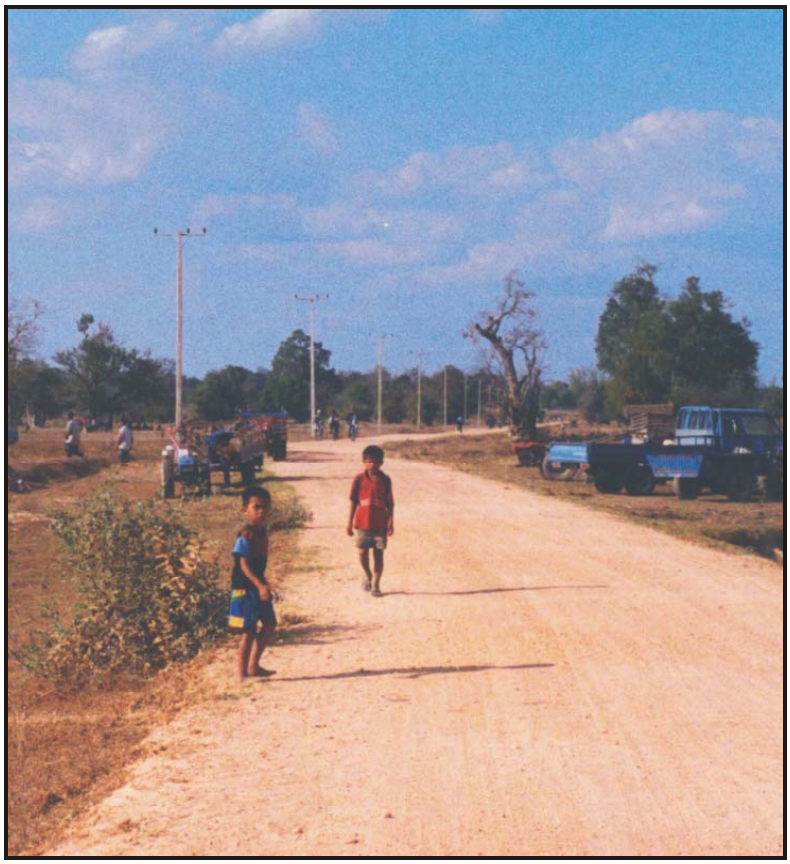
Feasibility Study

Use of Labour-based Works Technology in the Smallholder Development Project



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1 The Assignment

This assignment was carried out on the request of the ADB to assess the potential use of labour-based works technology for the construction and rehabilitation of roads under the infrastructure component of the Smallholder Development Project which the Bank is currently preparing.

During the assignment, all the roads initially identified for inclusion in the project were visited.

In addition, a brief cost assessment was carried out of the works envisaged, under the possible scenario that labour-based work methods are applied.

The project is still at its preliminary planning stages. ADB has engaged an international and a local consultancy firm which is currently preparing the detailed formulation of the project, funded under a Project Preparatory Technical Assistance (PPTA) grant to the Government of Lao PDR.

Since the PPTA consultant has recommended against the use of labour-based methods for any of the activities under the infrastructure component, the ADB requested the ILO through its ASIST[1] programme to further investigate this issue.

The assignment took place from 12 to 20 February 2002.

2 Summary of Findings

2.1 Use of Labour-based Works Technology

Having inspected the existing roads and tracks selected for upgrading and studying the preliminary estimates of works and selected design standards, it is clear that there is considerable scope for using labour-based works technology for upgrading all the roads selected.

This conclusion is justified on the basis of the fact that the technology has already been effectively applied for road works in this specific project area, where similar design roads were built using labour-based methods to comparable technical standards.

Labour availability was confirmed during the previous road works in the project area when this technology was applied.

The use of labour-based work methods will not delay the completion of works. Based on the experience from other projects in both Laos and neighbouring countries, it is evident that the works can be completed within the same time frame as originally envisaged using equipment intensive work methods.

Obviously, there is a need for training of both government and contractors' staff before labour-based methods can be effectively applied. The type of training required can be carried out by TCTI with some support from the technical assistance team.

[1] ASIST is a regional programme of the ILO, dealing with sustainable infrastructure provision through the use of local resources. Main areas of expertise cover integrated rural accessibility planning , labour-based works technology, small-scale contracting and infrastructure maintenance.

Technical assistance will be required at the same magnitude as already proposed by the consultant, basically consisting of a Contracts Management Adviser and two Field Engineers. The main difference in the terms of references of this staff, would be to add specific references to the use of labour-based works technology.

2.2 Including the Champasack to Phonethong Section

During the field inspections, it was established that there is only need for one bridge between Soukhouma and Mounlapamok. Furthermore, this river crossing would entail a shorter bridge than originally envisaged.

In addition, the field visit also discovered that the original estimates of quantities of work can be reduced, since a majority of the road section between Soukhouma and Mounlapamok pass through gently rolling terrain where embankment works are not required.

These cost savings, plus using the funds originally earmarked for the upgrading of the four ferry landings in Champasack Province, would be sufficient to cover the construction of the road from Champasack to Phonethong. This would significantly improve the access to the west bank of the Mekong River, linking these communities up with the national road network without relying on the use of ferries across the Mekong (ref. Map).

The Champasack to Phonethong section was originally included as part of the infrastructure component, but was omitted at a later stage in order to limit the size of the infrastructure component.

3 Project Brief

The objective of the project is to promote the development of smallholder commodity producers and agricultural enterprises in Lao PDR. At this stage, ADB has engaged consultants to assess the financial and economic viability of commodity production, processing, and trade, and examine the scope for future expansion. This technical assistance will (i) identify promising commodities, growing areas, groups of smallholders, and viable agricultural processing enterprises; (ii) assess the commodity outlook and marketing prospects; (iii) determine the willingness of farmers to supply traders and processors to participate in development, and design models for strengthening linkages; (v) formulate training, support and credit for smallholders based on analysis of potentials and constraints; (vi) determine means to strengthen MAF extension, training, and research for cash commodities; (vii) identify potential new agro-processing opportunities for private investment; and (viii) establish the framework for a market information system to benefit farmers and buyers.

As part of the preparatory work, the consultants have identified a series of rural infrastructure improvements which will form part of the ensuing loan financed project. These include rural road works, market construction and improvement of ferry landings.

