

Environmental Assessment Report

Environmental Impact Assessment
Project Number: 37559
April 2009

PAK: Multitranche Financing Facility for the National Highway Development Sector Investment Program, Project 2 (MFF0002)

Prepared by Government of Pakistan for the Asian Development Bank (ADB).

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EXECUTIVE SUMMARY

- **Background of the Project**

1. National Highway Authority (NHA) intends to widen the existing carriageway of Indus Highway N-65 from Sukkur to Jacobabad (a length of 68 Km). As per Government of Pakistan regulations, an Environmental Impact Assessment (EIA) Study is required for construction of all new roads worth Rupees 50 million and above. The above EIA Study was assigned to NESPAK by NHA in May 2006.
2. This EIA Report presents the environmental assessment for the above N-65 Road Section from Sukkur to Jacobabad.
3. Sukkur to Jacobabad Section of N-65 is a very important Road Section as it passes through three districts i.e. Sukkur, Shikarpur and Jacobabad of Sindh Province and links the province of Sindh with Punjab and Balochistan. The existing 2 lane road is insufficient for the inter-provincial transport needs of present population of the Project Area. Currently, on an average, 6,221 vehicles pass through Sukkur-Shikarpur Section and 4,563 vehicles pass through Shikarpur-Jacobabad Section everyday. It is estimated that by the year 2011, there will be approximately 8,326 vehicles passing through Sukkur-Shikarpur Section and 6,106 vehicles passing through Shikarpur-Jacobabad Section everyday. To meet the requirements of increasing traffic volume, NHA planned to upgrade the existing road into 4 lane dual carriageway. Length of the road section from Sukkur to Jacobabad is 68 Km, including a proposed Bypass at Shikarpur.
4. The construction and up-gradation of N-65 (including a new bypass at Shikarpur) will provide improved highway route to be utilised by the travellers of Sindh, Punjab and Balochistan Provinces. After the construction of the dual carriageway, the economic and commercial activities of the Project Area will get a considerable uplift.

- **Objectives and Schedule**

5. The prime objective of the proposed Project is to facilitate movement of people and goods transport in the Project Area and between Sindh and Balochistan Provinces by providing better access and enhance the efficiency of the existing road network.
6. The implementation of the proposed Project is expected to start in 2007 and complete in December 2008.

- **Project Components**

7. The Project will involve the up-gradation of the existing road section from Sukkur to Jacobabad via Shikarpur, including construction of a new bypass around Shikarpur City. Width of the flexible pavement on each side will be 7.3 metres. Internal and external treated shoulders of width 1.0 metre and 2.0 metres

respectively will be provided. The proposed RoW will be 110 ft (34 metres) from the centre of the road 55 ft. (17 metres) on each side).

- **Relevant Legislation and Guidelines**

8. To carry out the present EIA Study, the environmental legislation and Guidelines enforced by the Pakistan Environmental Protection Agency and Asian Development Bank (ADB) have been followed.

- **Components of the EIA Report**

9. The Report contains the identified environmental impacts and their mitigation measures. Besides, the Report also includes the preparation of Environmental Management and Monitoring Plan to cover the mitigation measures, monitoring requirements and institutional responsibilities (during design, construction and operation phases of the proposed Project).

- **Description of the Project**

10. After the completion of this Project, existing two lane road will be replaced by a 26.6 metre wide four lane dual carriageway. Additionally bypass will be constructed around Shikarpur City. Total length of the proposed bypass is about 4.9 Km. Bypass starts at Km 26+100 of N-65 from start point of Project Road (at Sukkur) and ends at Km 379+000. The centreline of improved road coincides with the existing road. RoW of the proposed road will be the same. Major construction work will generally remain confined within the RoW.

- **Description of the Environment**

11. Baseline conditions were studied for the physical, ecological resources and for socioeconomic environment. This road/highway passes through Sukkur, Shikarpur and Jacobabad Districts. The terrain is quite flat and levelled. All the three districts have mostly agricultural fields on both sides of the road. The Project Area is one of the hottest regions in the country with extremely severe climate, especially in summer. June and July are the hottest months and December and January are the coldest months. Annual average rainfall in the area ranges from 88 – 111 mm. The Project Area is irrigated by the canals emerging from Guddu Barrage system.
12. Rice and wheat are the major crops in all three districts. Due to intensive irrigation, water logging is commonly observed along the roadside. Water table is higher in the Project Area and varies from 3 to 20 m at certain locations. Industrial activity in the area is very scarce. One sugar mill, few rice and cotton ginning mills and some brick kilns are located in the district. The only significant source of air pollution is the emissions due to vehicular movement. Large amount of suspended particulate matter is generated when the vehicles move on unpaved shoulders and poorly maintained existing road.
13. In order to get true picture of the environmental condition of the Project Area, Consultants carried out water, air and noise monitoring with the technical assistance of Global Environmental Laboratory, Lahore.

14. Socio-economic environment of the Project Area were studied in detail for developing the baseline information about the affectees of the Project. Detailed surveys were carried out for this purpose. Section 3 describes the findings of this exercise in detail.
- **Project Alternatives**
15. Different alternatives of the proposed Project were analysed, by considering no Project, alternative transport modes and improvement of the existing carriageway. 'Improvement of the existing road with widening on both sides one by one and construction of a new bypass' was considered feasible due to least impacts and more benefits.
- **Environmental Impacts and Mitigation Measures**
16. Various probable impacts on the existing resources due to the proposed Project and vice versa were studied under the parameters of resettlement/ land acquisition, change of land use, dismantling of structures, relocation of existing utilities, soil erosion, water bodies, air pollution, noise, flora and fauna etc.
17. As a result of the EIA Study, increase in long-term economic activity and uplift of the standard of life of the people was visualised as a major positive impact of the proposed Project. It was also observed that there may be some negative impacts related to the proposed Project. Those are mostly related to the construction stage only and include land acquisition, soil erosion, improper disposal of spoil, loss of vegetation, displacement of population, disturbance to people, disruption of traffic and some possible impacts on the health and safety of general public and workers. Total land to be acquired for the construction of additional carriageway is around 48.1 acres, along the proposed bypass at Shikarpur. Construction activities will result in relocation/ rearrangement of various utilities within the RoW, including culverts, gas pipe line, PTCL cable, electrical poles, transmission, telephone poles and optic fibre lines.
18. Mitigation measures to eliminate/minimize those negative impacts have been proposed to bring them to an acceptable level through implementation of the Environmental Management and Monitoring Plans. Proper compensation will be given to the Project affectees in a judicious manner. Mitigation measures have been suggested for the pre-construction, construction and operational stages of the Project, taking into consideration the environmental impacts of the proposed Project. At Shikarpur, a new bypass is proposed to avoid traffic congestion because of internal city route.
- **Economic Assessment**
19. The Economic Assessment describes economic benefits of the proposed Project. Economic Internal Rate of Return (EIRR) is also provided. EIRR comes out as 23.55%, which is above 12%, the assumed opportunity cost of capital in Pakistan.

- **Environmental Management Plan (EMP)**

20. The EMP provides an approach for managing and monitoring environment related issues and describes the institutional framework and resource allocation. An Environmental management and monitoring plan has accordingly been devised to monitor various activities during the construction and operational phases of the Project, considering all the sensitive issues during the execution. The EMP will be implemented by NHA with the assistance of consultants. NHA will depute Deputy Director Environment to deal with the environmental related issues. Total estimated environmental mitigation cost will be around Rs. 127.28 Million.

- **Public Consultation and Information Disclosure**

21. Consultants' EIA team identified the stakeholders of the proposed Project and discussed the Project with them during the detailed field visits. Their views and concerns were noted and have been incorporated in this Report. After reviewing their concerns, mitigation measures have been suggested for giving them the due compensation.

- **Conclusion**

22. The Project for upgrading of a single carriageway into a 4-lane dual carriageway will involve some negative environmental impacts, which are mostly related to pre construction and construction stages of the Project and are however manageable by properly implementing the EMP. No long-term and significant adverse environmental impacts are however envisaged for the operation stage of the Project. Hence, the Project is environmentally feasible provided that the mitigation measures are properly implemented during the Project execution.

SECTION 1 INTRODUCTION

1.1 General

23. National Highway Authority (NHA) plans to upgrade and widen the existing N-65 Road section between Sukkur and Jacobabad. To comply with Pakistan's environmental regulations as conceived in the Pakistan Environmental Protection Act (PEPA) 1997, NHA had entrusted NESPAK with the assignment of carrying out an Environmental Impact Assessment of the N-65 up-gradation and dualisation from Sukkur to Jacobabad.
24. This report presents the Environmental Impact Assessment (EIA) Study for the up-gradation and dualisation of the National Highway, Sukkur-Jacobabad Section (N-65). At present this road section is only a two lane single carriageway, with widths varying from 6 to 7.5 metres. The Project aims to widen the existing carriageway to a 4 lane dual carriageway (14.6 metre wide) with a median in the centre. Total formation width of the proposed dual carriageway will be 26.6 metres (for widening of existing road) and 24.6 metres for new alignment.
25. N-65 is a crucial road link between Sindh and Balochistan provinces. It starts from Sukkur and ends at Quetta, passing through Sibbi/ Bolan Pass. Traffic moving between Punjab and Balochistan provinces also passes through this highway. Figure 1.1 and 1.2 shows the National Highway Network and location plan of the Project Area.
26. The proposed Project will facilitate the general public using this section of N-65, which has a predominant agrarian economy. Main crops being cultivated are wheat and rice. Therefore, the road will provide an easy access to the farmers for the transportation of crops from fields to the markets and other parts of the country by reducing the time required for transportation.
27. Up-gradation of N-65 will provide a fast and safe travelling route connecting the provinces of Balochistan, Punjab and Sindh. After the completion of the Project, the economic and commercial activities of the Project area are expected to get a boost due to efficient transportation of various goods/trade materials.
28. During the EIA study, NESPAK EIA Team maintained close coordination with M/s Loya Associates (the Design Engineers of the Project) regarding any modification and their comments/suggestions were incorporated for assessing environmental issues.

1.2 Proponent of the Project

29. National Highway Authority (NHA) is the proponent of the proposed Project with the following address:

National Highway Authority
27 Mauve Area, G-9/1,

Islamabad
Ph: 051-9260565

1.3 Overview of the Project

30. The length of this section is about 68 Km including Shikarpur Bypass. This Project section consists of the following major components:
- Construction of a 4 lane dual carriageway from Sukkur to Jacobabad; and
 - Construction of a new Bypass route around Shikarpur.

1.4 Scope of Study

31. The scope of the EIA study was to check the possible impacts of the proposed Project on its immediate surroundings on both short and long term basis. Then based on the nature and levels of those impacts, mitigation measures were delineated by the Consultants and accordingly this EIA Report was prepared. After the approval of this report from the Provincial Environmental Protection Agency (EPA) Sindh, the Contractor will be bound to follow the recommendations of this report during the execution of engineering activities on site.
32. In order to investigate the environmental, geological and social features of the Project Area, Consultants carried out two detailed site visits for collecting primary and secondary data to identify and establish the Corridor of Impact (COI) and mitigations required to minimise the adverse impacts. They collected valuable data about structures, trees, water channels etc. coming in the Right of Way (RoW) of N-65.

1.5 Project Categorisation

33. Pakistan Environment Protection Agency (Review of IEE/EIA) Regulations 2000, Schedule II, lists down the projects requiring an EIA study as under:
- “The Projects in schedule-II are generally major Projects and have the potential to affect a large number of people. They also include Projects in environmentally sensitive areas. The impact of such Projects may be irreversible and could lead to significant changes in landuse and the social, physical and biological environment.”
34. Schedule-II describes the requirements of EIA for transportation Projects as under:
35. Federal or Provincial Highways or major roads greater than 50 Million Rupees in value. Maintenance (rebuilding or reconstruction of existing roads) is exempted from the requirement of an EIA.
36. As per EPA Guidelines, the present Project is classified as “Schedule II” that requires an EIA study and approval from the concerned authority, prior to the construction.

37. Asian Development Bank (ADB) process classifies the projects requiring an EIA in Category A (OM 20) as under:
38. “Projects with potential for significant adverse environmental impacts. An environmental impact assessment (EIA) is required to address significant impacts”.
39. The present Project requires an EIA as it involves significant environmental impacts, i.e. resettlement of people and structures, cutting of trees, change in land use etc.
40. This EIA Report has been prepared following the Rapid Environmental Assessment (REA) Checklist of ADB guidelines. This checklist is attached as Annexure II.

1.6 Standards and Guidelines

41. Environmental issues and control in Pakistan are governed by Pakistan Environmental Protection Act, 1997. Guidelines and procedures for preparing EIA reports have been published by EPA in the form of “Pakistan Environmental Assessment Package”.
42. Requirements of Government of Pakistan and Asian Development Bank (ADB) that are to be met before commencement of the Project are as follows:
 - The legal requirements in Pakistan for Environmental Assessment for new projects under the Environmental Protection Act 1997;
 - ADB Guidelines for Environmental Assessment;
 - Pakistan National Environmental Quality Standards (NEQS) for gaseous, liquid (water), vehicular emissions and noise; and
 - The need for an EIA as part of the Government of Pakistan PC-1 planning approval process for this Project.

1.7 Components of the Report

43. This EIA Report has been prepared following the Pakistan Environmental Protection Agency (EPA) Guidelines for environmental assessment and Asian Development Bank (ADB) Environmental Assessment Guidelines. Report format consists of the following components:

1. Section 1: Introduction

44. This section represents an introduction of the entire EIA report. It provides information about the Project location and its benefits to the public. It discusses the scope of study and overview of the Project. The section also discusses the Project categorisation as per EPA criteria.
45. Besides, it provides information about the standards and guidelines that have to be followed.

2. Section 2: Description of the Project

46. In this section salient features of the Project are presented. It provides information about the following:

- a) Overview of the existing road;
- b) Location of the Project;
- c) Project components including geometric design standards;
- d) Project Right of Way (RoW);
- e) Construction material;
- f) Schedule of construction;
- g) Construction camps; and
- h) Workforce and machinery requirements.

3. Section 3: Description of the Environment

47. It provides an overview of the present environment of the Project area/site. It discusses the following:

- a) Methodology of the study;
- b) Physical environment;
- c) Ecological resources; and
- d) Socio-economic environment.

4. Section 4: Alternatives

48. This section discusses the Project Alternatives and proposed bypass at Shikarpur.

5. Section 5: Environmental Impacts and Mitigation Measures

49. This section provides the information on the anticipated environmental impacts and mitigation measures. It discusses the following:

- a) Project corridor;
- b) Pre construction/design phase;
- c) Construction phase; and
- d) Operation phase.

6. Section 6: Economic Assessment

50. This section describes both tangible and intangible benefits of the proposed Project. It consists of detailed economic analysis of the Project.

7. Section 7: Environmental Management Plan

51. This section describes the measures suggested for executing the Environmental Management Plan (EMP) at the Project site. It elaborates the following in detail:

- a) Objectives of EMP;
- b) Key Environmental and social components;

- c) Role of functionaries;
- d) Specific implementation responsibilities;
- e) Environmental monitoring;
- f) Environmental management plan;
- g) Environmental mitigation cost;
- h) Environmental technical assistance and training plan; and
- i) Environmental monitoring, mitigation and training costs.

8. Section 8: Public Consultation and Information Disclosure

52. This section consists of the information based on public consultation and information disclosure to them about the Project. It comprises of the following:

- a) Identification of main stakeholder;
- b) Scoping sessions;
- c) Stakeholders' concerns;
- d) Proposed measures for incorporating the stakeholders' concerns;
- e) Village meetings; and
- f) Future information disclosure plan.

9. Section 9: Conclusions

53. This section presents the conclusion of the whole study. It explains the following in detail:

- a) Feasibility of the Project;
- b) Identification of the main issues and concerns;
- c) Mitigation measures proposed;
- d) Benefits of the Project; and
- e) Surveillance and Maintenance of the Road after Construction.

SECTION 2 DESCRIPTION OF THE PROJECT

2.1 General

54. Sukkur to Jacobabad Section of N-65 is a very important Road Section as it passes through three districts i.e. Sukkur, Shikarpur and Jacobabad of Sindh Province and links the province of Sindh with Punjab and Balochistan.
55. Sindh Development Statistics Report was consulted for forecasting populations of the above three districts in 2006. It was found that the same population figures quoted in this Report are the same as quoted in District Census Reports of the three districts. Population of Sukkur, Shikarpur and Jacobabad Districts is approximately 1,210,089, 1,097,816 and 1,722,801 people respectively (calculated by Geometric Growth Method).
56. Major settlements along the road are Shikarpur City and a number of villages, i.e. Soomar, Sheikh Suleman, Lakhi, Jahaan Khan etc.
57. Prime objectives of the proposed Project are as follows:
- Facilitate the general public, particularly the people of Sukkur, Shikarpur, Jacobabad and the surrounding areas;
 - Increase the access of the rural and urban population to social services and markets, leading to improved quality of travel/livelihood;
 - Enhance the efficiency of road network;
 - Reduce the number of accidents; and
 - Improve inter-provincial trade among Sindh, Punjab and Balochistan.
- 5.8 The existing 2 lane road is insufficient for the inter-provincial transport needs of present population of the Project Area. To meet the requirements of increasing traffic volume, NHA planned to upgrade the existing road into 4 lane dual carriageway. Length of the road section from Sukkur to Jacobabad is 68 Km, including a proposed Bypass at Shikarpur.
59. Traffic projection data is given in Table 2.1.

Table 2.1

Annual Traffic Projections

A: Sukkur to Shikarpur Section

YEAR	MOTOR CYCLE/ RICKSHAW	CARS/ JEEP	WAGON/ PICKUP	BUS	TRUCKS 2-AXLE	3-AXLES			TRAILER 4-AXLES	TRAILER 5-AXLES	TRAILER 6-AXLES	Total Daily Traffic Volume
						TRUCKS	TRAILER	TOTAL				
2005 TRAFFIC COUNT	566	1306	1015	576	1131	494	2722	767	272	189	48	5870
GROWTH RATE	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	0.54
2006	600	1384	1076	610	1199	524	289	813	288	200	51	6221
2007 CONSTRUCTION PERIOD	636	1467	1141	647	1271	555	306	861	306	212	54	6595
2008 CONSTRUCTION PERIOD	674	1555	1209	686	1347	589	324	1841	324	225	57	7918
2009 BASE YEAR	714	1649	1282	727	1428	6249	344	968	343	238	60	7409
2010	757	1747	1359	771	1514	661	364	1026	364	253	64	7855
2011	803	1852	1440	817	1605	701	386	1087	386	268	68	8326

Source: Loya Associates, Karachi

B: Shikarpur to Jacobabad Section

YEAR	MOTOR CYCLE/ RICKSHAW	CARS/ JEEP	WAGON/ PICKUP	BUS	TRUCKS 2-AXLE	3-AXLES			TRAILER 4-AXLES	TRAILER 5-AXLES	TRAILER 6-AXLES	Total Daily Traffic Volume
						TRUCKS	TRAILER	TOTAL				
2005 TRAFFIC COUNT	507	733	782	226	1224	768	12	780	40	8	5	4305
GROWTH RATE	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	0.54
2006	537	777	829	240	1297	814	13	827	43	8	5	4563
2007 CONSTRUCTION PERIOD	569	824	879	254	1375	862	14	876	45	8	6	4836
2008 CONSTRUCTION PERIOD	603	873	931	270	1458	914	14	1841	48	9	6	6039
2009 BASE YEAR	640	925	987	286	1545	969	15	984	51	10	6	5434
2010	678	981	1047	303	1638	1028	16	1044	54	10	7	5762
2011	719	1040	1109	321	1736	1089	17	1106	57	11	7	6106

Source: Loya Associates, Karachi

60. Traffic projections for the Project Section are based on an annual vehicle growth rate of 6%. Table 2.1 presents the annual traffic projections based on a detailed traffic survey (carried out by Loya Associates, Karachi). According to the survey, types of vehicles using the Project Section are motor cycles, rickshaws, cars, jeeps, wagons, pickups, buses, trucks and trailers. Currently, on an average, 6,221 vehicles pass through Sukkur-Shikarpur Section and 4,563 vehicles pass through Shikarpur-Jacobabad Section everyday. It is estimated that by the year 2011, there will be approximately 8,326 vehicles passing through Sukkur-Shikarpur Section and 6,106 vehicles passing through Shikarpur-Jacobabad Section everyday. Therefore it is imperative to improve Sukkur-Jacobabad Section so that the safety of the travellers can be ensured.

