Initial Environmental Examination

P46377-PAK
TA 8406-PAK
July 2015

PAK: Provincial Road Improvement Program: Rehabilitation of the Tando Muhammad Khan to Badin Road

Prepared by the Engineering Consultant International Pvt. Ltd. (ECIL) for the Sindh Works and Services Department and the Asian Development Bank.

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Rehabilitation of the Project Road No. 5

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Abbreviations

ITEM	UNITS	DEFINITION
ADB		Asian Development Bank
ADB SPS		Asian Development Bank Safeguard Policy Statement 2009
CEWP		Construction Environmental Work Plan
Cm		Centimetre (1/100 metre)
cm^3		Cubic centimetre
CO	mg/m^3	Carbon monoxide
dBA		A measure of audible (the ear) noise
DBH		Diameter Breast Height
EARF		Environmental Assessment and Review Framework
EIA		Environmental Impact Assessment
EMC		
EMiT		Environmental Mitigation Table
EMoT		Environmental Monitoring Table
EMP		Environmental Management Plan
ES		Environment Specialist of Project Management Unit
GFP		Grievance Focal Person
GRM		Grievance Redress Mechanism
IA		Implementing Agency
IEE		Initial Environmental Examination
km/h		Kilometres per hour
LARP		Land Acquisition and Resettlement Plan
M		metre
Masl		metres above sea level
Mg		Milligram (1/1000 grams)
NEQS		National Environmental Quality Standards
NO_2	mg/cm^3	Nitrate or Nitrogen Dioxide
PD		Project Director
PMU		Project Management Unit
PPP		Public Private Partnership
RAP		Resettlement Action Plan
RoW		Right of Way
Rs		Pakistan Rupees
S-EPA		Sindh Environment Protection Agency
SPEQS		Sindh Provincial Env. Qual.. Standards
SO_2		Sulphur dioxide
TMK		Tando Muhammad Khan
TPM	ug/m^3	Total Suspended particulate matter, with particles ≥ 10 microns in size,

and a danger to lungs. Also referred to as PM_{10}

Executive Summary

The Government of Sindh (GoS), through its Work and Services Department (WSD), aims to provide an affordable, safe and sustainable road network in the province. To help achieve this, GoS sought assistance from the Asian Development Bank (ADB)to reconstruct or rehabilitate up to 400 kilometres (km) of deteriorated roads .

The road sections to be reconstructed or rehabilitated were selected from an initial list of 700 km of roads, then ranked in order of importance (primarily based on the traffic volume) and road condition. The initial technical ranking was adjusted to ensure a more even distribution of roads across the province resulting in a short list of six roads totalling 391 km of which 328km will be reconstructed or rehabilitated under the ADB loan. Reconstruction involves the removal of the asphaltic pavement base layers and granular sub-base layers, building up and widening of the sub-base layers where necessary to achieve the desired profile and providing new granular and asphaltic concrete sub-base base and riding surface. Rehabilitation involves roughening or applying a tack coat to the current riding asphalt layers to improve adhesion if it has become polished; and providing an overlay of new asphalt base and riding courses.

This report is Initial Environmental Examination (IEE) for the reconstruction of road number 5, the 67 km Tando Muhammad Khan – Badin Road which links the N5 at Khyber with the district administrative centre of Sanghar. The report has been prepared pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014 and ADB's Safeguard Policy Statement (SPS 2009).

The proposed activities will be confined to the existing road right-of-way (RoW). For the purposes of this IEE, potential impacts were considered within a corridor extending some 15 meters on either side of the road centreline. Both rehabilitation and reconstruction within the existing carriageway are ADB category B works, requiring an IEE.

Most of the environmental impacts such as shorter travelling time, better access to market, fuel savings, and less dust are positive and do not require mitigation. The social and poverty impacts of the rehabilitation project are addressed in detail in a separate Land Acquisition and Resettlement Plan report. However there are some adverse impacts during project preparation construction and operation.

Preconstruction Period: Environmental assessment documentation and the Environment Management Plan (EMP) are prepared and approved during the preconstruction period and translated into the local languages for distribution to all stakeholders. The EMP's mitigation (EmiT) and monitoring (EmoT) tables (Annex -1) identify actions to be undertaken by the Sindh Works and Services Department (WSD) and the Construction Supervision Consultant, including a task to brief the selected maintenance staff of the WSD and any contractors on the EMP and

the actions to be undertaken. WSD will provide a briefing to contractors on the contract and implementation requirements of the EMP.

Construction Period: Construction phase EMP actions focus mostly on contractor activities, the management of worksites and contractors' equipment and people. Specifically this part of the EMP focuses in defining ways to minimize effects such as dust generation, emission from vehicles and air quality, disposal of spoil and solid waste, noise and vibration from construction machinery, quarry and borrow material transport and disposal, contamination of surface and groundwater resources and work camp management.

Many of the culverts are blocked, damaged or poorly sized. Where the road is widened, the culverts will need to be extended. To gain access to the culvert or to provide for a new culvert, it will be necessary to provide a temporary road diversion, or to close one side of the road at a time and institute traffic controls. Repair of the road once culverts are replaced will follow a specific procedure defined in the EMP It may also be necessary to provide temporary diversion for the water around the area being worked. Ideally the work will be undertaken in dry season when water flows are minimal.

No mosques, graveyards and other cultural sites are within or neare this roadway and therefore no such features will be impacted. Only three trees need to be cut, while trees on the embankments will not be disturbed.

Appropriate mitigation protocols are defined in this IEE. A detailed inventory of the sites showing the approximate location of the structures is provided in the IEE. By applying careful highway design all other potential impacts can be avoided. However care will need to be taken during construction activity.

The contractor will be required to prepare a Site Specific EMP (SSEMP), including a number of subplans addressing, traffic management, sewage , garbage and oil waste management and borrow site opereation and demobilization of owned/operated by the contractor.

Operating Period - Operation period actions focus on confirming that the contractor has completed the EMP tasks required and that the operation of the improved road does not aggravate existing problems such as road safety. Speed limits will need to be monitored by traffic police.

The project has been discussed with local people, government officials and NGO as recorded in the IEE annex. There was general support for the project, with no serious issues raised. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust during construction. There was also a concern about safety, during construction, but generally a view that improved road conditions would improve safety.

A schedule of activities associated with reconstruction has been prepared and the potential environmental impacts of each activity assessed. For each activity, recommended mitigation and monitoring actions have been identified. These are covered in the EMP. All impacts are

minor and able to be mitigated. This IEE study authors concluded that the proposed road project will not lead to significant adverse environmental and social impacts. Careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements. The environmental safeguard implementation will have to be monitored by concerned agencies, including the Contractor, the Environment Specialist from the provincial environmental safeguards unit, the PMU and WSD. Due diligence, with mandatory coordination among various stakeholders will further ensure mitigation of any adverse impacts.

The estimated cost of implementing the EMP during all three project phases is estimated at Rs 28,403,148including a 10% contingency.

I. INTRODUCTION

A. The Project

1. The Government of Sindh (GoS), through its Work and Services Department (WSD), aims to provide an affordable, safe and sustainable road network in the province. To help achieve this, GoS sought assistance from the Asian Development Bank (ADB) to reconstruct or rehabilitate up to 400 kilometres (km) of deteriorated roads .
2. The worst sections of the project roads will be reconstructed, involving the removal of surface pavement, building up and in some cases widening of the sub-base layers and providing new asphaltic concrete base and riding surface. Other sections will be rehabilitated, involving scarifying the current riding asphalt layers and providing an overlay of new asphalt base and riding courses.
3. The road sections to be reconstructed or rehabilitated (Table 1) were selected from an initial list of 700 km of roads by ranking the roads in order of importance (primarily based on the traffic carried) and condition. The initial technical ranking was adjusted to ensure a more even distribution of roads across the province. A road map of Sindh showing the selected roads is shown as Figure 1.

Table 1 List of Selected Roads

No.	Road sections	Km
1	Kandhkot – Jacobabad	77
2	Jacobabad – Ratodero	55
3	Khyber – Sanghar	64
4	Sanghar – Mirpur Khas	64
5	Tando Muhammad Khan – Badin	67
6	Mirwah – Naukot	64
	Total	**391**

4. A separate IEE has been prepared for each road. This IEE has been prepared for road No.5, a 67 km long from Tando Muhammad Khan to Badin highway.

B. Purpose and Scope of the IEE

5. The purpose of this IEE is to identify potential impacts during all stages of the road reconstruction and rehabilitation project, list actions that will prevent or at least mitigate any negative effects of the work and specify a monitoring programme for implementation by the Works and Services Department (WSD), ensuring that the actions discussed in the IEE are carried out in a credible and timely manner.

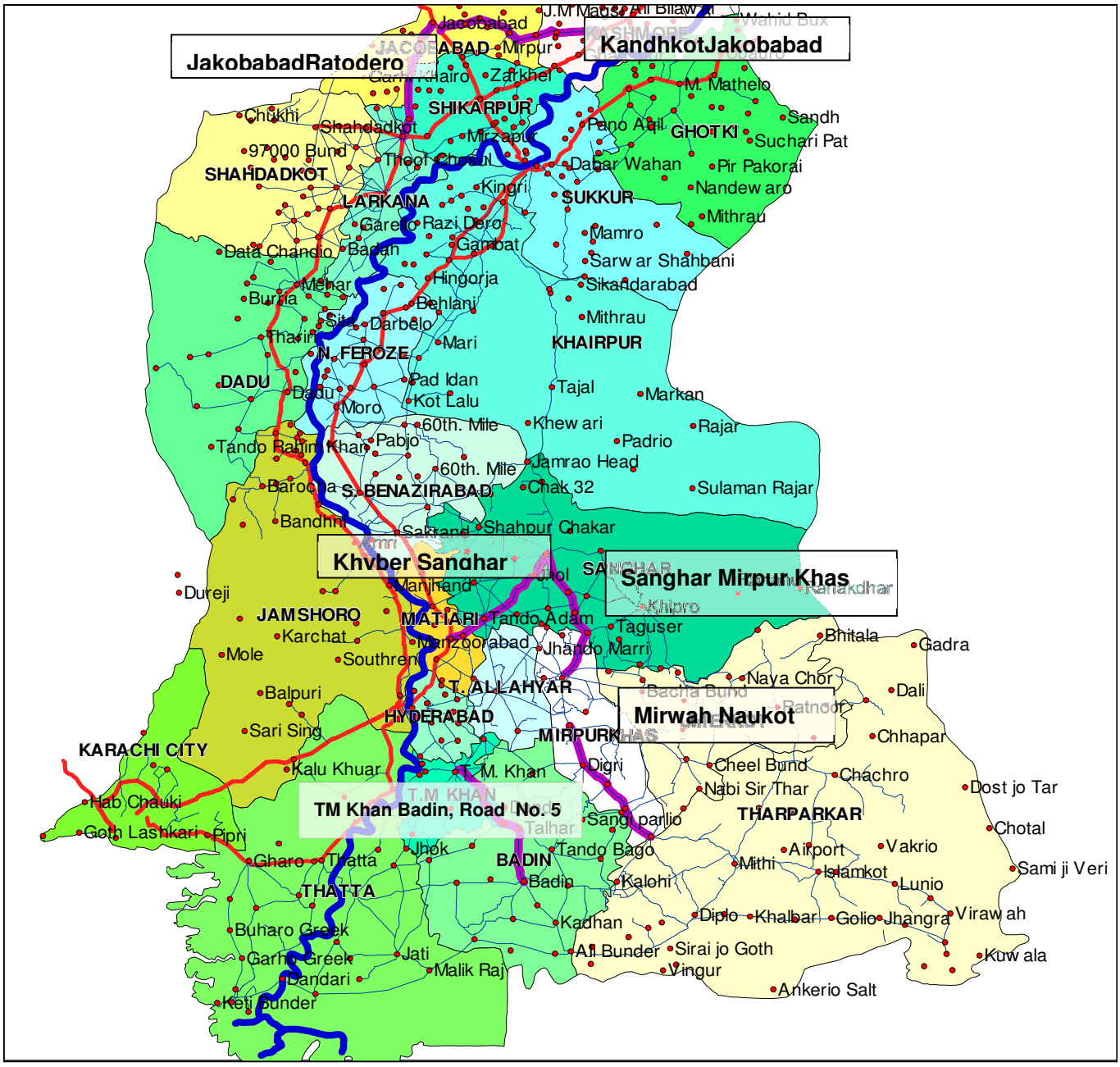

Figure 1 Sindh showing Project Roads; Project Roads in purple.

6. This IEE has been undertaken pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014 and ADB's Safeguard Policy Statement (SPS 2009).

7. The social and poverty impacts of the rehabilitation project are addressed in detail in a separate Land Acquisition and Resettlement Plan (LARP) report.

C. Regulatory Framework and Environmental Classification

1. Pakistani Regulations

8. The Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000 ("the PEPA regulations"), together with section 12 of the Pakistan Environmental Protection Act 1997 requires that every new development project in Pakistan is preceded by an environmental examination, leading to either no further action, an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the magnitude of the project and severity of impacts anticipated during construction and once the project becomes operational. The PEPA Regulation classifies all road rehabilitation and reconstruction, including reconstruction of existing paved roads as Category C, meaning that no environmental assessment is necessary and only a short justification statement need be submitted to the Sindh Environmental Protection Agency (SEPA).

9. Other Pakistani regulations that apply are: the National Environmental Quality Standards (NEQS) 1997 and various amendments which makes it illegal to discharge any effluent or emit air pollution or noise exceeding the National Environmental Quality Standard; the Sindh Wildlife Protection Ordinance 1972, the Wild Bird and Animal Protection Act 1992 and various other amendments which make it illegal to undertake any project activity inside a protected area (national park, wildlife sanctuary, or game reserve) or to hunt or poach wildlife without special permission; the Cutting of Trees (Prohibition) Act 1992 which makes it illegal to cut or chop down trees without the prior permission from the Forest Department; and the Antiquities Act 1975 which prohibits new construction in the proximity of a protected antiquity and empowers the GoP to prohibit excavation in any area that may contain articles of archaeological significance. These Acts must be well understood by contractors, who are required to ensure compliance by their workers.

2. ADB Safeguard Policy and Project Classification

10. ADB's Safeguard Policy Statement (SPS 2009) consists of three operational policies on the environment, indigenous people and involuntary resettlement. SPS 2009 provides information on good practice approaches to implement safeguards. Overall this policy aims to avoid or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process.

11. An initial screening of the project roads was undertaken to assess the potential impacts and risks. It was concluded that there would be limited, generally site-specific and reversible impacts that can be readily addressed through mitigation measures. In line with SPS 2009, this project is therefore classified as environment Category B and this IEE (including its Environmental Management Plan (EMP)) has been prepared consistent with ADB requirements for a category B project.

D. Methodology

1. Baseline Physical, Environmental and Social Data

12. The first task was to assemble all existing data on the road's physical condition and the proposed maintenance and rehabilitation actions to be applied. Using this knowledge, the project's corridor of impact, generally considered to extend 15m in both directions from the carriageway centreline, was identified and the existing ecological and social condition recorded. These data formed the baseline against which possible changes due to construction were defined.

13. The environmental assessment team completed a number of site visits to the road corridor to collect baseline environmental (physical and ecological) and social data.

2. Literature Review/Baseline

14. Relevant data were surveyed along with previous IEE/EIA studies conducted in the region. Legislative requirements and regulatory requirements pertaining to the project were also reviewed. Documents reviewed included:

- Power Distribution Enhancement Investment Program – Tranche –III Assisted by ADB MFF 0021- Pak; Initial Environmental Examination Report for The Construction of 132 KV New Matli Grid Station and Tando Muhammad Khan - 132 KV New Matli Double Circuit Transmission Line, October 2012.
- ADB Assisted Flood Emergency Reconstruction Project (FERP), Upper Sindh Package Loan 2742-Pak, Initial Environmental Examination (IEE) Prepared by ECIL for Sindh Works and Services Department Government of Sindh, November 2011.
- National Highway Development Sector Investment Program-Tranche3; Assisted by ADB; Environment Impact Assessment Study of Hasanabdal Havelian road Section E-35; Draft Report March 2012.
- Road assessment Program India; Initial Environmental Examination report Assam; Project no 37066; Prepared by Ministry of Rural Development for ADB; June 2008.
- Asian Development Bank, Safeguard Policy Statement Guideline; June 2009.
- Sindh Water Sector Improvement Program; Environmental Impact Assessment for works on Khipro and Mithrao Canal; A project of Sindh Irrigation and Drainage Authority; Pakistan; Volume; 1 September 2012

15. In addition, the following web sites were accessed relevant information extracted and included in this report. These sites are:

- http://www.meoweather.com date visited: September 2014
- www.pbs.gov.pkdate visited: September 2014
- http://dearsir.pk date visited: September 2014

3. Impact Identification

16. The activities to be undertaken in conjunction with or arising from the reconstruction or rehabilitation of the Project road were enumerated and the environmental impact of each action was assessed, taking into account the road's location and the existing environment. This included pre-construction activities, reconstruction and operation of the rehabilitated or reconstructed road.

