Initial Environmental Examination

September 2014

SRI: Integrated Road Investment Program – Project 2

North Western Province

Prepared by Environmental and Social Development Division, Road Development Authority, Ministry of Highways, Ports and Shipping for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 12 September 2014)

Currency unit	–	Sri Lanka rupee (SLRe/SLRs)
SLRe1.00	=	$ 0.00767
$1.00	=	SLR 130.300

ABBREVIATIONS

ABC	-	Aggregate Base Course
AC	-	Asphalt Concrete
ADB	-	Asian Development Bank
CBO	-	Community Based Organizations
CEA	-	Central Environmental Authority
DoF	-	Department of Forest
DSDs	-	Divisional Secretary Divisions
DWLC	-	Department of Wild Life Conservation
ECOP	-	Environmental Code of Practice
EIA	-	Environmental Impact Assessment
EMoP	-	Environmental Monitoring Plan
EMP	-	Environmental Management Plan
EPL	-	Environmental Protection License
ESDD	-	Environmental and Social Development Division
FBO	-	Farmer Based Organizations
GoSL	-	Government of Sri Lanka
GRC	-	Grievance Redress Committee
GRM	-	Grievance Redress Mechanism
GSMB	-	Geological Survey and Mines Bureau
IEE	-	Initial Environmental Examination
LAA	-	Land Acquisition Act
MER	-	Manage Elephant Range
MOHPS	-	Ministry of Highways, Ports and Shipping
NAAQS	-	National Ambient Air Quality Standards
NBRO	-	National Building Research Organization
NEA	-	National Environmental Act
NWS&DB	-	National Water Supply and Drainage Board
OPRC	-	Output and Performance - based Road Contract
PIC	-	Project Implementation Consultant
PIU	-	Project Implementation Unit
PRDA	-	Provincial Road Development Authority
PS	-	Pradeshiya Sabha
RDA	-	Road Development Authority
ROW	-	Right of Way
TOR	-	Terms of Reference

NOTE

In this report, "$" refers to US dollars unless otherwise stated.

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EXECUTIVE SUMMARY

1. The Integrated Investment Program (iROAD) is proposed by the Road Development Authority (RDA) under Ministry of Highways, Ports and Shipping (MOHPS) to improve transport connectivity between rural communities and socioeconomic centers. iROAD intends to connect 1,000 Grama Niladari Divisions1 (GNDs) throughout the country as rural hubs and link them to trunk road network to all weather standards, and operating a sustainable trunk road network of at least fair condition. The iROAD will be financed by the Asian Development Bank (ADB) under a Multi tranche Financing Facility (MFF) to have four tranches implemented over ten years. Tranche 2 covers: Sabaragamuwa, Kaluthara District of Western Province, North Western, Central, and North Central Provinces.

2. Roads under Tranche II are located in Puthlam and Kurunegala districts of North Western Province, Kandy, Matale and NuwaraEliya districts of Central Province, Anuradhapura and Polonnaruwa districts of North Central Province, Rathnepura and Kagella districts of North SabaragamuwaProvince and Kaluthara district of Western Province. In North Western Province, iRoad program will develop a total of 52 provincial and 62 rural roads with a total length of 760.48km. Out of this, 524.88km and 726.79 km rural roads are located within Kurunegala and Puthlam district. These roads have been selected for financing based on consultations with MOHPS, local authorities, and parliamentarians and a screening criteria on existing road conditions and development needs.

3. The proposed road upgrading will include: improvement and maintenance to all weather standards with single lanes facility, surfacing the existing pavement with asphalt concrete (AC) if the present surface is weak, repairing or reconstructing damaged culverts, introducing earth drains for all road sections and built up drains where necessary, and removing any irregularities on the existing vertical profile.

4. The Program was classified as environmental category B based on the ADB Rapid Environmental Assessment checklist for roads and highways. This Initial Environmental Examination (IEE) report was prepared consistent with the ADB Safeguard Policy Statement (SPS) 2009 and the Environmental Safeguards Compliance Manual of RDA. Key national environmental laws and regulations that guided the environmental assessment includes: National Environment Act (NEA) No. 47; Coast Conservation Act No 57 of 1981, National environmental protection and quality regulations; National Environmental (Protection and Quality) Regulation No. 1 of 1990; National Environmental (Ambient Air Quality) Regulations, 1994; National Environmental (Noise Control) Regulations No.1 of 1996; Fauna and Flora Protection Act (FFPO) No.2 of 1937; Forest Act No. 34 of 1951; Felling of Trees Control Act No. 9 of 1951; Soil Conservation Act, No. 25 of 1951; Explosives Act No. 36 of 1976; Buddhist Temporalities Ordinance No. 19 of 1931; and Antiquities Ordinance No. 9 of 1940, among others.

5. As provided in the EARF, no road under Tranche 2 is located inside strict national reserve. There will be no road widening inside legally protected or critical habitat. All project roads adjacent to protected or eco-sensitive areas are limited to existing RoW. Most environmental impacts attributed to the project and related activities are short-term, site-specific, and easily mitigated. Close coordination with the Department of Wildlife Conservation, Forest Department, and ADB were made in the screening of the roads to ensure the project will cause not significant adverse environmental impacts that will trigger an ADB environment “Category A” tranche or Prescribed Project classification consistent with domestic environmental laws and regulations

6. **Transect Walk.** In developing rural roads, the community participation and consultation has been identified as important. For this project, the participation of communities started at the very initial stage of the project through the transect walk. Transect walks are organized in close coordination with the Grama Niladari concerned at village level and Divisional Secretary at divisional level. In doing this, the project team and key informants conduct a walk along the road, to listen, to identify issues, and conditions and to ask questions to identify possible solutions. The field assessment was followed by preparation of Environmental Checklist (EC) for each candidate rural road and the IEE was prepared for the particular province while summarizing findings of each EC

7. **Public consultation and disclosure**. Consultations with stakeholders during the environmental examination involved local communities and government agencies like the Department of Wildlife Conservation (DWLC). During project implementation, signboards with project information detailing the nature of construction works, road length, construction period, name of contractor, contract sum and contact information for reporting complaints or grievances will be posted in three languages (Sinhala, Tamil and English) for the rural roads. Annual environmental monitoring reports will be prepared per province and submitted to ADB for disclosure on the ADB website.

A. Physical Environment

8. Based on major climatic zones of the country, Puthlam District falls in to Law country – Dry and Intermediate zones while Kurunegala District falls within low country Wet, Dry and Intermediate zones. Whereas roads in Puthlam District are located within Low country –Dry and Intermediate zones and the roads in Kurunegalaare located within Low country wet, Dry and Intermediate zones. The climatic environment of the project area is further categorized into agro-ecological zones[1](AEZ) which are categorized based on climate, soil, natural vegetation and land use pattern of an area. Majority of the roads in Puthlam are located in AEZs IL1, DL1, DL5 and in Kurunegalaare located in IL1, IL2 and DL1.

9. Rainfall pattern of North Western Province is, the south part of the province which comes partly under the wet zone, receives a well-distributed rainfall from both south west and north east monsoon while northern drier part receive rainfall only from the north-east monsoons which brings comparatively lower rainfall to the country. Kurunegala District receives the highest rain fall during the months of October to November and again in April to May. Kurunegala district has an average temperature of 27.5°C and during October to February it is 25^0 C. Puthlam district receives much of its rainfall from the south western monsoons(during the months of September to January) which the southern part of the district also receives rainfall from the north eastern monsoons (March to June). The Puthlam district experiences the minimum temperature in the range of 20.2^0 C - 26.5^0 C while the maximum temperature in the range of 30.0^0 C –34.8^0 C.

10. **Hydrology.** Seven roads in Puthlam district namely road IDs1, 4,12,14,16,18,20,44 are crossing streams. Wetlands and water bodies in the NWP covered an area of 4,670ha and 38.110ha respectively and there are 94 reservoirs within the Districts of Puthlam and

[1]The AEZ nomenclature is alphanumeric where the first upper case letter denotes the climatic condition (W-wet, I-intermediate, D-dry), the second upper case letter indicates elevation (L-low, M-medium, U-upper), the first number describes the moisture regime, and the last lower case letter indicates the rainfall distribution and other environmental factors where the decree of wetness degrades from letters *a* to *f* .

Kurunegala. Out of the 16 major rivers of Sri Lanka, five are located in the NWP with Deduruoya as the largest. In addition there are five other rivers in NWP. Out of these ten rivers, eight are located within the NWP and the other two are in the provincial boundaries.

11. **Air Quality and Noise.** Since the selected road sections are mostly located within rural areas, major sources of air pollution are not present. The general air quality in the project area is excellent except along unpaved roads and major intersections where temporary deterioration occurs. According to Schedules I and II of National environmental (Noise Control) regulations No.1 1996 (924/12), the study area belongs to “Low noise area”

12. **Natural Disasters.** Based on the landslide hazardous zoning maps of National Building Research Organization (NBRO), there is no any evidence of the areas that are susceptible to landslides in both districts.

B. Ecological Environment

13. The protected are comes under the direct control of Department of Wildlife and Conservation has only three strict nature reserves and none of them found in the North Western province. Out of 14 declared national Parks (Block 1, 2, 5) come under the Puthlam district. Five Sanctuaries have been located in the North Western province which includes the Bar Reef Marine, Kahalla-Pallekele, KimbulwanaOya, Anawilundawa and Tabbowa. The land area designed as Forest Reserves in NWP comes under the direct management of the forest Department while a large extent of land is administered by the DWLC Sri Lanka.

C. Demographic Characteristics

14. **Population and population density.** The Department of Census and Statistics estimated mid-year population of Kurunegala district in 2012 at 1,610,299persons with775,061 males and 835,234 females. During the same period, estimated mid-year population of Puthlam district was759,776 In Kurunegala district, population density is 348 persons per square kilometer while in Puthlam it is 264.

15. **Ethnicity**. Majority of population in Kurunegala (91.4%) and Puthlam (73.6%) districts are Sinhalese. Muslims are the second majority population in Puthlam..

16. **Distribution**. Majority of the population lived in rural areas in Kurunegala (97.5%) and Puthlam (90.5%). Among the 2 project districts Puthlamdistrict has the highest proportion of urban population (9.3%).

17. **Economic activities**. The 2012 labor force survey revealed agriculture is the prominent economic activity employing majority of workforce in Nuwara Eliya (67.4%) and Matale (43%) districts, while majority of the workforce is employed in services sector (50.5%) in Kandy district.

18. **Agriculture**. Agriculture is the prominent economic activity carried out in Kurunegala district. As per the labor force data, in Kurunegala district, 32.6% of the total population is engaged in agricultural sector. Coconut is the main agricultural crop. Coconut is grown as the main commercial crop, while pepper (*Piper nigrum*) and coffee (*Coffea arabics*) are grown as export crops. In addition, fruit crops such as pineapple (*Ananascosmosus*), banana (*Musa x paradisiacal*) and vegetables like tomato (*Lycopersiconesculentum*), bitter gourd (*Momordicacharantia*), pumpkin (*Cucurbita maxima*) are grown as highland crops in Kurunegala.

19. **Livestock**. Livestock farming such as poultry, goats and piggery farming are popular agricultural activities in some areas of Puthlam district and are potentially profitable investment avenues in this district.

20. **Industries**. As per the data from Department of Census and Statistics, 2012; among the 2 project districts, Kurunegala district has the highest proportion of workers engaged in industries (38.9%) followed by Puthlam (29.9%). Furthermore, productions of animal feed, textile weaving, sewing, garment manufacturing, coconut base industries and fruit packing have been identified as potential industries in the district. Majority of the operating industries in the Puttalam district is Fisheries (shrimp farming) and ornamental fishing. There is a well-established tourism industry in the Puthlam district North Western Province.

D. Socioeconomic status

21. **Literacy rate**. As of 2012 Census and Statistics, Kurunegala district shows the highest literacy rate (94.4%) compared to Puthlam (91.1%). Female literacy rate is lower than male literacy rate in all the two districts.

22. **Household income.** As per the 'Household Income and Expenditure Survey - 2009/10' of the Department of Census and Statistics, the monthly mean and median per capita income of Kurunegala district is higher than the Puthlam district.

23. **Poverty.** The poverty headcount index of the two districts (Puthlam and Kurunegal) in North Western province is higher than that of the country poverty headcount index. This higher poverty situation is due to predominance of agriculture based economy and lower base of industrial sector. Over the years from 1990 to 2009/10 a significant decrease of poverty headcount index is seen in all the project districts and at overall province level.

E. Existing Infrastructure facilities

24. **Energy.** Electricity is the main source of energy used for household lighting in the project districts with 84.6%, 84.7% reliance of the households in Kurunegala and Puthlam districts respectively. Kerosene is the second major source accounting for 13.6%, 13.9% of the households in Kurunegala and Puthlam districts respectively.

25. **Drinking water**. Majority of households in Kurunegala district (76.9%) use well water while in Puthlam district about 41.5% households use the same. About 32.2% of household depend on other sources like rural water supply projects, tube wells, bottled water, tank, river, etc. for drinking water in Puthlam district.

26. **Sanitation**. About 88.1% and 85.8% households in Kurunegala and Puthlam districts respectively use private toilets, while 10.5% and 10.7% households respectively in these districts share toilets with other families. Overall, 2.9% households do not use any toilet facility in Puthlam district.

27. **Education**. There are 867 schools in Kurunegala district followed by 348 in Puthlam district. Majority of which are co-education and only 10 exclusive boys and 14 excusive girls schools in the project districts.

F. Anticipated Environmental Impacts and Proposed Mitigation Measures

28. **Pre-construction stage**. Environmental impacts related to project siting in flood and erosion prone areas, and shifting of utilities were addressed. Hydrologic studies allowed the proper design of bridges and culverts to have adequate capacities based on 100- and 50-year flood return periods. Collected data and structural designs were validated by the Irrigation Department in collecting information and checking the adequacy of design, conducting construction operations during dry weather flow are possible mitigation measures. Road sections located in rolling and hilly terrain were identified and screened for susceptibility to erosion and counter measures were designed in consultation with the National Building Research Organization (NBRO). Finally, the need to safely shift electric power and telephone lines, and water supply mains along the ROW were defined for each road project. Detailed inventory, co-ordination with the concerned authorities, and the need for public notification forms part of the detailed EMPs.

29. **Construction phase**. Significant anticipated environmental impacts during construction phase are: (i) increase of local air pollution, noise and vibration from earthworks, pavement improvement operations, quarry operations, operation of hot mix plants, and operation of construction vehicles; (ii) deterioration of surface water quality due to silt runoff, emissions and spoil from labour camps; (iii) landslides; (iv) social and health impacts from labour camps; (v) disruption to access/traffic; (vi) loss of avenue trees; (vii) alteration of hydrology due to siltation of streams and (viii) occupational health and community safety. Principal mitigation measures imbedded in the EMP includes: (i) utilizing least noisy equipment and timing of equipment operation to reduce noise impacts; (ii) sprinkling of water on material storage and handling areas and unpaved road travel to control dust; (iii) installation of silt and oil traps, and avoiding storage of materials near water bodies to avoid contamination of receiving waters; (iv) bioengineering and slope stabilization to control erosion; (v) locate camps at least 100m away from water resources, provide septic tanks to treat wastewater, and link with local health programs on prevention and control of communicable diseases; (vi) maximize the hiring of local labor to avoid the establishment of big labor camps; (vii) traffic management to avoid congestion and maintain access of local residents; (viii) implement 1:3 compensatory plantation to off-set impacts from tree cutting; (ix) no camp, materials storage, hot mix plant will be allowed near the national park; (x) provision of personal protective equipment to all workers.

30. **Operation Phase**. Environmental impacts during operation and less significant involving the potential deterioration of water bodies from oil-contaminated runoff, disposal of debris and waste collected along the roadside including drainage canals, road crashes, and deterioration of air quality. Mitigation measures include regular maintenance of road drain and proper disposal of collected debris, provision of road safety appurtenances in the road design, and avenue plantation to control noise.

31. **Greenhouse gas emissions and addressing risk of climate change.** Using the Transport Emissions Evaluation Model for Projects (TEEMP) total annual emission was estimated at 7239.1 tons which is less than the 100,000 tons per year threshold set by ADB. The projected variations in temperature and precipitation, the project roads indicated vulnerability to these climate risks: landslide triggered by increased precipitation, fire, flood, drought, cyclone wind, cyclone surge, and coastal erosion. Key engineering measures taken to address these risks in the design are: i) increase in embankment height, ii) construction of new side and lead away drains, iii) construction of new culverts or widening of existing ones and iv) construction of new bridges which amounts to Rs 162 million (about $ 1.2 million) of approximately 1.05 % of the total civil works costs.

32. EMP implementation. The Ministry of Highways, Ports and Shipping (MOHPS) is the Executing Agency (EA) and RDA is the Implementing Agency and within RDA there will be a Project Implementation Unit (PIU). The PIU will be responsible for implementing the project and managing detailed design and supervision of the construction works and ensuring that all environmental safeguard requirements in accordance with this EARF are met. The PIU will be headed by a full time Project Director (PD) and supported by a team of engineers from RDA. The PIU will have a safeguards team with sufficient social and environment safeguards officers to cover the quantum and geographic distribution of works in all provinces under the investment program. The Project Implementation Consultants (PIC) will support the PIU for supervision of the design and construction works by the civil works contractor. The PIC team will include a team of environment safeguards consultants for conduction of regular monitoring of safeguards implementation on site.

33. **Environmental Management and Monitoring Plans.** A standard EMP was prepared as part of the IEE report, however, contract package specific EMP's will be prepared by the contractor by consonance to the standard EMP, road specific information in the environmental checklists and the detailed design (level 1 design). All costs for implementing the mitigation measures will be included in the Bill of Quantities (BOQ) by the contractor as implementation of the EMP will be the responsibility of the contractor. Contractors who implement rural road components will have a construction period of approximately two years and routine maintenance for three years. Monitoring of EMP implementation will be carried out during the preconstruction, construction, and operation and maintenance stages of the project. Based on the EMP, environmental monitoring checklists (EMC) will be prepared by the PIC for each of these stages. The EMC monitors the degree of compliance of the mitigation measures proposed in the EMP in all three stages. Every road must have at least one EMC completed during pre-construction, one to three during construction depending on the length of the road and one per year during operation and maintenance. Based on these records and site visits monitoring reports will be prepared during the construction and operation stage on an annual basis per province and submitted to ADB for disclosure on the ADB website. An Environmental Monitoring Plan (EMoP) provides the guidance to contractor and PIU on monitoring environmental quality and implementation of the EMP. Furthermore the contractor will also be responsible for updating EMP and EMOP if there are any significant changes in the project site conditions or engineering design.

34. **Grievance Redress Mechanism.** Starts at the grass roots level where complaints are received and addressed by the contractor, PIC or PIU representative on site. Grievances that are not immediately resolved are elevated to the Grama Niladhari (GN) levels and Divisional Secretariat (DS) level for final resolution.

G. Conclusion and Recommendations

35. The proposed iROAD subproject has been categorized as Category 'B' based on environmental screening and assessment of likely impacts while the initial environmental examination ascertains that it is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subproject, all of which are localized and temporary in nature and easy to mitigate.

36. The screening criteria ensure no road will cause significant adverse impacts. iROAD ensures no project road will trigger classification as an environment 'Category A' tranche in accordance with the ADB's SPS (2009); no project roads falling in part or whole inside a protected area will be selected under the investment program; (iii) project roads falling adjacent

to protected areas or eco-sensitive areas will be included only if there is no widening of the road “Right of Way” (ROW) or acquiring of land from the protected area or eco-sensitive area.

37. Candidate roads are dispersed over the entire province and few road sections are located near or within geologically and hydrological sensitive entities therefore mitigation measures will be incorporated to designs in order to bare any road related impacts at such locations. No roads are located in or adjacent to environmental sensitive areas declared by the DOFC and DWLC.

38. The initial environmental examination has discussed various aspects of the proposed rehabilitation and upgrading of 126 road sections comprising 760.48km length. Contractors are liable to keep the roads in operational status for approximately 3 years after the 2 years of construction period.

39. The IEE recommends to update EMP and EMC with package specific information and locations while EMOP to be road specific before commencement of construction activities. In addition EMC and EMOP should be effectively implemented in order to monitor application of the EMP.

40. The road network improvement in North Western province will boost economic activities in the province including potential growth in industries, tourism and agriculture in lagging rural areas which will be a positive step to the socio economic development of the country.

I. INTRODUCTION

A. Background

1. In Sri Lanka, about 85% of the population is living in the rural and peri-urban sector and out of that 84.7% are identified as poor. Poverty is concentrated in areas where connectivity to towns and markets, access to electricity and average educational attainment are relatively low, and agricultural labor is an important source of employment. Location attributes are highly correlated with each other, which indicate the many-sided nature of challenges faced by poor areas. Remote areas with lack of all-weather access to the socioeconomic centers have rendered a large portion of the rural population with poor agricultural productivity, limited employment opportunities and slow economic growth.

2. In order to address this problem and improve transport connectivity between rural communities and socioeconomic centers, the Road Development Authority (RDA) under Ministry of Highways, Ports and Shipping (MOHPS) has proposed an Integrated Road Investment Program (iRoad). The Government would like to select about 1000 Grama Niladari Divisions2 (GNDs) throughout the country as rural hubs according to the population, development potential and distance to trunk road network. As a first step for developing the rural hubs the government will enhance the connectivity by (i) improving rural access roads linking the rural hubs to trunk road network to all weather standards, and (ii) operating a sustainable trunk road network of at least fair condition.

3. This program will be financed by the Asian Development Bank (ADB) under a Multi tranche Financing Facility (MFF). The investment program is planned to have four tranches that will be implemented over a period of ten years. The first focus was on the Tranche 1, the Southern Province. Tranche 2 focuses on other five provinces as mentioned below for which feasibility studies are currently carried out.

- Sabaragamuwa Province
- Central Province
- North Central Province
- North Western Province
- Western Province (Kaluthara District)

4. This document presents the Initial Environmental Examination (IEE) prepared by Environmental and Social Development Division (ESDD) of RDA for North Western Province of Tranche 2 which covers 541.63km of rural roads to be upgraded and maintained to all weather standards. This report complies with the Environmental Assessment and Review Framework (EARF) iROAD MFF, the ADB Safeguard Policy Statement (2009), and the Environmental Compliance Manual of RDA.

5. As provided in the EARF, no road under Tranche 2 is located inside strict national reserve. No road widening inside legally protected or critical habitat. All project roads adjacent to protected or eco-sensitive areas are limited to existing RoW. Most environmental impacts attributed to the project and related activities are short-term, site-specific, and easily mitigated. Close coordination with the Department of Wildlife Conservation, Forest Department, and ADB were made in the screening of the roads to ensure the project will cause not significant adverse environmental impacts that will trigger an ADB environment “Category A” tranche or Prescribed Project classification consistent with domestic environmental laws and regulations.

[2] A Grama Niladhari Division (GND) is the smallest administrative unit in Sri Lanka

6. Accordingly i Road program will develop 760.48km of rural roads located within Puttalam and Kurunegala district respectively of North Western Province. These rural roads are currently governed by Provincial Road Development Authority (PRDA) and Pradeshiya Sabhas (PS, the local Authority) of North Western Province. The total length disaggregated to two districts Puttlam and Kurunegala of the province is presented in table 1.1. And particular road list is attached in appendix 1.

Table 1.1: District-wise length of roads in North Western Province

District	Number of Roads	Length of Roads (km)
Kurunegala	82	524.88
Puttalam	44	235.60
Total	**126**	**760.48**

Source: i Road Program, RDA

7. As mentioned in appendix 1.1, there will be three contract packages per district. The contractor will be responsible for construction of the road over 2 years and performance based maintenance for another 3 years.

B. Objectives of the proposed project

8. The broad objective of this project is to improve the connectivity of road network in rural areas of Sri Lanka, so that rural population can be conveniently involved in the nation wide economic and social development.

9. Specific objectives of this project are;

- To improve the road condition between rural communities and socioeconomic centers of the North Western Province,
- To upgrade and maintain about 760.48km of rural access roads in North Western Province connecting rural communities to all-weather standard,
- To improve connectivity between production centers and market places and improve linkage with the other districts and provinces,
- To facilitate to increase mobility by improving road network which link up with other provinces,
- To open up rural areas for development,
- To facilitate to generate efficiency gains by lowering the unit cost of individual producers through transport efficiency which will lead to increase their margins and profits thus making them generating another round of investments,
- To reduce rural poverty through improved access to (a) markets and economic centers (b) social infrastructure and (c) new employment opportunities

10. In order to achieve these objectives, the road network in Kurunegala and Puttalam districts will be upgraded with the following guidelines:

- Upgrade and maintain the existing roads to all weather standards
- Surfacing the existing pavement with Asphalt Concrete (AC) if the present surface is weak
- Repair or reconstruct damaged culverts
- Introduce earth drains for all road sections and built up drains where necessary
- Remove any irregularities that are on the existing vertical profile,

- There by improve the vehicle operating speeds while ensuring safety of road users.

C. Objectives of the Initial Environmental Examination

11. As mentioned, this IEE covers upgrading and maintaining 760.48Km of rural roads to all weather standards.

12. The purpose of this Initial Environmental Examination (IEE) is to gather and provide:

- Information about the following existing environmental settings of the project influential area;
  - Physical Environment (including climate, air quality, topography, soil, surface and ground water hydrology, and natural hazards etc),
  - Biological Environment (protected forest and wildlife areas, fauna and flora and presence of endemic, endangered species),
  - Social Environment (socio economic profile of the communities living in the project influence area, infrastructure facilities and land use)
- Identify beneficial and potential adverse impacts on the existing environment during preconstruction, construction and operational phases of the project;
- Propose effective mitigation measures to avoid/ minimize the project induced adverse impacts while enhancing the beneficial impacts, and;
- Formulate an effective Environmental Management Plan (EMP) which is common for all roads and will be specified to each contract package during bidding process, so as to sensitize and guide respective divisions of RDA in environmental and social safeguards compliance and sensitize and guide respective contractors in environmental and social safeguards compliance during construction stage.

D. Approach, Methodology and Personnel Involved

13. This IEE was carried out in compliance with the RDA manuals on environmental and social safeguards compliance in road development projects which is in line with national environmental and social safeguards acts/ policies and ADB safeguards policy statement, 2009. The field assessments were carried out during the month of July to August 2014 by Environmental and Social Development Division (ESDD) of RDA.

14. The field assessment was followed by preparation of Environmental Checklist (EC) for each candidate rural road and the IEE was prepared for the particular province while summarizing findings of each EC.

15. As mentioned, EC was prepared for each road to be upgraded under the i Road Program summarizing the following details;

- Road details
- Location information
- Climatic conditions of the project area
- Generic description of the surrounding environment
- Specific description of the road environment considering location of environmentally protected areas, occurrence of road related natural hazards, locations of road side trees, road side utilities and public properties etc.
- Public Consultation
- List of photographs taken along the road

16. Sample ECs are provided appended to this IEE report for reference. All ECs prepared for the North Western Province are available at the ESDD-RDA, and PIU upon request.

17. In order to collect the number of road side trees and road side utilities for preparation of ECs, the existing ROW was considered during field assessments as construction activities will be limited to the existing ROW. However for road sections where the existing ROW could not be demarcated, a 2m corridor from the edge of the existing carriageway to the both sides of the road was considered to count number of road side trees and utilities. A wider corridor of 100m to the either sides of the road was studied to explore any environmentally sensitive entity such as forest reserves and sanctuaries. Further public properties such as schools, temples and public wells located within 50m on the either sides of the road from the centerline of the road was taken in to account during field assessments.

18. ESDD of RDA prepared the IEE during the period from June to August, 2014. In preparation of the assessment findings of each EC within the province was analyzed and summarized. In addition to field data, 1:50,000 topographic map sheets of Survey Department of Sri Lanka were used to identify the land use pattern up to 200m or impact influential area on both sides of the existing center line of the existing road. Further satellite imagery available on-line from Google maps were used as a secondary information base. In addition information available in Management Information System (MIS) of ESDD was also utilized for the assessment.

19. The field assessment and preparation of EC were carried out by the environmental and social safeguards staff of ESDD while a trained multidisciplinary team including Hydrologist, Biologist/Ecologist, Acting Environment and Social Safeguards officer, Acting Social Impact Awareness officer and Acting Chemist of ESDD, RDA was engaged in preparation of the IEE. This core team was supported by assistant staff members of environment and social dimensions. The support and guidance given by Director and Deputy Directors of ESDD, Senior Project Director – i Road, and Project Director – i Road of RDA is highly appreciated.

II. DESCRIPTION OF THE PROJECT

A. Location of the project

20. As mentioned, all road sections selected for this project connect rural areas with the trunk road network in Puttalam and Kurunegala Districts in North Western Province. Accordingly a road length of 235.60km in Puttalam District, 524.88km in Kurunegala District will be upgraded and maintained to all weather standards under this project. The administrative divisions including the district and Divisional Secretariat (DS) Divisions falling within particular sections of road are presented in appendix 1.1. The respective GNDs crossed by each road are presented in the specific ECs given in the Appendix.

21. Location maps attached in Appendix 2.1 present the general location of rural roads in Puttalam and Kurunegala Districts respectively. And specific location maps for each roads attached in each ECs.

B. Need of the Project

22. Sri Lanka is currently driven to be a strategically important economic center by means of naval, aviation, commercial, energy and knowledge hub serving as a link between east and west using its geographical location effectively. Accordingly, an accelerated development program is undertaken by the Government of Sri Lanka (GOSL) by means of socio-economic and social infrastructure development. And North Western Province is one of the key provinces which is targeted to implement major development projects in order to facilitate economic and social infrastructure development. Proposed project of Northern Highway, Daduru Oya Development project, Road connectivity network parallel to DayataKirula program, Coal power plant at Norechchole are few of such major development projects offered to the North Western province. However to increase the effectiveness of the development, it should be assured that the benefits penetrate to the rural regions of the province as well as development potentials available in rural areas should be exposed. On the other hand 33.1% of the population of Kurunegala District is engaged in agriculture base employment while 16.3% are engaged in the manufacturing base employments and same as 18.1% of the population of Puttalam District are engaged in agriculture base employment while 20.1% are engaged in manufacturing base employments (Department of Census and Statistics, 2012). And in order to find a reasonable price for their products it is necessary to transport them to better markets which are mostly found in urban centers. In this regard, connectivity of these areas with the trunk road network is significant however it is found that the rural road network is still in dilapidated condition and not accessible in all weather conditions. Thus this situation fails to facilitate an efficient connectivity. Therefore after identifying the existing situation, the government intends to select about 1,000 rural communities according to the population, development potentials, and the distance to trunk roads to extend the development benefits to rural areas. And it is required to address the connectivity issues for these communities.

23. The proposed i Road Program of RDA will improve the transport connectivity between rural communities and socio-economic centers. And under the second tranche of the project, 760.48km of the North Western province will be upgraded and maintained to all-weather standard which will serve the rural communities. Improved connectivity will ultimately benefit the targeted communities by increased flow of economic opportunities and accessibility to developed markets and therefore it is expected to increase income generation possibilities of

rural communities. This will ultimately enhance the socio-economic development of such communities which will be a positive drive to development of the country.

C. Analysis of Alternatives

1. No Project Alternative

24. The GOSL will be initiating key infrastructure project in the province includes the Colombo - Kandy Expressway, 'A' graded road construction projects which are proposed between Bangadeniya to Galgamuwa, Kurunegala to Dambulla and Wariyapola to Halawatha. In order to sustain and maximize the socio-economic benefits from these investments, it I necessary to build an efficient road network connecting developed centers and under developed areas. Without the i ROAD, these flagship projects will not realize the expected benefits and the province will continue to stagnate. About 97.5% and 0.5% of the total population of Kurunegala district, and 90.5% and 0.2% in Puthlum District live in rural and estate communities, respectively having poor access to infrastructure facilities and socio-economic opportunities. The Poverty Head Count Index of Kurunegala and Puthlum Districts as of 2013 are 11.7% and 10.5%, respectively.

25. In terms of environmental quality, not improving the rural roads will contribute to the further deterioration of the road surface, increase flooding due to lack of cross- and side-drains, and increase erosion due to lack of slope protection. Poor road surface will result to increase in fuel consumption and combustion gas emissions, and increase in noise and dust levels which will result to poorer air quality particularly immediately along the project road. The lack of cross and side drains will increase the risk of damage to life and property on flood prone areas. On areas that are already prone to erosion, the inadequate infrastructure to stabilize the soil will result to loss in agricultural soil and increase sedimentation of receiving bodies of water. Limiting the road improving to the available RoW also minimized the need for vegetation clearing and tree cutting.2.3.2. With Project Alternative

26. With the i Road program 760.48km length of rural roads in North Western Province will be upgraded and maintained to all-weather standard improving accessibility of rural communities to socio-economic centers will be increased and enhance. income generation avenues. Improvement in road roughness, drainage, and strengthening against erosion will have their corresponding environmental benefits. However, the projected increase in traffic may increase the total emissions, traffic noise, and road crash.

D. Magnitude of Operations

1. Project Activities

27. The iRoad Program will upgrade and maintain selected road sections in North Western Province to all-weather standards. The selected rural roads are currently governed by Pradeshiya Sabhas (The local Authorities) of Puttalam and Kurunegala Districts and Provincial Road Development Authority (PRDA) of North Western Provincial Council. Under the project, rural and provincial roads of 220 kms in Puttalam District, 485 kms in Kurunegala District have been selected to be upgraded.

28. Selected roads are narrow with varying widths and bad surface condition.

29. As mentioned, it is proposed to upgrade and maintain selected roads in Puttalam and Kurunegala Districts to all weather standards under i Road Program. For rural roads, different typical cross sections have been developed to suit existing road condition; gravel, concrete, macadam and block pavementsand special attention has been provided to avoid land acquisition in all road sections. There proposed cross sections will be modified based on the available Right of Way (ROW) and for narrow road sections minimum 3m carriageway will be kept. The improved pavement will be of Asphalt Concrete (AC) which is comparatively a long lasting treatment. The proposed improvement works for selected roads are as follows;

- The widening of roads will be carried out only if there is sufficient right of way.
- If the existing surface is asphalt; it will be overlaid by the asphalt concrete.
- Base correction will be carried out if base failures are found along the road.
- If the existing surface is macadam based it will be overlaid by Aggregate Base Coarse (ABC) and asphalt as per the pavement design given by the Engineer.
- If the existing road surface is concrete paved and in good condition; it should be rectified and if it is damaged; it should be completely demolished and laid with ABC and asphalt.
- If the existing road surface is gravel; it will be reconstructed with ABC and asphalt.
- If the existing surface is block paved; it will be rectified to correct minor damages. Otherwise it will be completely demolished and will be laid with asphalt concrete.
- The buildup drain has been provided for town areas or other requested areas. Otherwise the earth drain will be provided.
- The earth work will be carried out in required areas.
- Finally road marking will be carried out.

