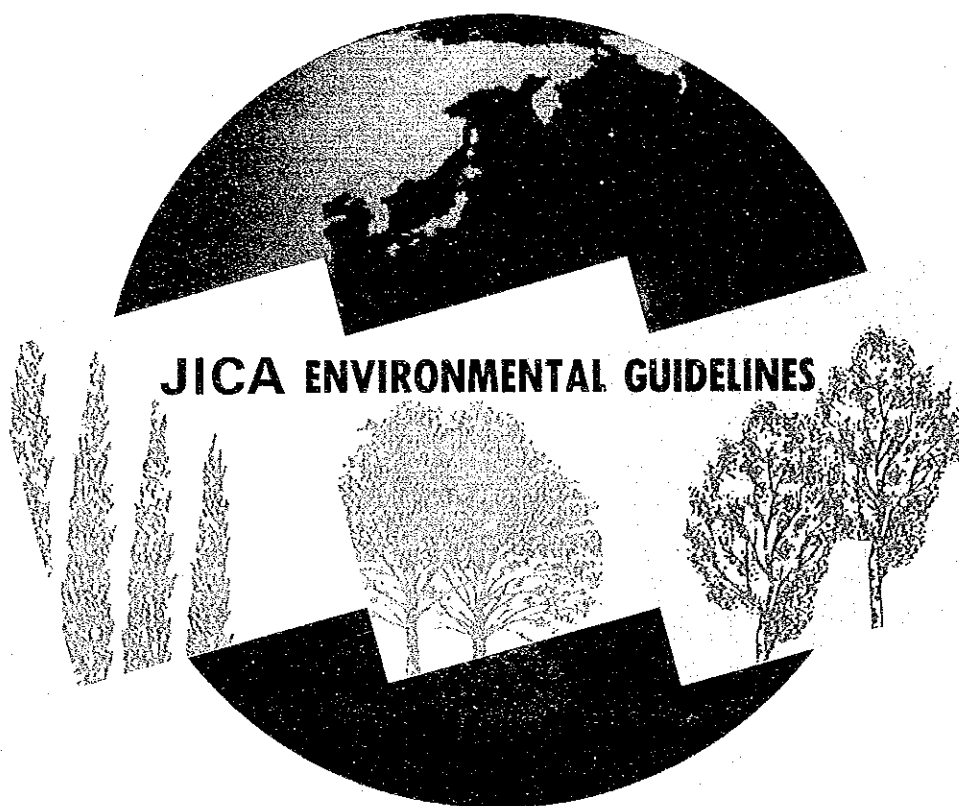


# ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS

## XIII TRANSPORTATION DEVELOPMENT



SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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# **ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS**

**XIII TRANSPORTATION DEVELOPMENT**

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## Environmental Guidelines for Infrastructure Projects

"Environmental Guidelines for Infrastructure Projects" was prepared to enable preparatory study members to conduct screening and scoping of environmental impact studies effectively and efficiently while maintaining a dialogue with their counterparts and officials concerned in the host countries for the purpose of predicting possible environmental problems caused by the infrastructure projects and to incorporate adequate environmental consideration into the projects.

The guidelines consist of the thirteen sectors below. This volume deals with environmental consideration for "Transportation Development".

Sector I	Ports and Harbors
Sector II	Airports
Sector III	Roads
Sector IV	Railways
Sector V	River and Erosion Control
Sector VI	Solid Wastes Management
Sector VII	Sewerage
Sector VIII	Groundwater Development
Sector IX	Water Supply
Sector X	Regional Development
Sector XI	Tourism Development
Sector XII	Transportation Development
Sector XIII	Urban Transportation Development

Note: The guidelines for dam construction were published in February 1990 as a separate volume.



## PREFACE

In order to support sustainable development in developing countries, it is of great importance to give sufficient consideration to the environment in the implementation of development programs.

The Japan International Cooperation Agency (JICA) has continually placed special emphasis on environmental technical cooperation and has taken into account pertinent environmental consideration in development studies and implementation of projects.

Based on the recognition of the importance of environmental issues, JICA has prepared the guidelines concerning screening and scoping methods of environmental impact studies for the purpose of contributing to the planning of infrastructure development projects with sufficient environmental consideration.

The guidelines are to be used by JICA study team members when conducting preparatory studies of social and economic infrastructure development projects.

JICA committed the preparation of the guidelines to the International Engineering Consultants Association and organized an advisory group headed by Mr. Michio Hashimoto, president of the Overseas Environment Cooperation Center. Designated advisors of the group were from the Ministry of Health and Welfare, the Ministry of Transportation, the Ministry of Construction, and the Environment Agency. Also, the Ministry of Foreign Affairs provided sound and useful advice to the advisory group.

To all of these organizations and the personnel involved, I wish to acknowledge their much appreciated support.

September 1992

Akira Kasai  
Managing Director  
Institute for International Cooperation  
Japan International Cooperation Agency





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## **TERMINOLOGY**

### **Environmental Consideration**

To study whether a development project will have serious environmental impacts on the project site and its surrounding areas, analyze the study results, and establish necessary measures for avoiding or alleviating any adverse environmental impacts.

### **Environmental Impact**

The undesirable effect on the existing overall conditions of air, water, soil, and living things, assets, social information and circulation of goods, which are related to human life, or on their combined structures.

### **Preliminary Environmental Survey**

The environmental survey conducted during the preparatory study stage of a development project. This includes screening and scoping of the environmental impacts of a particular project. This survey is regarded as a component of the initial environmental examination.

### **Initial Environmental Examination (IEE)**

The examination undertaken at the outset of the development project planning stage to determine the environmental impacts that may be created by the particular project based on existing information and data, easily accessible information relating to the particular project, and comments and judgements of specialists who are familiar with the environmental impacts of past similar projects. This examination should be carried out in a short period at a low cost.

IEE has the following two objectives : 1) to evaluate whether EIA is necessary for the project and, if so, to define its contents; 2) to examine, from an environmental viewpoint, the measures for alleviating the effects of the project which requires environmental consideration but not a full-scale environmental impact assessment.

### **Environmental Impact Assessment (EIA)**

To study, forecast, and evaluate the environmental impacts of a development project, which is judged a detailed environmental examination, and to propose the establishment of an environmental protection standard and measures for avoiding or alleviating environmental impacts.

### **Environmental Management Plan**

To formulate an environmental monitoring system or methods based on the environmental protection standard to monitor the project's environmental impacts on surrounding areas, aiming at adequately protecting the environment both during and after project implementation.



**Screening**

To evaluate whether or not it will be necessary to include an environmental consideration in a development project. Screening conducted in Japan before the preparatory study is called preliminary screening.

**Scoping**

To identify the important environmental impacts among those which can be caused by the implementation of a development plan or development project, and to define the study items of the IEE or EIA based on the findings.

**Project Description (PD)**

The major contents and features of the project. It includes the background of the project (including its upper level plan), the objectives, the executing agency, the beneficiary population, and the project scale.

**Site Description (SD)**

The compact description of the project site which includes the natural and social environmental conditions in the areas that may be affected by the project.

**Preparatory Study (PS)**

To examine the contents of the full-scale study of a requested project and to discuss the scope of work (S/W) of the full-scale study with the host country. This study is conducted at the preparatory stage of the project prior to conducting the full-scale study including the master plan and the feasibility study.

**Full-scale Study**

The study generally conducted continuously after the preparatory study by carrying out field surveys to prepare the study report of a development project. The study report, with its conclusions and recommendations for project realization or project implementation, is submitted to the government of the host country. The full-scale study includes the master plan study, feasibility study, detailed design study, and map preparation.



**Master Plan Study (M/P)**

The study for preparing the basic plans for various development projects. In general, it is sectoral, or for each project.

**Feasibility Study (F/S)**

The study for evaluating the possibility, adequacy, and investment efficiency of a project. In general, it attempts to objectively verify the feasibility of a project from social, technical, economic, and financial viewpoints.

F/S is the core of JICA's development studies. The study report provides the government of the host country with the information needed to decide whether or not to implement the project. It is also used by international financial institutions to evaluate the appropriateness of financing the project once the government submits its loan request.





## ABBREVIATIONS

TOR (T/R) :	Terms of Reference
S/W :	Scope of Work
M/M :	Minutes of Meeting
Q/N :	Questionnaire
IC/R :	Inception Report
DF/R :	Draft Final Report
F/R :	Final Report
OECD :	Organization for Economic Cooperation and Development
DAC :	Development Assistance Committee



## Use of the Guidelines

The guidelines were prepared to provide personnel involved in JICA's preparatory study (including the preparatory work in Japan) with information that can be used to prepare the preparatory study report or compile project specifications while carrying out field surveys, hearings, and holding discussions with the officials of the host country during a short-time visit.

The use of the guidelines is shown in Figure i and explained herewith.

### «Preparatory work in Japan»

#### 1) Examination of the request

After examining the request, follow the procedure given below, unless it is judged a soft-type infrastructure project, which is supposed to have no serious environmental impacts, such as the preparation of topographical maps or a telecommunication project.

