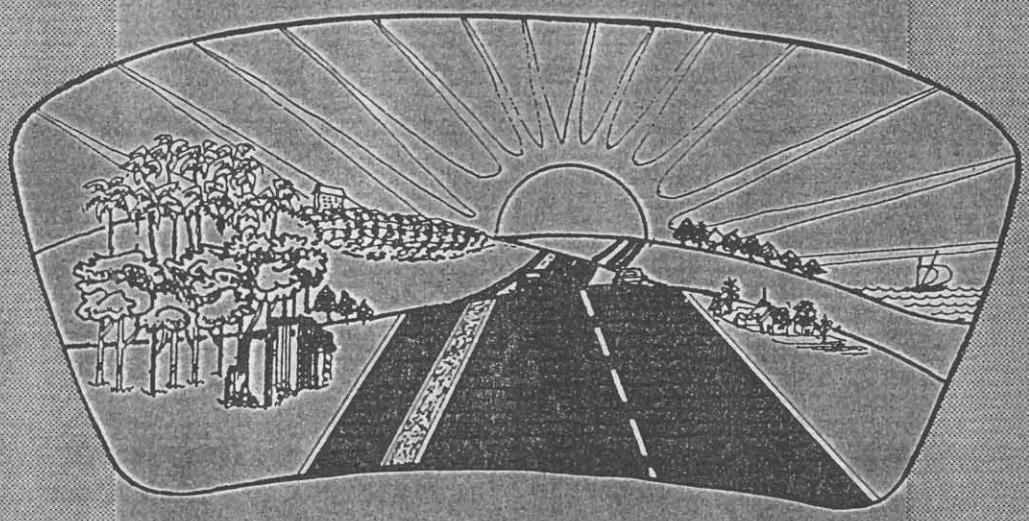
DEMOCRATIC SOCIALIST REPUBLIC OF
SRI LANKA

MINISTRY OF HEALTH, HIGHWAYS AND
SOCIAL SERVICES

ROAD DEVELOPMENT AUTHORITY

ENVIRONMENTAL IMPACT ASSESSMENT REPORT OF THE PROPOSED NEW SOUTHERN HIGHWAY



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CHAPTER 1

EXECUTIVE SUMMARY

1.1 Introduction

The concept of the New Southern Highway was introduced by the Road Development Authority (RDA) and the Ministry of Highways in the late 1980's as a part of the network of new highways (see Fig. 2-1) proposed to cater to the increasing transport demand of the country. This idea led to the conduct of Prefeasibility Studies on the so-called "Inland Trunk Road from Outer Circular Road to Galle and Matara", which studied 4 alternative traces from Bandaragama on the proposed "Outer Circular Road" to Matara. These prefeasibility studies have included preliminary environmental considerations in the route selection, as seen in the Prefeasibility Study Report prepared by Resources Development Consultants Ltd., (RDC) (1993).

The proposal has been accepted as a project justified for feasibility studies, and as such the RDA has initiated action on feasibility studies and Environmental Impact Assessment (EIA) studies. As can be seen in Fig. 2-2, EIA is required to assess the possible impacts of the project on the environment and to identify mitigation for such impacts that cannot be avoided, to be incorporated into the project. Detailed design of such mitigation measures proposed will have to be done at the stage of detailed design of the project, and implementation of them should be carried out at the project implementation stage. Finally, monitoring of the impacts and the control of them by the mitigation measures adopted should be done during the operation stage of the project, and steps taken to correct any unexpected or unforeseen impacts.

This study was undertaken by University of Moratuwa at the request of the RDA to study the environmental impacts of the proposed Alternate Southern Highway from Colombo to Matara, and to propose mitigatory measures in order to avoid or minimize those impacts. The Environmental Impact Assessment Report (EIAR) was prepared in accordance with the Terms of Reference (TOR) provided by the Central Environmental Authority (CEA).

University of Moratuwa conducted the EIA study by forming a team of consultants comprising an Ecologist, a Hydrology and Drainage Specialist, a Sociologist, a Land Use Planner, an Agricultural Economist, an Environmental Engineer, a Landscape Architect, a Traffic Engineer/Transport Planner and a Highway and Bridge Engineer, with an EIA Specialist with Environmental/Civil Engineering background as the Team Leader.

The objectives of the proposed highway project were defined by the RDA as follows:

1. To provide the required accessibility and mobility for the future development of the Southern Province and part of Western and Uva Provinces included in the Proposed Southern Area Development Plan (SADP).

2. To provide a highway to act as a catalyst in encouraging and attracting industries and services for the Economic and Social Development of the Western and Southern Provinces and beyond.

3. To provide a highway that will be a part of a proposed access controlled highway network in Sri Lanka to improve inter regional transportation.

Reasonable alternatives of achieving the stated objectives were identified by the RDA and the EIA consultants in consultation with the CEA as follows:

1. The situation without the Proposed Project.
2. Improvement and Widening of the Colombo-Galle-Matara Road. (A2)
3. Improvement of the existing railway from Colombo to Matara.
4. Proposed project with recommended mitigation, including the deviations of the trace suggested by affected public.

1.2 The Proposed Project

The proposed project is a high speed, access controlled highway from Colombo to Matara, designed to achieve the objectives mentioned in section 1.1 above.

The proposed highway is located in the Southern part of Sri Lanka in a corridor of 400 ft. from Colombo to Matara lying approximately 5 to 11 km inland of the existing A2, as shown in Fig. 3-3. At the Colombo end the proposed highway starts from a point in Mattegoda on the proposed Outer Circular Road, (Control Point (CP) 0). At Matara end the proposed trace ends at Hitteliya (CP 96) on Matara-Akuressa Road. However, the details of the section from CP 0 to CP 5 and CP 95A to CP 96 were not available to the EIA Team during the EIA study, and therefore the study was confined to the section CP 5 in Bandaragama to CP 95A in Godagama, Matara.

