ENVIRONMENTAL GUIDELINES

GUIDELINES FOR REDUCING THE ENVIRONMENTAL EFFECTS OF ROAD PROJECTS IN LAO PEOPLE'S DEMOCRATIC REPUBLIC

(Issued by Prime Minister's Decree No: 05/PM dated 14/1/95)

Note: Copied from original January 1998
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1. INTRODUCTION

1.1 Background

These Guidelines were prepared to help The Ministry of Communication Transport Post and Construction for identifying and reducing potential environmental effects of road development in Lao PDR. Such as to provide basic and practical assistance for current application, as well as set out a framework which can be expanded in the future.

1.2 Scope and Purpose

The Guidelines comprise:

- Section 2 covering the environmental procedures to be followed, and.
- Section 3 describing the likely potential environmental effects and mitigation measures;
- Appendix 1 sets out in tabular form the potential adverse effects, and the recommended mitigation measures to reduce or eliminate them. It is the practical heart of the Guidelines and can be used as a stand-alone document or as a check-list.

Appendix 1 can be used to identify and reduce the environmental effects of all road development projects in Lao, however if the potential effects are major an individual environmental assessment (EA) should also be prepared for that project. Hence to identify projects which could cause more major effects a simple screening criteria is included in the procedures set out in Section 2. More extensive and detailed screening criteria and procedures may later be developed.

The basic purpose of the Guidelines is to assist in reducing any adverse environmental impacts caused by road construction projects in Lao. This purpose will only be achieved however if the Guidelines are used by all those planning, designing and supervising road maintenance, rehabilitation or construction projects.
2. ENVIRONMENTAL PROCEDURES

2.1 Screening

The simple screening process proposed is set out in the following flow diagram:

- **PROJECTS**
  - Category
    - No significant environmental effects
  - Category II
    - Some potential Environmental effects
    - Prepare an Initial Environmental Evaluation (IEE)
      - Some significant effects identified
        - Prepare a Project Environmental Assessment (EA)
          - Prepare an Environmental Action Plan (EAP)
            - Use Appendix I during design & implementation
The screening decision in the first box of the flow diagram places a project into one of two categories:

**Category I: Projects with no potentially significant environmental impact.** These are projects that only include improvement/rehabilitation of roads within an existing right-of-way and are not located within or affect "environmentally sensitive areas".

**Category II: Projects with potentially adverse environmental impacts.** These are projects that require substantial widening and acquisition of new right-of-way and in particular roads on a new alignment. Projects with a major change in the use of the road may be included, and all roads located within, or affecting, "environmentally sensitive areas".

"Environmentally sensitive areas" would include zones of significant human habitation (urbanized areas, residential concentrations, hospitals, schools, commercial and market complexes), ecologically important zones such as wetlands, forests or any area relatively unaltered by humans, archeological/historical/cultural sites, and terrain with slope greater than 50 percent - especially when soils are erodible and near surface waters.

For all Category II projects the flow chart shows that an Initial Environmental Evaluation (IEE) is carried out to determine if a full Environmental Assessment (EA) needs to be prepared for the project. The scope and contents of an IEE should be limited to the following:

- Brief description of the proposed project works.
- Description of the relevant components of the existing environment, particularly those components which caused the area to be classified as "environmentally sensitive".
- An assessment of the effects of the specific road works activity on the relevant component of the existing environment already identified and described.
- Suggested practical mitigation measures to address or lessen the specific potential effects identified.
- A short report on any public consultations carried out, including names and details of those consulted, any suggestions made, and how these were incorporated into the mitigation measures recommended.
- A simple recommendation, either that the specific mitigation measures be implemented, together with the applicable ones from Appendix 1, or that a full EA is required. The latter recommendation should be made when simple mitigation measures are insufficient and/or there are other major potential environmental effects which should be considered in more detail.

- The TOR for a full EA if it is recommended that one be prepared. The TOR should ensure that the EA concentrates on the important issues identified in the IEE.
As shown on the flow chart, Category II projects not requiring a full EA, and all projects placed in Category I, should have a simple Environmental Action Plan (EAP) prepared for them listing the particular mitigating measures to be taken to reduce potential Environmental effects and identifying those responsible for the measures. The measures in the EAP will be selected from those in Appendix 1.

Category II projects which do require a full EA should have a more comprehensive EAP prepared as part of the preparation of a comprehensive EA. All new road construction projects are included in Category II so the indirect environmental effects they can cause are not covered in Appendix 1.

Indirect environmental effects are secondary effects arising from the access the road provides. For example, constructing a new road into a presently forested area could provide access for people to enter and cut down trees or establish settlements. These effects should be investigated as part of an IEE, or preferably a full comprehensive EA, especially if the road passes through an "environmentally sensitive areas". If there is already vehicular access then indirect effects are considered negligible and only direct effects of the construction work itself are likely to affect the environment. With direct effects it is usually possible to reduce, if not eliminate, them by applying the mitigation measures set out in Appendix 1.

2.2 Institutional Aspects

The National Organisation for Science, Technology and Environment (STENO) under the Prime Minister’s Office is the central entity responsible for coordinating environmental matter with the line Ministries.

The use of these Guidelines was recommended by STENO through ref. 1290/STENO dated 20th November 1997.