#### 2) Preliminary screening

Based on the request, collect and analyze the data and information and prepare the PD and SD in Japan, and conduct the preliminary screening by using them.

If any serious environmental impacts are suspected, the preparatory study team should include an environmental specialist.

Prepare questionnaires to the recipient government concerned and the draft of S/W including environment related items.

### «Work in the host country»

#### 3) Examination of the country's guidelines

At first, investigate the country's IEE/EIA implementing structure, the laws, and any existing guidelines (hereinafter referred to as the country's EIA guidelines). Then, it should be confirmed whether or not the project is subjected to IEE/EIA.

Case 1: If the contents of the country's EIA guidelines are sufficient, follow their guidelines.

Case 2: If the contents of the country's EIA guidelines are insufficient, follow their guidelines and add JICA's screening and scoping items.

Case 3: If the country has no EIA guidelines, follow JICA's guidelines.

#### 4) Screening

Reexamine the PD, SD, and the contents of screening prepared in Japan, based on the findings of the field surveys and data analysis. If it is evaluated that an IEE or EIA is required for the project, scoping should then be undertaken.

## 5) Scoping

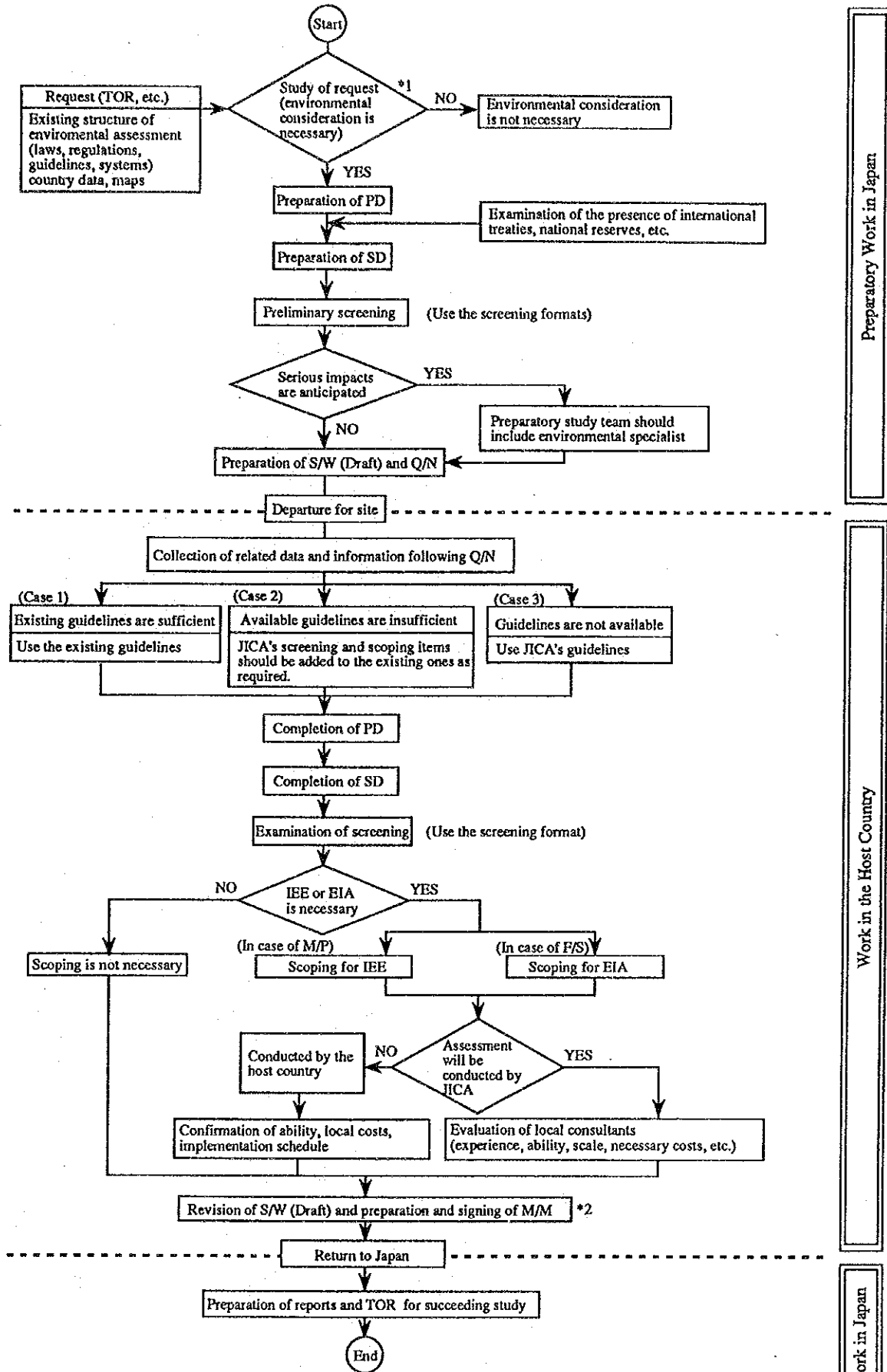
Evaluate the magnitude of impact on each environmental item, using the checklist method, to specify the items that are to be studied in IEE for M/P or EIA for F/S. In this process, making use of the explanation of items in the guidelines, try to grasp the features of possible environmental impacts. The results should be noted in the scope of work (S/W) and the minutes of meeting (M/M). When the environmental factors which may have serious impacts are not identified, it is necessary to mention in the M/M that such factors would be clarified through the full-scale study.

### «Work in Japan»

## 6) Report preparation

Based on the above-mentioned results, compile a preparatory study report which makes it possible to carry out the appropriate IEE or EIA in the full-scale study. TOR for the succeeding study should reflect the contents of the report.

Figure i Procedure of Environmental Consideration



Note : \*1. The environmental consideration is not necessary when infrastructure projects are not anticipated to have serious impacts, such as preparation of topographic maps and telecommunication projects, etc.  
 \*2. When the environmental factors that may have serious impact are not identified, it is necessary to mention in the M/M that such items would be clarified in the full-scale study.



## **CHAPTER 1**

# **OUTLINE OF ENVIRONMENTAL CONSIDERATION**





# CHAPTER 1

## OUTLINE OF ENVIRONMENTAL CONSIDERATION

### 1.1 Basic Concept

JICA's aid study report "Sectoral Study for Development Assistance-Environment" published in 1988 defined that "Environmental Consideration" is to study whether a development project will have significant impacts on the environment or not, to assess the impacts and to incorporate measures to prevent or alleviate their effects, if necessary.

The premise of this definition is the understanding that development aid should not end with a one-time involvement but should be continuous and sustainable. Thus, it is believed that environmental consideration is prerequisite for securing the sustainability of the development.

For the implementation of development projects in developing countries with the cooperation of the Japanese government, a careful environmental consideration should be carried out from the early stages of project planning with a long-term perspective in order to accomplish a well-balanced development.

As such development projects are implemented in the host countries, based on the decision making process of these countries, it is necessary to conform to their laws, rules and regulations related to environmental consideration.

In some developing countries, however, such laws, rules and regulations do not exist, while in others they are not properly enforced. The policies and structures for environmental consideration vary from one country to another.

Therefore, when undertaking the environmental consideration, it is necessary to take into account of the developing country's policies and structures and to understand the country's awareness of environmental problems, while holding sufficient discussions with the people concerned in a flexible manner.

With regard to environmental consideration, JICA's basic principles are to promote sustainable development aimed at improving the living standard of the residents, and harmonize the development with a desirable environment based on the country's willingness.

If environmental consideration is not sufficiently undertaken for implementing a development project and, if careful attention is not paid to the management of the surrounding natural resources, the base of the development might be jeopardized and the development might be halted. The base of the people's livelihood or even their subsistence can be also threatened. It is necessary, therefore, to try to ensure the sustainable development by harmonizing the development project with natural resources and the base of livelihood and subsistence of the residents in the area.

The guidelines describe screening and scoping procedures at the preparatory study stage to deal with the negative impacts of a development project on the environment of the project site and its surrounding area.