The proposed trace traverses though the three districts of Kalutara, Galle and Matara, and the following 14 Divisional Secretaries' Divisions (DSD): Bandaragama, Dodangoda, Matugama, Walallawita, Bentota, Elpitiya, Karandeniya, Baddegama, Bope-Poddala, Akmeemana, Habaraduwa, Welipitiya, Malimbada, Matara, while control point 0 to 5 lie in DSD of Homagama and Horana, in Colombo and Kalutara Districts.

It crosses 4 major rivers in the South Western-Southern part of Sri Lanka, viz. Kalu Ganga, Bentara Ganga, Gin Ganga and Polwatta Ganga.

According to the Prefeasibility Study Report (RDC, 1993) it was proposed to have intermediate interchanges at Moonamalawatte (near CP 27), Navadagala (near CP 37), Narawala (CP 62) and Dorape (near CP 70), with link roads to Aluthgama/Bentota, Kosgoda/Ahungalle, Dadalle/Galle and Koggala on the existing A2.

During the Economic Feasibility and EIA Studies, it was revealed that, in the light of the proposed plans for development of the Southern Area, and in order to achieve the declared objectives of the Southern Highway (ref. Section 1 objectives 1 and 2) it would be desirable to increase the number and slightly modify the location of the interchanges to maximize the social and economic benefits of the proposed project.

It is thus proposed to have intermediate interchanges at the following locations.

1.	Polgasowita	near CP 2
2.	Bandaragama	near CP 5
3.	Bombuwala	near CP 18
4.	Lewwanduwa, Welipenna	near CP 27
5.	Kurundugahahetekme	near CP 43
6.	Baddegama	near CP 54
7.	Akmeemana	near CP 65
8.	Kabaragala	near CP 72

The approximate acquisition width for road construction will be 200 ft (60 m) and the road platform is designed for a 4 lane highway, divided by a median of at least 3 m width. It is designed to maintain a speed of 100-110 km/h.

The typical cross section of the proposed highway is given in Fig. 3-5. The frontage roads on both sides will be provided to reduce community severance and access to the local communities for their activities along the road sides. The frontage roads provided will be for a 2 lane movement up and down with a platform width of 7m. Pedestrians, cyclists and local traffic will be allowed on this road.

Only motor traffic will be allowed on the express way, with limited access at interchanges.

In order to maintain access control, the expressway will be fenced along the acquisition boundary. All cross roads will be provided with over passes or under passes across the highway, in order to maintain the same accessibility for the vehicular and pedestrian traffic as before. A list of such crossing points with traffic counts is given in the Economic Feasibility Study Report (1996), an extract of which is given in Table 3-2 in the Appendix.

Four major bridges will be provided at the 4 major river crossings at

(a) Kalu Ganga - approximate span	200 m.
(b) Bentara Ganga - approximate span	75 m.
(c) Gin Ganga - approximate span	120 m.
(d) Polwathu Ganga - approximate span	50 m.

Seven medium sized bridges and thirty minor bridges, nearly eighty vehicle overpasses and underpasses and thirty pedestrian subways are proposed in the design. The bridges, overpasses and underpasses will be constructed with mass concrete or reinforced concrete foundations on cylinder or pile caps. The deeper structures will be precast, pretensioned or post tensioned components depending on the span.

1.3 The Proposed Alternatives

1.3.1 The Situation Without the Proposed Project

If the proposed project was not implemented, the existing A2 and the Coast Line Railway would have to serve the increased demand in traffic caused by the planned activities of the SADP, and the growth of other activities in the area.

1.3.2 Improvement and Widening of the A2.

This alternative looks at the improvement of the existing A2 from Panadura to Matara, a stretch of 136 km, as a four lane divided highway, similar to the proposed New Southern Highway. However, it will not be possible to use any access control on the pedestrians or vehicles on this road, due to the wide spread ribbon development along the existing road.

1.3.3 Improvement of the existing railway from Colombo to Matara.

This alternative includes improvements to the Coastline Railway, in order to satisfy the predicted future travel demand, by inserting concrete sleepers and rerailing, constructing an additional third line from Colombo to Panadura, and a second line from Panadura to Matara, together with widening or new construction of bridges and culverts, redesigning Galle station and an additional line from the Galle station to the Galle Port, and provision of Colour Light signaling system and other safety devices.

1.3.4. Proposed project with recommended mitigation, including some of the deviations of the trace suggested by affected public.

Several changes to the highway proposed by RDA were recommended by the Economic Feasibility Study team, in order to improve the safety of road users while maintaining the high speeds required to achieve the expected savings in travel time, and also to minimize acquisition of land. The following are the main changes proposed in this alternative.

1) The cross section of the highway to be changed to 4 lanes of 3.65 m, 2.4 m shoulders on either side, soft centre median of 10 m and a clear zone of 8 m on either side as shown in Fig. 3-10.

2) Frontage roads of 9.5 m width will be constructed on one side only, at locations where it is justified to provide them, considering the people's need and the social and financial cost of acquisition of land. It is proposed to provide such frontage roads for a length of 75 km of highway, where the width of acquisition will be 60m , while the balance length of 56.4 km will not be provided with frontage roads, reducing the width of acquisition to 50 m.

3) For a length of 10 km, where the acquisition is difficult, the centre median will be reduced to 3 m and breakable crash barriers will be provided. If further acquisition constraints are encountered due to site conditions or environmental/social issues, the clear zone may be reduced with introduction of breakable crash barriers on either side of the hard shoulders. However, this should be done only under exceptional circumstances.

4) In hilly areas, the most economical vertical alignment will be considered, thus reducing the depth of cut. On these sections, an additional lane (climbing lane) will be provided on the upward gradient only.

5) Out of the 4 main bridges of the Highway, frontage roads will be provided on the Kaluganga and Bentara Ganga (two widest rivers) only. These bridges for the frontage road may be restricted to 7.0 m wide. There will be approximately 60 other locations where 9.5 m wide minor bridges will be provided for the frontage roads.

