

CHAPTER - 3 METHODOLOGY

This chapter presents the EA/SA methodology in the project. The environmental and social inputs obtained during various project stages and the process followed in integrating environmental and social considerations into the project planning and design are discussed.

3.1 FEASIBILITY STAGE

The feasibility study involved prioritization of 3,328 km of SOS roads to identify the candidate roads for improvement in the project. The study was completed by the PCC in December 1997. The feasibility study included an analysis of the engineering, economic, environmental and social components for the project roads. As part of the feasibility, an environmental and social screening was carried out.

3.1.1 ENVIRONMENTAL AND SOCIAL SCREENING

Environmental and social screening that was carried out for the road network identified in the SOS, involved the following steps:

- i. Determining evaluation criteria for screening
- ii. Assigning weightages to the evaluation criteria
- iii. Evolving evaluation matrix by screening corridors for the identified criteria and
- iv. Ranking corridors in order of sensitivity

Corridors indicating best environmental performance were screened for further analysis. An inventory of environmental features along all the roads was developed to enable determination of evaluation criteria and their weightages. Public consultation during the screening also provided necessary input in determining weightages to evaluation criteria. Road links screened with the above methodology were ranked in order of sensitivity, and sensitive road links identified.

3.1.2 SECTORAL ENVIRONMENTAL ASSESSMENT

Sectoral EA (1999) for TNRSP was prepared after the investment decisions were made in the feasibility study. The Sectoral EA covered the set of roads established as candidates for improvement by the Feasibility study, to prioritise amongst the sub-projects in terms of environmental/social impacts, benefits and EA/SA requirements. The Sectoral EA approach was used to establish mechanisms for assessment, analysis and implementation in the various project phases.

Sequence of activities followed in the SEA preparation is presented below:

- v Study of existing institutional setup
- v Consultation with roadside communities and other stakeholders
- v Collection of baseline information for the study area
- v Analysis of alternative alignments
- v Impact assessment of the selected alignment
- v Environmental management plan for mitigation/management of negative impacts
- v Resettlement action plan for compensation/assistance to affected people/communities

3.13 ANALYSIS OF ALTERNATIVE ALIGNMENTS / CORRIDORS

Alignments proposed for upgradation based on the outputs of feasibility study have been subjected to further analysis on the environmental and social impacts. Certain localized environmental and social impacts identified during the study were to be avoided to minimize the impacts. Alternative alignments at such locations were analysed. Following methodology is adopted for analysis of the alternatives:

- ✓ Identification of alternative alignments – both existing and new alignments
- ✓ Estimation of engineering and economic parameters for comparison of alternatives
- ✓ Preparation of Inventory of environmental and social features for likely alternatives
- ✓ Consultation with the public on the identified alternatives
- ✓ Qualitative and quantitative analysis of the environmental and social inventory to arrive at the best alignment

3.2 DESIGN STAGE

Final alignments/corridors selected for upgradation are subjected to detailed designs. Public consultation has played major role in various design decisions. Cross-sections for the corridors were finalized with the inputs from public hearings and lessons learnt from the first phase of east coast road (ECR). During the design process, minor modifications are carried out in the width of CoI to reduce impacts. Design speeds are reduced in inhabited portions of the corridor to reduce the geometric corrections and consequent land acquisition. Minimum possible cross section was adopted through out the alignment, which did not necessitate analysis for alternative cross-sections as it can be of higher width only and would obviously have higher impacts compared to the adopted cross section.

About 2600km of roads are subsequently taken up under maintenance component. As no widening and land take is envisaged, these corridors are not subjected to EA/SA. However, to adequately address any inconsequential environmental/social impacts, an environmental and social management plan is to be prepared as part of the consolidation exercise.

3.2.1 ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impact assessment procedure proceeded simultaneously with detailed design of routes selected for improvement. The stepwise methodology adopted for the EIA is as follows:

3.2.1.1 *Assembly and Analysis of Data*

Data on various likely alternatives identified through engineering and economic parameters is collected. Public consultations have also been carried out in the process.

3.2.1.2 *Assessment of Alternatives*

The alternative alignments are analysed based on the data collected to arrive at final alignment having least environmental impacts.

3.2.1.3 *Baseline Surveys and Documentation*

Baseline information on various environmental parameters was collected for the selected alignment through primary surveys as ecological survey, air and noise pollution monitoring. These have been

supplemented with the data available from engineering surveys as hydrological surveys, soil investigations etc. The data has been assembled and documented for further analysis.

