ENVIRONMENTAL ASSESSMENT REPORT
(FINAL)

Bhaupur - Mughalsarai Section of EDFC

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ABBREVIATION

AAQ	Ambient Air Quality
ADB	Asian Development Bank
AFs	Affected Families
AIDS	Acquired Immunodeficiency Syndrome
ASI	Archaeological Survey of India
BIS	Bureau of Indian Standard
BOD	Biological Oxygen Demand
CC	Cubic Centimeter
CF	Conservator of Forest
Cl	Chlorine
CO	Carbon Monoxide
CPCB	Central Pollution Control Board
CPRs	Common Property Resources
CS	Construction Supervision
dB	Decibel
DDP	Desert Development Programme
DFC	Dedicated Freight Corridor
DFCCIL	Dedicated Freight Corridor Corporation of India Limited
DFO	Divisional Forest Offices
DO	Dissolved Oxygen
DR	Detailed Railway
EA	Environmental Assessment
EAC	Expert Appraisal Committee
EIA	Environment Impact Assessment
EMAP	Environment Management Action Plan
EMP	Environmental Monitoring Plan
EMU	Environment Management Unit
ESIMMS	Environmental and Social Impact Mitigation Measures Study
EWG	Environmental Working Group
Fe	Iron
GoI	Government of India
Hg	Mercury
HIV	Human Immunodeficiency Virus
ICCP	Information and Community Consultation Programme
ICDs	Inland Container Depot
IS	Indian Standards
LAA	Land Acquisition Act
LA_E	Exposure Noise Level
LAeq	Equivalent Noise Level
LPG	Liquefied Petroleum Gas
MLA	Member of Legislative Assembly
MoEF	Ministry of Environment & Forests
MP	Member of Parliament
N	Nitrogen
Na	Sodium
NEP	National Environmental Policy
NGO	Non Government Organization
NO	Nitrogen Oxide
NPRR	National Policy on Resettlement and Rehabilitation

NRCP	National River Conservation Plan
OM	Organic Matter
OP	Operational Policy
PAFs	Project Affected Families
PAPs	Project Affected Person
Pb	Lead
PCCF	Principal Conservator of Forest
PDA	Passenger Diesel A (Plain Route) Train
PUC	Pollution Under Control Certificate
RAP	Resettlement Action Plan
ROB	Railway Over Bridge
ROW	Right of Way
RPM	Respiratory Particulate Matter
RRP	Resettlement and Rehabilitation Plan
RUB	Railway under Bridge
SC	Scheduled Caste
SDOE	State Department of Environment
SEIA	State Environment Impact Assessment
SIA	Social Impact Assessment
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
SR	Sensitive Receptors
ST	Scheduled Tribe
TOR	Terms of Reference
VRC	Village Rehabilitation Committee
WB	World Bank
WLS	Wildlife Sanctuaries
Zn	Zinc

EXECUTIVE SUMMARY

1.0 BACKGROUND

Ministry of Railways initiated action to establish a Special Purpose Vehicle for construction, operation and maintenance of the dedicated freight corridors. This led to the establishment of "Dedicated Freight Corridor Corporation of India Limited (DFCCIL)", to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the dedicated freight corridors. DFCCIL was incorporated as a company under the Companies Act 1956 on 30th October 2006. Mumbai-Delhi and Delhi-Howrah route have a current capacity utilization of more than 140%. This has led to the saturation of the Railways system in terms of line capacity utilizations on these corridors, which are specifically called the Western and Eastern corridor respectively. Dankuni-Sonnagar-Ludhiana section has been identified as part of the Eastern Corridor and from JNPT to Dadri via Vadodara-Ahmedabad- Palanpur-Phulera-Rewari is called Western Corridor. These corridors encompass a double line electrified traction corridors Dankuni-Khurja-Dadri and single line from Khurja to Ludhiana section under EDFC. The total length of EDFC works out to 1839 Km. The present study confines from Mugalsarai (KM. 667.00) to Bhaupur (KM. 1048) of EDFC.

2.0 OBJECTIVES OF THE ASSIGNMENT

As per the current regulations of Government of India, railway projects do not require conducting Environmental Impact Assessment (EIA) studies and obtaining Environmental Clearance (EC) from the Ministry of Environment and Forests (MoEF). However, considering the magnitude of activities envisaged as part of EDFC, the DFCCIL decided to conduct an EA and prepare an Environmental Management Plan (EMP) to mitigate potential negative impacts of the project. The Environmental Management Framework (EMF) has already been prepared for Phase-I of EDFC, i.e. Khurja to Bhaupur Section. The same is applicable for this section.

3.0 SCOPE OF ENVIRONMENTAL ASSESSMENT (EA)

The scope includes environmental assessment and environmental management plan for Mugalsarai-Bhaupur section of EDFC corridor. The EA process also envisaged to develop a comprehensive Environmental Management Frame work (EMF) for Mughalsarai – Khurja which would be adopted by DFCCIL as a part of the corporate Environmental Policy for DFCCIL.

EMF was prepared during phase-1 of Mughalsarai-Khurja i.e., Bhaupur-Khurja section EA. The same was referred and updated suitably. The objective of the EMF is to provide guidance to DFCCIL in conducting subsequent monitoring & reporting, and undertaking corrective actions, to develop and exercise mechanisms for effective supervision of the DFC Project during implementation and guidelines in terms of for environmental regulations.

4.0 DESCRIPTION OF PROJECT

The present project confines from Mugalsarai (km. 667.00 near Ganj Kwaja) to Bhaupur (km 1048.00) of EDFC. Total length from Mughalsarai to Bhaupur is around 392 km. This section is an important section of Howrah-Delhi double line electrified main trunk route of Northern Central Railway connecting the Northern, Central and Eastern regions of the country. The entire stretch of Mughalsarai-Bhaupur is in the State of Uttar Pradesh and passes through Kanpur Dehat, Kanpur Sadar, Fathepur, Kaushambi , Allahabad, Mirzapur and Chanduli Districts of Uttar Pradesh. There are number of major cities and settlements all along the section and to avoid such heavily built up area, eight detours (Kanpur, Fathepur, Khaga, Sirathu, Bhawari, Allahabad, Manda and Mirzapur) have been proposed at these locations. Since the proposed DFC track generally runs on the left side of the IR tracks (from Mughalsarai to Bhaupur), proposed detours are not considered for the right side (RHS) of the IR network because of technical constrains and high cost of construction for underpass / flyover to the IR tracks

5.0 KEY ENVIRONMENTAL LAWS AND REGULATIONS

Table 1 presents the environmental regulations and legislations relevant to project.

Table 1: Environmental Regulations and Legislations

S.No.	Act / Rules	Purpose	Applicability	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	The project activities should maintain emission standards	MoEF. GoI; DoE, State Gov. CPCB; SPCB
2	Environmental Impact Assessment Notification-14th Sep-2006	To provide environmental clearance to new development activities following environmental impact assessment	Linear Railway projects are not included in the Notification of 14th Sep, 2006 and EC under this acts is not applicable. However, as per MoEF circular No. No. L-llOll/47/2011-IA.II(M), dated 18th May 2012, borrow / quarry areas of <5ha, which will be used in project, require prior environmental clearances	MoEF
3	Notification for use of fly ash,1999	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	Possibility of use of fly ash shall be explored in Engg. designs	MoEF
4	The Forest (Conservation) Act 1927 The Forest (Conservation) Act. 1980 The Forest (conservation) Rules 1981	To check deforestation by restricting conversion of forested areas into non-forested areas	Applicable, Forest land is involved in the project.	Forest Department, Govt. UP (for land conversion below 5 hectare & 40 % density).
5	MoEF circular (1998) on linear Plantation on roadside, canals and railway lines modifying the applicability of provisions of forest (Conversation) Act, to linear Plantation	Protection / planting roadside strip as avenue/strip plantations as these are declared protected forest areas.	Applicability of Forest conservation act to Roadside strip Plantations .	MoEF
6	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by specifying the emission standards.	Emissions from construction machinery and vehicle should be checked time to time.	UPPCB

S.No.	Act / Rules	Purpose	Applicability	Authority
7	Water Prevention and Control of Pollution) Act , 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Various parameters in Effluents from construction sites and workshops are to be kept below the prescribed standards	UPPCB
8	Noise Pollution (Regulation and Control Act) , 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	DG sets at construction sites and workshops should be provided with acoustics enclosures.	UPPCB
9	Ancient Monuments and Archaeological Sites and Remains(Amendment & Validation Act, 2010	Conservation of cultural and historical remains found in India	If any historical remains are found, would be notified/ surrendered to the Competent Authority.	National Monuments Authority of India
10	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Shall be taken as per requirements	UPPCB
11	Explosive Act 1984	Safe transportation, storage and use of explosive material	Respective Authorization shall be obtained from CCE	Chief Controller of Explosives (CCoE)
12	Minor Mineral and concession Rules	For opening new quarry.	Quarry Licenses shall be obtained by Contractors.	District Collector
13	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989	To check vehicular air and noise pollution.	All vehicles in Use shall obtain Pollution Control Check certificates	Motor Vehicle Department
14	National Forest Policy1952 National Forest Policy (Revised) 1988	To maintain ecological stability through preservation and restoration of biological diversity.	Forest land is involved in the project.	Forest Department, GoI and GoUP
15	The Mining Act	The mining act has been notified for safe and sound mining activity.	Quarry Licenses shall be obtained by Contractors.	Department of mining, GoUP
16	Hazardous waste (Management, Handling & Transboundry)Rules, 2008	Management and storage of hazardous waste.	Applicable	UPPCB /MoEF
17	The Railway (Amendment) Act , 2008	Land acquisition	Land acquisition is involved	GoI
18	The Petroleum (Amendment) Rules, 2011	Use and storage of petroleum products	Applicable	CCoE /DC

For projects with potential to have significant adverse environmental impacts (Category-A) an environmental impact assessment (EIA) is required. Category B projects are judged to have some

adverse environmental impacts, but of lesser degree or significance than those for category A projects and require an Environmental Assessment (EA) to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the EA is regarded as the final environmental assessment report as is the case for this project. The project railway line passes through very small patches of degraded forests area. No presence of endangered fauna and flora along the project railway line has been noticed. A small parcel of forest land will be required for to the proposed project. The Government of India has issued Environmental Impact Assessment Notification in 1994 under Environmental (Protection) Act, 1986, which was amended in September, 2006. Railway projects do not fall under its purview requiring an environmental clearance from MoEF. However, consent to operate (or NOC) will be required from SPCB under the Air and Water Acts for operating equipment during construction phase.

It has been established that there is a need for improving the infrastructure capacity of the transport sector to cater the projected demand for freight and good movement. By building up the rail infrastructure which uses 1/6th the fossil fuel consumption as compared to road, overall improvement n environmental condition is envisaged. Over and above since traction in this case would be electricity based, there is a possibility that this electricity can come from the budding nuclear capacity of the nation. Thus there can not be more eco-friendly and efficient transport system to meet with the demand of India's growth economy than the proposed dedicated freight corridor.

Since this is a large scale project and likely to have some reversible impacts on environment during construction phases and some impact, not of much significance, during operation as well, this project is being considered as "**A" Category project** as per the World Bank safeguard policy. This will help not only in tweaking the construction stage to be more eco-compliant but to have better and more environment friendly construction to establish most efficient and eco-friendly system.

6.0 BASE LINE ENVIRONMENT

Data was collected from secondary sources for the macro-environmental setting like climate, physiography (Geology and slope), biological and socio-economic environment within Project Influence Area, CPM Office/ Project District. First hand information have been collected to record the micro-environmental features within Corridor of Impact,(CoI) i.e. project area of 5 km on both side of the project alignment. Collection of first hand (Primary) information includes preparation of base maps, extrapolating environmental features on proposed alignment, environmental monitoring covering ambient air, water, soil, noise and vibration, tree enumeration, location and measurement of socio-cultural features abutting project alignment. The environmental profile and strip plan have been prepared. The ambient air quality was monitored at 23 locations and result shows that all the parameters are well within the limits of National Ambient Air Quality Standards, 2009. The water sampling was done at 30 locations and it was found that the water quality of the area is good and meeting the drinking water standard except for bacteriological parameters for surface water samples.

7.0 ENVIRONMENTAL SENSITIVITY OF THE PROJECT & SUMMARY OF THE ENVIRONMENTAL FEATURES ALONG THE PROPOSED ALIGNMENT

The entire environmental profile covering five km on both side of the proposed alignment has been studied, and strip plans have been prepared to cover the RoW of the proposed alignment in parallel as well as detour sections. Based on this analysis, the following conclusions can be drawn about alignment:-

a) Do not pass through any National Park, Wild life Sanctuary or sensitive natural resources.
b) Do not affect wetlands.
c) Do not require acquisition of reserve / protected forest areas except 0.998 Ha forest land in Mirzapur district. Total land to be acquired is 1400 Ha.
d) Total number of PAFs are 13034, PAPs are 63968, CPRs are 55.

There are number of major cities and settlements all along the section and to avoid such heavily built up area, eight detours (Kanpur, Fathepur, Khaga, Sirathu, Bhawari, Allahabad, Manda and Mirzapur) have been proposed at these locations.

The project alignment runs through 2 perennial rivers Yamuna(Km 827*) & Tonse (Km794) and number of small water bodies such as Pandu river(Km 1023,983), Ojhla(km 739,741), Khajuri(Km731,736,738) , Balwan(Km 718), Baharia (Km 718) and Jirgo(Km 702).

(The alignment is passing through Allahabad detour at this chainage and chainage mentioned is the projected chainage from present IR alignment in toposheet).*

The alignment also crosses the lower Ganga Canal and its distributaries at number of locations (km 1039, 1025,1013,1002, 996, 970, 951, 950, 945, 942, 935, 915, 906, 887, 805, 803, 786, 773, 749, 730, 722, 720, 716, 715, 714, 711, 709, 708). The impacts on the canal however are mitigated during design by providing adequate cross drainage works at the locations.

Number of religious structures, schools / educational institutions and Hospitals are located along the proposed alignment.

The proposed alignment is expected to involve the cutting of 18148 trees. Most of these tree species comprise of common species such as Neem, Pepal, Mango, Eucalyptus, Gulmohar etc. and do not involve endangered species.

8.0 PUBLIC CONSULTATION AND DISCLOSURE

The Public Consultation Meetings for the proposed Eastern Dedicated Freight Corridor were conducted at 40 locations. during March to April, 2011 and again at few locations in September, 2011. For these meetings, environmentally sensitive villages that could potentially be affected by the proposed project were selected. The overall objective of the public consultation was to provide information to the stakeholders and collect feedback from them on related environmental issues. Total 75 PCMs were held. The summary findings of public consultation are as follows:-

i. Protection of school close to DFC alignment; erection of a protection wall was suggested.
ii. Fruit bearing trees in lieu of trees to be felled were suggested;
iii. Underpass for crossing DFC to go other side for farming was demanded; DFCC agreed to consider the same;
iv. Green belt to curb noise was suggested;
v. Boundary wall for protection of animals & humans was suggested at some PCMs; DFCCIL explained that DFC alignment would be on a high embankment, hence protection of animals & humans are taken care of. However, at places where house or school etc. are too close to DFC alignment, protection wall would be considered;
vi. Level crossings having high TUV should be provided with either ROB or RUB; DFCCIL has planned ROB/RUB for LCs wherever feasible and decided to close few LCs as well;
vii. Underpass was demanded for few locations; DFCCIL agreed to consider the same;
viii. Community raised issues of air pollution, noise during construction; DFCCIL explained measures proposed for dust suppression, air, water, noise monitoring and pollution control;
ix. Loss of tubewell, bore well were raised; DFCCIL explained alternative measures being considered;
x. Water for irrigation, drainage, free water course during rains were also demanded; DFCCIL noted the points for taking adequate measures;
xi. Participants raised the issue of job in railways;
xii. Villagers want to know clear cut rules for compensation. People are confused; details of laid down procedure as per RAA 2008, NRRP 2007 & Entitlement Matrix were explained to the participants;

xiii. Participants suggested that compensation should be according to the quality of land; Unemployment will increase due to increase in number of landless people; DFCCIL explained details about compensation package;

xiv. At some PCMs participants expressed requirement of more time for relocation after getting money in lieu of land acquired and employment of unemployment youths in the villagers as labours during construction;

xv. Villagers demanded DFCCIL use their machineries like tractors etc. during DFC project;

9.0 ANALYSIS OF ALTERNATIVES

There are number of major cities and settlements all along the section and to avoid such heavily built up area, eight detours (Kanpur, Fathepur, Khaga, Sirathu, Bhawari, Allahabad, Manda and Mirzapur) have been proposed at these locations. Since the proposed DFC track generally runs on the left side of the IR tracks, proposed detours are not considered for the right side of the IR network because of technical constrains and high cost of construction for underpass / flyover to the IR tracks. However, various alternatives have been analysed keeping in view environmental, social and technical parameters. The details of the parallel (total 261.00 Km) and detour locations (total 130.21Km) are given below in the table. All the detours are on the left side (w.r.t. railway alignment from Mugalsarai to Bhaupur) i.e., south side of the railway track .All the parallel alignments are on the left hand side of the existing railway track.

Locations of the Parallel Alignment

From	To	P/D	Start	End	Length(Km)
Mirzapur Detour End	Section End (Ganj Khawaja near Mugalsarai)	Parallel	667.00	726.00	59.00
Allahabad Detour End	Manda Detour Start	Parallel	772.00	808.00	36.00
Bharwari Detour End	Allahabad Detour start	Parallel	841.00	861.00	20.00
Khaga Detour End	Sirathu Detour Start	Parallel	884.00	906.00	22.00
Fathepur Detour End	Khaga Detour Start	Parallel	910.00	938.00	28.00
Kanpur Detour End	Fathepur Detour Start	Parallel	945.00	1001.00	56.00
Sub-Total					**261**

Locations of the Detour Alignment

Sl. No.	From	To	P/D	Start	End	Length(Km)
1.	Mirzapur Detour Start	Mirzapur detour End	Detour	726.00	742.00	21.30
2.	Manda Detour Start	Manda Detour End	Detour	769.00	772.00	3.50
3.	Allahabad Detour Start	Allahabad I Detour End	Detour	808.00	841.00	29.97
4.	Bharwari Detour Start	Bharwari Detour End	Detour	861.00	867.00	7.78
5.	Sirathu Detour Start	Sirathu Detour End	Detour	880.00	884.00	4.70
6.	Khaga Detour Start	Khaga Detour End	Detour	906.00	910.00	4.24

Sl. No.	From	To	P/D	Start	End	Length(Km)
1.	Mirzapur Detour Start	Mirzapur detour End	Detour	726.00	742.00	21.30
2.	Manda Detour Start	Manda Detour End	Detour	769.00	772.00	3.50
3.	Allahabad Detour Start	Allahabad I Detour End	Detour	808.00	841.00	29.97
4.	Bharwari Detour Start	Bharwari Detour End	Detour	861.00	867.00	7.78
7.	Fathepur Detour Start	Fathepur Detour End	Detour	938.00	945.00	10.31
8.	Kanpur Detour Start	Kanpur Detour End	Detour	1001.00	1048.00	48.41
Sub-Total						**130.21**
Total length (parallel + detour) Total length is considered **393 km**						**391.21 (Total length approx. 393 km)**

10.0 PARALLEL SECTIONS WITH REDUCED ROW

Sr. No.	Chainage		Width (m)	Reason
	From	To		
1.	685.800	686.340	60	Thick habitation along road
2.	686.340	686.740	60	Thick habitation along road
3.	700.300	700.600	25	Thick habitation along NH running parallel to existing track
4.	712.500	712.700	30	NH running parallel to existing track
5.	745.000	745.150	25	NH running parallel & hill
6.	1.400	1.600	35	Canal parallel to proposed track
7.	846	846/ 24-26	25	Avoid mass dismantling of structures
8.	847/ 23-25	853/ 27-29	36	Avoid dismantling of structures
9.	855/ 5-7	856/ 11-13	36	Avoid IOC pipeline & dismantling of structures
10.	858/ 5-7	861.000	36	Avoid IOC pipeline
11.	872/ 7-9	872/ 17-19	25	Avoid dismantling of structures
12.	921/ 15-17	922/ 15-17	26-39	Existing RUB yard of IR & avoid dismantling of structures
13.	972/ 13-15	973/ 29-31	31	Existing BKO yard of IR

11.0 POTENTIAL IMPACT

Environmental impact assessment assessment identified potential impacts associated with this project. These are given below:

a) Acquisition of small parcel of 0.998 Ha. forest land;
b) Cutting of about 18148 trees;
c) Earth work of 0.18 million m^3 in cutting, 28.2 million m3 in embankment and 2 million m3 of ballast;
d) Increased noise & vibration levels in 15 number of sensitive receptors located close to the alignment; SRswithin ROW are proposed for relocation.
e) Impacts on about 55 CPRs;
f) Health & safety issues during construction activities;

g) Alignment passes over two perennial rivers Yamuna (km 827) & Tonse (Km 794)

12.0 MEASURES FOR THE MITIGATION OF ENVIRONMENTAL IMPACTS

Mitigation measures have been proposed for countering potential impacts. These are as follows:

a) Compensatory afforestation against forest land acquired as per condition of MoE&F while granting permission;
b) Plantation of about 35000 trees along the alignment on either side of the track;
c) Dust suppression measures are proposed during Earth work. Permission will be obtained from concerned authority for quarrying;
d) Noise suppression & suitable noise barriers are proposed for sensitive receptors; 16 sensitive receptors outside ROW will require either relocation or noise barrier. However, all 134 sensitive receptors within ROW will require to be re-located.
e) Vibration control measures during design stage of track and locomotive & rakes besides vibration suppression measures like plantation are proposed for the identified sensitive receptors;
f) Relocation of affected CPRs;
g) Occupational Health & safety measures for workers during construction activities and at labour camps;
h) Water quality of the rivers Yamuna (km 827) & Tonse (Km 794) will be monitored and maintained;
i) Suitable drainage will be provided

13.0 ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan describes specific mitigation measures. These include following:

i. About 35000 trees along the alignment will be planted;
ii. Afforestation against about 0.998 Ha. forest land to be acquired;
iii. Rehabilitation plan for borrow areas;
iv. Noise barriers of various degrees for number of sensitive receptors;
v. Relocation of CPRs;
vi. Borrow area management plan to control degradation of surrounding landscape for excavation work following of standard IRC-10:1961;
vii. Specific safety and silicosis exposure reduction strategy during construction;
viii. Soil protection measures;
ix. Temporary drainage during construction;
x. Permission will be obtained for tree cutting with suitable comensation;
xi. Crossing passage for wildlife near forest area, ponds will be provided for wildlife in forest area;
xii. Measures will be taken for arachaeological important chancefinds as per ASI Act.
xiii. Estimated cost for Environmental Management is Rs. 723.4 million**.**
xiv. Silicosis exposure reduction strategy is given for reference.

CHAPTER-1: INTRODUCTION

1.1 BACKGROUND

Indian Railway (IR) is one of the largest railway systems in the world. It serves a landmass of over 3.3 million sq.m. and a population of over one billion. The last 50 years have seen a tremendous growth in the Indian transportation sector. In the past few years, the volume of rails freight has increased by over five times and the number of passenger kilometers has increased over seven times. The tonnage handled by Indian ports has increased 16 times while the airfreight has increased 30 times. Railway freight, which was 73 MT in 1950-51, had increased to 474 MT in 2000-01, at an average annual increase of 18.30 percent. However, post 2001, the freight traffic has grown at an annual average of 8.50 percent and about 1015 MT of freight was transported in 2011-12.This rapid increase in freight traffic is attributed to India's economic growth which resulted in traffic congestion.

1.2 DEDICATED FREIGHT CORRIDOR

To cater to the rapid growth and demand for additional capacity of rail freight transportation, Government of India has initiated development of 'Dedicated Freight Corridors' along eastern and western Routes, connecting the metro cities of Delhi- Howrah and Delhi-Mumbai. Dedicated Freight Corridor Corporation of India Limited (DFCCIL) was established to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the dedicated freight corridors.

- The western corridor is a 1483 km double line track from Mumbai (JNPT) to Delhi near Dadri and connects the cities of Vadodara, Ahmedabad,Palanpur, Phulera and Rewari.
- The eastern corridor is a 1839 km track from Dankuni, near Howrah (Kolkata) to Ludhiana. This encompasses a double line electrified traction corridor from Dankuni to Khurja (820 Km), Khurja to Dadri on NCR double line electrified corridor (46 Km) and single electrified line from Khurja to Ludhiana (412 Km).

Eastern and Western corridors will meet at Dadri, near Delhi. The current report deals with Mugalsarai to Bhaupur section of Eastern corridor.

1.3 OBJECTIVES OF EA & EMF

As per the current regulations of Government of India, railway projects do not require conducting Environmental Impact Assessment (EIA) studies and obtaining Environmental Clearance (EC) from the Ministry of Environment and Forests (MoEF). However, considering the magnitude of activities envisaged as part of EDFC and to meet the World Bank Safeguard policies, DFCCIL has engaged the services of M/s Advantage India, New Delhi as a consultant to conduct an EA and prepare an Environmental Management Plan (EMP) to mitigate potential negative impacts of the project. Scope of work included review & updating EMF prepared during phase-I of Mughalsarai-Khurja i.e., Bhaupur-Khurja section.

Following are objectives of the EA study:-

- Identify potential environmental impacts to be considered in the design of Bhaupur- Mugalsarai section of EDFC and recommend specific measures to avoid / mitigate the impacts.
- Formulate an implementable Environmental Management Plan (EMP) integrating the measures to avoid the identified impacts and an appropriate monitoring and supervision mechanism to ensure EMP implementation.
- Review the proposed alignment and other components of entire EDFC and identify possible environmental issues to be addressed during the planning, design, construction and operation of the project.
- Recommend suitable institutional mechanisms to monitor and supervise effective implementation of EMF and respective EMPs.

1.4 SCOPE OF WORK

The scope of work of Environmental Assessment consists of the following:-

i. Brief Description of the proposed project comprising various proposed activities, their phased implementation and their inter-linkages with regard to environmental impacts.
ii. Detailed Environmental Profile of the Project Influence Area (within 5 km on either side of the proposed alignment) with details of all the environmental features such as Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Natural Habitats, School, Irrigation Canals, Utility Lines, other sensitive receptors, etc. have been covered.
iii. Detailed Field Reconnaissance of the Proposed Alignment, with strip maps presenting all the environmental features and sensitive receptors (trees and structures in the ROW, Structures Reserve Forests, Sanctuaries / National Parks, Rivers, Lakes / Ponds, Religious Structures, Archaeological monuments, Natural Habitats, Schools, Irrigation Canals, Utility Lines, other sensitive structures) along the project corridor. The environmental features recorded on the strip maps indicating their distance from the centre line of the proposed alignment.
iv. Detailed Base Line Environmental Monitoring of various Environmental Attributes such as ambient air quality, noise levels, vibration levels, water quality (surface & groundwater), ecological profile, etc.
v. Assessment of Environmental Impacts of the project, including analysis of alternatives has been carried out for both 'with the project' and 'without the project' scenarios. In case of detour / by pass locations the alternatives should consider alignment parallel to the existing rail line and the proposed detour / bypass alignment (s).
vi. Measures for the Mitigation of Environmental Impacts and opportunities for enhancement for all the impacts identified. The measures for the mitigation of impacts should consider options such as minor modifications in alignment, reduction of RoW and engineering measures such as noise barriers / attenuation measures, RUBs/ ROBs, protection of water bodies, conservation of archaeological / heritage structures, etc. Opportunities for enhancement of environmental resources, cultural properties or common property resources explored and recommendations for appropriate measures for implementation.
vii. Public Consultation and Disclosure of the project and its impacts have been carried out as per the WB operational policies.
viii. Environmental Management and Monitoring Plan, comprising a set of remedial (prevention, mitigation and compensation) measures have been developed by the consultant and ensure that these are commensurate with nature, scale and potential of the anticipated environmental impacts with necessary Institutional Mechanism for the implementation and monitoring of EMP.
ix. The Environmental Management Framework (EMF) was prepared during phase-I (i.e., Bhaupur-Khurja section) study and the same will remain valid for this section of Mughalsarai-Bhaupur. However, EMF has been re-visited & updated. EMFcomprises of following:-

- Screening and Scoping Criteria for assessing the Environmental Significance for various projects / sub-projects of EDFC.
- Categorization of Projects / sub-projects / components of EDFC, such as construction of track, detour lines, bridges, RUBs / ROBs, signalling systems, freight stations, electric substations, ancillary facilities, etc.
- Methodology to carry out the EIA study, guidance on securing various clearances for the project and during construction / operation. Systems, Policies and Procedures for environmental management during EDFC operation and maintenance, including health and safety aspects.
- Institutional Mechanism for the implementation and monitoring of environmental management for EDFC.
- Training and Capacity Building requirements for the implementation and operationalization of the EMF.

