

Road Maintenance through Community Contracting as an Instrument of Rural Development in India by Mobile Applications

Penki Ramu, Ram Kumar, B.A.V, Sandeep Reddy G, Praveen B.

Abstract: India has most of the rural-based road network with 70.23% and the total rural network of about 39.3 lakh Km's for the year 2015-16. In countries like India 2/3rd of the population lives in rural areas and they contribute 46% to the gross national income. The rural road network has increased on an average of 1.55 times for the past seven decades. With increase in the road network rapidly, maintenance becomes complex and at the same time it is essential to maintain roads regularly for improving their serviceability. Maintaining these roads under community-based contracting by the local villagers will give an opportunity for employment and reduces their migration to urban areas. Road tracking and condition survey applications were used for preparing the database of the road network. Data collected was further imported into the computer system to prepare the maintenance plans, contract packages and tenders are called from the community. Contracts are allocated to group members in a community based on age, gender, interest, residence, ethnic group, poverty and leadership skills as well as other skills like reading, writing, and math skills. Community contracting is applicable for small works like bush clearing, clearing side drains, pothole patching and rejuvenate/fog spray. Giving these types of works to the local community will indirectly develop the social, economic and cultural ethics of the rural areas. It also helps in reducing the paper works and improves the quality of work as those works are done by local people.

Keywords: Community Contracting, Road Tracking, Condition Survey.

I. INTRODUCTION

68.8429% (83.3 Crore) of the population of India live in rural areas as per census of India 2011 and it is evident that the soul of India lies in the development of rural areas. Development of villages and living conditions of the people in the rural areas depends on the development of rural roads which is possible by the guidance of both government and people. Due to lack of employment opportunities in rural sectors people are migrating to urban areas in search of jobs.

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The investments on road sector increased the demand on reduction of poverty and increasing the facilities of health and education. PMGSY (Pradhan Mantri Gram Sadak Yojana) which has launched in December, 2000 has contributed for the development of rural roads in India to a great extent.

1.1 Rural Employment Related Problems in India:

1.1.1 Unemployment: In a huge populated country like India unemployment is a serious problem which acts as a major hindrance for the economic development of the country. It is of structural nature and is due to lack of adequate productive capacity. Proper managing and use of human resources always contributes for the economic development of a country. In India unemployment is mainly due to shortage of capital and inadequate employment opportunities. There are two standard methods of measuring the unemployment. The first one is person rate of unemployment (PRU) which is the ratio of total number of unemployed to the total number of persons in the labour force. The second one is time rate of unemployment (TRU), which is defined as the ratio of total person days unemployed to the total labour force person days during the reference period [1]. In a developing country like India the rapid increase in population leads to increase in the unemployment and labour market. Agriculture and construction activities are predominant for economic and employment which are governed by seasonal fluctuations [2].

1.1.2 Informality: Employees without formal contracts, work benefits or social protection who are employed by formal or informal employees or by households. Informal employment can exist depending on the labour regulations and the extent to which they are compiled and enforced and informal employment can exist to any wage type of employment [3]. The following are certain wage types: Employees of informal enterprise, casual or day labour, temporary or part time workers and home worker. Early in 1970s this informality concept was introduced and was considered as short term happening. But proving the expectations wrong informal enterprises turned out into an integral part of developing economies irrespective of the economic growth in terms of their stake in overall employment. The employment-based Informality definition is Illegal labor practices. The research application is to measure the extent of labour laws violated by employers and limitations of illegality are underreported in statistical sources. Labour laws in the country are Informality and formality.

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Informal are many in low-income countries. Day labours, Temporary and domestic workers are come under Informal employees. Also, the unpaid family employees, household enterprises workers and small firm's workers are under the Informal category.

Although, many developing countries have good economic growth but still stubbornly with high Informal employment. It may increase in the upcoming years. Thus, it is a critical issue for the policymakers to improve the conditions to remain informally employed.

1.1.3 Lack of Mobility: Mobility, in simpler terms, is capacity to move freely i.e. from the place we are to all over across the country includes [4]. In Indian context, Caste system is an influencing factor causing rural unemployment. It is spreading of groups across different occupation which is restricting the occupational mobility of the rural areas. Due to caste system an occupation in rural India is hereditary in nature. Much population in India will go unemployed when number of caste members is more than services demanded.