In addition to the above changes provided by the Economic Feasibility Study Team, several alterations to the trace were suggested by the local people in order to mitigate the problems of acquisition of land containing dwelling houses. Such deviations were suggested at the following locations:

(1) Bandaragama - **CP 5 to 8**
(2) Paragastota - **CP 9 to 10**
(3) Kaluganga crossing at Diyagama and Ukwatte - **CP 12A and 13**
(4) Undupitigoda, Gamgoda at **CP 14 to 16**
(5) Yatadola and Navuththuduwa - **CP 23 to 25**
(6) Navuththuduwa - **CP 25**
(7) Uragaha, near **CP 31-32**
(8) Atakohota - **CP 37**
(9) Kurundugahahetekma, Thalawa, Elpitiya - **CP 38 to 43**
(10) Kabaragala and Danduwana - **CP 70 to 71**
(11) Hallala - Weligama - **CP 86**

Out of the above, the deviations at **CP 12A-13** and **CP 23-25** were rejected due to reasons explained in Chapter 3. Other deviations to the trace were considered as mitigatory measures and included in this alternative

1.4 Justification of the Project

Economic Analysis conducted by the Economic Feasibility Study Team has revealed that all alternatives other than the no project alternative are economically feasible projects, with Economic Internal Rate of Return (EIRR) values ranging between 19.4% and 23.4%. However, even though the Alternatives 2 and 3 proposed are both economically feasible, and can be recommended as stand alone projects which will achieve another set of objectives, it will only be the proposed project and the alternative 4, which is the proposed project with recommended mitigation, which will help to achieve all the objectives stated in section 1 above. Therefore only these proposals can be considered as suitable projects, capable of achieving the stated objectives.

1.5 EIA Methodology

The EIA was carried out by the Team of Consultants who looked at the different aspects of the physical, biological and social environment. Scoping sessions were held at the offices of the 14 Divisional Secretaries (DS) which were attended by the DS Office staff, Grama Niladharies (GN), Samurdhi leaders, Non Governmental Organizations (NGO's), people's representatives and the affected people.

The anticipated significant impacts were first identified using a relevance matrix of 43 environmental elements and 24 project elements. The consultants studied the extents and significance of the probable impacts of the proposed project and the alternatives and methods of mitigation available for mitigation of significant impacts. The alternatives were evaluated on the basis of benefit/cost analysis. An extended cost benefit analysis was carried out to evaluate the justification of the recommended project under different scenarios after valuing the environmental impacts using best methods currently available.

1.6 The Existing Environment

The existing environment of the proposed project area was extensively studied by the consultants. Relevant data was collected from various sources, including:

- Maps and Desk Studies
- Field Sampling
- Extensive Surveys
- Other sources such as:
  - Irrigation Department
  - Meteorological Department
  - Archaeological Department
  - Department of Agrarian Services
  - University of Moratuwa and other Libraries.

The main physical features of the environment of the project area are derived from the fact that the entire proposed trace as well as alternatives lie on the lowest peneplain, which is mainly flat, with a few low hills and undulations, and being in the wet zone, it has its fair share of water bodies. The proposed trace crosses four major rivers, Kaluganga at Diyagama, Bentaraganga at Ranthotuwila, Ginganga at Nayapamulla and Polwattuoya at Kananke and also several tributaries and minor streams.

There are no precious mineral resources identified in the project area, although there are extensive deposits of rocks, which can be harvested for the construction of the highway. Some potential quarry sites have been already identified by the RDA for this purpose. Sufficient gravel and fill material also is available in the project area, and potential borrow sites are being identified by RDA. However, mining of river sand will be a very sensitive environmental issue, and large quantities required for construction will not be available. Therefore it is recommended that sea sand is exploited for construction purposes.

The soil characteristics of the project area suggests that a large portion of the trace, which falls on flood plains contain associations of half bog to bog soils and mixed alluvial soil, characteristic of flood plains. It has been reported that in the Ginganga flood protection scheme, 60% of the 21.7 km bund has been constructed on peaty soil, which had a maximum thickness of 9m, and in Nilwalaganga scheme too, a 5m thick layer of peat was encountered. These soils are of very low strength and high compressibility, and need to be filled suitably, for construction.

On the other hand, the corridor in which the existing A2 and the Railway are situated, the soils are sandy Regosols, and associations of Red Yellow Podzolic soils (RYP) with Plithite and Quartzite.

Water, available in abundance in the form of surface water and ground water, is used by the people of the area for drinking, domestic, irrigation and recreation purposes. The National Water Supply and Drainage Board (NWS&DB) extracts water for drinking water supplies from Kaluganga, Ginganga, Polwattu Oya and Nilwalaganga. Therefore the quality of water in these water bodies is a sensitive issue. Out of the major waterways, only Bentaraganga is not used as a source of public water supply. It is however, used as a recreational water body, very popular among tourists, both local and foreign.

Water samples were tested from 10 waterways crossing the trace, including the four major rivers at points close to the crossing points. None of the water bodies seem to have salinity intrusion up to the sampling points. On the other hand, analysis of samples collected from water bodies crossing existing A2 indicated very high salinity in Hikkaduwa Ganga and Ratgama lake, and high salinity in most other water bodies. However, Kaluganga, Ginganga and Nilwalaganga did not show salinity at these sampling points either. In general, it can be seen that the water quality deteriorates as the water flows downstream.

Analysis of water samples collected from surface water bodies near the construction site at Godagama revealed that the water quality in these water bodies was very poor, with high sulphate content and high Biochemical Oxygen Demand (BOD) values. Water from Lenaduwa Ela near the new Southern Highway site office at Palliyagoda has high sulphate content and low pH, probably indicating the surface run off from the acid-sulphate soil in the nearby abandoned paddy fields.

Ground water is widely used by the people of villages where public water supplies are not available. The well water quality in most areas is satisfactory, and it is unlikely to have a significant impact from the project activities. The ground water quality in wells near the construction site is poor, but the reason for this is probably more the soil condition than the project activities.