4. Mitigation Measures and Environmental Management Plan

17. For each action with potential impacts, a mitigative measure and action to either prevent or minimize negative effects was identified and a monitoring requirement specified. These were compiled into a comprehensive Environmental Management Plan (EMP) which also identifies where and when actions will need to be undertaken and who will be responsible.

18. The list of activities, impacts and mitigative measures is included in the EMP (Chapter VII and Annex 1).

II. PROJECT DESCRIPTION

A. Project Description

19. The project is to reconstruct the provincial highway S77 (Hyderabad to Badin) between the district centre of Tando Muhammad Khan and the district centre of Badin. The road passes two provincial towns, Matli, and Talhar. When reconstruction is complete, the road will improve the linkage between Badin and Tando Muhammad Khan, Hyderabad, Karachi and North Sindh (Figure 1).

B. Existing Condition of Project Road

20. The road surface is mostly in good condition, but needs strengthening to cope with expected loads. An estimated 17 km near the southern end has failed and requires urgent renewal.

21. A typical cross section is shown as **Error! Reference source not found.**.

C. Re-Construction & Rehabilitation to be Undertaken

1. Scope of Work

22. The project design has allowed for the entire length of the Tando Muhammad Khan to Badin road to be reconstructed with new sub-base, base and wearing course. It may be possible in some places to limit the works to pavement rehabilitation. The final decision will be made by the site engineer , and will depend on the exact condition of the base material. This section describes the steps required for both rehabilitation and reconstruction, and the EMP provides a full list of maintenance, rehabilitation and reconstruction actions, impacts and mitigations measures

23. The proposed activities will be confined to the existing road right-of-way (RoW). extending some 15 meters on either side of the road centreline..

2. Reconstruction of existing carriageway

24. Reconstruction involves the removal of the asphaltic pavement base layers and granular sub-base layers, building up and in widening of the sub-base layers where necessary to achieve the desired profile and providing new granular and asphaltic concrete sub-base base and riding surface.

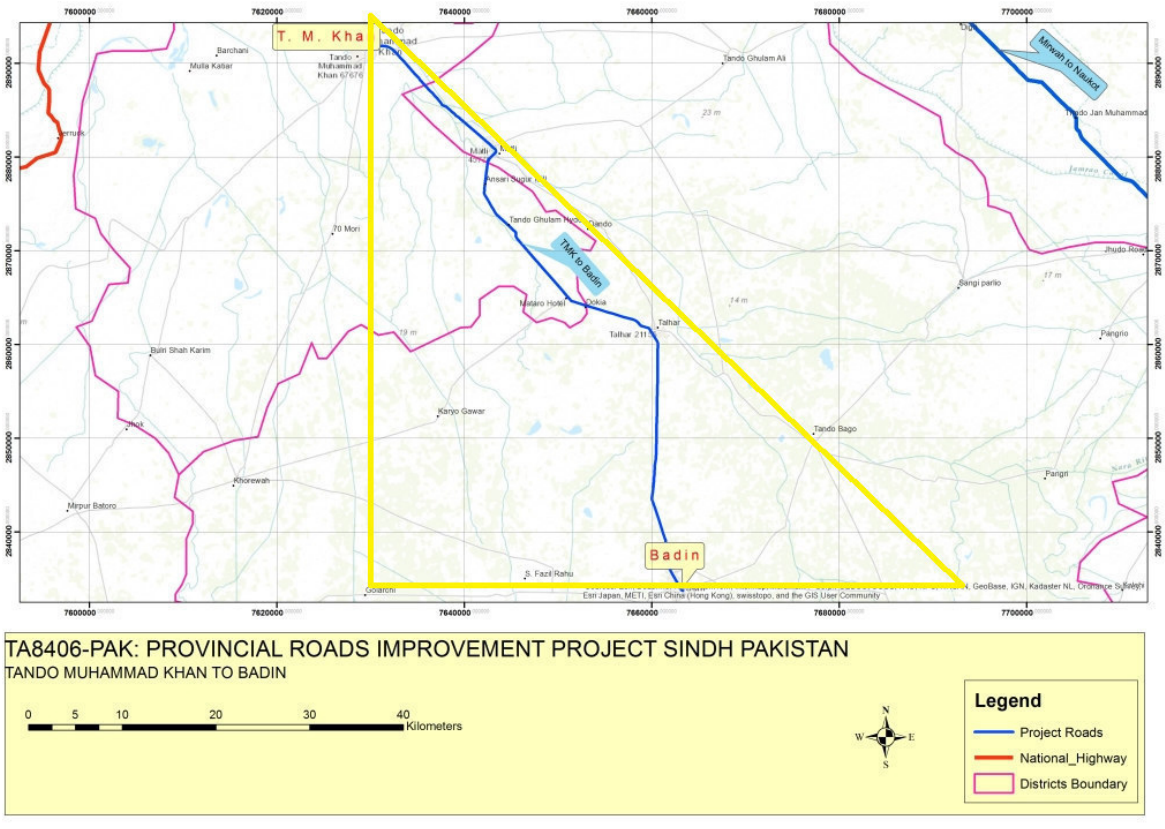

Figure 2 Tando Muhammad Khan to Badin Road

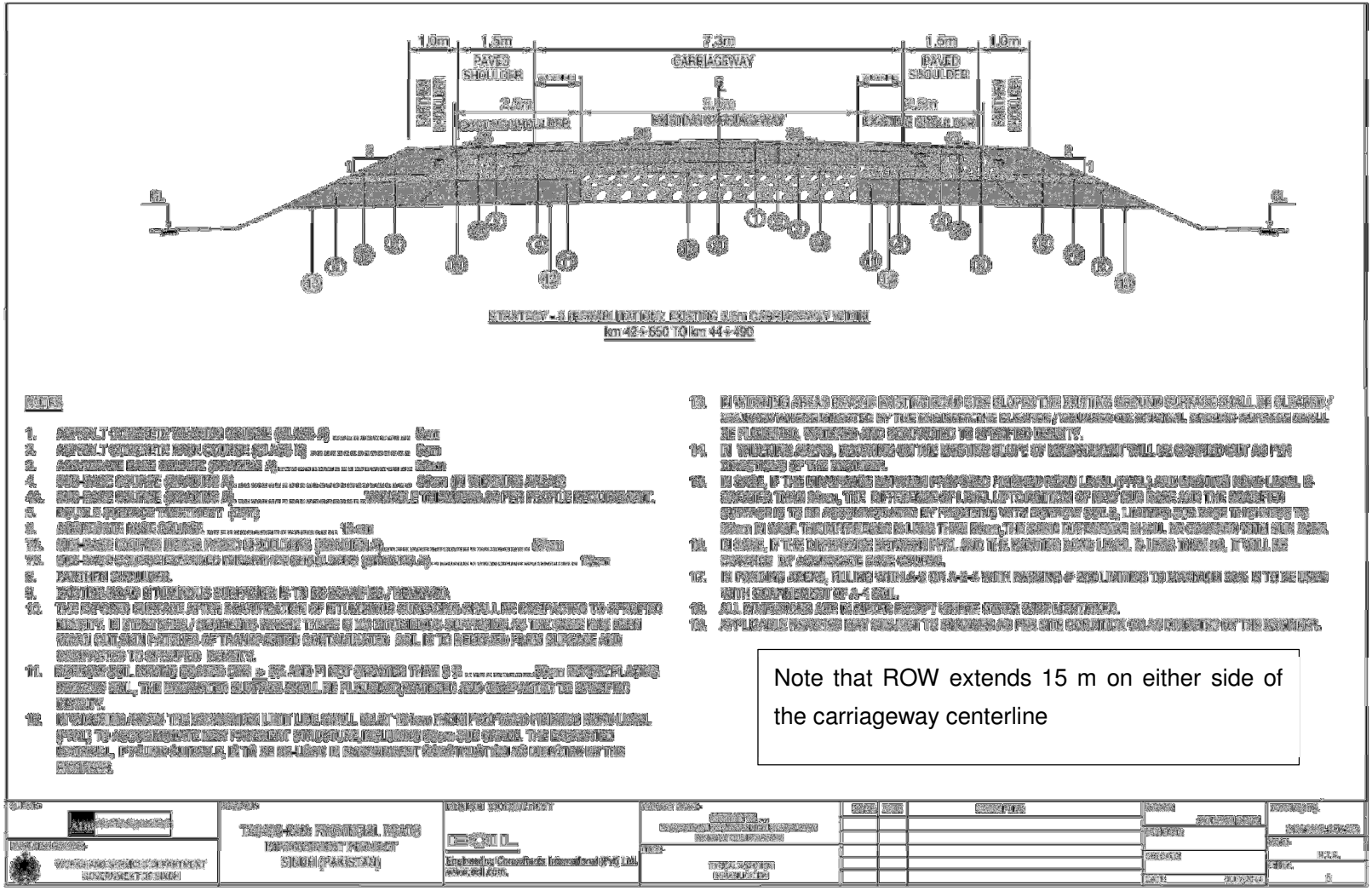

Figure 3 Typical Cross section showing Existing Road

25. The main steps involved in reconstructing a section of road are:

i. Clear vegetation on the existing shoulder and 40 cm beyond the base of the shoulders (widened if required) to provide clear access to the construction site.

ii. Remove and dispose of existing bituminous surfacing. Unsuitable or contaminated base and sub base material is also to be removed and transported to an approved disposal site.

iii. Use borrow materials to repair the existing earthen shoulder. The shoulders shall be graded, watered and compacted to a specific density.

iv. Use recycled or new crushed aggregate to provide a compacted 30cm aggregate base course over the width of the pavement

v. Lay a 90 mm asphaltic concrete base course (may vary as per profile)

vi. Lay a 50 mm asphaltic concrete wearing course

vii. Place 150mm aggregate base course on the earthen shoulders and grade and compact to level with the top of the wearing course.

viii. Apply road markings and install signage and safety barriers as applicable

ix. Undertake any planting as appropriate

3. Rehabilitation (Overlay)

26. Rehabilitation involves roughening or applying a tack coat to the current riding asphalt layers to improve adhesion if it has become polished; and providing an overlay of new asphalt base and riding courses. The key steps are:

i. Clear vegetation on and up to 40cm from the base of the shoulders to provide clear access to the construction site

ii. Use borrow materials to repair the existing earthen shoulder. The repaired shoulders shall be graded, watered and compacted to a specific density.

iii. Any localized potholed cracked, distressed stretches / areas the patch work in full depth of existing bituminous layer(s) will be carried out before laying of new asphalt concrete layer.

iv. Roughen and or apply a bitumen tack coat to the existing bituminous surface. Material removed is to be transported to an approved disposal site.

v. Lay a 90 mm asphaltic concrete base course (may vary as per profile)

vi. Lay a 50 mm asphaltic concrete wearing course

vii. Place 150mm aggregate base course on the earthen shoulders and grade and compact to level with the top of the wearing course.

viii. Apply road markings and install signage and safety barriers as applicable

ix. Undertake any planting as appropriate

4. Reconstruction and Rehabilitation of Culverts

27. Many of the culverts are blocked, damaged or are inadequate for expected requirements. Where the road is widened, the culverts will need to be extended. To gain access to the culvert or to provide for a new culvert, it will be necessary to provide a temporary road diversion, or to close one side of the road at a time and institute traffic controls. Reopening of the road will follow the relevant steps outlined in Section 2 above. It may also be necessary to provide temporary diversion for the water channel around the area being worked. Ideally the work will be undertaken in dry season when water flows are minimal.

a. Repair and rehabilitation

28. If the existing culvert can be repaired, the main steps are:

i. Remove vegetation from culvert inlet and outlet up to 15 ft, from either side.

ii. Where Culverts needs extension, provide a sand cushion of about 1 ft. (300 mm) in thickness and place lean concrete as a base for the new culvert extension.

iii. In the culvert's base slab all pitting shall be rectified by providing bonding agent and a steel reinforced concrete cover of 3" in thickness.. Anchor bars shall be drilled into the base slab.

iv. The masonry side walls shall be deep pointed. Masonry that has deteriorated will be replaced with good quality bricks and mortar.

v. The top slab shall be examined for cracks, which shall be repaired with epoxy injection. If steel reinforcing is exposed and rusted, it shall be removed and replaced. The concrete shall be chipped, a bonding agent applied and concrete shall be applied in the form of plaster. Steel rods shall be drilled into the old concrete at 18" centres and grouted.

vi. After rectification work is carried out all the areas shall be coated with Brushcrete Compound (an acrylic waterproofing compound).

vii. Restore roadway and shoulders

b. Replacement or new culverts

29. If an existing culvert requires replacement, old material will need to be cleared and either used as fill (as sub base, or to restore used borrow pits for example) or disposed of at an approved disposal site.

i. Preparation of the site as for repair and extension

ii. New RCC slab culverts will have a reinforced concrete slab base with steel anchor bars, masonry walls and reinforced concrete slab top.

iii. Restoration of the carriageway.

c. Rectification of Bridges

30. One bridge, located at chainage (41+535) requires repair; while the bridge at chainage (34+425) needs to be replaced. Temporary diversion of traffic may be required. The following are the main steps that will be involved.

    i. Cleaning of all concrete surfaces including girders and transoms.
    ii. Providing plaster to guardrails and posts including curbs wherever necessary.
    iii. Cleaning expansion joints.
    iv. Repairing training works (where necessary).This involves placing rocks and boulders in the water course either separately or inside wire casings.
    v. New deck construction (as & where required depending upon the deteriorated condition of deck slab). This involves the removal and disposal of the damaged material and construction and placement of a reinforced concrete slab,

D. Construction Materials

31. Construction materials require transportation from the source to the work site as follows.

32. **Stone-** Stone for base course is available in abundance at Kotri quarry which lies at a distance of 25 Km from Hyderabad towards Karachi. This quarry is very large and meets the requirement of all the Sindh Province. The availability of stone for base course can be supplemented from Ganja quarry which is at a distance of 15 Km South of Hyderabad opposite Airport

33. **Bitumen-**The National Refinery Karachi (200 km from Tando Muhammad)is major supplier of bitumen for Pakistan, and supplies will have to be trucked to the local-area asphalt plant. There will be no problem in its procurement right from the source.

34. **Cement** - There are quite a few cement factories in the vicinity of project road ,namely Zeal Pak Cement Factory in Hyderabad (30 km from Tando Muhammad), Lucky Cement Limited and Power Cement Factory in Nooriabad (120 km from Tando Muhammad Khan).

35. **Sand**-Good quality of sand is available at Bollori which is 15 Km beyond Kotri quarry as well as from Jamshoro which is in the vicinity of Hyderabad (50 km from Tando Muhammad Khan) There are other quarry sites available in the sub-project area which can be utilized. These are all within 70 km of where road maintenance and rehabilitation will take place.

36. **Steel Reinforcement (Rebar)-**The main Steel Industry of Pakistan is in Karachi. In addition, the following steel mills are being run in Hyderabad, and can supply rebar, but only after proper materials testing:

    - Mehran Mills
    - Islam Mills

- Hyderabad Mills

37. The distance from Hyderabad mills to Tando Muhammad Khan, the project start location, is about 34kilometres.

38. **Aggregate and Concrete**- Crushed stone aggregate for concrete is available in Nooriabad, Jamshoro, (Petaro) all between 20-80 kilometres range at Nooriabad and Jamshoro.

    - Crushed Aggregate for Asphalt Concrete Petaro Quarry
    - Sub Base (Muram) Kotri Quarry
    - Aggregate Base Course Petaro Quarry
    - River Sand From Indus River Basin

39. **Bricks**- The existing bridges and culverts have masonry abutments and piers constructed using locally manufactured bricks. There are many brick kilns along this project road.

