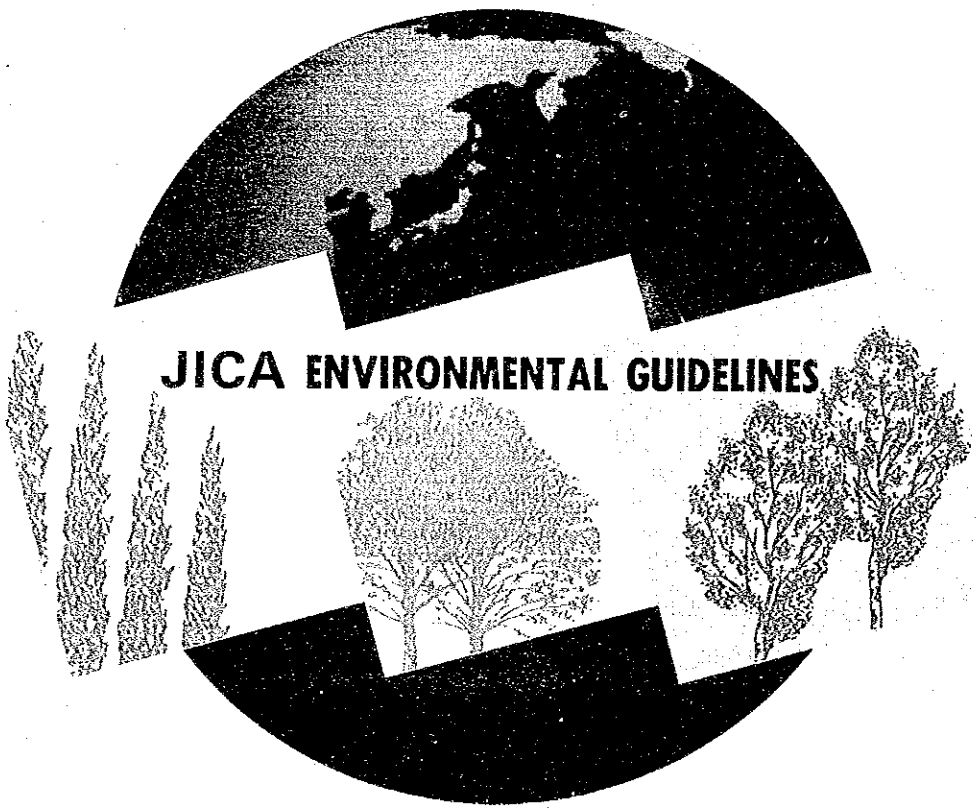
ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS

III ROADS



SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS

III ROADS

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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 "Roads".

Sector I	Ports and Harbors
Sector II	Airports
Sector III	Roads
Sector IV	Railways
Sector V	River and Erosion Control
Sector VI	Solid Waste 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

