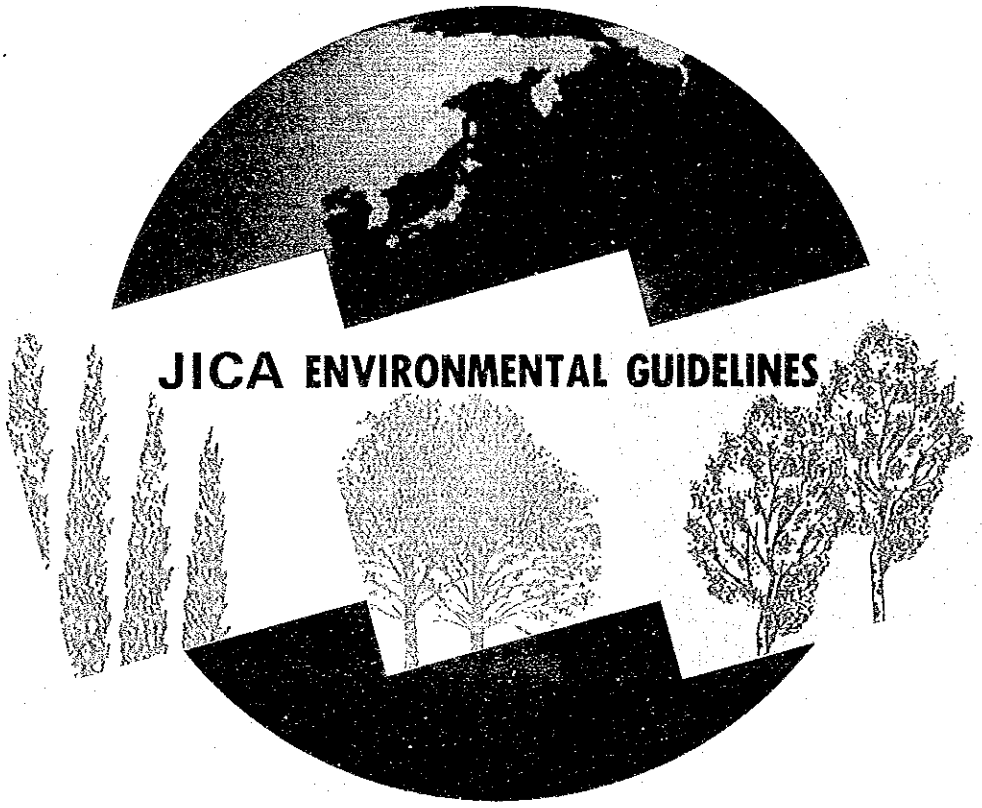
ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS

Ⅳ RAILWAYS



SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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JICA ENVIRONMENTAL GUIDELINES

SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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 "Railways".

