LAO PEOPLE'S DEMOCRATIC REPUBLIC

PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

MPWT - SEACAP 21 - DFID

SLOPE STABILISATION TRIALS
ON ROUTE 13N
KASI – PHOU KHOUN – LUANG PRABANG
AND ROUTE 7
PHOU KHOUN – LUANG PRABANG/XIENG KHUANG BORDER

MODULE 1 REPORT

SUBMITTED BY

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in association with

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LAO CONSULTING GROUP

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SEACAP 21 Slope Stabilisation Trials
Module 1 Report

PROJECT PLANNING AND INITIATION

CONTENTS

APPENDICES

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
DFID	Department for International Development
DOR	Department of Roads
DPWT	Department of Public Works and Transport
EU	European Union
GPS	Global Positioning System
JICA	Japan International Cooperation Agency
LCG	Lao Consulting Group
MPWT	Ministry of Public Works and Transport
MOU	Memorandum of Understanding
NAFRI	National Agriculture and Forestry Research Institute
NCB	National Competitive Bidding
RAD	Road Administration Division
RFP	Request for Proposal
RMP	Road Maintenance Project
SEACAP	South East Asia Community Access Project
SIDA	Swedish International Development Agency
STEA	Science, Technology and Environment Agency
TOR	Terms of Reference

SUMMARY

The scope of work for SEACAP 21 is divided into four modules. This report is concerned with the first module, Module 1 Project Planning and Initiation.

Module 1 covers the period October 2006 to November 2007. The TOR for SEACAP 21 divides Module 1 into a number of key activities. These are listed below, together with a brief description of the work actually undertaken:

Develop a working arrangement with the Road Administration Division

Since there was a direct linkage between the Consultant's Team Leader and the Director of the Road Administration Division, a working relationship was quickly developed and maintained by regular meetings between RAD staff and the Consultant's staff.

Access primary information relevant to current slope stabilisation measures being undertaken

Although the Consultant was unsuccessful in locating the original road construction drawings and other related data, we were able to obtain information relevant to the bioengineering work carried out at km 363.6 on road 13N, including some relevant reports as well as some historic data from the Luang Prabang DCTPC on earlier slope stabilisation work carried out on Route 13N.

Access or derive ancillary data sets

Other ancillary data sets included climatic data – particularly historic and current rainfall data, although the most relevant rainfall records were only available from July 2006, as well as topographic and geological mapping and aerial photography, although all of relatively small scale. Bioengineering data was collected from a number of sources including research institutes and environmental agencies

Input and collate existing data into a finalised database

The data acquired was not of a type that could be collated into a database. However, much of the data is in electronic format and will be further analysed in Modules 2 and 3.

Review the sections identified for the trials

The general area of the trials was set by an MOU between MPWT and DFID as 'along the National Road No 13N (Kasi - Phou Khoun - Luang Prabang) and National Road No 7 (Phou Khoun – Luang Prabang/Xieng Khouang border). In February 2006 the Consultant carried out a detailed inspection which revealed more than twenty sites in total which were worthy of attention. The slopes mainly fell into the following broad categories:

- Category A. Shallow failure/soil erosion on slopes (usually cut) above the road but not through the road bench.
- Category B. Shallow failure/slope erosion on loose fill slopes below the road, usually the result of slip clearance.
- Category C. Deep seated failure on slopes (usually cut) above the road but not through the road bench.
- Category D. Deep seated failure through or beneath the road bench and extending to the slopes below and sometimes above the road.

A ranking exercise was carried out to establish which sites carried the highest risk if nothing was done. The table below summarises the main characteristics of each potential slope stability trial site, the right hand columns indicating the ten originally preferred sites, the final list, for further analysis and design.

Route	Chainage (km)	Elevation (m)	Failure Category	Risk Ranking	Final List?	Phase	
						1	2
13N	238.0	735	A & B	3*	Yes	Yes	
	242.6	958	D	3			**
	254.0	1290	D	3	Yes		Yes
	258.6	1395	A & B	5			
	260.3	1317	C/D?	3	Yes		Yes
	262.9	1172	A/C?	4			
	287.2	941	D	3			**
	311.4	1320	A & B	5			
	316.6	1072	A & B	4	Yes	Yes	
	317.9	984	D	3?			**
	326.4	598	D?	4			
	326.9	530	D?	4			
	332.7	444	C	4	Yes		Yes
	335.8	596	D	5			
	336.4	621	D	3	Yes		Yes
	337.5	663	B	5			
	337.7	672	A & B	4	Yes	Yes	
	338.9	745	A & B	4			
	339.9	790	C	4	Yes		Yes
	341.2	844	A	5			
7	3.3	1302	D	3	Yes		Yes
	6.1	1465	D	3	Yes		Yes

* Ranking increased due to threat to electricity pylon
** To be included in phase 2 only to outline design

Table 2. Main Characteristics of Potential Trial Sites

Inevitably the choice of sites for the final list had an element of subjectivity. In addition to the considerations of failure category, risk ranking and elevation, the slope stabilisation trials were required to address a variety of failure mechanisms. Although there were still three site locations with a Risk Ranking of 3 which were not originally selected for the final list, these were eventually included thus raising the number of sites in the trials from ten to thirteen.

Undertake detailed planning of the main field programme

Since bioengineering works are ideally carried out close to the beginning of the rainy season, it was proposed that the slope stabilisation work should be subdivided into two phases:

- Phase 1 would concentrate on those slopes where the works were predominantly bio-engineering but with some minor structural work (e.g. toe revetments, slope and roadside drainage). The designs for these were expected to comprise the application of standard details and were therefore anticipated to be relatively straightforward. The implementation of these works was scheduled for May to July 2007.
- Phase 2 would concentrate on those slopes where the works were predominantly structural (i.e. where the slope instability is more deep-seated) but where some bio-engineering measures will also be required for surface erosion protection. For these slopes the design process would take longer, some requiring small-scale ground investigation work and all requiring engineering geological mapping and analysis. The civil works for these were scheduled for the period November 2007 to March 2008, and the bio-engineering works scheduled for the period May to July 2008.

Prepare the detailed design

Phase 1 detailed design began in December 2007 as soon as the topographic survey work had been completed. Three sites were involved: km 238.0, km 316.6 and km 337.7. Phase 2 detailed design began in January 2008. Ten sites were involved: km 242.6. km 254.0, km 260.3, km

287.2, km 317.9, km 332.7, km 336.4 and km 339.9 all on Route 13N, and km 3.3 and km 6.1 both on Route 7.

Identify specifications and costings

Although we had access to numerous specifications related to slope stabilisation works that we had used elsewhere in the past, it was decided to utilise, to the maximum extent practicable, specifications that had already been used in previous projects in Lao PDR, since these would be more likely to be familiar to local contractors. For historic unit rates for the civil works a number of relevant local sources were used, but for the bioengineering works it was necessary to derive these from first principles with considerations of labour, materials and construction plant (if relevant) needed for each activity.