The existing air quality in the project areas is very good, as there are no major industries or heavy traffic anywhere along the trace. Along the existing A2, air quality measurements revealed that the concentration of primary air pollutants are within acceptable levels.

The noise level along the proposed trace is very low, as most of the trace is along undeveloped land. Six noise sensitive areas have been identified along the trace which require special attention. Measurements carried out on existing A2 shows that the noise level, specially during the peak hour traffic conditions, is excessive.

Drainage, flooding and soil erosion are the physical processes of major concern in the project area. Kaluganga, Bentotaganga, Ginganga and Polwattu Ganga are the four major rivers crossing the proposed highway trace. The general drainage pattern is from the central hills towards the sea across the proposed trace. As such, the major drainages which cross the proposed highway trace continue to flow across the existing A2 and the Rail track. However there is a significant number of drainage paths that cross the proposed trace from the seaside towards the central hills, to subsequently join a major drainage path which drains towards the West, Southwest or South. The watershed boundaries pertaining to the natural drainages across the proposed trace are identified on a 1:50,000 topographic map and given in the Appendix, and the extents of each drainage area and details of the four major catchments are tabulated. Flooding is a frequent occurrence in majority of the project area. The people of the area are very concerned about the possible worsening of the situation by the construction of the highway on embankment. Results of a flood survey carried out is given in the report. There are several Irrigation and Flood Protection schemes in the project area. The important schemes are Ginganga, Nilwala Ganga, Bentaraganga right bank and Ranthotuwila Schemes.

Locations of drainage structures necessary to convey the surface run off, crossing points of all identified irrigation and drainage canals, and other irrigation structures in the area are marked on 1:50,000 topographic maps.

With respect to the biological environment, the habitats encountered by the expressway may be categorized as man made habitats (home gardens, paddy fields and plantations) and natural or semi-natural habitats (marshland, rivers, streams, scrubland or forest). In the former category, the natural vegetation has been cleared and replaced with either mixed vegetation as in homestead gardens or monocultures as in plantations. Volunteer species also occur amongst cultivated plants. In the latter category too, the habitats have been subject to the impact of human activities to varying extents but nevertheless they retain some degree of naturalness. These habitats, both man-made and natural, alternate randomly with each other and recur along the trace. Each type of habitat has its own characteristic flora and associated fauna wherever it occurs along the trace. The vegetation of each habitat sampled in this study may be considered to be representative of the particular habitat type.

Vegetation profiles of each type of habitat (except scrublands and forests) was prepared using data collected on field studies. None of the species found in paddy fields and marshlands, home gardens, rubber, tea and other plantation were found to be endemic, rare or endangered. On the other hand, the forests in the wet zone are known to be high in endemicity and genetic diversity, and several such species were identified in field studies. However, the proposed trace does not make incursions into natural forests, although a few forest patches were found in the 1 km belt that was studied.

Although the aquatic vegetation found on the river banks near the trace included several endemic species, only one species listed as "threatened" was found.

Fauna being much less visible than flora, much of the information on them was gathered from literature. Lists of species most likely to be present within a 1 km belt along the highway trace were compiled by persons having specialized knowledge of various animal groups based on field observation, backed by published and unpublished reports and personal communications. Animals living in the disturbed habitats are used to human presence and activities and possess a high degree of adaptability to changes.

A large number of mammals, amphibians, birds, reptiles, fish and invertebrate species found in the 1 km belt studied are endemic, and/or threatened. However, most of these species are found in other parts of the country and the region.

The social environment in the project area was studied by a team of 3 consultants, who are working and/or residing in the southern area.

The present land use pattern in the project area is greatly influenced by the topography of the area, and can be broadly classified into home gardens, tea, rubber and small scale mixed crop plantation, paddy fields (abandoned and cultivable), marshlands, water ways and scrub jungle. Agricultural lands with 61.9% of area coverage, is the dominant land use, followed by 31.2% of residential lands, 5.9% forest lands and 1.0% wet lands when the Road Trace Zone, consisting of the 15 DSD is considered. Throughout the trace, forest land could be found in Jambugahahena in Bentota DSD and Kandewatte Gedara, Kalupahana Kanda and Wawulugala hermitage in Walahanduwa and Habaraduwa DSD's. Two forest reserves of Kalugalahela and Kudagala in Habaraduwa DSD have been encroached at present. Several state lands of small extent have been distributed under village expansion schemes.

4 school buildings and 1 cemetery were also found within the 120 m (400 ft) corridor. Taking the whole region, the population densities range from 5 to 200 per ha. The settlement pattern

of the area is influenced by the availability of educational services, infrastructure networks, and other services like electricity and water supply. It is found that the densities are much higher along the existing A2 corridor than the proposed road trace corridor.

The social structure of the project area is that of predominantly rural environment, where the economy is predominantly agricultural. There are also a few townships which also cater to the rural community. The majority of people living in the project area are small agricultural producers belonging to traditional families who have been living in their ancestral lands. These families have an extended network of kinship relationships based on consanguinity or matrimony. Therefore, such families have to be considered as aggregate social units sharing common interest for their survival and progress. Some of the people are in fact not migrants but a group of settlers from neighboring villages. These families are recipients of crown lands distributed under village expansion schemes implemented in the sixties. A few migrant families are within the project area, especially in the GN Divisions (GND) which are in close proximity to urban centres e.g. Vidagama and Kolamediriya in the Bandaragama DSD; Mattegoda in the Homagama DSD and Dodangoda - North- East in the Dodangoda DSD.

A heterogeneity based on caste, ethnicity or religion is hardly found in these communities, but inequality based on the distribution of income/wealth is very significant in a large number of locations. Caste conflict was in existence in only one GND within the Matugama DSD.

The ethnic and religious composition of the population in the project area was found to be consistently a majority Sinhala/Buddhist one with less than 5% of the population belonging to other ethnic groups and religions. Out of 81 GND, 54 were found to be completely Sinhalese. The housing boom witnessed in the country in the early 1980's has made an influence in the housing development in the project area, and about 50% of the existing houses have been built within the last two decades. This process of housing development is still continuing, and most houses are equipped with modern amenities. Investment on a permanent house is of top priority in the family budget.

