

## 10. Website Development

The study team set up the Internet website ([www.mpwt-gis.gov.kh](http://www.mpwt-gis.gov.kh)) as shown in Figure 33) during the project. The website seeks to promote the GIS data advertisement and distribution of Phase 1 through the Internet. Unfortunately, the data downloading system is not currently functioning due to a technical problem: The facilities of a local Internet service provider, for downloading the data, are not well-organized in Cambodia.

To solve the above-mentioned problem, the data delivery system was changed from the original idea of IC/R.

During the project, approximately more than two hundred visitors to the website were counted so far.

Figure 33: Web site Project Home Page



## **11. Workshop**

The major objective of Workshop 1 was to familiarize the effective applications of the survey results of Phase 1 within the organizations of Cambodia by using the data operational manuals of ArcView. . On Workshop 2, the expanded applications of the database created by the survey results was demonstrated by preparing the demo-data as linked by “Bridge Data Inventories,” which is owned by the Ministry of Public Works and GIS database. Workshop 3 was held in March 2003. Many participants is expected in Workshop 3 including representatives of other agencies concerned. First, the study team will report all progress made and the final product of Phase 2. Then, twenty presentations will make by the team and agencies concerned. Finally the team has will make a recommendation for the future plan of GIS activity in Cambodia.

### **11.1. Workshop-1**

#### **11.1.1. Date and Time for the Workshops**

Workshop 1: September 28, 2001 — Conference Room on 2<sup>nd</sup> Floor of MPWT

Workshop 2: March 1, 2002 — Conference Room on 2<sup>nd</sup> Floor of MPWT

Workshop 3: March 5, 2003 — Conference Room on 2<sup>nd</sup> Floor of HTL Sunway

#### **11.1.2. Major Organizations participating**

- 1) Road Department, MPWT
- 2) National Geographic Institute, Ministry of National Lands
- 3) Ministry of Environment
- 4) Ministry of Regional Development
- 5) Ministry of Forestry
- 6) Ministry of Agriculture
- 7) Cambodian Land Mine Center
- 8) Cambodian Mekong River Committee
- 9) Institute Technology Cambodia
- 10) Mekong River Committee

- 11) Ministry of Metal Industry
- 12) Air Port Construction Department, MPWT
- 13) Harbor Department, MPWT
- 14) Maeda Construction Company
- 15) JAHDS (NGO)
- 16) JICA Phnom-pen Office

### **11.1.3. Program of Workshops**

#### **Workshop 1:**

1. Opening Speech (by General Director)
2. Introduction of Phase 1 (by JICA Team)
3. How to Use Phase 1 Data in ArcView (by JICA Team)
4. GIS Application (by MPWT)
5. Data Distribution Status (by MPWT)
6. Introduction of Phase 2 (by JICA Team)
7. Existing Data Verification (by JICA Team)
8. Landsat TM, SPOT Geo-coding Using ERDAS (by JICA Team)
9. Homepage Content (by JICA Team)
10. Questions
11. Closing Speech (by Dr. Heng , Senior Technical Adviser )

Workshop 1 had 56 participants, beyond our expectations. In order to familiarize the uses of the survey results, data operational manuals have been distributed to the participants, and a presentation for the technical methods of data creation was made by using a projector as a technical transfer for the participants. The demonstration was given by using Vector GIS software, ArcView, which was likely to contribute to the understanding of the participants because of ArcView's popularity as the preferred GIS software in Cambodia. The data operational manuals were also distributed later through the participating organizations.

Among the programs offered at the workshop, the image processing operations, noted above under Item 8, was likely to be of deep interest because the raster GIS software like Erdas is not yet popular in Cambodia due to their expensive costs. It is

therefore hoped that the operational skills of the precise Erdas software owned by MPWT will be more improved.

Among the questions presented was a request from the Geological Institute of Ministry of the Mineral Industry, for the distribution of the intermediate results such as aerial photographs and satellite images. Aerial photographs used for Phase 1 were provided to them in exchange for their letter of appreciation.

## **11.2. Workshop 2:**

### **11.2.1. Program**

#### **Part 1: Progress Report**

- 1). Opening Speech (by General Director)
- 2). Summary of GIS Data Building Procedure (by JICA Team)
- 3). Data Preparation of Land Use (by Mr. Kok Seng, MOE)
- 4). Data Preparation of Geology (by Mr. Meng, Geological Dept)
- 5). Data Preparation of Infrastructure (by Mr. Rath, MPWT)
- 6). Screen Digitizing by ArcView (by JICA Team)

#### **Part 2: Technology Transfer**

- 1). SPOT Orthophoto Creation by Erdas (by JICA Team)
- 2). Orthophoto Creation by Erdas (by Mr. Pannarith, MPWT)
- 3). Orthophoto Creation by PCI (by Mr. Ponnaban, NGD)
- 4). Map Symbolization (by JICA Team)
- 5). GIS Application for Bridge Database (by Mr. Rath, MPWT)
- 6). Questions
- 7). Closing Speech (by Dr. Heng, Senior Technical Adviser)

Workshop 2 had almost the same number of participants as Workshop 1. about 50. At Workshop 2, more Cambodians were present, from not only the counterpart to MPWT, but also from other participating organizations of the project. It would be worthwhile for the participation of the Cambodian presenters to prepare the demonstration materials by using presentation software, ArcView, ERDAS, and PCI in

cooperation with the JICA Team. The workshop was divided into Part 1 and Part 2. The progress report was presented during Part I, and the technical transfer was presented at Part 2. The preparation of digital ortho-photo by using raster GIS software (ERDAS) and vector GIS software (ArcView) and the technical transfer for data capture by using ortho-photo were considered to be the two subjects of the most interest among the participants. It would be useful to continue the technical transfer of these subjects for the participants continued advancement.