Assist RAD in preparing bid documents

Bid documents for phase 1 were prepared over the period November 2006 to January 2007. Following the necessary approvals from the World Bank and MPWT, the contract went out to bid on 21st March with the submission date eventually set at 25th April. A site visit and prebid meeting were held during the bid period and a total of five bids were received. Bid documents for phase 2 were prepared over the period February 2007 to July 2007. Again, following the necessary approvals from the World Bank and MPWT, the contract went out to bid on 30th August with the submission date set at 5th October. A site visit and prebid meeting were held during the bid period and a total of seven bids were received

Draft a detailed data collection programme

This is currently under way and the relevant data will be presented as part of Modules 2 and 3.

Draft an information dissemination and training strategy

Discussions are planned with RAD on the precise scope and content of Module 4 to best suit the future needs of MPWT.

Submit a report detailing project actions and outcomes

This activity was covered by the Progress Reports issued every two months.

Assist MPWT in assessment and award of works contracts

The bid assessments were carried out by the MPWT bid evaluation committee, although assistance was provided by the Consultant, as necessary, with the provision of the contract documents. In each case the contracts were awarded to the lowest bidders.

1. INTRODUCTION

In late 2007, the Ministry of Communication, Transport, Post and Construction (MCTPC) was reorganised and renamed the Ministry of Public Works and Transport (MPWT). In order to avoid future confusion, the term MPWT is used throughout this report. This similarly applies to the Departments (DCTPCs) which are termed DPWTs.

The scope of work for SEACAP 21 is subdivided into four modules:

- Module 1 Project Planning and Initiation
- Module 2 Representative Data Capture
- Module 3 Data Interpretation
- Module 4 Information Dissemination and Training

In accordance with the TOR, the Consultant is required to submit detailed 'End of Module' Reports which should include a summary that can be used to disseminate the main outcomes of the Modules. Each of these Reports is to be submitted to MPWT for comments and feedback, and these comments are then appended to the Report before submission to SEACAP PMO. Accordingly, now that the scope of work for Module 1 is complete, this first Module Report is submitted to MPWT

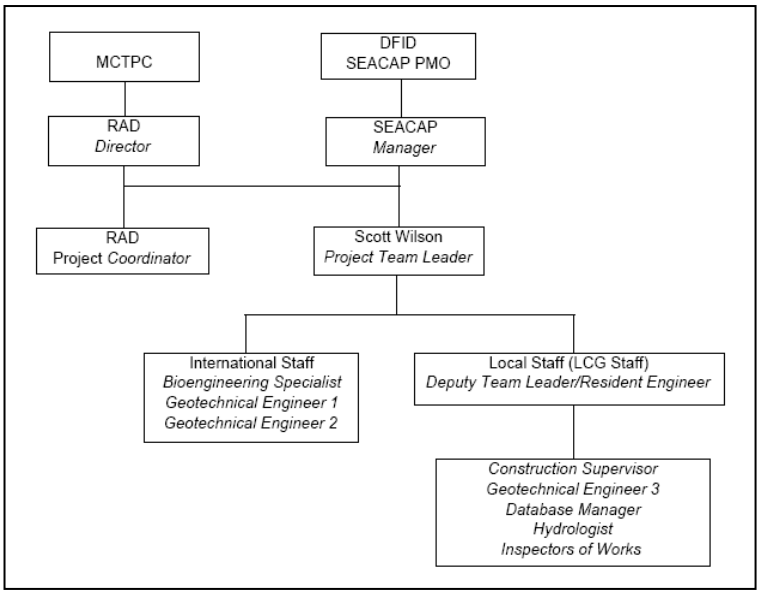
Although the TOR envisaged a stepped progression from one Module to the next, this was found to be impracticable, and in his Inception Report submitted in November 2006 the Consultant proposed a revised workplan and staffing schedule (see Appendix A.1). This was accepted. It will be seen that Module 1 considerably overlaps both Modules 2 and 3. Module 1 proceeded closely in accordance with the revised workplan, commencing in October 2006 and finishing in November 2007.

The TOR subdivide each Module into a series of key activities, and for ease of reference these are repeated in the next section for Module 1 with a detailed commentary on the work actually carried out.

2. KEY ACTIVITIES

2.1 Develop a working arrangement with the Road Administration Division

Figure 1 below indicates the relationship between DFID, MPWT, the Consultant and the Consultant



It will be seen from figure 1 that there is a direct link between the Project Team Leader, Tim Hunt, the RAD Director, Chanh Bouphalivanh, and the RAD Project Coordinator, Sengmany Sysouvanthong, and an indirect link with all the other staff members, both international and local.

Meetings were held on a regular informal basis between the Project Team Leader, the Deputy Team Leader, and the RAD Director. These meetings usually included Sak Dalat and Phouthasen Khamanivong, both Deputy Directors of RAD. During these meetings the progress of the work was discussed together with any problems that might have arisen, and a strategy agreed to overcome them. In particular the design work was closely coordinated with the RAD Project Coordinator, who carried out joint site inspections with the Consultant and also shared office space in the Consultant's office in Vientiane.

We believe that a good, close and working relationship was established with RAD, and that this continues.

2.2 Access primary information relevant to current slope stabilisation measures being undertaken

Primary information relevant to the current slope stabilisation measures being undertaken appeared to be relatively sparse. In particular we were unsuccessful in locating construction drawings and other related data for ADB 4 and ADB 8 (Routes 13N and 7) Road Improvement Projects, which were carried out between the mid 1990s and early 2000s. However we were able to obtain information relevant to the bioengineering work carried out at km 363.6 on road 13N, including the proceedings of the JICA-supported 'Seminar on Road slope on Route 13N in Laos' and 'The Handbook on Road Slope Revegetation Works in Laos', both dated March 2006, as well as some historic data from the Luang Prabang DCTPC on earlier slope stabilisation work carried out on Route 13N.

2.3 Access or derive ancillary data sets

Other ancillary data sets included:

- Climatic data. Historic daily rainfall and temperature records were obtained from the Meteorological Department of the Ministry of Agriculture and Forestry for the three recording stations nearest to the project area, Luang Prabang, Vang Vieng and Xieng Khuang (Phonsaven). Unfortunately, since all these stations are located within areas of low topography, none are likely to give rainfall data truly representative of the mountainous topography of the project area. However, a recording station was set up in 2006 in Phou Khoun, although records were only available from July 2006 onwards. Although we were aware that the main site office for ADB 8 (Rural Access Road Development Project) was located in Phou Khoun for several years, no historical rainfall data appeared to be available.
- Global Positioning System (GPS) data. GPS data was acquired for each of the slopes examined within the project area using a hand-held device.
- Topographical mapping. We obtained hard copy 1:100,000 scale topographical maps of the project area from the National Geographic Department. These were published in 1985.
- Aerial photography. Some aerial photography was purchased from the National Geographic Department covering part of the project area, but this was of limited value due to its small scale
- Geological mapping. Some geological data was accessed from the London Geological Society, developed by the British Geological Survey, but this again was considered to be too small in scale to provide much in the way of site-specific information.