(Source: PIU, i Road Program, RDA)

30. Proposed typical cross sections are attached in Annex 3.

31. Improvements on cross and side drainage of the particular roads will be considered in locations where structures have been badly damaged or rectification of the drainage is significantly required. Several road sections as identified in Chapter 4 of this report are located in flood prone areas. The proposed road design in these sections were modified to withstand frequent inundations (please refer to Appendix 3)

32. The proposed improvement will be limited along the existing ROW, no building or temporary structure will be fully or partially affected by the Program.

2. Requirement of Construction Material

33. Material required for construction will be explored from the project area. Existing sites which are operated with relevant licenses and approvals will be used especially for extraction of metal and sand. Offshore sand could also be used for construction subjected to confirmation of quality. If new material extraction sites will be opened for this project, necessary licenses and approvals will be obtained from relevant agencies.

34. Based on engineering estimates prepared for each road for North Western Province, approximate quantities of material required for each package are given in Table 2.1.

Table 2.1.Cost of Climate Adaption Measures (in millions)

District	Increase Embankment Height	New Side and Lead away drains	New/Widneng Culverts	New Bridges	Total
Kurunegala	106.065	170.28	546.82	0	**823.165**
Puttalam	24.444	1.28	47.37	85.5	**158.594**
Total	**130.509**	**171.56**	**594.19**	**85.5**	**981.759**

III. POLICY AND LEGAL FRAMEWORK

A. National Environmental Act and other applicable regulation

35. The National Environment Act (NEA) No. 47 is the key environmental policy framework which is administered through the Central Environment Authority (CEA) of the Ministry of Environment and Renewable Energy (ME&RE). NEA No. 47 was enacted in 1980 and NEA amendment Act No. 56 of 1988 stipulated the regulations for assessing and managing environmental impacts and obtaining the environmental clearance in a timely and systematic manner. It also provides guidelines for environment management, management of natural resources, fisheries, wild life, forestry, soil conservation, environment quality, environment protection and approval of projects. The environmental clearance process is implemented through the designated Project Approving Agency (PAA) as prescribed by the Minister under section 23 Y of the NEA. The procedure that should be followed for obtaining environmental clearance is described under section 23CC and 32 of the NEA.

36. The environmental clearance process should be initiated by submitting the completed Basic Information Questionnaire (BIQ) to CEA with preliminary information about the project including exact locations of the project components, extent and environmental sensitivity related to project activities. Based on this CEA decides whether the project is a “Prescribed Project”3 or not and who the PAA will be for administering the IEE or EIA process to obtain environmental clearance if the proposed project is a prescribed project. For Prescribed project CEA or the designated PAA will issue a TOR for the IEE or EIA required.

37. The scope of the investment program includes rehabilitation and upgrading of existing rural and national roads with no widening. According to the Gazette Extra-ordinary No. 772/22 of 24th June 1993 and subsequent amendments all rehabilitation works for existing highways and roads do not fall within the category of Prescribed Projects. Hence, it is likely that the project roads under the investment program will not be required to prepare an IEE or EIA for securing an environmental clearance. However, further amendments to the NEA on requirements for material extraction, emissions, noise and vibration levels that are relevant for the project will need to be followed. Necessary revisions will need to be made within the project to meet the new requirements if there are any.

38. If a project road falls adjacent to the boundary or inside a protected area, necessary clearance will need to be sought from the Department of Wildlife Conservation (DWC) even if there will be no widening of the road ROW. Depending on the sensitivity of the protected area, the DWC may require conduction of an IEE or EIA study for the respective road. No works are allowed in project roads falling inside Strict Nature Reserves.

39. While the NEA is the key environmental legislation under GOSL there are a number of other environmental laws and regulations that are applicable to the investment program as given in Table 3.1 below.

[3] Under the NEA, a prescribed project means that the project requires a full Initial Environmental Examination or Environmental Impact Assessment (EIA) study depending on the TOR issued by CEA for securing the environmental clearance

Table 3.1: Applicable National Laws and Regulations for the Investment Program

Legislation	Relevance and main content	Authorizing Institution
Coast Conservation Act No 57 of 1981	This act regulates any un authorized construction within the coastal zone, by making it mandatory to obtain permits for any Development activity falling within the coastal zone.	Coast Conservation and Coastal Resources Management Department
National environmental protection and quality regulations under Extraordinary gazette notification No. 1534/18 and No. 1533/16 of 2008 under NEA section 32 & 23A, 23B	This regulates the discharge and deposit of any kind of waste or emission into the environment and stipulates requirements for an Environmental Protection License (EPL) depending on the project activity. Examples of activities requiring and EPL are: asphalt processing plant, concrete batching plants, treatment plants, sewerage networks, mechanized mining activities etc.	CEA
National Environmental (Protection and Quality) Regulation No. 1 of 1990 published in Gazette Extraordinary No. 595/16 of February, 1990	Provides standards for discharging effluents into inland surface water during proposed project activities.	CEA
National Environmental (Ambient Air Quality) Regulations, 1994, published in Gazette Extraordinary, No. 850/4 of December, 1994 and amendment gazette No. 1562/22 of 2008	Provides standards for emissions to the air during proposed project activities.	CEA
National Environmental (Noise Control) Regulations No.1 of 1996 and its amendments	Regulates maximum allowable noise levels for construction activities during proposed project activities	CEA
National Environmental (Vehicle Horns) Regulations, No. 1 of 2011	Regulates maximum allowable noise emanating from vehicular horns on a highway or road any motor vehicle use during project construction activities	CEA
National Environmental (Municipal Solid Waste) Regulations, No. 1 of 2009	Regulates dumping municipal solid waste along sides of any national highway or at any place other than places designated for such purpose by the relevant local authority during proposed project activities	CEA
Fauna and Flora Protection Act (FFPO) No.2 of 1937 amended in 1993 and 2009	The act specifies that any development activity taking place within one mile from the boundary of a National Reserve declared under the Ordinance requires	Department of Wildlife Conservation

Legislation	Relevance and main content	Authorizing Institution
	an EIA/IEE which provide for the protection and conservation of fauna and flora of Sri Lanka and their habitats; for the prevention of commercial and other misuse of such fauna and flora and their habitats for conservation of biodiversity of Sri Lanka; and to provide for matters connected there with.	
Forest Act No. 34 of 1951	This act is to consolidate and amend the law relating to the conservation , protection and management of forest and forest resources for the control of felling and transport of timber and Forest and for matters connected therewith or incidental thereto.	Department of Forest
Felling of Trees Control Act No. 9 of 1951 as amended through Act No. 30 of 1953	This Act sought to prohibit and control felling of specified trees (mainly intended to stop indiscriminate felling of specified trees) in the country.	Department of Forest Conservation
Water Resources Board Act, No. 29 of 1964 and (Amendment) Act, No. 42 of 1999	The act controls and regulates developments (including conservation and utilization) of water resources; prevention of pollution of rivers, streams and other water resources; formulation of national policies relating to control and use of water resources.	Ministry of Irrigation and Water Resources Management
Soil Conservation Act, No. 25 of 1951 and Amended No. 24 of 1996	This Act makes provisions for the enhancement of productive capacity of soil; to restore degraded land for the prevention and mitigation of soil erosion; for the conservation of soil resources and protection of land against damage by floods, salinity, alkalinity, water logging; and to provide for matters connected therewith or incidental thereto	Department of Agriculture
Explosives Act No. 36 of 1976	To provide control of explosions and regulations of matters connected with explosive activities related with the project.	Ministry Of Defense
Municipal Councils Ordinance No. 29 of 1947, the Urban Councils Ordinance No. 61 of 1939 and the Pradeshiya Sabha Act No. 15 of 1987 as amended in 2010	Regulates and control actions pertaining to socioeconomic development such as roads, culverts, bridges, ferries, waterways and other means of local transport and related site clearance for constructing worker camps, site offices etc. and methods taking place within the command area relevant to government laws and	Ministry Of Local Government And Provincial Council

Legislation	Relevance and main content	Authorizing Institution
	regulations	
Flood Protection Ordinance No. 04 of 1924, No 22 of 1955	An ordinance for protection of areas subjected to damage from floods. This includes declaration of flood areas, preparation of schemes for flood protection and other rules and regulations regarding flood in the country	Irrigation Department
Crown Land Ordinance Act No. 1947	An ordinance to make provision for the grant and disposition of crown lands in Sri Lanka; for the management and control of such lands and the foreshore; for the regulation of the use of the water of lakes and public streams; and for other matters incidental to or connected with the matters related to proposed project	Land Commissioners Department
Agrarian Development Act No. 46 of 2000 (Section 32)	This act regulates using paddy land for a purpose other than agricultural cultivation without the written permission of the Commissioner General.	Agrarian Services Department
Land development statuette No. 7 of 2002 the western province provincial council, amendment No. 1287/26 of 2003	A statute for regularizing utilization of state lands situated within the western province either by state or the provincial council, for regulating the distributing of the aforesaid lands and lands in possession of the provincial council, for augmenting productivity of lands and for matters connected with or incidental to them this statute is in compliance with the crown lands ordinance no. 08 of 1947 (chapter 454) and the land development ordinance no.19 of 1935 chapter 464 as amended by land development (amendment) acts, no. 16of 1969 no.27 of 1981,no 22 of1998,no, 22 of 1995 1996. Of divesting of state lands, no. 07 of 1979	Governor _ Western Province Provincial Council And Land Commissioners Department
Sri Lanka Land Reclamation and Development Corporation Act 15 of 1968 as amended by Act No 52 of 1982	This act established Sri Lanka Land Reclamation and Development Corporation which grants permission for the public to fill marshy land subject to provision of storm water drainage.	Sri Lanka Land Reclamation and Development Corporation
National Thoroughfares Act, No. 40 of 2008	This act is known as RDA act which provide for planning, design construction, development, maintenance and administration an integrated public road network in Sri Lanka.	Road Development Authority

Legislation	Relevance and main content	Authorizing Institution
Urban Development Authority (UDA) Law No 41 of 1978 and Urban Development Projects (Special Provisions) Act No 2 of 1980	This law provides for the establishment of an UDA to promote integrated planning and implementation of economic, social and physical development of certain areas as may be declared by the minister to be urban development areas and for matters connected with the relevant project activities. Urban Development Projects (Special Provisions) Act No 2 of 1980 is an act to provide for the declaration of lands urgently required for carrying out urban development projects and to provide for matters connected there with relevant project activities.	Urban Development Authority (UDA) under the ministry of Urban Development and Defence
Town and country planning ordinance No. 13 of 1946 and The Town & Country Planning (Amendment) Act, No. 49 of 2000	This regulates the National Physical Plan with transport as the main component	National Physical Planning Department (NPPD) under the Ministry of Urban Development and Defense
Buddhist Temporalities Ordinance No. 19 of 1931	This act provides necessary assistance to administer and protect the property of Viharas, interventions to settle disputes regarding property of Viharas and makes recommendations to release money to be paid as compensation in respect of property of Viharas acquired by government for any development project	Department of Buddhist Affairs
Cemeteries and burial grounds ordinance No. 9 of 1899 and amendments	The act regulates any disturbance, removal of burial, monuments and use of such areas for development project	Local Government Authority
Antiquities Ordinance No. 9 of 1940 and amendments	The act regulate activities of projects located in close proximity of any archeological reserves	Department of Archaeology

40. Under the NEA (No). 47 and some of the laws and regulations listed in Table 3.1 above, there are specific requirements for clearances, permits and licenses required for road projects as listed in Table 3.2 below.

Table 3.2: Applicable Approvals required for the Investment Program

Project stage	Approvals	Project Related Activity	Relevant Agency
Pre-Construction	Environment clearance	Implementation of the project	Central Environment Authority

Project stage	Approvals	Project Related Activity	Relevant Agency
Stage Note: Although clearances and approval should be obtained during preconstructi on stage it is valid throughout the project cycle. However this should be renewed before expiry date	Clearance from Coast Conservation and coastal resources management department	Development activities in coastal areas	Coast Conservation and coastal resources management department
	Industrial Mining License (IML)	Operation of quarries, borrow areas and other material extraction sites	Geological Survey and Mines Bureau
	Environmental Protection License (EPL)	Operation of material extraction site including operation of asphalt plants, treatment plants etc.	CEA
	Local Governmer Authority Trade license and machinery permits	Deciding waste disposal sites, material storage and sites for worker camps and other project stations Trade license should be obtained for asphalt plants, batching plants, quarries etc.	Respective Provincial Council, Local authorities and respective Pradeshiya Sabha
	Explosive Permits	Blasting activities	Ministry of Defence
	Approval for removal of trees	Road clearance for construction	Forest department, CEA and local authorities
	Disturbance to Padd Lands	Ground preparation for ROW and side drains	Commissioner of Agrarian Services
Construction stage	Consent from relevant government agencies	Construction of bridges, culverts and other drainage systems, land filling, dredging activities	Department of Irrigation, Department of Agrarian services, Local government authority, Land Reclamation and Development Cooperation
	Approval from relevant state /local agencies for the removal/ temporary disturbances for existing utilities	Surfacing, construction of bridges and side drains, embankment filling works	NWSDB for water lines, Ceylon electricity Board for Electric cable/poles, Sri Lanka Telecom for land line telephone cables, poles, Pradeshiya sabha, other local authorities for drainage, sewer systems etc.

1. Environmental Protection License (EPL)

41. The Environmental Protection License (EPL) is a regulatory/legal tool under the provisions of the National Environmental Act No: 47 of 1980 amended by Acts No 56 of 1988 and No 53 of 2000. Industries and activities which required an EPL are listed in Gazette Notification No 1533/16 dated 25.01.2008. Industries are classified under 3 lists i.e., List "A","B" and "C" depending on their pollution potential.

42. Part "A" comprises of 80 significantly high polluting industrial activities and Part "B" comprises of 33 numbers of medium level polluting activities. EPL for industries in lists "A" and “B” have to be obtained from the relevant Provincial Offices or District Offices of the CEA.

43. Part "C" comprises of 25 low polluting industrial activities which have been delegated to Local Government Authorities, namely Municipal Councils, Urban Councils and Pradeshiya Sabhas. EPL for the industries in List "C" has to be obtained from the respective Local Authorities. The Local Authorities carry out issuing of EPLs and related functions such as follow up, monitoring and law enforcement.

44. Objectives of the EPL

- To prevent or minimize the release of discharges and emissions into the environment from prescribed (industrial) activities in compliance with national discharge and emission standards.
- To develop an approach to pollution control that considers discharges from prescribed (industrial) processes to all media (air, water, land) in the context of the effect on the environment.
- To contain the burden on industry, in particular by providing guidance on pollution control for polluting processes.
- To ensure that the system responds flexibly both to changing pollution abatement technology and to new knowledge such as cleaner production, waste minimization etc.

2. International Agreements and Conventions

45. Sri Lanka is also a signatory to a number international agreements and conventions related to environmental conservation. Those that are relevant for this investment program are provided below:

- Conventions on Wetlands of International Importance Especially as Water Fowl habitats (Ramsar)
- Convention concerning the protection of the World Cultural and Natural Heritage
- Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES)
- Convention on the conservation of Migratory Species of Wild Animals (CMS 1979)
- United Nations Framework Convention on Climate Change
- Convention on Biological Diversity
- Plant Protection Agreement for Asia and the Pacific region

B. Policy Framework

3. ADB Safeguards policy statement, June 2009

46. ADB's safeguard policy framework consists of three operational policies on the environment, Indigenous People, and involuntary resettlement. All three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require that (i) impacts are identified and assessed early in the project cycle; (ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and (iii) affected people are informed and consulted during project preparation and implementation. The policies apply to all ADB-financed projects, including private sector operations, and to all project components.

47. The objective of environment safeguards policy is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.

48. Proposed projects are screened according to type, location, scale, and sensitivity and the magnitude of their potential environmental impacts, including direct, indirect, induced, and cumulative impacts.

49. Projects are classified into the following four categories:

- **Category A.** A proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.
- **Category B.** The proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.
- **Category C.** A proposed project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.
- **Category FI.** A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities have minimal or no environmental impacts or risks.

50. **Policy Principles:** Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.

51. Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential trans boundary and global impacts, including climate change. Use strategic environmental assessment where appropriate.

52. Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative.

53. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.

54. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.

55. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.

56. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.

57. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.

58. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase outs. Purchase, use, and manage

pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.

59. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.

60. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of “chance find” procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.

IV. DESCRIPTION OF EXISTING ENVIRONMENT

61. Selected roads to be upgraded under iRoad Program are scattered in Kurunegala and Puttalam Districts of North Western Province. This chapter describes the general environment in the districts and along the corridor of impact particularly along which environmental or social sensitive entities are observed.

62. In addition, ECs prepared for each road summarizes the environmental profile with specific chainage-wise information and supported with photographs. Sample ECs are provided in Appendix 6.4.

A. Physical Environment

1. Climate, land use, terrain and Soil

63. Based on major climatic zones of the country, the North Western Province encompasses all three major climatic zones; intermediate, dry and wet zone. These different climatic zones together with the coast have made this province very diverse in nature. The two major cities in NWP are Kurunegala and Puttalam. Highly to moderately rolling hills can also be found in the south and south east parts of the province.

64. Relatively small area of the Kurunegala District falls within the wet zone of the country while the majority of the land mass comes under the intermediate and dry zones. Puttalam district falls within the Intermediate climate zone as well as the Dry Zone. The dominant soil group of the NWP is Reddish Brown Earth (RBE) which considered the major soil group of the dry and intermediate climatic zones of Sri Lanka. The climatic environment of the project area is further categorized in to agro – ecological zones which are categorized based on climate, soil, natural vegetation and land use pattern of an area. The specific agro-ecological zones related to candidate road sections and their characteristics are presented in table 4.1 below.

Table 4.1: Climatic characteristics of candidate roads

District	Agro-ecological Zone	Roads (ID) falls in to agro-ecological zone	75% expectancy value of rainfall (mm)	Description (Land use, Terrain, Soil groups)
Puttalam	IL1	19,20,21,22,23, 24,25.26,27,28, 29,30,31,32,33, 34,35,36,37,38, 39, 40,41,42, 43,44	>1020	Coconut, Mixed Home Garden, Paddy , Export Agricultural Crops (Few-peper) Flat, Undulating to Rolling terrain. LHG Soils, Alluvial, Imperfectly drained Red Yellow Pedsolic soils with strongly mottled sub soil.
	DL1	9,10,11,12,13,1 4,15,16,17,18	>775	Coconut ,Mixed Home Garden , undulating and flat RBE and Low Humic Gley soils
	DL5	1,2,3,4,5,6,7,8,	>500	Coconut Mixed Home Garden. Gently Undulating terrain RBE, LHG and Alluvial Soils

District	Agro-ecological Zone	Roads (ID) falls in to agro-ecological zone	75% expectancy value of rainfall (mm)	Description (Land use, Terrain, Soil groups)
Kurunegala	IL1	1,2,3,4,5,6,7,8, 9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,40,41,42,44	>1020	Coconut, Mixed Home Garden, Paddy , Export Agricultural Crops (peper), Banana, Pineapple Flat, Undulating to Rolling terrain. LHG Soils, Alluvial, Imperfectly drained Red Yellow Pedzolic soils with strongly mottled sub soil.
	IL2	33,34,35,53,54, 55,56,57,58, 59,60,61,62	>1150	Coconut ,Mixed Home Garden , Paddy, Export Agricultural Crops (pepper), Pineapple Flat Undulating to Rolling Terrain Reddish brown earth, LHG and Immature Brown Loams (IBL), Alluvial soils
	DL1	63,64,65,66,67 68,69,70,71,72 73,74,75,76,77 78,79,80,81,82	>775	Coconut ,Mixed Home Garden , Paddy, Export Agricultural Crops (pepper), Banana Undulating and flat RBE and Low Humic Gley soils

LHG - Low Humic Gley, RYP - Red Yellow Podsolic, IBL - Immature Brown Loam, RBE - Reddish Brown Earth

65. Rainfall pattern of North Western province is influenced by two monsoons; South-West Monsoon and North-East Monsoon. The south part of the province which comes partly under the wet zone, receives a well-distributed rainfall from both south- west and north- east monsoons while northern drier parts receive rainfall only from the north- east monsoons which brings comparatively lower rainfall to the country. Kurunegala has an average temperature of 27.50 C and during October to November and again in April to May. Two dry spells during the period of mid- January to mid-March and a much longer spell in June to September occur in the project area. The Puttalam district experiences the minimum temperature in the range of 20.20 C - 26.50 C while the maximum temperature in the range of 30.00 C - 34.80 C. Puttalam district receives much of its rainfall from the south-western monsoon (during the month of September to January) while the southern part of the district also receives rain fall from the north-eastern monsoon (March – June).

2. Hydrology

66. The Kala Oya considered as the Northern boundary and the Maha Oya considered as the southern boundary of the North Western Province. The the land use information gathered by the Survey Department of Sri Lanka 1992 and 1998, wetlands and water bodies in the NWP covered an area of 4,670ha and 38.110ha respectively and there are 94 reservoirs within the Districts of Puttalam and Kurunegala. Out of the 16 major rivers of Sri Lanka, five are located in

the NWP with Deduru oya as the largest. In addition there are five other rivers in NWP. Out of these ten rivers, eight are located within the NWP and the other two are in the provincial boundaries.

Table 4.2.Major rivers in the Northwestern Province

S.No.	Name of the river
1	Kala Oya
2	Moongil Aru
3	Mee/Mi Oya
4	Madurankuli Aru
5	Kalagamuwa Oya/Kolamunu Oya/Badullu Oya
6	Patampola Oya
7	Daduru Oya/ Sengal Oya
8	Karambala Oya
9	Rathmal Oya
10	Maha Oya

67. Puttalam district is encompasses the western part of the NWP with a 228km of coastal belt. The Puttalam district borders to Kala Oya and Modara Gam Aru in the north. Rural road sections as given in annex 1 which are to be improved under i Road program are located within hydrology sensitive areas of NWP. 97% of the basins come under the North Western Province (Puttalam and Kurunagala). These basins are predominantly situated in the Dry Zone of the country.

68. The Kala Oya basin begins from the Mathale district cutting across Anuradapura and Kurunegala districts and ending up to the Puttalam district. Main stream of the Kala Oya and its tributaries flow in to the Dutch Bay before entering the sea.

69. Tabbowa, a manmade reservoir, was constructed by damming the Nanneri Oya, a major tributary of Mi Oya, for for irrigation purposes. This tank and its environments are comes within the Karuwalagaswewa Sanctuary, which is important habitat for elephants and water birds. The wetland has very rich biodiversity including its immediate environment consisting of tropical dry/mixed evergreen forest. Scrubland and grassland communities such as Terminalia arjuna, Naucleaorientallis, Barringtoniaceylanica, Syzygiummakull, Vitexlecoxylon and Caesalphiabonduce. There are many economically valuable timber species such as Diospyrosebenum, Tectonagrandis, Terminalia arjunaAzadirachtaindica and Manilkarahexandra.

3. Air Quality and Noise

70. Since the selected road sections are mostly located within rural areas, major sources of air pollution are not present. The general air quality in the project area is excellent except along unpaved roads and major intersections where temporary deterioration occurs.

71. An extract from the National Environmental (Ambient Air Quality) Regulations, declared in 1994 is presented in Table 4.3.

Table 4.3: National Ambient Air Quality Standards

Parameter	Averaging time (hrs)	NAAQS (mg m^{-3})	NAAQS (ppm)
Carbon Monoxide	8	10	9

Parameter	Averaging time (hrs)	NAAQS (mg m^{-3})	NAAQS (ppm)
Nitrogen Dioxide	24	0.10	0.05
	8	0.15	0.08
Sulphur Dioxide	24	0.08	0.03
Lead	24	0.002	-
TSP	24	0.03	-
PM10	8	0.35	-

Source: Gazette of the Democratic Socialist Republic of Sri Lanka, 850/4 (20 December, 1994)
PM 10 – particulate matter < 10 µm
NAAQS – National Ambient Air Quality Standards (NAAQS)

72. Vehicle Emission Test (VET) became mandatory in 15th July 2008 in order to enforce the environmental standards on vehicle emission provided in the Motor Traffic Act (Emission Control) Regulation of 1994, 817/6, Part I, Section I. This move is a part of the efforts to improve the air quality in the island. And this regulation is applicable for all construction vehicles as well.

73. The area mostly includes rural areas with a good vegetation cover and therefore the noise levels are relatively low. According to Schedules I and II of National environmental (Noise Control) regulations No.1 1996 (924/12), the study area belongs to “Low noise area”. Therefore the ambient noise level of the area can be considered as 55 dB (A) during day time (06.00 hrs-18.00 hrs) and 45 dB (A) night time (18.00 hrs - 06.00 hrs). Rich vegetation in the project area acts as an efficient noise absorbent.

4. Occurrence of Natural Disasters in the Project Area

74. Being the coastal districts of the country Puttalam District is prone to natural hazards such as tsunami, storm surge, coastal erosion and sea level rise etc. During field surveys for each road, major landslides were not observed. However, some road related slope failures and also the areas with severe soil erosions were observed along the candidate roads which were located at Dodamgaslanda, Mawathagama and Polgahawela electorate in Kurunegala district while considerable landslides were not observed during field survey in Puttalam District.

75. No serious flood related incidents were reported in the NWP at risk of natural disasters. Only information obtained was an incident occurred about 10 years ago is overflowing of Daduru Oya during at heavy rain period. The following roads are however prone to localized flooding: Road nos. 14, 26, 33, 34, 36, 61, 62, 77, 80, 82 in Kurunegala and 2, 9, 12, 14, and 15 in Puttalam.

B. Ecological Environment

1. Existing Habitats with Respect to Flora and Fauna and Protected areas

76. Both manmade habitats i.e., home gardens, paddy fields, plantations of tea, rubber, coconut and cinnamon, and natural or semi natural habitats i.e., marshland, streams, coastal area, scrubland and forest could be observed adjacent to the project area. Many natural habitats within the project area have been subjected to the impact of human activities of varying extents; nevertheless they retain some degree of naturalness.

77. In addition to common land use pattern as mentioned above, there were some specific land uses were observed along the individual road packages. Sanctuary, forest reserves, and also coastal area can be considered as ecologically sensitive locations found in the project area. Table 4.5, 4.7 present such sensitive locations crossed by the roads or located adjacent to concerned roads.

78. As well, a section of the road ID No 1 lays beside “MahaUswewa” , 4 lays beside “Kottukachchiya Lake”, UppuAru (stream) locates RHS of the road ID 12 and 1.5Km lays along this stream and a section of the road traverses beside the estuary which meets Kala Oya and UppuAru, road ID 15 starts from boundary of the Puttalam Lagoon and runs toward inland, Road ID 14 starts from a side of Puttalam Lagoon, Road ID 18 traverses along Beach side, a section of the road ID 28 lays beside “KarawitagaraWewa”. These are the identified areas of proposed road connectivity with the hydro ecological sensitive areas in Puttalam district.

79. According to the fauna and flora protection ordinance established in 1937-1938. Five categories of protected areas have been listed; strict nature reserves, national parks, nature reserves, jungle corridors & Intermediate zones. Out of these, 4 are still exists (Strict nature reserves, national parks, nature reserves, jungle corridors). Other three categories were introduced in 1993 (Act no 49) by amending the fauna and flora ordinance in Sri Lanka. The newly introduced categories are Refuges, marine reserves and Buffer Zones. Altogether there are 8 categories (Including Sanctuaries) of protected areas administrated by the Department of While 4.2.1.7 Life and Conservation of Sri Lanka (DWLC). No areas have been declared up to now under the three new categories introduced in 1993.The protected are comes under the direct control of Department of Wildlife and Conservation has only thee Strict nature reserves and none of them found in the North Western province. Out of 14 declared national Parks (Block 1,2,5) come under the Puttalam district. Five Sanctuaries have been located in the North Western province which includes the Bar Reef Marine, Kahalla-Pallekele, Kimbulwana Oya, Anawilundawa and Tabbowa. The land area designed as Forest Reserves in NWP comes under the direct management of the forest Department while a large extent of land is administered by the DWLC Sri Lanka.

C. Socio - Economic Environment

1. Condition of road infrastructures

80. Roads are the main transportation mode in Puttalam and Kurungala districts. The region is served by an extensive rail & road transport system providing linkages to the major cities and ports in Sri Lanka. Some major roads include, A3, A6,vA10 and A12. There are plenty of C, D, and E class roads (local authority roads) in the two districts. In addition to roads, rail transport is also a prominent transportation mode with Puttalam and Kurungala are popular railway stations in NWP.

2. Demographic Characteristics

81. **Population and population density**. As per the Census of Population and Housing 2012, population of the Kurunegala district in 2012 was 1,610,299 persons which is the third highest of the country. This population includes 775,061 males and 835,238 females. During the same period, it was reported that, population of Puttalam district is 759,776 persons. In Kurunegala district population density is 348 persons per square kilometer while Puttalam its 264 persons per square kilometer. Refer table 4.4 below for additional information.

Table 4.4: Population by gender

District	Population				Total population	Population density per km^2
	Male	%	Female	%		
Kurunegala	775,061	48.1	835,238	51.9	1,610,299	348
Puttalam	368,860	48.5	390,916	51.5	759,776	264

Source: Department of Census and Statistics, 2012

82. **Population by Ethnicity.** With regard to ethnicity, majority of population in both districts are Sinhalese i.e. 91.4% and 73.6% in Kurunegala and Puttalam districts respectively. Then other categories such as Muslims and Sri Lanka Tamils comes second and third places. Table 4.5 shows the population data of affected districts by ethnicity.

Table 4.5: Distribution of population by the ethnicity

District	Sinhalese		SL Tamil		Indian Tamil		Muslim		Burger		Other		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Kurunegala	1,471,339	91.4	18,763	1.2	3,582	0.2	113,560	7.1	711	0.0	2,344	0.1	1,610,299
Puttalam	559,031	73.6	47,523	6.3	2,503	0.3	146,820	19.3	1,481	0.2	2,418	0.3	759,776

Source: Department of Census and Statistics, 2012

3. Main economic activities

83. **Agriculture.** Agriculture is the prominent economic activity and carried out very successfully in these two districts. As per the labor force data, in Kurunegala district, 32.6% of the total population is engaged in agricultural sector. Coconut is the main agricultural crop. Coconut is grown as the main commercial crop, while pepper (Piper nigrum) and coffee (Coffea arabics) are grown as export crops. In addition, fruit crops such as pineapple (Ananas cosmosus), banana (Musa x paradisiacal) and vegetables like tomato (Lycopersicon esculentum), bitter gourd (Momordica charantia), pumpkin (Cucurbita maxima) are grown as highland in Kurunegala. In Kurunegala and Puttalam districts 32.6% and 28.9% of the total employed population is engaged in agricultural sector. Major agricultural cultivation of the Puttalam district is coconut while coconut and paddy is identified as the major cultivation in Kurunrgala district.

84. **Livestock.** Livestock farming such as poultry, goats and piggery farming are also popular agricultural activities in some areas of Puttalam district. Livestock farming in poultry and piggery are potentially profitable investment avenues in this district.

85. **Fishing.** Sea fishing is also a prominent economic activity for many people in Puttalam district. This is because of the vast extent of its sea area and the large number of lagoons situated along the coast. In addition to sea fishing, fresh water fishing or inland fishing also performs an important role. Availability of a large number of manmade irrigation reservoirs (known as tanks) from ancient times mainly in Puttalam district has made inland fishery a common livelihood activity. During off seasons of sea fishing, inland fishing becomes more attractive for fishermen and consumers as well.

86. **Industries.** In Puttalam district, out of the total employed population, only 29.7% is engaged in the industrial sector (Department of Census and Statistics, 2012) and in the Kurunegala district it is 30.9%. In Puttalam district coconut base industries have been identified at a scale of large and medium also at the scale of domestic industries. Furthermore, manufacturing of tile and brick, animal feed, Ornamental fish breeding centers, Tourism have been identified as potential industries in the district. Comparatively, industrial sector activities in Kurunegala district are lower than the Puttalam district. Out of the total employed population, majority of the Kurunegala district are engaged in the agricultural sector. As per the Department of Census and Statistic data 2011, 16.3% of the Kurunegala district is engaged in the manufacturing industries.

Table 4.6: No. of Industrial Establishments (with 5 or more persons engaged)

District	No. of industrial establishments	No. of employees
Kurunegala	1,880	57,468
Puttalam	1,323	19,871

Source: Department of Census and Statistics, 2012

4. Socioeconomic status

87. **Education.** As per the department of Census and Statistics – 2012, Kurunegala district shows the highest literacy rate about 94.4 percent compared to Puttalam district (91.1). With respect to the gender, male literacy rate is higher than female literacy rate in both districts. Refer table 4.7 for more information.

Table 4.7: Literacy rate by district – 2012

District	Literacy Rate		Total
	Male	Female	
Kurunegala	95.3	93.7	94.4
Puttalam	92.5	89.8	91.1

Source: Department of Census and Statistics, 2012.

88. **Household Income.** As per the 'Household Income and Expenditure Survey - 2009/10' of the Department of Census and Statistics, the monthly mean and median per capita income of Kurunegala district is relatively higher than Puttalam district. This is due to generating of higher agricultural production to the national economy by comparatively low number of population. There is no significant difference of per capita income levels between Kurunegala and Puttalam districts.

Table 4.8: Mean and Median Monthly per capita Household income by district -2009/10

District	Average monthly income	
	Mean (Rs)	Median (Rs)
Kurunegala	9866	5372
Puttalam	8375	5008

Source: Department of Census and Statistics, Household Income and Expenditure Survey-2009/10

89. **Poverty Situation.** Table 4.9 shows the poverty headcount index with country and project district. Kurunegala district is higher than that of country poverty head count index. Puttalam district it seems very close to country index in 2009/10. This higher poverty situation is due to prevailing of agricultural based economy and lower investment on industrial sector due to inadequate infrastructure facilities such as road, electricity, water and telecommunications.

Table 4.9: Poverty Headcount Index of Affected provinces and districts

Province/Districts	Poverty Headcount Index (%)				
	1990/91	1995/96	2002	2006/07	2009/10
Sri Lanka	26.1	28.8	22,7	15.2	8.9
North Western Province	25.8	27.7	27.3	14.6	11.3
Kurunegala	27.2	26.2	25.4	15.4	11.7
Puttalam	22.3	31.1	31.3	13.1	10.5

Source: Household Income and Expenditure Survey - 2009/10, Department of Census and Statistics, 2011

5. Existing Infrastructure facilities

90. **Energy source of Households.** In the project districts electricity is the main source of household lighting accounting for 84.7% households in Kurunegala and 84.6% in Puttalam for lighting. Kerosene is the second major source use for lightening and percentage usage in both districts are almost the same too, i.e Kurunegala 13.6% and Puttalam 13.9%. Below table 4.10 summarizes energy source of households.