2.2 Overview of the Existing Road

61. There is already a 2 lane existing road with a paved width varying from 6 metres to 7.5 metres at various locations, and roughness of about 10 IRI. Earthen shoulders of varying widths (1 to 3 metres) have been provided on both sides of the road. Right of way (RoW) of the road is 110 ft /33.53 metres (55 ft. /16.76 metres on each side from the centre of road). The overall condition of the road is good, however wear and tear is considerable due to heavy traffic passing through the road and repair/ patch work has been done in some portions. Due to the increasing traffic volume and absence of any physical median between the road, accidents are common, which result in a number of casualties.

2.3 Location of the Project

62. The proposed Project falls under the administrative jurisdiction of Sukkur, Shikarpur and Jacobabad Districts. Project Section starts from the point near Sukkur, where Sukkur bypass terminates at N-65 (N:1116711.016, E:2232730.381). The Section ends at Jacobabad, at the start of Jacobabad Bypass (N:1174213.870, E:2200747.000) as shown in Fig. 1.2. The Proposed Project Site is located at south-western side of Sukkur and on the north-eastern side of Jacobabad.
63. It runs along the existing Railway Line on its left side up to Shikarpur and then it crosses over to right side of the Railway Line. Nearly 70% of this Road Section is located in Shikarpur District, 20% in Jacobabad and 10% in Sukkur District.
64. The Project Area is located at an elevation of 70 to 75 meters above mean sea level and is entirely flat and level plain without any mountains or hills. The land gradually slopes from the northeast to southwest. The project area lies between 27°-05' to 28°-10' north latitude and from 68°-16' to 69°-43' east longitude.

2.4 Project Components

65. The various Project components include widening of the existing road from Sukkur to Jacobabad and construction of a new Bypass around Shikarpur City. After the completion of this Project, existing two lane road will be replaced by a 26.6 metre wide four lane dual carriageway. Same cross section will be provided throughout the length of the section. Figures 2.1 (a),(b),(c), (d) and (e) show the proposed cross-sections.

66. The Geometric Design features of the proposed N-65 Section are presented in Table 2.2.

Table 2.2
Geometric Design Features

S. No.	Parameters	Units	Plain Terrain	Hilly Terrain
1	Design speed	KPH	100	60
2	Min. Radius	M	437	123
3	Rate of Super elevation (Max.)	%	6	8
4	Pavement cross slope	%	2	2
5	Shoulder cross slope	%	4	4
6	Formation width (on each side)	Metre	13.3	13.3
7	Pavement width (on each side)	Metre	7.3	7.3
8	Median (on each side)	Metre	1.5	1.5
9	i) Shoulder width (in open fill area)	Metre	3.0 (Outer)	2.0 (Outer)
	ii) Shoulder width (in rocky area)	Metre	1.2 (Inner)	1.0 (Inner)
10	Min. stopping sight distance	Metre	185	85
11	Min. passing sight distance	Metre	670	410
12	Rate of vertical curvature	Metre		
i)	K-Value for crest curves:	Metre		
ii)	Stopping sight distance	Metre	52	11
iii)	Passing sight distance	Metre	520	195
13	K-Value for sag curve	M%A	45	18
14	Min. value of vertical curve	Metre	60	36
15	Fill slopes	Horizontal:Vertical	2:1	
16	Cut slopes	Horizontal:Vertical	1:2	
17	Max. grade	%	2.5	6
18	Min. grade	%	0.3% or flatter, if the conditions permit so. Special consideration to be given for drainage.	
19	Right of Way (RoW)	Metre	34 (urban) 67 (rural)	20
20	Culverts	No.	80	
21	Bridges	No.	3	
22	Design life of road	Years	10	

Source: Loya Associates

67. Design of Road Section shall be carried out on the basis of latest traffic counts, fresh soil investigations and data of existing pavement. Pavement design shall be updated according to AASHTO Guide for the Design of Pavement (AASHTO 1993) with appropriate load factors. The final pavement design shall be cross-checked through mechanistic design method. The pavement design will be based on Project traffic keeping overload factors in view. Pavement shall be designed for a life of 10 years with an overlay for another 5 years.

2.4.1 Proposed Bypass at Shikarpur

- 68 Shikarpur Bypass starts at Km 26+100 of N-65 from start point of Project Road (at Sukkur) and ends at Km 379+000 of N-55 (point where Kashmore bypass

intersects N-55), while traversing through Kashmore bypass. Total length of the proposed bypass is about 4.9 Km.

69. 48.1 Acres of privately owned additional land (agricultural) will have to be acquired for the construction of Shikarpur Bypass.

2.5 Project Right of Way

70. The existing Right of Way (RoW) of the highway is 110 ft. (34 metres) for the Urban Areas and is 220 ft. (67 metres) for the Rural Areas, as per 'Land Acquisition Report' of the same Project. The centreline of improved road coincides with the existing road. RoW of the proposed road will be the same. Major construction work will generally remain confined within the RoW.

2.6 Construction Materials

71. The materials used in construction and up-gradation of the highway include coarse aggregates (crush), fine aggregates (sand), soil, water, asphalt, reinforcement, cement etc. Almost all these raw materials are locally available in the country. Aggregate waste material of existing road will be reused in up gradation of road.

(i) Crushed Aggregate

72. A well developed source of crushed aggregate is available at Arore, near Rohri. Several crushers of medium sizes are exploiting these resources. Well known crusher companies are Atta Muhammad Crusher (Arore) and Fauji Crusher (Ubhan Shah). The quantities available are extensively large, however mining leases have already been obtained by various parties.

(ii) Fine Aggregate (sand)

73. Few sources of limited quantity are available in Ubhan Shah, however extensive screening will be required. Good quality sand is available from Bolari, near Haiderabad and it is the main source of sand supplied throughout Sindh province.

(iii) Sub-grade Material

74. Large quantity of sub-grade (soil) is abundantly available at various locations near the Project site. Borrow pits of suitable material at a reasonable reach will be selected.

(iv) Embankment Material

75. The embankment material can be borrowed in huge quantities from Ubhan Shah, near Kot Diji and Arore, near Rohri. In most cases, the contractors will lease private land in the vicinity on short term basis for the purpose of acquiring earth material, after the approval of NHA designated engineer.

(v) Water

76. Groundwater is available throughout the alignment in large quantities. Intensive pumping is done at Sukkur Bypass, Deha, Jahaan Khan, Lakhi, proposed Shikarpur bypass, Kashmore bypass, Sultan Kot, Hamayoun and near Jacobabad bypass etc. The depth of watertable is generally from 5 metres to 20 metres. The water available near the surface water bodies is of good quality and potable in nature, which is suitable for all construction and drinking requirements. In addition to the groundwater resource, surface water is also available from Sindh Wah and Begari Wah.

(vi) Asphalt, Reinforcement and Cement

77. Asphalt, reinforcement and cement will be transported from National Refinery Karachi, Steel Mill Karachi and cement factories from Karachi respectively.

2.7 Engineer's Cost Estimate

78. Table 2.3 presents the cost estimates for carrying out the proposed engineering works:

**Table 2.3
Summary of the Engineer's Cost Estimates**

S. No.	Cost Description	Amount (Rs.)
1	Earth Works & Allied Activities	64,735,980
2	Sub-Base and Base Courses	1,354,346,980
3	Surface Courses and Pavement	415,900,840
4	Structures:	
	Culverts	56,300,576
	Bridge Substructure	27,132,319
	Bridge Superstructure	32,162,177
5	Drainage and Protection Works	151,036,672
6	Ancillary Works	107,289,046
7	General Items	27,465,000
Total:		2,236,369,590

Source: Loya Associates, Karachi

2.8 Construction Schedule

79. The implementation of the Project is expected to commence in January 2007 and the estimated completion date will be at the end of December 2008. At present, the Project is at the engineering design stage.

2.9 Construction Camps

80. Camp sites will be selected keeping in view the availability of an adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate

distance from sensitive areas in the vicinity. Final locations will be selected by the contractor after the approval from NHA.

81. The area requirement for construction camps will depend upon the workforce deployed and the type and quantity of machinery mobilized. In view of the area required, it will not be possible to locate camp sites within the ROW and the contractors will have to acquire land on lease from private landowners.

2.10 Workforce and Machinery Requirements

82. Table 2.4 gives the typical workforce requirement for N-65 (Sukkur-Jacobabad) Section for managerial staff, engineers and labourers.
83. 85 labourers will be required during construction of the Road, out of which 30 will be skilled, 15 will be semi-skilled and 40 will be unskilled labourers.

Table 2.4

Workforce Requirement for Construction and up-gradation of N-65 Sukkur -Jacobabad Section

No.	Contractors Staff	Workforce Required
A. Managerial Staff		
1	Project Manager	1
2	Deputy Project Manager	1
3	Office Manager	1
4	Accountant	1
5	Purchaser	2
6	Quantity Surveyor	2
7	Computer Operator	2
B. Site Staff		
1	Material Engineer	1
2	Site Engineer	3
3	Surveyor	4
4	Foreman	4
5	Skilled Labourer	30
6	Semi-skilled Labourer	15
7	Labourer	40
	Total	107

Source: Loya Associates, Karachi

84. Table 2.5 gives the number of different types of machinery likely to be deployed on site. However, any other machinery/equipment can be used according to requirement.

Table 2.5

Estimated Machinery Requirements for N-65 Sukkur - Jacobabad Section

S. No.	Machinery	Nos. Required
1	Dump trucks	12
2	Graders	3
3	Dozers (D-8)	2
4	Vibratory rollers	6

S. No.	Machinery	Nos. Required
5	Water boozers	6
6	Loaders	2
7	Asphalt plant	1
8	Asphalt distributor	1
9	Crushing plant	1
10	Air compressors	1
11	Broomers	2
12	Asphalt Paver	1
13	PTR	4
14	Static steel tyred rollers	2
15	Sheep foot rollers	2
15	Generators (10 KV)	2
16	Concrete batching plant	1
17	Vibrators	6
18	Concrete transit mixers	3
19	Rig (and accessories)	1
20	Tri pod	1
21	Welding plants	2
22	Concrete Bucket & Funnel	1 (each)
23	P.C Girder launcher	1
24	Form work	2 sets
25	Scaffolding pipe	9000 m

Source: Loya Associates, Karachi

SECTION 3 DESCRIPTION OF THE ENVIRONMENT

3.0 General

85. The existing environment around the proposed Project Area has been studied with respect to physical, ecological, cultural and socio-economic aspects.
86. The direct "Corridor of Impact" (Col) due to construction of the Highway is 110 ft. (34 metres), which is within Right of Way (RoW) of the proposed road. However effect of the loads generating from the moving traffic can be felt beyond the design RoW. Therefore indirect Col is beyond the proposed RoW.
87. Human impacts such as road safety, traffic noise, vehicular emissions and other types of associated pollution are already present along the highway. These factors are therefore discussed as part of the existing environmental conditions in the Project Area. This will allow the determination of baseline conditions against which the incremental impact of the proposed Project can be assessed.

3.1 Methodology

88. The existing information to establish a baseline of the proposed Project Area was collected from different Government Departments/Public Sector agencies. Further, detailed field visits to the site were also carried out in order to have a first hand information about the social and environmental conditions/issues of the Project Area.
89. Potential impacts of the proposed Project were ranked on the basis of their magnitude, severity and reversibility.
90. In order to assess the impacts of the proposed Project on the people living in the vicinity of the Project Area, detailed survey was conducted and existing environmental/socio-economic conditions and salient features of the area were duly observed. In addition, the relevant secondary data were also obtained from the District Census Reports for Sukkur, Shikarpur and Jacobabad. During the detailed site visit, relevant government agencies/ departments (Annexure III) were also consulted for the relevant data. To establish baseline ambient air, noise and surface and groundwater conditions of the area; air and water samples for laboratory analysis were collected from locations in all three districts, whereas noise levels were measured at various locations.
91. Locations for conducting air and water sampling, and conducting noise measurements were selected according to their likeliness to be affected from the proposed Project. These locations were distributed equally in all three districts. Locations like schools, hospitals etc. were given priority due to their sensitivity.
92. Global Environmental Laboratory (GEL) was selected for carrying out the environmental monitoring of this NHA Project.

3.2 Physical Environment

3.2.1 Meteorology and Climate

93. The Project Area falls in an arid Subtropical Climate zone, characterised by hot summers and mild winters. From April onwards, the summer season continuous usually up to the middle of October after which it becomes cool and the day temperature also begins to recede. May, June and July are the hottest months. The months of August and September are stuffy and suffocating due to higher humidity levels. The winter months are December, January and February.
94. The temperature remains high during the months of June, July and August and sometimes reaches upto 50°C.
95. Table 3.1 shows the temperature, precipitation and relative humidity recorded at Sukkur for the period of 30 years.

Table 3.1
Month-Wise 30 Year Mean Maximum and Minimum Temperature, Precipitation and Humidity Data (Sukkur and Shikarpur)

Month	Mean Temperature (°C)		Precipitation (Millimetres)	Relative Humidity (%)
	Maximum	Minimum		
January	22.88	8.36	3.47	53.24
February	25.32	10.92	8.03	48.24
March	31.17	16.42	5.68	43.05
April	37.60	22.04	1.54	35.41
May	42.43	26.22	3.96	34.37
June	43.59	28.35	4.35	44.10
July	40.82	27.92	25.62	54.82
August	38.65	26.75	19.78	59.55
September	37.97	24.93	9.98	55.91
October	35.33	20.33	1.27	46.84
November	29.89	14.38	0.59	57.73
December	24.01	9.59	3.79	62.06
Annual (Average)	34.13	19.68	88.11	48.41

Source: Data Processing Centre, Pakistan (District Census Reports – Sukkur and Shikarpur)

96. Above data represent the temperature, precipitation and relative humidity for both Sukkur and Shikarpur as they are very closely located cities. The mean maximum and minimum temperatures in June (the hottest month) are 43.59 and 28.35 °C respectively and in January the coldest month, 22.88 °C and 8.36 °C respectively as per records for the 30 year period (1961-1990).
97. The Project Area has very few rainfalls. The average annual rainfall for the 5 years from 1995 to 1999 is about 111 mm per annum as per records of metrological station at Sukkur. The rainfall was highest during 1997 as 188.8 mm and lowest during 1996 as 22.4 mm, as indicated in Table 3.2.

Table 3.2
Five Year Meteorological Data of Sukkur/Rohri Station

Year	Temperature (°C) during various years		Average Rainfall (mm)	Humidity (%)	
	Minimum	Maximum		0800 hrs.	1700 hrs.
1995	9.3	45.1	175.9	65	35
1996	7.5	42.5	22.4	63	32
1997	7.5	41.5	188.8	69	37
1998	6.8	41.9	54.1	66	38
1999	8.7	43.5	116.7	65	32

Source: Development Statistics of Sindh 1999

98. The wind direction in summer is towards south and southwest; whereas in winter it is towards north and northeast. The dust storms and hot winds blow continuously during the months of March and May.
99. Jacobabad is famous for its very hot weather. It's the second hottest city of the country after Sibi. The temperature is unusually high in the months of June, July and August. The mean maximum and minimum temperatures during summer in the month of June are about 45 °C and 30 °C respectively. The data is based on the temperatures taken for 30 year period (1961-1990). However, at present maximum temperature crosses 50 °C during summer. Maximum and minimum temperatures during winter are about 23 °C and 8 °C respectively for 30 year period (1961-1990).

Table 3.3
Month-Wise 30 Year Mean Maximum and Minimum Temperature, Precipitation and Humidity Data (Jacobabad)

Month	Mean Temperature (°C)		Precipitation (Millimetres)	Relative Humidity (%)
	Maximum	Minimum		
January	22.60	7.68	3.10	50.88
February	25.24	10.48	7.03	48.23
March	31.28	16.30	10.32	42.76
April	38.00	22.33	1.93	33.01
May	43.08	26.74	1.74	30.93
June	44.33	29.38	4.70	41.16
July	40.56	29.22	36.79	56.18
August	38.24	28.25	26.31	62.20
September	37.00	25.85	11.21	59.38
October	35.32	20.29	2.31	48.87
November	30.06	14.08	1.14	45.75
December	24.11	8.74	3.69	52.73
Annual (Average)	34.15	19.95	110.40	47.70

Source: Data Processing Centre, Pakistan (District Census Report – Jacobabad)

3.2.2 Air Quality

100. The major air quality issue in the Project Area is suspended particulate matter (SPM) due to heavy dust. A lot of dust occurs due to dry atmosphere and the situation gets aggravated by the human activity. Large amount of SPM is generated when the vehicles move (to overtake other vehicles) on unpaved shoulders. After the construction of the Project, SPM will be reduced due to paved shoulders. Trucks, buses and other passenger vehicles passing on the existing N-65 Highway are normally poorly maintained. Unburnt fuel also adds to the air pollution.
101. For establishing baseline ambient air quality conditions, three monitoring sites were selected and ambient air samples were collected from:
1. Petrol Pump at the start of Project Area near Sukkur (Chainage: 0+300);
 2. Taluka Hospital, Lakhi Town (Chainage: 17+550); and
 3. Petrol Pump near the end of Project Area close to Jacobabad City (Chainage: 68+075).
102. Sampling locations were selected in areas with extensive settlements and at sensitive locations. Sampling was conducted for 24 hour period. Samples were taken at downwind side and from 5 – 10 metres from the edge of the road. During sampling, average temperatures were 36, 35 and 37 °C respectively. Sampling locations and laboratory reports are provided in Annexure IV. Results of laboratory analysis of ambient air quality parameters are given in Table 3.4.