3.2.1.4 Assessment of Potential Impacts

Based on the data collected, potential environmental impacts have been assessed. Assessment was carried out for various stages of project preparation and implementation as pre-construction, construction and operation phases. Impacts anticipated are subjected to further analysis through quantification to ascertain their magnitude to the extent possible.

3.2.1.5 Mitigation and Enhancement measures

Mitigation measures are devised for the impacts anticipated in addition to enhancement of various elements as ponds, cultural properties and incidental spaces identified.

3.2.1.6 Community Consultations

Consultation with the roadside communities and stakeholders has been an integral part of the project at all stages of its preparation. Outputs of the consultations are suitably incorporated in the designs. Documentation of community consultations held at apex, district and village level is carried out.

3.2.1.7 Implementation Arrangements

Existing setup for implementation of the suggested design with the PIU is studied. Modifications required for existing implementation and institutional setup is suggested.

3.2.1.8 Environmental Management Plans

Environmental mitigation and enhancement measures suggested are presented in the form of a plan for the implementing agency to follow. The plan being implemented is to be monitored hence both the monitoring and reporting mechanisms are incorporated along with budgetary provisions.

3.2.1.9 Resettlement Action Plan

Resettlement impacts identified in the project on the road site communities and stakeholder is being mitigated through the provisions made in the R&R policy of the project. All mechanisms adopted for the impact minimization, compensation and assistance measures are presented along with the implementation, monitoring and evaluation responsibilities.

3.2.2 INDEPENDENT REVIEW OF EA/SA

In line with the requirements for Category A¹ projects, an independent review has been carried out. The approach adopted for the Independent Review exercise is presented in the following sections.

3.2.2.1 Preliminary Discussions with the Client / World Bank

The preliminary discussion with the client and the WB gave an insight into the project progress and shortcomings in the project initiation stage.

¹ TNRSF has been classified as a Category "A" project due to its cumulative magnitude of environmental and social impacts.

3.2.2.2 *Review of the Project Documents*

A desk review of the EA/SA outputs was carried out to assess the compliance with the WB policies. Some of the issues identified during the desk review demanded site verification whereas some needed consultations with stakeholders, authorities and NGOs and these have been subsequently carried out. Outputs of EA/SA have been verified with the design and implementation plans for determining the extent of mainstreaming of environmental issues.

3.2.2.3 *Site visits and Consultations*

Following the preliminary review of documents, site visits to project roads were undertaken by the review team to (i) verify on site whether the EA/SA has incorporated the environmental and social concerns and (ii) assess whether adequate measures are suggested in the project to address those. Baseline information presented in the EA and information on PAPs of residential, commercial as well as community properties were verified on site. Consultations with various officials were also carried out during the visit.

3.2.2.4 *Review Findings*

Identification of gaps and deficiencies: Gaps and deficiencies are identified in the baseline data, assessment of impacts as well as the environmental management plans. The identified gaps are presented in Independent Review Report. Location specific changes required in the design as per the observations on design and the existing field conditions are also identified.

Critical issues to be addressed: Some of the critical issues that were raised by various stakeholders were to be fully addressed in the project. Specific methodology for addressing each of the issues is worked out.

3.2.3 CONSOLIDATION OF EA/RAP

Reports of PCC prepared as standalone documents for Phase I and Phase IA of TNRSP is consolidated for all the Packages TNRSP01, 02, 03 and 04 into a single report. Gaps and deficiencies identified in the independent review are subsequently filled up in the consolidation exercise of EA and RAP. Some of the critical issues as land use & salinity levels, ground water utilization and availability of water for construction, especially along eastern corridor are addressed. Impacts identified on air, noise, ecology and cultural properties are adequately addressed in the package wise environmental management plans with additional budgetary provisions.

3.2.3.1 *Primary Surveys and Completion of Baseline*

Gaps are identified in the baseline information regarding air, noise, soil, water - both surface and ground water. Detailed primary surveys are conducted for collection of baseline information on these components along all the corridors. Information on locations suitable for enhancements as cultural properties, incidental spaces and places of local significance was collected through detailed field visits. Additional baseline information for addressing some of the critical issues identified in the review was also collected.