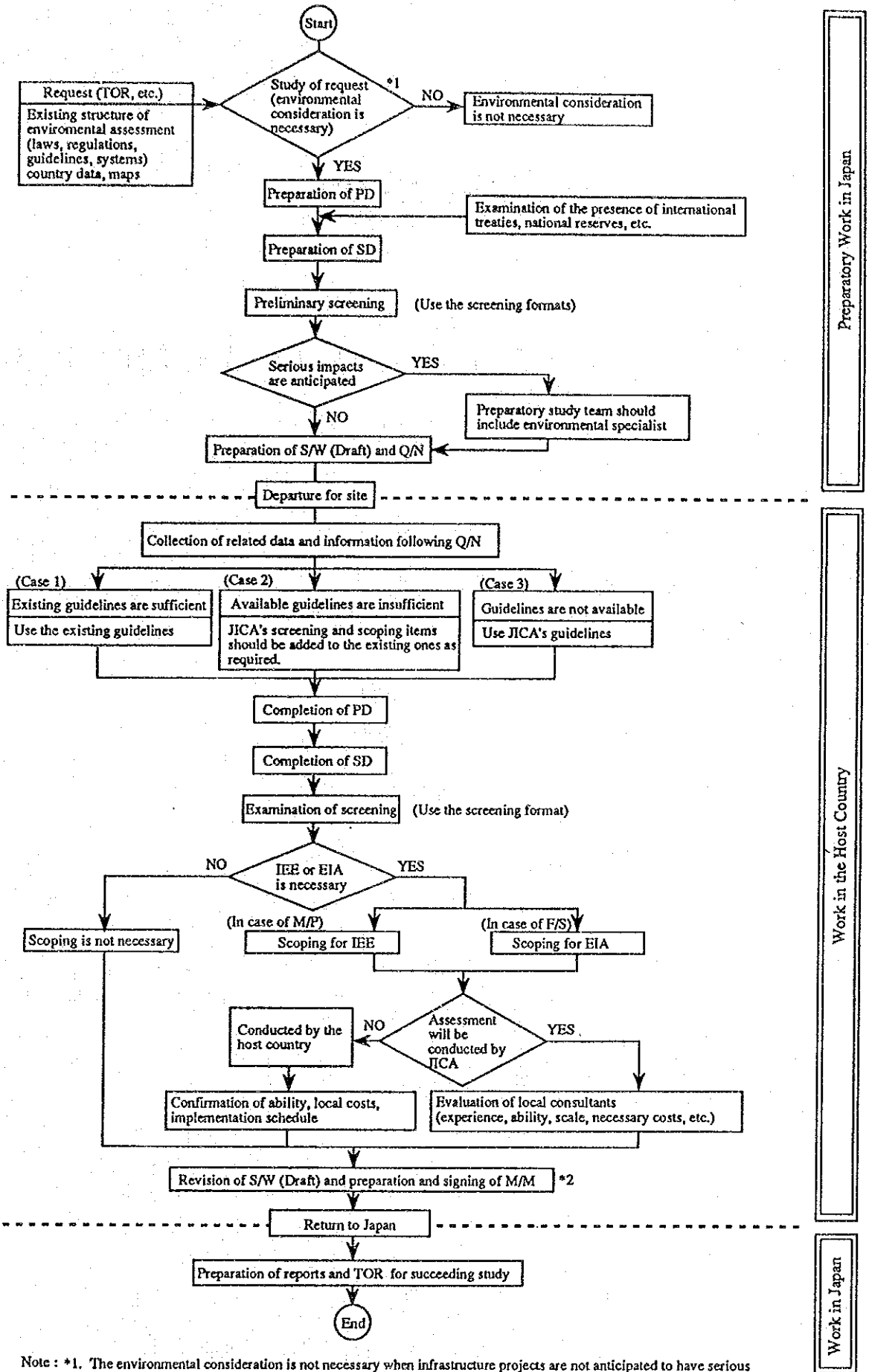
Evaluate the magnitude of impact on each environmental item, using the checklist method, to specify the items that are to be studied in IEE for M/P or EIA for F/S. In this process, making use of the explanation of items in the guidelines, try to grasp the features of possible environmental impacts. The 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 necesary to mention in the M/M that such items would be clarified in the full-scale study.

CHAPTER 1

OUTLINE OF ENVIRONMENTAL CONSIDERATION

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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