### **11.3. Workshop 3**

#### **11.3.1. Program**

- 1) Opening Speech.....(by HE. KHY Tainglim)
- 2) Project Overview..... (by Mr. ITO: Team)
- 3) The Evaluation of the Existing GIS Data.....(by Mr. Sah: Team)
- 4) Infrastructure Interpretation.....(by Mr. Rath, MPWT)
- 5) Land Use Interpretation.....(by Mr. Kokseng, MOE)
- 6) Landform Analysis and Limestone Mapping.....(by Mr. Meng,  
Geological Dept and Dr. Heng, Senior Tech. Adviser to MPWT)
- 7) Question and Discussion....
- 8) Land Use and Landform Digitizing.....(by Mr. Sah: Team)
- 9) Aerial Photography Report.....(by  
Finnmap)
- 10) Ortho-Photo Creation .....(by Mr Ponnaban, NGD)
- 11) Infra Data Digitizing and Map Symbolization...(by Mr. Yamaya, Team)
- 12) Demonstration of Using Data by ArcView.....(by Mr. Sah, Team)
- 13) Data Distribution Status of Phase 1.....(by Mr. Phanarith, MPWT)
- 14) GIS Training Report.....(by Mr. Phanarith, MPWT)
- 15) Bridge Inventory application.....(by Mr. Rath, MPWT)
- 16) Demobilization of Soldier Living Maps .....(by Mr. Rath, MPWT)
- 17) Identification of Hungry Population (by Mr. Seang, LUMO )
- 18) Change & Replacement of Land Use (by Mr. Seang, LUMO )
- 19) Question and Discussion.....
- 20) Closing Speech.....(by Dr. Heng, Senior Technical Adviser)

At Workshop 3 (March 2003), hundred twenty participants attended including representatives of other concerned agencies. First, the Study team reported about all

the progress and final products of Phase 2. Then, technical approaches were explained and several kinds of GIS application were introduced in this workshop. The team also made recommendations for the future plan of GIS activity in Cambodia.

## **12. Consultation Meeting**

### **12.1. The First Consultation Meeting**

#### **12.1.1. Acceptance of Inception Report**

The study team visited the Kingdom of Cambodia on 16th May, 2001 in order to carry out “The Study on the Establishment of GIS Base Data for the Kingdom of Cambodia.” The team had a series of meeting and discussions on the IC/R with the officials of the Ministry of Public Works and Transport.

The IC/R was clearly presented using Power Point software . After the presentation, other details such as the study methodology, work plans, work processes and staffing, equipment, and facilities were discussed with the mapping center (previous RSP staffs of Phase 1). As a result of discussion, the Inception Report was accepted by MPWT. It should be noted that the following items were discussed in the IC/R:

#### **(1) Study area**

The study area is exactly the same as the one proposed in the S/W agreement based on the Inception Report (Figure 1).

#### **(2) Map symbols**

The map symbols used in Phase 2 were discussed. It was finally concluded that the same map symbols and specifications used in Phase 1 should be applied to Phase 2.

#### **(3) Land-use legend**

The land-use legend used in Phase 2 was discussed. It was finally concluded that the same legend used in Phase 1 should be applied to Phase 2.

(4) Surface geology/ geomorphology (land form) legend

The surface geology/ geomorphology (land form) legend used in Phase 2 was discussed and it was concluded that the same legend used in Phase 1 should be applied to Phase 2.

(5) Specification of the GIS database

The designs and specification of the GIS database used in Phase 1 should be adopted for Phase 2. It was also further suggested that they should be integrated using ArcInfo in the final stage, prior to delivery.

### **12.1.2. Summary of the Discussion**

The following items were discussed and agreed upon by both sides.

(1) Distribution of GIS Data

Both sides agreed to set up a home page to promote the GIS data distribution through the Internet.

MPWT agreed to set up the administrative procedure for the data ordered by users and, to take the concurrence from the Ministry of Land Management, Urban Planning and Construction, if necessary.

The team suggested that the distribution system of hardcopy maps of Phase 1 should be established in cooperation with the National Geographic Department. MPWT also agreed with the recommendation and promised to carry out the distribution of the remaining paper maps from Phase 1.

(2) Request of MPWT regarding On-the-Job Training (OJT)

The MPWT side requested the team transfer the technique of geo-correction of satellite data to MPWT staff. The MPWT side requested the study team for additional extensive training in Japan to the MPWT staff.

(3) Staff for Interpretation

MPWT communicated that the amount of current technical staff the related departments of MPWT retain would not be sufficient to carry out the interpretation works of the project. In order to proceed with the interpretation

tasks efficiently, MPWT shall provide more technical staff by recruiting from the related agencies.

(4) Existing Aerial Photos

The negatives of existing aerial photos are available at the Cambodian National Mekong Committee (CNMC). However, hard copy preparation is a time-consuming process, MPWT, therefore, agreed to coordinate in borrowing the necessary aerial photos from CNMC.

## **12.2. The Second Consultation Meeting**

The study team visited MPWT in September for Workshop 1. (The second consultation meeting with MPWT for the complete project implementation.) The following topics were discussed:

- (1) Topographic mapping activity, (i.e. the inter-ministries meeting held on 01 August 2001 at the Council Minister's Office).

The inter-ministries meeting suggested transferring the topographic mapping activity from MPWT to NGD in August 2001. The study team reported to JICA on this matter and met with MPWT.

As a result of this discussion, the study team reported difficulty in changing the counterpart agency, and subsequently suggested that MPWT send an official letter to NGD to participate in the project.

- (2) The schedule of the interpretation work for land use and land form .

The interpretation work was rescheduled because of a delay with the satellite imagery.