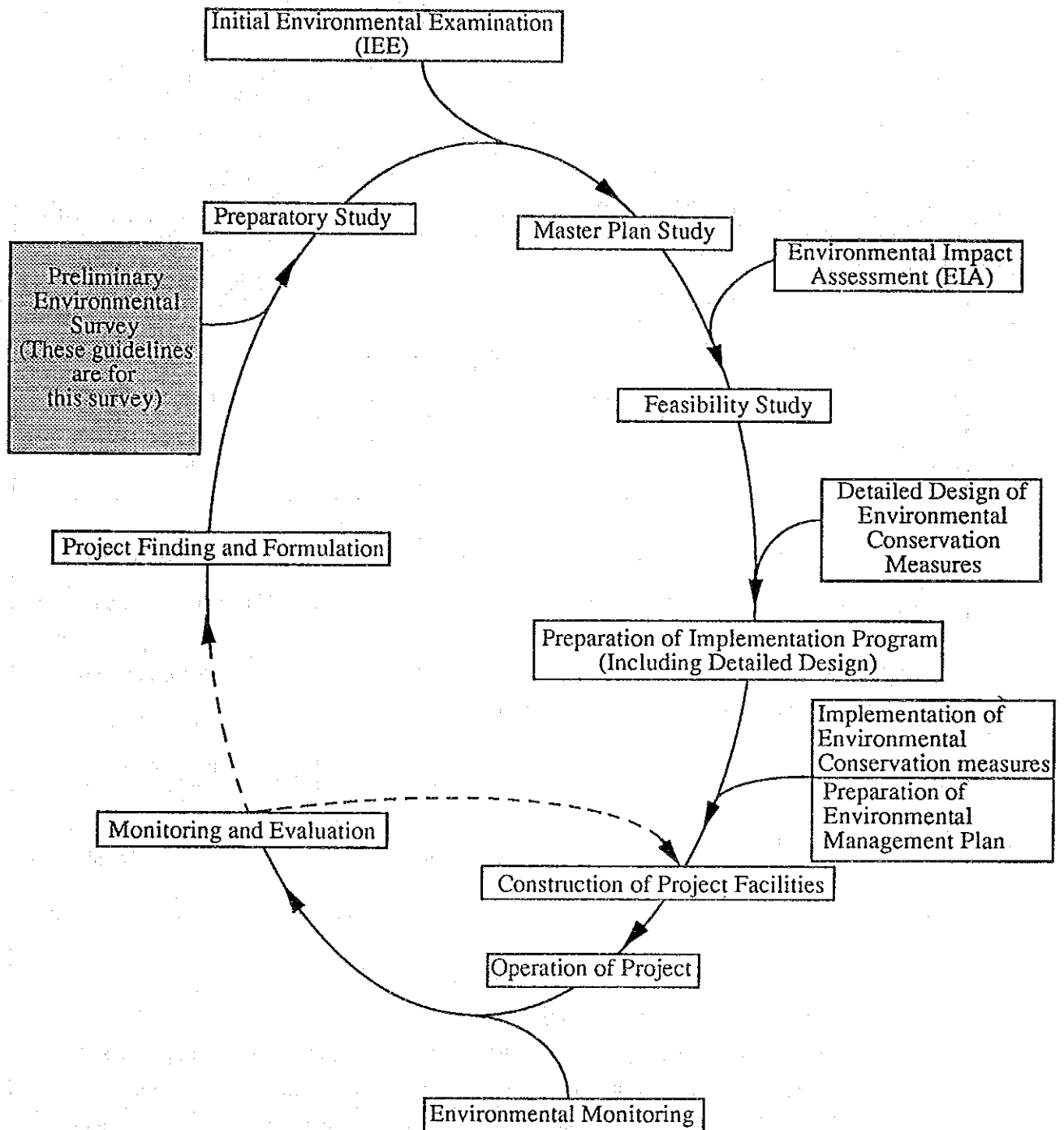
The process of environmental consideration in a project cycle is shown in Figure 1-1.

A development project begins with its finding and formulation. At each stage of the cycle, a series of environmental considerations, such as a preliminary environmental survey, an initial environmental examination (IEE), environmental impact assessment (EIA), and the design of environmental protection measures take place. Environmental monitoring is then conducted with project implementation. Through this process, sustainable development can be attained.

Definition of the environmental management plan mentioned here is limited to the monitoring system which handles the environmental impacts caused by the project.

Tables 1-1 and 1-2 illustrate the time flows corresponding to the project implementation stages and the environmental consideration stages. The flows start with an environmental survey, followed by the EIA, proceed to the examination of environmental conservation measures, and then to the monitoring stage.

Figure 1-1. Flow of Environmental Considerations in Project Cycle



**Table 1-1 Project Implementation Stages and Corresponding Environmental Consideration Stages**

Project Implementation Stages				Environmental Consideration Stages
Implementation by JICA	Preparatory Study			Preliminary Environmental Survey
	Full-scale Study	Master Plan Study	Feasibility Study	Initial Environmental Examination (IEE)
		Feasibility Study		Environmental Impact Assessment (EIA)
Implementation by Executing Agency	Preparation of Project Implementation Plan (Including Detailed Design)			Examination of Environmental Conservation Measures
	Project Construction			Implementation of Environmental Conservation Measures
	Project Facility Operation			Environmental Monitoring

- Notes: 1. This table does not indicate strict correspondence.  
 2. Some projects do not require IEE or EIA.  
 3. Preparation of the project implementation plan includes the detailed design of the environmental conservation facilities and their construction.  
 4. The item enclosed in a separate box indicates the major boundary for the guidelines.

**Table-1.2 Incorporation of Environmental Consideration into JICA's Development Studies**

	Study Flow	Contents and Timing Investigation	Examination Items
Project Finding	Request/Project Finding ↓ Acceptance of TOR ↓ Study on TOR	(Preliminary Screening) Judgment on necessity of IEE or EIA ↓ (Screening) Review of preliminary screening	The project judged to cause serious environmental impact shall be rejected.
Preparatory Study	↓ Preparatory Study ↓ Discussion and Agreement on S/W ↓ Preparation of Preparatory Study Report	↓ (Scoping) Decision of important items for IEE or EIA Decision of work boundaries	(Preparation of M/M, S/W) Examine the description of agreed items on screening and scoping. (Reporting) Clarification of background and agreed items.
Selection of Consultants	↓ Preparation of Project Specification ↓ Selection of Consultants	↓	(Project Specification) Define the boundary and work volume of IEE or EIA to be conducted by consultants  (Selection of consultants) Evaluate the appropriateness of the proposal for the project specification.
Full-scale Study	↓ Preparation of and Discussion on IC/R ↓ Implementation of IEE or EIA ↓ Explanation of and Discussion on DF/R ↓ Preparation of F/R	↓	(IEE or EIA) Discussion and decision on IEE/EIA items and methods based on the results of scoping.  (Supervision of survey) Check whether IEE or EIA is conducted properly.  (Final reporting) Clarification of IEE or EIA results and recommendations.

Source: JICA, "Sectoral Study for Development Assistance-Environment", 1988.

Note: The shaded part is mainly covered by the guidelines.

## 1.2 Environmental Consideration for Transportation Development Plans

### 1.2.1 Definition of Transportation Development Plans in the Guidelines

Transportation development plans in the guidelines deal with draft plans for transportation in a wide area related with airport, port and harbour, railway and road projects, and master plans concerned with transportation, e.g., regional traffic net plans.

### 1.2.2 Typical Possible Impacts and the Points of Environmental Consideration

Typical impacts in transportation development plan are described below. Particular consideration of these impacts is necessary.

#### Resettlement

People living in the project site would be relocated due to land acquisition for construction of facilities for transportation. Loss of livelihoods of inhabitants to be resettled, difficulty in social and cultural adaptation in the resettlement site may occur.

Conditions of the inhabitants to be resettled and resettlement site should be investigated in environmental consideration.

#### Fauna and Flora

Habitats of animals would be lost by eliminating vegetation in the project area. Breeding and living of plants and animals would be affected by exhaust gas and noise from airplanes and running vehicles after operation. Migration routes and habitat areas could be disturbed by the construction of transportation facilities.

The above impacts would cause a decrease in wild life and useful species for human life or extinction of precious species. The decrease and extinction of natural enemies and other species could result in an outbreak of certain species which can be pests and pathogenic insects.

The value of plants and animals and ecological features of the site should be studied thoroughly.

#### Air Pollution

Exhaust gas and dust from construction equipment and vehicles in the construction stage and exhaust gas from vehicular traffic after operation would cause air pollution.

The health of inhabitants and plants and animals would be affected. In case the volume of exhaust gas is enormous, sulfur oxides may contribute to acid rain, carbon monoxide and dioxide may contribute to global warming.

In urban areas, the effect of nitrogen oxides and sulfur oxides should be considered carefully.

### Noise and Vibration

In the construction stage, the operation of construction equipment and detonations would create noise and vibrations. In the operational stage, airplanes and operating vehicles could cause noise and vibration.

Noise would affect facilities, such as hospitals and schools, disturb sleep at night, interfere with the breeding of livestock and cause the dispersion of wildlife.

Highly populated areas, e.g. urban areas, and areas having specific religious facilities may need particular consideration.





## **CHAPTER 2**

### **PROJECT DESCRIPTION AND SITE DESCRIPTION**



## CHAPTER 2 PROJECT DESCRIPTION AND SITE DESCRIPTION

### 2.1 Basic Concept

To conduct screening and scoping of the potential environmental impacts that may be caused by a development plan or project, it is essential to fully understand the "project description" and "site description" at the earliest stage.

Project description includes the contents and features of the project, such as its background, objectives, location, executing agency, number of beneficiaries, scale, structure, construction method, operation and maintenance, etc..

Site description includes the present conditions of the natural and social environment and pollution in and around the project area.