- Soil mapping/land use. Although some mapping has been carried out by the Forestry Department, these were not relevant to the project sites.
- Bioengineering data. Material was collected from the National Agricultural and Forest Research Institute (NAFRI), the Science, Technology and Environment Agency (STEA), the UN and other donor agencies, academic research organisations such as the Mekong River Commission and the Australian National University, and other sources. These all helped to provide background information specific to Laos on biological diversity, soil conservation initiatives, community issues and the relationships between road access and poverty. We already had access to a wide range of international material on bio-engineering measures appropriate to upland rural areas in south-east Asia.

2.4 Input and collate existing data into a finalised database

The data acquired was not of a type that could be collated into a database. However, much of the data is in electronic format and will be further analysed in Modules 2 and 3

2.5 Review the sections identified for trials

2.5.1 General

The general area of the trials was set by an MOU between MPWT and DFID as 'along the National Road No 13N (Kasi - Phou Khoun - Luang Prabang) and National Road No 7 (Phou Khoun – Luang Prabang/Xieng Khouang border). The exact locations for the trial will be determined by the Consultant and DoR in the inception phase'.

Within the project area, Route 13N was upgraded to a fully sealed road under the ADB 4th Road Improvement Project during the period 1996-9 and Route 7 under the ADB 8th Road Improvement Project during the period 1999-2002. The roads vary in altitude from 230m at Kasi, rising to 1385m at Phou Khoun (and even higher to 1485m along Route 7), and then reducing to 350m at Luang Prabang. The total road length is approximately 73km between Kasi and Luang Prabang along Route 13N, and approximately 42km between Phou Khoun and the provincial border along Route 7. The average annual rainfall varies from about 3900mm at Vang Vieng to around 1400 mm at Luang Prabang.

According to the 'Mineral Exploration and Development Plan' geological map produced by the ADB in 1991 the underlying geology comprises mainly muddy limestones of Carboniferous or Devonian age.

The present land use is a mixture of agriculture and forestry, often dominated by low-intensity subsistence farming based on shifting cultivation. There is no undisturbed forest near the potential trial sites, and where it does occur the rain forest has been highly disturbed with many trees removed and the under-storeys significantly altered. Secondary re-growth is common in many locations. Agriculture includes substantial areas of the local hill aerobic rice, but also a range of other un-irrigated grains, tubers and vegetables grown on sloping land. Livestock are generally absent. Apart from the few towns and villages bordering the road, the rural population is very sparse.

2.5.2 Potential Slope Stability Trial Sites

The original Request for Proposal (RFP) issued by Crown Agents on behalf of DFID in July 2005 contained ten suggested locations for the trial sites, all along Route 13N, some of which had already been the subject of stabilisation measures by the Luang Prabang DPWT when the RFP had been issued. In our proposal, however, we noted that there were other locations of equal or higher merit that were worthy of inclusion.

In November 2005, during the course of a further inspection with representatives from DFID and RAD, six MPWT-preferred sites was identified, including three along Route 7, and in February 2006 the Consultant carried out a more detailed inspection which revealed more than twenty sites in total which might be worthy of attention.

During October and November 2006, additional site visits were made in which it was noted that two further sites had been the subject of stabilisation measures by the DPWT. The resulting locations of the potential trial sites are given in figure 2 below.

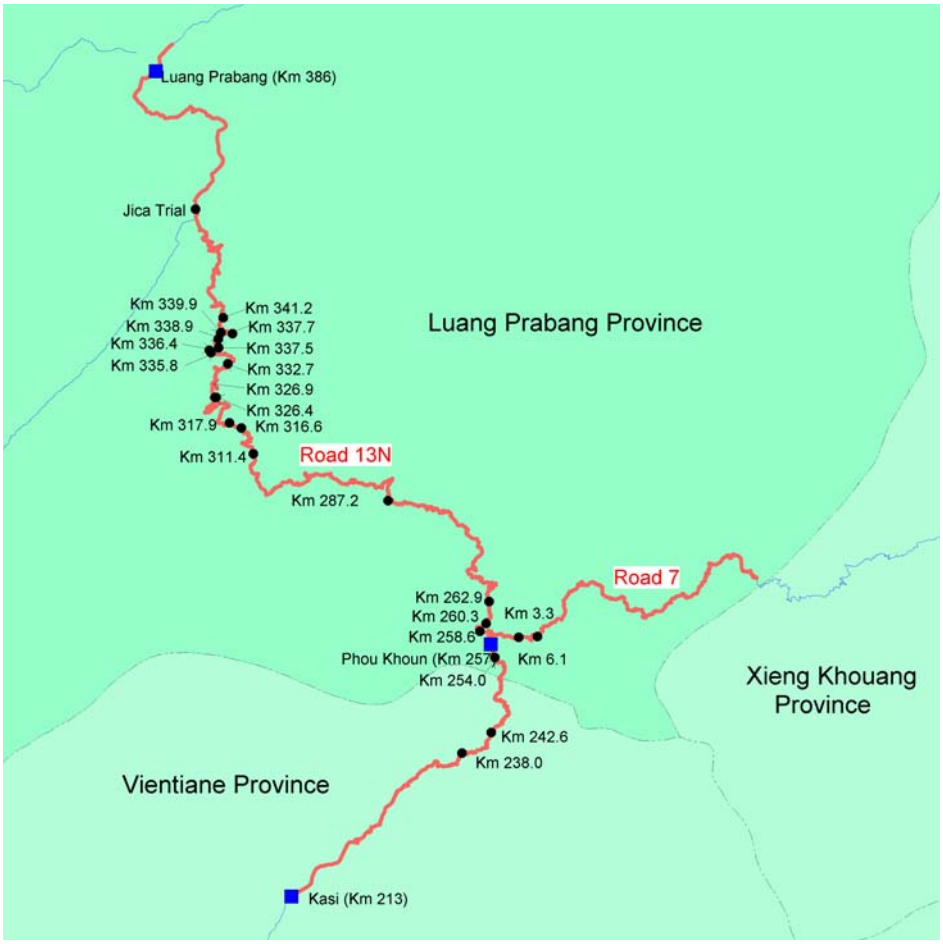


Figure 2. Location of Potential Trial Sites

It will be noted that there was a preponderance of sites between km 332.7 and km 341.2 (nearly a third of the total in a distance of under 9km), possibly due to an exceptional localised high intensity rainfall event or to localised weaknesses in geological structure or material composition.

All the sites were initially identified from a moving vehicle, although each individual inspection was then made on foot. In this manner, most if not all of the obvious unstable locations along the project roads were inspected.

2.5.3 Trial Site Final List

The TOR requires the Consultant to 'Prepare a final list of the road sections for survey based on a likely spread of matrix variables'. Apart from financial considerations in respect of remedial

works, it was recommended that the number of sites should be limited to ten, as envisaged in the RFP and in the Consultant's original proposal.

In consideration of the final list we first needed to define the sites according to their failure mechanisms. Figure 3 gives a general picture of the typical slope instability problems affecting a road in sidelong cut and fill in steep terrain.