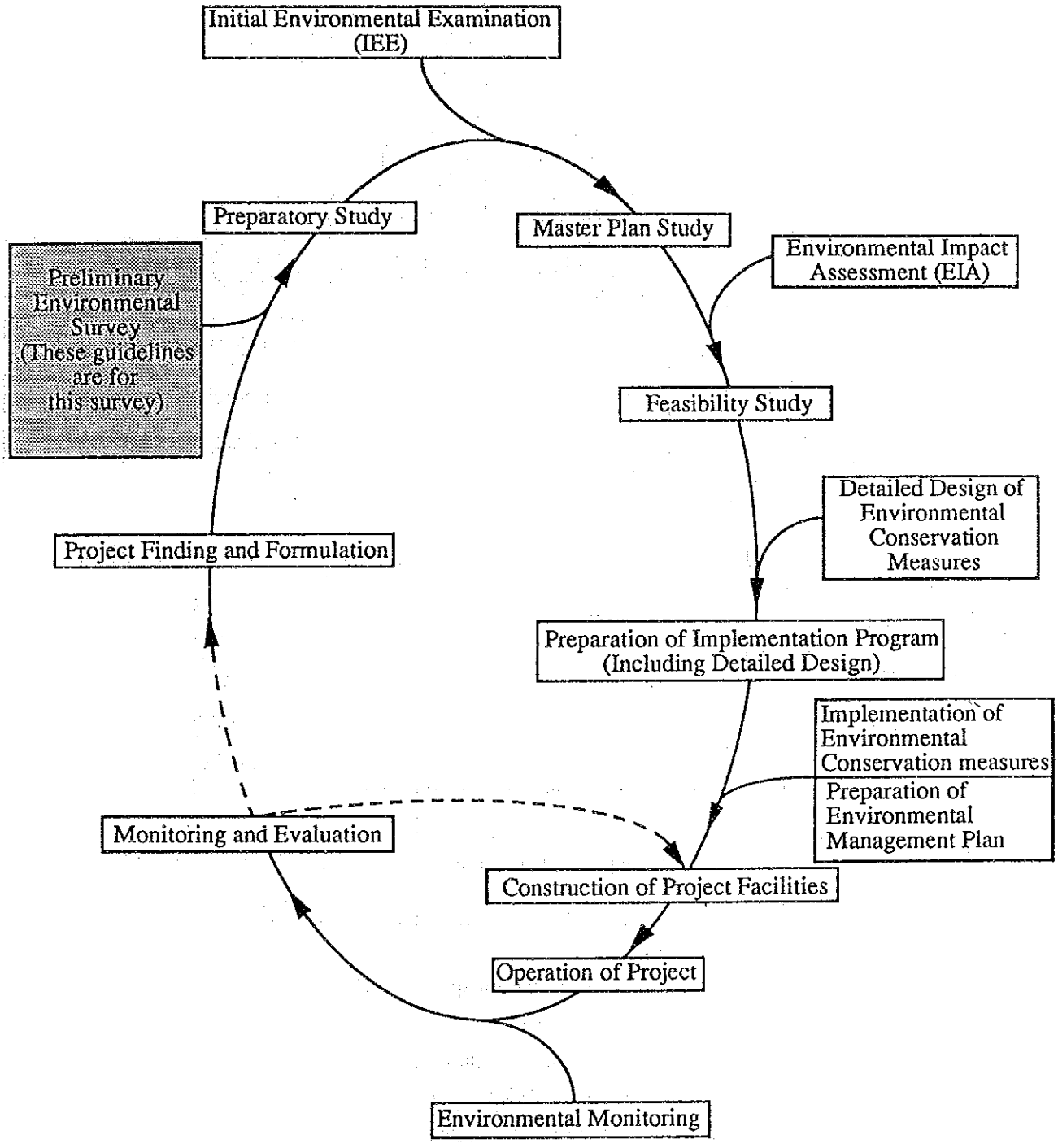

Table 1-1 Project Implementation Stages and Corresponding *Environmental Consideration Stages*

<table>
<tr><td colspan="4">Project Implementation Stages</td><td>Environmental Consideration Stages</td></tr>
<tr><td rowspan="3">Implementation by JICA</td><td colspan="3">Preparatory Study</td><td>Preliminary Environmental Survey</td></tr>
<tr><td rowspan="2">Full-scale Study</td><td>Master Plan Study</td><td rowspan="2">Feasibility Study</td><td>Initial Environmental Examination (IEE)</td></tr>
<tr><td>Feasibility Study</td><td>Environmental Impact Assessment (EIA)</td></tr>
<tr><td rowspan="3">Implementation by Executing Agency</td><td colspan="3">Preparation of Project Implementation Plan (Including Detailed Design)</td><td>Examination of Environmental Conservation Measures</td></tr>
<tr><td colspan="3">Project Construction</td><td>Implementation of Environmental Conservation Measures</td></tr>
<tr><td colspan="3">Project Facility Operation</td><td>Environmental Monitoring</td></tr>
</table>

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	The project judged to cause serious environmental impact shall be rejected.
Preparatory Study	↓ Preparatory Study	(Screening) Review of preliminary screening (Scoping) Decision of important items for IEE or EIA Decision of work boundaries	
	↓ Discussion and Agreement on S/W ↓ Preparation of Preparatory Study Report		(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 Road Projects

1.2.1 Definition of Road Projects in the Guidelines

Road projects in the guidelines deal with the construction and operation of the roads for vehicular traffic and the large-scale rehabilitation and operation of existing roads.

1.2.2 Typical Possible Impacts and the Points of Environmental Consideration

Typical impacts by road projects are described below. Particular consideration of these impacts is necessary.

Resettlement

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

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

Fauna and Flora

Animals habitats would be lost by the removal of vegetation for road construction. Breeding, plant life and animals would be affected by exhaust gas and noise caused by vehicles after construction. Migration routes and habitat areas could be interrupted by road facilities. Commencement of road operations would bring an increase of immigrants who would change the forest along the route into cultivated land thereby disrupting the habitats and environment.

The above impacts would cause a decrease in the number of valuable species or the extinction of precious species that would result in the degradation of biodiversity. The decrease and extinction of predatory species and other species could result in an outbreak of other species, especially pests and pathogenic insects.

The value of plants and animals and the ecological features of the site, as well as the social concern for plants and animals, should be studied thoroughly.

Air Pollution

Exhaust gas and dust from construction equipment and vehicles during the construction stage and exhaust gas from vehicular traffic after the commencement of operations would cause air pollution.

