

**CHAPTER 4**  
**EVALUATING**  
**IMPACTS**

**ENVIRONMENTAL**

## **CHAPTER 4**

# **EVALUATING ENVIRONMENTAL IMPACTS**

## **CHAPTER 4 EVALUATING ENVIRONMENTAL IMPACTS**

### **4.1 Introduction**

The object of the Project at this stage, as has been described earlier, is concerned with looking at a range of factors in order to develop a master plan and determine the route and/or elements of a route (e.g. bridges) that would have the highest priority for the economic and social development of Lao PDR. The intent here is to provide sufficient information that will allow decision-makers to make informed choices based on an understanding of the positive and negative environmental dimensions of different road segments.

The study team recognizes that it is important that the route selection eventually is seen as a social and political decision making process based on the best available technical information and analysis. This analysis must therefore be seen as data to be used for Lao PDR to establish priorities.

The consideration of a master plan is driven by a series of imperatives but clearly economic development and the alleviation of poverty must be seen as the driving forces behind the master plan. In addition, the protection of the environment is clearly essential for the ongoing development and survival of the poor and the region.

The study uses four categories of environment (socio-economic, cultural, natural/ecological and physical) that are suggested in the Lao PDR road assessment review process as organizing elements.

A list of publications consulted can be found in ANNEX. The different approaches used were:

- Interviews held with a cross-section of stakeholders.
- A significant number of publications were reviewed. This work was reviewed with particular emphasis on road construction in the southern part of the country.
- A field visit was conducted and the major routes were reviewed and existing social and cultural environmental conditions were observed.
- All the information was then evaluated and conclusions drawn to aid in the decision making process.

While there have been a number of generic studies carried out there is little specific and comparable data available for the area in question. It must be understood that the analysis carried out and conclusions reached at this stage of the Project are based on a new and untried process together with a database that is often inadequate.

## **4.2 National Legislative and Stakeholder Involvement**

There are a number of laws, regulations and guidelines that have an influence on the overall environmental management and protection in Laos. It is our assessment that many of the laws provide a supporting process of impact evaluation and management.

Selected Laws, Regulations and Guidelines include:

- Law on Environmental Protection Law #02/NA/99 (1999).
- National Forestry Law #01-96 (1996)
- Preservation and Management of National Cultural Heritage Notice #943 (1995)
- National Biodiversity Conservation Areas – Prime Minister’s Decree #164 (1993)
- Management and Protection of Aquatic Animals, Wildlife and Hunting and Fishing – Council of Ministers Decree #118/PCM (1989)
- Decree 1074 of the Ministry of Agriculture and Forestry (1996)
- Declaration of the President #125/PO on the Forestry Law approved by National Assembly #04/NA (1996)
- Environmental Guidelines for Reducing the Environmental Effects of Road Projects in Lao PDR, World Bank, 1994.
- Strengthening Social and Environmental Management in Lao PDR, Science, Technology and Environment Agency and, MIH Department of Electricity and MCTPC Department of Roads, ADB TA 3133—LAO, July 2000.
- Regulation on Environment Assessment in Lao PDR, Science, Technology and Environment Agency, SIDA, 2002

The specific priority alternative chosen by the study process will be the first that will be formally considered through the process established and administered by the Science, Technology and Environment Agency (STEA). It will also be the first considered by the newly formed Social and Environment Division of the Department of Roads. (A simplified version of the STEA process can be found in Figure 4.2.1.

Stakeholder involvement is seen as a primary objective of the ongoing study process. While the views of local people are of paramount importance it is essential that all stakeholders be given an opportunity to review plans and comment on them from their particular perspectives. Recognizing the multiplicity of interests and objectives this is an essential part of the ongoing process of determining the best possible design and management of the selected route and elements. The stakeholders that will be consulted are identified in Figure 4.2.2.

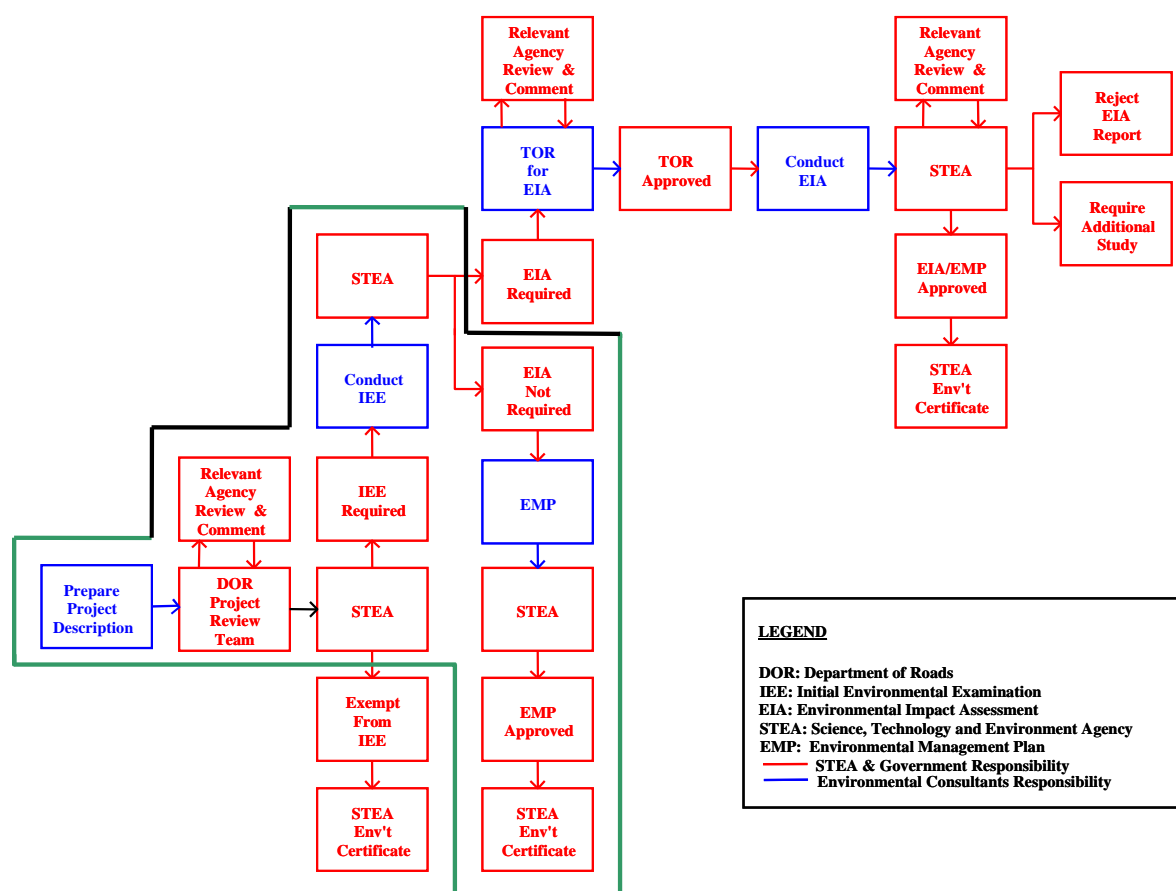


Figure 4.2.1 Environmental Assessment Process for the Lao PDR Department of Roads

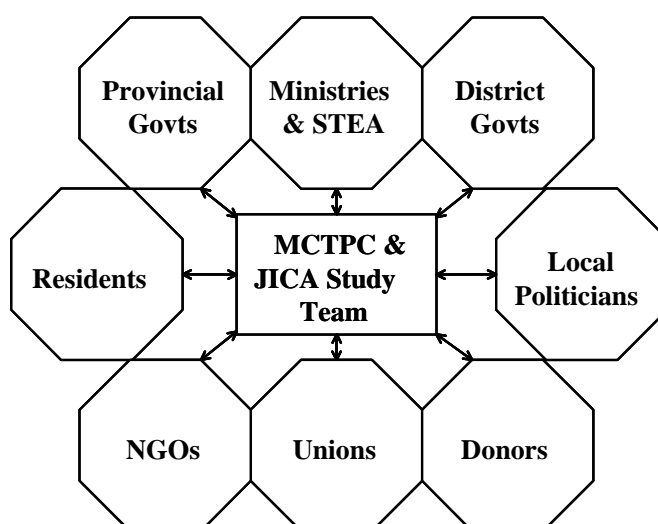


Figure 4.2.2 Project Stakeholders

### **4.3 Policy Context**

From an analysis of various government documents the country's primary national goals can be defined as:

- Economic growth
- Poverty reduction
- National integration
- Environmental protection.

It is important that the assessment process take these national goals into account in weighing various options and plans.