- (3) Holding the Workshop 1

The Workshop of Phase 1 was successfully held at MPWT. There were 56 participants at the Workshop, including representatives of other agencies concerned. All participants were given a chance ask questions on Phase 1 data distribution procedures and the manual of data use of Phase 1.



- (4) Necessity of upgrading the equipment and software.

MPWT requested the study team donate the new GIS equipment to be able to process the data and information effectively. The team promised to convey the request to JICA headquarters.

- (5) Necessity of field work.

MPWT explained that the necessary fieldwork should be carried out to keep the GIS database accurate, as there was a lot of uncertainty in the formation of the Phase 1 maps. The team proposed discussing this matter at the third consultation to be held in November.

The technical problems of the data download system will be communicated through the website.

The following technical problems were identified by the study team:

- 1) The file size of Phase 1 data-set is too large to be up/downloaded. Thus, it will be a time consuming process (i.e. @ 12 minute/Mb).
- 2) Computer networking facilities have not yet been well-developed in Cambodia.
- 3) Downloading the provisions of each map will require a sophisticated structure for the website.

After receiving the report from the Team, MPWT suggested that data should be delivered by CD-ROM to the user.

### **12.3. The Third Consultation Meeting**

The Study team had another meeting with MPWT in November 2001 regarding the necessary issues, previously discussed in September, and the minutes of the meeting were available on 25<sup>th</sup> November 2001.

#### **12.3.1. The Utilization of the Output of Phase 1 by the Team.**

MPWT received the “Proposal of Utilization of Output from Phase 1,” which was prepared by the team in September 2001. MPWT agreed on the team’s recommendation and promised to carry out the distribution of the remaining output of Phase 1.

### **12.3.2. Participation of NGD**

MPWT reported that a communication network was established at NGD. This department has full responsibility for the national base map data. As a result, it was decided that NGD participate in the project as a cooperation agency for topographic mapping activity.

### **12.3.3. Home Page Uploading**

The study team reported that Internet website was uploaded successfully. This website is to promote the GIS data distribution of Phase 1 through the Internet in accordance with the second consultation meeting of September 2001. The team explained again about the problem of the data down loading system using the website. The problems were:

- 1) The size of the database file is large, and it may require a long time to download the 30 Mb of land use data (6 hours @ 12 minute/Mb).
- 2) The facilities to download the data are not well-organized in Cambodia.
- 3) The downloading of each map may require the construction of a very complicated website.
- 4) To avoid the problems mentioned above, both sides agreed that MPWT would deliver the data of Phase 1 by CD-ROM after receiving the request through the Internet from the users.

### **12.3.4. Reporting the Interpretation Activity**

The team reported the results of the interpretation, which was completed by October as follows:

- 1) Land use interpretation

30% of the land use interpretation for this year's portion was completed. The rest of the interpretation continues. It is expected that this part will be finished by the end of January 2002.

- 2) Geology/Geomorphology (Land form) interpretation

**60% of interpretation was completed in Land form (geology/geomorphology). It is expected to be finished by the end of December.**

3) Topographic mapping interpretation

**30% of topographic map interpretation was completed by the end of February.**

#### **12.3.5. Request of MPWT**

1) Additional aerial photo-sets

MPWT addressed their concerns on the delay of the interpretation and indicated that the delay of interpretation was caused by insufficient numbers of the aerial photo-set despite the different types of interpretation work (such as topography, land use and land form) available. Therefore, MPWT requested the team add two more sets of photographs, so that the interpretation team will be able to catch up on the delay.

The team explained that this year's budget was already limited to purchasing only 1 set of contact prints of the existing photographs and new photographs. Therefore, it was difficult to prepare two more sets this year. To solve the program, the team proposed making photocopies with high-quality paper so that the interpreters will be able to carry out their jobs. MPWT accepted this method for this year but requested again two more sets of contact prints for next year's interpretation.

2) Field checking

MPWT proposed the field checking for the interpretation work, since there were still a lot of uncertainties in formation in the Phase 1 maps. The team explained that the budget did not include field checking in this year. MPWT understood the explanation of the study team, but MPWT proposed adding the field check program in the second year. MPWT also shared that security is fully restored throughout the country. Therefore, the field teams can operate in safe conditions.

3) Upgrading the equipment and software.

The GIS equipment donated by JICA is now obsolete, as the database has increased in size; the old equipment is now too slow for data analysis and downloading. Therefore, MPWT requested JICA to donate the new GIS equipment so that it can process the data effectively.

4) Counterpart training in Japan

MPWT requested the team receive their GIS expert training in Japan next year.

The team promised to convey these four requests to JICA Headquarter.

#### **12.3.6. Reply of JICA for the Request of MPWT through the Team**

Concerning the above-mentioned requests of MPWT through the second and the third consultation meeting, JICA HQTS replied that it was difficult to provide additional photographs, to upgrade the equipment and software and provide counterpart training in Japan due to the budget limitations. Expenses related to field checking, however, were agreed to in order to keep the information as accurate as possible. Therefore, field verification is to be carried out in April 2003.

#### **12.4. The Forth Consultation Meeting**

The Study team had another meeting with MPWT in February 2002 regarding the necessary issues, previously discussed in November 2001, and the minutes of the meeting were available on 4<sup>th</sup> March 2002. In brief, the minute of meeting include the status of interpretation work and Aerial Photography, technical transfer, field works and request of MPWT.

#### **12.5. The Fifth Consultation Meeting**

The Study team had another meeting with MPWT in March 2003 regarding the necessary issues, previously discussed in February 2002, and the minutes of the meeting were available on 12<sup>th</sup> March 2003. In brief, the minute of meeting included the discussion about time schedule for the recommendation of Draft Final Report (DF/R), status of Aerial Photography, Workshop III, Final check of data on Cambodian side and Request of donation of the equipment.