4 Location of Road Works Activities

The planned road improvement works are located in Savannakhet and Champasack Provinces, basically covering three road alignments. One of the roads is situated on the west bank of the Mekong in Champasack Province. In Savannakhet, two roads

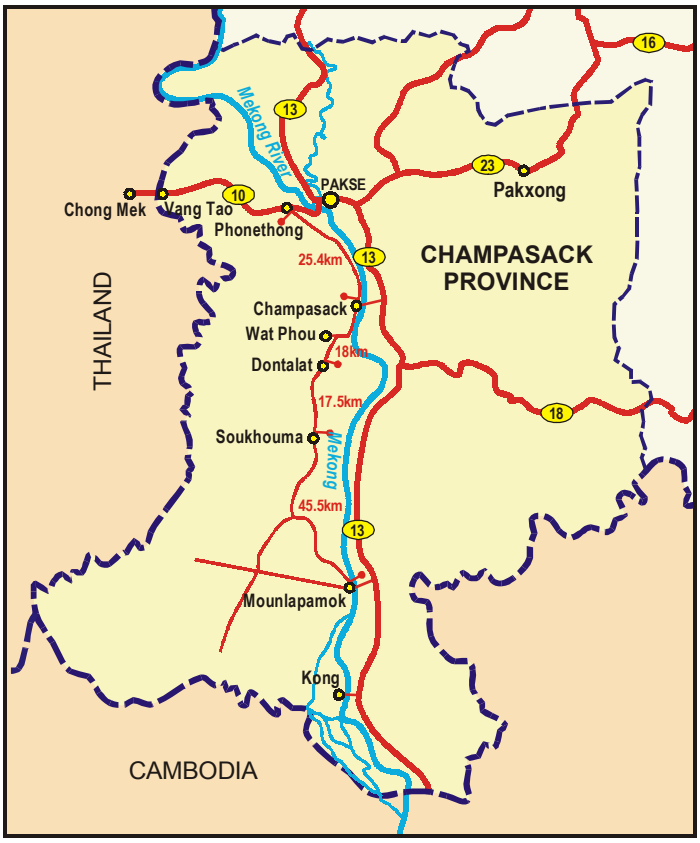
have been selected, one located in Songkhone District and the other in Champhone and Xonboury Districts.

Although Lao PDR is renowned for its mountainous terrain, all of these roads are located in the plains of the Mekong River basin. For this reason, there are minor challenges as regards to the topography, since all the roads are located in flat to gently rolling terrain.

These roads form part of the public road network providing basic access to the rural areas from the national road network.

4.1 Champasack Province

The road identified in Champasack Province is located close to the western banks of the Mekong River, starting in the town of Champasack running south through Dontalat, Soukhouma and finally ending in Mounlapamok (see map). Champasack and Mounlapamok are currently accessed from the national network through ferries across the Mekong River to National Road No. 13.



The consultants had originally proposed to upgrade the ferry landing facilities as the recommended strategy to improve access to these parts of the Province, and thereby linking the proposed road improvements into the overall road network in the area.

During the field visits, it was established that since the road section from Soukhouma to Mounlapamok required less investments than originally envisaged, it would be possible to include the upgrading of the track from Champasack town to Phonethong, thereby linking up with National Road No. 10. This alternative would then provide all-weather access to the west bank of the Mekong River without relying on the ferry connections in Champasack and Mounlapamok. With the recently completed bridge crossing the Mekong, it would then be possible to travel from Pakse to these communities without the use of the ferries.

From Champasack town to the junction to Wat Phou, the road travels through densely populated areas. This section has a bitumen surface which show evidence of recent maintenance works. Thereafter, the road to Dontalat consists of a gravel road on which the DCTPC is currently carrying out rehabilitation works (replacement of culverts and regravelling). From Dontalat to Soukhouma, the road has recently been graded, however, it is evident that this section require a lifting of the road levels to avoid flooding in the rainy season. The terrain along the road sections from Champasack Town to Soukhouma consists mainly of flat rice fields, which flood during the rainy season.

From Soukhouma to Mounlapamok, there is only a track which is only accessible during the dry season. This alignment also crosses a river where there is a need to install a 50 metre bridge. As opposed to the previous sections along this road alignment, there are no villages or settlements along this 45km section. The terrain is predominantly pasture land used by the villages situated 3 to 7 km to the east of the track, along the Mekong River. With the exception of 4 to 5 km at the beginning and the end of this section, the road alignment passes through slightly rolling terrain which does not flood during the rainy season.

4.2 Savannakhet Province

Two roads have been selected in Savannakhet.

One is located in Songkhone District providing access from National Road No. 13 to the village of Thapasoum. This road was rehabilitated latest in 1997, but apparently has not received much maintenance since then. Thapasoum is an important port village next to the Mekong River, with a considerable cross-border trade with Thailand. This road is located in gently rolling terrain with rice field in the low areas. Earthworks will involve lifting the embankments in the flood prone sections and reinstating the camber in the high lying areas. In comparison to the other selected roads, the works quantities are relatively low on this road with an average increase of road levels of 0.30 metres.

The second road starts in Champone District and ends in Xonboury District. Back in 1995, the ILO constructed a village access road which connects to the end of this road. The beginning of this road has been suffering serious flooding during the rainy season caused by a nearby river. Some of this section will require a considerable increase of the road levels. The first half of this road passes through an area with intensive farming with good irrigation systems also allowing for dry season rice farming. The latter half of the road alignment passes through gently rolling terrain similar to the Songkhone road.

DCTPC has recently graded the Xonbury Road and is currently carrying out some bridge repairs.

Both of these roads pass through relatively densely populated areas with a number of villages along the road alignment.

5 Type of Works Envisaged

The plan is to upgrade all three roads to a modified Class VI road. This basically involves the lifting of the road level in flat areas, providing a camber to ensure proper

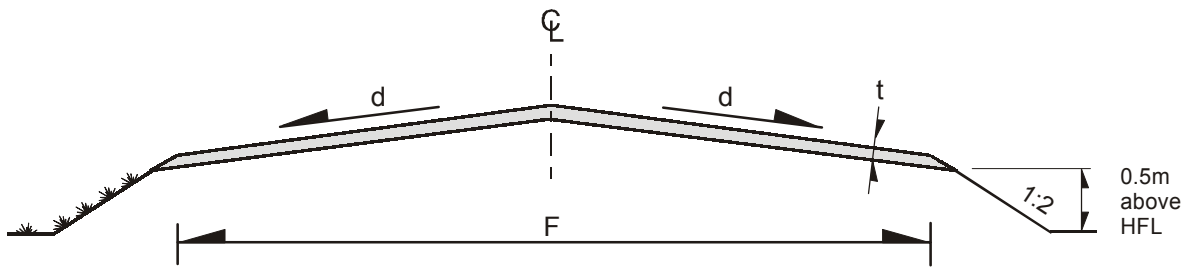
surface runoff and a laterite wearing course. In addition, there is a need for installing proper drainage, i.e. side drains, culverts and bridges.

With the exception of the track from Soukoma to Mounlapamok in Champasack (and the connection to Phonethong), these are all existing roads which receive some limited maintenance through the provincial departments of MCTPC. As a result, it is only the track from Soukoma to Mounlapamok which requires new construction[2], while the other roads selected will only require rehabilitation and some improvement works. Major bridge work is only envisaged in Champasack Province.