In particular, if the project site includes such areas as follow, they should receive special attention:

- a) Areas requiring soil conservation (high risk areas of erosion, salinization, etc.).
- b) Arid and semiarid areas subject to desertification.
- c) Tropical forests.
- d) Water sources.
- e) Habitats of value for the protection and conservation and/or sustainable use of fish and wildlife resources (wetlands, mangrove, swamps, coral reefs, etc.)
- f) Areas of unique interest (historical, archaeological, cultural, aesthetic and scientific).
- g) Areas of concentrations of population or industrial activities where further industrial development or urban expansion could create significant environmental problems.
- h) Areas of particular social interest to specific vulnerable population groups (e.g., nomadic people or other people with traditional life styles).

It should be borne in mind that the above items must be thoroughly studied in each project step.

### 2.2 Project Description and Site Description of Transportation Development

The project description and the site description should be clarified in the formats shown in Tables 2-1 and 2-2 for screening and scoping.

However, at the project finding and preparatory study stages, sufficient information for the project description and site description may not be available. Thus, during the preparatory work prior to the preparatory study in the host country, the formats of Tables 2-1 and 2-2 should be filled in as complete as possible using all available information. The additional necessary information should be supplemented during the field surveys.

**Table 2-1 Format for Project Description (Transportation Development)**

Item	Description
Project Name	
Background	
Objectives	
Location	
Executing Agency	
Beneficiaries	
Project Components	
Type of Plan	Integrated Transportation Plan/Related Plan with Industrial Development/Transportation Facilities and Structures/ Rehabilitation
Contents of Plan	Demand Estimate/ Planning of Medium and Long Range Plan/Basic Planning for Transportation Facilities
Road Plan	Num. of Road____, Ext.____ km, Design speed____ km/hr
Railway Plan	Num. of Railway____, Ext.____ km,
Port and Harbor Plan	Num. of Port and Harbor____, Type; Freight/Ferryboat
Airport Plan	Num. of Airport____, Type; International/Domestic, Ext. of Runway____ m
Others	

Note : The format should be filled in on the basis of the available existing data and information.

**Table 2-2 Format for Site Description (Transportation Development)**

Item		Description
Project Name		
Social Environment	Inhabitants: (residents/indigenous people/their views on the project, etc.)	
	Economic Activities / Transportation: (international and/or domestic freight/ transportation network, terminal)	
	Land Use: (agriculture, forestry/ natural conservation area/ industrial area, etc.)	
Natural Environment	Topography and Geology: (mountain area / wetland / faults, etc.)	
	Water system, Coast, Climate: (erosion, accretion sand, water depth, wind direction, etc.)	
	Fauna and flora: (rare species/mangroves /coral reefs, etc.)	
Pollution	Complaints: (pollution of the upmost concern, etc.)	
	Measures taken: (institutional measures/ compensation, etc.)	
Others		

Note: The format should be filled in on the basis of the available existing data and information.



## **CHAPTER 3**

## **SCREENING**





## CHAPTER 3 SCREENING

### 3.1 Basic Concept

JICA's 1988 report, "Sectoral Study for Development Assistance-Environment," defines screening as "a process of judgement on whether a development project requires an environmental impact study or not." That is to say, screening is the first judgement in the process of environmental consideration and should commence at the initial stage of the project, such as project finding.

Screening in the guidelines is also based on the above definition. However, the evaluation of whether or not the IEE/EIA is required for a project should be based on appropriate ideas and views for harmonizing the sustainable development with the residents' livelihood and surrounding environment by taking into consideration the project features and its environment, but not on the quantitative standards.

### 3.2 Screening Methods

#### 3.2.1 Outline

As for the procedures for screening in addition to the provisions detailed in the annex to the 1985 OECD council recommendations, JICA's report, "Sectoral Study for Development Assistance-Environment", describes the following cross-sectional viewpoints:

- Can the project adversely affect the sustainability of production which depends mainly on natural resources ?
- Will the project significantly affect people's health ?
- Will the project lead to a deterioration or loss of valuable living resources and their habitats ?
- Will the project have an unreasonable impact on the livelihoods and subsistence of the people concerned ?

Based on the above viewpoints, the screening method should be examined in detail.

If there are laws or regulations concerning the environmental impact assessment for the project in the host country, it is necessary to discuss with the officials concerned of the country to make better environment considerations in accordance with the laws and regulations by referring to the guidelines.

On the other hand, if there are no such laws or regulations in the host country, it may be possible to formulate a standard with respect to the project scale and the land-use conditions for evaluating whether the development project requires an environmental

impact assessment or not. However, setting up a quantitative standard for judgement is not only difficult but its effectiveness is also doubtful because Japanese development assistance is provided to various countries and their environmental characteristics are vastly different.

It is considered to be more effective, therefore, to formulate certain ideas and viewpoints with qualitative expressions for evaluating screening.

### 3.2.2 Screening of Transportation Development Plans

Based on the above consideration, the following concepts are established in the preliminary environmental survey :

- The development project should be planned in such a way as to provide society with sufficient benefits while securing the areas' sustainable development and growth without being detrimental to the lives and existence of the residents.
- The development project should be planned in such a way as to maintain harmony with the natural environment, while avoiding significant damage to the existing environment, and preserve valuable natural environmental assets.

The examination of screening should be conducted from practical viewpoints for each environmental item based on the above concepts. The results of the examination should be clarified by using the screening format as shown in Table 3-1 and should be included in the preparatory study report.

The evaluation result of each environmental item should be noted on the format whether or not environmental impacts exist. As the overall evaluation, the conclusion and the reason for evaluating whether or not IEE/EIA is required should be described briefly on the format.

The guidelines should be applied for all environmental impacts that may be caused by the project implementation not only in the project area but also in any area that may be directly or indirectly affected during the construction and after the operation of project facilities.

**Table 3-1 Format for Screening (Transportation Development)**

No.	Environmental Item	Description	Evaluation	Remarks (Reason)
<b>Social Environment</b>				
1.	Resettlement	Resettlement due to land occupancy (transfer of rights of residence/land ownership)	[Y][N][?]	
2.	Economic Activities	Loss of bases of economic activities, such as land, and change of economic structure	[Y][N][?]	
3.	Traffic and Public Facilities	Impacts on schools, hospitals and present traffic conditions such as the increase of traffic congestion and accidents	[Y][N][?]	
4.	Split of Communities	Split of communities by interruption of inter-community traffic	[Y][N][?]	
5.	Cultural Property	Damage to or loss of value of churches, temples, shrines, archaeological remains or other cultural assets	[Y][N][?]	
6.	Water Rights and Rights of Common	Obstruction of fishing rights, water rights, rights of common	[Y][N][?]	
7.	Public Health Condition	Deterioration of public health and sanitary conditions due to generation of garbage and the increase of vermin	[Y][N][?]	
8.	Waste	Generation of construction and demolition waste, debris and logs	[Y][N][?]	
9.	Hazards (Risk)	Increase in risk of landslides, cave-ins and accidents	[Y][N][?]	
<b>Natural Environment</b>				
10.	Topography and Geology	Changes of valuable topography and geology due to excavation or filling work	[Y][N][?]	
11.	Soil Erosion	Topsoil erosion by rainfall after reclamation and vegetation removal	[Y][N][?]	
12.	Groundwater	Contamination caused by drainage and filtrated water in excavation work and exhaustion of groundwater by overdrafting	[Y][N][?]	
13.	Hydrological Situation	Changes of river discharge and riverbed condition due to land fill and drainage inflow	[Y][N][?]	
14.	Coastal Zone	Coastal erosion and sedimentation due to landfill or change in marine condition	[Y][N][?]	
15.	Fauna and Flora	Obstruction of breeding and extinction of species due to changes of habitat conditions	[Y][N][?]	
16.	Meteorology	Changes of temperature, precipitation, wind, etc. due to large-scale land reclamation and building construction	[Y][N][?]	
17.	Landscape	Change of topography and vegetation due to reclamation Deterioration of aesthetic harmony by structures	[Y][N][?]	
<b>Pollution</b>				
18.	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	[Y][N][?]	
19.	Water Pollution	Pollution by inflow of silt, sand and effluent from factories into rivers and groundwater	[Y][N][?]	
20.	Soil Contamination	Contamination caused by dust and asphalt emulsion	[Y][N][?]	
21.	Noise and Vibration	Noise and vibration generated by vehicles, airplanes, factories ,etc.	[Y][N][?]	
22.	Land Subsidence	Deformation of land and land subsidence due to the lowering of groundwater table	[Y][N][?]	
23.	Offensive Odor	Generation of exhaust gas and offensive odor by facility construction and operation	[Y][N][?]	
<b>Overall Evaluation:</b> Either IEE or EIA is necessary for the project implementation?			[Y][N]	



## **CHAPTER 4**

### **SCOPING**



## CHAPTER 4 SCOPING

### 4.1 Basic Concept

In JICA's 1988 report, "Sectoral Study for Development Assistance-Environment," scoping is defined as "a process of identification of the critical environmental impacts out of the possible environmental impacts of a development project. Through the scoping process, the priority fields or items of an environmental impact assessment are also identified". Further, it recommends that scoping should be carried out through discussions with the government of the host country. These discussions are to be based on discussion items prepared in advance, and by taking into account the aforementioned cross-sectional judgement provisions.