1.1.4 Gender Issues: In rural areas of India women are treated as less competent than men and are paid less. This scenario also affects the unemployment of rural women that is to be addressed.

1.1.5 Lack of Skill Enhancement: Upgradation of skills is a continuous phenomenon and the present-day world demands it to convert opportunities into jobs. With increase in number of unemployed every year enhancing skill has become one of the top priorities.

1.2 Need For Maintenance of Rural Roads:

The Indian Roads Congress defined road maintenance as a "routine work performed to upkeep pavement, shoulders and other facilities provided for road users, as nearly as possible in their constructed conditions under normal conditions of traffic and forces of nature". Maintenance is "essential to get optimum service from the pavement structure during its life period." Maintenance of rural roads is essential because it safeguards initial investments in construction and rehabilitation by its ability to prolong life of roads by reducing the rate of deterioration. It provides smooth running surface thereby reducing cost of operating vehicles. Maintenance allows road to remain open on a continuous basis for traffic and thus improves reliability of transport services and socio economic benefits of improved road access are sustained.

In many countries roads are most important public assets. Immense benefits are obtained by road improvements, through improved access, safety speed comfort and reduced operating costs of vehicles. For sustained benefits, a well-planned program must follow program of maintenance. Without proper maintenance, roads fall into disrepair and prevent full potential of road development [5]. Roads play a vital role in preventing the villages which are isolated, providing various opportunities to the people in those villages which in turn resulting in their self development and also development of nation. Because of well road connectivity too such types of villages, the immediate action also can be taken during emergencies or any type of natural calamities. By providing all weather roads the Animal drawn vehicles are well replaced by Motorized vehicles which in turn resulting in fast mobility. As a result of well development means of

transport many recreational and social trips can be formed. By providing well developed roads in rural areas it becomes easy to transport material or goods to distant places like market places. Many dairy products, agricultural products can be transported and sold based on the remunerative prices of that farmer. The traffic on the roads also increases resulting in overall development of such places. By the construction of rural road connections it changes life pattern and brought awareness of living like dressing, recreation etc. It brings new technological development ideas for agro-industries, farming, etc. The change in attitudes can be brought by understanding of each other ideas to create rural road development connections and it will bring qualitative change in living pattern of life. Educational standards of people living in rural community are connected to the villages through the road network. The students living in the village get the easy access to their education place, efficient and good teaching staff may show interest to those road connected schools. By this the education standards is improved and literacy level is enhanced. Connecting rural roads to nearby villages, towns and highways may improve or increase the health care centers and more number of staff gets opportunity to work. This may also create interest to qualified doctors to work in villages. The farmers in the villages produce high amount of products and it is easy to transport to nearby town with a good accessibility and low cost on transportation. Thus the productivity from the villages may contribute more economy to the country. Construction of all-weather roads makes easy and continuous transport throughout the year for the transport of daily products like vegetables, milk etc. By providing road links between villages it also gives an opportunity to entrepreneurs to set up their units in the villages. Raw materials produced by the villages can be utilized by entrepreneurs for producing their finished products in the unit. It reduces the transportation cost and benefit to farmers to sell their raw materials to nearby unit. Thus produced products can be available to village people at low cost. By establishing industries in villages it provides good employment opportunity to local people. Maintenance of these constructed rural roads provides employment to local people, thus overall it reduces the migration of rural folks to cities. Development of rural areas with roads will bring interaction between villages around them and to exchange their ideas with others. If the constructed roads are not maintained regularly there are four direct implications; they are 1. Depreciation of road network value, 2. Increase in vehicle operation cost, 3. Decrease in economy contributed by villages and 4. Decrease in employment opportunities. If there is a shortage of money the following criteria to be done i.e., maintaining the roads regularly and the existing roads are to be maintained before funding the new ones because tomorrow, it will be much more expansive [5].

1.2.1 Economic Development: Economic benefits increases over time from road that serve rural areas.

the extent of benefits is very large from roads, as we know that change in economic is caused by agriculture production, supply of fertilizers & seeds, change in crop patterns and other factors like roads example agriculture depends on supply of fertilizers and similarly quality of seeds depends upon environmental factors like soil and climate, similarly investment on road is truly depended on road usage and potentialities of area.

