CHAPTER - 1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Highways Department (HD), Government of Tamil Nadu (GoTN) is preparing the Tamil Nadu Road Sector Project (TNRSP) with World Bank (WB) loan assistance.

The GoTN invited the World Bank in 1995, to assist a program to improve State Highways (SH), Major District Roads (MDR) and Other District Roads (ODR) in the state. Most of the existing roads under this classification are of single lane configuration, significant portion of which is in poor condition. To meet the increasing traffic demands of the state and the deteriorating road conditions, GoTN initiated a Strategic Options Study (SOS) in 1995. The SOS identified 3,238 km of roads that were in need of upgradation, assessed based on several criteria as constricted cross section in corridors of higher traffic volumes, continuity and completeness of road network, routes with high traffic of commercial vehicles, bus routes etc.

In May 1997, GoTN appointed the Project Co-ordinating Consultants (PCC) who was entrusted with the mandate of identification and prioritization of corridors for improvement and subsequently the preparation of designs for the same. The feasibility study carried out by the PCC on the SOS corridors identified 1,542.9 km of roads for upgrading and implementation in three phases. The study also identified 27 towns for bypassing and had economic, engineering and environmental justifications for these alignments. However due to the high costs of the bypasses and funding issues, TNRSP was formulated involving the corridors in north-eastern and eastern parts of Tamil Nadu for upgradation. Besides 2600 km of roads are identified for regular maintenance funding under the project.

The upgradation component has been divided into four contract packages to be implemented in the first phase. These include the Northern corridor (TNRSP 01) 397.1km long[1] and the Eastern Corridor (TNRSP 02, TNRSP 03 and TNRSP 04) along the eastern coast for a length of 334.3 km. The 11.2km long Ramanathapuram bypass (TNRSP05) is likely to be implemented in subsequent phase of the project. A total of 14[2] bypasses totaling a length of 106.6 km have been planned as part of the upgradation component. The length of the corridors by packages and links is indicated in the **Table 1.1**. The corridors under different packages of TNRSP are indicated in **Figure 1.1**

1.2 EXISTING CONDITION OF ROADS

1.2.1 NORTHERN CORRIDOR

The sealed width of road varies from 3.6 m to 8.0 m with an average sealed width of 4.9 m with the result that, over large sections of these roads, two on-coming vehicles cannot operate effectively. The roughness of the Northern Corridor roads varies from 5.7 to 9.7 IRI (**Table 1.1**).

[1] TNRSP 01 is further sub divided into TNRSP 01 (E), TNRSP 01 (N) and TNRSP 01 (S).

[2] Environmental Assessment for Ramanathapuram Bypass shall be carried out in subsequent phase of the project.