1.5 METHODOLOGY

In order to assess the environmental impacts due to the proposed project, observations were made through repeated field visits. Relevant secondary data was also collected from various government agencies such as District Collector/Gazetteer Office, Indian Meteorological Department, District Statistical Office, Central Ground Water Board, Survey of India, Geological Survey of India, District Industries Centre, District Forest Office, and Archaeological Survey of India.

The **environmental profile** of the project influence area and strip maps are prepared based on the following.

- **Toposheets (scale 1:50000) of Survey of India: -** Toposheets have been collected from Survey of India, Dehradun and proposed alignment has been marked on the topo sheets.
- **Field reconnaissance of the proposed alignment: -** The entire area has been surveyed to gather the information on environmental features.
- **Collecting the data of sensitive receptors during field visit: -** The details on sensitive receptors such as schools, religious structures, hospitals etc. are collected and marked on the strip map.
- **Public consultation at village level: -** During public consultation, the information on sensitive receptors are also collected and marked on strip maps.

Based on the data collected, the strip maps and environmental profile was developed to present all the environmental features and sensitive receptors.
Preparation of Base line environmental profile comprised, collection of meteorological data from nearest IMD stations (Allahabad and Kanpur) and field monitoring of ambient air quality, water quality, noise, vibration, soil quality and ecological components as per relevant IS methods / Central Pollution Control Board Standards.

An **analysis of alternatives** alignments was carried out and finalized based on reconnaissance survey of project impact zone, analysis of data and screening to minimize impact on environment covering settlements, sensitive receptors, ecological components.

Series of **Public consultations** were conducted at villages through the project office of DFCCIL at Mughalsarai, Allahabad and Kanpur.

Based on the baseline environmental status and project activities, potential impact has been identified, assessed and predicted and appropriate mitigative measures have been suggested in planning phase, construction phase and post-construction phase.

Environmental management and monitoring plan have been formulated based on the outcome of the environmental impact assessment.

1.6 ORGANIZATION OF THE REPORT

The outputs of the study are presented in nine chapters, as presented below.

Chapter-1 provides brief background of the project, scope of the EIA study, methodology and organization of the report.
Chapter-2 describes type of the project, salient features of the project with details on various components of the project.
Chapter-3 describes legal and administrative framework / policy relevant to the present project.
Chapter-4 covers the environmental profile of the study area within 5 km on either side of the proposed alignment and strip maps presenting all the environmental features and sensitive receptors covering trees and structures within RoW.

Chapter-5 assesses the nature, type and dimensions of the study area and describes the relevant physical and biological environmental components along the proposed railway line. The database on the environmental components relevant to decisions about project location; design and operation have been assembled from various secondary sources and primary monitoring of ambient air quality, noise and vibration levels, water and soil quality, aquatic and terrestrial ecology.

Chapter-6 assesses the various alternatives covering parallel alignment / detours options and details on selection of final alignment to minimize the negative social and environmental impacts.

Chapter-7 covers the prediction of potential environmental impacts by the development of the project on the surrounding area. The impacts due to development of the proposed Dedicated Freight Corridor are assessed for planning phase, construction phase and implementation phase.

Chapter-8 covers the mitigation measures to mitigate the negative impacts due to the development of proposed EDFC on various parameters of the environment during various phases of the project are discussed in this chapter.

Chapter-9 covers the details on public consultation meeting, disclosure of the project and its impacts are covered in this chapter.

Chapter-10 covers the environmental management plan for various environmental parameters, implementation details, monitoring plan and environmental budget.

CHAPTER-2: PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter presents the details of various project components and their salient features, based on the detailed project report prepared by DFCCIL.

2.2 SIZE & LOCATION OF EASTERN DFC

A major portion of eastern corridor is located on the Allahabad Division of Northern Central Railway and is being designed for a maximum speed of 100 km/h for train operation.

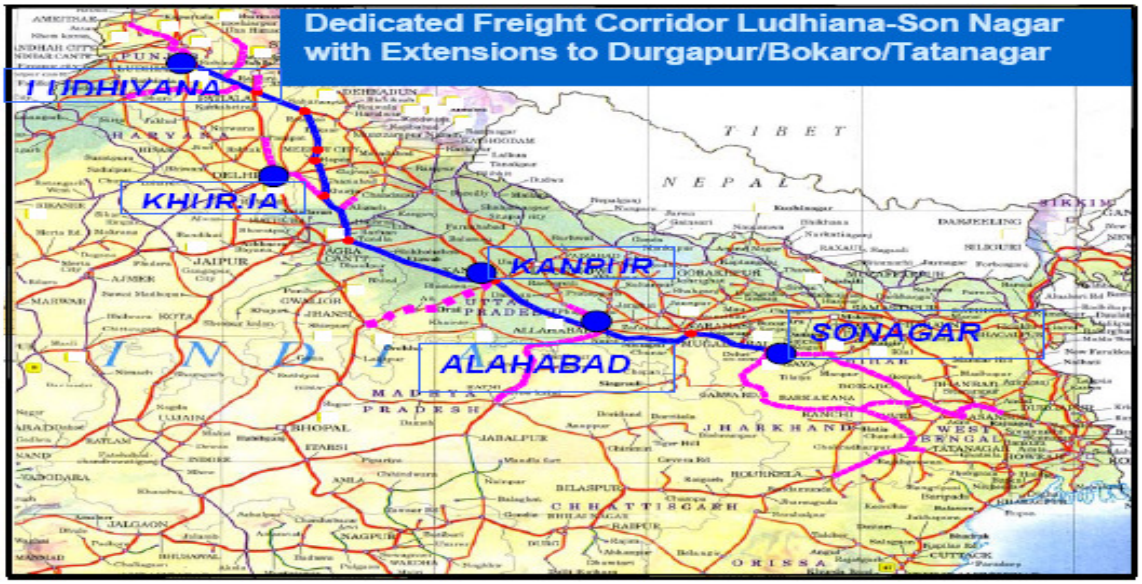
The Total length from Bhaupur to Mugalsarai section (the section under the present study), is about 392 km. This section starts at Bhaupur station at km 1148.00 and ends at Ganj Khawaja near Mugalsarai at km 667. The entire stretch is in the State of Uttar Pradesh and passes through Kanpur Dehat, Kanpur Sadar, Fathepur, Kaushambi , Allahabad, Mirzapur and Chanduli Districts of Uttar Pradesh.

The terrain of the project area is generally flat. Yamuna &Tons are important rivers crossing the alignment. The entire length lies in the Indo-Gangetic planes.

The proposed corridor is generally, parallel to the existing railway track and utilizes available railway land. A spacing of 13-15m is provided between the existing track and the DFC track and in yards a spacing of 7 m is provided. Wherever land is not available and environmental sensitive features are involved, the project proposes detours based on the following criteria.

i. Busiest railway stations, where there is no space to pass the DFC track even after yard modifications,
ii. Which involves involuntary displacement of large number of people and families and dismantling of large number of structures etc. so as to reduce social impact and public unrest there of.
iii. Which involves forest area, so as to avoid impacts on ecological resources.

A schematic map of eastern corridor is presented in **figure 2.1**



2.3 SALIENT FEATURES OF THE PROJECT

The proposed alignment is divided in two sections, summarized description of each section are described as under:

2.3.1 Bhaupur-Prempur Section:

This section starts at Delhi end of Prempur station at km 992.5 and ends at km 1048 near Bhaupur. The entire stretch passes through 2 districts i.e Kanpur Dehat & Kanpur Sadar. There is dense inhabitation near the Kanpur Railway Stations and detour has been planned in this stretch Existing Rly Land was limited and it was not possible to take the alignment through the Railway Land hence the proposed DFC alignment has been diverted by taking a detour to avoid acquisition of built up structures/ dwellings and thereby avoid a foreseeable public resettlement problem. No surface crossings of roads (i. e. Level Crossings) have been proposed on this detour and RUBs of different spans have been proposed. Different span arrangements for proposed RUB are 12.2m to 30.5m x 5.5m for N.H, 5.5m x 5.5m for State Highway, 5.5m x 4.5m for Important District Road and 5.5m x 3.5m for small Village Road/ Cart Tracks. Average Embankment height has been worked out to 4 - 7 m due to provision of RUB in Detour Portion. The terrain here is generally flat and there is no Major river crossing the alignment. Hence there is no Important Bridge in the section. The entire length lies in the Indo- gangetic planes. The soil in the area is Loamy to Loamy Sand as usually found on doab region. Agriculture is the predominant land use in this region. The summarized details of the section is presented in Table 2.1

Table-2.1: Summarized features of Bhaupur-Prempur Section

Description	Details
Route length (km)	56.51 km
Parallel:	8.50 km
Detour:	48.41 km
No. of Detour	1 - Kanpur Detour
Gradient	
Ruling Gradient	1 in 200 (Compensated)
Steepest Gradient in yards	1 in 1200, 1 in 400 in exceptional cases
Standard of Construction	
Gauge	1676mm
Rails	60 Kg 90 UTS rails
Sleeper	PSC, 1660 Nos./km for main line & 1540 Nos./km for loop line & sidings
Points & Crossings	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.
Ballast	300 mm cushion
Design speeds	100 kmph
Design Axle load	Freight Traffic with 32.5 tonne axle load
Formation	
Bank width for Double line	13.5m.
Slope on Embankment	2H:1V
Cutting Width for Double line	19.25 m

Description	Details
Earthwork	C.B.R. > 5
Earthwork for Top 1m.	C.B.R. > 8
Slope of cutting (ordinary Soil)	1 : 1
Blanketing thickness	0.60 m
Curves	
Maximum degree of curvature	2.5 degree
Grade Compensation on curves	at the rate of 0.04 % per degree of curvature
Track Centers (Minimum)	
Between two tracks of DFC	6 m
Between Existing track and DFC	15.0 m
Bridges	
Standard of Loading	32.5 tone axle load, 15 tone/m trailing load (DFC Loading)
Number of Important Bridges	Nil
Number of major bridges	4 (Total waterway 134.2 m)
Number of RUBs (Major)	2
Number of RUBs (Minor)	40
Number of Minor Bridges	50 (Total waterway 155.8 m)
Number of Rail Flyovers	1
Road Crossings	
Number of level crossings	2
Stations	**1**
Junction Stations	3 (New Sarsaul, New Bhimsen & New Bhaupur)
Crossing Stations	-
Additional Land Required	249 hectares

2.4 DETAILS OF MUGALSARAI-KARCHANA-PREMPUR SECTION:

This section start near Ganj Khawaja near Mugalsarai at chainage (667) and end near Prempur (992.5).The section is having Seven detours.The summarized silent features of Mugalsarai–Karchana-Prempur Section are presented inTable-2.2.

Table-2.2: Summarized features of MGS-Karchana-Prempur Section

S.No.	Description	Details
1.0	**Length**	
1.1	Total Length	392 km
1.2	Track Length Parallel	249 km
1.3	Track Length Detour	143 km
2.0	**No. of Detours**	7

S.No.	Description	Details
3.0	**Standard of Construction**	
3.1	Gauge	1676 mm
3.2	Rails	60 Kg 90 UTS rails
3.3	Sleeper	PSC, 1660 Nos./km for main line & 1540 Nos./km for loop line & sidings
3.4	Points & Crossings	60 kg rail, 1 in 12 curved switches with CMS crossings on Fan shaped PSC sleepers layouts.
4.0	**Design Standards**	
4.1	Ballast	300 mm cushion
4.2	Design speeds	100 kmph
4.3	Design Axle load	Freight Traffic with 32.5 tone axle load
4.4	Ruling Gradient	1 in 200 (Compensated)
5.0	**Formation**	
5.1	Bank width for Double line	13.5 m.
5.2	Slope on Embankment	2H:1V
5.3	Cutting Width for Double line	19.25 m
5.4	Earthwork (minimum 1.0m)	C.B.R.>8
5.5	Earthwork	C.B.R.>5
5.6	Blanketing thickness	0.60 m
5.7	Slope of cutting (ordinary Soil)	1:1
6.0	**Curves**	
6.1	Maximum degree of curvature	2.5 degree
6.2	Grade Compensation on curves	At the rate of 0.04% per degree of curvature
7.0	**Track Centers**	
7.1	Between two tracks of DFC	6 m
7.2	Between Existing track and DFC	13-15.0 m(Minimum 7 m at thickly populated locations to avoid displacement of inhabitants)
8.0	**Bridges**	
8.1	Important	2 (Yamuna & Tons Rivers)
8.2	Major	53
8.3	Minor	321
9.0	**Rail to Rail Flyovers**	3 ▪ Manikpur- Allahabad Railway line – UP & DN Lines) ▪ Jeonathpur (Single DFC Track - DN Line) ▪ Chunar (Chopan Line Crossing - Double DFC Tracks – UP & DN Lines)

S.No.	Description	Details
10.0	**RUB's**	89
11.0	**ROB's**	**2** ▪ Mughalsarai ▪ Ahraura Road
12.0	**Road Crossings**	
12.1	Number of level Crossing	72
13.0	Standard of Loading	32.5 tons axle load
14.0	Stations	
14.1	Junction Stations	4
14.2	Crossing Stations	8
15.0	Additional Land Required	1151 Ha. (includes **0.998 Ha. forest land**)

It may be noted that ROBs & RUBs proposed in the above tables are tentative at this stage. Actual number of ROBs & RUBs may vary at the time of actual project implementation due to policy decision of Ministry of Railways and concerned state Government. Similarly, number of junction & crossing stations as well as additional land requirement may vary at the final stage of project conceptualization. Figures given in the tables above are based on project DFR at the time of conducting EIA.

Figure 2.2: Map showing Bhaupur-Mugalsarai Section of the DFCC Project

The details of the parallel (261.00 Km) and detour locations (130.21) are given in the table No. 2.3 and table 2.4. All the detours are on the left side (w.r.t. railway alignment from Mugalsarai to Bhaupur) of the railway track .All the parallel alignments are on the left hand side of the existing railway track.

Table-2.3: Locations of the Parallel Alignment

From	To	P/D	Start	End	Length(Km)
Mirzapur Detour End	Section End (Ganj Khawaja near Mugalsarai)	Parallel	667.00	726.00	59.00
Allahabad Detour End	Manda Detour Start	Parallel	772.00	808.00	36.00
Bharwari Detour End	Allahabad Detour start	Parallel	841.00	861.00	20.00
Khaga Detour End	Sirathu Detour Start	Parallel	884.00	906.00	22.00
Fathepur Detour End	Khaga Detour Start	Parallel	910.00	938.00	28.00
Kanpur Detour End	Fathepur Detour Start	Parallel	945.00	1001.00	56.00
Sub-Total					**261**

Table-2.4: Locations of the Detour Alignment

Sl. No.	From	To	P/D	Start	End	Length(Km)
1.	Mirzapur Detour Start	Mirzapur detour End	Detour	726.00	742.00	21.30
2.	Manda Detour Start	Manda Detour End	Detour	769.00	772.00	3.50
3.	Allahabad Detour Start	Allahabad I Detour End	Detour	808.00	841.00	29.97
4.	Bharwari Detour Start	Bharwari Detour End	Detour	861.00	867.00	7.78
5.	Sirathu Detour Start	Sirathu Detour End	Detour	880.00	884.00	4.70
6.	Khaga Detour Start	Khaga Detour End	Detour	906.00	910.00	4.24
7.	Fathepur Detour Start	Fathepur Detour End	Detour	938.00	945.00	10.31
8.	Kanpur Detour Start	Kanpur Detour End	Detour	1001.00	1048.00	48.41
Sub-Total						**130.21**
Total length (parallel + detour) Total length considered **393km**						**391.21** **Total length approx. 393 km**

2.5 PARALLEL SECTIONS WITH REDUCED ROW

Table 2.5 provides information on parallel sections where ROW is reduced and the reason thereof.

Table-2.5: Parallel sections with reduced ROW

Sr. No.	Chainage		Width (m)	Reason
	From	To		
14.	685.800	686.340	60	Thick habitation along road
15.	686.340	686.740	60	Thick habitation along road
16.	700.300	700.600	25	Thick habitation along NH running parallel to existing track
17.	712.500	712.700	30	NH running parallel to existing track
18.	745.000	745.150	25	NH running parallel & hill
19.	1.400	1.600	35	Canal parallel to proposed track
20.	846	846/ 24-26	25	Avoid mass dismantling of structures
21.	847/ 23-25	853/ 27-29	36	Avoid dismantling of structures
22.	855/ 5-7	856/ 11-13	36	Avoid IOC pipeline & dismantling of structures
23.	858/ 5-7	861.000	36	Avoid IOC pipeline
24.	872/ 7-9	872/ 17-19	25	Avoid dismantling of structures
25.	921/ 15-17	922/ 15-17	26-39	Existing RUB yard of IR & avoid dismantling of structures
26.	972/ 13-15	973/ 29-31	31	Existing BKO yard of IR

2.6 DESIGN FEATURES

2.6.1 Gauge

The proposed alignment DFC line almost is parallel to the existing line and the Gauge for the DFC line has necessarily to be Broad Gauge. (BG) (1676mm).

2.6.2 Category of Line

The proposed DFC line is having a potential of maximum permissible speed of 100 kmph for goods trains to meet the anticipated traffic requirements. All bridges will be constructed to DFC loading standard with 32.5 t axle load.

2.6.3 Ruling Gradients

The ruling gradient for the proposed line has been kept as 1 in 200(compensated). Grade compensation has been provided at the rate of 0.04% per degree of curvature as per Para 418 of Indian Railway's Permanent Way Manual. The maximum length of loop and tonnage of goods trains catered for in the design are 1500m and 3600T respectively.

2.6.4 Curves

For permitting maximum permissible speed of 100 kmph, a radius of 638 m (2.74º) is adequate with Cant as 140 mm and Cant deficiency as 75mm. However, maximum degree of curve is restricted to 2.5 degrees in the proposed corridor.

2.6.5 Section

Vertical curves as specified in para 221 of Engineering Code (Para 419 of Indian Railways Permanent Way Manual) have been provided. As per Engineering Code, vertical curves have been provided only at those locations where the algebraic difference in change of grade is equal to or more than 4mm/m i.e.0.4%. A minimum radius of the vertical curves of 4000m as applicable for 'A' category lines for BG has been adopted.

2.6.6 Spacing between Tracks

Spacing between track Centre to centre spacing of DFC tracks has been specified as 6 m and centre to centre spacing of DFC tracks from existing track has been specified as at 13m to 15m to avoid the infringement of existing IR infrastructure. However, spacing of DFC track has been reduced to 7.0 m at thickly populated locations to reduce/avoid the displacement of inhabitants.

2.6.7 Formation

Being a double line construction, a top width of 13.5 m has been considered for embankment with side slopes of 2:1. Formation width in the cutting has been kept as 19.5 m. with side drains. Typical cross section of the proposed freight corridor is presented in figure below

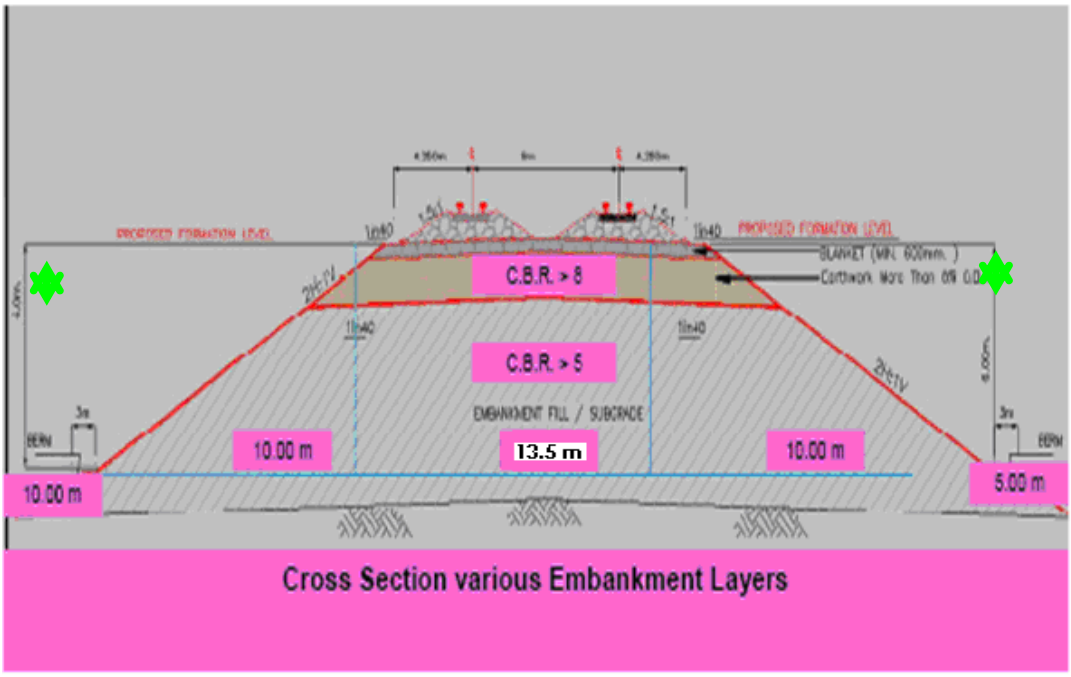


Fig- 2.3 Typical cross-section of DFC formation

2.6.8 Bank

Formation width of 13.5m on straight alignment has been considered. The slopes on banks are proposed as 2H: 1V. Where the bank height is more than 6m, a berm of minimum 3.0 m width has been proposed at every 6m height.

2.6.9 Cutting

A bottom width 19.90 m with 1:1 slopes including side drains on both sides have been kept. Where the cutting height is more than 6m, berm of 3m width has been proposed at every 6 m cutting height.

2.6.10 Blanketing

Blanketing layer is provided with 0.600 m depth.

2.6.11 Fixed Structure Clearance

Minimum vertical clearance as per SOD for ROB and FOB would be 6.85 to accommodate OHE suitable for the design speed of 100 kmph.

2.6.12 Permanent Way

The track structure shall consist of 60 kg/m, 90 UTS, FF first class new rails on PSC sleepers having 1660 nos. per km density for main line. First class rails with PSC sleepers having 1540 nos/km density have been adopted for Loop lines and sidings. It is proposed to provide CWR/LWR as per the provision of the P-Way manual.

2.6.13 Points and Crossings

Points and Crossing with 60 kg rail on MBC sleepers with fan shaped Layouts, 1 in 12 on running lines and for non-running lines and sidings with curved switches and CMS crossings have been proposed.

2.6.14 Ballast

The depth of hard stone ballast (65mm size) cushion below MBC sleepers has been kept as 300mm for main lines. Therefore, a quantity of 4.316 cum/m for straight portion is provided. Provision for wastage, curvature and Points & crossing has been considered as per the provision of Para 263 of P-Way Manual. Querry area or source for ballast will be decided considering MoE&F Rules.

2.6.15 Road Crossings/Level Crossing

There are about seventy two level crossings on the alignment between Bhaupur to Mugalsarai section.

2.6.16 Stations

The Freight Corridor will have two types of stations. Stations required for normal operating requirements are called crossing stations and stations where the loads have to be transferred to/ from existing railway network have been called as Junction Stations. There are four Junction Stations and eight Crossing Stations have been proposed in a manner that there is at least either crossing station or junction station will exist at approximately 40 km interval along the alignment . 1500 m long loops are to be provided at junction stations and 750 x2m loop are to be provided at crossing stations as per guidelines issued by DFCCIL . At station necessary rooms for S & T have been proposed. Each station will comprise of a small 2-room office with basic amenities for DFC staff. Photographs of sites for proposed Junction & Crossing stations are given as Figure 2.5 to 2.15. Site for a TSS at Jeonathpur is also given as Figure 2.16.

The details of the existing railway stations and proposed DFC stations are provided in the table No. 2.5 below.

Table-2.6: Details of the existing stations and Proposed DFC Stations

Details of Existing Stations			
S.No.	**Station**	**Changing**	**Remark**
1	Bhaupur	1039.93	New Bhaupur Junction station(1048) ,
2	Panki	1028.50	
3	Govindpuri	1021.15	
4	Chandari	1015.25	
5	Chakeri	1008.14	
6	Rooma	1003.59	
7	Sarsaul	997.14	New Sarasaul Junction Station (997.5)
8	Prempur	991.20	
9	Karbingwa	985.93	
10	Aung	979.32	
11	Bindki Road	973.51	
12	Kanspur Gaugali	965.64	
13	Malwan	958.31	New Malwan ,Crossing Station (960-962.5)
14	Kurastikalan	949.23	
15	Fathepur	942.19	
16	Rama	936.31	
17	Fazulla pur	930.96	
18	Rusalabad	922.04	New Rasulabad , Crossing Station (918-920.5)
19	Sathnaraini	914.94	
20	Khaga	907.68	
21	Katoghan	900.65	
22	Kanwar	894.63	
23	Athsarai	889.10	
24	Sirathu	882.38	New Shujatpur Crossing Station (875.13-877.17)
25	Shujatpur	872.90	
26	Bidanpur	868.35	
27	Bharwari	862.73	
28	Manoharganj	854.80	
29	Syaid Sarwan	847.26	
30	Manuri	842.98	New Manauri , crossing station (839.7-842.2)
31	Bamhrauli	834.49	
32	Subadarganj	829.23	
33	Allahabad	825.54	
34	Naini	818.06	
35	Chheoki	816.65	
36	Karchana	807.48	New Karchana ,Junction Station (Allahabad Detour)
37	Beerpur	798.28	
38	Majaroad	787.27	

Details of Existing Stations			
S.No.	**Station**	**Changing**	**Remark**
39	Unchdih	778.92	New Unchdih ,Crossing Station (784.058-786.558)
40	Mandaroad	770.77	
41	Jigna	762.46	
42	Gaipura	755.41	
43	Behori	747.13	
44	Vindhyachal	743.21	
45	Mirzapur	735.85	New Mirzapur, Crossing Station (746.365-748.265), at detour location
46	Jhingura	727.53	
47	Pahare	720.72	
48	Dagmagpur	711.99	New Dagmagpur ,Crossing Station (698.965-701.465)
49	Chunar	704.77	
50	Kailahat	694.87	
51	Ahraura Road	686.35	New Jeonathanpur ,Junction Station (677-680) & New Ahraura Road Crossing Station (681.25-683.765)
52	Jeonathanpur	680.46	
53	Mughalsarai	672.65	
54	Ganj Kwaja	666.00	

2.6.17 Residential Accommodation

Residential accommodation is planned at stations. Standard type II, III & IV quarters have been proposed as per the requirement. At each station 20 nos. houses (10 Type II, 7 Type III, and 3 Type IV) have been proposed to house the essential staff.