The MCTPC adopted them for general use by letter ref. 017/MCTPC dated 5th January 1995.

Their use was approved by the Prime Minister’s letter 05/PM dated 14th January 1995.

A draft “National Environmental Action Plan” has been prepared by a working group funded by the World Bank.

2.3 Staffing

An Environmental Unit has been established as part of the Planning - Technical Division of the Department of Communication of MCTPC and is responsible for ensuring the environmental soundness of projects within the road sector.

The duties of this Unit include:

- ensuring that these Guidelines or donor specific environmental criteria are applied to all road projects controlled by MCTPC.
- ensuring that all projects are screened according to the flow chart in Section 2.1.
- ensuring that an IEE is prepared for any Category II project.
ensuring that a comprehensive EA is prepared if recommended in the IEE
ensuring an EAP is prepared for every project.
ensuring that all road projects comply with any environmental legislation as it is enacted.
increasing awareness of environmental aspects of road projects.
developing and expanding these Guidelines.

2.4 Technical Assistance

Technical assistances in particular for the Environmental Unit, P.T.D, could be of assistance developing these Guidelines, as well as, instituting broader environmental plans, policies and regulations.

The Term of Reference (TOR) for such expatriate technical assistance should include the responsibilities listed in 2.3, and in particular the expatriate consultant should be responsible for developing and expanding the Guidelines. Some input could also be required to assist in the development of broader environmental plans, policies and legislative acts.

3. ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

3.1. Introduction

Appendix 1 both identifies potential environmental effects and contains suggested mitigation measures for each adverse impact identified. It is therefore the most useful part of these Guidelines and is set out in simple tabular form so that it is easily read and referred to. Appendix 2 expands on some of the suggested mitigation measures and Appendix 3 contains some suggested contract clauses to put effect to the measures.
Essentially Appendix I is a 'Code of Sound Environmental Practice' which addresses practical environmental issues during the design and construction phases of road projects. The proposed screening process set out in Section 2.1 will ensure that broader issues, such as any indirect environmental effects of a new road project, will be dealt with in a comprehensive EA for that project.

3.2. Identification of Environmental Effects

The first step in reducing adverse environmental effects is to identify those components of a project, that is activities, which could potentially cause them. The aim of breaking down a project into its component activities is that it can then be assumed that the effect of each activity is the same, and the same mitigation measures can be applied, no matter which project the activity is part of. To ensure that this assumption is valid activities are classified as different if they take place in different existing environments, for example different terrains, where this could affect the impact the activity has.

Aspects of road planning and design, and road construction activities, which could potentially affect the environment, and for which potential effects have been identified and assessed, are listed in the first column in Appendix 1. These are mostly activities which could potentially cause a direct effect on the environment. The activities are listed under three phases, namely, the planning and design phases, the construction preparation phase including ancillary operations, and the construction phase of the road.

Following is an explanation or definition of each of the activities listed so far in Appendix 1 (activity numbers in brackets):

Setting Design Standards (1.1) - refers to decisions on standards such as carriage way and shoulder width, design speed, minimum curve radius, maximum grade, steepest cut and fill batter slope etc., which can all have a major influence on the direct effects that a project has on the environment. For any new roads, the project-specific EA which is prepared should address the effects of alternative design standards in more detail than included in these Guidelines.

Design - General (1.2) - covers a number of aspects of the design process which can potentially affect the environmental impact that the road has.

Design - Drainage (1.3) - identifies a number of potentially adverse environmental effects which can result from the design of the drainage system. This includes both culverts and irrigation ditches as well as the road pavement drainage system such as side ditches.

Acquiring Land (1.4) – refers to the process of obtaining land for road widening, or for constructing a new road. The potential effects impact on the social/cultural components of the environment rather than the physical ones. For any new roads the project-specific EA which is prepared should address this issue in more detail.

Relocating People (1.5) - refers to the process, separate from any formal acquiring of land, of moving people off land required for road widening, or for constructing a new road. Those required to be relocated may not have any formal right to the land but the potential social/cultural effects can be just as great. For any new roads the project-specific EA which is prepared should address this issue in more detail.
Mobilising Equipment (2.1) - include the delivery of materials, plant and equipment to the site before the work commences. It often involves the use of heavy transport vehicles which can cause air and noise pollution.

Mobilising Workforce (2.2) - refers to the introduction of a workforce from outside the local area which can be culturally or even ethnically different from the local population. This can cause social problems between the outsiders and the local people, as well as having an impact on the health and long-term economic well-being of the local community.

Establishment and Operation of a Labour Camp (2.3) - refers to the camp established to house the workforce which could result in the pollution of watercourses and in a depletion of local resources such as timber which the local people may have been using on a sustainable basis.

Establishment and Operation of Base Camp and Workshops (2.4) - refers to the depot or base where construction machinery is kept and serviced, fuels and oils are stored, and stockpiles of materials are kept. Frequently the site office is also located there and sometimes the base camp is combined with the labour camp although the activities and their effects on the environment are different and should be assessed separately.

Setting Up and Operation of an Asphalt Plant or Asphalt Preparation Area (2.5) - is an activity which could involve setting up and operating a major mechanical asphaltic concrete production plant, including conveyors, oil fired rotary aggregate dryers/heaters and batch mixers. On the other hand it may just involve heating aggregate and bitumen over open wood fires and hand mixing.