So, the resulting growth comes from all factors which have been considered. Normally village posses an established agriculture sector as a set on existing alignment mostly discontinuous mud/earthen road due to no other transportation facility. When mud/earthen road is replaced by metal road the traffic composition also changes, where animal driven vehicle is replaced by motor driven vehicle. Therefore improvement in the form of market road is economically benefited to village [6].

1.2.2 Cultural Development: Interaction, understanding and exchange of ideas are more frequently bought together among the communities to develop the roads by breaking the central barrier. Acculturation takes place by breaking cultural reservation. It's finer outlook, changes in knowledge and attitudes, social contacts and latest technology, etc, are more likely intangible to nature which feels like sense of security.

1.2.3 Social Development:

The development of roads had broken the cultural barricades in between the communities, which are more frequently brought jointly for interactions of ideas exchange. Therefore, the cultural reservations are broken and the blending of cultures causes change in social, psychological and culture. They are more of difficult to describe, understand or measure the feel of security and finer outlook, the knowledge regarding latest technology, change in attitude, social contacts, etc. There are direct implications of poor maintenance, transport costs get increases, values of road network get depreciated, economic development tends to decrease and employment opportunities also get decreased, rural access get decline.

II. COMMUNITY CONTRACTING AS AN INSTRUMENT OF DEVELOPMENT

Indian government has been introduced various programs like MGNREGA to solve the unemployment problem, especially in villages. Even though, government could not provide permanent solution for unemployment, due to lack of infrastructure and inefficient connectivity of rural areas to markets and industries. The rural road network provides better facility for people to travel for job or business, which increases the employment opportunities in villages. It is also observed that the productivity of the village enterprises increases, if the village is provided with better connectivity and infrastructure resulting in novel opportunities for villagers to get more jobs.

2.1 What Is Community Contracting?

Community Contract: Contracts are agreement based rather than that of tender rates. Incase if any other contractor wishes for the contract they go for the technical proposal from which estimation is carried out. Document made should be easy to understand even to the person who is unaware of it.

Complicated contracts are taken up by sub contractors under the guidelines of road agency. As both have same qualities in work they work with same passion and finishes work with no conflicts. Community contracting plays an important role in planning, identifying and implementing the project. In short this kind of agreement is between funding agency and community. It undertakes the project according to the agency and no tendering is needed as it satisfies all the project criteria. Community contracting means direct contracting of small works to a local community by the gewog administration. No tendering or comparison of quotations is needed provided that all the criteria stated in this Community Contracting Protocol are satisfied. A Community Contract means a contract let by the gewog administration to a Community Contractor in accordance with this Community Contracting Protocol. Community contracting is defined as the procurement on or by the community behalf. Generally, the community refers to a group of people in some place or having particular characteristics in common or social groups (two or more people gathers regularly to interact and share the feel of unity common identity) or some basic level finances should identify the need of the project and approach the funds. Size of community varies on type of sub project [7]. Generally a community is represented by organization of community that enters into a contract with funding agency and handles the obtaining of project. Community contract is the contract given to the community group by a government body or a NGO (or) to carry out the manual works that are essential in the Community Action Plan prepared by the members of the community group, which has got registered in Community Development Council of that particular area. Usually the activities will be the building of small-scale community infrastructure based on the Action Plan prepared in the priority order. Over a period of time community contracts will be used for a various innovative activities like provision of services and skill enhancement beyond developing the infrastructure. It is noted that the community contracts materializes from the problem identifying and prioritizing process and agreeing on the plans that are to be realized. The community assisting organization (or) community commission usually prepares the technical plan of community contracting. Governing of works and services by signing in the contracts with providers (such as consultants, builders, drivers and professionals) exclusively working within the sub-district. Community contracting has happen to a popular arrangement for small-scale works that are targeted towards the beneficiaries of limited groups such as villages or a particular neighborhood in an urban area. It is an approach developed by the development agencies in order to achieve a high level local participation from the end users in all stages of project from conception to planning and from planning to works implementation.