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

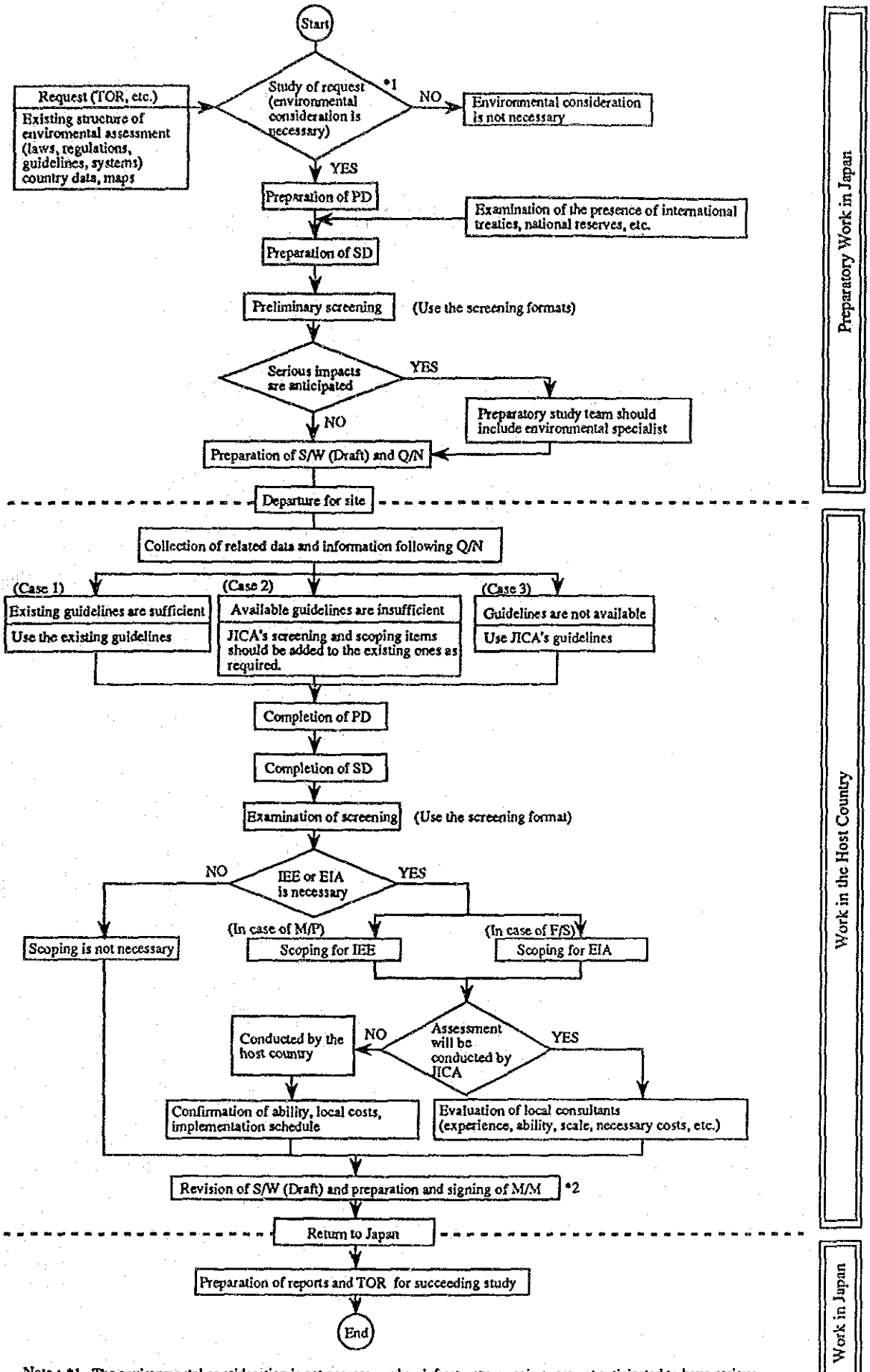
Evaluate the magnitude of impact on each environmental item, using the checklist method, to specify the items that are to be studied in IEE for M/P or EIA for F/S. In this process, making use of the explanation of items in the guidelines, try to grasp the features of possible environmental impacts. The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