5.1 Design Standards

It is proposed to upgrade all the roads (and tracks) to a modified Class VI standard[3]. This basically consists of a 6 metre wide carriage with a 25 cm laterite surface. This is a standard design for gravel roads which is common in Lao PDR as well as in a number of other countries in the region as well as elsewhere[4].

The design is shown in the figure below, where it is also compared to the design used by (i) the ILO labour-based road works project in Lao PDR, and (ii) the ADB financed Rural Infrastructure Improvement Project in Cambodia – both projects applying labour-based road works technology.



Project	Formation Width, F (m)	Camber, d (%)	Gravel thickness, t (m)
Smallholder Development Project	6	3 – 6	25
ILO Labour-based Rural Road Project	5.5	8	10
ADB Rural Infrastructure Improvement Project Cambodia	5.4	8	20

To achieve this end product, the improvement works will mainly consist of:

- lifting embankments through flood prone terrain,
- reinstating road surface drainage (camber),
- rehabilitating side drains,
- installing/repairing culverts, and
- providing new gravel surfacing.

[2] If the project decides to include the road link from Champasack to Phonethong, this will also require new construction, including the construction of two new bridges.

[3] Ref. MCTPC Road Design Manual

[4] For comparison, Cambodia is using similar designs, where the total formation width is 5.4 metres with a gravel surface thickness of 0.2 m for the construction of secondary and tertiary roads.

Some road sections, particularly in Champasack where new construction is required, there is a need to widen the existing roads/tracks, which will include activities such as bush clearing, grubbing, replacement of sub-standard soils and constructing entirely new embankments.

This assessment of the use of labour-based technology is based on applying the same design standards and achieving the same end product. This implies that (i) the performance requirements of the upgraded roads, and (ii) the material specifications remain unchanged, i.e. degrees of compaction, quality of materials, etc.

5.2 Traffic Counts

At the same time as this assignment was carried out, the PPTA consultant carried out traffic counts in relation to the three roads identified. The results of this survey clearly show that the chosen design standards are appropriate for the type and volume of traffic currently encountered and which is expected once the improvements have been completed.

It is also well worth noting that the current traffic levels are similar to those encountered on rural roads in other countries where labour-based work methods were used to upgrade and maintain the roads.

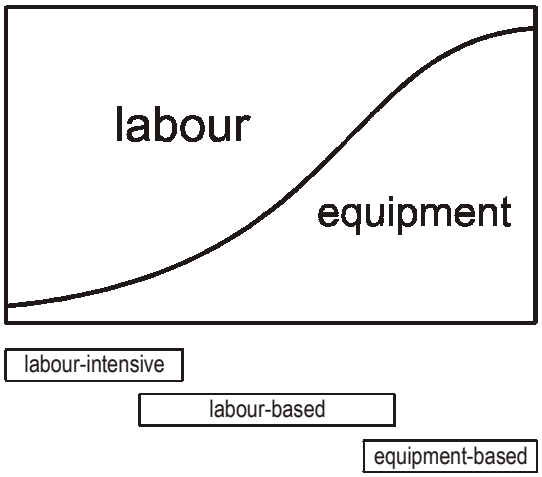
6 Choice of Technology

From the initial discussion held with the consultants as well as other parties currently involved in the preparations of this project, it is evident that there is a need to clarify the exact definition of labour-based technology, and in particular distinguish it from labour-intensive works which are commonly applied in food for work programmes.

There are several categories of rural infrastructure improvement programmes that use large numbers of unskilled labour:

- Relief Programmes responding to natural or man-made catastrophes, (i.e. droughts, severe floods, war, etc). Their prime objective is to provide food and income to the affected individuals. Although such programmes may also improve infrastructure, this is considered as a by-product.
- Employment Generation Programmes - These projects give little attention to cost and quality effectiveness. Once more, asset creation is a secondary objective.
- Asset-Creation Programmes - These attempt to improve infrastructure at the lowest possible cost, maintaining accepted quality levels and applying the most *appropriate* technology. Simultaneously, they supply employment opportunities in the rural areas, providing supplementary cash income to farmers.

To avoid a common misconception, it is important to distinguish between labour-based methods and labour-*intensive* methods. In contrast with labour-based technology, the labour-intensive approach seeks to maximise the use of labour with minimum use of mechanised equipment, often at the expense of cost and quality efficiency.



Labour-based technology can be defined as the construction technology which, while maintaining cost competitiveness and acceptable engineering quality standards, maximises opportunities for the employment of labour (skilled and unskilled) together with the support of light equipment and with the utilisation of locally available materials and other resources.

6.1 Work Methods

For most of the roads identified, the main task will be to upgrade already existing roads and tracks, following the original road alignments. Considering the purpose of the roads and expected traffic volumes, standard gravel roads of 6 metre carriage width, with a 20-25 cm laterite surface should be appropriate.

Earthworks is mainly expected to involve (i) excavation of drainage systems and preparation of chamber, and (ii) building up or lifting the road embankment in flood prone areas - 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 conventional work methods which have always relied on a high degree of manual labour.

6.2 Use of Equipment

As mentioned earlier, labour-based methods do not exclude the use of equipment. The way the technology has been adapted to the conditions in Southeast Asia, there is a considerable amount of equipment still required when using this technology. For comparison, the table below shows the most common equipment used for labour-based and equipment intensive methods when building rural roads in the type of terrain prevalent in the Smallholder Development Project.

Activity	Labour-based Methods	Equipment-intensive Methods
Bush Clearing	labour only	Bulldozer or front wheel loader
Grubbing	labour only	Bulldozer or front wheel loader
Earthworks	vibrating rollers water bowsers	Vibrating rollers water bowsers excavator grader
Camber Formation	vibrating rollers water bowsers	Vibrating rollers water bowsers excavator grader
Side Drains	labour only	Grader
Gravelling	vibrating rollers water bowsers trucks excavator or front wheel loader	Vibrating rollers water bowsers trucks excavator or front wheel loader grader

6.3 Feasibility of Using Labour-based Work Methods

From a technical standpoint, there are no valid reasons for not using labour-based works technology for the construction and rehabilitation of the roads selected in the Smallholder Development Project.

In general, the envisaged works are very similar to the previous rural road works carried out by the ILO in Lao PDR.

Although the technical design chosen in this project varies slightly from the design applied in the ILO project, the activities in which labour-based methods are envisaged will be identical. These are bush clearing, grubbing, earthworks, levelling and laterite spreading. For these activities, the productivity rates established during the ILO project can be applied without any modifications.

It should also be noted that in the neighboring country Cambodia, the ADB is currently funding two major rural road works programmes which has so far completed more than 600 km of rural roads at similar standards as what is envisaged in the Smallholder Development Project. As a matter of fact, the average quantities of work in the rural roads works programmes in Cambodia exceed the estimated average quantities in the Smallholder Development Project by more than 30 percent[5].