Table 4.10: Type of Household Lighting source-2012

District	Electricity from national grid	Rural Hydro power project	Kerosene	Solar power	Bio Gas
Kurunegala	84.6	0.5	13.6	1.3	0.0
Puttalam	84.7	0.0	13.9	1.3	0.0

Source: Department of Census and statistics, 2012.

91. **Drinking Water.** As shown in below table 4.11, majority of households in both districts use pipe borne water Kurunegala (76.9%) and Puttalam (47.5%). Particularly, in Kurunegala district, a larger percentage, more than 75% use protected well water for drinking purpose. However, the both districts record the second highest as other, i.e. 32.2% of households in Puttalam district and 11.8% in kurunegala district use water for drinking through sources of rural water supply projects/river tanks/streams. Also, a substantial percentage, i.e. 18.7% of the households in Puttalam district use tap water for their drinking purpose. Still there are households using unprotected wells for drinking water such as 5.2% in Kurunegala while 1.4% in Puttalam district.

Table 4.11: Source of Drinking water

District	Protected well	Unprotected well	Pipe born water	Other
Kurunegala	76.9	5.2	6.1	11.8
Puttalam	47.5	1.4	18.7	32.2

Source: Department of Census and statistics, 2012.

92. **Sanitary facilities.** As shown in Table 4.12, majority of households in these two districts use private toilets, at 88.1% in Kurunegala district and 85.8% in Puttalam district. Meanwhile, 2.9% of households in Puttalam and 1% of households in Kurunegala district do not use toilets.

Table 4.12: Type of Toilets - 2012

District	Private	Sharing with others	Common/Public toilets	Not using
Kurunegala	88.1	10.5	0.3	1.0
Puttalam	85.8	10.7	0.7	2.9

Source: Department of Census and statistics, 2012

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

93. This chapter describes anticipated impacts on the environment during preconstruction, construction and operational stages of the project which have been identified during the Environmental Assessment. Feasible mitigation measures were designed based on environmental best practices to minimize the adverse impacts (or manage to acceptable limits) while enhancing the beneficial impacts of the project.

A. Pre-construction phase

1. Project induced natural hazards

94. **Road construction in flood prone areas.** As described in chapter 4, some roads in Kurunegala and Puttalam Districts may prone for floods at some locations where some streams cross and some paddy field areas. As per analysis of the hydrological pattern of specific locations, there could be some level of floods depending on the rainfall intensity and drainage condition of the road. As well, there could be a need to expand or enlarge bridges or culverts as per analysis of drainage engineers to overcome such disasters in hydrological sensitive areas. If new culverts and bridges are designed and constructed without adequate openings and without considering the hydrology of such areas, natural drainage pattern of upstream areas would get severely altered during intensive rains.

95. Designing bridges and culverts with adequate openings is based on detailed hydrological studies, considering relevant flood return periods and liaising with institutions like Irrigation Department. As well, collecting information, checking the adequacy of design and conducting construction operations during dry weather flow will be supportive instruments for mitigating the impacts on the people and surrounding environment due to floods. When designing culverts and bridges, RDA uses the “RDA bridge design manual” which specifies to consider a 50 year flood return period in culvert designs and a 100 year flood return period for designing bridges.

96. **Impacts due to landslides.** Though there is no any evidence of the areas that are susceptible to landslides in both districts, some road sections located in hilly areas could be prone to landslides. It is possible to occur landslides if natural slopes and natural drainage barriers are disturbed or blocked by the construction activities during extreme rainfall events.

97. **Shifting of utility supply lines.** For the road upgrading works, electricity power lines, telephone lines, and water supply mains located closer to the ROW will be shifted. Such utility facilities are available within the existing ROW are identified in ECs the exact number of utilities to be shifted will be updated during the preparation of specific EMPs. Proper co-ordination with the relevant service providing authorities in advance and supervision during shifting will help to reduce any impacts to relevant utility supply lines. Advance notice to the public about discontinuation of the utility supplies could help the public to adjust to the situation before hand. Therefore, difficulties faced by the public could be minimized in the case of sudden disruption of these services.

B. Construction phase

1. Landslides during construction stage

98. Since the proposed upgrading is restricted to the available ROW, minimal disturbance to the road side natural slopes is expected and possibility of project induced landslides is minimal. Proper coordination will be maintained with NBRO for roads which already have landslides or slope failures. The contractor's activities will not lead to landslides and if any such incident occurs will immediately inform RDA and provide suitable means to prevent damage adjacent land and property.

2. Hydrological impacts

99. The construction of culverts and bridges may temporarily block or divert streams, disturbing the natural drainage pattern and create flooding condition in the area. Improperly stored construction materials can block natural drainage pattern. The contractor will take all measures necessary or as directed by the Engineer to keep all drainage paths and drains clear at all times. Temporary storage of material will made only in approved sites by the engineer where natural drainage is not disturbed. All waste will be disposed at locations approved by the Local Authority. If flooding or stagnation of water is caused by contractor's activities, contractors shall provide suitable means to prevent loss of access to any land or property and prevent damage to land and property.

100. No material including excavated soil will be allowed to be disposed near water bodies or in paddy lands, even on temporary basis, to curtail any undue wash off of soil and debris to nearby water bodies and agricultural lands. The contractor will ensure that not to damage or block any manmade drainage canal even for temporary basis. If blocked, the contractor will remove such debris without any delay.

3. Increase of local air pollution, noise and vibration

101. Earthworks, pavement improvement operations, quarry operations, operation of hot mix plants, operation of construction vehicles and operation of concrete plants during construction period will emit (dust and fumes, which will contribute to) the local air pollution.

102. Heavy machinery used for construction work such as vibrators and compactors and operation of heavy vehicles at higher speeds will create noise and vibration which will cause nuisance to residents in settlements. Sensitive receptors like schools, hospitals and places of worship are particularly vulnerable to nuisance from noise. Structures located near the roads are at risk to structural damage like cracks due to construction vibration.

- Ensuring that construction plant and equipment is maintained to high operable standards, and also, exhaust baffles are fitted and maintained in a high serviceable condition.
- Limiting operations to times when they have least impact on settlement areas, especially near schools and other sensitive locations such as hospitals and places of worship.
- Vibration should be controlled with the agreement of the Engineer at locations where sensitive receptors are found. Precondition survey should be carried out if requested by the engineer at identified locations.
- Regular sprinkling of water to dampen the construction surface will reduce the emission of dust.
- Install the dust barriers at sensitive locations to avoid drifting of dust

4. Deterioration of surface water quality due to silt runoff, emissions and spoil from labour camps

103. In order to upgrade roads, clearing of roadside vegetation within the ROW, excavation and removal of unsuitable soil, cutting trenches for roadside drains and removal of degraded surface of roads will be required. Such activities may develop temporary piles of soil and debris along the road edge.

104. These activities could cause temporary erosion and siltation of water bodies, drainage canals and irrigation systems.

105. Run off contaminated with oil, grease, and emissions from construction vehicles, equipment and material stores, wastewater and solid waste from worker camp sites will cause the deterioration of surface water sources if they are released to adjacent water bodies.

106. Following measures should be adopted to mitigate deterioration of surface water quality due to silt runoff, discharges and spoils from construction and labor camps;

- Reuse of waste soil for refilling of borrow pits if any
- Where earthworks take place adjacent to water bodies, silt traps shall be installed prior to the commencement of earthwork activity
- All temporary unsuitable soil dumps and debris should be removed from site to approved disposal sites
- If temporary soil dumps are left at the site for a long time proper remedial measure to minimize soil erosion should be practiced
- Temporary soil dumps should not be placed near water bodies
- All fills, back fills and slopes should be compacted immediately to reach the specified degree of compaction,
- Suitable local drainage measures should be established to properly drain the water in the construction area to the nearby waterways
- Establishment of suitable mulch to cover the slopes of embankments
- All materials (including toxic and hazardous material) required for construction shall be stored at secure and managed sites, sited away from water bodies,
- Construction vehicles and equipment will be maintained in good operable condition, ensuring no undue leakage of oil or fuel,
- Construction vehicles and equipment will be serviced only at properly managed and equipped workshops and waste oil will be collected and disposed at approved locations,
- Sanitation arrangements will be made at worksites and any accommodation facilities provided for workers' accommodation, ensuring that no raw sewage is released into drains or water bodies.

5. Social and Environmental Impacts due to Establishment of Labor Camps

107. Labor camps may need to be established near the road alignment and improper sanitation, wastewater and solid waste disposal risk contaminating nearby surface water sources. Stagnant water from the labor camp can create mosquito breeding and vector for communicable diseases to the workers and host communities. Social conflicts may arise due to use of illicit liquor and unpleasant behavior which causes inconvenience to local community.

108. Labor camps will be located at least 100m away from water resources. Proper sanitary facilities will be provided to the labor camps and proper way of disposing wastewater and other waste matter generated from camps as agreed with the Public Health Inspector (PHI) will be strictly observed.

109. Maximize recruiting of local labor to minimize the need for migrant workers and avoid potential and health conflicts with the host community. Awareness programs should be conducted targeting workers as well as local community in order to minimize and avoid any such conflicts.

6. Disruption to Traffic/Transportation

110. Improvement works on the road pavement and reconstruction of culverts will impede existing traffic flows. The movement of trucks and other construction vehicles may cause accident risks and may damage other roads that they use to bring construction materials to the construction sites. Following measures should be considered to minimize the impacts on existing traffic;

- Providing advance information to the public about the planned construction works,
- Use of flagmen control traffic flows at constricted sites, including safe crossing for pedestrians especially near town areas and schools.

7. Biological impacts

111. **Impact on Protected Areas and Sensitive Ecosystems.** There are no anticipated impacts on the protected areas and sensitive ecosystems. No project road is located in or within 100m of any forest, wildlife reserve, and sanctuaries.

112. **Impacts on terrestrial flora.** During the construction stage loss of vegetation within the ROW is inevitable. Most of the trees that will be affected are fruit bearing and ornamentals which includes Milla (*Vitex altissima*), Palu (*Manikara hexandra*), Kaluwara (*Diospyro sebemum*), Kohabi (*Azadirachata indica*) and Suriya (*Thespesia pupulnea*). This could aggravate the erosive processes especially during the rainy season.

113. All construction works will be carried out in a manner that the destruction or disruption of vegetation is minimal. A compensatory tree planting program will be developed at a rate of at least three (3) good specimens of tree species planted for each tree removed. If there no space available along the road for tree planting, these trees will be the planted o home gardens, schools, government institutions, private institutes and government institutes in the project area.

114. Suitable species of trees will be distributed free of charge among the interested parties by the contractor with the consultation of Department of Forest/Central Environmental Authority/Agrarian Service Department/community based organization.

128. **Impacts on terrestrial fauna.** No impacts of fauna is anticipated as no road is encroaching or located near forest, wildlife reserve, and sanctuaries.

115. **Impact on aquatic fauna and flora.** There will be soil erosion from stock piles, excavation, oil and grease from construction vehicles which will deteriorate the water quality of

the receiving water body including increase in turbidity leading to temporary impairment to sustain aquatic fauna and flora.

116. This impact could be mitigated through proper by siting of all hot mix plants, crusher plants, workshops, and temporary worker camps and storing of toxic and hazardous materials at approved locations, recycling and dumping of solid waste at locations approved by local authorities, maintenance of vehicles and equipment in good operable condition, ensuring no leakage of oil or fuel and the fitting of proper exhaust baffles. No solid waste will be dumped into water bodies.

8. Establishment of invasive species

117. During the construction stage, soil brought into the project area from outside may contain seeds of alien invasive species. Also, the construction machinery and vehicles can accidentally introduce seeds of such plants if used without proper cleaning. Temporary facilities such as labour camps, dumping sites, soil storage sites are potential locations where invasive plant species can get established in quick succession. This will negatively affect both the natural and manmade habitats.

118. It is observed that several alien invasive species have dominated the vegetation in certain sections. Therefore, there is a possibility that such invasive species may invade new areas if the waste plant material generated during site clearing and dredging activities (if any) is disposed to areas away from the project.

9. Impacts Due to Extraction and Transportation of Construction Materials

119. Sources of construction materials such as gravel /metal could be obtained from the quarry and borrow sites. Extraction and transportation of materials from such sites will cause noise, vibration, dust, induced slope failures, negative visual impacts, creation of mosquito breeding sites and damage to private properties and minor roads. Heavy trucks transporting materials to construction sites will cause disturbances to local traffic, damage minor roads, and increase dust and noise nuisance.

120. This could be mitigated by using quarry and borrow sites approved by Geological Survey and Mines Bureau (GSMB). Spoils will not be dumped along road side and near water bodies. Spoils, top soil and denuded materials will be reused for restoring of borrow sites and transported materials should be covered using polythene or any other suitable material to avoid dust blow. Keeping provisions for repairing and restoration of the roads used for the transportation of construction materials by the contractor in the contract document and use of covers over transported materials to guard against dust blow and water spraying to dampen the surface will mitigate the impacts due to transportation of construction material.

10. Requirement of lands for the road upgrading

121. The land acquisition has not been envisaged for this project expecting that available right of way will be adequate to carry out road improvements. In case of requirement of land, the lands will be taken after negotiating with land owners through involvement of a third party.

122. During construction, temporary occupation of privately owned land may be required for stock piling and use as yards. If such a necessity occurs the contractor with the concurrence of project staff will sign a temporary occupational contract with the owner.

11. Safety of Workers and Public

123. Construction activities pose potential hazards to both workers and public. Safety to workers and the public will be enhanced by;

- Proper briefing and training of workers on safety precautions, and their responsibilities for the safety of themselves and others
- Provision of Personnel Protective Equipments (PPE) to be used at every time involved in when construction activities and high visibility jackets at night
- Ensuring that plant and vehicle operators are properly licensed and trained
- Arranging for the provision of first aid facilities, readily available trained paramedical personnel, and emergency transport to the nearest hospital
- Arranging for regular safety checks of vehicles and material, and allocation of responsibility for this
- Ensuring that quarry operations, particularly blasting is carried out and supervised by trained personnel. As well, the explosives are stored in a secure location and that all due precautions are taken to ensure that blasting does not induce rock falls
- Provision of hazard warning signals around construction sites, and directing vehicle and pedestrian traffic away from work sites
- Provision of traffic management plans during construction including barricading of openings and lighting at night where required.

12. Management of Construction Debris/Waste

124. Debris can be generated by dismantling of existing pavement. Collected dust and unused iron bars or damaged support structures constitute significant wastes. Mitigation for solid waste from construction camp has been given in construction camp section.

125. The existing bitumen surface can be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, haulage routes, etc.

126. All excavated materials from roadway, shoulders, verges, drains, cross drainage and the like may be used for backfilling embankments, filling pits, and landscaping to the extent feasible. Unusable debris material should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in an environmentally accepted manner as follow:

- Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.
- Unproductive/wastelands shall be selected for dumping sites.
- Away from residential areas and located at downwind side of these locations.
- Dumping sites do not contaminate any water sources, rivers etc, and
- Dumping sites have adequate capacity equal to the amount of debris generated.
- Public perception and consent from the village about the location of debris disposal site has to be obtained before finalizing the location.
- Form works will be re-used to the extent possible, more than 20 times as dictated by good practice. All stripped formworks will be examined for any damage and rectified in the workshop for re-use. Rectification includes plugging holes, and straightening bent steel props.

C. Operational Phase

1. Impacts on water resources

127. Improvements to the road drainage will result in improved storm water flows, and reduce the frequency of blockages from occurring. Risks to the public health caused by stagnant water bodies acting as disease vector breeding places will be reduced. By designing the drains to withstand, appropriate storm events will reduce the risk of any operational failure of the drainage system and regular maintenance will further reduce the chances of failure.

128. In addition, improper handling of chemicals used for maintenance works such as paints, pesticides and asphalt will degrade nearby water bodies. Proper handling of such chemicals under strict supervision will minimize risk of water pollution during the maintenance period.

2. Disposal of unsuitable material

129. De-silting of drains, culverts and bridges, removal of road side vegetation and removal of damaged/degraded road surfaces during the maintenance period will generate unsuitable soil, vegetation and debries. Collected materials will be properly disposed to avoid to avoid blocking of drainage.

3. Extraction of material for repairing and maintenance works

130. For repairing of maintenance of carriageway and other structures, material such as gravel, aggregates and sand will be required. And mitigation measures specified in 5.2.7 will be adopted to minimize impacts due to maintenance activities of the roads.

4. Pedestrian and commuter safety

131. Improvements to the road surface will be conducive to safe vehicle travel at higher speeds. Such speeds may increase the incidences of accidents. Incorporating the following measures will offset this negative impact;

- Provision of centreline road marking where possible, edge delineation etc...
- Provision of clearly marked signing at townships, sensitive areas such as schools, temples
- Enforcement of speed limits and other traffic rules, especially within the town limits
- Placing of sign boards for animal crossings

132. Furthermore, safety of road users could be ensured during repairing of carriageway and hydraulic structures by placing standard signboards, barricading of the repairing site etc.

5. Air quality and noise

133. Higher speed limits will reduce the travel time through the area and better surface conditions will reduce the number of accelerations and decelerations in travelling thereby reducing the emissions to the air. Therefore, the project is expected to have a positive effect on overall air quality. Necessary traffic signs and signals will be installed in sensitive areas such as schools, temples to warn drivers and avoid making unnecessary horn.

D. Positive Impacts of the Project

1. Socio - economic benefits

134. Following socio-economic benefits are expected to transfer to the affected populations of roads selected under the i Road Program.

- Improvements in road connectivity reduce regional disparity, open up new markets, generate employment opportunities and thereby reduce poverty in lagging areas.
- An efficient and convenient transportation system will accelerate the economic growth by facilitating easy and faster mobility of people, goods and services and reducing disparities in regional development.
- The road network improvement in North Western Province will boost economic activities including potential growth in industries, tourism, fisheries and agriculture in lagging areas.
- Good road network will reduce transport cost and travel time leading to increase the profit margin of the small-scale farmers. The market expansion increases the marketability of the product.
- The wages of agricultural laborers will be increased when profit margins and sales are increased due to the road development.
- Similarly, better road network will provide access to schools and other services. In the long term this will improve education level and other associated life values (health status, awareness and social skills) of the people and they will become more competitive in the labor markets in finding their destinies.

E. Climate Change Impacts and Risks

1. Climate Change Mitigation

135. The Transport Emissions Evaluation Model for Projects (TEEMP)[4] developed by Clean Air Asia[5] was utilized to assess the CO_2 gross emissions with- and without the project improvements which is mainly surface roughness and directly impacts speed and fuel consumptions. It also allows the assessment of future congestion, if they will occur in the future given the projected increase in traffic and road capacity with-and without the project improvements like lane configuration and road roughness.

2. Key road upgrading features

136. iRoad Tranche II will upgrade 115 rural roads with a total aggregated length of 726.79 km distributed across Kurunegala and Puttalam districts, North Western Province. No land acquisition will be allowed and all improvements will be limited to the existing 1-lane configuration with 3.0m carriageway with an asphalt concrete surface. Road roughness will decrease from the general condition of 8.0 m/km to 2.5 m/km. Other improvements include the repair or reconstruct damaged culverts, introduction of earth drains for all road sections and built

[4] TEEMP is an excel-based, free-of-charge spreadsheet models to evaluate emissions impacts of transport projects.
[5] A network of 250 organizations in 31 countries established by the Asian Development Bank, World Bank, and USAID to promote better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors.

up drains where necessary, removal of any irregularities that are on the existing vertical profile, and road safety appurtenances.

137. Traffic forecast were taken from the economic analysis for each road section disaggregated into vehicle types and share to the annual average daily traffic.

138. Road capacity of 7,200 PCU/lane/day for rural roads was adopted for the project. Emission factors were mostly taken from the CBCP/MOEF (2007) Draft Report on Emission Factor Development for Indian Vehicles, the Automotive Research Association of India, and C. Reynolds et.al (2011) Climate and Health Relevant Emissions from in-Use Indian for three-wheelers rickshaw as follow:

Table V.1. CO2 Emission Factors

Vehicle Type	Gas	Diesel	LPG/CNG
2-Wheel	1.37 kg/l		
3-Wheel	2.12 kg/l		3 kg/l
Cars/bus/bus	2.24 kg/l	2.58 kg/l	

3. Estimated Carbon Emissions

139. For each kilometer of rural road upgrading, CO2 emission from construction is estimated at 11 tons[6]. Total annual emission without the project is estimated at 5,723 tons.

4. Climate Risks and Adaptation needs

140. Climate risks were identified following both top down and bottom up approaches. Under the top down approach changes of key climate parameters, mainly temperature and precipitation were projected for 2050 using an ensemble of Global Climate Models (GCMs). Given the projected variations of temperature and precipitation the project roads were screened for the following types of climate risks:

- **Increased precipitation**. Seasonal runoff may lead to erosion and siltation of water courses, ponds and reservoirs. Risk of flooding and precipitation induced landslide events as there are existing hazards associated with heavy precipitation in the some of the project roads.
- **Flood**. Climate change is projected to influence the frequency and intensity of flood events. Existing engineering designs may not take into consideration the impact of climate change on the risks from flooding. A more localised and in-depth assessment must be carried out.
- **Sea Level Rise**. Some recent research suggests that global sea levels could be 0.75 to 1.9m higher by the end of the century. Local changes in ocean density/dynamics and land movements can also add to, or lessen, the effects of sea level rise at a given location. Sea level rise has the potential to accelerate the rate of coastal erosion. Changes in erosion regimes also impact the rate of sedimentation in other areas, particularly in estuarine and other tidal settings.
- **Temperature Increase**. There is a potential for an increase in incidences where current design standards will not be sufficient. The design, operational and maintenance standards should be reviewed - take into consideration current impacts

[6] R. Shanthini (2006). Impact of Sri Lankan Rural Roads on Greenhouse Gas Emissions & Mitigation and Climate Change – A Case Study. http://www.rshanthini.com/tmp/CP551SD/RuralRoadandGHG.pdf

of high temperatures as well as potential future changes. Heatwaves put stress on roads and other transport links.

- **Natural Hazards.** a) Landslide Triggered by Precipitation. All roads and road sections 10km off the coastal areas are potentially susceptible to low to medium levels of landslide risk; b) Coastal Erosion. Coastal erosion has been identified as a major hazard in many coastal areas of Sri Lanka, particularly along northwestern coastline in Puttalam District ; c)Tsunami. Tsunamis are infrequent in Sri Lanka but have caused severe damages, and recent understanding of the tectonics of the Indian Ocean region points to an increasing risk of earthquakes.
- **Temperature Increase**. There is a potential for an increase in incidences where current design standards will not be sufficient. The design, operational and maintenance standards should be reviewed - take into consideration current impacts of high temperatures as well as potential future changes. Heatwaves put stress on roads and other transport links.

141. Key engineering measures taken to address these risks in the design are: i) increase in embankment height, ii) construction of new side and lead away drains, iii) construction of new culverts or widening of existing ones and iv) construction of new bridges. As shown in the succeeding Table.

Cost of Climate Adaption Measures (LKR.million)- North Central Province

District	Increase Embankment Height	New Side and Lead away drains	New/Widening Culverts	New Bridges	Total
Kurunegala	106.06	170.28	364.12	0	**640.46**
Puttalam	24.44	2.85	47.37	85.5	**160.16**
Total	**130.5**	**173.13**	**411.49**	**85.5**	**800.62**

142. Tranche-2 has earmarked LKR5,350M to address climate change risk by increasing road embankment height on flood and tsunami prone areas, provision of side drains and new culverts, and construction of small bridges representing about 8.36% of the total civil work cost[7].

[7] US$492.14M @ 1US$:130LKR

VI. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MANAGEMENT PLAN AND GRIEVANCE REDRESS MECHANISM

A. Institutional Arrangements

143. The Ministry of Highways, Ports and Shipping (MOHPS) is the Executing Agency (EA) and the secretary to the ministry will be responsible for decisions on overall approvals and operational policies of the project. RDA will be the IA and within RDA there will be a PIU. The PIU will be responsible for implementing the project and managing detailed design and supervision of the construction works and ensuring that all environmental safeguard requirements in accordance with this EARF are met. The PIU will be headed by a full time Project Director (PD) and supported by a team of engineers from RDA. The PIU will have a safeguards team with sufficient social and environment safeguards officers to cover the quantum and geographic distribution of works in all provinces under the investment program. RDA will have a Surveys and Preparation of Engineering Design (SAPE) team that will be responsible for conducting studies including environmental assessments of all project roads before the processing and approval each project. The Project Implementation Consultants (PIC) will support the PIU for supervision of the design and construction works by the civil works contractor. The PIC team will include a team of environment safeguards consultants for conduction of regular monitoring of safeguards implementation on site.

B. Responsibilities

144. Detailed list of responsibilities of the EA, IA, PIU, PIC, SAPE, and contractors for implementation of environmental safeguard matters are presented in Table 6.1.

Table 6.1: Responsibilities for Environmental Safeguards Implementation

	Agency	Responsibility
1.	Ministry of Highways, Ports and Shipping (EA)	– Make final decision on roads to be included under the investment program – Overall responsibility for project design, feasibility, construction and operation and guide RDA to play its role as the IA – Ensure that sufficient funds are available to properly implement all agreed environmental safeguards measures – Ensure that all projects and roads, regardless of financing source, complies with the provisions of ADB's SPS 2009 and GoSL's environmental laws and regulations – Ensure that tender and contract documents for civil works include all relevant parts of the environmental assessment and project agreements – Submit annual safeguards monitoring reports to ADB
2.	Road Development Authority (IA)	– Ensure that Project complies with ADB's SPS and GoSL laws and regulations – Ensure that the project complies with all environment safeguard requirements as given in this EARF

	Agency	Responsibility
		– Ensure that tender and contract documents for civil works include all relevant parts of the environmental assessment and project agreements
3.	Project Implementation Unit (PIU) with support of safeguards team	– Ensure that Project complies with ADB's SPS and GoSL laws and regulations – Ensure that the project complies with all environment safeguard requirements as given in this EARF – Ensure that the environment checklist is completed each and every project road – Review and approve the environment checklists – Based on the findings of the completed environment checklist for all project roads complete one Rapid Environment Assessment (REA) checklist as required by the ADB SPS for the respective project – Ensure the preparation of one province level IEE report based on the information from the project road environment checklists and other consultations and literature review as necessary – Ensure the preparation of due diligence reports on the environment safeguards performance of the earlier project before the approval of the next project – Obtain feedback on draft IEE report findings from major stakeholders where necessary and facilitate necessary revisions – Facilitate public disclosure of safeguard documents where necessary in accordance to the requirements of ADB and CEA – Ensure that environmental protection and mitigation measures in the Environmental Assessment report and EMP are incorporated into the design (level 2 design) – Ensure that requisite measures from the Environmental Assessment report and EMP are incorporated into the bid and contract documents – Ensure that necessary provisions are made in the contract documents for the EMP to be updated in accordance with revisions in the final detailed design (level 1 design) – Organize environmental management capacity building activities for PIU and orientation and awareness training for PIC and contractors as described in para 21 of this EARF. – Ensure that RDA has obtained necessary environmental clearances, permits, license(s) etc. from CEA and other agencies as specified in this EARF (Table 3)

	Agency	Responsibility
		– Review and approve the contract package specific EMP's and EMOP's prepared by the contractor – Ensure that contractors obtain necessary environmental permits, license(s) etc. from respective agencies as specified in this EARF (Table 3) prior to commencement of civil works contracts – Facilitate the establishment of a grievance redress mechanism, as described in this EARF and respective IEE report, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances related to environment safeguards – Ensure that all mitigation measures as given in the EMP are implemented properly – Ensure proper conduction of environmental monitoring during pre-construction, construction and operation phases – Review and approve the monitoring checklists and reports prepared by the PIC and conduct field spot checks to verify the accuracy of the monitoring checklists – Ensure annual environmental monitoring reports are prepared and submitted to ADB for disclosure on their website on an annual basis – Identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to ADB and during project implementation – Facilitate additional environmental assessment (if required) for specific sub-projects and submit to ADB and CEA for review and clearance – Review and approved EMP's if they get updated and revised by the contractor
4.	ESDD, RDA	– Facilitate and act as resource persons during training workshops under the investment program – Provide technical advice and support as necessary to the PIU – Monitor implementation of safeguards under the investment program on a bi-annual basis as necessary
5.	SAPE team under RDA	– Conduct field surveys and complete the environment checklist for each and every project road – Based on the findings of the completed environment checklist for all project roads complete one Rapid Environment Assessment (REA) checklist as required by the ADB SPS for the respective project

	Agency	Responsibility
		– Prepare one province level IEE report and standard EMP based on the information from the project road environment checklists and other consultations and literature review as necessary – Make necessary revisions to the IEE based on feedback from the PIU, PIC, ADB or other agencies such as CEA as necessary
6.	Project Implementation Consultants (PIC)	– Review and approve the contract package specific EMP's and EMOP's prepared by the contractor – Daily on site supervision for implementation of environmental safeguards – Completion of monitoring checklists during pre-construction, construction and operation and maintenance stages for each road – Close coordination and communication with the contractor to facilitate implementation of all mitigation measures identified in EMP – Preparation of monitoring reports and submission to PIU, RDA – Provide technical support and advise for addressing complaints and grievances and participate in resolving issues as a member of the GRC – Provide technical advice and on the job training to the contractors as necessary – Preparation of annual monitoring reports based on the monitoring checklists and submission to RDA for further submission to ADB – Preparation of due diligence reports on the environment safeguards performance of the earlier project before the approval of the next project – Review the environmental assessment report prepared by the SAPE team under RDA – Review and approve updated/revised contract specific EMP's as necessary
7.	Contractor	– Based on the standard EMP, environment checklists for each road and the detailed design (level 1 design) prepare a contract package specific EMP for approval by the PIC and/or PIU before start of physical works – Based on the standard Environmental Monitoring Program (EMOP) on collection of environmental quality data prepare contract package specific (EMOP) for approval by the PIC and/or PIU before the start of physical works – Ensure that adequate budget provisions are made for implementing all mitigation measures specified in the EMP – Participate in induction training on EMP provisions and requirements delivered by the PIU

	Agency	Responsibility
		– Obtain necessary environmental license(s), permits etc. from relevant agencies as specified by EARF (Table 3) for associated facilities for project road works, quarries, hot-mix plant etc. prior to commencement of civil works contracts – Implement all mitigation measures in the EMP – Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by PIU. – Ensure compliance with environmental statutory requirements and contractual obligations – Collect the baseline data on environmental quality before the start of physical works and continue collection of environmental quality data as given in the Environmental Monitoring Plan during construction and operation – Participate in resolving issues as a member of the GRC – Respond promptly to grievances raised by the local community or any stakeholder and implement environmental corrective actions or additional environmental mitigation measures as necessary. – Based on the results of EMP monitoring, cooperate with the PIU to implement environmental corrective actions and corrective action plans, as necessary. – Annually review the road specific EMP and update it if required
8.	ADB	– Review REA checklist and endorse or modify the project classification and recommend the ToR for the Environmental Assessment report – Review IEE reports and disclose the draft and final reports on the ADB's website as required – Issue project approval based on IEE reports; – Monitor implementation and monitoring of EMP through due diligence missions – Provide assistance to the EA and IA of project roads, if required, in carrying out its responsibilities and for building capacity for safeguard compliance – Monitor overall compliance of the project roads to this EARF – If necessary provide further guidance to the IA on the format, content, and scope of the IEE reports and annual or semi-annual monitoring reports for submission to ADB
9.	CEA	– Review and approve Environmental Assessment reports required by the project as per GoSL environmental laws – Issue, and renew environmental licenses as

	Agency	Responsibility
		required by the contractor and PIU during the project cycle – Undertake monitoring of the project's environmental performance

C. Environmental Management Plan and Monitoring

145. Environmental Safeguards Manual of RDA and the ADB SPS, outlines the requirements for an Environmental Management Plan (EMP) which is presented as a matrix developed based on best practices for environmental management. This IEE report includes one general or standard EMP for the rural roads as given in Appendix 5. These standard EMPs cover all impacts and mitigation measures identified within the respective province. Contract package specific EMP's will required to be prepared by the contractor by referring to the standard EMP, road specific information in the environmental checklists and the detailed design (level 1 design). All costs for implementing the mitigation measures must be included in the Bill of Quantities (BOQ) by the contractor as implementation of the EMP will be the responsibility of the contractor and the PIU will oversee the effectiveness of the implementation with the assistance of the PIC.

146. Contractors will have a construction period of approximately two years and routine maintenance for three years. A typical EMP prepared for the rural road is attached in Annex 5.

147. Monitoring of EMP implementation will be carried out during the preconstruction, construction, and operation and maintenance stages of the project. Based on the EMP, environmental monitoring checklists (EMC) will be prepared by the PIC for each of these stages. The EMC monitors the degree of compliance of the mitigation measures proposed in the EMP in all three stages. Every road must have atleast one EMC completed during pre-construction, one to three8 during construction depending on the length of the road and one per year during operation and maintenance. Sample EMC based on the standard EMP is provided in Appendix 5. Records of these completed monitoring checklists must be systematically maintained within the PIC and/or PIU office. Based on these records and site visits monitoring reports will be prepared during the construction and operation stage on an annual basis9 per province and submitted to ADB for disclosure on the ADB website.

148. In addition there will be an Environmental Monitoring Plan (EMoP) based on the project cycle to monitor EMP implementation by measuring environmental parameters. During the pre-construction phase baseline data on air, water quality and noise levels will need to be collected. This data will provide baseline information on the existing conditions which could be used to compare the changes in quality levels during construction and operational phases. Such a comparison will reflect how effective the EMP is and help to revise it to rectify any shortcomings that will cause any adverse impacts. Appendix 6 presents a sample EMOP. Based on these sample or standard EMOP's the contract will be required to prepare contract package specific EMOPs.

[8] The monitoring checklist during construction stage will be completed three times when the progress of physical works is 25%, 50% and 75% respectively. This may not be practically feasible for shorter roads that are only 1 to 3 km long. Hence for these shorter roads only one completed monitoring checklist during construction stage will be adequate.

[9] The first annual monitoring report will cover the period starting from the date of first contract award.

149. Furthermore the contractor will also be responsible for updating EMP, EMC and EMOP if there are any significant changes in the project site conditions or engineering design.

D. Grievance Redress Mechanism

150. Grievances from the affected people on social and environmental issues during project implementation will be addressed mainly through the existing local administrative system. Depending on the nature and significance of the grievances or complaints, grievances will be addressed at three levels. The first will be at the grass roots level where complaints will be directly received and addressed by the contractor, PIC or PIU representative on site. Grievances which are simple but still cannot be addressed at the grass roots level will be addressed at the Grama Niladhari (GN) level. More complex grievances which cannot be addressed at the GN level will be addressed at the Divisional Secretariat (DS) level. There will be a Grievance Redress Committee (GRC) at the GN and DS levels.