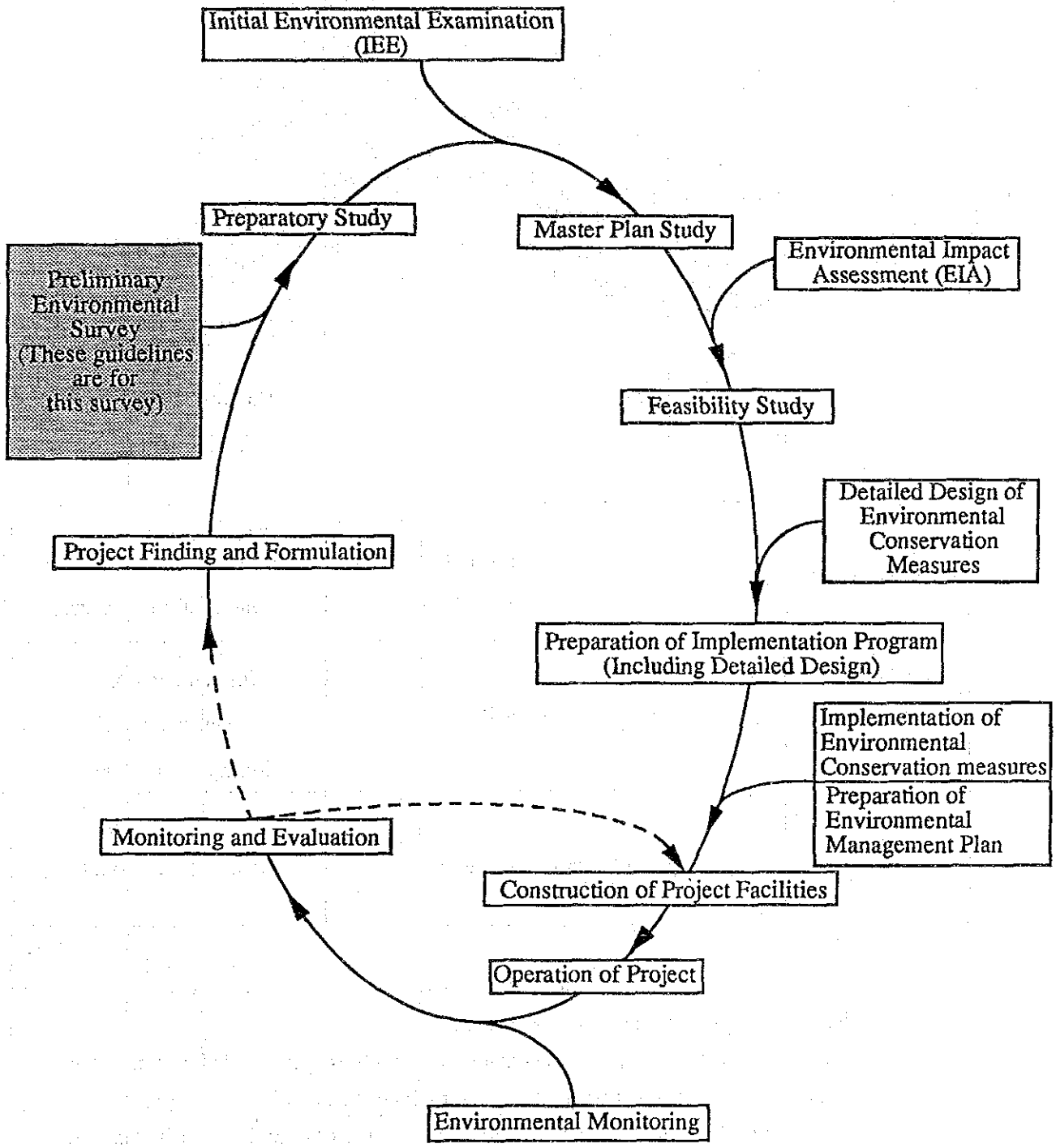

Table 1-1 Project Implementation Stages and Corresponding Environmental Consideration Stages

<table>
<tr><th colspan="4">Project Implementation Stages</th><th>Environmental Consideration Stages</th></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 Railway Projects

1.2.1 Definition of Railway Projects in the Guidelines

Railway projects in the guidelines deal with new inter-city trunk ways and large-scale improvement including changes of routes. The improvement and grade separation of existing railways in urban areas, the improvement of signal systems, electrification and the improvement of yards have small impacts on environment compared to the construction of a new railway. Their impacts should be appropriately estimated by referring to this series.

The development of new trunk railways include rails, stations and yards. Thus, the guidelines cover these components and the impacts caused by the operation of trains.

1.2.2 Typical Possible Impacts and the Points of Environmental Consideration

Typical impacts in railway projects which need particular consideration are as follows:

Resettlement

Inhabitants would be resettled due to land acquisition for railway construction. Loss of livelihood of inhabitants and difficulty in social and cultural adaptation to the relocation site may take place.

Conditions of inhabitants to be resettled and the relocation site should be investigated thoroughly.

Fauna and Flora

Vegetation on railways would be removed, which may bring about the loss of habitat of animals. Breeding and habitats of animals may be disturbed by noise from running trains, and migratory routes and habitat areas could be disrupted by railway facilities.

The above incidents may lead to a decrease in wild animals and the extinction of precious species. Decrease in natural enemies and extinction of other species could bring about an outbreak of other animals and vermin.

The value of plants and animals and features of the ecosystem of the area should be considered.

Noise and Vibration

Noise and vibration would be generated by operation of construction equipment and detonations during the construction stage. In the operational stage, operating trains may cause noise and vibration.

Facilities which require particular tranquillity, such as hospitals and schools, would be affected. Sleep may be disturbed at night, livestock breeding would be affected and wild animals may disperse.

Careful consideration is needed in highly populated areas or areas having unique religious facilities.

