Alvekodi Location

4.6 Dhareshwar Villege, Kumta taluk:

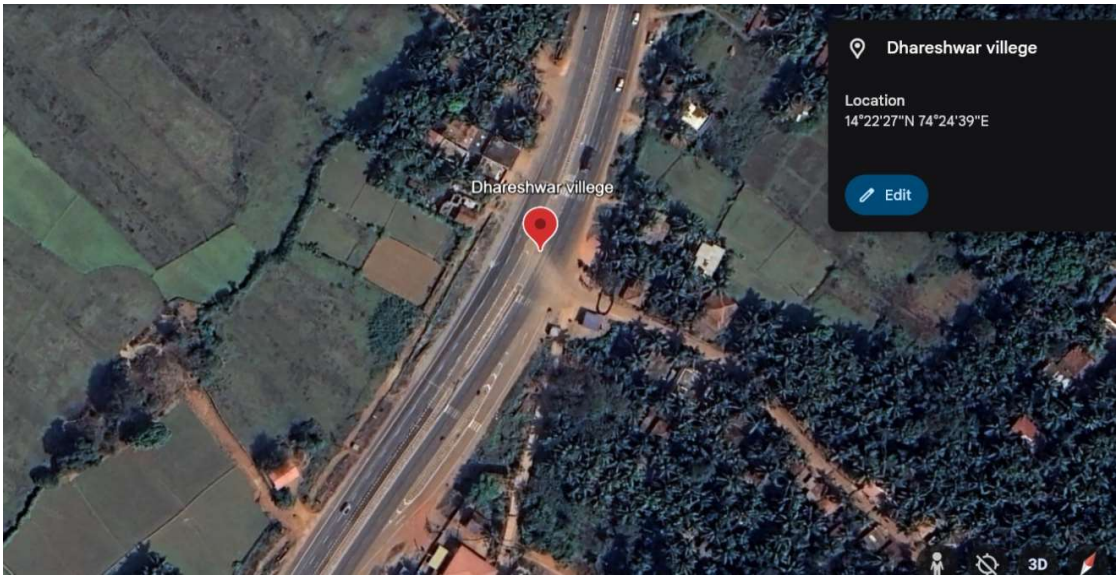

Fig 4.11: Dhareshwar Village map location

Observation at Dhareshwar Village Location:

1) **Structural Deficiencies:** Poor design and construction of culverts and small bridges can lead to structural weaknesses, resulting in cracks, settlements, or even collapse.
2) **Inadequate Capacity:** Culverts and bridges may be designed with insufficient capacity to handle peak flow conditions, leading to overtopping and flooding.
3) **Poor Maintenance:** Lack of regular maintenance can result in blockages, erosion, and deterioration of the structure, reducing its effectiveness and lifespan.

4) **Scour and Erosion:** Insufficient protection against scour and erosion can undermine the foundations of culverts and bridges, leading to instability.
5) **Hydraulic Inefficiency:** Poor hydraulic design can cause water flow obstructions, sediment accumulation, and backwater effects, impacting the structure's performance.

Proposed Corrective Measures for at Dhareshwar Village Location

1) Improved Design and Construction:

a) **Structural Integrity:** Ensure that culverts and small bridges are designed and constructed to meet the required structural standards and load-bearing capacities. Use appropriate materials and construction techniques to enhance durability.
b) **Load Assessment:** Perform accurate load assessments considering current and future traffic volumes, environmental conditions, and potential impacts.

2) Adequate Capacity Planning:

a) **Hydraulic Analysis:** Conduct detailed hydraulic analysis to determine the required capacity of culverts and bridges to handle peak flow conditions and prevent overtopping.
b) **Future Projections:** Consider future increases in water flow due to climate change and urban development in the capacity planning.

3) Regular Maintenance and Inspection:

a) **Maintenance Schedule:** Implement a regular maintenance schedule to inspect and clean culverts and bridges, removing debris and blockages to ensure proper water flow.
b) **Condition Monitoring:** Use condition monitoring techniques, such as visual inspections and non-destructive testing, to identify and address structural issues early.

4) Scour and Erosion Protection:

a) **Scour Countermeasures:** Install scour countermeasures, such as riprap, gabions, or concrete aprons, around the foundations of culverts and bridges to protect against erosion.
b) **Bank Stabilization:** Implement bank stabilization measures, such as vegetation planting or retaining walls, to prevent erosion near the structure.