2.7 LAND

Proposed DFC track is planned at about 13 -15m c/c from existing UP line of Delhi - Howrah route of North Central Railway. Formation width of proposed

DFC track (double line) has been planned for 13.5m and side slopes of 2:1 in embankment and 1:1 in cutting. In addition to the above, a minimum 10m & 5m extra land from the toe of the bank is planned for the service road and maintenance purposes.

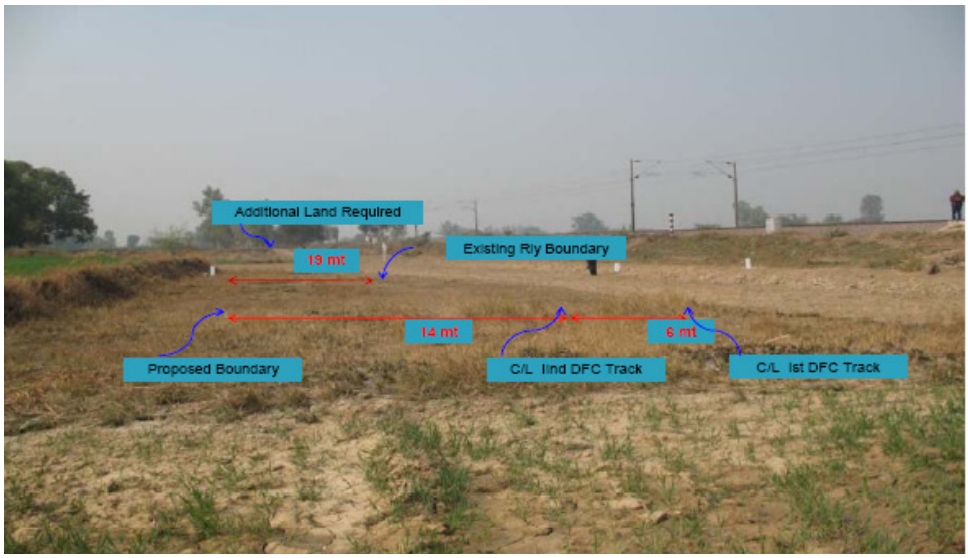


Fig - 2.4 Typical layout of land having DFC and existing Railway track

Since the detour is proposed in embankment, the land requirements are higher compared to the parallel section (about 45m to 110m depending up on height of embankment).

A land strip of about 1000 x 60 m of additional land will be acquired for the storage of construction material (dumping yard) at about every 40 km. In addition to the above, about 2500m x 100m of land strip will be acquired for crossing / junction stations. Land will also be acquired for electrical installation such as S.P., S.S.P. & T.S.S as per norms of DFC Electrical Department. There is no interference with the military installations and major townships. The table 2.6 show the land required for the project.

Table-2.7: Land Required for Various Purposes (Area in ha, length in km)

Section	Chainage km		Distribution of length (km)		Total			
	From	To	Parallel	Bypass	Length	District	Village	LA (Ha)
CPM Mughalsarai	672.65	680.28	8.00	0	8.00*	1	10	9
CPM Allahabad (E)	680.28	807.45	108.00	26	134.00	3	173	634
CPM Allahabad (W)	807.45	991.20	133.00	59.00	192.00	4	154	508
CPM Kanpur	991.20	1048	-	58.00	58.00	2	35	249
Total (MGS-BAU)			249	143.00	392.00	7	372	**1400**

2.7.1 Utilities

The project involves shifting of number of utility services such as electrical lines (HTL/LTL), oil pipeline transformers, tube wells, bore wells, hand pumps etc. A detailed shifting plan for each of the utilities need to be prepared.

In general a high tension line runs parallel on south side of the existing alignment. Care has been taken to maintain the same pattern in detours sections also. The HTL/LTL lines are crossing the alignment in detours at several locations . Barauni-Kanpur oil pipeline of Indian Oil is one of the major utility need to be shifted. The utilities will be shifted in consultation with the stakeholder agencies including local panchayats and owners of private utilities. Appropriate funds will be allocated in the project for utility shifting.

2.7.2 Turfing

Considering high embankments in detours sections (more than 4 m), turfing has been proposed in detour sections and in major bridge approaches.

2.7.3 Tree Plantation

The project proposes plantation of minimum 6,000 trees along the alignment on either side of the track.

2.7.4 Side Drains

The proposed alignment runs parallel at 13m-15m distance from the existing alignment. In between two embankments, a gully formation is expected. To avoid water logging in the gully areas, concreted side drains (0.750m width with 1:1 side slope) have been proposed.

2.7.5 Retaining Walls

The project proposes retaining walls to manage site specific issues such as lack of space or impacts on densely populated areas, etc. The location will be identified in consultation with local population considering the engineering requirements.

2.8 STRUCTURE WORK

2.8.1 Major Bridges

Spanning arrangement & linear waterway for major bridges in parallel portion has been decided based on opening/spans of existing Railway bridges as well as Hydraulic calculations. All the major bridges are proposed as PSC girder bridges at 15-20m away from the existing location. All bridges are proposed to DFCCL Standard (BG) with a maximum axle load of 32.5 MT, for the Locomotive and a trailing load of 12 t/m. DFCCIL has given standard G.A.D. for 12.2.m & 18.3m span based on which, quantities have been calculated for estimation. GAD for 24.4m & 30.5m span have been based on RDSO drawing for H.M. Loading. Spanning arrangement for bridges on detour has been decided as per hydraulic calculations. Substructures of all major bridges are proposed to be RCC with pile foundations. Total 57 major bridges are proposed along the alignment.

2.8.2 Important Bridges

There are two important bridges proposed at rivers Yamuna & Tonse. Yamuna Bridge is proposed about 5 Km upstream of existing Yamuna Railway Bridge and falls in Allahabad detour. Its span arrangement is 21x48.15 and location has been decided based on detailed model study by IRI Roorkee Bridge on Tonse is located parallel to existing Railway Tonse Bridge and follow the same span arrangement.

2.8.3 Minor Bridges

The project proposes 371 minor bridges at various locations. The minimum clear span for new bridges has been proposed as 1.2m. RCC boxes have been proposed as per standard drawing GAD given by DFCCIL. The linear waterway for all the minor bridges has been proposed on the basis of bridges on existing railway line for parallel section. Spanning arrangement for detour portion has been decided based on

Hydraulic calculations. Balancing culverts have been proposed at suitable location for detour portion as the entire project area is having very gentle slope (2m/ km).

2.8.4 Railway Flyover

Rail Flyovers have been provided wherever the Freight Corridor line is to cross any existing branch or main line. Rail flyovers are proposed with earthen embankment & main structure with composite Girder. Three Rail flyovers have been proposed along the proposed alignment to cross either double line or single line. All flyovers are proposed on existing double line and on earthen embankment with central portion in composite girders. RCC abutment Pile foundation is proposed for all the flyovers.

Five Rail flyover is proposed between (i) Ahraura Road-Jeonathpur, (ii) Chunar-Chopan line, (iii) Iradatghanj-Link Jn., (iv) Bhimsen-GMC & (v) Maitha-Bhaupur.

2.8.5 ROBs & RUBs

DFC alignment has been taken on embankment at detours, RUBs have been proposed at road crossing where existing railways alignment cross the road..

Number of RUBs which are proposed in the Bhaupur-Mugalsarai section. While deciding the spanning arrangement, future widening of respective road has been duly considered.

2.8.6 Sleepers

60 Kg/90UTS rails on PSC sleepers with a density of 1660 sleepers per km with 300 mm ballast cushion have been provided for the main line. In station yards, for the loop lines, 60Kg rails on PSC sleepers with a density of 1540 sleepers/Km with 300 mm ballast cushion has been proposed. The main line is proposed to be provided with LWR / CWR. Loop line is provided with SWR/ LWR. Entire project length is proposed for track circuiting. Glued joints are provided wherever required. 60 Kg points and crossings on PSC fan shaped layouts are proposed.

Flash butt welding is proposed to convert the single rails into LWR/CWR as per plan approved by DFCCIL by contractor's portable road trailer mounted flash butt welding machine.

The required quantity of ballast to the maximum extent (not less than 4.314 cum per meter length) is to be brought by contractor's dumpers on the formation and laid on the proposed alignment by contractor's pavers. Extensive testing on the completed new tracks is proposed to be done using the track recording and oscillograph cars for assessing track geometry and ride quality. PSC sleepers are transported from the factory by road and stacked at dumping yard locations. Transportation charges for sleepers have been considered for a distance of 300km. Hard Stone ballast of 65 mm size with 300 mm cushion on the main line, turnouts, on loops and sidings is proposed. Nearly 4.3 cum / running meter of ballast is required for the track.

2.8.7 Electric Sub-stations

The electric sub-stations are having the facilities of signals / relay rooms and have a requirement of area around 140 x 100 m. The sub-stations are having booster transformers and return conductors with a maximum voltage capacity of 27.5 KV.

2.8.7.1 Traction Service Stations (TSS)

The basic consideration in locating the traction substations is to ensure the satisfactory voltage condition on the OHE, while the maximum voltage at sub-station should not exceed 27.5 kV, the voltage of the farthest and based on

the traction load conditions taking into account the traffic density, the loads and the speed of the train and terrain shall not fall below 19 kV. The total area requirement for each TSS is 140 x 85 meter and these shall be located along the railway track.

2.8.7.2 Sectioning and Paralleling Post (SP)

The conventional neutral section in the OHE at the sectioning and paralleling post is 41 m long and overlaps type. The electric locomotive coasts through this dead section in case it comes to a halt under this portion of OHE, there being no power in the OHE, the electric locomotive becomes immobile. In such a situation it needs to be pushed or pulled by another locomotive to bring it under a live OHE. The site for location of the neutral section, therefore, needs to be selected with case, so that the terrain assists the train in negotiating it. Accordingly the natural section for the sectioning post should be located on a straight track at sufficient distance from a stop signal either behind or ahead of it. In undulating terrain the neural section should be located in a valley.

2.8.7.3 Sub-Sectioning and Paralleling Post (SSP)

Between the feeding post and the sectioning post a number of intermediate sub-sectioning and paralleling posts are inserted in the OHE, to provide remote controlled switches for facilitating isolation of faulty sections of OHE. The area requirement for the SSPs is 55 x 25 meter

2.8.7.4 Tower Wagon Sheds

These are proposed at crossing stations and junction stations.

2.8.7.5 Signal and Signal Rooms

Signals are proposed at every 2 km length with a provision of one signal rooms for ten numbers of signals.

2.9 FENCING

RCC Jali fencing shall be provided on all stations for 2 km Length.

2.10 SERVICE ROAD

As per the policy decided by DFC, service road has been proposed adjoining the embankment. Service road has been planned for 5.5 m width with W.B.M surface. Hume Pipe culverts have been proposed along the service road where there is a minor bridge location on proposed alignment. Service road is discontinued at Major bridges, rail flyovers and densely populated area.

2.11 LABOUR FOR CONSTRUCTION

Approx. 60 skilled and 100 unskilled will be employed for a given stretch during the construction phases. Local labour is adequately available and will be utilized during the construction phase.

2.12 WATER REQUIREMENT

The total water requirement during construction period will be about 3600 cubic meter per kilometre for entire construction period of about 3 -1/2 years. Total water requirement will be around 5 million cu. Mtr. for entire construction period and the same will be met through local water resources with permission from concerned authority.

2.13 CONSTRUCTION MATERIAL

Construction material will be required in sufficiently large quantities. While sand will be obtained from rivers e.g., *Yamuna* after permission from concerned authority

(within 100 km from the Project alignment), rail, sleepers, cement and steel will be obtained through respective by manufacturers.

The project involves about 180,000 cubic meter of earthwork in cutting and 28,200,000 cubic meter of earth work in embankment. Borrow earth for these activities will be obtained by the contractor from the borrow areas, as per the guidelines detailed out in the subsequent sections of this EIA report.

It is estimated that about 2,00,0,000 cubic meter of ballast would required for laying the track. The ballast would be obtained by the contractor from authorized quarries, as approved by the engineer in charge and in compliance to the guidelines detailed out in the subsequent sections of this report.

2.14 CONSTRUCTION PERIOD

The construction period for the completion of the freight corridor from Bhaupur to Mugalsarai will be three and half years.

2.15 GREEN INITIVES

Opportunity will be explored for energy conservation, rain water harvesting and utilisation of solar energy.

- Harnessing of solar energy can be fruitfully implemented in staff quarters, station & substation buildings as well as for street lighting.
- Water conservation procedures will be adopted in staff quarters & stations.
- Rain water harvesting can be implemented in staff quarter complex, stations.
- Feasibility of such initiatives will be considered during design stage.

2.16 COST ESTIMATES

The cost of the project is estimated to be about Rs. 4375 Crore which includes the civil construction cost, cost of land acquisition and contingencies and other charges. The estimated electrical and signalling cost is 1596 crore The average per Km cost covering civil and electrical is approximately 15 Crore .The costs have been estimated based on typical cross sections of the project and the unit rates of IRC standard Data book.