Table 3.4
Analysis of Ambient Air Quality

S. No.	Sukkur					Lakhi, Shikarpur					Jacobabad				
	Time	CO	SO ₂	NO ₂	PM ₁₀	Time	CO	SO ₂	NO ₂	PM ₁₀	Time	CO	SO ₂	NO ₂	PM ₁₀
	Hour	ppm	µg/m ³	µg/m ³	µg/m ³	Hour	ppm	µg/m ³	µg/m ³	µg/m ³	Hour	ppm	µg/m ³	µg/m ³	µg/m ³
1	06:00	1	2.4	4.8	68.5	08:00	1	6.1	8.2	145.3	09:00	2	5.1	8.9	141.2
2	07:00	1	3.2	5.7	92.3	09:00	1	7.6	10.1	150.1	10:00	1	5.6	9.4	136.9
3	08:00	3	8.4	9.6	109.4	10:00	2	9.8	15.2	175.2	11:00	0	5.9	9.8	130.7
4	09:00	2	9.6	17.1	191.2	11:00	3	7.2	9.8	150.4	12:00	1	6.5	10.4	135.6
5	10:00	1	10.8	14.9	182.8	12:00	3	6.9	9.4	144.3	13:00	1	6.2	10.1	134.9
6	11:00	2	16.8	26.5	267.4	13:00	2	6.5	9.1	148.1	14:00	1	6.8	10.8	138.1
7	12:00	1	14.2	21.4	211.2	14:00	3	7.0	10.2	155.6	15:00	2	5.4	9.2	128.9
8	13:00	1	11.1	15.0	199.7	15:00	1	5.8	8.7	148.7	16:00	0	5.0	8.1	121.3
9	14:00	0	9.4	13.8	172.4	16:00	2	6.1	9.0	147.2	17:00	0	4.8	7.8	118.6
10	15:00	0	10.4	15.2	201.3	17:00	1	7.6	12.4	168.5	18:00	1	5.3	8.4	128.7
11	16:00	1	12.5	17.3	231.0	18:00	1	5.6	7.9	144.4	19:00	1	5.8	8.7	136.8
12	17:00	1	13.9	19.2	241.1	19:00	2	6.9	9.8	143.8	20:00	2	6.7	9.5	140.2
13	18:00	3	17.1	27.1	275.9	20:00	2	5.1	8.2	140.6	21:00	2	6.2	9.1	139.1
14	19:00	2	12.7	16.8	229.4	21:00	1	4.4	6.8	142.4	22:00	2	6.0	8.9	138.2
15	20:00	0	11.3	15.4	204.3	22:00	0	4.7	7.3	141.6	23:00	1	5.5	8.3	135.7
16	21:00	0	8.1	11.4	157.4	23:00	1	4.3	6.7	124.4	00:00	1	3.4	5.7	129.1
17	22:00	1	6.2	6.7	130.2	00:00	0	4.1	6.5	108.6	01:00	0	2.5	3.4	115.8
18	23:00	0	5.8	4.6	54.1	01:00	0	BDL	BDL	98.6	02:00	0	BDL	BDL	90.2
19	00:00	0	3.1	3.3	70.8	02:00	1	BDL	BDL	75.4	03:00	0	BDL	BDL	81.1
20	01:00	0	2.4	3.2	65.3	03:00	0	2.1	3.1	81.6	04:00	0	BDL	BDL	60.4
21	02:00	0	BDL	BDL	56.1	04:00	2	2.4	3.4	96.8	05:00	1	2.3	3.1	105.1
22	03:00	0	BDL	BDL	63.6	05:00	1	4.2	4.1	116.7	06:00	2	2.8	3.6	125.1
23	04:00	0	BDL	BDL	57.6	06:00	3	4.6	5.8	140.6	07:00	1	3.1	5.2	126.4
24	05:00	0	2.2	3.4	62.5	07:00	3	5.8	6.1	156.7	08:00	2	4.2	5.3	135.4
24 Hour Average		0.83	7.98	11.35	149.81		1.50	5.21	7.40	135.23		1	4.37	6.82	123.9
USEPA (NAAQS) for 1 hour average		35	180	70	150*		35	180	70	150*		35	180	70	150*

BDL= Below Detection Limit; USEPA (NAAQS)= United States Environmental Protection Agency (National Ambient Air Quality Standards)

* 24 hour average (Tests Performed and Reported by: Global Environmental Laboratory)

103. As ambient air quality standards have not yet been developed in Pakistan, therefore for comparison, USEPA standards are referred.
104. One hour average value of CO for Sukkur, Jacobabad and Shikarpur ranges from 1 to 3 ppm and peak hourly value from 2 to 3 ppm, which is well within the permissible limit. One hour average value of SO₂ for Sukkur, Jacobabad and Shikarpur ranges from 4.3 to 8 µg/m³ and peak hourly ranges from 6.8 to 17.1 µg/m³. These values are within the permissible limit. Table 3.3 shows that NO₂ values are also within the standard values at Sukkur, Jacobabad and Shikarpur.
105. One hour average value of NO₂ for Sukkur, Jacobabad and Shikarpur ranges from 6.8 to 11.4 µg/m³ which shows that NO₂ values are within the permissible limit value and peak hourly ranges from 10.8 to 26.5 µg/m³. One hour average value of PM₁₀ for these cities are 149.81, 135.23 and 123.9 µg/m³ respectively. All of these values are within limit.
106. It is clear from the analysis of ambient air quality that in the morning and evening the pollution level is higher as compared to afternoon and late night. The reason behind this is that during hot weather people do not prefer to travel during the afternoon hours. In the late night, people avoid travelling due to safety concerns.
107. Due to the increase in the traffic with the passage of time, it is estimated that average values of CO, SO₂, NO₂ and PM₁₀ will also increase. As annual traffic is expected to increase by 34% by the year 2011, values of these parameters will also increase in the same ratio.

3.2.3 Noise

108. Noise along the existing N-65 Highway from Sukkur to Jacobabad Section is not a serious issue. Roadside noise levels were measured at a distance of about 6 metres from the edge of the highway (about 7.5 m from the source). Average noise level along the road is between 58 – 73 dB(A), whereas peak noise level is between 74 – 84.5 dB(A). Table 3.5 presents the peak and average noise levels recorded at different locations. Average values for the section are all well within the NEQS i.e. 85 dB(A). However average noise levels are slightly higher than the WHO Guideline values. Also noise levels near Govt. High School, Jahanabad and Agriculture College, Sukkur were marginally below the NEQS limit of 85 dB(A). NEQS do not prescribe a noise level limit for the receptors. However, these values may reach excessive levels in areas where new construction will be initiated and also during operation when traffic levels reach operating design volumes.

Table 3.5
Average Noise Levels at Various Locations

S. No.	Source/Location	Noise Level dB(A)		NEQS dB(A)	WHO dB (A)
		Peak	Average		
1	Govt. High School Jahanabad			85 (7.5 m from the source)	70 (for Industrial, Commercial, shopping and traffic areas)
1.1	Near Main Gate	84.5	72.3		
1.2	Class Room	78.4	66.6		
2	Tehsil Hospital, Lakhi Town			85 (7.5 m from the source)	70 (for Industrial, Commercial, shopping and traffic areas)
2.1	Near Main Gate	79.1	58.4		
2.2	Ward	69.9	53.2		
3	Agriculture College, Sukkur				
3.1	Near Main Gate	83.8	70.4		
3.2	Inside Building	68.4	62.6		
4	Govt. Primary School, Abad				
4.1	Near Main Gate	74.6	65.9		
4.2	Class Room	68.8	58.3		

(Tests Performed and Reported by: Global Environmental Laboratory)

3.2.4 Surface Water and Groundwater

109. The Indus River and its associated canals and water courses form the largest irrigation system in the world. However, the Project road passes at a distance of about 10 Km at right side of the Indus River. The highway crosses many water bodies, i.e. Sindh Wah (non-perennial canal), Baigari Wah (non-perennial canal) and number of distributaries and water courses.
110. All three districts are irrigated by the canals coming from the Guddu Barrage system. The land is also irrigated by tubewells. Excessive irrigation and seepage from canals has caused waterlogging and salinity problems in the Project Area.
111. In order to evaluate the water quality, surface water samples were collected from three water bodies, i.e. Sindh Wah (canal), Begari Wah (canal) and Sukkur Barrage. Groundwater samples were also collected from three locations at Sukkur, Shikarpur and Jacobabad. Table 3.6 and Table 3.7 show the Surface water and groundwater analyses respectively.

Table 3.6
Surface Water Analysis

S. No.	Parameter	Unit	Location of Sampling		
			Sindh Wah	Begari Canal	Rice Canal (near Sukkur Barrage)
1	pH	No unit	8.2	7.7	7.9
2	Dissolved Oxygen (DO)	ppm	6.5	6.83	7.32
3	Alkalinity	mg/l	52.0	68.0	88.0
4	TSS	mg/l	821.0	827.0	844.0
5	Turbidity	NTU	598.0	715.0	721.0

(Tests Performed and Reported by: Global Environmental Laboratory)

112. Large aquifer sources of groundwater underline the Indus basin. They form an important source of water supply throughout the Project Area with the use of tube wells, motorised pumps and hand pumps. Groundwater in the Indus Basin is, however, of variable quality and tends to be non-saline only near the surface water bodies. Water is generally saline. Aquifers are recharged by means of seepage during flood season. The depth of groundwater table varies from 3 metres to 20 metres along the route.

Table 3.7
Groundwater Analysis

S. No.	Parameter	Unit	Location of Sampling			WHO Guidelines
			Near Begari Canal (Distt. Sukkur)	Shah Faisal Filling Station (Distt. Jacobabad)	Hand Pump (Meharki Boring-Distt. Shikarpur)	
1	pH	No unit	8.3	7.5	7.6	6.5~8.5
2	Dissolved Oxygen (DO)	Ppm	3.59	3.43	3.93	
3	Arsenic	mg/l	0	0	0	0.01
4	Chlorides	mg/l	168.0	730.0	28.0	250.0
5	Total Hardness	mg/l	97.0	239.0	109.0	500.0
6	Nirate	mg/l	1.7	2.3	2.0	50.0
7	Sodium	mg/l	28.6	106.0	80.1	200.0
8	TDS	mg/l	352.0	1286.0	490.0	1,000.0
9	Turbidity	NTU	0.17	0.19	0.81	5.0
10	E-Coli	cfu/100ml	0	0	0	0

(Tests Performed and Reported by: Global Environmental Laboratory)

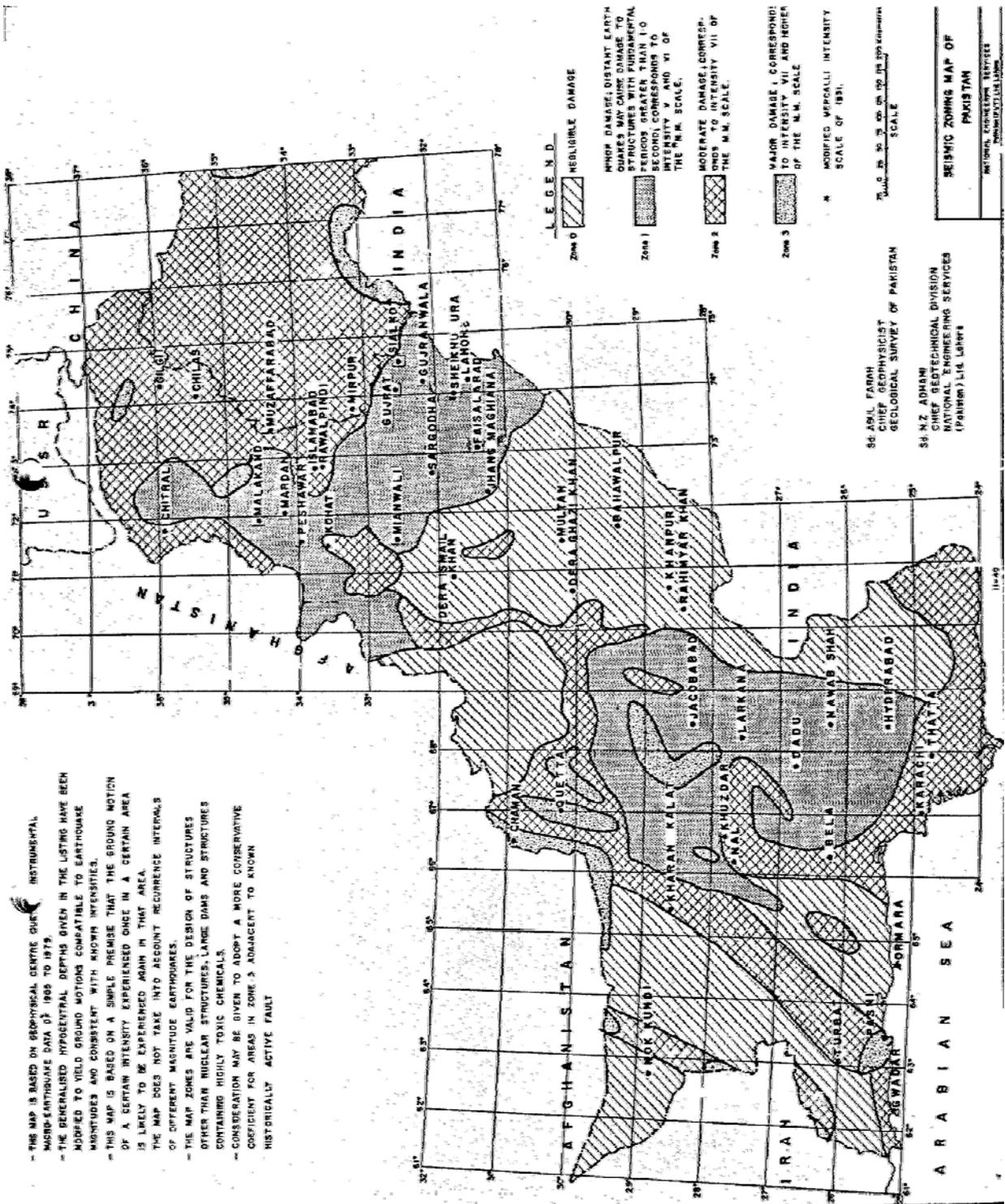
3.2.5 Topography and Geology

113. Topography of the Project Area is predominantly flat with mild slope towards the south. The soil in the Project Area is rich alluvial loam. The soil falls in arenaceous zone and is termed as recent alluvium deposit. The land consists of stretches of levelled or nearly levelled alluvial plains, scalloped inter fluves formed by deposits of the Indus River.

114. The soil contains varying proportions of clay and sand. The predominant composition is sandy loam though beds of clay, clay loam and sand are frequently met with. New deposition is almost pure sand, which becomes stable through continuous deposition of silt and then becomes able to sustain agriculture and trees.

3.2.6 Siesmicity

115. According to the seismic zone map of Pakistan, the Project Area lies in Zone 1 of Modified Mercalli (M.M.) intensity scale, i.e. minor damage, distant earthquakes may cause damage to structures with fundamental period greater than 1.0 second, corresponds to intensity V and VI the M.M. scale as given in Fig. 3.1.



- THIS MAP IS BASED ON SEISMOLOGICAL DATA FROM INSTRUMENTAL MACRO-EARTHQUAKE DATA OF 1905 TO 1975.

- THE GENERALISED HYPOCENTRAL DEPTHS GIVEN IN THE LISTING HAVE BEEN MODIFIED TO YIELD GROUND MOTIONS COMPATIBLE TO EARTHQUAKE MAGNITUDES AND CONSISTENT WITH KNOWN INTENSITIES.

- THIS MAP IS BASED ON A SIMPLE PREMISE THAT THE GROUND MOTION OF A CERTAIN INTENSITY EXPERIENCED ONCE IN A CERTAIN AREA IS LIKELY TO BE EXPERIENCED AGAIN IN THAT AREA.

- THE MAP DOES NOT TAKE INTO ACCOUNT RECURRENCE INTERVALS OF DIFFERENT MAGNITUDE EARTHQUAKES.

- THE MAP ZONES ARE VALID FOR THE DESIGN OF STRUCTURES OTHER THAN NUCLEAR STRUCTURES, LARGE DAMS AND STRUCTURES CONTAINING HIGHLY TOXIC CHEMICALS.

- CONSIDERATION MAY BE GIVEN TO ADOPT A MORE CONSERVATIVE COEFFICIENT FOR AREAS IN ZONE 3 ADJACENT TO KNOWN HISTORICALLY ACTIVE FAULT

Fig. 3.1: M.M Scale

3.2.7 Agriculture and Crop Pattern

116. Agriculture in the vicinity of N-65 is predominantly irrigated agriculture. The Project Area depends on non-perennial canals from Guddu Barrage. The shortage of water is generally experienced in winter and it greatly hampers Kharif cultivation.
117. The Project Area is mainly rice growing area. The main crop during Kharif is rice and Wheat during Rabi season. Table 3.8 represents the major crops and respective Tehsils of the Project Area. Cotton is also grown but there is a lot of variation in production. Peas are also grown in small quantities. Major Rabi season crop is wheat. Besides, Barley and Gram are also cultivated in small quantities, as shown in Table 3.8 below.

Table 3.8
Major Crops with their Average Yields

S. No.	Tehsil	Cropping Pattern	
		Rabbi	Kharif
1	Sukkur	Wheat, Barley, Gram	Rice, Bajra, cotton
2	Lakhi	Wheat, Barley, Gram, Pulses	Rice, Sugarcane, Cotton Jowar
3	Garhi Yasin	Wheat, Barley, Gram, Pulses	Rice, Sugarcane, Cotton Jowar
4	Shikarpur	Wheat, Barley, Gram, Pulses	Rice, Sugarcane, Cotton Jowar
5	Jacobabad	Wheat, Gram, Rape Seeds	Rice, Jawar, Bajra, Cotton

Courtesy: Agriculture Extension Departments (Sukkur, Shikarpur and Jacobabad)

118. Table 3.9 represents the per acer yield of the crops grown in both Rabi and Kharif seasons of Shikarpur district in which falls the major portion of the Project Area. Per acer yield is low as compared to other areas of the country. According to the Agriculture departments, low yield is due to scarcity and salinity of water.

Table 3.9
Major Crops with their Average Yields

S. No.	Crops	Yield Per Acer(Kg)	Crops	Yield Per Acer(Kg)
Kharif			Rabi	
1	Rice	1400-1600	Wheat	800-1000
2	Cotton	200-1000	Fodder	1200-1500
3	Fodder	1200-1500	Vegetables	500-700
4	Tomatoes	500-700	Sunflower	600-800

Courtesy: Agriculture Extension Department Shikarpur

3.2.8 Industrial and Commercial Activities

119. There are very few industrial and commercial activities in the Project Area. Only a few small industries are located in the vicinity of N-65 highway, i.e. some rice

husking factories, an oil mill, a rice mill and some pickle factories. Some crop storage depots are also located along the roadside.

120. Oil and gas explorations is also in progress around the Project Area, which raises the significance of this Section of the National Highway.

3.3 Ecological Resources

3.3.1 Flora

121. Flora of the Project Area falls in the scrub Dry Tropical Thorn Forest Zone. This is the natural vegetation of the Indus Basin. It has the capacity to survive and grow in areas with extremely high temperatures and low precipitation.
122. The flora consists of thorny and hard wooded species. Acacia species are the dominant one. The trees usually have short boles and low branching areas. Their usual height is 6-9 metres. The leaves are small, except in a few genera like Salvadoran and Caltrops.
123. Main trees in the Project Area are Acacia nilotica (Keekar), Eucalyptus camaldulensis (Safaida), Phoenix dactylifera (Date Palm), Dalbergia sissoo (Shisham). Azadirachta indica (Neem), Salvadora oleoides (Peelu) and Ficus religiosa (Peeple).
124. Tamarix dioica (Lai), Calotropis procera (Akk), Aerea javanica (Bui), Salsola barysma (Chota Iona), Zizyphus nummularia (Mallah) and Prosopis juliflora (Mesquit) in bush form are seen in abundance along the roadside.
125. Among the grasses; Arislida depressa (Lumb), Eleusine compressa (Chemmer), lasiurus indicus (Gorkha) and Saccharum bengalensis (Kana) are found in the Project Area. Typha augustata (Koonder or Dib) is found along the water ponds scattered on both sides of the road.
126. The main fruit grown in the Project Area is date. Besides date, guava and grape fruits are also grown in the area. Fields spreading over several acres were seen along the roadside where sunflower has been cultivated. Similarly falsa crops were seen in the vicinity of the highway. Among vegetables turnips, radish, potatoes, peas, spinach, carrot and lady finger are grown in the area. Onion is another major vegetable grown in the Project Area.