Education, health and transport and other infrastructure facilities available to the residents were studied, and found to be sufficient on average, for another 10 years, if there is no significant change in the existing trend of population growth. However, in places in close proximity to urban centres, a higher population growth rate can be expected, and hence the available infrastructure facilities will become inadequate in the near future.

The life style of people in the project area is simple and it is not far different from what could be seen in any peasant community in the rest of the country. The most valuable properties for them are the land and the house. For a majority, land is the means of survival and house is the symbol of stability. A substantial amount of family labour and income have been invested on the existing houses. The market dependence is high in almost every family given that cash crops such as tea, rubber and cinnamon provide the main source of income. However, a part of the food requirements of a majority of families is met by subsistence agriculture.

Data pertaining to employment within the project area reveals that nearly a third of the population is employed in the agricultural sector. Other forms of employment in the area are state or private sector employment, self employment (craftsmen), small scale business activities and casual labour.

The major crops grown in the project area are tea, rubber, coconut and paddy, rubber and paddy being the largest in extent.

Although coconut is the least cultivated major crop, it is gaining importance in the southern end of the project area, probably due to the rising price of coconuts and oil, and poor yields of rubber.

Since rice is the staple food of Sri Lanka, paddy cultivation is wide spread throughout the project area. It is mostly a rainfed small holding crop, and average yield per hectare varies considerably among the plots, mainly depending on the water regime.

The least productive paddy lands are found in the Baddegama and Matara DSD, close to Ginganga and Nilwalaganga flood plains. Some of these paddy lands have been abandoned by the farmers, due to infertility caused by increased salinity of the soil high in Iron and Sulphur (Iron pyrite) which has under gone oxidation due to improved drainage. The flood protection bunds have created this problem, as the soil which used to get washed off regularly with the floods do not get that opportunity now, and also the canals dug by the side of the bund have been instrumental in lowering the water table in the former marsh areas. Apart from this, a large number of paddy fields which are subject to floods are cultivated only during the Maha season.

Land tenure is a complex issue in paddy cultivation as Thattu Maru, Katti Maru and various forms of Ande exists in the different areas.

Tourism being an important economic activity in the southern coastal area, the present situation of the tourism industry was also studied. A large majority of the tourists who visit the country are holidaying, and therefore, are not concerned about travel time savings. The most interesting place to visit is the Sri Lankan country side and many of them travel by public transport. Majority of the tourists interviewed at Hikkaduwa were satisfied with the present transportation system, and therefore only about 35% of the tourist traffic could be expected to be diverted from existing A2 to the proposed highway.

The variation of property values within the zone was studied, using a model developed for this purpose. Out of a large number of variables initially used, it was found that the important variables that determined the property values were availability of water, telephone facilities, distance to the railway station, police station, industrial cities and schools, as well as the quality of life.

Aesthetically, the existing site could be termed to possess rural, rustic, simple, unsophisticated, semi urban qualities and average or low scenic value when compared to more picturesque parts of Sri Lanka. It has no recorded ancient ruins, but a large number of temples and other places of worship are present in the project area, a few of which are found to be over 500 years old.

1.7 Anticipated Impacts of the Proposed Project

The most significant impacts anticipated from the project on the physical environment are on the construction materials, surface and ground water quality, air quality, noise level, hydrology/drainage and erosion/siltation. The activities that are likely to cause significant

damage are material exploitation, site clearing, cut and fill, reclamation of land, drainage, disposal of spoil, construction of bridges and culverts, pesticide use in soft landscaping and vegetation cover, re-settlement of the dislocated people and in planned and unplanned development during the operation stage. Thus it can be seen that most of the impacts are caused by construction related activities, and can be avoided or mitigated by taking proper action during the planning, design and construction stage.

The highway, being 127 km long and approximately 45 m wide, requires enormous amounts of construction materials. However the highway construction material of environmental sensitivity is sand, as exploitation of sand from river beds has led to environmental problems already. Since surface water is used for public water supplies, and ground water is very commonly used for domestic purposes in majority of houses in the project area, quality of water is a sensitive issue, and impacts on them will be significant.

Various activities during construction such as operation and maintenance of construction equipment, application of pesticides and herbicides in turfing and landscaping operations, spillage of construction materials etc. will lead to pollution of waterways if not properly controlled. During the operation phase, the most significant impacts will arise from accidents, particularly of those involving vehicles transporting hazardous materials and petroleum products, and from service areas and secondary development due to the highway.

The air quality and noise levels will have temporary impacts during the construction phase, due to operation of construction machines, dust etc. and long term impacts during the operation phase due to traffic flow. However, calculations show that primary pollutant concentrations other than particulate matter will not exceed the stipulated ambient air quality standards even in year 2026 (using predicted traffic volumes given in the Economic Feasibility Study Report), and therefore mitigation action is required for reduction of only particulate matter in vehicular emissions. On the other hand, excessive noise levels will be reached in certain sections of the highway from the year 2001, and mitigatory action will have to be planned for noise control.

Out of all impacts on the physical environment, the most significant is the anticipated impact on flooding and drainage. Approximately 40% of the proposed trace lies along paddy lands and marshes, which act as flood retention areas. The volume of such flood retention areas will be significantly reduced due to filling up for the highway, frontage roads, service areas, and also secondary development activities, particularly in narrow flood plains. Construction of bridges and culverts will constrict the flow paths of flood waters, and hence a significant impact will be felt on the streamflow movement in major rivers. Disposal of material could cause obstructions to drainage paths if not properly located. These will also increase the number of days that land will be under water during flooding occurrences.

Another significant impact that could result from the construction of the highway on embankment in the flood plains is the deterioration of soil quality due to the absence of the flushing action of the flood waters. The soil may become saline and/or acid sulphur, such as found in the Nilwala and Gin Ganga flood protection schemes. This impact will be of major significance on fertile paddy lands that are cultivated twice an year, and those that depend on flood waters for fertilizer.