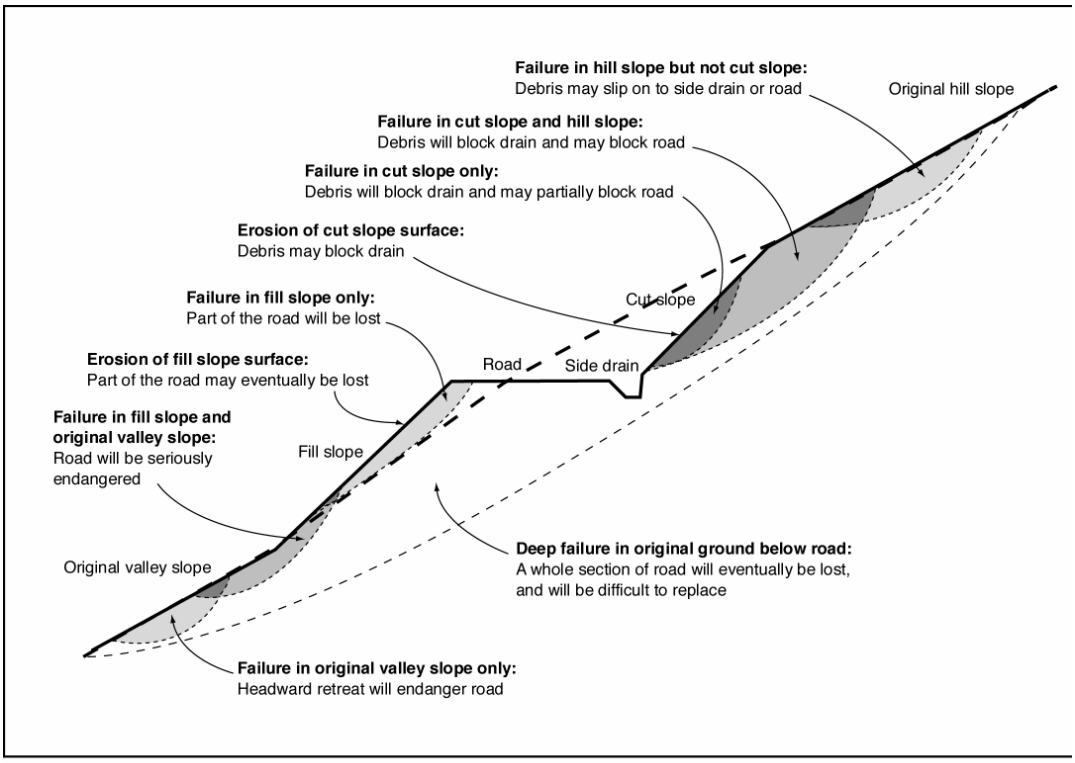


Figure 3. Typical instability problems in soil/weathered rock slopes

The slopes mainly fell into the following broad categories:

- Category A. Shallow failure/soil erosion on slopes (usually cut) above the road but not through the road bench.
- Category B. Shallow failure/slope erosion on loose fill slopes below the road, usually the result of slip clearance.
- Category C. Deep seated failure on slopes (usually cut) above the road but not through the road bench.
- Category D. Deep seated failure through or beneath the road bench and extending to the slopes below and sometimes above the road.

In general terms, Categories A and B could largely be stabilised by using bio-engineering techniques (but with some minor civil works). Categories C and D would inevitably require significant civil works.

Second, we needed to consider risk, in this case the consequences of doing nothing at a particular trial site. Table 1 overleaf gives a recommended ranking.

Finally, one further factor that needed to be taken into account was elevation. Plant species that grow well at a low elevation may sometimes not grow well, or be entirely absent in the natural vegetation, at a high elevation. It was preferable to have a spread of elevation in the trial sites.

Expected consequences if nothing done	Ranking				
	1	2	3	4	5
Occupied buildings damaged or destroyed	✓				
Road completely lost		✓			
Road partially lost			✓		
Road completely blocked			✓		
Slip debris likely to fall on pedestrians or vehicles, wall collapse			✓		
Wall damaged				✓	
Road partially blocked				✓	
Roadside drainage damaged or blocked					✓
Road subsidence					✓
Continued erosion destroying vegetation cover					✓

1. Top priority, emergency measures required immediately, buildings may need to be evacuated.
2. High priority, realignment may be necessary.
3. Moderate priority, but some temporary remedial measures required immediately e.g. slip clearance, emergency road signing.
4. Low priority, but some temporary remedial measures required quickly e.g. slip clearance
5. Least priority, but should be tackled as soon as possible under routine maintenance.

Table 1. Ranking of Consequences if nothing done

Table 2 below summarises the main characteristics of each potential slope stability trial site, the right hand columns indicating the ten preferred sites, the final list, for further analysis and design.

Route	Chainage (km)	Elevation (m)	Failure Category	Risk Ranking	Final List?	Phase	
						1	2
13N	238.0	735	A & B	3*	Yes	Yes	
	242.6	958	D	3			**
	254.0	1290	D	3	Yes		Yes
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	262.9	1172	A/C?	4			
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	317.9	984	D	3?			**
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	332.7	444	C	4	Yes		Yes
	335.8	596	D	5			
	336.4	621	D	3	Yes		Yes
	337.5	663	B	5			
	337.7	672	A & B	4	Yes	Yes	
	338.9	745	A & B	4			
	339.9	790	C	4	Yes		Yes
	341.2	844	A	5			
7	3.3	1302	D	3	Yes		Yes
	6.1	1465	D	3	Yes		Yes

* Ranking increased due to threat to electricity pylon
** To be included in phase 2 only to outline design

Table 2. Main Characteristics of Potential Trial Sites

Inevitably the choice of sites for the final list had an element of subjectivity. In addition to the considerations of failure category, risk ranking and elevation, the slope stabilisation trials were

required to address a variety of failure mechanisms. It will be seen that at the time of the Inception Report there were still three site locations with a Risk Ranking of 3 which were not originally selected for the final list. However, these were eventually included, thus raising the number of sites in the trials from ten to thirteen.

2.6 Undertake detailed planning of the main field programme

Reference should be made to Appendix A.1.

First, construction work that can more accurately be described as civil works needs to be carried out during the dry season (roughly November to April), particularly for earthworks, although some other types of structural work can extend into the wet season. Construction work that can be more accurately described as bio-engineering works is best carried out at the beginning of the wet season, say May to July.

Second, the requirement to follow RMP2 standard procedures implies a contract procurement period of between three and six months. The RMP2 Maintenance Programme 6 and 7 Tentative Time Schedules themselves indicate a normal 12 month period from the initial data survey through to award of construction contract, and even this is said to be prone to delay.

This second requirement precluded any construction work commencing on the project slopes until October 2007, 12 months from project commencement. However, if the pre-construction procedures could be fast-tracked for those slopes where the work was predominantly bio-engineering, then at least some slope stabilisation work could be undertaken at the beginning of the 2007 wet season, i.e. May through to July.

