

**SEMINAR: SUSTAINABLE ACCESS
AND LOCAL RESOURCE SOLUTIONS**
Date : 28 – 30 November 2005

TITLE: **Agricultural Roads in Bhutan**

AUTHOR: Ugyen Chewang, Ministry of Agriculture, Bhutan

1 Introduction

With a rural population of close to eighty percent, and thirty percent of the population living under the poverty line, the challenge of poverty alleviation in rural areas is of paramount importance in Bhutan. One of the primary development programs is enhancing rural access.

Bhutan is an agrarian country and depends mainly upon the agriculture and natural resources. The main concern of the Royal Government is the improvement of rural economy and the livelihood of the farmers. The absence of adequate roads access to rural farms is one of the major causes of farmers not being able to exploit the market demand for food and cash crops. Food and cash crops being perishable in nature do not reach the mainstream market due to transportation difficulties, although there is sufficient demand for farm grown crops. Further, farm inputs cannot be delivered in time nor in sufficient quantities to boost production of farm produce.

Therefore, a farm road is a key component that could bring about rural development in Bhutan. Farm roads contribute significantly to generating increased agricultural incomes and productive, employment opportunities, access to social services, which would enhance the quality of rural life thereby contributing to rural happiness.

The most remote villages in the country have been found to be some of the poorest villages as well. Such findings have formed the basis for setting the current priorities of our Ministry in the field of agriculture development. In rural areas, development of high value crops and diversification would not be much helpful if access to markets is not available. The pilot household income and expenditure survey 2000 concluded that poverty in Bhutan is clearly a rural phenomenon. For a small country like ours, the total target to construct 587 km of farm roads over a span of five years is a clear testimony of the importance attached to rural infrastructure.

Though the construction of farm roads had started before the Ninth Five Year Plan (9FYP), it was only in the 9FYP it received main thrust and implementation boom. Although, no study of the impact of farm roads has been carried out, the department has conducted a few *ad hoc* impact studies on feeder roads in selected locations. Though farm roads and feeder roads may seem similar, they are different in a number of ways starting from the design difference to the objective difference.

2 9th Five Year Plan

The 9FYP planning exercise is guided by five overall goals namely; 1) improving the quality of life and income, especially of the poor; 2) ensuring good governance; 3) promoting private sector growth and employment generation; 4) preserving and promoting cultural heritage and environment conservation; and 5) achieving rapid economic growth and transformation. This resulted in road development being given high priority. As the majority of the people depend on agriculture for their livelihood the Plan places priority on improving rural road

infrastructure combined with multi-sectoral plans for modernization of agriculture. These interventions are aimed to enhance agricultural productivity as well as to improve access to markets. The observation that villagers nearer to the road are more prosperous in terms of economic and social well being than those further away is a clear indication that poverty reduction, increasing opportunities and enhancing the quality of social services can be achieved by improving the rural access through infrastructure expansion.

The Bhutanese approach to development has been shaped and guided by the concept of Gross National Happiness (GNH) enunciated by His Majesty King Jigme Singye Wangchuk in the late 1980s, which indicates that development has many more dimensions and that development should be understood as a process that seeks to maximize happiness rather than economic growth.

The Royal Government of Bhutan (RGoB) has addressed a wide range of poverty issues broadly through the expansion of social services, rural development and income generation activities, wherein a vast majority of our population has benefited in very tangible ways.

3. Vision 2020

In the Vision 2020 document, provisions have been included that stress the importance of improving rural access through infrastructure expansion of roads.

Local communities irrespective of their location within the Kingdom stress the importance of roads and electricity. They serve to bring the communities out of their isolation, they increase access to markets and services, and they facilitate rural industrialization and hence create productive employment outside the RNR (Renewal Natural Resources) sector. Both roads and electricity are instrumental in improving both the standard of living and quality of life in the rural areas and are thus able to contribute to a reduction in rates of rural-urban migration.