40. **Water** -The Project road crosses a number of watercourses, minor and major canals. The Contractor will be able to use canal water for general construction purposes with the permission of State Irrigation Department and Sindh Irrigation & Drainage Authority. While the amount of water required is considerable, it is should be negligible when compared with the amount available. According to residents along the road, well water suitable for drinking is available at a depth varying from 12 to 14 meters.

41. **Reuse /Recycling of scarified material from the road surface** The material from the scarification / removal of the existing road surface is judged by the material engineer as being not suitable for use on the Project road due to its poor quality and the small quantities involved which makes recycling uneconomic. This leaves the following options.

    Option 1: Waste material that meets required specifications will be used as fill when constructing or repairing the shoulders.

    Option 2: Waste material can be used to refill borrow pits and covered with topsoil[1]

    Option 3: Scarification materials can be spread on earthen link roads, and compacted with rollers, improving the road surface as well as reducing road dust.

42. The total quantity of material to be disposed of is estimated to be 35,476.00 m^3.

[1]A detailed investigation by T. Townsend (1998) on the leaching characteristics of asphalt road waste found that such material was safe to use in any non-agricultural use setting, i.e. as soil material in fields, borrow area fill or for secondary road repair.etc.

III. DESCRIPTION OF THE ENVIRONMENT

43. The description of the environment of the project roads requires baseline data on the following:

- Physical Environment
- Ecological Resources
- Socioeconomic Environment

A. Physical Environment

1. Topography

44. Sindh can be divided into four distinct parts topographically: (a) Kirthar range on the west; (b) a central alluvial plain bisected by the Indus River; (c) a desert belt in the east; and (d) the Indus delta in the South.

45. The Tando Muhammad Khan-Badin road lies in the central alluvial plain.

2. Soils

46. The soils of the Project area are of recent alluvial origin and are basically suitable for irrigated agriculture. Although, stratification is complex, the majority of soils are within the range of fine sandy loam to silty clay loams with the latter being most common. Sandy soil can be found in the desert and sand mixed clay loam 3 -5 m in depth laid over sandy soils in the Nara and Jamrao Canal command area. All soils contain calcium carbonate and most contain gypsum. Salinity is wide spread but generally ephemeral: with adequate water and drainage, most soils can be reclaimed by simple leaching.

47. The alluvial deposits date back to the time when Hakro River (Eastern Nara) flowed through this area during the Sama and Soomra period 1298-1520 CE[2] in Sindh.

3. Climate

48. The seasons in Pakistan can be best classified as

- Winter, from December to March
- Pre-monsoon (summer), from April ton Monsoon, from June to September
- Monsoon, from June to September
- Post-monsoon, from October to November
- Summer season runs from April until October and winter runs from November to March.

[2] http://en.wikipedia.org/wiki/Samma_Dynasty site visited on 18.01.2015

https://thesalientfeaturesoftheruleofsoomradynasty.wordpress.com/category/soomra-dynasty/ site visited on 18.01.2015

49. Sindh lies between two monsoon zones, the southwest monsoon from the Indian Ocean and the northeast or retreating monsoon deflected toward Sindh by the Himalayan Mountains, and as such it escapes the influence of both, resulting in a rainfall of only 15to 18 cm per year.

50. For the Tando Muhammad Khan-Badin road, the minimum and maximum mean monthly temperature, precipitation and relative humidity are given in Table 2.

Table 2 Average Air Temperature and Precipitation in Tando Muhammad Khan and Badin[3]

Month	Tando Muhammad Khan			Badin		Precipitation (mm)
	Temperature ^{0}C		Precipitation (mm)	Temperature ^{0}C		
	Maximum	Minimum		Maximum	Minimum	
January	23.8	11.8	14.3	25.78	8.73	0.96
February	27.8	14.7	5.6	28.59	11.60	3.60
March	33.3	18.7	6.9	34.02	16.80	2.30
April	38.2	23	5.5	38.40	21.80	2.49
May	40.6	26.1	4.8	39.85	25.47	0.69
June	39.5	27.9	12.1	38.02	27.46	10.76
July	36.7	27.3	20.7	35.1	27.04	70.49
August	35.4	26.3	50.4	33.61	26.06	89.88
September	36.1	25.2	13.4	34.36	24.87	34.43
October	35.8	22.8	3	35.80	21.70	3.72
November	31.1	18.5	0.1	31.87	15.86	1.67
December	25.5	13.8	15.6	26.68	10.10	1.11

4. Air Quality and Noise

51. The Tando Muhammad Khan-Badin road is located in a rural area and human activity is primarily related to agriculture, although there are some sugar mills / industries also. The major air quality issue is total suspended particulate matter (TPS) and NO_2. The TPS level can exceed acceptable levels due to the presence heavy dust. Human activity such as from sugar mills and cultivation of the fields aggravates the situation. Some dust is generated when vehicles overtake on unpaved shoulders. The incidence of this happening should be reduced with the Project.

52. Since WSD has not yet established its own environmental monitoring capacity, there are no comprehensive air quality and traffic noise monitoring data available. However data

[3] http://www.meoweather.com site visited September 2014

are available from studies relating to the construction of the new 132 KV Matli Grid Station and the new Double Circuit Transmission Line. The sampling points for these studies are located along the subproject road. (Table 3).

Table 3 Ambient Air Quality at One Station– Tando Muhammad Khan-Matli Road [4]

Parameter	**Units**	Sampling location Matli	NEQS 2013 24h Avg.
Total suspended particulates	mg/m^3	1.09	0.50
Oxides of sulfur (SOx)	mg/m^3	0.0685	0.120
Oxides of nitrogen	mg/m3	0.0480	0.040
Carbon dioxide	mg/m3	0.782	5.00

Note:

53. Existing traffic volume is relatively low (Table 7) and the adjacent land use is primarily agricultural. Both road and other ambient noise levels increase when the road enters a town. Existing noise levels (Table 4) were recorded from previous studies and reflect the expected low noise conditions. The noise levels were within the acceptable limits of commercial area NEQS /GoP Standard in day time and acceptable range for transport corridors as defined in Pakistan.

Table 4: Noise intensity in medium-sized towns[5]

Location	**Noise intensity dBA**			**NEQS /GoP Standards: 2012 (Commercial Zone/Residential Zone)**	
	High	**Medium**	**Low**	**Day**	**Night**
TM Khan-Matli road	63.14	46.21	34.35	65/55	55/45

5. Hydrology

54. Sindh province is mostly irrigated through the Indus river system (canals and tributaries) and large aquifer sources of groundwater underline the Indus basin. They form an important source of water supply throughout the Project Area with many tube wells, motorized pumps and hand pumps. Groundwater in the Indus Basin is, however, of variable quality and tends to be non-saline only near the surface. Aquifers are recharged by means of seepage during flood season. The depth of the groundwater table varies

[4] IEE for construction of 132KV grid new Matli Grid Station and Tando Muhammad Khan -132 KV New Matli Double Circuit Transmission Line and units converted from ug/m^3 and ppm to mg/Nm^3

[5] IEE for Construction of 132 KV New Matli Grid Station and Tando Muhammad Khan – 132 KV New Matli

from 3 meters to 25 meters along the route. Tando Muhammad Khan district is irrigated by the canals from the Sukkur and Kotri barrage and by rain water. However, other modes of land irrigation such as river water and tube wells are also used. The area being fed by Kotri is further divided in perennial and non-perennial system of irrigation. The irrigation network is mainly comprises Guni Canal, Akram wah and Nasir canal . There are two major canals, three minor canals and thirty six water courses crossed by the Tando Muhammad Khan- Badin Road. These water sources are the major source of drinking water as well as water for irrigation. Table 5 show the list of water sources crossing Tando Muhammad Khan to Badin road with their chainage.

Table 5 Location and Type of Water Courses Crossed by Tando Muhammad Khan to Badin Road

Canal	Watercourse	Minor	Chainage (m) : 0.00=TMK Town
	1		1500.000-1600.000
	1		1900.000-2000.000
	1		2600.000-2700.000
	1		3600.000-3700.000
		1	3900.000-4000.000
1			6800.000-6900.000
	1		7900.000-8000.000
	1		10000.000-10100.000
	1		10100.000-10200.000
	1		10800.000-10900.000
		1	12800.000-12900.000
	1		14000.000-14100.000
	1		18900.000-19000.000
	1		19000.000-19100.000
	1		19350.000-19450.000
	1		20600.000-20700.000
	1		23400.000-23500.000
	1		25500.000-25600.000
		1	27050.000-27150.000
	1		28900.000-29000.000
1			30200.000-30300.000

Canal	Watercourse	Minor	Chainage (m) : 0.00=TMK Town
	1		42100.000-42200.000
	1		45750.000-45850.000
	1		48600.000-48700.000
	1		49100.000-49200.000
	1		50000.000-50100.000
	1		52300.000-52400.000
	1		52900.000-53000.000
	1		53600.000-53700.000
	1		53800.000-53900.000
	1		55700.000-55800.000
	1		59900.000-60000.000
	1		60500.000-60600.000
	1		62400.000-62500.000
	1		62800.000-62900.000
	1		63300.000-63400.000
	1		63700.000-63800.000
	1		64100.000-64200.000
	1		64100.000-64200.000
	1		65300.000-65400.000
	1		66500.000-66600.000
02	**36**	**03**	

55. Excessive irrigation and seepage from canals has caused water logging and salinization problems near Badin. Recent floods have exacerbated this problem, since farmers have converted inundated fertile agricultural lands into large aquaculture operations, whose waters generally evaporate, bringing salts to the soil surface

6. Seismicity

56. According to the seismic zone map of Pakistan, the Project Area lies in a zone where minor to moderate damage can occur (Figure 4)

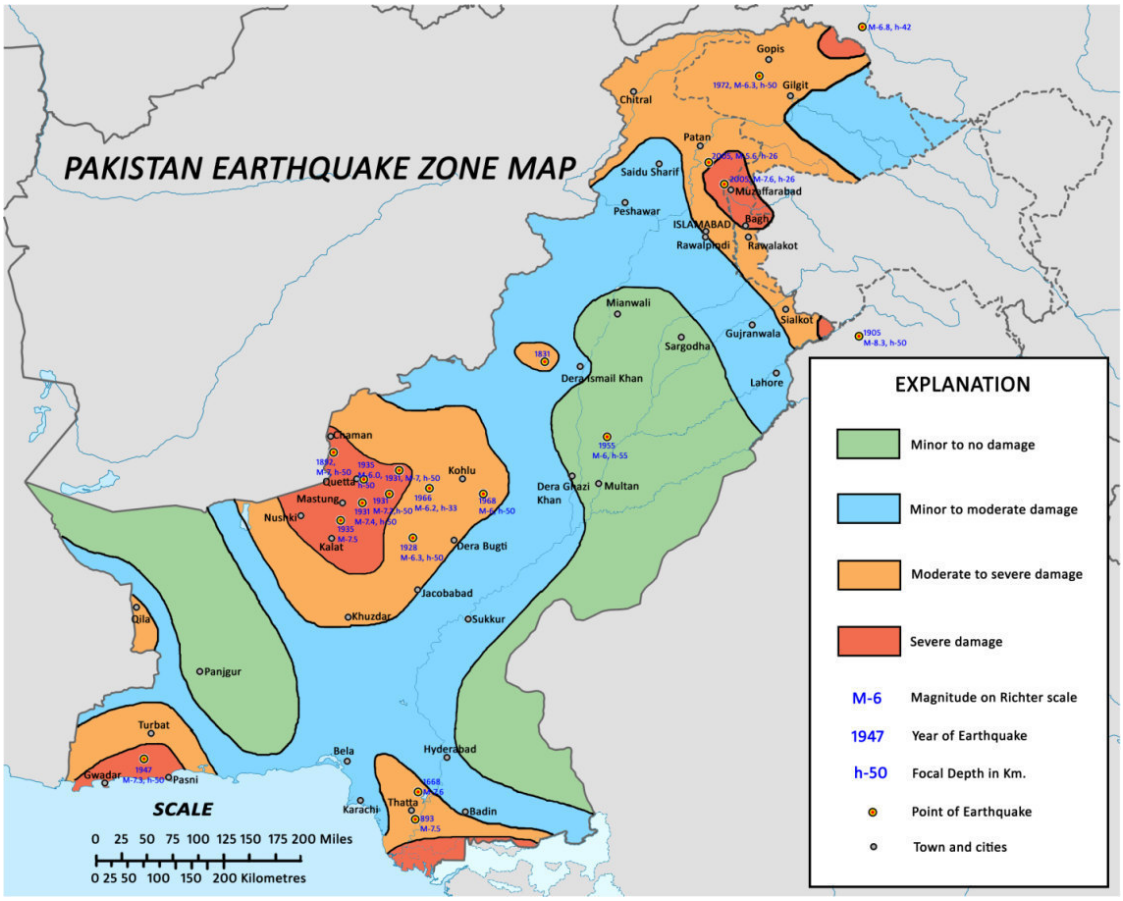

Figure 4 Pakistan Earth Quake Zones

7. Archaeological and Cultural Resources

57. In order to identify potentially sensitive community structures, a survey of the Project impact area was undertaken between June 2014 and Sept 2014. Structures were identified through direct observation and by interviewing those living within the project area. Most of the structures were located near towns and urban areas.

58. Mosques, shrines and graveyards are of historical, cultural and religious importance for the people. Fourteen Mosques, three Graveyards and two Shrines were identified as being potentially affected by the proposed work on the Tando Muhammad Khan to Badin road. A detailed inventory of the sites showing the approximate location of the structures is provided in Table 6. By applying careful highway design all potential impacts were avoided. However care will need to be taken during construction activity.

Table 6 List of Archaeological and Cultural Resources impinging to the ROW

0-10 km			11-20			21-30			31-40			41-50			51-60			61-70		
M	S	G	M	S	G	M	S	G	M	S	G	M	S	G	M	S	G	M	S	G
1	0	0	4	0	1	3	0	0	2	0	0	2	1	0	1	1	1	1	0	0
Mosque (M) =14 , Shrines (S)= 2 and Graveyards (G)= 3																				

B. Ecological Resources

59. Due to the high intensity of human settlement, land cultivation and industry, undisturbed natural habitats are very limited. There is nevertheless still significant plant and animal diversity.

C. Flora

60. The Project Area falls within the Tropical Thorn Forest ecosystem, however much of the natural vegetation has been replaced by agricultural crops, mainly rice, sugarcane, cotton, maize, mong, mash, millet and sorghum sown in April-June and harvested during October-December; and wheat, gram, lentil, tobacco, canola, barley and mustard, planted in October-December and harvested in April-May.

61. The dominant trees in lower Sindh are babul (Populus euphrafica), ber (Zizypuhs numularia) and several verities of Tamarix such asplai(Tamarix gallica) and jhao (Tamarix diocia), talhi (Dalbergia sisoo), kri (Tamarix gallica), karir (Copparisa phylla).

62. Of more concern would be damage to old plantations of Azadirachta indica (Neem), Albizialeb bek (Shrin), Ficus religiosa (Peepal), Acacia nilotica (Babul), Cordia myxa (Lasura) and Ficus benghalensis (Borh), and recent plantation of Cornucopias. These trees have significant medicinal value or are important culturally.

63. Among the grasses; Lumb (Arislida depressa), Chemmer (Eleusine compressa), Gorkha(lasiurus sindicus) and Kana (Saccharum bengalensis) are found in the Project Area. Koondeor Dib (Typha augustata) is found along the water ponds scattered on both sides of the road.

D. Fauna

1. Mammals

64. Many decades ago, the project area was rich in wildlife but these have been depleted due to conversion of habitat to agricultural lands. Jackal, squirrel, fox, rats, mongoose and several species of bats are still found in the area.

65. Domestic animals including goats, sheep, camel, cows, donkey and buffalo are the dominant users of the land and have severely degraded wildlife habitat.

2. Reptiles

66. Reptiles include snakes such as cobra (Naja naja), rattlesnakes (Crotalus horridus) and rat eater snakes (several varieties). Small and medium sized lizardsare also a common sight in the area. These include monitor lizard (Varanu ssp.), spiny tailed lizard(Uromatix hardwickii) and fringed toed lizard (Acanthodactyluscontoris). Turtles are also present in the area especially in the vicinity of moist lands, ponds, canals and during rainy seasons.