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 Railway 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 (Railways)

Items	Description
Project Name	
Background	
Objectives	
Location	
Executing Agency	
Beneficiaries	
Project Components	
Type of Project	Construction / Expansion / Elevation / Electrification / Improvement
Power Source / Features	Steam / Electricity / Diesel, Passenger / Freight Car, Single / Double Track
Line length	New:_____km, Elevated:_____km, Improvement:_____km
Stations / Station Square	No. of Stations:_____ , Request for Square : Yes / No
Substantial Facilities	Yard:_____, Repair Shop:_____,
Transport Demand	Passengers:_____person / yr, Freight :_____ ton / yr.
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 (Railways)

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 and 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 Railway 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 (Railways)

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 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 log	[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 deforestation	[Y][N][?]	
12.	Groundwater	Lowering of the groundwater table due to over drafting and turbid water caused by construction work	[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 change of vegetation due to coastal reclamation and coastal changes	[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 drainage from trains into rivers and groundwater	[Y][N][?]	
20.	Soil Contamination	Contamination of soil by drainage and toxic substance through infiltration and diffusion	[Y][N][?]	
21.	Noise and Vibration	Generation of noise and vibration by operation of cars and yards	[Y][N][?]	
22.	Land Subsidence	Deformation of land and land subsidence due to 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 Railway Projects

The checklist for scoping of railway 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 not only the railway routes, stations, and related facilities, but also the entire area where the various impacts, such as noise and vibration, are expected to affect directly or indirectly.

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

Environment Items \ Project Type / Sectors			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 (Railways)

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 (Railways)

		Major Facilities / Activities	Rails / Stations / Yards						
		Activities which may cause impacts / Environmental Items	Overall	Before Operation		After Operation			
				Reclamation and Spatial Occupancy	Operation of Construction Equipment and Vehicles	Spatial Occupancy	Operation of Trains	Operation and Maintenance of Yards	Accumulation of People and Goods
Social Environment	1	Resettlement	◎	◎					
	2	Economic Activity	○	○					○
	3	Traffic and Public Facility	○		○	○	○		
	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 (Railways)

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 (Railways)

Item	1. Resettlement
Description	Resettlement due to occupancy of land (transfer of rights of residence and/or land ownership)

Causes of Effect

1 Acquisition of land for the construction of railways and stations

Possible Environmental Impacts

1. Loss of living foundation of inhabitants to be resettled. Social and cultural inadaptability to the new resettlement area may occur.
2. Friction 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 would be difficult:
   a) The life of inhabitants depend upon the particular environment of the site.
   b) The inhabitants are currently well-off.
   c) Desirable 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. Communication with inhabitants and publication of information
3. Proper management of living and economic condition 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 (Railways)

Item	2. Economic Activity
Description	Loss of basis of economic activities such as land, and change of economic structure

Causes of Impacts

1. Loss of arable land and forests, land reclamation, and change in land use
2. Change of industrial structure following the inflow and outflow of population and goods resulting from the operation of railways.

Possible Environmental Impacts

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
2. Inconvenience in accessing between both sides of the railways and stations
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 enlarge the gap between the rich and poor.

Useful Factors for Evaluation

1. In case important industries exist in the site, the effect may be critical.
2. Increase in land use value along the route would make it difficult for industries having low value-addition to survive.
3. In self-sufficient areas, the effect of an inflow of people and goods on the economy would be significant.

Measures

1. Sufficient compensation to the land owners and people who are engaged in the related economic activities
2. Guarantee of substitute
3. Securing of substitute traverse way

Related Subjects for Study

1. Local economy and city planning
2. Future plans of the area, e.g., regional development plan

Table 4-5 Explanation of Item 3 (Railways)

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

Causes of Impacts

1. Obstruction of existing traffic and school routes by crossings when the route is above ground
2. Decrease in road traffic owing to change of transport from road, along the route, to the railway

Possible Environmental Impacts

1. Slow traffic due to crossings. A decline of existing transport and its surrounding area by change of transport. Creation of noise and traffic accidents around stations as a result of congested conditions
2. Obstruction of existing traffic which may affect the daily life of inhabitants, such as the use of schools and hospitals

Useful Factors Evaluation

1. Grade separation could be considered if the route crosses roads and other transport facilities.
2. As a station could be a junction with other transports, the area transport system should be investigated comprehensively.
3. Relation with station plaza development and other city planning should be considered.
4. Particular attention is required if the site involves schools, hospitals and other public facilities.

