# Report

on

# Study and GIS-based Mapping of Village Road Network

Taluka - Lanja, District - Ratnagiri





IITB - UMA Team April 2024

# **Table of Contents**

Table of Contents	2
1. Background	3
2. Objectives and Methodology	4
3. Steps in Engaging Institutes/Graduate Students for Internship	5
4. Design of Internship	6
4.1 Quality	6
4.2 Connectivity	9
4.2.1 Utility Value(UV) of Habitation	9
4.2.2 Road Matrix Index (RMI)	9
4.3 Bridges	11
5. Mobile Apps, Software, and Instruments for Internship	12
6. Engagement with Kolhapur Institute of Technology	12
7. Actual Execution of Internship Activity	13
7.1 Selection of Villages	14
7.2 Training and Workshop	14
7.3 Lanja Base	15
7.4. Procedure for One Village	16
7.5. GIS Mapping of Road Network	17
7.6 Secondary Data	18
7.7 Report	18
8. Overall Comments on Student Work	20
9. Future Expansion	20

## 1. Background

'Unnat Maharashtra Abhiyan' (UMA) is a programme of the Department of Higher and Technical Education, Government of Maharashtra, designed and implemented by the Indian Institute of Technology, Bombay (IITB). UMA aims to align curricula and research in higher education towards better development outcomes, train students for a future role as development professionals, and strengthen the connection between the community and regional colleges through curricular work on local developmental problems. The programme vision is to build a platform for academia, especially local higher educational institutes to engage with society, community, and state.

The IITB-UMA team has been working in Ratnagiri district for the last two years. During this tenure, the IITB-UMA team designed various activities to study on local issues like rural water supply, public transport. The IITB-UMA team designed and developed a methodology to study rural water supply (RWS) and road sectors, conducting a pilot study (2022-23) in Rajapur Taluka of Ratnagiri. In Rajapur, the team has studied the road network in 6 villages and the rural water supply in 10 villages. Before Rajapur village-level sector-specific pilot studies, we did a study in Wade village (Taluka Devgad) on flood and soil erosion of coastal parts due to small streams with Kolhapur Institute of Technology (KIT) students.

The Chief Executive Officer (CEO), Zilla Parishad (ZP) Ratnagiri, approached and requested a study of the assessment of the drinking water status of 20 tanker-fed villages. This study (May-July 2023) was conducted with the help of students of local colleges (Arts, commerce and science) and presented to respective GPs (Dec-Jan 2024) so they could take action in their village action plan. Parallely, the IITB-UMA team dealt with local state departments and produced sample case study reports that fulfilled the requirements of both academic needs and state agencies.

In this context, the ZP CEO agreed to produce a report on the internal village road network of Lanja Taluka. It was decided that a field-based study should be done, which will increase the understanding of roads to the public, and a detailed analysis will help local government authorities in decision-making and priotize road development plans. For this, we designed and developed a methodology by conducting pilot studies on 3 GPs: Devdhe, Kot, and Isavali. Then ZP Ratnagiri did an MoU with IITB for mapping of Lanja Taluka village road network. We upgraded and designed a study method based on several IRC codes and government methods. Such various and wide experiences helped us to conduct KIT Internship.

This report consists of designing a field-based internship in various development sectors, detailed activities of student internships and their utility to the Public work department, Zilla Parishad, and finally to GP for designing the village action plan. This will help academic

institutes and government departments to involve students and faculty members in studying the local development issues.

# 2. Objectives and Methodology

The following are the objectives of the internship programme:

- 1. To train students to work on real-world problems through field-based academic activities
- 2. To design and develop a methodology for field-based academic activities.
- 3. To prepare maps and reports of the village road network, which serves as a local knowledge product.