### **13. Transfer of Technology**

The Cambodian national GIS database comprising of Topographic maps, Land use maps, Geology and Geomorphology (Land form ) maps was completed by the end of Phase 2. It is noteworthy that the technical skills of mapping have been transferred to the Ministry of public works and Transportation. Before and after each technical transfer throughout Phases 1 and 2 (conducted from 1996 to 2003), an appraisal was made, as shown in Table 16

#### **13.1. Annex of Report**

Operation manuals were prepared for each item for MPWT staff as a ANNEX in this report.

ANNEX is included Map symbol and its application rule, GIS data definition and Field report.

ANNEX are as follows:

- (1) Annex I.....MAP SYMBOL
- (2) Annex II.....DATABASE SCHEMA DEFINITION
- (3) Annex III.....ArcView OPERATION MANUAL
- (4) Annex IV.....ERDAS MNUAL
- (5) Annex V.....RASTER VECTOR CONVERSION
- (6) Annex VI.....MAP SYMBOLIZATION
- (7) Annex VII.....LAND USE INTERPRETATION KEY
- (8) Annex VIII.....FIELD IDENTIFICATION REPORT

.

Table 16: Appraisal of technical transferring

Item	Status before Project	Status after Project	Necessary Technology for in near Future
1) Ground Control Survey	No practice	Because the GCPs were obtained from the old 1/50,000 maps, the overall technologies of ground survey could not be transferred, however point positioning GPS technology has been transferred. Also, the datum and coordinates system transformation has been transferred.	Ground control survey technique should be learned from other department in MPWT. GPS and leveling instruments is available in Inland water Department.
2) Aerial Photo Interpretation	UNDP has conducted technical transfer.	After the termination of UNDP's support, some photo interpreters moved to another ministries, however they were re-assigned to this project. Together with skillful interpreters, some proper interpreters of MPWT were trained. All of them had received advanced training during the project.	
3) Aerial Triangulation	No practice	No practice	Aerial Triangulation method should be obtained to cooperate with Geography Department in near future.
4) Field Verification	No practice	Technical skills to prepare skeleton maps by Arc View and field verification have been transferred.	Only logistic support is required
5) Image Analysis	No practice	As the results of introduction of image analysis technique and OJT, geometric correction and preparation of ortho-photo images could be conducted. Though MPWT has presently no 3D-analytical plotter, 2D-mapping by using ortho-photo images is now possible.	

6) Plotting	No practice	Digital data capture on geographic information is now possible by the ortho-photo using ArcView. Trained interpretation skills will contribute to such data capture.	No instrument is available in Cambodia but it must be introduced for the Data capturing by 3 dimensional photogrametric method in near future.
7) Map Compilation/ Symbolization	No practice	Technical transfer of map symbolization has been conducted using Adobe Illustrator software on OJT. The counterpart has prepared a general map at the scale 1/500,000, and this will be contributed to schools throughout the country.	
8) GIS Data generation	Digitizing technologies by using PC ArcInfo had been available.	Not only digitizing but also input techniques (by introducing ArcInfo 7.2 and ArcView 3.1) have been trained for: -digitizing without digitizing table -scanning -Raster/Vector conversion -topology structuring -data quality control	
9) GIS Data Analysis and Application	No practice	GIS data analysis and simulation technologies have been practiced and obtained. Applications of bridge inventories and distribution map of discharged soldiers were presented in Workshop	In MPWT, the use of GIS application has just started and its technical level is still at a basic. For the GIS solution of National Master plan, more efforts to learn and practice the advanced technology are necessary.
10) Facilities of Operation Room	Only space was available.	The following equipments were introduced: <b>Hardware</b> -Personal Computer 12 sets -Degitizer 2 set (A0) -Data server 1 set -Colore printer 1 set(A3) -Lazer printer 1 set (A3) -Scanner A4 1 set	JICA survey equipment introduced in Phase 1 has contributed greatly to the effective transfer of technology on OJT. But the following equipments shall be upgraded to latest version. <b>Hardware</b> -Personal computer Pentium III to latest  <b>Software</b>

		<ul style="list-style-type: none"> <li>-Copy machine 1 set</li> <li>-Stereo scope 6 set</li> <li>-Generator 1 set</li> <li>-Furniture 1 set</li> <li>-Map Rocker 1 set</li> <li><b>Software</b></li> <li>-ArcInfo 7.1 1 license</li> <li>-ArcView3.1 5 licenses</li> <li>-Erdas Imagine 8.3 1 license</li> <li>-PC ArcInfo 5 licenses</li> <li>-Illustrator 8.0 2 license</li> <li>-Photoshop 5.0 1 license</li> </ul>	<ul style="list-style-type: none"> <li>-Arc/Info 7.1 to ArcGIS 8.1</li> <li>-ArcView 3.1 to ArcGIS 8.1</li> <li>-Erdas Imagine 8.3 to Erdas Imagine 8.5</li> <li>-PC Arc/Info to ArcGIS 8.1</li> <li>-Illustrator 8.0 to Illustrator 9.0</li> <li>-Photoshop 5.0 to Photoshop 6.5</li> </ul>
11) Human Resources	Not available	<ul style="list-style-type: none"> <li>Management 1</li> <li>-GIS specialist 2</li> <li>-GIS technician 3</li> <li>-Interpreter 3</li> <li>-Map editor 3</li> <li>(Illustrator)</li> <li>-Image analyst 1</li> <li>-System engineer 1</li> </ul>	Trained staff should be secured permanently through the institutional enhancement in MPWT



### 13.2. GIS application

As advanced GIS technology, some application were made during the project.

### 13.2.1. Land suitability analysis

This application is an analysis for the agricultural land suitability for Battambang Province in the phase 1. The development possibility of the agricultural land where is undeveloped was analyzed by overlay method using the land use, landform and topographic data.