Measures

1. Grade separation of the railways
2. Grade separation of the roads
3. Grade separation of the station plaza
4. Improvement of transport system
5. Installation of safe facilities

Related Subjects for Study

1. Land use and traffic conditions
2. Future land use and transportation plans
3. Higher level regional development plan

Table 4-5 Explanation of Item 4 (Railways)

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

Causes of Impacts

1. Interruption of existing routes, traffic of inhabitants and commercial distribution by land acquisition for railways and stations

Possible Environmental Impacts

1. Inconvenience in daily activities of inhabitants and the 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. Sufficient compensation
2. Preparation of substitute traverse ways
3. Creation of new transport system

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 (Railways)

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

Causes of Impacts

1. Damage to and/or loss of historical assets and cultural property by land reclamation for railway construction
2. Increase in traffic of people due to the development of railway
3. Vibration caused by trains

Possible Environmental Impacts

1. Damage to or vanishing of unique cultures and loss of opportunity for academic research. Tourism and other tertiary industries that depend on the cultural assets may lose their business opportunities.
2. Local people's feelings may be aggravated by loss of precious cultural assets in the area.
3. Increase of tourists would affect the unique culture in the area.
4. Vibration caused by trains could crack and damage cultural property.

Useful Factors for Evaluation

1. Impacts would be critical when the cultural property is recognized historically and culturally important from a global viewpoint or is unique to the area.
2. Countries with longer histories are likely to have more cultural property to preserve.
3. Careful consideration should be given to officially registered cultural assets.
4. Buildings and structures in unique communities should be given careful consideration.

Measures

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

Related Subjects for Study

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

Table 4-5 Explanation of Item 6 (Railways)

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

Causes of Impacts

1. Occupation of arable land and forests for the construction of railways and stations
2. Obstruction or alteration of fishery field in case the route traverses rivers or passes by the coast

Possible Environmental Impacts

1. Effects on economic activity or livelihood, such as fishery in rivers, burning charcoal and hunting in mountains where the route passes through, and the obstruction of use of drinking water, irrigation and industrial water by crossing their flow.
2. Conflicts may occur. Generally, water rights would become a problem in downstream areas.

Useful Factors for Evaluation

1. The impact would be significant if the route passes over rivers and through mountains which are important for the livelihood of inhabitants or industries.
2. Rights of use of rivers and mountains are often recognized by custom even if they are not established by law.
3. Water rights or land use rights may be recognized if water intake facilities, navigation facilities and charcoal-burner sheds exist.

Measures

1. Alternate route selection and reexamination of the project contents
2. Planning in consideration of existing water rights and right of common
3. Increase of crossing facilities
4. Compensation

Related Subjects for Study

1. Local economy and land ownership
2. Hydrological survey
3. Forest vegetation

Table 4-5 Explanation of Item 7 (Railways)

Item	7. Public Health Condition
Description	Deterioration of public health and sanitary conditions, such as the generation of garbage and increase of vermin

Causes of Impacts

1. Unsanitary management of the facilities
2. Direct discharge of excreta without adequate treatment from long-distance trains

Possible Environmental Impacts

1. Increase of flies on garbage from dining cars and train stations, and an increase of rats and other pathogenic animals and insects which feed on leavings. They could be vectors of disease.
2. Aggravation of the health condition along the route by the waste and sewage discharge from trains, and an outbreak of communicable diseases .

Useful Factors for Evaluation

1. Special attention should be paid if epidemics have been experienced around the area in the past.
2. Any investigation is required of river discharge and water quality if the sewage flows into streams.

Measures

1. Careful design of toilets and sewage treatment system of cars
2. Pests and vector insect prevention by pesticides
3. Infection prevention by public education on sanitation

Related Subjects for Study

1. Public health condition of the area
2. Habitation and propagation of small mammals (e.g., rats) and pathogenic insects (e.g., flies)
3. Meteorological data (e.g., precipitation and humidity)
4. Topography and geology of the area, especially wetland

Table 4-5 Explanation of Item 8 (Railways)

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 construction of the railways and stations
2. Generation of general waste from waiting rooms, dining and other offices due to the activated economic and social activities around stations

Possible Environmental Impacts

1. Aggravation of environment due to inadequate disposal, nonexistence of disposal site or illegal disposal if disposal cost is high.
2. Waste disposal into streams and coast may bring about water pollution, land degradation and an outbreak of pathogenic animals which feed on garbage.

Useful Factors for evaluation

1. Amount of debris could be estimated from the excavation scale.
2. A large amount of construction waste would be created if the demolition of existing structures is involved.
3. Problems would occur when the waste collection and disposal system is not established.