It was therefore proposed that the slope stabilisation work was subdivided into two phases:

- Phase 1 would concentrate on those slopes where the works were predominantly bio-engineering but with some minor structural work (e.g. toe revetments, slope and roadside drainage). The designs for these were expected to comprise the application of standard details and were therefore anticipated to be relatively straightforward. The implementation of these works were scheduled for May to July 2007.
- Phase 2 would concentrate on those slopes where the works were predominantly structural (i.e. where the slope instability is more deep-seated) but where some bio-engineering measures will also be required for surface erosion protection. For these slopes the design process would take longer, some requiring small-scale ground investigation work and all requiring engineering geological mapping and analysis. The civil works for these were scheduled for the period November 2007 to March 2008, and the bio-engineering works scheduled for the period May to July 2008.

This two-phase approach had a number of advantages:

- The phase 1 bio-engineering slopes will be exposed to two wet seasons during the lifetime of the project.
- It allowed for lessons to be learned from the phase 1 bio-engineering to be incorporated into the phase 2 bio-engineering, particularly with respect to identifying the most successful plant species and planting methods and patterns.
- It allowed, where necessary, for some remedial planting to the phase 1 slopes during phase 2.

Originally it was suggested that the phase 2 civil works be kept contractually completely independent from the phase 2 bio-engineering, in order that a community-based approach could be piloted. However, following a detailed review by the bio-engineering specialist, we came to the view that the proposed community-based bio-engineering work for the Phase 2 sites was not feasible due to the fact that the RMP2 procurement procedures do not take into account these types of contracts and because there are no institutional procedures set in place for this type of

work to be undertaken on National roads. As a result of these findings we included all the Phase 2 bio-engineering work in the Phase 2 detailed designs, specifications and bid documents.

This basic approach was agreed, and detailed topographic survey work began in November 2007. This was followed by a ground investigation in February 2008 at seven sites scheduled for Phase 2.

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2.7 Prepare the detailed design

With MCTPC's agreement to the final list of sites, the design work proceeded first for all the phase 1 sites and then for all the phase 2 sites.

2.7.1 Phase 1 sites

Phase 1 detailed design began in December 2007 as soon as the topographic survey work had been completed. Three sites were involved: km 238.0, km 316.6 and km 337.7. As already noted, these were sites where the main emphasis would be on bioengineering, with some minor structural work. A typical phase 1 design drawing is shown in Appendix B. Concerns were expressed by the Consultant at the stability of an electricity pylon at the top of the slope for which we could not guarantee its safety using bioengineering measures alone. Fortunately the electricity authorities decided to relocate the pylon and so this never became a serious issue.

2.7.2 Phase 2 sites

Phase 2 detailed design began in January 2008. Ten sites were involved: km 242.6. km 254.0, km 260.3, km 287.2, km 317.9, km 332.7, km 336.4 and km 339.9 all on Route 13N, and km 3.3 and km 6.1 both on Route 7. As already noted, these were sites where the main emphasis would be on structural engineering, with the bioengineering required for surface protection. A typical phase 2 design drawing is shown in Appendix B.

Three sites require special mention. The sites at km 260.3, km 317.9 and km 336.4 were similar in that these slope failures were relatively deep seated and affected the entire road bench and are occurring over a much larger area than the road carriageway itself. Any future instability is likely to be progressive rather than catastrophic. In all cases the failures have caused the original road to sink and in all cases the failures are likely to be very costly to completely stabilize. Although the ground investigation mentioned in 2.6 covered all three sites, we were unable to determine the depths of the failure plane and the precise modes of failure remained speculative. As a result of this, a movement monitoring programme was set up for the first two sites for the 2007 wet season whereby a number of surface monuments were surveyed on a monthly basis and installed slip indicators checked. In the meantime, in order not to hold up the progress of the Phase 2 detailed design, the remedial works to be carried out have been designed mainly to reducing the volume of surface water from entering the failed areas and therefore hopefully reducing the slope movements. However, these are only very temporary measures and further large scale movements must be expected in the longer term.

2.8 Identify specifications and costings

2.8.1 Specifications

Although we had access to numerous specifications related to slope stabilisation works that we had used elsewhere in the past, our preference was to utilise, to the maximum extent practicable, specifications that had already been used in previous projects in Lao PDR, since these would be more likely to be familiar to local contractors. As it happened, we decided to utilise or adapt specifications used for ADB 10, but with several additions, particularly for the bioengineering work and for sprayed concrete.

2.8.2 Costings

In order to produce reasonably accurate cost estimates for the site work it was desirable to have access to historic unit rates. For the civil works we used a number of relevant local sources, but for the bioengineering works it was necessary to derive these from first principles with considerations of labour, materials and construction plant (if relevant) needed for each activity.

2.9 Assist RAD in preparing bid documents

Two sets of bid documents were prepared; one for phase 1 and the other for phase 2. Both sets of bid documents comprised:

- Invitation for Bids
- Contract Data
- Bill of Quantities
- Instruction to Bidders
- Standard Forms
- Qualification Information Forms
- Conditions of Contract
- Technical Specifications
- Description of the Works
- Drawings

2.9.1 Bid documents for phase 1

Bid documents for phase 1 were prepared over the period November 2006 to January 2007. Following the necessary approvals from the World Bank and MPWT, the contract went out to bid on 21st March with the submission date eventually set at 25th April. A site visit and prebid meeting were held during the bid period and a total of five bids were received. Three of the bids came close to, or below the Engineer's Estimate.

2.9.2 Bid documents for phase 2

Bid documents for phase 2 were prepared over the period February 2007 to July 2007. Again, following the necessary approvals from the World Bank and MPWT, the contract went out to bid on 30th August with the submission date set at 5th October. A site visit and prebid meeting were held during the bid period and a total of seven bids were received. All but one bid came below the Engineer's Estimate.

2.10 Draft a detailed data collection programme

In our Inception Report we proposed that our data collection programme comprised:

- Regular inspections and assessments of the stabilised slopes within the project area
- Regular inspections and assessments of the remaining 'unstabilised' or untreated slopes within the project area
- Inspection and assessment of areas with similar topography and rainfall in other parts of Lao PDR particularly with respect to slope instability and the remedial measures adopted.

This is currently under way and the relevant data will be presented as part of Modules 2 and 3.

2.11 Draft an information dissemination and training strategy

Module 4 comprises information dissemination and as indicated in Appendix A.1 is scheduled to take place over the period May to September 2008. This is scheduled to comprise:

- The delivery of a series of guidelines, design manuals and specifications covering slope stabilisation and bioengineering
- A Slope Stabilisation Workshop in Vientiane

We are currently in discussion with RAD on the precise scope and content of these to best suit the future needs of MPWT.

A Knowledge Exchange workshop was held at the end of January 2007 to which more than 70 participants attended including representatives from MPWT, donor agencies, and local and international consultants. The aim of SEACAP 21 was described and technical presentations given on slope stability and bioengineering. A further presentation on SEACAP 21 was given at the SEACAP Practitioners Meeting in Hanoi in September 2007.

Informal on-the-job training has been provided to MPWT and LCG staff during the detailed design and implementation phases.

2.12 Submit a report detailing project actions and outcomes

This activity was covered by the Progress Reports issued every two months.