5) Hydraulic Efficiency:

a) **Smooth Flow:** Ensure the design facilitates smooth water flow through the culvert or bridge without causing significant obstructions or sediment accumulation.

b) **Sediment Control:** Incorporate sediment control measures, such as silt traps or sediment basins, upstream of the structure to reduce sediment load and maintain hydraulic efficiency.

Fig 4.12: Dhareshwar Village Location

4.7 Binaga Location:

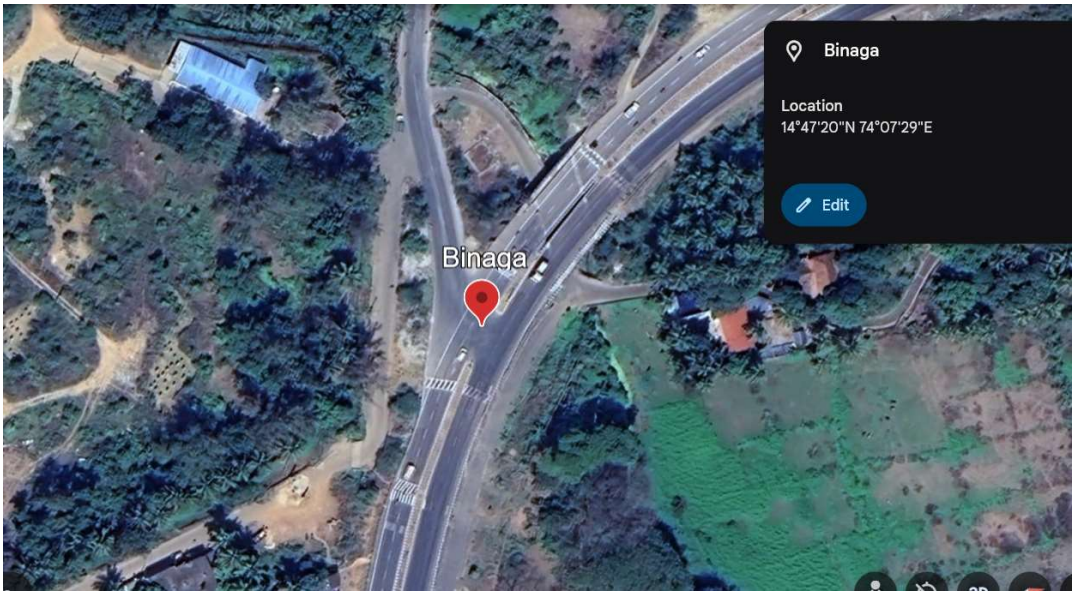

Fig 4.13 Binaga Map Location

Observations at Binaga Location:

1) **Inadequate Road Infrastructure:** Urban roads may lack essential infrastructure such as proper pavements, drainage systems, and pedestrian facilities, leading to congestion and safety hazards.
2) **Poor Traffic Management:** Inefficient traffic management systems can result in frequent traffic jams, increased travel times, and higher accident rates.
3) **Inadequate Parking Facilities:** Insufficient or poorly managed parking facilities can lead to illegal parking on roads, contributing to congestion and accidents.
4) **Poor Maintenance of Road Infrastructure:** Lack of regular maintenance can lead to the deterioration of road surfaces, signage, and other infrastructure, impacting safety and usability.
5) **Bus Bay Issues:**

a) A proper bus bay is not provided.
b) This causes buses to stop on the main road, obstructing traffic flow.

6) **Intersection Issues:**

a) There are intersections on both sides of the bus stop.

b) Proper turning lanes and traffic lights are not provided.
c) This creates confusion and potential hazards for both drivers and pedestrians.

Proposed Corrective Measures for Binaga Location

1) Improved Road Infrastructure:

a) **Proper Pavements:** Ensure all urban roads have well-designed and maintained pavements to facilitate smooth traffic flow and enhance safety.
b) **Drainage Systems:** Implement efficient drainage systems to prevent waterlogging and road damage, particularly during heavy rains.
c) **Pedestrian Facilities:** Provide adequate pedestrian facilities, including footpaths, crossings, and pedestrian signals, to ensure the safety of pedestrians.