151. At the GN level the GRC members will be:

i)	Grama Niladari of the area	Chairman
ii)	Representative of PIU	Secretary
iii)	Representative of Supervision Consultant	Member
iv)	Representative of Contractor	Member
v)	A community member/religious leader	Member
vi)	Woman representative from the local community	Member

152. At the DS Level GRC members will be:

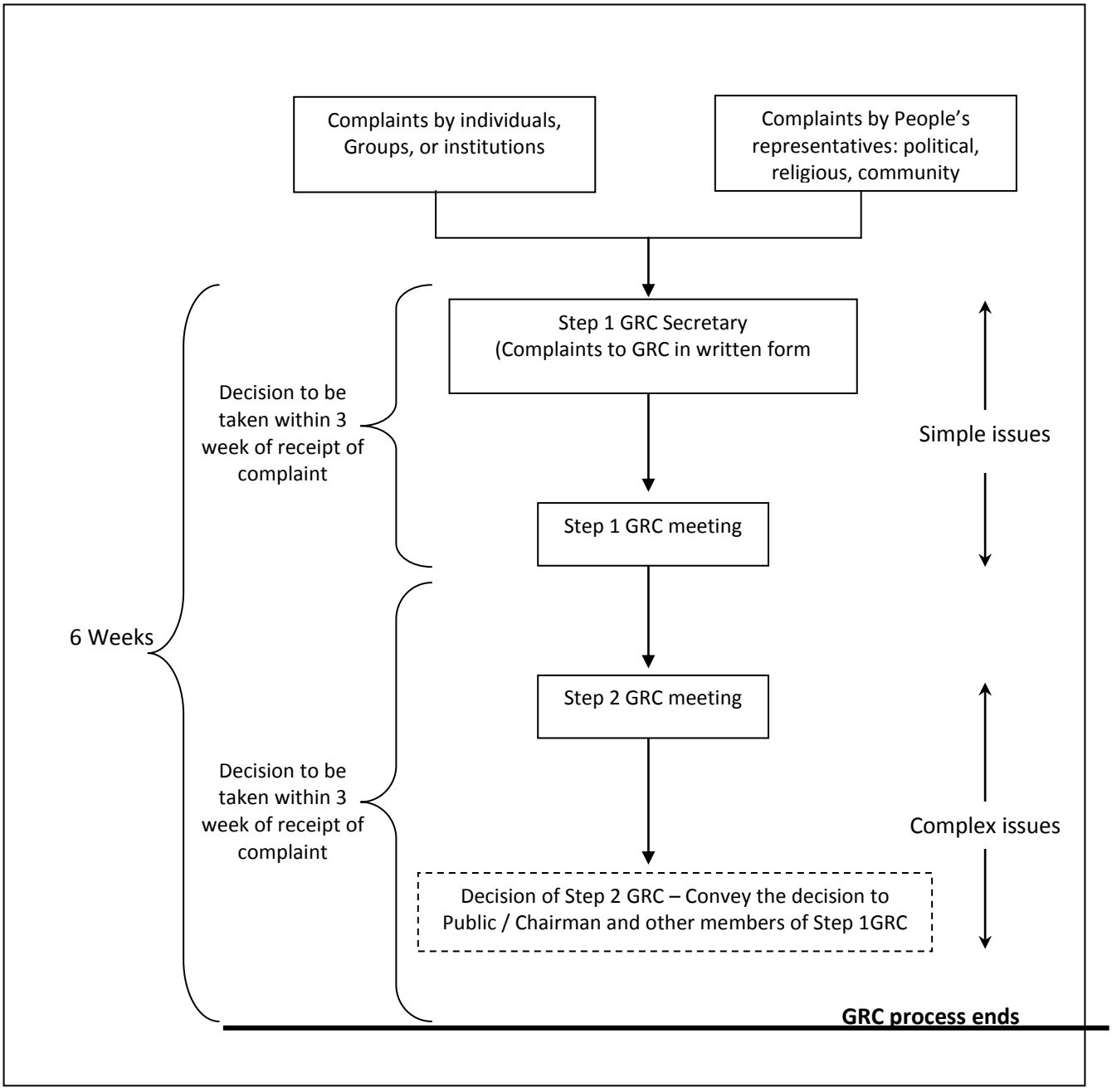
i)	Divisional Secretary of the area	Chairman
ii)	Representative of PIU	Secretary
iii)	Grama Niladari	Member
iv)	Representative of Supervision Consultant	Member
v)	Representative of Contractor	Member
vi)	Representative of a social organization (NGO/CBO) of the area	Member
vii)	A community member/religious leader	Member
viii)	Woman representative from the local community	Member

153. To make the GRM process gender responsive the GRC will include one woman member to represent the local community women. Further when grievances or complaints are submitted to the GRC, both women and men complainants will be treated equally and necessary measures will be taken to address the grievance in the best way possible.

154. Recommended steps with timeline on the operation of the GRM is provided in Figure 6.1. Adjustments may be made to the GRM during processing of succeeding tranches if necessary and accordingly described in the respective IEE. In addition a complaints contact person will be designated within the PIU to help address all concerns and grievances of the local communities and affected parties. Contact details of this person will be provided in the project information display board that will be placed at the project site.

155. The flow chart of the GRM is presented in Figure 6.1.

Figure 6.1.GRM Process



VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. One on one consultation

156. One on one consultations were held with local community people living in the project area during month of July 2014. A summary of the one on one public consultation is given in Table 7.1

157. People in the project (Approximately a total of 400 males and 250 females) area have positive ideas about the road development and their ideas indicate the importance of the road network development in the southern province. The main benefits perceived by the public are listed below.

- Easy transportation for people and agro products
- Easy access to main towns
- Ability use roads in all weather conditions
- Less travel time for school children
- Improvement in living standard of people
- Security for women, children and elders
- Increased road safety
- Potential development to tourism industry and other industries
- Town development and increase in land value
- Increased connectivity among villages

158. Objective of this activity was to understand the viewpoints of the stakeholders and to respond to their concerns and suggestions during the early stages of the project there by reducing any objections towards the project, incorporate any valuable suggestions by the public in to the design so as to reduce any adverse impacts to the environment.

159. In addition, consultations were held with the Department of Wildlife Conservation (DWLC) in order to obtain their views on roads located near protected areas. DWLC confirmed that there will be no major impacts on the forestlands since the road improvement works will be strictly within the existing ROW.

B. Focus Group Discussions

160. In addition to the one on one interviews, Focus Group Discussion (FGDs) representing the three districts were carried out as a part of transact walk for each road

161. Key comments and suggestions made during above meetings are listed below. It should be noted that some participants made comments on the rural road segment of i Road program (even during one on one interviews). These comments are also included in this summary.

Table 7.1: A summary of FGDs held for IROAD project

Location of FGD	Comments made by participants	File photo
Kurunegala District		
Dabadeniya DS	• Road edges need to be well constructed to avoid accidents • Road reconstruction without drains are no means and land donation is also promised • Slope failures could be initiated if cut slope angles are too high • Due to high water flow during rains, road comes under flood, therefore, culverts are needed to be constructed at such locations • New culverts, bridges and drains need to be constructed to drain out water • Importance of Road maintenance is highly emphasized after reconstruction • Due to bad drainage, nobody travels on the road and earth drains are needed. • Marginal profit is gained due to damages on the Agri. products	 
Galgamuwa DS	• Quality road surfaces and safety features needed to be considered to avoid accidents in culvert and bridge designs. • Poor road conditions affect the agricultural and other economic activities in the area • Construction works need to be properly monitored. • Agri products are highly damaged while being transported to markets. It leads to huge income loss • Blockage of drainage causes flooding over some road sections. • Stability of cut slopes are important. • Construction works need to be properly monitored.	

Hiriyala DS	• Side drains and culverts needs to be maintained after reconstruction • Blockage of drainage flow causes flooding over some road sections. • Quality supervision is needed to ensure the quality of the road. • Existing drains are filed with soil and debris. Hence, road surface is highly eroded. • This project will ensure the safety of women, children and elderly who uses these roads • Drainage investigation is important and this should be done with the help of village people	
Puttalam District		
Chilaw Ds	• It is required to make bends straight to minimize accidents • Soil erosion of road embankment and land inundation should be avoided • Culvert capacity needs to be enhanced as compared to the drainage volume • Road clearing is needed to construct in better way first • Road sub base at certain locations need to be improved. If not the improved road surface will be • Affected • Road safety is minimal , hence, it is needed to be widened at some locations • Reconstruction of highly damaged road surface is a must as it has barred vehicle transportation, and travelling to the hospital by patients and pregnant mothers • Improvement of roads in the area will help in the economic development. • PradeshiyaShabahs (PS) did not do any road improvement for last 10 years in the area.	 

Anamaduwa DS	• Agri products are damaged while being transported to markets. It leads to huge income loss • The minor bridges broken need to be reconstructed to provide access to local community. • Embankments slope has eroded during the rainy season. • •The culverts are damaged and malfunctioned , and they need to be shifted towards the ROW to get a good road width • Easy access to transport Vegetable to kurunegala market. • During the rainy season, private hiring vehicles do not like traveling on these roads. • Storm water drainage system has to be improved because during the rainy season difficult to use this road • Good alternative for reduction of the traffic Jam • Reconstruction will be better solution for dust emission in the dry season. • After reconstruction need to be deployed school bus	 
Nanththandiya Ds	• Road side drains and all other existing drainage structures need to be properly investigated and reconstructed where necessary • Many employers use this road reconstruction is crucial. • Road side drains and all other existing drainage structures need to be properly investigated and reconstructed where necessary. • It is important to improve/ widen road sections with sharp bends and locations with poor visibility. This will improve road safety. • Road reconstruction without widening is no meaning.	

C. Disclosure of information

162. According to the National Environment Act no. 47 and its amendment no. 56, only Prescribed Projects are subjected to specific information disclosure requirements. Since this project is not a prescribed project no information disclosure is required.

163. According to the requirements of the ADB SPS, for environment category B project roads the respective draft IEE will be disclosed before the Management Review Meeting (MRM) or equivalent meeting or approval of the respective project, if there is no MRM. Signboards with project information including details on nature of construction works, road length, construction period, name of contractor, contract sum and contact information for reporting complaints or grievances will be posted in three languages (Sinhala, Tamil and English) for rural roads. For the national (OPRC) roads there will be sign boards on period of works and contact information for reporting complaints or grievances in three languages.

164. During project implementation annual environmental monitoring reports will be prepared per province and submitted to ADB for disclosure on the ADB website.

D. Transect Walk

165. In developing rural roads, the community participation and consultation has been identified as important. For this project, the participation of communities started at the very initial stage of the project through the transect walk. Transect walks are organized in close coordination with the Grama Niladari concerned at village level and Divisional Secretary at divisional level. In doing this, the project team and key informants conduct a walk along the road, to listen to identify issues, and conditions and to ask questions to identify possible solutions. Following figure details the stages of participatory project preparation.

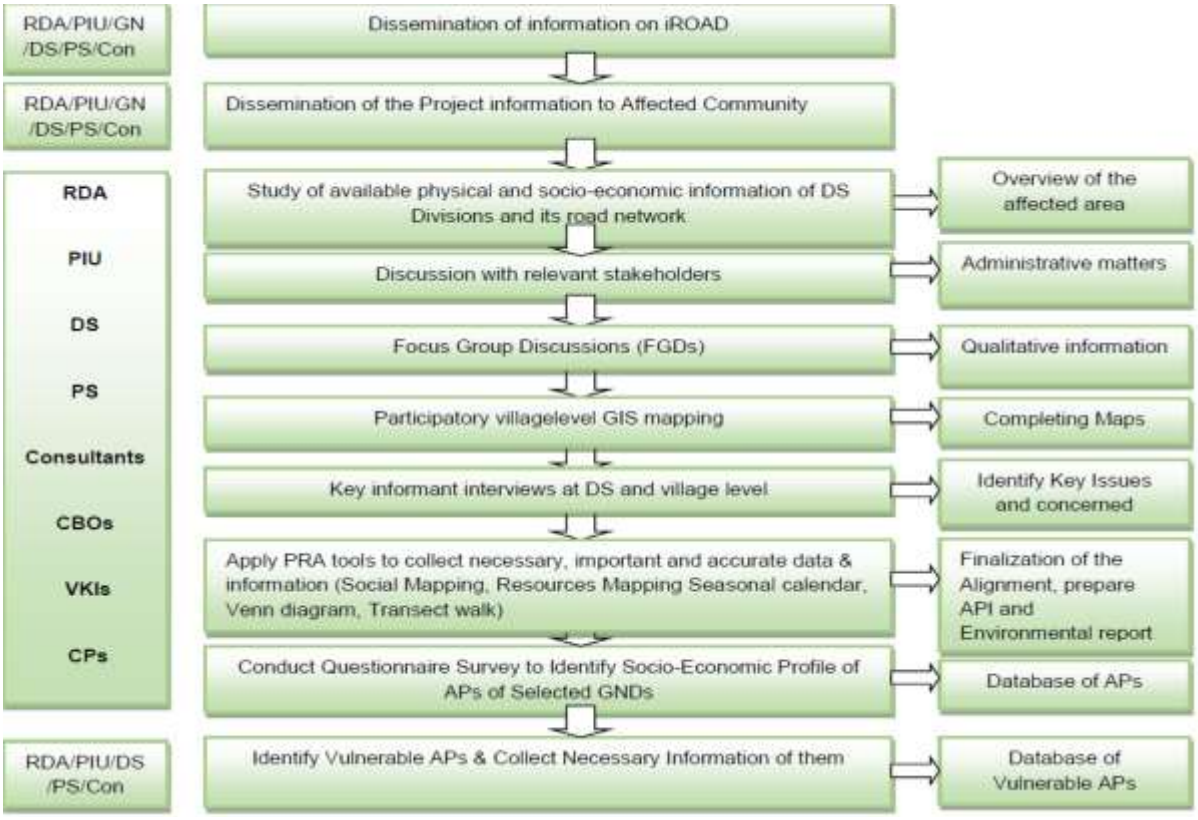


Figure 7.1: Stages of participatory project preparation

Source: Page 41, Appendix 3, Resettlement Framework, Integrated Road Investment Program

VIII. CONCLUSION AND RECOMMENDATIONS

166. The information on existing social environment suggests that agriculture as well as industries is the main occupation for most of population in the North Western province and poverty and unemployment still prevails in the region. The public consultation confirmed that the roads couldn't be used during rainy seasons and lack of connectivity within the region. Thus, the public welcome this development project and expect an improvement to their socio economic situation with the project.

167. This Initial Environmental Examination has discussed various aspects of the proposed rehabilitation and upgrading of 126 road sections comprising about 760.48km length. Contractors are liable to keep the roads in operational status of for approximately 3 years after the 2 years of construction period.

168. As discussed, candidate roads are dispersed over the entire province and few road sections are located near to ecologically and hierologically sensitive entities however as the proposed improvement is restricted to the available ROW the impact on such locations. No roads are located in or adjacent to environmental sensitive areas declared by the DOFC and DWLC.

169. Further the IEE recommends updating EMP and EMC with package specific information and locations while EMOP to be road specific before commencement of construction activities. In addition EMC and EMOP should be effectively implemented in order to monitor application of the EMP.

170. The road network improvement in North Western province will boost economic activities in the North Western province including potential growth in industries, tourism, fisheries and agriculture in lagging rural areas, which will be a positive step to the socio economic development of the country.

APPENDIX 1: LIST OF ROADS TO BE UPGRADED UNDER I ROAD PROGRAM

KURUNEGALA DISTRICT - NORTH WESTERN PROVINCE

Serial No	Electoral Area	D.S Division	Road ID	Road Name	Road Category	Length (KM)	Sub Total (Km)	Total (Km)
1	Bingiriya	Bingiriya	30	Talgahapitiya Junction to Walrawa Road	PRDA	5.50	8.10	**25.20**
2			32	Kaduruwewa School to Wallawewa School Road	PRDE	2.60		
3		Udabaddawa	33	Karulla, Horathapola Kibulkotumulla via Haliyagara Road	PS	6.70	15.60	
4			34	Meladeniya Juncion Udawela Kakiriyamdiththa,Ganegoda to Ambawewa Road	PRDA	8.90		
5		Kumbukgahamulla	36	Kmbukgahamulla central coleage Mawatha	PS	1.50	1.50	
6	Paduwasnuwara	Paduwasnuwara West	76	Kamburapola Junction to Pahalagamuwa,Nindawela Road	PS	5.00	40.00	**58.35**
7			77	Hunugama Junction to Nallur Junction	PS	6.60		
8			78	Frunt of the predeshiya shaba Junction to Bogolla Kiriwellewa,thethagodagedara, Paduwasnuwara via Oligama Road	PS	5.00		
9			80	Near the Paduwasnuwara Temple Moragolla sanasa to Pagahawela school , Medagama Aranya senasana road	PS	4.90		
10			79	Madulla Junction to Ihalagama Road		4.50		
11	Paduwasnuwara		97	Hidiyamulla Junction to Guruthippala Junction	PS	4.50		
12			98	Magulagama Junction to Ambagahalanda Mohoththawagoda Junction	PS	5.00		
13			99	Wilbagedara Junction to Dunupotha Rathmalla Junction Road	PS	4.50		
14		Paduwasnuwara East	81	Mawee ela Junction to Thelibewa Temple via Ilukpitiya Junction	PS	7.65	18.35	
15			82	Nagollagoda,Ahetumulla,higuregama Temple road	PC	4.60		
16			83	Kajuwatta Junction to Koonwewa ,Balagolla Road	PS	6.10		
17	Kuliyapitiya	Kuliyapitiya East	47	Bihalpola Muthugala Road	PC	10.10	28.95	**34.05**
18			48	Ihalamuluthangala to Korale Junction Road	PC	3.70		
19			49	Nakkawattha,Temple Road , Kaballa Road	P.S.	2.15		
20			50	Katupotha, Dalupothagama, thoranegedara, Kirimatiyawa Road	PC	6.50		
21			86	Horambawa Mawee Ela Road	PS	6.50		

Serial No	Electoral Area	D.S Division	Road ID	Road Name	Road Category	Length (KM)	Sub Total (Km)	Total (Km)
22		Kuliyapitiya West	55	Kosgahamula Junction to Damdeniya Road	PC	5.10	5.10	
23	Katugampala	Pannala	56	Elabadagema, Bummanna,Kadirapola,Labbala via Nigambo Kurunegala Road	PRDA	10.80	30.10	**30.10**
24	Katugampala		57	Jayagama kete Junction to Nabirittankadawara via Walipennagahamulla Road	PRDA	6.30		
25			58	Eliwila,Daraluwa via Yakwila Road	PRDA	8.10		
26			59	Nendalagamuwa Aurweda Junction to Ninuwangamuwa Walakumburumulla Road	PRDA	4.90		
27	Dambadeniya	Alawwa	1	Boyawalana Nawathalwatta Wewwala School Road Across Habaralagasinn Madurupitiya Road	PC	9.20	26.90	**38.15**
28			2	Paramaulla to Morugama Across Bujjomuwa Road	PS	3.50		
29			3	Bowala near of Madawala grossary from Yaththalgoda Railway station across Raththanhena Temple Mallakanda AcrossWewala Palle Kakulawala Road	PS	5.70		
30			4	6 Mile Post, Thumbulla Road	PS	2.50		
31			100	Humbuluwa Henahundeniya via ambowa wanathal waththa hospital Road		5.00		
32			101	Alawwa horokgasdeniya Road		1.00		
33		Narammala	5	Dampelessa Dostarawatta Acroos Welikumburawatta Road	PS	3.90	11.25	
34			6	Dambagirigama Darandeniya Peragahamula Road	PS	4.35		
35			102	Pahatha medagoda welikuburawaththa Road		3.00		
36	Polgahawela	Polgahawela	41	Hodalla, Polpitiya, Dambagolla, Kandahena Road	PC	6.15	11.25	**23.75**
37	Polgahawela		43	Panaliya Relwey gate to Pillwatta Road	PC	5.10		
38		Weerambugedara	45	Piduruwella,sandagala,weherabanda Road	PC	5.90	12.50	
39			46	Pambe,Lokahettiya,Ranawala gedara Road	PC	6.60		
40	Kurunegala	Kurunegala	68	Malpitiya Junction to Bogamuwa Junction Theeragama Road (Katupitiya Rabukkana Road)	PRDA	7.20	19.00	**25.40**
41			70	Porapola Junction to Talvita Siradunna Junction Road	PS	7.40		
42			71	Colombo Road Narammala Kurunegala Main Road Kubalpola Junction Hal para (Colombo Road to Kurunegala Road	PRDA	4.40		
43			74	Wawa gedara Ranaviru School to Klohogedara	PS		2.80	

Serial No	Electoral Area	D.S Division	Road ID	Road Name	Road Category	Length (KM)	Sub Total (Km)	Total (Km)
				via Yanthampalawa Junction		2.80		
44			75	Minhettiya Baddegama Kelimune junction Road	PS	3.60	3.60	
45	Mawathagama	Mawathagama	17	Wataraka Junction to Uda Iguruwaththa via Kudumiriya Road	PRDA/PS	6.40	6.40	**21.55**
46		Mallawapitiya	20	Belgodakanda,Muwankanda, Katawala Bolgodakanda,Kosgolla Road	PRDA/PS	5.00	15.15	
47			21	Pilikada Thampana, Idulgodakanda,via Werawella,Katupitiya	PRDA/PS	10.15		
48	Dodamgaslanda	Ridigama	37	Kiribathgalla Road	PS	3.30	30.20	**30.20**
49			38	Palle Horombuwa Ginihiriya Margaya Road	PS	7.75		
50	Dodamgaslanda		39	Mirissala, Egodamulla Mahawela Junction Road	PS	6.50		
51			84	Miliyadda- Ikiriwaththya Bokkawala Road	PC	6.00		
52			40	Delvita, Kithulgolla, Dunumawa Mirissala Road	PS	6.65		
53	Hiriyala	Ganewaththa	22	Nabiriththawewa Junction to Hunupola,Siradunna Via ,Pannala,Welebant Road,Ganewatta,AG Division	PC	25.10	41.10	**56.00**
54			87	Hiripitiya Aluthgama Kalawana Road	PS	6.00		
55			88	Ussawa to Dmbahera Akurawa road via Diggalwaththa Polkatuwa	PS	6.00		
56			89	Hakwatuna Oya Bridge to Rathmale Road via Dagellagama kalawana	PS	4.00		
57		Ibbagamuwa	23	Bannaggama Junction Via Nalawa Road	PRDA/PS	14.90	14.90	
58	Wariyapola	Wariyapola	61	Rambawewa Junction to Ambakadawara,Hettigedara via Mirihanegama Road	PS	5.35	17.75	**22.85**
59	Wariyapola		62	Werella Junction to Naramana ,Thambarawa Road	PC	5.00		
60			65	wariyapola to Amunugama,Malasma,Goluwawa road	PS	3.50		
61			66	Mahakeliya Randeniya Junction to Randeniya,Wellagal Riad	PC	3.90		
62		Bamunakotuwa	67	Jarman Junction to Nnawagatta Yatikadurawa,Ketapatwehera,Thembilipolgaha Junction	PS	5.10	5.10	
63	Nikaweratiya	Kobeigane	26	Padeniya Kobeigane Road	PRDA	11.10	11.10	**44.35**

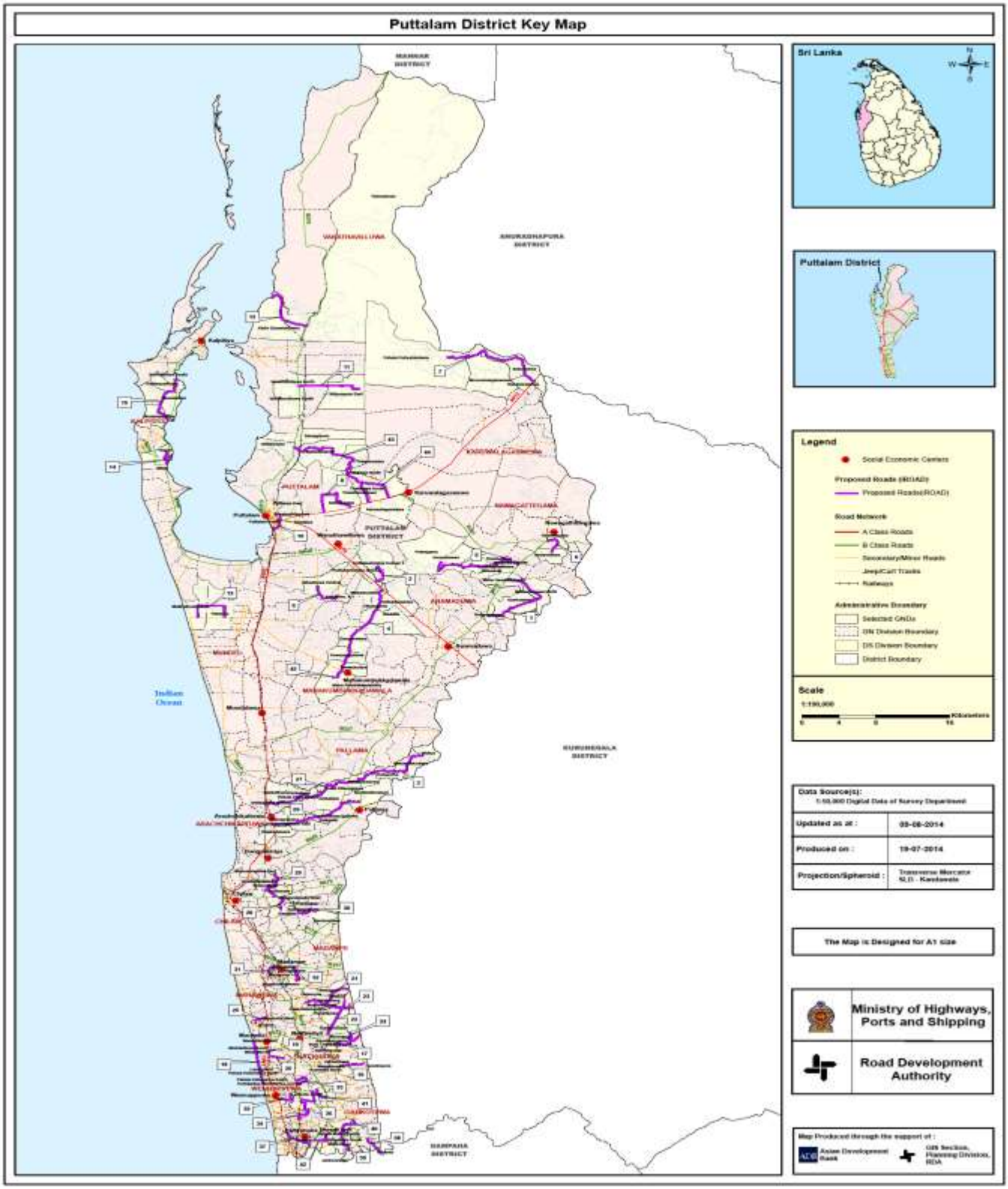
Serial No	Electoral Area	D.S Division	Road ID	Road Name	Road Category	Length (KM)	Sub Total (Km)	Total (Km)
64		Kotawehera	27	Palugolla Iginimitiya Road (Aluthgama Kotawehera Road	PRDA	11.00	11.00	
65		Rasnayakapura	28	Kurunegala Puttalam, Kunuketiya Junction to Malpanawa across Rasanayakapiura	PS	9.60	20.80	
66			29	Kurikulama Junction to Kadigawa across Subasinghepura across Magurankadawala Road	PRDA	11.20		
67		Nikaweratiya	24	Gangoda Road(Jayalanka trade centre to court complex via Budumuththawa temple)	PS	1.45	1.45	
68	Galgamuwa	Galgamuwa	90	Iginimitiya to Wannikudawewa road via nanneriya junction	PS	15.00	43.00	**69.30**
69			91	Paluwewa Junction to Giribawa via Ussana road	PS	5.00		
70			92	Wathuwaththegama to mudiyanegama via kumbukkadawala	PS	9.00		
71			93	Amunukole junction to Meegalewa via Jayalanda cap ela Bandaragama	PS	14.00		
72		Ehetuwewa	7	Ihalagama Junction to Nochchiya across Wannikudawewa to Road	PS	4.60	26.30	
73			8	Giribawa Warawewa to Sandagala Road	PRDD	9.90		
74			10	In front Atharagalla School Gurugoda Kothalawetiya Kalegama Road	PS	6.60		
75			11	Kathnoru Junction to near the School Reswehera Temple Road	PS	5.20		
76	Yapahuwa	Mahawa	12	Wilawa Junction to Kumbukwewa Road	PS	6.87	12.37	**45.63**
77			94	Daladagama to Nikaweratiya Ambanpola Road via wathupalagama, polpithigama,waduressa	PS	5.50		
78		Polpithigama	13	Hathpokuna Galkatayagama across Millagoda Road	PS	9.40	20.66	
79			14	Madahapola Mahayaya Madahapola Road		8.26		
80			95	Makulpotha to Henawa	PS	3.00		
81		Ambanpola	16	Nelumpathwewa Udadiulwewa Road	PS	7.60	12.60	
82			96	Kasikote Junction to Meeoya Bridge via Peella	PS	5.00		
TOTAL						**524.88**	**524.88**	**524.88**

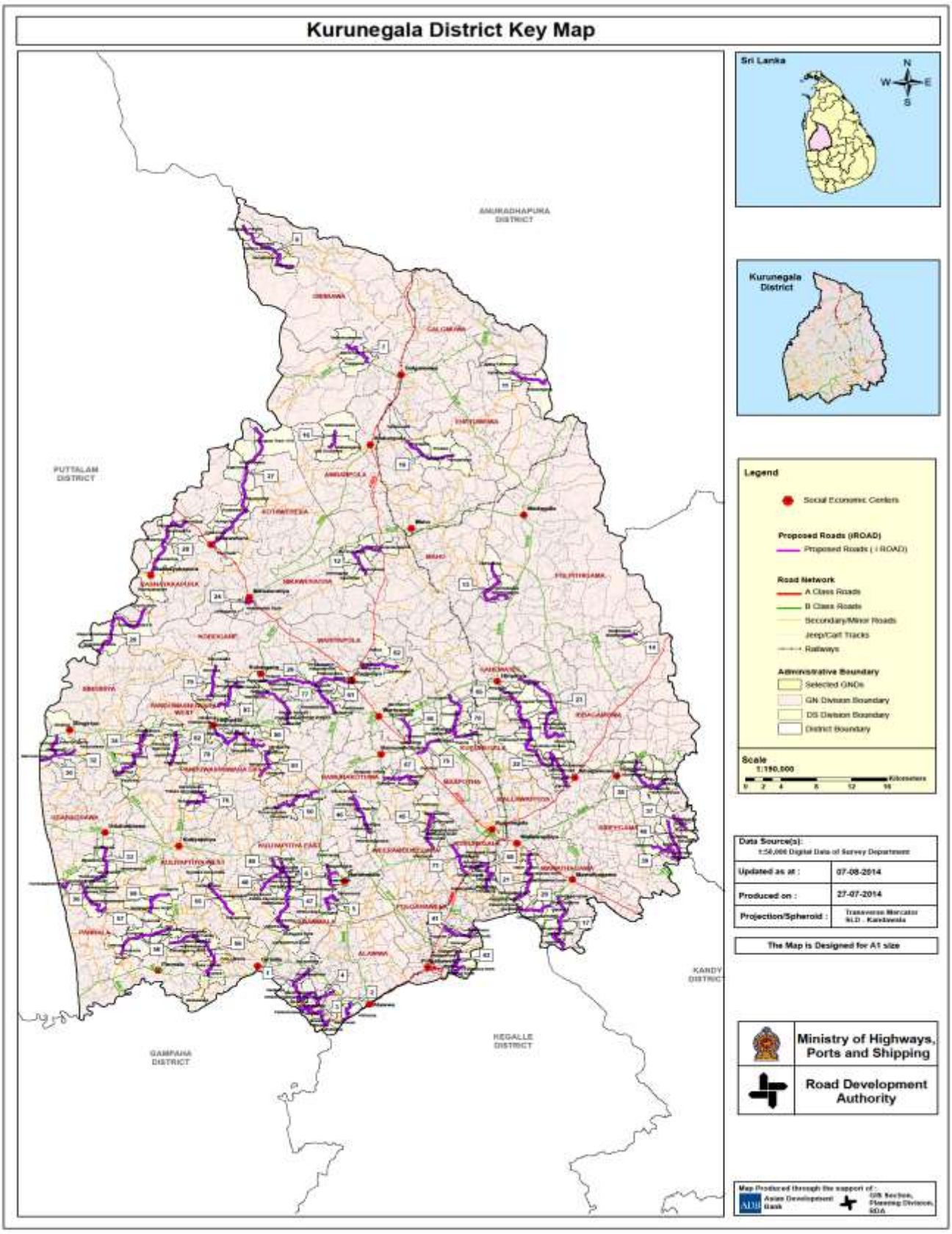
PUTHLAM DISTRICT - NORTH WESTERN PROVINCE

Serial No	Electoral Area	D.S.Division	Road ID	Road Name	Road Category	Length (KM)	Sub Total	Total
1	**Puttalam**	**Puttalam**	**8**	Road to sirrumbiadiya 4th mile Post to Anuradhapura road 6th mile post via Manaweriya and Sellakandal Area.	PS	7.30	**13.14**	**44.27**
2			**10**	Outer Circular Road Puttalam	PRDD	2.17		
3			**9**	Madyama Attavilluwa to Kiwla Road	PS	3.67		
4		**Wanathawilluwa**	**11**	Wanathawilluwa 12 mile post to Morapathawa school road	PS	7.05	**14.22**	
5			**12**	Eluwankulama to Gangewadiya	PS	7.17		
6		**Kalpitiya**	**14**	Thihali Eaththala Internal Road	PRDD	3.50	**10.76**	
7			**15**	Kandakuda Palliwasathurei Road	PRDA	7.26		
8		**Mundalama**	**13**	Paalasola Junction To Mukkuthoduwawa Via Paalasola Pradana Mawatha 100Acs State	PS	6.15	**6.15**	
9	**Anamaduwa**	**Anamaduwa**	**1**	Mahaus wewa -Waththegedara - Thalgaswewa	PS	12.20	**18.20**	**90.10**
10			**2**	Mellankulama Junction -Near Hospital to Kottukachchiya village	PS	6.00		
11		**Nawagaththegama**	**5**	Welewawa garment junction - Tharanagaha wawa-Rajawegama road	PS/Irrigation	12.24	**15.24**	
12			**6**	Internal Road at Nawagaththegama - Galgamuwa main Road.	PS	3.00		
13	**Anamaduwa**	**Karuwalagaswewa**	**7**	Saliya wewa junction to Neela bemma road	PS/Irrigation	13.00	**33.00**	
14			**43**	Thabbowa karuwalagas wewa outer circle	PRDA	7.00		
15			**44**	Mailankulama Tabbowa temple junction	PS	13.00		
16		**Mahakubukkadawala**	**4**	Mahakubukkadawala Kottukachchiya Road	PRDD	12.40	**14.16**	
17			**45**	Mahakubukkadawala Hospital road	PS	1.76		
18		**Pallama**	**3**	Adammana Junction- Medawakkulama Road	PS	9.50	**9.50**	
19	**Chilaw**	**Arachchikattuwa**	**26**	Arachchikattuwa to Pallama via Adippala	PRDD	10.95	**23.51**	**38.00**
20			**27**	Nalladarankattuwa to Wendakaduwa via Aththanganaya	PRDD	12.56		
21		**Chilaw**	**28**	E/Mungandaluwa Raraviru Lanka thilaka Mawatha toKaravita Temple	PS	1.98	**10.38**	
22			**29**	Thiththakade to Manuwangama via Thissogama coparative shop	PS	5.38		
23			**30**	Karavitagara Juntion to Kongasyaya Road via Dabakale Road	PS	3.02		