2.13 Assist MPWT in assessment and award of works contracts

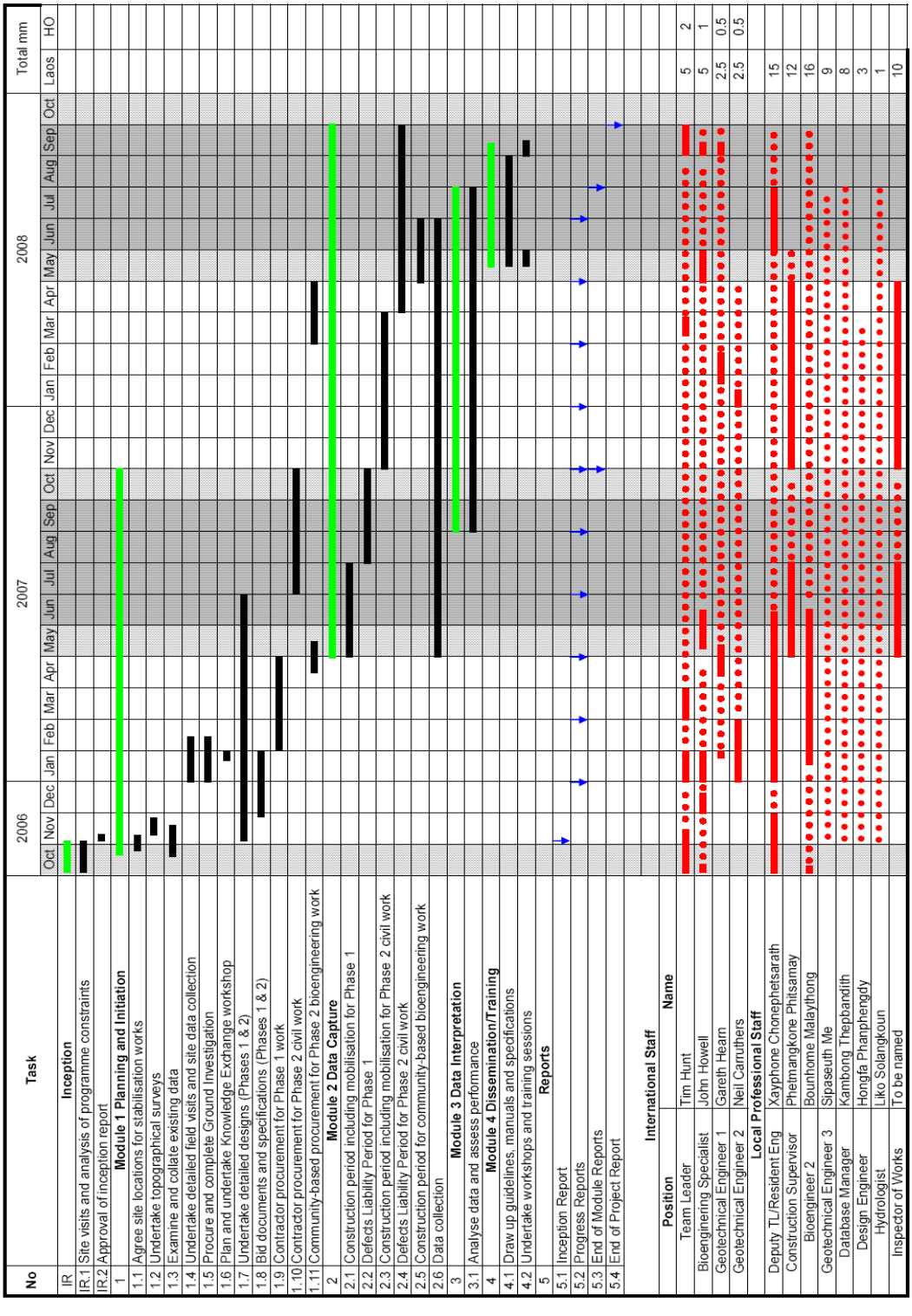
The bid assessments were carried out by the MPWT bid evaluation committee, although assistance was provided by the Consultant, as necessary, with the provision of the contract documents. In each case the contracts were awarded to the lowest bidders.

3. FUTURE MODULE REPORTS

The activities listed in Section 2 complete the scope of work of Module 1. As Appendix A.1 indicates, Modules 2 and 3 overlap with Module 1 and these are currently ongoing. It is now anticipated that Module 2, Representative Data Capture, will be completed by August 2008, along with Module 3, Data Interpretation. Module 4, Information Dissemination and Training, will commence soon and be completed at the end of SEACAP 21 in September 2008.