Fig 1.1 Upgradation and Maintenance corridors in TN RSP

Table 1.1: Length of the Project Roads under Upgradation Component

From	To	Exist Road Survey (1997)			Treatment	Project Length
		Width	AADT	IRI		
TNRSP01						
Chidrambaram	Bypass				2LSS	16.9
Sirkazhi	Bypass				2LSS	8.8
Sub-Total Contract TNRSP 1 (E)						25.7
Arcot	Arani	4.3	8817	6.9	2LSS	24.6
Arani W	Bypass				2LSS	5.3
Arani	Polur	7.0	1038	6.0	2LRR	20.6
Polur	Bypass				2LSS	4.9
Polur	Tiruvannamalai	7.0	1522	5.7	EPM	24.7
Tiruvannamalai	Bypass				2LSS	10.9
Chengam	Polur	5.8	1058	8.3	2LRR	45.1
Tiruvannamalai	Tirukkovilur	5.2	2318	6.5	2LSS	27.9
Tirukkovilur	Bypass				2LSS	4.4
Tirukkovilur	Ulundurpettai	3.6	559	9.7	2LRR	28.7
Sub-Total Contract TNRSP 1 (N)						197.1
Vriddhachalam	Bypass				2LSS	9.2
Vriddhachalam	Jayamkondacholapuram	4.0	558	8.4	2LRR	30.4
Ariyalur	Bypass				2LSS	7.6
Ariyalur	Jayamkondacholapuram	3.6	1167	8.1	2LMR	43.6
Jayamkondacholapuram	Kumbakonam	7.0	2639	6.9	2LRR	39.5
Kumbakonam	Bypass				2LRR	8.8
Kumbakonam	Thiruvarur	3.9	1002	8.4	2LMR	35.5
Tiruvarur	Bypass				2LSS	0.5
Sub-Total Contract TNRSP 1(S)						175.1
Sub-Total Contract TNRSP01 (E,S and N)						**397.9**
TNRSP02						
Nagapattinam	Bypass				2LSS	10.2
Nagapattinam	Tiruppundi	6.1	3481	6.3	2LSS	14.3
Tiruppundi	Tirutturaippundi	3.5	1250	7.5	2LMR	22.6
Tirutturaippundi	Bypass				2LMR	3.1
Muthupet	Bypass				2LMR	4.8
Tirutturaippundi	Manora	3.0	995	8.4	2LMR	43.8
Manora	Kattumavadi	3.0	600	8.0	2LMR	17.8
Sub-Total Contract TNRSP - 02						**116.6**
TNRSP03						
Kattumavadi	Mimisal	2.7	762	9.4	2LMR	31.5
Mimisal	Vattanam	4.7	498	7.2	2LMR	16.7
Vattanam	Tondi	3.9	1250	7.7	2LMR	6.6
Tondi	Devipattinam	3.7	565	7.4	2LMR	33.9
Devipattinam	Ramanathapuram	8	1522	6.8	2LGS	11.1
Sub-Total Contract TNRSP - 03						**99.8**
TNRSP04						
Ramanathapuram	Kilkkari	7.4	1698	5.7	EPM	15.6
Kilakkari	Sayalkudi	3.2	772	9.0	2LMR	42.7
Sayalkudi	Vembar	3.2	433	9.2	2LMR	19.3
Vembar	Kulattur	3.5	182	10.0	2LMR	18.9
Kulattur	Tuticorin	6.9	859	7.1	2LMR	21.5
Sub-Total Contract TNRSP - 04						**129.1**
TNRSP05						
Ramanathapuram[3]	Bypass	11.2				11.2
Sub-Total Contract TNRSP - 05						**11.2**

[3] Environmental Assessment for Ramanathapuram Bypass shall be carried out in subsequent phase of the project.

Total	**743.4**

1.2.2 EASTERN CORRIDOR

Table 1.2 summarizes the present condition of Corridor 1 roads. The width of the right-of-way varies from 4.8 m to 42.8 m. The sealed width of roads varies from a minimum of 2.7 m between (Kattumavadi and Mimisal) to a maximum of 9.7 m (between Tarangambadi and Karaikal). For most of the 458 km distance between Cuddalore and Tuticorin, the sealed width is 5.5 m or less i.e. intermediate lane width or less; two on-coming vehicles cannot operate effectively on these sections of roads. The roughness[4] of the Corridor 1 roads varies from 4.9 to 10.0 IRI **(Table 1.1).**

1.3 PROJECT OBJECTIVES

The project is formulated with the following objectives:

- Improving performance of the road network for enabling traffic to move safely, expeditiously, economically and comfortably;
- Improve road connectivity to major towns, ports and backward areas for stimulating growth;
- Providing roads that facilitate movement of industrial, agricultural, fishery and other products to markets;
- Facilitate religious tourism

1.4 PROJECT BENEFITS

With the implementation of the project, following benefits apart from the benefits targeted through the objectives are envisaged:

- Short term employment opportunities due to construction activities and development of diversified skill set for local labours
- Improved economic development of corridor villages
- Improved environmental conditions along the roadside due to judicious design
- Improved aesthetics due to enhancements and landscaping
- Decrease in animal crossings in RF and safe cattle crossing
- Improvement in the drainage conditions along the corridors due to improved design and construction of cross drainage structures
- Improved tree cover along southern portions of eastern corridor due to planting of saline resistant and more robust species
- Improved safety of road users and roadside communities

[4] A well controlled, machine-laid asphaltic road normally provides a surface with IRI in the 2.5 to 3.5 range. The higher the IRI, the rougher the road surface and the poorer the ride quality and safety for vehicle occupants.