2.2 Why Community Contracting:

Community Assets and Incomes: In addition to the community assets created with the funds channeled through the projects, community contracting provides an efficient means of injecting incomes directly into the pockets of local poor community members who obtain work opportunities; as well as into local enterprises through procurement and works contracted out locally. This has a tremendous impact on stimulating economic activity and improving access to social services such as education and health.

Capacity Building: The process develops capacity of all stakeholders involved,

from the communities who gain work and organizational skills, and confidence to engage with external partners and the local authorities; to the local authorities whose management, oversight and monitoring skills are enhanced.

Governance and Transparency: From a governance perspective the approach supports and builds existing local governance structures. Its participatory nature and consultative processes support dialogue and accountability within communities, between communities and their leadership and the local authorities. At the onset the concept is shared with the community through mobilization workshops, where the process and procedures are fully explained and discussed including ways to participate, recruitment, setting wage rates, procurement and costing. Social issues such as equity in recruitment and remuneration; health and safety (including wider societal concerns such as HIV/ Aids) are also discussed. During implementation regular on-site meetings keep the community aware of progress.

Empowerment: Community contracting projects provide an entry point into communities. The projects enable, often for the first time, communities to be in the driving seat of the externally funded development projects. The approach has had a profound impact on the communities that have been involved with the ILO program. There are immense psychological and empowering effects of providing communities, who have become dormant, resources to assume responsibility for their own development. The approach becomes a major catalyst in transforming a people who may have found themselves relegated to a passive/recipient role in supply driven humanitarian response situation to an assertive and empowered community who are confident in articulating their priorities and development plans. It is a process to influence attitudinal growth as much as delivery (community articulated) of tangible needs and demands.

Cross-Community Dialogue/Conflict Resolution: Different communities who have been supported and awarded community contracts are brought together in forums to learn from each other, which nurtures cross community dialogue and helps ease past tensions where they have existed.

2.3 Community Contracting For Various Sectors:

□ Footpath which are paved □ Settlement is accessed by roads to and within □ Water tanks, water wells □ Hand pumps with platforms □ Schools, college, institutes □ Clinics, community parks, community halls □ Small scale sewer systems and drains □ Small bridges and culverts □ Housing involving in post tsunami projects

2.4 Comparisons between Community Contracting and Conventional Contracting Methods:

When all the circumstances are appropriate, community contracting can have the following advantages over commercial contracting or direct implementation of works: a. Community contracting gives hope for the local people to assume ownership of the output project. Planning is done by community people. Cost of project is also low when compared to commercial contracting. this type of contracting is useful in the places where contractors are not ready to take up the project. It also provides an employment opportunity for the local people. Community people help to give the high quality output as they are the beneficial people by the project. It is also easy for the maintenance of the project. As the local people are skilled and experienced by the work, there will be sustainable operation and maintenance after the completion of project.

a) In the process of planning, we have conventional contract which is for outside professionals and community contract for community. And In the process of design, conventional contracting is for outside professionals and community contract is for community assisted by professionals.

b) In the physical works process, conventional contract is for outside contractor and community contact is for community. And In the process of labour, conventional contract is for machine intensive and community contract for labour intensive.

c) In the process of experience, conventional contract goes out of community and community contract stays within the community and In the process of work quality, conventional contract may changes of being community and community contact is good, it's their own.

d) In the process of profit margin, conventional contract is high and community contact is low and In the process of ownership feeling, conventional contract is for none and community contract is very high.

III. ROAD SECTOR AND COMMUNITY CONTRACTING

3.1 The Symbiotic Relationship between Community contracting and Road Maintenance:

Road users have their equitable interest, but they will be prepped to pay for roads only if the work is effectively completed in given stipulated time and they expect the demand value for the money as in return. The participation of road users can generate replacement or substitute market discipline to support the agency to use the resources effectively and efficiently presenting it from abusing in monopoly power. The ownership advantages do not hold at finance and market discipline. When the users are convinced with the government about the services provided are to serve their needs, there they will automatically support the whole range of inventiveness. Ownership can be made a basement for the genuine partnerships with the road users who are completely work with government authorities to improve safety on roads, reduce fuel, smuggling, etc.