UMA developed various case studies on the regional problems and developed methodology for such studies. Based on these case studies, we trained the regional college faculty members and students through workshops, mini and graduate projects, and field-based studies. We believe that the outcome of such studies are as follows:

Students	Academic Institutes	Government Organizations (GPs, line departments)
<ul> <li>a) Experiential learning through field based-activities</li> <li>b) Interaction with various state agencies and community</li> <li>c) Report writing on real-life issues</li> </ul>	<ul> <li>a) Community engagement activity</li> <li>b) Documentation/procedures for floating field-based academic activities for students in the future.</li> <li>c) Produce reports on local development issues, which serve as local knowledge products.</li> </ul>	<ul><li>a) Increase the engagement with the academic institutes</li><li>b) Enhance the capacity of the department and increase participation of students in current projects</li></ul>

#### Table 1. Expected Outcome of Internship Programme

## Methodology

As mentioned above, this internship activity is associated with the road sector. Roads are important assets to accelerate local development and provide last-mile connectivity to access various needs for the daily routine of civil society. Therefore, assessing the current status and study of the local road is essential for decision-makers and the local community. In this context, we developed a methodology to study the road network. The following is the methodology of the internship programme on study and GIS based mapping of the village road network.



Figure 1. Methodology of the internship programme

# 3. Engagement with IITB-UMA Team for Internship

One of the major objectives of UMA project is to create academic space for field-based projects/studies in the domain relevant to development and train future professionals for state development needs. We always help development-related studies by regional institutes and train regional higher educational institutes for the same. Our team provides support in the form of content for field-based studies, training, sample reports, methodology, handholding, and other support. Also, we welcome ideas from different regional institutes so we both work hand in hand. Following is a detailed process for engaging with HEIs to conduct field-based internship on local development issues.



Figure 2. Procedure to Engage with UMA

# 4. Design of Internship on Road Sector

The main part of the GIS-based study of the village road network is to map planned and unplanned roads within the village. The planned roads which are recorded and assigned specific numbers by government authorities like (ZP, PWD, etc.). E.g. VR115, MDR63,etc. The unplanned roads were not recorded by any government authorities but are recorded in 'Gav Namuna - 23' of Gram Panchayat of respective villages. They are named with reference to local locations like habitations and assets (Temple, GP headquarters, Smashan, Primary Health Centres, etc.).

The internship is designed on two main components of village road networks, i.e., quality and connectivity. While studying roads, we should consider parameters like serviceability (physical condition), stability (structural capacity), connectivity, etc. We focused on serviceability (quality) and connectivity during this internship program.

## 4.1 Quality

Evaluating existing road surfaces is necessary to plan maintenance, prioritize road work, and reconstruct existing roads. Hence, to evaluate road surfaces, we refer to IRC82 - 2015. For our eight-week internship, we're using IRC82-2015 to visually assess surface distress by identifying its type and magnitude. We designed a visual surface distress measurement sheet through physical distress and a quantitative visual assessment is done. Distress is quantify for every 200 m road path. Following is the measurement book of distress:

	Visual Surface Distress Measurement									
Village Nan	ne		_				Date	//		
GP Name-				Name of t	he surveyor	-				
				1						
From	nage To	Cracking	Patching	Potholes	Settlement	Ravelling	Shoving	Rut depth	WBM Missing	Any Other Distress Observerd

Figure 3. Surface Distress Measurement Sheet

After measuring distress, it is necessary to calculate its percentage and the rating factor for each distress based on IRC82-2015 (see Annexure I). The Final Rating Value is calculated by taking the average of the Weighted Rating Values of all parameters viz. Cracking, raveling,

potholes, shoving, patching, settlement and rut depth. Based on final rating values, the first three road categories are defined. But as ground reality, sometimes road conditions are very bad and serious so we defined the fourth category. If the wearing course and WBM layer (any one of those or both) are missing more than 40% of the considered patch length (here 200m), then classify it as the fourth category.