Considering the impacts of the project on the ecological environment, loss of scrub jungle and marshland habitats may have some impacts on the animals living in these areas. However, the

more significant impact of the construction of the highway on animals is the division of small populations living in their natural habitat, by the highway, which will endanger their survival. Noise and vibrations from construction machinery and traffic on the road may have a scaring effect on birds and mammals initially, but they are known to get accustomed to noise as long as the intensity of the noise does not damage their auditory organs.

Aesthetically, the project itself may cause negative or positive impacts, depending on the design, construction and attention to detail. In addition, during construction activities damage to vegetation, loss of topsoil, erosion of sites due to excavation, dust, noise and vibration, and hindrance to proper drainage could be anticipated. During the operation of the highway, encroachment on historic and religious places, noise, visual intrusion by structures and billboards that may come up by the roadside, and disturbance to the character and environmental quality of the project area would be some of the anticipated impacts.

There will be both positive and negative impacts of the project on the land use. The increased mobility will give the people an opportunity of choosing the route, and will lead to stabilization of land prices in the coastal belt.

Due to the improved accessibility at locations near the proposed interchanges, large extents of presently undeveloped lands may develop into settlements, industries tourist areas etc. These would in turn provide employment to the rural population, and an improvement in the rural economy will result. On the other hand, there will be negative impacts on the agricultural sector, by way of loss of agricultural labour and land, which will lead to marginalization of agricultural land. However, if unplanned development is allowed to take place in the project area, it would result in haphazard development leading to numerous problems.

Another very important impact of the proposed project on the land use pattern in the area is relocation of the people and establishments displaced by the project. It is estimated that there are 2088 developed properties affected by the project when considering the 120m wide corridor, out of which 1791 units are residential. However, the estimated number of houses within the 60m road trace is 973. A survey conducted among the people who will be displaced showed that 38% would prefer to be relocated within the present village, and 37% would agree to move to close by areas, while 12% would agree to move to any suitable area, and balance 15% are not willing to be relocated. Looking at the social environment, the major negative impacts of the project will be severance of communities and breaking up of the social structure due to the dislocation of the people residing on land that will be acquired for the highway. This is specially difficult for the elderly and handicapped people, who depend upon their neighbouring relatives for their survival. Being rural villagers, all the communities right along the trace from Bandaragama to Matara are closely knit, with a high degree of interdependence among the families. Moving some of the families out of this system is a major issue. In addition, the loss of a house is another main issue for most families, the value of the house being several fold more than the market value, due to the added sentimental value.

Planned development in the project area will result in more job opportunities and general improvement of the living standard for the people of the project area. However, these may also result in migration and settlement of people from other parts of the country, which may result in social conflicts. If proper sanitary and waste disposal facilities are not provided for the work camps and newly settled people, the Public Health of the project area will be affected. Another cause for concern is the abandoned borrow pits and quarries, in which water may collect and lead to mosquito breeding with the associated water related diseases.

A general improvement in the infrastructure facilities such as water and electricity supply, telecommunication as well as health and education services can be anticipated in the project area, particularly near the interchanges.

There will be both positive and negative impacts on the agriculture and fisheries sectors. Due to speeding of transport, reducing wastage during transport, opening up of new markets for the produce, timely availability of inputs etc., there will be positive impacts. On the other hand, due to the loss of agricultural land, movement of agricultural labour force into service sector employment, and marginalization of agricultural land, there will be negative impacts on agriculture.

Considering employment, agricultural employment being the major sector, will have negative impacts due to the reasons mentioned above. In the other employment categories, there are no significant negative impacts anticipated, except on individual basis. When those who are casual labourers are displaced, they will be confronted with difficulty in finding employment, unless they are relocated in the same neighbourhood. On the other hand, major positive impacts may be anticipated in construction related employment, during the construction phase of the project, Employment opportunities will be available during the operation stage of the project too, in road maintenance and services sector.

Land value in the project area will have a positive impact, the study showing that the highest increase will be at the centre of the interchange points, decreasing outwards from there. The rate of increase of property values will depend on the rate of urbanization and development in the respective areas.

The proposed project may have positive impacts on tourism development if tourism related facilities are provided along with the construction of the highway.

In respect of expanding the industrial and agricultural base of the country and the increased interest in developing the southern province of the country (which was neglected during the past few decades by the previous governments), the proposed highway will be of paramount importance in providing the necessary impetus for investment in large scale industries including those which are agro-based. Increased investment and industrial development will also demand more labour and, the southern youth will be offered with more employment opportunities. Although quantification of benefits is rather difficult at this stage, one cannot forget the Multiplier-Accelerator effects of investments which yield significant social benefits.

1.8 Mitigation Measures:

The major adverse impact of the proposed project on people is the destruction of a large number of properties and severance and the breakup of closely linked communities. According to findings of a sample survey carried out by the sociologist in the EIA team, a majority of the affected people did not object strongly to the construction of the highway.

The opinions given by the people in the sample with regard to the construction of the highway are given in Table 1-1.

Table 1-1 : Opinions expressed by people regarding the construction of the project

Opinion	Percentage of families
Very good	28
Good	40
Undecided	22
Not very favourable	09
Totally unfavourable	01
Total	100

Source: Sample survey 1996

According to these opinions it can be seen that the response of the people for the project is emphatic and positive. A negative response was given by only 10% of families in the sample.

However, although the response to the project by a majority of residents in the area is positive, potential adverse impacts should be mitigated by measures which are acceptable to the people affected.

At the meetings the EIA Team held at the DS Offices in the project area, the villagers and people's representatives suggested various alternative routes to the road trace, which, in their opinions would minimize the damage to the environment, particularly to the residential buildings. These suggestions are listed in section 1.3.4, and briefly described in Chapter 3 (section 3.4.4). The Environmental impacts of acquisition of dwelling houses is much more difficult to be mitigated than those of loss of paddy lands and drainage problems created by the construction of the highway on paddy lands or other cultivations. Some of the social problems associated with these petitions are described in Chapter 6 under social impacts. The EIA team is of opinion that these requests for shifting of the trace are acceded to by the RDA, provided there are no technical problems, such as obtaining the correct alignment required to achieve the design speed of the highway, excessive amounts of cut or fill etc..