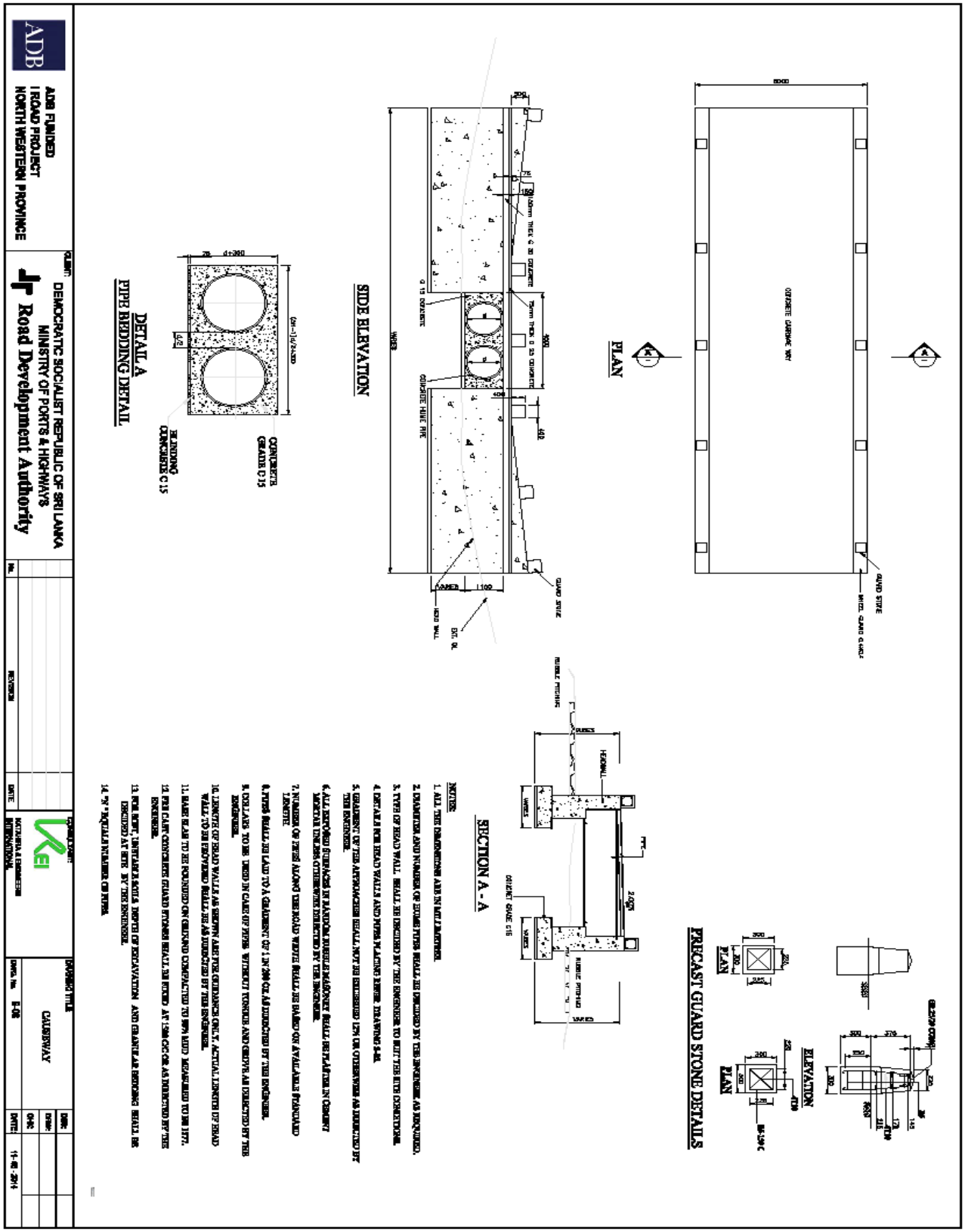
Serial No	Electoral Area	D.S.Division	Road ID	Road Name	Road Category	Length (KM)	Sub Total	Total
24		**Madampe**	**31**	Madampe Ihalagama Road	PS	1.71	**4.11**	
25			**32**	Suduwalla Juntion to Mukunuwatawana Road	PS	2.40		
26	**Naththandiya**	**Naththandiya**	**15**	Megahawila Juntion to Yakkdessawa Primery School Road	PRDD	2.62	**33.93**	**33.93**
27	**Naththandiya**	**Naththandiya**	**17**	Bandurawa to Maningala via Sadanangama Katuwa Goda Road	PRDD	3.87		
28			**18**	Katuneriya to Marawila Road (Bech road)	PRDD	5.86		
29			**20**	Keenakale wathu meda Road	PS	1.87		
30			**21**	Waduraba boTree to Walahapitiya Cemetery via Muttibadivila Post Office Road	PRDD	6.82		
31			**22**	Yatakalana Temple to Thabbowa Kotabagaya Road	PRDD	5.12		
32			**23**	Hawana to Thalgasagaraya via Niramisiya Pannangoda Janapadaya	PS	3.28		
33			**24**	Gurugodalla to Kuliyapitiya Nattandiya Main Road	PS	1.49		
34			**46**	Iranawila American voice road to Iranawila chilaw road via smidugama	PS	3.00		
35	**Wennapuwa**	**Wennapuwa**	**33**	Srigampala Church to Zinnor Juntion via Aubowan Junction	PRDD	2.94	**29.30**	**29.30**
36			**34**	Weralugaha road Balldi Junction Bandaranayake Janapadaya to Dummaladeniya Haldaduwana Road	PRDD	4.80		
37			**35**	Wennappuwa -Edanda Road	PRDD	2.38		
38			**36**	Bandirippuwa - Krimatiyana Jerad Mawatha and to End of Jaya Mawatha	PRDD	2.86		
39			**37**	Edward Karunayake Piyanama Mawatha to Dabaravila via Godalla Church	PRDD	3.33		
40			**38**	Dekwela Road	PRDD	2.31		
41	**Wennapuwa**	**Wennapuwa**	**39**	Atiyawala Temple Road (North)	PRDD	2.80		
42			**40**	Atiyawala Mohattimulla Road	PRDD	3.40		
43			**41**	Kirimatiyane Varalla Watta Road (Joint to Wennappuwa Road)	PRDD	2.08		
44			**42**	Morakkuliya to Dankotuwa	PRDD	2.40		
TOTAL						**235.60**	**235.60**	**235.60**

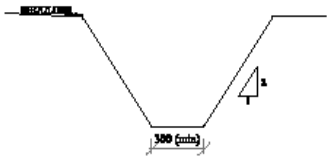
Appendix 2: General Location Map




Kurunegala District Key Map
Sri Lanka
N
W
E
S
Kurunegala District
ANURADHAPURA DISTRICT
PUTTALAM DISTRICT
KANDY DISTRICT
KEGALLE DISTRICT
GAMPAHA DISTRICT
Legend
Social Economic Centers
Proposed Roads (iROAD)
Proposed Roads (i ROAD)
Road Network
A Class Roads
B Class Roads
Secondary/Minor Roads
Jeep/Cart Tracks
Railways
Administrative Boundary
Selected GNDs
GN Division Boundary
DS Division Boundary
District Boundary
Scale
1:150,000
Kilometers
0 2 4 8 12 16
Data Source(s):
1:50,000 Digital Data of Survey Department
Updated as at : 07-08-2014
Produced on : 27-07-2014
Projection/Spheroid : Transverse Mercator
Everest - Kandawala
The Map is Designed for A1 size
Ministry of Highways, Ports and Shipping
Road Development Authority
Map Produced through the support of :
Asian Development Bank
GIS Section, Planning Division, RDA

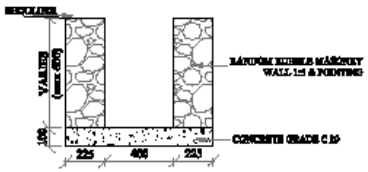
Appendix 3: Cross Sections



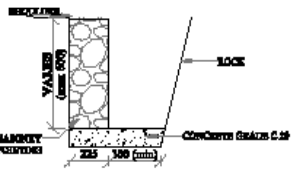


TYPE - A

EARTH DRAIN
SCALE : 1:25

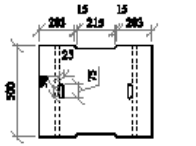


TYPE - B

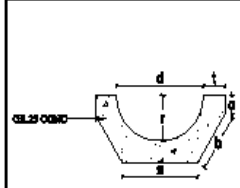


TYPE - C

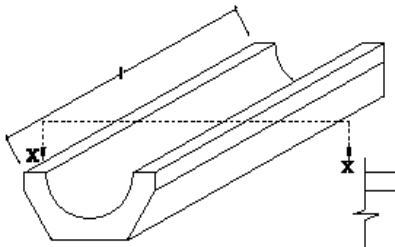
MASONRY RUBBLE LINED DRAIN
SCALE : 1:25



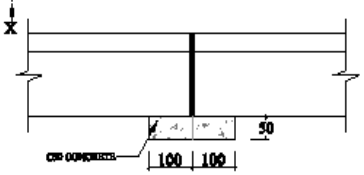
PLAN OF 650mm X 500mm X 150mm
COVER SLAB



SECTION X-X



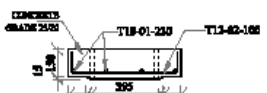
PLAN VIEW



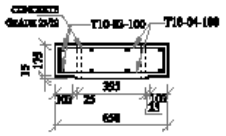
FIXING DETAILS

TYPE	DIAMETER	THIKNESS (t)	LENGTH (l)	a	b	c	d/2 (r)	R/F
9"	225	50	600	216	140	40	112	R6
12"	300	50	600	250	160	75	150	R6

PRECAST OPEN CHANNEL DRAIN (TYPE D)
SCALE : 1:10

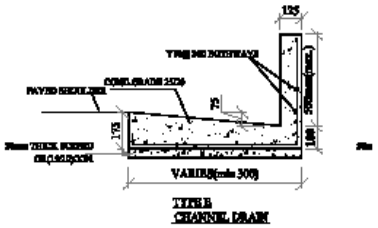


SECTION OF 650mm X 500mm X 150mm
LIGHT DUTY PEDESTRIAN COVER SLAB

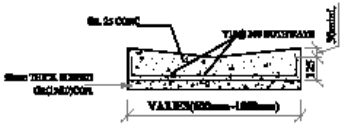


SECTION OF 650mm X 500mm X 175mm
HEAVY DUTY COVER SLAB

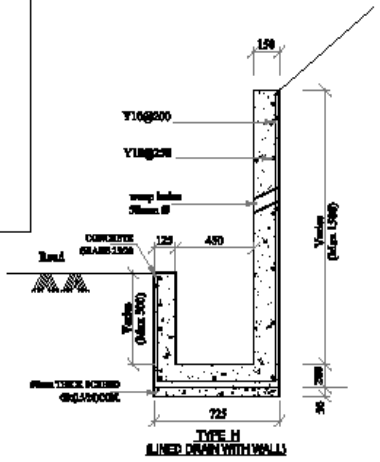
DETAIL OF COVER SLAB
(SCALE 1:25)



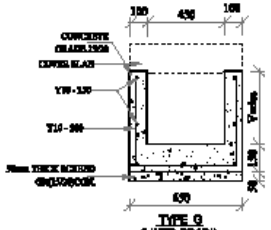
TYPE B
CHANNEL DRAIN



TYPE F
SIDE DRAIN



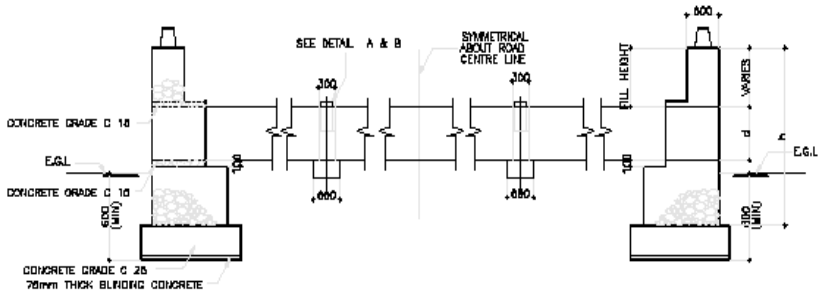
TYPE H
(LINED DRAIN WITH WALL)



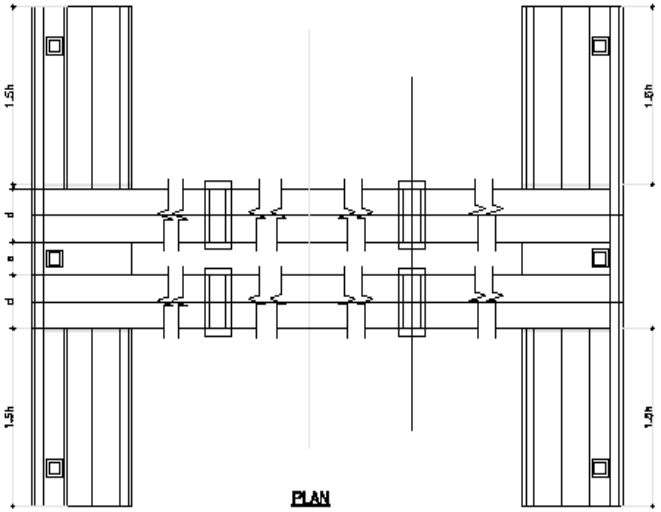
TYPE G
(LINED DRAIN)

REINFORCEMENT CONCRETE DRAINS
SCALE : 1:25

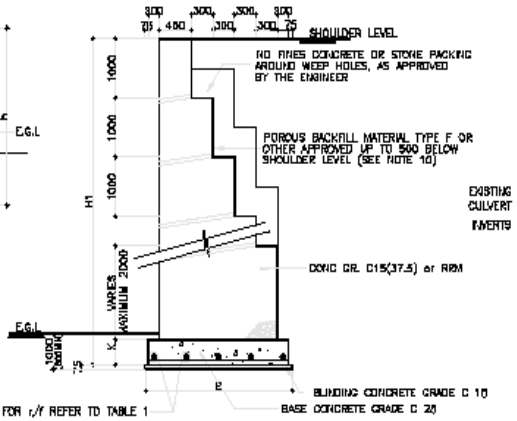
ADB FUNDED I ROAD PROJECT NORTH WESTERN PROVINCE	CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA MINISTRY OF PORTS & HIGHWAYS Road Development Authority	No. REVISION DATE	CONSULTANT: KEI KOYAMA & EMMESSEE INTERNATIONAL
DRAWING TITLE: TYPICAL DRAIN SECTIONS	DRG. No. 138-01	DSN: DRN: CHK: DATE: 23-08-2014	

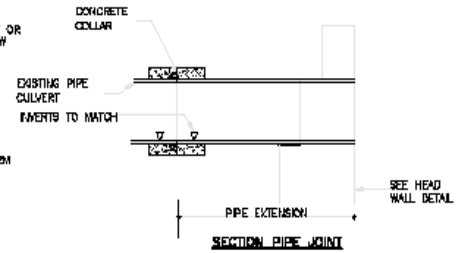


SECTIONAL ELEVATION



PLAN

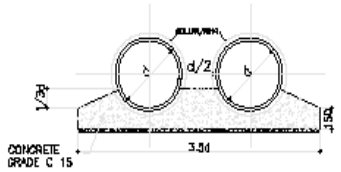




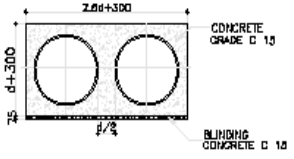
SECTION PIPE JOINT

TABLE 1
WING WALL DETAIL

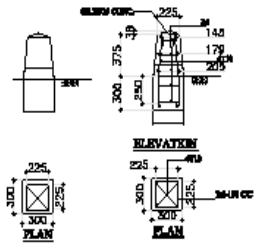
TYPE	H1 (mm)	B (mm)	X (mm)	r/f (FOR STEEL)
(1)	≤1300	860	300	12mm ϕ @ 200
(2)	1301–2400	1150	400	12mm ϕ @ 150
(3)	2401–3500	1450	500	16mm ϕ @ 200
(4)	3501–4600	1750	500	16mm ϕ @ 150
(5)	4601–5500	2050	500	16mm ϕ @ 150



DETAIL A
SECTION THROUGH PIPE JOINT
FOR FILL HEIGHT>1000



DETAIL B
PIPE BEDDING DETAIL
FOR FILL HEIGHT < 1000



PRECAST GUARD STONE DETAILS

NOTES:

1. ALL THE DIMENSIONS ARE IN MILLIMETRES.
2. DIAMETER OF THE HUME PIPE SHALL BE DECIDED BY THE ENGINEER AS REQUIRED.
3. TYPE OF HEAD WALL SHALL BE DECIDED BY THE ENGINEER TO SUIT THE SITE CONDITIONS.
4. ALL EXPOSED SURFACES IN RANDOM RUBBLE MASONRY SHALL BE PLASTER IN CEMENT MORTAR UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. NUMBER OF PIPES ALONG THE ROAD WIDTH SHALL BE BASED ON AVAILABLE STANDARD LENGTH.
6. PIPES SHALL BE LAID TO A GRADIENT OF 1 IN 200 OR AS DIRECTED BY THE ENGINEER.
7. COLLARS TO BE USED IN CASE OF PIPES WITHOUT TONGUE AND GROVE AS DIRECTED BY THE ENGINEER.
8. LENGTH OF HEAD WALLS AS SHOWN ARE FOR GUIDANCE ONLY. ACTUAL LENGTH OF HEAD WALL TO BE PROVIDED SHALL BE AS DIRECTED BY THE ENGINEER.
9. SLOPE OF EMBANKMENT FILL TO BE 1:1.5 OR AS DIRECTED AT BY THE ENGINEER.
10. BASE SLAB TO BE FOUNDED ON GROUND COMPACTED TO 90% MDD MEASURED TO BS 1377.
11. 75mm Ø PVC PIPE WEEP HOLES SHALL BE PROVIDED ABOVE THE FINISHED GROUND LEVEL AT A SPACING OF 1.0m C/C VERTICALLY AND HORIZONTALLY, STAGGERED TO A SLOPE OF 1:20.
12. PRE CAST CONCRETE GUARD STONES SHALL BE FIXED AT 1500 C/C OR AS DIRECTED BY THE ENGINEER.
13. FOR SOFT, UNSTABLE SOILS DEPTH OF EXCAVATION AND GRANULAR BEDDING SHALL BE DECIDED AT SITE BY THE ENGINEER.
14. TYPE OF EMBANKMENT PROTECTION TO BE AS DIRECTED BY THE ENGINEER.

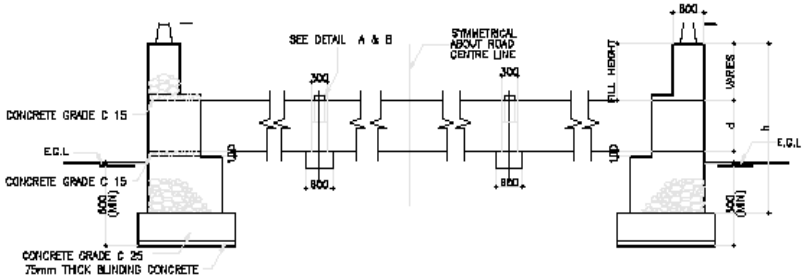
ADB FUNDED
I ROAD PROJECT
NORTH WESTERN PROVINCE

CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

No.	REVISION	DATE

CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: PIPE–DOUBLE
DRAWING No. S–02
DSN: DRN: CHK:
DATE: 19–08–2014



SECTIONAL ELEVATION

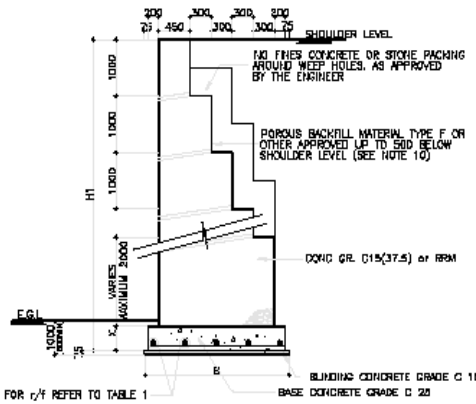
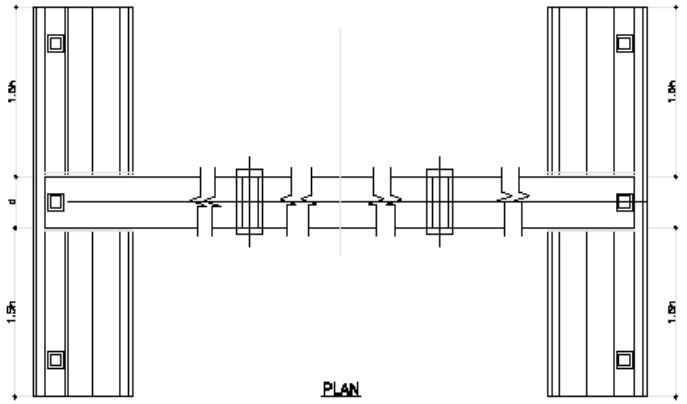
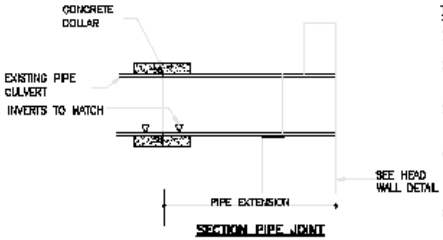


TABLE 1
WING WALL DETAIL

TYPE	H1 (mm)	B (mm)	X (mm)	r/f (FOR STEEL)
(1)	≤1300	850	300	12mm ϕ @ 200
(2)	1301–2400	1150	400	12mm ϕ @ 150
(3)	2401–3500	1450	500	16mm ϕ @ 200
(4)	3501–4500	1750	500	16mm ϕ @ 150
(5)	4501–5600	2050	600	16mm ϕ @ 150



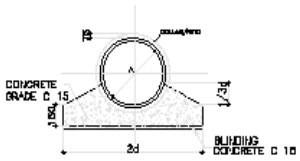
PLAN



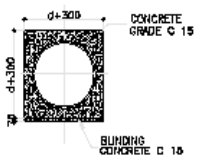
SECTION PIPE JOINT

NOTES:

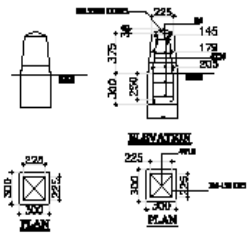
1. ALL THE DIMENSIONS ARE IN MILLIMETERS.
2. DIAMETER OF THE HUMB PIPE SHALL BE DECIDED BY THE ENGINEER AS REQUIRED.
3. TYPE OF HEAD WALL SHALL BE DECIDED BY THE ENGINEER TO SUIT THE SITE CONDITIONS.
4. ALL EXPOSED SURFACES IN RANDOM RUBBLE MASONRY SHALL BE PLASTER IN CEMENT MORTAR UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. NUMBER OF PIPES ALONG THE ROAD WIDTH SHALL BE BASED ON AVAILABLE STANDARD LENGTH.
6. PIPES SHALL BE LAID TO A GRADIENT OF 1 IN 200 OR AS DIRECTED BY THE ENGINEER.
7. COLLARS TO BE USED IN CASE OF PIPES WITHOUT TONGUE AND GROVE AS DIRECTED BY THE ENGINEER.
8. LENGTH OF HEAD WALLS AS SHOWN ARE FOR GUIDANCE ONLY. ACTUAL LENGTH OF HEAD WALL TO BE PROVIDED SHALL BE AS DIRECTED BY THE ENGINEER.
9. SLOPE OF EMBANKMENT FILL TO BE 1:1.5 OR AS DIRECTED AT BY THE ENGINEER.
10. BASE SLAB TO BE FOUNDED ON GROUND COMPACTED TO 90% MDD MEASURED TO BS 1377.
11. 75mm Ø PVC PIPE WEEP HOLES SHALL BE PROVIDED ABOVE THE FINISHED GROUND LEVEL AT A SPACING OF 1.0m C/C VERTICALLY AND HORIZONTALLY. STAGGERED TO A SLOPE OF 1:20.
12. PRE CAST CONCRETE GUARD STONES SHALL BE FIXED AT 1500 C/C OR AS DIRECTED BY THE ENGINEER.
13. FOR SOFT, UNSTABLE SOILS DEPTH OF EXCAVATION AND GRANULAR BEDDING SHALL BE DECIDED AT SITE BY THE ENGINEER.
14. TYPE OF EMBANKMENT PROTECTION TO BE AS DIRECTED BY THE ENGINEER.



DETAIL A
SECTION THROUGH PIPE JOINT
FOR FILL HEIGHT>600



DETAIL B
PIPE BEDDING DETAIL
FOR FILL HEIGHT < 600



PRECAST GUARD STONE DETAILS

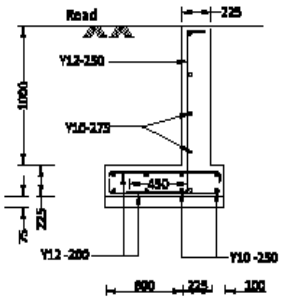
ADB FUNDED
I ROAD PROJECT
NORTH WESTERN PROVINCE

CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

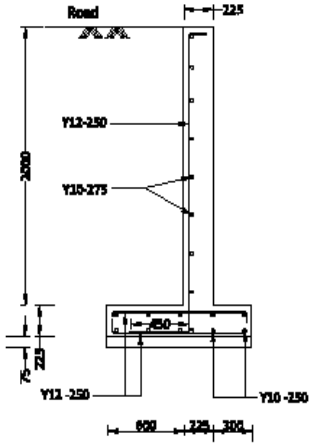
No. | REVISION | DATE

CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

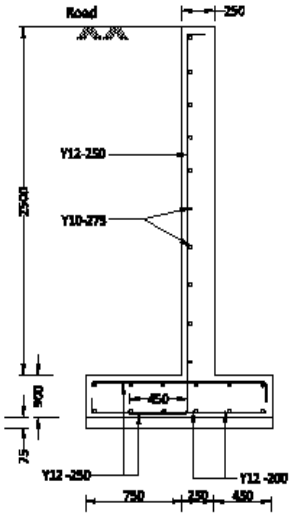
DRAWING TITLE: PIPE – SINGLE
DRAWING No. S–01
DSN: | DRN: | CHK: | DATE: 11-08-2011



SECTION OF WALL
1m Wall



SECTION OF WALL
2m Wall

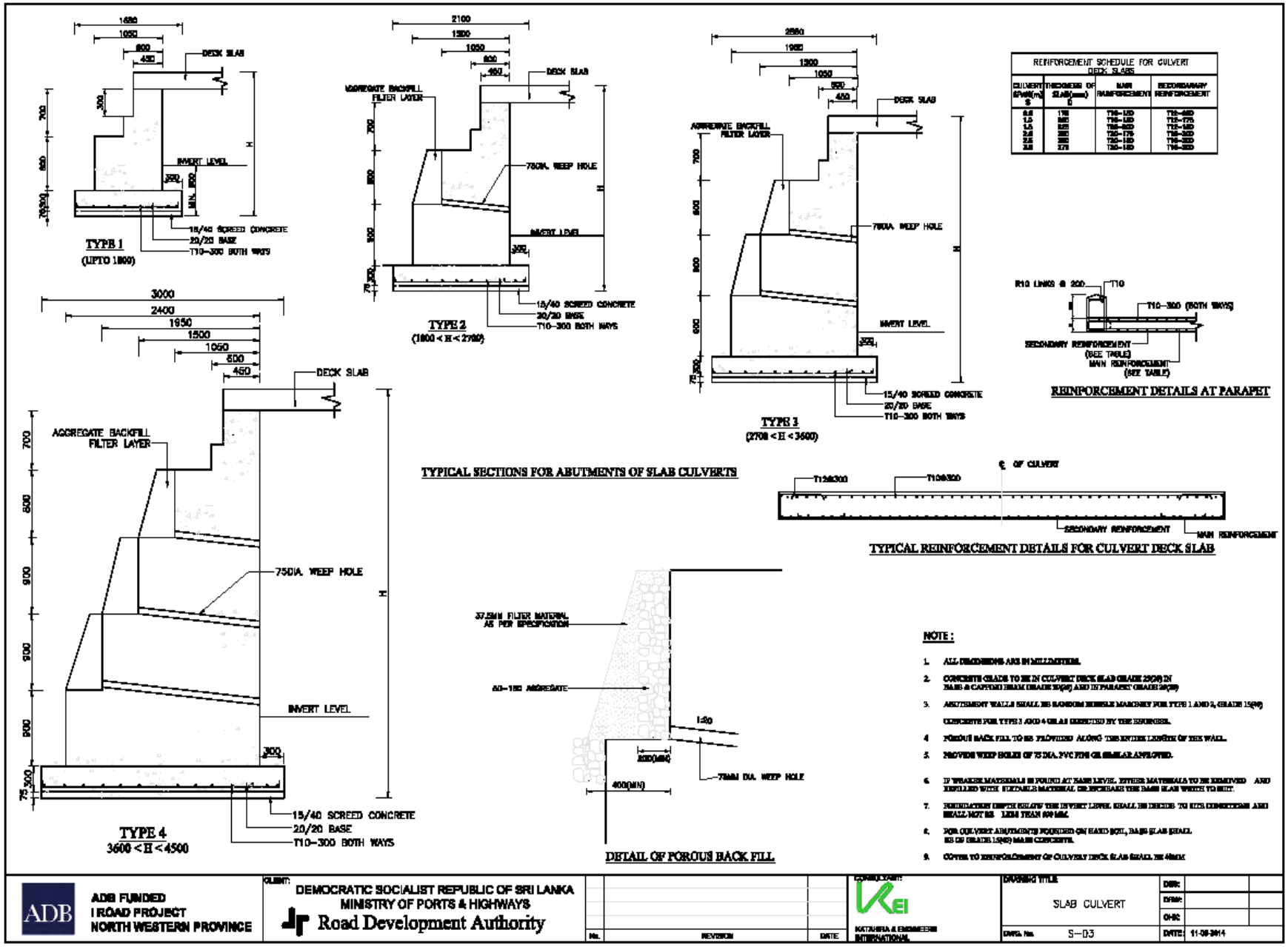


SECTION OF WALL
2.5m Wall

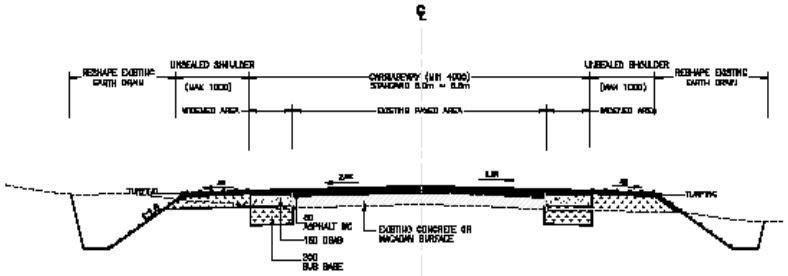
NOTES:

1. ALL THE DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED
2. THIS DRAWINGS PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS, SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. ALL FOUNDATION PADS SHOULD BE IN GRADE C 30 AND SCREED IN GRAD C15 CONCRETE SCREED 15 mm THICK UNLESS OTHERWISE SHOWN.
4. SEGREGATION JOINTS IN EACH WALL TYPE SHOULD BE AS SHOWN OR AS DIRECTED AT SITE TO SUIT SITE CONDITIONS.
5. CONCRETE GRADE SHALL BE GR. 25/20
6. REINFORCEMENT SHALL BE HOT ROLLED HIGH YIELD STEEL TO SS 6-629 WITH MIN fy =460 N/SQMM.
7. CLEAR COVER TO REINFOLCEMENT SHALL BE 50 MIN.
8. REFER DRAWING S-03 FOR THE DETAIL OF FOLOCH BACKFILL
9. 75 DIA PVC WEEP HOLES SHALL BE PROVIDED AT 2000 SPACING (STAGGERED) AND BE LAID TO A SLOPE OF 1:10.