2) Enhanced Traffic Management:

a) **Traffic Signals and Signs:** Install and maintain traffic signals and signs at appropriate locations to guide drivers and manage traffic flow effectively.
b) **Intelligent Traffic Systems:** Implement intelligent traffic management systems that use real-time data to optimize traffic flow and reduce congestion.
c) **Traffic Police Presence:** Increase the presence of traffic police at critical junctions to manage traffic and enforce traffic rules.

3) Adequate Parking Facilities:

a) **Multi-Level Parking:** Develop multi-level parking facilities in congested urban areas to accommodate more vehicles and reduce on-street parking.
b) **Parking Management Systems:** Implement parking management systems that provide real-time information about parking availability and guide drivers to vacant spots.
c) **Enforcement of Parking Rules:** Enforce strict parking rules to prevent illegal parking and ensure smooth traffic flow.

4) Regular Maintenance of Road Infrastructure:

a) **Maintenance Schedule:** Develop and adhere to a regular maintenance schedule for road surfaces, signage, and other infrastructure to keep them in good condition.
b) **Pothole Repair:** Promptly repair potholes and other road damages to ensure the safety and comfort of road users.

c) **Signage and Markings:** Regularly inspect and repaint road markings and signs to ensure they remain clear and effective.

5) Improving the Bus Bay:

a) Construct a designated bus bay off the main road to allow buses to pull over without obstructing traffic.

b) Ensure the bus bay is clearly marked and has adequate space for buses to safely enter and exit.

Fig 4.14 Binaga Location

4.8 Khafri Temple Cross, Karwar Town:

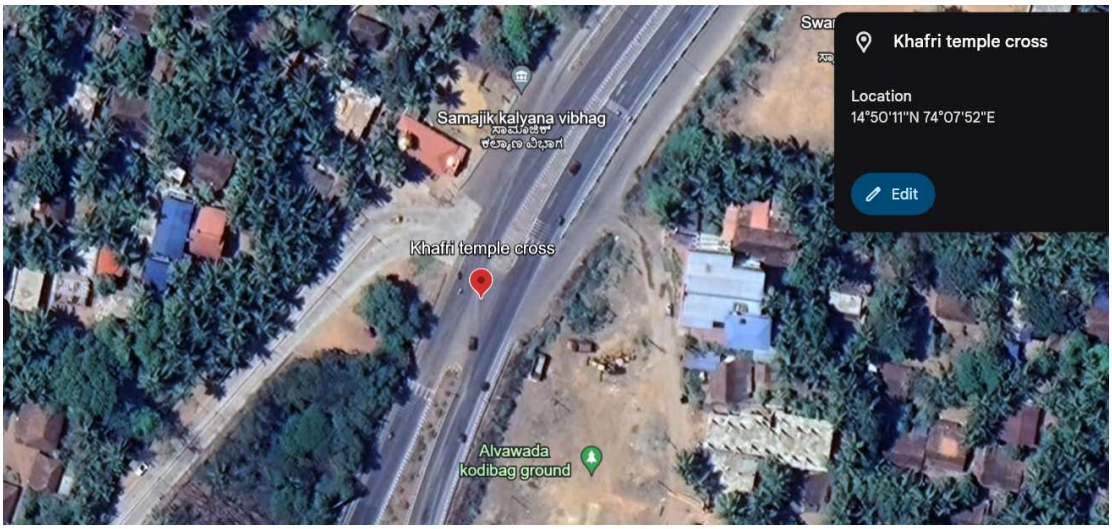

Fig 4.15 Khafri Temple Cross map Location

Observations at Khafri Temple Cross Location:

1) **Insufficient or Inadequate Barriers:** Lack of sufficient safety barriers or crash barriers in critical locations such as sharp curves, steep embankments, bridges, and high-speed zones.
2) **Poor Quality and Design of Barriers:** Use of low-quality materials or improper design of barriers, which can result in the barriers failing to effectively absorb and redirect the impact during collisions.
3) **Improper Installation:** Incorrect installation of barriers, leading to reduced effectiveness in preventing vehicles from veering off the road.
4) **Lack of Maintenance:** Failure to regularly inspect and maintain barriers, leading to deterioration, damage, and reduced effectiveness over time.
5) **Inadequate End Treatments:** Improper or lack of end treatments for barriers, which can create hazardous conditions for vehicles in the event of a collision.