Several roads are unpaved, but it is convenient to pass a four-wheeler is considered the fifth category. Some roads are used by pedestrians, which is considered the sixth category. So, the final road categories are as follows:

Sr. No.	<b>Road Category</b>	Explanation				
1.	Good	Final rating value is between (2.1-3) as per IRC				
2.	Fair/Average	Final rating value is between (1.1-2) as per IRC				
3.	Poor	Final rating value is less than or equal to 1 as per IRC				
4.	Very Poor	If wearing course and WBM layer (any one of those or both) is missing more than 40%				
5.	Unpaved Road	Unpaved/Kaccha road convenient to pass four wheel vehicle.				
6.	Pedestrian Root	Roads used by pedestrians.				

Table No. 2 Road Categories



Figure 4. Categorization of Road Quality

From our pilot study, we categorize road quality based on the above picture (Figure 4), as per the criteria mentioned in Table 2. The following are the key steps for the road quality measurement survey:

- 1. GPS tracking of roads
- 2. Examining and identifying defects on the roads through vehicles for each 200 m road path
- 3. Giving color codes to the roads according to their categories

#### 4.2 Connectivity

Road connectivity is very important for the study of village road networks. Roads provide access to various facilities and commodities. A road's value increases if it serves its purpose more efficiently. Following are some points we should consider while studying road connectivity:

#### 4.2.1 Utility Value(UV) of Habitation

The utility value for the habitation should consider a set of demographic, socio-economic, infrastructure, and level of development data. We refer to IRC SP20-20 for the utility value of habitation. Hence, with the help of UV of habitations we may set priorities to connect habitations. We prepared a template of the utility value of habitation (Figure 9) used during fieldwork to determine the utility value of habitations.

								UTILITY VAL	UE FOR HABIT	ATION							
	VILLAGE NANE-				NAME OF SU	RVEYOR -									DATE -		
	GRAM PANCHAYAT NAME -				1												
Sr. No.	Habitation Name	Population	SC/ST population	Primary school	Middle school	High school	Intermediate/ College	Vocational school	Dispensary	Maternity and child welfare centres	PHC/ Veterinary	Police station	Post office	Electrified	Panchayat Headquarter	No. of days markets held	Hilly/coastal area

Figure 5. Utility Value of Habitation

#### 4.2.2 Road Matrix Index (RMI)

Government authorities plan the development programme to upgrade already constructed roads. Road Matrix Index helps them to fairly decide which road should be constructed first. We refer 'Marks Matrix for existing Roads under Up-gradation' given by Government of Maharashtra to calculate RMI (शासन परिपत्रक क्रमांक: ग्रासयो-2015/प्र.क्र.8/पंरा-7). We prepared a template of the road matrix index (Figure 10) used during fieldwork to prioritize roadworks.

							N	larks Mat	rix for exis	ting Ro	ads under	Up-gradation								
	VILLAGE NANE-							NAME OF S	URVEYOR -									DATE -		
	GRAM PANCHA	YAT NAME -																		
SR. NO	ROAD NO.	From	То	Road Surface Type	Benefitted Population	ST Bus Trips	Primary School	High School	10 + 2 Institute	m	Degree College	Gram Panchayat HQ	Talathi/Circle office	Tahsil & Block HQ	PHC/ SUB CENTRE	Rural Hospital	Sand Quarry	Metal Quarry	Industrial Area & Sugar Factory	WBM-Gravel- Missing Surface (Iw) Length
																		Act	ivate Wir	dows

#### Figure 6. Road Matrix Index

#### 4.2.3 Geometric Design

The geometric design of roads is an important component of roads. It provides safety and comfortability to both driver/passenger and vehicle. It includes concepts like superelevation, road widening, vertical and horizontal curves, gradients, cross-sectional elements of roads, etc. While studying rural roads in Lanja taluka, we focused on cross-sectional elements of roads. Students measured important cross-sectional elements of roads through measuring tapes. Following are the measured cross-sectional elements of the roads:

- a) Carriage Width
- b) Shoulder
- c) Roadway width



Figure 7. Cross-sectional Elements of Roads

## 4.3 Bridges

Bridges play a major role in transportation and connectivity in rural areas. Especially in hilly areas, as it connects pathless habitations. Due to this, fast and continuously progressive development takes place in the village. The rural communities get access to various important facilities like health care, education, business transport, etc.. In the rainy season, many villages are cut off from taluka or district places due to floods and the absence of bridges. We refer to IRC05-2015 to study bridges. The main part of the bridge study is to study the current status of bridges, dependant wadis and population, and seasonality of streams/rivers The following parameters are considered during the study of bridges:

- 1. Based on function, i.e., Road Over Bridge, Road Under Bridge, and Underpasses
- 2. Based on length, i.e., Culvert, Bridge, Minor bridge, Major bridge, Long span bridge
- 3. Based on level, i.e., High-level bridge, Submersible bridge
- 4. Based on construction material, i.e., RCC, Steel, and Timber

We have designed a template to study bridges from technical and socioeconomic points of view (See Table 3).

अ.क्र.	नाव	प्रकार	बांधणीचा प्रकार	लांबी (मी)	रुंदी (मी)	अवलंबित लोकसंख्या (अंदाजे)	अवलंबित गावे / वाड्या	सद्यस्थिती	टिप्पणी

Table 3. Study of bridges





Figure 8. Bridges

# 5. Mobile Apps, Software, and Instruments for Internship

Various applications and instruments are used during fieldwork. The following table shows some applications that were used during fieldwork.

Sr. No.	Application/Instru ments	Use
1)	GPS Logger	To track and measure length. Also used to quantify distress.
2)	SWMaps	To refer planned road shapefile obtained from PMGSY and Village Boundary Shapefile
3)	NoteCam	To take the latitude and longitude of assets and bridges.
4)	Measuring Tape	To measure the cross-sectional of roads and dimensions of bridges
5)	QGIS	Open-source software for GIS mapping and Analysis of spatiotemporal data

Table No. 4 Application and Their Uses

# 6. Engagement with Kolhapur Institute of Technology

KIT is one of the UMA institutes working with IITB-UMA team since 2017. As mentioned earlier, in 2022-23, KIT's College of Engineering students completed the detailed study with the IITB-UMA team. Final year students had assessed soil erosion of the hilly region in Wade village. This year, by the initiative of Dr. Aditya Khebudakar, HOD Civil Department, 13 students were selected for an 8-week internship program. After a chain of communication by various methods, they demanded field-based internship and sent an official letter (Fig.9)

R.S. No. 1998/1-3. Gokul Shirgaon, Kolhapur - 416 234. Maharushira, INDIA. Tel. +91 7769001199, 9168781199 Email: Infl@@kitooki.in Web: : www.kitcoeki.in		KOLHAPUR
		Accredited 'A+' Grade by NAAC, Bengaluru
Ref. : KIT/CEK/		Date :
KIT/CEK/No. 1963		Date: 19 <sup>th</sup> December, 2023
To,	14	
Dr. Gopal Chavan,		
Coordinator,		
UMA Cell IIT Bombay, Mumbai.		
Subject: Request for 08 Weeks industrial	training of B. Tech.	in Civil Engineering.
Sir,		
An Institute established in May 1983, Engineering (Autonomous), Kolhapur, Ma educationalists. Institute is accredited Accredited, the Institute has been recc infrastructure. It is affiliated to Shivaji U Delhi. Currently, the Institute is offering at	Kolhapur Institute harashtra reflects th with 'A <sup>+</sup> ' grade by gnized about it's Jniversity, Kolhapu nd running ten UG p	of Technology's (KIT) College of e vision of leading industrialists and y NAAC in October 2023. NBA over all academic excellence and r and is approved by AICTE, New rograms as well as six PG programs.