Measures

1. Establishment of adequate waste collection and disposal system
2. Establishment of method and site for debris and construction waste disposal
3. Careful construction planning and management
4. Publicity and promotional activities to reduce household garbage and industrial waste

Related Subjects for Study

1. Estimation of waste volume and study on chemical and physical characteristics of the waste
2. Study on land use for finding disposal site

Table 4-5 Explanation of Item 9 (Railways)

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 railway construction
2. Excavation of tunnels in mountainous area and underground

Possible Environmental Impacts

1. Landslide or landslip by cut and fill in steep slope areas and high risk areas
2. Large-scale cutting would change the balance of the soils and create land cave-ins or upheavals
3. Interruption of the railway in tunnels by leakage of groundwater and cave-ins
4. Landslides and failure might damage land and houses and may 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. Special attention should be paid to areas having intense rainfall.
3. Special attention is required in an area that has experienced landslides or earthquakes in the past.

Measures

1. Alternate route selection
2. Protection measures against landslide or failure
3. Adequate drainage along the route
4. Slope protection

Related Subjects for Study

1. Topographical and geological survey, and study on soil nature
2. Distribution of landslide sites and faults
3. Case studies of past disasters
4. Meteorological data

Table 4-5 Explanation of Item 10 (Railways)

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 railway construction

Possible Environmental Impacts

1. Precious topography and geology may be altered or vanish because of the limitation of alignment if the route passes through an area having academically valuable topography or geology.
2. Large-scale cut and fill may bring about disasters, such as landslides, soil erosion, cave-ins and land upheavals.

Useful Factors for Evaluation

1. Large-scale excavation and landfill would be required in mountainous areas because alignments of railways take up considerable space, both horizontally and vertically, making it difficult to cope with the topography and geology.
2. Alignment may become strict under a faster design speed, making it difficult to avoid geological or geographical preservation areas.
3. Academic value may be higher in older layers and complicated topography.
4. Underdeveloped places remaining in urban areas may have soil conditions that are technically difficult to develop.

Measures

1. Alternate route selection
2. Slowdown of the design speed

Related Subjects for Study

1. Geological and archaeological surveys
2. Case study
3. Land use

Table 4-5 Explanation of Item 11 (Railways)

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

Causes of Impacts

1. Exposure of topsoil due to land reclamation or clearing of vegetation for railway 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. Railways and stations on or under the large cutting would be carried away or buried by slope failure.
3. Lives of inhabitants would be in jeopardy by the destruction of houses, if the scale of a slope failure is large.

Useful Factors for Evaluation

Potential of soil erosion is high under the following conditions:

1. Large-scale deforestation
2. Intensive rainfall in rainy season. Time for taking countermeasures may also be short.
3. Steep topography and high wind speed

Measures

1. Alternate route selection
2. Setting of construction schedule for the high risk areas in dry season
3. Slope protection (e.g., vegetation cover by fast growing plants)

Related Subjects for Study

1. Topographical and geological surveys
2. Meteorological data
3. Case study in the surrounding area

Table 4-5 Explanation of Item 12 (Railways)

Item	12. Groundwater
Description	Change of distribution and level of groundwater by large-scale excavation and turbidity by earthworks

Causes of Impacts

1. Disruption of groundwater flow by large-scale excavation or tunnel construction which would alter the distribution of groundwater and increase turbidity of groundwater
2. Decrease of groundwater recharge function due to change of outflow rate by removal of vegetation
3. Overdrafting of a large quantity of groundwater because of an increased water demand for the development around the stations and the operation of maintenance plants

Possible Environmental Impacts

1. Depression 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 depression 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 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 groundwater conservation measures
3. Development of substitute water source

Related subjects for Study

1. Hydrogeology, e.g., determination of aquifer
2. Pumping tests
3. Water utilization

Table 4-5 Explanation of Item 13 (Railways)

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

Causes of Impacts

1. Change of hydrological regime by the construction of structures, such as piers, when the route passes over lakes and rivers

Possible Environmental Impacts

1. Change of the habitat condition of aquatic life by the alternation of the riverbed, which would affect fishery
2. Effect on inland navigation and tourism by change of water depth, flow and flow rate

Useful Factors for Evaluation

1. Special attention should be paid to valuable aquatic life habitats.
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 (Railways)

Item	14. Coastal Zone
Description	Coastal erosion and change of vegetation due to coast reclamation and coastal changes

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

Useful Factors for Evaluation

Impact would be significant if the project site has following conditions:

1. Precious nature, such as mangrove forests and coral reefs
2. Excellent fishing ground and other industrial conditions
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 beach nourishment
4. Compensation for fishery

Related Subjects for Study

1. Valuable nature, e.g., mangrove forests, coral reefs
2. Fishery and related industries
3. Industries which utilize the coastal zone
4. Past case of disaster such as high tide