With the above definition and the methods used by various agencies, the guidelines provide material for conducting adequate scoping. The guidelines would enable even those who are not IEE and EIA specialists to understand the overall picture of the development project to conduct the sufficient scoping work during the short-term preparatory study period.

### 4.2 Scoping Methods

#### 4.2.1 Outline

There are several technical methods for environmental impact assessment and its scoping. Each of them is selected in accordance with the project type, the project planning level, the features of the environmental conditions, etc. The most common methods are the checklist method, the matrix method, the overlay method, and the network method. In particular, the checklist and the matrix methods are commonly used by most agencies.

For "identification of the critical environmental impacts out of the possible impacts of a development project," as required by the definition of scoping in the "Sectoral Study for Development Assistance-Environment," it is necessary to include all environmental items which can be predicted to arise along with implementation of the project. To accomplish this, the checklist method seems to be the easiest to understand and the most useful.

Based on the above consideration, the checklist method is proposed for scoping in the guidelines.

To clarify important fields and items among those listed on the checklist, it is necessary to understand the causal relationships between the environmental items and the project related activities during the construction and the operation periods. Thus, to make it easier to understand scoping, the guidelines show typical causal relationships between development activities and environmental items by using the matrix as well as the checklist.

For reference purposes, a comprehensive matrix covering 13 sectors of social and economic infrastructure development projects is shown in Table 4-1.

#### 4.2.2 Scoping of Transportation Development Plans

The checklist for scoping of transportation development plans is shown in Table 4-2. The matrix for understanding the causal relationship between the development activities and the environmental items is shown in Table 4-3.

To use the checklist for scoping, the following conditions and procedures should be taken into account:

(1) Application conditions

1) Periods covered by scoping

Scoping should cover both the construction and operation periods.

2) Spatial extent of scoping

Scoping should cover the project site and surrounding area.

3) Types of Environmental Impacts

Environmental impacts subject to scoping are those having negative impacts on the existing environment.

(2) Evaluation method of important fields and items

The evaluation of each item should be rated according to the following categories:

A (serious impact is expected);

B (some impact is expected);

C (extent of impact is unknown but further examination is required because it might become clear as the study progresses);

D (no impact is foreseeable and IEE/EIA is not required).

Important fields and items for IEE/EIA should be identified with reference to "possible environmental impacts," "useful factors for evaluation," "measures," and "related subjects for study" as listed in Table 4-5.

The opinions and views of the host country should also be taken into consideration for the evaluation.



(3) Overall Evaluation

The evaluation results of each environmental item and the reasons for the evaluation should be clearly described on the checklist. The items evaluated as A, B, or C should be examined based on the screening concept to determine whether or not IEE/EIA is required, and the policies for further study of those items should be outlined. If it is possible to alleviate or avoid some environmental impacts by taking adequate measures, the contents should be described.

If, as the result of the evaluation, there are items which are evaluated as "C" or higher, some studies should be conducted for these items.

For the overall evaluation, opinions and views of the host country should be taken into consideration.

The overall evaluation form is shown in Table 4-4.

Table 4-1 Comprehensive Matrix

Project Type		Sectoral Development									Comprehensive Development			
		1. Ports and Harbors	2. Airports	3. Roads	4. Railways	5. River and Erosion Control	6. Solid Waste Management	7. Sewerage	8. Groundwater Development	9. Water Supply	10. Regional Development	11. Tourism Development	12. Transportation Development	13. Urban Transportation Development
Environment Items														
Social Environment	1 Resettlement	⊙	⊙	⊙	⊙	⊙	○	○		○	○	○	○	○
	2 Economic Activities	○	○	○	○					○	○	○	○	○
	3 Traffic and Public Facilities	○	○	○	○	○	○				○	○	○	○
	4 Split of Communities		○	○	○	○				○	○	○	○	○
	5 Cultural Property	○	○	○	○	○				○	○	○	○	○
	6 Water Rights/Rights of Common	⊙	○	○	○	⊙			○	○	○	○	○	
	7 Public Health Condition				○		○			○	○	○		
	8 Waste	○	○	○	○	○	○	○			○	○	○	○
	9 Hazards ( Risk )	○	○	○	○						○	○	○	○
Natural Environment	10 Topography and Soil Condition	○	○	○	○	○				○	○	○		
	11 Soil Erosion		○	○	○					○	○	○		
	12 Groundwater			○	○		○		⊙	○				
	13 Hydrological Situation	○	○	○	○	⊙	○			○	○	○	○	
	14 Coastal Zone	⊙	○	○	○	○	○			○	○	○		
	15 Fauna and Flora	⊙	⊙	⊙	⊙	⊙	○	○		○	○	○	○	
	16 Meteorology									○		○		
17 Landscape	○	○	○	○	○	○	○		○	○	○	○		
Pollution	18 Air Pollution	○	○	⊙			⊙	○			○		○	
	19 Water Pollution	○	○	○	○	○	⊙	○	○	○	○	○		
	20 Soil Contamination	○		○			○					○	○	
	21 Noise and Vibration	○	⊙	⊙	⊙	○	○	○	○	○	○	○	○	
	22 Ground Subsidence								⊙					
	23 Offensive Odor	○					⊙	○			○			

Note:⊙ : The environmental items to which special attention has to be paid

They might cause serious impacts that may affect the project formulation depending on the magnitude of the impacts and the possibility of the measures.

○ : The environmental items which may have a significant impact depending on the scale of project and site conditions

No mark : The environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.

In case of the comprehensive development projects, all the items are classified in ○, because their studies are usually at the master planning stage and the extent of impacts are not clear.

Table 4-2 Checklist for Scoping (Transportation Development )

No.	Environmental Item	Evaluation	Reason
<b>Social Environment</b>			
1.	Resettlement		
2.	Economic Activities		
3.	Traffic/Public Facilities		
4.	Split of Communities		
5.	Cultural Property		
6.	Water Rights and Rights of Common		
7.	Public Health Condition		
8.	Waste		
9.	Hazards (Risk)		
<b>Natural Environment</b>			
10.	Topography and Geology		
11.	Soil Erosion		
12.	Groundwater		
13.	Hydrological Situation		
14.	Coastal Zone		
15.	Fauna and Flora		
16.	Meteorology		
17.	Landscape		
<b>Pollution</b>			
18.	Air Pollution		
19.	Water Pollution		
20.	Soil Contamination		
21.	Noise and Vibration		
22.	Land Subsidence		
23.	Offensive Odor		

Note 1: Evaluation categories :

A: Serious impact is expected.

B: Some impact is expected.

C: Extent of impact is unknown ( Examination is needed. Impacts may become clear as study progresses.).

D: No impact is expected. IEE/EIA is not necessary.

Note 2: The evaluation should be made with reference to the "explanation of item" (Table 4-5)

Table 4-3 Matrix for Scoping ( Transportation Development )

Major Facilities / Activities Activities which may cause impacts Environmental Items		Roads / Railways / Ports and Harbors / Airports						
		Overall Evaluation	Before Operation		After Operation			
			Reclamation and Spatial Occupancy	Operation of Construction Equipment and Vehicles	Spatial Occupancy	Operation of Vehicles, Ships and Airplanes	Operation/Maintenance of Supplemental Facilities	Accumulation of People and Goods
Social Environment	1 Resettlement	○	○					
	2 Economic Activities	○	○		○			○
	3 Traffic and Public Facilities	○				○	○	
	4 Split of Communities	○			○			
	5 Cultural Property	○	○			○		○
	6 Water Rights/Rights of Common	○	○		○	○		
	7 Public Health Condition	○				○		
	8 Waste	○	○				○	
	9 Hazards ( Risk )	○	○			○		
Natural Environment	10 Topography and Geology	○	○		○			
	11 Soil Erosion	○	○		○			
	12 Groundwater							
	13 Hydrological Situation	○	○		○		○	
	14 Coastal Zone	○	○		○			
	15 Fauna and Flora	○	○	○	○	○		
	16 Meteorology	○	○		○			
17 Landscape	○	○		○				
Pollution	18 Air Pollution	○		○		○		
	19 Water Pollution	○	○	○			○	
	20 Soil Contamination	○				○		
	21 Noise and Vibration	○		○		○		
	22 Land Subsidence							
	23 Offensive Odor	○				○	○	

Note:○ : The environmental items which may have a significant impact depending on the scale of the project and site conditions

No mark : The environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.