3.3.2 Fauna

i) Mammals

The Project Area was at a time rich in wildlife. At present jackal, squirrel, fox, rats and mongoose are still found in the area. Wolf is also reported and is an endangered species. Hyena is also a rarity and marked as an endangered species. Porcupine is seen even along the road side and causes lot of damage to young plants and crops. Bats, especially of the genera chiropteran are also seen in the area.

Domestic animals include goats, sheep, camel, cows and buffaloes. Another important domestic animal of the area is donkey, which is used for pulling carts, etc. a common sight in the Project Area.

ii) Reptiles

These include snakes like cobra, rattle snakes and rat eater snakes. Small and medium sized lizards are also a common sight in the area. These include spiny tailed lizard (*Uromatix hardwickii*) and fringed toed lizard (*Acanthodactylus contoris*).

Turtles are also present in the area especially in the vicinity of moist lands, ponds and during rainy seasons.

iii) Birds

Important bird species found in the Project Area are common crow, common mayna, house sparrow and common teal. These birds are frequently visible along the roadside.

Grey and black partridges, though present in the area, have been reduced to a minimum quantity due to excessive hunting. Other birds include Indian roller (Chai) crested lark, vultures and quail.

Water fowls were seen in plenty along the small and large ponds located on both sides of N-65. These water birds include white stork, white pelican, herring gull, ringed plover pond heron, little brown dove and white beaked king fisher.

3.3.3 Protected Areas

127. Protected areas are maintained for the protection of endangered species, habitats, ecosystems, archaeological sites, monuments, buildings and other cultural heritage. Protected areas can be broadly categorized into the following three groups:

- i) **Ecosystems:** Ecosystems include protected areas such as wildlife sanctuaries, national parks and game reserves. Along the project route no such ecosystem exists within 3 kilometres on either side of the road. There are no wildlife sanctuaries located within 3 Km of the Project Area. However a game reserve called the Indus Dolphin reserve exists near Sukkur. This game reserve is near the portion of the Indus River from Sukkur to Guddu Barrage and has an area of 44,200 hectares. It was notified in the year 1974 as a game reserve to save the Indus Dolphin from extinction. World Wide Fund for Nature (WWF) has launched a project in this tract for the conservation of this unique creature found only in the mighty Indus.
- ii) **Archaeological and cultural sites:** Along the project route within 200 feet from either side of the road, there are no archaeological sites, monuments, antiquities, cultural heritage or world heritage sites.

In Sukkur City and in Shikarpur City there are some archaeological monuments, Masoom shah Shrine and Tower, Sadhubela (sacred Temple for Hindus), Sat Bahion Jo Aastan, Hathi Gate in Shikarpur City, which will get benefit of the Project because of more visitors. On the other hand these monuments are not likely to be affected due to the Project, as they are situated far away from the Project area.

- iii) **Wet Lands:** There are no major wet lands in the area except Sukkur Barrage located across Indus River. It has an area of 4000 acres and commercial fishing is carried out here. Many small ponds are however observed to be scattered along the entire route on both sides of the National Highway. One large pond exists near Shikarpur City having an area of several acres, which was seen to have been filled with Tulip flowers. Typha grows profusely along these water ponds.

3.3.4 Endangered Species

128. Shisham is the endangered plant (flora) because of a viral disease. Falcon and partridges (grey and black) are the endangered birds (fauna) in the vicinity of this section.

3.4 Socio-economic Environment

129. N-65 starts from Sukkur near Sukkur bus stand and passes from Districts Shikarpur's Tehsils Ghari Yasin, Lakhi and Shikarpur. It reaches Tehsil Jacobabad of District Jacobabad.
130. Sindhi is mother tongue of the residents. Shalwar kameez and dothi kurta are the common dresses of males and females. Some modern young males also wear pants and shirts.
131. The demographic profiles of these areas are as follows:

(a) Sukkur Tehsil

Total population of the Tehsil was 374,178 with a growth rate of 2.35% as recorded in 1998 Census. Population composition was 113 females compared to 100 males. 90% of the population resided in urban areas and just 10% lived in rural areas. Average household size was 7.5.

(b) Lakhi Tehsil

This Tehsil had a population of 188,298 with a growth rate of 0.6%, as recorded in 1998 Census. Population composition was 106 females compared to 100 males. 51% population resided in urban areas and 49% lived in rural areas. Average household size was 6.8.

(c) Garhi Yasin

Total population of the Tehsil was 227,966 with a growth rate of 2.67% as recorded in 1998 Census. Population composition was 107 females compared to

100 males. 90% of population resided in rural areas and just 10% lived in urban areas. Average household size was 5.6.

(d) Shikarpur

Tehsil had a population of 272,493 with a growth rate of 2.45% as recorded in 1998 Census. Male to female ratio was 108:100. Fifty one (51) % of population resided in rural areas and 49% lived in urban areas. Average household size was 6.8.

(e) Jacobabad

Total population of the Tehsil was 267,998 with a growth rate of 2.33% as recorded in 1998 Census. Population composition was 107 females compared to 100 males. 49% population resided in urban areas and 51% lived in rural areas. Average household size was 7.1.

The demographic characteristics were studied through village profiles of all the villages situated along the road. These villages are located in above mentioned Tehsils (Talukas). According to this survey the demographic characteristic of these Tehsils were as follows.

Table 3.10
Demographic Characteristics

S. No.	Tehsils (Talukas)	Male(%age)	Female(%age)
1	Sukkur	47	53
2	Lakhi	49	51
3	Garhi Yasin	48	52
4	Shikarpur	52	48
5	Jacobabad	48	52

Source: EIA Field Survey Team (NESPAK)

3.4.1 Socio-economic Survey of the Project Affectees

132. The information regarding socio-economic conditions is derived from primary data collection and from secondary sources i.e. (District Population Census Reports 1998 for the concerned districts, Design utility folders, prepared by the design consultants Engineering Consultant International Limited-ECIL, Karachi), IUCN literature and primary sources, i.e. village profile, focus census, Commercial activities survey, women profile survey, building valuation survey, scoping sessions and personal field observations.

3.4.2 Consultation and Participation Process

133. Totally 150 questionnaires were filled at different locations in the Project Area. Among the respondents 100 were males and 50 were females. Methodology adopted for selection of the respondents was random sampling of respondents from all the villages, towns and cities, situated along the route. These respondents were from all walks of life with different professional back grounds.

3.4.3 Baseline Information

134. Out of the 150 respondents 67% were males while 33% were females, 61% were married, 39% were unmarried, 37% were literate, 63% were illiterate, 44% were employed and 56% were unemployed (including housewives and students). Table 3.11 presents the general profile of the Project Area.

Table 3.11
General Profile

S. No.	Respondents	No.	Percentage (%)
1	Male	100	67
2	Female	50	33
3	Married	92	61
4	Unmarried	58	39
5	Literate	56	37
6	Illiterate	94	63
7	Employed	66	44
8	Unemployed	84	56

Source: EIA Field Survey Team (NESPAK)

3.4.4 Respondents' Age Group

135. Respondents were selected from mature groups of people. 18% of the respondents were less than 25 years old, 20% belonged to age group between 26 to 35 years, 22% fell in the age group between 36 to 45 years, 20% between 46 to 55 years and 20% of the respondents were more than 56 years old. Table 3.12 presents the distribution of respondents according to age group.

Table 3.12
Respondents' Age Group

S. No.	Age Group	Both Sexes	Percentage	Male	Percentage	Female	Percentage
1	15-25	27	18	20	20	7	14
2	26-35	30	20	17	17	13	26
3	36-45	33	22	19	19	14	28
4	46-55	30	20	18	18	12	24
5	56-65	30	20	26	26	4	8
Total		150	100	100	100	50	100

Source: EIA Field Survey Team (NESPAK)

3.4.5 Education Facilities

136. Educational facilities in the Project Area are inadequate, so it becomes difficult for the parents to educate their children from far off villages. It becomes difficult specially where the transportation facilities are inadequate. In many villages, no local qualified lady is available to teach the girls and no-one from outside is willing to come for teaching in such a remote area, so girls are bound to go to the

boys schools. Table 3.13 below shows the status of educational institution along the Col.

Table 3.13
Education Facilities in the Project Area

Primary School		Middle School		High School		Deeni Madrassa (Religious School)	
Male	Female	Male	Female	Male	Female	Male	Female
14	9	8	6	4	2	2	-

Source: EIA Field Survey Team (NESPAK)

137. Besides the above mentioned Schools some higher level educational institutes are also situated along the route like Sukkur Agricultural college, Lakhri degree college, and Agriculture training institute

3.4.6 Education Level

138. Literate respondents had different education levels. Out of 56 literate respondents: 32% had primary level of education, 29% had education up to Matriculation and 23% had qualification up to intermediate and only 16% were graduate or postgraduate. Educational status of the respondents is shown in the Table 3.14.

Table 3.14
Educational Status

S. No.	Education level				
1	Respondents	Primary	Middle/ Secondary	Intermediate	Graduation/ Post Graduation
2	Male	12	12	10	7
3	Female	6	4	3	2
Total		18	16	13	9
Percentage		32	29	23	16

Source: EIA Field Survey Team (NESPAK)

3.4.7 Social Amenities

139. During socio-economic survey to develop the social baseline of the Project Area, the respondents were inquired about the utilities in their homes. Almost all the respondents had electricity in their homes whereas 43% had the facility of water supply in their homes. On the other hand 20%, 15% and 25% of the respondents respectively had the facility of Sui gas, landline phone and sewerage system at their homes. Table 3.15 presents the social amenities available in the area.

Table 3.15
Social Amenities

S. No.	Social Facility	Number	Percentage (%)
1	Electricity	153	98
2	Water Supply	65	43
3	Sui Gas	30	20
4	Telephone	23	15
5	Sewerage	30	20

Source: EIA Field Survey Team (NESPAK)

3.4.8 Professional Status

140. Table 3.16 presents the professional status of the respondents. 16 % of the respondents were unemployed; a few of them were students. Among the respondents “economically active”, 10 % were farmers, 28 % were businessmen and 20 % were labourers.

Table 3.16
Professional Status

S. No.	Profession	Number of Respondents	Percentage (%)
1	Agriculture	25	17
2	Business	24	16
3	Labor work	11	7
4	Service	6	4
5	Housewives	34	23
6	unemployed	50	33
Total		150	100

Source: EIA Field Survey Team (NESPAK)

3.4.9 Household Income Levels

141. During the socio-economic survey, respondents were inquired about their total monthly income from all sources. Table 3.17 shows the income levels of the respondents. Majority of the respondents i.e. 24% had their income ranging between Rs.10000-15000/month. 19% had income below Rs.5000/month. 23 % respondents belonged to the income group ranging between Rs.5000-10000/month, 19% between Rs.15,000 to 20,000/month and just 15% had an income more than Rs.25,000/month.

Table 3.17
Income Levels

S. No.	Monthly Income Group (Pak Rs.)	Number	Percentage (%)
1	1,000-5,000	29	19
2	5,000-10,000	34	23
3	10,000-15,000	36	24
4	15,000-20,000	28	19
5	25,000+	23	15
Total		150	100

Source: EIA Field Survey Team (NESPAK)

3.4.10 Land Holding

- 142 During the survey it was identified that about 17% of the respondents belonged to the agricultural sector and some of those respondents had leased out their lands as a second business/ source of income. Majority of the respondents had very small land holdings; almost 77% of the respondents had landholdings of less than 10 acres. Only 3% had landholdings of more than 20 acres. The land holding status of the respondents is shown in Table 3.18.

Table 3.18
Land Holding

S. No.	Land in Acres	No.	Percentage (%)
1	1-5	15	50
2	5-10	8	27
3	10-15	5	17
4	15-20	1	3
5	20+	1	3
Total		30	100

Source: EIA Field Survey Team (NESPAK)

3.4.11 Borrowing Status

143. During the public consultation it was identified that a reasonable proportion of the respondents, i.e. 37 % had borrowed money from different sources such as Agriculture Bank, feudal lord, or relatives. Table 3.19 shows the barrowing status of the respondents.

Table 3.19
Borrowing Capacity

S. No.	Borrowing Status	Number	Percentage (%)
1	Under debt	56	37
2	Without any debt	94	63
Total		150	100

Source: EIA Field Survey Team (NESPAK)

3.4.12 Housing Characteristics

144. 27% of the respondents live in kacha houses, 49% respondents have semi pacca houses and 24% live in kacha (mud) houses. Table 3.20 shows the characteristics and percentage of houses in the Project Area.

Table 3.20
Types of Construction

S. No.	Construction Type	Number	Percentage
1	Kacha	41	27
2	Semi Pacca	73	49
3	Pacca	36	24
Total		150	100

Source: EIA Field Survey Team (NESPAK)

3.4.13 Culture and Tradition

145. The food of the inhabitants is very simple. Maize, wheat and rice are eaten in the project area. The use of Desi ghee and lassi is very popular in the rural area. Milk is also available in sufficient quantity. The people of the area are fond of meat especially various forms of beef. The use of ornaments among the females is also common. The females decorate themselves with ear-ring and bangles with rare use of cuba (egg like cups), connected by chains or a flat circle shaped gold hanging on fore-head.

3.4.14 Caste System

146. Project Area lies in interior Sindh adjacent to Balochistan Province. Therefore population of the Project Area comprises both of Sindhi and Baloch people. Following caste and tribes were identified during the survey.

Table 3.21
List of the Settlements

S. No.	Tehsils (Talukas)	Castes
1	Sukkur	Sher, Mehar, Qurashi, Jamali, Lolorie, Sheikhs
2	Lakhi	Sayed, Ludra, Samro, Rahejas, Mehar, Sheikhs
3	Garhi Yasin	Mangi, Sanch, Machi, Gurgigi, Channas, Mangwal
4	Shikarpur	Baloch, Samro, Sanch, Mehar, Jogi, Memon
5	Jacobabad	Panwer, Mehar, Kaheer, Rindh, Jakhrani, Jamali, Bughti, Memon

Source: EIA Field Survey Team (NESPAK)

3.4.15 Religion

147. Religion plays a vital role in people's life. Majority of the Project Area population is Muslim. Cultural festivals are mostly related with religious traditional events. The visit to shrines (termed as Ziarat) is a very common among people. Table 3.22 below provides the distribution of population by religion. The only minority in Project Area is Hindu who mostly live in cities and are engaged in business activities, therefore their proportion in rural areas is very small.

Table 3.22
Religious Status of the Respondents

S. No.	Respondents	Total No.	Muslim	Percentage (%)	Non Muslim	Percentage (%)
1	Male	100	93	93	7	7
2	Female	50	49	98	1	2

Source: EIA Field Survey Team (NESPAK)

3.4.16 Roads and Communication

148. Communication network is a fundamental prerequisite for economic activity to take place. The surrounding villages of the project area are well connected with main road and district headquarters through metalled roads.

3.4.17 Gender Component

149. Gender is a critical issue that is connected to any sustainable development process, which is usually perceived as woman specific issues. In order to assess the socio-economic condition of the women of the area, a Gender component survey was conducted by taking a reasonable sample of women. A total of 67 women from the project area were interviewed by the female staff, so that they could feel comfortable. Regarding the level of awareness about the project, mostly the women were aware about the construction of Road project.
150. Table 3.23 shows the condition of women surveyed according to the table 30% women surveyed were educated and 70% were uneducated just 28% were working women and 72% were household ladies. 62% were unmarried and 38% were married. Only 44% women surveyed said they had an opportunity of studying if they want. Rest of the women said that they had no access to school or college. This shows lack of education facilities and trend of not educating the women in the Project Area. 26% of women surveyed said that they had access to lady health visitor and just 18% had access to government doctor. 32% women visit private doctor in case of sickness and 24% have to go to quacks. This table represents the overall situation of the women surveyed.

Table 3.23
Social Condition of Women of the project Area

Age Group	Educated	Uneducated	Working Women	Household Ladies	Unmarried	Married	Access to Education Facility	Access to Health Facility			
								Lady Health Visitor	Govt Doctors	Private Doctors	Quacks
16-25	3	7	6	9	3	4	4	3	2	2	1
26-35	4	6	4	4	5	5	3	2	1	2	2
36-45	2	7	2	9	8	4	5	4	3	3	2
46-55	3	5	1	8	10	3	6	1	1	5	3
56 & above	3	10	1	6	5	3	4	3	2	4	4
Total	15	35	14	36	31	19	22	13	9	16	12
% age	30	70	28	72	62	38	44	26	18	32	24

Source: EIA Field Survey Team (NESPAK)

3.4.18 Concerns Regarding the Project

151. Almost all the population of the project area has concerns regarding the road widening, which are ranked in the under-mentioned Table 3.24

Table 3.24
Stakeholders Concerns

S. No.	Concerns	No. of Respondents	Percentage of Respondents
1	Livelihood will be disturbed in case losing business and agriculture land	87	28
2	Residential area will be affected	102	32
3	No compensation payment is given to affectees, especially tenant	62	20
4	Jobs will not be provided to local people during construction	30	10
5	Privacy will be disturbed due to construction work	32	10
Total		313	100

Source: EIA Field Survey Team (NESPAK)

3.4.19 Literacy Status

152. Literate respondents had different education levels. Out of 56 literate respondents: 32% had primary level of education, 29% had education up to Matriculation and 23% had qualification up to intermediate and only 16% were graduate or postgraduate. Educational status of the respondents is shown in the Table 3.25.

Table 3.25
Literacy Rate

S. No.	Education level				
	Respondents	Primary	Middle/ Secondary	Intermediate	Graduation/ Post Graduation
1	Male	12	12	10	7
3	Female	6	4	3	2
Total		18	16	13	9
Percentage (%)		32	29	23	16

Source: EIA Field Survey Team (NESPAK)

3.5 Drinking Water

153. Project Area lies on the belt where underground water is brakish and not suitable for drinking. Use of this water is not good even for the agricultural purposes, but ironically most of the villages are deprived of any proper water supply system. During the field survey it was observed that only two localities Lakhi and Jahan khan had the facility of water supply. In many areas, people have to fetch water from remote areas.

3.6 Power Supply

154. Electricity is available to all the villages. Firewood and kerosene oil are the major sources of energy in case of non-availability of electricity. Solely, fire wood is used for cooking.

3.7 Civic Facilities

155. The health care facilities are one of the major determinates of a society's social development and quality of life. Healthy manpower is imperative for economic growth. No serious disease was reported in the Project Area, however due to unhygienic conditions arising from the solid waste and stagnant water, mosquito breeding takes place that can give rise to serious diseases, i.e. Malaria, Typhoid etc. Licensed lady health visitor are almost non-existent in the area with major reliance on traditional child birth attendant for assisting the delivery. Comparatively larger villages have the facility of basic health unit (BHU) and/or dispensary but people of the Project Areas have to approach their respective district headquarters in case of serious health problems. Being Divisional Headquarter Sukkur has good health facilities. In most of the villages people consult the private practitioners and quacks.

**Table 3.26
Available Health Facilities along the Col**

S. No.	Health Facilities	Number
1	Tehsil Head Quarter Hospital	1
2	Rural Health Unit	4
3	Dispensary	1
4	Private Medical Shop	12

Source: EIA Field Survey Team (NESPAK)

3.8 Non-Governmental Organizations (NGO's)

156. In district Sukkur some NGO's are working on education health and agriculture like Leadership for Environment and Development (LEAD) Pakistan, World Wide Fund for Nature (WWF) and Sindh Rural Support Organization (SRSO). While in Shikarpur District only Marrie Stopes Pakistan is working on reproductive health and in Jacobabad only SRSO is working. Community Based Organisations (CBO's) that involve the local villagers in developmental projects are deficient in the Project Area.