Setting Up and Operating a Quarry or Borrow Pit (2.6) - usually involves a mechanical digger removing suitable material from a selected site, sometimes for stable fill but usually to produce sub-base or basecourse which will usually involve the use of explosives to first break up the rock.

Setting Up and Operating a Quarry Wining Rock from River or Stream Beds (2.7) - usually involves a mechanical digger of some sort removing rocks of a suitable size for crushing from the river bed and loading them onto trucks, although sometimes the rocks are selected and loaded by hand.

Setting Up and Operating a Rock Crushing Plant (2.8) - is sometimes done as part of the quarry operation or sometimes as part of the asphalt production plant, although it is a separate activity which has separate potential effects on the environment. Usually the operation is carried out using large and noisy mechanical crushers although sometimes it is done by hand if labour is cheap and time is not critical.

Earthworks Involved in Widening in Flat Terrain (3.1) - This activity would usually involve only minor cut and fill operations but could involve removing significant roadside vegetation.
Earthworks Involved in Widening in Steep Terrain or through Unstable Land (3.2) This activity would usually involve cut and fill operations depending on the shape and width of the existing formation. Cutting back batters could involve removing significant roadside vegetation which may have become established on the existing batters.

Earthworks Involved in Widening through Settlements (3.3) - This could affect buildings, even if the widening takes place within the road reserve, because they have often been constructed closer to the road than they should have been. Similarly footpaths, tracks or public utility lines could be affected.

Drainage Improvement Works (3.4) - includes the construction of all drainage works which is mainly ditches beside the road but also includes culverts and any other pipes or structures required to channel or control stormwater flow.

Pavement Base Construction or Gravel Surfacing (3.5) - These two activities are identical and involve the placing and rolling of the gravel pavement layers, Sometimes using vibrating rollers.

Bituminous Surfacing (3.6) - is the placing and compaction of any of the various bitumen sealing or rescaling surfaces such as, for example, single bituminous surface treatment (SBST), double bituminous surface treatment (DBST) or asphaltic concrete.

Transport of Project Materials (3.7) - includes the transport of earth, rock, gravel (crushed rock), bitumen, asphaltic concrete and any other material used, or the transport of any equipment or machinery used, during the construction.

The potential effects of each of these activities are assessed in a qualitative fashion in the second column in Appendix 1.

At this stage only a limited number of the most important activities and their potential impacts have been included in Appendix 1. They were selected from a large number of potential impacts identified in a number of references (References 3 to 9). This selection was partly done to keep the Guidelines simple at this stage, which will make it more likely that they will be used. As familiarity with the concepts increases within the MCTPC the Guidelines can be expanded as explained in Sections 2.3 and 2.4.

Note that only the effects of road works activities on the environment are identified, not the effects of the environment on the road. Examples of the latter are major landslides, caused by land clearing or cultivation, or scour, caused by flooding or meandering rivers, which damage a road or bridge. Designing roads to withstand these effects of the environment is a road engineering problem.

3.3 Environmental Mitigation Measures

The third column in Appendix 1 contains suggested mitigation measures for each potentially negative environmental impact of an activity identified. The mitigation measures should be applied to any project which includes the particular activity. Many of the mitigating measures are simply sound engineering practice, which may already be regularly applied to works under the control of the MCTPC, but it is hoped that Appendix 1 will be a useful checklist. The difficulty with road projects is to ensure that the mitigation measures developed are
actually applied in practice. It has been found that the best way to ensure this is to integrate the measures, as far as possible, into design and construction processes and procedures.

The measures set out in the first section under 'Planning, Design & Land Acquisition' should all be considered and implemented during the planning and design process and every designer should ensure that they are conversant with all the potential effects. The measures for activities 1.4 'Acquiring Land' and 1.5 'Relocating People' are also for project administrators to implement.

The relevant mitigating measures in the second and third sections, 'Construction Preparation' and 'Construction', should all be included in the contract documents to ensure they are carried out. Many of the mitigating measures should also have an item included in the bill of quantities for the contract if it is a unit price contract. An identified extra payment will ensure that the contractor actually carried out the work, will ensure there is money budgeted for it and will clearly identify any extra costs associated with environmental measures.

All potential effects and mitigating measures should also be included in any training courses, or general guidelines, prepared for those supervising contracts.

Appendix 2 contains more detailed suggestions and advice for both road designers and those supervising road construction contracts on environmentally sound design and construction practices. It basically expand on the suggested mitigation measures outlined in the last column of Appendix 1 and, where applicable, the clause numbers refer to the relevant activity numbers in Appendix 1.

There are some measured which are more general and are more to do with increasing general environmental awareness, including that of local people who can have a substantial effect on some of the mitigation measures. These measures can be covered in training courses on the environmental aspects of road projects but have not so far been included in either Appendix 1 or 2.

There are some suggested contract clauses in Appendix 3 which could be used in contract documents to ensure that certain mitigation measures are carried out by the contractor. These clauses should be used with caution, and may need to be reworded for specific contracts, to ensure that they do not contradict other parts of the contract documents and fit neatly into the style and format.