The requirement of very large quantities of sand for the construction of the highway will be unavoidable. However, river sand use must be limited to only activities that cannot be carried out with sea sand using best available technology. River sand mining should be carried out under strict supervision from only permitted sites. For all other uses, sea sand pumped from off- shore should be used. To avoid impacts on the marine environment, the guidelines for sand removal within the coastal zone specified by the Coast Conservation Department (CCD) should be strictly followed in mining of off-shore sea sand required for the construction.

The following are mitigatory actions that have to be carried out by the contractors, and as such, it is best to include them in the tender documents, so that there will be no conflicts with the contractors later on:

(a) Borrow areas should be left in a form that is environmentally acceptable, flat or hilly areas turfed or covered with vegetation, depressions landscaped into ponds or used for spoil disposal and covered with soil and landscaped.

(b) Spreading of dust, particularly in built up areas and tea plantations, during the construction phase, while exploitation and transport of construction material, cut and fill operations, and other construction processes should be minimized by the best internationally available methods at the time of construction.

(c) Labour forces should be provided with proper sanitation and waste disposal facilities, so that environmental pollution is avoided.

(d) Noise should be controlled during construction activities, limiting the high noise generating activities to the daytime only, and equipment with best internationally available noise control measures should be used for all construction related activities.

(e) All exposed earth surfaces should be covered with turfing or vegetation to prevent soil erosion. Top soil should be removed and stored for this purpose.

(f) If access to work places, agricultural lands, markets, schools etc. is blocked during the construction period, the people should be provided with satisfactory temporary access during those periods.

Several other mitigatory measures should be incorporated into the detailed design of the highway itself. These include the improvement of the cross section to improve the safety and security aspects, detailed hydrological studies to decide on the correct drainage requirements and flood openings, consideration of increasing the design flood return period from 25 years to about 50 years to improve the reliability of service of the highway and to reduce occurrence of flooding due to the road embankment, and aesthetic design of structures to merge into the existing rustic environment.

There are some other mitigatory measures, which need to be carried out as special activities. The relocation of the people whose houses are affected by the project, and payment of compensation to those whose properties are acquired for the project are two such activities. Important points to be considered in these activities, as suggested by the sociologist, socio-economist and the land use planner of the EIA team, based on field surveys, analysis and scoping meetings conducted by the EIA team, are given in the report.

Some of the main considerations are:

- Since the economic loss to society from demolition of structures exceeds that from all future net agricultural income foregone, it is advantageous to preserve structures as far as possible. Whenever acquisition of agricultural land can be substituted for demolition of structures, such a strategy would enhance the social benefits of the project.

- Delays in informing the people about the definite acquisition of their land should be minimized, as the indecision leads to numerous hardships for the people.

- When acquiring residential land and houses, alternative land should be provided together with sufficient compensation to enable families to build and move into new houses.

- When providing alternative land, every attempt should be made to give land close to the acquired land, preferably in the same GND, in order to preserve the social structure of the village.

- If such relocation land is not available, land acquired near the interchanges for development should be offered to the displaced people.

- In payment of compensation for acquired land with structures, particularly dwelling houses, the minimum payment should be the market value. However, this will not compensate for costs associated with community severance, migration, additional travel costs, search costs etc. A realistic value of the factors by which the market value has to be adjusted needs to be established after detailed study taking the above factors into consideration.

- Compensation for non-residential land should be paid on the basis of the present market value of the property. In estimating the value of cash crops such as tea, rubber and coconut, the potential income within the next 10 years should be taken into account.

- The payment of compensation should not be delayed for more than a year after moving into the alternative land.

- In the case of cultivated paddy land coming under the tenant farmer system, compensation should be paid to both the land owner and the tenant farmer, as practiced at present.

- Those whose livelihood was affected by displacement should be relocated at places where they could find employment, or be given preference when employing for the construction activities.

Another such activity is the planned development of the project area, in order to mitigate the impacts of haphazard development. This can be carried out by vesting an area of land including the corridor from the beach to 1 km east of the centre line of the highway, and the proposed townships east of the highway under the control of the Urban Development Authority (UDA) or any other designated body. This would enable planning of the land use of the newly opened up areas by applying zoning, development planning standards, infrastructure standards, urban design standards, building standards etc. With planned development, projects will be prioritized, and a balanced development will take place.

Finally, there are some other impacts where the degree of mitigation to be applied depends on social, economic and environmental factors. An example is the mitigation of possible loss of paddy cultivations by salinization and acidification of soil, as experienced in the Nilwala Ganga and Gin Ganga Flood Protection Schemes. Approximately 40% of the proposed trace is located on paddy lands and marshlands, which are subjected to frequent flooding. The paddy cultivations depend on the floods for fertilizer, as well as flushing out of excessive salt build up, and the high water table prevents oxidation of the iron pyrites to produce sulphuric acid. If the highway is constructed on an embankment, even though sufficient openings are provided for the discharge of flood waters, it will not have the same flushing action on the soil. Thus, the possibility is there for the soil to become unsuitable for paddy cultivation. On the other hand, if this is to be mitigated, the stretch of highway located in the paddy fields will have to be elevated above ground, to accommodate the free flow of flood waters. A decision has to be taken whether the investment on such construction to save the total extent of paddy lands is justified, or whether a part of the paddy cultivation is traded off, leaving only the fertile lands for cultivation, and paying the owners compensation and acquiring the land for development, creating sufficient flood detention ponds to compensate for the loss of retention areas.

1.9 Further Studies Needed

Following areas were identified in the EIA study as requiring further study. These studies should be done at the detailed design stage of the project.