3.2.3.2 *Additional study for Critical Issues*

- Land use

An effort has been made to provide a direction for land use planning along the eastern corridor by integrating development with resource availability, factoring in environmental concerns and thresholds along the eastern coast. This shall be aimed at (i) directing and rationalizing development along critical areas and (ii) Streamlining development along non-critical areas. The approach adopted involved the following steps:

I: Evaluation of the existing land use planning approach

Existing agencies involved in the land use control and their regulations are studied. Apart from these agencies, regulations of other agencies like, Tamil Nadu Pollution Control Board, Fisheries Department indirectly controlling development of industries, fisheries, water extraction, and imposing restrictions as CRZ are studied.

II: Analyze the existing land use characteristics along the corridor

The land uses along the project road for a distance of 100 meters on either side were inventoried through a reconnaissance survey wherein the adjoining land uses along the corridor were recorded. The recorded data is analysed to provide section wise land use character along the corridor.

III: Identify development trends and locations vulnerable to induced development

To understand the development trends of individual settlements and to assess their potential for induced development, extensive consultations were held with the community and the various stakeholders along the corridor. These discussions together with a basic analysis of the census and socio-economic data of the project districts provided the basis for identifying areas susceptible to induced development impacts.

IV: Assess the environmental constraints and potentials for development

To assess the water situation along the coast and to understand the implications of the developments that can be induced due to the project on the existing water situation, extensive data collection on the ground water resources, (of about 200 wells within 30km from the coast) was carried out. The environmental components analyzed included:

- v Geomorphological characteristics,
- v Soil types and characteristics
- v Water resources including,
- v Water potential of river basins
- v Categorization of blocks based on ground water potential and degree of exploitation
- v Ground water table
- v Total Dissolved Solids (TDS) and Salinity levels of the wells within 30km from the coast and,
- v Forests and other protected areas

Thematic maps are prepared for these components. The thematic map preparation also involved plotting of the TDS and salinity contours within a band of 30km from the coast using SURFER 32.

V: Assess intrinsic suitability for specific land uses

Analysis of the data collected for the environmental components formed the basis for the identification of criteria for each of the components. For e.g. criteria for assessing the ground water potential of the blocks was based on the level of extraction as over exploited, dark, grey and white. Areas suitable for specific landuses are obtained from application of the identified criteria.

VI: Identify and delineate critical areas, based on overlay and composite suitability

The thematic maps were overlaid to identify and delineate areas that are suitable for development. This also enabled the identification of areas not suitable for residential, commercial and industrial uses, through exclusion. Such a suitability analysis was done for all land uses identified. These individual suitability maps were overlaid to work out a composite overlay.

VII: Finalize mechanisms for implementation and implementation arrangements

Landuse regulatory mechanisms are to be evolved for the areas identified as not suitable for specific landuses. Findings of the suitability exercise and the induced development issues related to the land use changes were presented to various governmental agencies². The land use workshop provided a forum for assessing the situation and arriving at an implementation mechanism that would address the core issue of induced development by planning and regulating land uses.

- Water for construction

Water requirements and availability for construction is worked out in detail for both the northern and eastern corridors. Methodology adopted for the study involved the following steps:

I: Assessing water requirement for the project

Water requirement of the project is estimated based on water requirements for road making, dust suppression, domestic uses of construction workers and other uses.

II: Estimating water demand at construction sites

A number of construction sites would be working simultaneously and water available at nearest point from the construction site would be utilized as water sources. The total water demand is divided as per the requirements at such individual construction sites.

III: Preparing inventory of available supply sources

Surface water sources available along the corridors are inventoried as part of primary surveys conducted in the consolidation exercise. Approximate size and presence of water in most of the ponds could be ascertained, especially along eastern corridor as the survey was conducted in summer season. The inventory is prepared as per the traverse distance along each corridor to identify distance between two water sources.

IV: Assessing ground water situation

Ground water situation along the corridor districts is assessed based on ground water level information collected from the PWD(Ground Water).

² A land use workshop conducted by the Highways Department on the 25th of September 2002 to work out mechanisms for managing land uses along the corridor.

V: Ascertaining water availability as per the construction demand

Based on the availability of water along the corridors and water demand at construction sites, locations of water availability and water scarce stretches are identified.

VI: Identification of alternative sources of water in water scarce stretches

Alternative sources of water have been identified through elaborate discussions with the PIU, water resources specialists and other government agencies.