Monitoring is required to ensure that the mitigation measures contained in the last column in Appendix 1, and especially those incorporated into clauses in contract documents, are actually carried out and are effective. By including clauses into a contract document, and specific items into the bill of quantities forming part of a contract, monitoring and supervision of the application of these measures is automatically included in the normal engineering supervision of the contract.
Those responsible for supervising road construction contracts should be made aware of the importance of environmental mitigation clauses in contracts as part of their normal training. They should also be made aware of the extra responsibilities of supervisors to liaise directly with local people, so that they can monitor the effects of the work on them and immediately instruct the contractor to introduce measures to reduce any adverse effects. This is clearly spelt out for some of the measures in the last column in Appendix 1.

Should those supervising a contract detect any previously unexpected environmental problems, there should be provisions in the contract to allow them to instruct the contractor to take immediate action to remedy the situation. Suggested draft wording of an appropriate clause to include in contract documents is also included in Appendix 3.

Reference


APPENDIX 1

ENVIRONMENTAL EFFECTS and MITIGATION MEASURES

For Road Projects in Lao PDR measures

Further details of mitigation measures are included in Appendix 2
Some suggested clauses for contract document are appendix 3.

<table>
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<th>ACTIVITY</th>
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<th>MITIGATION MEASURES</th>
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<tbody>
<tr>
<td>1. Planning, Design &amp; land Acquisition</td>
<td>1.1 Setting Design Standards</td>
<td>If standards are too high excessive earthworks can cause other effects. (See activities under &quot;3. Construction&quot;)</td>
</tr>
<tr>
<td>1.2 Design-General</td>
<td>Land requirements affect local people.</td>
<td>Minimise land acquisition and resettlement in selecting alignment.</td>
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<td></td>
<td>Existing buildings, possibly illegally constructed within the road reserve, could be affected.</td>
<td>Attempt to negotiate a fair design or compensation solution which does not cause undue hardship but also does not encourage others to build within the road reserve.</td>
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<td></td>
<td>Roads and embankments can cause severance and social disruption.</td>
<td>Include appropriate number of bridges and culverts in the design to minimise inconvenience to local people.</td>
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<td>Road widening can affect existing lines of roadside tress.</td>
<td>Widen one side only to retain trees on at least one side.</td>
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<td>Roads can have impacts on wildlife, virgin forest areas, cultural relics etc.</td>
<td>Avoid such areas as much as possible in the design.</td>
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<td>Roads can cause noise and air pollution.</td>
<td>Integrate into the design, where appropriate sound barriers, forest belts etc.</td>
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<td>ACTIVITY</td>
<td>POTENTIAL EFFECTS</td>
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<td>1.2 Design-General (continued)</td>
<td>Roads can cause an increase in traffic speeds and accidents affecting road users, local people and animals.</td>
<td>Ensure a safe design including speed restriction and warning signs, footpaths, safe crossings and fences to control livestock as necessary and where possible. Discuss possible designs with local people.</td>
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<td>Traffic on roads can increase pollution of adjacent surface water bodies.</td>
<td>Plant or preserve a vegetative buffer zone between the road and a surface water body.</td>
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<td>Traffic can cause dust pollution on gravel roads especially through settlements.</td>
<td>Incorporate sections of bituminous surfacing through settlements for gravel road designs.</td>
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<tr>
<td>1.3 Design - Drainage</td>
<td>Can alter hydrological regimes and affect flooding and existing irrigation systems.</td>
<td>Ensure culverts, and road drainage are adequately designed to minimise effects.</td>
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<td>Can cause negative impacts of concentrating water and increasing scour and soil erosion.</td>
<td>Ensure design improves the drainage system by rectifying any existing problems, such as scour of adjacent lands, which should be checked for during the monsoons. Include tree/turf planting in design where possible.</td>
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<td>Can affect washing/drinking water supplied. Local people sometimes interfere with drainage systems because of this, which can result in damage to the road.</td>
<td>Incorporate washing/drinking water needs into the design. Discuss with local people.</td>
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<td>Drainage from service areas can cause water pollution.</td>
<td>Install adequate waste water treatment facilities at service areas.</td>
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### Activity

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<tr>
<td>1.4</td>
<td>Acquiring land</td>
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<td>1.5</td>
<td>Relocating People</td>
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<tr>
<td>2.1</td>
<td>Mobilising Equipment</td>
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<td>2.2</td>
<td>Mobilising Workforce</td>
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<td>2.3</td>
<td>Establishment and Operation of Labour Camp</td>
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### Potential Effects

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<tr>
<td>Can cause dissatisfaction and opposition from landowners and users.</td>
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<td>Can cause dissatisfaction and opposition from people relocated.</td>
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<tr>
<td>Air and noise pollution for any nearby settlements.</td>
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<tr>
<td>The introduction of an outside workforce can have a negative impact on the health and social well-being of local people.</td>
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<td>Possible pollution caused by domestic sewage and solid wastes.</td>
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<td>Possible excessive or uncontrolled use of fuelwood in labour camp.</td>
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<td>Possible development of labour camp into a permanent settlement.</td>
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<td>Possible poaching of local game by outside contractors. Insist contractor removes the labour camp.</td>
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### Mitigation Measures