#### **4.3.1 Economic Growth**

As with all national governments economic development is one of the important goals of the national government in order to ensure the creation of wealth and gainful employment for all its citizens. In the case of this project the concern will be on how a road system and a particular route can best contribute to that economic growth. Different routes will provide for different types of economic growth and opportunities. Clearly only national representatives can provide guidance as to the alternative routes that best meet the economic goals of the nation.

#### **4.3.2 Poverty Reduction**

The reduction of poverty can be seen as a subset of the overall goal of economic development. However experience has shown that while overall national economic conditions may improve in a country the condition of the poor may remain the same or in some cases deteriorate even within a climate of economic expansion. Since many of the development organizations are now very much oriented to providing or lending funds on the basis of a project's ability to reduce poverty this goal becomes an important consideration in the choice of any route.

If one adopts the poverty definition of ADB and other development organizations to include a range of quality of life and access considerations, the choice of a particular route becomes even more important in meeting the poverty reduction goal.

### **4.3.3 National Integration**

In a sparsely populated country with many small villages representing numerous ethnic minorities, a road system can help to bring people together and to achieve a much better level of communication in order to contribute to the process of nation building.

Lao PDR is characterized by diversity. There are over 230 ethnic groups from four ethno linguistic families. Biological diversity mirrors that of the ethnic dimensions of the society. From the interaction of ethnic and biological diversity has evolved a large variety of agro-ecological issues and livelihood systems.

The importance of viewing ethnic diversity as a strength rather than a weakness has become increasingly clear in recent years. The value of indigenous knowledge as a repository of information on complex multi-formed ecological structures and natural resource conservation has been demonstrated and should be regarded as part of the national heritage. Each ethnic group has identifiable strengths.

The Resolution of the Party Central Organization Concerning Ethnic Minority Affairs in the New Era, 1992 calls for the promotion and expansion of the traditional culture of each ethnic minority (“to allow the mental lives of each ethnic minority to blossom and contribute to the reach multi-formed and multicolored cultures of our Lao nation”).

Achieving integration while maintaining ethnic diversity is a challenge.

### **4.3.4 Environmental Protection**

In many documents there is a stress on the need for environmental protection in all activities in Lao PDR. There is a strong recognition of the important role that the natural environment will play in providing for prosperity in the future and the food needs of the population. Adopting an alternative that helps to provide for environmental protection has to be seen as an important dimension in meeting national goals.

The goal of environmental protection seems to be difficult to achieve at times given the essential role that nationally protected areas played in meeting the basic needs especially of the poor. Non-timber forest products (NTFPs) are an important source of income and nutrition for poor villagers. In fact, the average annual income from NTFPs accounts for about 40% of total household income. However, this income makes up 90% of the total income for the poorest groups. As populations increase the conflict between resource conservation and meeting basic food needs from NTFPs will become a crucial issue to be resolved.

#### **4.3.5 Resolving Conflicting Objectives**

The government of Lao PDR recognizes the dilemma of achieving these four objectives. In fact, the National Socio-Economic Development Plan 2001-2005 states, “Social economic development must provide efficient, continuous and stable ways of securing the balance between economic development, social cultural development and sustainable environmental protection”.

#### **4.4 Definitions**

It is important to define poverty and access in the consideration of a master plan and impact assessment.

##### **4.4.1 Poverty**

When discussing poverty there are universal understandings of fundamental concerns in human development: adequate food, adequate shelter, secure livelihoods, accessible safe water, adequate health care, quality schooling for children and productive, creative and satisfying environments. Social interaction, community participation, and people’s opportunity to determine their own culture and tradition are intangible yet important considerations for human development.

##### **(1) Basic Poverty Definitions**

Some basic poverty definitions include (Source: Overcoming Human Poverty, UNDP Poverty Report, 2000):

###### **Income Poverty**

- Extreme poverty: Lack of income necessary to satisfy basic food needs – usually defined on the basis of minimum calorie requirements.
- Overall poverty: Lack of income necessary to satisfy essential non-food needs such as clothing, energy and shelter.

###### **Human Poverty**

- Lack of basic human capabilities: illiteracy, low nutrition, abbreviated lifespan, poor maternal health, and illness from preventable diseases. Indirect measures are lack of access to roads, services and infrastructure – energy, sanitation, education, communication, and drinking water – necessary to sustain basic human capabilities.



## **(2) Roads as Poverty Priorities for Villagers**

It is essential to note that in many of the surveys transportation, roads and access are not included in the top five causes of poverty or main solutions to poverty as reported in Poverty in the Lao PDR – Participatory Poverty Assessment (PPA). Whether it is because other issues are of greater importance or there is a lack of knowledge about the importance of roads cannot be determined at this time but it should be noted that many groups certainly do not see roads as the highest priority. On the other hand, they may be seen as important facilitators to achieving other objectives. In the poverty report mentioned above land, lack of cash, livestock disease, natural disasters, environmental degradation and lack of water are seen as the primary issues. Lack of roads in fact is No. 10 under other causes of poverty that were cited. When the main solutions for poverty were surveyed roads, were seen as number 8.

However, other studies indicate that the problem most cited by villagers in preventing economic growth is the lack of all-weather roads. Accessibility to markets during the wet season is essential since this is when most agricultural goods are mature and ready for sale. In many villages, tons of valuable crops, such as bananas and pineapples rot each year due to lack of transportation access.

## **(3) Education**

The same report identifies formal education as a luxury, which is at times unavailable or unaffordable and remains a concern that is secondary to making a living. Problems in education that emerge include the quality of the education provided, that is, the qualifications of the teachers and irregularity of teacher attendance, the language of the teacher and curriculum since many ethnic minorities had either a poor or total lack of understanding of Lao. There is always the concern among those struggling to make a living of the relevance of education. The PPA study suggests that at the present time it appears that providing educational facilities for poor people has little effect on the people's lives.

## **(4) Health**

Malaria and dysentery are reported as being the important health problems. The high cost of medicines and access to hospitals and medical practitioners are seen as the main problems. Villagers report that they prefer to die in the village among families and friends rather than risk being transported long distances over difficult terrain to a hospital, and possibly having to meet the cost of treatment by having to sell a cow or buffalo.

Many villages have no access to health care and where it does exist there are two major problems: too few medicines and language problems. It seems that villagers and health personnel cannot communicate with a result the villagers do not go to the health centers.

There are also signs of psychological problems where there are apparently observable symptoms of depression, fatalism and opium addiction.

#### **4.4.2 Access**

One of the overriding concerns in this study is to increase access for social and economic development. In many respects access is defined by the building of roads often to fairly exacting standards requiring a certain type of surface possibly even with shoulders built into the road system. While this type of road may be necessary for accommodating economic development imperatives at a national level thereby allowing large trucks to transport goods to another country there are many other physical alternatives to increasing access for villagers.

For many poor villagers a high standard road is of little purpose since it will be some time – before they will ever be in a position to own a vehicle. For many the means of transportation is by foot, bicycle and in some instances motorcycles. It should therefore be considered that there is a range of ways of meeting the access needs of the poor within the region and that only one possibility is a road. In other instances, given financial resources it may be appropriate and in fact preferable to look at improved all weather trails with adequate river crossings that will allow access to schools and health services. These trails may also allow for the transportation of agricultural goods to the nearest markets. These improved trails could be designed in such ways that at a future date they could be expanded into roads built to accepted standards.

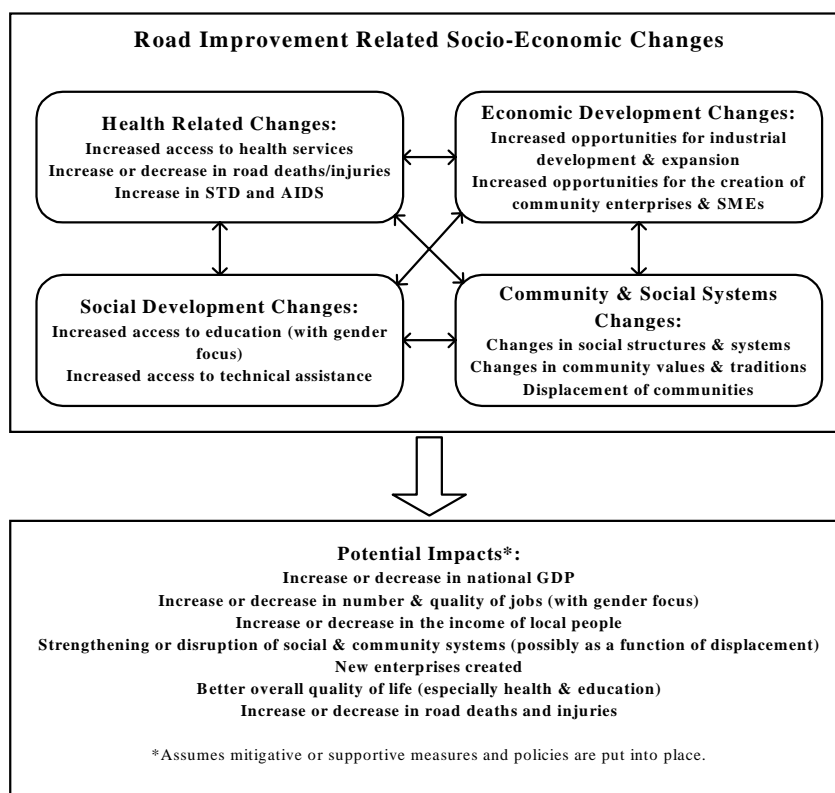
In other cases the existing roads that are often no more than a trail in some instances can be improved to ensure all weather access especially to health services. This will mean building low technology and low-cost bridges to span the water bodies that inhibit the villagers' access to various services.