**Table 4-5 Explanation of Item 1 (Transportation Development Plan)**

Item	1. Resettlement
Description	Resettlement due to occupancy of land (transfer of rights of residence and/or land ownership)
Causes of Impacts	
1. Land acquisition for the construction of transportation facilities	
Possible Environmental Impacts	
1. Loss of living foundation of inhabitants to be resettled. Social and cultural inadaptability to the new settlement site may occur. 2. Conflict between the permanent residents and resettlers over social and economic burden 3. Deterioration of living standard after resettlement due to the poor compensation system in some countries or the status of illegal occupants	
Useful Factors for Evaluation	
1. If the following conditions are involved, resettlement will be difficult. a) The inhabitants live on the special environmental resources of the site. b) The inhabitants are currently well-off. c) Favorable relocation site is not available in the vicinity. 2. Careful handling is needed if racial or tribal problems exist.	
Measures	
1. Resettlement site selection considering the wishes of the inhabitants 2. Meetings with the inhabitants and provision of necessary information 3. Improvement of living and economic condition in the resettlement site 4. Compensation 5. Job training and guidance	
Related Subjects for Study	
1. Population of the inhabitants to be resettled and their economic condition 2. Condition of the resettlement site 3. Past cases of resettlement	

**Table 4-5 Explanation of Item 2 (Transportation Development Plan)**

Item	2. Economic Activities
Description	Loss of bases of economic activities, such as land, and changes to the economic structure
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Loss of arable land and forests</li> <li>2. Land reclamation and change in land use</li> <li>3. Inflow and outflow of population and goods resulting from the operation of transportation facilities</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Effects on regional economy because of a decrease in agriculture and forestry production due to loss of arable land and forests, change of population distribution caused by alternate land use, change of commercial activities and job opportunities.</li> <li>2. Inconvenience of intercommunication between the both sides of the transportation facilities.</li> <li>3. Rise in land value around the facilities would change the regional economy structure.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. In case important industries exists in the site, the effect of the relocation on the local economy and employment may be significant.</li> <li>2. Increase in land use value along the route would make industries with low productivity difficult to survive.</li> <li>3. In self-sufficient areas, the impact of the inflow of people and commodities on the economy would be significant.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Sufficient compensation to the land owners</li> <li>3. Securing of substitute</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Local economy and industry</li> <li>2. Future plans of the area, e.g., regional development plan</li> </ol>

Table 4-5 Explanation of Item 3 (Transportation Development Plan)

Item	3. Traffic and Public Facilities
Description	Impacts on schools, hospitals and present traffic condition, such as traffic congestion and accidents.
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Replacement of transport means by new transportation facilities</li> <li>2. Operation of vehicles, airplanes, etc.</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Depression or extinction of the existing traffic and transport facilities due to the realization of mass transport</li> <li>2. Increase in traffic accidents, traffic jams and other traffic problems caused by an increase in traffic</li> <li>3. The noise of vehicles and airplanes may affect schools, hospitals, religious spots and other public facilities. The possibility is higher in urban area.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Careful consideration should be given to local traffic and transport facility conditions, especially the conditions along access roads to the existing route.</li> <li>2. Careful consideration should be given when there are schools, hospitals, religious spots and other public facilities in the area.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Examination of the contents of the plan</li> <li>2. Installation of safety facilities</li> <li>3. Mitigating measures to protect public facilities</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Land use and traffic conditions</li> <li>2. Future land use plan and transportation plan</li> <li>3. Distribution of the public facilities</li> </ol>



Table 4-5 Explanation of Item 4 (Transportation Development Plan)

Item	4. Split of Communities
Description	Community split due to interruption of area traffic
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Interruption of traffic of inhabitants and commercial distribution by the construction of new roads, railways, etc.</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Inconvenience in daily activities of inhabitants and impacts on economic activities</li> <li>2. Creation of detached territories or isolated areas</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. In case isolated areas are created, countermeasures should be considered to reduce the negative effects.</li> <li>2. Careful consideration is needed if there are communities having long existing customs or traditions and are tightly united in their social activities.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Securing of alternative routes</li> <li>2. Creation of new traffic system</li> <li>3. Sufficient compensation</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Social structure of the region</li> <li>2. Transportation system, distribution of goods, and regional economy</li> <li>3. Higher level regional development plan</li> </ol>

Table 4-5 Explanation of Item 5 (Transportation Development Plan)

Item	5. Cultural Property
Description	Loss of or damage to the value of churches, temples, shrines and archaeological remains and other cultural assets
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Damage to and/or loss of historical assets and cultural property by land reclamation for road or railway construction</li> <li>2. Increase in traffic of people due to the development of roads</li> <li>3. Noise and air pollution caused by vehicles</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Damage to or vanishing of unique cultures and loss of opportunity for academic research, and damage to the tourism business opportunities which depend on the cultural property</li> <li>2. Aggravation of inhabitants' feeling caused by the loss of valuable cultural assets in the area</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Impacts would be critical when the cultural property is recognized historically and culturally important from global viewpoints, or it is unique to the area.</li> <li>2. Countries with longer histories may have more cultural property to preserve.</li> <li>3. Careful consideration is required when dealing with officially registered cultural assets.</li> <li>4. Careful attention should be paid to buildings and other facilities in unique communities, even if they are small.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the traffic routes and contents of the plan</li> <li>2. Preservation or relocation of cultural property</li> <li>3. Meetings with the inhabitants and provision of necessary information</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Laws and regulations concerning preservation of cultural properties.</li> <li>2. Local history and folklore</li> <li>3. Preservation or relocation plans</li> </ol>

Table 4-5 Explanation of Item 6 (Transportation Development Plan)

Item	6. Water Rights, Rights of Common
Description	Obstruction to fishing rights in rivers, water rights and rights of common
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Occupation of arable land and forests for the construction of transportation facilities</li> <li>2. Occupation or alteration of fishery field if the facilities traverse rivers or passes by a coastal area</li> <li>3. Activated traffic of people brought on by the improvement of traffic convenience</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. If common land exists in the planning area, its use will be restricted and fishing grounds would be affected by water pollution.</li> <li>2. Easy access to the forests may bring about illegal invasion and logging. It may also affect the production activities of local people.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Careful consideration should be given to old communities which may have common forests or land.</li> <li>2. Careful attention should be paid when the route passes through a fishing ground.</li> <li>3. Water rights may be established not as a legal right, but as custom.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection and study of project components</li> <li>2. Provision of new common land</li> <li>3. Meetings with the inhabitants and provision of necessary information</li> <li>4. Compensation</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Local history and folklore</li> <li>2. Type of land ownership (by laws or custom)</li> </ol>

Table 4-5 Explanation of Item 7 (Transportation Development Plan)

Item	7. Public Health Condition
Description	Aggravation of sanitary condition, e.g., generation of waste and increase of vermin
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Unsanitary management of facilities in the case of railways (e.g., especially direct discharge of excreta without sufficient treatment from long-distance trains)</li> <li>2. Generation of waste due to operation of transportation facilities</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Outbreak of flies on waste from facilities (e.g., airports and stations), rats and other harmful animals and insects which feed on leavings. They could be vectors of disease.</li> <li>2. In the case of railways, the health condition along the route would be aggravated by waste and sewage discharge from trains ; infectious disease might break out and spread.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Particular attention should be paid if the area has experienced infectious diseases in the past.</li> <li>2. Investigation is required on the stream flow and water quality if the sewage flows into a stream.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of toilets and sewage treatment systems of train cars</li> <li>2. Pests and vector insects prevention by pesticides</li> <li>3. Improvement of collecting and treatment systems of waste</li> <li>4. Infection prevention by public education on sanitation</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Public health conditions in the area</li> <li>2. Living and breeding conditions of harmful animals and insects, such as rats and flies</li> <li>3. Meteorological data, such as rainfall and humidity</li> </ol>

**Table 4-5 Explanation of Item 8 (Transportation Development Plan)**

Item	8. Waste
Description	Generation of construction and demolition waste, debris, waste oil and logs
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Generation of debris and construction waste due to the construction of roads</li> <li>2. Generation of general waste following the operation of transportation facilities</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Reclamation and dredging in rivers or coast would cause water pollution by the inflow and/or disturbance of sand and silt.</li> <li>2. In case waste disposal sites for debris and demolition waste are not available, sanitary problems and deterioration of landscape will be brought about.</li> <li>3. Inflow of waste oil may seriously affect aquatic life and birds.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. The volume of debris can be estimated from the scale of earth work.</li> <li>2. A large amount of demolition waste may be produced when the project includes the demolition of buildings, such as for the reconstruction of incineration plants.</li> <li>3. Disposal of debris would become a critical problem in urban areas.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Establishment of waste disposal sites for debris and demolition waste</li> <li>2. Establishment of waste treatment plants for waste oil and demolition waste</li> <li>3. Careful construction planning and management</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Land ownership and land use to determine a suitable disposal site</li> <li>2. Study on volume of waste, physical and chemical characteristics of the waste</li> <li>3. Laws and regulations concerning waste disposal</li> </ol>

Table 4-5 Explanation of Item 9 (Transportation Development Plan)

Item	9. Hazards ( Risk )
Description	Increase in risk of landslides, cave-ins and accidents
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Installation of storage facilities for hazardous materials, such as fuel</li> <li>2. Cut, fill and excavation in large scale for the construction of transportation facilities</li> <li>3. Occurrence of accidents due to operation of the transportation system</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. The lives of the inhabitants and users of facilities may be threatened and inhabitants' livelihood (e.g., production activities, houses, transportation, etc.) may be affected by disasters, such as landslides or cave-ins.</li> <li>2. Accidents together with natural disasters may cause serious damage.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Careful attention should be paid in an area where natural disasters frequently occur.</li> <li>2. Careful attention should be paid if villages exist in the vicinity.</li> <li>3. Careful attention should be paid if pipelines exist underground.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Careful construction planning and management</li> <li>3. Establishment of preventive systems and countermeasures against accidents and disasters</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Meteorological study</li> <li>2. Topographical and geological surveys</li> <li>3. Case study of past disasters</li> </ol>