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<tr>
<td>Discuss with those affected at all stages. Pay reasonable compensation for impact on properties and/or disruption of incomes.</td>
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<tr>
<td>Discuss with those affected at all stages and provide suitable new resettlement locations with adequate infrastructure. In consultation with affected people design compensation and resettlement policies (both land and non-land based) aimed at restoring incomes to levels existing before resettlement.</td>
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<td>Control contractors' vehicle speeds and noise.</td>
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<td>Insist that contractor employ local people where possible.</td>
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<td>Insist that the contractor installs and maintains a septic tank system, and a system for disposing of solid wastes.</td>
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<td>Insist the contractor supplies alternative fuel for cooking and heating in the labour camp.</td>
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<td>Insist contractor removes the labour camp. At the completion of the contract.</td>
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<td>Prohibit poaching and make contractor responsible for his workers.</td>
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<tr>
<td>2.4 Establishment and Operation of Base Camp and Workshop.</td>
<td>Air and noise pollution for any nearby settlements. Possible ground and water contamination by oil, grease, and fuel in yards.</td>
<td>Locate basecamp and workshop away from any residential settlements. Collect and recycle lubricants. Avoid spills and have a ditch around the area with a settling pond/oil trap at the outlet.</td>
</tr>
<tr>
<td>2.5 Setting Up and Operation of an Asphalt Plant or Asphalt Preparation area.</td>
<td>Air and noise pollution for any nearby settlements. Possible ground and water contamination by bitumen or solvents. Cutting down trees to use as fuelwood for heating bitumen and stones.</td>
<td>Locate asphalt away from any residential settlements. Avoid spills but surround area with a ditch with a settling pond/oil trap at the outlet. Insist that the contractor not use fuelwood for heating during the processing of any materials.</td>
</tr>
<tr>
<td>2.6 Setting Up and Operating a Quarry or Borrow Pit.</td>
<td>Noise, vibration and dust from blasting could affect any nearby settlements or other sensitive areas.</td>
<td>Locate plant away from any residential or other environmentally sensitive areas such as hospitals, intensive livestock production areas or wildlife breeding areas. Also avoid farmlands or forests as much as possible. Restrict work to daylight hours and limit the size and frequency of any blasting.</td>
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<tr>
<td>2.6</td>
<td>Setting Up and Operating a Quarry or Borrow Pit</td>
<td>Accidents from blasting.</td>
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<td>(continued)</td>
<td>An abandoned quarry or borrow pit can be a dangerous area for children and result in stagnant water breeding mosquitoes.</td>
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<td>Removing material and disturbing the river flow can cause sediment for downstream users and can also undermine or damage the river banks.</td>
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<td>Changing the river bed could affect local fishing areas.</td>
</tr>
<tr>
<td>2.7</td>
<td>Setting Up and Operating a Quarry Winning Rock from River or Stream Beds.</td>
<td>Air and noise pollution for any nearby settlements and dust on local crops and vegetation and in watercourses.</td>
</tr>
<tr>
<td>2.8</td>
<td>Setting Up and Operation a Rock Crushing Plant.</td>
<td>Erosion from earthworks can increase sedimentation in drains, waterways and irrigation ditches.</td>
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<tr>
<td>3.1</td>
<td>Earthworks Involved in Widening in Flat Terrain.</td>
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<tr>
<td>3.2 Earthworks Involved in Widening in Steep Terrain, Or through Unstable Land.</td>
<td>Can cause slips or landslides, and erosion from earthworks can increase sedimentation in drains, waterways and irrigation ditches.</td>
<td>Limit earthworks to the dry season as much as possible. Construct walls and protect exposed earthworks with mulch, fabric and plant cover.</td>
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<td>Spoil disposal by simply side tipping is unsightly and can concentrate runoff and cause erosion.</td>
<td>Insist contractor disposes of spoil to designated stable tipping areas.</td>
</tr>
<tr>
<td>3.3 Earthworks Involved in Widening in through Settlements.</td>
<td>Existing property frontages, footpaths, tracks or public utility lines could be disturbed.</td>
<td>Reduce effects of widening through settlements by covering over drains to enable the area to be used by pedestrians and/or for parking.</td>
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<tr>
<td></td>
<td>Possible noise and vibration, especially if earthworks involve blasting, could affect nearby settlements or other sensitive areas.</td>
<td>Restrict work to daylight hours and limit the size and frequency of any blasting near settlements (especially hospitals) and near intensive livestock production and wildlife breeding areas.</td>
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<td></td>
<td>Historical remains or cultural items could be uncovered.</td>
<td>Contractor to ensure all such finds are reported and discussed with representatives of the local people.</td>
</tr>
<tr>
<td>3.4 Drainage Improvement Works.</td>
<td>Spoil disposal from drain excavation by simple side tipping is unsightly and can concentrate runoff and cause erosion.</td>
<td>Insist contractor disposes of spoil to designated stable tipping areas.</td>
</tr>
<tr>
<td></td>
<td>Works can have temporary affects on irrigation or washing/drinking water supplies.</td>
<td>Ensure contractor takes into account local water uses. Temporary drainage may have to be constructed.</td>
</tr>
</tbody>
</table>
### APPENDIX 1 (continued)