Figure 9. Letter from KIT college for 8-week internship

After this, UMA-IIT Bombay and KIT's College of Engineering, Kolhapur, mutually decided the roles of individuals. They are as follows:

Sr. No.	Component	IITB	КІТ		
1.	Training+ Deskwork + On-field activity	Training and guidance	Making infrastructure available, Deskwork activity		
2.	Fieldwork and report writing for one village per week for each group	Coordination and other activities of fieldwork.	Fieldwork , analysis, and report writing.		
3.	Fieldwork and report writing	Coordination and communication	Fieldwork, analysis and report writing.		
4.	Assessment of Students	IITB will assess students as per KIT's academia structure.	KIT will assess students as per KIT's academia structure.		

Table 5. Role of Institutes

KIT assigned a separate faculty coordinator during this internship programme. IITB and KIT worked mutually to conduct an efficient internship programme.

# 7. Actual Execution of Internship Activity

During two months of internship, students completed the study of roads in 28 GPs having 56 revenue villages. There were 13 students in four groups. They stayed at Lanja during the internship period and in the village while doing fieldwork.

## 7.1 Selection of Villages

- 1. A total of 28 GPs are selected based on population density and road network length of planned roads. Also, we ensure that selected GPs cover and represent the Lanja block.
- 2. After selecting GPs, we form a cluster of four GPs. So, during fieldwork, students should be near each other. It was helpful in logistics like travelling from Lanja to an allotted village. Also, it is helpful to manage four groups at a time.



Figure 10. Cluster of Selected Villages

3. Later, we selected GPs as per their complexity. First, we started with villages having less road network and area. Then, in the middle of the internship, select GPs have a large road network and area. In the last two weeks, villages have less road network and area. It helps in two ways - 1) During the start of the internship, students require more time to grasp the whole process, ease for fieldwork, and small villages with less road network and area really help them. 2) In the last tenure of the internship, we faced challenges like changes in exam time and others, so we had fewer challenges during fieldwork.

## 7.2 Training and Workshop

The IITB-UMA team visited KIT's College of Engineering, Kolhapur, and conducted a training workshop on the 16th and 17th of January 2024. The training module is divided into two components - 1. Desk work, and 2. Fieldwork. The deskwork consists of the following parts:

- a) Secondary Data Analysis
- b) Technical Study of Roads

c) Hands-on Training on QGIS.



Figure 11. Training Workshop at KIT College and Panhale Village

In the fieldwork part, we conduct field training on ODR 101 at Panhale village. During this training, we provide hands-on training on applications used in fieldwork. Also, training on the quantification of distress was conducted.

# 7.3 Lanja Base

Students arrived in Lanja on 20th Jan 2024. The IITB-UMA team made living and food arrangements. For nine boys, a 2 BHK flat was rented for two months, and a 1 BHK flat for four girls. The mess was nearest to the boys' flat. The distance between the two flats was only about 1 km. The students have two-wheelers, which they use for local transport.



Figure 12. Students living arrangement

#### 7.4. Procedure for One Village

#### 1. Pre-Field Work

The students prepared a reference map on QGIS. Also, they form a data set for SW Maps.

#### 2. Field Work

- a) Students used to visit allotted villages on their bikes or Auto Rickshaw.
- b) First, students met with village officials and villagers at Gram Panchayat office and discussed the study plan. They collected data from Gram Sevak and from Sarpanch, like population, number of habitations and name, Gav Namuna - 23, name of assets, dependent population on roads, information of important and newly proposed roads, problems of villagers regarding connectivity, etc.
- c) Later, they visited their living arrangement in their respective allotted villages. Generally, living arrangements were made at a house who migrated to another city, or students used to live in anyone's house with them. The food arrangement was done by villagers.
- d) After collecting information and checking necessary arrangements in the afternoon, students started actual fieldwork. An auto rickshaw was arranged by the Gram Panchayat. Students traveled by auto rickshaw at 8-10 km/hr. For doing fieldwork, an auto rickshaw is an efficient vehicle as we can observe roads from both sides of openings. If possible one person was allotted by GP with students who had proper knowledge of the village. Students did surveys on roads. During fieldwork, students measured different attributes of the bridge, such as length, width, dependent population, current status, etc. There are some routes where a vehicle did not go (category 6); such roads are tracked by students through walking, which are 3 to 6 km long.
- e) The location of assets, habitations, bridges, etc., was collected with the help of NoteCam. And the roads were tracked through a GPS logger.
- f) During the stay, students discussed road and village conditions with villagers.
- g) Again, the same day, they started studying the road network. The total fieldwork was completed within 1 to 3 days.