Fig. 2.5 Site for Proposed Junction station at Jeonathpur

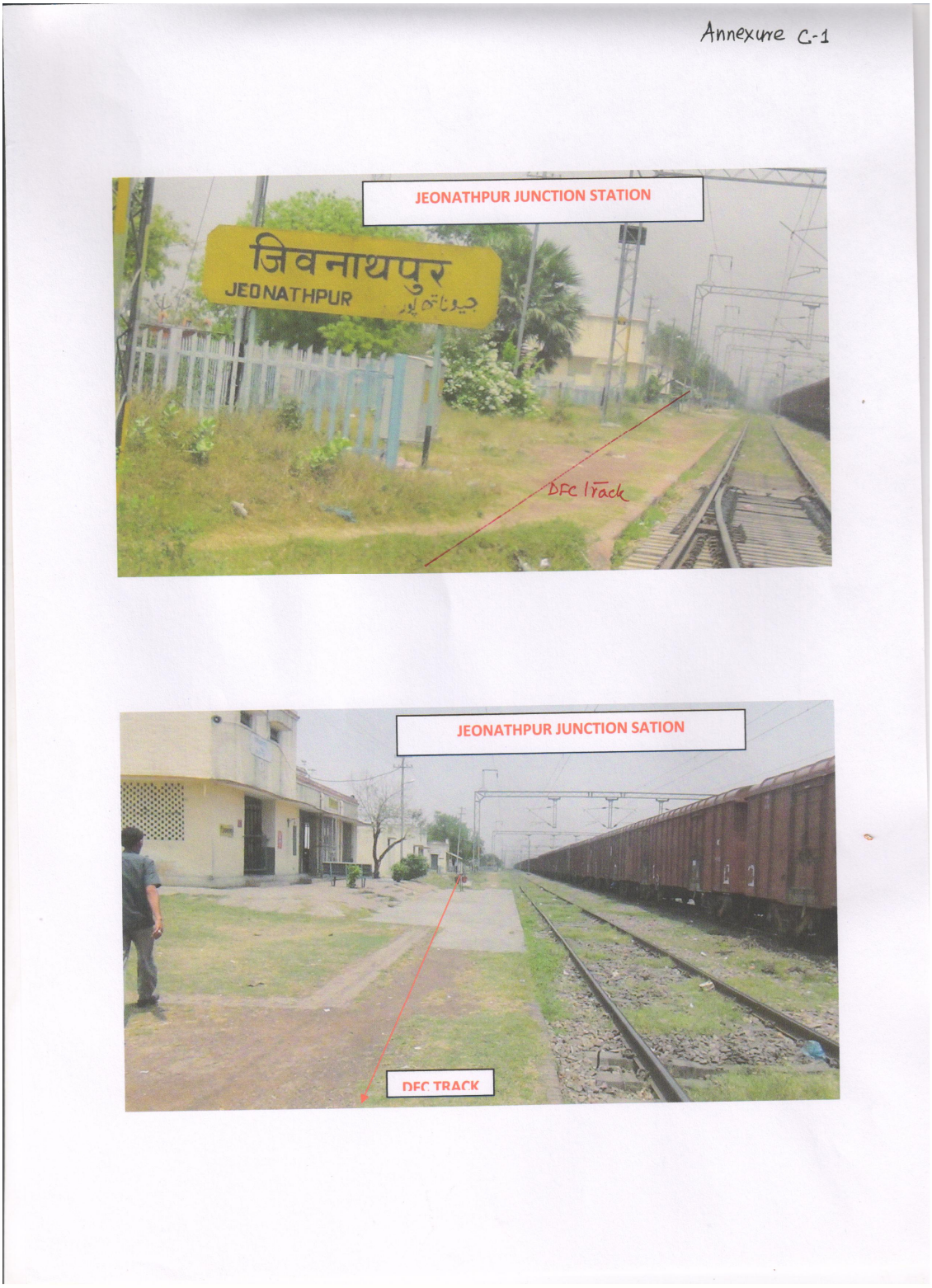


Fig. 2.6 Site for Proposed Junction Station at Ahraura

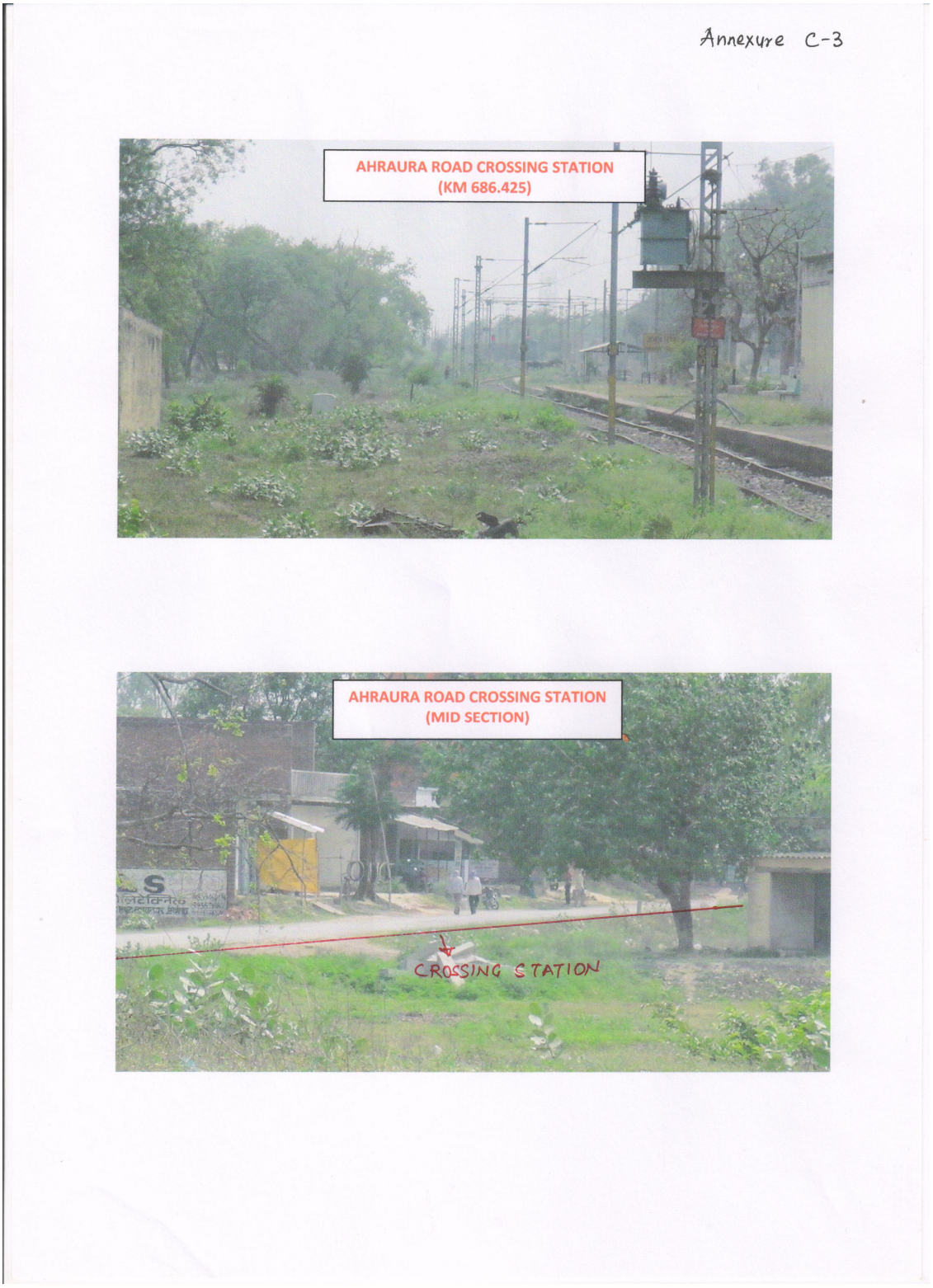


Fig. 2.7 Site for Proposed Crossing Station at Dagmagpur

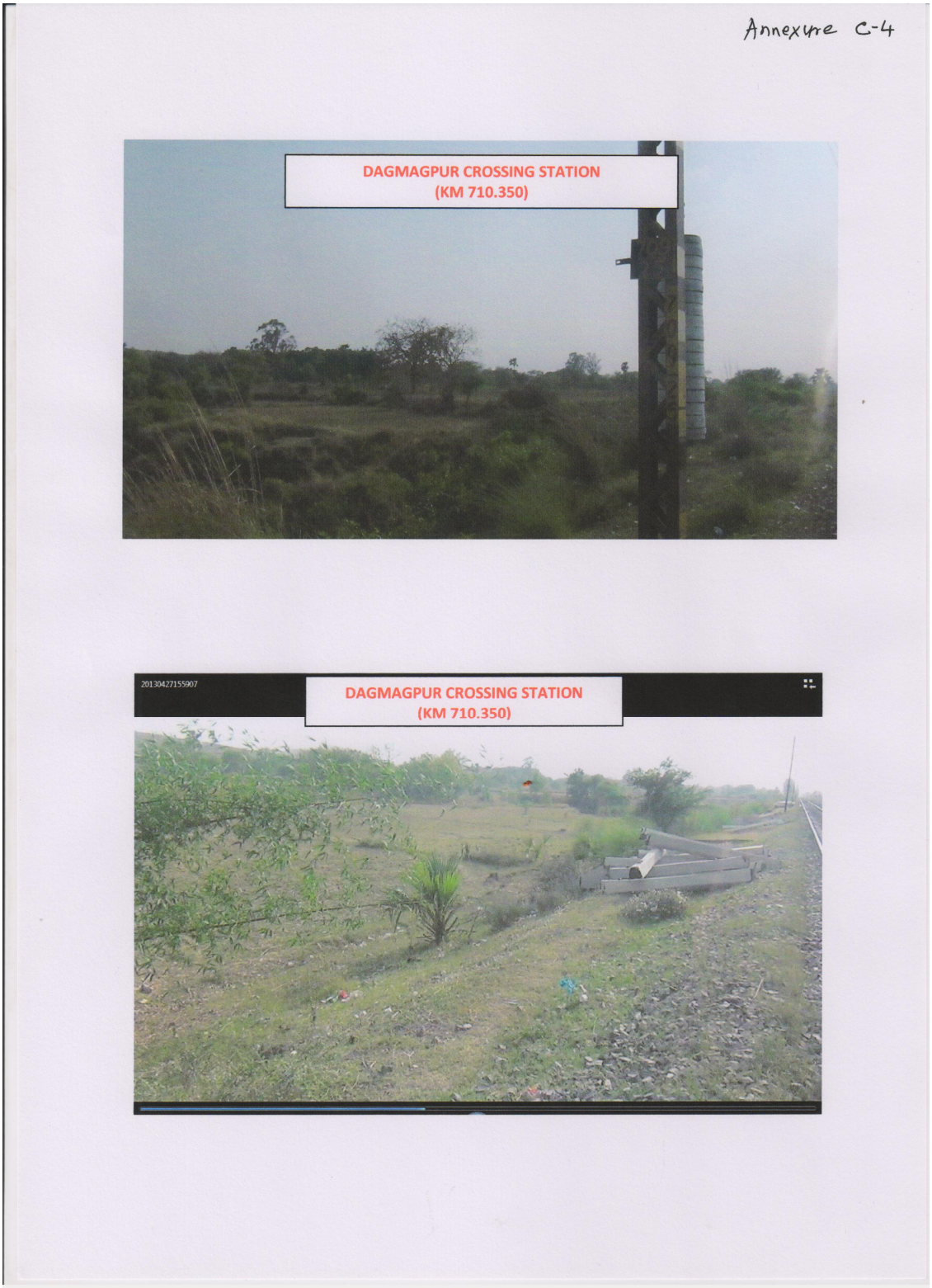


Fig. 2.8 Site for Proposed Crossing Station at Mirzapur

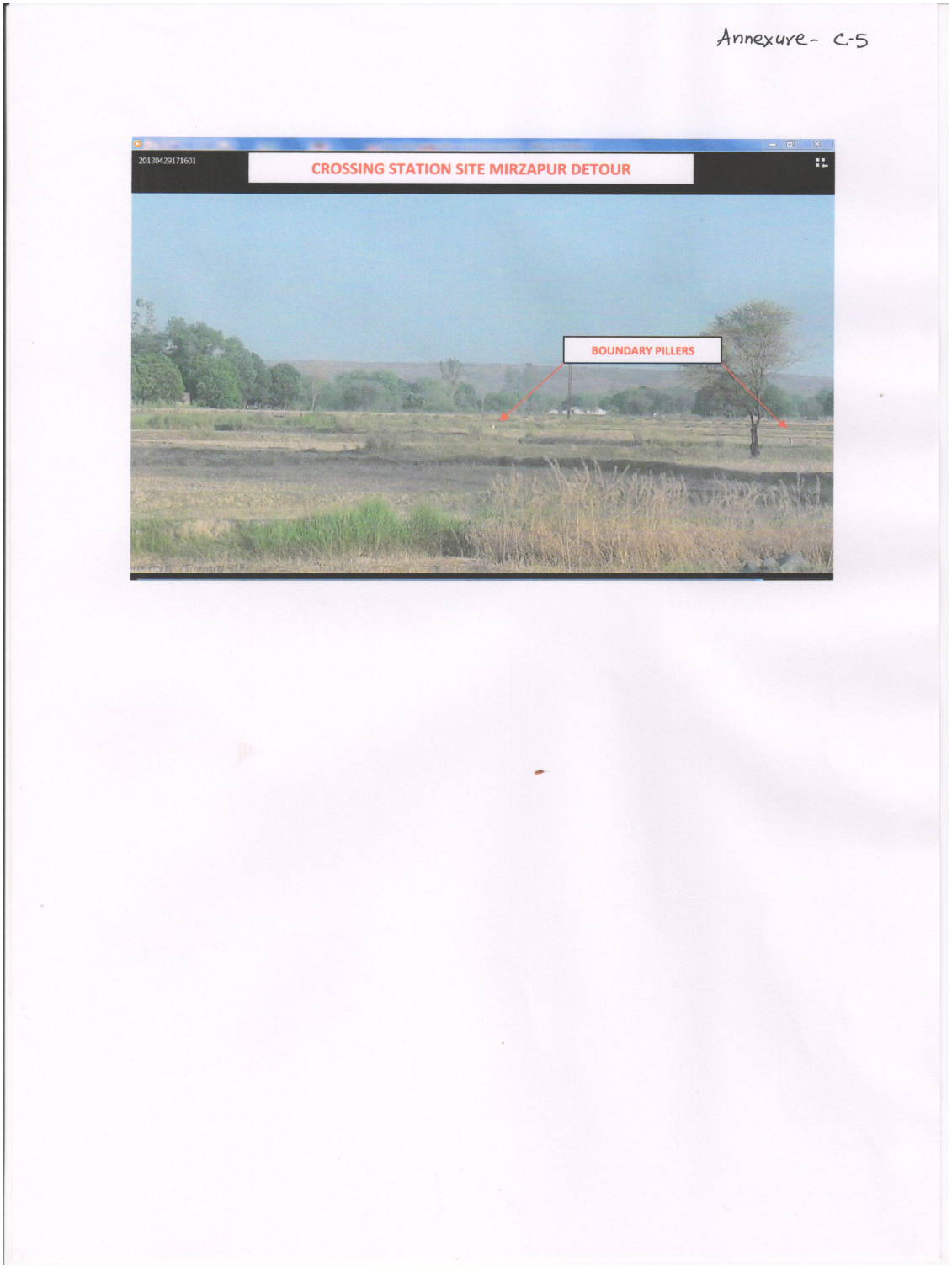


Fig. 2.9 Site for Proposed Crossing Station at Unchdih

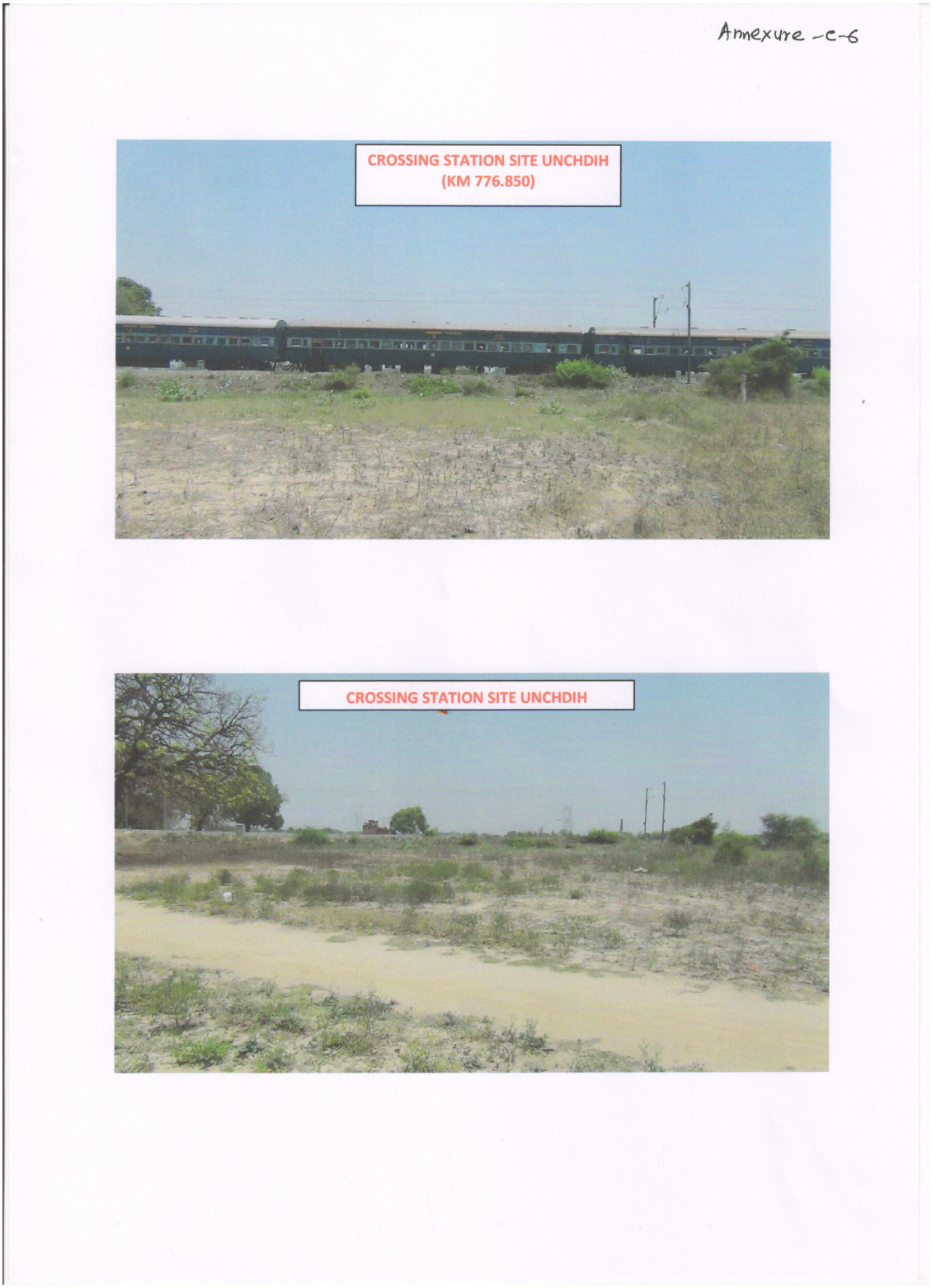


Fig. 2.10 Site for Proposed New Kanpur Junction Station

Fig. 2.11 Site for proposed New Karchana Junction Station

Fig. 2.12 Site for New Malwa Crossing Station

Fig. 2.13 Site for Proposed New Manauri Crossing Station

Fig. 2.14 Site for Proposed New Rasoolabad Crossing Station

Fig. 2.15 Site for Proposed New Sujatpur Crossing Station

Fig. 2.16 Site for Proposed TSS at Jeonathpur

Annexure - C-7

CHAPTER-3: LEGAL AND ADMINISTRATIVE FRAMEWORK/ POLICY

3.1 INTRODUCTION

This chapter presents a review of the existing environmental, forest related regulations and statutory acts/ rules applicable to this project. This chapter also outlines various issues related to the framework in place for environmental clearance of projects with reference to the Government of India and Government of Uttar Pradesh.

3.2 ENVIRONMENTAL CLEARANCE REQUIREMENTS

3.2.1 Government of India requirements

As per MoEF notification dated 14 September 2006 and its amendments Railway project does not require environmental clearance.

3.3 STATE LEVEL CLEARANCE REQUIREMENTS

Besides, the MoE&F environmental clearance requirements, the project requires clearance from some of the state level agencies as discussed below.

3.3.1 Forest Clearances

The proposed project required **0.998 Ha** Forest land diversion in Mirzapur .To acquire any type of forests land permission from forest department need to be undertaken as per forest act 1980. Project requires to cut trees for which permission from district Magistrate office and Forest Department are required.

3.3.2 State Pollution Control Board (SPCB) Requirements

Projects require obtaining No Objection Certificate (NOC) from Uttar Pradesh State Pollution Control Boards in pursuant to the Water (Prevention and 'Control of Pollution) Act of 1974, the Cess Act of 1977 and the Air (prevention and Control of Pollution) Act of 1981. In the present project context it needs to obtain NOC from UPPCB.

3.3.3 Clearance

The Indian legislations and environmental regulations are given in the Table No. 3.1 below.

Table-3.1: Related Indian Legislation and their Applicability

S.No.	Act / Rules	Purpose	Applicability	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	The project activities should maintain emission standards	MoEF. GoI; DoE, State Gov. CPCB; SPCB

S.No.	Act / Rules	Purpose	Applicability	Authority
2	Environmental Impact Assessment Notification-14th Sep-2006	To provide environmental clearance to new development activities following environmental impact assessment	Linear Railway projects are not included in the Notification of 14th Sep, 2006 and EC under this acts is not applicable. However, as per MoEF circular No. No. L-llOll/47/2011-IA.II(M), dated 18th May 2012, borrow / quarry areas of <5 Ha, which will be used in project, require prior environmental clearances	MoEF
3	Notification for use of fly ash,1999	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	Possibility of use of fly ash shall be explored in Engg. designs	MoEF
4	The Forest (Conservation) Act 1927 The Forest (Conservation) Act. 1980 The Forest (conservation) Rules 1981	To check deforestation by restricting conversion of forested areas into non-forested areas	Applicable, Forest land is involved in the project.	Forest Department, Govt. UP (for land conversion below 5 hectare & 40 % density).
5	MoEF circular (1998) on linear Plantation on roadside, canals and railway lines modifying the applicability of provisions of forest (Conversation) Act, to linear Plantation	Protection / planting roadside strip as avenue/strip plantations as these are declared protected forest areas.	Applicability of Forest conservation act to Roadside strip Plantations .	MoEF
6	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by specifying the emission standards.	Emissions from construction machinery and vehicle should be checked time to time.	UPPCB
7	Water Prevention and Control of Pollution) Act , 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Various parameters in Effluents from construction sites and workshops are to be kept below the prescribed standards	UPPCB
8	Noise Pollution (Regulation and Control Act) , 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	DG sets at construction sites and workshops should be provided with acoustics enclosures.	UPPCB

S.No.	Act / Rules	Purpose	Applicability	Authority
9	Ancient Monuments and Archaeological Sites and Remains(Amendment & Validation Act, 2010	Conservation of cultural and historical remains found in India	If any historical remains are found, would be notified/ surrendered to the Competent Authority.	National Monuments Authority of India
10	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Shall be taken as per requirements	UPPCB
11	Explosive Act 1984	Safe transportation, storage and use of explosive material	Respective Authorization shall be obtained from CCE	Chief Controller of Explosives (CCoE)
12	Minor Mineral and concession Rules	For opening new quarry.	Quarry Licenses shall be obtained by Contractors.	District Collector
13	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989	To check vehicular air and noise pollution.	All vehicles in Use shall obtain Pollution Control Check certificates	Motor Vehicle Department
14	National Forest Policy1952 National Forest Policy (Revised) 1988	To maintain ecological stability through preservation and restoration of biological diversity.	Forest land is involved in the project.	Forest Department, GoI and GoUP
15	The Mining Act	The mining act has been notified for safe and sound mining activity.	Quarry Licenses shall be obtained by Contractors.	Department of mining, GoUP
16	Hazardous waste (Management ,Handlin g & Transboundry)Rules, 2008	Management and storage of hazardous waste.	Applicable	UPPCB /MoEF
17	The Railway (Amendment) Act , 2008	Land acquisition	Land acquisition is involved	GoI
18	The Petroleum (Amendment) Rules, 2011	Use and storage of petroleum products	Applicable	CCOE /DC

3.4 OTHER LEGISLATIONS APPLICABLE TO CONSTRUCTION PROJECTS

The DFCCIL shall ensure that other legislations like Child Labour (prohibition and Regulation) Act; 1986, Minimum Wages Act; 1948, The Factories Act; 1948, The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 etc. are followed.

3.4.1 World Bank Operational Policies

The operational policies of the Bank, both triggered and non-triggered, the details and the applicability to the Project road are provided in the Table 3.2. The World Bank environment assessment (EA) requirements are based on a three-part classification system such as Category A, Category B and Category C as defined by the World Bank OP 4.01. A Project designated as Category A, requires a full environmental assessment (EA) whereas Category B projects require a lesser level

of environmental investigation. Category C projects require no environmental analysis beyond that determination.

Table-3.2: World Bank Safeguard Policies / IFC Performance Standards

Sl. No.	Safeguard Policy	Subject Category	Triggered	Triggered By	Mitigation Measures	Documentation
1.	OP 4.01	Environment Assessment	Yes	Sensitive areas and impacts on environmental and social components	Mitigation measures incorporated	EIA and EMP prepared
2.	OP 4.11	Physical Cultural Resources	Yes	Risk to cultural properties	Adequate mitigation measures if affected	EMP prepared
3.	IFC Performance Standards	Labour & Occupational Health	Yes	Labour and construction camp	Compliance of IFC Standards	EIA & EMP prepared; Safety & Occupational Health measures during construction will be adequately covered in Contract document & DFCCIL SHE manual will be referred.

3.4.2 Type of Project

For projects with potential to have significant adverse environmental impacts (Category A) an environmental impact assessment (EIA) is required. Category B projects are judged to have some adverse environmental impacts, but of lesser degree or significance than those for category A projects and require an Environmental Assessment (EA) to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the EA is regarded as the final environmental assessment report as is the case for this project. The project railway line passes through very small patches of degraded forests area. No presence of endangered fauna and flora along the project railway line envisaged. It may also be mentioned that there is only marginal acquisition for forest land due to the proposed project. The Government of India has issued Environmental Impact Assessment Notification in 1994 as a part of Environmental (Protection) Act, 1986 and amendments in September 2006. Railway projects do not fall under any category requiring an environmental clearance from MoEF. Only No Objection Certificate (NOC) is required from SPCB under the Air and Water Acts.

It has been established that there is a need for improving the infrastructure capacity of the transport sector to cater the projected demand for freight and good movement. By building up the rail infrastructure which uses $1/6^{th}$ the fossil fuel consumption as compared to road, overall improvement n environmental condition is envisaged. Over and above since traction in this case would be electricity based, there is a possibility that this electricity can come from the budding nuclear capacity of the nation. Thus there can not be more eco-friendly and efficient transport system to meet with the demand of India's growth economy.

Since this is a large scale project and likely to have some reversible impacts on environment during construction phases & some impact, not of much significance,

during operation, this project is being considered as **'A' category** project as per the World Bank safeguard policy. This will help not only in tweaking the construction stage to be more eco-compliant but setting systems to have better and more environment friendly construction in forthcoming railway projects. DFCCIL is committed to establish most efficient and eco-friendly system.

3.4.3 Clearance Requirements for the Project

The summary table showing time requirements for agency responsible for obtaining clearance, and a stage at which clearance will be required is given below:

Table-3.3: Summary of Clearances & NOC

Sl. No	Type of clearance	Statutory Authority	Applicability	Project stage	Time required	Responsibility
1.	Forest Clearance	State Department of Environment and Forest and MoEF	Diversion of Forest land	Pre construction	6-8 months	DFCC
2.	Tree felling permission	Forest department	Felling of trees	Pre construction	15 days	DFCC
3.	NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For establishing plants	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
4.	NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For operating Hot mix plants, Crushers and batching plants	Construction (Prior to work initiation)	1-2 months	Concessionaire / Contractor
5.	Permission to store Hazardous Materials	State Pollution Control Board	Storage and Transportation Of Hazardous Materials and Explosives	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
6.	Explosive license	Chief controller of explosives	Storage of explosive materials	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
7.	PUC certificate for use of vehicles for construction	Department of Transport	For all construction vehicles	Construction (Prior to work initiation)	1-2 months	Concessionaire / Contractor
8.	Quarry lease deeds and license	Dept. of Geology and Mines	Quarrying and borrowing operations	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
9.	NOC for water extraction for construction and allied works	Ground Water Authority	Ground water extraction	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor

3.5 CONCLUSION

The project requires no prior environmental clearance. However, clearance for the diversion of 0.998 Ha. forest land and permission for cutting around 17,122 trees

within the proposed right of way of the alignment, will be required from the Forest Department. In addition to the above, the contractor would require the following NOCs & licenses from the authorities during construction:

- NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB for establishing and operating plants from SPCB
- PUC certificate for use of vehicles for construction from Department of Transport
- Quarry lease deeds and license and Explosive license from Dept. of Geology and Mines & Chief controller of explosives
- NOC for water extraction for construction and allied works from Ground Water Authority

The Contractor shall obtain above NOC for construction work. Apart from the above clearances, the contractor also has to comply with the following:

- The Mines Act, 1952, The Child Labour (Prohibitation & Regulation) Act, 1986, The Equal Remuration Act, 1976, The Contract Labour (Regulation & Abolition) Act, 1970, The Payment of Wages (Amendments) Act, 2005 and The Public Liability Insurance Act, 1991.
- The Clearance of Engineer for location and layout of Worker's Camp, Equipment yard and Storage yard.
- Clearance of Engineer for Traffic Management Plan for each section of the route after it has been handed over for construction.
- An Emergency Action Plan should be prepared by the contractor and approved by the Engineer for accidents responding to involving fuel & lubricants before the construction starts. Submit a Quarry Management Plan to the Engineer along with the Quarry lease deeds.

CHAPTER-4: ENVIRONMENTAL PROFILE OF THE PROJECT INFLUENCE AREA

4.1 INTRODUCTION

This section presents the environmental profile of the project influence area and its salient features. The objective of the profile is to ascertain the environmental sensitivity of the project, and identify the likely impact zones of the project.

Considering the nature of the project alignment, an area of about 5.0 km on either side of the corridor has been considered for studying the profile. The environmental features such as reserved forest, sanctuaries / national parks, rivers, lakes and ponds, religious structures, archaeological monuments, natural habitats, schools, irrigation canals along with other sensitive receptors were mapped in the profile through detailed field inventories and presented on the topo sheets (on a scale of 1:50,000) of Survey of India.

In addition to the above, the detailed walks through surveys were carried out to map specific environmental features within the Right of Way (ROW) of the proposed alignment. These features were presented on strip maps. Sections below, presents the details of both these surveys.

Strip maps have also been prepared and is part of the EA report.

4.2 METHODOLOGY

The methodology followed in the preparation of the environmental profile of the project influence area and strip maps comprised the following:-

- **Collection of Toposheets (scale 1:50000 & 1:250000 of Survey of India** from Survey of India and demarcation of the proposed alignment on the toposheets.
- **Field reconnaissance of the proposed alignment through detailed walk through surveys**
- Mapping of **sensitive receptors** such as schools, religious structures, hospitals etc.
- Interactions with **local villagers and resource persons to understand the importance of various** sensitive features and other local resources (if any).

The data collected from the above tasks was mapped on the detailed Kilometer wise strip maps and topo sheets on a scale of 1:50,000.

4.3 ENVIRONMENTAL PROFILE OF THE PROJECT INFLUENCE AREA

The environmental profile of the influence area (within 5.0 km on either side of the proposed alignment presented in **Annexure-4.1**, indicates that:-

- the alignment generally runs through plain areas of Indo-Gangetic plains and is devoid of sensitive environmental features
- at many of the locations, lower ganga canal and its distributaries cris-crosses the alignment
- The alignment also crosses through major rivers Yamuna (Km 827*) & Tonse (Km 794).
  [*Location of Yamuna bridge shown as Km 827 is the projected chainage of existing IR.]

No sensitive features such as wildlife sanctuary, wetland, ASI Protected monument etc. were observed in the project influence area.

4.4 ENVIRONMENTAL FEATURES WITHIN PROJECT ROW

The environmental features within the right of way (RoW) of the project were recorded through the kilometre wise strip maps, as presented in Annexure 4.1, indicate that the proposed alignment, The silent features are summarized below:

- Does not pass through any Wildlife Sanctuary/ National Park or sensitive natural resources
- Does not affect wetlands
- No ASI monument restricted area is encroached by the proposed DFC alignment
- Require acquisition 0.998 Ha forest Land in Mirzapur district. Figure 4.1 shows forest land at village Attari.
- There are number of Major cities and settlements all along the section and to avoid such heavily built up area, eight detours(Kanpur, Fathepur, Khaga, Sirathu, Bhawari, Allahabad, Manda and Mirzapur) have been proposed at these locations.
- The project alignment runs through 2 perennial rivers Yamuna(Km827) &Tonse (Km794 Km) and number of small water bodies such as Pandu river(1023,983), Ojhla(739,741), Khajuri(731,736,738), Balwan(718), Baharia (718) and Jirgo(702).
- The alignment also crosses the lower Ganga Canal and its distributaries at number of locations(km1039, 1025,1013,1002,996,970 ,951,950,945 ,942 ,935 ,915 ,906,887,805,803 ,786, 773, 749 ,730,722,720 ,716 ,715, 714, 711, 709, 708). The impacts on the canal however are mitigated in the design by providing adequate cross drainage works at the locations.
- Number of religious structures, schools / educational institutions and Hospitals are located along the proposed alignment. The Km wise details of these structures are presented in **Table 4.1**.
- Alignment at Fathepur detour is passing through a degree college (RituRaj Degree College) at Asti Bajiapti village (Km 945) as college is going to be directly impacted , this college has come up after notification of land acquisition under section 20A and award for the same has also been declared by the competent authority. The legal case has been filed in Hon'ble High Court and case is under process. Detour alignment may be shifted if found technically feasible and as per outcome of the court.
- The proposed alignment is expected to involve the cutting of approximately 17000 trees. Most of these tree species comprise common species such as neem, pepal, mango, eucalyptus, Gulmohar etc., and doesn't involve cutting of any sensitive / endangered species. The number of Trees within ROW chainagewise, girth wise and species wise are presented in Annexure 4.2

4.5 List of sensitive receptors surveyed during EIA study is given at Annexure- 4.1. All these are not so located for taking mitigation measures. Summary list of sensitive receptors for which mitigation measures are required are given in the table below. Detail list is given in Table 8.4 & 8.5 later in this report.

Table-4.1: Details of Sensitive Receptors requiring relocation / protection

Sensitive	Within ROW	Outside (ROW) UPTO 100 MTR
Religious Structure	29	1
School/ college	5	9
Hospital	1	5
Water Bodies	99	-
Trees	18148	-

All important features surveyed do not require relocation or protection measures. Affected community property resources are 55 and list is available in Table 5.27 later in this report at Chapter-5.

Annexure-4.1

List of important features

Summary of Important Features Along with Corridor (KM 667-676)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	3	Nil
School	NIL	6
Hospital	NIL	1
Water Bodies	3	3
Trees	93	Not applicable
Summary of Important features Along with Corridor (KM 676-688)		
Sensitive	**Within ROW**	**Outside ROW Upto 100 MTR**
Religious Structure	2	1
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	5	1
Trees	166	Not applicable
Summary of Important Features Along with Corridor (KM 688-698)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	5	NIL
School	NIL	NIL
Hospital	NIL	1
Water Bodies	5	1
Trees	432	Not applicable
Summary of Important Features Alongwith Corridor (KM 698-708)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	7	NIL
Trees	445	Not applicable
Summary of Important Features Along with Corridor (KM 708-718)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	2
Hospital	NIL	NIL
Water Bodies	12	NIL
Trees	345	Not applicable
Summary of Important Features Along with Corridor (KM 718-728)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	8	NIL
Trees	362	Not applicable
Summary of Important Features Along with Corridor (KM 728-738)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	1
School	1	1
Hospital	NIL	NIL

Water Bodies	8	NIL
Trees	671	Not applicable
Summary of Important Features Along with Corridor (KM 728-738)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	1
School	1	1
Hospital	NIL	NIL
Water Bodies	9	NIL
Trees	671	Not applicable
Summary of Important Features Along with Corridor (KM 738-748)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	2
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	6	NIL
Trees	609	Not applicable
Summary of Important Features Along with Corridor (KM 748-758)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	2
School	1	1
Hospital	NIL	NIL
Water Bodies	4	NIL
Trees	316	Not applicable
Summary of Important Features Along with Corridor (KM 758-768)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	3	1
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	9	NIL
Trees	258	Not applicable
Summary of Important Features Along with Corridor (KM 768-778)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	4	1
School	NIL	1
Hospital	NIL	NIL
Water Bodies	1	NIL
Trees	506	Not applicable
Summary of Important Features Along with Corridor (KM 778-788)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	5	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	12	NIL
Trees	430	Not applicable
Summary of Important Features Along with Corridor (KM 788-798)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	8	NIL
School	NIL	NIL
Hospital	1	NIL
Water Bodies	5	NIL
Trees	973	Not applicable
Summary of Important Features Along with Corridor (KM 798-808)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	3	NIL
School	NIL	1
Hospital	NIL	NIL
Water Bodies	7	NIL

Trees	405	Not applicable
Summary of Important Features Along with Corridor (KM 808-818)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	2	1
Trees	351	Not applicable
Summary of Important Features Along with Corridor (KM 818-828)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	1
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	2	NIL
Trees	672	Not applicable
Summary of Important Features Along with Corridor (KM 828-838)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	1
School	NIL	1
Hospital	NIL	NIL
Water Bodies	3	1
Trees	488	Not applicable
Summary of Important Features Along with Corridor (KM 838-848)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	4	NIL
School	2	NIL
Hospital	1	NIL
Water Bodies	4	NIL
Trees	659	Not applicable
Summary of Important Features Along with Corridor (KM 848-858)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	NIL
School	NIL	NIL
Hospital	1	1
Water Bodies	5	NIL
Trees	310	Not applicable
Summary of Important Features Along with Corridor (KM 858-868)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	1
School	1	NIL
Hospital	NIL	NIL
Water Bodies	9	NIL
Trees	558	Not applicable
Summary of Important Features Along with Corridor (KM 868-878)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	1
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	2	NIL
Trees	693	Not applicable
Summary of Important Features Along with Corridor (KM 878-888)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	8	NIL
Trees	430	Not applicable
Summary of Important Features Along with Corridor (KM 888-898)		

Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	4	NIL
Trees	421	Not applicable
Summary of Important Features Along with Corridor (KM 898-908)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	4	1
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	6	NIL
Trees	372	Not applicable
Summary of Important Features Along with Corridor (KM 908-918)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	3	NIL
Trees	302	Not applicable
Summary of Important Features Along with Corridor (KM 918-928)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	NIL	NIL
Trees	483	Not applicable
Summary of Important Features Along with Corridor (KM 928-938)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	1
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	5	NIL
Trees	411	Not applicable
Summary of Important Features Along with Corridor (KM 938-948)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	3	NIL
School	1	1
Hospital	NIL	NIL
Water Bodies	12	1
Trees	518	Not applicable
Summary of Important Features Along with Corridor (KM 948-958)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	NIL
School	2	NIL
Hospital	NIL	NIL
Water Bodies	4	NIL
Trees	389	Not applicable
Summary of Important Features Along with Corridor (KM 958-968)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	2
School	2	NIL
Hospital	NIL	NIL
Water Bodies	5	NIL
Trees	673	Not applicable
Summary of Important Features Along with Corridor (KM 968-978)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	NIL

School	1	NIL
Hospital	NIL	NIL
Water Bodies	3	NIL
Trees	630	Not applicable
Summary of Important Features Along with Corridor (KM 978-988)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	2	NIL
Trees	622	Not applicable
Summary of Important Features Along with Corridor (KM 988-998)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	4	NIL
Trees	531	Not applicable
Summary of Important Features Along with Corridor (KM 998-1008)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	NIL
School	NIL	1
Hospital	NIL	NIL
Water Bodies	1	NIL
Trees	596	Not applicable
Summary of Important Features Along with Corridor (KM 1008-1018)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	7	NIL
Trees	294	Not applicable
Summary of Important Features Along with Corridor (KM 1018-1028)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	2	NIL
School	NIL	1
Hospital	NIL	NIL
Water Bodies	2	NIL
Trees	166	Not applicable
Summary of Important Features Along with Corridor (KM1028-1038)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	1	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	5	NIL
Trees	242	Not applicable
Summary of Important Features Along with Corridor (KM 1038-1048)		
Sensitive	**Within ROW**	**Outside (ROW) UPTO 100 MTR**
Religious Structure	NIL	NIL
School	NIL	NIL
Hospital	NIL	NIL
Water Bodies	4	NIL
Trees	302	Not applicable

Annexure 4.2

Chainage-wise, Girth-wise and Species-wise Number of Trees within ROW

Chainage (Km.)	Common Name of Trees	Botanical Name of Trees	No. of Trees	Girth, meter		
				0.6-0.9	0.9-1.20	>1.20
1038-1048	Aam	*Mangifera indica*	33	16	13	4
	Mahua	*Madhuca longifolia var. latifolia*	27	15	9	3
	Neem	*Azadirachta indica*	21	13	6	2
	Peepal	*Ficus religiosa*	04	1	2	1
	Bargad	*Ficus Benghalensis*	02	1	1	0
	Arjuna	*Terminalia arjuna*	18	11	5	2
	Babool	*Acacia arabica*	46	16	26	4
	Sheesham	*Dalbergia sissoo*	51	19	26	6
	Gulmohar	*Delonix regia*	15	5	8	2
	Jamun	*Jambulina sp*	06	2	3	1
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	24	14	10	0
	Amrood	*Feijoa*	08	3	4	1
	Poplar	*Liriodendron*	14	6	8	0
	Bel	*Aegle marmelos*	02	1	1	0
	Eucalyptus	*Eucalyptus globules*	14	6	8	0
	Khajoor	*Phoenix dactylifera*	09	6	3	0
	Sagwan	*Tectona grandis*	04	1	3	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		04	3	1	0
		Total Number of Trees	**302**	**139**	**137**	**26**
1028-1038	Aam	*Mangifera indica*	19	14	5	0
	Mahua	*Madhuca longifolia var. latifolia*	30	19	11	0
	Neem	*Azadirachta indica*	28	19	9	0
	Peepal	*Ficus religiosa*	06	4	1	1
	Bargad	*Ficus Benghalensis*	02	0	1	1