3. Birds

67. Important bird species found in the project area are the common crow (Corvusbrachyrhynchos), common mynah (Acridotherestristis), house sparrow (Passer domesticus) and common teal (Anascrecca). These birds are frequently visible along the roadside. Grey and black partridges (Perdixperdix and Melanoperdixniger), though present in the area, have been reduced to a minimum quantity due to excessive hunting. Other birds include Indian roller (Coraciasbenghalensis), crested lark (Galeridacristata), vultures (several varieties) and quail. White heron (Ardeaalba) and black heron (Egrettaardesiaca) are also plentiful and inhabit the ponds located on both sides of project roads. Water birds, including white stork (Ciconiaciconia), white pelican (Pelecanusonocrotalus), little brown dove (Spilopeliasenegalensis) and white throated king fisher(Halcyon smyrnensis) are most often found using the roadside ponds as feeding areas.

E. Ecosystems

68. Ecosystems include protected areas such as wildlife sanctuaries, national parks and game reserves. Six wetlands which are found in the District Badin of the sub-project but none near or within RoW of the Tando Muhammad Khan Badin Road.

69. There are six wetlands located in the Badin District, but there is no wildlife sanctuary or game reserve located in the project district. The nearest wild life sanctuaries area is the Rann of Kutch some at 140 Kilometres to the north-east and Nara Desert some 130 kilometres south-east of the road corridor.

70. The nearest wetland is Nurri Lagoon, which is very shallow brackish lagoon with barren mudflats on the northern side. The site has consistently recorded very large concentrations of migratory water birds on a seasonal basis. Salinity and sedimentation are increasing due to the intrusion of the sea in this area. The privately-owned land provides livelihood to about 3,000-4,000 people in surrounding villages, chiefly through fisheries. Invasive species, such as Typha and occasionally Tamarix, are seen to be hindering the growth and diversity of native flora, and population pressures, including accelerating agricultural and industrial pollution, offer challenges. The Nurri lagoon area is some 40 km to the south west of the road and the reconstruction of the project will have no impact.

F. Socio-Economic Environment

1. Road Transport

71. A traffic study was conducted to estimate the likely traffic on the road. Data were collected using video cameras, data logger and manual field observation. There data

show the number of vehicles by type. Twenty four hour traffic counts for the subproject road are given in Table 7

Table 7 Twenty four hour Traffic count for the Hyderabad –Badin Road

Location	Motorcycle	Car/ 4wd	Rick shaw	Vans/ PU	Mini bus	Bus	Trucks 2 Axle	Trucks 3 Axle	Trailer 4 Axle	Trailer 5 axle	Tractor trailer	Total
TM Khan - Matli	2290	432	2936	846	359	0	634	70	47	50	15	7680
Matli - Talhar	4324	725	2420	1017	254	10	474	47	44	4	75	9390
Talhar - Badin	5161	948	1604	564	161	11	400	95	18	12	233	9206

72. The Consultant was advised that traffic levels can be significantly higher during the sugar and cotton harvesting seasons, and therefore met with sugar refineries and cotton ginning mill operators to determine the annual loaded movements, the traffic catchment areas and the main destinations. Based on these discussions, the average annual daily traffic was estimated to include approximately 400 heavy vehicles a day (mainly 2 axle trucks and tractor-trailers); twice the number surveyed in June.

2. Structures Affected

73. During the topographic survey it is revealed that there will be no structures affected, including residential, commercial, religious and cultural sites. This has also been mentioned in LARP recommendation section 2.1 and table 2.1.

3. Drinking Water

74. During the survey it was learned that the water supplied by municipal authorities in the project area is generally not suitable for drinking due to inadequate treatment. Most drinking water is surface water, but some communities and villages are totally dependent on ground water. The characteristic of ground water varies from location to location; with areas close to irrigational canals having comparatively better quality water while water in more distant locations is saline.

4. Industrial and Commercial Activities

75. There is no heavy industry in the project area. There are a number of secondary industries within the district that support the agricultural economy such as rice husking, a sugar refinery, cotton ginning and flour mills. There are also some brick kilns

5. Employment and Income Sources in Project Area

76. Nearly all employment in the project area is in the agriculture or agriculture product processing sector. Most common jobs involve harvesting, picking, threshing, animal rearing transport driving and guarding. Local labourers commonly gain employment

during the sugarcane harvesting season for crop harvest, loading and transport. Sugar mills in the surrounding area also employ skilled and unskilled labour. Various sugar mills and cotton gins create employment and continue to contribute significantly to the local economy.

77. Agricultural lands are owned by landlords and farmers work for a share of the sale of the crop. They live in the fields in small houses made from wet soil, cow dung and palm leaves, graze a few cattle and grow vegetables for food.

78. Market places are typically located adjacent to the main roads where economic activity is highest. The grain and cattle markets are open every day except Fridays. Shops in the market places are mostly grocery shops and small hotels and are typically owned by local people. Smiths, workshops, hardware commodities and other house-hold items are available from stores in these markets.

79. Those not employed in agriculture include cobblers, carpenters, blacksmiths and barbers with lower incomes. Their daily wage is between Rs. 400 and 500, however, economic opportunities are limited and people face difficulties finding employment other than irregular temporary work. They are usually uneducated.

80. Agriculture is the most widespread source of income in the project area (65% of all income). Thirty percent of the population earn income as shopkeepers, small business, and as labourers in the sugar, cotton and rice industry and 5% have government jobs in departments such as the agriculture department, forest department, post office, police, transport and the Pakistan army.[6]

6. Demography

81. The project road is located in the Tando Muhammad Khan district, and the demography is diverse (Table 8).

Table 8 Demography of the Subproject road Tando Muhammad Khan to Badin[7]

Factor	Tando Muhammad Khan	Badin
Area km^2	1831	6726
Population (Persons) Male Female	447,114 232,499(52%) 214,615(48%)	1,136,044 597,573(52.60%) 538,471(47.40%)
Sex ratio (M:F)	110:100	111.100
Population Density Urban Population	168.9 per km^2 161,902 (27%)	168.9 per km^2 1,864,880(16.25%)

[6] Project of Sindh irrigation and Drainage Authority EIA report for Works on Khipro and Mithrao Canal; September 2012

[7] www.pbs.gov.pk, http://dearsir.pk

Factor	Tando Muhammad Khan	Badin
Rural Population	1443,919 (73%)	949,556(83.58%)
Avg Household size	6	5.3
Literacy ratio 10+ Male Female	36.00% 49.00% 23.00%	24.6% 35.07% 12.09%

82. Tribal people include Halapotra, Hingora, Syed, Almaani, Dars, Jamali, Mahendo, Khoso, Kolhi, Junejo, Leghari, Memon, Malik, Lashari, and Solangi. Sindhi language is commonly spoken in the majority of the communities in the project area. However, Sariaki Balochi,, Urdu, Punjabi and Siraiki languages are also spoken and understood.

7. Archaeological, Cultural and Historical Resources

83. There are no archaeological, cultural or historical resources in this corridor and none will be impacted by any of the work activities.

IV. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Design (Pre-Construction) Phase Impacts

1. Lack of Environmental Capacity

a) Description

84. During the field surveys it became clear that the provincial and district government officials who will be charged with overseeing the construction are unfamiliar with the environmental impacts associated with road repairs and EMP implementation. As a result the likelihood of the mitigative and monitoring measures being implemented is low.

b) Mitigation Measure

85. During the preconstruction period and once the contractors have been selected the proponent, working with the Construction Supervision Consultant will complete a one day workshop to inform government agencies and contractors on environmental safeguards, the implementation of the project EMPs and credible environmental reporting. The workshop will be based on the presentation of examples and provision of templates for contractors and agency officials/inspectors to use.

2. Lack of Integration of IEE/EMP Requirements into Construction Bid Documents

a) Description

86. The Bidding documents should reflect the requirement to select a qualified and experienced contractor. Bidding documents should reference or present the methodology pono how to apply acceptable environmental and social safeguards at worksites. The bidder's environmental, social and safety methodology shows material deviation, reservation or omission towards environmental, social and safety specification.

b) Mitigation Measures

87. PMU will check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP

3. Loss of Vegetation and Trees

a) Description

88. There are various trees located on the both sides of the Tando Muhammad Khan to Badin road. Trees close to the traffic lanes are a road safety hazard. Hence while from the topographic survey it appears that tree cutting can be avoided, it may nevertheless be necessary to curt some in order to meet road safety standards. There will be loss of

vegetation in some locations, but always within the road RoW According to the LARP report section 1 Table 1.1 three mature trees will be cut to pave the way for the required width of carriageway

b) Mitigation Measures

89. Loss of vegetation cover shall be minimized and the carriageway will be aligned so as to avoid the need to cut down trees if possible. New plantations will be included in the design of the right of way and trees will be replaced at a ratio of three trees planted for every tree more than 10cm Diameter Breast Height (DBH) that is cut down .

4. Erosion

a) Description

90. Any areas where topsoil must be removed will be prone tor rapid erosion due to either the monsoon rains or the dry winds . Topsoil and deeper layers will wash into surface waters or be swept into the air creating dusty conditions, impacting a wide range of community assets.

b) Mitigation Measures

91. Sindh WSD will prepare an earthworks checklist that defines for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is completed. Use of soil from private land will be minimized and only after consultation with and compensation of landowners

5. Disturbance to Archaeological and Cultural Sites

92. There are no cultural or archaeological sites found in the Tando Muhammad Khan-Badin road and thus no mitigation measures are required.

6. Material Haul Routes

a) Description

93. Hauling of material has significant impacts on the community, public safety, traffic congestion, air quality and lifespan of the town road ways.

b) Mitigation Measures

94. the number of construction vehicles hauling materials along urban roads and anywhere where there are road side residences will be limited and the WSD will establish a route plan to minimize this disruption.

7. Consultation Plan with affected roadside landowners

a) Description

95. The roadside residents and landowner may come across in relation to the road side schedule in installation of new fence, rubbish dumping, weed control and feral animal control which may cause disruption to the road side landowners.

b) Mitigation Measures

96. Rehabilitation work will result in access from a business and residence to the road being cut off or limited at times. To prepare for this inconvenience, WSD will define a road work information exchange procedure requiring the contractor to contact roadside landowners well in advance of the work taking place define the access restriction and the measures to be taken to allow movement around the construction work.

8. Contractor's Environmental Safeguards Capacity

a) Description

97. The responsibilities of safeguards unit reviews and finalize the document relating to environmental issues. Contractor with less capacity of safeguards do not comply with workplace environmental, social and safety regulations.

b) Mitigation Measures

98. Unfortunately contractors have a very poor record complying with workplace and environmental safety regulations. To address this WSD will require the contractor to define a Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment

B. Construction Phase Impacts

1. Dust Generation: Transport of Materials

a) Description

99. A small increase in particulate matter (dust) is expected within the construction airshed. Dust from vehicles hauling construction materials to the work sites will be a problem for roadside communities during the dry season, and has been known to impact people as far away as 200 m from the roadside.

b) Mitigation Measures

100. The Contractor will be required to have an approved (by The Construction Supervision Consultant) dust control program. This will involve i) regular sweeping of haul roads passing through settled areas if spills of material have taken place, ii) spraying of water on unsealed roads and work areas within villages and past houses located close to the

road, iii) sealing road surfaces in urban areas as a first priority and iv) storing construction materials close to the work site to minimise haul distances.

2. Dust Generation: Quarry and Batch Plant Operations

a) Description

101. All quarry operations generate dust primarily during the crushing operations to create aggregate. Batch plants require cement, dry sand and a gravel to be fed into a mixing chamber, and the addition of water to make concrete. Considerable fine dust in emitted when bagged cement is loaded manually into the batch plant hopper, as well as from the conveyor system bringing the materials to the plant.

b) Mitigation Measure

102. Dust from the cement work will be avoided by using bulk cement brought to the plants in large tanker trucks and transferred to the plant hoppers via a closed system. Batch plants will need to be equipped with dust suppression equipment, now standard on most such facilities, or will need to be retrofitted if contractors' existing systems are out of date.

3. Erosion

a) Description

103. Excavation will expose bare soils that may erode. This will include sites such as; borrow pits, quarries, road embankments, culverts, bridge abutments and road diversions.

b) Mitigation Measures

104. Excavation of earth fill will be limited to ≤ 20cm. Where use of agricultural land is unavoidable, the top 15cm of topsoil will be stripped and stored and then replaced after removal of borrow material. Where deep ditching is carried out, the top half metre layer will be stripped and stockpiled. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later. Where ditches and borrow pits cannot be fully rehabilitated, land owners will be compensated via a written agreements between the land owner and contractor.

4. Emissions from Vehicles Exhaust

a) Description

105. Increase in air pollution from vehicular and machinery exhaust due to operation of construction machinery and increased movement of construction trucks will occur but will be minimal. The road repair and reconstruction work in relation to the existing traffic will generate relatively minor emissions.

b) Mitigation Measures

106. The Construction contractor will be required to keep equipment in good condition and to repair or replace vehicles producing visible black smoke and provide evidence that three vehicles have been given an emission inspection with 12 months of the start of the work. Secondly no construction vehicles will be left idling for more than 2 minutes.

5. Disposal of Spoil and Solid Waste

a) Description

107. As part of the reconstruction process, the asphalt layers of the existing road will be removed, together with base course material that is unsuitable for re-use. There will also be unused construction material (sand and aggregate), empty drums, concrete waste and waste from work camps.

b) Mitigation Measures

108. The asphalt and base course removed from the existing road will be recycled[8]. It may be re-used in the soft shoulders or as fill for other parts of the new road depending on the quality of the material. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt can be pulverised, spread on access roads and compacted.

109. The contractor will identify dumping locations for construction debris and non hazardous solid waste with respective Taluka Municipal Association (TMA) Tando Muhammad Khan, Badin, and Environment Protection Agency.

110. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through Sindh EPA approved waste contractor under the section 13 of Sindh Environment Protection Act 2014.

6. Noise and Vibration

a) Description

111. Sources of noise include improper silencing of vehicles and equipment used on the road construction site, aggregate crushing facilities as well as batch plants. These will impact on local communities and will be most pronounced close to or within urban areas.

112. Vibration will occur during compaction when vibratory rollers are used to compact sub grade materials. This is unlikely to cause permanent damage.

[8] A detailed investigation by T. Townsend (1998) on the leaching characteristics of asphalt road waste found that such material was safe to use in any non-agricultural use setting, i.e. borrow area fill or for secondary material in fields, etc etc.

b) Mitigation Measures

113. The Contractor will need to ensure that; (i) machinery has installed working noise attenuation equipment such as sound mufflers, and (ii) machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between the contractor and the local communities. Any aggregate crushing facilities within 500m of any residential or commercial areas will be required to install noise attenuation measures such as baffles or barriers 2 m high and located between the plant and the noise receptor. Noise will be measured against the Sindh Provinclal and Pakistan National Environmental Quality Standards . Exceedances of these standards will require immediate noise reduction measures such as baffles and barriers

7. Quarry /Borrow Material

a) Description

114. Transport of construction material (aggregate and fill) may raise environmental and social issues, including the possibility of damage to bridges and pavements if vehicles are overloaded.

115. Borrow pits may cause problems such as damage to agricultural land or drainage, water ponding, loss of vegetation and crops. Problems may arise if the contractor extracts material from borrow areas without the permission of the Landowner.

b) Mitigation Measures

116. The Contractor will need to ensure that loaded trucks do not exceed bridge and pavement axle load specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected by the construction supervision consultant.

117. The contract documents shall require that the contractor obtains fill and other construction material from authorized/licensed quarry sites. Other borrow material must be taken only with the consent of the land owner, and must be in compliance with provincial environmental regulations. If found to be in violation of existing regulations, the contractor will be fined and be required to completely rehabilitate and re-vegetate the site(s).

118. The contractor will ensure that the removal of productive agriculture land and soil cover (vegetation) is minimised.

8. Contamination of Water Resources (Surface and Ground)

a) Description

119. Lubricants that enter the ground environment can render the area unusable and may pollute groundwater. Agriculture fields, aquatic systems, community owned stream channels and canals can be polluted by fuel and lubricants entering these systems.