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>POTENTIAL EFFECTS</th>
<th>MITIGATION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 Pavement Base Construction or Gravel Surfacing.</td>
<td>Dust noise and vibrations.</td>
<td>Include and allowance for watering in the contract and control contractors equipment noise and vibrations especially close to settlements.</td>
</tr>
<tr>
<td></td>
<td>Effect on traffic and pedestrian safety.</td>
<td>Provide an allowance for, and insist the contractor uses, safe traffic control as necessary and causes the minimum possible disruption to all traffic.</td>
</tr>
<tr>
<td>3.6 Bituminous Surfacing.</td>
<td>Possible pollution of waterways or groundwater by bituminous products or solvates.</td>
<td>Strict control to avoid spills or clean up immediately after and prohibit work in rain.</td>
</tr>
<tr>
<td>3.7 Transport of Project Materials.</td>
<td>Air and noise pollution for any nearby settlements and damage to existing roads.</td>
<td>Control contractors vehicle speeds, noise and weight of loads and control dust and flying debris by covering loads or wetting material if necessary. Construct temporary roads if necessary. Use locally available construction material wherever possible to minimise transport distances.</td>
</tr>
</tbody>
</table>
SOME SUGGESTED DETAILS FOR ENVIRONMENTAL MITIGATION MEASURES

For Road Projects in Lao PDR

(Clause numbers refer to activity number in Appendix 1)

(1.1) Geometric design standard for roads should be prepared for present conditions in Lao PDR. As an example simple Desirable Minimum Standards for Local or Provincial roads with less than 100 vehicles per day, for three different terrains, could be:

<table>
<thead>
<tr>
<th>Flat to Rolling</th>
<th>Hilly</th>
<th>Mountainous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surfacing</td>
<td>Gravel</td>
<td>Gravel</td>
</tr>
<tr>
<td>Pavement Width (m)</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Pavement + Shoulder (m)</td>
<td>7.5</td>
<td>6.0</td>
</tr>
<tr>
<td>Design Speed (kph)</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Max. Gradient(%)</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

It may be considered that the above standards are too low for Provincial roads and higher standards could be set for them. However care should be taken not to set the standards too high, not only to avoid environmental effects, but also because it may make road projects designed to those standard economically not viable. Similar tables to that above could be prepared for each different class of road and for different ranged of traffic volumes.

(1.1) Typical cross section standards should also not be set at too high. It is suggested that in most situations a cut slope of 1:1/2 (Vertical to horizontal) is adequate, with provisions for flattening the batter, if instructed by the Engineer, in areas where soils are soft. Adequate maintenance funds should also be available in the first few years after construction to allow for removing from the road any material that may slip down. If the height of the cut is more than 5 metres then a 1 metre wide bench should be constructed at every 5 metres height interval. This bench should slope back towards the batter slope to allow water to run off along the bench parallel with the road alignment, and discharge into the roadside drain. Cut off drains may also be required in adjacent high ground above the cut to minimise water running down, and erosion of, the slope.
Traffic signs are an important safety and directional feature of roads and should be shown on the design drawings for any road rehabilitation or construction project. Similarly other safety measures such as guard-rails should be considered at particularly dangerous locations. Through settlements, or other areas where there are significant numbers of pedestrians, paths for them to walk safely should be included in the design or simply formed during construction when natural walking routes can often be observed.

One of the main aims in the design of the road drainage system is to ensure that storm runoff is not concentrated to such an extent that it causes erosion. This means that on sideling cuts sufficient cross road drains, or culverts, should be provided and the outlets designed to reduce the water velocity and prevent erosion. Usually in steep country a pipe, or open lined outlet drain, will be required all the way to a natural stream. Longitudinal roadside drains should be either lined, or have energy dissipaters or check dams to slow down the water, to prevent erosion where the slope of the drain is greater than 5%. Where the slope is greater than 10% the drain should always be lined.

It is important that consultations are carried out, at all stages of any road project, with the local people affected by the project. These consultations should first take place at the initial planning stage of the project, before the design is finalised, as the information obtained could result in changed or improvements to the design, or even the alignment. Consultations should be conducted by someone within MCTPC who can authorise changes. They can take the form of public meetings at say village level. Meeting only with village chiefs are usually not sufficient to cover all the issues, or bring out all the concerns of local people. Because many people cannot foresee effects further consultations, after construction has started, should also be carried out.

Quarries or borrow pits should preferably be part of the initial design of a road so that the locations can be selected to avoid environmentally sensitive areas, or areas where runoff and erosion cannot be controlled. Environmental damage can be minimised if the design, size, and method of operation of quarried to be used are specified in the contract documents. If, on the other hand, the contractor selects the site, then the supervising Engineer must ensure that it can be operated without any undue adverse effects on the environment, and may need to put conditions or restrictions on its use before giving his approval for that site. Consideration should be given to the depth, and the steepness of the side slopes, which will be allowed, remembering the need to leave the area drained and stable on completion of the contract. If the onus is put on the contractor he may be able to organise his operation in such a way that the area can be used as a spoil disposal area to restore it back to a safe and stable condition. The suggested contract clause in Appendix 3 includes a provision for prior approval in writing by the Engineer for any quarry or borrow pit.
When storing, handling and preparing asphalt mixes it is very important for the Engineer to ensure that the contractor takes the following necessary precaution:

Stockpile sites for drums are to be reasonably level and kept clear of undergrowth and rubbish.