Figure 13. Glimpses of Field Work

## 7.5. GIS Mapping of Road Network

Geographic Information Systems (GIS) is a computer-based tool that creates a visual representation of geographic data. As previously mentioned, through this internship, we mapped the planned and unplanned roads of the villages. With the help of GIS, students prepared maps showing assets, habitations, and road quality. We used shape files of planned roads obtained from the PMGSY office. We track down unplanned roads on our own. We also take the latitude and longitude of important assets, such as bridges and habitations, with the help of mobile apps. The whole data set was later imported into QGIS and prepared maps.

There are open data sources (Github, CommunityGIS) from which we obtained village boundary shape files.

The following tools were used while preparing maps:

- a) Label To give labels to features
- b) Style To assign symbols and colors so we can differentiate features.
- c) Split Feature To split features as per requirement.
- d) Clipping To separate features from the set (particular village boundary from a cluster of village boundaries)
- e) Intersection To extract roads as per village boundary with carrying attribute fields.
- f) Split Lines by Maximum Length To split line features per required chainage.
- g) Joint Layer- To join calculated Final Rating Value to respective patch



Figure 14. GIS map of the village road network

#### 7.6 Secondary Data

Students gathered work done on roads in different sets of works from e-Gramswaraj for the last five financial years. eGramSwaraj is a portal developed by the Ministry of Panchayati Raj that aims to bring better transparency in decentralized planning, progress reporting and reporting based on activities. The Panchayats have been mandated to prepare a Village Action Plan (VAP) for economic development and social justice using the resources available to them. As per the information available on the e-GramSwaraj website, details of expenditure incurred during the last five years on the construction/repair of roads, construction/repair of culverts, and construction/repair of sewers in Gram Panchayat were collected. Interns did an analysis of the types of work completed and the amount spent in the last five-year Gram Panchayat Development Plan (GPDP).

#### 7.7 Report

The report writing is the last step of the internship activities. The report contains the detailed methodology, desk work on secondary data, execution of fieldwork, collection of primary data, and final analysis of primary data. The data collected from the field is used to prepare village road network maps. The typical table of contents of the village report is shown in Figure 15.

One village fieldwork typically required 2-3 days for a group of 3 students. After 2-3 days of fieldwork, all students gathered at Lanja base and prepared maps and reports. A map of road

quality along with assets to ensure connectivity and road quality maps were prepared by students with the help of open-source QGIS software. Students calculated the final rating value and their respective nomenclature, RMI, and UV of Habitations, analyzed e-Gramswaraj, analyzed the quality of roads, and prepared a report. This whole process took 2-3 days, depending on the size of the GP area.



Figure 15. Structure of the report

Documentation of village infrastructure is essential for preparing village action plans. Such village road network reports give an overall idea of the road conditions in the village. The district-level agencies like Zilla Parishad and Panchayat Samiti use these reports for rational decision making on road construction and maintenance work concerning connectivity and quality. These reports act as local knowledge products and are mainly consumed by local state agencies, higher technical institutions, and the local community.

Such local knowledge products are useful for academicians from HEIs to design field-based activities under experiential learning. The local community uses these reports for planning work and demands more work and money from the government. These reports may play an important role during village-level Gramsabha to decide the priorities of work in the village.

## 8. Conclusion and Way Forward

#### **Experience and Comments of Students**

Our internship aimed to provide students with real-world experience and develop their skills in fieldwork, documentation, and analysis. Here's what we noticed while working with them: Students showed dedication and worked hard. They were enthusiastic during fieldwork. They demonstrated good observational skills and suggested ways to improve field-based studies. They were aware of regional issues and wanted to explore them further. They communicated effectively with local authorities, and villagers and what they learned from the internship work.