1.5 PROPOSED IMPROVEMENTS

1.5.1 UPGRADATION ROADS

Treatment given for the upgradation roads varies from link to link based on their existing conditions and the future requirements. There are five treatments applied in the project for upgradation:

- 2 Lane Sealed Shoulders (2LSS)
- 2 Lane Gravel Shoulders (2LGS)
- 2 Lane Minor Realignment (2LMR)
- 2 Lane Rural Realignment (2LRR) and
- Enhanced Periodic Maintenance (EPM)[5]

Widening of the road to two lane and strengthening of carriageway on the existing alignment is involved in the first four treatments but only maintenance of the road shall be carried out in the EPM. For each of the treatments three variations of the cross sections as rural, village and urban are considered for the design. These are aimed at minimizing impacts on the roadside assets and economise on the design aspects. **Table 1.1** gives details of the treatment given to the corridors.

A description of each of the treatments given for upgradation corridors is given below.

1.5.1.1 2 Lane Sealed Shoulders (2LSS)

The 2LSS standard of road provides a 10 m sealed width with a carriageway of 7m for two lane and sealed shoulders of 1.5m width on either side, consistent with IRC 73-1980. The project will include normal road infrastructure, such as longitudinal drains, kerbs and footpaths in urban and village areas. A Combination of overlay of the existing road (wherever possible) and pavement widening will achieve the 10m seal. The rural sections will have 1.5 m of sealed shoulder and 1.0 m of gravel shoulder. The paved shoulders increase the capacity of a two-lane road to its limit, prior to the high-cost alternative of four lanes. They allow for separation of slow and fast moving vehicles, and also provide a secure stopping area for vehicles clear of the traffic lane (**Figure 1.2**). A Continuous painted line will define the traffic lane edge.

In the past, a sealed shoulder comprised a coarse textured premix carpet over a thin granular base. This was not attractive to slow-moving vehicles. To encourage slow-moving vehicles to use the shoulder, and for its protection, there will be full-depth pavement under the seal. Without this, the flexibility of the shoulder subgrade under frequent truck loading will lead to its early failure and loss of asset and seal. Sealed shoulders are provided where traffic volumes is high and this implies frequent use. As well as slow-moving vehicles, heavily laden vehicles use the shoulder to avoid on-coming traffic that is overtaking.

[5] EPM refers to a treatment method for upgradation roads and does not refer to the maintenance corridors.

Paved shoulders permit fast vehicles to overtake without forcing oncoming traffic off the sealed surface and should therefore contribute to a reduction in the accident rate. The sealed shoulder will allow 1.8 m wide ox carts to essentially leave the traffic lane used by fast moving traffic. The IRC standard indicates a paved shoulder width of 1.5 m; this is adequate for two vehicles going in one direction to safely pass while there is a vehicle traveling in the opposite direction.

In villages the additional 1.5 m sealed pavement width provides continuity between the sealed shoulder rural road and village widths; this also allows additional sealed space off the through lane for village activities and for slow traffic. Open masonry drains provide local drainage. In urban sections there will be an additional 2.5 m sealed pavement for slow traffic and parking off the through lanes, and closed masonry drains for roadside drainage.

1.5.1.2 2 Lane Gravel Shoulders (2LGS)

The 2LGS standard of road provides a 7m carriageway, consistent with IRC 73-1980. It includes normal road infrastructure, such as longitudinal drains, kerbs and footpaths in towns and sealed light traffic surfaces in the villages (**Figure 1.3**). A combination of overlay of the existing pavement (wherever practical) and pavement widening achieves the 7m seal. In the rural sections shoulders are of gravel, 2.5 m wide and meet the IRC: 73 (1980) standard for a 12 m roadway (two lane State Highways in plain and rolling terrain).

Urban sections include a sealed slow lane of 2.5 m on both sides of the carriageway. This may, however, be reduced to a minimum of 0.5 m in constrained situations. Village section includes a 1.5 m widened pavement both sides of the carriageway, which may similarly be reduced in constrained village areas.