3.2 International Evidences:

1. Malawi Social Action Fund: Project Sites: School, borehole project (Ching’ombe, Kasungu district), School project (Mchesi, Lilongwe district)), health clinic project (Mayani, Dedza district), borehole project (Magombo village, Lilongwe, Discussions the project conducted by the committee organization members, local influential people, contractors who had delivered services to the society and society members. Methodology adopted here is the valuation of local stakeholder viewpoints community contracting in the MASAF was led in May 1999.

Data was composed from communities that have applied projects under community contracting and engaged on three micro-projects such as water supply and sanitation, school and health center. Workshops were directed with numerous service providers and contractors who had operated on MASAF projects in the Lilongwe district. Focus groups were held to spot the issues from the viewpoints of different stakeholders. This was trailed by additional in-depth look up to communities. Summits were also apprehended with an array of local government officials.

2. Northeast Brazil Poverty Alleviation Project: A project was conducted in Paraiba, northeast Brazil in June 1999 on Community contracting rural poverty alleviation project [RPAP]. The methodology adopted here is Interview was conducted for the members of seven communities which are benefited by the project. These communities have a population of 200 to 800 with an average of 80 families. They represent the poor communities which were targeted by project.

3.3 Suitability on Indian Roads:

A. Database: The database required for road contracting is prepared by using mobile applications which requires no specialist, less time and very less tools and workmen. Here a mobile application called Survey is used to collect data like pavement condition, road defects tracking and road works required to be taken by the contractor. This application is well suitable for community contracting since budget involved in this contracting is very less and this application is handy in regular maintenance of rural roads.

B. Usage of Mobile Applications: For this study a rural road having stretch of 5km was considered to collect data related to its defects by using survey mobile application. A person carrying mobile with pre installed application and simple tools like a measuring tape, was travelled by means of a bicycle or motorbike along the selected rural road from starting to end seeking for any road defects that needs to be repaired under community contracting. Where ever the person finds a road defect, he stopped there and loads data regarding the defect in the mobile application. Following steps explains the procedure involved in use of mobile application.

Step-1: The preface of the application when opened is looks as shown in figure-1. The selected road was given a road id as NG12; the length of the road was given as 7km and the range 100m. It automatically locates the latitude and longitude co-ordinates of the defect where the person was standing.

Step-2: By clicking on the select category, a drop box appears as shown in figure- 2, consisting option; left, Right,

carriageway and other, which means where the defect is located with respect to carriageway. Here we have selected carriageway that means the defect is located on carriageway itself.

Step-3: After that the type of defect was selected by clicking select type, which shows a drop box with much possible defect types as shown in figure-3. The type of defects varies based on the selected category. Since we have selected category as carriageway it showed the defects related to carriageway such as; Patching of pothole, repairing of the base course, sealing the cracks, removal of debris, resealing, overlaying asphalt, reshaping of camber and a empty selection option for a kind of defect which is out list. The defect observed was Pothole Patching, so we have selected the same.

Step- 4: Enter the value of defect by taking measurements; the application was designed with default units based on type of defect anyway this can be erased and required units can be typed. The pothole which we observed was measured to be 0.5 square meter and is shown in figure- 4 And type the appropriate remark on the defect to have addition information for fast progress of work.

Step-5: Click on save button to save the data to the designation file which will be saved in text format. As soon as the data saved the application shows a conformation message saying ‘record saved to file’ and clears the previous given content expect road id, road length and range indicating that application is ready for next input. If next input is related to other road then the road id and road length can be changed accordingly. Similarly other effects on the same road were observed within the stretch of 7km and recorded data related to the observed defect was saved in the same file. Few images of next observed and recorded defects on the same rural road are given in figures 6 to 9.