	Arjuna	*Terminalia arjuna*	16	9	7	0
	Babool	*Acacia arabica*	37	21	16	0
	Sheesham	*Dalbergia sissoo*	42	27	15	0
	Gulmohar	*Delonix regia*	09	6	3	0
	Jamun	*Jambulina sp*	02	1	1	0
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	02	1	1	0
	Beri	*Ziziphus mauritiana*	24	16	8	0
	Amrood	*Feijoa*	12	7	5	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	07	2	5	0
	Khajoor	*Phoenix dactylifera*	03	2	1	0
	Sagwan	*Tectona grandis*	01	1	0	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		02	1	1	0
		Total Number of Trees	**242**	**150**	**90**	**2**
1018-1028	Aam	*Mangifera indica*	00	0	0	0
	Mahua	*Madhuca longifolia var. latifolia*	10	6	4	0
	Neem	*Azadirachta indica*	21	16	5	0
	Peepal	*Ficus religiosa*	04	3	1	0
	Bargad	*Ficus Benghalensis*	02	1	1	0
	Arjuna	*Terminalia arjuna*	13	9	4	0
	Babool	*Acacia arabica*	24	11	13	0
	Sheesham	*Dalbergia sissoo*	38	24	14	0
	Gulmohar	*Delonix regia*	12	7	5	0
	Jamun	*Jambulina sp*	08	5	3	0
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0

	Imali	*Tamarindus indica*	02	1	1	0
	Beri	*Ziziphus mauritiana*	08	5	3	0
	Amrood	*Feijoa*	02	1	1	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	08	5	3	0
	Khajoor	*Phoenix dactylifera*	05	3	2	0
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		06	4	2	0
		Total Number of Trees	**166**	**103**	**63**	**0**
1008-1018	Aam	*Mangifera indica*	31	19	12	0
	Mahua	*Madhuca longifolia var. latifolia*	46	27	19	0
	Neem	*Azadirachta indica*	28	18	10	0
	Peepal	*Ficus religiosa*	04	3	1	0
	Bargad	*Ficus Benghalensis*	02	1	1	0
	Arjuna	*Terminalia arjuna*	16	13	3	0
	Babool	*Acacia arabica*	48	27	21	0
	Sheesham	*Dalbergia sissoo*	22	12	10	0
	Gulmohar	*Delonix regia*	10	7	3	0
	Jamun	*Jambulina sp*	04	3	1	0
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	22	17	5	0
	Amrood	*Feijoa*	08	5	3	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	25	14	11	0

	Khajoor	*Phoenix dactylifera*	13	8	5	0
	Sagwan	*Tectona grandis*	06	4	2	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		09	6	3	0
		Total Number of Trees	**294**	**184**	**110**	**0**
998-1008	Aam	*Mangifera indica*	37	13	13	11
	Mahua	*Madhuca longifolia var. latifolia*	37	12	9	16
	Neem	*Azadirachta indica*	52	24	14	14
	Peepal	*Ficus religiosa*	20	9	3	8
	Bargad	*Ficus Benghalensis*	08	1	1	6
	Arjuna	*Terminalia arjuna*	33	14	6	13
	Babool	*Acacia arabica*	71	27	19	25
	Sheesham	*Dalbergia sissoo*	48	19	23	6
	Gulmohar	*Delonix regia*	12	3	1	8
	Jamun	*Jambulina sp*	06	1	1	4
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	02	1	1	0
	Beri	*Ziziphus mauritiana*	36	5	3	28
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	14	7	5	2
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	139	16	7	116
	Khajoor	*Phoenix dactylifera*	14	9	5	0
	Sagwan	*Tectona grandis*	04	3	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		59	5	2	52
		Total Number of Trees	**596**	**169**	**114**	**313**
988-998	Aam	*Mangifera indica*	28	13	5	10
	Mahua	*Madhuca longifolia var. latifolia*	33	4	17	12

	Neem	*Azadirachta indica*	29	9	14	6
	Peepal	*Ficus religiosa*	18	7	3	8
	Bargad	*Ficus Benghalensis*	12	4	3	5
	Arjuna	*Terminalia arjuna*	14	4	5	5
	Babool	*Acacia arabica*	63	20	31	12
	Sheesham	*Dalbergia sissoo*	42	14	7	21
	Gulmohar	*Delonix regia*	20	5	6	9
	Jamun	*Jambulina sp*	24	8	4	12
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	03	1	1	1
	Beri	*Ziziphus mauritiana*	31	2	3	26
	Amrood	*Feijoa*	56	0	26	30
	Poplar	*Liriodendron*	11	0	0	11
	Bel	*Aegle marmelos*	04	0	2	2
	Eucalyptus	*Eucalyptus globules*	25	11	14	0
	Khajoor	*Phoenix dactylifera*	35	15	6	14
	Sagwan	*Tectona grandis*	07	5	2	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		74	14	22	38
		Total Number of Trees	**531**	**136**	**171**	**224**
978-988	Aam	*Mangifera indica*	39	18	16	5
	Mahua	*Madhuca longifolia var. latifolia*	28	9	19	0
	Neem	*Azadirachta indica*	58	22	23	13
	Peepal	*Ficus religiosa*	16	4	6	6
	Bargad	*Ficus Benghalensis*	12	1	4	7
	Arjuna	*Terminalia arjuna*	57	2	14	41
	Babool	*Acacia arabica*	55	17	14	24
	Sheesham	*Dalbergia sissoo*	30	8	11	11

	Gulmohar	*Delonix regia*	44	5	16	23
	Jamun	*Jambulina sp*	11	2	5	4
	Kathal	*Artocarpus heterophyllus Lam*	31	13	16	2
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	51	0	12	39
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	21	0	0	21
	Bel	*Aegle marmelos*	04	0	0	4
	Eucalyptus	*Eucalyptus globules*	50	19	17	14
	Khajoor	*Phoenix dactylifera*	30	14	5	11
	Sagwan	*Tectona grandis*	09	6	3	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		74	17	21	36
		Total Number of Trees	**622**	**157**	**202**	**263**
968-978	Aam	*Mangifera indica*	60	27	19	14
	Mahua	*Madhuca longifolia var. latifolia*	25	13	6	6
	Neem	*Azadirachta indica*	43	22	13	8
	Peepal	*Ficus religiosa*	30	9	11	10
	Bargad	*Ficus Benghalensis*	12	0	0	12
	Arjuna	*Terminalia arjuna*	16	3	2	11
	Babool	*Acacia arabica*	34	13	5	16
	Sheesham	*Dalbergia sissoo*	19	5	8	6
	Gulmohar	*Delonix regia*	12	3	4	5
	Jamun	*Jambulina sp*	16	4	5	7
	Kathal	*Artocarpus heterophyllus Lam*	04	0	0	4
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	37	0	23	14
	Amrood	*Feijoa*	11	0	0	11

	Poplar	*Liriodendron*	05	0	0	5
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	128	42	38	48
	Khajoor	*Phoenix dactylifera*	47	29	11	7
	Sagwan	*Tectona grandis*	15	9	6	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		112	39	46	27
Total Number of Trees			**630**	**218**	**197**	**215**
958-968	Aam	*Mangifera indica*	37	11	12	14
	Mahua	*Madhuca longifolia var. latifolia*	38	12	14	12
	Neem	*Azadirachta indica*	40	11	19	10
	Peepal	*Ficus religiosa*	14	2	3	9
	Bargad	*Ficus Benghalensis*	07	0	0	7
	Arjuna	*Terminalia arjuna*	06	0	0	6
	Babool	*Acacia arabica*	45	17	23	5
	Sheesham	*Dalbergia sissoo*	40	21	15	4
	Gulmohar	*Delonix regia*	31	11	14	6
	Jamun	*Jambulina sp*	12	3	5	4
	Kathal	*Artocarpus heterophyllus Lam*	05	0	0	5
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	90	19	9	62
	Amrood	*Feijoa*	41	8	12	21
	Poplar	*Liriodendron*	11	0	0	11
	Bel	*Aegle marmelos*	44	4	8	32
	Eucalyptus	*Eucalyptus globules*	118	9	8	101
	Khajoor	*Phoenix dactylifera*	33	7	4	22
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		56	5	12	39

		Total Number of Trees	**673**	**142**	**159**	**372**
948-958	Aam	*Mangifera indica*	33	18	15	0
	Mahua	*Madhuca longifolia var. latifolia*	17	9	8	0
	Neem	*Azadirachta indica*	32	17	15	0
	Peepal	*Ficus religiosa*	10	4	3	3
	Bargad	*Ficus Benghalensis*	12	5	2	5
	Arjuna	*Terminalia arjuna*	12	3	9	0
	Babool	*Acacia arabica*	35	14	21	0
	Sheesham	*Dalbergia sissoo*	35	13	20	2
	Gulmohar	*Delonix regia*	04	1	3	0
	Jamun	*Jambulina sp*	26	9	14	3
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	13	7	6	0
	Amrood	*Feijoa*	19	14	5	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	51	23	28	0
	Khajoor	*Phoenix dactylifera*	35	21	14	0
	Sagwan	*Tectona grandis*	09	7	2	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		46	21	25	0
		Total Number of Trees	**389**	**186**	**190**	**13**
938-948	Aam	*Mangifera indica*	28	4	15	9
	Mahua	*Madhuca longifolia var. latifolia*	34	14	13	7
	Neem	*Azadirachta indica*	37	19	12	6
	Peepal	*Ficus religiosa*	08	1	2	5
	Bargad	*Ficus Benghalensis*	07	1	2	4

	Arjuna	*Terminalia arjuna*	29	7	19	3
	Babool	*Acacia arabica*	41	13	20	8
	Sheesham	*Dalbergia sissoo*	44	14	24	6
	Gulmohar	*Delonix regia*	16	7	5	4
	Jamun	*Jambulina sp*	08	1	1	6
	Kathal	*Artocarpus heterophyllus Lam*	07	0	0	7
	Imali	*Tamarindus indica*	07	1	1	5
	Beri	*Ziziphus mauritiana*	22	11	7	4
	Amrood	*Feijoa*	25	7	13	5
	Poplar	*Liriodendron*	27	13	8	6
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	35	18	17	0
	Khajoor	*Phoenix dactylifera*	41	17	13	11
	Sagwan	*Tectona grandis*	10	5	4	1
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		92	14	27	51
		Total Number of Trees	**518**	**167**	**203**	**148**
928-938	Aam	*Mangifera indica*	44	9	14	21
	Mahua	*Madhuca longifolia var. latifolia*	35	7	16	12
	Neem	*Azadirachta indica*	31	6	14	11
	Peepal	*Ficus religiosa*	13	2	1	10
	Bargad	*Ficus Benghalensis*	14	0	0	14
	Arjuna	*Terminalia arjuna*	29	2	15	12
	Babool	*Acacia arabica*	52	9	19	24
	Sheesham	*Dalbergia sissoo*	20	7	9	4
	Gulmohar	*Delonix regia*	20	6	3	11
	Jamun	*Jambulina sp*	10	1	1	8
	Kathal	*Artocarpus heterophyllus*	02	0	0	2

		Lam				
	Imali	*Tamarindus indica*	03	1	1	1
	Beri	*Ziziphus mauritiana*	01	1	0	0
	Amrood	*Feijoa*	16	0	0	16
	Poplar	*Liriodendron*	09	0	0	9
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	17	11	6	0
	Khajoor	*Phoenix dactylifera*	25	7	2	16
	Sagwan	*Tectona grandis*	05	2	3	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		63	4	22	37
		Total Number of Trees	**411**	**75**	**126**	**210**
918-928	Aam	*Mangifera indica*	34	6	9	19
	Mahua	*Madhuca longifolia var. latifolia*	47	19	18	10
	Neem	*Azadirachta indica*	27	7	8	12
	Peepal	*Ficus religiosa*	17	1	2	14
	Bargad	*Ficus Benghalensis*	14		6	8
	Arjuna	*Terminalia arjuna*	26		17	9
	Babool	*Acacia arabica*	45	13	20	12
	Sheesham	*Dalbergia sissoo*	29	12	6	11
	Gulmohar	*Delonix regia*	13	1	3	9
	Jamun	*Jambulina sp*	18	2	8	8
	Kathal	*Artocarpus heterophyllus Lam*	18	3	6	9
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	14	0	0	14
	Amrood	*Feijoa*	26	0	0	26
	Poplar	*Liriodendron*	11	0	0	11
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	69	4	3	62

	Khajoor	*Phoenix dactylifera*	14	1	1	12
	Sagwan	*Tectona grandis*	01	0	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		56	1	11	44
		Total Number of Trees	**483**	**70**	**119**	**294**
908-918	Aam	*Mangifera indica*	11	4	6	1
	Mahua	*Madhuca longifolia var. latifolia*	36	2	13	21
	Neem	*Azadirachta indica*	23	2	8	13
	Peepal	*Ficus religiosa*	16	2	3	11
	Bargad	*Ficus Benghalensis*	02	0	0	2
	Arjuna	*Terminalia arjuna*	23	0	11	12
	Babool	*Acacia arabica*	46	2	21	23
	Sheesham	*Dalbergia sissoo*	15	3	6	6
	Gulmohar	*Delonix regia*	13	2	3	8
	Jamun	*Jambulina sp*	11	0	5	6
	Kathal	*Artocarpus heterophyllus Lam*	06	0	1	5
	Imali	*Tamarindus indica*	05	0	1	4
	Beri	*Ziziphus mauritiana*	13	4	2	7
	Amrood	*Feijoa*	09	1	2	6
	Poplar	*Liriodendron*	08	0	0	8
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	02	1	1	0
	Khajoor	*Phoenix dactylifera*	11	2	1	8
	Sagwan	*Tectona grandis*	01	1	0	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		49	1	16	32
		Total Number of Trees	**302**	**27**	**100**	**175**
898-908	Aam	*Mangifera indica*	29	6	15	8
	Mahua	*Madhuca longifolia*	36	11	16	9

		var. latifolia				
	Neem	*Azadirachta indica*	51	27	13	11
	Peepal	*Ficus religiosa*	30	7	11	12
	Bargad	*Ficus Benghalensis*	02	0	0	2
	Arjuna	*Terminalia arjuna*	12	0	0	12
	Babool	*Acacia arabica*	87	23	43	21
	Sheesham	*Dalbergia sissoo*	08	4	2	2
	Gulmohar	*Delonix regia*	13	1	1	11
	Jamun	*Jambulina sp*	11	2	3	6
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	24	1	0	23
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	04	0	0	4
	Bel	*Aegle marmelos*	04	1	1	2
	Eucalyptus	*Eucalyptus globules*	01	1	0	0
	Khajoor	*Phoenix dactylifera*	10	1	1	8
	Sagwan	*Tectona grandis*	01	0	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		47	1	21	25
		Total Number of Trees	**372**	**86**	**128**	**158**
888-898	Aam	*Mangifera indica*	28	8	11	9
	Mahua	*Madhuca longifolia var. latifolia*	24	7	11	6
	Neem	*Azadirachta indica*	44	13	27	4
	Peepal	*Ficus religiosa*	16	2	8	6
	Bargad	*Ficus Benghalensis*	07	0	0	7
	Arjuna	*Terminalia arjuna*	08	0	0	8
	Babool	*Acacia arabica*	41	13	22	6
	Sheesham	*Dalbergia sissoo*	48	27	16	5

	Gulmohar	*Delonix regia*	09	0	0	9
	Jamun	*Jambulina sp*	30	11	15	4
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	11	0	0	11
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	64	14	11	39
	Khajoor	*Phoenix dactylifera*	31	12	8	11
	Sagwan	*Tectona grandis*	08	3	5	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		50	7	4	39
		Total Number of Trees	**421**	**117**	**138**	**166**
878-888	Aam	*Mangifera indica*	163	52	103	8
	Mahua	*Madhuca longifolia var. latifolia*	37	7	18	12
	Neem	*Azadirachta indica*	38	16	13	9
	Peepal	*Ficus religiosa*	01	0	0	1
	Bargad	*Ficus Benghalensis*	02	0	0	2
	Arjuna	*Terminalia arjuna*	13	0	0	13
	Babool	*Acacia arabica*	17	0	0	17
	Sheesham	*Dalbergia sissoo*	28	9	15	4
	Gulmohar	*Delonix regia*	07	1	2	4
	Jamun	*Jambulina sp*	05	2	2	1
	Kathal	*Artocarpus heterophyllus Lam*	05	1	3	1
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	06	3	3	0
	Amrood	*Feijoa*	03	1	2	0

	Poplar	*Liriodendron*	03	1	2	0
	Bel	*Aegle marmelos*	04	0	0	4
	Eucalyptus	*Eucalyptus globules*	03	2	1	0
	Khajoor	*Phoenix dactylifera*	25	1	3	21
	Sagwan	*Tectona grandis*	01	0	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		69	1	26	42
		Total Number of Trees	**430**	**97**	**194**	**139**
868-878	Aam	*Mangifera indica*	74	37	16	21
	Mahua	*Madhuca longifolia var. latifolia*	175	69	90	16
	Neem	*Azadirachta indica*	31	14	4	13
	Peepal	*Ficus religiosa*	18	4	3	11
	Bargad	*Ficus Benghalensis*	00	0	0	0
	Arjuna	*Terminalia arjuna*	72	29	32	11
	Babool	*Acacia arabica*	58	18	28	12
	Sheesham	*Dalbergia sissoo*	26	9	11	6
	Gulmohar	*Delonix regia*	22	5	2	15
	Jamun	*Jambulina sp*	06	0	0	6
	Kathal	*Artocarpus heterophyllus Lam*	01	0	0	1
	Imali	*Tamarindus indica*	31	0	0	31
	Beri	*Ziziphus mauritiana*	56	0	56	0
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	06	0	0	6
	Bel	*Aegle marmelos*	13	3	5	5
	Eucalyptus	*Eucalyptus globules*	38	5	2	31
	Khajoor	*Phoenix dactylifera*	19	2	3	14
	Sagwan	*Tectona grandis*	02	1	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		45	1	13	31

	Total Number of Trees		**693**	**197**	**266**	**230**
858-868	Aam	*Mangifera indica*	46	17	20	9
	Mahua	*Madhuca longifolia var. latifolia*	43	27	10	6
	Neem	*Azadirachta indica*	34	13	17	4
	Peepal	*Ficus religiosa*	10	3	2	5
	Bargad	*Ficus Benghalensis*	08	1	1	6
	Arjuna	*Terminalia arjuna*	43	4	32	7
	Babool	*Acacia arabica*	65	42	14	9
	Sheesham	*Dalbergia sissoo*	65	27	34	4
	Gulmohar	*Delonix regia*	23	17	4	2
	Jamun	*Jambulina sp*	08	1	3	4
	Kathal	*Artocarpus heterophyllus Lam*	06	0	0	6
	Imali	*Tamarindus indica*	05	0	0	5
	Beri	*Ziziphus mauritiana*	78	4	13	61
	Amrood	*Feijoa*	26	14	12	0
	Poplar	*Liriodendron*	11	7	4	0
	Bel	*Aegle marmelos*	14	3	9	2
	Eucalyptus	*Eucalyptus globules*	14	8	6	0
	Khajoor	*Phoenix dactylifera*	07	3	4	0
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		49	3	15	31
	Total Number of Trees		**558**	**196**	**201**	**161**
848-858	Aam	*Mangifera indica*	31	5	17	9
	Mahua	*Madhuca longifolia var. latifolia*	14	2	5	7
	Neem	*Azadirachta indica*	24	9	7	8
	Peepal	*Ficus religiosa*	05	0	1	4
	Bargad	*Ficus Benghalensis*	07	0	1	6

	Arjuna	*Terminalia arjuna*	16	4	6	6
	Babool	*Acacia arabica*	19	8	6	5
	Sheesham	*Dalbergia sissoo*	26	11	7	8
	Gulmohar	*Delonix regia*	07	0	0	7
	Jamun	*Jambulina sp*	15	3	4	8
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	02	0	1	1
	Beri	*Ziziphus mauritiana*	22	2	0	20
	Amrood	*Feijoa*	19	3	5	11
	Poplar	*Liriodendron*	09	0	0	9
	Bel	*Aegle marmelos*	02	0	2	0
	Eucalyptus	*Eucalyptus globules*	18	5	13	0
	Khajoor	*Phoenix dactylifera*	25	3	12	10
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		46	3	22	21
		Total Number of Trees	**310**	**60**	**110**	**140**
838-848	Aam	*Mangifera indica*	46	14	14	18
	Mahua	*Madhuca longifolia var. latifolia*	41	18	11	12
	Neem	*Azadirachta indica*	56	27	15	14
	Peepal	*Ficus religiosa*	27	3	7	17
	Bargad	*Ficus Benghalensis*	01	0	0	1
	Arjuna	*Terminalia arjuna*	42	6	15	21
	Babool	*Acacia arabica*	78	29	23	26
	Sheesham	*Dalbergia sissoo*	51	22	24	5
	Gulmohar	*Delonix regia*	28	13	9	6
	Jamun	*Jambulina sp*	09	3	5	1
	Kathal	*Artocarpus heterophyllus*	02	0	1	1

		Lam				
	Imali	*Tamarindus indica*	04	1	2	1
	Beri	*Ziziphus mauritiana*	08	3	5	0
	Amrood	*Feijoa*	29	7	9	13
	Poplar	*Liriodendron*	17	11	6	0
	Bel	*Aegle marmelos*	06	1	5	0
	Eucalyptus	*Eucalyptus globules*	87	29	16	42
	Khajoor	*Phoenix dactylifera*	39	22	7	10
	Sagwan	*Tectona grandis*	07	5	2	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		81	27	22	32
		Total Number of Trees	**659**	**241**	**198**	**220**
828-838	Aam	*Mangifera indica*	32	7	9	16
	Mahua	*Madhuca longifolia var. latifolia*	29	8	9	12
	Neem	*Azadirachta indica*	24	6	7	11
	Peepal	*Ficus religiosa*	16	1	2	13
	Bargad	*Ficus Benghalensis*	04	1	1	2
	Arjuna	*Terminalia arjuna*	18	5	9	4
	Babool	*Acacia arabica*	46	13	19	14
	Sheesham	*Dalbergia sissoo*	48	19	23	6
	Gulmohar	*Delonix regia*	24	4	9	11
	Jamun	*Jambulina sp*	13	2	5	6
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	27	5	3	19
	Amrood	*Feijoa*	25	2	2	21
	Poplar	*Liriodendron*	11	0	0	11
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	74	4	48	22

	Khajoor	*Phoenix dactylifera*	37	3	21	13
	Sagwan	*Tectona grandis*	01	1	0	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		55	3	36	16
		Total Number of Trees	**488**	**84**	**203**	**201**
818-828	Aam	*Mangifera indica*	30	8	13	9
	Mahua	*Madhuca longifolia var. latifolia*	46	19	14	13
	Neem	*Azadirachta indica*	26	11	4	11
	Peepal	*Ficus religiosa*	24	7	9	8
	Bargad	*Ficus Benghalensis*	28	15	7	6
	Arjuna	*Terminalia arjuna*	27	13	9	5
	Babool	*Acacia arabica*	44	14	23	7
	Sheesham	*Dalbergia sissoo*	46	26	11	9
	Gulmohar	*Delonix regia*	53	18	22	13
	Jamun	*Jambulina sp*	14	1	2	11
	Kathal	*Artocarpus heterophyllus Lam*	15	0	1	14
	Imali	*Tamarindus indica*	34	9	13	12
	Beri	*Ziziphus mauritiana*	25	0	25	0
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	22	1	21	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	77	27	18	32
	Khajoor	*Phoenix dactylifera*	43	19	24	0
	Sagwan	*Tectona grandis*	15	3	12	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		103	16	55	32
		Total Number of Trees	**672**	**207**	**283**	**182**
808-818	Aam	*Mangifera indica*	28	8	11	9
	Mahua	*Madhuca longifolia*	41	14	15	12

		var. latifolia				
	Neem	*Azadirachta indica*	37	17	7	13
	Peepal	*Ficus religiosa*	18	2	7	9
	Bargad	*Ficus Benghalensis*	07	0	1	6
	Arjuna	*Terminalia arjuna*	16	5	4	7
	Babool	*Acacia arabica*	33	8	20	5
	Sheesham	*Dalbergia sissoo*	48	22	19	7
	Gulmohar	*Delonix regia*	15	1	5	9
	Jamun	*Jambulina sp*	09	1	3	5
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	06	0	0	6
	Beri	*Ziziphus mauritiana*	05	2	3	0
	Amrood	*Feijoa*	04	1	3	0
	Poplar	*Liriodendron*	02	1	1	0
	Bel	*Aegle marmelos*	02	1	1	0
	Eucalyptus	*Eucalyptus globules*	17	5	2	10
	Khajoor	*Phoenix dactylifera*	05	3	2	0
	Sagwan	*Tectona grandis*	02	1	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		54	2	2	50
		Total Number of Trees	**351**	**94**	**107**	**150**
798-808	Aam	*Mangifera indica*	23	5	3	15
	Mahua	*Madhuca longifolia var. latifolia*	21	2	7	12
	Neem	*Azadirachta indica*	35	14	11	10
	Peepal	*Ficus religiosa*	14	2	4	8
	Bargad	*Ficus Benghalensis*	08	1	1	6
	Arjuna	*Terminalia arjuna*	33	3	4	26
	Babool	*Acacia arabica*	39	19	9	11
	Sheesham	*Dalbergia*	40	11	24	5

		sissoo				
	Gulmohar	*Delonix regia*	20	3	8	9
	Jamun	*Jambulina sp*	10	1	2	7
	Kathal	*Artocarpus heterophyllus Lam*	05	0	0	5
	Imali	*Tamarindus indica*	07	0	1	6
	Beri	*Ziziphus mauritiana*	26	2	4	20
	Amrood	*Feijoa*	10	4	6	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	06	0	0	6
	Eucalyptus	*Eucalyptus globules*	23	7	4	12
	Khajoor	*Phoenix dactylifera*	33	5	2	26
	Sagwan	*Tectona grandis*	02	1	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		50	5	3	42
		Total Number of Trees	**405**	**85**	**94**	**226**
788-798	Aam	*Mangifera indica*	120	59	45	16
	Mahua	*Madhuca longifolia var. latifolia*	34	13	15	6
	Neem	*Azadirachta indica*	24	4	11	9
	Peepal	*Ficus religiosa*	19	5	7	7
	Bargad	*Ficus Benghalensis*	15	7	2	6
	Arjuna	*Terminalia arjuna*	140	63	72	5
	Babool	*Acacia arabica*	134	72	54	8
	Sheesham	*Dalbergia sissoo*	159	58	90	11
	Gulmohar	*Delonix regia*	140	56	72	12
	Jamun	*Jambulina sp*	10	0	0	10
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus*	12	3	9	0

		mauritiana				
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	68	44	12	12
	Khajoor	*Phoenix dactylifera*	40	21	13	6
	Sagwan	*Tectona grandis*	07	5	2	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		47	21	13	13
		Total Number of Trees	**973**	**431**	**417**	**125**
778-788	Aam	*Mangifera indica*	55	24	19	12
	Mahua	*Madhuca longifolia var. latifolia*	27	11	8	8
	Neem	*Azadirachta indica*	29	9	14	6
	Peepal	*Ficus religiosa*	09	2	5	2
	Bargad	*Ficus Benghalensis*	08	1	2	5
	Arjuna	*Terminalia arjuna*	28	9	13	6
	Babool	*Acacia arabica*	63	28	35	0
	Sheesham	*Dalbergia sissoo*	55	31	19	5
	Gulmohar	*Delonix regia*	22	9	11	2
	Jamun	*Jambulina sp*	15	8	6	1
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	02	1	1	0
	Beri	*Ziziphus mauritiana*	26	16	10	0
	Amrood	*Feijoa*	25	8	17	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	40	9	6	25
	Khajoor	*Phoenix dactylifera*	09	7	2	0
	Sagwan	*Tectona grandis*	02	1	1	0