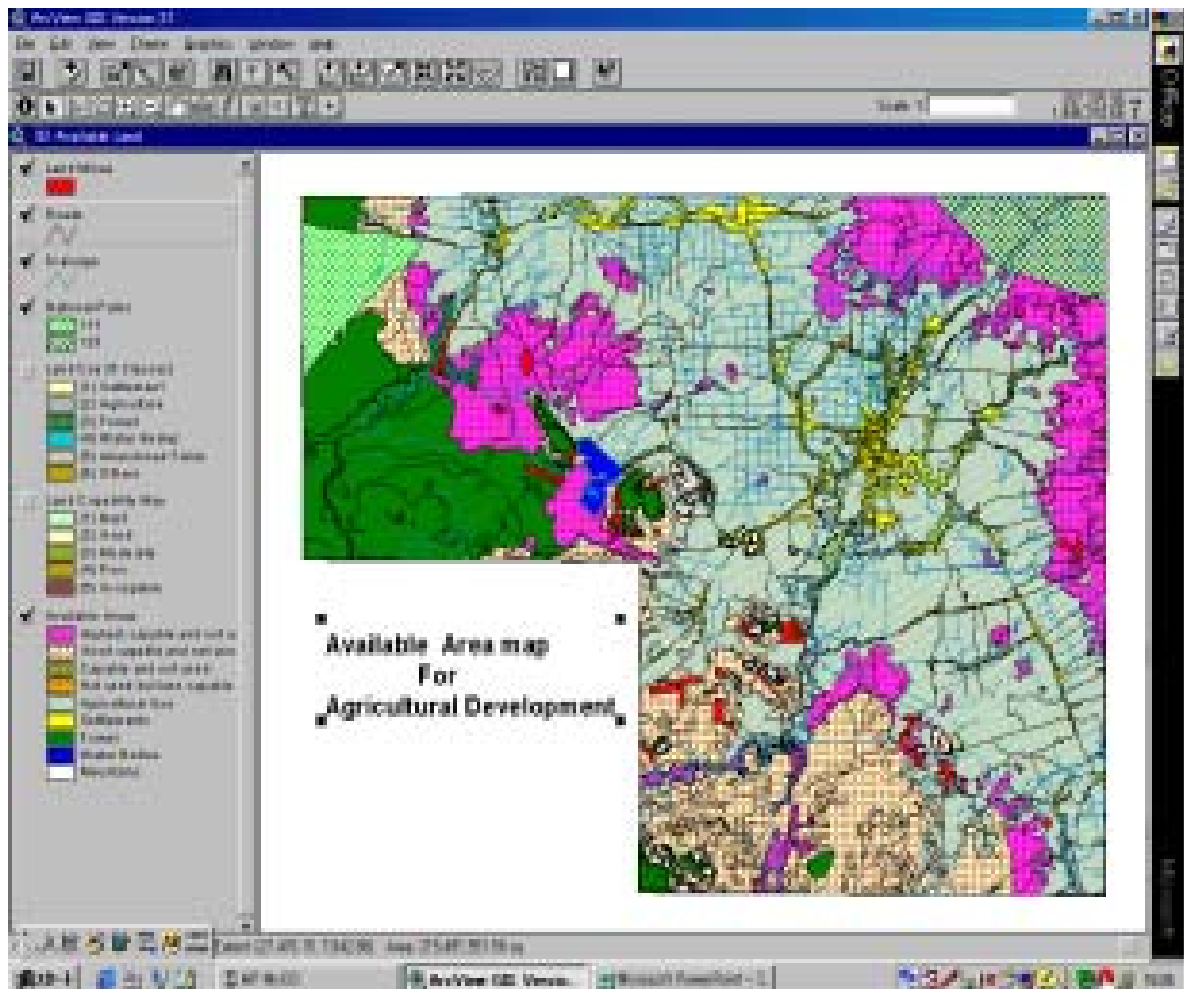


Figure 34: agricultural land suitability analysis

### 13.2.2. Route selection for National road No.6

Route 6 has been suffering damage due to the flooding every year. Because of that, repair by the ADB loan is repeated every year. Route selection for National road 6 was tried to find another route which is no flooding by the analysis of the water body and land form.