- Drums containing cleaning oil should be stacked on end with the filling hole upwards and tilted (by resting one side on a piece of timber) to prevent water accumulating on the top of the drum.

- Drums containing kerosine, fuel oil, and cut-back bitumen should be stacked on their sides with the filling hole upwards. The bungs should be tested for tightness when stacking, and at regular intervals during storage.

- Drums of bitumen emulsion may be stacked on end or on their sides, but if stored for any length of time the drums should be rolled regularly.

- When filling a bitumen distributor tank or kettle with bitumen, in preparation for heating, it is essential to check and ensure that there is no water in the tank prior to loading, as this will cause a violent expansion of the bitumen with consequent frothing and boiling over.

- During the blending of bitumen with kerosine (diluent) for the manufacture of cut-back bitumen, the temperature will rise above the flash point of the diluent. (Kerosine has a flash point of 140°F.) No naked flames or smoking should be allowed in the vicinity of the blending tank, and the temperature of the bitumen to be cut back should be kept as low as possible.

- When fighting a fire in a bitumen tank water should not be used. The contractor should provide and maintain on site a carbon dioxide (CO₂) extinguisher for fire fighting purposes.

Because soil conditions in Lao are very variable it is a sensible precaution in any road design to include designs for some standard and simple retaining wall structures, such as crib walls, and put an allowance for a certain area of these in the Bill of Quantities. This means that if problems are encountered with steep and unstable slopes during construction then the supervising Engineer can simply call for a wall to be built at that location. Similarly for any earthworks batters which do not require a wall, but could be subject to surface erosion, the engineer should be able to order the exposed earthworks to be protected by mulch, fabric and plant cover, and a certain area of this should also be allowed for in most contracts. This is particularly important if the surface erosion is also likely to cause sedimentation in local watercourses.
In steep, forested country it is often preferable to use a backhoe rather than a bulldozer or traxcavator to do the basic earthworks. A backhoe can excavate and remove material, and load it into trucks, without the excessive side spill which often occurs, especially with bulldozers.

The supervising Engineer should designate the areas where spoil is disposed of, especially in steep country. The area should first be roughly levelled or benched to prevent future slipping. Where possible spoil disposal areas should not be located uphill of rivers, or lakes, or near populated areas, but if they are then drains should be dug around the disposal area, and silt traps, using settling ponds and local brush, constructed at the outlets of these drains. Note that a general suggested contract clause in appendix 3 requires the contractor to locate and control disposal areas as directed by the engineer, and includes a separate item in the Bill of Quantities for this. It may be advantageous in difficult terrain to actually locate and design the spoil disposal area from the start, and include the details in the contract to ensure that the contractor allows for it in his price.

Often local people use roadside drainage ditches as part of their irrigating system, or they may have constructed small dams in these ditches to pond the water for use as the local village water supply for washing or bathing. These uses should be noted during the initial planning of the project and discussed during consultations with the local people. Wherever possible these uses should be catered for in the design of the project. If not allowed for then local people may in future re-establish these uses themselves, but damage the road, or the drainage system, in the process.
APPENDIX 3

SAMPLE ENVIRONMENTAL CLAUSES FOR CONTRACT DOCUMENTS

For Road projects in Lao PDR

(Clause numbers refer to activity numbers in Appendix 1)

General

( ) Notwithstanding other obligations, if, in the opinion of the Engineer, damage is being done to the environment by the Works under construction the Engineer may instruct the Contractor to cease work immediately, or change the approach or method of work. (See Sample Bidding Documents, Word Bank, Dec. 1991, Part II 2.1)

( ) The Provisional sum, Item__ in the Bill of Quantities, is for any work deemed to be required by the Engineer to remedy any unexpected environmental problems, or potential environmental problems, which may arise as a result of the Works. The Engineer may instruct either the Contractor, or a nominated Subcontractor, to carry out the work.

( ) The Contractor shall ensure that full consideration is given to the control of environmental aspects, and that all provisions of the design and specification requirements relating to pollution of the environment, and protection of adjacent land and waterways, are complied with.

(2.1) Mobilisation of heavy equipment to and from the site shall be carried out at time of lowest traffic on the routes used.

(2.1, 3.7) The Contractor shall use selected routes, as advised by the Engineer, and appropriately sized vehicles suitable to the class of road, and shall restrict loads to prevent damage to roads and bridges used for transportation purposes to the project site. The Contractor shall be held responsible for any damage caused to the roads and bridges due to the transportation of excessive loads, and shall be required to make good such damage to the approval of the engineer.

(2.1, 3.7) The Contractor shall not use any vehicles, either on or off road, whose exhaust or noise emissions are grossly excessive, and in any built up areas noise mufflers shall be installed and maintained in good condition on all motorised equipment under the control of the Contractor.

(3.3, 3.5) The Contractor shall limit construction works to between 6am and 10pm if it is to be carried out in or near residential areas.

(3.5, 3.7) The contractor shall also avoid the use of heavy or noisy equipment in specified areas late at night, or in sensitive areas such as near a hospital.

APPENDIX 3 (continued)
(3.5, 3.7) To prevent dust pollution during dry periods the Contractor shall carry out regular watering of earth and gravel haul roads and shall cover soil haulage trucks with tarpaulins if the soil is dry.

