

Chapter 5

Scope of Labour-based Technology

5.1 General

In Chapter 1 the issue of the viability of labour-based methods of construction was raised. It was suggested that there were several reasons why these techniques have not been given the attention that they deserve.¹ The overwhelming evidence is that the technology can be successfully employed on both small and large scale projects. The over-riding factor in deciding on their use would be their ability to achieve the required standards at a competitive cost.

Under the right socio-economic conditions, labour-based methods are entirely suitable for rural road works, irrigation canals, river control and land conservation projects. Even on major civil works, such as national highways, the techniques have a role to play for those activities for which they are technically and economically viable.

Labour-based technology should be viewed as an option. There is a danger of approaching these methods as if they were something strange or, worse, backward. The simple fact is that in economies with a low wage level and a shortage of foreign exchange, one would be foolish to ignore consideration of technologies which emphasise the use of the available resource, labour and which limits the use of foreign exchange on equipment. Whether one method or the other is appropriate in particular circumstances or for different types of projects is a question for evaluation. One however has to consider the two alternatives based on the actual prevailing conditions rather than on received "wisdom" from the industrialised countries.

Numerous studies carried out by several agencies including the World Bank and the ILO in many countries including Lao PDR, have demonstrated that when the right conditions are present in a given area, labour-based technology is the most cost-effective approach to rural infrastructure development. These conditions include:

- o sufficient numbers of under- or unemployed persons in the areas where the work is required plus local availability of construction materials;
- o low wage levels (under US\$ 4.00 per day according to World Bank studies);
- o shortage of conventional construction equipment and high capital costs;
- o Government commitment to the development of employment and generation of income in the rural areas;
- o small contractors skilled in labour-based technology and capable of supervising the work efficiently; and
- o competence of the public sector agencies responsible for rural infrastructure works in the areas of contracting and supervision of contractors' performance.

Lao PDR would generally fall into that group of countries where the use of labour-based methods should be seriously considered. The first four criteria are already met and the latter two are being developed, as discussed below.

¹ Not least amongst these is the feeling that "rich countries are rich because they use machinery". In fact they use machinery because they are rich.

Labour Supply

The population density in the rural areas of Lao PDR is relatively low. However, villages tend to be clustered along a road alignment, most sections of road alignments are within walking distance from a village. Taking a low figure of 40 households per village and assuming that 2 persons from each households can be recruited, there will be up to 80 labour from a village available for the 6 months period of the dry season. Significant improvements can be achieved by concentrating effort on rehabilitating or upgrading the already existing roads, particularly the provincial and local roads to a maintainable all-weathered standard. This type of activity can easily be achieved by the level of labour availability previously indicated.

Sufficient labour-supply has always been a key issue in discussions relating to the feasibility of labour-based technology in Lao PDR. However, it is today clearly proven that even in remote areas where population densities are comparably low, it is still possible to recruit sufficient labour.

Being an agricultural based economy, the majority of the work force are in the agricultural sector,

which are normally fully engaged in farming activities less than six months of the year. Most of these farmers need to seek other income generating activities to supplement insufficient farming outputs. Labour-based rural infrastructure programmes are therefore an effective approach to improving both the rural infrastructure and providing additional cash incomes to rural households.

Works in the rice fields start at the beginning of the rainy season in June and finish just before the winter start at the end of November. However, intense works only occur in the first two months during land preparation and planting and in the last month during harvesting.

For the rest of the period, the farmers spend their time partly tending the rice fields and partly with other food gathering activities. A rural employment programme should therefore have no problem in labour supply if the programme activities are planned such that large numbers of labour are engaged on full time basis only during the dry season, and a smaller full-time work-force during the wet season.

Wage Rates

In Lao PDR the opportunity cost of unskilled labour has been found to be about US\$ 1.7 per work day, although there are seasonal variations with labour supply being at a premium during the sowing and harvesting periods of the agricultural cycle.