Farming and related activities must become more profitable and young people must perceive farming not as a subsistence activity they associate with 'backwardness' but as a field of opportunity. The continuation of the focus on rural development and the further commercialization of agriculture are essential components in our urbanization strategy.

4. Farm Road: definition and mandate

There are five categories of roads in Bhutan: highways, Dzongkhag roads, feeder roads, urban roads, and farm roads. A farm road is a road that links agricultural production areas to the national highways and/or markets. Class D road type of the Road Design Manual (PWD/DoR), which is the lowest classification of motorable roads, is used as the geometric design standard of farm roads. Once a farm road is constructed and handed over to a community, the responsibility of repair and maintenance is placed on the community.

The Royal Government has placed high priority to the construction of farm roads with the objective of linking the potential agricultural surplus areas in the hinterland to markets or nearby highways to facilitate the movement of inputs, agricultural surplus products, farm machinery, etcetera. The aim of the Government is to improve the rural economy and ultimately to raise the overall living standard in the rural villages and to make the rural areas more attractive in order to prevent rural-urban migration of these people.

The existing Government policy mandates the Division of Roads (DoR) to construct roads. Under DoR, the pace of farm road construction has not picked up to the desired pace. This has also slowed down the pace of progress of RNR programs. Further, the farm roads have

not been related to production and potential production areas. Thus, the Government has transferred the mandate of farm road construction to the Ministry of Agriculture (MoA).

5. Engineering parameters

The farm roads shall be most economical and environmental friendly if the following engineering parameters are followed strictly:

- (a) The alignment should be as direct as possible to provide maximum economy in the construction, maintenance and transportation.
- (b) The selected route should be feasible in relation to attaining grades below the maximum allowable gradient.
- (c) Unstable hilly features (rock dips, fissured strata, and landslide prone areas) that can cause considerable maintenance problems in the future should be avoided.
- (d) The vertical alignment should provide adequate sight distances over all crests. Needless rise and fall in the final road level should be avoided.
- (e) The following specifications shall be adopted:

Ruling gradient	6% (1 in 16.7)
Limiting gradient	7% (1 in 14.3)
Exceptional gradient	10% (1 in 10)
Type of pavement	-Road with ordinary earth surface -Water-bound Macadam (WBM)
B/R wall	-Hammer dressed dry wall for <3m in height -RRM for walls >3m
Formation width	4.60 meters
Carriageway width	3.00 meters
Shoulder	0.50 meters (5% cross fall)
Slide drain width (V-shaped)	0.60 meters
Side slope	1 in 2 in loose soil and 1 in 4 in stiff clay
Design speed of road	20 – 40 km per hour
Pavement cross fall	4% in straight sections of road
Radius of curvature	-Minimum – 25 meters -Exceptional – 10 meters

- (f) One passing place should be provided for every kilometer. These should be 20 meters long on inside edge and 10 meters long on the outside edge with 3 meters width.
- (g) Provision of suitable cross drainage facilities where the farm roads cross a natural drainage path. For smaller catchments, the cross drainage structure should invariably be a culvert arrangement, whereas for larger catchments the cross drainage structure should be a multi-cell culvert or a wooden bridge.

6 Implementation responsibilities

The RNR engineering Division of the Department of Agriculture is assigned as the lead agency in the planning of the farm road development program at the national level. As outlined in the Ministry's 'Guidelines for Farm Roads Development' the implementation arrangement is specified below.

The concept of relating farm roads to production and potential production areas should not be compromised in the implementation. The Dzongkhag will be the implementing agency for the farm road construction.

The role of agencies at central and Dzongkhag level are specified below.
The Ministry of Agriculture is responsible for:

- national planning and programming for Farm Roads development;
- ensuring that all cooperating agencies fulfill their implementation roles in accordance with the Guidelines;
- working closely with the Ministry of Works and Human Settlement in planning the road network of the country;
- proper coordination to ensure optimum utilization of limited resources;
- seeking adequate resources to support the selected roads;
- signing a Memorandum of Understanding (MoU) with the Dzongkhags.