APPENDIX A Workplans

A.1 Inception Report Workplan

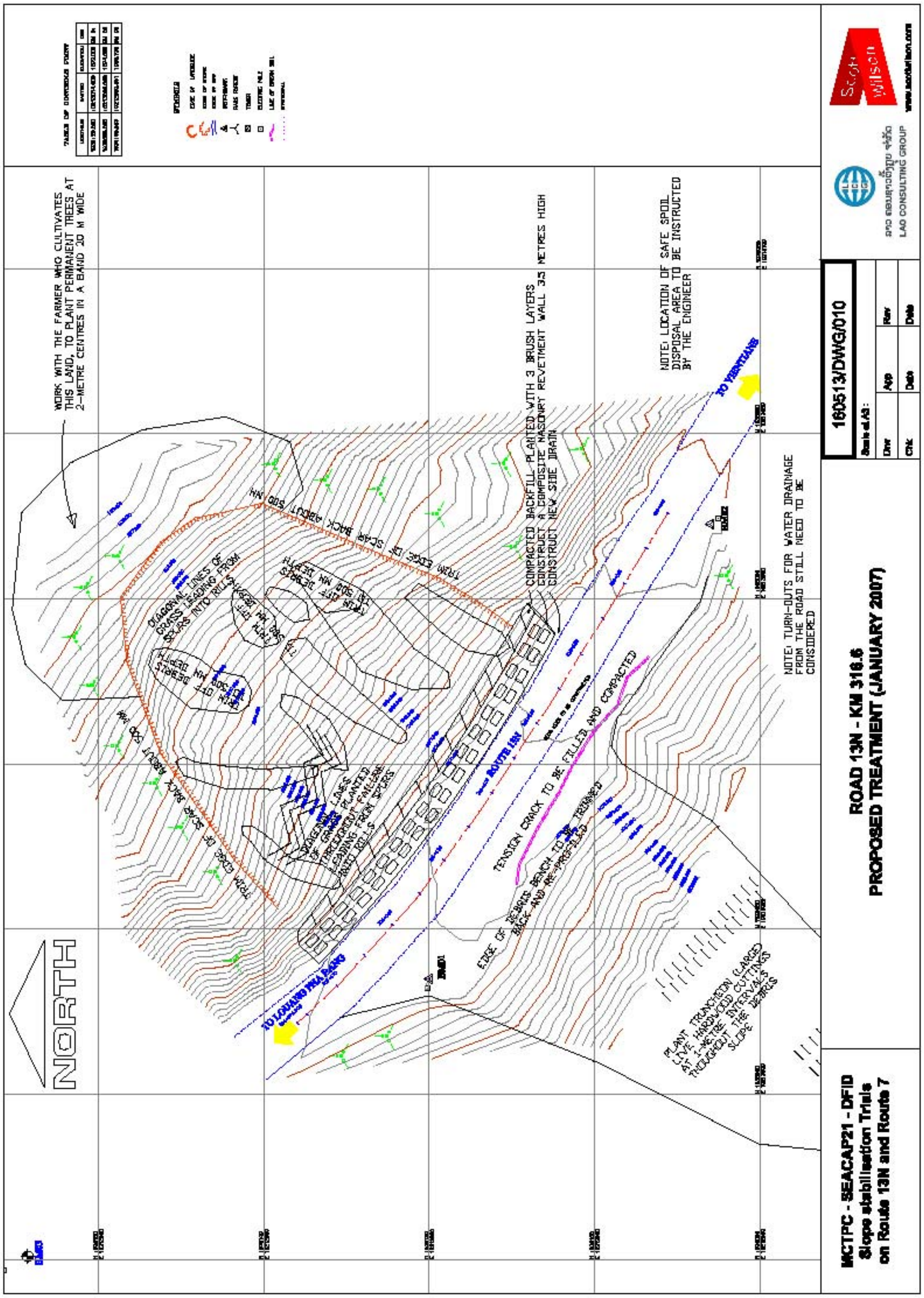


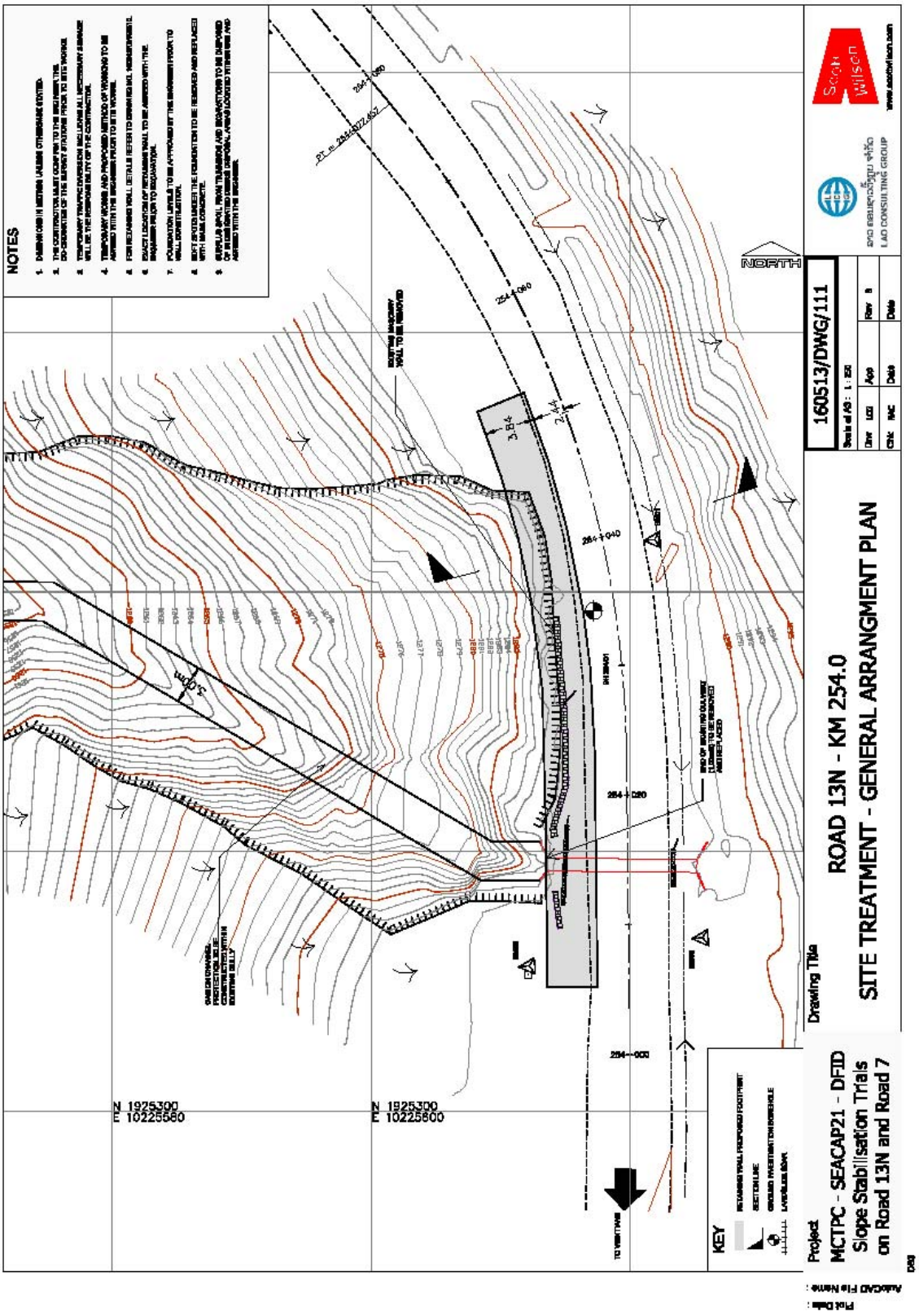
A.2 Actual Module 1 Workplan

No	Activity	2006			2007										
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1	**Module 1 Planning and Initiation**														
1.1	Develop relationship with RAD														
1.2	Access primary information relevant to slope stability														
1.3	Access or derive ancillary data sets														
1.4	Input and collate existing data into database	(scheduled for Modules 2 and 3)													
1.5	Review sections identified for the trials														
1.6	Undertake planning of field programme														
1.7	Prepare detailed design														
1.8	Identify specifications and costings														
1.9	Assist RAD with bid documents														
1.10	Draft detailed data collection programme														
1.11	Draft information dissemination and training strategy	(mostly scheduled for Module 4)													
1.12	Submit detailed report on actions and outcomes														
1.13	Assist MPWT with assessment and award of contracts														

APPENDIX B Typical Contract Drawings

B.1 Typical Phase 1 Contract Drawing
B.2 Typical Phase 2 Contract Drawing


NORTH
WORK WITH THE FARMER WHO CULTIVATES THIS LAND, TO PLANT PERMANENT TREES AT 2-METRE CENTRES IN A BAND 20 M WIDE
COMPACTED BACKFILL PLANTED WITH 3 BRUSH LAYERS
CONSTRUCT A COMPOSITE MASONRY REVETMENT WALL 3.3 METRES HIGH
CONSTRUCT NEW SIDE DRAIN
NOTE: LOCATION OF SAFE SPOIL DISPOSAL AREA TO BE INSTRUCTED BY THE ENGINEER
NOTE: TURN-OUTS FOR WATER DRAINAGE FROM THE ROAD STILL NEED TO BE CONSIDERED
TO VIENTIANE
TO LOUANG PRA BANG
TENSION CRACK TO BE FILLED AND COMPACTED
EDGE OF DEBRIS BENCH TO BE TRIMMED BACK AND RE-PROFILED
PLANT TRUNCHEON (LARGE LIVE HARDWOOD CUTTINGS) AT 1-METRE INTERVALS THROUGHOUT THE DEBRIS SLOPE
TRIM EDGE OF SCAR BACK ABOUT 500 MM
DIAGONAL LINES OF GRASS LEADING FROM SPURS INTO RILLS
ROAD 13N - KM 316.6
PROPOSED TREATMENT (JANUARY 2007)
MCTPC - SEACAP21 - DFID
Slope stabilisation Trials on Route 13N and Route 7
160513/DWG/010
LAO CONSULTING GROUP
www.scottwilson.com