Fig. 5 image of the Pothole observed on left side of the carriageway

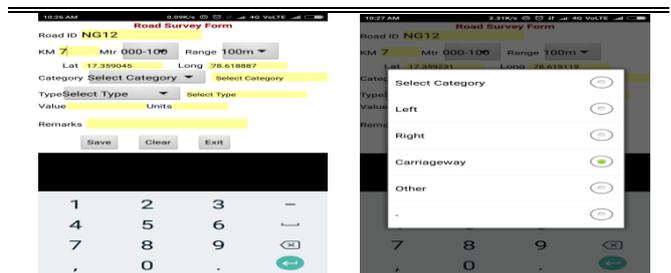


Fig. 1

Fig. 2

Road Maintenance through Community Contracting as an Instrument of Rural Development in India by Mobile Applications

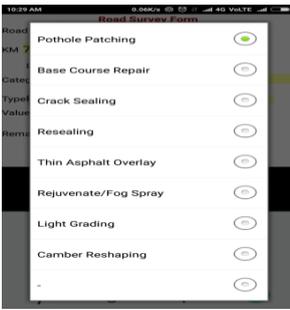


Fig. 3

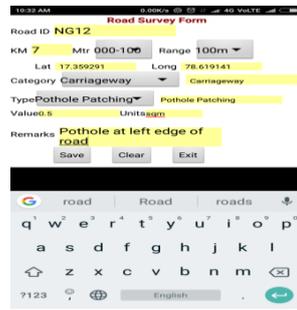


Fig. 4

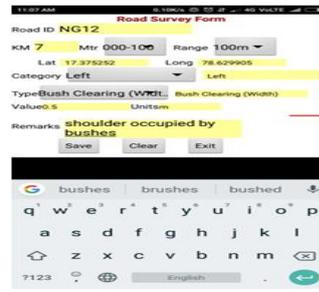


Fig. 7 Bush Clearing on Shoulder

D. Mobile Application Output Data for Community Contracting:

The application was able to record the input data which was given while condition surveying of road and gives as output in text format. It also records the date and time of the given input which can be useful in time to time tracking the status of maintenance or repair.

Table -1 shows the output data of mobile application obtained in our condition survey for 7 km stretch rural road (date and time were not included in this table). Further, Google maps application was used effectively to have complete idea and quick tracking of the road work that needs to be done under community contracting at each location by using obtained latitude and longitude co-ordinates and is shown in figure- 10 – 12. For preparing the database for roadwork's, Road tracking and condition survey applications were used for collecting road inventory and condition data. These collected data were further imported into the computer system and the maintenance plans, contract packages are prepared and called for tenders a community. Contracts are allocated to group members in a community based on age, gender, interest, residence, ethnic group, poverty and leadership skills as well as other skills like reading, writing, and math skills are given preference. Community contracting is applicable for small works like bush clearing, clear side drains, pothole patching and rejuvenate/fog spray. Giving these types of works to the local community will indirectly develop the social, economic and cultural ethics of the rural areas. It also helps in reducing the paper works and improves the quality of contracted work as those works are done by local people.