* Development of a resettlement plan for the displaced people.
* Determination of compensation payable to the displaced persons, and acquired houses, agricultural lands and business premises.
* Hydrological studies to determine the most suitable design flood return period for the highway and structures.
* Decision on the sections of highway that needs to be elevated and those that can be on embankment, in retention areas.
* Off shore sand mining activity - location and methodology.

Some guidelines on the carrying out of the above studies are given in the report. However, sufficient details of the proposed project are not available at the present stage to carry out these studies.

1.10 Monitoring Program

In order to ensure that the anticipated impacts are not underestimated, or any unanticipated impacts are presenting during the implementation of the proposed project, a monitoring plan is given in the report where the indicators of changes in the environment are identified, and methodology of monitoring is proposed. Some of the main items in the proposed monitoring plan are:

- The establishment of a monitoring committee by the CEA, consisting of members from organizations responsible for the natural and social environment of the project area, as listed in Chapter 8.

- The cost of monitoring, including holding of monitoring committee meetings should be borne by the project proponent.

- Some of the indicators to be monitored are:

  * the air, surface water and ground water quality and noise level within the project area,
  * frequency of flooding, areas of inundation and duration of flood retention in developed areas
  * occurrence of water borne and mosquito related diseases in the project area
  * variations in agricultural productivity
  * exploitation of sea sand and river sand for construction activities etc.

1.11 Recommendation

Extended cost benefit analysis was carried out for the proposed project by internalizing the environmental impacts that can be valued using latest available valuation techniques.

Extended Benefit/Cost Ratios were calculated for the following 3 scenarios:

1. Highway built on embankment over the entire length (allowing for drainage only) and acquisition of all paddy/marsh lands.
2. Highway built elevated over entire length of marshlands and paddy fields.
3. Elevation of half the length of highway along marshlands and paddy fields.

CRITERIA	EXTENDED B/C	NPV (Rs m)	EIRR (%)
Scenario 1 Highway on embankment	5.32	71021	22.6
Scenario 2 Elevated highway	1.57	31558	12.7
Scenario 3 Highway elevated over 50% of retention areas.	2.45	51702	15.8

NPV - Net Present Value

The results showed that even in Scenario 2, the project can be justified, as the EIRR is higher than the opportunity cost of capital, which is 10% according to the National Planning Department. The more likely situation, however, would be scenario 3, with 50% of the length of highway on retention areas being elevated above ground to avoid threat of flooding impact.

The sensitivity analysis carried out to test the response of the model to uncertainties in terms of changes in costs and benefits showed that 25% increase in all costs and 25% decrease in all benefits would still yield an EIRR of 12.3% under drainage scenario 3, while this value fell just below opportunity cost of capital (to 9.6%) under drainage scenario 2.

Thus it can be seen that the Alternative 4, the proposed project with mitigation is the project alternative with the highest social and economic benefit to the country which can achieve the stated objectives, and as such, the recommendation of the EIA study team is the implementation of the proposed project with mitigation measures and monitoring, as described in the report.

4. Field Work

Field Studies were carried out to collect information and data pertaining to the following areas along the proposed trace and the existing Colombo-Galle- Matara Road and Railway Corridor

(a) Water quality, air quality and ambient noise level measurements
(b) Flood information, static ground water level measurements, earth stability information
(c) Socio-economic data
(d) Land Use Data
(e) Social Statistics
(f) Data on existing places of archaeological and religious interest.
(g) Data on vegetation, animals, birds and aquatic life.

ANNEX II

LIST OF PREPARERS

1. Team Leader : Prof. (Mrs.) Niranjanie Ratnayake
Date of Birth : 06.10.1951
Educational Qualifications: B Sc. Eng. (Hons)(Cey) - 1974, M.Eng(Wales) - 1978
Professional Qualifications: Chartered Engineer, MIE(SL) - 1987
Present Position: Associate Professor in Civil Engineering, Department. of Civil Engineering, University of Moratuwa.
Experience: 22 years of University teaching, research, and consultancy in Environmental Engineering and Environmental Impact Assessment.
17 papers and publications, 10 consultancy assignments
Areas of Specialization: Environmental Engineering, Environmental Impact Assessment

2. Ecologist : Dr. I.V.S. Fernando
Date of Birth : 02.11.1940
Educational Qualifications: B.Sc.(Cey) - 1967 (Zoology Special), DIC, M.Sc. (Lond) -1969, Ph.D. (Manchester) - 1975
Present Position: Senior Lecturer in Zoology, University of Kelaniya
Experience: 26 Years of University Teaching
Areas of Specialization: Entomology and Ecology

3. Hydrology and Drainage Specialist : Dr. N.T.S. Wijesekera
Date of Birth : 19.04.1955
Educational Qualifications: B.Sc. Eng. (Sri Lanka) - 1979, PG Dip in Hydraulic Eng. (Moratuwa) - 1987, M. Eng. (Tokyo)- 1990., D.Eng. (Tokyo) - 1993
Professional Qualifications: Chartered Engineer, MIE(SL) - 1983, MICE (London) - 1983
Present Position: Senior Lecturer in Civil Engineering, University of Moratuwa
Experience: 14 Years as Project Engineer, Design Engineer, Senior Design Engineer and Senior Engineer (contracts), Mahaweli Engineering and Construction Agency, Mahaweli Authority of Sri Lanka.
3 Years of University teaching, research and consultancy
9 Publications and Presentations.
Areas of Specialization: Water Resources Engineering, Irrigation Engineering

4. Sociologist : Mr. R. M. Ranaweera Banda
Date of Birth : 22.12.1952
Educational Qualifications: B.A. (Hons) (Peradeniya) in Sociology - 1977, M.A. in Sociology (Colombo) - 1988
Present Position: Senior Lecturer in Sociology, Department of History and Sociology, University of Ruhuna
Experience: 7 years as Research Officer and Senior Research Officer at Marga Institute, Colombo
10 years of University teaching and research
19 Publications and Presentations.
Area of Specialization : Sociology