#### **Challenges in Conducting an Internship**

The study of one village's road network was completed within 5 to 7 days. This timeframe overlapped with exams such as GATE and mid-semester assessments, which lasted two months. Despite these challenges, with the dedication and hard work of the students, the study of 28 Gram Panchayats (comprising 56 revenue villages) was successfully completed. For further details, please refer to Annexure II for the actual village-wise fieldwork schedule.

#### Suggestions from Students on internship:

The students suggest the technical part of our Lanja road network study. Some suggestions are as follows:

- It is observed that roads are often more disturbed than IRC's standards. Also, due to a lack of skills, road surface quality doesn't comply with IRC's recommendations. So, it would be better if we added more categories based on local road conditions.
- Also, during the quantification of roads, we didn't consider the intensity of distress. We may use it to calculate the final rating value. There are several literatures about it.
- Camber slope, gradient, etc., may also be measured.

#### Fieldwork-based internship opportunities

NEP 2020 has given priority to field-based activities in the regular curriculum to provide societal exposure to graduate students during college days and earn credit for the same. Since the last two years, KIT college students have done internships on village-level issues, align their academic activity, and given credit to students. Such activities will become main stream in the academic institutes to enhance community engagement of HEIs. It's clear that from our experience of Ratnagiri internship activity, any HEIs can do this type of field-based internship engaging with local state agencies. HEIs will design the methodology to study the surrounding problems through the internships/projects/assignments.

Recently, the Maharashtra government enacted a Government Resolution on internships with government agencies (See Figure 18).



Hence, it is a great opportunity for educational institutions to design internships on various development issues with local state agencies (Roads, RWS, Electricity, etc.) to develop utilizable local knowledge products. The IITB-UMA team will provide support in content, training, and execution of the internship programme.

# Annexure I

## 1. Rating factor for each distress based on IRC82-2015 Table Pavement Distress-Based Rating for Highways

Defects (type)	Range of Distress					
Cracking (%)	>10	5 to 10	<5			
Ravelling (%)	>10	1 to 10	<1			
Potholes (%)	>1	0.1 to 1	<0.1			
Shoving (%)	>1	0.1 to 1	<0.1			
Patching (%)	>10	1 to 10	<1			
Settlement and Depression (%)	>5	1 to 5	< 1			
Rut depth (mm) using 3 m straight edge	>10	5 to 10	<5			
Rating	1	1.1 - 2	2.1 - 3			
Condition	Poor	Fair	Good			

Table Pavement Distress Based Rating for MDR(s) and Rural Roads (ODR and VR)

Defects		Range of Distress	
Cracking (%)	>20	10-20	< 10
Ravelling (% )	>20	10-20	<10
Pothole (%)	>1	0.5 to 1	<0.5
Patching (%)	>20	5-20	<5
Settlement and depression (%)	>5	2 to 5	<2
Rating	1	1.1 - 2	2.1 - 3
Condition	Poor	Fair	Good

## Table Assigned Fixed Weightages

S.No.	Parameter	Weightage (Fixed) (Multiplier Factor)
1	Cracking	1.00
2	Ravelling	0.75
3	Potholes	0.50
4	Shoving	1.00
5	Patching	0.75
6	Settlement	0.75
7	Rut Depth	1.00