7 Labour Availability

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

Adequate supply of labour was confirmed during the previous road works carried out by the ILO in Savannakhet Province. As mentioned earlier, some of the works will take place in the same locations as the ILO were operating. Actually, it is highly likely that some of the workers, if recruited by the Smallholder Development Project, will have previous working experience from the ILO project.

The preferred labour force for this type of works will be around 200 to 300 workers depending on the magnitude of current works. In Savannakhet, the ILO already has experience that shows that if the conditions of employment are attractive, there should be no problems recruiting this number of workers.

Based on the census carried out in 1995, the population densities in the districts where the roads are situated are summarised in the table below. The table indicates that only Mounlapamok District have population densities which are considerably lower than

[5] For rural road works, earthworks are one of the largest cost items in the bill of quantities. In flat terrain, this mainly consists of embankment construction, and therefore the magnitude of works can be compared on the basis of the height of the embankment to be constructed. In the ADB funded Rural Infrastructure Improvement Project in Cambodia, embankments were on average lifted 0.7 metres in comparison to the Smallholder Development Project where it is estimated that the average level increase is 0.45 metres. Although the formation width is 0.6 metres wider in the Lao project, the higher embankments in Cambodia results in 30 percent more earthworks.

the areas in Savannakhet Province where the ILO previously carried out road works using labour-based methods. On the other hand, Mounlapamok District has an overall population which is comparable to the other districts. The main difference is that the geographical size of this district is considerably larger than the other districts, thereby giving a lower population density. Given the fact that (i) the majority of the population in this district is found along the west bank of the Mekong River, and (ii) these villages are only 3 to 7 kilometres away from the selected road alignment, labour availability should be sufficient in this district as well.

Experience from the previous ILO project show that workers are willing to travel from more than 10 km away to seek employment.

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 five months a year. Most of these farmers need to seek other income generating activities to supplement insufficient earnings. Employment through labour-based infrastructure works

is therefore an efficient approach to improving both rural infrastructure and providing additional cash incomes to rural households.

District	Population	Area (km^2)	Density (persons/km^2)
Champasack	49,455	908	54
Soukhouma	38,202	1290	30
Mounlapamok	32,322	2327	14
Songkhone	81,929	1619	51
Champone	86,612	1029	84
Xonboury	34,661	1286	27

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 farming activities. A rural road works 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.

Experience also shows that with the use of incentive schemes such as task work, the labour is normally released from their duties at the road works sites after 5 to 6 hours, still leaving some time left for duties back in the village or on their farms.

7.1 Labour Wages

The appropriate wage rate for unskilled labour still needs to be determined.

The previous ILO labour-based road works project used a wage rate of approximately 2 US$/day, back in 1995 and 1996. More recently, a project in Xieng Khouang has been applying a rate around 3 US$ per day. Paid labour, for example for rice planting, is currently being paid at a rate of 20,000 Kip per day, equivalent to US$ 2.10.

Equally, it is important to compare rates with what unskilled labour would receive if they work in Thailand as migrant labour.

The previous work carried out by the ILO was executed through force account, i.e. not involving private contractors. This time, it is envisaged that the contractors will be employing the labour force. Although, it is important to stress that the contractors should be free to negotiate the exact level of wages they wish to employ, it is necessary to establish some guidelines on what would be reasonable levels. The rates will need to comply with government minimum rates (if any), and need to be sufficiently attractive without detrimental effects on the labour requirements of the agriculture sector.

Equally, they need to be within the limits at which labour-based work methods are still economically viable[6].

From the indicators described above, it seems as if a wage rate between 2 to 3 US$/day would be appropriate. However, it is recommended that a detailed study is carried out by a rural economist before the exact level is determined. The ILO has developed a methodology for this type of assessment which has been applied in the past in Lao PDR[7].

8 Work Programme

The use of labour-based work methods will not delay the completion of works. The main difference from the original work programme is that it is expected that works can start earlier than originally envisaged. By (i) using appropriate surveying methods and involving the DCTPCs in this work, and (ii) relying on local competitive bidding, it should be possible to complete the preparatory works and mobilise contractors during the first year of the project.

If the works are divided into appropriate lots, the construction works can be completed within a period of two to three years. It is envisaged that the contractors work throughout the rainy season with minor delays. Experience show that if work is properly planned, it is possible to extend the construction period throughout most of the rainy season.

This basically implies that the road sections passing through low lying terrain, which floods during the rainy season, are improved during the dry season, and the higher lying areas are worked on during the rainy season. This also fits well into the labour availability patterns of the farming communities along the road alignments, since the more demanding works in the flood prone areas, requiring more labour, can be carried out in the agricultural slack period (dry season).

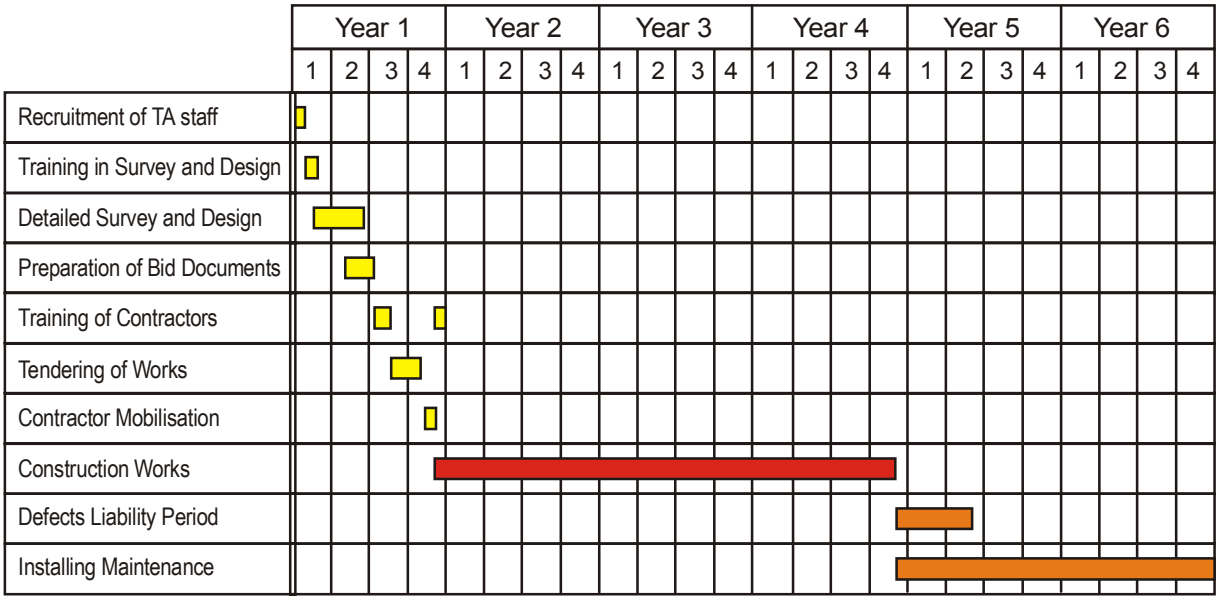
To ensure a reasonable progress of works, as well as retaining a certain size on the contract values, thereby ensuring that the works are attractive enough to the right category of contractors, it is recommended that the road works contracts are packaged into 15 to 20 km sections, adjusted for the magnitude of the works required in the

[6] Studies carried out by the World Bank show that labour-based methods can be competitive for rural infrastructure works with wage rates up to 4 US$/day for unskilled labour.