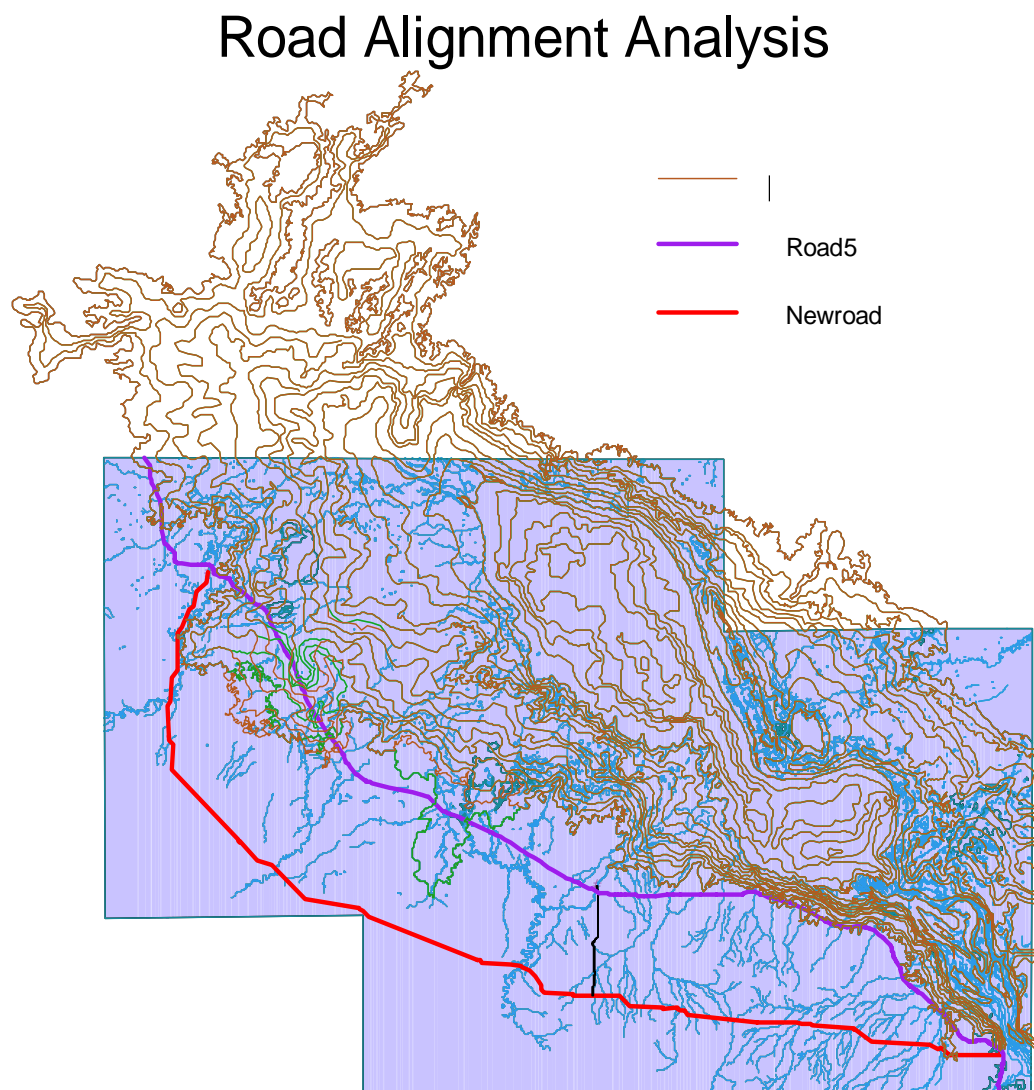


Figure 35: Route selection for National road No.6

### 13.2.3. Bridge inventory

This application tried to create a bridge inventory database using GIS. It was presented at the Workshop of the phase 2.

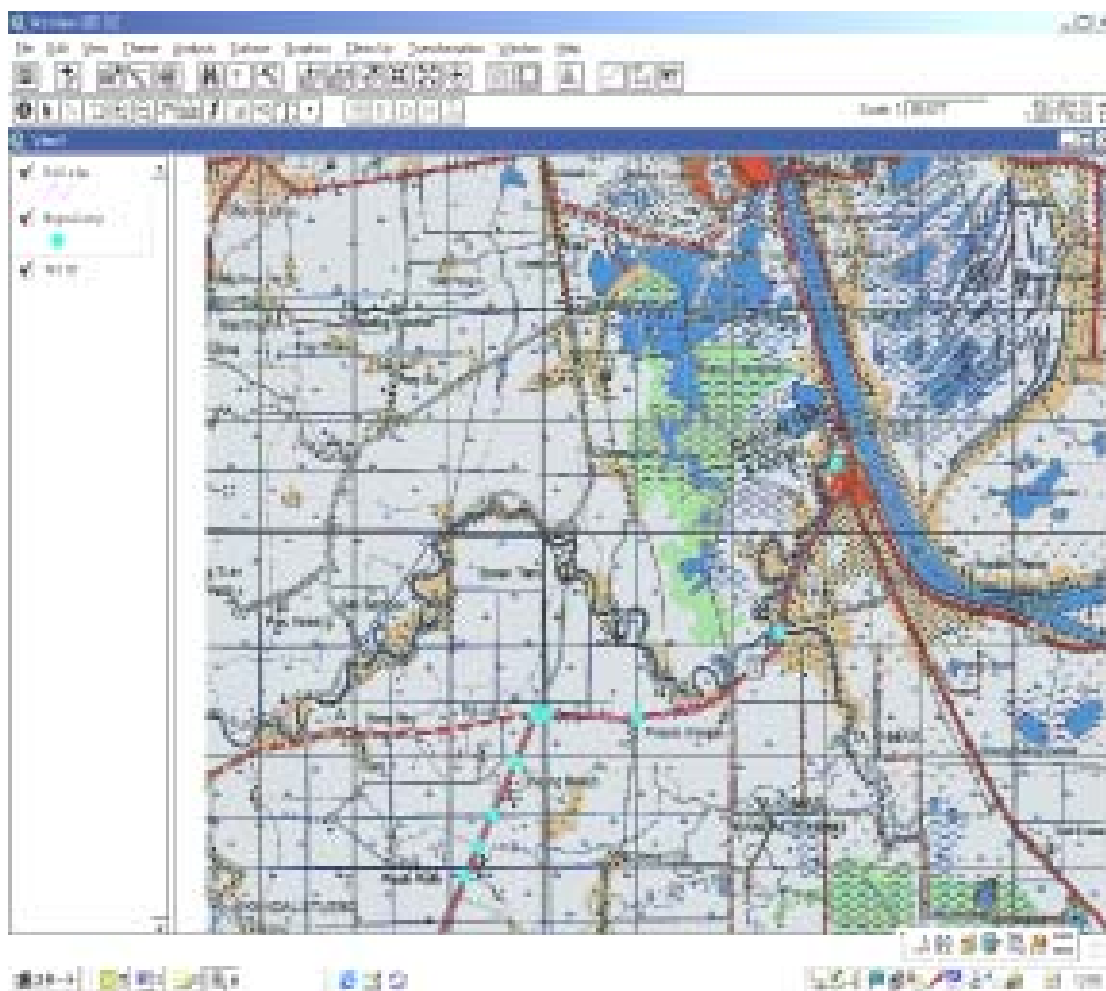


Figure 36: Bridge inventory

#### 13.2.4. Retirement soldier status Maps.

This application was developed by the request of the JICA Indochina sections.