It is also important to consider access for villagers not directly situated on an improved road. In order to ensure complete access villages within reasonable distance from a main road should also be considered as part of the funding and design considerations. Without all weather connections from these villages access has not essentially been improved for certain periods of the year due to flooding problems.

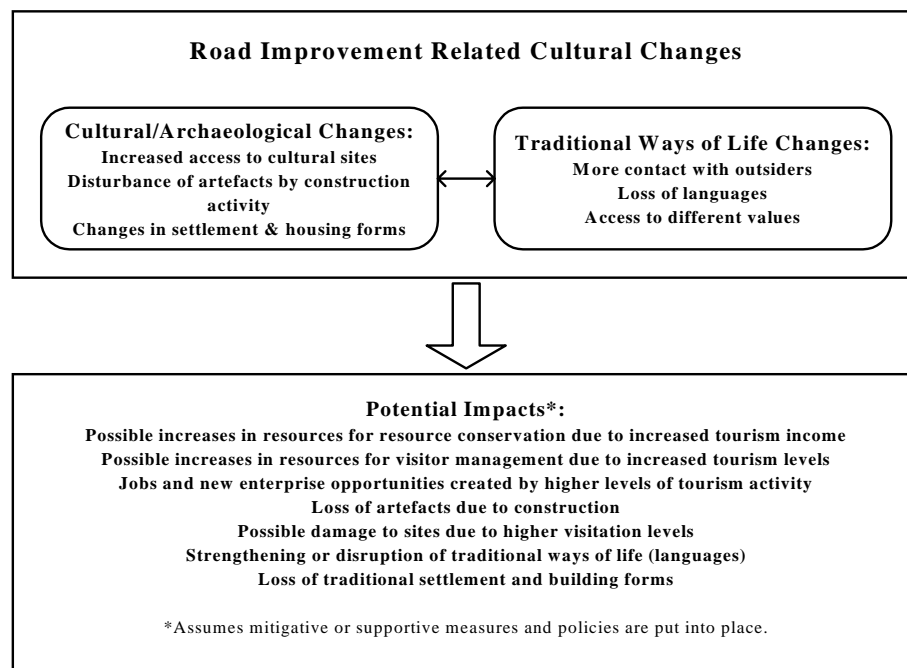
In evaluating alternatives and developing a master plan it should be considered that there are a range of alternatives that can be included in order to ensure access. The definition of access must therefore be flexible in the consideration of achieving the goal of poverty reduction that requires access to markets as well as to essential social services.

## 4.5 Factors in Measuring Environmental Changes and Impacts

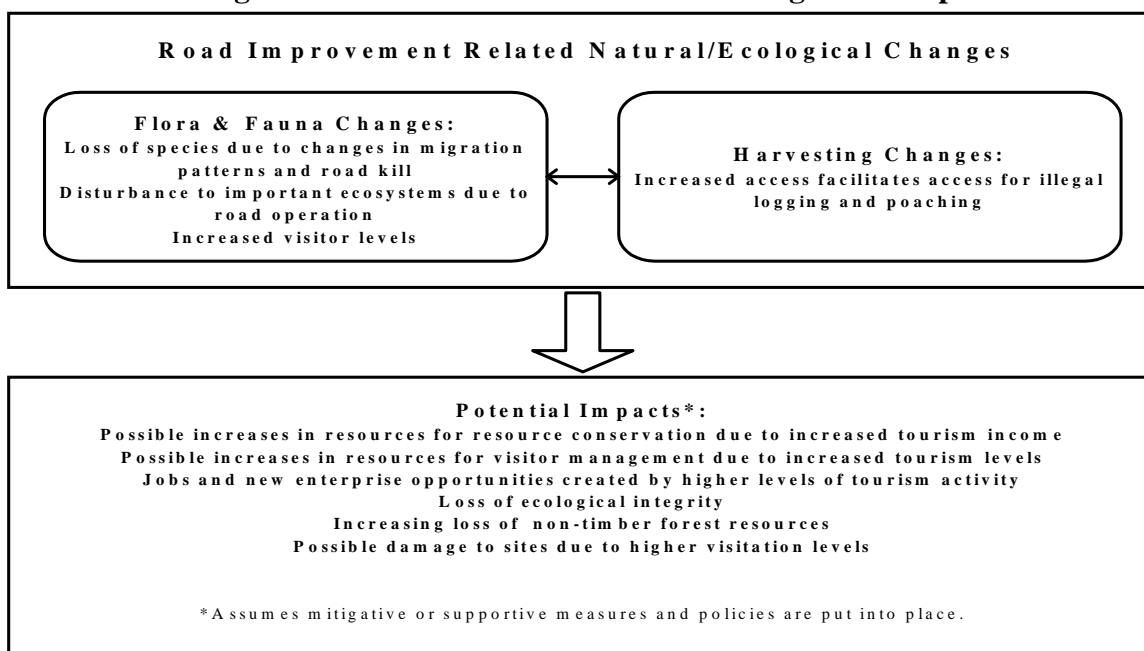
A number of factors have been utilized in assessing different route alternatives and priorities.



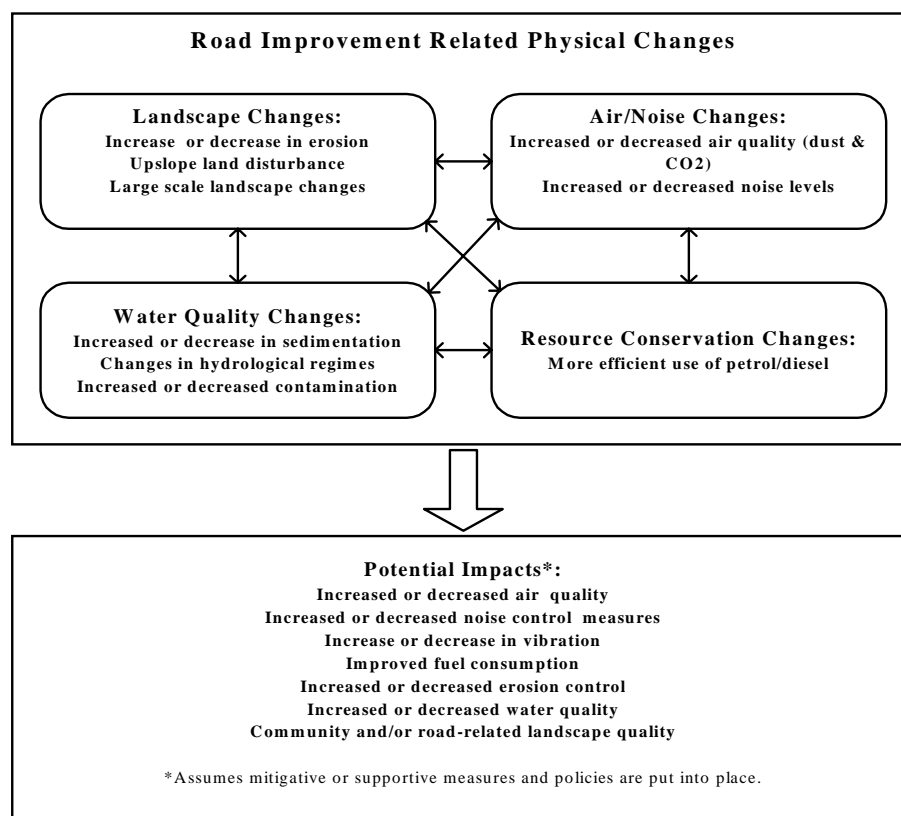
**Figure 4.5.1 Socio-Economic Changes and Impacts**



**Figure 4.5.2 Cultural Environment Changes and Impacts**



**Figure 4.5.3 Natural/Ecological Changes & Impacts**



**Figure 4.5.4 Physical Environment Changes & Impacts**

## 4.6 Environmental Resources/Assessment Factors

Based on available information some of the essential data necessary to weigh different alternatives and develop a master plan are included in this section as means of understanding the analysis that is included later in this report.