(3.5) Adequate traffic control measures shall be maintained by the Contractor throughout the duration of the Contract, and prior to any restriction being applied to two way traffic movement written permission must be obtained from the Engineer for the proposed traffic control measures to be used and for the length of time the restriction is proposed to be in place.

(2.2) The Contractor shall recruit locally as large a proportion of the workforce as is possible, and shall provide appropriate training where necessary.

(2.3) The Contractor shall install and maintain a temporary septic tank system for any residential labour camp established and ensure that this does not cause any pollution of nearby watercourses. The contractor shall also make the system inoperative and safe on completion of the contract and the removal of the camp.

(2.3) The Contractor shall establish a method and system for storing and disposing of all solid wastes generated by the labour camp and/or the base camp.

(2.3) The Contractor shall not allow the use of fuelwood for heating or cooking in any labour or base camp but shall provide alternate facilities using other fuels.

(2.4, 2.5) The Contractor shall ensure that site offices, depots, asphalt plants and workshops are located in appropriate areas, as approved by the Engineer, and not within 500 metres of existing residential settlements, and asphalt plants not within 1000 metres.

(2.4, 2.5) The Contractor shall also ensure that site offices, depots and particularly storage areas for diesel fuel and bitumen, and asphalt plants, are not located within 500 metres of watercourses, and are operated so that no pollutants enter watercourses, either overland or through groundwater seepage, especially during periods of heavy rain. This will require lubricants to be recycled and a ditch to be constructed around the area with an approved settling pond/oil trap at the outlet.

(2.5) The contractor shall not use fuelwood as a means of heating during the processing or preparation of any materials forming part of the Works.
Quarries or Borrow Pits

(2.6) Approval to open a new borrow area, on land or in river, or to operate an existing area, shall be obtained from the Engineer in writing before any borrow operation is commenced, and the operation shall cease immediately and permanently at any location when instructed to by the Engineer. Pits shall be prohibited, or have restrictions applied to their operation, where they might interfere with the natural or designed drainage. River locations shall be prohibited where they might undermine or damage the river banks or cause too much fine material to be carried downstream.

(2.6) The Contractor shall ensure that all borrow pits used are left in a trim and tidy condition with stable sides and slopes, and drained so that no stagnant water bodies are created which could breed mosquitos.

(2.7) Rock or gravel won from a river shall be removed over some distance so as to limit the depth of material removed to one tenth of the width of river at any one location, and not disrupt the river flow or damage or undermine the river banks.

(2.8) The contractor shall ensure that rock crushing plants are located as approve by the Engineer, and not close to environmentally sensitive areas, or within one kilometre of existing residential settlements, and operated with approved dust control devices fitted.

Earthworks-General

(3.1, 3.2) The Contractor shall not carry out any earthworks during the rainy season unless specific permission is obtained in writing from the Engineer or his representative for properly controlled earthworks at specific locations.

(3.1, 3.2) The Contractor shall maintain stable cut and fill slopes at all times and shall cause the minimum possible disturbance to areas outside the prescribed limits of the work.

(3.1, 3.2) The Contractor shall complete cut and fill operations to final cross-sections at any one location as soon as possible and preferably in one continuous operation and not leave partly completed earthworks, especially during the rainy season.

(3.1, 3.2) The Contractor shall ensure that any cut or fill slopes are planted in grass or other plant cover as soon as possible to protect them from erosion.

(3.1, 3.2) To prevent erosion cut off drains and toe-drains shall be provided at the top and bottom of slopes as shown on the drawings or as directed by the Engineer.
Earthworks - Disposal of Surplus Material

(3.2, 3.4) Any spoil cut to waste, or material removed from drains, shall be disposed of to designated stable tipping areas as directed by the Engineer, and separate items are included in the Bill of Quantities to allow for this.

(3.2, 3.4) Side tipping of surplus excavated material shall only be permitted where specifically allowed by the Engineer.

(3.2, 3.4) Before starting any earth-moving operation at any location the Contractor shall obtain the Engineer's approval of the areas he proposes to use as waste dumps. Locations for waste dumps are not to be sites where they will cause future slides, interfere with agricultural land or any other properties or cause soil from the dump to be wasted into any watercourse. During may need to be dug within and around the waste dumps as directed by the Engineer and this, together with the proper placement of the spoil, should be allowed for in the cut to waste item in the Schedule of Quantities. The only item in the Schedule of Quantities paid for separately is the haul distance (m$^3$ times kms) to the waste dump directed by the Engineer.

Note that some consider a separate item for hauling spoil material to designated waste dumps is too difficult and complicated to administer and if the locations of waste dumps have been decided as part of the design, or if the Contractor is made aware of the criteria which will be used by the Engineer in selecting waste dumps, then a separate measurement or payment could be omitted for complying with this requirement.

Drainage Works

(3.1 to 3.4) The Contractor may need to construct temporary drains and particularly temporary sedimentation basins and brushwood barriers to avoid excessive sedimentation entering local streams river or lakes. These works will be carried out by the Contract when instructed to by the Engineer but no separate payment will be made for the work. The onus is therefore on the Contractor to carry out all works in such a manner so as to avoid erosion and the subsequent of sedimentation.