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

In urban areas, the effect of soot, carbon monoxide, nitrogen oxides and sulfur oxides must be considered carefully.

Noise and Vibration

During the construction stage, the operation of construction equipment and detonations would create noise and vibration. During the operational stage, vehicles could cause noise and vibration.

Noise would affect facilities requiring particular tranquility, 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, need special consideration.

CHAPTER 2

PROJECT DESCRIPTION AND SITE DESCRIPTION

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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 Road Projects

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 (Roads)

Item	Description
Project Name	
Background	
Objectives	
Location	
Executing Agency	
Beneficiaries	
Project Components	
Type of Project	Construction / Rehabilitation
Type of Roads	Highway/Ordinary, Urban/Rural Area, Plain/Mountainous Area
Target Year/ Traffic Volume	In year of ____ , _____cars/hour, (_____cars/day)
Extension/Width/Lanes	Ext_____km, Width_____m, No. of Lanes_____.
Road Structure	Embankment / Elevated / Underpass / Others ( )
Supplemental Facilities	Interchanges:_____points , Toll Gates:_____points
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 (Roads)

Item		Description
Project Name		
Social Environment	Inhabitants: (residents/indigenous people/their views on the project, etc.)	
	Land use: (urban area / farmland / historic site / scenic spot / hospitals, etc.)	
	Economy / Transport: (commerce / agriculture / forestry / bus terminal, etc.)	
Natural Environment	Topography, Geology: (steep slopes / soft ground / wetland / faults, etc.)	
	Fauna and Flora and their habitats: (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 Road Projects

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 (Roads)

No.	Environmental Item	Description	Evaluation	Remarks (Reason)
Social Environment				
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	Community split due to interruption of area traffic	[Y][N][?]	
5.	Cultural Property	Damage to or loss of the 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][?]	
Natural Environment				
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	Change of distribution of groundwater by large-scale excavation	[Y][N][?]	
13.	Hydrological Situation	Changes of river discharge and riverbed condition due to landfill 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][?]	
Pollution				
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 into rivers and groundwater	[Y][N][?]	
20.	Soil Contamination	Contamination of soil by dust and chemicals, such as herbicides	[Y][N][?]	
21.	Noise and Vibration	Noise and vibration generated by vehicles	[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][?]	
Overall Evaluation: 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 Road Projects

The checklist for scoping of road projects 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 its vicinities.

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 / Sectors / Environment Items	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
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 (Roads)

No.	Environmental Item	Evaluation	Reason
Social Environment			
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)		
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 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 (Roads)

Major Facilities / Activities		Roads / Roadside Facilities / Construction Roads					
Activities which may cause impacts / Environmental Items		Overall Evaluation	Before Operation		After Operation		
			Reclamation and Spatial Occupancy	Operation of Construction Equipment	Occupancy of Land	Operation of Vehicles	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 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 the project and site conditions

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

Table 4-4 Overall Evaluation Form (Roads)

Environmental Item	Evaluation	Study Plan	Remarks

Note: 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.

Table 4-5 Explanation of Item 1 (Roads)

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 road construction

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 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 consideration 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 provisions of necessary information
3. Improvement of living and economic conditions of 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 (Roads)

Item	2. Economic Activities
Description	Loss of bases of economic activities, such as land, and change to the economic structure

Causes of Impacts

1. Loss of arable land and forests
2. Land reclamation and change in land use
3. Change of industrial structure following the inflow and outflow of population and goods resulting from the road construction

Possible Environmental Impacts

1. Effects on the 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
2. Inconvenience in accessing between both sides of the route
3. In self-sufficient areas, although cash income would increase by the adoption of cash crops, malnutrition might result.
4. Rise in land value along the route would widen the gap between the rich and poor.

Useful Factors for Evaluation

1. Increase in land use value along the route would make it difficult for industries having low value-addition to survive.
2. In self-sufficient areas, the effect on the economy caused by the inflow of people and commodities would be significant.
3. If important industries exist in the site, the effect of relocation on the local economy and employment may be significant.

Measures

1. Alternate route selection
2. Sufficient compensation to the land owners
3. Securing of substitute

Related Subjects for Study

1. Local economy and industry
2. Future plans of the area such as a regional development plan

Table 4-5 Explanation of Item 3 (Roads)

Item	3. Traffic and Public Facilities
Description	Impacts on schools, hospitals and present traffic conditions, such as increased traffic congestion and accidents

Causes of Impacts

1. Replacement of transport means by road traffic
2. Emergence and increase of vehicular traffic

Possible Environmental Impacts

1. Depression or extinction of the existing traffic and transport facilities owing to the emergence of mass transport introduced by the new road
2. Increase in traffic accidents, traffic jams and other traffic problems caused by an increase in traffic
3. Effect of noise caused by vehicles on schools, hospitals, religious spots and other public facilities. The possibility is higher in an urban area.