[7] Assessment of Labour Availability in the Lao People's Democratic Republic, Vaidya and Sarma

various road sections. As a result, the road works would involve 3 to 4 contracts in Champasack and 3 contracts in Savannakhet. Since access is relatively good to the project areas, all the contracts could be carried out concurrently.

Training will mainly be carried out while carrying out the work for which the training is targeted. This applies both to the survey and design stage as well as during implementation of road works. For this reason, the training will not lead to any significant delays in the overall work programme.



9 Use of Local Contractors

The works will be carried out using private contractors, engaged through local competitive bidding. The procurement of the works will need to comply with both the Government regulations for procurement of works as well as the Bank guidelines covering small civil works[8]. These procurement regulations can also be applied when using labour-based work methods.

During previous missions to the same provinces, it has been established that there are a number of locally based contracting firms with past experience of executing civil works contracts. Although the number of firms having carried out work for the road authorities is limited, there are a number of companies which have worked in the irrigation and building sector.

During previous interviews with these firms, it became evident that they where quite willing to carry out works using labour-based work methods. As a matter of fact, this issue seemed to be of less importance. When describing the magnitude of the works

[8] Ref: Implementing Rules and Regulations on Government Procurement of Goods, Construction, Repairs and Services
Guidelines for Procurement Under Asian Development Bank Loans
ADB Guidelines on Procurement of Small Civil Works

and the contract values, this information seemed to be more relevant than the choice of technology.

Lastly, it is important to note that although it is of interest to the project that a certain local contractor capacity is found in the project provinces, this work will also attract the interest of contracting firms from elsewhere in the country and which are also fully eligible to bid for this work.

9.1 Technical Specifications

The main changes required in the contract documents are in relation to the technical specifications. Since the standard technical specifications of MCTPC both describe methods and performance requirements of the end product, it is required to modify this document in order to reflect the technology choice.

This exercise has already been carried out in the Shifting Cultivation Stabilisation Project where some 50 km of rural roads will be constructed using a mix of labour-based methods and equipment.

9.2 Contract Documents

MCTPC have prepared and use standardised contract documents for road works. Although the standard documents applied for major highway works have been modified for contract values less than US$ 250,000, these documents are still rather volumous. It is therefore recommended that not only the technical specifications, but also the general conditions of contract are reviewed to more appropriately serve the purpose of contracting out rural road works. This can be carried out as part of the preparatory works carried out during the first year of project implementation.

9.3 Contract Management

Contract management can be carried out through the DCTPCs with support provided by the technical assistance. Equally, it is proposed that the DCTPC staff carry out the detailed survey and design of the road works under the guidance of the TA. As a final output of the survey and design stage, complete sets of bidding documents will be prepared with design drawings, road condition inventories, bill of quantities and work specifications.

Works specifications and general conditions of contract can be prepared in parallel to the survey works. Once the survey works have been completed, Bill of Quantities can be added and tendering can commence. Similar to the Shifting Cultivation Stabilisation Project in Houaphanh, it is proposed that the provinces carry out the tendering process.

Supervision of works should be assigned to the DCTPC with support from the TA. Payment of the contractors should be decentralised to the province in order to secure payment on time. It is important to note that when the contractors employ a considerable labour force, timely payments are crucial for the contracts in order for them to pay their workers on time.

10 Technical Assistance

The level of technical assistance required, if labour-based works technology are applied would be similar to the level already proposed by the PPTA consultant. Basically, it would require an international adviser for the overall management of the works in addition to two field engineers locally recruited. The difference would mainly consist of expanding on the terms of reference for these positions, to also possessing adequate experience in the use of labour-based road works technology.

Planning and supervision of the works contracts will be done by the DCTPC. It is anticipated that the capacity at provincial level may be insufficient in this respect. For this reason, it is proposed to strengthen the capacity of the DCTPC by:

- organising training in surveying, estimating works and contracts management, and
- technical and managerial advisory support during the implementation of survey and construction works, thus providing a transfer of technology and capacity building exercise as an integrated part of this project component.

A majority of the training can be carried by the Telecom and Communication Training Institute, TCTI, which already possess good knowledge and experience in the training required. Technical assistance should be organised through (i) a field engineer posted in each province, for the survey/design phase and for the majority of the construction period, providing both the contractors and the DCTPC with advisory support and on-the-job training, and (ii) a Contracts Management Engineer to support the overall management and quality assurance of the infrastructure component.

With the active involvement of the DCTPCs, there is no need for a supervision consultant for the road works. Equally, there is no demand for a design consultant for the detailed survey of the road works. The savings from not using consultants for these activities can therefore be used to strengthen the capacity of the DCTPCs, through training, added work experience, field allowances for their staff, purchase of office and other technical equipment, etc.

11 Costs

Rural roads of this type of design, constructed using labour-based works technology are known to cost approximately 10 to 15,000 US$ per kilometre[9], under similar terrain conditions and labour wages. Labour-based road works in both Lao PDR and Cambodia confirms these direct cost figures.

The exact cost of the works depends on a number of variables – the most significant being:

- quantities of work,
- labour wage rates,
- haulage costs of materials,
- availability of suitable building materials, and
- unit prices offered by the contractors.

In addition, road works entail a number of other indirect costs, such as design and supervision overheads, land acquisition, UXO clearing, etc. The following cost

[9] Includes cross-drainage structures such as drifts and culverts, however excludes construction of bridges.

calculations relate to the direct construction costs. The indirect costs are independent of the choice of technology.

Finally, it should be noted that the cost calculations for both alternative choices of technology are preliminary estimates and not based on any detailed surveys of the quantities. In the cost comparisons, the quantities of work are based on the assessment made by the PPTA consultant, and remain unchanged for both technologies.

To avoid any under-budgeting of the works, quantities of works are most probably on the high side. Equally, to safeguard against any market variations in terms of prices offered by the contractors, the unit rates applied are estimated on the high side.

The following table show a summary, comparing the direct costs using equipment-intensive or labour-based methods.