120. Materials brought onto the site will generate a range of possible environmental pollutants for water resources. The main concerns will be from containers such as bitumen drums and plastic that may be brought on site as wrapping material if they are not properly disposed of.

.

b) Mitigation Measures

121. Fuel and oil storage areas should be located at least 250m away from any watercourses and be provided with a concrete platform and be bounded with interceptor traps so that any fuel leakage is retained within the site. Wash down water from machinery repair areas also needs to be directed into this system and held in retention areas for treatment. Refuelling should, wherever possible, be carried out at the fuel storage area and not be permitted within or adjacent to watercourses. When the facility is no longer required the contractor will need to remove the structures and also excavate and remove any contaminated soil for disposal at an EPA /Local Municipal Authority approved site. New soil should be brought in as required so that the ground surface is re-established.

122. Asphalt should not be applied during heavy rain so as to avoid it being washed into watercourses.

123. Water channels must be diverted properly and a protection mechanism provided. Alternatively construction should be undertaken during the dry season.

124. Surface water in channels will be monitored against “irrigation water quality standards” of Water and Power Development Authority, WAPDA. Ground water quality use for human consumption will be monitored against the National Drinking Water Quality Standards.

9. Damage / disturbance to Utilities Services

a) Description

125. Utility services within the RoW may include electrical cables, telephone lines and gas pipelines. It is possible that road widening and reconstruction will disturb/damage these.

b) Mitigation Measures

126. A relocation plan of the utilities will be developed during the preparation of the LARP. The Contractor will need to be aware of the location of these services so that disruptions are not caused. Placing the responsibility for any repair of the services with the Contractor will assist in avoiding damage to these services.

10. Traffic Disturbance

a) Description

127. Construction work will require traffic to be diverted around areas, or delayed while work is being done.

b) Mitigation Measures

128. A traffic diversion plan will be developed by the contractor and approved by the Construction Supervision Consultant. Proper warning signs and flags will need to be displayed at the commencement of any road construction or diversion section so as to alert drivers to the changed road conditions. Old signage should be removed to reduce confusion, as soon as the work is done. This will be the responsibility of the Contractor.

11. Health and Safety Concerns

a) Description

129. Poorly constructed or maintained work camps can be unhygienic and affect worker health. Stagnant water that may remain in borrow pits and in discarded waste such as plastics, old tires and metal containers can create breeding habitats for mosquitoes and rodents.

130. While unlikely, because generally local people will be hired for the project, there is a possibility that concentrations of workers will result in the transmission of communicable diseases (such as STI's and HIV/AIDS) to the local community.

131. Accidents will inevitably happen, but are more likely if safety procedures and practices are not in place.

132. Secondly inadequate precautions during the handling of construction materials such as bagged cement, could lead to serious health problems among workers. Cement dust is very fine and highly corrosive to lung tissue and can lead to permanent damage if breathed in. Since much of the transfer of cement to the batch plant is still done by manual labour pouring the 30kg bags into hoppers, the risk to workers not wearing protective gear is high.

b) Mitigation Measures

133. Where possible, work camps shall be kept remote from settlements, however all camps shall be provided with septic sanitation facilities and potable water. A solid waste collection program must be established so that no garbage is left on the ground or enter streams where it can affect downstream water quality, aquatic environments and human health.

134. Local labour will be actively sought out by the contractor, thereby reducing the need for work camps. Local labour can reduce social concerns as these people will return to their villages at night and act in accordance with accepted community norms.

135. The Contractor will need to have an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard Worker Health and Safety measures and contractors will be bound to implement these fully. This will include mandatory wearing of dust masks for any cement handling operations or at any area were cement dust is in the air.

136. Monitoring will be required for the solid waste disposal at camp site and to ensure that the health and safety plan based on contract specifications is followed. Cement feed hopper areas will be inspected daily to insure compliance with the requirement of dust masks.

12. Interruption/ Contamination of Water channels

a) Description

137. There are forty one watercourses crossing the project road: details were given in table 5. Repair or replacement of the crossing will often require temporary diversion of, or work within, the watercourse. This could affect the water supply to agriculture land of communities living nearby, and could lead to contamination.

138. Temporary traffic diversions disrupt and can be a danger to traffic.

b) Mitigation Measure

139. Where water crossings are being repaired. The water channel should be diverted or a protection mechanism provided to avoid contamination. Where possible, construction will be made in dry season.

140. The contractor should provide an adequate sized diversion so that there shall be no disturbance to water flows of canal /water course.

141. A traffic management plan shall be provided by the contractor. Signage and lighting may also be provided to reduce the likelihood of accidents.

142. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed

13. Pressure on Local Resources

a) Description

143. A labour force that is not properly supplied with adequate rations or cooking/heating fuel will aggravate demands on local supplies of fuel wood and wildlife. The project labour force can impose a burden on community water supply and sanitation systems.

b) Mitigation Measures

144. Where possible, local labour will be hired for the project so there will be no additional impact on natural and social resources and services. At all times workers must be supplied with the required daily rations or a living allowance as per their contract and at the same time contractors will be required to inform employees in writing about the consequences of illegal hunting, including the loss of a job and possible detention by local authorities.

14. Inadequate Camp Site Good Housekeeping

a) Description

145. While the use of local labour should minimise the need for on-site worker accommodation, there will nevertheless be a need for a work camp with office accommodation, catering, ablutions, prayer area, etc

b) Mitigation Measure

146. The contractor will be responsible for the construction, management the operation of the construction work camps to minimize the impact of construction activities on land; ensure adequate provision of waste disposal and health and safety of construction workers. The contractor will carry out the following activities to manage the disposal of construction waste.

- Train work force in storage and handling of materials
- Fire fighting
- Camp sewage will be treated in pit latrines or septic tanks which will be drained and sewage taken to a sewage treatment plant for processing. The treatment/management will be done according to the provision defined in the Pakistan EPA-specifications, which the contractor will have to become familiar with. Disposal will be recorded in a table and submitted as part of the semi-annual reporting to ADB.

147. Contractor will prepare as part of site specific EMP the following special sub-plans:.

- Traffic management plan-addressing construction related delays and a protocol for day-to-day management. Traffic management is also addressed in the contract specifications for the engineering works.
- Waste management plan specifying the treatment and disposal of garbage, sewage and oily waste at the contractor's camps and yards.
- Borrow site management plan –addressing preparation of access roads and decommissioning following use, of any borrow sites opened by the contractor. Operating licensed facilities will not be included in this management plan, as they are already monitoring by the authorities.

148. The SSEMP, together with the sub-plans will be approved by the executing agency as well as the ADB, prior to the contractor mobilizing to the field

C. Operation Phase Impacts

Most of the impacts at the operation stage are positive and do not require mitigation. These include:

- Improved access to markets
- Reduced travel times
- Lower vehicle operating costs
- Reduced dust

149. However there are some negative impacts and these are listed in the following sections.

1. Lack of Environmental Safeguards.

a) Description

150. While the proposed project will be completed adhering to environmental safeguards measured defined in the EMP and GoP standards, the contractor has to ensure the action taken during all stages are in compliance with this EMP.

b) Mitigation Measure

151. The contractor, will provide a mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract and submit that to the PMU before the final payment can be released.

2. Increased Traffic Volumes

a) Description

152. The Consultant's traffic forecast predicts an increase in traffic of up to 20% as a result of the road improvement. This brings with it increased noise and emissions, increased risks associated with the transport of materials and increased interaction with pedestrians and non-motorised transport.

b) Mitigation Measure

153. Traffic calming measures and speed limit signage will be provided to reduce the impact of the traffic through populated areas. Crossing areas will be marked and amber flashing lights installed in urban areas, when full traffic signals are not warranted.

3. Increased Risk of Accidents

a) Description

154. While the proposed road improvements will make the road safer in some respects, the increase in traffic and the potential for higher speeds may result in more road accidents especially in urban areas where there is a potentially dangerous mix of non-motorized, two, three and four-wheel traffic using the same carriageway.

155. The requirements of SPS 2009 have resulted in a road design that has had to balance road safety against the need to displace affected people encroaching into the road RoW .

b) Mitigation Measures

156. Improved traffic signage and road markings will be used to warn motorists of impending changes in road standards and to advise appropriate speeds

157. Properly designed traffic calming measures such as speed humps, speed signs and, possibly traffic signals will be installed within settlements.

158. Traffic police should be trained to more consistently enforce road rules.

159. If accidents do occur, one of the most effective ways of reducing deaths from road crashes is to reduce the time between the trauma occurring and hospital treatment. To this end an emergency ambulance provided by the local authorities would be the most effective. Failing that, better enforcement of the road rules and more stringent penalties/fines should be sought.

V. GRIEVANCE REDRESS MECHANISM

A. Organisation

160. WSD will implement a three step grievance procedure for all project-affected people adjacent to the Tando Muhammad Khan to Badin Road. WSD will appoint a Grievance Resolution Officer (GRO) within its project management unit with the responsibility to ensure that the grievance redress procedures are known to the public and followed by the contractor.

161. A local grievance committee (GRC) will be constituted by the Works and Services Department (WSD). The GRC will consist of the GRO, a Grievance Focal Person (GFP) who can be Community Leader, locally present NGO representative, the resettlement specialist or environment specialist from the WSD Environmental Safeguards Unit (depending on nature of grievance), one person from the revenue department and one or more co-opted members of the public. The GRC should include at least one woman.

162.

163. WSD will ensure that the grievance procedure is accessible to all community members, including vulnerable people such as single mothers, the very poor ,the elderly, and youth. Contact information, including contact addresses, emails, hotline numbers and websites will be posted at works site offices and on community notice boards in all towns. GRO will consult with affected village committees prior to work commencing to inform them of the grievance procedure, relevant contacts and methods of resolution to maximise accessible to potentially affected persons.

164. Contact details will be distributed by the GRO to each village head in the appropriate local language, for posting in the village office.

165. To ensure women have access to the grievance mechanism, focus group discussions will be held to design protocols that are suited to their needs, including, access to the provincial ombudsman's office. Outreach programs will be tailored by GRC to women's needs to ensure information is communicated to them.

B. Procedure

166. The GRO will place a complaint register at an accessible location (Union Council office, Mosque, or at Camp Office) for respective community so anyone can register their complaint in this register and will check it on weekly basis.

167. The first step (Figure 5) on receiving a grievance will be for theGFP to take up the issue with the GRO to refer the matter to the contractor, and given one week to respond to the grievance.

168. Any complaint that is not resolved directly will be referred to the GRC. The GRC will resolve the complaint within two weeks and inform the aggrieved party in writing the action taken against grievance.

169. If the complaint cannot be resolved at the GRC level, the issue will be referred to the director in charge of the Project Management Unit (PMU) if the grievance related to actions of the contractor or to the Provincial Ombudsman if the grievance relates to actions of WSD, the PMU or provincial government officers.

170. If the complaint still unresolved at the Provincial Ombudsman level, as the last step it may be taken at the national /provincial legal system. GRM shall take every possible effort to resolve the complaint at project level.

171. During loan implementation, all complaints received will be tracked and their resolution fully documented and reported to ADB by the PMU. The process will include the following elements:

(i) Tracking forms and procedures for gathering information from the contractor/highway section and complainant(s);
(ii) Updating the complaints database routinely;
(iii) Identifying grievance patterns and causes, promoting transparency and information disclosure, and periodically evaluating the effectiveness of the grievance mechanism and environmental controls, and
(iv) Collecting and submitting input for inclusion in progress reports for ADB.

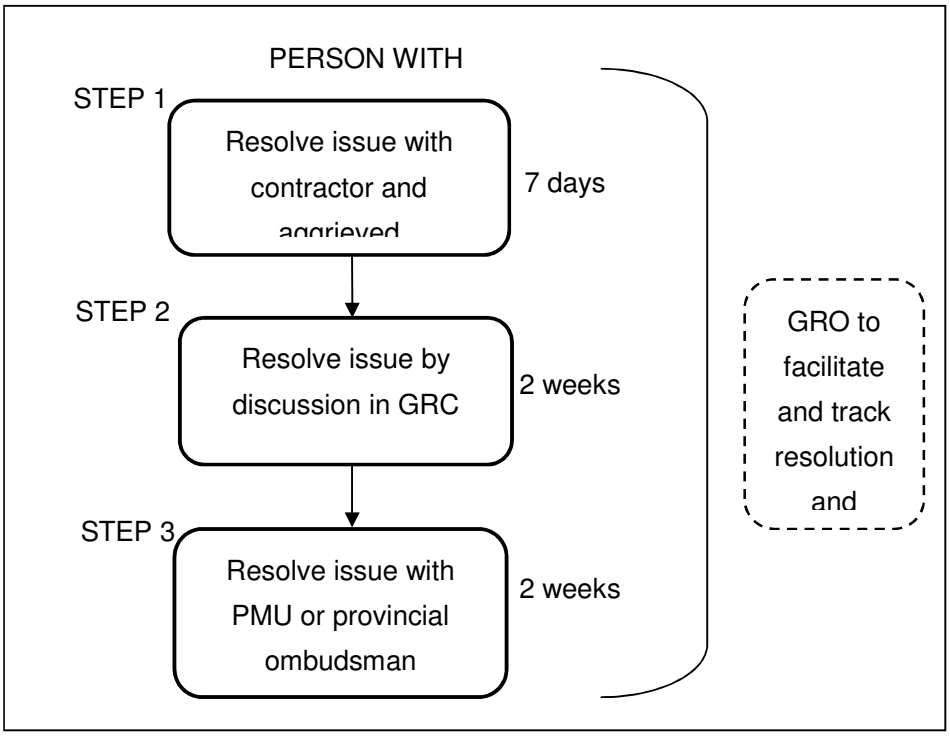

Figure 5. Steps of the Grievance Redress Process

VI. PUBLIC CONSULTATION

A. Objectives of Public Consultation

172. The overall objectives of the consultation process were as follows:

- To inform all interested people on the likely positive and negative effects of the road project and encourage feedback from stakeholders on IEE findings, principally the impacts and proposed mitigation measures;
- To gain a consensus on the impacts identified, their importance and the relevance and effectiveness of the mitigation measures proposed;
- To provide confidence that all relevant issues and mitigation measures have been identified, agreement that the mitigation measures are adequate, and that nothing significant has been missed;
- To enable incorporation of stakeholder views and concerns in the IEE.

B. Consultation Process

1. Scope

173. The environmental consultants conducted meetings with local people, NGOs and government departments. The latter included the municipal administration, Additional Deputy Commissioner-I and Municipal Office Tando Muhammad Khan. During these meetings a description of the project (appropriate to the audience) was given, along with an overview of the project's likely social and environmental impact.

174. The interviews with the government representatives and NGOs were based on issues such as solid waste management, wastewater, forest, wildlife and archaeological sites whereas discussions with general public concentrated on their concerns relating to the project and likely impacts during the construction and operation phases. These included both environmental and concerns.

2. Community Consultations

175. Community consultations consisted of formal and informal meetings at Tando Muhammad Khan, Matli, Talhar and Badin City. The consultation exercise was conducted in both Sindhi and Urdu languages. A non-technical oral description of the project was given providing an overview of all likely positive and negative impacts. Following which, an open discussion was held so that the participants could voice their concerns and opinions. All participants were encouraged to voice their concerns and opinions. Participants were also asked to suggest alternatives where they had particular concerns.

176. Feedback obtained from the stakeholders was documented, and all issues and suggestions raised were recorded in survey forms. Both social and environmental issues were raised. The social issues are discussed in more detail in the Summary Poverty Reduction and Social Strategy report.

177. The people interviewed (Table 10) had only minor worries and generally agreed that most effects would be temporary only. Some common concerns regarding the shortage of electricity, potable and non-potable water, wastewater disposal, traffic congestion, poor roads, minimal employment opportunities, and security issues were raised. None of these issues related specifically to road reconstruction but were general complaints. All appreciated the project and said that it would boost the value of property, while some said that business, economic and employment situation in the area will also improve.