Useful Factors for Evaluation

1. Local traffic and transport facility conditions, especially the conditions along the access roads to the existing route, should be considered carefully.
2. It is necessary to refer to the regional development plan or city planning.
3. Careful consideration should be given to schools, hospitals, religious spots and other public facilities in the area.

Measures

1. Examination of the project contents
2. Rehabilitation of the existing traffic system, especially along the access route
3. Installation of safety facilities
4. Environmental protection measures for public facilities

Related Subjects for Study

1. Land use and traffic conditions
2. Future land use plan, transportation plan
3. Higher level regional development plan
4. Distribution of the public facilities

Table 4-5 Explanation of Item 4 (Roads)

Item	4. Split of Communities
Description	Community split due to interruption of area traffic

Cause of Impacts

1. Interruption of existing route by the construction of new roads
2. Interruption of traffic of inhabitants and commercial distribution

Possible Environmental Impacts

1. Inconvenience in daily activities of inhabitants and effect on economic activities
2. Creation of detached territories or isolated areas

Useful Factors for Evaluation

1. In case isolated areas are created, the effect is obvious and countermeasures should be considered.
2. Careful consideration is needed if there are communities having long existing customs or traditions and that are tightly united in their social activities.

Measures

1. Securing of alternative routes
2. Creation of new community centers
3. Sufficient compensation

Related Subjects for Study

1. Social structure of the region
2. Transportation system, distribution of goods, and regional economy
3. Higher level regional development plan

Table 4-5 Explanation of Item 5 (Roads)

Item	5. Cultural Property
Description	Damage to or loss of the value of churches, temples, shrines and archaeological remains and other cultural assets

Causes of Impacts

1. Damage to and/or loss of historical assets and cultural property by land reclamation for road construction
2. Increase in traffic of people owing to the development of road
3. Noise and air pollution caused by vehicles

Possible Environmental Impacts

1. Increase possibility of theft due to construction activity and activated traffic, and damage to or vanishing of a unique culture by the flow of different cultures and the loss of opportunity for academic research
2. Damage to tourism business opportunities which depend on cultural property
3. Aggravation of inhabitants' feeling caused by the loss of precious cultural assets in the area

Useful Factors for Evaluation

1. Impacts would be critical when the cultural property is recognized historically and culturally important from a global viewpoints or is unique to the area.
2. Countries with longer histories may have more cultural property to preserve.
3. Careful consideration should be given to officially registered cultural assets.
4. Careful attention should be paid to buildings and other facilities in unique communities.

Measures

1. Reexamination of the traffic routes and contents of the plan
2. Preservation or relocation of cultural property
3. Meetings with the inhabitants and provisions of necessary information

Related Subjects for Study

1. Laws and regulations concerning preservation of cultural property
2. Local history and folklore
3. Preservation or relocation plans and measures

Table 4-5 Explanation of Item 6 (Roads)

Item	6. Water Rights , Rights of Common
Description	Obstruction of fishing rights in rivers, water rights and land use rights

Causes of Impacts

1. Occupancy of arable land and forests for road construction
2. Obstruction or alteration of fishing grounds if the roads traverse rivers or pass by coastal areas
3. Increase in traffic

Possible Environmental Impacts

1. Effect on the people who have utilized the common land in case the route passes through the common land. The effects may extend to the culture and industry of the area.
2. Occupancy of the fishing ground would affect fishery. Easy access to forests may cause illegal entry and logging.

Useful Factors for Evaluation

1. Special attention should be paid to old communities likely to have common forests or land.
2. Careful attention should be paid when the route passes through fishing ground.
3. Water rights or land use rights may exist if water intake facilities, navigation facilities and charcoal-burner sheds exist.

Measures

1. Alternate route selection and reexamination of project components
2. Provision of new common land
3. Meetings with inhabitants and provisions of necessary information
4. Sufficient compensation

Related Subjects for Study

1. Local history and folklore
2. Type of land ownership, e. g., by laws or custom

Table 4-5 Explanation of Item 8 (Roads)

Item	8. Waste
Description	Generation of construction and demolition waste, debris and logs

Causes of Impacts

1. Generation of debris and construction waste due to the construction of roads
2. Generation of general waste following the use of the roads and an increase of economic activities

Possible Environmental Impacts

1. Exposed waste may diminish aesthetic values and affect vegetation. It may also cause the pollution of soil and water.
2. Dumping from vehicles would affect aesthetic values along the route and cause sanitary problems.