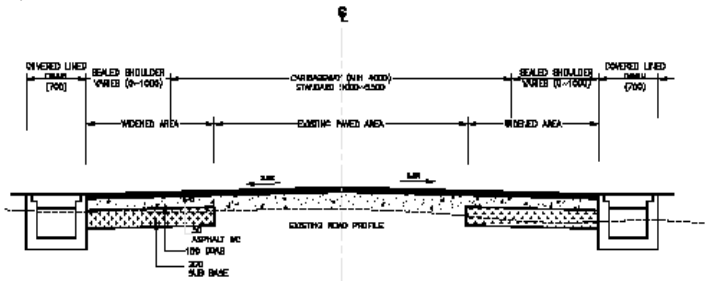
ADB FUNDED I ROAD PROJECT NORTH WESTERN PROVINCE	CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA MINISTRY OF PORTS & HIGHWAYS Road Development Authority	No.	REVISION	DATE	CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL	DRAWING TITLE: RETAINING WALL REINFORCED CONCRETE	DSN: DRN: CHK: DATE: 11-06-2014
						DWG. No. S - 05 - A	


DECK SLAB
INVERT LEVEL
15/40 SCREED CONCRETE
20/20 BASE
T10-300 BOTH WAYS
TYPE 1
(UPTO 1800)
AGGREGATE BACKFILL
FILTER LAYER
75DIA. WEEP HOLE
TYPE 2
(1800 < H < 2700)
TYPE 3
(2700 < H < 3600)
TYPE 4
3600 < H < 4500
REINFORCEMENT SCHEDULE FOR CULVERT DECK SLABS
CULVERT SPAN(m) S
THICKNESS OF SLAB(mm) D
MAIN REINFORCEMENT
SECONDARY REINFORCEMENT
R10 LINKS @ 200
T10
T10-300 (BOTH WAYS)
SECONDARY REINFORCEMENT (SEE TABLE)
MAIN REINFORCEMENT (SEE TABLE)
REINFORCEMENT DETAILS AT PARAPET
TYPICAL SECTIONS FOR ABUTMENTS OF SLAB CULVERTS
℄ OF CULVERT
T12@300
T10@300
SECONDARY REINFORCEMENT
MAIN REINFORCEMENT
TYPICAL REINFORCEMENT DETAILS FOR CULVERT DECK SLAB
37.5MM FILTER MATERIAL AS PER SPECIFICATION
A0-150 AGGREGATE
1:20
75MM DIA. WEEP HOLE
DETAIL OF POROUS BACK FILL
NOTE :
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. CONCRETE GRADE TO BE IN CULVERT DECK SLAB GRADE 25(20) IN
WALLS & CAPPING BEAM GRADE 30(20) AND IN PARAPET GRADE 30(20)
3. ABUTMENT WALLS SHALL BE RANDOM RUBBLE MASONRY FOR TYPE 1 AND 2, GRADE 15(10)
CONCRETE FOR TYPE 3 AND 4 OR AS DIRECTED BY THE ENGINEER.
4. POROUS BACK FILL TO BE PROVIDED ALONG THE ENTIRE LENGTH OF THE WALL.
5. PROVIDE WEEP HOLES OF 75 DIA. PVC PIPE OR SIMILAR APPROVED.
6. IF WEAKER MATERIALS IS FOUND AT BASE LEVEL, EITHER MATERIALS TO BE REMOVED AND REFILLED WITH SUITABLE MATERIAL OR INCREASE THE BASE SLAB WIDTH TO SUIT.
7. FOUNDATION DEPTH BELOW THE INVERT LEVEL SHALL BE DECIDE TO SUIT CONDITIONS AND SHALL NOT BE LESS THAN 600 MM.
8. FOR CULVERT ABUTMENTS FOUNDED ON HARD SOIL, BASE SLAB SHALL BE OF GRADE 15(10) MASS CONCRETE.
9. COVER TO REINFORCEMENT OF CULVERT DECK SLAB SHALL BE 40MM
ADB
ADB FUNDED
I ROAD PROJECT
NORTH WESTERN PROVINCE
CLIENT:
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority
No.
REVISION
DATE
CONSULTANT:
KATAHIRA & ENGINEERS INTERNATIONAL
DRAWING TITLE
SLAB CULVERT
DRAWING No.
S-03
DES:
DRN:
CHK:
DATE: 11-06-2014

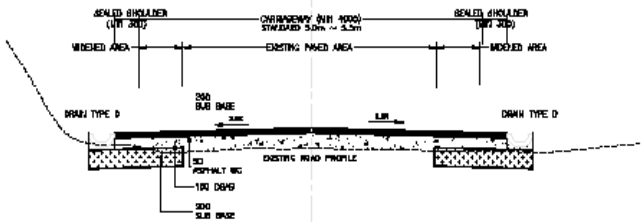
PROPOSED TYPICAL SECTIONS (TS) FOR PRDA ROAD



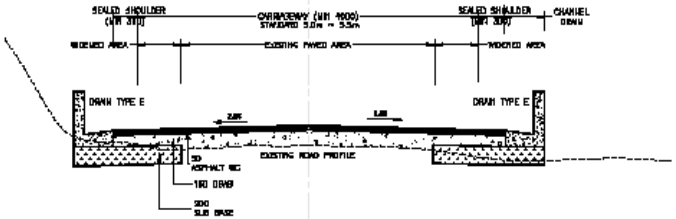
TS–F (TYPICAL SECTION FOR OVERLAYING)



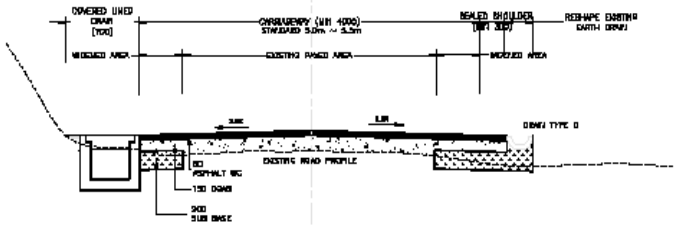
TS–G (TYPICAL SECTION FOR ROAD RECONSTRUCTION) (BOTH SIDE LINED DRAIN)



TS–H (TYPICAL SECTION FOR ROAD RECONSTRUCTION) (BOTH SIDE TYPE "D" DRAIN)



TS–I (TYPICAL SECTION FOR ROAD RECONSTRUCTION) (BOTH SIDE TYPE "E" DRAIN)



TS–J (TYPICAL SECTION FOR ROAD RECONSTRUCTION) (ONE SIDE LINED DRAIN AND OTHER SIDE TYPE "D")

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (CBR>30%)	GS
	GRANULAR CAPPING (CBR>10%)	GC
	SHOULDER FILL	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS–01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S–04 & S–05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

ADB FUNDED
I ROAD PROJECT
NORTH WESTERN PROVINCE

CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

No.	REVISION	DATE

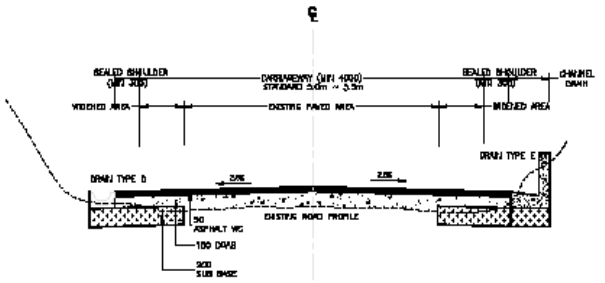
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PRDA ROAD

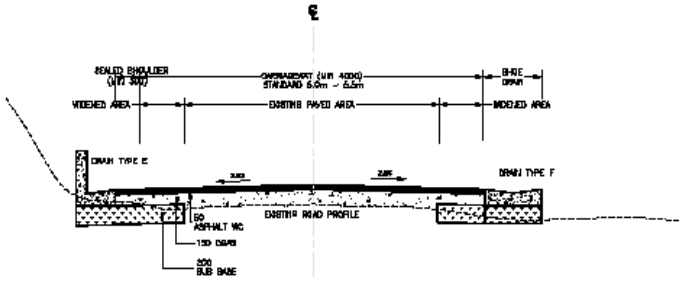
DRAWING No. TS–PRDA–02

DSN: | DRN: | CHK: | DATE: 07–07–2014

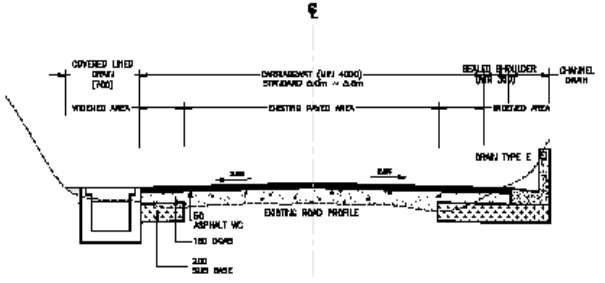
PROPOSED TYPICAL SECTIONS (TS) FOR PRDA ROAD



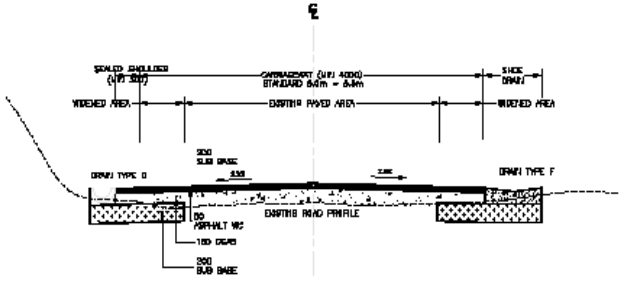
TS-K (TYPICAL SECTION FOR ROAD RECONSTRUCTION)
(ONE SIDE TYPE "D" DRAIN AND OTHER SIDE TYPE "E")



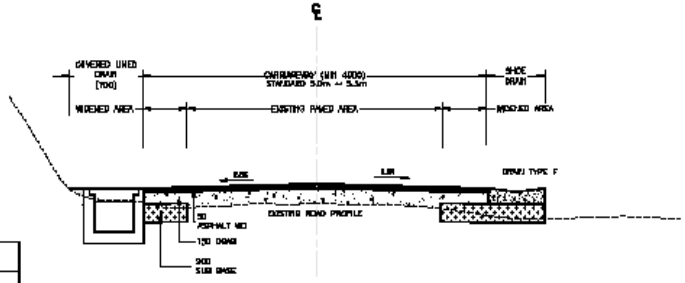
TS-L (TYPICAL SECTION FOR ROAD RECONSTRUCTION)
(ONE SIDE TYPE "E" DRAIN AND OTHER SIDE TYPE "F")



TS-M (TYPICAL SECTION FOR ROAD RECONSTRUCTION)
(ONE SIDE LINED DRAIN AND OTHER SIDE TYPE "E")



TS-N (TYPICAL SECTION FOR ROAD RECONSTRUCTION)
(ONE SIDE TYPE "D" DRAIN AND OTHER SIDE TYPE "F")



TS-O (TYPICAL SECTION FOR ROAD RECONSTRUCTION)
(ONE SIDE LINED DRAIN AND OTHER SIDE TYPE "F")

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS-01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S-04 & S-05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (CBR>30%)	GS
	GRANULAR CAPPING (CBR>10%)	GC
	SHOULDER FILL	

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NORTH WESTERN PROVINCE

CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

No.	REVISION	DATE

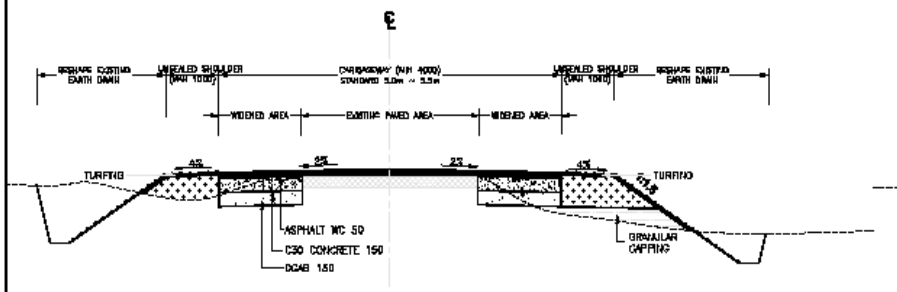
CONSULTANT: KATAHENA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PRDA ROAD

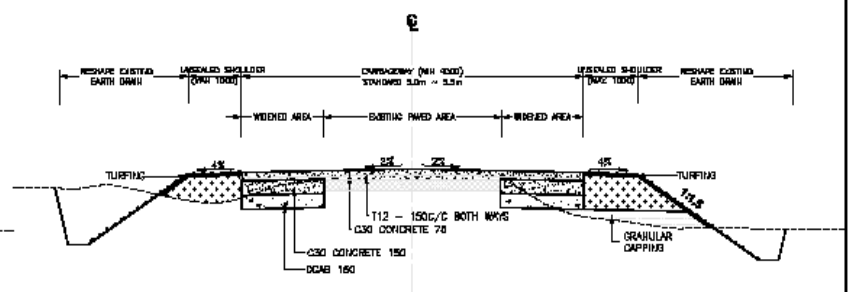
DWG. No. TS-PRDA-03

DSN: DRN: CHK: DATE: 07-07-2014

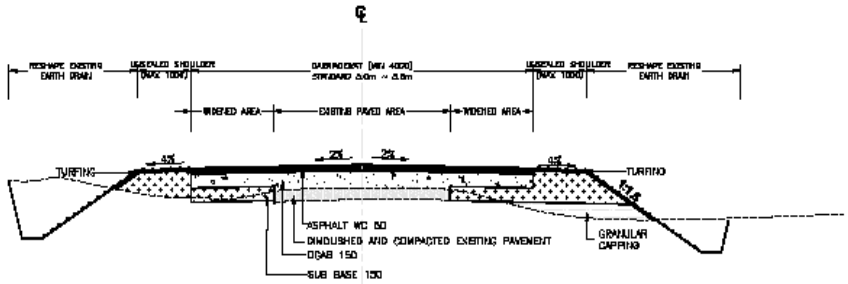
PROPOSED TYPICAL SECTIONS (TS) FOR PRDA ROAD



TS–P (TYPICAL SECTION FOR OVERLAYING ON CONCRETE SURFACE)



TS–Q (TYPICAL SECTION FOR OVERLAYING ON CONCRETE SURFACE – PARTLY DAMAGED)



TS–R (TYPICAL SECTION FOR OVERLAYING ON CONCRETE SURFACE – DAMAGED)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS–01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S–04 & S–05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I–CBR>30%)	GS
	GRANULAR CAPPING (TYPE II–CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	

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CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

No.	REVISION	DATE

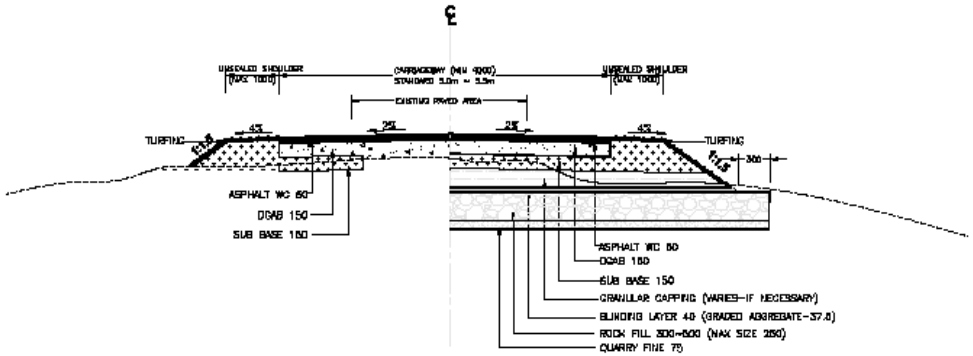
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PRDA ROAD

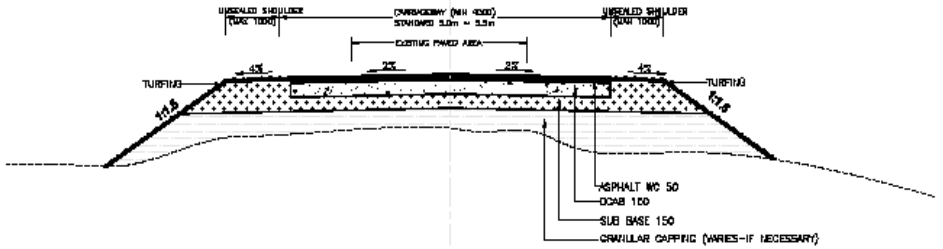
DWG. No. TS–PRDA–04

DSN: | DRN: | CHK: | DATE: 07–07–2014

PROPOSED TYPICAL SECTIONS (TS) FOR PRDA ROAD



TS-S (TYPICAL SECTION FOR MARSHY & WEAK SOIL AREA)



TS-T (TYPICAL SECTION FOR EMBANKMENT AREA)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. D5-01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S-04 & S-05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.
10. THICKNESS OF THE ROCK FILL SHALL BE DECIDED BY THE ENGINEER AS PER SITE CONDITION.

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I-CBR>30%)	GS
	GRANULAR CAPPING (TYPE II-CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	

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CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
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No.	REVISION	DATE

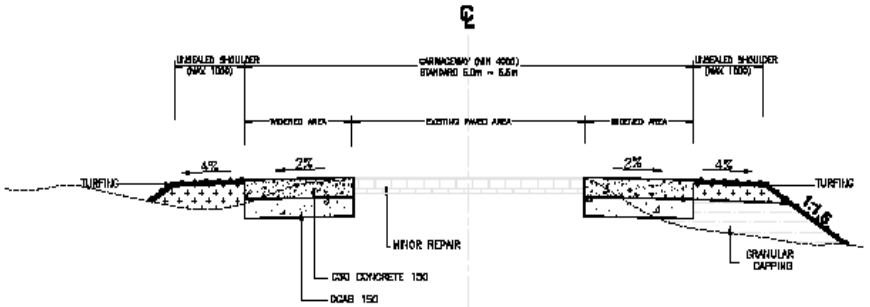
CONSULTANT: KATAHENA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PRDA ROAD

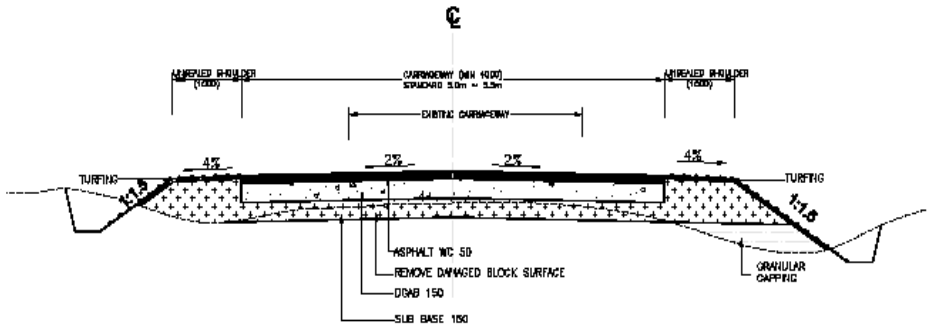
DWG. No. TS-PRDA-05

DSN: DRN: CHK: DATE: 07-07-2014

PROPOSED TYPICAL SECTIONS (TS) FOR PRDA ROAD



TS–U (TYPICAL SECTION FOR BLOCK PAVED SURFACE – GOOD CONDITION)



TS–V (TYPICAL SECTION FOR BLOCK PAVED SURFACE – DAMAGED)

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I–CBR>30%)	GS
	GRANULAR CAPPING (TYPE II–CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS–01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S–04 & S–05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm. IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.

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No.	REVISION	DATE

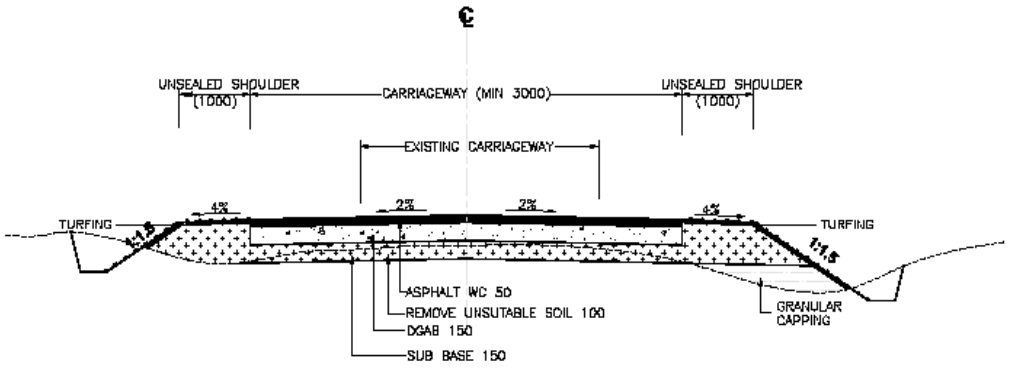
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PRDA ROAD

DSN: DRN: CHK:

DWG. No. TS–PRDA–08 DATE: 07–07–2014

PROPOSED TYPICAL SECTIONS (TS) FOR GRAVEL ROAD



TS-A (TYPICAL SECTION FOR GRAVEL SURFACE

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I-CBR>30%)	GS
	GRANULAR CAPPING (TYPE II-CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS-01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S-04 & S-05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.

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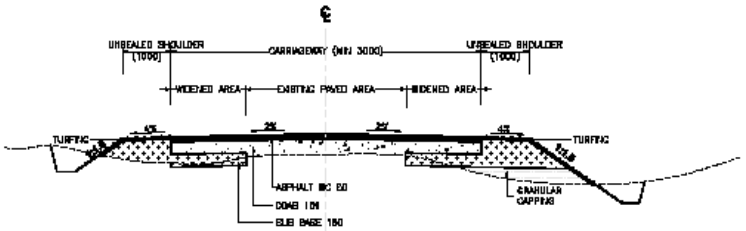
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PS ROAD

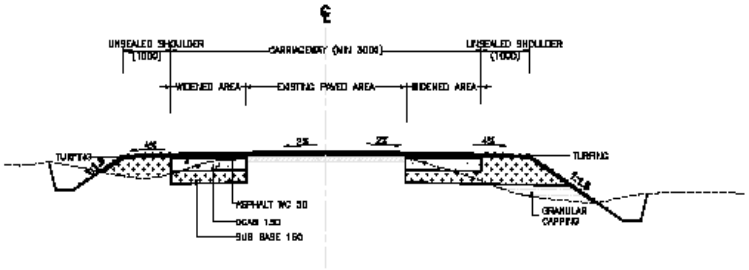
DWG. No. TS-PS-01

DSN: | DRN: | CHK: | DATE: 23-06-2014

PROPOSED TYPICAL SECTIONS (TS) FOR MACADAM ROAD



TS–B (TYPICAL SECTION FOR RECONSTRUCTION OF MACADAM SURFACE)



TS–C (TYPICAL SECTION FOR OVERLAYING ON MACADAM SURFACE)

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I–CBR>30%)	GS
	GRANULAR CAPPING (TYPE II–CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS–01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S–04 & S–05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm. IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

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Road Development Authority

No.	REVISION	DATE

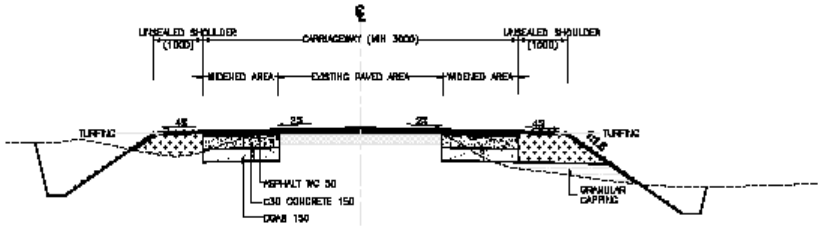
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PS ROAD

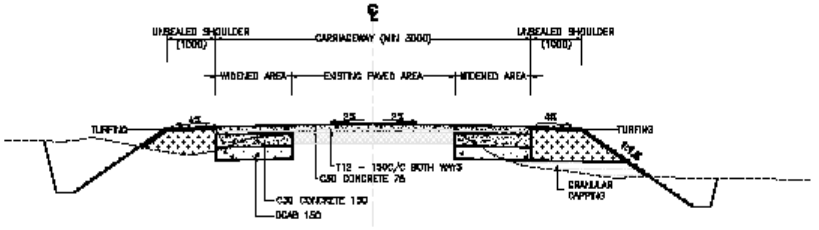
DWG. No. TS–PS–02

DSN: DRN: CHK: DATE: 23–06–2014

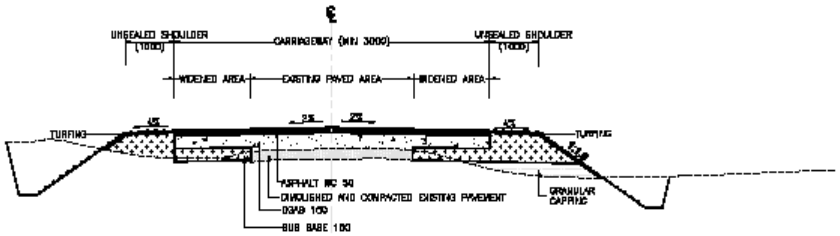
PROPOSED TYPICAL SECTIONS (TS) FOR CONCRETE ROAD



TS–D (TYPICAL SECTION FOR OVERLAYING ON CONCRETE SURFACE)



TS–E (TYPICAL SECTION FOR OVERLAYING ON CONCRETE SURFACE – PARTLY DAMAGED)



TS–F (TYPICAL SECTION FOR OVERLAYING ON CONCRETE SURFACE – DAMAGED)

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I–CBR>30%)	GS
	GRANULAR CAPPING (TYPE II–CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS–01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S–04 & S–05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

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CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
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Road Development Authority

No.	REVISION	DATE

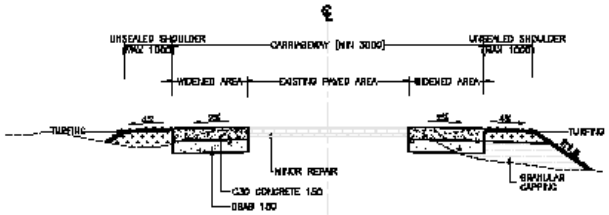
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PS ROAD

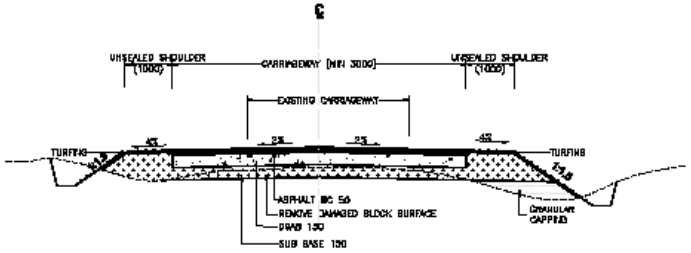
DRAWING No. TS–PS–03

DSN: | DRN: | CHK: | DATE: 23–06–2014

PROPOSED TYPICAL SECTIONS (TS) FOR BLOCK PAVED ROAD



TS–C (TYPICAL SECTION FOR BLOCK PAVED SURFACE – GOOD CONDITION)



TS–H (TYPICAL SECTION FOR BLOCK PAVED SURFACE – DAMAGED)

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I–CBR>30%)	GS
	GRANULAR CAPPING (TYPE II–CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS–01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S–04 & S–05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm. IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
8. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

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Road Development Authority

No.	REVISION	DATE

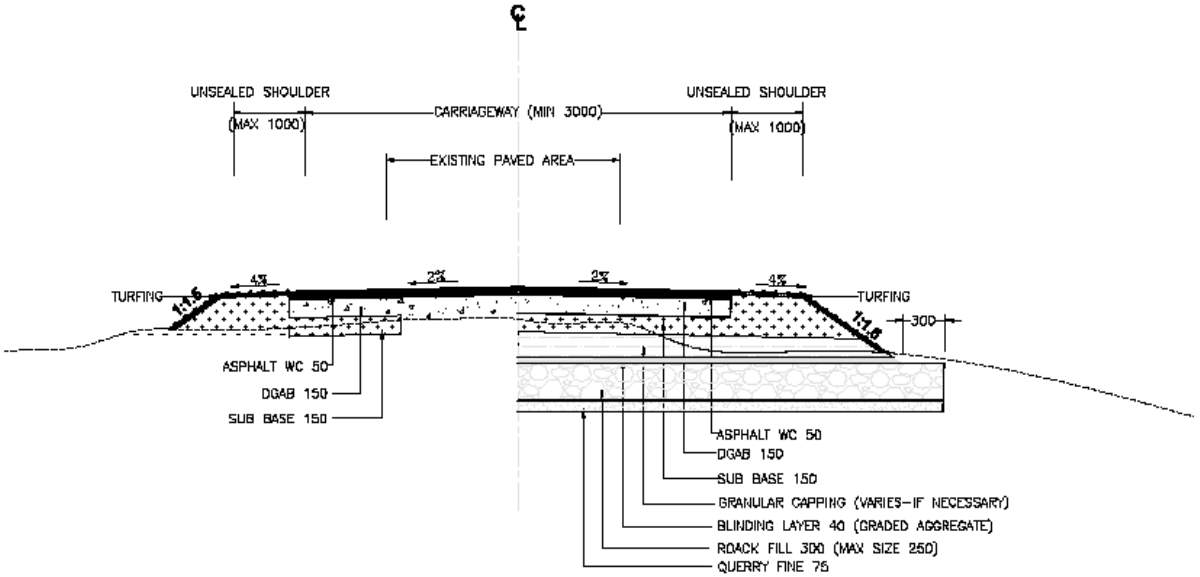
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PS ROAD

DWG. No. TS–PS–04

DSN: DRN: CHK: DATE: 23–06–2014

PROPOSED TYPICAL SECTIONS (TS) FOR WEEK SOIL AREA



TS-M (TYPICAL SECTION FOR MARSHY & WEAK SOIL AREA)

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I-CBR>30%)	GS
	GRANULAR CAPPING (TYPE II-CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS-01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S-04 & S-05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

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Road Development Authority

No.	REVISION	DATE

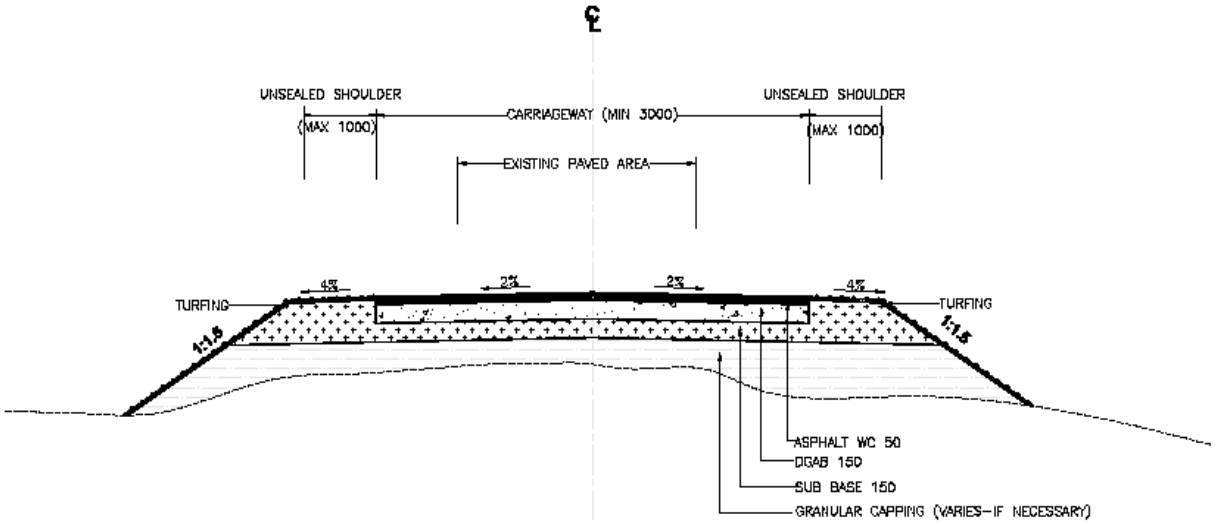
CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

DRAWING TITLE: TYPICAL CROSS SECTION FOR PS ROAD

DWG. No. TS-PS-06

DSN: DRN: CHK: DATE: 23-06-2014

PROPOSED TYPICAL SECTIONS (TS) FOR EMBANKMENT AREA



TS-N (TYPICAL SECTION FOR EMBANKMENT AREA)

LEGEND:

	ASPHALT WEARING COURSE	WC
	DENSE GRANULAR AGGREGATE BASE	DGAB
	GRANULAR SUB BASE (TYPE I-CBR>30%)	GS
	GRANULAR CAPPING (TYPE II-CBR>10%)	GC
	SHOULDER FILL	
	BLINDING LAYER (GRADED AGGREGATE)	
	ROCK FILL (MAXIMUM SIZE 250mm)	
	QUARRY FINE	
	C30 CONCRETE	
	INTERLOCKING BLOCK	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE MENTIONED.
2. THIS DRAWING PROVIDES A GUIDANCE ONLY. EXACT DETAILS TO SUIT SITE CONDITIONS SHALL BE DECIDED BY THE ENGINEER AT CONSTRUCTION STAGE.
3. SELECT DRAINS AS PER SITE CONDITION FOR DRAIN DETAILS REFER DRAWING NO. DS-01
4. FOR TOE WALL DETAILS REFER DRAWING NO. S-04 & S-05.
5. IF THE SPECIFIED MINIMUM DIMENSIONS SHOWN IN THE DRAWING CAN NOT BE MAINTAINED DUE TO ROW RESTRICTIONS THE DIMENSIONS CAN BE REDUCED SUBJECT TO THE APPROVAL OF THE ENGINEER.
6. INTERFACING DETAILS WITH ADJACENT BUILDINGS/LANDS SHOULD BE DECIDED ACCORDING TO THE SITE CONDITIONS.
7. MINIMUM THICKNESS OF DGAB SHOULD BE 100mm TOP OF THE EXISTING PAVEMENT.
8. MINIMUM THICKNESS OF THE GRANULAR CAPPING LAYER SHOULD BE 100mm, IF THE THICKNESSES < 100mm USE GRANULAR SUB BASE.
9. ISOLATED BASE FAILURE SECTION SHOULD BE RECTIFIED PRIOR TO EXISTING PAVEMENT STRENGTHENING.

ADB FUNDED
I ROAD PROJECT
NORTH WESTERN PROVINCE

CLIENT: DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

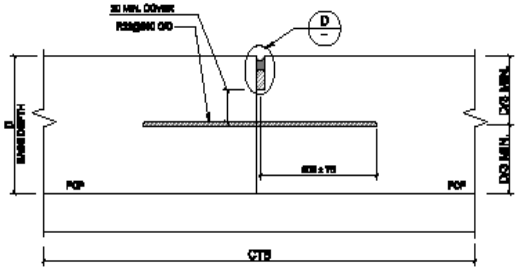
No.	REVISION	DATE

CONSULTANT: KATAHIRA & ENGINEERS INTERNATIONAL

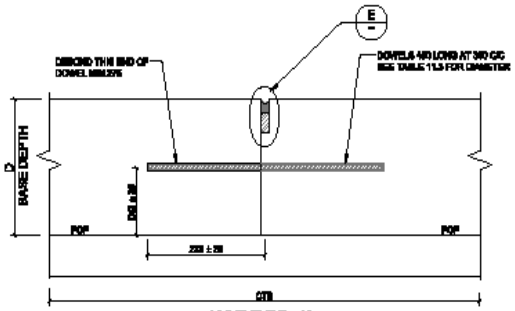
DRAWING TITLE: TYPICAL CROSS SECTION FOR PS ROAD

DRAWING No. TS-PS-07

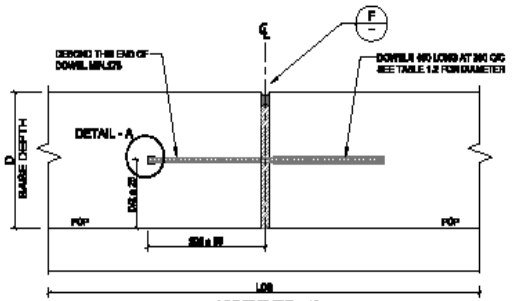
DSN: | DRN: | CHK: | DATE: 23-06-2014



JOINT TYPE - J1
DETAIL OF LONGITUDINAL / TIED JOINT



JOINT TYPE - J2
DETAIL OF TRANSVERSE CONTRACTION JOINT



JOINT TYPE - J3
DETAIL OF EXPANSION JOINT

TABLE 1.1: UNTIED JOINTS - SILICONE SEALANT DIMENSIONS

SLAB LENGTH L OR WIDTH * (m)	DESIGN JOINT OPENING (mm)	SEALANT WIDTH Ws (mm)	SEALANT DEPTH Ds (mm)	RECESS Rs (mm)		JOINT DEPTH Dj (mm)
				CONTRACTIONS	ISOLATIONS & EXPANSIONS	
≤ 4.8	2	7 (+3, -0)	7 (+3, -0)	5 ± 5	5 ± 2	35 ± 5
4.8 ≤ 6.8	3	8 (+3, -0)	8 (+3, -0)	5 ± 5	5 ± 2	35 ± 5
6.8 ≤ 8.0	4	10 (+3, -0)	10 (+3, -0)	6 ± 5	5 ± 2	40 ± 5
8.0 ≤ 8.5	4	11 (+3, -0)	11 (+3, -0)	6 ± 5	5 ± 2	45 ± 5
8.5 ≤ 11.5	5	12 (+4, -0)	12 (+4, -0)	7 ± 5	10 ± 4	45 ± 5
11.5 ≤ 13.0	6	14 (+4, -0)	14 (+4, -0)	5 ± 5	10 ± 4	45 ± 5
13.0 ≤ 16.0	6	17 (+5, -0)	17 (+4, -0)	10 ± 5	12 ± 4	50 ± 5
Bridge Approch Slabs		25 ± 4	14 (+4, -0)	10 ± 4	12 ± 4	50 ± 5

NOTE: * SLAB LENGTH (IN THE CASE OF TRANSVERSE JOINTS) OR WIDTH (IN THE CASE OF LONGITUDINAL JOINTS) ARE CALCULATED AS THE AVERAGE OF SLABS ABUTTING THE JOINT UNDER DESIGN.