178. A matrix of concerns raised by community members was prepared (Table 9). The register of attendance is provided as Table 10. A pictorial record of the meetings is included as Annex 2

Table 9: Summary of Concerns Raised During Stakeholder Consultations

Issues	**Concerns raised by community**	**Remarks**
Road design	Storm drainage should be provided at Matli and Talhar Road must accommodate the heavy traffic of the sugar cane and cotton seasons	Drainage channels are proposed un all urban areas Seasonal traffic has been taken into account.
Interaction / Conflict with local community	Immigrant workers may be of different backgrounds and culture or they may involve in the illegal activities in the area and conflict between the community and worker may occur	Immigrant workers should be well scrutinized before their deployment in the project area.
Employment	Provision of semi-skilled and unskilled jobs for local labour.	Unskilled jobs will be given to locals people where possible. Training will be provided
Livelihood	Restriction of livestock grazing and accident killing of livestock and local residents. measure should be taken minimize the business loss at the TM Khan to Badin Road during the construction activity	Grazing areas should be protected and speed of vehicles will be limited to avoid accidents. The land use and resettlement plan addresses disturbance during construction

Issues	Concerns raised by community	Remarks
Safety of Community	Speed Restrictions, Traffic police may be deployed Flagmen need to be in place for traffic control, which is thought particularly important for the towns located along the roadside.	International Safety Standards for the road safety and community safety shall be adopted and maintained.
Medical Facility	Unavailability of Medical Facility	Reconstructed road will improve access to existing facilities
Dust, loss of trees and agricultural land	Existing damaged road creates lot of dust Trees and farmlands near the RoW should be protected leftover construction material shall be collected at completion of the activity	Dust will be reduced when road has been re-constructed Disturbance to trees and farmland will be minimal
Other issues	Minimizing the construction duration Road should be rehabilitated as early as possible Traffic congestion due to damaged road Travel time is increased due to damaged road	Construction will be programmed to minimise the length of disruption at any one point These issues will be addressed once road constructed

179. As appropriate these concerns have been incorporated into the EMP items.

Table 10 General Public attending Public Consultation at TM Khan- Badin Road

Name	Town/Village	Position /Occupation
Mr. Wadero Ammo	Matli /Baran Leghari	Village leader
Mr. Muhammad Yousuf Leghari	Matli /Baran Leghari	Farmer
Mr. Shahmir Leghari	Matli /Baran Leghari	Farmer
Mr. Ismail Leghari	Matli /Baran Leghari	Restaurant /Tea Shop
Mr. Bukhtiar Ali	Matli /Baran Leghari	Farmer
Mr. Sultan	Matli /Baran Leghari	Labor /Famer
Mr. Nabi Bux	Matli /Baran Leghari	Farmer
Mr. Sonharo	Matli /Baran Leghari	Farmer

Name	Town/Village	Position /Occupation
Mr. Soomro	Matli /Baran Leghari	Farmer
Mr .Baran Leghari	Matli /Baran Leghari	Farmer
Mr. Vessria	Matli /Baran Leghari	Farmer
Mr. Mashooq Ali Shah	Tando Ghulam Haider	Shopkeeper
Mr. Taj Muhammad Shah	Tando Ghulam Haider	Village Leader
Mr. Qabool Muhammad Shah	Tando Ghulam Haider	Teashop
Mr. Inyatullah Shah	Tando Ghulam Haider	Farmer
Mr. Liaquat Ali Shah	Tando Ghulam Haider	Farmer
Mr. Mahesh Kumar	Talhar	Fertilizer Dealer
Mr .Kishore Kumar	Talhar	Fertilizer Dealer
Mr. Dilip Kumar	Talhar	Fertilizer Dealer
Mr. Rakesh Kumar	Talhar	Shop owner

3. Government Agencies

180. Stakeholders including local government and provincial government officials, local and international NGOs, and related stakeholders were consulted at their offices (Table 11). All the stakeholders were given maximum project information and were shown a detailed map of the area. Their concerns and suggestions are reproduced below. Attendance lists of the stakeholders from the four communities consulted in the subproject was collated and reproduced in Annex 2.

181. Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr. Aijaz ul Hassan	Provincial Government	District Municipal Administration
Mr. Shakeel Memon	Provincial Government	District Municipal Administration
Mr. Sikandar Ali Bhatii	Provincial Government	District Municipal Administration
Mr. Kishore Kumar	NGO	Thar Deep
Mr. Muhammad Hussain	NGO	HANDS

a) Assistant Deputy Commissioner-I (Tando Muhammad Khan)

182. A meeting for consultation was held with Assistant Deputy Commissioner I Mr. Aijaz ul Hassan. He raised the following points after welcoming the proposed project activity in his area of command. The meeting was held at the Office of the Assistant Deputy Commissioner Office Tando Muhammad khan. Their views are as under:

- Local people should get preferential treatment for the employment on the road project;
- A suitable alternate route should be made available during project execution, proper diversions shall be maintained;
- Rice husking traffic will need to be managed in the area of Rice Mills.
- He mentioned that there is no proper landfill site for the solid waste / construction waste material disposal in the TMK; waste generated from the city is being dumped in the ditches at private lands upon their request.
- He also mentioned that wastewater generated from the city is being dumped in the seepage drains. There is no wastewater treatment plant in the city.
- He suggested that during the construction phase proper alternative routes shall be provided to avoid the accidents.
- He also suggested that this road may constructed with dual carriage way, as heavy traffic use this road and due to the various Oil and Gas fields in the area, traffic is increasing day by day.

b) Chief Sanitary Inspection Tando Muhammad Khan

183. A meeting was held with Chief Sanitary Inspection Officer I, Mr Shakeel Memon The meeting was held Assistant Deputy Commissioner Office Tando Muhammad khan. After welcoming the project, and he raised the following points.

- Generally they supported the project and were of the opinion that there is dire need of these kinds of project shall be started as soon as possible.
- He mentioned that there is no proper landfill site for the solid waste / construction waste material disposal in the TMK; waste generated from the city is being dumped in the ditches at private lands upon their request.
- He also mentioned that wastewater generated from the city is being dumped in the seepage drains. There is no wastewater treatment plant in the city.
- He suggested that during the construction phase proper alternative routes shall be provided to avoid the accidents.

- He also suggested that during session of Sugar-cane crushing and rice husking traffic shall be managed in the areas.

4. Non-Government Organizations

184. After the 2010 floods, various NGOs were established with local and foreign funding to participate in the relief works. Some of these NGOs are still involved in various projects related to social and environment development and were consulted for this project. Mr. Muhammad Hussain from the NGO HANDS, Mr Kishore, Thar Deep made the following comments and suggestions;

- As roads are vital for communication during the any emergency; this project should be started as soon as possible.
- Better road conditions will reduce the rate of accidents around the sugar mills
- Road works should be sprayed with water to avoid dust generation in the urban and rural areas during construction.

C. List of Public and NGO Sector Stakeholders Consulted

185. A number of stakeholders, other than the general public, who are likely to benefitted or be involved during the project execution phase, were also consulted (**Error! Reference source not found.**)

Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr. Aijaz ul Hassan	Provincial Government	District Municipal Administration
Mr. Shakeel Memon	Provincial Government	District Municipal Administration
Mr. Sikandar Ali Bhatii	Provincial Government	District Municipal Administration
Mr. Kishore Kumar	NGO	Thar Deep
Mr. Muhammad Hussain	NGO	HANDS

Table 11 List of Public and NGO Sector Stakeholders

Name of Stakeholder Representative	**Type of Stakeholder**	**Department / Occupation/ Designation**
Mr. Aijaz ul Hassan	Provincial Government	District Municipal Administration
Mr. Shakeel Memon	Provincial Government	District Municipal Administration

Name of Stakeholder Representative	**Type of Stakeholder**	**Department / Occupation/ Designation**
Mr. Sikandar Ali Bhatii	Provincial Government	District Municipal Administration
Mr. Kishore Kumar	NGO	Thar Deep
Mr. Muhammad Hussain	NGO	HANDS

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives of Environmental Management Plan

186. The purpose of the environmental management plan (EMP) is to provide a summary of the predicted impacts associated mitigative measures and monitoring actions so as to minimize potential negative impacts and enhance positive impacts from the Project. The EMP will provide a guide (almost checklist) for the main stakeholders, namely the owner, contractor and operator of the road, on what mitigative actions need to be taken and where and when they are needed. It will thus help to improve the likelihood that adverse impacts are mitigated, project benefits are showcased, and an environmentally beneficial standards of best practice is provided to all those involved. In particular, the EMP:

- Defines roles and responsibilities for those involved in the implementation of the EMP and identifies areas where these roles and responsibilities can be shared with other stakeholders
- Provides concise instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact, making these legally binding through their inclusion in contract specifications
- Defines the requirements for communication, documentation, training, management and implementation of the mitigative measures; and,
- Specifies actions required to assess compliance with and effectiveness of the mitigation measures through a compliance and effects monitoring mechanism, defined in the EMP's two action tables.

B. The Environmental Management Plan

187. The EMP, mitigation and monitoring tables for the Tando Muhammad Khan-Badin Road project is included as Annex 1 to this report. It will be included in the contract documents in its entirety as an environmental clause, referenced as a mandatory exercise or integrated into the contract specifications as specific clauses. The estimated costs (Table 12) will be used to prepare a specific environmental safeguards section in the construction Bill of Quantities, thus enabling the Construction Supervision Consultant to pay only as environmental tasks are completed and complied with.

188. The EMP will be revised if project design and construction parameters are changed significantly, then updated during the pre-construction stage of the project.

1. Preconstruction Phase

189. The pre-construction period is the time when road planners can influence the road design and work, thereby avoiding or reducing to an acceptable level any potential negative impacts. The value of the environmental assessment process can be

undermined if this IEE and its EMP are not shared with or adopted by relevant parties during the design and bidding stages. A number of common issues and solutions are described in the EMP.

190. In line with ADB SPS (2009), impacts and risks have been identified in the context of the project's corridor of impact. For rehabilitation projects, this impact corridor is the road RoW (20m-25m), any haul routes established for the work, and any temporary storage areas, usually located within the RoW. All construction materials will be purchased from fully licensed suppliers, who are assumed to be operating in an environmentally acceptable manner as defined by the national and provincial EPAs.

191. The EMP's mitigation (EmiT) and monitoring (EmoT) tables (Annex 1) identify eight important actions to be undertaken by the Sindh Works Department and the Construction Supervision Consultant, including a task to brief the selected maintenance staff of the WDS and any contractors on the EMP and the actions to be undertaken.

192. All environmental assessment documentation shall be prepared and approved during the preconstruction period, translated into the local language and distributed to all stakeholders, namely the local works department, the contractor(s), any monitoring agency and local government managers, for use in implementation of the environmental management actions. By knowing where and what environmentally sensitive receptors exist, and what issues are likely to arise in the future, Sindh Works and Services Department will be able to avoid serious impacts by modifying designs, adjusting alignments or switching to more sustainable methods and/or materials.

193. Sindh WSD will provide a briefing to contractors on the contract and implementation requirements of the EMP.

2. Construction Phase

194. A major factor that can lead to the failure to implement an EMP is lack of qualified environmental experts with the contractors, and therefore (often total) lack of understanding of the EMP and good environmental management practice. An extensive training plan for the Contractor and PWD is being incorporated which need to be implemented. This should help to address this problem. Using the EMP, the contractor will prepare an Environmental Management Work Schedule (EMWS) placing all measures defined in the general EMP in a time bound schedule. It will identify mitigation and monitoring actions required in relation to particular construction activities. The contractor, with advice from the Environment and Social Unit ESU (a section within the PMU), and will be mainly responsible for implementing the EMP.

195. There are fourteen construction phase EMP actions focusing mostly on contractor activities, the management of worksites and contractors' equipment and people. Specifically these actions focus on defining ways to minimize effects such as dust

generation, emission from vehicles and air quality, disposal of spoil and solid waste, noise and vibration from construction machinery, quarry and borrow material transport and disposal, contamination of surface and groundwater resources and work camp waste management.

196. A Site specific EMP (SSEMP) is to be prepared by the contractor, based on the generic EMP provided in the IEE. The SSEPM will perform a risk assessment of all mitigation options and will propose site specific mitigation options that would be appropriate and commensurate with the actual impact. The contractor will not be able to start the construction works before the approval of SSEPM from PMU and final approval from ADB.

3. Operating Phase

197. The three actions defined for the operation period focus on confirming that the contractor completed the EMP tasks required and that the operation of the improved road does not aggravate existing problems such as roadside safety. There will be some increase in the speed and volume of traffic, raising potential road safety issues (e.g. Q1 and 2 during the consultation sessions). Speed limits will be monitored through traffic police as discussed earlier.

198. Most of the impacts are positive due to better road conditions which do not require any mitigation measures such as:

- Reduced travelling time
- Better access to Market
- Fuel efficiency (less consumption)
- Less dust generation (since road surface will be sealed)
- Safer journey

C. Cost Estimates

199. The cost of implementation of the environmental safeguards includes both the direct cost of the mitigation measures and the costs of monitoring the execution of the EMP such as laboratory costs. monitoring visits, training costs, and equipment. Table 12 shows the cost to be included in the BOQ items by the contractor, while Table 13 shows the environmental monitoring cost that will be borne by the IA through the PMU.

Table 12 EMP Implementation and monitoring estimated cost for Contractor

Items	Unit	Unit Cost	No of Units	Estimated 1st year	Estimated 2nd Year	Total (Rs)
Training (Different trainings for 191 persons)	Rs			465562	465562	931124

Items	Unit	Unit Cost	No of Units	Estimated 1st year	Estimated 2nd Year	Total (Rs)
Generators & Construction Machinery Noise Monitoring	No.	7000	78	6552,000	6552,000	13104,000
Drinking Water Quality Monitoring (During Const)	Test	10000	12	120,000	120,000	240,000
Workers Communicable Disease Screening Test	Test	8000	191	152,8000	------	152,8000
Personal Protective Equipment (for 200 persons approx) replacing every year)	No.	????	200	1070000	1070000	2,140,000
Fire Fighting Equipment purchase and refilling	No.		30	250,000	100,000	350,000
Health & Hygiene	??	--	--	738960	738960	1477920
Noise Meter	No.	25000	2	50,000	----	50,000
Contractor's Environmental Officer	No.	150,000	1	1800,000	1800,000	3,600,000
Contingency Cost 10%						**2,582,104**
Total						**28,403,148**

D. INSTITUTIONAL CAPACITY NEEDS, PROPOSED STRENGTHENING AND IMPLEMENTATION ARRANGEMENTS

1. Technical Capacity Building

200. The Sindh Provincial Road Improvement Project (PRIP) will be coordinated by the WSD as the executing agency (EA) with a project management unit (PMU) established within the WSD as Implementation Agency. The PMU will stdregthened to include capacity to implement and monitoring mitigative and monitoring actions defined in the EPM and social assessment reports.

201. A dedicated Environment and Social unit (ESU) will be established within the PMU. Unit will be headed by the PMU Project Director and will have the two qualified environmental specialists. One for the upper Sindh Area roads, and other for Lower Sindh region roads. Both will monitor the environment related issues and monitor the Contractor and consultant progress and report the Project Director WSD and ADB.

2. Implementation Arrangements

202. The Project Management Consultant (PMC) will support the Deputy Directors and the PMU during all stages of project development. The PMC's environment experts will

support the ESU by ensuring that project road works comply with ADB's SPS (2009), PEPA 1997 and S-EPA 2014 (Table 13.); and of course with the EMP

Table 13 PRIP Implementation Organization

Role	**Body**
Executing Agency (EA)	Works and Services Department Sindh
Implementation Agency (IA)	Works and Services Department, Project Management Unit
Design Consultants	To be appointed
Project Management Consultants	To be appointed
IEE Environment Consultants	Engineering Consultants International ECIL
Social Consultants	Environment Management Consultants (EMC)
Technical and Financial Support	Asian Development Bank

203. The ESU, with assistance from of the PMC's environmental specialist will:

- Prepare environmental screening checklists;
- Ensure that the EMPs, including all proposed mitigation measures and monitoring programs are properly implemented by the contractor.
- Ensure the health and safety of workers, and community guidelines are being followed by the contractor.
- Share information and disclosure of environmental safeguard documents (including any Corrective Action Plans prepared in cases of change to original project design) as required.
- Carry out visits to construction sites, work camps, quarries and borrow pits to review the environmental performance of the contractors; and,
- Ensure that the required environmental training is provided to the staff concerned;

204. Contractor will hire two full time persons to address the environmental safeguards; Environmental Engineer's responsibilities will include;

- Prepare Site specific EMP as per generic EMP of this road.
- Monitor the work and undertaken the monthly reporting.
- Carryout site visits of construction camp, construction site(s), quarries and borrow pits to review environmental status and rectify the non-compliances.
- Supervise the environmental monitoring is being carried out as pre-defined frequencies mentioned in EMP
- Coordinate with PMU Environment specialist to conduct site visits.
- Impart trainings as per schedule.
- Prepare monthly environmental monitoring report

205. Environment inspector responsibilities will include;

- Conduct day to day Site inspection activities for any non-compliance
- Conduct environmental monitoring activities through certified environmental laboratory.