Useful Factors for Evaluation

1. The volume of debris can be estimated from the scale of excavation.
2. A large amount of demolition waste may be produced when the project includes the demolition of buildings.
3. Disposal of debris would become a critical problem in urban areas.

Measures

1. Establishment of proper waste collection system and disposal system
2. Securing of sufficient waste disposal site
3. Careful construction plan and management

Related Subjects for Study

1. Study on volume of waste, physical and chemical characteristics of the waste
2. Land ownership and land use to determine a suitable disposal site
3. Laws and regulations concerning waste disposal

Table 4-5 Explanation of Item 9 (Roads)

Item	9. Hazards (Risk)
Description	Increase in risk of landslides, cave-ins and accidents

Causes of Impacts

1. Cut and fill and land reclamation for road construction
2. Insufficient drainage
3. Decrease in rainwater intrusion owing to the paving of road surfaces

Possible Environmental Impacts

1. Damage to and collapse of the road surfaces as a result of poor flood water drainage.
2. In case of impermeable paving, surface runoff caused by heavy rain will cause soil erosion and flooding.
3. Large-scale cutting would change the balance of the soil and create land cave-ins or upheavals.
4. Landslides and similar failures might damage land and houses and threaten the lives of inhabitants.

Useful Factors for Evaluation

1. Probability of landslide is high in areas having steep hills of soft soil with high porosity.
2. Careful attention should be paid if villages exist in the vicinity.
3. Careful attention should be paid in areas having intense rain in a short time period.

Measures

1. Alternate route selection
2. Adequate drainage work
3. Protection of the slopes
4. Monitoring and maintenance system

Related Subjects for Study

1. Topographical and geological surveys
2. Meteorological study
3. Case study of past natural disasters

Table 4-5 Explanation of Item 10 (Roads)

Item	10. Topography and Geology
Description	Change of valuable topography and geology by excavation and land reclamation

Causes of Impacts

1. Cut and fill, and excavation of underground for road construction

Possible Environmental Impacts

1. Topography and geology would be altered by cut and fill. It may bring about landslides or soil erosion.

Useful Factors for Evaluation

1. Careful attention should be paid in the following types of areas:
   a) areas which have important topography and/or geology,
   b) areas of steep hills of soft soil with high porosity,
   c) areas which have rainfall of high intensity.
2. Urban areas have little concern with this problem.

Measures

1. Alternate route selection
2. Examination of the construction method
3. Restriction of land use in the vicinity

Related Subjects for Study

1. Topographical and geological survey
2. Landslide sites
3. Land use

Table 4-5 Explanation of Item 11 (Roads)

Item	11. Soil Erosion
Description	Topsoil erosion by rainfall after land reclamation or vegetation removal

Causes of Impacts

1. Exposure of topsoil caused by land reclamation or removal of vegetation for road construction
2. Rainfall and flood during construction

Possible Environmental Impacts

1. Loss of topsoil by surface runoff or wind may affect growth of plants and animals, agriculture and forestry.
2. Sediment would create water turbidity and affect aquatic life and river discharge in downstream areas.

Useful Factors for Evaluation

1. Probability is high under the following conditions:
   a) steep topography with sandy soil.
   b) heavy or intense rainfall, or strong wind.
   c) scarce vegetation coverage.

Measures

1. Protection against soil erosion, e.g., vegetation cover, slope protection
2. Alternate route selection
3. Examination of construction method and schedule

Related Subjects for Study

1. Soil, topographical and geological surveys
2. Meteorological study
3. Land use

Table 4-5 Explanation of Item 12 (Roads)

Item	12. Groundwater
Description	Change of the distribution of groundwater by large-scaled excavation

Cause of Impacts

1. Disruption of groundwater flow by large-scale excavation or tunnel construction which would alter the distribution of groundwater and bring about turbidity of groundwater
2. Decrease of groundwater recharge function due to change of outflow rate by clear cutting of vegetation
3. Extraction of a large quantity of groundwater because of an increased water demand for the operation of large service areas and cleaning of roads

Possible Environmental Impacts

1. Lowering of the groundwater level and the exhaustion of wells which may affect the groundwater use in the project site
2. Land degradation on alluvial or clayey soil layer due to the lowering of the groundwater level
3. Water pollution during the construction and saltwater intrusion in the coastal areas which would deteriorate the water quality and affect the water use

Useful Factors for Evaluation

1. Shallow wells which use unconfined groundwater are susceptible to the impacts.
2. Particular attention should be paid if the groundwater level has a tendency to decline or land degradation has already progressed in the area.
3. Careful attention should be paid to saltwater intrusion when the project site is located near the sea.