	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		15	2	5	8
		Total Number of Trees	**430**	**176**	**174**	**80**
768-778	Aam	*Mangifera indica*	32	8	19	5
	Mahua	*Madhuca longifolia var. latifolia*	18	2	7	9
	Neem	*Azadirachta indica*	61	17	27	17
	Peepal	*Ficus religiosa*	15	4	1	10
	Bargad	*Ficus Benghalensis*	08	1	1	6
	Arjuna	*Terminalia arjuna*	61	15	27	19
	Babool	*Acacia arabica*	70	21	41	8
	Sheesham	*Dalbergia sissoo*	48	17	24	7
	Gulmohar	*Delonix regia*	20	8	7	5
	Jamun	*Jambulina sp*	13	3	4	6
	Kathal	*Artocarpus heterophyllus Lam*	07	0	0	7
	Imali	*Tamarindus indica*	06	0	0	6
	Beri	*Ziziphus mauritiana*	17	4	5	8
	Amrood	*Feijoa*	20	11	9	0
	Poplar	*Liriodendron*	29	7	15	7
	Bel	*Aegle marmelos*	06	2	4	0
	Eucalyptus	*Eucalyptus globules*	25	17	8	0
	Khajoor	*Phoenix dactylifera*	16	9	7	0
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		31	11	5	15
		Total Number of Trees	**506**	**159**	**212**	**135**
758-768	Aam	*Mangifera indica*	59	18	29	12
	Mahua	*Madhuca longifolia var. latifolia*	23	4	9	10
	Neem	*Azadirachta indica*	20	5	6	9

	Peepal	*Ficus religiosa*	12	1	5	6
	Bargad	*Ficus Benghalensis*	11	2	5	4
	Arjuna	*Terminalia arjuna*	07	0	0	7
	Babool	*Acacia arabica*	20	5	12	3
	Sheesham	*Dalbergia sissoo*	14	3	6	5
	Gulmohar	*Delonix regia*	15	2	4	9
	Jamun	*Jambulina sp*	08	1	1	6
	Kathal	*Artocarpus heterophyllus Lam*	05	1	2	2
	Imali	*Tamarindus indica*	04	0	0	4
	Beri	*Ziziphus mauritiana*	00	0	0	0
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	16	9	7	0
	Khajoor	*Phoenix dactylifera*	09	5	4	0
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		32	5	4	23
		Total Number of Trees	**258**	**63**	**95**	**100**
748-758	Aam	*Mangifera indica*	40	14	12	14
	Mahua	*Madhuca longifolia var. latifolia*	33	7	5	21
	Neem	*Azadirachta indica*	38	15	5	18
	Peepal	*Ficus religiosa*	17	4	7	6
	Bargad	*Ficus Benghalensis*	20	1	2	17
	Arjuna	*Terminalia arjuna*	09	2	1	6
	Babool	*Acacia arabica*	46	7	16	23
	Sheesham	*Dalbergia sissoo*	22	1	2	19
	Gulmohar	*Delonix regia*	14	2	1	11
	Jamun	*Jambulina sp*	10	1	1	8

	Kathal	*Artocarpus heterophyllus Lam*	01	0	1	0
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	24	0	0	24
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	03	1	2	0
	Eucalyptus	*Eucalyptus globules*	02	1	1	0
	Khajoor	*Phoenix dactylifera*	01	0	1	0
	Sagwan	*Tectona grandis*	01	1	0	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		33	0	1	32
		Total Number of Trees	**316**	**57**	**58**	**201**
738-748	Aam	*Mangifera indica*	107	29	50	28
	Mahua	*Madhuca longifolia var. latifolia*	61	14	26	21
	Neem	*Azadirachta indica*	33	9	15	9
	Peepal	*Ficus religiosa*	12	1	3	8
	Bargad	*Ficus Benghalensis*	06	0	0	6
	Arjuna	*Terminalia arjuna*	24	1	2	21

	Babool	*Acacia arabica*	59	13	24	22
	Sheesham	*Dalbergia sissoo*	23	2	9	12
	Gulmohar	*Delonix regia*	39	3	9	27
	Jamun	*Jambulina sp*	06	0	0	6
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	35	5	4	26
	Amrood	*Feijoa*	49	4	13	32
	Poplar	*Liriodendron*	06	0	0	6
	Bel	*Aegle marmelos*	02	0	0	2
	Eucalyptus	*Eucalyptus globules*	49	17	11	21
	Khajoor	*Phoenix dactylifera*	23	11	6	6
	Sagwan	*Tectona grandis*	05	4	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		66	14	6	46
		Total Number of Trees	**609**	**127**	**179**	**303**
728-738	Aam	*Mangifera indica*	30	11	12	7
	Mahua	*Madhuca longifolia var. latifolia*	60	21	28	11
	Neem	*Azadirachta indica*	47	19	22	6
	Peepal	*Ficus religiosa*	23	2	5	16
	Bargad	*Ficus Benghalensis*	08	3	3	2
	Arjuna	*Terminalia arjuna*	50	21	16	13
	Babool	*Acacia arabica*	68	18	44	6
	Sheesham	*Dalbergia sissoo*	78	21	42	15
	Gulmohar	*Delonix regia*	16	3	11	2
	Jamun	*Jambulina sp*	04	1	1	2
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2

	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	45	7	13	25
	Amrood	*Feijoa*	66	9	7	50
	Poplar	*Liriodendron*	21	9	12	0
	Bel	*Aegle marmelos*	10	1	3	6
	Eucalyptus	*Eucalyptus globules*	58	18	14	26
	Khajoor	*Phoenix dactylifera*	26	13	4	9
	Sagwan	*Tectona grandis*	04	3	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		55	11	6	38
		Total Number of Trees	**671**	**191**	**244**	**236**
718-728	Aam	*Mangifera indica*	36	13	20	3
	Mahua	*Madhuca longifolia var. latifolia*	20	2	3	15
	Neem	*Azadirachta indica*	11	1	2	8
	Peepal	*Ficus religiosa*	07	0	1	6
	Bargad	*Ficus Benghalensis*	07	1	1	5
	Arjuna	*Terminalia arjuna*	07	0	0	7
	Babool	*Acacia arabica*	11	0	0	11
	Sheesham	*Dalbergia sissoo*	25	3	9	13
	Gulmohar	*Delonix regia*	18	1	1	16
	Jamun	*Jambulina sp*	09	1	0	8
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	09	0	0	9
	Amrood	*Feijoa*	19	6	13	0
	Poplar	*Liriodendron*	08	0	0	8
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	114	7	5	102

	Khajoor	*Phoenix dactylifera*	14	4	1	9
	Sagwan	*Tectona grandis*	02	2	0	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		41	7	3	31
		Total Number of Trees	**362**	**48**	**59**	**255**
708-718	Aam	*Mangifera indica*	16	2	5	9
	Mahua	*Madhuca longifolia var. latifolia*	19	1	2	16
	Neem	*Azadirachta indica*	28	5	11	12
	Peepal	*Ficus religiosa*	13	1	2	10
	Bargad	*Ficus Benghalensis*	06	0	0	6
	Arjuna	*Terminalia arjuna*	11	1	0	10
	Babool	*Acacia arabica*	63	13	29	21
	Sheesham	*Dalbergia sissoo*	25	8	11	6
	Gulmohar	*Delonix regia*	14	0	0	14
	Jamun	*Jambulina sp*	21	5	4	12
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	00	0	0	0
	Amrood	*Feijoa*	30	11	19	
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	23	16	7	0
	Khajoor	*Phoenix dactylifera*	33	9	7	17
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		45	7	2	36
		Total Number of Trees	**345**	**74**	**100**	**171**
698-708	Aam	*Mangifera indica*	23	2	5	16
	Mahua	*Madhuca longifolia var. latifolia*	11	0	0	11

	Neem	*Azadirachta indica*	49	13	21	15
	Peepal	*Ficus religiosa*	14	3	8	3
	Bargad	*Ficus Benghalensis*	04	0	0	4
	Arjuna	*Terminalia arjuna*	20	0	0	20
	Babool	*Acacia arabica*	41	8	23	10
	Sheesham	*Dalbergia sissoo*	89	25	60	4
	Gulmohar	*Delonix regia*	64	24	34	6
	Jamun	*Jambulina sp*	10	1	3	6
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	06	0	0	6
	Beri	*Ziziphus mauritiana*	01	1	0	0
	Amrood	*Feijoa*	02	1	1	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	30	19	11	0
	Khajoor	*Phoenix dactylifera*	34	8	6	20
	Sagwan	*Tectona grandis*	03	2	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		42	9	7	26
		Total Number of Trees	**445**	**116**	**180**	**149**
688-698	Aam	*Mangifera indica*	26	1	0	25
	Mahua	*Madhuca longifolia var. latifolia*	17	0	1	16
	Neem	*Azadirachta indica*	17	2	3	12
	Peepal	*Ficus religiosa*	10	1	1	8
	Bargad	*Ficus Benghalensis*	09	1	2	6
	Arjuna	*Terminalia arjuna*	09	0	0	9
	Babool	*Acacia arabica*	42	8	32	2
	Sheesham	*Dalbergia sissoo*	30	11	17	2

	Gulmohar	*Delonix regia*	24	3	9	12
	Jamun	*Jambulina sp*	16	0	0	16
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	06	0	0	6
	Beri	*Ziziphus mauritiana*	08	2	6	0
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	35	0	0	35
	Bel	*Aegle marmelos*	04	0	0	4
	Eucalyptus	*Eucalyptus globules*	55	39	16	0
	Khajoor	*Phoenix dactylifera*	42	19	13	10
	Sagwan	*Tectona grandis*	07	5	2	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		63	21	14	28
		Total Number of Trees	**422**	**113**	**116**	**193**
676-688	Aam	*Mangifera indica*	22	4	11	7
	Mahua	*Madhuca longifolia var. latifolia*	13	1	3	9
	Neem	*Azadirachta indica*	19	5	8	6
	Peepal	*Ficus religiosa*	14	4	6	4
	Bargad	*Ficus Benghalensis*	08	2	4	2
	Arjuna	*Terminalia arjuna*	08	0	0	8
	Babool	*Acacia arabica*	11	2	5	4
	Sheesham	*Dalbergia sissoo*	87	29	51	7
	Gulmohar	*Delonix regia*	12	1	2	9
	Jamun	*Jambulina sp*	03	0	0	3
	Kathal	*Artocarpus heterophyllus Lam*	02	0	0	2
	Imali	*Tamarindus indica*	02	0	0	2
	Beri	*Ziziphus mauritiana*	04	1	3	0
	Amrood	*Feijoa*	00	0	0	0

	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	07	5	2	0
	Khajoor	*Phoenix dactylifera*	11	2	1	8
	Sagwan	*Tectona grandis*	01	0	1	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		18	1	1	16
		Total Number of Trees	**242**	**57**	**98**	**87**
667-676	Aam	*Mangifera indica*	02	0	0	2
	Mahua	*Madhuca longifolia var. latifolia*	05	3	2	0
	Neem	*Azadirachta indica*	05	2	1	2
	Peepal	*Ficus religiosa*	03	1	2	0
	Bargad	*Ficus Benghalensis*	00	0	0	0
	Arjuna	*Terminalia arjuna*	04	2	2	0
	Babool	*Acacia arabica*	02	2	0	0
	Sheesham	*Dalbergia sissoo*	00	0	0	0
	Gulmohar	*Delonix regia*	02	2	0	0
	Jamun	*Jambulina sp*	01	1	0	0
	Kathal	*Artocarpus heterophyllus Lam*	00	0	0	0
	Imali	*Tamarindus indica*	00	0	0	0
	Beri	*Ziziphus mauritiana*	00	0	0	0
	Amrood	*Feijoa*	00	0	0	0
	Poplar	*Liriodendron*	00	0	0	0
	Bel	*Aegle marmelos*	00	0	0	0
	Eucalyptus	*Eucalyptus globules*	00	0	0	0
	Khajoor	*Phoenix dactylifera*	00	0	0	0
	Sagwan	*Tectona grandis*	00	0	0	0
	Others (Chilwaila, Jungle Jalebi, Baken, Awala etc.)		00	0	0	0
		Total Number of Trees	**24**	**13**	**7**	**4**
		Total	**17122**	**5013**	**5842**	**6267**
		Total number of trees to be cut as per joint survey	**18148**			

Fig. 4.1 View of Forest Land at Village Attari

CHAPTER-5: BASELINE ENVIRONMENTAL PROFILE

5.1 INTRODUCTION

This chapter assesses the nature, type and dimensions of the study area and describes the relevant physical and biological environmental components along the proposed railway line. The data on various environmental components related to the project area has been assembled from various secondary sources and primary environmental surveys on ambient air quality, noise and vibration levels, water and soil quality, aquatic and terrestrial ecology. A detailed profile prepared based on the above information is presented in the subsequent sections of this chapter.

5.2 BASELINE ENVIRONMENTAL SURVEYS

As presented in table 5.1 below, detailed base line environmental surveys were carried out for the key components of environment (ambient air, water quality, soil, noise, vibration, terrestrial and aquatic ecological parameters) during June -July, 2010 and march-April, 2011. Data on meteorology has been collected from the nearest IMD stations at Kanpur and Allahabad. The environmental monitoring was done along the proposed freight corridor covering detour as well as parallel sections.

Table-5.1: Details of Baseline Data Collection Schedule

Field	Parameters	No. of Sampling Locations	Sampling Duration	Frequency	Criteria for selection of no. of samples and locations
Ambient Air Quality	SO_2 NOx SPM RPM PM2.5 CO	23	24 hrs continuous	During June-July ,2010and march-April ,2011	Covering residential, commercial and industrial locations as per NAAQ standards, 1994 and as per NAAQ ,2009. The no. of samples have been selected to represent the baseline ambient air quality covering parallel as well as detour locations
Meteorology	Wind Speed Wind Direction Ambient Temperature Rainfall Humidity Atmospheric Pressure	02	June,2010 to May ,2011	Long term data at 8:300 and 17:30 IST	Nearest IMD stations viz. Kanpur and Allahabad to represent the meteorological condition of the study area
Water Quality (Surface & Ground Water Sample)	Physical Parameters pH, BOD, Chloride, Sulphate, Iron, Phosphate, Sodium, Total Hardenss etc.	30 (22 ground water &08 surface water)	Random	July ,2010 and March,2011, twice at each location	As per IS Standards covering ground water and surface water
Noise	L_{eq}	23	24 hrs continuous	During June-July ,2010and march-April ,2011	The monitoring was done to represent sensitive, residential locations as per NAAQ 1994 standards w.r.t. Noise covering parallel as well as detour locations

Field	Parameters	No. of Sampling Locations	Sampling Duration	Frequency	Criteria for selection of no. of samples and locations
Vibration	L_{max}	17	24 hrs continuous / during passing of various trains	March – April ,2011	The sensitive and residential locations have been covered in parallel as well as detour locations
Soil	pH, N, P, K, etc.	23	Random	July ,2010 and March,2011, twice at each location	As per IS Standards to represent the soil quality in terms of fertility in the study area
Ecology	Aquatic	04	Random	June – July ,2010	Terrestrial by quadrate and line transact, aquatic by plankton and phyto and zoo benthos to assess the aquatic and terrestrial ecology, secondary data from Forest Deptt.
	Terrestrial	08	Random	June- July ,2010	

5.3 METEOROLOGY

The project area presents tropical climatic characteristics; however, variations exist due to the difference in altitudes between various locations. The entire stretch from Bhaupur to Mugalsarai passes through nine districts of Uttar Pradesh i.e. Kanpur Dehat, Kanpur Sadar, Fathepur, Kaushambi , Allahabad, Mirzapur and Chanduli . To understand the meteorological features of the project area, data has been collected from the two nearest meteorological stations (monitored by Indian Meteorological Department), at Kanpur and Allahabad Table 5.2 summarizes the meteorological characteristics of the project area.

Table-5.2: Meteorological Data DuringJune 2010 to May 2011

IMD Station: Allahabad (height above msl : 98 m)									
Month	**Ambient Temperature, ^{0C}**		**Atmospheric Pressure, hPa**		**Relative Humidity, %**		**Average Wind Speed, km/hr.**	**Pre-dominant Wind Direction**	**Rainfall, mm**
	Average Daily Max.	**Average Daily Min.**	**At 8:30 hrs.**	**At 17.30 hrs.**	**At 8:30 hrs.**	**At 17.30 hrs.**			
June ,2010	41.1	29.2	988.2	984.1	36	41	7.6	NE ,E ,W	150.6
July ,2010	34.2	26.1	988.1	985.0	55	72	7.3	E ,SW,W	180.3
August ,2010	32.9	25.8	989.8	983.4	80	78	6.5	Ne ,E ,W	200.5
September 2010	33.	248	993.8	990.5	85	69	5.5	E ,W	190.5
October ,2010	33.1	202	1001.0	997.1	80	54	3.2	W	40.6
November ,2010	28.5	13.9	1006.1	1001.2	69	51	2.5	W	4.2
December, 2010	23.2	8.1	1006.9	1003.5	64	58	2.8	W	5.2
January, 2011	20.2	7.0	1006.1	1002.1	74	54	3.4	W	15.2
February, 2011	25.1	11.1	1003.4	1000.6	79	38	4.2	W	12.5
March 2011	33.2	16.3	1000.4	997.1	67	26	4.9	W & NW	8.5
April 2011	40.1	22.8	996.4	991.2	48	22	6.1	W & NW	5.2
May 2011	42.5	26.7	991.5	980.1	33	24	8.5	W & NW	10.4
IMD Station: Kanpur (height above msl : 126 m)									
June ,2010	40.2	28.9	988.1	981.5	52	38	12.5	E, W	102.1
July ,2010	34.5	26.1	984.7	980.7	81	71	10.2	E, W	220.2
August ,2010	33.1	25.8	986.2	982.1	85	78	8.4	E, W	265.4
September, 2010	34.2	24.2	991.4	985.2	82	70	8.8	W, E	80.4
October ,2010	32.5	19.6	997.1	991.2	68	52	6.8	W, E	50.1
November, 2010	29.2	12.1	1000.2	997.2	64	48	4.7	W, NW	2.0
December, 2010	24.5	8.2	1001.2	1000.1	72	52	6.5	W & N	7.8

January, 2011	22.3	8.1	1002.8	999.1	78	50	7.8	W & E	20.7
February, 2011	26.1	11.2	1000.1	997.2	67	36	10.1	W & NW	10.4
March 2011	32.8	16.5	997.2	992.4	54	28	12.4	W & NW	6.5
April 2011	39.4	22.3	993.2	989.1	38	22	11.9	W & NW	5.0
May 2011	41.6	26.9	985.9	985.3	41	20	12.5	W & NW	12.6

Source: IMD, Allahabad&Kanpur

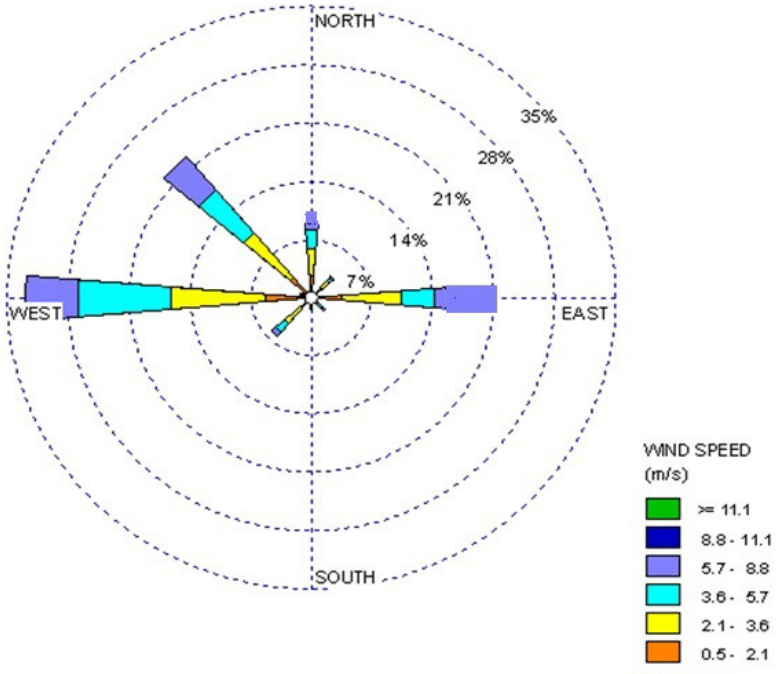


Figure-5.1: Kanpur (June ,2010 to May 2011)

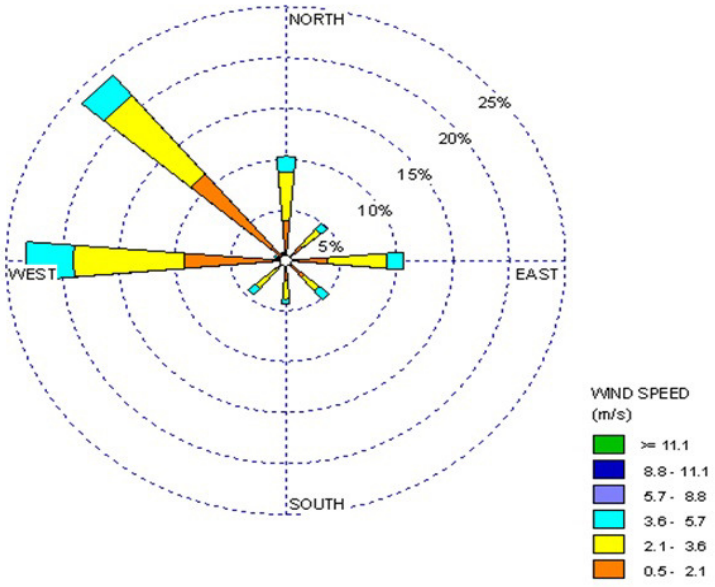


Figure-5.2: Allahabad (June ,2010 to May 2011)

5.3.1 Temperature

The meteorological data observed during the winter season shows that daily maximum temperature varies from 20.2 to 26.1 ^{0}C and the temperature

characteristics in this season are relatively similar. During winter, Kanpur has the highest daily maximum temperature at 26.1 ^{0}C, and Allahabd has the minimum daily temperature of 7 ^{0}C. During summer season, the average daily maximum temperature is around 42 ^{0}C during May 2011.

5.3.2 Relative Humidity

The relative humidity of the project area varies from 64% to 79% at 8:30 hrs during winter season and 36% to 58% at 17:30 hrs. The relative humidity decreases during summer and lowest (20%) was recorded at Kanpur in May 2011.

5.3.3 Wind Speed and Direction

Analysis of wind records shows that the winds are generally light to moderate in this area. The pre-dominant wind directions are West to North west in Kanpur and Allahabad.. The maximum average wind speed was observed in May 2011 at all the stations, while, November ,December were comparatively calm.

5.3.4 Atmospheric Pressure

The minimum and maximum monthly Atm pressure varies from 985.9 to 1006.9 hPA at 08:30hrs and from 980.3 to 1003.7 hPA at 17.30hrs.

5.3.5 Rainfall

The average rainfall recorded is highest in August and lowest in November 2011 The month-wise total rainfall is shown in Table 5.2.

5.4 AMBIENT AIR QUALITY

Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x), SPM , RSPM and PM2.5 are the Five major air pollutants, which cause concern to environment and other living beings. In order to understand the base line trends of these pollutants in the project area, ambient air monitoring was carried out at 23 locations during June –July ,2010 and during March ,2011 along the proposed DFCC corridor from Bhaupur to Mugalsarai. The locations were selected based on impacted residential area, sensitive receptors both in parallel alignments and detour locations. Monitoring was carried out continuously for 24 hours at each station.

5.4.1 Methodology (Air Monitoring)

The air pollution analysis techniques include the evaluation of the following:

1. Suspended Particulate Matter (SPM), RSPM and PM2.5
2. Sulphur dioxide (SO_2)
3. Nitrogen oxides (NO_x)
4. Carbon Monoxide (CO)

As regard the techniques for collection of sample of particulate matter, the “Respirable Dust Sampler Envirotech Model APM 460 BL” was used for air monitoring. The dust particulate matter were collected on filter paper (size GF/A 20.3 x 25.4 cm) and dust cup and the gaseous pollutants were collected simultaneously by a known volume of air through a number of bubblers of different flow rate through appropriate solution for absorbing different gases. The gaseous air pollutant samples were collected in glass impinges filled with adsorbing solvents by passing of ambient air and analyzed according to standard method.

Calculation

For particulate matter

RSPM ($\mu g/m^3$) = (weight of filter paper after sampling – initial weight of filter paper) / volume of air.

SPM ($\mu g/m^3$) = RSPM + (final weight of cyclonic cup – initial weight of cyclonic cup) / volume of air.
PM2.5 = (weight of filter paper after sampling – initial weight of filter paper) / volume of air

For gaseous pollutants
SO_2 ($\mu g/m^3$) = $(A - A_0) \times 1000 \times B \times D / V$
NO_x ($\mu g/m^3$) = $(A - A_0) \times 1000 \times B \times D / 0.82V$

Where, A = Sample Absorbance,
A_0 = Reagent blank Absorbance, and
B = Calibration factor (µg/absorbance)
D = Volume of absorbance solution in impinger during monitoring / volume of absorbing solution taken for analysis.
V = Volume of Air Sample in liters.

CO was monitored by using sensor based Non Dispersive Infrared equipment which gives direct result.

Fig- 5.3 Air Sampling Ambient Air Monitoring at Kadilpur Hospital

Fig- 5.4 Ambient Air monitoring at Pahada

The ambient air monitoring was done in June -July 2010 and in March-April,2011 . Monitoring was not done during rainy days. The monitoring result of June- July,2010 are presented in Table 5.3 and March-April, 2011result will be presented in Table 5.4

Table-5.3: Ambient Air Quality Along The Project Corridor (June-July, 2010)

S.N.	Monitoring Stations	SPM	RPM	PM2.5	SO2	NOx	Prescribed Limit as per NAAQS ,2009 in ug/m3
1	Behora village Primary school	161	59	24	12	16	SPM -200 RPM-100 PM2.5-60 SO2-80 Nox-80 CO-2000 (For industrial, rural, residential and other areas for 24 hrs except CO which is having 8hrs standards.)
2	Mungari village Near railway crossing	185	71	32	16	20	
3	Dhanu pur Rewa road	194	76	34	16	24	
4	Kadil pur Hospital	188	71	29	14	16	
5	Jalal pur Village	179	65	28	14	15	
6	Bharwari Village	166	60	25	12	14	
7	Saiyad Sarwan village	184	79	32	15	18	
8	Behrampur village	157	55	22	10	14	
9	Srayamethapur village	188	75	34	14	21	
10	Ekarai village	178	64	32	15	19	

S.N.	Monitoring Stations	SPM	RPM	PM2.5	SO2	NOx	Prescribed Limit as per NAAQS ,2009 in ug/m3
11	Prempur village	159	57	30	16	20	
12	Malva station	185	72	35	12	19	
13	Bindki village	151	48	20	10	12	
14	Mejaroad near station	175	66	22	11	14	
15	Chilbila village	163	60	25	10	18	
16	Gaiyapur village	169	56	26	12	17	
17	Vindhyachal Temple	187	75	28	15	18	
18	Chandipur village	198	81	35	12	24	
19	Pahada village	163	58	32	14	21	
20	Jamuai village	172	60	34	16	24	
21	Jeonath pur	181	62	32	15	22	
22	Punki (Kanpur)	284	98	49	20	29	
23	Bhaupur	169	61	36	13	17	

Table-5.4: Ambient Air Quality Along The Project Corridor (March-April, 2011)

S.N.	Monitoring Stations	SPM	RPM	PM2.5	SO2	NOx	Prescribed Limit as per NAAQS ,2009 in ug/m3
1	Behora village Primary school	178	68	31	15	18	SPM-200 RPM-100 PM2.5-60 SO2-80 Nox-80 CO- 2000 (For industrial ,rural ,residential and other areas for 24 hrs. except CO which is having 8hrs standards)
2	Mungari village Near railway crossing	192	74	33	18	20	
3	Dhanu pur Rewa road	231	78	38	17	26	
4	Kadil pur Hospital	210	74	32	17	20	
5	Jalal pur Village	198	69	36	16	18	
6	Bharwari Village	181	64	29	13	20	
7	Saiyad Sarwan village	193	84	35	18	21	
8	Behrampur village	165	61	29	12	16	
9	Srayamethapur village	201	78	37	16	23	
10	Ekarai village	189	65	37	18	24	
11	Prempur village	178	67	37	18	22	
12	Malva station	204	78	41	15	23	
13	Bindki village	167	51	26	12	10	
14	Mejaroad near station	189	68	24	12	15	
15	Chilbila village	191	61	28	14	21	

S.N.	Monitoring Stations	SPM	RPM	PM2.5	SO2	NOx	Prescribed Limit as per NAAQS ,2009 in ug/m3
16	Gaiyapur village	178	58	23	16	20	
17	Vindhyachal Temple	187	78	30	16	19	
18	Chandipur village	204	84	41	14	27	
19	Pahada village	179	67	35	15	24	
20	Jamuai village	170	65	38	20	22	
21	Jeonath pur	191	66	35	18	21	
22	Punki (Kanpur)	307	108	55	22	31	
23	Bhaupur	181	65	38	18	20	

Note:-
1 All Result are in ug/M3
2 Carbon Monoxide are found below 1PPM in all monitoring Stations except at Panki where it was found 1850 ug/m3

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A review of ambient air quality data presented in tables 5.3 and 5.4, above shows that air quality of the project area is generally good except SPM and found within NAAQS .