### 4.6.1 Socio-Economic Resources and Assessment Factors

The wider economic development issues are considered in the previous chapter of this report and clearly are of importance in assessing the impact of improved roads on the overall social and economic conditions of the inhabitants of this part of the country. In the overall master planning process these factors will be incorporated into the decision-making process. Much of the information for the following tables has been obtained from as yet unpublished study prepared by a major development agency and has been reviewed by the Study Team.

**(1) Poverty**

Table 4.6.1 provides data on the 1992/1993 and 1997/1998 percentages of people who are considered to be living in poverty. It is encouraging to see that the poverty rate is declining (if somewhat slowly) in most regions and provinces. It should be noted however that poverty levels have actually risen, if only marginally, in Saravan. Most of the provinces are within a reasonable range of the national level of poverty with the exception of Sekong and Attapeu that actually has 7% more poor than the national average.

As discussed earlier poverty has many dimensions and it is useful to look at the fact that in the case of the population without access to primary care most of the provinces rank in the bottom 50% and Champasack ranks as lowest.

**Table 4.6.1 Percentage Poor by Regions and Provinces**

<b>Regions/Provinces</b>	<b>1992/93</b>	<b>1997/98</b>	<b>Poverty Growth Rate</b>
Vientiane Municipality	24.4	12.2	-14
Northern Region	58.4	52.5	-2
Central Region	39.5	34.9	-2.5
Southern Region	45.9	38.4	-3.6
Saravan	36.7	39.6	1.5
Sekong	65.9	45.7	-7.3
Champasack	43.6	35.6	-4
Attapeu	72.2	45.3	-9
Lao PDR	45.0	38.6	-3

**(2) Health Care**

Another important dimension to poverty discussed earlier is that of access to health care and Table 4.6.2 indicates one dimension of the health-care situation in this part of the country.

**Table 4.6.2 Access to Primary Health Care**

<b>Province</b>	<b>Population Without Access To Primary Health Care By Rank</b>
Savannakhet	13
Champasack	17
Saravan	11
Attapeu	10
Sekong	5

**(3) Access**

One of the goals of a road improvement program is obviously to increase access of villagers to various services and markets. It is important to note as illustrated in Table 4.6.3 that significant portion of the residents of some of the provinces are more than 6 km from a main road. As has been discussed even with improvements to national roads significant proportions of the population will still be some distance from a main road especially in the rainy season. It is interesting to note that in some cases over 50% of the villages do not have access during the rainy season. It is more disturbing however to note that even in the dry season there are villages that do not have access to a main road.

**Table 4.6.3 Access to Main Roads**

	<b>% Of Villages Which Are 6+ Km From Main Road</b>	<b>% of Villages With Access In Rainy Season</b>	<b>% of Villages With Access in Dry Season</b>
Whole country	35	53	79
Vientiane Municipality	21	100	100
Savannakhet	31	57	100
Champasack	37	43	68
Saravan	19	51	100
Attapeu	32	35	78
Sekong	39	57	69

**(4) Education and Literacy**

Another important indicator of poverty relates to education and it can be seen in Table 4.6.4 that only a small percentage of the villages have complete primary schools and a significant proportion of the population have not completed any basic education.

**Table 4.6.4 Education Profile**

	<b>% Of Villages With Primary School in Village</b>	<b>% Of Villages With Complete Primary Schools</b>	<b>% Of Population (Aged 6+ Years) Who Have Not Completed Any Basic Education</b>
Whole Country	85	33.2	42.5
Savannakhet	82	38.5	44.2
Champasack	98	15.2	33.2
Saravan	91	22.0	54.0
Attapeu	85	23.6	53.1
Sekong	68	19.1	65.2

## (5) Population Distribution

Much of the population is distributed in the flat areas along major rivers and roads. Table 3.6.5 identifies the population numbers within 5 km of the different road links.

### 4.6.2 Cultural Resources and Assessment Factors

As can be seen in Table 4.6.5 there are a number of physical and tangible resources within each of the provinces.

**Table 4.6.5 Physical & Tangible Cultural Resources**

Province	Resources
Savannakhet	<ul style="list-style-type: none"> <li>▪ Wat Sainyaphum and Wat Lattanalannsi in Savannakhet</li> <li>▪ That Ing Hang (considered to be the second holiest religious edifice in southern Lao after Wat Phou Champasack).</li> <li>▪ Heuan Hin south of Savannakhet is a set of Khmer ruins</li> <li>▪ That Phon.</li> </ul>
Saravan	<ul style="list-style-type: none"> <li>▪ That Kadaotuk (300 year old stupa)</li> </ul>
Sekong	<ul style="list-style-type: none"> <li>▪ Near Ho Chi Minh Trail</li> </ul>
Attapeu	<ul style="list-style-type: none"> <li>▪ Ho Chi Minh Trail with an intact SAM missile launcher in Pa-am</li> </ul>
Champasack	<ul style="list-style-type: none"> <li>▪ Champasack Historical Heritage Museum.</li> <li>▪ 20 wats in Pakse of which Wat Luang and Wat Tham Fai are the most famous.</li> <li>▪ Angkor period ruins of Wat Phou Champasack.</li> <li>▪ Several temples in Champasack in particular Wat Muang Kang..</li> <li>▪ Um Muang (also known as To Mo) a Khmer temple ruin.</li> <li>▪ At Ban Phapho there is an elephant training center.</li> <li>▪ Wat Phuang Kaew in the center of Muang Khong.</li> <li>▪ Tham Phou Khiaw (Green Mountain cave).</li> <li>▪ Wat Hua Khong Pha Nyai monastic building.</li> <li>▪ Wat Phou Khao Kaew</li> </ul>

There are also many minority groups in this region and which have been discussed earlier. They are identified in Table 4.6.6.

**Table 4.6.6 Minority Groups in Southern Lao PDR**

Province	Minority Groups in Southern Lao
Saravan	<ul style="list-style-type: none"> <li>▪ Number of Mon-Khmer groups such as the Ta-oy (Tahoy), Lavai, Katang, Alak, Laven, Ngai, Tong, Pao, Kanay, Katu and Kado.</li> <li>▪ At Tumlan a Katang village 40 km. north of the capital via route 23 there is a 100m longhouse for 30 families and local weaving.</li> <li>▪ Ta-oy district east of Tumlan.</li> </ul>
Sekong	<ul style="list-style-type: none"> <li>▪ Traditional home of several Lao Theung or Mon-Khmer tribes, The most populous of the Mon-Theung ethnicities are the Katu and Talieng.</li> <li>▪ Weaving.</li> </ul>
Attapeu	<ul style="list-style-type: none"> <li>▪ Weaving.</li> <li>▪ 11 ethnic groups with the Lave, Nge and Talieng predominating</li> </ul>
Champasack	<ul style="list-style-type: none"> <li>▪ Host of small Mom-Khmer groups (Suay, Ta-oy, Lavai, Chieng, Nyaheum, Laven, Kaseng, Katang, Nge, Inthi, Oung, Katu, Kien, Salaso, Tahang, and Kate.</li> <li>▪ Well known for its mat-mii silks and cottons.</li> </ul>



Province	Minority Groups in Southern Lao
	▪ Festivals

### 4.6.3 Natural/Ecological Resources and Assessment Factors

Lao PDR contains a significant number of important biodiversity areas. These areas take many forms including National Biodiversity Conservation Areas (NBCAs), numerous wetlands as well as other areas of natural/ecological importance. In this section some of these resources are described and listed since they will be referred to later in the discussions of various road alternatives and the master plan.

The major natural environment international organizations as well as national bodies see the maintenance of ecological integrity of as many areas as possible as a major goal. For example, World Wildlife Foundation (WWF) in its Country Strategic Action Plan (Program Focus) 2001 – 2006 of March 2001 identifies significant areas of Southern Lao PDR as having “priority forest landscapes”.

The relationship of key natural/ecological resources can be seen in Figure 4.6.1.