Measures

1. Alternate route selection
2. Use of construction methods adopting conservation measures of groundwater
3. Development of alternative water source

Related Subjects for Study

1. Hydrogeological survey, e.g., determination of aquifer
2. Pumping tests
3. Water use

Table 4-5 Explanation of Item 13 (Roads)

Item	13. Hydrological Situation
Description	Change of river discharge and riverbed condition due to the inflow of drainage or landfill

Causes of Impacts

1. Hydrological regime would be altered by the construction of structures, such as piers, when the route passes over lakes and rivers.

Possible Environmental Impacts

1. Alteration of riverbed would change the habitat condition of aquatic life and affect fishery.
2. Navigation and tourism may be affected by the change of water depth, flow and flow rate.

Useful Factors for Evaluation

1. Careful attention should be paid to the habitats of valuable aquatic life.
2. Particular attention is required if the communities in the area utilize the water for navigation, fishery and tourism.

Measures

1. Alternate route selection
2. Compensation for fishery

Related Subjects for Study

1. Aquatic life
2. Water use

Table 4-5 Explanation of Item 14 (Roads)

Item	14. Coastal zone
Description	Coastal erosion and sedimentation due to landfill or change in marine condition

Causes of Impacts

1. Excavation and dredging for the construction of piers when the route passes through the coastal zone
2. Increase or decrease in sediment supply to the surrounding marine area owing to the change in tide

Possible Environmental Impacts

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 the change of littoral drift , which would affect tourism and fishery
2. Impacts on natural environment, including an increase in risk of coastal disaster, resulting from the depression of the wave dissipation effect by natural coast

Useful Factors for Evaluation

Impact will be significant if the project site has:

1. Precious nature, such as mangrove forests and coral reefs,
2. Excellent fishing field and other business field,
3. Tourism utilizing the sea and the coast,
4. High risk of disaster, such as high tide.

Measures

1. Alternate route selection
2. Installation of wave dissipation revetment and breakwater
3. Artificial nourishment
4. Compensation for damage in fishery

Related Subjects for Study

1. Valuable natural environment, e.g., mangrove forests, coral reefs
2. Fishery and related industries
3. Industries which utilize the coastal zone

Table 4-5 Explanation of Item 15 (Roads)

Item	15. Fauna and Flora
Description	Obstruction of breeding and extinction of species caused by change of habitat condition

Causes of Impacts

1. Removal of vegetation and extinction of habitats of animals due to the construction of roads and related facilities
2. Generation of exhaust gas and noise from running vehicles
3. Disruption of migratory routes and habitats of animals by the existence of roads and related facilities

Possible Environmental Impacts

1. A decrease in useful creatures for human activities or extinction of valuable species
2. Livelihood of people, including the hunting of animals and collection of forest products, would be threatened and the recreational value would be decreased.
3. Decrease of natural enemies and extinction of other species may result in an outbreak of other animals, pests and harmful insects.

Useful Factors for Evaluation

Particular attention should be paid in the case of following:

1. The site includes vulnerable ecosystem, such as primary forests, swamp and mangrove forests.
2. There are species peculiar to the region.
3. Many people make their living by hunting and use of animals.
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).
5. There are bilateral and multilateral conventions on wildlife.

Measures

1. Relocation of plants and animals
2. Sufficient compensation
3. Careful route selection
4. Careful construction designing
5. Protection measures for fauna and flora

Related Subjects for Study

1. Existing vegetation, topographical and geological survey.
2. Distribution of animals.
3. Affiliation of conventions concerning wildlife protection.
4. Livelihood of inhabitants.

Table 4-5 Explanation of Item 17 (Roads)

Item	17. Landscape
Description	Change of topography and vegetation by land reclamation. Deterioration of aesthetic harmony by appearance of structures

Causes of Impacts

1. Change of topography and vegetation by construction, and appearance of roads and piers

Possible Environmental Impacts

1. Damage to the value of the scenery by the change of landscape which may have cultural values or close relationship with the life of local people (e.g., religious importance)
2. Tourism and local people's life may be affected by the damage.

Useful Factors for Evaluation

1. Particular attention should be paid to the landscape that has cultural values from an international viewpoint.
2. The particular meanings or roles of the landscape (religious object, tourist attraction, etc.) in the area should be studied.