The Engineering Division (ED) of the Department of Agriculture will:

- lead the technical planning of farm roads development;
- screen out road proposals received from Dzongkhags using the selection criteria;
- co-ordinate with Forestry Development Corporation Limited (FDCL) to plan road construction in areas that fall within their Forestry Management Units;
- support Dzongkhags in selection, survey, design and construction planning and provide timely technical back-stopping;
- along with other relevant agencies carry out monitoring and evaluation of the programme;
- where feasible, provide construction machinery on hire from its centralized pool. (Although the contractors are expected to arrange their own machinery, the Ministry will maintain its machinery base to ensure that construction machinery are available at all times to avoid delays.)

The Dzongkhag is responsible for:

- putting up proposals submitted by GYTs to the DYT. The DYT shall screen and prioritize the Dzongkhag's programme;
- the day-to-day implementation of the programme;
- obtaining all necessary clearance certificates and complete other pre-construction requirements like survey, design, and estimating;
- contracting out the road construction following standard procedures;
- managing and supervising the construction in conformity with existing Guidelines to ensure adequate quality standards and timely completion;
- sending regular progress reports to enable the ED to monitor progress;
- signing a MoU with the beneficiaries upon completion of construction.

The beneficiaries will:

- submit their proposal to GYT. The GYT shall assess the need and incorporate in their plans;
- assist the Dzongkhag in the detail investigations leading to final selection;
- appoint representative(s) who along with the Dzongkhag engineers will be responsible for supervision and quality control during construction;
- sign a MoU with the Dzongkhag to form an association/cooperative for operation and maintenance of the road.

7 Site selection process

As outlined in the 'Guidelines for Farm Road Development', the farmers shall put a request to GYT and discuss the genuine need for such a proposal. If the GYT resolves that the need was genuine then the GYT Chairman shall certify the parameters, except the viability analysis and engineering parameters, and submit the same to Dzongkhag. The RNR Sector Heads and Dzongkhag engineers shall visit the proposed sites and reconfirm the submission by GYT, and accordingly submit to the DYT session. If the DYT resolution is to go ahead as requested, a central team from MoA shall visit the site and verify if the parameters are met.

Technical sanction shall be accorded after the technical, social and economic appraisals. In the event if there are too many viable proposals from different Dzongkhags priority for implementation shall be given to those potential areas with fewer roads. As far as possible, equity in the development of farm roads shall be ensured.

The construction shall generally follow the technical specifications laid down in the 'Guidelines for Farm Road Development' of the Ministry of Agriculture. Farmers benefiting from the farm road shall agree to form themselves into Group/Association to implement and maintain the road.

Active participation of the farmers shall be given importance. They shall be involved right from the beginning i.e. from the choice of alignment of road, planning, designing and through construction phase. This is deemed important with the idea that these exercises will enhance their skills in routine operation and maintenance and in instilling a sense of ownership. Achieving this calls for support to farmers to: establish associations/committees, draft constitution and bylaws for implementing and maintaining its activities, open and operate bank accounts for future maintenance, and enhance their technical and managerial capability. Once completed and handed over, the beneficiary committees should be in position to take up the responsibility of operation and maintenance.

8 Farm road selection parameters

8.1 Market outlet

Farm roads should either connect production areas directly to markets or feed to other road types. An isolated farm road, not bridging the production areas to markets and other outlets, shall defeat the objective of the farm roads.

8.2 Road length

The farm road proposed shall benefit a certain sphere of production areas. This area shall be identified and demarcated either in administrative units or in beneficiary groups. The size of the area and number of beneficiaries associated with it shall be important factors determining the length of the road.

Farm roads cannot meet the entire requirement of rural access for the Bhutanese farmers. They are not meant to be a substitute for the Feeder Road Programme of DOR. Thus, lengthy roads requiring several years of construction should be avoided. For practical purposes, road lengths of over ten kilometres per site will not be selected. And every kilometre of the road should be able to serve an average of ten households.