At the labour wage of 2.00 US\$/day there seems to be no problem of labour supply. In Oudomxay, where the ILO labour-based road project operates in the remote areas, up to 30% of the workers come from more than 10 km away to seek employment. With some assistance from the project, these workers set up camps near the project site. Labour productivity rates is found to be comparable with experience from neighbouring countries.

Equipment Levels

Whilst the Lao economy is certainly growing, it still suffers from a shortage of foreign exchange. The construction equipment that exists in the country is generally brought in by foreign donors or foreign contractors involved in the large infrastructure programmes.

Whilst some small equipment is produced in Lao PDR, most of it is imported from Thailand or China. The equipment that does exist is concentrated in the urban areas or in the vicinity of the large infrastructure programmes such as Road 13.

In the rural areas construction equipment is conspicuous by its absence. Most provincial offices of the MCTPC have very limited equipment and there is relatively little supply from the private sector. In the private sector the demand for equipment is for that which is commensurate with the type of work that local contractors are capable of doing. So they require concrete mixers, compressors and, maybe a small truck.

Government Commitment

This has been discussed elsewhere and, suffice it to say here that, it is clear that the government's policy is towards the development of the rural areas. This policy, however, is not merely to generate agricultural surplus but to improve the lives of the rural dwellers through providing employment and generating income. Labour-based approaches fit squarely within this policy.

Contractor Development and Local Level Capacity

In these two areas there are weaknesses. On the one hand the NEM policy is relatively recent and there has been little time for the development of a viable domestic construction sector. In addition, the process of developing the capacity of the provincial governments has only recently begun in response to the governments concern to improve the delivery capacity of the decentralised governmental system.

These two issues are pursued further in the subsequent chapters.

Appropriateness of Labour based Technology

Before there are any proposals for the expanded use of labour-based methods, one key question needs to be answered. Are labour-based methods appropriate for the development of the secondary and tertiary road network in the provinces? The evidence from the ILO pilot projects and from other projects suggests that labour is available, that it is possible develop effective management and supervisory capacity for labour-based programmes. However, the methods must reach the required technical standard.

When considering the use of labour-based technology in road works projects, it is important to acknowledge its limitations. In some circumstances, traditional equipment-based work methods are more effective and may provide higher quality outputs, such as large excavation works, rock excavation and haulage of materials over long distances. It would be incorrect therefore to take an ideological view of the use of labour-based methods. Where they are not capable of reaching the required standard then equipment should be used. Nevertheless, the experience so far in Lao PDR is that in most cases it is not necessary to resort to the use of heavy equipment.

In general, the priorities for road improvement relate to providing all-year road access to regions where such access today only exists during the dry season and in some cases not at all. In most cases, these roads will improve access to district centres or other larger regions with poor road conditions. The main task will be to upgrade already existing earth roads, following the original road alignments. Considering the purpose of the roads and expected traffic volumes, standard gravel roads of 5-6 metre carriage width, with a 10-15 cm laterite surface and a curvature catering for design speeds of 40 km/h should be appropriate.

Earthworks is mainly expected to involve re-excavation of drainage systems and preparation of camber - activities which are well suited for the use of manual labour. Surface materials will most probably need to be transported using traditional equipment (tipper trucks and loader/excavator) and compacted using vibrating rollers. Levelling works, if properly organised, can be carried out by labour. Bridge and culvert works should follow established work methods which have always relied on a high degree of manual labour.

This method of organising rural road works has proven to be a technically and economically sound solution for the provision of all-weather road access to rural areas both in Lao PDR and in several other developing countries. By choosing an effective balance of labour and equipment, these roads can be effectively constructed/rehabilitated to acceptable quality standards at an average cost of approximately US\$ 15,000 per kilometre.

Finally, by awarding the provision of laterite to larger contractors which possess proper haulage and excavation equipment, the remaining works can be awarded to smaller domestic contracting firms with limited access to equipment.