**Table 4-5 Explanation of Item 10 (Transportation Development Plan)**

Item	10. Topography and Geology
Description	Change of valuable topography and geology by excavation and land reclamation
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Land reclamation for construction of roads, railways and airports</li> <li>2. Change of hydrological regime in rivers and coasts by construction of piers and groins</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Topography and geology would be altered by cut and fill.</li> <li>2. Land reclamation in sloping areas may cause landslides or soil erosion and result in water pollution and flooding.</li> <li>3. Change of hydrological regime in rivers and coasts would cause erosion and sedimentation and then change the topography.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Careful attention should be paid to the following types of areas:             <ol style="list-style-type: none"> <li>a) areas which have academically important topography and/or geology,</li> <li>b) areas which have intense rainfall,</li> <li>c) coastal areas which are already eroded.</li> </ol> </li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Restriction of land use in the vicinity</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Topographical and geological surveys</li> <li>2. Hydrological regime in rivers and coasts</li> <li>3. Land use survey</li> </ol>

Table 4-5 Explanation of Item 11 (Transportation Development Plan)

Item	11. Soil Erosion
Description	Topsoil erosion by rainfall after land reclamation or vegetation removal
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Exposure of topsoil caused by land reclamation or removal of vegetation for facility construction</li> <li>2. Rainfall and flooding during construction</li> <li>3. Increase of surface water due to the construction of paved roads and runways</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Loss of topsoil by surface water or wind may affect the growth of plants and animals, and agriculture and forestry.</li> <li>2. Drift soil would create water turbidity and affect aquatic life and river discharge in downstream areas.</li> <li>3. Pavement of roads and runways may be destroyed by a large quantity of runoff.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Probability is high under the following conditions:             <ol style="list-style-type: none"> <li>a) steep topography with sandy soil,</li> <li>b) heavy or intense rainfall or strong wind,</li> <li>c) low vegetation coverage.</li> </ol> </li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Protection against soil erosion, e.g., vegetation cover, slope protection</li> <li>2. Alternate route selection</li> <li>3. Examination of construction method and schedule</li> <li>4. Measures for drainage</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Soil, topographical and geological surveys</li> <li>2. Meteorological study</li> <li>3. Land use survey</li> </ol>



**Table 4-5 Explanation of Item 13 (Transportation Development Plan)**

Item	13. Hydrological Situation
Description	Change of river discharge, velocity of flow and riverbed condition due to landfill or shifted construction
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Hydrological regime would be altered by landfill or construction of structures, such as piers, in the case of development in lakes and rivers.</li> <li>2. Runoff coefficients would change due to the decrease of the vegetation cover or the increase of the paving of ground surfaces in the case of large-scale reclamation and affect the river discharge.</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Alteration of hydrological regime would change the habitat condition of aquatic life and affect fishery.</li> <li>2. Navigation and tourism may be affected by change of water depth and flow rate.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Special attention should be paid to the habitats of valuable aquatic life.</li> <li>2. Particular attention is required if the communities in the area utilize the water for navigation, fishery and tourism.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Compensation for fishery</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Aquatic life</li> <li>2. Water use</li> </ol>

Table 4-5 Explanation of Item 14 (Transportation Development Plan)

Item	14. Coastal Zone
Description	Coastal erosion and sedimentation due to landfill or change in marine condition
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Excavation and dredging for the construction of transportation facilities, such as ports and harbors</li> <li>2. Increase or decrease in sediment supply to the surrounding marine area due to the changes in tide, flow rate and stream line of rivers</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Damage to and loss of mangrove forests and/or coral reefs caused by altered coastal topography, coastal erosion and extinction of tideland due to change of littoral drift, which would affect tourism and fishery</li> <li>2. Impacts on natural environment, including an increase in risk of coastal disaster resulting from the depression of the wave dissipation effect by the natural coast</li> <li>3. Ports in the river may be affected by an increase or decrease in sediment supply</li> </ol>
Useful Factors for Evaluation	<p>Impact would be significant if the project site has:</p> <ol style="list-style-type: none"> <li>1. precious nature, such as mangrove forests and coral reefs,</li> <li>2. excellent fishing ground and other business fields,</li> <li>3. tourism utilizing the sea and the coast,</li> <li>4. high risk of disaster such as high tide.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Installation of wave-breaking works and breakwater</li> <li>3. Artificial beach nourishment</li> <li>4. Compensation for damage in fishery</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Valuable natural environment, e.g., mangrove forests, coral reefs</li> <li>2. Industries which utilize the coastal zone and rivers</li> <li>3. Study of disaster such as high tide</li> </ol>

Table 4-5 Explanation of Item 15 (Transportation Development Plan)

Item	15. Fauna and Flora
Description	Obstruction of breeding and extinction of species caused by changes to habitat conditions
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Noise and vibration from construction equipment and vehicles</li> <li>2. Removal of vegetation and extinction of animal habitats in the planning area</li> <li>3. Generation of exhaust gas and noise from operating vehicles and airplanes</li> <li>4. Disruption of migratory routes and animal habitats by the existence of transportation facilities</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. A decrease in useful creatures for human activities or extinction of valuable species</li> <li>2. Livelihood of people, including hunting animals and collection of forest products, would be threatened, and recreational value would be decreased.</li> <li>3. Decrease of natural enemies and extinction of other species may result in an outbreak of other animals, pests and harmful insects.</li> </ol>
Useful Factors for Evaluation	<p>Particular attention should be paid in the case of following:</p> <ol style="list-style-type: none"> <li>1. the site includes vulnerable ecosystem, such as primary forests, swamps and mangrove forests,</li> <li>2. there are some species peculiar to the region,</li> <li>3. many people make their living by hunting and use of animals,</li> <li>4. there are endangered or rare species listed in the Red Data Books by the International Union for Conservation of Nature and Natural Resources ( IUCN ),</li> <li>5. there are bilateral and/or multilateral conventions on wildlife.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Relocation of plants and animals</li> <li>2. Assistance for living of affected people</li> <li>3. Careful route selection</li> <li>4. Careful construction designing</li> <li>5. Protection measures for fauna and flora</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Existing vegetation, topographical and geological surveys</li> <li>2. Distribution of animals</li> <li>3. Affiliation of conventions concerning wildlife protection</li> <li>4. Livelihood of inhabitants,</li> </ol>

Table 4-5 Explanation of Item 16 (Transportation Development Plan)

Item	16. Meteorology
Description	Changes of temperature, precipitation, wind, etc., due to large-scale land reclamation and building construction
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Changes of topography and large-scale deforestation for the construction of transportation facilities</li> <li>2. Appearance of high-rise buildings and elevated bridges</li> <li>3. Large-scale pavement</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Change of hydrological condition and micro-climate, such as temperature, precipitation, wind, and humidity</li> <li>2. Effect on farming by the change of temperature and precipitation when weather-sensitive crops are planted</li> <li>3. Effect on the people, including pedestrians and residents, in the area when there is a large change in the wind condition</li> </ol>
Useful Factors for Evaluation	<p>Under the following conditions, the environmental impacts would be significant:</p> <ol style="list-style-type: none"> <li>1. The plan requires large-scale deforestation or topographical changes.</li> <li>2. There is a major agricultural industry in the area.</li> <li>3. There is water-sensitive vegetation.</li> <li>4. The plan includes the construction of high-rise buildings.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Examination of the contents of the plan</li> <li>2. Compensation for the damage</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Meteorological study (temperature, precipitation, wind, evapotranspiration, etc.)</li> <li>2. Condition of agriculture and forestry</li> <li>3. Vegetation</li> </ol>

Table 4-5 Explanation of Item 17 (Transportation Development Plan)

Item	17. Landscape
Description	Change of topography and vegetation by land reclamation. Deterioration of aesthetic harmony by appearance of structures
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Change of topography by the construction and appearance of transportation facilities</li> <li>2. Occurrence of air and water pollution</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Damage to the value of the scenery by the change of landscape which may have a cultural value or close relationship with the life of local people (e. g., religions)</li> <li>2. Tourism and local people may be affected.</li> <li>3. Deterioration of landscape by air and water pollution may affect tourism.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Particular attention should be paid to the landscape that has cultural values from a global viewpoint.</li> <li>2. The particular meanings or roles of the landscape (religious object, tourist attraction, etc.) in the area should be studied.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Careful consideration of location, scale, figure, material and color of facilities</li> <li>2. Forestation using indigenous trees</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Tourist facilities and their utilization</li> <li>2. Local history and folklore</li> <li>3. Living condition of local people</li> </ol>

Table 4-5 Explanation of Item 18 (Transportation Development Plan)