5.5 NOISE LEVEL

Noise attributed to a line project depends on factors such as traffic intensity, the type and condition of the traffic. Excessive high noise levels are a concern for sensitive receptors, i.e., hospitals, educational institutions, etc. The baseline information about the existing noise level along the railway tracks have been collected by monitoring the noise levels.

The Central Pollution Control Board has specified ambient noise levels for different land uses for day and night times. Importance was given to the timing of exposure and areas designated as sensitive. **Table 5.5** presents the noise standards specified by the Central Pollution Control Board.

Table-5.5: National Standards for Ambient Noise

Area Code	Category	Limits in Decibels (dB A)	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zones	50	40

Source: Central Pollution Control Board, New Delhi

Note: (1) Daytime: 6 AM to 10 P.M., Night-time 10 PM to 6 AM;
(2) Silence zone is an area up to 100 m around premises as hospitals, educational institutions and courts.

Locations for noise monitoring along the project route were identified based on the criteria same as those used for air monitoring but the relative importance of each criterion carries a weight age in arriving at the final set of locations. The noise monitoring was carried out at 23 locations covering commercial, residential and silence zones in June-July, 2010 and March-April ,2011 for continuously 24 hrs

covering day and night as per relevant Noise standards of CPCB.

5.5.1 Methodology for Noise Monitoring

The intensity of sound energy in the environment is measured in a logarithmic scale and is expressed in a decibel (dB) scale. Ordinary sound level meter measures the sound energy that reaches the microphone by converting it into electrical energy and then measures the magnitude in dB. In a sophisticated type of sound level meter, an additional circuit is provided ,which modifies the received signal in such away that it replicates the sound signal as received by the human ear and the magnitude of sound level in this scale is denoted as dB (A) .The sound levels are expressed in dB (A) scale for the purpose of comparison of noise levels, which is accepted by Central pollution Control Board(CPCB) as per Environment (Protection) Act, 1986 (29 of 1986) read with rule 5 of the Environment (Protection) Rules, 1986, the Central Government.

The noise monitoring was carried out within 30 m from railway track in each parallel location and near the receptors in detour location by using CYGNET Model 2001, which consists of data logger facility. The noise was recorded continuously for 24 Hrs. Simultaneously types of all the trains passing through the track were recorded. The Leq during day and night (6 AM to 10 PM reckoned as Day and 10PM to 6 AM as Night) were calculated as per the National Standards for Ambient Noise levels. The monitored noise levels during June-July, 2010 and March –April, 2011 are presented in Table 5.6 and 5.7 respectively.

Fig- 5.5 Noise Level Monitoring at Gaipura

Fig- 5.6 Noise Level Monitoring at Panki

Table-5.6: Noise Levels along the Alignment (June-July, 2010)

S.N.	Monitoring Stations	Leq dB(A) Day	Leq dB(A) Night	Leq dB(A) Max	One Train is passing dB(A)	Two Train is passing dB(A)	Remarks
1	Behora village Primary school	48.5	38.9	62	-	-	Detour
2	Mungari village Near railway crossing	67.5	61.2	90.8	87.6	90.8	
3	Dhanu pur Rewa road	64.2	54.8	76.9	-	-	Detour
4	Kadil pur Hospital	46.5	37.5	58.6	-	-	Detour
5	Jalal pur Village	68.1	62.3	90.1	86.9	90.1	
6	Bharwari Village	50.1	39.8	65.7	-	-	Detour
7	Saiyad Sarwan village	69.8	62.6	90.4	85.7	90.4	
8	Behrampur village	68.2	62.1	90.3	84.5	90.3	
9	Srayamethapur village	70.1	63.2	90.4	86.1	90.4	
10	Ekarai village	67.3	64.6	90.7	85.2	90.7	
11	Prempur village	68.9	63.3	91.0	84.9	91.0	
12	Malva station	70.1	64.6	90.8	84.7	90.8	
13	Bindki village	70.7	63.9	90.4	84.3	90.4	
14	Mejaroad near station	70.2	64.3	90.6	84.5	90.6	
15	Chilbila village	51.5	40.2	64.9	-	-	Detour
16	Gaipura village	69.6	63.2	89.3	84.2	89.3	
17	Vindhyachal	70.0	64.7	88.2	84.5	88.2	

S.N.	Monitoring Stations	Leq dB(A) Day	Leq dB(A) Night	Leq dB(A) Max	One Train is passing dB(A)	Two Train is passing dB(A)	Remarks
	Temple						
18	Chandipur village	47.6	36.8	55.1	-	-	Detour
19	Pahada village	68.5	63.2	90.2	84.6	90.2	
20	Jamuai village	67.2	63.2	89.5	84.0	89.5	
21	Jeonath pur	68.1	64.7	91.2	85.1	91.2	
22	Punki (Kanpur)	62.1	54.8	77.5	-	-	Detour
23	Bhaupur	71.6	64.5	91.4	87.3	91.4	

Table-5.7: Noise Levels along the Alignment(March—April,2011)

S.N.	Monitoring Stations	Leq dB(A) Day	Leq dB(A) Night	Leq dB(A) Max	One Train is passing dB(A)	Two Train is passing dB(A)	Remarks
1	Behora village Primary school	47.6	39.1	63.1	-	-	Detour
2	Mungari village Near railway crossing	65.1	60.2	91.8	87.8	91.8	
3	Dhanu pur Rewa road	63.2	53.7	77.9	-	-	Detour
4	Kadil pur Hospital	48.2	37.5	58.9	-	-	Detour
5	Jalal pur Village	69.1	61.4	90.2	86.1	90.2	
6	Bharwari Village	51.2	38.2	67.1	-	-	Detour
7	Saiyad Sarwan village	67.2	62.1	90.0	85.9	90.0	
8	Behrampur village	67.2	63.2	90.1	84.1	90.1	
9	Srayamethapur village	67.8	61.7	90.2	86.4	90.2	
10	Ekarai village	65.3	62.4	90.2	85.2	90.2	
11	Prempur village	68.1	63.7	91.7	84.0	91.7	
12	Malva station	67.1	64.8	90.2	84.5	90.2	
13	Bindki village	68.7	63.0	90.2	84.3	90.2	
14	Mejaroad near station	69.1	64.1	91.6	84.7	91.6	
15	Chilbila village	50.5	40.9	64.0	-	-	Detour
16	Gaiyapur village	67.2	61.2	88.3	84.2	88.3	
17	Vindhyachal Temple	68.1	64.0	89.2	84.5	89.2	
18	Chandipur village	47.6	36.5	54.7	-	-	Detour
19	Pahada village	68.5	63.1	90.8	84.6	90.8	
20	Jamuai village	67.2	62.2	89.2	84.0	89.2	
21	Jeonath pur	68.1	64.0	91.1	85.7	91.1	
22	Punki (Kanpur)	62.1	54.7	77.2	-	-	Detour
23	Bhaupur	71.6	64.0	91.1	87.9	91.1	

Source: Consultant Survey

The result shows that noise levels are well within the limits at detour locations and exceed the limit at parallel locations.

5.5.2 Result and Discussions

Review of noise levels presented in table 5.6 and 5.7 indicates that the noise levels exceed permissible standards at all the locations along the existing railway track (where DFC is proposed in parallel). The noise levels are even higher along these locations when two trains cross the location simultaneously (maximum value of 91.8dB(A)).

However, noise levels in detour locations are generally within the permissible standards.

Further to understand the noise levels due to train movements, noise levels were also monitored at 12.5, 25 & 50 Meter from the center of the track (for a combination of train movements) at Karchana Station and presented in Table 5.8.

Table- 5.8: Noise levels for different train movements

Category of Trains	Running speed (km/hr)	Railway Noise Level dB (A)					
		Leq			Lmax		
		12.5	25.0	50.0	12.5	25.0	50.5
Passenger train	38.1	75.1	69.1	60.3	92.2	88.1	76.1
Passenger train	84.2	74.1	70.1	61.5	94.0	90.0	78.2
Passenger train	40.2	75.4	68.4	61.2	92.4	86.4	72.0
Passenger train	45.1	76.0	67.9	62.0	93.5	87.1	74.5
Passenger train	42.3	75.5	68.5	62.1	92.0	86.4	71.9
Freight train	52.1	74.1	69.2	60.5	94.0	89.2	78.2
Freight train	28.5	72.1	67.7	60.3	90.7	87.0	72.9
Freight train	37.1	72.2	67.2	61.5	93.2	88.2	73.5
Freight train	38.5	73.1	66.1	61.0	93.5	88.1	72.7
Freight train	42.5	74.5	68.2	61.2	92.1	87.4	74.3

As presented in table 5.8 above, the noise levels between passenger trains and freight trains, show a marginal difference. However, the noise attenuation was found to be ranging from about 5 dB (A) from 12.5 to 25 m and about 10 dB (A) from 25 to 50 m, from the center of the railway track. Similar to noise levels, the attenuation levels both for passenger and freight trains were noted to be same. This indicates no significant impact on noise levels due to the category of train type.

5.6 VIBRATION

5.6.1 Background Information

Vibration assessments are a key element of the environmental impact assessment process for mass transit projects. Vibration may lead to damage of cultural assets and other establishments near railway tracks and also may have impact on the human health.

Experience has shown that vibration is among the major concerns with regard to the effects of a railway project on the surrounding community.
Vibration is often associated with noise but is a problem in its own right. Notwithstanding health effects to the passengers it impacts the inmates of the buildings close to the track in the form of scare, sleeplessness and postural discomfiture. It also affects the buildings in the form of short and long term impacts.

Vibration can also be affecting the train drivers and operators including drivers of specialist vehicle used during the construction phase. Appropriate mitigation measures will vary but may include design considerations for vehicles and equipment, control of exposure times, proper maintenance, protective clothing and alterations to working practices. A Detailed elaboration has been provided regarding the mitigation measures available.

Measurement

As discussed in the earlier sections, the proposed track runs in two different alignments.

I. One parallel to the existing track, which could involve,
- Higher amplitude vibrations impacting the buildings now coming closer to railway vibrations (within critical distance) on the side of new track
- Higher amplitude vibrations impacting all close buildings and human inmates due to instances of multiple trains running at same instance of time
- Higher frequency of such multiple train running instances resulting to higher time of exposure
- Increased impact due to increased speeds of Freight Trains.
- Increased impact due to higher No of freight trains running closer

II. Detours from the existing track passing through areas of different land use:

On detours there are no existing tracks at the moment. And introduction of DFCC tracks cause vibration. In addition there will be impact due to construction activity itself.

Finally there will be impacts due to DFC operations which will be in the form of

- Creation of a new Vibration environment along the detour effecting the building and inmates present within the critical distance of impact of vibrations
- Impacts due to trains running, at higher speeds / axle loads.

As part of the base line analysis of vibration levels, data was collected through measurement of vibration levels at several locations along parallel tracks as well as detour locations, covering all the possible scenarios mentioned above.

The same data has been used to predict impacts on sensitive locations along the entire corridor. The highest vibration values based on the 100km/hr speed of freight trains (containers or tankers) have been used for the prediction of impacts.

5.6.2 Standards on Vibration Measurements for Rail Projects

There are no specific standards for vibration levels in India. However there are number of international standards (as indicated below) for evaluating the potential impacts for building damage and also the human response.

ISO Standards on vibration (ISO 2631/2- 1989, ISO 8041-1990, and ISO 4866-1990)

JIS Z-8735 (Method of measurement for vibration levels) and JIS C-1510 (Standard for Vibration level meter).

BS 6472
DIN 4150

While each of the above standards has specific approach to the measurement and assessment of vibration impacts, considering the fact that the feasibility study for the project was carried out based on Japanese standards (JIS 8735 and JIS 1510) and DFC is also implementing same standards in the western corridor, the same standards have also been in the current study. The important features of GIS 8735 are:-

- depend on one single parameter i.e. Lpeak as against multiple parameters such as (VDV and PPV)
- does not require further calculations after the collection of data,
- The standards suggests single parameter to assess the vibration impacts on buildings and the residents with one common parameter.

Considering the above, the above JIS Z 8735 have been following for measuring and prediction of vibration impacts of the project.

5.6.3 Methodology

The ambient vibration levels and railway vibration levels were measured as part of the base line surveys.
While railway vibrations were measured for various train types and speeds at varying distances, the ambient vibrations were measured on Sensitive Receptors.

5.6.4 Measurement Instrument

As according to JIS C 1510, vibration meter 1220E manufactured by IMV Japan, was chosen for measuring vibration. The instrument provides vibration measurements in all the three axes and also measures velocity or acceleration parameters. The instrument, also captures and stores values at predefined intervals and calculates maximum and minimum or percentile values.
Specifications of the selected instrument are below:

Fig- 5.7 Vibration monitoring instrument

Featurs

- Conforms to JIS C1510-1995.
- Measures vibration pollution from factory, construction site and traffic.

- Calculates Vibration level Lv, Vibration acceleration level Lva, Max. value Lmax, Min value Lmin, Time rate vibration level (Lx : 5-value), Power averaged level (Leq) in 3-direction and displays with selection

Model	VM-1220E
Frequency Range	1 - 80 Hz
Measuring Range	30 - 120 dB
Level Range	20 dB step, 2-range 30 -90dB, 50 -110dB
Linearity	75dB
Measured Item	Vibration level Lv, Vibration acceleration level Lva, Max. value Lmax, Min value Lmin, Time rate vibration level (Lx: 5-value),Power averaged level (Leq)
Measuring Time	1s,3s,5s,10s,1min,5min,10min,15min,30min,1h,8h,24h Manual (Max 199h59min59s)
Ambient Condition	Temperature Range: 10 -50^{0}C Humidity: 30 – 90% (not dew condensation)

5.6.5 Vibration Levels

Based on the approach formulated above, the vibration levels were measured at the following locations along the project corridor and result are presented in Table 5.9.

Table-5.9: Ambient Railway Vibration

S. No.	Location	Vibration Level (Maximum) 12.5 M from Track on parallel Section	Vibration Level (Maximum) 25 M from Track on parallel Section	Remark
1.	Behora village Primary school, Detour	43.2		At Detour ,vibration levels are measured within ROW
2.	Mungari village Near railway crossing	80.1	64.9	
3.	Dhanu pur Rewa road ,Detour	62.7	-	Near highway
4.	Kadil pur Hospital , Detour	46.9	-	
5.	Jalal pur Village	78.5	63.2	
6.	Bharwari Village , Detour	48.9	-	
7.	Saiyad Sarwan village	74.9	61.3	
8.	Behrampur village	79.2	62.5	
9.	Srayamethapur village	78.2	63.1	
10.	Ekarai village	77.9	64.1	
11.	Prempur village	78.7	64.3	
12.	Malwan station	80.1	64.2	
13.	Bindki village	79.3	63.9	
14.	Mejaroad near station	78.4	62.9	
15.	Chilbila village , Detour	50.2	-	
16.	Gaipura village	76.8	62.3	
17.	Vindhyachal Temple	77.4	63.2	
18.	Chandipur village ,Detour	48.2	-	
19.	Pahada village	75.8	62.9	
20.	Jamuai village	78.3	63.2	
21.	Jeonath pur	79.4	64.1	
22.	Punki (Kanpur) , Detour	51.2	-	
23.	Bhaupur	78.5	63.9	

Fig-5.8 Vibration monitoring At Karchana

Table-5.10(A): Vibrations Measured at Karchana (12.5m., 25.0m. & 50m.as per Japanese Standards

Speed	Vibration in dB at 12.5m.	Vibration in dB at 25m.	Vibration in dB at 50m.
Passenger Trains			
95.1	74.2	66.7	39.4
102.1	80.1	61.1	41.2.2
77.2	70.7	62.8	55.3
91.4	68	62.8	56.2
72.9	64.8	55.6	46.3
32.1	73.2	62.4	59.0
65.3	71.1	58.9	45.5
80.3	72.7	59.2	43.7
96.1	73.7	53.1	45.8
60.5	71.7	59.7	36.2
16.5	70.3	60.3	51.1
88.1	71.3	57	47.8
104.4	72.6	54.6	44.3
29.2	63.7	62.7	44.2
96.7	71.9	60.8	50
31.4	70.2	60.6	58.8
92.3	68.8	63.3	44.8
71.4	63.7	59.9	54.9
25.2	67.1	51.2	41.7
20.1	73.9	64.9	56.7
17.4	77.1	63.8	61.3

Speed	Vibration in dB at 12.5m.	Vibration in dB at 25m.	Vibration in dB at 50m.
78.2	74.2	54.3	48.9
51.3	66.9	53.9	49.1
Freight Open Wagon Trains			
90.3	72.6	61.3	48.2
91.2	71.4	60.3	46.7
70.2	77.2	55.5	48.5
101.3	65.2	64.6	58.7
99.4	72.1	65.3	57.1
52.6	68.3	65.1	63.2
96.1	70.1	47.1	41.2
92.8	66.3	61	53.2
102.2	71.0	64.2	48.0
92.1	72.1	64.2	52.1
97.2	65.4	556	47.9

Table-5.10(B): Vibrations Measured at Karchana (12.5m., 25.0m. & 50m.as per Japanese Standards

Speed	Vibration in dB at 12.5m.	Vibration in dB at 25m.	Vibration in dB at 50m.
Passenger Trains			
95.1	74.2	66.7	39.4
102.1	80.1	61.1	50.2
78.2	70.7	62.8	55.3
90.3	68	62.8	57.3
72.1	64.8	55.6	46.3
31.7	73.9	62.8	59.6
66.5	71.2	60.7	45.5
81.4	72.7	61.2	43.7
96.3	73.7	53.1	45.8
60.75	71.7	59.7	36.3
15.5	70.3	60.4	51.8
87.6	71.3	57	47.8
107.2	72.6	54.6	44.3
28.4	63.7	62.7	44.2
95.2	71.9	60.8	50
30.7	70.2	60.6	58.8
93.1	68.8	63.3	44.8
70.4	63.7	59.9	54.9
24.5	67.1	51	41
21.2	73.9	64.9	56.7
17.3	77.1	63.8	60.6
81	74	54.3	48.9

Speed	Vibration in dB at 12.5m.	Vibration in dB at 25m.	Vibration in dB at 50m.
50.4	66.9	53.9	49.1
Freight Open Wagon Trains			
92.5	73.6	62.3	49.7
96.5	70.2	61.2	46.9
68.3	78.5	55.5	48.5
102.5	68.2	64.6	58.7
104.2	71.9	65.3	57.1
51.6	68	65.6	63.9
97.2	69.9	47.3	41.2
91.8	66.8	60	53.1
102.4	71.3	64.4	48.9
95.5	72.3	64.5	52.6
97.2	65.8	55.5	47.5

Table-5.11: Vibrations Measured at Karchana for Freight Closed Wagon and Other Trains

Category of Train	Speed	Vibration in dB at 17.5m.	Vibration in dB at 30m.	Vibration in dB at 55m.
Closed Wagon	40.12	77.1	60.2	54.1
Tanker	36.21	78.2	61.1	51.4
Cargo	56.23	68.5	53.2	36.4
Cargo	51.22	68.1	60.2	37.2

Analysis:
Based on the monitored data, it is concluded that vibration levels gradually decrese with distance from the tracks. The monitored values are not showing any direct coralation with speed and varies as per the type of trains ,axle load and other topographical factors. The data collected along with the patterns of Vibration propagation with distance, speed, axle load for single, dual and multiple train operations have been estimated and used in prediction of impacts

5.7 WATER: HYDROLOGY AND DRAINAGE

5.7.1 Surface water & Drainage

The project area from Bhaupur to Mugalsarai is a part of the Ganges basin, which contains the largest river system on the subcontinent comprising the Rivers of Ganga, Yamuna and number of other rivers. The flow in the basin is largely contributed by the southwesterly monsoon winds from July to October, as well as on the flow from melting Himalayan snows in the hot season from April to June. Tropical cyclones originating between June and October in Bay of Bengal also contribute to water flows in the basin. The average annual rainfall varies from 760 mm at the western end of the basin to more than 2,290 mm at the eastern end.

The proposed alignment of DFC cross perennial rivers of Yamuna and Tonse part of Ganga Basin . The general slope of the area was noted to be from North West to South East with elevation ranging from 126 MSL at Kanpur to 86 MSLAllahabad.

Passing through the districts of Kanpur, Fathepur ,Allahabad, etc. these areas are located in the central plains and South Western Semi Arid agro-climatic zones of Uttar Pradesh.

Important rivers and streams in the project area are part of Yamuna drainage basin and comprises of River Tonse, Arind and its tributaries.

The Upper Ganges canal is the original Ganges Canal, which starts at the Bhimgoda Barrage near Har ki Pauri at Haridwar, traverses Meerut and Bulandshahr and continues to Nanu in Aligarh district, where it bifurcates into the Kanpur and Etawah branches. A channel from a weir at Narora intersects the canal system 48 km downstream from Nanu, and continues past the Sengar River and Sersa River, past Shikohabad in Mainpuri district to become the Bhognipur branch which was opened in 1880. This branch, starting at village Jera in Mainpuri district, runs for 166 km to reach Kanpur. At kilometre 64 the Balrai escape carries excess water through a 6.4 km. channel through the ravines to discharge into the Yamuna. This branch has 386 km. of distributary channels.

The Bhognipur branch, together with the Kanpur and Etawah branches, is known as the Lower Ganges Canal. The old channels of the old Kanpur and Etawah branches between Nanu and the point of intersection by the channel from Narora, are known as "stumps", and are utilized only when the supply of water in the lower Ganges system runs low.The main branch of the river passes Kanpur before breaking into several branches.

5.7.2 Ground Water

The project area is underlain by thick pile of quaternary sediments which comprises sands of various grades, clays and *kankar*. The quaternary sediments overlain the pre-existing Vindhyan Basement with the thickness varies from 286 to 380 meters. The Vindhyan basin tends to grow deeper from west to east.

The Central Ground Water Board, Aligarh demarcates the project area in to a three tier aquifer system occurring down to bed rock, as indicated below.

I Aquifer Group	00.00-130.00 mbgl – Quality: fresh
II Aquifer Group	100.00 – 150.00 mbgl – Quality: brackish to saline
III Aquifer Group	130.00 – 300.00 mbgl – Quality: brackish to saline

The ground water is encountered in the first aquifer group, while deeper aquifers are under semi-confined to confined conditions. Overall, the depth of ground water in the project area generally varies from 2.57 to 21.00 m below ground level, during pre-monsoon period and ranges between 2.13 m and 16.73 m below ground level during post-monsoon period. The ground water levels are observed to be ranging between 2.32 and 7.24 m during field survey.

With good to moderate water yield capacities, the first aquifer group is fit for domestic and industrial consumption. The yield is expected to be around 2000-3000 lpm through tube wells and 1000-2000 lpm through shallow tube wells in the eastern part of project area.

5.8 WATER QUALITY

In order to assess the base line water quality of water bodies, samples were collected from 22 hand pumps / tube wells, irrigation canals and , Riversas presented in table 5.12 and 5.13, The ground water quality along the alignment is good and acceptable as per desirable limit IS 10500.

Table-5.12: Water Quality Results (June-July, 2010)

S.N.	Location	pH	BOD	Chloride	Fluoride	Sulphate	Iron	Phosphate	Sodium	Total Hardness
	Permissible Limit as per IS:10500	6.5-8.5	03	1000	1.5	400	1.0	-	-	600
	Behora village	7.5	<2	14	1.3	55.62	0.15	.02	54	264
2	Mungari village	7.1	<2	14	1.5	46.89	.09	.05	54	324
3	Dhanu pur	6.9	<2	16	1.2	48.65	.11	.06	68	298
4	Kadil pur	7.3	<2	8	0.6	67.45	.21	.01	95	260
5	Jalal pur Village	7.2	<2	6	0.8	69.04	.24	.02	81	182
6	Bharwari Village	6.9	<2	12	0.9	21.00	.24	.02	21	84
7	Saiyad Sarwan village	7.1	<2	56	0.6	71.22	.42	.01	55	346
8	Behrampur village	7.4	<2	38	0.8	67.11	.18	.009	87	280
9	Srayamethapur village	6.8	<2	14	0.5	48.21	.31	.01	28	301
10	Ekarai village	7.2	<2	64	0.9	48.11	.09	.02	72	267
11	Prempur village	7.5	<2	8	1.4	61.12	.10	.15	16	255
12	Malva station	7.4	<2	6	1.5	56.43	.21	.019	12	298
13	Bindki village	7.1	<2	15	1.3	55.34	.24	.09	23	289
14	Mejaroad	7.5	<2	10	0.8	66.12	.40	.08	16	267
15	Chilbila village	7.0	<2	22	0.9	71.21	.19	.06	18	212
16	Gaiyapur village	7.9	<2	44	0.6	43.72	.21	.03	36	206
17	Vindhyachal	7.5	<2	48	0.8	67.41	.22	.09	26	205
18	Chandipur village	7.8	<2	22	0.9	55.84	.23	.07	31	195
19	Pahada village	7.3	<2	32	0.7	55.13	.25	.07	24	178
20	Jamuai village	7.2	<2	36	1.1	57.81	.26	.06	27	205
21	Jeonath pur	7.5	<2	34	1.2	55.11	.41	.03	32	212
22	Punki	7.7	<2	24	1.6	67.23	.32	.05	28	321

S.N.	Location	pH	BOD	Chloride	Fluoride	Sulphate	Iron	Phosphate	Sodium	Total Hardness
	Permissible Limit as per IS:10500	6.5-8.5	03	1000	1.5	400	1.0	-	-	600
23	Tonse river Nr balua	7.2	10	10	0.1	14.21	.41	.003	21	12
24	Ojala Nala	7.8	12	16	0.15	12.34	.30	.007	18	115
25	Vindaychal Pond	7.3	32	28	0.9	45.12	.41	.008	32	156
26	Madho nala/Umeria nala	7.4	8	12	0.2	15.12	.34	.004	8	141
27	Yamuna river	7.3	22	11	0.1	16.67	.25	.004	12	112
28	Lower Ganga Canal	7.2	15	16	0.2	18.44	.31	.001	10	91
29	Pandu river	7.7	8	11	0.3	19.65	.19	.003	10	109
30	Arind River	7.3	10	12	0.1	21.22	.35	.004	5.8	131
	Desirable Limit as per IS 10500	6.5-8.5	-	250	1.0	200	1.0	-	-	300

Note: All values are in mg/l except pH , The samples upto SL 22 are Ground water and others are Surface water samples.