The use of labour-based methods for routine road maintenance has generally been accepted by the government through the introduction of lengthmen to maintain the national road network. In addition, it is possible to enter into community contracts where the provincial authorities will have a contract with a village or group of villages for the maintenance of the road. This method is useful in areas where the villages are rather scattered and the lengthman system is difficult to operate.

5.2 A National Programme

It is possible to think in terms of a nationwide programme of labour-based rural road works. The on-going ILO assisted labour-based road project has proven that it is possible to carry out rural road works relying on a high degree of locally available resources. Despite operating in some of the more remote areas of the country, this project has managed to deliver desperately needed infrastructure and employment. It has also clearly proved that with proper training programmes provided, it is possible to establish an efficient rural road works programme within and under the management of the existing government technical agencies in the provinces. In addition, if the programme was oriented to the use of small contractors it would at one and the same time develop local capacity, take away the heavy administrative load from the provincial authorities and reduce the supervisory burden from the local government engineers.

Nevertheless one should not give the impression that the development of the programme will not be without its difficulties. This is discussed in detail in later chapters. In brief, it will require a major effort in terms of:

- o training at all levels and for the private sector,
- o the development of effective management and administrative procedures,
- o improved financial procedures at the local level, and
- o more participatory processes for the planning and selection of roads.

Such a programme would need to be seen in relation to the overall condition and status of the road network in Lao PDR.

5.3 Current Condition of Rural Roads

Roads in Lao PDR are classified into four groups according to its function:

National Roads	are of high technical standard, serving the nation's economic, political, and cultural development and national defence, linking the capital with other provinces and linking the country with neighbouring countries and main ports, also serving the most important tourist links;
Provincial Roads	serve economic, social and cultural development, tourism and defence within a province, prefecture or special growth area, linking province to province or district to district;
Local Roads	contribute to economic development and bringing other benefits to towns and villages, linking either district to district, district to village, or village to village;
Special Roads	intend to serve mining, industrial, agricultural or forestry development or required for national defence.

MCTPC is responsible for the construction and periodic maintenance of the national road network, while the provinces are responsible for the provincial and local roads. Recently, the MCTPC also delegated the responsibility for routine maintenance of national roads to the provinces.

Estimates from the Transport Planning Unit (TPU) summarise the existing network and its condition as follows:

	Bitumen	Laterite	Earth	Total
National Roads	1,674	1,646	1,144	4,464
Provincial Roads	360	1,970	3,566	5,896
Local Roads	78	1,073	4,711	5,862

However, this does not fully describe the situation with regard to access to the rural areas. Of the total provincial road network less than 35 percent is thought to be passable in the wet season and only half of the population is estimated to have road or river transport access throughout the year. Only 51 district centres of the total of 133 have all-weather access, and 15 have no road access even in the dry season.

From the above figures it is evident that the need for rural road development are enormous and varied. In the rural road sector, the needs are not just for development of village and district roads, but also of provincial roads. In some provinces, the most immediate need is building roads to connect the isolated provinces to the main road network. As the network of rural roads (provincial, district and village roads) is small and in an unmaintainable state, the needs also include reconstruction of roads to a maintainable state and extension of the network to reach isolated district and major villages particularly in the mountainous regions.

5.4 A Framework for a Labour-based Approach

As mentioned above, past efforts to improve the road network in the country has concentrated on upgrading the national road network. The next step is now to improve the secondary and tertiary road network to all-weather standards. Due to the current poor condition of secondary roads and the resulting limited access to the districts, any future road improvement programme in the provinces will first need to address the secondary road network. This implies that the first task will be to provide all-weather access to all of the country's 133 districts.

From the past labour-based road works programmes it is now possible to develop a good picture of the costs of and timescale for upgrading the rural road network in Lao PDR. Although the existing road network still does not provide access to the entire population, it may provide some cost indications for providing a functionable rural road network in the country.