# Annexure II

Sr. No.	Village Name	Group No	Field Work Details		Report Writing			
			Started	Ended	Writing Started	Submitted	Remark	
1)	Vivali	1	23/01/2024	25/01/2024	01/02/2024	03/02/2024		
2)	Beni Khurd	2	23/01/2024	25/01/2024	01/02/2024	03/02/2024		
3)	Aasage	3	23/01/2024	25/01/2024	01/02/2024	03/02/2024	-	
4)	Panhale	4	23/01/2024	25/01/2024	01/02/2024	03/02/2024		
5)	Koldhe	1	29/01/2024	29/01/2024	12/01/2024	15/02/2024		
6)	Kondye	2	30/01/2024	31/01/2024	12/01/2024	15/02/2024		
7)	Majal	3	29/01/2024	30/01/2024	12/01/2024	15/02/2024	4 to 8 Feb GATE exam	
8)	Javade	4	29/01/2024	29/01/2024	12/01/2024	15/02/2024		
9)	Kurne	1	09/02/2024	11/02/2024	17/02/2024	19/02/2024		
10)	Veral	2	09/02/2024	11/02/2024	17/02/2024	19/02/2024		
11)	Math	3	09/02/2024	11/02/2024	17/02/2024	19/02/2024	-	
12)	Aajnari	4	09/02/2024	11/02/2024	17/02/2024	19/02/2024		
13)	Satavali	1	20/02/2024	22/02/2024	23/02/2024	25/02/2024		
14)	Golavashi	2	20/02/2024	22/02/2024	23/02/2024	25/02/2024	26 to 29 Feb KIT College Annual function	
15)	Rawari	3	20/02/2024	22/02/2024	23/02/2024	25/02/2024		
16)	Roon	4	20/02/2024	22/02/2024	23/02/2024	25/02/2024		

17)	Waghangaon	1	02/03/2024	03/03/2024	05/03/2024	07/03/2024		
18)	Rigane	2	02/03/2024	03/03/2024	05/03/2024	07/03/2024		
19)	Aargaon	3	02/03/2024	03/03/2024	05/03/2024	07/03/2024		-
20)	Whel	4	02/03/2024	03/03/2024	05/03/2024	07/03/2024		
21)	Beni Budruk	1	09/03/2024	10/03/2024	23/03/2024	25/03/2024	1)	Students
22)	Harche	2	08/03/2024	10/03/2024	23/03/2024	25/03/2024	completed fieldwork on March 12, 2024, and took	completed fieldwork on
23)	Bhade	3	08/03/2024	09/03/2024	23/03/2024	20/04/2024		
24)	Khanavali	4	07/03/2024	08/03/2024	23/03/2024	25/03/2024		leave for
25)	Kolewadi	1	11/03/2024	11/03/2024	27/03/2024	29/03/2024		from March 13,
26)	Korle	2	11/03/2024	12/03/2024	27/03/2024	29/03/2024		2024.
27)	Salpe	3	11/03/2024	11/03/2024	29/03/2024	01/04/2024	2)	And started to write the
28)	Govil	4	11/03/2024	11/03/2024	05/04/2024	25/04/2024		remaining reports from March 22, 2024.

# Annexure 3

Department	Possible Field-based Internship Topics	<b>Regional Agencies/departments</b>		
Civil/Geography	<ol> <li>Study and GIS-based Mapping of Village Road Network</li> <li>Study and GIS-based Mapping of Rural Water Supply</li> <li>GIS-based watershed delineation at the village level</li> </ol>	Zilla Parishad		
Mechanical	Mechanical1. Study of Rural Water Supply and PDN2. Study and GIS based mapping of drains and sewage in a village3. Study of small MSME in village/city			
Electrical	<ol> <li>Structural demonstration of value of capacitor on Ag feeders</li> <li>Energy estimation of the village using EET tool</li> <li>LT network restructuring of overloaded DTs</li> <li>Design of standalone Solar system for residential area/drinking water supply</li> </ol>	Zilla Parishad MSEDCL		
IT/CSE	<ol> <li>Mapping of bus routes at Taluka bus depot</li> <li>Mapping of cropland and soil health</li> <li>Study and GIS based mapping of drains and sewage in a village</li> </ol>	Zilla Parishad MSRTC		
Sociology1. Documentation and mapping of the pastoral path 2. Study and mapping of common pool resources and their		Independent		
Chemistry	<ol> <li>Ward/Village level measurement and tracking of solid and liquid waste</li> <li>Water quality assessment of different water sources at village/ward level</li> </ol>	Gram Panchayat Municipal Corporation		