SECTION 4 ALTERNATIVES

4.0 General

157. It is very important to evaluate different alternatives to arrive at the best possible option. Different alternatives that were evaluated are briefed as follow:

4.1 No Project

158. According to the Traffic Projection Survey (refer to Table 2.1), it is estimated that in the future years more and more people will be using the N-65 (Sukkur – Jacobabad Section). According to the survey, total daily traffic is increasing at a rate of 6% per year. It is estimated that in 2011, there will be approximately 8,326 vehicles passing through Sukkur-Shikarpur Section and 6,106 vehicles passing through Shikarpur-Jacobabad Section everyday.
159. Without the proposed Project the existing road from Sukkur to Jacobabad (N-65) will continue to be the main transportation corridor in the area. Traffic volume on the existing N-65 (National Highway) is anticipated to increase with the passage of time, as indicated from the traffic projection survey.
160. Traffic congestion is expected to increase in the future and road conditions are expected to deteriorate due to ever increasing traffic volume.
161. Therefore the “No Project” conditions will result in further worsening of the present environmental conditions and increased disturbance to residents of the area and the road users. Socio-economic conditions will also deteriorate due to lack of proper link between Sindh and other provinces. The effect of “no build” alternative for N-65 would therefore result in longer travelling times and accidents due to the shorter width of the existing road.

4.2 Alternate Transport Modes

162. The alternate transport modes include railways, air travel and other access roads. Air access from Sukkur to the other parts of the country is already available and the people of Jacobabad and surrounding areas use N-65 for access to the Sukkur Airport. Rail track bound for Karachi and Quetta already passes along the road but this option cannot be considered as an alternate keeping in view the traffic pattern and connectivity with surrounding areas.

4.3 Improvement of the existing Carriageway

163. In terms of the movement of people and goods, road transportation facilitates majority of travellers in the Project Area. Further improvement of the road system will enhance economic development by providing reliable corridor for the movement of goods and passengers to and from other provinces. For this and other reasons, the implementation of the Project is the only viable solution for reducing traffic congestion and providing safe and good quality route for movement of people and goods. Different options for the proposed route were examined as discussed below:
- i. Improve the existing road with the same alignment by widening on both sides;
 - ii. Upgrade the existing 2 lane road into 4 lane dual carriageway by extending on both sides from centreline of the existing road; and

- iii. Construct a completely new carriageway parallel to the existing road.
164. The most feasible option was selected by considering following factors:
- Potential environmental and social impacts;
 - Capital and recurrent cost;
 - Environmental mitigation costs and benefits.
165. The second option was selected by considering the above mentioned factors and the road will now be constructed first on one side and then on the other side from centreline of the existing road to a 4 lane dual carriageway. This alternative has the advantage of enhanced safety during construction and operational stages, and less disruption to the passing traffic during construction. It will also minimise resettlement of structures, trees and other utilities. Provision of new bypass at Shikarpur will facilitate the traffic. Its merits are discussed in section 4.4 hereafter.
166. First option was rejected because of the disturbance to the moving traffic during construction. Also their will be more disturbance to the people living in the vicinity of the project area if construction on both sides is initiated simultaneously.
167. Third option was not selected due to the increased resettlement of structures, trees and other utilities. In this case project cost will also increase, which will be an unnecessary burden on the national exchequer.

4.4 Provision of Bypass at Shikarpur

168. Bypasses are used to either shorten the travelling time on the highway route or to specifically reroute traffic away from the existing cities/towns and commercial areas to provide safety to the citizens living in the cities/towns. NHA has decided to provide a bypass outside Shikarpur so that the traffic moving between Sukkur and Jacobabad can move without any hindrance. Traffic projection survey shows that traffic on this important route will increase in the coming years. Provision of the bypass will also facilitate the residents of Shikarpur who are vulnerable due to the passing of high traffic volume from the city.

SECTION 5 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.0 General

169. This section identifies the overall impacts of construction/ rehabilitation works on the physical, biological and socio-economic environment of the Project Area. This assessment also includes the impact of traffic volume due to improved road conditions. In addition, it also narrates the measures that will mitigate the Project's adverse environmental effects. Following is a description of the perceived environmental impacts (positive/negative) of the Project with their proposed mitigation measures.

5.1 Project Corridor

170. The Project corridor is delineated according to two criteria: right of way (RoW); which the NHA is legally entitled to, and Corridor of Impact (Col), i.e. the width of the corridor that will be impacted, directly or indirectly, by the Project during the construction and operational phases.

a) Project Right of Way (RoW)

The proposed Project corridor will have a well defined RoW that will be 110 ft. (34 metres) for urban areas and 220 ft. (67 metres) for rural areas. Major construction works will generally remain confined within the RoW. All the infrastructure and commercial activities within the existing or proposed RoW need to be relocated and have direct impact of the Project.

b) Corridor of Impact (Col)

Corridor of Impact (Col) was delineated as the extent, which has direct or indirect impact of Project. Direct impacts of the Project, caused by relocation, are visioned within the RoW and indirect impacts, caused by noise, dust emissions, camp sites and borrow sites could be beyond the RoW. After the detail site visits, Indirect Corridor of Impact (Col) was defined as area covered within 200 metres (100 metres on both sides of the Road section from its centre).

5.2 Pre-Construction/Design Phase

171. Following is the brief description of impacts envisaged during Pre-construction/ Design phase:

5.2.1 Topography

172. The topography along the Project Area will change to some extent because of construction of Project related structures such as embankments, culverts etc. Visual changes to the topography will be of permanent and minor negative in nature and do not require any mitigation measures, except that the Project design should consider aesthetic concerns.

5.2.2 Formation Width in Built-up Areas

173. The formation width in built-up areas may result in creating hindrance to market opportunities, loading and vending activities for the locals. This impact is temporary and minor negative in nature. Mitigation measures will include:

- In built-up areas, apply as feasible some flexibility in order to avoid excessive resettlement;
- Incorporate technical design features that allow flexible shoulder width in towns; and
- Explore the incorporation of additional parking lots and bus bays.

5.2.3 Land Acquisition and Clearing

174. The Project-impact related activities will be land acquisition and clearing of the Right of Way (ROW) that will result in causing disturbance to the affected residents of the Project Area. Land acquisition is mainly required for construction of Shikarpur Bypass, where 48.1 acres of agricultural land will be purchased. Clearing is required for areas already under NHA jurisdiction where temporary squatters are doing their businesses.

175. This impact will be permanent and moderately negative in nature and mitigation measures will involve careful alignment and route selection by the designer to minimise the impact. Also adequate budget will be provided in the Project cost for the compensation to the affected people as per Land Acquisition Act, 1894 and ADB's resettlement guidelines for the lost assets and restoration of their livelihoods.

- **Shikarpur Bypass**

Shikarpur Bypass is proposed for avoiding the traffic congestion and blocking within the city due to excessive traffic movement along the Project Section. Its construction will not only save the travelling time but will also be beneficial to the citizens of Shikarpur City. Following are the associated merits of Shikarpur Bypass:

- Time saving due to uninterrupted traffic;
- Safety of the citizens of Shikarpur;
- Reduction in traffic congestion in Shikarpur;
- Reduction in noise and air pollution of Shikarpur; and
- Motivation to the travellers for using Project Section.

176. Following are the associated demerits of Shikarpur Bypass:

- Acquisition of additional land (additional funds required for purchasing the land);
- Reduction in precious agricultural land (depletion of agricultural activities);
- Unpleasant and non-compromising attitude of the affectees unless they are properly compensated; and
- Property related issues due to division of land in two parts along the proposed Bypass.

177. Due to these issues, proper mitigation measures should be suggested at the Design stage so that the Bypass should be more and more beneficial.

5.2.4 Changes in Nearby Land Value

178. The proposed Project is expected to increase the land values, especially in areas where no road infrastructure is present i.e. villages through which Shikarpur Bypass is proposed to pass. Landowners will have an opportunity to sell their land on increased prices and start a new business.
179. This Impact will be a major positive in nature.

5.2.5 Flora

180. Due to the proposed Project, about 2,704 trees (2,658 number of non-fruit trees and 46 number of fruit trees) will be cut for the widening of the existing road. This may affect the ecological habitat of the area. This impact will be permanent and moderate negative in nature.
181. Proposed mitigation measures include the following:
- Incorporate technical design to minimise removal of roadside plantation;
 - Apply flexibility in decision as which side to be widened;
 - Plan for compensatory and compulsory plantation for each felled tree, 4 plants of similar floral function/type; and
 - Disallow introduction of exotic species or species with known environmental setbacks (e.g. Eucalyptus, Prosopis).

5.2.6 Change in Hydrologic Regime

182. As the proposed Road passes through the flood prone areas due to Bigiari Wah and Sindh Wah canals, it may result in changing the hydrologic regime of the area, resulting in flood damages to local community and the proposed road. Also flood flows may damage structures or cause drainage problems in urban areas.
183. Maximum flood level observed at Sukkur Barrage was in July 2005. 1,300,000 cusec flow of water was recorded during that flood at Sukkur Barrage. However the N-65 Sukkur-Jacobabad Section was not affected.
184. Possible impacts due to flood are temporary but may have significant adverse (major negative) impacts, i.e. erosion of road surface; damage to the crops, bridges etc. Mitigation measures will include:
- Provision of culverts to control flood damages and provision of safety of embankments against floods; and
 - Provision of sufficient sizes of drains to take design flows.

5.2.7 Waterlogging and Salinity

185. Almost 35-40% of the land along the Project Road Section is badly affected by waterlogging and salinity. The waterlogged and saline land needs proper measures in the immediate vicinity of the proposed Road alignment because if no mitigation is provided, the road may settle at certain locations. Embankments can also weaken due to this phenomenon. This impact is permanent but moderately adverse in nature. Mitigation measures will include:
- Provide drainage culverts at suitable locations in water logged areas; and
 - Ensure design of pavement by considering water logged areas.

5.2.8 Restricted Access Problems

186. Due to the proposed Project, entry/ exit problems may occur for residents as well as loss of commercial activities due to the proposed carriageway. As discussed above, built up area along the proposed Shikarpur Bypass will be bifurcated. This impact is permanent and major negative in nature, if proper mitigation is not provided.
187. Mitigation measures will include provision of underpasses, overhead pedestrian's bridges, u-turns and zebra crossings in the design to minimize the impact. Farmers and peasants need access to the Road for transporting their products to the markets and their entrance from fields and katcha roads is inevitable, therefore u-turns must be located at appropriate places.
188. In order to avoid accidents, it is suggested that the u-turns should be designed with the provision of an additional turning lane.

5.2.9 Resettlement Issues

189. As a result of the proposed road widening, 19 houses, 311 commercial units, 22 small mosques, 2 Police station mosques, 4 graveyards, 1 Rangers headquarter (boundary wall), 9 Police checkposts, 2 Rangers check posts, 1 Police quarter and 2 bus waiting sheds will be affected. Resettlement of these affectees will cast a negative impact on their lives. They will have to shift their houses and business setups permanently. To mitigate the impacts of resettlement, a separate Resettlement Action Plan has been prepared.
190. This impact is permanent and moderate negative in nature. Mitigation measures include:
- Avoiding relocation of settlements during design stage as much as possible;
 - Developing proper judicious compensation package for affectees; and
 - Developing scheme for the new construction of affected mosques and relocation of graveyards with the involvement of community.

5.2.10 Public Utilities

191. Due to the proposed Project, public utilities affected may create disruption of public services and inconvenience. This impact is temporary and may be considered as moderately negative in nature. Mitigation measures will include:
- Provision in design and budget for the relocation of the existing utility infrastructures wherever required and necessary; and
 - All public utilities (e.g. water pipes, power/ telephone lines likely to be affected by the carriageway widening need to be relocated well ahead of time before the actual commencement of road widening works.

5.2.11 Historical/ Archaeological Places

192. There is no historical/ archaeological place in the vicinity of the Project RoW.

5.3 Construction Phase

193. Following is the brief description of impacts envisaged during Construction Phase:

5.3.1 Topography

194. As a result of construction, topography of the Project Area will be changed. One of the important activities during construction will be the cutting and dismantling of pavements and borrow areas that will have an environmental impact on the topography of the Project Area.
195. This impact is temporary and minor negative in nature. Mitigation measure for this impact is the proper landscaping (construction of stone pitching/riprap across the embankments).

5.3.2 Land Acquisition and Resettlement

196. Due to the construction of the proposed Project, land acquisition and resettlement will occur in some villages and towns and at Shikarpur Bypass. This will result in loss of infrastructure, livelihood and commercial activities.
197. This impact is permanent and major negative in nature. Mitigation measure will involve judicious compensation as per Resettlement Action Plan to be paid for relocation of properties to the displaced population. Compensation should be given before actual dislocation.

5.3.3 Borrow/ Open Pits

198. According to the study carried out by Loya Associates, Karachi the potential sources of soil can be borrowed in huge quantity from Ubhan Shah near Kot Diji and Arore near Rohri.
199. Borrow/ open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments.
200. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area.
201. This impact is permanent and moderately adverse in nature. Mitigation measures will include:
- Conversion of borrow pits into fish farms and care in selection of borrow areas;
 - Necessary permits must be obtained for any borrow pits from the competent authorities;
 - No excavations should be allowed within a distance of 100 metres of the RoW;
 - In borrow pits, the depth of the pits should be regulated so that the sides of the excavation will have a slope not steeper than 1: 4;
 - Soil erosion along the borrow pit should be regularly checked to prevent/mitigate impacts on adjacent lands;
 - In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
 - Borrow pits can be used for sanitary landfill, but during the excavation, top 20 cm soil cover should be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.

5.3.4 Air Quality

202. Air quality may be affected from the following sources:

- Construction machinery;
- Hydrogen carbons from asphalt plants and vehicular traffic;
- Dust emissions due to wind blowing; and
- Uncontrolled burning of construction waste.

203. Impact of air emission may be carried over long distances depending upon the wind speed, direction, the temperature of the surrounding air and atmospheric stability.

204. Emissions from crushers and quarry sites can cause health impacts, i.e. coughing, flu, difficulty in inhaling, irritation in eyes and reduction in visibility. This impact is temporary and minor negative in nature.

205. Mitigation measures will include:

- Dust control by equipping asphalt, hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions;
- Surface treating or overlaying diversion tracks with shingle, and sprinkling water across diversion tracks;
- Ensuring that haul trucks carrying aggregate fill materials are kept covered with canvass sheet to help contain construction material being transported between sites.
- Enforcing the NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery; and
- Dust mask will be provided to the workers. Proper dust collection system should be ensured at crushers and continuous sprinkling of water.

5.3.5 Construction Waste Disposal (Wastewater, Oil, Solid Waste etc.)

206. Due to construction activities waste will be generated at construction and contractors camp site. The construction waste will include wastewater, oil spillage from machinery and solid waste etc. This will result in unhygienic conditions, health risk to work force and general public at the camp site.

207. Following are the types and sources of construction waste:

- Oil, grease etc. from construction machinery;
- Solid waste from extra construction material and food;
- Wastewater from washing and sprinkling; and
- Sanitary waste from staff toilets.

208. This impact is temporary and minor negative in nature. Mitigation measures will include:

- Wastewater effluent from contractor's workshop and equipment washing yards would be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams;
- Training of working force in the storage and handling of materials and chemicals that can potentially cause soil contamination;
- Solid Waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan;

- Sanitary wastes generating from staff and labour camps must be disposed off in environment friendly manner, i.e. provision of septic tank etc. for toilet wastes; and
- Aggregate waste material of existing road will be reused in up-gradation of road.

5.3.6 Geology and Soil

209. Due to construction activities soil erosion and contamination may occur. Soil erosion may occur around roadside, contractors camps and at embankment works as a result of unmanaged run-off from equipment washing yards, excavation of earth, cutting operation, embanking and clearing of vegetation whereas contamination of soil by oil and chemicals at asphalt plant sites, workshops areas and equipment washing yards may limit future use of lands for agricultural purposes.
210. This impact is temporary and moderate negative in nature. Mitigation measures will include:
- Low embankments will be protected by planting Vetiver grass that can flourish in relatively dry conditions;
 - The plant site/ workshop areas will be restored to the original condition. The contaminated soil will be removed and disposed at appropriate site; and
 - Soil contamination by asphalt will be minimized by placing all containers in caissons.

5.3.7 Noise

211. Noise is one of the most pervasive environmental problems in the urban areas especially on the road side. Noise pollution will be due to increase in mobility and construction activity. However, this impact will be temporary but moderate negative in nature. All mitigation measures mentioned below should be taken in order to minimize the impacts of noise in the Project Area. These measures include, but are not limited to the following:
- Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices;
 - Confining excessively noisy work to normal working hours in the day;
 - Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc.;
 - Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time; and
 - Locating the rock crushing, concrete mixing and material shipment yards away from residential areas, particularly schools, hospitals and nursing homes.

**Table 5.1
Maximum Limits of Noise Levels**

Noise Level dB (A)	Situation
194	Lung damage
180	Ear drum rupture
150	Absolute limit with ears protected
150	Maximum of instantaneous noise
135	Absolute maximum with ears unprotected
100	Prolonged noise causing permanent damage

90	Factory work for an 8-hour day, 5 days a week
*85	Ear protection should be worn
80	Noise on building or construction sites
70	Normal road traffic near residential areas

Source: "Environmental Degradation" by Engr. Col. Mumtaz Hussain
 * Above 85 dB(A) ear protection devices should be worn.

Table 5.2
General Noise Levels of Machinery and Equipment

S. No.	Equipment	Noise-Level in dB (A)
1	Earth Moving Machinery	75-85
2	Material Handling Equipment	75
3	Stationary Equipment	75
4	Tools, Hammers and Drivers	80-95

Source: The General Services Administration, Construction Noise Specification, USEPA 1972

Table 5.3
Construction Equipment Noise Levels

S. No.	Equipment	Observation Point to the Source (meters)	Noise dB(A)
1	Wheeled loading	5	90
2	Grader	5	90
3	Vibration pavement roller	5	86
4	2-wheel vibration pavement roller	5	81
5	3-wheel pavement roller	5	81
6	Tire pavement roller	5	76
7	Bulldozer	5	86
8	Wheeled pneumatic dredger	5	84
9	Sprayer	5	87
10	Power generator	5	98
11	Impact drill	5	87
12	Impact pile driver	5	112
13	Truck	5	92
14	Concrete mixer	5	91
15	Concrete pump	5	85
16	Mobile lift	5	96
17	Pneumatic hammer and rock crusher	5	98
18	Breaker	5	84
19	Pneumatic spanner	5	95

Source: Guangzhou City Center Inner Ring Road Project, Environmental Assessment Report (1997)

5.3.8 Surface and Groundwater

212. Surface water might get contaminated due to the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.

213. This impact is temporary and minor negative in nature. Following are the mitigation measures:

- The surface and groundwater reserves must be adequately protected from any source of contamination such as the construction and oily waste that will degrade its potable quality.
- The solid waste will be disposed off in designated landfill sites to sustain the water quality for domestic requirements.
- Regular water quality monitoring according to determined sampling schedule;
- The contractor should ensure that construction debris do not find their way into the drainage or irrigation canals which may get clogged;
- Work on irrigation canal areas will be kept to a minimum, protective walls be (re-constructed);
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas;
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond;
- Construction work close to the streams or other water bodies will be avoided, especially during monsoon period;
- Construct temporary or permanent devices to prevent water pollution due to increased saltation; and
- Wastes must be collected, stored and taken to approve disposal site.