NOTES
NORTH
KEY
ROAD 13N - KM 254.0
SITE TREATMENT - GENERAL ARRANGMENT PLAN
160513/DWG/111
Project
MCTPC - SEACAP21 - DFID
Slope Stabilisation Trials
on Road 13N and Road 7
Drawing Title
N 1925300
E 10225580
N 1925300
E 10225600
254+040
254+020
254+000
TO VIENTIANE

APPENDIX C List of data produced in connection with Module 1

Reports

Inception Report November 2006
Progress Report No 1 November-December 2006
Progress Report No 2 January – February 2007
Progress Report No 3 March – April 2007
Progress Report No 4 May – June 2007
Progress Report No 5 July – August 2007
Progress Report No 6 September – October 2007

Specifications

Clearing and Grubbing
Demolition
Structural Excavation
Gabion Structures
Masonry Structures
Slope Protection
Slope Preparation for Bioengineering
Disposal of Soil
Free Draining Structural Backfill
Subsoil Drains
Pipe Culverts
Ditch, Apron Protection and Inlet and Outlet Structures
Falsework and Formwork
Steel Reinforcement
Structural Concrete
Site Planting and Sowing

Construction Drawings

Phase 1

160513/DWG/001	R13N, Km 238.0	Topographic map
160513/DWG/002	R13N, Km 238.0	Cross-sections
160513/DWG/003	R13N, Km 238.0	Site assessment
160513/DWG/004	R13N, Km 238.0	Proposed treatment (January 2007)
160513/DWG/005	R13N, Km 238.0	Construction details: check dams and slope drains
160513/DWG/007	R13N, Km 316.6	Topographic map
160513/DWG/008	R13N, Km 316.6	Cross-sections
160513/DWG/009	R13N, Km 316.6	Site assessment
160513/DWG/010	R13N, Km 316.6	Proposed treatment (January 2007)
160513/DWG/011	R13N, Km 316.6	Construction details: revetment wall above road and treatments below road
160513/DWG/012	R13N, Km 337.7	Topographic map
160513/DWG/013	R13N, Km 337.7	Cross-sections
160513/DWG/014	R13N, Km 337.7	Site assessment
160513/DWG/015	R13N, Km 337.7	Proposed treatment (January 2007)
160513/DWG/016	R13N, Km 337.7	Construction details: slope profiling and roadside drainage
160513/DWG/501	Typical details	Grass slips and grass planting lines
160513/DWG/502	Typical details	Shrub and tree planting
160513/DWG/503	Typical details	Hardwood cuttings
160513/DWG/504	Typical details	Brush layering, fascines and palisades
160513/DWG/505	Typical details	Live check dam and vegetated stone pitching

Phase 2

160513/DWG/100	R13N, Km 242.6	Site assessment – Engineering Geology
160513/DWG/101	R13N, Km 242.6	Site assessment – Elevation of Backscar
160513/DWG/102	R13N, Km 242.6	Site treatment – General Arrangement Plan
160513/DWG/110	R13N, Km 254.0	Site assessment – Engineering Geology
160513/DWG/111	R13N, Km 254.0	Site treatment – General Arrangement Plan
160513/DWG/112	R13N, Km 254.0	Site treatment – Cross Section at 254+040
160513/DWG/113	R13N, Km 254.0	Site treatment – Culvert Repair and Outfall Channel
160513/DWG/120	R13N, Km 260.3	Site assessment – Engineering Geology
160513/DWG/121	R13N, Km 260.3	Site treatment – General Arrangement Plan
160513/DWG/130	R13N, Km 287.2	Site assessment – Engineering Geology
160513/DWG/131	R13N, Km 287.2	Site treatment – General Arrangement Plan
160513/DWG/132	R13N, Km 287.2	Site treatment – Cross Sections
160513/DWG/140	R13N, Km 317.9	Site assessment – Engineering Geology
160513/DWG/141	R13N, Km 317.9	Site treatment – General Arrangement Plan
160513/DWG/150	R13N, Km 332.7	Site assessment – Engineering Geology
160513/DWG/151	R13N, Km 332.7	Site treatment – General Arrangement Plan
160513/DWG/152	R13N, Km 332.7	Site treatment – Cross Sections
160513/DWG/153	R13N, Km 332.7	Site treatment – Elevation of Retaining Wall
160513/DWG/160	R13N, Km 336.4	Site assessment – Engineering Geology
160513/DWG/161	R13N, Km 336.4	Site treatment – General Arrangement Plan
160513/DWG/170	R13N, Km 339.9	Site assessment – Engineering Geology
160513/DWG/171	R13N, Km 339.9	Site assessment – Elevation of Cut Slope
160513/DWG/172	R13N, Km 339.9	Site treatment – General Arrangement Plan
160513/DWG/173	R13N, Km 339.9	Site treatment – Cross Sections
160513/DWG/180	R7, Km 3.3	Site assessment – Engineering Geology
160513/DWG/181	R7, Km 3.3	Site treatment – General Arrangement Plan
160513/DWG/182	R7, Km 3.3	Site treatment – Cross Sections
160513/DWG/190	R7, Km 6.1	Site assessment – Engineering Geology
160513/DWG/191	R7, Km 6.1	Site treatment – General Arrangement Plan
160513/DWG/192	R7, Km 6.1	Site treatment – Cross Section at Km 6+140
160513/DWG/500	Typical details	Masonry Retaining Walls
160513/DWG/501	Typical details	Gabion Retaining Walls
160513/DWG/502	Typical details	Slope Drainage (1)
160513/DWG/503	Typical details	Slope Drainage (2)
160513/DWG/504	Typical details	Check Dams and Slope Protection
160513/DWG/505	Typical details	Pipe Culverts (1)
160513/DWG/506	Typical details	Pipe Culverts (2)
160513/DWG/510	Typical details	Grass slips and grass planting lines
160513/DWG/511	Typical details	Shrub and tree planting
160513/DWG/512	Typical details	Hardwood cuttings
160513/DWG/513	Typical details	Brush layering, fascines and palisades
160513/DWG/514	Typical details	Live check dam and vegetated stone pitching
160513/DWG/515	Typical Details	Gabion wire bolsters

Internal Papers

Decision-making in slope management
Options for community participation
Review of bioengineering and related issues
Working document on data and training
SEACAP 21 concept for basic access support
Review of road maintenance

Summary sheets for design background for trial sites

Powerpoint Presentations

Knowledge Exchange Workshop, Vientiane
SEACAP 21 Project Introduction
SEACAP 21 Slope Stabilisation
SEACAP 21 Bioengineering and Communities
Slope Stability in Mountainous Terrain

SEACAP Practitioners Meeting, Hanoi
Slope Stabilisation Trials on Route 13N and Route 7 in Lao PDR