Propose Corrective Measures for Khafri Temple Cross Location

1) **Adequate Installation of Safety Barriers:**

a) **Critical Locations:** Install safety barriers and crash barriers at all critical locations such as sharp curves, steep embankments, bridges, high-speed zones, and areas with high accident rates.

b) **Standards Compliance:** Ensure barriers are installed according to MoRTH standards and guidelines, with appropriate consideration for the specific site conditions.

2) **High-Quality Materials and Proper Design:**

a) **Material Quality:** Use high-quality materials that meet the required standards for durability and impact resistance.

b) **Design Specifications:** Ensure the design of the barriers adheres to MoRTH specifications, providing effective impact absorption and redirection.

3) **Correct Installation Techniques:**

a) **Professional Installation:** Engage qualified professionals and follow best practices for the correct installation of barriers to ensure they function as intended.

b) **Proper Alignment:** Ensure barriers are properly aligned and anchored to withstand impact forces.

4) **Regular Maintenance and Inspection:**

a) **Maintenance Schedule:** Implement a regular maintenance schedule to inspect barriers for damage, wear, and tear. Conduct necessary repairs or replacements promptly.

b) **Monitoring:** Use monitoring systems to track the condition of barriers and identify any issues that need attention.

Fig 4.16 Khafri Temple cross

CHAPTER 5

CONCLUSION

- 4week of internship at NHAI gave us knowledge about working and role of structural, highway and quality control departments in construction project.
- we Gained practical knowledge in calculating quantities of concrete and bar bending schedule for various bridges by referring into drawings.
- we Participated in both office-based and in-site structural studies, understanding of major and minor bridges, type of culverts.
- We learned about the cross section of highway and its layers.
- we learned the process involved in aggregate crushing plant.
- We got a brief idea about working of RMC plant, Bitumen plant and Garage sections for regular maintenance of equipment.

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ANNEXURE

College Permission letter

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY
(A Unit of Alva's Education Foundation ®,Moodbidri)
Affiliated to Visvesvaraya Technological University, Belagavi
Approved by AICTE, New Delhi & Recognised by Government of Karnataka
Accredited by NAAC with A+ Grade and NBA (CSE & ECE)

To,

The Project Director
NHAI, Honnavar Division

From,

Dr. H Ajith Hebbar
Professor and HOD, Civil Engineering
Alva's Institute of Engg and Tech, Moodbidri, DK

Respected sir,

As per our previous email communication with NHAI Mangalore office and the telephonic conversation with NHAI Engineer, Honnavar PIU office, here is the list of 5th sem students who are participating in the Internship in NHAI, Honnavar PIU division. **The proposed date of internship is 30th October 2023 to November 30th, 2023** (30 Days including Sundays or as per NHAI regulations). Further we may recall here, an MOU between NHAI (Mangalore Division) & AIET was signed on 12.10.2021 for Adoption of NHs by Engineering Colleges for the Stretch of 4/6 Laning of Goa Karnataka Border – Kundapura section of NH-66 from Ch 208.000 to Ch 280.940. & Mangalore city Bypass. Hence I request you to do needful in this regard.

The Student Information is as follows,

S.No.	Student Name	USN	Male / Female	Mob	Email
1	A. DHANUSH	4AL21CV001	MALE	9148066595	4al21cv001@gmail.com
2	D S CHAITHRESH	4AL21CV003	MALE	9482696885	4al21cv003dschaithresh@gmail.com
3	S V VINAYAKA BHANDARKAR	4AL21CV011	MALE	8861149017	bhandarka543@gmail.com
Internal Guide / Contact Point				Prof Shankargiri, Mob : 8073232168 , giricivil@aiet.org.in	

Academic Performance

S.No.	Student Name	USN	% of Marks Scored in Semester Exam		
			1st Sem	2nd Sem	3rd Sem
1	A. DHANUSH	4AL21CV001	73.4	73.5	78.4
2	D S CHAITHRESH	4AL21CV003	71	77.33	77.8
3	S V VINAYAKA BHANDARKAR	4AL21CV011	74.2	71.8	80.5

Thanks and Regards,

Dr. H Ajith Hebbar

AIET, 30/10/2023

H.O.D.
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Alva's Institute of Engg. & Technology
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Company Acceptance Letter