Urban and village sections include local drainage via masonry drains, covered in the urban areas and open in the villages to facilitate cleaning and maintenance. A local commitment is required to maintain the drains. However, the benefits of a drainage system in terms of additional pavement life, quality of life and amenity, outweigh the additional maintenance requirement. The PCC considered various options for villages, including covered drains, drive-over open concrete spoon drains and kerbs. Covered drains, while desirable, are not likely to be appropriately maintained. A drive-over concrete drain would require full-depth pavement on both sides and have little capacity; in the flat terrain it would be very hard to maintain a fall on the surface level invert.

The high cost of these alternatives made them undesirable. A broken separator kerb (300 mm break every 4 m) will allow drainage but exclude heavy traffic from the low-strength pavement for light and pedestrian traffic behind the kerb.

1.5.1.3 Two Lane Minor Realignment (2LMR)

The two lane minimum realignment standard is the minimal level of improvement before maintenance. The new road follows the existing alignment providing a structural overlay and widening to a minimal formation width. In the rural area this provides overlay and widening to a 9.0m formation width and provision of longitudinal drainage (**Figure 1.4**). Where there is sufficient allowance within the existing right-of-way some minor local realignment to ease sharp bends will take place. The proposed works consists of a structural overlay and widening, generally on the existing alignment to a minimum of 7.0 m

sealed carriageway and 1.0 m gravel shoulders. The treatment provides a road and drainage upgrade without large expenditure and land acquisition effects, minimizing overall development costs.

1.5.1.4 2 Lane Rural Realignment (2LRR)

The 2LRR standard of road provides a 7m carriageway, consistent with IRC 73-1980. It includes normal road infrastructure, such as longitudinal drains, kerbs and footpaths in towns and sealed light traffic surfaces in the villages (**Figure 1.5**). A combination of overlay of the existing pavement (where practical) and pavement widening achieves the 7m seal.

The rural section road shoulders are 2.5 m gravel and meet the IRC: 73 (1980) standard for a 12 m roadway (two lane State Highways in plain and rolling terrain). The steepest allowable slope is 3:1 but flatter slopes or slope stabilization may be required to ensure stability. Existing trees are to be retained whenever possible, where base trunk is clear of shoulder edge confirmation on site by the engineer. New tree locations shall be a minimum of 6.0m from the edge of carriageway (9.5m from centerline). For embankment heights above 2.5m in rural areas, guard stones should be provided at the road edges.

Urban and village sections include local drainage via masonry drains, covered in the urban areas and open in the villages to facilitate cleaning and maintenance. A broken separator kerb (300 mm break every 4 m) will allow drainage but exclude heavy traffic from the low-strength pavement for light and pedestrian traffic behind the kerb. Longitudinal drain location shall be selected on site to provide pavement drainage and avoid removal of existing trees where possible. On village & urban sections significant existing trees may be retained where base trunk is 1.5m or more, clear of carriageway. On urban section maximum intrusion of existing buildings is to within 1.0m of face of kerb (minimum footpath width is, therefore, 1.0m). Fixed objects such as power poles, light poles are to be relocated (excluding existing trees) where they fall within the inside of the kerb face for village and urban sections.

1.5.1.5 Enhanced Periodic Maintenance (EPM)

Enhanced periodic maintenance is the provision of structural pavement overlay and shoulder maintenance without widening.[6]

1.5.2 MAINTENANCE ROADS

About 2600 km of roads spread over all parts of Tamil Nadu are identified for regular maintenance. The maintenance works involve rehabilitation of pavement, overlay the wearing coat wherever required and provision of earthen shoulders. Initially about 180 km of roads is proposed for widening to two-lane configuration but is subsequently dropped from the widening and is being taken up for regular maintenance. The corridors included in the maintenance component are given in **Appendix 1.1**.