The below table describes the cost of upgrading the existing mapped rural roads using labour-based methods supported with a limited amount of equipment:

Provincial Roads		Length	Unit Cost ¹	Total Cost
Reconstruction	65%	3,832	20,000	76,640,000
Rehabilitation and Spot Improvements	35%	2,064	10,000	20,640,000
Local Roads				
Reconstruction	100%	5,862	14,000	82,068,000
Grand Total/Average		11,758	15,253	179,348,000

1. Includes provision of bridges and other drainage structures

If this work is undertaken during a period of the next 10 years, completing 50% during the first 5 years would correspond well to the government public expenditure programme for 1996-2000.

A key question is whether it is possible to achieve sufficient production rates when applying labour-based work methods. The existing rural road network consists of approximately 11,600 km of provincial and local roads. With the currently planned investment programme it would be possible to finance the improvement of half of this network during the next five year, i.e. 1,160 km per year. This is an average production of 65 kilometres per province per year.

As a comparison with the current force account operations in the ongoing ILO project, the current capacity of the DCTPCs in Oudomxay and Savannakhet should be able to produce 60 km per year provided sufficient funds were made available. Experience from other countries show that trained and equipped small-scale contractors with a labour force of 150 - 200 workers can each complete 15 km per year of gravelled roads to similar standards. With 4-5 trained contracting firms operating in each of the provinces, the required capacity could be achieved.

Clearly, all these figures are illustrative only. Nevertheless, they do suggest that a nationwide programme would be feasible by labour-based methods in relation to the cost per km presently being achieved, the budget allocations for roads and the potential output of the DCTPCs and the domestic construction industry.

5.5 Possible Impact

In the past, little attention was paid to rural infrastructure development as priority was given to developing large scale infrastructure, and as a consequence rural infrastructure has remained largely underdeveloped. Support to this sector is therefore necessary to reduce this enormous backlog. In addition, as there is a strong link between rural infrastructure and rural development, the development of rural infrastructure will address the development needs of the 80 percent of the population who live in the rural areas, 53 percent of whom live below the poverty line.

Labour-based construction programmes are not an end in themselves. They would form part of an overall strategy focusing on use of local resources in the rural areas. For it is self evident that the task facing the government in terms of rural development is enormous. Whilst external funds will of course be necessary, it is obvious that the country will have to depend as much as possible on its own resources.

The government is well aware of this and programmes such as the IRAP local level planning programme are a clear indication of the governments desire to put the responsibility and the authority for local level planning in local hands. Techniques of rural infrastructure which also emphasise the use of local resources will therefore form another part of this strategy.

The government has priority programmes of increasing the access of rural people to goods and services, reducing slash and burn agriculture, enhancing food security and developing ethnic minorities. A programme of labour-based rural infrastructure fits well into this framework.

Immediate Effects

In the labour-based projects currently being executed in the country, labour costs constitute 40 percent of the total construction costs. In terms of employment creation, if the entire rural road network were improved using labour-based methods this would create an additional 58,000 work years of employment over the next 10 years. Perhaps more importantly it would put \$7.2 million into the rural economy every year over the coming 10 year period.

One should also distinguish between short term employment for road improvement works and long term employment for road maintenance. Providing routine maintenance to the entire rural road network using the lengthman system would involve 11,500 workers having full time employment.

Even more significantly, the foreign exchange component of the programme would be reduced from 70 to 20 percent. This would mean a total foreign exchange saving of some US\$ 90 million, most of which would be spent on wages in the rural areas and purchase of local goods, materials and services.

Long-term Effects

The improved roads will contribute to the process of rural development by contributing to agricultural productivity, through expanding access of farm families to markets as well as to health, education and other social services, now severely inhibited by the lack of an adequate and well maintained transport system. This of course would be true whether labour-based or equipment methods were used.

What has been observed in other countries where labour-based projects have operated is the effect on the local economy of the income from the labour-based work. Clearly, some of the money will be used for the purchase of basic items of food, household articles and clothing. However, it will probably also be used for obtaining better health care, education services and farm inputs. In addition, it provides the possibility of the local people making use of the roads through payments for transport services.

Studies on labour-based programmes have shown that it is these secondary benefits of the use of the income derived that is the most important element of these programmes.