#### (1) National Biodiversity Conservation Areas (NBCAs)

Each of the provinces has NBCAs within their boundaries. There are high levels of protection provided to NBCAs and many have multiple objectives. It is important to note that government policy is to ensure participatory action with villagers in developing sustainable conservation strategies through a local partnership approach that strongly advocates the people’s participation in natural resource management conservation. This objective is still in its infancy and few of the areas have detailed inventories and management plans. There are equally few trained area and resource managers available. Within the Department of Forestry the Division of Forest Resource Conservation has the technical responsibility for the NBCAs. The NBCA structure comprises three major components:

- Forest and Land-use Planning and Management
- Community Development and Extension
- Participatory Conservation.

It is important to remember that the NBCAs do not only contain natural and ecological phenomena but also human settlements. There are guardian villages that are responsible for various dimensions of the conservation process. There are four types of villages:

- Enclave villages where the settlement and village-use land fall entirely within the NBCA boundary.
- Straddle villages where the settlement area is usually outside the NBCA but some

village-use land falls within its boundaries.

- Adjacent villages where the settlement area and village-use land border the NBCA but do not encroach into it.
- External villages where villages and land use are external to the NBCA boundary but their activities still impact on it.

The distribution of NBCAs by province is illustrated in 4.6.7.

**Table 4.6.7 NBCAs by Province**

Province	No.	NBCAs
Savannakhet	1	▪ Dong Phou Vieng
Saravan & Sekong	2	▪ Xe Sap
Saravan & Savannakhet	3	▪ Xe Bang Nouan
Champasack and Saravan	4	▪ Phou Xiang Thong
Champasack	5	▪ Dong Hua Sao
Attapeu	6	▪ Dong Amphan
Champasack & Attapeu	7	▪ Xe Pian

Each of the NBCAs will be briefly discussed here using information obtained directly from the publication Fact Sheets for National Biodiversity Areas in Lao PDR.

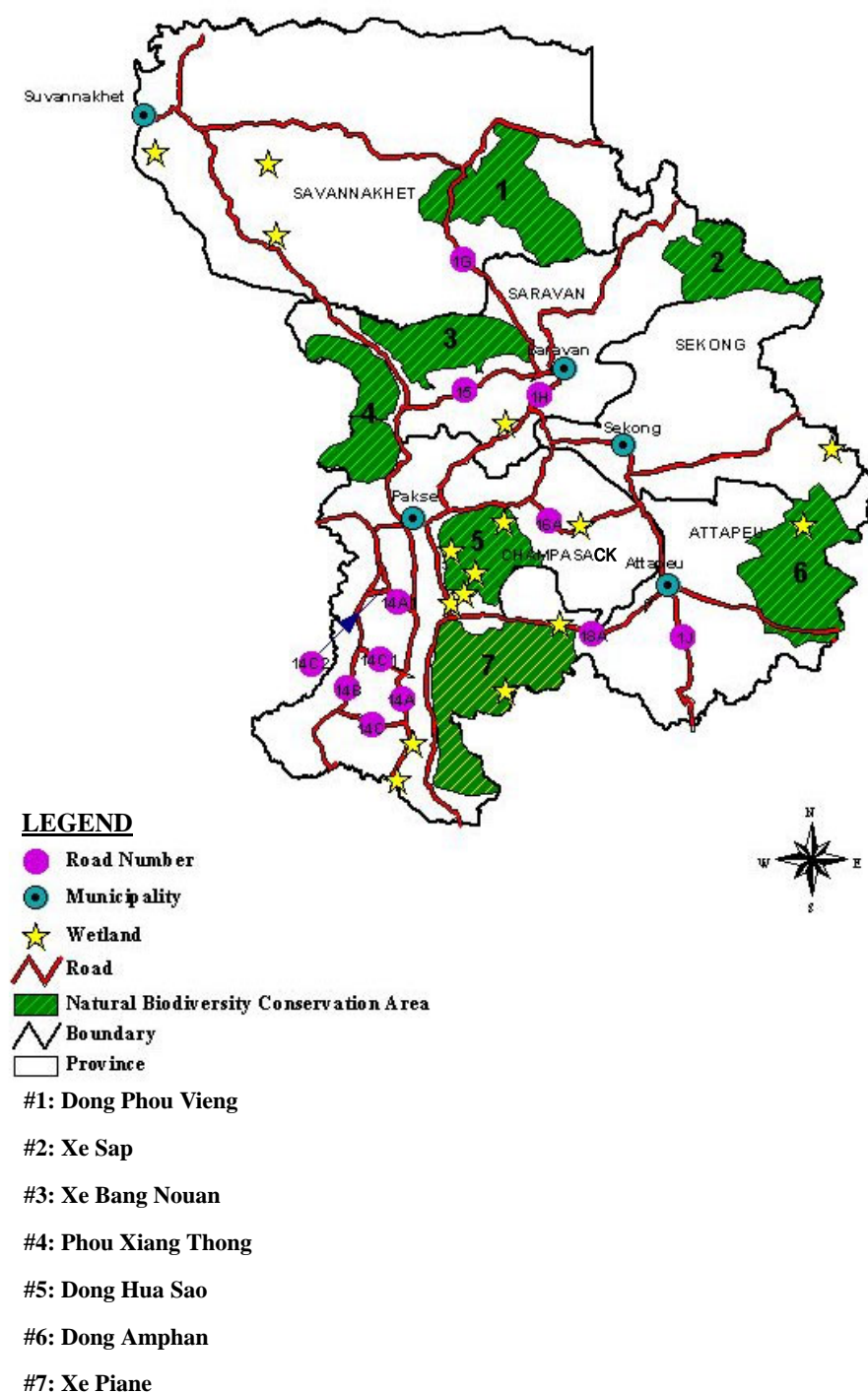


Figure 4.6.1 Key Natural/Ecological Resources

**Dong Phou Vieng NBCA (#1 on Figure 4.6.1)**

Province: Savannakhet

Discussion:

The area has a small number of national priority and globally threatened vertebrates. It is an area of exceptional aquatic diversity including economically important species. There are also significant populations of various vertebrates as well as two herds of elephants. There it is an authentic Lao Teung culture with ritual ties to the land with five different languages spoken of which at least two are in danger of extinction. There are also several spiritual forests.

**Xe Sap NBCA (#2 on Figure 4.6.1)**

Provinces: Saravan & Sekong

Discussion:

The area has a small number of national priority and globally threatened vertebrates because of its geographical position, altitude range and undisturbed old-growth evergreen forest types, as well as its extensive areas of high elevation. The protected area has unique importance in the NBCA system in Lao PDR. It has a nationally significant population of two species of bears, as well as regionally significant population of gaur. Tigers are also present. The indigenous Lao Teung culture has strong ties to the land. There are five different Lao Teung languages spoken in the protected area, one of which at least is in danger of extinction. There is always the threat of the international animal trade business. Upgraded road and bridges on the north side of the road may lead to unsustainable resource use in some areas.

**Xe Bang Nouan NBCA (#3 on Figure 4.6.1)**

Provinces: Saravan & Savannakhet

Discussion:

The area contains a number of national priority and global threatened vertebrates. There is a threat from destructive and commercial fishing with indigenous poison virtually along all accessible streams.

**Phou Xiang Thong NBCA (#4 on Figure 4.6.1)**

Provinces: Champasack and Saravan

Discussion:

It is reported that this area contains various forest types and other terrestrial habitats that form a complex habitat mosaic. Many of the vertebrates are at high risk. It is the only NBCA on the Mekong River and extends along some 100km of its course. Populations of wildlife key species are generally low. Some of a species are of high global and very high national significance. It is reported that road access across the reserve to settlements along the Mekong would undermine the new policy of no new settlements established by the government. Preventing the upgrading of existing roads or major foot trails to vehicle tracks is seen as a management priority. Unrestrained collection of forest products is a problem that involves large groups spending several days in remote areas living off the land.

**Dong Hua Sao NBCA (#5 on Figure 4.6.1)**

Province: Champasack

Discussion:

This protected area is accessible from all major all weather roads in the West and North. Old logging roads reach most of the lowland flats and roads to copy plantations that facilitate access to formally remote sections of the protected area. It contains a large number of national priority and globally threatened vertebrates. It is the only protected area that protects semi-evergreen forest of the Boloven Plateau. It also contains significant tracks of low land semi-evergreen forest interspersed with wetlands. Populations of wildlife key species are generally low. One of the principal threats is the conversion of mature forests to establish coffee plantations. The impacts on prime semi-evergreen forest are often associated with road construction. This is by far the most pressing and difficult problem.

