

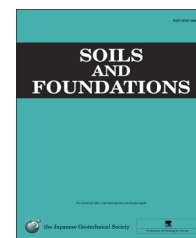


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Improvement of rural access roads in developing countries with initiative for self-reliance of communities

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Abstract

This study presents an approach to help alleviate poverty from a geotechnical engineering viewpoint. In order to improve accessibility of rural access roads to communities in rural areas of developing countries, a method to reinforce the base course with “do-nou”, a Japanese term for soil bag, has been developed. With this method, local available resources can be mobilized and the community can be involved. The main challenges are to build the base course without the necessity for qualified base course material or compaction equipment to bear the traffic load. The applicability of the available bags in developing countries to the base course was confirmed through tensile strength tests. The effectiveness of the reinforcement of “do-nou” was evaluated through a series of full-size model driving tests. The base course, built with “do-nou” and compacted manually, was able to reduce the settlement of the surface to 33% of that built with the conventional method, just by the spreading of gravel subjected to the traffic load. The technical transfer of reinforcement with “do-nou” to communities in developing countries will make it possible for the members of the communities themselves to work on rural access roads to improve trafficability. The applicability and limitations of road repair with “do-nou” were confirmed through a review of demonstrations and practices in Kenya. Typical sections with flat terrain, sags and gentle slopes, where trafficability was lost during the rainy seasons, were found to be effectively repairable with “do-nou”. Sections with steep slopes, however, are beyond the scope of “do-nou”. From an assessment of the impact after the technical transfer in Kenya, it was found that the application of “do-nou” motivates and empowers the community to initiate its own development. This earth reinforcement technology can be applied to the skills utilized by the communities in developing countries to improve the trafficability of rural access roads by considering the conditions of rural areas. Based on this technology, an approach is proposed to promote the concept of community involvement in repairing rural access roads and to enable the members of communities to improve the conditions of the roads by themselves at a low cost.

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1. Introduction

Despite massive progress in reducing poverty in several parts of the world over the past couple of decades, notably in East Asia, there are still about 1.4 billion people living at a subsistence level with less than US \$1.25 per day; this constitutes 22% of the population in developing countries. At least 70% of them are living in rural areas (International Fund for Agricultural Development, 2010.). The lack of accessibility

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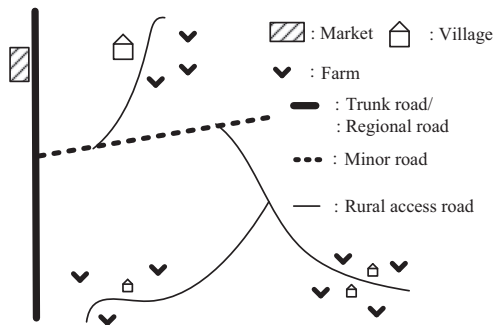


Fig. 1. Pattern diagram of road network in rural area.



Photo 1. Farmers in Kenya transporting their products on rural access roads.

to rural roads has been identified as one of the main causes of poverty among rural people (Lebo and Schelling, 2001a).

A pattern diagram of a road network in a rural area is shown in Fig. 1. Most of the rural roads and rural access roads in developing countries are unpaved, graveled or even just earth roads. During the rainy seasons, they are in such a poor condition that people struggle to pass along them by tractor, bike or even non-motorized traffic (NMT), such as bicycles or animal-drawn carts. Due to the difficulty of reaching markets to sell their agricultural produce and other goods in the rainy seasons, rural people are locked into subsistence farming. Buyers also cannot reach the village; thus, the cash crops cannot be exchanged for money and the crops rot. Better market incentives for farmers are blunted because of the physical barriers and economic costs of transporting goods to and from local markets. The impassability of the rural access roads also hampers the provision of basic social services, such as health, education and information.

The rural roads in developing countries, on which 20–200 vehicles travel per day, have been improved by governments with the financial and technical assistance of donor agencies as part of their policies for rural development. These policies have included the creation of employment opportunities, the provision of infrastructures and the fostering of agriculture (McCutcheon, 1989). Considering the lack of income opportunities in many rural areas and the intractable problems inherent in the deployment and operation of mechanical equipment for small-scattered works, labor-based technology (LBT) has been considered as the normal choice for rural road works. LBT might be defined as the economically efficient employment of as great a proportion of labor as is technically feasible, to produce as high a standard of road as demanded by the specifications and allowed by the available funding (Bjorn, 2008). Generally, these projects have targeted the rehabilitation and maintenance of rural roads or regional roads. However, the effectiveness and sustainability of past programs for rural roads has been hampered by the lack of a coherent policy framework and institutional focus on planning, funding and maintenance (Riverson et al., 2002).

Rural access roads are the lifeline for people living along the roads, and they provide intra- and near-village transport connecting the houses and farms in various communities, as shown in Fig. 1. Rural access roads are generally earth roads

less than 20 km in length. Transport activities on rural access roads are performed to a certain extent on foot, sometimes by intermediate means of transport, such as bicycles and animal-drawn carts, and occasionally by motorized transport. The average daily motorized four-wheeled traffic on most rural access roads is below 50 vehicles per day (VPD), whereas the NMT can be a multiple of this number.

Rural access roads have rarely been dealt with by government projects. Due to financial constraints, cost efficiency and the small number of beneficiaries, the priority of policy makers and donor agencies to take care of these roads is low. Therefore, rural communities suffer from poor road conditions (see Photo 1). It is often argued that there is a necessity for further research on local resource mobilization and community involvement in order to maintain access between markets and rural areas (Riverson et al., 2002). However, geotechnical engineers have not yet offered solutions for improving rural access roads.

In this study, we discuss an approach for improving rural access roads with the initiative for the self-reliance of communities along these rural access roads. For this purpose, however, it is necessary to overcome the typical low availability of equipment and materials in rural areas. One of the main challenges for geotechnical engineers is to build road base course, without equipment for compaction, using qualified base course materials on the soft subgrade. These conditions do not favor or help maintain trafficability.

2. Improving rural access roads in developing countries

2.1. Road improvement with initiative for self-reliance of communities

The aim of the authors is to encourage the initiative of members of local communities by enabling them to repair the roads using simple technologies with locally available material and labor. Once the communities acquire such skills, it is expected that the problematic portions where they lose trafficability during rainy seasons can be repaired by the communities themselves. This promotes the sustainability of rural access roads, even though governments rarely intervene to improve rural roads because of a lack of funds. It is true that frequent repair works will be needed. However, if people receive proper training, they will be able to repair the roads by

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