8.3 Cross-drainage structures

The Ministry of Agriculture cannot support roads requiring the construction of permanent bridges. Bridges are complex and expensive structures and cannot be covered under the scope of Farm Roads. Cross-drainage structures will include culverts, causeways and light wooden bridges. If the road has to cross a large river, the Dzongkhag will make separate arrangements for the bridge.

8.4 Technology adoption

After the road has been built, farmers will be required to implement specific projects to demonstrate the benefits of easy access to markets and other services. They will adopt some improved technologies promoted by the RNR sector suited to the production potential of the area. Local resource endowments and climatic conditions will influence the choice. The project will focus on any of the following: improved agronomic practices, HYV of cereals, pasture development, social forestry, AI and improved livestock breeds, formation of farmers' cooperatives, etcetera.

8.5 Environment factors

No road sites shall disturb declared reserves, and catchment areas. No other activities considered harmful to the environment, such as, quarrying, and logging should operate on the farm roads or their vicinity. The excavated soil and other materials shall not be dumped over the edge of the road but properly disposed in selected locations.

8.6 Timeframe

The length of the road and the geo-physical conditions in the area will determine the time required to complete construction. The Dzongkhag Engineering Section (DES) in consultation with the Engineering Division shall, depending on the topography and other physical features of the site, estimate the time required for construction.

The farm road after completion of construction requires some time for proper stabilization. It will depend mostly on the length of the road and engineering parameters. An establishment period of one year after satisfactory completion will be considered the defect liability period during which the contractor's security deposit will be used for repair of damages unless caused by natural disasters. The road will then be formally handed over to the beneficiary group.

8.7 Equity development

The balanced development principles shall be promoted, where applicable. While the equity development of farm roads may contradict the purpose of bridging market and production and potential production areas by roads, there shall be cases where the implementation may require prioritization because of resource constraints with the Government. In such cases, priority shall be given to those potential areas with fewer roads if all other criteria are met. The Engineering Division will ensure equity development of farm roads.

9 Mechanization

Until recently, the construction of the farm roads was done on cost sharing basis between the RGoB and the beneficiaries. The labour component had to be born by the benefiting communities. However, considering the number of programmes implemented with beneficiary contribution, difficulty was experienced to make substantial progress. Given the huge numbers of farm roads construction planned, it was seen as the best option to contract the construction works to the private sector. The construction will be managed by the Dzongkhag and the beneficiaries. With the involvement of the private sector, considerable progress has been achieved. Most of the road contractors are equipped with huge machinery required for the road work which is not only faster than labour but also cheaper. The most commonly used machinery used in the farm roads construction are listed below.

Bulldozer

Heavy earth moving machinery like bulldozers are efficient in formation cutting and sub grade preparation however are preferred to other machines which can also be used in different ways. This is also in line with using machinery, which can construct roads in a more environmentally friendly manner.

Excavator

Bulldozers are fast being replaced by excavators due to their advantage over the former. It can excavate, load and dispose excavated materials in a much better location. Back slope cutting can be achieved successfully with this machinery. Owing to its multiple uses, this machinery is fast becoming popular in the road construction industry.

Dump truck

Dump trucks are trucks which can carry about 10 ton. It is used for disposing excavated soil in an environmentally friendly manner. The debris are loaded by excavator and unloading can be done by itself.

Air compressor

During the construction, heavy rocks are blasted. For blasting, holes need to be drilled using an air compressor.

Wheel-loader

Wheel-loaders are primarily used to load excavated material to the dump trucks. However this machinery can also be used to excavate and push debris.

10 Road maintenance

Unlike other categories of road, no annual maintenance budget is maintained. On completion of the construction works, the beneficiaries will sign a MoU with the Dzongkhag for operation and maintenance of the road. Dzongkhag will conduct regular visit to assess how the maintenance is carried out and advise accordingly.

In the event of major problems, the concerned Dzongkhag will carry out assessment of the damages and after establishing that these damages were not caused by negligence on the part of the beneficiaries, the Dzongkhag will then arrange for repair works following standard norms.