**Dong Amphan NBCA (#6 on Figure 4.6.1)**

Province: Attapeu

Discussion:

There are a wide variety of habitat types found in the area. It contains a significant amount of UXOs. There are a number of national priority and globally threatened vertebrates. Its value is significant due to its remote location, rugged terrain and broad number of habitats. The most immediate and serious threats to the protected area are hunting and other wildlife extraction particularly for trade. This is potentially the most damaging as this hunting targets many key species such as tigers, douc langurs and buff-cheeked gibbon. Much of a threat is reported to come from Vietnam. Rattan collection is severe especially along the eastern border with Vietnam and will probably increase as roads are finished that connect the two countries. The construction of the Xe Kaman hydropower dam will inundate much of the old-growth evergreen/semi-evergreen forest. This is the area with the highest biodiversity conservation value.

**Xe Piane NBCA (#7 on Figure 4.6.1)**

Provinces: Attapeu &amp; Champasack

Discussion:

Many of the reported vertebrates are at high risk at both the national as well as global level. From a biodiversity perspective Xe Piane is seen as **one of the top three protected areas** in Lao PDR and among the top 10 in Southeast Asia. No other protected areas in Lao PDR closely resemble it in terms of its habitats and key species. It contains a large area of relatively undisturbed forest that is actively important for supporting wide-ranging large

mammal species and some birds. At least 22 mammal key species are present in the area. Three of these are of “Acute National Conservation Priority” with a further seven being of a “High National Conservation Priority”. Xe Pian is one of only two protected areas in Lao PDR that has been confirmed to contain key large mammal species of tiger, elephant, gaur and banteng. It also contains a cultural site near Ban Kiatngong. This is clearly an essential protected area for consideration.

## Summary

Each of these areas has value from at least one if not many perspectives. Some have been already altered by human use and as discussed above are experiencing serious threats. It is obvious that road construction has had and will continue to have serious impacts on these areas. Any decisions made about road development must take the negative impacts on these important national and international environments into account and stronger mitigative measures put into place in order to insure that these international and national habitats are maintained for future generations.

## (2) Wetlands

There have been a number of wetlands identified by IUCN as presented in Table 4.6.8 and Figure 5.6.1. The assessments are those of the author based on published information.

**Table 4.6.8 Wetlands**

Province	Wetlands	Significance
Savannakhet	<ul style="list-style-type: none"> <li>▪ Nong Louang Wetland Group</li> <li>▪ Xe Champhon Wetlands</li> <li>▪ Savannakhet Wetlands</li> </ul>	<ul style="list-style-type: none"> <li>▪ High</li> <li>▪ High</li> <li>▪ Minor</li> </ul>
Attapeu	<ul style="list-style-type: none"> <li>▪ Xe Pian – Xe Khanpho Wetlands</li> <li>▪ Nong Patomkeen</li> </ul>	<ul style="list-style-type: none"> <li>▪ Significant</li> <li>▪ Significant</li> </ul>
Champasack	<ul style="list-style-type: none"> <li>▪ Dong Hua Sao Wetlands</li> <li>▪ Nong Sam Wetlands</li> <li>▪ Bung Nong Ngom Wetland Group</li> <li>▪ Soukhoum Wetlands</li> <li>▪ Ban Takang Wetlands</li> <li>▪ Khone Falls Wetlands</li> <li>▪ Paksong Wetlands</li> <li>▪ Upper Xe Namnoy Wetlands</li> </ul>	<ul style="list-style-type: none"> <li>▪ Significant</li> <li>▪ Minor</li> <li>▪ Significant</li> <li>▪ Little information</li> <li>▪ Little information</li> <li>▪ Significant</li> <li>▪ Medium</li> <li>▪ Significant</li> </ul>
Saravan	<ul style="list-style-type: none"> <li>▪ Xe Set Reservoir</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minor</li> </ul>
Champasack & Attapeu	<ul style="list-style-type: none"> <li>▪ Xe Kong Plains</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minor</li> </ul>

### (3) Other Resources

There are a number of other natural/ecological resources that have been identified as can be seen in Table 4.6.9.

**Table 4.6.9 Natural/Ecological Resources**

Province	Resources
Saravan	<ul style="list-style-type: none"> <li>▪ Nong Lua (Siamese crocodiles)</li> <li>▪ Nong Kangdond</li> </ul>
Attapeu	<ul style="list-style-type: none"> <li>▪ Large valley surrounded by mountains and rivers with lush flora.</li> <li>▪ Impressive waterfalls (e.g. Nam Tok Katamtok and Taat Se Noi)</li> </ul>
Champasack	<ul style="list-style-type: none"> <li>▪ Boloven Plateau (The Plateau houses many ethnic groups and there is a strong relationship between cultural environment factors and the natural environment.)</li> <li>▪ Several waterfalls (most visited Taat Lo and Taat Fan).</li> <li>▪ Si Phan Don (Four Thousand Islands).</li> <li>▪ Don Khong (Khong Islands).</li> <li>▪ Khon Phapheng Falls</li> </ul>

#### 4.6.4 Composite Environmental Conditions

Based on the information provided above it is possible to provide a “snapshot” of each province using a number of environmental conditions as can be seen in Table 4.6.10.

**Table 4.6.10 Composite Environmental Conditions**

Province	Composite Environmental Conditions
Savannakhet	<ul style="list-style-type: none"> <li>▪ Socio-Economic: This province tends to rank higher than its neighboring provinces in southern Lao PDR in most of the indicators discussed. It however ranks poorly in terms of access to primary health care and overall, as can be seen from the indicators, is in urgent need (as are all provinces) of social and economic development. High population distribution along Mekong and major roads.</li> <li>▪ Cultural: The province has That Ing Hang and Heuan Hin people as well as a number of Mon-Khmer groups.</li> <li>▪ Nature/Ecological: The province contains several resources including one NBCA and a portion of another as well as two significant wetlands.</li> </ul>
Attapeu	<ul style="list-style-type: none"> <li>▪ Socio-Economic: As measured by all of the indicators this province ranks poorly within the southern part of country as well as the overall country itself. It has one of the highest levels of poverty, has a very small percentage of villages with access during the rainy season, has a very low level of villages with complete primary schools and a low rate of adult literacy. Low population density.</li> <li>▪ Cultural: 11 ethnic groups live in the province.</li> <li>▪ Nature/Ecological: The province contains several resources: one NBCA and a portion of another as well as two significant wetlands together with other resources.</li> </ul>

Province	Composite Environmental Conditions
Champasack	<ul style="list-style-type: none"> <li>▪ Socio-Economic: This province is somewhat mixed in its social and economic conditions. Interestingly it has one of the highest adult literacy rates as reported but a very small percentage of villages with complete primary schools. It ranks poorly in terms of access both during the rainy as well as the dry seasons. It is encouraging to note that its poverty rate has declined by 4% but is still high. High population distribution along Mekong and major roads.</li> <li>▪ Cultural: The province has a large number of resources and in particular Wat Phou as well as many small Mon Khmer groups.</li> <li>▪ Nature/Ecological: The province contains several resources including one NBCA and portions of two others as well as eight significant wetlands and several other resources some of international significance. Low population density.</li> </ul>
Sekong	<ul style="list-style-type: none"> <li>▪ Socio-Economic: This province rates poorly in terms of literacy rates having the lowest rates in the region and ranks 15th in the country. Only a small percentage of villages have complete primary schools and it has the highest percentage of the population not having completed any basic education. It has a high level of poverty but ranks highly in terms of population with access to primary health care. Low population density.</li> <li>▪ Cultural: The province is the traditional home of several Lao Teung and Mon Khmer people.</li> <li>▪ Nature/Ecological: The province contains a small number of resources and a portion of one NBCA.</li> </ul>
Saravan	<ul style="list-style-type: none"> <li>▪ Socio-Economic: This province has an average level of poverty for the country and interestingly has experienced a small increase in the rate of poverty. It ranks in the 50% of the country in terms of access to primary health care and a very low number of villages have complete primary schools. A high percentage of the population has not completed any basic education. Almost 50% of its population lacks basic literacy. Low population density.</li> <li>▪ Cultural: A number of Mon Khmer groups live in the province.</li> <li>▪ Nature/Ecological: The province contains a number of resources including portions of three NBCAs, a wetland and other resources.</li> </ul>

#### 4.7 Evaluating Changes and Impacts in the Overall Systems and Environments

Any road alternative will bring about environmental/system changes of varying levels. These changes in the environment will have impacts on various environmental systems (socio-economic, cultural, physical and natural). Some of the changes will be direct while others will have an indirect influence on various conditions and situations. It is clear that some of the changes will affect the entire region while others may have an influence on a particular system only at a very localized level. The changes to the system in some cases may



be of a short duration (i.e. during construction phase) while others will be long-term.