It shows a present condition of the retired Retirement soldier in Canpong Cham Province

.It will present at the Workshop 3.

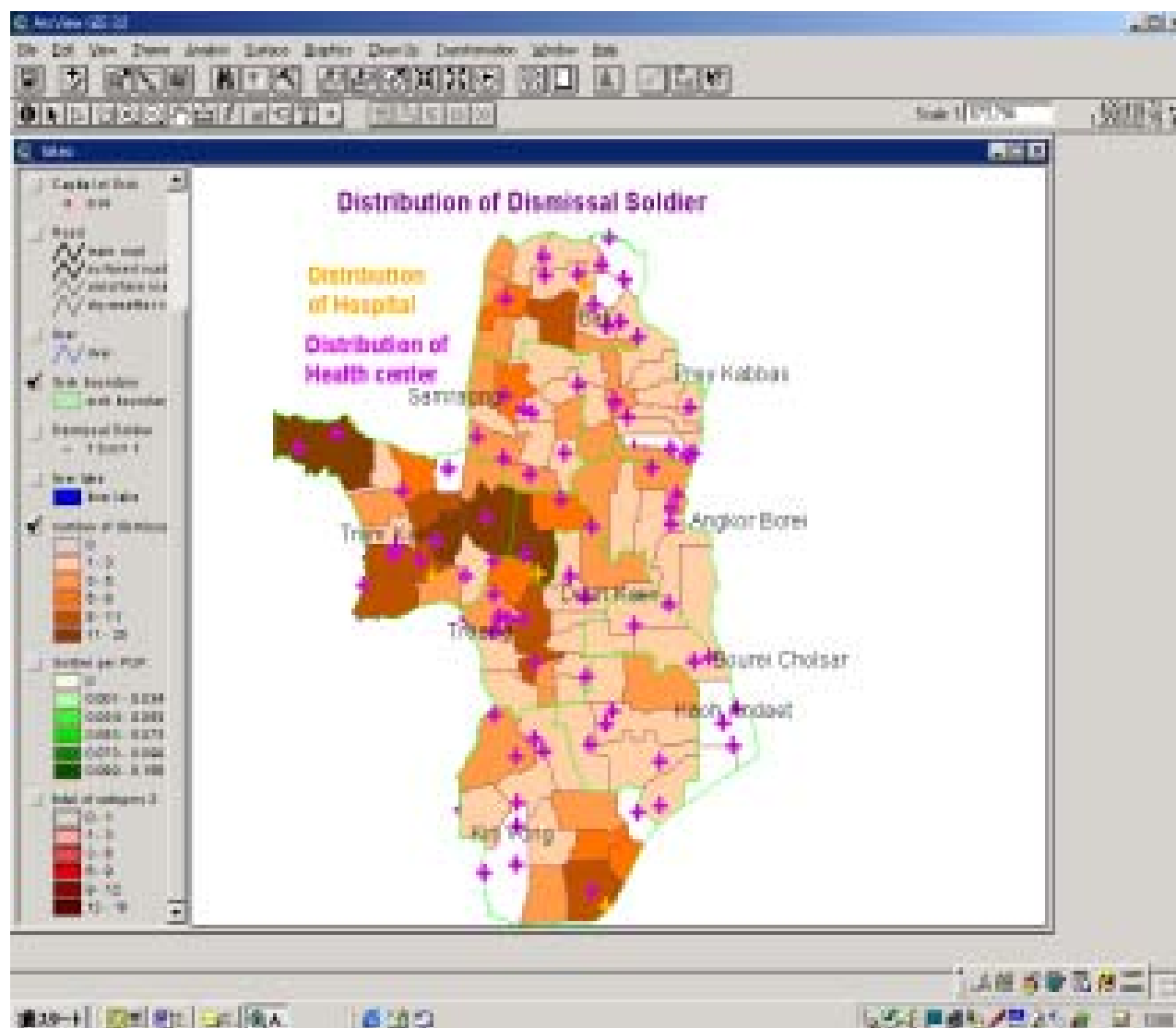


Figure 37: Retirement soldier status Maps

### 13.2.5. Land Use Change (1992/93-1996)

This application tried to show the change in land use in Chamkar Leu district, Kampong Cham Province during the period of 1992/93-1996. This was presented in workshop 3 of Phase 2.