Direct Costs	Length	Equipment		Labour	
Road	km	US$	US$/km	US$	US$/km
Soukhoma - Mounlapamok	45.5	649,326	14,271	550,432	12,097
Champasack - Soukhoma	35.5	646,531	18,212	576,272	16,233
Champasack - Phonethong	25.4	689,984	27,165	574,252	22,608
Songkhone - Thapasoum	28.0	326,120	11,647	266,900	9,532
Champone - Xonboury	26.0	605,808	23,300	512,288	19,703
Grand Total	**160.4**	**2,917,768**	**18,191**	**2,480,143**	**15,462**
Cost savings				437,625	

As can be seen from the table above, the cost savings from using labour-based works technology are approximately US$ 430,000, which constitutes a 15 percent saving in the direct construction costs. Considering the small difference between the two alternatives, and since these are preliminary figures, and not based on a detailed survey of the works, a detailed survey will most probably have a higher impact on any future changes in these cost estimates.

What is more important in regards to choice of technology, is the fact that when using labour-based methods, roughly 30 percent of the direct costs will be covering labour wages. Obviously, this direct cash injection into the rural communities may have a significant impact on poverty eradication in the project area. As compared to using conventional equipment-based work methods, where the labour component is less than 5 percent, this is an important consideration in a rural development project.

Annex 1 Details of Cost Calculations

Songkhone - Thapasoum

Equipment-intensive Work Methods					Labour-based Methods		
Description	Unit	Quantity	Rate	Amount	Quantity	Rate	Amount
Scarifying old surface	m2	196,000	0.15	29,400	196,000	0.15	29,400
Reshaping road surface	m2	196,000	0.10	19,600	196,000	0.10	19,600
Embankment from Cut	m3			0	54,600	1.50	81,900
Embankment from Borrow	m3	54,600	2.20	120,120			0
Gravel Surface (laterite)	m3	42,000	3.50	147,000	42,000	3.00	126,000
Repair of culverts and bridges	LS			10,000			10,000
Total Direct Costs				**326,120**			**266,900**
Cost per Kilometre		28		**11,647**			**9,532**

Average embankment height 0.30 m

Champone to Xonboury

Equipment-intensive Work Methods					Labour-based Methods		
Description	Unit	Quantity	Rate	Amount	Quantity	Rate	Amount
FROM KM 0.0 TO 7.5 FLOOD PRONE SECTION							
Scarifying old surface	m2	48,750	0.15	7,313	48,750	0.15	7,313
Reshaping road surface	m2	48,750	0.10	4,875	48,750	0.10	4,875
Embankment from Borrow	m3	100,875	2.20	221,925	100,875	1.80	181,575
Gravel Surface (laterite)	m3	11,250	3.50	39,375	11,250	3.00	33,750
Side Drains	m3	2,400	0.50	1,200	2,400	0.50	1,200
Repair of culverts and bridges	LS			15,000			15,000
Removal of trees	LS			3,000			3,000
Approach embankment prot.	LS			15,000			15,000
Embankment protection	LS			25,000			25,000
Sub-total				332,688			286,713
FROM KM 7.5 TO 26 (18.5 KM)							
Scarifying old surface	m2	129,500	0.15	19,425	129,500	0.15	19,425
Reshaping road surface	m2	129,500	0.10	12,950	129,500	0.10	12,950
Embankment from Borrow	m3	48,100	2.20	105,820	48,100	1.50	72,150
Gravel Surface (laterite)	m3	27,750	3.50	97,125	27,750	3.00	83,250
Side Drains	m3	44,400	0.50	22,200	44,400	0.50	22,200
New culverts (800mm)	m	56	100	5,600	56	100	5,600
Repair of culverts and bridges	LS			10,000			10,000
Sub-total				273,120			225,575
Total Direct Costs				**605,808**			**512,288**
Cost per Kilometre		26		**23,300**			**19,703**

Average embankment height 1.50 m and 0.38 m

Champasack to Soukhouma

Equipment-intensive Work Methods					Labour-based Methods		
Description	Unit	Quantity	Rate	Amount	Quantity	Rate	Amount
FROM KM 0.0 TO 4.0							
Pothole patching	m2	2,400	2.70	6,480	2,400	2.70	6,480
Side drains	m3	9,600	0.50	4,800	9,600	0.50	4,800
New culverts 600mm	m	16	90.00	1,440	16	90.00	1,440
Resealing	m2	24,000	1.20	28,800	24,000	1.20	28,800
Sub-total				**41,520**			**41,520**
FROM KM 4.0 TO 9.5							
Scarifying old surface	m2	45,500	0.15	6,825	45,500	0.15	6,825
Reshaping road surface	m2	45,000	0.10	4,500	45,000	0.10	4,500
Embankment from Borrow	m3	21,000	2.20	46,200	21,000	1.80	37,800
Base course (laterite)	m3	8,938	3.50	31,281	8,938	3.00	26,814
Prime Coat	m2	33,000	0.40	13,200	33,000	0.40	13,200
First Sealing	m2	33,000	1.20	39,600	33,000	1.20	39,600
Second Sealing	m2	33,000	1.00	33,000	33,000	1.00	33,000
FROM KM 9.5 TO 10.5							
Pothole patching	m2	650	2.70	1,755	650	2.70	1,755
Side drains	m3	4,800	0.50	2,400	4,800	0.50	2,400
Repair of culverts and bridges	LS			5,000			5,000
Resealing	m2	6,000	1.20	7,200	6,000	1.20	7,200
Sub-total				**190,961**			**178,094**
FROM KM 10.5 TO 18 (Wat Phou Junction to Dontalat)							
Scarifying old surface	m2	67,500	0.15	10,125	67,500	0.15	10,125
Reshaping road surface	m2	67,500	0.10	6,750	67,500	0.10	6,750
Embankment from Borrow	m3	18,000	2.20	39,600	18,000	1.80	32,400
Gravel Surface (laterite)	m3	12,188	3.50	42,656	12,188	3.00	36,564
Repair of culverts and bridges	LS			5,000			5,000
Sub-total				**104,131**			**90,839**
FROM KM 18 TO 35.5 (Dontalat to Soukhouma)							
Scarifying old surface	m2	148,750	0.15	22,313	148,750	0.15	22,313
Reshaping road surface	m2	148,750	0.10	14,875	148,750	0.10	14,875
Embankment from Borrow	m3	63,000	2.20	138,600	63,000	1.50	94,500
Gravel Surface (laterite)	m3	28,438	3.50	99,531	28,438	3.00	99,531
New culverts 800mm	m	104	100.00	10,400	104	100.00	10,400
Side drains	m3	32,400	0.50	16,200	32,400	0.50	16,200
Repair of culverts and bridges	LS			8,000			8,000
Sub-total				**309,919**			**265,819**
TOTAL				**646,531**			**576,272**
Cost per Kilometre		35.5		**18,212**			**16,233**