5.3.9 Flora

214. There will be cutting of a large number of trees due to the proposed construction activities. This impact will be temporary and major adverse in nature. In total, around 2658 non fruit and 46 fruit trees (Date Palm) will have to be cut, that will need mitigation during the operation phase. Mitigation measures during construction include:
- Contractor must be bound to establish the staff and labour camps, and workshop at barren (non vegetative) land; and
 - Camps should be confined by fencing around the area so that no waste should approach the flora.

5.3.10 Social and Cultural Problems

215. People will face minor exit/entry problems during the construction activities. Most of the mosques falling in the RoW are Katcha and none of them is a Jamia Masjid (main mosque). The impact of construction on entry/exit problem is of minor nature as there is no major shrine or mosque located in the immediate vicinity of RoW.
216. This impact is temporary and minor negative in nature. Mitigation measures will include timely completion of the construction work and provision of alternate routes during the construction.

5.3.11 Traffic Management

217. Due to construction activities traffic management may be a problem in the Project area. This may result in traffic jams and cause inconvenience to the people passing through the Project Area due to movement of vehicles carrying construction materials. It will also increase the traffic load on the existing highway, thus deteriorating the existing condition of the highway. Since, during construction period the existing highway will be operational for the traffic movement, therefore the traffic management will not be a major problem.
218. This impact is temporary and minor negative in nature and can be mitigated by providing proper alternate traffic management plan during rehabilitation of existing

road. Existing road should be upgraded in phases and during construction of new road, parallel road should be used for traffic. Proper traffic management with marking should be done on the existing road.

5.3.12 Waterlogged and Wetland Areas

219. There is no wetland in the Project Area or its immediate vicinity. However, almost 30-35% land is waterlogged. This problem is seasonal, in winter season water table rises up and in summer it drops down once again. The belts of the waterlogged lands are mixed up with cultivable land; therefore it's difficult to segregate both types.
220. Main impact of the waterlogged area is that it reduces the bearing capacity of the soil. This effect is moderate negative in nature and needs immediate attention. Mitigation measures include dewatering, use of sandpits and boulders.

5.3.13 Poverty Alleviation

221. National Environmental Policy of the Government of Pakistan emphasizes on the achievement of environmental sustainability and poverty reduction to enhance the economic growth. Increased economic activity in the Project Area by involvement of local people in the Project related activity. Local labour will be hired, which will provide them an opportunity to develop their skills and capacities. After serving in this Project, the local can utilize their skills in future endeavours.
222. As a result of Road improvement prices of nearby lands will increase that will be a positive thing for the local people. After the construction of Shikarpur Bypass, local people will get a chance to open shops and hotels in its vicinity. This will provide them more earning opportunities, which will enhance economic profile of the area. This is a moderate positive impact.
223. Regarding the resettlement issue It is required that these settlements should be relocated and handled in such a way that those affectees might not be turned into poor or vulnerable groups. At the time of formulating compensation package, shifting charges, idle time compensation and 15% contingencies charges should be accounted for (Resettlement compensation package is discussed in Resettlement Action Plan).

5.3.14 Lifestyle and Culture

224. Change in local lifestyle and culture may occur when the local and migrant workers will come in contact during the construction works. This impact is permanent and minor positive.

5.4 Operational Phase

5.4.1 Noise

225. Due to increase in traffic volume, noise is expected to increase. This impact is permanent and minor negative. Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further improvement can be made with the help of National Highway and Motorway Police (NHMP) by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a clearance certificate.

5.4.2 Deterioration of vehicles

226. Improved road condition will result in less wear and tear to vehicles; it will also result in less fuel consumption.
227. This impact is permanent and major positive in nature.

5.4.3 Community Development/ Commercial Activities

228. Improved road condition will promote better business opportunities such as new petrol pumps and hotels. In addition, such an activity will also increase the land value that will benefit the local residents. This impact is permanent and major positive in nature.

5.4.4 Air Quality

229. Improvement in road condition will help reduce traffic related emissions in the short term by allowing a smoother traffic flow. However, in the longer run, increased traffic levels may lead to higher values of emissions.
230. This impact is permanent and two-fold. It is positive, in case of improvement of road conditions; and minor negative, when traffic volume increases.
231. Mitigation measures will include:
- Setting up of system to monitor air quality along the Project Area in accordance with acceptable International standards;
 - Monitoring emissions of vehicles as per NEQS;
 - Helping the owners and occupants of the affected premises to identify and implement special measures such as hedges and vegetation to reduce air pollution.

5.4.5 Time Saving

232. Due to increase in speed and undisturbed flow of traffic, travelling time will be saved to reach at destination. Trade will improve due to better transport opportunities. This impact is permanent and major positive in nature.

5.4.6 Safety Concerns

233. Improved dual carriageway will improve safety conditions and will reduce accidents and loss of lives due to better traffic movements. This impact is permanent and major positive in nature.

SECTION 6 ECONOMIC ASSESSMENT

6.0 General

234. This section includes the overall economic benefits in relation to environmental costs resulting due to implementation of the proposed project.

6.1 Economic Benefits

235. The economic benefits resulting due to the implementation of the proposed project will include:

- i) Decreasing the vehicle operating cost and travel time costs due to better/improved road facility, reduced traffic congestion, uninterrupted and smooth traffic flow, and for shorter route between Kashmore and Sukkur.
- ii) Improved air quality in the Project Area as a result of less traffic jams and improved road condition due to upgrading of the existing road and construction of bypass for Shikarpur City;
- iii) Less bad effects on health resulting in decreasing the medical cost of the people;
- iv) Increase in value of land along the Shikarpur Bypass resulting due to gentrification effect;
- v) It will improve the commercial activity in the Project area resulting in economic uplift of the people of the Project area.

236. The benefits listed at place (i) above relating to proposed bypass/improved road users, are direct benefits are comes under the category of tangible benefits. These benefits have been quantified for undertaking economic analysis.

237. Other benefits [Item (ii) to (v) above] are of the nature of environmental/ social benefits which though very important, however can not be quantified (intangible) in monetary terms.

6.2 Environmental Costs

238. The total environmental cost has been worked out to be Rs. 127.8 million. This includes Rs. 122.70 million as Resettlement cost (including training and monitoring cost) and Rs. 3.40 million as Environmental Mitigation cost. This cost has been added to the Project Investment cost of 2,926.10 million. The total investment costs in financial terms thus estimated as Rs. 3,053.9 million (Rs. 2,926.10+127.8 million) has been converted into economic terms as Rs. 2,763.78 million by applying SCF (Standard Conversion Factor) of 0.905.

239. Annual Operation and Maintenance (O&M) cost and overlaying costs have been worked out as Rs. 3.054 million and 630.08 million respectively. Both expressed in economic terms are as Rs. 2.764 million and 570.22 million respectively.

240. Economic Internal Rate of Return (EIRR) has been thus worked out, against total cost of Rs. 2,763.78 million, as 25.30%, which was well above 12% the assumed opportunity cost of capital in Pakistan, thus rendering this Project economically viable for implementation.

SECTION 7

ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

7.1.1 General

241. This section provides an approach for managing and monitoring environment related issues and describes the institutional framework for environmental management and resource allocations to be carried out by the National Highway Authority (NHA) for mitigating the negative impacts of Sukkur to Jacobabad Road Section (N-65).

7.1.2 Objectives of Environmental Management Plan (EMP)

242. The EMP will help the NHA address the foreseen adverse environmental impacts of the Project, enhance the Project's overall benefits and introduce standards of good environmental practices. The primary objectives of the EMP are to:

1. Define the responsibilities of Project proponents in accordance with the three Project phases (design, construction and operation);
2. Facilitate the implementation of the mitigation measures by providing the technical details of each Project impact, and proposing an implementation schedule of the proposed mitigation measures;
3. Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
4. Identify training requirements at various levels and provide a plan for the implementation of training sessions;
5. Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
6. Providing a cost estimate for all proposed EMP actions.

7.1.3 Key Environmental and Social Components

243. The key environmental and social issues associated with this Project are as follows:

244. The key environmental and social issues associated with this part of the project are as follows:

1. Resettling commercial structures owned by squatters presently operating within the proposed construction limit of the project corridor;
2. Appropriately locating temporary construction camps, asphalt plants, and waste disposal sites, and the environmental impact of operating these facilities;
3. Regulating the procurement of borrow material and topsoil erosion during construction;
4. Avoiding the obstruction of highway drainage system during construction and operation;

5. Enhancing and maintaining avenue tree plantation along the entire length of the project corridor;
6. Minimizing the impact on cultural sites or structures and community-owned assets during construction and operation; and
7. Ensuring pedestrian and traffic safety during construction and operation.

7.1.4 Role of Functionaries for Implementation of EMP

General

245. This sub section describes the methodology required for the implementation of EMP in conjunction with the NHA, Design Consultants, EIA Team, Supervision Consultants and Contractors. The executing agency of the Project will be National Highway Authority (NHA). General Manager (NHA/ADB) will be the overall Incharge of the Project. The GM (NHA/ADB) will delegate the supervisory responsibilities of the Project to the Project Director who will have professional staff supported by a team of consultants including Environmental Monitoring Specialists/Consultants.
246. Environmental Protection Agency (EPA) Sindh will act as the overall regulatory body. The specific roles of key functionaries are described hereafter.
247. The Organizational setup of the management plan is shown in Fig. 7.1.

i) National Highway Authority (NHA)

a) Project Director

The Project Director (NHA) will be responsible for the successful implementation of the Project. He will be assisted by the Supervision Consultants. The Project Director will have two Deputy Directors; one for Sukkur-Shikarpur Section and the other for Shikarpur-Jacobabad Section of N-65.

b) Director (Environment, Social and Land/Resettlement)

The Director (Environment, Social and Land/Resettlement) will be the overall Incharge for handling the NHA's obligations with respect to the EMP. The Director (Environment, Social and Land/Resettlement) will depute one Deputy Director (Environment) for the Project, who will be responsible for ensuring that the provisions of the EMP are implemented. In addition, the Deputy Director (Environment) will also coordinate with the EPA Sindh, provincial Agriculture, Forest and Wildlife departments, NGOs/ CBOs and other public/ private sector organisations.

Deputy Director (Environment) will be assisted by Assistant Director (Environment) for the execution of Environmental Management Plan (EMP) for each section of the Project.

Deputy Director (Social and Land/Resettlement) will be responsible for the land acquisition and resettlement related issues.

Executive District Officer (E.D.O Revenue) will be assisted by D.D.O (Revenue), Assistant Revenue Officer and Patwaries in assessing the award price for land acquisition to the affectees.

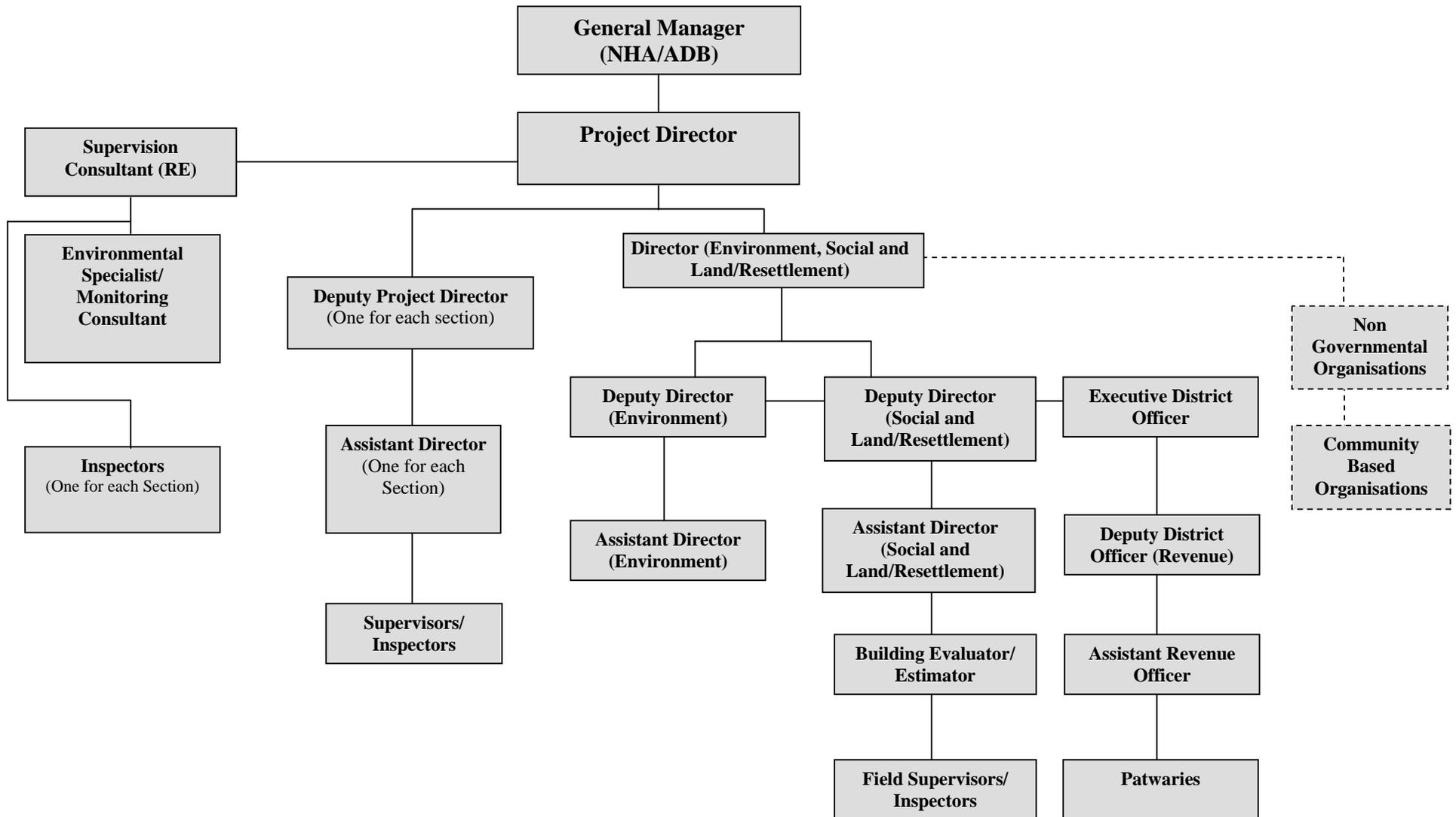


Fig. 7.1: Organisation Chart for Construction, Environmental Management and Resettlement Action Plan

ii) EIA Consultants

EIA consultants will prepare a comprehensive EIA and EMP of the Project in compliance with Pak EPA and ADB Guidelines.

iii) Design Consultants

The design consultants will ensure that all the mitigation measures proposed for the design phase are incorporated in the design and included in the contract documents.

iv) Supervision Consultants

Supervision Consultants appointed by the GM (NHA/ADB) will be headed by a "Project Manager", who will be an Engineer. He along with his team will supervise the Project contractors to ensure quality of work and fulfilment of contractual obligations. The Supervision Consultants (SC) will provide one Environmental Specialist/Monitoring Consultant (MC) who will:

1. Ensure that all the environmental and social parameters/provisions comply with the applicable standards;
2. Ensure that day-to-day construction activities are carried out in an environmentally sound and sustainable manner;
3. Organise periodic environmental training programmes and workshops for the Contractors' staff and NHA site staff in consultation with the NHA; and
4. Develop "good practices" construction guidelines to assist the Contractors and NHA staff in implementing the EMP.

v) Construction Contractor

EMP will be made a part of the contract agreement and the contractor will ensure that all Project activities are in compliance with the EMP and NEQS.

7.2 Specific Implementation Responsibilities

248. This section describes the implementation and supervision responsibilities for the different phases of the Project.

a) Design Phase/ Pre-Construction Phase

The Director (Environment, Social and Land/Resettlement), NHA and his staff with the assistance of EIA consultant are responsible for ensuring that the Project design and specifications adequately reflect the EMP and the Resettlement Policy Framework (RPF). He will ensure the Project's compliance with environmental regulations and donor requirements; and ensure stakeholder participation in the Project design.

The responsibilities of Director (Environment, Social and Land/Resettlement) may be briefly described as follows:

1. To coordinate with regulatory agencies including EPAs, EIA consultant, local NGOs, that could assist the NHA in independent reviews of environmental and social compliance;
2. To supervise environmental and social assessment reports, and provide substantial inputs and guidance to the EIA consultant;
3. To get the approval of EIA from the EPA Sindh; and

4. To ensure that the design consultant have incorporated all the mitigation measures proposed for the design phase in the design and included in the contract documents.
249. Specifically, before the start of the Project, the NHA's Deputy Director (Social and Land/Resettlement) will ensure that the following activities are carried out in a transparent manner and according to the acceptable standards:
1. Identifying and verifying Project affected persons (PAPs) on the basis of specified documents;
 2. Identifying which public facilities and utilities need to be relocated;
 3. Identifying alternative resettlement sites for PAPs outside the RoW;
 4. Carrying out a consultation and dissemination campaign with regard to compensation procedures, entitlement packages, and proposed alternative resettlement sites;
 5. Preparing individual entitlement files;
 6. Preparing and approving compensation budgets;
 7. Ensuring that an adequate notice period is given to PAPs before shifting; and
 8. Providing shifting assistance to displaced squatters and to assist squatter-owners to salvage their facilities as per ADB Guidelines.

b) Construction Phase

The NHA will appoint Supervision Consultants, who along with the Deputy Director (Environment) will oversee the working of contractor in accordance with the EMP.

- The Supervision Consultant will liaise with the Project staff to monitor environmental compliance during the construction;
- He will supervise the construction and provide technical support to help ensure compliance with the EMP;
- The Supervision Consultants will assess the environmental impact of highway construction;
- He will monitor the progress of work and adherence of the contractor to the EMP and Resettlement Action Plan; and
- He will direct the Contractor to work in such a manner that all Project activities are in compliance with the EMP and NEQS.

c) Operation Phase

The Deputy Director (Environment) and his staff will be responsible for the following:

1. Coordinating with the operational staff working under the Regional General Manager to monitor environmental compliance during highway operation;
2. Advising on, and monitoring tree plantations along the highways;
3. Reporting on the progress of environmental compliance to the federal and EPA Sindh;
4. Assessing the long-term environmental impacts of highway operation;
5. Sustaining a working partnership among the NHA, EPA Sindh, Agriculture, Forest and Wildlife departments of Sindh, NGOs and other related public private sector organizations; and
6. Reporting to Director (Environment) about progress of the work.

7.3 Environmental Monitoring

250. This section provides a monitoring plan that identifies the roles and responsibilities of Project staff involved in environmental and social monitoring and lists the parameters that will be used in the monitoring process.

7.3.1 Objectives

251. The main objectives of the pre-construction and construction phase monitoring plans will be to:

- Monitor the actual impact of the works on physical, biological and socio-economic receptors within the Project corridor for indicating the adequacy of the EIA;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the EIA;
- Ensure compliance with legal and community obligations including safety on construction sites;
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMP; and
- Ensure the safe disposal of excess construction materials.

252. The main objectives of monitoring during the operation phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long-term impact on the corridor's physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- Compile periodic accident data to support analyses that will help minimise future risks; and
- Monitor the survival rate of avenue plantations.