[6] This is a treatment option envisaged in the upgradation component and is not a part of maintenance component. This treatment is used at locations along the upgradation component where the corridor meets design standards

1.6 ENVIRONMENTAL ASSESSMENTS IN THE PROJECT

The Project Co-ordinating Consultants (PCC) as part of the project preparation has carried out the Environmental and Social Assessments for the project. Incorporation of environmental and social concerns into the project planning design has been taken up at all stages of the project preparation. As

Figure 1.2 2 Lane Sealed Shoulders (2LSS)

Figure 1.3 2 Lane Gravel Shoulders (2LGS)

Figure 1.4 2 Lane Minor Realignment (2LMR)

Figure 1.5 2 Lane Rural Realignment (2LRR)

part of the feasibility studies, a screening of the road corridors based on an evaluation of the environmental and social components enabled the identification of environmentally sensitive road sections. These environmental implications were factored into the feasibility analysis for the project for selection and prioritization of the project roads.

A Sectoral Environmental Assessment (SEA) was conducted to analyze the wider environmental issues in the project. The SEA found that most of the sections of routes that are candidates for improvement require detailed environmental assessment. Based on the outputs and recommendations of the SEA, Environmental Impact Statements (EIS) and Environmental Management Plans (EMP) were prepared for the individual upgradation corridors. To address the Resettlement and Rehabilitation (R&R) issues in the project, a Resettlement Action Plan (RAP) was prepared by the PCC. TNRSP has been classified as a Category "A" project due to its cumulative magnitude of environmental and social impacts. In accordance with the WB requirements for Category A projects, an Independent Environmental Review has been taken up for the project preparation activities of TNRSP. This environmental assessment report has been prepared consolidating the gaps and deficiencies identified during the Environmental Review.

Consultation with the community and the stakeholders has been carried out as an integral part of the project preparation. Participatory sessions at various levels, including state, district and village levels were conducted[7] at the various stages of project preparation. As part of the independent review, consultations with officials/stake holders/communities/ NGOs have been carried out. Outcome of these consultations are documented and presented in **Appendix 6.2** and **6.3**.

1.7 RESOURCE REQUIREMENTS IN THE PROJECT

1.7.1 NATURAL RESOURCES

Requirement of natural resources and their extraction is the prime reason for environmental impacts. Magnitude of impacts anticipated is dependent on the quantum of resource extraction. Natural resource requirements of the project are presented in the following sections to give a preliminary idea of the magnitude of project impacts. Natural resources required for the project can be classified into land to be acquired, water required for construction purposes, and other material resources from quarry and borrow areas.

1.7.1.1 Land

Since the project involves upgradation of district roads, geometric corrections are required to bring it to the project specifications. These corrections increase the requirement for land. Minimization of land acquisition has been worked out in the project by limiting the land acquisition to the Corridor of Impact (CoI), instead of clearing the Right of Way (RoW). The land requirement for the project under various land uses is presented in the **Table 1.2**.

[7] Documentation of these exists in form of a Public consultation Report, March 1999 for the project

Table 1.2: Land Required for the Project

Type of Land	Contract Package-wise Land Requirements (in ha)				
	TNRSP-01	TNRSP-02	TNRSP-03	TNRSP-04	Total
Private Agriculture Land (Wet)	174.46	65.92	6.34	2.48	249.21
Private Agriculture Land (dry)	69.44	17.26	15.98	21.84	124.53
Urban Land	5.00	5.00	1.00	0.06	11.06
Other (Government Land)	109.55	48.44	22.99	6.93	187.93
Total	358.47	136.63	46.31	31.31	572.74
Source: Resettlement Action Plan, December 2002.					

1.7.1.2 Water

Water requirement for construction is a critical element, especially along the coastal stretches of TNRSP 02, 03 and 04, where intrusion of seawater has rendered the ground water unfit for consumption. Fresh water along these stretches is limited to the surface water bodies as tanks and ponds, which get recharged from the perched aquifers. Quantity of water required for construction is estimated to be 1280 m3 / day for northern corridors and 910 m3 / day for eastern corridors. Since no clash of use between the construction requirements and domestic water requirements of the local people is to be encountered, appropriate arrangements have to be made by the contractor for procurement of water.

1.7.1.3 Earth (Borrow material)

Borrow material is required for filling embankments, approaches to bridges and at locations requiring correction of vertical alignments. The quantities of borrow material required for the upgradation corridors are estimated to be 2,954,162 m^3. The material shall be procured mostly from pond beds and other regions as identified in the detailed design. It is the responsibility of the contractor to transport the material in such a manner as to cause minimum impacts on the haul roads.