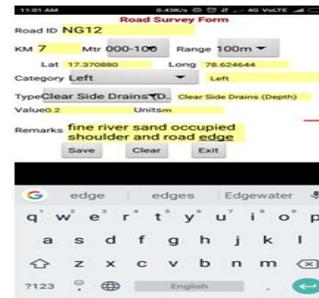


Fig. 8 Debris Removal

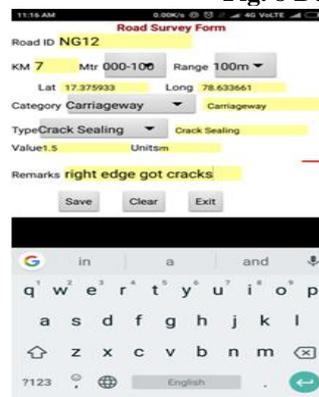


Fig. 9 Crack Sealing of Road Edges

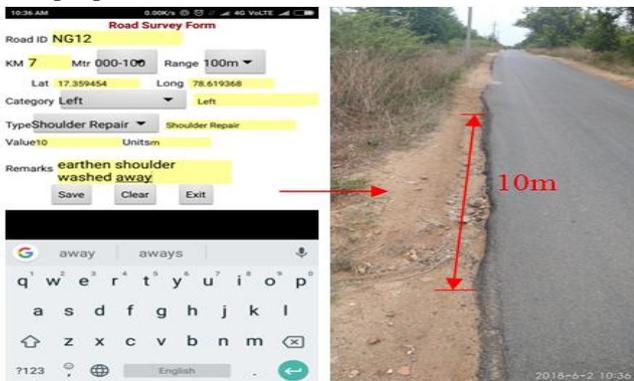


Fig. 6 Shoulder Repair



Fig. 10 Roads Work Points

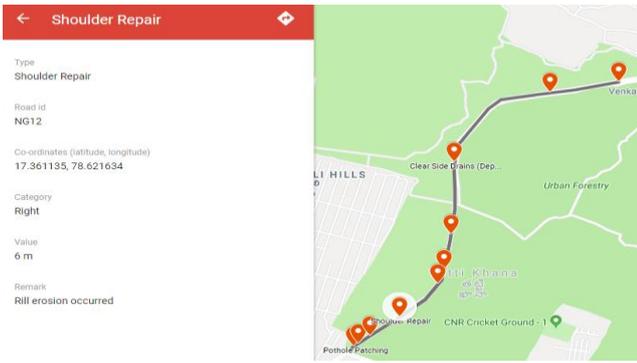


Fig. 11 Details of Particular road work

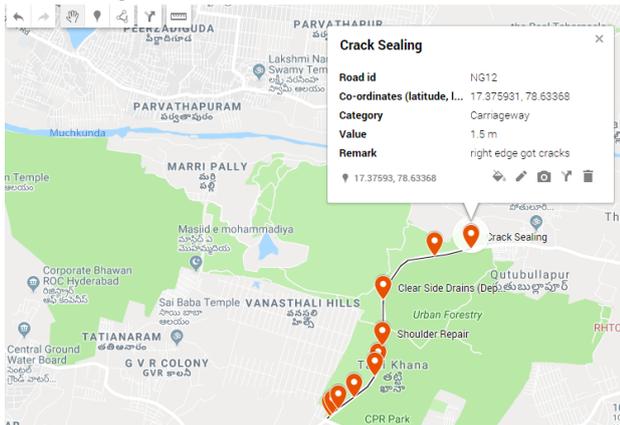


Fig. 12 Google Map Showing Each Road Works Needs To Be Done

IV. CONCLUSION

1. Community contracting can be linked with NAREGA (National Rural Employment Guarantee Act) in rural areas where the maintenance of roads by the local authorities like R&B department is a hectic task.
2. The maintenance of the rural roads is prominent concept to prevent the various types of distress
3. occurring on the flexible pavement listed as alligator cracking, top down cracking, bottom cracking, rutting, fatigue, and raveling etc. and the most important distresses are Rutting and Fatigue cracking

4. The maintenance of the pavements are to be done when the values exceeds than the desired limit. Fatigue cracking in 20% area has been considered for traffic up to 30 msa and 10% for traffic beyond that and for Rutting 20mm in 20% of the length for design traffic up to 30msa and 10% of the length for the design traffic beyond.

5. Technology in the form of Mobile application can be effectively used for collecting and storing the information about the distresses and their maintenance measures.

6. Above all are important for the improvement of socio-economic conditions of rural India thereby contributing for overall development.

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Table -1 Condition Survey and Tracking Data from Mobile Application

Road id	Length	Co-ordinates (latitude, longitude)	Category	Type	Value	Remark
NG12	7.00	17.359276,78.619127	Carriageway	Pothole Patching	0.5 sqm	Pothole at left edge of road
NG12	7.00	17.359454,78.619368	Left	Shoulder Repair	10 m	earthen shoulder washed away
NG12	7.00	17.359941,78.619990	Left	Clear Side Drains (Depth)	0.02 m	fine sand covered over shoulder and edge of road
NG12	7.00	17.361135,78.621634	Right	Shoulder Repair	6 m	Rill erosion occurred
NG12	7.00	17.363226,78.623732	Other	Road Signs Replacement	1 no’s	No warning Road sign
NG12	7.00	17.364125,78.624095	Right	Shoulder Repair	12 m	shoulder washed away



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NG12	7.00	17.366321,78.624493	Right	Shoulder Repair	1.5 m	Rill erosion occurred
NG12	7.00	17.370880,78.624644	Left	Clear Side Drains (Depth)	0.2 m	fine river sand occupied shoulder and road edge
NG12	7.00	17.375252,78.629912	Left	Bush Clearing (Width)	0.5 m	shoulder occupied by bushes
NG12	7.00	17.375931,78.633680	Carriageway	Crack Sealing	1.5 m	right edge got cracks