7.3.2 Monitoring Roles, Responsibilities and Schedules

a) Internal Monitoring

The Project staff engaged in social and environmental monitoring is listed below, followed by descriptions of the monitoring responsibilities specific to each post:

- DD (Environment)
- Supervision Consultants

Overall monitoring plan is shown in Table 7.2 .

b) Deputy Director (Environment)

The Deputy Director (Environment) will have overall responsibility for Environmental Monitoring and Evaluation (M&E). This includes the following:

1. Ensuring the availability of human and material resources required for environmental monitoring;
2. Generating periodic monitoring reports and disseminating these among the management and appropriate staff members;

3. Ensuring that the required environmental training is provided to the staff concerned; and
4. Contracting out external monitoring to independent firms and ensuring that periodic environmental audits are carried out.

The DD (Environment) and his team will also be responsible for:

1. Carrying out visits to the construction sites to review the environmental performance of the contractors; and
2. The status of the Project's consultation strategy.

c) Supervision Consultant

Supervision Consultant will involve the Environmental Expert/ Monitoring Consultant and Resident Engineer. The Resident Engineer will overlook the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP. The Monitoring Consultant (MC) on the other hand will carry out the environmental monitoring and report to DD (Environment) for adequacy of the monitoring program as specified in EMP. The MC will also induct a Technical Training Consultant to educate the Contractor's and NHA's staff.

7.3.3 Monitoring Parameters

a) Environmental Monitoring Parameters

The following environmental parameters will be monitored at locations identified during the construction phase (e.g. location of asphalt plants, construction camps. etc.).

- Ambient Air Quality (NO_x, SO_x, CO and PM₁₀)
- Asphalt Plant Emissions (smoke, dust, etc.)
- Ambient Noise Levels; and
- Water Quality

b) Social Monitoring Parameters

Social monitoring will be carried out based on the following indicators:

- Number of PAPs to be resettled/ relocated/ provided livelihood assistance where required;
- Availability and adequacy of alternative resettlement sites for PAPs (by number and type);
- Inventory and valuation of PAPs' affected assets;
- Pre- and post-resettlement incomes of PAPs;
- Notice period given to PAPs before shifting them from their original locations within the RoW;
- Number of vulnerable PAPs compensated under the EMP;
- Verification of shifting assistance provided to displaced squatters and to squatter-owners allowed to salvage their facilities;
- Number and nature of consultations carried out, as well as targeted stakeholders;
- PAPs' perspectives on compensation procedures, entitlement packages, and proposed alternative resettlement sites;

- Record of any problems due to restricted access to the highway during construction and whether ramps/ diversions have been provided where required;
- Number of grievances recorded and redressed;
- Number of public facilities and utilities to be relocated;
- Number of mosques/ shrines/ graves to be relocated (if any) and corresponding contribution of affected communities and NHA; and
- Verification of relocation of mosques/ shrines/ graves.

7.3.4 Reporting Structure and Outcomes

253. Progress reporting will be the overall responsibility of the Project Director who will provide inputs to the Supervision Consultants for submission to GM (NHA/ADB). The Supervision Consultants will be responsible for submitting a monthly environmental/ social report for the Project to GM (NHA/ADB). In addition, the DD (Environment) will prepare a quarterly report encompassing environmental concerns, and following review by the Director (Environment, Social and Land/Resettlement) he will submit the report to the EPA Sindh.

7.4 Environmental Management Plan

254. The Environmental Management Plan based on the mitigation measures (indicated in Section 5 of this Report) is presented in Table 7.1 below.

Table 7.1 (a): Environmental Management Plan (Design/ Pre-Construction Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
1	Topography	RoW Clearing Visual changes to topography	Minimize the degradation of the natural topography of the area	Design Consultants (DC)
2	Land Acquisition and clearing	Land acquisition and resettlement	Minimize acquisition of precious/fertile land	DC
3	Flora	Cutting of trees falling within the corridor	1. Design alignment in such a manner that minimum trees should be cut; 2. Provision for replantation	DC
4	Flood hazards	Flood damages to the local community and road due to blockage of breach points	Providing culverts to control flood damages	DC
5	Social/ cultural	Exit/entry problems for the residents and loss of commercial activity. Safety hazards for the pedestrians.	Provision of Zebra Crossings/ U turns in the design	DC
6	Resettlement Issues	Relocation of households, commercial and public buildings	Suggested separately in RAP	Land Acquisition Committee
7	Religious Places	Resettlement of some small mosques and shifting of some graves	Compensation mode for mosques and graves should be in accordance with the guidelines of religion and religious leaders of the area should be involved in this matter	Land Acquisition Committee

Table 7.1 (b): Environmental Management Plan (Construction Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
1	Topography	Cutting and dismantling of pavements and borrow area	<ol style="list-style-type: none"> 1. Landscaping and construction of stone pitching/ riprap across the embankments 2. Land management to take care of the drop in the elevation of the borrow areas. 	Construction Contractors (CC) and Supervision Consultants (SC)
2	Land Acquisition and Resettlement	Loss of agricultural land, livelihood, commercial activities and loss of fertile plough layer at camp sites and asphalt plants and drop in the elevation of the borrow areas.	Compensation for loss in agricultural products	CC, NHA's land/ social staff
3	Borrow/ open pits	Borrow and open pits are potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife	Where deep ditching is to be carried out, the top one meter layer of ditching area will be stripped and stockpiled. The ditch will initially be filled with scrap material from construction and then levelled with the stockpiled top soil	CC and SC
4	Air Quality	Dust and vehicular emissions-Air quality will be affected by fugitive dust and emissions from construction machinery, asphalt plants and vehicular traffic. Emission may be carried over long distances depending upon the wind speed, direction, the temperature of the surrounding air etc.	<p>Dust control by equipping asphalt, hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions.</p> <p>Sprinkling of water across diversion tracks. Ensuring that haul trucks carrying asphalt concrete mix and/ or aggregate fill materials are kept covered with tarpaulin to help contain construction material being transported between sites.</p> <p>Enforcing the NEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery.</p>	SC and NHA's Staff
5	Construction waste disposal (Wastewater, oil and solid waste etc.)	Unhygienic conditions	<p>Wastewater effluent from contractors workshop and equipment washing yards would be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams</p> <p>Training of work force in the storage and handling of materials and chemicals that can potentially cause soil contamination</p> <p>Solid waste generated during construction and in camp</p>	CC and SC

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S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
			sites will be properly treated and safely disposed off in demarcated waste disposal sites. Debris generated by dismantling of existing pavement structures will be recycled subject to the suitability of the material.	
6	Health and Safety Hazards	Accidental risks	Training workers in construction safety procedures; equipping all construction workers with hard boots, helmets, gloves and protective masks.	Training assistant hired by NHA.
7	Geology and Soil	Soil erosion may occur around contractors camps as a result of unmanaged run-off from equipment washing yards. Possible contamination of soil by oil and chemicals at asphalt plant sites, workshops areas and equipment washing yards may limit future use of lands for agricultural purposes.	Low embankments will be protected by planting 'Vetiver' grass that can flourish in local conditions. High embankments will be protected by constructing stone pitching or riprap across embankments. This practice will also be applied across cross drainage structures where embankments are more susceptible to erosion by water run-off. Appropriate measures for slope protection like vegetation cover will be taken. Soil contamination by asphalt will be minimized by placing all containers in caissons.	CC, SC and NHA staff for land affairs
8	Noise	Noise pollution due to increased vehicular mobility and construction activity	Selection of up-to-date equipment and plant, with reduced noise level ensured by suitable in built damping techniques and appropriate muffling devices. Confining excessively noisy work to normal working hours in the day. Providing the construction workers with suitable hearing protection like ear cap, ear muffs etc. Avoiding heavy machinery like percussion hammers and pneumatic drills, especially during night time. Locating the rock crushing, concrete mixing and materials shipment yards at least 2km from residential areas, particularly schools, hospitals and nursing homes.	SC and NHA staff

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S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
9	Surface and Groundwater	Surface water might get contaminated by the disposal of construction waste generated due to the Project activity; this contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.	The surface and groundwater reserves will be adequately protected from any source of contamination such as the construction and oily waste that will degrade its potable quality. The solid waste will be disposed off in designated landfill sites to sustain the water quality for domestic requirements.	SC and NHA staff
10	Flora	Cutting of trees due to Project related construction activities.	Re-plantation of indigenous species.	NHA staff for forest
11	Utilities	Construction activities will result in relocation of various utilities within the RoW, including electrical poles, transmission and telephone lines	1. Strengthening of utilities, wherever required; 2. Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area	NHA staff and local concerned departments.
12	Local communities	Migrant construction workers inevitably cause social unease and active disputes with the local community due to cultural differences. In addition, the involvement of migrant workers in the Project activity will reduce the employment opportunity for the locals, construction activity at site will also cause disturbance, to the already existing businesses along the Project area and pedestrians movements.	Migrant worker camp sites will preferably be located approximately 500 metres away from local settlements and sensitivity towards local customs and traditions will be encouraged. Good relations with the local communities will be promoted by employing skilled and un-skilled natives, providing proper compensations for the losses of businesses and alternate paths for the routine movement of the pedestrians.	NHA, CC and SC in coordination with Union Councils and local NGO's
13	Social/ cultural	Exit/entry problems for the residents; Movement of people to the mosque/ shrine will be disturbed.	Timely completion of the construction works and provision of alternate routes	CC and SC
14	Water logged & Wetland Areas	Road can settle in such areas if not designed and constructed according to the design specifications for such conditions.	Road sections in waterlogged and wetland areas should be designed according to the relevant design specifications for such conditions and design must be followed by the contractor's staff.	DC and CC

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S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
15	Traffic Management	Disturbance to routine traffic plying in the Project area	Alternate traffic management plan	NHA and NHMP

Table 7.1 (c) Environmental Management Plan (Operation Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
1	Noise	Noise is expected to increase due to increase in traffic volume	Provision of adequate noise barriers such as hedges and indigenous tree species. In addition, the height of boundary walls of sensitive receptors such as basic health units, schools and colleges will be raised along the Project corridor.	SC
2	Air Quality	Improvement in road condition will help reduce traffic related emissions in the short term by allowing a smoother traffic flow. However, in the long run, increased traffic levels and congestion will lead to pollution levels well above the international standards such as WHO guidelines and JICA standards.	Setting up of a system to monitor air quality along Project area in accordance with acceptable international standards. Helping the owners and occupants of the affected premises to identify and implement special measures such as hedges and vegetation to reduce air pollution	SC

Note: DC (Design Consultant) CC (Construction Contractor), SC (Supervision Consultant), NHA (National Highway Authority), NHMP (National Highway & Motorway Police)

Table 7.2 Environmental Monitoring Plan

Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
Pre-Construction/ Design								
	Air Quality SO _x NO _x CO PM ₁₀	5 metres from the edge of pavement downwind at three selected locations	134 ppb 106 ppb 35 ppm 200 µg/m ³	2	Baseline once prior to construction @ Rs.75,000/ location	NHA	Continuous 24 hours	150,000/-
	Water Quality E-Coli	Community groundwater sources near the edge of the RoW at three selected locations on existing/ proposed highway	0 cfu/100 mL (WHO guidelines)	3	Once before construction starts @ Rs. 1,500/test for 3 locations	NHA		4,500/-
	Noise Levels on dB(A) Scale	Three locations: 5 m from the edge of the pavement, at sensitive location like basic health unit, school, madrassa and residential/ commercial area.	WHO Noise Guidelines	3	Once before start of construction @ Rs.500/- source	NHA	12 hours, readings taken at 15 sec intervals over 15 min, every hour and then averaged.	1,500/-
Construction								
	Air Quality PM ₁₀	35 metres from the hot mix plant in downwind direction	200 µg/m ³	8	Once every 6 months during construction period @ Rs. 5000/ location	Monitoring Consultants (MC)	Continuous 12 hours or over one full working day	40,000/-
	Air Quality SO _x NO _x PM ₁₀	5 m from edge of the pavement downwind	134 ppb 106 ppb 200 µg/m ³	8	Once every 6 months during construction period @ Rs. 50,000/ location	MC	Continuous 12 hours or over one full working day	400,000/-
	E-Coli	Community groundwater source near the edge of the RoW two selected locations on existing/ proposed highway	WHO drinking water quality guidelines	8	Once a every 6 months during construction and the start of the operation phase @ Rs. 1,500/test	MC	-	120,000/-
	Noise Levels on dB(A) scale	7.5 m from the equipment whose noise level is to be determined	WHO noise guidelines	40	Throughout the construction phase, once every 6 months @ Rs.500/ source	MC	Reading taken at 15 Sec. intervals over 15 min, every hour and then averaged	20,000/-

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Project Stage	Parameters	Details of Location	*Standards/ Guidelines	No. of Samples	Frequency	Responsibility	Duration	Cost (Rs.)
	Noise Levels on dB(A) scale	5 m from edge of the pavement at three selected locations on existing/proposed highway	WHO Noise Guidelines	20	Once every 6 months during construction phase @ Rs.500/source	MC	24 hours, readings taken at 15 sec intervals, over 15 min, every hour, and then averaged	10,000/-
	Oil and Grease	Five selected locations in contractor's equipment yards, as identified by the supervision consultant	Threshold set by USEPA for each contaminant	10	Once a year in construction phase @ 1,000/sample	MC	-	10,000/-
Operation								
	Air Quality SO _x NO _x CO PM ₁₀	5 m from the edge of the pavement downwind background concentration near a residential area at a sensitive location e.g. hospital or school, taken at 3 selected locations on the highway	134 ppb 106 ppb 35 ppm 200 µg/m ³	6	3 samples twice a year for three years @ Rs. 50,000/location	MC	Continuous 24 hours (Assuming three years past Project monitoring)	150,000/ year i.e 150,000 (3 years)
	Water Quality E-Coli	Community ground water sources near RoW – two selected locations on existing/ proposed highway	WHO Drinking Water Quality Guidelines	6	Once a year in summer, just before monsoon season for three years @ Rs.1,500/test	MC	-	90,000/ year i.e 270,000 (3 years)
	Noise Levels on dB(A) scale	Three locations: 5 metres from the edge of pavement, at sensitive location and a residential/commercial area	WHO noise guidelines	9	Once a year after start of operation for three years @ Rs.500/ source	MC	24 hours, readings taken at 15 sec, 15 min, every hour and then averaged	4,500/-
	Tree plantation survival rate of trees and revelation	On each visit the number of surviving trees to be compared with the number of samplings planted	The survival rate should be at least 70%, below which replantation shall be done		Every year for three years or more depending upon the survival rate	MC & NHA		
							Total Monitoring Cost	1,180,500

- SO_x, NO_x, CO values are compared with WHO guidelines
- MC – Monitoring Consultant
- DC – Design Consultant

7.5 Environmental Mitigation Cost

255. To minimise the negative impacts arising due to increased vehicular activity on the road, the mitigation measures could be:

- (i) Tree plantation (number of trees planted will be 4 times the number of trees cut) for reducing the air pollution along with the excessive noise;
- (ii) Plantation of excessive trees along the Project Section; and
- (iii) Installation of street lights in the areas having excessive population on both sides of the Section.

256. Table 7.3 gives the mitigation costs for the above mentioned mitigation measure.

**Table 7.3
Cost for Mitigation Measures**

Proposed Mitigation	Detail	Area/length	Cost (Rs.)	Cost (Million Rs.)
Trees Plantation for replacing cut trees	2,704 trees in total road section will be cut down and 10,816 new trees will be planted.	68.5 Km	40/plant	0.43
Plantation of excessive trees	Plantation of extra trees in the Project area	68.5 Km	20,000/Km	1.37
Installation of street lights in the populated areas	Double-arm, street light poles @ 50m C/C will be installed (40 nos.)	2 Km	40,000/pole	1.60
Sub Total				3.40
Environmental Monitoring Cost				1.18
Resettlement Costs including Monitoring and Training Costs (as per Resettlement Action Plan)				122.70
Sub Total				122.70
Overall Mitigation Cost:				127.28

7.6 Environmental Technical Assistance and Training Plan

257. An environmental and social training and Technical Assistance (TA) programme will be carried out to build the NHA's capacity to effectively implement this EMP, as well as to facilitate the improved environmental management of future highway Projects by increasing the environmental and social awareness of NHA staff in general. The NHA with the collaboration of Monitoring Consultants (MC) will arrange the environmental training sessions for their staff. The objective of these sessions will be to help establish appropriate systems, and to train senior NHA staff responsible for managing environment, operations, and planning, who can then impart training at a broader level within and outside the NHA (i.e., the training of trainers). The Consultants will organize training courses for NHA staff, in specialized areas such as air and noise pollution monitoring; develop environment operation

manuals in consultation with the NHA's Environmental wing. The details of this training program are presented in Table 7.4

Table 7.4
Personnel Training Programme/ TA Services

Provided by	Contents	Trainees/ Events	Duration
Monitoring consultants/ organizations specializing in environmental management and monitoring	Short seminars and courses on: Environmental laws and regulations daily monitoring and supervision	Three seminars for NHA Project staff	2 days
Monitoring consultants/ organizations specializing in social management and monitoring	Short seminars and courses on: Social awareness	Three seminars for Project staff dealing in Social/lands matters	2 days
Monitoring consultants/ organizations specializing in Occupational, health and safety issues	Short lectures relating to Occupational Safety and Health	Two seminars for contractor's staff	2 days

7.7 Environmental Monitoring, Mitigation and Training Costs

258. For an effective implementation of environmental mitigation measures, it is very important to provide sufficient funds for implementation of environmental mitigation measures, monitoring and training. The total cost of these items has been included in the Resettlement Costs. The total environmental costs amounts to 127.28 millions

SECTION 8 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

8.0 General

259. This section deals with the information disclosure to the public and consultation sessions held with the different stakeholder groups that are likely to be affected by the implementation of the proposed Project. The consultation process was carried out as per the guidelines of ADB and EPA.
260. This consultation process had the following objectives:
1. Share information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment of the Project corridor;
 2. Understand stakeholders' concerns regarding various aspects of the Project, including the existing condition of the highway, upgrading requirements, and the likely impact of construction related activities and operation of the improved highway;
 3. Provide an opportunity to the public to influence Project design in a positive manner;
 4. Obtain local and traditional knowledge, before decision making;
 5. Increase public confidence about the proponent, reviewers and decision makers;
 6. Reduce conflict through the early identification of controversial issues, and work through them to find acceptable solutions;
 7. Create a sense of ownership of the proposal in the mind of the stakeholders; and
 8. Develop the proposal which is truly sustainable.

8.1 Identification of main Stakeholder

261. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. During the field survey different stakeholders identified were the local residents, government officials, shop owners, hotel owners, vendors, petrol pump owners and general public. All those stakeholders had different types of stakes according to their professions.

8.2 Scoping Sessions

262. A series of scoping sessions and focus group discussions were also carried out with local communities and local government representatives. The meetings were held at various locations.
263. Generally, people were found to be aware of the need to upgrade the highway, and indicated their support for the present NHA Project. The proposed improvement of the existing 2 lane carriageway met with particular support since it will reduce traffic congestion and other highway hazards near settlements along the Project corridor. Local communities demanded that they should be part of a continuous consultation process with other stakeholders at different stages of the Project including the design, construction, and operational periods. The scoping sessions were carried out according to the schedule indicated in Table 8.1.