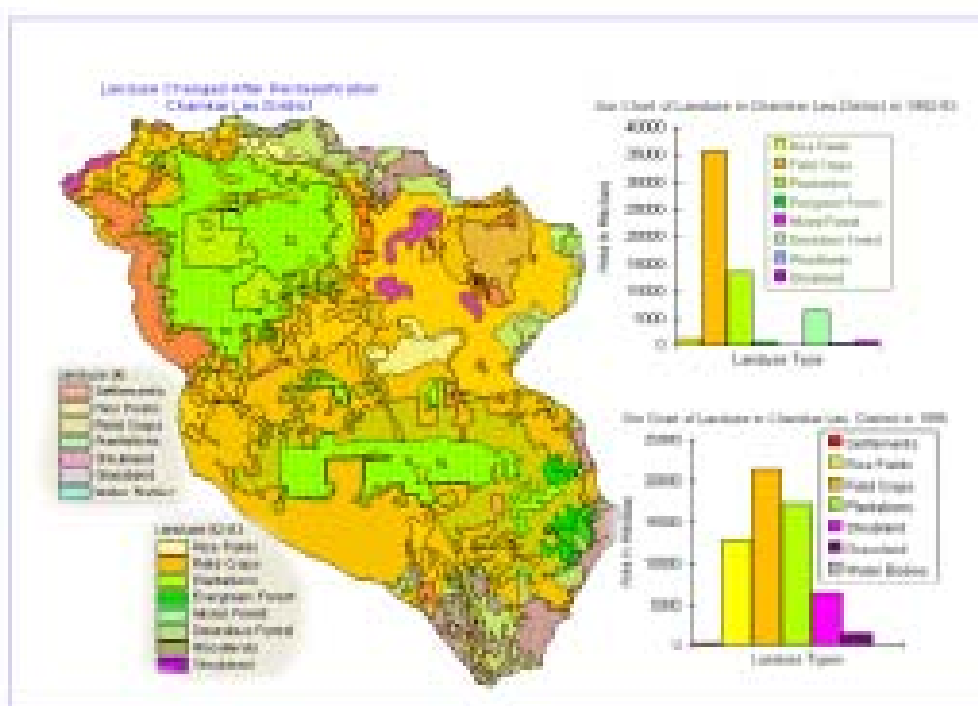


Figure 38: Land Use Change Map (1992/93-1996)

### 13.2.6. Communes with Hungry People Affecting the Protected Areas.

This application was developed to show food insufficient communes where people might be affecting the protected area in Cambodia. Photos indicate the Problem due to hungry people. This application was presented in the workshop 3 of Phase 2.

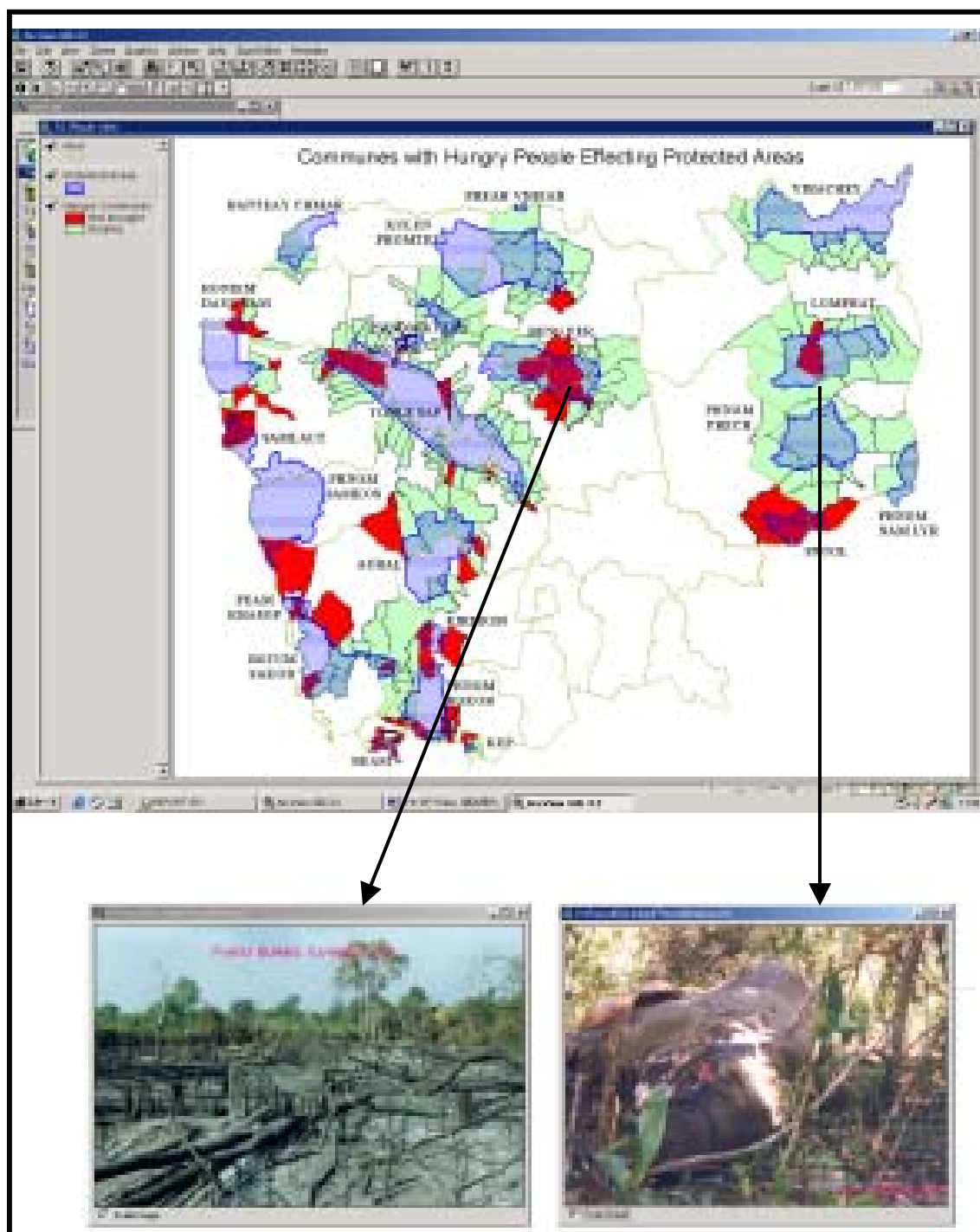


Figure 39: Communes with Hungry People Affecting Protected Areas

### **13.3. Preparation of the operation manuals**

The operation manuals were prepared for each item for MPWT staff as a ANNEX in this report. The item of manuals are as follows:

- (1) ArcView operation manual

See Annex III

- (2) Image processing for Landsat, Spot-ortho and ortho-photos

See Annex IV

- (3) Raster Vector Conversion

See Annex V

- (4) Head-up digitizing

See Chapter 3.5 “Digitizing for Infrastructure Information” in this report

- (5) Map symbolization

See Chapter VI