Soukhouma to Mounlapamok

Equipment-intensive Work Methods					Labour-based Methods		
Description	Unit	Quantity	Rate	Amount	Quantity	Rate	Amount
Clearing and Grubbing	m2	707,273	0.12	84,873	707,273	0.12	84,873
Common Excavation	m3	79,465	1.20	95,358	79,465	1.20	95,358
Embankment from Cut	m3			0	97,462	1.50	146,193
Embankment from Borrow	m3	97,462	2.20	214,416			0
Gravel Surface	m3	61,340	3.50	214,690	61,340	3.00	184,020
Side Drains	m3	2,523	0.80	2,018	2,523	0.80	2,018
Concrete pipes 400 mm	m	35	50	1,750	35	50	1,750
Concrete pipes 600 mm	m	39	80	3,120	39	80	3,120
Concrete pipes 800 mm	m	127	100	12,700	127	100	12,700
Concrete pipes 1000 mm	m	128	120	15,360	128	120	15,360
Concrete pipes 1500 mm	m	28	180	5,040	28	180	5,040
Total Direct Costs				**649,326**			**550,432**
Cost per Kilometre		45.5		**14,271**			**12,097**

Average embankment height 0.32 m

Phonethong to Champasack

Equipment-intensive Work Methods					Labour-based Methods		
Description	Unit	Quantity	Rate	Amount	Quantity	Rate	Amount
Clearing and Grubbing	m2	42,868	0.12	5,144	42,868	0.12	5,144
Common Excavation	m3	77,936	1.20	93,523	77,936	1.20	93,523
Embankment from Cut	m3			0	108,819	1.50	163,229
Embankment from Borrow	m3	108,819	1.80	195,874			0
Rock Excavation	m3	15,587	7.50	116,903	15,587	5.70	88,846
Gravel Surface	m3	48,380	3.50	169,330	38,100	3.00	114,300
Concrete pipes 800 mm	m	30	100	3,000	30	100	3,000
Concrete pipes 1000 mm	m	390	120	46,800	390	120	46,800
Concrete pipes 1500 mm	m	20	180	3,600	20	180	3,600
RC Box Culvert 1.5x1.5	m3	46	120	5,520	46	120	5,520
RC Box Culvert 2.0x2.0	m3	72	120	8,640	72	120	8,640
RC Box Culvert 2.5x2.5	m3	158	120	18,960	158	120	18,960
Wing walls for pipe culverts	m3	43	110	4,730	43	110	4,730
Wing walls for box culverts	m3	36	110	3,960	36	110	3,960
Steel	t	28	500	14,000	28	500	14,000
Total Direct Costs				**689,984**			**574,252**
Cost per Kilometre		25.4		**27,165**			**22,608**

Average embankment height 0.60 m

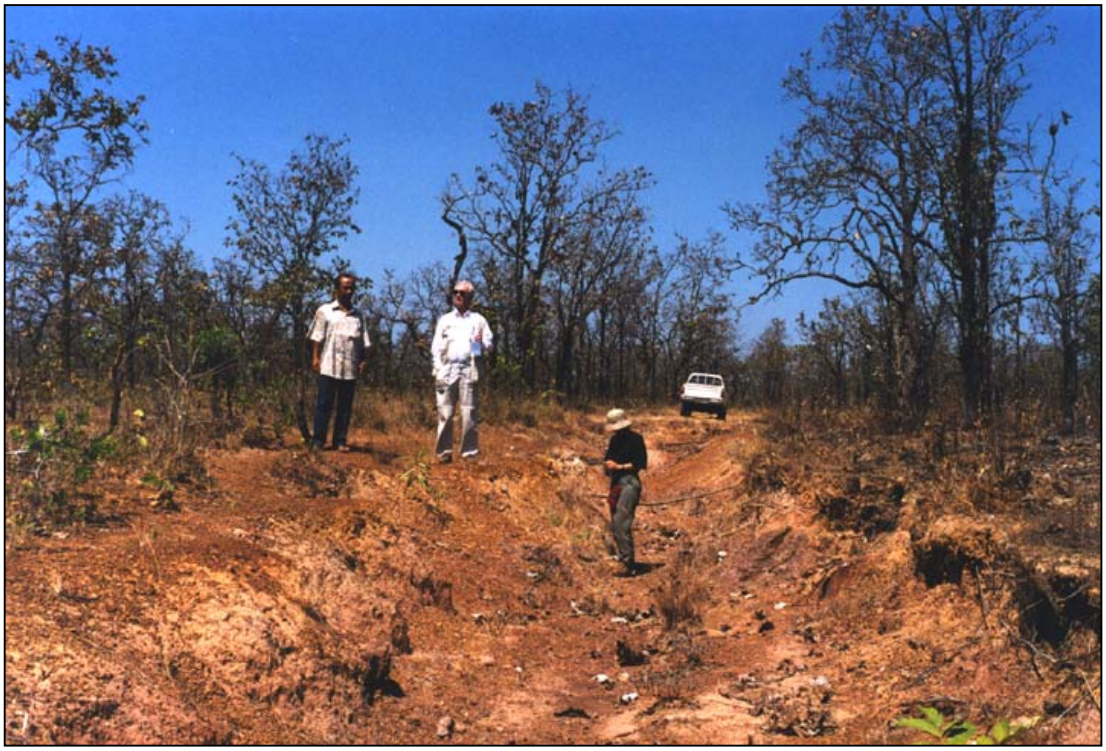
Annex 2 Field Visit

Start of the track from Soukhouma to Mounlapamok

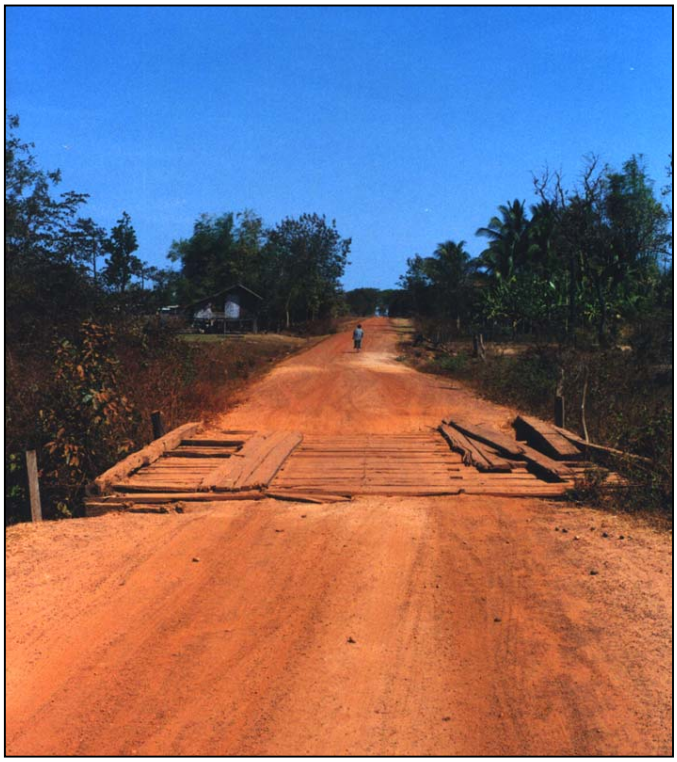
Middle section of the track from Soukhouma to Mounlapamok