Measures

1. Reexamination of the project contents
2. Landscape architecture

Related Subjects for Study

1. Folklore
2. Livelihoods of the inhabitants
3. Tourism

Table 4-5 Explanation of Item 18 (Roads)

Item	18. Air Pollution
Description	Pollution caused by exhaust gas and toxic gas from vehicles and factories

Causes of Impacts

1. Exhaust gas from construction equipment and vehicles, and dust generated by earthwork
2. Exhaust gas from running vehicles

Possible Environmental Impacts

1. Exhaust gas and dust would affect the health of people, plants and animals along the route.
2. If the amount of the exhaust gas is enormous, nitrogen oxides and sulfur oxides may contribute to acid rain, and carbon dioxide to the global warming .

Useful Factors for Evaluation

1. If houses are densely built in the area, the impact will be larger.
2. If dry and wet seasons are separated, the impact will be greater during the dry season.
3. If the number of vehicles increases significantly, special attention should be paid.
4. If the gradient of slope is large, the concentration of exhaust gas from running vehicles will be higher.

Measures

1. Dust prevention by sprinkling water or chemicals during construction
2. Alternate route selection
3. Reexamination of construction methods

Related Subjects for Study

1. Urban planning and regional planning
2. Distribution of public facilities
3. Distribution of fauna and flora
4. Air quality standard and regulations on emission of pollutants

Table 4-5 Explanation of Item 19 (Roads)

Item	19. Water Pollution
Description	Pollution by inflow of silt , sand and effluent into rivers and groundwater

Causes of Impacts

1. Disturbance of sediments by construction of piers when the route passes over lakes, streams and rivers
2. Erosion caused by the change of vegetation and topography
3. Use of herbicides to the roadbed, flush out of dust and oil on the road surface during rain

Possible Environmental Impacts

1. Effect on aquatic life by water pollution or turbid water
2. Contamination of water by herbicides would affect the aquatic life and the health of inhabitants who use the water.

Useful Factors for Evaluation

1. Careful consideration should be given when the water is used by habitants or businesses in the downstream area.
2. Particular attention should be paid if important aquatic species exist.

Measures

1. Careful construction planning and management
2. Compensation to the people and business concerning the water use
3. Creation of habitats for valuable aquatic species
4. Study on maintenance methods, such as clearing grass without herbicides

Related Subjects for Study

1. Water use and watershed use industries
2. Valuable aquatic species

Table 4-5 Explanation of Item 20 (Roads)

Item	20. Soil Contamination
Description	Contamination of soil by dust and chemicals, such as herbicides

Causes of Impacts

1. Dispersion of paving materials, such as asphalt emulsion, during construction
2. Spreading herbicides for maintenance
3. Exhaust gas and dust from running vehicles

Possible Environmental Impacts

1. Enlargement of the impacts through such a process that heavy metals in dust and chemicals in herbicides accumulated in soil are absorbed in plants under a certain condition , and leak out into water system
2. Effects on vegetation by contaminated soil with paving materials
3. Health hazards to the inhabitants who use the groundwater which is contaminated through penetration

Useful Factors for Evaluation

Careful consideration is required in the following cases:

1. There is arable land along the route.
2. There are sources of drinking water in the vicinity.
3. Groundwater is utilized in the area.

Measures

1. Careful construction planning and management
2. Roadbed maintenance without herbicides
3. Restriction on land use in the proximity

Related Subjects for Study

1. Land use
2. Water use

Table 4-5 Explanation of Item 21 (Roads)

Item	21. Noise and Vibration
Description	Noise and vibration generated by vehicles

Causes of Impacts

1. Operation of construction equipment and vehicles for construction and detonations
2. Operation of vehicles

Possible Environmental Impacts

1. Effect on hospitals and schools by noise, and the disturbance of sleep by vehicles operating at night, especially in urban areas
2. Obstruction of breeding of cattle and dispersion of wildlife
3. Cracks in buildings on soft ground caused by vibration

Useful Factors for Evaluation

Impact would be significant under the following conditions:

1. There are facilities which require calm circumstance, or densely populated areas.
2. There is important cattle industry.
3. There are habitats of valuable wildlife.
4. There is weak ground such as filled land or clayey soil layer.

Measures

1. Reexamination of the project contents
2. Use of low noise and vibration construction equipment
3. Careful construction planning and maintenance considering time and period of the work
4. Installation of acoustic walls and buffer zone
5. Compensation for damage to livestock

Related Subjects for Study

1. Geological survey
2. Land use, distribution of inhabitants and public facilities, living condition of inhabitants
3. Habitats of valuable wildlife

Appendix Flowchart of the Environmental Impacts of Road Projects