206. ADB's responsibility will be to review IEEs , approve the document and confirm that the GoP has completed it due diligence and also approved the assessment..

3. Monitoring and Reporting

207. Following section describes monitoring and reporting frequencies and responsibilities;

a) Implementing Agency

- The IA's Environmental Safeguards Unit will prepare a compliance monitoring checklist, based on the EMP and brief Environment Engineer of the Contractor on its use and implementation schedule. The checklist will be completed monthly.
- Carry out field visits for HSE compliance monitoring on quarterly basis
- The Implementing agency will use the compliance checklist reports, plus a semi-annual audit of the work as the bulk of the content of the semi-annual construction monitoring report to ADB..

b) Project Management Consultants

- Ensure the compliance monitoring is being carried out monthly, quarterly and semi annually during the construction period.
- If non compliance in reorded, conduct review meetings with Contractor to address the non-compliance.

c) Contractor

- Contractor Environment Engineer will be required to submit monthly checklists to the Implementing Agency duly reviewed by PMC, defining what mitigative actions have been undertaken and where this work was done.
- Conduct the Environmental Monitoring (Air, Drinking water Canal Water, Noise (ambient noise and equipment noise) as per frequencies and parameters mentioned in the EMP.

VIII. CONCLUSION AND RECOMMENDATIONS

A. Principal Findings

208. This, the Tando Muhammad Khan to Badin Road IEE is one of six been prepared for the Provincial Road Improvement Project of Government of Sindh Works and Services Department.

209. The proposed rehabilitation/reconstruction work is expected to have very little negative environmental impact. The work will be constrained within the current right of way and thus there will be no significant impact on adjoining lands, cultural sites, fauna or flora. There is a minimal requirement for resettlement of roadside squatters and is being addressed in a separate LARP report

210. The following are the main issues identified and concerns raised during the study:

- The project is in predominantly bad condition and travelling time is around double the time that would be expected for a road in good condition;
- The road embankment is eroded in some places;
- There are mosques, graveyards and shrines built impinging to the ROW of the project road no cultural or sensitive structure will be affected.
- There are major and minor canals and waterways crossing the road, requiring special care during construction works
- There are six wetlands located in District Badin. All are far from the project road and will be unaffected.

B. Conclusion

211. The improvement of the Tando Muhammad Khan to Badin road, is limited to road reconstruction within the existing right of way. The impacts can be mitigated with the measures proposed in the Environmental Management Plan.

212. Provided the EMP is followed, there should be no damage to cultural and archaeological sites. Trees located on the embankments will not be disturbed. The environmental safeguards will have to be monitored by the Contractor, Environment Specialist of the PMC as well as the WSD. Due diligence, with mandatory coordination among various stakeholders, will further ensure mitigation of any adverse impacts.

213. This IEE study concludes that the proposed road project will not lead to significant adverse environmental and social impacts of such nature or magnitude , and that a more detailed report in the form of an EIA is not needed. Careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements.

214. The project has been discussed with local people, government officials and NGO, yielding general support for the project. There were no serious environmental issues raised or matters that the Consultant had overlooked. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust. There was also a concern about safety, especially during construction, but generally a view that improved road conditions would improve safety.

C. Recommendations

215. A schedule of activities associated with reconstruction has been prepared and the potential environmental impacts of each activity assessed. For each activity, recommended mitigation and monitoring actions have been identified. These are covered in the Environmental Management Plan. All impacts are minor and able to be mitigated.

216. The following recommendations are carried over from the text:

- Environmental monitoring, via close adherence to the EMP will be carried out by the IA and the contractor, in order to minimise damages to the environment, workers or the community. This will be enforced through contract specifications and an environmental BoQ section.
- The contractor will ensure that borrow material /earth-fill will be obtained from the approved sites.
- Trees located on the embankments will not be disturbed.
- Asphalt plant shall be located at least two kilometres from settlements
- Construction camps will be located a minimum of 1000m from existing settlements, built-up areas and at least 500m from canals.
- Excavation of earth fill will be limited to an appropriate depth of 20cm.
- Canals and other water resources will be closely monitored to ensure no blockages occur as a result of the work and that no contamination of the surface water occurs during the construction period.
- A dust abatement program will be implemented that includes spraying water on roads and work areas within villages and past houses adjacent to the road.
- Health and safety plans will be prepared.
- Construction work shall not hinder local people's access to nearby facilities.
- SSEMP will be developed by the contractor which needs to be reviewed by the PMC, approved by IA and final approval is required from ADB. Contractor will not able to start the construction till the SSEMP is not approved.

- An emergency and safety plan will be developed by the contractor/PMU for bridges and roads near canals and waterways.
- Grievances redress mechanism will be implemented by the IA and adhered to by the contractor to ensure that community complains are addressed and recorded.

Annex 1

Table 14 Environmental Management Plan: Environmental Mitigation Table (EmiT) and Environmental Monitoring Table (EmoT)

Environmental Management Plan (EMP):Environmental Mitigation Table (EmiT)

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
1. Pre-Construction Period Impacts					
1.1. Lack of environmental technical capacity within WSD and its PMU in environmental assessment and design, management, supervision and reporting.	WSD will establish a unit, or at least a person within the PMU, to manage environmental, social and safety aspects of maintenance projects. The PMU will be staffed by at least one full-time suitably qualified Environment Specialist, who will ensure that environmental safeguard measures associated with this and other projects are credibly implemented, including provision of necessary training to WSD road maintenance staff.	A PMU will be established prior to loan effective- ness, with training completed during detailed design. Contractor training, and environmental briefing will be conducted prior to mobilization.	Head office WSD	WSD	WSD
1.2. Consideration of IEE/EMP in preparation of the detailed design and bid documents.	PMU will check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP.	Before the tendering	NA	WSD	Supervision Consultant
1.3. Loss of Vegetation and trees	During detailed design the supervising engineer/consultant will modify the design on order to minimize the removal of mature trees from roadsides; carriage	Design and implementation planning for TM Khan to Badin road	At any locations where mature trees will be cut down.	WSD	PMU

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
1.4. Top Soil Erosion	Sindh WSD will prepare an earthworks checklist that defines for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is completed. Use of soil from private land will be minimized and only after consultation with and compensation of landowners.	During Planning phase, in parallel with the preparation of bid documents	At any locations where borrow pits, quarries will be operated.	WSD	Supervision Consultant
1.5. Disturbance to Archaeological and Cultural Sites	No cultural or archaeological sites have been identified in the TM Khan to Badin road and thus no mitigation measures are required.	----	---	-----	-----
1.6. Materials Haul Routes	Construction vehicles hauling materials along urban roads and anywhere where there are roadside residence will be limited and the WSD will establish a route plan to minimize this disruption	Prior to contractor mobilization	NA	WSD	Supervision Consultant
1.7. Consultation Plan with affected roadside landowners	Rehabilitation work will result in access from a business and residence to the road being cut off or limited at times. To prepare for this inconvenience, WSD will define a road work	Completed prior to contractor mobilization and provided the contractor as part of the contract documentation	NA	WSD	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	information exchange procedure requiring the contractor to contact roadside landowners of the work, the period of access restriction and the measures taken to allow movement around the construction work.				
1.8. Contractor's Environmental Safeguards Capacity	Unfortunately contractors have a very poor record with complying with workplace and environmental safety regulations. To address this WSD will require the contractor to define a Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment	Plan to be provided the Consulting Engineer and PMU prior to start of work	WSD	WSD	Supervision Consultant
2. Construction Period Impacts					
2.1 Dust Generation Transportation of Material					
A small increase in particulate matter (dust) is expected within the ambient air of the construction area and from vehicles hauling construction materials to the work sites.	i. The Contractor will be required spray water on unsealed roads and work areas within villages and past houses located close to the road and giving priority to sealing in urban areas. ii. Dust control at the construction site will be controlled by watering,	Throughout the construction period	Anywhere where there is material moved, earthworks cutting and filling.	Contractor	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	setting strict speed limits of no more than 30kph in or near settled areas.				
2.2 Dust Generation: Quarry and Batchling Plant Operation	i. Dust from the cement work will be avoided by using bulk cement brought to the plants in large tanker trucks and transferred to the plant hoppers via a closed system. ii. Batch plants will need to be equipped with dust suppression equipment, now standard on most such facilities, or which can be easily retrofitted	Throughout the construction period	Anywhere where there is material moved, earthworks cutting and filling.	Contractor	Supervision Consultant
2.3 Top Soil Erosion	i. Excavation of earth fill will be limited to an appropriate depth of 20cm. ii. Where use of agricultural land is unavoidable, the top 15cm of topsoil will be stripped and stored and then replaced after removal of borrow material. iii. Where deep ditching is carried out, the top half metre layer will be stripped and stockpiled. iv. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later.	During Construction	At any locations where borrow pits, quarries will be operated.	WSD	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	v. Where ditches and borrow pits cannot be fully rehabilitated, land owners will be compensated as provided in agreements between the land owner and contractor				
2.4 Increase in air pollution from vehicular and machinery exhaust	Emissions will be minimised by: i. ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturer's specifications; ii. use of appropriate octane fuel and haul loads within specified limits. iii. Vehicle idling time limits to no more than 2 minutes, iv. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive TPM pollution.	During Construction	Construction Site	Contractor	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
2.5 Disposal of Spoil and Solid Waste					
2.5.1 asphalt layers and base materials of the existing road	i It may be re-used in the soft shoulders or as fill for other parts of the new road depending on the quality of the material. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt can be pulverized, spread on access roads and compacted.	During Construction	All Construction Sites	Contractor	Supervision Consultant
2.5.2 Unused construction material (sand, crush), empty drums, concrete waste and waste from work camps.	i The contractor will identify dumping locations for construction debris and non-hazardous solid waste with TMA Tando Muhammad Khan, TMA Badin and EPA Hyderabad. ii The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through Sindh EPA approved waste contractor s under section 13 of the Sindh Environment Protection Act 2014. iii The cost of disposal of hazardous and non-hazardous waste shall be included in the Contractors BOQ.	During Construction	All Construction Sites	Contractor	Supervision Consultant
2.6 Noise & Vibration					

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
2.6.1 Noise and Vibrations associated with earthworks and haul roads.	i Enforcing a speed limit of 30 kph within 500m of any village and the use of water sprinkling for dust settling at least on road for 500m on either side of a village. ii Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800. iii Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between contractor and local communities.	During Construction period	Construction areas	Contractor EHS Inspector	Supervising Consultant
2.6.2 Excessive Noise at sensitive sites	At the same locations and times that surface water quality is tested, noise measurements will be completed, but with measurements taken at sensitive receptors As defined in the IEE	Throughout construction period, at least every month, using a portable sound pressure meter.	As listed in IEE: Schools, residential areas ,Mosques and health care facilities along the road side, and as identified in the IEE.	Contractor EHS Inspector	Supervising Consultant
2.7 Quarry/Borrow Materials					
2.7.1 Overloading of trucks, may damage pavement, bridges, and culverts	i. The Contractor will ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be	Throughout construction period	Construction sites	Contractor EHS Inspector	Supervising Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	required to monitor the transport of material, recording vehicle movements and weights, to be inspected.				
2.7.2 Risk of erosion and destruction of landscape / agriculture land from side borrow operations.	ii. Any need for borrow material outside of the RoW will be subject to local environmental approvals and procedures and should also be carried out in consultation with ES of IA/PMU.	Construction Period	Along any stretches where road will be raised and fill is needed, particularly in areas with long visual distances	Contractor EHS Inspector	Supervising Consultant
2.7.3 contractor extracts material from borrow areas without the permission of the Landowner.	iii. It will be ensured by PMU that borrow material will be purchased/ or taken only after the consent of the land owner has been obtained.	Construction Period			
2.8 Contamination of Water Resources (Surface& Ground)					
Surface water can be polluted by entering cement and other chemicals used in rehabilitation works.	i. All fuel storage sites must `be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. ii. Fuel and oil storage areas should be at least 500m away from watercourses and repair and fuelling yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site. iii. Wash down water from machinery repair areas to	Throughout the construction period	Based on an analysis of soil conditions by contractor /and consultant hydrology and geotechnical expertise	Contractor	Supervision Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	be directed into this system that retains the oil and grease. Refuelling to be carried out at the fuel storage area and not be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the road before, during and after the work has been completed on that crossing. iv. Water channels have to be diverted properly, protection arrangements should be provided at each culvert / water crossing				
2.9 Damage / disturbance to Utilities within RoW	i. A relocation plan of the utilities will be developed during the preparation of the LARP. The Contractor will need to be aware of the location of these services so that disruptions are not caused. ii. Placing the responsibility for any repair of the services with the Contractor will assist in avoiding damage to these services.	Before the start of construction work. Design phase.	Where utilities services located	Contractor EHS Inspector	Supervising Consultant
2.10 Traffic Disturbance					

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
Loss of access for roadside residents	Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and properties connecting the project road/area, Work that affects the use of side roads and existing access shall not be undertaken without provision of adequate alternate routes; to the prior satisfaction of the Engineer and affected persons. Contractor shall submit the Traffic plan which needs to be approved from The Engineer.	Construction Period	Town Crossings Canal Crossings	Contractor EHS Inspector	Supervising Consultant
2.11 Health and Safety Concerns					
2.11.1 Protecting the workforce and maintaining a safe working environment. 2.11.2 Transmission of communicable diseases (such as STI's and	i. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, cleaning agents, herbicides and pesticides. ii. Contractor must provide protective masks to milling machine operators, and anyone working in the area of the milling machine dust-cement hopper area, with	217. Construction period	218. Construction Camps, Construction sites and Asphalt Plant area	219. Contractor EHS Officer	220. IA

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
HIV/AIDS) to the local community.	masks of a micron size, capable of capturing dust down to 2 microns. iii. Contractor to provide high-visibility clothing for workers at sites that have active traffic. Any works at night should be adequately lit and high visibility clothing worn and contractor should provide basic training on use of protective clothing and equipment. v. All Construction labour and staff of the contractor and consultant will be tested for the communicable disease (STD &STI).				
2.12 Intruption /Contamination of Water channels					
Movement/drainage of surface water interrupted due to improper construction activities, inadequate diversions and notifications.	i. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /water course. ii. Protection mechanisim should be provided to avoid contamination. iii. Contractor should prepare traffic management plan, duly approved by the Engineer. Contractor shall also provide appropriate	Construction period	Culverts and bridges	Contractor EHS Officer	IA

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	diversions, with signages and lighting arrangements, to avoid any accidents. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed				
2.13 Over Used Local Resources					
Project Labor force can impose a burden on, water resource, wildlife, fuel wood, and sanitation system.	i. Local labour will be hired for the project so there will be no additional impact on natural and social resources and services.	Construction period	Construction Camps, Work site and Asphalt Plant area	Contractor EHS Officer	IA
2.14 Contractor Good Housekeeping Practices not Applied					
Contractor's work areas and camps not maintained, no proper waste management, environmental health and safety measures.	i. All camps shall be provided with septic sanitation facilities and potable water. ii. A solid waste collection program must be established iii. Monitoring will be required for the solid waste disposal at camp site and to ensure that the health and safety plan based on contract specifications is followed. iv. Once the site is no	Throughout the construction period	All construction camps , work areas and contractor 'yards'	Contractor EHS Inspector	Supervising Consultant

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	longer needed the contractor must fully decommission it, with special emphasis on waste removal and clean up of any spills or hazardous materials plus any necessary re-vegetation.				
3. Operating Period					
3.1 Missing environmental safeguards completion report	The contractor, will provide an mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract and submit that to the PMU before the final payment can be released	1 month before the end of the construction period	NA	WSD & Contractor	WSD
3.2 Air Quality degraded and Noise Level Increase	Maintenance Dept. will endeavour to keep road dust free and speed limit signs will be maintained. Police will improve enforcement of limits and conduct spot checks if muffler systems on trucks. Also signed re no-horn use will be erected in urban areas.	Operation period	All nearby Towns	Traffic Police	-
3.3 Increased Risk of Accident and Injury	Appropriate traffic calming and signage will be installed for the driver, speed limits shall be monitored by the traffic police to avoid any accident and	Operation period	As per design	Contractor and Traffic police	ES/PMU /IA

Environmental Issue	Mitigation Measure	Time frame	Location	Implementer	Supervisor
	subsequent spillage. An emergency service may be provided by the local authorities.				