Item	18. Air Pollution
Description	Pollution caused by exhaust gas from vehicles and factories
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Exhaust gas and dust from construction equipment and vehicles</li> <li>2. Exhaust gas from operating vehicles and airplanes</li> <li>3. Leakage of fuel in airport oil supply operations</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Exhaust gas and dust would affect the health of the residents.</li> <li>2. Plants and animals would also be affected.</li> <li>3. If the amount of the exhaust gas is great, nitrogen oxides and sulfur oxides may contribute to acid rain, and carbon dioxide to global warming .</li> <li>4. In case hazardous materials are treated, hazardous gas may leak.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Careful consideration is needed if facilities requiring clean air, such as hospitals, are located nearby.</li> <li>2. A large amount of dust would be generated from unpaved roads.</li> <li>3. Careful attention should be paid if hazardous materials, especially volatile ones, are stored and used.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Examination of construction method and schedule for preventing dust</li> <li>2. Proper management of hazardous materials</li> <li>3. Reexamination of construction methods</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Air quality standard and regulations on emission of pollutants</li> <li>2. Distribution of public facilities</li> <li>3. Distribution of fauna and flora</li> </ol>

**Table 4-5 Explanation of Item 19 (Transportation Development Plan)**

Item	19. Water Pollution
Description	Pollution by inflow of silt , sand and dust into rivers and groundwater
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Disturbance of sediments by the construction of piers and reclamation when transportation facilities are constructed in lakes, streams and rivers</li> <li>2. Erosion caused by the change of vegetation and topography</li> <li>3. Washout of dust and oil during rain</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Aquatic life would be affected by temporary water pollution or turbid water during the construction stage.</li> <li>2. Contamination of water by inflow of oil and dust would affect the aquatic life and the health of inhabitants who use the water.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Careful consideration should be given when the water is used by inhabitants or industries nearby or in a downstream area.</li> <li>2. Particular attention should be paid if important aquatic species exist.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Examination of the project plan</li> <li>2. Compensation to the people and business concerning the water use</li> <li>3. Creation of habitats for valuable aquatic species</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Water use and watershed use industries</li> <li>2. Water quality</li> </ol>

Table 4-5 Explanation of Item 20 (Transportation Development)

Item	20. Soil Contamination
Description	Contamination of soil by dust and chemicals, such as herbicides
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Dispersion of paving materials, such as asphalt emulsion, during construction</li> <li>2. Exhaust gas and dust from operating vehicles</li> <li>3. Spreading herbicides for facility maintenance</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Increase of impact through a process whereby, under certain conditions, the heavy metals in dust and chemicals in herbicides are accumulated in the soil and absorbed by plants and eventually enter the water system</li> <li>2. Health hazards to the inhabitants who use groundwater contaminated by penetration</li> </ol>
Useful Factors for Evaluation	<p>Careful consideration is required in the case of following:</p> <ol style="list-style-type: none"> <li>1. there is arable land along the route,</li> <li>2. groundwater is utilized in the area.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Development of alternate traffic system</li> <li>2. Examination of alternate water sources</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Land use</li> </ol>



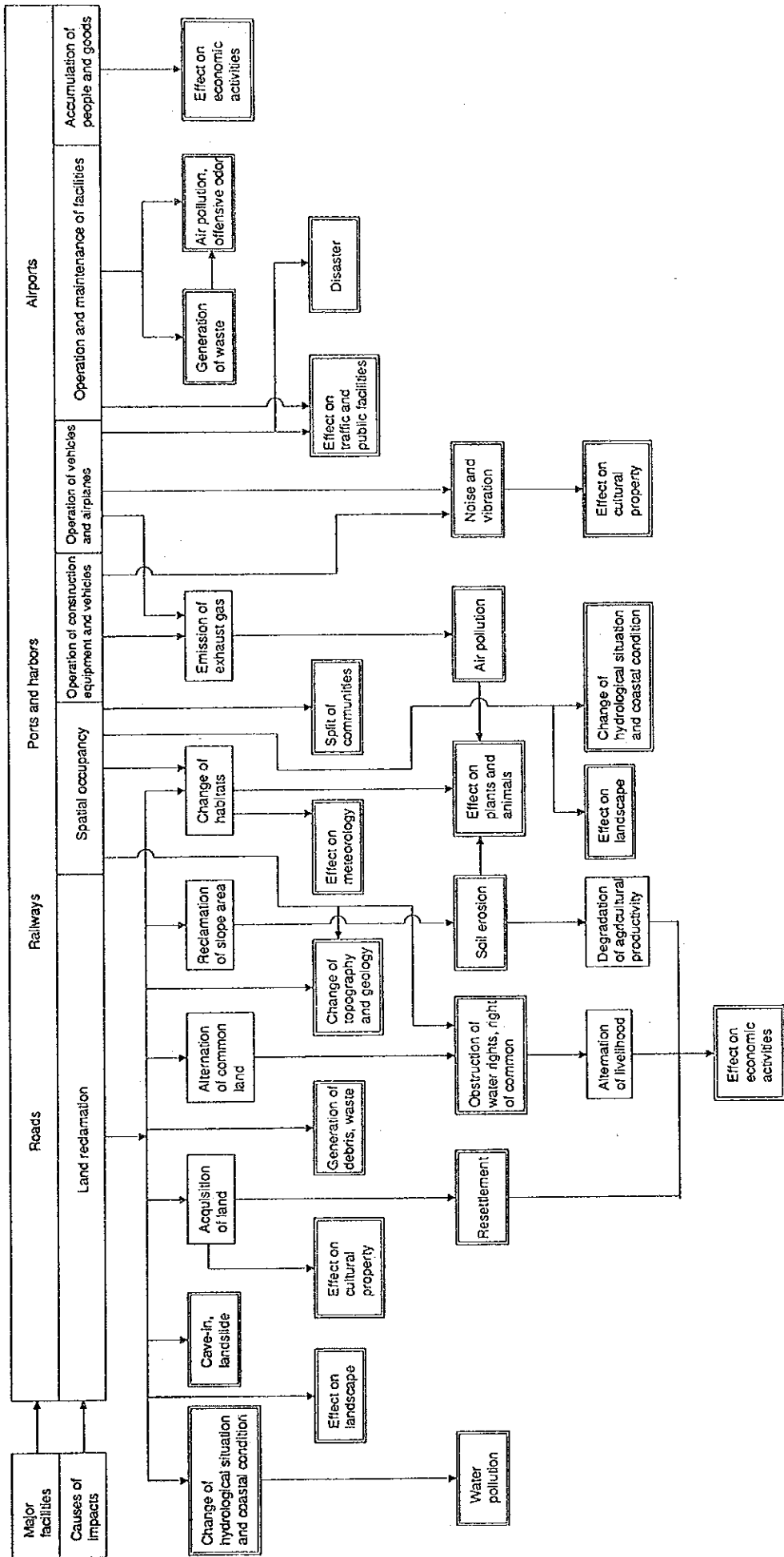
**Table 4-5 Explanation of Item 21 (Transportation Development Plan)**

Item	21. Noise and Vibration
Description	Noise and vibration generated by vehicles, airplanes, factories, etc.
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Operation of construction equipment and vehicles for construction and detonations</li> <li>2. Operation of vehicles and airplanes</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Hospitals and schools would be affected by noise. Sleep would be disturbed by vehicles operating at night.</li> <li>2. Obstruction of breeding of cattle and dispersion of wildlife may occur.</li> <li>3. Cracks in buildings on soft ground caused by vibrations</li> </ol>
Useful Factors for Evaluation	<p>Impact would be significant under the following conditions:</p> <ol style="list-style-type: none"> <li>1. there are facilities requiring calm circumstances, and densely populated areas,</li> <li>2. there is an important cattle industry,</li> <li>3. there are habitats of valuable wildlife,</li> <li>4. there is weak ground such as filled land or cohesive soil layer.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Use of low noise and vibration construction equipment</li> <li>3. Examination of construction schedule and working hours, and careful construction planning and management</li> <li>4. Installation of acoustic walls and buffer zones</li> <li>5. Compensation for damage on livestock</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Geological survey</li> <li>2. Land use, distribution of inhabitants and public facilities, living condition of inhabitants</li> <li>3. Habitats of valuable wildlife</li> </ol>

Table 4-5 Explanation of Item 23 (Transportation Development Plan)

Item	23. Offensive Odor
Description	Generation of exhaust gas and offensive odor by facility construction and operation.
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Waste oil, exhaust gas and waste would produce offensive odors in the operation of airport, port, railway facilities, etc..</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Offensive odor is produced by waste and exhaust gas in inland area, and by water pollution caused by inflow of waste oil and effluent in rivers and coastal area. It would deteriorate the amenity of life.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Impact would be larger in densely populated area.</li> <li>2. In stagnant water areas, there is a high possibility of generation of offensive odor.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Isolation of the site from residential area</li> <li>2. Examination of facility contents</li> <li>3. Proper treatment of effluent and waste</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Meteorological and hydrological conditions</li> <li>2. Higher level regional plans</li> </ol>

Appendix Flowchart of the Environmental Impacts of Transportation Development Plans



Note :  : indicates the environmental items shown in Table 4-3.

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