It is clear that only the people from within the country and the regions as well as the communities themselves can make decisions on what is an acceptable level of change. This decision-making involves a process of trade-offs where local benefits and costs have to be balanced with the larger societal needs and concerns. Technical experts may identify what are seen to be potential impacts but only the people themselves (politicians, officials and residents) can make final determinations on trade offs and priorities.

It is important to consider that the provision of roads can only be seen as a facilitating element in the overall process of urban and rural development. It must be assumed that with the provision of increased access provided by a road(s) the means of accessing the available health and educational services will also have to be provided in one form or another. Otherwise it will be impossible for the very poor to increase their quality of life if they are unable to travel in a cost-effective and timely fashion to the necessary facilities. It must therefore be assumed that the provision of a road(s) is accompanied by other development inputs.

#### **4.8 Assessing Construction Phase Impacts**

The specific impacts of the construction activity cannot be discussed at this stage since the nature of the specific route and elements is not yet known. What specific types of materials will be utilized and where the materials themselves will be obtained have yet to be determined. It is obvious that the location of quarries, for example, will have important environmental impacts which must be considered and which will be carefully assessed in the detailed impact assessment that follows later in this project within the IEE process.

In general, construction phase impacts can be seen to include the following impacts especially if the proper management and monitoring mechanisms are not in place.

- Soil erosion.
- Upslope land disturbance.
- Contamination of atmospheric and surface water resources.
- Alteration of hydrological regimes.
- Increased sedimentation in streams and rivers.
- Additional airborne dust and other pollutants from construction activities such as excavation and production of concrete at local plants.
- Increased traffic and congestion.

- Delivery trucks and construction equipment may use local streets and bring additional pollutants to local residential areas.
- Vibration impacts from heavy equipment may cause damage to surrounding structures.
- There will be increased noise from the construction process.
- The quality of life of a community can be disrupted at least on a temporary basis.
- Workers from outside the region may cause social disruption within the community. (The concern for prostitution and aids is always a possibility.)
- Workers who come in to the area may stay thereby disrupting social and community land use and values.
- There will be an increased health risk to the public due to the construction activity.
- Without proper procedures cultural objects and archeological finds could be damaged.

Positive impacts:

Increased income can be gained if local workers are hired in the construction process.

## **4.9 Discussion of Overall Operational Impacts**

### **4.9.1 Socio-Economic Impacts**

There is no doubt that from a national as well as a regional and local perspective economic development benefits will be considered as being of paramount importance and possibly overriding in terms of national priorities. Concerns in the opening up of new markets and providing the means to move goods and services through to Vietnam, Cambodia or Thailand are seen by many as essential to the ongoing economic development of the country. It is important to remember that the existence of roads may be seen as a necessary condition for economic growth but does not guarantee industrial development unless government policies and international economic conditions are supportive of such development.

The only industry that can be identified clearly with any level of confidence of potentially benefiting from better quality roads is tourism since there is already an existing level of tourism activity. As well there are significant cultural as well as natural/ecological resources that could be packaged to increase tourism numbers and income. Roads have to be seen as simply one of the series of investment initiatives to ensure that the required investment is attractive. A great deal more could be said about this sector and this will be discussed in full detail in the more specific route alignment study.

Before any tourism planning and development occurs the carrying capacities of the various natural environments will have to be determined. Some of the reports indicate that some

protected areas may have very low carrying capacities and have little potential to accommodate tourism activity and maintain their ecological integrity.

There may be some need for resettlement based on route alignments but however, there is sufficient legislation in place to ensure that in most cases this issue can be handled in an equitable manner.

The Study Team has identified a significant concern about the impact of increased traffic through many of the village environments from the perspective of safety. With increased traffic there is no doubt that the safety of villagers will be diminished without proper planning and design. For some of the larger villages a route that detours around the settlement may be preferable for safety as well as efficiency purposes.

The possibility for the spread of HIV/AIDS by truckers is a distinct possibility and care must be taken in the education process to guard against this very serious health issue which will be facilitated by national roads especially those linking Laos with other countries

From an overall socio-economic perspective there can be no argument that with proper planning and design the improvement of the roads in Southern Lao PDR in varying degrees of sophistication will have a positive social and economic benefit on the country, region and the cities and villages where road access is provided.

#### **4.9.2 Cultural Impacts**

With the level of information available there does not appear to be any serious impacts on archeological or historical resources. The only concern as discussed earlier is that with increased access to sites there may be damage due to the lack of management plans and sufficient and well-trained staff. Access will bring with it positive benefits if the government recognizes the value of these resources in the overall tourism planning and development process and allocates sufficient resources for restoration as well as management. This will have significant benefits in maintaining the cultural heritage of the country.

The improvement of roads will lead to increased interactions between local people and those from other countries or other regions of Lao PDR. With this interaction there is always the danger of traditional ways of life and languages being lost. If this is recognized early on when measures can be taken to ensure that in fact traditional values and lifestyles are strengthened in order to be able to resist the changes that will come about with increased access and contact.

It must also be remembered that the influence of television has far more impact on changes in cultural traditions and languages than a road can possibly have. Nevertheless, it should be recognized that there might be changes that will come about from the introduction of better quality roads. From a positive perspective this will allow for increased contact between national as well as provincial and district officials with people of the villages thereby meeting the national goal of integration.

If other roads are used as an example the improvement of roads to national standards can have a significant impact on the physical form of both villages as well as buildings. Villages are reconfigured to take advantage of the retail possibilities provided by the road and with that comes changes to the physical landscape. This can be seen as a matter of the evolution of physical form in the country or a serious impact on the cultural dimensions of the country. This is really a question for national and local bodies to deal with but it is an impact of road improvement. With proper planning and management the introduction of new roads can be seen as a positive force in the overall cultural development of the southern region.

#### **4.9.3 Natural/Ecological Impacts**

Since most of the roads are along existing alignments with sufficient cleared area there should be minimal natural/ecological impacts of road improvements given proper construction and operational policies and methods. The exception as noted in other parts of this section would be **route 18A** where there would be significant changes required if the road were to be developed to national road standards.

The overriding concern from a natural and ecosystem environment perspective is the impact of increased access to all of the NBCAs. As noted in earlier sections road access can have significant negative impacts on increasing the exploitation of non-timber forest resources. Larger scale exploitation of both timber as well as non-timber forest products will reduce the biodiversity of the area having long-term impacts on both the ecological integrity of the country as well as the welfare of its poorer residents.

While other impacts may be seen to be positive there is no doubt that the introduction of roads will have a negative impact on the protected areas and wetlands of the region.

On the other hand there are some positive benefits for natural resources where there will be sufficient access for these resources to become tourist attractions thereby increasing income and generating new resources for the conservation of the natural and ecological environment.

#### 4.9.4 Physical Impacts

Overall the improvement of roads if properly designed can have positive impacts on air quality, noise levels, erosion and water management. Given the fact that many of the roads are along existing alignments there will be little disruption of the physical landscape. The only exceptions are Routes 1G, 16A and 18A where there will be a need for significant disruptions of the physical landscape in order to accommodate a road if it is to be designed to accepted standards for a national route.

#### 4.9.5 Conclusion on Impacts

It can be concluded therefore that the majority of the routes have no negative impacts on the social/economic, cultural and physical environments. Some would have a higher priority from the perspective that they serve larger populations within five km of the road itself. Some of the routes have the potential for significant environmental damage and therefore would be seen as high negative impact alternative especially given present levels of protection and capacity.

#### 4.10 Route Specific Assessments

In this section route specific environmental changes and impacts will be discussed. The impact assessment has used the rating system described in Table 4.10.1.

**Table 4.10.1 Assessment Criteria**

<b>Impact</b>	<b>Positive</b>	<b>Negative</b>
<b>High</b>	+++	---
<b>Medium</b>	++	--
<b>Low</b>	+	-
<b>No impact/change</b>	NIC	NIC

Based on the data presented earlier the overall impacts of the various routes are summarized in Table 4.10.2.

**Table 4.10.2 Overall Impacts**

	<b>Socio-Economic Environment Impacts</b>	<b>Cultural Environment Impacts</b>	<b>Natural Environment Impacts</b>	<b>Physical Environment Impacts</b>
<b>1G</b>	++	NIC/-	- - -	---
<b>1H</b>	+	+ /NIC	NIC	+
<b>1J</b>	+	+ /NIC	- -	- -
<b>14A</b>	++	+ /NIC	-	-
<b>14A1/14B/14C2</b>	+	++	NIC	+
<b>14C/14C1</b>	+	+ /NIC	NIC	+
<b>15</b>	++	+ /NIC	NIC	+
<b>16A</b>	+	+ /NIC	- -	- - -
<b>18A</b>	++	+ /NIC	- - -	- - -

#### **4.10.1 Low Negative/High Positive Impact Routes**

##### **Route 1H (Route 20 – Route 16)**

###### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased all weather access will provide new opportunities for improvements in education and health care. Given that 6,300 people live within five km there are a small number of people who would potentially benefit from increased access to various services and markets.