Farmers benefiting from the farm road shall agree to form a group or a cooperative to implement and maintain the road. The group/cooperative shall have its own constitution and bylaws for implementing its activities. Farmers have local arrangement for maintenance of Chhu-lam and Tsa-lam, where a road is equally divided into several sections, and each section is handed over to a group of farmers. Similar mechanism may be adopted and applied for the road maintenance.

11 Roads are not enough

Provision of a road alone will not be of much use if it is not used effectively. Roads alone do not guarantee to improve the livelihood and reduce poverty if adequate transport facilities are not there. Vehicles will be few on these roads as passengers and loads are few and have high probability of getting stuck during wet period. Therefore alternative transportation means, which are most effective and affordable to the farmers, need to be explored.

Ministry of Agriculture under the leadership of Lyonpo Sangye Ngyedup has started redesigning the RNR centres to service the Geogs in multiple ways. The centre will be the hub of geog where the development activities of the Geogs will be centered. Apart from office of agriculture services, other offices and social services will be also concentrated within the centre such that people coming for one reason can use the benefit of other services as well. One of the units that will be housed is a power tiller hire and maintenance workshop. With rural connectivity, more and more farmers are procuring power tillers, which is the indication of improvement of livelihood. For those farmers who could not afford it, they can hire it from the geog centre. This is a sincere effort to help the poorer farmers. A power tiller is perhaps the most suited machinery to the Bhutanese farmers considering the fact that it can plough and could also be used for transportation of goods to the markets. This also allows mechanization of the farms and takes care of the labour shortages in the farm.

12 Conclusions

Farm roads penetrate into the heart of rural community and reach those needy poor for whom road access will increase their income and reduce poverty. The perishable products like vegetables and dairy products cannot reach market centres where the demand is high due to lack of speedy and quick means of transport. The villagers have to dispose it off in the village itself where the prices are quite low. Therefore farm roads which reduce travel time and improve access to the facilities and services are highly needed.

Visits to the different villages confirm that communities near the road are much better off than the villages further away from the road. It is evident that remoteness does contribute to the poverty and that road access will be a key factor in alleviating poverty. The result of the impact study of the rural roads in selected areas done by Ministry of Finance clearly shows the positive effect of roads in increasing the living condition and reducing the poverty.

Thus, it can be clearly said that a road brings about tremendous socio-economic development in the village and increases the quality of life and the happiness of the people, especially when combined with other interventions like the development of multi-functional RNR centres.

List of Acronyms

DYT	Dzongkhag Yargye Tshodgue
GYT	Geog Yargye Tshogchung
DES	District Engineering Cell
GNH	Gross National Happiness
ED	Engineering Division
PWD	Public Works Department
DoR	Department of Roads
DoA	Department of Agriculture
MoA	Ministry of Agriculture
MoU	Memorandum of Understanding
RNR	Renewal Natural Resources
RGoB	Royal Government of Bhutan
9FYP	9 th Five Year Plan

Glossary

Dzongkhag	District
Geog	Sub-district or Block
DYT	District Development Committee
GYT	Block Development Committee

References

National Environment Commission (1998), The Middle Path: National Environment Strategy for Bhutan, Royal Government of Bhutan, Thimphu.

Planning Commission (1999), Bhutan 2020: A Vision for Peace, Prosperity and Happiness, Royal Government of Bhutan, Thimphu.

Ministry of Agriculture (2005), Rural-Urban Migration in Bhutan, Policy and planning Division, Ministry of Agriculture, Royal Government of Bhutan, Thimphu.

Ministry of Finance, Pilot Participatory Impact Assessment of Rural Roads on Rural Poverty, Department of Planning, Royal Government of Bhutan, Thimphu.

Ministry of Finance (2004), Poverty Reduction Strategy Paper, Department of Planning, Royal Government of Bhutan, Thimphu.

Ministry of Finance (2002), Ninth Plan Document, Department of Planning, Royal Government of Bhutan, Thimphu.

Ministry of Agriculture (2003), Guidelines for Farm Road Development, Royal Government of Bhutan.