Table 4-5 Explanation of Item 15 (Railways)

Item	15. Fauna and Flora
Description	Disturbance of breeding and extinction of species due to change of habitat conditions

Causes of Impacts

1. Removal of vegetation and extinction of animal habitat for railway construction
2. Generation of exhaust gas and noise from construction road and vehicle operations
3. Disruption of migratory routes and animal habitats by the existence of railways and related facilities

Possible Environmental Impacts

1. A decrease in useful creatures for human activities or extinction of valuable species
2. The livelihood of people, including hunting 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 pathogenic insects

Useful Factors for Evaluation

Particular attention should be paid under the following conditions.

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

Measures

1. Relocation of plants and animals
2. Compensation for livelihood of affected people
3. Careful route selection
4. Careful construction plan and management

Related Subjects for Study

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

Table 4-5 Explanation of Item 17 (Railways)

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

Causes of Impacts

1. Change of topography and vegetation for railway construction
2. Appearance of facilities and structures

Possible Environmental Impacts

1. Valuable scenery in the region would be destroyed or deteriorated by land reclamation, vegetation change and change of topography. The change of landscape may alienate the feelings of inhabitants.
2. Tourism could be affected in the area where the landscape is an important resource. Inhabitants' feelings may be aggravated if the landscape is related to their religion.

Useful Factors for Evaluation

1. Feeling of inhabitants about the shapes and colors of the facilities may depend on their consciousness of the landscape.
2. Measures to be taken would differ depending on whether the facility itself is a problem or the facility obstructs the background.
3. Cultural assets specified by laws and regulations should be dealt with carefully.
4. Careful consideration should be given to the role of the landscape in terms of religion and tourism, etc., in the area.

Measures

1. Reexamination of the route and project contents
2. Meetings with the inhabitants and provisions of necessary information

Related Subjects for Study

1. Distribution of tourism spots and historical sites
2. Local history and folklore
3. Protection or relocation planning

Table 4-5 Explanation of Item 19 (Railways)

Item	19. Water Pollution
Description	Pollution by the inflow of silt and sand and drainage from trains into rivers and groundwater

Causes of Impacts

1. Surface runoff from railways contaminated by sewage from car toilets and iron powder produced by friction between rails and wheels which would flow into streams and lakes
2. Discharged cleaning water from yards which would penetrate into groundwater through permeable soil
3. Turbid water caused by excavation during the construction of piers and abutments when the routes pass over rivers and lakes

Possible Environmental Impacts

1. Water use , fishery, landscape and recreation in downstream areas will be affected by the pollution of rivers and lakes if drainage flows into them without treatment.
2. Pollution of groundwater would affect the groundwater use in the area.
3. Turbid water during the construction would affect aquatic life, though it may be temporary.

Useful Factors for Evaluation

1. In case the construction scale of railways (e.g., extension and width) is large and the route passes through wetlands, the potential of pollution will be higher and the volume of drainage will also be larger. Therefore, special attention should be paid to the capacity of drainage pumps and other treatment facilities.
2. Particular attention is necessary to avoid leakage of hazardous substances if there are intakes for drinking water in the downstream area.
3. Careful consideration is required when there is use of groundwater in the area.

Measures

1. Adoption of cars which do not discharge excreta from toilets
2. Collection of waste water through ditches and pipes, installation of treatment plant with sufficient capacity
3. Turbid water prevention by sewage sedimentation tank and prevention sheets

Related Subjects for Study

1. Conditions of river and groundwater
2. Water use and watershed use around the site
3. Water quality standard

Table 4-5 Explanation of Item 21 (Railways)

Item	21. Noise and Vibration
Description	Generation of noise and vibration by the operation of cars and yards

Causes of Impacts

1. Noise and vibration caused by the operation of cars and yards
2. Use of construction equipment and vehicles for construction, such as bulldozers and dump trucks.

Possible Environmental Impacts

1. Hospitals and schools along the route would be affected by noise. Sleep would be disturbed by trains at night
2. Obstruction of breeding of livestock and dispersion of wildlife
3. Negative impacts on the property and the daily life of inhabitants (e.g., cracks would be developed in buildings by vibrations when the ground is soft)

Useful Factors for Evaluation

Careful consideration should be given if the area has the following conditions.

1. There are facilities which require calm circumstance, such as hospitals and rest houses.
2. There is soft ground. Effect of vibration would be significant.
3. There is cattle feeding.