A. Compliance Monitoring

1. Works and Services Department (WSD) and the Supervising Consultant and to a lesser extent the contractor shall be responsible for the implementation of the Environmental Monitoring measures specified in the Environmental Monitoring Table (EMoT). During the construction period monthly safeguard monitoring checklists and observations on air, noise and water quality will be presented in a tabular monitoring reports and submitted to the Implementation Agency ES- PMU,. Monitoring reports and notes to file shall be prepared as per the frequency mentioned in the EMoT and shall be assembled by the PMU and its construction supervision consultant into semi-annual monitoring reports, as mandatory submissions to ADB. Noise measurements will be obtained via a portable noise meter to be used by the contractor and/or the PMU's safeguard specialist or the Supervising Consultant's environmental specialist.

Environmental Management Plan (EMP): Environmental Monitoring Table (EMoT)

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
1. Pre-Construction Period Impacts						
1.1. Lack of environmental technical capacity within WSD and its PMU in environmental assessment and design, management, supervision and reporting.	WSD will establish a unit, or at least a person within the PMU, to manage environmental, social and safety aspects of maintenance projects. The PMU will be staffed by at least one full-time suitably qualified Environment Specialist, who will ensure that environmental safeguard measures associated with this and other projects are credibly implemented, including provision of necessary training to WSD road maintenance staff.	Confirm that WSD and Contractor training is carried out during the relevant timescales.	At least 1 month before construction begins Within the 1st month construction begins.	Environment person working within PMY	PMU	WSD
1.2. Lack of integration of IEE/EMP requirements into construction bid documents.	PMU will check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the environmental boundaries defined in the EMP.	Confirm that bid documents, contracts and have specific environmental items or there is a specific reference to the EMP	Before the tendering and before contract finalized	Date and time that confirmation completed filed with PMU	PMU-monitor	PMU or Supervision Consultant (if available)
1.3. Loss of Vegetation and trees	During detailed design the supervising engineer/consultant will modify the design on order to minimize the removal of mature trees from roadsides; carriage	Monitor to obtain copy of plan and record compliance—for presentation in smi-annual audit report	Prior to start of construction	Date and time that confirmation completed recorded & filed with PMU	PMU-monitor	PMU

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
1.4. Top Soil Erosion	Sindh Works will prepare an earthworks checklist that will define, for the contractor, limits to the excavation during the road rehabilitation. Instructions for topsoil management will also be defined, including the removal and storage of all topsoil to be used in landscaping, once the road work is done Encroachment on private land will be minimized and only after consultation with landowners and and compensation of losses Land owners will be compensated This will be monitored through ES- PMU	Monitor checks that topsoil management steps prepared and ready for implementation	During Planning phase, in parallel with the preparation of bid documents	Copy of topsoil protection actions	PMU	Supervision Consultant
1.5. Disturbance to Archaeological and Cultural Sites	There are no cultural or archaeological sites found in the Tando Muhammad Khan to Badin road and thus no mitigation measures are required.	----	---	-----	----	-----
1.6. Materials Haul Routes	Construction vehicles hauling materials along urban roads and anywhere where there are roadside residence will be limited and the WSD will establish a route plan to minimize this disruption.	Route plan confirmed by PMU-planners and recorded for use in audit report	Prior to contractor mobilization	Written and dated note indicating compliance & inspection	PMU	Supervision Consultant
1.7. Consultation Plan with affected roadside landowners	The work along this road will affect the access from a business and residence to the road . WSD will define a road work information exchange procedure requiring the contractor to inform roadside landowners of the work, the period of access restriction and the	Review of plan and confirm a) consultation action proposed b) inclusion of timetable and c) inclusion of clean	Completed prior to contractor mobilization and provided the contractor as part of the contract	Written and dated note indicating compliance	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	measures taken to allow movement around the construction work, as well as actions to be taken to re-establish the preconstruction access	up and reconnection action.	documentation			
1.8. Contractor's Environmental Safeguards Capacity	Contractors frequently do not comply with workplace and environmental safety regulations. To address this WSD will require the contractor to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, mandatory use of Personal Safety Equipment	Review Construction contracts and specifications- to check content for OHS plan content.	Plan to be provided the Consulting Engineer and PMU prior to start of work	Written and dated note indicating compliance	PMU	Supervision Consultant
2. Construction Period Impacts						
2.1 Dust Generation : Transport of Materials						
i. A small increase in TPM (dust) is expected within the ambient air of the construction area and from vehicles hauling construction materials to the work sites.	i. The Contractor will be required spray water on unsealed roads and work areas daily, within villages and past houses located close to the road and giving priority to sealing in urban areas. ii. Dust control at the construction site will be controlled by watering, setting strict speed limits of no more than 30kph in or near settled areas.	Travel work areas and check for dust—and if found take immediate action with contractor	Anywhere where there is material moved, earthworks cutting and filling.	Written and dated note indicating compliance or issue and action taken	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
2.2 Dust Generation: Quarry and Batchling Plant Operation	i. Dust from the cement work will be avoided by using bulk cement brought to the plants in large tanker trucks and transferred to the plant hoppers via a closed system. ii. Batch plants will need to be equipped with dust suppression equipment, now standard on most such facilities, or which can be easily retrofitted	Travel Quarry and Batchling Plant Operation site and check for dust—and if found take immediate action with contractor. Inspect batching plant dust supersseion mechnisim, its maintenance log book.	Anywhere where Quarry and Batchling Plant is being operated.	Written and dated note indicating compliance or issue and action taken	PMU	Supervision Consultant
2.3 Top Soil Erosion	i. Excavation of earth fill will be limited to an appropriate depth of 20cm. ii. Where use of agricultural land is unavoidable, the top 15cm of topsoil will be stripped and stored and then replaced after removal of borrow material. iii. Where deep ditching is carried out, the top half metre layer will be stripped and stockpiled. iv. The ditch will be filled initially with debris/scrap material from old construction and levelled with stockpiled topsoil later. v. Where ditches and borrow pits cannot be fully rehabilitated, land owners will be compensated as provided in	i. Check query sites for depth. ii. Ensure contractor store topsoil properly, and restore query site as much as possible at end of work. iii. Ensure Land owner get adequate compensation	At any locations where borrow pits, quarries will be operated.	. Written and dated note indicating compliance or issue and action taken	WSD	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	agreements between the land owner and contractor					
2.4 Increase in air pollution from vehicular and machinery exhaust	Emissions will be kept to a minimum by: i. ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturer's specifications; ii. use appropriate octane fuel and haul loads within specified limits. iii. Vehicle idling time limits to no more than 2 minutes and v. Equipment maintenance specifications will be imposed through construction inspection and regular reporting. v. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive TPM pollution.	Record findings and conduct regular inspections in association with construction supervision	Throughout the construction period	Inspection note to file for use in contractor reporting and in semi-annual audit report	PMU	Supervision Consultant
2.5 Disposal of Spoil and Solid Waste						

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
i. Asphalt layers and base materials of the existing road	i. It may be re-used in the soft shoulders or as fill for other parts of the new road depending on the quality of the material. It may also be used as back-fill for borrow pits and then over-lain with top soil. Asphalt can be pulverized, spread on access roads and compacted.	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	PMU	Supervision Consultant
ii. Disposal of waste sand, aggregate, empty drums, concrete waste and waste from work camps.	i. The contractor will identify dumping locations for construction debris and non hazardous solid waste with TMA Tando Muhammad Khan, and TMA Badin and EPA Hyderabad. ii. The contractor shall identify any hazardous waste as part of its health and safety plan and dispose of the material through Sindh EPA approved waste contractor s under section 13 of the Sindh Environment Protection Act 2014. iii. The cost of disposal of hazardous waste and non-hazardous waste shall be included in the Contractors BOQ item.	Monitor to check waste handling and disposal procedure of contractor	Throughout construction period	Note to file, signed and dated	PMU	Supervision Consultant
2.6 Noise & Vibration						
i. Noise and Vibrations associated with earthworks and haul roads.	i. Enforcing a speed limit of 30 kph within 500m of any village and the use of water sprinkling for dust settling at least on road for 500m on either side of a village, Same approach is to be taken if the other site is used.	Using a portable noise meter, monitor checks conditions , and inspects if work conducted within permitted time	Throughout construction period	Inspection note, signed and dated	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	ii. Restricting operating hours through roadside villages and settlements to between hours of 0700 and 1800. iii. Large and noisy machinery operations close to urban areas are restricted to daylight hours, and a schedule agreed to between the contractor and the local communities.	period on urban zones				
ii. Excessive Noise at sensitive sites, identified in IEE, i.e. schools, residential areas, mosques, health care centers	ii. At the same locations and times that surface water quality is tested, noise measurements will be completed, but with measurements taken at sensitive receptors As defined in the IEE	Noise measurements at these sites recorded bv monitor and if excessing, immediate action to erect temporary barriers	Throughout the construction period	Inspection note with noise reading results	PMU	Supervision Consultant
2.7 Quarry/Borrow Materials						
i. Overloading of trucks, damaging pavement, bridges, culverts etc	i. The Contractor will need to ensure that loaded trucks do not exceed road, bridge and pavement specifications and are checked by weighbridges. The contractor will be required to monitor the transport of material, recording vehicle movements and weights, to be inspected.	Examine weighbridge records and compare to amount of material moved	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
ii. Risk of erosion and destruction of landscape / agriculture land from side borrow operations.	ii. Side borrow action is discouraged. However, any need for such work will be subject to local environmental approvals and procedures and should also be carried out in consultation with ES of IA/PMU.	Inspect all side borrow activities and establish what permission given, and if none require immediate closure and restoration of the site.	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant
iii. contractor extracts material from borrow areas without the permission of the Landowner.	iii. It will be ensured by PMU that borrow material will be purchased/ or taken only after the consent of the land owner has been obtained.	Inspect all borrow areas outside RoW and establish permit/ agreement to take materials	Throughout construction period.	Inspection note re findings, dated and signed		
2.8 Contamination of Water Resources (Surface& Ground)						
i. Surface water can be polluted by entering cement and other chemicals used in rehabilitation works	i. All fuel storage sites must `be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected. ii. Fuel and oil storage areas should be at least 500m away from watercourses and repair and fuelling yards to be equipped with an impervious platform, with interceptor traps so that any fuel leakage is retained within the site. iii. Wash down water from machinery repair areas to be directed into this system that retains the oil and grease. Refuelling to be carried out	Regular inspection of work camps, contractors yard, fueling areas , fuel storage	At least monthly throughout the construction period.	Checklist showing check fuel and lubricant handling, waste oil management , machinery was down water control, etc. signed and dated--filed. Checklist showing the	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	at the fuel storage area and not be permitted within or adjacent to watercourses. Surface water channels crossed by the road will be monitored upstream and downstream of the crossing once before, during and after the work has been completed on that crossing. iv. All diversions must be checked for Signages and lightings on weekly basis,	Regular monitoring of diversion for signages and lightings	At least fortnightly where diversions are placed	check for lighting and signages signed and date filled		
2.9 Damage / disturbance to Utilities within RoW	i. A relocation plan of the utilities will be developed during the preparation of the LARP. The Contractor will need to be aware of the location of these services so that disruptions are not caused. ii. Placing the responsibility for any repair of the services with the Contractor will assist in avoiding damage to these services.	Review of notifications and approvals from all utilities as per the legal requirements	Before the start of construction work. Design phase.	Inspection note re findings, dated and signed	PMU	Supervision Consultant
2.10 Traffic Disturbance						

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
i. Loss of access for roadside residents	Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and properties connecting the project road/area, Work that affects the use of side roads and existing access shall not be undertaken without provision of adequate alternate routes; to the prior satisfaction of the Engineer and affected persons. Contractor shall submit the Traffic plan which needs to be approved from The Engineer.	Inspect construction areas where access is an issue and establish if contractor is managing problem and if local residents are satisfied	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant
2.11 Health and Safety Concerns						
i. Protecting the workforce and maintaining a safe working environment. ii. Transmission of communicable diseases (such as STI's and HIV/AIDS) to the local community.	i. Contractor must provide safety vests, hard hats and protective footwear, dust masks (good for 2.5 micron size particles) and ear plugs for all workers handling heavy machinery, and working with hazardous materials such as concrete, asphalt, paints, cleaning agents, herbicides and pesticides. ii. ii.Contractor to provide high-visibility clothing for workers at sites that have active traffic. Any works at night should be adequately lit and high visibility clothing worn. Contractor to provide basic training on use of protective clothing and equipment. iii. All Construction labour and staff of the contractor and consultant will	Inspection of construction sites to ensure proper use of OHS gear and contractor enforcement	Throughout construction period	Inspection note re findings, dated and signed	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	briefed in STD's and given option to be tested (personal choice).					
2.12 Intruption /Contamination of Water Sources						
	i. Contractor should provide the adequate sized diversion, so that there shall be no disturbance to water flows of canal /water course. ii. Protection mechanisim should be provided to avoid contamination. iii. Contractor should prepare traffic management plan, duly approved by the Engineer. Contractor shall also provide appropriate diversions, with signages and lighting arrangements, to avoid any accidents. iv. The land used for the temporary diversion and the water course shall be restored as far as possible to its initial state once the work has been completed	Inspection of diversion along the road, check signages, lighting any leakage etc at the diversion and recityfy through contractor. Ensure contractor has adequetly restored temporary land.	Culverts and bridges	Contractor EHS Officer	IA /PMU	Supervision Consultant
2.13 Over Used Local Resources						
i. Project Labor force can impose a burden on, water resource, wildlife, fuel wood, and sanitation system.	i. Local labour will be hired for the project so there will be no additional impact on natural and social resources and services.	Inspection of work areas and meet with local officials to establish if excessive use of local resources is a concern	Throughout construction period—at least once when work is near or in a community	Meeting note signed and dated	PMU	Supervision Consultant

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
2.14 Contractor Good Housekeeping Practices not Applied	i. All camps shall be provided with septic sanitation facilities and potable water. ii. A solid waste collection program must be established iii. Monitoring will be required for the solid waste disposal at camp site and to ensure that the health and safety plan based on contract specifications is followed. iv. Once the site is no longer needed the contractor must fully decommission it, with special emphasis on waste removal and clean up of any spills or hazardous materials plus any necessary re-vegetation.	Inspect all camp operations including worker housing and all waste management procedures	Throughout the construction period while work camps are in operation	Inspection note re findings, dated and signed	PMU	Supervision Consultant
3. Operating Period						
3.1 Missing environmental safeguards completion report	The contractor, will provide an mitigation and monitoring completion report listing all actions taken in compliance with this EMP items defined and with any other safeguard requirement specified in the contract document and submit that to the PMU before the final payment can be released	Obtain completion report and review for compliance	1 month before the end of the construction period	Note to file and copy of completion report	WSD	WSD
3.2 Air Quality degraded and Noise Level Increase	Maintenance Dept. will endeavour to keep road dust free and speed limit signs will be maintained. Police will improve enforcement of limits and conduct spot checks if muffler systems on trucks. Also signed re no-horn use	WSD to take necessary action	During the operation of the upgraded road—on a continuing basis	Note to file indicating status of this maintenance work	WSD	WSD

Environmental Issue	Mitigative Measure	Monitoring Action	Timing	Monitoring Delivered By	Implemented by	Supervised by
	will be erected in urban areas.					
3.3 Increased Risk of Accident and Injury	Traffic speed limit and noise restriction signage will be installed along the road and monitored by the traffic police An emergency service may be provided by the local authorities. Traffic calming in urban areas including speed-bumps.	WSD to take necessary action	During the operation of the upgraded road—on a continuing basis	Note to file indicating status of this maintenance work	Traffic Police and WSD	WSD