1.7.1.4 Quarry Material

Road metal and gravel from quarry shall be utilized for pavement surface and layers below pavement. The quarry material required for the upgradation corridors are estimated to be 5,777,502 m^3. The material procurement will be responsibility of the contractor.

1.7.2 SOCIAL ENVIRONMENT

Though the project designs have been worked out to accommodate the proposed cross-sections within the existing RoW, clearance of squatters and encroachers within the CoI has been unavoidable. Also, there exist several stretches where the RoW available is insufficient to accommodate the proposed cross-section. At these locations, acquisition of private land and structures has been necessitated. Apart from these, the 13 bypasses that have been proposed in the project will involve acquisition of land, mostly agricultural. Incidental to the acquisition of land for the project, impacts on roadside properties including community properties occur.

To evaluate the impacts anticipated due to the resource extraction and devise the project to be environmentally acceptable an environmental assessment is prepared.

1.8 PROJECT COSTS

The total cost of project inclusive of environmental and resettlement costs is estimated to be INR 11881.21 Million. Break up of cost provisions is provided in the **Table 1.3.**

Table 1.3: Estimate for Engineering, R&R and EMP

Contract Package	Particulars	Project Length (Km)	Engineering Cost Based on 2002 in Rs(M) [1]	R&R Cost in Rs.(M)	EMP Cost in Rs.(M)	Total Cost in Rs.(M)
TNRSP01	Arcot Elavanasur Vridhachallam Thiruvarur Chidambaram & Sirkazhi Bypasses	397.4	6608	563.10	76.68	7247.78
TNRSP02	Nagapattinam Kattumavadi	117	1977	179.96	27.03	2183.99
TNRSP03	Kattumavadi Ramanathapuram	99.8	1237	59.79	20.75	1317.54
TNRSP04	Ramanathapuram Tuticorin	117.9	1148	48.45	21.10	1217.55
Total (Base Cost) in INR (Million)			**10970**	**851.30**	**145.56**	**11966.86**
Total (Base Cost) in US$ (Million)			**228.54**	**17.73**	**3.032**	**249.30**
Note: Costs for Road Works including Bridges						
Source: EMP, RAP and Detailed Project Estimates by PIU.						

1.9 STRUCTURE OF THE EA

Environmental assessment process in the project involved assessment of social and cultural aspects of the project including the natural environment. For the anticipated impacts, management measures are incorporated in the environmental management plan and resettlement action plan. The present report is structured to present the environmental assessment with a holistic approach incorporating social and cultural aspects. However, the social aspects are presented in detail in the resettlement action plan. Following is the structure of the consolidated EA report.

Chapter 2: Policy, Legal and Administrative Framework

This chapter provides the existing institutional, legislations and policies applicable to the project. Existing status of clearances of GoI and GoTN applicable and the Operational policies of WB applicable are also presented.

Chapter 3: Methodology

This chapter provides the overall methodology and approach adopted for the environmental assessment in the project. Process adopted for public participation and mainstreaming of environmental concerns is presented.

Chapter 4: Baseline Environmental Profile

The chapter presents characteristics of the study area in terms of its natural, social and cultural environment. An exhaustive inventory of environmental features supplemented by primary surveys of PCC and independent review consultants as well as several secondary sources is presented.

Chapter 5: Analysis of Alternatives

This chapter presents a comparative analysis of various alignment options at project level and corridor level. Alternative alignments for various bypasses and also for short realignments are presented.

Chapter 6: Public Consultation

The project involved extensive public consultations at various stages of project preparation. Consultations are documented at all levels and an extract of the outcome of these consultations are presented in this chapter.

Chapter 7: Environmental Impacts

The nature, type and magnitude of potential impacts anticipated in the project are presented in this chapter. The information is based on the environmental assessment of the PCC, supplemented by the field surveys and additional secondary data collection of during consolidation of the project.

Chapter 8: Environmental Management Measures

Environmental mitigation, management and enhancement measures incorporated into the project are presented in this chapter. Institutional arrangements for implementation of the suggested measures and the cost implications are also presented in this chapter.

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