Traffic on the Soukhouma to Mounlapamok track

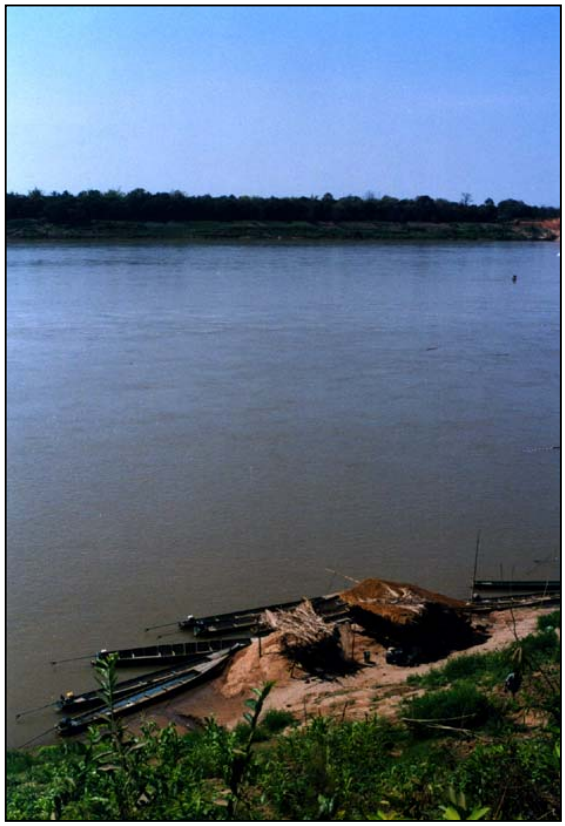
River crossing on the Soukhouma to Mounlapamok section

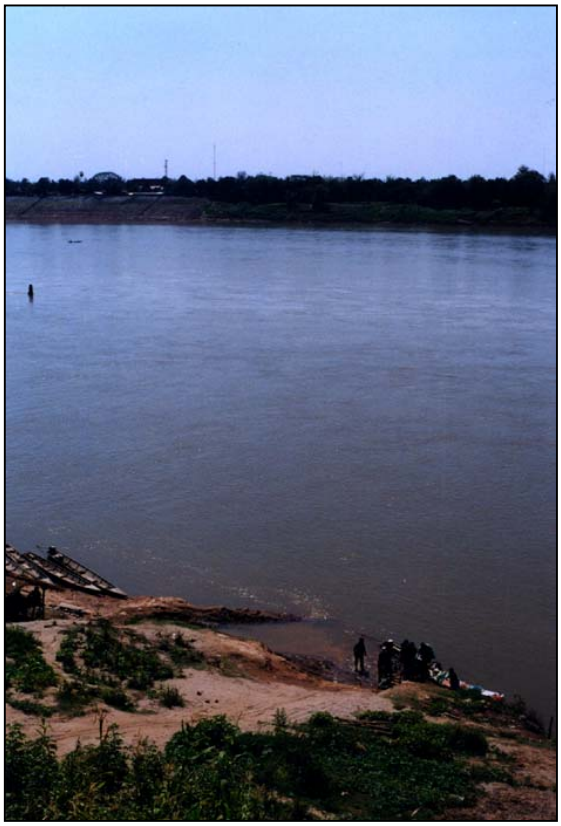


Laterite deposits along the Soukhouma to Mounlapamok track

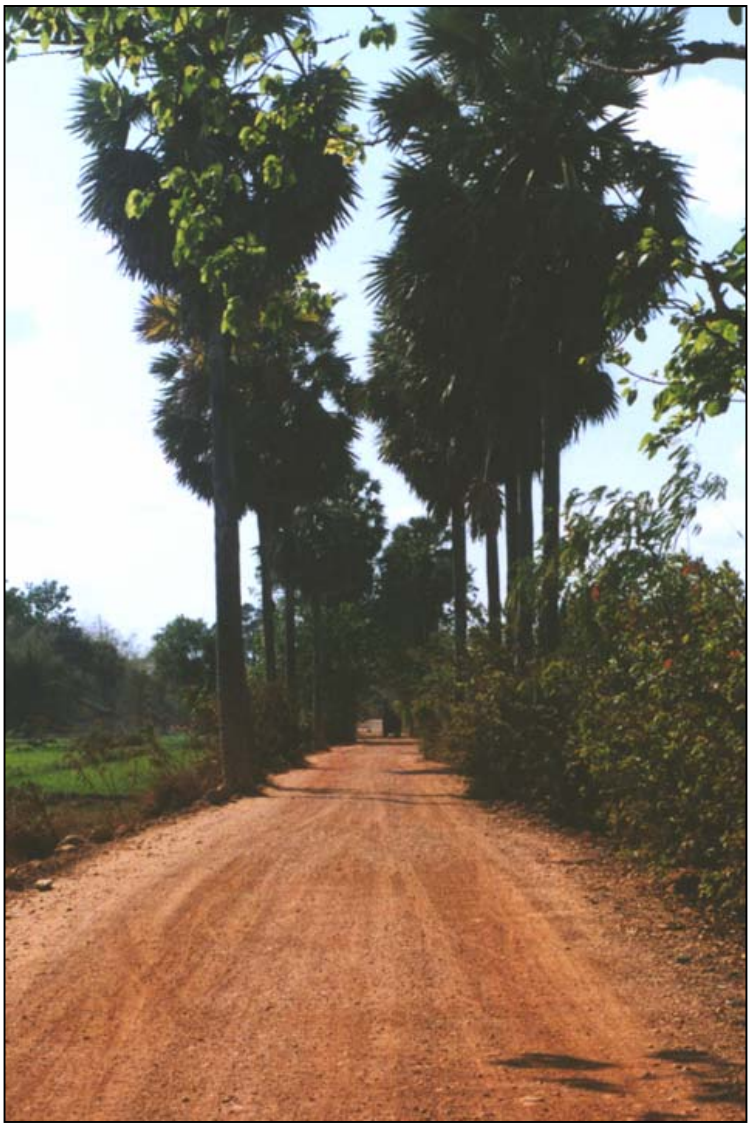


Songkhone to Thapasoum Road





Landing site for the cross border trade in Thapasoum



Beginning of the Champone to Xonboury Road