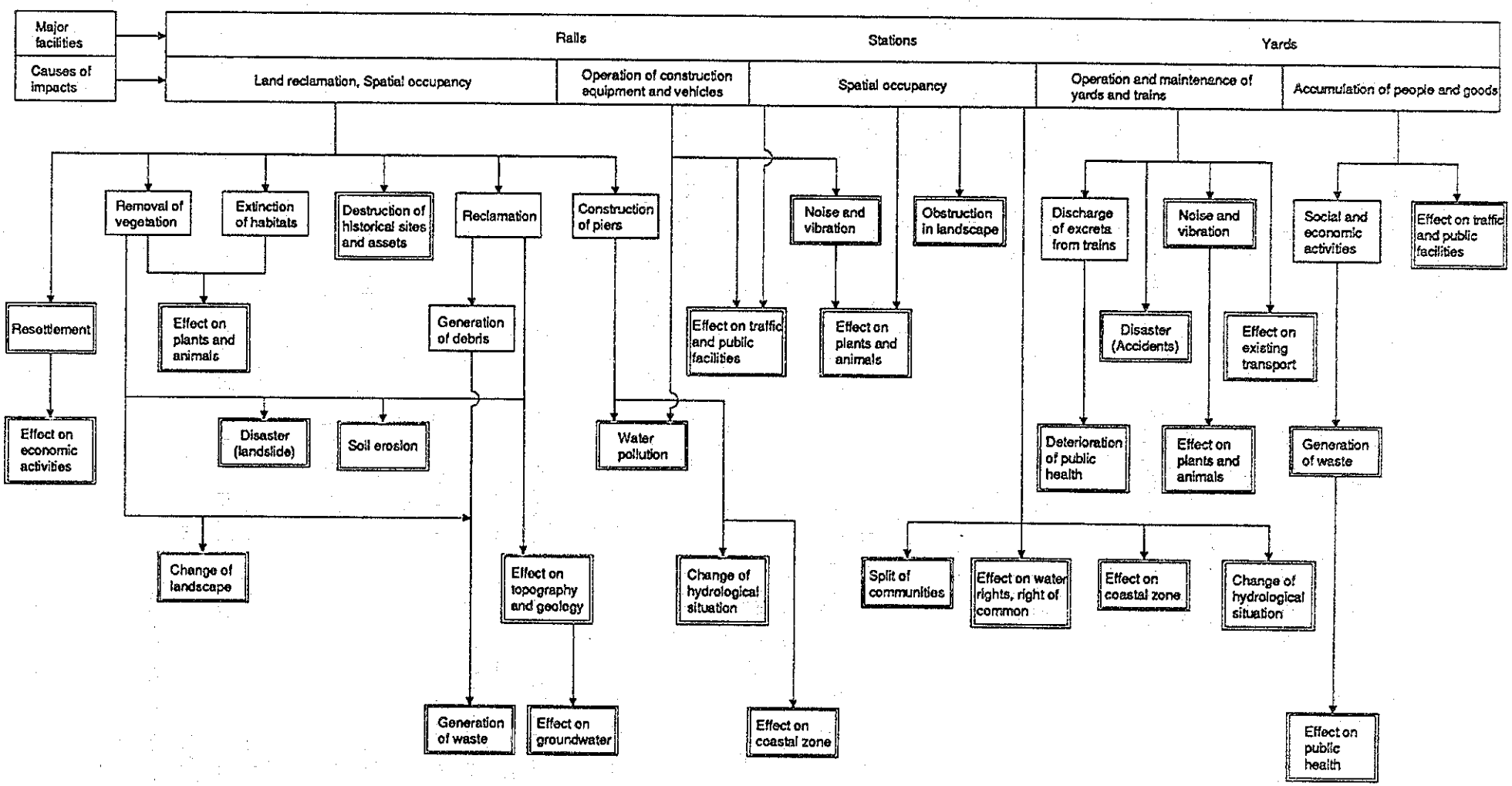
Measures

1. Alternate route selection
2. Installation of acoustic walls and buffer zone
3. Consideration of operation speed, intervals and hours
4. Adjustment of construction hours, especially on weekends and at night
5. Compensation for damage on livestock and buildings

Related Subjects for study

1. Land use, distribution of inhabitants and public facilities, living conditions of inhabitants
2. Topographical and geological survey
3. Habitats of valuable wildlife

Appendix Flowchart of the Environmental Impacts of Railway Projects



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