Table 8.1
Schedule of Scoping Sessions

S. No.	Date	Time	Location	Topic	No. of Participants
1	27 th May 2006	10:00 am	Sukkur Bypass	Project introduction & Suggestions of Stakeholders	12
2	27 th May 2006	05:00 pm	Lakhi Town	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed	9
3	28 th May 2006	10:30 am 10:30 am	Jahan Khan Village Mad Ghosa Balawal, Dadu K.N.Shah Road	Project introduction & Suggestions regarding Road Safety Resettlement issues were discussed	10
4	28 th May 2006	1:30 pm 16:30 pm	Sultan Kot village Punjal Sheikh	Project introduction & Discussion on Compensation Package with the Affectees	18
5	29 th May 2006	10:30 am 15:30 pm	Hamayon Abad	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed	9
6	30 th May 2006	13:30 pm	Lodhran village	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed	6
7	1st June 2006.	14:30 pm	Bagrari Pull	Project introduction & Discussion on Compensation Package with the Affectees Resettlement issues were discussed	8

Stakeholders' Concerns

264. The most commonly concerns raised during the meetings are listed herewith:

(a) Highway Design

- Improve general standards of construction;
- Abate dust emissions by providing paved road shoulders;
- Construct median in the centre of road for the safety of moving traffic.
- Provide U-turns where required, and provide bypasses near settlements;

- Provide drain outlets to help drain away run-off from the highway, particularly in waterlogged areas and in areas where road level is higher than that of surrounding settlements;
- Provide footpaths and lanes for slow-moving traffic, particularly cyclists;
- Provide rest areas and toilet facilities along the highway; and
- Plant trees along the highway that could be entrusted to the care of local communities.

(b) Highway Construction

- Avoid undue delays in road construction and ensure that Project works are carried out quickly;
- Avoid dumping construction material along the highway and median;
- Adopt measures to minimise dust, smoke, and noise pollution, and to control spillages from construction machinery;
- Implement a proper solid waste management plan;
- Induct local labour into the construction workforce as far as possible to avoid social conflict between the migrant labour and local communities; and
- Provide proper diversion for the traffic during construction to avoid traffic congestion, related hazards, and dust emissions.

(c) Highway Operation

- Erect cautionary and inforamatory signs;
- Control over-speeding, overloading, the use of loud horns near schools, traffic disorders and violations of traffic regulations;
- Specify speed limits where required;
- Prohibit commercial vendors and squatters from encroaching on the RoW;
- Ensure that cross-drainage pipes and culverts are regularly cleaned; and
- Regularly remove accumulated piles of rubbish from the RoW.

Categories of different stakeholders are presented in Table 8.2.

Table 8.2
Categories of Different Stakeholders and their Stakes

Stakeholders	Concerns/ Aspirations Raised	Mitigation Measures	Proposed in EMP
Residents	i) Noise and air pollution should be controlled; ii) There should be less exit/entry problems for the residents; iii) Proper relocation of utilities; and iv) Waste material should be disposed off in a proper way.	i) Discussed in Section 5, under construction and operational phases	Discussed under Section 7 in Table 7.1 (a), (b) & (c)
Office workers	i) Noise and air pollution should be controlled; and ii) Proper relocation of utilities.	i) Discussed in Section 5, under construction and operation phases; and ii) Steps will be taken to minimize the negative impacts on business activities.	Discussed in Table 7.1 (a), (b) & (c)
Shops owners	i) Dust and air pollution should	i) Discussed under	Discussed in Table

Stakeholders	Concerns/ Aspirations Raised	Mitigation Measures	Proposed in EMP
	be controlled; ii) Proper relocation of utilities; and iii) Business will decrease during construction.	Section 5, during construction and operation phase; and ii) Steps should be taken to minimize the negative impacts on business activities.	7.1 (a), (b) & (c)
Hotel owners	i) Dust and air pollution should be controlled; ii) Proper relocation of utilities; and iii) Reduction in the business activities during construction.	i) Discussed under Section 5, during construction and operation phase; and ii) Steps will be taken to minimize the negative impacts on business activities.	Discussed in Table 7.1 (a), (b) & (c)
Vendors	i) Possible loss of livelihood; and ii) Displacement from the location.	Assistance in shifting and compensation will be provided during the transition period.	Discussed in Table 7.1 (a), (b) & (c)
Petrol pump owners	i) Reduction in the business activities during construction; and ii) U-turns should be provided.	i) Steps will be taken to minimize the negative impacts on business activities ii) Feasible U turns should be provided	Discussed in Table 7.1 (a), (b) & (c)
General Public N.G.O(Non governmental organization)	i) Noise and air pollution should be controlled; ii) Proper alternate routes should be provided; iii) Proper relocation of the affected people; and iv) Proper relocation of utilities.	i) Discussed under Section 5, during construction and operational phases	Discussed in Table 7.1 (a), (b) & (c)

8.4 Proposed Measures for incorporating the Stakeholders' Concerns

(a) Highway Design

The contractors and design consultants will include the following environmental and safety provisions in the project design under the Project:

- Highway safety audits and improved road markings/signage and demarcation of accident-prone areas in order to improve the horizontal and vertical geometry, and reduce conflicting movement during operation, particularly along inhabited stretches of road;
- Traffic control devices, including information and cautionary signs, signals, traffic diversion and road markings, to ensure pedestrian safety during construction and operation;
- A tree plantation programme to compensate for the anticipated loss of vegetation during the construction activities, and to help abate pollution caused by emissions, dust, and noise during highway operation; and
- Outfalls for the highway median and side drains to divert surface run-off from the carriageway, and protect ribbon development areas and settlements.

(b) Highway Construction

The following measures will be carried out in order to protect surrounding communities from the expected impact of construction:

- Project facilities will be located at a minimum distance of 500 metres from existing settlements and built-up areas. In order to avoid restricting the mobility of local people, construction vehicles will remain confined within their designated areas of movement.
- Sensitivity towards local customs and traditions will be encouraged to minimise social friction. Good relations with local communities will be promoted by encouraging contractors to provide opportunities for skilled and unskilled employment to locals, as well as on job training in construction for young people.
- NHA is bound to comply with the prevailing national/provincial regulations concerning pollution and waste disposal.
- Solid waste generated during construction and at camp sites will be properly treated and safely disposed off only in demarcated waste disposal sites approved by the supervision consultant; and
- All necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights) erected as required by the NHA/NHMP (National Highway and Motorway Police). All such barricades will be set up as per local regulations.

(c) Highway Operation

- The NHA will work closely with the newly established NHMP to ensure that drivers as well as pedestrians observe traffic rules and that the safety of the pedestrians is not compromised;
- NHA and NHMP will maintain the traffic signs and signals and make sure that in case of some emergency, the affectees are provided emergency services without any delay; and
- Traffic management plans will be prepared and implemented in conjunction with the NHMP and roadside commuters to reduce congestion and traffic hazards.

8.5 Village Meetings

265. Village meetings have many uses in participatory development, including information sharing and group consultation, consensus building, prioritising and sequencing of interventions and collaborative monitoring and evaluations. Concerns raised during village meetings have been discussed in Table 8.3.

8.6 Future Information Disclosure Plan

266. After suggesting the possible solutions of the stakeholders' concerns, the solutions (final EIA report) will be disclosed once again before the stake holders and general public. EIA report will be accessible to interested parties on request and the version of final report will be available in the nearest library and its summary will be available in stakeholders' mother tongue.

Table 8.3
Village Meetings and the Concerns

S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
1	Cattle Colony Sukkur	40	450	13.06.06	20	Dykes should be along the road. Service Road Should be provided. During road construction the chance of accidents increases it should be avoided by stopping heavy traffic during construction.	Economics opportunities for the people of area. Employment opportunity for the people of area. Transport Facility will be improved.
2	Village Manzor Mehar	50	400	14.06.06	18	Proper Bus Bays should be constructed. Village Laborer should be hire during construction	Transport Facility will be improved.
3	Lakhi Town	50	500	15.06.06	17	Provision For Cattle crossing. Under pass should Be constructed. Waiting room with proper facility of water and lavatory should be constructed	Better transport facilities. Chance of labor work during construction. Less time consumption during Journey
4	Jahan Khan	300	3000	16.06.06	21	Dust Pollution During Construction. Labor should be get from our village. Service road should be constructed.	Better transport facilities. Chance of labor work during construction. Less time consumption during Journey
5	Hamayon	50	750	16.06.06	16	Accidents Chances will be increase. Service road should be constructed. Level of both roads should be kept same.	Unemployment will be decrease .Patients would easily go to big cities
6	Abad	300	6000	16.06.06	18	Road should be constructed on the same ROW .Dust or Noise pollution should be avoided. Govt should give consideration to water problem too for the area.	We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.
7	Bagrari Pull	60	800	16.06.06	17	Service road should be provided. Sign board should be provided along the settlement and school. Proper arrangements should be done to avoid construction hazards.	We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.
8	Sultan Kot	50	300	17.06.06	13	Waiting sheds with water and lavatory facilities should be provided. Speed breakers Should be constructed to break the speed of fast moving traffic.	People will be able to reach big cities easily. Village people will never migrated to big cities

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S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
9	Village Mad Ghosa	100	1000	17.06.06	12	Bypass Should be provided to avoid population resettlement .Houses and shops should not be dislocated .Compensation should be given before demolition. Business should be disturbed .Village will be ruin .We don't want to leave our society and culture. We have no trust on govt Agencies. Masque Khudabad should be saved.	People will be able to reach big cities easily. This road will link the people of two provinces. Economy of the area will be boasted village at people will never migrated to big cities
10	Village Punjal Sheikh	150	1800	17.06.06	21	Land should be acquired from the other side of the road where is no settlement and is agriculture land. These house which are going to demolish are our whole life earning. We all are poor farmers and not in position to construct new houses. There is no got land in near vicinity. Mosque should not be shifted because people are highly sensitive about it.	Different kind of conveyances will be available. Different kind of industries will be installed.
11	Lodhran village	600	6000	18.06.06	15	Sharps curves should be avoided. Signboards should be installed along the public property. Median wall should be constructed between service lane and main road.	Better transport facilities will be available.
12	Malhi Ghoth	35	500	18.06.06	20	Fair and proper compensation should be given .Compensation should be given well in time .footpath should be constructed along the road. Fast trafficking should be prohibited near the villages. Proper sign boards should be installed along the road. Culverts should be constructed to avoid the accumulation of rain water on the road along row. Separate service lane should be constructed for local traffic.	We will enjoy better trans port facilities. Business facilities will be generated. Better transport facilities will be available.
13	Village Manzor Khan Panwar	250	2000	19.06.06	16	Fair and proper compensation should be given .Compensation should be given well in time.	It is good for the economic and social life of the area. Road will provide easy access to market.
14	Sardar Adim	150	2000	19.06.06	18	People of the area are facing many economic	Economic activities will get a boost.

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S. No	Village Name/ Venue	Total House hold	Population	Date	No of Participant	Main Concerns	Expectations
	Khan Panwar					hardships govt should announce a compensatory package for them. Proper system and place should be marked for boarding and dropping of passengers for public transport. Proper system of drainage and cleanliness of the road should be introduced.	
15	Haji Jhandro Village	250	2500	19.06.06	19	Under pass or over head bridge should be constructed. Proper bus stand should be provided. There should be tree plantation along the road to avoid the air pollution.	Better transport facility will be available .better chance of employment will be available during construction and after construction .roadside business will be generated.
16	Village Soomro Ghot	200	2500	20.06.06	19	A proper system to cater the rain water should be constructed along the road .Overloading should be checked .traffic police should be posted to regulate the traffic. Carts and <i>tongas</i> should not be allowed on the road.	Better transport facilities will be available.
17	Ahmed Pur	400	6400	20.06.06	22	Fair and proper compensation should be given .Compensation should be given well in time.	Better transport facilities will be available.
18	Village Kaher			20.06.06	13	Waiting sheds with water and lavatory facilities should be provided. Bus bays should be constructed U turn should be provided.	It is good for the economic and social life of the area. Road will provide easy access to market.
19	Malhi Ghoth	35	900	21.06.06	16	Accidents Chance will be increase. Under pass should be provided. Service road should be provided	Better transport facility will be available. Better chance of employment will be available during construction and after construction .roadside business will be generated.
20	Ghot M. Ibraheem Sheikh	40	3000	21.06.06	17	Fair and proper compensation should be given. Compensation should be given well in time.	It is good for the economic and social life of the area. Road will provide easy access to market.

SECTION 9 CONCLUSIONS

9.0 General

267. This section presents conclusions of the entire EIA Report. Present Project has been conceived to provide fast and safe access to the traffic using Sukkur – Jacobabad Section of National Highway, N-65 that joins the provinces Punjab and Balochistan with Sindh. The conclusions are based on the findings of detailed environmental assessment, which has been carried out as a requirement of Federal EPA.

9.1 Feasibility/ Practical Utility of the Project

268. In order to check the feasibility of the ADB funded Project, an EIA study was carried out by a team of NESPAK experts. After carrying out detailed field surveys, it was felt that this Project will prove to be very beneficial in overcoming the problems being faced due to the single (non-standard) 2-lane carriageway.

9.2 Various Options considered for the Project

269. Various options were considered for this Project that included “No project”, Alternate transport modes” and “Improvement of the existing carriageway”. These have been discussed in detail in Section 4 of this Report. The last option was selected because it fulfills the Project requirements in the best way.
270. Three alternatives were discussed for the improvement of the existing carriageway, i.e. Widening of the both sides of existing road with the same alignment; up-gradation of the existing 2 lane road into 4 lane dual carriageway by extending on both sides from centreline of the existing road; and construction of a completely new carriageway parallel to the existing road. Second option was selected after discussing the associated benefits.
271. After the completion of this Project, a 4 lane dual carriageway will be available for the traffic moving between Sindh and Balochistan provinces, which will increase safety and comfort of the travellers and also reduce the travelling time.

9.3 Availability of Resources and Materials

272. Availability of resources and materials for the execution of present Project has been discussed in Section 2 of this Report. All the resources are available in the vicinity of the Project Area, except reinforcement, asphalt and cement that will be purchased from Karachi.

9.4 Identification of the Main Issues and Concerns

273. During the field surveys, significant efforts were made to identify the main social, cultural and environmental issues related to the execution of this Project. Government departments and agencies were also contacted for

obtaining salient information. Following is the list of main issues and concerns:

- Resettlement of the structures, i.e. houses, mosques, schools, shops, graveyards, electric poles etc. that fall within the design Right of Way (RoW);
- Cutting of excessive number of trees falling within the proposed corridor;
- Due to the change in the hydrologic regime, flood water can cause damage to the local community and road;
- Disturbance to the public movement during construction;
- Reduction in the business activities during construction;
- Noise and air pollution due to the operating of construction machinery during construction phase of the Project;
- Solid waste generation during construction; and
- Oil spillages from construction machinery, resulting in soil and groundwater contamination.

9.5 Mitigation Measures proposed

274. In order to overcome the social, cultural and environmental issues discussed above, following mitigation measures have been proposed (detail available in Section 7):

- All the affectees should be compensated for their properties, falling in the RoW, through judicious compensation packages. For this purpose all such structures have been measured and evaluated for their costs estimation.
- Trees that are within the corridor and have to be cut down should be compensated by planting new trees in a ratio 4:1 to the cut trees.
- Provision of culverts can be made to control flood damages and ensuring safety of embankments against floods. Drains should be designed to take the design flows.
- In order to minimise the disturbance to the public during construction, road should be constructed in two parts (it should be widened on one side at a time). Informatory signs and warning boards should be displayed. Zebra Crossings and U turns provided at appropriate places will help people safely cross the road even after the construction.
- Compensation should be made to the affectees for loss in business/ commercial activities.
- Air and dust pollution can be controlled by equipping asphalt, hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions. Haul trucks carrying asphalt concrete mix and/ or aggregate fill materials should be kept covered with tarpaulin to help contain construction material being transported between sites.
- Noise pollution due to working machinery and equipment must be taken seriously. All the workers must be provided with suitable hearing protection like ear cap, ear muffs etc. Machines and equipment noise should be controlled by providing appropriate muffing devices to the construction workers.
- Solid waste generated during construction and in camp sites should be properly treated and safely disposed off in demarcated waste disposal sites. Aggregate waste material of existing road can be

reused in up-gradation of road. Sanitary wastes generating from staff and labour camps must be disposed off in environment friendly manner, i.e. provision of septic tank etc. for toilet wastes.

275. Table 9.1 summarises the overall findings and recommendations of the present EIA Study in matrix form.

Table 9.1
Findings and Recommendations of the EIA Study

S. No.	Main Findings	Recommendations
1	Project will cause resettlement of the houses, mosques, schools, shops, graveyards, electric poles etc. that fall within the design Right of Way (RoW)	Judicious compensation packages should be given to the affectees for their properties. Religious structures should be relocated/ compensated by involving local religious leaders.
2	A large number of trees will have to be cut for widening the existing Road.	New trees must be planted in a ratio 4:1 to the cut trees.
3	Due to the change in hydrologic regime, floods can damage road and local community.	Proper designing of drains and provision of culverts at appropriate locations can control flood damages.
4	During the construction phase, public movement will be disturbed.	Construction of road will be done in two parts (it should be widened on one side at a time). Informatory signs and warning boards should be displayed. Zebra Crossings and U turns should be provided at appropriate places.
5	Execution of the construction works will reduce the business activities of the area.	Proper compensation should be provided to the affectees for their business losses.
6	Project activities (operating of construction machinery during construction phase of the Project) will increase noise and air pollution of the Project Area.	<ul style="list-style-type: none"> • Air and dust pollution can be controlled by equipping asphalt, hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions. Haul trucks carrying asphalt concrete mix and/ or aggregate fill materials should be kept covered with tarpaulin to help contain construction material being transported between sites. • For minimising the effects of heavy noise emissions from working machinery and equipment, all the workers must be provided with suitable hearing protection like ear cap, ear muffs etc. Machines and equipment noise should be controlled by providing appropriate muffling devices.
7	Solid waste will be generated during construction phase of the Project.	Solid waste generated during construction and in camp sites will be properly treated and safely disposed off in demarcated waste disposal sites. Aggregate waste material of existing road can be reused in up-gradation of road. Sanitary wastes generating from staff and labour camps must be disposed off in environment friendly manner, i.e. provision of septic tank etc. for toilet wastes.

9.6 Benefits of the Project

276. After the execution of the Project, people living in the Project Area and the travellers of the National Highway (N-65) will get the following benefits:

- Overall safety of passengers will be increased.
- Less time will be required for travelling and reaching the destination.
- During the construction phase, local labour will be accommodated in the construction activities.
- Economic condition of the area is expected to get an uplift due to better approach to the nearby markets.
- Inter-provincial trading will get a boost due to better communication passage.

9.7 Environmental Management Plan (EMP)

277. An Environmental Management Plan (EMP) has been provided in Section 7 of this Report. The EMP will facilitate the NHA in taking mitigation measures for potential environmental impacts of the Project. It will also enable NHA to enhance the Project's overall benefits and introduce standards of good environmental practices. Roles and responsibilities of functionaries have also been defined in the EMP for effective management of the Project components.

9.8 Surveillance and Maintenance of the Road after Construction

278. National Highway Authority (NHA) and National Highway and Motorway Police (NHMP) will take care of the road after upgrading/ widening. NHA will look after its surface condition and make sure that there are no encroachments within the Right of Way (RoW).

279. National Highway and Motorway Police (NHMP) will be responsible for ensuring smooth traffic flow on the road. They will advise NHA to provide the required facilities for reducing the road accidents and hazards.

9.9 Proposed Measures for incorporating the Stakeholders' Concerns

280. During the detailed survey, Consultants' EIA team identified the main stakeholders of the proposed Project and discussed the Project with them in order to get knowledge about their concerns and worries. Section 8 of this Report discusses public consultation and information disclosure in detail. It also describes the measures suggested for mitigating these concerns.