###### **Cultural**

The road passes within five km of a number of villages with a significant minority population raising issues of the cultural preservation and protection.

###### **Natural/Ecological**

The route does not pass through or near any significant natural environment areas.

###### **Physical**

There appear to be no potential negative impacts of this route other than physical changes to the form of villages and associated buildings.

##### **Route14A1 (Route14A – Route14B) / Route14B (Route 16 – Cambodia Border) /**

##### **Route14C2 (Route14A1 – Route14B)**

###### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased access will provide new opportunities for improvements in education and health care.

The population within five km is 54,400 people and therefore a sizable number of

people would potentially benefit from increased access to various services and markets.

### **Cultural**

The road passes within five km of a limited number of villages with minority populations raising issues of cultural preservation and protection. This route has the potential of opening up access to Wat Phou with its potential positive economic impacts.

### **Natural/Ecological**

This route does not pass through any environmentally sensitive areas and has the potential to open up tourism access to important natural/ecological resources in the southern part of the country. Without proper market studies and management strategies it is difficult at this time to predict the actual economic impact of the road as a facilitator for tourism activity.

### **Physical**

There appear to be no potential negative impacts of this route other than physical changes to the form of villages and associated buildings.

## **Route 14C (Route 14A – Route 14B) / Route 14C1 (Route 14A – Route 14B)**

### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased access will provide new opportunities for improvements in education and health care. The population within five km is 16,900. Therefore a small number of people would potentially benefit from increased access to various services and markets.

### **Cultural**

The road passes within five km of a limited number of villages with a significant minority population raising issues of cultural preservation and protection.

### **Natural/Ecological**

This route does not pass through any environmentally sensitive areas.

### **Physical**

There appear to be no potential negative impacts of this route other than physical changes to the form of villages and associated buildings.

**Route 15 (Route 13S – P. Saravan)****Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased access will provide for new opportunities for improvements in education and health care. The population within five km is 58,800 population and therefore a sizable number of people would potentially benefit from increased access to various services and markets.

**Cultural**

The road passes within five km of a large number of villages with a smaller minority population raising issues of the cultural preservation and protection.

**Natural/Ecological**

This route passes alongside a national protected area and has the potential of providing access with the negative impacts discussed earlier in this chapter.

**Physical**

There appear to be no potential negative impacts of this route other than physical changes to the form of villages and associated buildings.

**4.10.2 Medium/High Negative Impact Routes****Route 1G (Route 15 – Route 9)****Socio-Economic**

There appears to little possibility for negative impacts and certainly increased access will provide for new opportunities for improvements in education and health care. Given that the population within five km there is 32,500 people with a 65% minority population and a sizable number of people would potentially benefit from increased access to various services and markets.

**Cultural**

The road passes within five km of a number of villages with a significant minority population raising issues of cultural preservation and protection. Two Lao Teung languages are threatened in the Dong Phou Vieng NBCA.

**Natural/Ecological**

This route runs through one protected area, Dong Phou Vieng NBCA (#1 in Figure



4.6.1) and alongside another protected area, Xe Bang Nouan NBCA (#3 on Figure 4.6.1). As described in Section 4.6.3 (1) both of these areas contain resources of national and international significance and a road through Dong Phou Vieng could have serious impacts. These conditions may demand that serious consideration should be given to at least divert the northern portion of the route outside of Dong Phou Vieng. Strong mitigation measures will have to be in place to protect the portions of the protected areas affected by the road during the construction and operational phases.

### **Physical**

There does not appear to be any potential negative impacts of this route other than physical changes to the form of villages and associated buildings. If the route is diverted there could be significant physical impacts.

## **Route 1J (Route 18B – Cambodia Border)**

### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased access will provide new opportunities for improvements in education and health care. The population within five km is 14,500 people with a 33% minority population and therefore a small number of people would potentially benefit from increased access to various services and markets.

### **Cultural**

The road passes within five km of a limited number of villages with a significant minority population raising issues of cultural preservation and protection.

### **Natural/Ecological**

The route does not pass through or near any significant natural environment areas.

### **Physical**

There appear to be a little negative impacts of this route other than physical changes to the form of villages and associated buildings.

## **Route 14A(Route 16 – Cambodia Border)**

### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased

access will provide for new opportunities for improvements in education and health care. Given that the population within five km is 72,000, with a 6% minority population, a very sizable number of people would potentially benefit from increased access to various services and markets.

### **Cultural**

No negative impacts can be identified, except area of Wat Phou and Ancient City listed as a World Heritage by UNESCO.

This route has the potential of opening up access to Wat Phou with its potential important positive economic impacts not only to the local but also national economy.

### **Natural/Ecological**

This route does not pass through any environmentally sensitive protected areas but does have access to the Mekong River which is of significant international as well as national importance. Increased access will certainly bring with it the possibility for more settlements that will have an impact on the water quality of the Mekong

### **Physical**

There appear to be a little negative impacts of this route especially along Mekong River and adjacent Ancient city in Champasack town, other than physical changes to the form of villages and associated buildings.

## **Route 16A (Route 11 – Route 16)**

### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased access will provide for new opportunities for improvements in education and health care. Given that 13,600 people population live with 5 km of the main road and therefore a small number of people would potentially benefit from increased access to various services and markets.

### **Cultural**

This road if improved will impact on a sizable number of minority people.

### **Natural/Ecological**

This route passes through Boloven Plateau that while not recognized as an NBCA is an ecological area which could be negatively impacted by a road improvement.

### **Physical**

This route will have negative impacts and will change the landscape if road improvements are implemented.

## **Route 18A (Route 13S – Route 1I)**

### **Socio-Economic**

There appears to be little possibility for negative impacts and certainly increased access will provide new opportunities for improvements in education and health care. The population within five km is 43,000 people with a 39% minority population and therefore a sizable number of people would potentially benefit from increased access to various services and markets.

### **Cultural**

The road passes within five km of a number of villages with a significant minority population raising issues of cultural preservation and protection.

### **Natural/Ecological**

This is a route with significant natural/ecological impacts given that it borders one of the most important protected areas in Lao PDR and one of the top 10 in Southeast Asia, Xe Pian NBCA (#7 on Figure 4.6.1) in the country and passes very close to another protected area, Dong Hua Sao NBCA (#5 on Figure 4.6.1). Xe Pian also contains sizable important wetlands. Serious consideration should be given to not improving this route to national standards until the required ecological, regulatory and capacity issues have been dealt with. It is recommended that the road be improved for local use providing for all-weather access as has been discussed earlier. On the basis of natural/ecological concerns this road be seen as a low priority for improvement to national standards.

### **Physical**

If this road is developed to national road standards there would be serious impacts on the physical environment given the need to make considerable changes to the landscape in order to meet engineering standards.

## **4.11 Overall Conclusions**

### **4.11.1 Potential Negative Impacts**

Many of the potential negative social impacts can be dealt with through the design and mitigation process. It is clear that the process of resettlement will have to be a sensitive one that follows national procedures and regulations. Careful planning as well as the management of both the construction and operational processes may also minimize the potential impacts of road improvements on the cultural environment in many ways. Many of the potential physical environment impacts are also of a nature where a good quality design and management process can ensure minimal negative impacts.

The highest level of negative impact has to relate to the natural/ecological environment of some of the possible route alignments. There is no doubt that increased access will bring added pressures to negatively exploit national resources. There must also be a concern for the potential loss of animal species due to the intrusion of a road especially given higher levels of vehicular activity and speed. Given the existing level of data it is difficult to quantify this set of impacts but there is no doubt that one of the major considerations in choosing a road alignment must be in recognizing the potential impact on the ecological/natural environment. There is a particular concern of the natural/ecological impacts of any road improvements to routes 1G and 18A. Very careful study must be undertaken if the routes are seen as priorities and if they are to be developed to national road standards. There may be a case where access is improved for local purposes but full-scale improvement should be delayed until the natural/ecological capacities are improved and the full impacts of a road on the NBCAs are understood.

### **4.11.2 Potential Positive Impacts**

Improved access will provide a strong set of positive socio-economic impacts. As was discussed earlier, the assumption is that the necessary complementary mitigation and facilitation mechanisms are used to ensure the fullest possible benefits of any road construction and improvement. The social indicators presented above highlight the high priority that must be given to providing all weather access to all residents of the region (or at least those within 5 km of a designated road).