- Ecology and Natural Habitat Plan

The areas of ecological significance such as Reserve Forest, Biosphere Reserve, Wild life Sanctuary, Social Forestry along or in close proximity to the corridors have been studied with respect to the impact of the road upgrade on the existing flora and fauna. The Northern Corridor passes close to 6 Reserve forests cuts the sides of two reserve forests. The Eastern corridor does not pass through any Reserve Forests and the nearest Reserved Forest is at a distance of 3 Km. However, ecology of the area is studied and natural habitat plan is prepared. The methodology involved following steps:

I: Inventorisation of the ecological areas within 25 km radius of the project corridors

This is done through secondary information collected from the State Forest department.

II: Detailed field visits

Detailed field visits are carried out along all the corridors with special emphasis on identified ecological areas. This is done through local ecologists having thorough knowledge of the flora and fauna found in the region. Quadrant surveys are carried out to assess the species diversity along the corridors.

III: Analysis of the Species inventory

The species identified are checked with the IUCN red list and Schedule of species as per the Wild life Protection Act (1972).

IV: Location of threats

Locations of probable impacts based on the above analysis and behavioral pattern of the faunal species are identified.

V: Mitigation/management measures

Precautionary measures are devised at locations of threat and necessary budgetary provisions are made in the EMP. The documentation of this process is presented in the **Appendix: 8.2** - Natural habitat plan.

- Tree Plantation Strategy

Widening along the corridors will involve removal of existing roadside trees within a distance of 1m from the edge of the shoulder. Compensatory plantation is envisaged to offset the loss. A detailed study on the impacts on roadside plantation is taken up as part of the project preparation. Methodology involved the following steps:

I: Inventorisation of roadside plantation, species wise and girth wise

II: Assessment of the number of trees to be removed due to widening

- III: Identification of locations for compensatory plantation
- IV: Selection of species for road side plantations
- V: Preparation of landscape details along different cross sections
- VI: Institutional strengthening of the PIU for implementation of the proposed landscape design
- VII: Preparation of implementation schedule for the plantation
- VIII: Monitoring of the survival of saplings

Necessary budgetary provisions are made in the EMP for implementation of the roadside plantation. Formats for reporting the survival of saplings is prepared to aid in regular monitoring. The details of tree plantation strategy are presented in **Appendix: 8.3** - Tree Plantation strategy.

3.2.3.3 Impact Assessment

Based on the PCC reports and additional information collected as part of the consolidation exercise, assessment of impacts for parameters identified to be deficient in analyses is carried out. The analysis is modified to be more quantitative.

3.2.3.4 Mitigation and Enhancement Measures

Mitigation measures are devised for the impacts in construction and operation stages identified. Priority is given to provision of avoidance and precautionary measures. Specific designs for locations suitable for enhancement are prepared in addition to generic enhancement measures as enhancement of shrines, temple complex, pond and temple, sacred groves.

3.2.3.5 Environmental Management Plans

Environmental management plans are devised for each contract package. The plan presents mitigation measures devised in the project in format suitable for reference during implementation. Necessary drawings for mitigation/enhancement measures along with BoQ and specifications are presented. Necessary budgetary provisions are made to ensure sufficient funds are available for their implementation.

3.2.3.6 Environmental and Social Management Plan

To offset inconsequential environmental and social impacts along maintenance corridors an environmental and social management plan is prepared. The plan includes exclusion criteria for selection of corridors for maintenance. Corridors selected after screening using the exclusion criteria shall be subjected to the conditions of the ESMP. This document is prepared based on sample visits to selected maintenance corridors and baseline information provided by the PIU.

3.2.3.7 “Mainstreaming the Environmental Component”

Necessary budgetary provisions and implementation aspects are worked out in detail for inclusion in the main contract to ensure mainstreaming of the environmental management provisions in the project.

3.2.3.8 Stakeholders Consultation

With the finalized designs, inputs from the stakeholders are sought for incorporation of any grievances due to the project. Stakeholder’s consultations are being utilized as a platform to discuss all project related issues and arrive at mutually acceptable designs.

3.2.3.9 *Finalisation of EA/RAP outputs*

With the completion of draft reports, available for review of the bank and stakeholders, EA/RAP outputs are being finalized with their inputs.

3.3 EA/SA OUTPUTS

Following documents are generated as outputs of the EA/SA consolidation exercise:

- v Consolidated Environmental Assessment
 - ♣ Natural Habitat Plan
 - ♣ Cultural Properties Plan
 - ♣ Tree Plantation Strategy
 - ♣ Study on Induced development
- ♣ Resettlement Action Plan
- ♣ Package wise Environmental Management Plan
- ♣ Environmental and Social Management Plan
- ♣ Environmental Assessment Summary

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