DETAIL - A

TABLE 1.2: DOWEL DIAMETER

BASE SLAB THICKNESS (mm)	DOWEL DIAMETER (mm)
150 < D ≤ 175	20
175 < D ≤ 200	25
200 < D ≤ 250	32
D > 250	40

GENERAL NOTE:-

CHARACTERISTIC STRENGTH

- FLEXURAL STRENGTH OF CONCRETE - 4.50 N/mm² (AT 28 DAYS)
- YIELD STRENGTH FOR MILD STEEL REINFORCED DOWELS - 250 N/mm²
- YIELD STRENGTH FOR TORE STEEL REINFORCED DOWELS -460 N/mm²

PAVING

- PAVING WITHIN TRAVEL LANES MUST PRECEDE PAVING WITHIN ADJACENT SHOULDER LANES.

TIEBARS

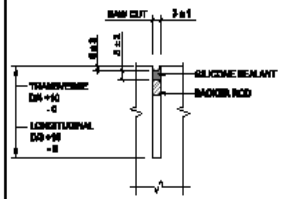
- TIEBARS MUST BE PROVIDED IN TIED LONGITUDINAL JOINTS AT THE SPECIFIED SPACING.

JOINT DETAILS

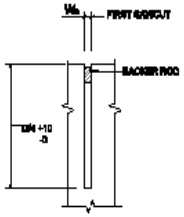
- SEALANT RESERVOIR DIMENSIONS SHOWN IN DETAIL "D" ARE APPLICABLE WHEN JOINTS ARE SPACED AT CENTERS NOT EXCEEDING 4.6m REFER TO TABLE 1.1 FOR OTHER JOINT CENTERS.
- ALL FORMED JOINTS IN THE BASE (INCLUDING TIED JOINTS)MUST BE DEBONDED IN ACCORDANCE WITH THE SPECIFICATION.
- UNLESS OTHERWISE SHOWN, TRANSVERSE CONNECTION JOINTS MUST TYPICALLY BE CONSTRUCTED AT A SKEW OF 1 IN 10 TO THE CENTER LINE.THE SKEW MAY BE REDUCED AS NECESSARY TO ACHIEVE THE SPECIFIED SLAB DIMENSIONS BUT THE SKEW MUST NOT BE INCREASED TO YIELD CORNER ANGLES MORE ACUTE THAN 84°.
- JOINTS KERBS (eaL) MUST BE LOCATED TO COINCIDE WITH JOINTS IN THE ADJOINING BASE.

DOWELS

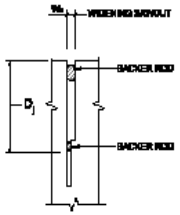
- DOWELS MUST BE LOCATED NOT CLOSER THAN 150mm TO A LONGITUDINAL JOINTS.THE OFFSET TO THE FIRST DOWEL MUST BE NOT GREATER THAN 250mm.



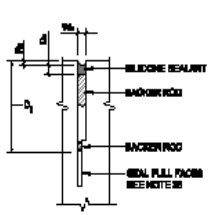
DETAIL - E



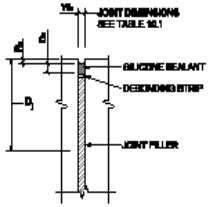
D1 - PRELIMINARY SEALING



D2- TEMPORARY SEALING



D3 - PERMANENT SEALING



DETAIL - F

ADB FUNDED
I ROAD PROJECT
NORTH WESTERN PROVINCE

CLIENT:
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS & HIGHWAYS
Road Development Authority

No.	REVISION	DATE

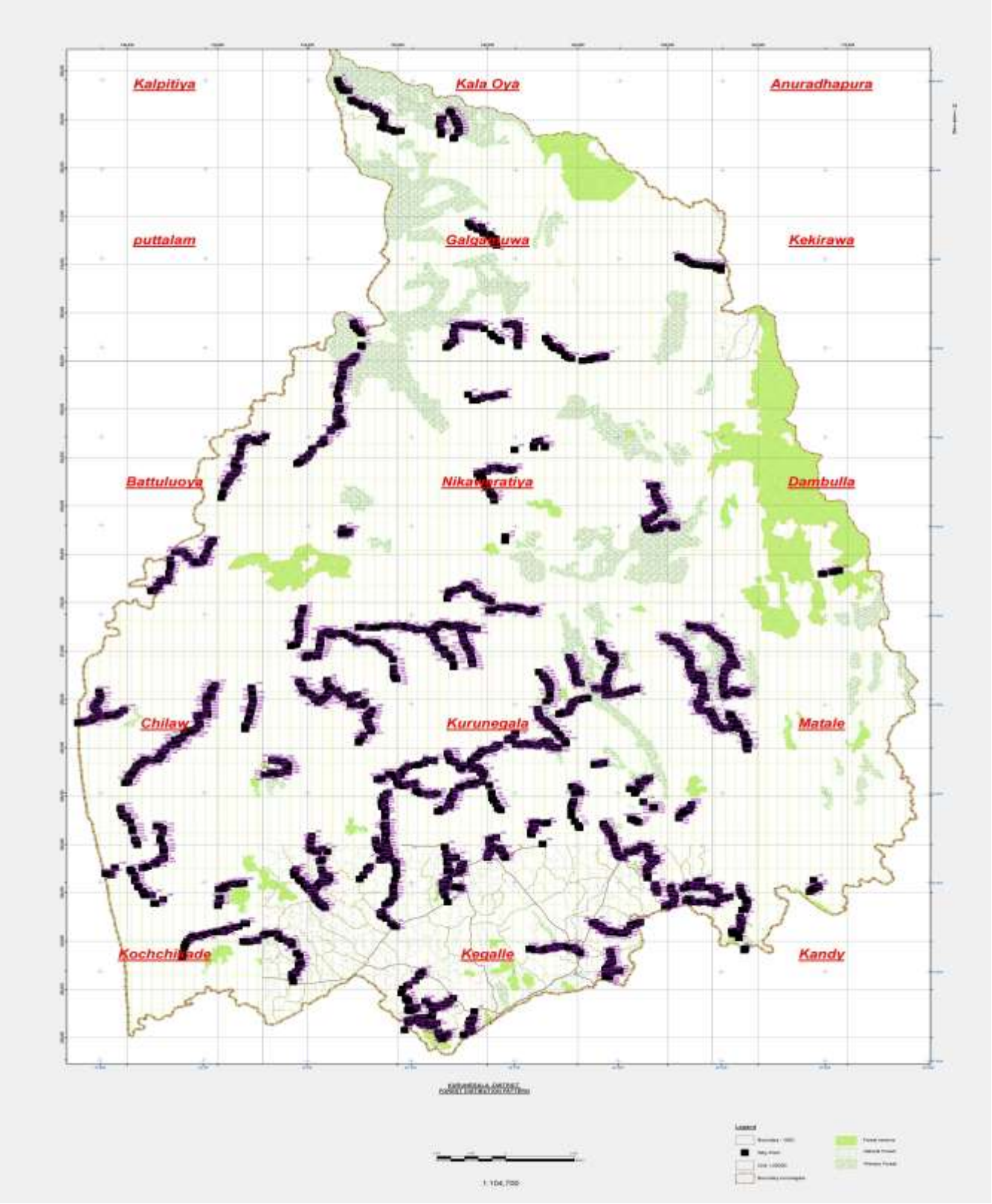
CONSULTANT:
KATAHIRA & ENGINEERS INTERNATIONAL

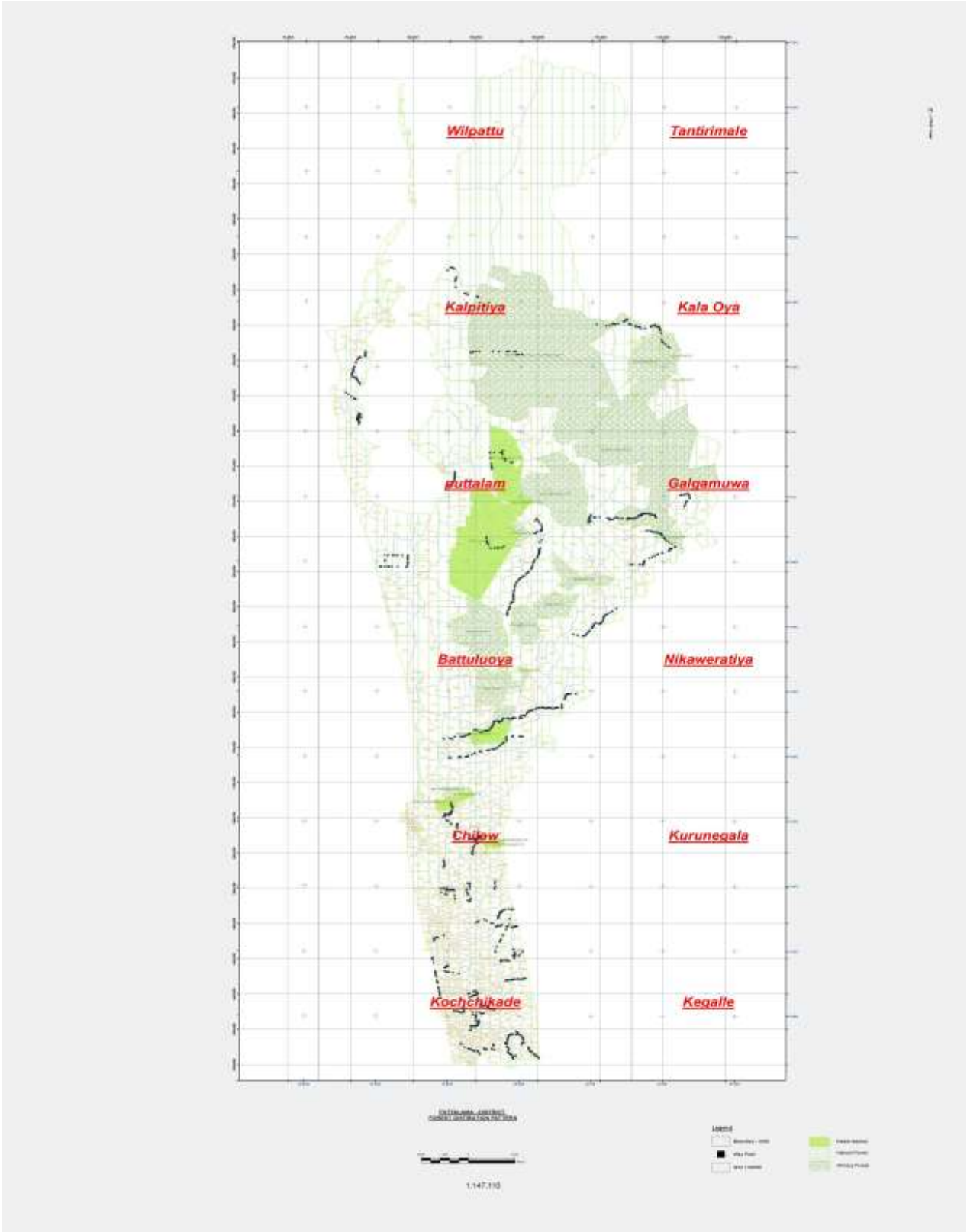
DRAWING TITLE: DETAILS OF JOINT CONSTRUCTION

DWG. No. RTS-05

DSN: | DRN: | CHK: | DATE: 07-07-2014

Appendix 4: Landslide Hazard Maps




Wilpattu
Tantirimale
Kalpitiya
Kala Oya
puttalam
Galgamuwa
Battuluoya
Nikaweratiya
Chilaw
Kurunegala
Kochchikade
Kegalle

APPENDIX 5: ENVIRONMENTAL MONITORING PLAN

Standard Environmental Management Plan
Upgrading of Rural Roads to all Weather Standards – Northwestern Province

District:
Package Name:
Road Name:
Road ID:
Total length:

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
I	**Design and Preconstruction Stage**					
1.	Climate Change Consideration and Vulnerability screening	○ Compliance to climate change vulnerability check point given under IEE and adoption of necessary mitigative measures as may be required ○ Efforts shall be made to plant additional trees for increasing the carbon sink. The trees may be planted with help of DoF (Department of Forest) and space for additional planting (if the remaining space within ROW is not adequate) will be explored with the help of DoF, Divisional Secretary (DS) and Community Based Organizations (CBO).	Throughout the project and other possible areas of tree planting	Design costs.	PIU, Design consultants	Project Implementation Unit (PIU)
2.	Clearing of vegetation and removing trees	○ All efforts shall be taken to avoid tree cutting wherever possible. ○ Requisite permission from DS shall be obtained for cutting of roadside trees ○ Cut trees shall be handed over to the Timber Corporation. ○ Provision of Compensatory Afforestation shall be made on 1:3.ratio basis. ○ Only native species with the advice of	Throughout the project area	Costs for tree removal. Costs for compensatory tree replanting.	Contractor	PIU, Project Implementation Consultant (PIC), DS

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		DoF will be selected for replanting and locations for tree replanting will be as closer as possible to the tree removed. o And if road side space for replanting is not available, other possible locations such as schools, public areas will be explored with the help of DoF, DS and CBOs of the area. o Provision shall be made for additional compensatory tree plantation. Any leftover of trees shall be removed and disposed in approved manner.				
3.	Shifting of utilities	o The proposed Right of Way (ROW) shall be clearly demarcated on the ground. o All efforts will be made to minimize o shifting of utilities o Utility shifting shall be planned in consultations and concurrence of the relevant service provider. o Required permissions and necessary actions will be taken from relevant service provider on a timely basis for removing and shifting utility structures before road construction activities begin. o The public/users of the particular service should be aware well in advance about the timing of the shifting/removal of the relevant utility lines when the service will be disrupted	Utility facilities located along either the side of the road which may be shifted due to the road improvement	Costs to cover shifting and reconstruction of utilities and common property resources must be included under project costs.	Contractor	PIU, PIC, CEB, Sri Lanka Telecom, NWS&DB, Community based water supply schemes if any

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
4.	Impacts to common properties	○ Common properties outside the ROW will not be affected due to road improvement ○ All efforts will be made to minimize shifting of common properties located within the ROW if any. ○ Structures with religious importance will not be touched ○ Any common property built within the existing ROW and to be removed due to road improvement will be reconstructed as to the satisfactory level to the relevant owner	Throughout the road with special attention to any common property to be shifted	Costs of removing and repairing common properties	Contractor	PIU, PIC
5.	Hydrology and Drainage	○ Provision of adequate cross drainage structure shall be made to ensure smooth passage of water and maintaining natural drainage pattern of the area. Here, special attention should be paid for flood prone areas. ○ The discharge capacity of the cross drainage structure shall be designed accordingly. ○ Provision of adequate drainage structures shall be made in water stagnant/logging areas. ○ The construction work near water body shall be planned preferably in dry season so that water quality of the water channel is not affected due to siltation and rain water runoff. ○ Provision of additional cross drainage structure shall be made in the areas where nearby land is sloping towards road alignment on both the sides.	Near all drainage crossings, rivers, streams and flood prone areas.	Included in project costs.	PIU, Design consultants	PIU, SRRDA

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
6.	Landslide impacts	○ Possibility of occurrence of project induced landslides is marginal as the road improvement activities will not touch slopes outside ROW. ○ However prior consent should be obtained from National Building Research Organization (NBRO) for roads along which landslide prone locations are already observed. ○ And special attention should be paid in designing at particular locations of such roads and also recommendation of NBRO if any should be incorporated to the designs	Throughout the project area with special attention to locations which are landslide prone	Included in project costs.	PIU, Design consultants	PIU, SRRDA
II.	**Construction Stage**					
1.	Landslide impact	○ As the improvement will be within the ROW, there will be minimal disturbance to the road side natural slopes and therefore possibility of occurring project induced landslides is minimal. ○ However proper coordination should be maintained with NBRO for roads which already have landslides or slope failures along its trace when construction activities are carried out and any recommendation from NBRO should be adhered. ○ Further contractor's activities shall not lead to create landslides and if any such incident occurs, he should immediately inform RDA and contractors shall provide suitable means to prevent loss of any access and prevent damage to land and property	Throughout the project area with special attention to roads which already have landslides and locations previously stuck by landslides	To be included under contractors costs	Contractor	PIU, PIC
2.	Flood impacts	○ The contractor shall take all measures necessary or as directed by the	Throughout the project	To be included	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		Engineer to keep all drainage paths and drains clear of blockage at all times. o Temporary storage of material should only be within approved sites by the engineer where natural drainage is not disturbed. o All wastes should be disposed only at locations approved by the Local Authority of the area. o If flooding or stagnation of water is caused by contractor's activities, contractors shall provide suitable means to prevent loss of access to any land or property and prevent damage to land and property. o No material including excavated soil should be allowed to be disposed near water bodies or in paddy lands (even on temporary basis) to curtail any undue wash off of soil and debris in to such nearby water bodies and agricultural lands. o The contractor should be advised not to damage or block any manmade drainage canal even for temporary basis. If blocked the contractor should remove such debris without any delay preventing any long interruptions of water flow which could damage or hinder cultivation activities resulting in loss of crop and produce especially in the upstream side of the drainage path	area with special attention to roads which are prone to floods	under contractors costs		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
3.	Sourcing and transportation of construction material	**Borrow Earth**: o The borrow earth shall be obtained from borrow pits which are operated with GSMB and CEA approvals. o And if new borrow pits are opened for the project, necessary approvals and licenses should be obtained from GSMB and CEA. And all conditions laid down in such licenses should be strictly adhered. o All completed borrow pits should be rehabilitated to satisfy conditions given in the industrial mining license of GSMB o Borrowing earth from agricultural land shall be minimized to the extent possible. Further, no earth shall be borrowed from already low-lying areas. **Aggregate** : o The stone aggregate shall be sourced from existing licensed quarries o Copies of consent/ approval / rehabilitation plan for use of existing source will be submitted to PIU through PIC. o Topsoil to be stockpiled and protected for use at the rehabilitation stage. **Transportation of Construction Material** o Existing tracks / roads are to be used for hauling of materials to the extent possible. o The vehicles deployed for material transportation shall be spillage proof to avoid or minimize the spillage of the material during transportation.	Throughout the project area with special attention to borrow pits and quarries to be used in each package	To be included under contractors costs	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
5.	Loss of Productive Soil, erosion and land use change	○ The top soil from the productive land (borrow areas, road widening areas etc.) shall be preserved and reused for plantation purposes. ○ It shall also be used as top cover of embankment slope for growing vegetation to protect soil erosion. ○ Shrubs shall be planted in loose soil area.	Throughout the project area and camps sites, storage areas and temporary offices	To be included under contractors costs	Contractor	PIU, PIC
		○ It shall be ensured that the land taken on lease for access road, construction camp and temporary office of the storage facilities is restored back to its original land use before handing it over to land owner.				
6.	Slope protection and stabilization	○ Slope protection measures must be carried out using appropriate engineering and bio-engineering measures in combination with drainage improvement measures were appropriate ○ Only native plant species will be selected for the bio-engineering works ○ Follow up watering and maintenance of the plants must be carried out to ensure the survival of the plants and success of the slope stabilization	In project areas falling inside landslide prone	To be included under contractors costs	Contractor	PIU, PIC
7.	Compaction and Contamination of Soil	○ To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route. ○ The productive land shall be reclaimed after construction activity. ○ Fuel and lubricants shall be stored at	Throughout the project area with special attention to paddy and other agricultural lands	To be included under contractors costs	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		the predefined storage location. o The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils. o All efforts shall be made to minimise the waste generation. Unavoidable waste shall be stored at the designated place prior to disposal.				
		o To avoid soil contamination at the wash-down and re-fuelling areas, “oil interceptors” shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to relevant parties. o Any land degraded due to construction activities should be restored to the satisfactory level of the owner				
8.	Establishment of Construction Camp, temporary office and storage area	o Construction camp sites and storage areas shall be located away from any local human settlements, water bodies and forested areas (minimum 0.2 km away) and preferably located on land which is not productive (barren/waste lands presently). If these are not possible private land maybe taken on lease as standard practice. o The construction camps, office and storage areas shall have provision of adequate water supply, sanitation and all requisite infrastructure facilities. o The construction camps, office and storage areas shall have provision of septic tank/soak pit of adequate	Throughout the project area with special attention to labour camps, storage areas and office premises	To be included in contractor’s cost	Contractor	PIU, PIC, LA

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		capacity so that it can function properly for the entire duration of its use. o All construction camps shall have provision of rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided to the extent possible. o The construction camps, office and storage areas shall have provision of health care facilities for adults, pregnant women and children. o Personal Protective Equipment (PPEs) such as helmet, boots, ear plugs for workers, first aid and firefighting equipment shall be available at construction sites before start of construction. An emergency plan shall be prepared to fight with any emergency like fire. o Provision shall be made for domestic solid waste disposal in acceptable manner. The solid waste shall be handed over to the waste collecting system of the Local Authority (LA) of the area and wastewater should be disposed with the approval of the PIC. o Provision of paved area for unloading and storage of fuel oil, lubricant oil, away from storm water drainage.				
9.	Construction Debris and waste	o Excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. o Unusable debris material and removed pavements of roads should be suitably	Throughout the project area and all disposal sites	To be included under contractors costs	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		disposed off at pre-designated disposal locations, with approval of the concerned authority such as LA/DS. o The bituminous wastes if any shall be disposed in secure manner and environmentally accepted manner eg. Disposed in a pit that is covered properly and adequate revegetation is carried out or others. o In establishing disposal sites, unproductive/wastelands shall be selected with the help the PIC and villagers. The dumping site should be of adequate capacity. It should be located without causing nuisance to residential areas. Dumping sites. Further flood prone areas should be avoided in selecting disposal sites				
10.	Air and Noise Quality and vibration	o Vehicles delivering loose and fine materials like sand and aggregates shall be covered. o Dust suppression measures such as water sprinkling, shall be applied in all dust prone locations such as unpaved haulage roads, earthworks, stockpiles and asphalt mixing areas. o Batching plants and asphalt (hot mix) should be operated with necessary licenses (Environmental Protection License (EPL) and trade license) and plants shall be located at least 0.2 km away and in downwind direction of the human settlements and should not disturb normal life of residents. o Material storage areas shall also be located downwind of the habitation area.	Throughout the project road with special attention to schools, hospitals and religious places located along candidate roads	To be included under contractors costs	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		○ Hot mix plant shall be fitted with stack of adequate height (30m) or as may be prescribed in the EPL to ensure enough dispersion of exit gases. ○ Diesel Generators (DG) shall also be sound proof or fitted with stack of adequate height. ○ Construction vehicles and machineries shall be periodically maintained. o All heavy equipment and machinery shall be fitted in full compliance with the national regulation, Noise Control Regulations - Extra Ordinary Gazette ○ No. 924/12 May 1996 amended by Extra Ordinary Gazette 937/7 April 1997. ○ No construction along community areas will be permitted during night time ○ Contractor shall take appropriate action to ensure that construction works do not result in damage to adjacent properties due to vibration. If any damages occur, contractor will be responsible for rectifying the damage.				
11.	Tree plantation	○ Compensatory forestation shall be made on 1:3.ratio basis. ○ Only native species should be selected with the consent of DoF for replanting ○ Additional trees shall be planted wherever feasible. ○ Follow up maintenance of planted saplings will be carried out for a minimum of 3 years	Throughout the all project roads.	To be included under contractors costs	Contractor	PIU, PIC
12	Ground Water and Surface Water Quality and	○ The contractor shall arrange for water required during construction in such a way that the water availability and supply to nearby communities remains	Throughout the project area with special attention to	To be included under contractors	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
	Availability	unaffected. o Water intensive activities shall not be undertaken during dry period to the extent feasible. o Provision shall be made to link side drains with the nearby ponds for facilitating water harvesting if feasible. o Preventive measures such as proper storage of unsuitable soil, construction chemicals, servicing construction vehicles in approved sites, slope stabilisation, etc shall be taken for prevention of siltation and pollution of water bodies.	streams, public wells and marshes	costs		
13	Occupational Health and Safety	o The requisite PPE (helmet, mask, boot, hand gloves, earplugs) shall be provided to the construction workers and it should be ensured that labourers use PPE during working hours. o Workers' exposure to noise will be restricted to less than 8 hours a day. Workers duty shall be regulated accordingly. o First aid facility should be readily available at every construction site throughout the construction period o Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp/temporary office/storage areas. o Domestic solid waste at construction camp shall be properly collected and handed over to the solid waste collecting system of LA. o Records on health and safety related accidents measures taken to address	Throughout the project roads	Costs to be borne by Contractor	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		must be maintained o Adequate signboards shall be placed much ahead of diversion site to caution the road users. The road signs should comply with the Road Safety Manual of RDA. o It is proposed to discuss with the Department of Railways for providing adequate safety measures at unmanned railway crossing where applicable. Adequate clearly visible sign shall be provided on both sides of the railway crossing. o Road furniture including footpaths, railings, storm water drains, crash barrier, traffic signs, speed zone signs, pavement markers and any other such items will be provided to enhance the road o safety where necessary at the completion of the project o Monitor and record road crashes during construction and maintenance stages and take appropriate remedial actions				
14	Impacts on Biodiversity	o No solid waste or spoil dumping sites, hot mix plants and worker camps should be located within or close to the protected areas. o Prior approval should be taken from the relevant department for entrance or temporary alteration of properties belongs to such areas. o Strict worker force supervision should be carried out by the contractor when conducting construction work within the area and the construction works should	Near forest reserves, national parks, sanctuaries if any	To be included in contractor's cost	Contractor	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		be completed within a minimum specified time period. o Restrictions on the daily working hours between daylight and sunset must be enforced in sites near protected areas or wildlife zones o Conditions which may be required by the DWLC for roads located adjacent or close to protected areas must be met o For roads falling near protected areas appropriate measures such as posting of information sign boards on the presence of wildlife, speed controls such as speed bumps etc. must be installed as appropriate o Other measures to facilitate wildlife movement across the road such as exclusion fences may be installed with o advise of DWLC o Ensure that construction timing of cross drains and bridges will not affect the migration or breeding of aquatic species. The contractor will seek guidance from pertinent agencies to identify rivers and creeks harbouring sensitive aquatic life. o Ensure that the timing of tree removal does not coincide with breeding season of birds or other fauna if the trees are being used by birds and other fauna				
III	**Post Construction and Operational Stage**	o				
1.	Occurrence of landslides	o In such case, contractor is responsible for clearing the road and restore the access as soon as possible (during the maintenance period) after informing RDA (PIU and relevant Executive	Throughout the project area	To be included in contractor's maintenance cost	Contractor (during maintenance period) and RDA	PIU/RDA

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		Engineer of RDA). o Here, contractor should also comply with recommendations of NBRO if any.				
2.	Hydrology and Drainage	o Regular removal/cleaning of deposited silt shall be done from drainage channels and outlet points before the monsoon season. o Renovation of the drainage system by repairing removing encroachments/ congestions shall be regularly conducted	At project road locations with drainage structures	To be included in contractor's maintenance cost	Contractor (during maintenance period) and RDA	PIU/RDA
3.	Air and Noise Quality	o Placing sign boards for speed limitation and honking restrictions to be enforced near sensitive locations.o Removal of dust & mud collected on road surface to avoid dust emanation o Strategically locating compensatory plantation along sensitive noise receptors to provide additional attenuation o Installation of noise and dust barriers if levels are found to exceed required standards.	Throughout the project roads	construction cost and maintenance cost	Contractor (during maintenance period) and RDA	PIU/RDA
4.	Site restoration	o All construction camp /temporary office/material storage areas are to be restored to its original conditions or as agreed with the land owner. o The borrow areas rehabilitation will be as per the conditions laid down in GSMB approval.	All locations of construction camps/temporary office/ material storage, and borrow areas	To be borne by the contractor	Contractor (during maintenance period) and RDA	PIU/RDA
5.	Tree replanting	o Contractor to undertake survivability assessment and report to PIU the status of compensatory tree plantation.	All tree replanted areas	To be borne by the contractor	Contractor (during maintenance	PIU/RDA

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Costs	Responsible for Implementing	Responsible for Monitoring
		○ Additional plants should be planted for dead plants if any			period) and RDA	
6.	Occupational Health and Safety	○ The requisite PPE (helmet, mask, boot, hand gloves, earplugs) shall be provided to the construction workers and it should be ensured that labourers use PPE during working hours. ○ First aid facility should be readily available at the construction site ○ Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp/temporary office/storage areas. ○ Domestic solid waste at construction camp shall be properly collected and handed over to the solid waste collecting system of LA. ○ Records on health and safety related accidents measures taken to address must be maintained	Throughout the project roads and camp sites if any	To be borne by the contractor	Contractor (during maintenance period) and RDA	PIU/RDA

Appendix 6: Environmental Monitoring Checklists

Appendix 6.1 Environmental Monitoring Checklist during Design and Pre-Construction Stage
Upgrading of Rural Roads to all Weather Standards

District:
Road Name:
Road ID:
Total length:
Report No. and date:
Completed by:

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status(Complied, partly complied, not complied)	Corrective action proposed if any
I	**Design and Preconstruction Stage**				
1.	Climate Change Consideration and Vulnerability screening	○ Compliance to climate change vulnerability check point given under IEE and adoption of necessary mitigative measures as may be required ○ Efforts shall be made to plant additional trees for increasing the carbon sink. The trees may be planted with help of DoF (Department of Forest) and space for additional planting (if the remaining space within ROW is not adequate) will be explored with the help of DoF, Divisional Secretary (DS) and Community Based Organizations (CBO).	Throughout the project area and other possible areas of tree planting		
2.	Clearing of vegetation and removing trees	○ All efforts shall be taken to avoid tree cutting wherever possible. ○ Requisite permission from DS shall be obtained for cutting of roadside trees	Throughout the project area		

		○ Cut trees shall be handed over to the Timber Corporation. ○ Provision of Compensatory Afforestation shall be made on 1:3.ratio basis. ○ Only native species with the advice of DoF will be selected for replanting and locations for tree replanting will be as closer as possible to the tree removed. ○ And if road side space for replanting is not available, other possible locations such as schools, public areas will be explored with the help of DoF, DS and CBOs of the area. ○ Provision shall be made for additional compensatory tree plantation. Any leftover of trees shall be removed and disposed in approved manner.			
3.	Shifting of utilities	○ The proposed Right of Way (ROW) shall be clearly demarcated on the ground. ○ All efforts will be made to minimize ○ shifting of utilities ○ Utility shifting shall be planned in consultations and concurrence of the relevant service provider. ○ Required permissions and necessary actions will be taken from relevant service provider on a timely basis for removing and shifting utility structures before road construction activities begin. ○ The public/users of the	Utility poles located along either the side of the road which may be shifted due to the road improvement		

		particular service should be aware well in advance about the timing of the shifting/removal of the relevant utility lines when the service will be disrupted			
4.	Impacts to common properties	○ Common properties outside the ROW will not be affected due to road improvement ○ All efforts will be made to minimize shifting of common properties located within the ROW if any. ○ Structures with religious importance will not be touched ○ Any common property built within the existing ROW and to be removed due to road improvement will be reconstructed as to the satisfactory level to the relevant owner	Throughout the road with special attention to any common property to be shifted		
5.	Hydrology and Drainage	○ Provision of adequate cross drainage structure shall be made to ensure smooth passage of water and maintaining natural drainage pattern of the area. Here, special attention should be paid for flood prone areas. ○ The discharge capacity of the cross drainage structure shall be designed accordingly. ○ Provision of adequate drainage structures shall be made in water stagnant/logging areas. ○ The construction work near water body shall be planned preferably in dry season so that water quality of the water	Near all drainage crossings, rivers, streams and flood prone areas		

		channel is not affected due to siltation and rain water runoff. ○ Provision of additional cross drainage structure shall be made in the areas where nearby land is sloping towards road alignment on both the sides.			
6.	Landslide impacts	○ Possibility of occurrence of project induced landslides is marginal as the road improvement activities will not touch slopes outside ROW. ○ However prior consent should be obtained from National Building Research Organization (NBRO) for roads along which landslide prone locations are already observed. ○ And special attention should be paid in designing at particular locations of such roads and also recommendation of NBRO if any should be incorporated to the designs	Throughout the project area with special attention to locations which are landslide prone		

Appendix 6.2 Environmental Monitoring Checklist during Construction Stage
Upgrading of Rural Roads to all Weather Standards

District:
Road Name:
Road ID:
Total length:
Report No. and date:
Completed by:

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
1.	Landslide impact	○ As the improvement will be within the ROW, there will be minimal disturbance to the road side natural slopes and therefore possibility of occurring project induced landslides is minimal. ○ However proper coordination should be maintained with NBRO for roads which already have landslides or slope failures along its trace when construction activities are carried out and any recommendation from NBRO should be adhered. ○ Further contractor's activities shall not lead to create landslides and if any such incident occurs, he should immediately inform RDA and contractors shall provide suitable means to prevent loss of any access and prevent damage to land and property	Throughout the project area with special attention to roads which already have landslides and locations previously stuck by landslides		
2.	Flood impacts	○ The contractor shall take all measures necessary or as directed by the Engineer to keep all drainage paths and drains clear of blockage at all times. Here special attention should be paid to flood prone areas. ○ Temporary storage of material should only be within approved sites by the engineer where natural drainage is not disturbed. ○ All wastes should be disposed only at	Throughout the project area with special attention to roads which are prone to floods.		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		locations approved by the Local Authority of the area. ○ If flooding or stagnation of water is caused by contractor's activities, contractors shall provide suitable means to prevent loss of access to any land or property and prevent damage to land and property. ○ No material including excavated soil should be allowed to be disposed near water bodies or in paddy lands (even on temporary basis) to curtail any undue wash off of soil and debris in to such nearby water bodies and agricultural lands. ○ The contractor should be advised not to damage or block any manmade drainage canal even for temporary basis. If blocked the contractor should remove such debris without any delay preventing any long interruptions of water flow which could damage or hinder cultivation activities resulting in loss of crop and produce especially in the upstream side of the drainage path			
3.	Sourcing and transportation of construction material	**Borrow Earth:** ○ The borrow earth shall be obtained from borrow pits which are operated with GSMB and CEA approvals. ○ And if new borrow pits are opened for the project, necessary approvals and licenses should be obtained from GSMB and CEA. And all conditions laid down in such licenses should be strictly adhered. ○ All completed borrow pits should be rehabilitated to satisfy conditions given in the industrial mining license of GSMB ○ Borrowing earth from agricultural land shall be minimized to the extent possible. Further, no	Throughout the project area with special attention to borrow pits and quarries		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		earth shall be borrowed from already low-lying areas. **Aggregate :** ○ The stone aggregate shall be sourced from existing licensed quarries ○ Copies of consent/ approval / rehabilitation plan for use of existing source will be submitted to PIU through PIC. ○ Topsoil to be stockpiled and protected for use at the rehabilitation stage. **Transportation of Construction Material** ○ Existing tracks / roads are to be used for hauling of materials to the extent possible. ○ The vehicles deployed for material transportation shall be spillage proof to avoid or minimize the spillage of the material during transportation.			
5.	Loss of Productive Soil, erosion and land use change	○ The top soil from the productive land (borrow areas, road widening areas etc.) shall be preserved and reused for plantation purposes. ○ It shall also be used as top cover of embankment slope for growing vegetation to protect soil erosion. ○ Shrubs shall be planted in loose soil area. ○ It shall be ensured that the land taken on lease for access road, construction camp and temporary office of the storage facilities is restored back to its original land use before handing it over to land owner.	Throughout the project area and camps sites, storage areas and temporary offices		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
6.	Slope protection and stabilization	○ Slope protection measures must be carried out using appropriate engineering and bio-engineering measures in combination with drainage improvement measures were appropriate ○ Only native plant species will be selected for the bio-engineering works ○ Follow up watering and maintenance of the plants must be carried out to ensure the survival of the plants and success of the slope stabilization	In project areas falling inside landslide prone		
7.	Compaction and Contamination of Soil	○ To prevent soil compaction in the adjoining productive lands beyond the ROW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route. ○ The productive land shall be reclaimed after construction activity. ○ Fuel and lubricants shall be stored at the predefined storage location. ○ The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils. ○ All efforts shall be made to minimise the waste generation. Unavoidable waste shall be stored at the designated place prior to disposal. ○ To avoid soil contamination at the wash-down and re-fuelling areas, “oil interceptors” shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to relevant parties. o Any land degraded due to construction activities should be restored to the	Throughout the project area with special attention to paddy and other agricultural lands		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		satisfactory level of the owner			
8.	Establishment of Construction Camp, temporary office and storage area	○ Construction camp sites and storage areas shall be located away from any local human settlements, water bodies and forested areas (minimum 0.2 km away) and preferably located on land which is not productive (barren/waste lands presently). If these are not possible private land maybe taken on lease as standard practice. ○ The construction camps, office and storage areas shall have provision of adequate water supply, sanitation and all requisite infrastructure facilities. ○ The construction camps, office and storage areas shall have provision of septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. ○ All construction camps shall have provision of rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided to the extent possible. ○ The construction camps, office and storage areas shall have provision of health care facilities for adults, pregnant women and children. ○ Personal Protective Equipment (PPEs) such as helmet, boots, earplugs for workers, first aid and firefighting equipment shall be available at construction sites before start of construction. An emergency plan shall be prepared to fight with any emergency like fire. ○ Provision shall be made for domestic solid waste disposal in acceptable manner. The solid waste shall be handed over to the waste collecting system of the Local Authority (LA)	Throughout the project area with special attention to labour camps, storage areas and office premises		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		of the area and wastewater should be disposed with the approval of the PIC. o Provision of paved area for unloading and storage of fuel oil, lubricant oil, away from storm water drainage.			
9.	Establishment of Construction Camp, temporary office and storage area	o Excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. o Unusable debris material and removed pavements of roads should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority such as LA/DS. o The bituminous wastes if any shall be disposed in secure manner and environmentally accepted manner eg. Disposed in a pit that is covered properly and adequate revegetation is carried out or others. o In establishing disposal sites, unproductive/wastelands shall be selected with the help the PIC and villagers. The dumping site should be of adequate capacity. It should be located without causing nuisance to residential areas. Dumping sites. Further flood prone areas should be avoided in selecting disposal sites	Throughout the project area and all disposal sites		
10.	Air and Noise Quality and vibration	o Vehicles delivering loose and fine materials like sand and aggregates shall be covered. o Dust suppression measures such as water sprinkling, shall be applied in all dust prone locations such as unpaved haulage roads, earthworks, stockpiles and asphalt mixing areas. o Batching plants and asphalt (hot mix) should	Throughout the project road with special attention to schools, hospitals and religious places		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		be operated with necessary licenses Environmental Protection License (EPL) and trade license) and plants shall be located at least 0.2 km away and in downwind direction of the human settlements and should not disturb normal life of residents. o Material storage areas shall also be located downwind of the habitation area. ○ Hot mix plant shall be fitted with stack of adequate height (30m) or as may be prescribed in the EPL to ensure enough dispersion of exit gases. ○ Diesel Generators (DG) shall also be sound proof or fitted with stack of adequate height. ○ Construction vehicles and machineries shall be periodically maintained. o All heavy equipment and machinery shall be fitted in full compliance with the national regulation, Noise Control Regulations - Extra Ordinary Gazette No. 924/12 May 1996 amended by Extra Ordinary Gazette 937/7 April 1997. ○ No construction along community areas will be permitted during night time ○ Contractor shall take appropriate action to ensure that construction works do not result in damage to adjacent properties due to vibration. If any damages occur, contractor will be responsible for rectifying the damage.			
11.	Tree plantation	○ Compensatory afforestation shall be made on 1:3.ratio basis. ○ Only native species should be selected with the consent of DoF for replanting ○ Additional trees shall be planted wherever feasible. ○ Follow up maintenance of planted saplings will be carried out for a minimum of 3 years	Throughout the road.		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
12.	Ground Water and Surface Water Quality and Availability	○ The contractor shall arrange for water required during construction in such a way that the water availability and supply to nearby communities remains unaffected. ○ Water intensive activities shall not be undertaken during dry period to the extent feasible. ○ Provision shall be made to link side drains with the nearby ponds for facilitating water harvesting if feasible. ○ Preventive measures such as proper storage of unsuitable soil, construction chemicals, servicing construction vehicles in approved sites, slope stabilisation, etc shall be taken for prevention of siltation and pollution of water bodies.	Throughout road with special attention to streams, tanks and marshes		
13.	Occupational Health and Safety	○ The requisite PPE (helmet, mask, boot, hand gloves, earplugs) shall be provided to the construction workers and it should be ensured that labourers use PPE during working hours. ○ Workers' exposure to noise will be restricted to less than 8 hours a day. Workers duty shall be regulated accordingly. ○ First aid facility should be readily available at every construction site throughout the construction period ○ Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp/temporary office/storage areas. ○ Domestic solid waste at construction camp shall be properly collected and handed over to the solid waste collecting system of LA. ○ Records on health and safety related accidents measures taken to address must be maintained	Throughout the road		

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		○ Adequate signboards shall be placed much ahead of diversion site to caution the road users. The road signs should comply with the Road Safety Manual of RDA. ○ It is proposed to discuss with the Department of Railways for providing adequate safety measures at unmanned railway crossing where applicable. Adequate clearly visible sign shall be provided on both sides of the railway crossing. ○ Road furniture including footpaths, railings, storm water drains, crash barrier, traffic signs, speed zone signs, pavement markers and any other such items will be provided to enhance the road safety where necessary at the completion of the project ○ Monitor and record road crashes during construction and maintenance stages and take appropriate remedial actions			
14.	Impacts on Biodiversity	○ No solid waste or spoil dumping sites, hot mix plants and worker camps should be located within or close to the protected areas. ○ Prior approval should be taken from the relevant department for entrance or temporary alteration of properties belongs to such areas. ○ Strict worker force supervision should be carried out by the contractor when conducting construction work within the area and the construction works should be completed within a minimum specified time period. ○ Restrictions on the daily working hours between daylight and sunset must be enforced in sites near protected areas or wildlife zones ○ Conditions which may be required by the	Near forest reserves, national parks, sanctuaries if any	To be included in contractor's cost	PIU, PIC

SL. NO.	Project Action/ Environmental Attributes	Mitigation Measures	Location/ numbers	Compliance status (Complied, partly complied, not complied)	Corrective action proposed if any
		DWLC for roads located adjacent or close to protected areas must be met ○ For roads falling near protected areas appropriate measures such as posting of information sign boards on the presence of wildlife, speed controls such as speed bumps etc. must be installed as appropriate ○ Other measures to facilitate wildlife movement across the road such as exclusion fences may be installed with ○ advise of DWLC ○ Ensure that construction timing of cross drains and bridges will not affect the migration or breeding of aquatic species. The contractor will seek guidance from pertinent agencies to identify rivers and creeks harbouring sensitive aquatic life. ○ Ensure that the timing of tree removal does not coincide with breeding season of birds or other fauna if the trees are being used by birds and other fauna			

NOTE: Each report must enclose photographs to demonstrate the mitigation measures implemented

Appendix 6.3 Environmental Monitoring Checklist during Post-Construction or Operation Stage
Upgrading of Rural Roads to all Weather Standards

District:
Road Name:
Road ID:
Total length
Report No. and date:
Completed by

SL. NO.	Environmental Attributes		Mitigation Measures	Location	Compliance status (Complied, partly complied, not complied)
III	**Post Construction and Operational Stage**				
1.	Occurrence of landslides	○ In such case, contractor is responsible for clearing the road and restore the access as soon as possible (during the maintenance period) after informing RDA (PIU and relevant Executive Engineer of RDA). ○ Here, contractor should also comply with recommendations of NBRO if any.	Throughout the project area		
2.	Hydrology and Drainage	○ Regular removal/cleaning of deposited silt shall be done from drainage channels and outlet points before the monsoon season. ○ Renovation of the drainage system by repairing removing encroachments/ congestions shall be regularly conducted	At project road locations with drainage structures		
3.	Air and Noise Quality	○ Placing sign boards for speed limitation and honking restrictions to be enforced near sensitive locations.o Removal of dust & mud collected on road surface to avoid dust emanation ○ Strategically locating compensatory plantation along sensitive noise receptors to provide additional attenuation ○ Installation of noise and dust barriers if levels are found to exceed required standards.	Throughout the road		
4.	Site restoration	○ All construction camp/temporary office/material storage areas are to be restored to its original conditions or as agreed with the land owner. ○ The borrow areas rehabilitation will be as per the conditions laid down in GSMB approval.	All locations of construction camps/temporary office/ material storage, and borrow areas		

5.	Tree replanting	○ Contractor to undertake survivability assessment and report to PIU the status of compensatory tree plantation. ○ Additional plants should be planted for dead plants if any	Tree replanted areas		
6.	Occupational Health and Safety	○ The requisite PPE (helmet, mask, boot, hand gloves, earplugs) shall be provided to the construction workers and it should be ensured that labourers use PPE during working hours. ○ First aid facility should be readily available at the construction site ○ Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp/temporary office/storage areas. ○ Domestic solid waste at construction camp shall be properly collected and handed over to the solid waste collecting system of LA. ○ Records on health and safety related accidents measures taken to address must be maintained	Throughout the project road and camp sites if any		

SAMPLE ENVIRONMENTAL CHECKLISTS

Integrated Road Investment Program (iROAD)

Road Name: MilankulamaThabbowa temple junction.
Road ID: 44
District Name: Puttalum.
DSD &GNDs:

DSD	GNDS
Anamaduwa	Karuwalagaswewa

Total length of the ROAD:13Km.
Road surface varies as macadam, concrete and gravel, from the start to end.
Carriage way and the ROW are generally wide and the utility may not affected due to the road improvement activities. The road traverses through areas surrounded by the (few)thick vegetated areas, cultivated lands of paddy, vegetable (Chena),many areas of cashew plantation.Road runs parallel to the existing irrigation canal at the area ch 10+900.

Climatic Conditions

Temperature– ^{0}C	High: 34.8^{0}c	Low:30^{0}c
Humidity	High: 65%	Low:52%
Rainfall Rainy Season	Less than 750mm per annum. September - December	

A. Location of the Road and Generic description of Environment

No:	Type of Ecosystem	Yes	No	Explanation
1	Type of Terrain(Plain/Undulating/Hilly/Mountainous) (Explain the topography of the area and how many km of the road are located in the hilly area)	√		Low land Flat undulating
2	Forest Area/mangrove/other natural habitats (Explain whether the road passes through forest areas or located along the forest areas and distance from shoulder to the forest area.)		√	The road not passes through any forest area but in some places there were thick vegetation, Dry zone vegetation (Arid lands) on either side of the road trace and other natural habitat found within the section are wetlands (Tanks/streams), cultivated lands and home gardens.
3	Inhabited Area		√	
4	Agricultural land	√		Paddy Cultivation areas at 00+800 to01+900 RHS&LHS. 3+400 LHS&RHS. Vegetable Cultivation areas at 2+100 to 3+200 LHS and Chena Cultivation at5+400 LHS
5	Barren Land		√	

B. Specific description of the Road Environment

No	Parameter/Component	Yes	No	Explanation
1	Are there any areas with landslides or erosion problems along the road? (If yes, indicate the location whether Right or left side and the chainage)		√	Since the area is flat, possibility to landslides may be zero.

No	Parameter/Component	Yes	No	Explanation
2	Are there any Tanks/Streams/Rivers etc, along / crossing the road or any lakes/Swamps besides the road? (If yes, list them indicating the location Right/left or crossing and the chainage)		√	Canal crossing was observed at 01+000, 1+900, 6+500 and near the end point. Canal flows parallel to the road from 01+000 to 04+400LHS. 10+900(RHS) – Irrigation Tank (Wewa)
3	Is the area along the project road prone to flooding or any problem of water stagnation and other drainage issues? (If yes, mention the chainage, flood level and frequency)		√	No area identified as experienced in previous floods during the field reconnaissance. But some areas of water stagnation were observed due to poor drainage facilities.
4	Are there any trees with a dbh of 30cm or more affected on either side from the centre line of the road alignment? (If yes, attach list of trees indicating the location (Right or Left side) and the chainage)	√		Many trees are located on both sides from edge of carriageway from 0+000km to6+600km. However only about 03 trees may be affected due to the road improvement. Please refer Annex:01
5	Along the road and within 100m of the road shoulder, are there any faunal habitat areas, faunal breeding grounds, bird migration area, or other similar areas? (If yes, specify details of habitat with chainage)		√	However, since the road traverses near various ecosystems such as paddy areas/Home gardens/Streams/ tanks/areas with thick vegetation, that can be a niche for any ecological habitat Nevertheless, there may be no effect or any damages to such habitat due to the project, since the activities may limit within the ROW.
6	Along the Road and within 100m of the road shoulder is there any evidence of flora &fauna species that are classified as endemic, endangered/Threatened species?		√	However, there may be such floral and faunal species that are unidentified during the site inspection. Since the activities may limit within the ROW, the area within the 100m of the road shoulder will not be affected due to the project activities.
7	Are there any utility structures within 10m on either side from the centre line of the road alignment? (If yes, attach list with chainage)		√	Electricity post in some places inside the ROW.46 numbers of electric poles on RHS and 16numbers of electric poles on LHS were observed. However,And since the ROW and the carriage way are generally wide, none of them may be affected due to the road improvements. Please refer Annex 02
8	Are there any religious, cultural or community structures/buildings within 50m on either side from the centre line of the road alignment? (If yes, attach list with chainage)	√		Please refer Annex03.

C. Public consultation

No	Consultation activities	yes	no	remarks
1	Consultation with local community was conducted before finalizing the alignment (Attach the list of people met and dates)	√		Public consultation during field reconnaissance was carried out for preparation of the Environmental check list. (Details of public consultation are attached)
2	Any suggestion received in financing the alignment	√		Their request is to improve the road to the motor able condition.
3	If suggestions received, were they incorporated into the design?	√		Check lists are forwarded for necessary actions.

D. Please attach the following:

I. List of utility indicating location (left or right side of the road) and chain age (as required under C. 7)
II. List of community structures indicating location (Left or right side of the road) and chainage (as required under C.10)
III. Project Map
IV. Photographs of the project area showing at least 10m on either side from center line of road alignment. Every 2km or less of road must have at least 1 photograph.

Annex 1: Affected trees (within Existing ROW)

Chanage	Tree (Common name)	Scientific name	Left	Right
00+950	Milla	*Vitex altissima*		√
04+500	Palu	*Manikara hexandra*	√	
06+200	Kaluwara	*Diospyro sebemum.*	√	

Annex 2: Affected Utility Structures (Within existing ROW)

Chainage (Km)	Utility structure	Left	Right
None			

Annex 3: List of List of community structures

Chainage (km)	Location	Left	Right
00+000	Thabbowa temple		√
03+600	Budda statue	√	
O4+200	Thenuwara Primary School.		√
04+250	Multi Cooparative Shop	√	
04+400	G.N.Office		√

Annex 4: Photographs of the Project Area.

Photo 1	Photo 2	Photo 3
		
Start point of the road	Road section-concreted	Road section-Gravel

Photo 4	Photo 5	Photo 6
		
Road section at Bridge	Stream crosses the road	Road section-Damaged.

ENVIRONMENTAL CHECKLIST
Integrated Road Investment Program (iROAD)

Road Name: Internal Road at Nawagaththegama - Galgamuwa main Road
IRoad No: 06
District Name: Puttalum.

DSD	GNDS
Nawagaththegama	**Rambakenayagama**

Total length of the ROAD: 3km
Road surface is macadam from start to ch2+300, and the rest of the road surface is gravel. The carriage way of road section varies 2.8 –3.8m from the start to end. The road passing through arid scrubs marshy vegetated area within the ch03+500 to ch04+750 and also home gardens, Paddy lands and the catchment areas for the small irrigation tanks which are located beyond the100m or closer to the road track could be identified.

Climatic Conditions

Temperature– ^{0}C	High: 34.8^{0}c	Low:30^{0}c
Humidity	High: 55%	Low:48%
Rainfall Rainy Season	Less than 500 mm per annum. September - December	

A. Location of the Road and Generic description of Environment

No:	Type of Ecosystem	Yes	No	Explanation
1	Type of Terrain(Plain/Undulating/Hilly/Mountainous) (Explain the topography of the area and how many km of the road are located in the hilly area)	√		Altitude 160 ft Low land Flat undulating Dry and Arid
2	Forest Area/mangrove/other natural habitats (Explain whether the road passes through forest areas or located along the forest areas and distance from shoulder to the forest area.)		√	The road not passes through any forest area but there were Isolated marginal Scrubs marshy vegetated area located at 03+500-04+750 RHS&LHS and also few thick vegetated areas.
3	Inhabited Area		√	From the start to end scattered settlements are observed.
4	Agricultural land	√		Paddy/mix cultivation/home gardens.
5	Barren Land		√	

B. Specific description of the Road Environment

No	Parameter/Component	Yes	No	Explanation
1	Are there any areas with landslides or erosion problems along the road? (If yes, indicate the location whether Right or left side and the chain age)		√	Since the area is flat, possibility to landslides may not occur.
2	Are there any Tanks/Streams/Rivers etc, along / crossing the road or any lakes/Swamps besides the road? (If yes, list them indicating the location Right/left or crossing and the chain age)		√	No stream crosses the road but a small ela (water path) flows parallel adjacent to the area from Ch 0+100 – 0+400 RHS.

No	Parameter/Component	Yes	No	Explanation
3	Is the area along the project road prone to flooding or any problem of water stagnation and other drainage issues? (If yes, mention the chain age, flood level and frequency)		√	However with poor drainage facility (Road side drains) it was identified some areas where the storm water flows over the road.
4	Are there any trees with a dbh of 30cm or more affected on either side from the centre line of the road alignment? (If yes, attach list of trees indicating the location (Right or Left side) and the chain age)	√		244 trees are located on both sides from edge of carriage way from 0+000km to 5+000km. However only 04 trees may be affected due to the road improvement. **Please Refer Annex:01**
5	Along the road and within 100m of the road shoulder, are there any faunal habitat areas, faunal breeding grounds, bird migration area, or other similar areas? (If yes, specify details of habitat with chain age)		√	But since the road traverses in the vicinity of various ecosystems such as paddy areas/Home gardens/Coconut Plantation and the areas with arid scrubs marshy vegetation, that can be a niche for any ecological habitat. But there may be no effect or any damages to such habitat due to the project since the activities may limit within the ROW.
6	Along the Road and within 100m of the road shoulder is there any evidence of Isolated marginal Scrubs marshy forest area located at 03+500-04+750 RHS&LHS flora &fauna species that are classified as endemic, endangered/Threatened species?		√	However, there may be such floral and faunal species that are unidentified during the site inspection. Since the activities may limit within the ROW, the area within the 100m of the road shoulder will not be affected due to the project activities.
7	Are there any utility structures within 10m on either side from the centre line of the road alignment? (If yes, attach list with chain age)		√	60 numbers of electric poles on RHS and 20 numbers of electric poles on LHS were observed. However, since the ROW and the carriage way are generally wide, none of them may be affected due to the road improvement activities. **Please Refer Annex 02**
8	Are there any religious, cultural or community structures/buildings within 50m on either side from the centre line of the road alignment? (If yes, attach list with chain age)	√		There are four structures identified as religious/ cultural or community centers located within the relevant area. **Please Refer Annex 03.**

C. Public consultation

No	Consultation activities	Yes	No	Remarks
1	Consultation with local community was conducted before finalizing the alignment (Attach the list of people met and dates)	√		Public consultation during field reconnaissance carried out for preparation of the Environmental check list. (Details of public consultation are attached)
2	Any suggestion received in financing the alignment	√		They requested to maintain the road side drains and to install

No	Consultation activities	Yes	No	Remarks
				culverts with adequate capacity**.**
3	If suggestions received, were they incorporated into the design?	√		To avoid the inconvenience that may create due to the poor drainage facility, for the people who use the road.

D. Please attach the following:

I. List of utility structures located within the study area (within exiting ROW or within 2mcorridor of either sides of the road from the edge of the carriageway if the ROW is not clear) indicating location and side of the road (Right Hand Side (RHS) or Left Hand Side (LHS)) asrequired under B.7.(Refer annex 2)
II. List of community structures indicating location and the side of the road (RHS or LHS) as required under B.8. (Refer Annex 3)
III. Photographs of the project area showing at least 02 m on either side from centre line of road alignment are attached in annex 4.
IV. List of trees with 30cm DBH or more located within study area (within existing ROW or within 2m from edge of the carriageway to the either sides of the road if ROW is not clear) as required in B.4.

Annex 1: Affected trees (within Existing ROW)

Chanage	Tree (Common name)	Scientific name	Left	Right
02+250	Thal	*Borossus flabelifer*	√	
04+100	Kaluwara	*Tectonea grandis*	√	
04+200	Kumbuk	*Termidaia arujuna*		√
04+900	Kaluwara	*Tectonea grandis*	√	

Annex 2: Affected Utility Structures (Within existing ROW)

Chainage (Km)	Utility structure	Left	Right
None			

Annex 3: List of List of community structures

Chainage (km)	Location	Left	Right
01+800	Rambakanyagama School	√	
02+750	Rambakanyagama Temple		√
O2+850	Community well Rambakanyagama Play ground		√
03+300	Multipurpose Community Building		√

Annex 04: Photographs of the Project Area.

Photo 1	Photo 2	Photo 3
		
Start point of the road	Utility post located at 00+150 LHS	Rambakanyaya Primary School.01+800 LHS

Photo 4	Photo 5	Photo 6
		
Irrigation Tank at 2+750	Isolated marginal Scrubs marshy vegetation- area from 03+500 to 04+750 RHS&LHS	End point of the Road

ENVIRONMENTAL CHECKLIST
Integrated Road Investment Program (iROAD)

Road Name :Kosgahamula Junction – Dambadeniya Road Katugampola fair
Road ID : 54
District Name :Kurunegala
DSD & GNDs :

DSD	GNDS
West Kuliyappitiya	**Kandegedara , Katuwaththewela , Katugampala**

Total Length of the road: 5.1
Road surface is macadam from start to end but the severely damaged areas could be identified within about 2km area near to the end point. Width of the carriage way varies from 2.7 – 3.6m and the ROW is generally wide but not clear within several areas. There is a narrow bridge at the ch0+300 and a narrow bend at 3+600. Majority of the lands at both sides consists with coconut cultivation and the rest of the road traverses through thick vegetated areas, paddy and home gardens.

Climate Conditions

Temperature– ^{0}C	High: 27.5^{0}c	Low: 25^{0}c
Humidity	High: 75%	Low: 68%
Rainfall Rainy Season	1000mm April-May September-November	

A. Location of the Road and Generic description of Environment

No:	Type of Ecosystem	Yes	No	Explanation
1	Type of Terrain (Plain/Undulating/Hilly/Mountainous etc.) (Explain the topography of the area and how many km of the road are located in the hilly area)	√		Altitude –0173ft-0196ft The terrain of the road trace could be described as plain
2	Forest Area/mangrove/other natural habitats (Explain whether the road passes through forest areas or located along the forest areas and distance from shoulder to the forest area.)	√		The road not passes through any forest area but in some places there were thick vegetation on either side of the road trace and other natural habitat found within the section are Coconut cultivation, paddy areas, home gardens, Stream vegetation etc.
3	Inhabited Area	√		Scattered settlements are observed From the Start to end.
4	Agricultural land	√		Coconut cultivation/ Paddy/mix cultivation/home gardens.
5	Barren Land		√	

B. Specific description of the road Environment

No	Parameter/Component	Yes	No	Explanation
1	Are there any areas with landslide or erosion problems along the road? (If yes, indicate the location whether Right or Left side and the chain age)		√	No active land slide areas were observed during the field reconnaissance.

No	Parameter/Component	Yes	No	Explanation
2	Are there any Tanks/streams/rivers etc. along/crossing the road or any lakes/swamps beside the road? (If yes, list them indicating the location Right/ Left or crossing and the chain age)	√		Chainage where the Stream crossing were observed at 0+300
3	Is the area along the project road prone to flooding or any problems of water stagnation and other drainage issues? (If yes, mention chain age, flood level and frequency)		√	However with poor drainage facility (Road side drains) it was identified some areas where the storm water flows over the road. But no proper side drains for storm water at both sides.
4	Are there any trees with a dbh of 30 cm or more within the existing ROW (within two fences on either sides) or within 2m corridor from the edge of the carriage way on either side (If the existing Row is not clear)? (If yes attach list of tree indicating the location (Right or left side) and the chain age)	√		Many trees located on either side of the road from the edge of the existing carriage way. Only about five trees are located very close within the ROW. And since the ROW and the carriage way are generally wide, four of them may be affected due to the road improvements. **Please refer Annex – 1**
5	Along the road and within 100m of the road shoulder, are there any Faunal habitat areas, Faunal breeding ground, bird migration area, or other similar areas? (If yes, specify details of habitat with Chain age)	√		But since the road traverses in the vicinity of various ecosystems such as paddy areas/Home gardens/Streams/ areas with thick vegetation, that can be a niche for any ecological habitat. But there may be no effect or any damages to such habitat due to the project since the activities may limit within the ROW.
6	Along the road and within100m of the road shoulder is there any evidence of Flora and Fauna species that are classified as endemic, endangered /Threatened Species?		√	However, there may be such floral and faunal species that are unidentified during the site inspection. Since the activities may limit within the ROW, the area within the 100m of the road shoulder will not be affected due to the project activities.
7	Are there any utility structures[1] within 2 m on either side fromthe centre line of the roadalignment or within the existing Row of the road? (If yes, attach list with chain age)		√	112 numbers of electric poles on LHS and 42numbers of electric poles on RHS were observed within 5km. However, And since the ROW and the carriage way are generally wide, none of them may be affected due to the road improvements. **Please Refer Annex 2**

No	Parameter/Component	Yes	No	Explanation
8	Are there any religious, cultural or communitystructures/buildingswithin 20m on either side from the Centre line of the roadalignment? (If yes attach list with chain age)	√		There are four places identified as Religious /cultural places/public structures which are located within the 20m corridor. **Please refer Annex – 3**

C. Public Consultation

No	Consultation Activities	Yes	No	Remarks
1.	Consultation with localcommunity was conductedbefore finalizing the alignment. (Attach list of people met and dates)	√		Public consultation during field reconnaissance carried out for preparation of the Environmental check list. (Details of public consultation are attached)
2.	Any suggestion receivedin finalizing the alignment and road related environmental issue	√		Proper supervision is needed to ensure the quality of the road
3.	If suggestions received, werethey Incorporated into the design?	√		The suggestions were examined by environmental specialists and were incorporated in to design after that.

D. Please attach the following:

I. List of utility structures located within the study area (within exiting ROW or within 2mcorridor of either sides of the road from the edge of the carriageway if the ROW is not clear) indicating location and side of the road (Right Hand Side (RHS) or Left Hand Side (LHS)) as required under B.7. (Refer annex 2)

II. List of community structures indicating location and the side of the road (RHS or LHS) as required under B.8. (Refer Annex 3)

III. Photographs of the project area showing at least 02 m on either side from centre line of road alignment are attached in annex 4.

IV. List of trees with 30cm DBH or more located within study area (within existing ROW or within 2m from edge of the carriageway to the either sides of the road if ROW is not clear) as required in B.4.
Please refer to the annex 1 for the list of trees

Annex 1: Affected trees (within Existing ROW)

Chanage	Tree (Common name)	Scientific name	Left	Right
1+200	Tekka	*Tectonna grandis*	√	
2+600	Kohomba	*Azadirachata indica*		√
3+500	Suriya	*Thespesia populnea*	√	
4+000	Puwak	*Areca catuchu*		√

Annex 2: Affected Utility Structures (Within existing ROW)

Chainage (Km)	Utility structure	Left	Right
None			

Annex 3:List of community structures

Chainage (km)	Location	Left	Right
0+400	School	√	
0+600	Buddhist monastery		√
2+700	School		√
3+700	Buddha shrine with a Bo tree		√

Annex – 04: Photographs of the Project Area.

Photo 1	Photo 2	Photo 3
		
Road section near Starting point	Road section/Bridge	Affected tree
Photo 4	**Photo 5**	**Photo 6**
		
Road section	Road sectionarea	Road section near to end point

STANDARD ENVIRONMENTAL MONITORING PLAN (EMOP)

STANDARD ENVIRONMENTAL MONITORING PLAN (EMOP) FOR THE PERFORMANCE INDICATORS
Rural Road Component – Central Province

This Environmental Monitoring Plan (EMOP) is prepared for a typical rural road located in Central Province. Therefore this EMOP should be updated before commencement of the project with specific locations of monitoring for each candidate road. And the environmental specialist of the Project Implementation Consultant (PIC) of the project is responsible for selection of specific locations of each road with the help of the relevant contractor and updating the EMOP. The updated EMOP for each road should be approved by the Project Implementation Unit (PIU) well in advance to the construction phase and also it should be noted that baseline monitoring should be carried out by the contractor before the construction stage.

Environmental Component	Project Stage	Parameters	Frequency	Locations	Standards	Rate	Approximate Cost (SLRs)	Implementation	Supervision
Air Quality	Design and Construction stage	TSPM, PM10, NO_x, CO, SO_x, Pb	Design: Once Construction: 3 times per year for 2 years	Minimum 2 locations (Locations to be identified with the help of PIC)	NAAQS of Sri Lanka	Rs 40,000 per location	560,000.00	Contractor through approved monitoring agency	RDA/ESD
	Operation stage	TSPM, PM10, NO_x, CO, HC, Pb, SO_x	Once per year for 3 years	-do-	NAAQS of Sri Lanka	Rs 40,000 per location	240,000.00	Contractor/RDA through approved monitoring agency	RDA/ESD
Water Quality	Design and Construction stage	EC, pH, DO, TSS, BOD, Oil and grease, Lead, E. Coli	Design: Once Construction: 3 times per year for 2 years	Minimum 2 locations (Locations to be identified with the help of PIC)	CEA advisory guidelines	Rs 10,000 per location	140,000.00	Contractor through approved monitoring agency	RDA/ESD
	Operation stage	EC, pH, DO, TSS, BOD, Oil and Grease,Lead, E. coli	Once per year for 3 years	-do-	CEA advisory guidelines	Rs 10,000 per location	60,000.00	Contractor/RDA through approved monitoring agency	RDA/ESD
Noise Levels	Design and Construction stage	dB levels	Design: Once Construction: 3 times per year for 2 years	Minimum 2 locations (Locations to be identified with the help of PIC)	National Environmental (Noise Control) Regulations 1996(no.	Rs 10,000 per day	140,000.00	Contractor through approved monitoring agency	RDA/ESD

Environmental Component	Project Stage	Parameters	Frequency	Locations	Standards	Rate	Approximate Cost (SLRs)	Implementation	Supervision
					924/12)				
	Operation stage	dB levels	Once per year for 3 years	-do-	National Environmental (Noise Control) Regulations 1996 (no. 924/12)	Rs 10,000 per day	60,000.00	Contractor/RDA through approved monitoring agency	RDA/ESD
Flora	Design stage		1 visit	Locations to be identified with the help of PIC	Diversity of existing species	Rs 20,000 per visit	20,000.00	RDA, through recognized community based organization	RDA/ESD
	Construction stage	Replanting of trees	1 visit	Locations to be identified with the help of PIC	Diversity of species replanted	Rs 20,000 per visit	20,000.00	Contractor/RDA	
	Operation stage	Survival of trees	1 visit	-do-	Percentage of survival	Rs 20,000 per visit	20,000.00	Contractor/RDA	RDA/ESD
Fauna	Design stage	Diversity of species	1 visit	Locations to be identified with the help of PIC		Rs 20,000 per visit	20,000.00	Contractor/RDA	RDA/ESD
	Construction stage	Diversity of species	1 visit	-do-		Rs 20,000 per visit	20,000.00	Contractor/RDA	RDA/ESD
	Operation stage	Diversity of species	1 visit	-do-		Rs 20,000 per visit	20,000.00	Contractor/RDA	RDA/ESD
	Total						1,320,000.00 (10,153.80 US$)		

Abbreviations:TSPM = Total Suspended Particulate Matter, PM10 = Respirable Particulate Matter < 10□m diameter, NO_x = Oxides of Nitrogen, CO = Carbon Monoxide, SO_x = Oxides of Sulphur, Pb = Lead, HC = Hydro Carbons, EC = Electrical Conductivity, DO = Dissolved Oxygen, TSS = Total Suspended Solids, BOD = Biological Oxygen Demand, ESD = Environmental and Social Division, RDA = Road Development Authority.
1$ = SLRs. 130.00 (April, 2014