Table-5.13: Water Quality Results(March-April, 2010)

S.N.	Location	pH	BOD	Chloride	Fluoride	Sulphate	Iron	Phosphate	Sodium	Total Hardness
1	Behora village	7.2	<2	17	1.0	56.21	0.10	.01	58	261
2	Mungari village	7.0	<2	15	0.7	49.22	.08	.03	61	345
3	Dhanu pur	7.1	<2	15	1.0	47.00	.12	.08	71	285
4	Kadil pur	7.1	<2	11	0.8	65.00	.22	.03	101	278
5	Jalal pur Village	7.1	<2	9	0.5	69.21	.18	.04	79	194
6	Bharwari Village	6.8	<2	14	0.6	27.00	.24	.02	21	102
7	Saiyad Sarwan village	7.3	<2	61	0.8	71.12	.39	.02	61	341
8	Behrampur village	7.2	<2	35	0.9	67.11	.17	.01	81	289
9	Srayamethapur village	6.9	<2	18	0.6	48.00	.30	.02	32	309
10	Ekarai village	7.1	<2	67	1.1	39.22	.07	.03	70	288
11	Prempur village	7.2	<2	10	1.2	6012	.12	.19	19	267
12	Malva station	7.1	<2	9	1.4	55.22	.20	.04	14	298
13	Bindki village	7.4	<2	18	1.2	51.34	.26	.01	21	288
14	Mejaroad	7.2	<2	12	0.7	6212	.41	.04	17	269
15	Chilbila village	7.1	<2	23	0.8	70.21	.20	.04	21	215
16	Gaiyapur village	7.0	<2	49	0.3	55.72	.22	.03	38	211
17	Vindhyachal	7.0	<2	39	0.5	61.41	.23	.09	28	214
18	Chandipur village	7.6	<2	29	0.8	58.84	.23	.07	32	199
19	Pahada village	7.4	<2	30	0.1	51.13	.27	.08	28	181
20	Jamuai village	7.3	<2	39	1.0	57.81	.26	.06	23	210
21	Jeonath pur	7.9	<2	33	1.2	54.15	.40	.02	36	211
22	Punki	7.1	<2	20	1.2	60.31	.35	.05	35	356
23	Tonse river Nr balua Village	7.5	12	12	0.11	21.20	.29	.05	24	61

S.N.	Location	pH	BOD	Chloride	Fluoride	Sulphate	Iron	Phosphate	Sodium	Total Hardness
24	Ojala Nala	7.1	14	19	0.12	12.31	.34	.07	20	117
25	Vindaychal Pond	7.5	42	31	0.19	41.12	.40	.08	36	181
26	Madho nala/Umeria nala	7.4	10	15	0.21	21.12	.38	.08	9	145
27	Yamuna river	7.3	24	14	0.16	15.32	.29	0.21	18	121
28	Lower Ganga Canal	7.2	14	21	0.21	19.42	.32	.008	14	96
29	Pandu river	7.5	10	14	0.32	21.35	.18	.004	15	124
30	Arind River	7.1	12	14	0.11	24.23	.32	.004	7	134
	Desirable Limit as per IS 10500	6.5-8.5	-	250	1.0	200	1.0	-	-	300

Note: All values are in mg/l except pH , The samples upto SL 22 are Ground water and others are Surface water samples.

5.9 GEOLOGY

As discussed earlier, the proposed alignment of the project is a part Ganga plain lying between the rocky Himalayan belt in the north and the southern hilly tract comprising Pre-Cambrian rocks. Flexing of the Indian lithosphere in response to the compressive forces due to collision, and thrust fold loading produced the Ganga Plain foreland basin. The basin is filled with recent alluvial sediments which is at places more than 1,000 m, thick and an amalagam of sand, silt, clay in varying proportions. As presented in figure, the project alignment from Bhaupur (Kanpur) to Mugalsarai is located in the younger alluvium of Ganga Basin and generally there is no significant variation in geology.

Source:- Directorate of Geology and Mining, U. P.

Fig- 5.9 Geological map of U.P.

5.10 GEOGRAPHY AND SOIL QUALITY

Since the project is situated in the younger alluvium of Ganga Basin, the soil is prone to erosion. The entire alluvial plain along the alignment can be divided into three sub-regions These include, the eastern tract know as scarcity areas with highest population density and lower per capita land, the central tract and western tract comprising well developed irrigation system.

However, being alluvial the land is very fertile and cultivation of rice, wheat, millets, gram, barley and sugar cane, etc are the chief crops of the region.

In order to establish the base line soil profile, samples were collected from twenty three locations, spread across the project area. As presented in table 5.14 and 5.15 below, the soil in the project area is good for agricultural and plantation purposes and NPK ratio is favorable.

Table-5.14: Soil Analysis Result (June-July, 2010)

S.N.	Location	pH	Nitrogen	Phosphate	Potassium	Sodium	Sample Sources
1	Behora village	7.8	0.42	0.14	21.6	120.62	Agricultural land
2	Mungari village	6.9	0.51	0.11	18.1	102.48	Agricultural Land
3	Dhanu pur	7.1	0.72	0.09	61.4	98.65	Orchard Land
4	Kadil pur	7.6	0.21	0.06	56.47	154.61	Agricultural land
5	Jalal pur Village	6.9	0.50	0.12	29.18	69.04	Orchard Land
6	Bharwari Village	7.0	0.58	0.078	66.92	81.97	Agricultural land
7	Saiyad Sarwan village	7.2	0.68	0.05	31.34	89.75	Agricultural land
8	Behrampur village	7.5	0.42	0.15	75.81	135.23	Agricultural land
9	Srayamethapur village	7.2	0.80	0.11	71.09	109.89	Orchard Land
10	Ekarai village	6.8	0.11	0.10	53.65	90.48	Agricultural land
11	Prempur village	7.2	0.74	0.31	41.31	61.12	Agricultural land
12	Malva station	7.5	0.59	0.021	46.07	86.43	Agricultural land
13	Bindki village	7.3	0.31	0.10	16.01	55.34	Agricultural land
14	Mejaroad	7.7	0.58	0..16	67.04	66.12	Orchardl land
15	Chilbila village	7.0	0.08	0.02	25.58	79.71	Agricultural land
16	Gaiyapur village	7.9	0.72	0.01	61.52	43.72	Agricultural land
17	Vindhyachal	7.5	0.95	0.09	71.31	67.41	Agricultural land
18	Chandipur village	7.1	0.61	0.07	62.02	55.84	Orchard land
19	Pahada village	7.3	0.80	0.16	71.46	56.09	Agricultural land
20	Jamuai village	7.2	0.40	0.08	38.61	57.81	Agricultural land
21	Jeonath pur	7.5	0.72	0.09	25.00	55.1	Agricultural land
22	Punki	7.6	0.72	0.26	90.67	76.41	Agricultural land
23	Bhaupur	7.2	0.54	0.07	70.34	78.11	Agricultural land

Table-5.15: Soil Analysis Result (March-April,2011)

S.N.	Location	pH	Nitrogen	Phosphate	Potassium	Sodium	Sample Sources
1	Behora village	7.9	0.48	0.19	20.6	122.22	Agricultural land
2	Mungari village	7.1	0.43	0.21	15.1	99.41	Agricultural Land
3	Dhanu pur	7.2	0.77	0.18	63.4	91.65	Orchard Land
4	Kadil pur	7.1	0.22	0.16	54.21	150.22	Agricultural land
5	Jalal pur Village	6.8	0.61	0.14	26.21	67.11	Orchard Land
6	Bharwari Village	7.2	0.59	0.19	65.33	82.33	Agricultural land
7	Saiyad Sarwan village	7.0	0.70	0.11	39.34	75.75	Agricultural land
8	Behrampur village	7.5	0.41	0.12	69.81	124.29	Agricultural land
9	Srayamethapur village	7.2	0.88	0.16	70.21	110.89	Orchard Land
10	Ekarai village	7.4	0.12	0.11	51.60	87.48	Agricultural land
11	Prempur village	6.9	0.72	0.36	39.30	60.10	Agricultural land
12	Malva station	7.2	0.61	0.10	46.00	83.00	Agricultural land
13	Bindki village	7.1	0.32	0.12	15.02	54.01	Agricultural land
14	Mejaroad	7.2	0.51	0.31	65.02	67.12	Orchardl land
15	Chilbila village	7.1	0.09	0.09	29.50	71.22	Agricultural land
16	Gaiyapur village	7.2	0.79	0.19	67.51	42.78	Agricultural land
17	Vindhyachal	7.8	0.98	0.10	72.21	66.44	Agricultural land
18	Chandipur village	7.3	0.62	0.19	65.02	54.84	Orchard land
19	Pahada village	7.0	0.71	0.15	69.46	58.09	Agricultural land
20	Jamuai village	7.8	0.20	0.18	38.40	59.22	Agricultural land
21	Jeonath pur	7.2	0.79	0.17	28.21	56.2	Agricultural land
22	Punki	7.1	0.71	0..27	91.00	85.11	Agricultural land
23	Bhaupur	7.4	0.50	0.10	70.32	79.21	Agricultural land

5.11 LAND USE

The study area lies under the Gangetic Plain is flat and mostly featureless. The Ganges and its tributaries have washed down silt and soils. These have formed rich beds of alluvium, up to 600 metres deep. The elevation of the plain gradually decreases from 365 metres in the northwest at Hardwar to 80 metres in the east at Varanasi. The southern hill and plateau region runs along the southern edge of Uttar Pradesh. It includes the Vindhya Hills in the southeast, which rise to more than 600 metres in some places. The hills back onto the central Indian plateau.

Study area is a part of catchment of Yamuna and Tonse rivers and the alluvial soils found are extremely fertile. There are few areas where the salt content in the soil is too high for successful cropping. Soils in the hills tend to be thin, stony, easily drained, and with much lower fertility.

The terrain of the proposed alignment passes through plain terrain. The proposed project is located in plain terrain. Land use pattern for the rest of the rail line is predominantly agricultural barring few built up areas in the towns & villages. There is no existence of protected or reserved forest along the project route except Mirzapur District.

5.12 ECOLOGICAL RESOURCES

Flora and Fauna are indicators of the environment. They respond not only to one environmental factor but also to an interacting group of factors. These communities influence and react sensitively to change in the balance of environmental stresses. Depletion of biodiversity is mainly due to intense anthropogenic pressure owing to "Population Explosion" mainly for expansion of agriculture, over exploitation of forests for day to day needs, over grazing and illicit felling, shifting cultivation, development activities like, irrigation, construction of hydro-electric dams, road construction including mining activities- all leading to dysgenic selection. Rationale use of the resources is therefore, quite important in the management of biodiversity, the habitat, species and gene pools prevalent in an area, because once it is lost, it becomes an uphill task to reverse the process. Therefore, a detailed knowledge of the diversity of the area definitely helps in managing the area properly following suitable practices. The study was conducted in the project area to assess all possible consequences on the biological environment.

Floral and faunal surveys conducted for assessing the biological diversity and its status over a period of time that forms an integral part of Impact Assessment Techniques. The present study is highlighting the various issues pertaining to floristic diversity and the faunal wealth including Ethno-botany and silvicultural issues in the Dedicated Freight Corridor Chainage and also the area beyond alignment. Accordingly, for Environmental Impact Assessment (EIA) studies, the total area has been sub-divided into the following areas;

- Dedicated Fright Corridor Chainage
- About 1km surrounding area of DFC
- Natural vegetation in the study area.
- Forest area (Protected/Reserved/Sanctuary)
- Rivers in vicinity

Site Selection Criteria:

Three sampling locations were selected to AA the terrestrial eco-system, with due consideration to the following points.

a) Major affected area

b) Natural vegetation in the study area.
c) National Parks, Sanctuaries, Reserve / Protected Forest in the study area.
d) Natural Water Bodies in the study area

On sight survey & visual examination of terrestrial flora & fauna have been made in the entire area in the vicinity of proposed DFC Project. Aquatic Study carried out at all the major rivers & ponds. Major aquatic ecological attributes are Tons River near Balua Village, Yamuna River near Purna Village, Karnawati River near Chainage no. 740/23-24, Ojhla Nala near Ranibari Village, Khajuri River and Belvan River near Belvan Village. Jargo River was dry, so no Ecological Sampling done in this river.

OBJECTIVES

The biological study of the area has been conducted in order to understand the ecological status of the existing natural environment and fauna to generate baseline information and evaluate the probable impacts on the biological environment.

FLORA (Vegetation)

Floral studies were carried out for following objectives:

1. To make an inventory/checklist of plants found in the study area.
2. To analyze the existing vegetation under influence zones of the project.
3. To know the density (trees/unit area) of each of the species in the vicinity of the project.

FAUNA

Terrestrial Fauna

Terrestrial fauna was evaluated to gain an insight in the following respects for species of carnivore, ungulates, non-human primates, birds/butterflies, reptiles and invertebrates.

1. To prepare an inventory of the terrestrial fauna
2. To assess present status of fauna
3. To assess the impacts of the proposed DFC project on the terrestrial fauna.

Aquatic Fauna

The study was carried out in the project site aiming at:

1. Inventorization of different aquatic species (plankton, benthos, fishes).
2. Population density of the macro invertebrates and fishes in the river.
3. To identify the feeding and breeding grounds of economically important fishes.
4. To assess the existing status of endangered species.

METHODOLOGY

Floral Study

A nested quadrate technique was used for sampling the vegetation. The size and number of quadrates needed were determined using the species area curve (Mishra, 1968) and the running mean method (Kershaw, 1973). Summarization of previously used methods and recommendations led to the use of more than often (10x10m) quadrates laid out for sampling the tree stratum and 1x1m quadrates for herbs, grasses and seedlings of tree species less than 1.3cm dbh (diameter at breast height) at different altitudinal gradients using GPS. However, for examining the shrub species 3x3m sample plots were laid out. The enumeration of the vegetation was done by measuring dbh individually in case of woody vegetation, and collar diameter in case of herbs and grasses using the tree caliper and electronic digital caliper. In case of grasses and sedges, each erect shoot is considered to a plant tiller and the enumeration was done by laying 1m x 1m quadrates at random, further subdivided

into 10 x 10 cm segments. Four such segments selected at random were analyzed from each quadrate by counting the tillers individually as per the method used was that of Singh and Yadava (1974).

The vegetation data collected for phytosociological information were quantitatively analyzed for density, frequency and abundance according to Curtis and McIntosh (1950). The relative values of frequency, density and dominance of all the species were summed up to represent Importance Value Index (IVI). The followings are the formulae to derive frequency, density, dominance, IVI etc.

$$\text{Frequency} = \frac{\text{Total number of quadrats in which species occurred}}{\text{Total number of quadrats studied}}$$

$$\text{Abundance} = \frac{\text{Total number of individuals of species in all quadrats}}{\text{Total number of quadrats in which species occurred}}$$

$$\text{Density} = \frac{\text{Total number of individuals of a species}}{\text{Total number of quadrats studied}}$$

IVI = Relative frequency + Relative dominance (basal area) + Relative density

$$\text{Relative Frequency} = \frac{\text{Frequency of the species}}{\text{Total frequency of all species}} \times 100$$

$$\text{Relative Density} = \frac{\text{Density of the species}}{\text{Total density of all species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Dominance of the species}}{\text{Total dominance of all species}} \times 100$$

$$\text{Relative Abundance} = \frac{\text{Abundance of the species}}{\text{Total abundance of all species}} \times 100$$

Diversity of the Forest Vegetation

The tree species diversity for each stand in different forest types was determined using Shannon Wiener information function (Shannon and Wiener, 1963), which is:

$$\bar{H} = \sum_{i=1}^{s} \left(\frac{Ni}{N}\right) log_{10} \left(\frac{Ni}{N}\right)$$

Where, Ni is the total number of individuals of species and N is the total number of all species in a stand.

Concentration of dominance

Concentration of dominance (Cd) was measured by Simpson Index (Simpson, 1949):

$$CD = \sum_{i=1}^{S} \left(\frac{Ni}{N}\right)^2$$

Where, Ni and N were the same as for Shannon Wiener information function. This index ranges from one, if all the individuals belong to one species, to (1/s) if they are equally divided among species (S).

Faunal Study

Terrestrial Fauna

A ground survey was carried out in the impact zone of the proposed DFC project. Important animal groups: butterflies (insects), birds and mammals inhabiting the area were surveyed.

For sampling butterflies the standard '*Pollard Walk method'*; for birds '*point sampling*' along the fixed transect (foot trails) and for sampling mammals, '*direct count on open width (20m) transect'*, were used on fixed transects. Sampling was carried for 3 h on each of the tree transects at each site.

Seasonal variation in species diversity of different groups of animals (butterflies and birds) were evaluated using Shannon-diversity Index (***H'***) to know the season of peak diversity in the area amongst the post monsoon seasons studied.

$$H' = -\Sigma^{N}_{1}\ Pi\ ln\ Pi$$

(From species 1 to n; n= total number of species)
Where, **Pi** is the proportion of the individual species in the total population.

Aquatic Fauna

Evaluation of Phyto-benthos and Plankton

Samples of periphyton were obtained by scraping of 3 cm2 area of the boulders and preserved in 1 ml of Lugol's solution. The upper surface of boulders was scraped with the help of sharp razor. Three replicates were obtained and integrated. For qualitative studies the keys of Trivedy and Goel (1984) and Ward and Whipple (1959) have been used for identifying the filamentous and non-filamentous algae. However, for identifying diatoms, permanent mounts were prepared and identified. For computing abundance (as %) 300-400 diatom cells were identified in each sample (with BX-40). Plankton samples were collected using a tericot ring net. The samples were preserved in lugol's solution and carried to the laboratory for their study. Sedgewick-Rafter cell counts (APHA 1992, 1998) were made and density was recorded as cell mm2. Zooplanktons were also counted and the density was recorded as cell per litre volume of water.

Evaluation of Benthic Macro-Invertebrates

Benthic macro-invertebrates were collected using raviusing surber's square foot sampler (Welch, 1948) adopting random sampling device, from the designated sampling sites in Tons, Karawati, Khajuri & Belavan rivers. Jigro river is seasonal river & was dry at the time of sampling. The samples were collected from the pebbles, cobbles and gravels surface upto 15 cm sediment depth at different elevations. All collected specimens were preserved in 8% formalin solution or 70 % alcohol and identified upto the generic level with the aid of keys given by Usinger (1950), Pennak (1953), Ward and Whipple (1959), Edmondson (1959), Needham and Needham (1962), Macan (1979), Tonapi (1980) and Edington and Hildrew

(1995). The density of benthic macroinvertebrates was expressed as unit per meter square (unit/m2). The spatial variations in community structure were recorded by computing percentage abundance.

Evaluation of Fish Fauna

Fish including their spawns, fry and fingerlings were caught from the different selected sites. Various morphometric parameters of the captured specimens had been recorded and fish were identified up to the species level with the help of keys given in Day-Fauna, Jayaram (1981), Menon (1987) and Talwar and Jhingran (1997). Aquatic vegetation, which the fish might have preferred as a food and breeding substrate was also sampled. Percentile contribution of different fish species (by umber and by weight) to the total fish catch was determined. The information was also sought from primary sources as well as secondary sources

To assess the fish diversity different fishing gears like cast net, scoop net, hand net, hook and line method and pot method were used. They were also visually observed in different habitats. The fishes were caught on spot, counted and immediately released back into the water. The cast net was thrown in different habitats in a stretch of about 500 m of the river reach length at all study sites. Only few specimens of individual fish species were collected.

Flora of the project Area

General survey of flora has been carried out district wise. On the basis of Survey and secondary data collected from forest office a large variety of Trees, herbs and shrubs found suited to climatic condition. The structure and type of vegetation depends on climatic conditions and physiographic as well as requirements of the local inhabitants of an area. The vegetation in the study area is deciduous type in nature. Mainly tropical dry deciduous type of species found in the study area. These are found in all parts of the plains, and usually in central eastern and western regions. The trees are mostly deciduous. Since sunlight reaches the ground in abundance, shrubs and grasses also grow here.. Important trees are Sal, Palas, Amaltas, Bel, Anjeer etc. Neem, Peepal, Sheesham. Mango, Jamun,Babool, Imli (Tamarind) etc. grows along riverbanks and in other moist regions.

Flora of study area on the basis of general survey is listed below:

Table-5.16: List of General Flora of study area

Plant Species	Vernacular Name	Enthanobotanical Values
Anisomeles ovata	Jangali Tulsi	Medicinal
Achyranthes aspera	Apmarg	Drugs, Medicinal
Azadirachta indica	Neem	Medical, Timber, Fuel
Acacia nilotica	Kikar	Timber, Fuel
Acacia leucophloea	Babul	Timber, Fuel
Albizzia lebbek	Siras	Timber, Fuel
Acacia catechu	Khair	Medical, Timber, Kattha
Aegle marmelos	Bel	Food, Timber, Mythological
Bauhinia variegate	Kachnar	Ornamental
Butea monosperma	Palash	
Cassia fistula	Amaltas	Aesthetic, Fuel
Calotropis procera	Aak	Medicinal

Plant Species	Vernacular Name	Enthanobotanical Values
Cynodon dactylon	Dub	Fodder
Calotropis procera	Akman	
Cuscuta reflexa	Amarbel	Medicinal
Dalbergia sissoo	Shisham	Timber, Fuel
Desmostachya bipinnata	Dab	Huts
Delonix regia	Gulmohar	Aesthetic, Recreational
Eucalyptus hybrid	Safeda	Timber, Fuel
Emblica officinalis	Amla	Mythological, Fuel Timber,
Erianthus munja	Munj	Huts
Ficus religiosa	Papal	Mythological, Timber
Ficus benghalensis	Bargad	Timber, Fuel
Holoptelea intgrifolia	Papri	Timber, Medicinal
Mimosa pudica	Chiumui	Aesthetic
Mangifera indica	Aam	Food, Timber, Fuel
Madhuca indica	Mahua	Recreational, Medicinal
Moringa oleifera	Sahijan	Food, Fuel, Medicinal
Nerium indica	Kaner	Aesthetic, Recreational
Opuntia dillenii	Nagphani	Medicinal
Polyalthia longifolia	Ashok	Aesthetic, Recreational
Prosopis julifera	Kabuli kikar	Timber, Fuel
Phoenix dactylifers	Khajur	Food, MFP (Fan)
Populus sp.	Poplar	Timber
Pongamia glabra	Karanj	Medicinal
Ocimum gratissimum	Ram Tulsi	
Sathura matel	Datura	Poison, Medicinal
Saccharum spontaneum	Kans	Huts
Syzygium cumini	Jamun	Food, Timber
Tarminalia arjuna	Arjuna	Aesthetic, Recreational
Teminalia belerica	Baheda	Medicinal, Timber
Tribulus terrestris	Gokharu	Medicinal
Tactona grandis	Teak	
Zizyphus numularia	Jahrberi	Food, Fodder

All the plant species which are used by the people for various purposes are also distributed in other parts of the state are listed below:

Table-5.17: List of Ethno-botanically important Plant Species recorded along chanage and its Adjoining Area

S. No	*Species*	Habit	Local name	Edible	Fodder	Fuel wood	Medicinal	Timber	Ornamental
1.	*Aconitumheterophyllum*	Herb	Atish				+		
2.	*Aesculus indica*	Tree	Khanor	+	+	+			
3.	*Ailanthus* sp.	Tree	Dhunri		+	+			
4.	*Ajuga bracteosa*	Herb	Neel khanti				+		
5.	*Ajuga parviflora*	Herb	Neel khanti				+		
6.	*Alnus nitida*	Tree	Peeyak			+			
7.	*Angelica glauca*	Shrub	Chora				+		
8.	*Artemisia dracunculus*	Herb	Jhaum				+		
9.	*Artemisia gmelli*	Herb	Thav				+		
10.	*Asparagus sp.*	Shrub					+		
11.	*Astragalus candolleanus*	Shrub				+			
12.	*Berberis lyceum*	Shrub	Kashmal, Chindu	+			+		
13.	*Bergenia stracheyi*	Herb	Saprotri				+		
14.	*Brassica campestris*	Herb	Sarson	+					
15.	*Cannabis sativa*	Herb	Bhang	+					
16.	*Carum carvi*	Herb	Kala zira				+		
17.	*Cedrus deodara*	Tree	Diar					+	
18.	*Celtis australis*	Tree	Khirik		+	+			
19.	*Coriandrum sativum*	Herb	Dhania	+					
20.	*Cotoneaster acuminate*	Shrub		+					
21.	*Cynodon dactylon*	Herb	Dhup grass		+				
22.	*Delphinium denudatum*	Herb					+		
23.	*Desmodiummicrophyllum*	Shrub	Piri		+	+			
24.	*Duchesnea indica*	Herb		+					
25.	*Elaeaganus umbellate*	Shrub	Kanju	+					
26.	*Ferula jaeskeana*	Shrub					+		
27.	*Ficus palmate*	Tree	Thuva	+	+				
28.	*Foeniculum vulgare*	Herb	Saunf	+					

S. No	*Species*	Habit	Local name	Edible	Fodder	Fuel wood	Medicinal	Timber	Ornamental
29.	*Fragaria vesca*	Herb	Mobala	+					
30.	*Hypericum oblongifolium*	Shrub					+		
31.	*Jasminum humile*	Shrub							+
32.	*Lilium thomsonianum*	Herb							+
33.	*Loniceraquinqueloculans*	Herb							+
34.	*Mentha longifolia*	Herb	Pudina				+		
35.	*Micromeria biflora*	Herb					+		
36.	*Morchella esculenta*	Herb	Guchhi	+					
37.	*Morus serrata*	Tree	Croon/toot/Gurun	+	+	+			
38.	*Nasturtium officinale*	Herb	Chu nali	+					
39.	*Olea cuspidate*	Tree	Kou		+				
40.	*Phytolacca acinosa*	Shrub	Rantlag				+		
41.	*Picea smithiana*	Tree	Rae					+	
42.	*Picrorhiza kurrooa*	Herb	Karoo				+		
43.	*Pinus wallichiana*	Tree	Kail					+	
44.	*Pistacia intergerrima*	Tree	Kakar shinghi		+		+	+	
45.	*Plantago lanceolata*	Herb	Isabgol				+		
46.	*Plantago major*	Herb	Isabgol				+		
47.	*Poa* sp	Herb	Ghaas		+				
48.	*Polygonum capitatum*	Herb					+		
49.	*Populus deltoidea*	Tree	Popuar					+	
50.	*Populus nigra*	Tree	Poplar					+	
51.	*Prinsepia utilis*	Shrub		+					
52.	*Prunus armeniaca*	Tree	Chulli	+					
53.	*Punica granatum*	Tree	Rare/dadu	+					
54.	*Pyrus pashia*	Tree	Kainth	+	+				
55.	*Quercus ilex*	Tree	Ban		+	+			
56.	*Plectranthus rugosus*	Shrub	Kot				+		
57.	*Rhamnus virgatus*	Shrub	Tharangu		+				
58.	*Rhus cotinus*	Shrub				+			

S. No	*Species*	Habit	Local name	Edible	Fodder	Fuel wood	Medicinal	Timber	Ornamental
59.	*Rhus parviflora*	Shrub				+			
60.	*Robinia pseudoacacia*	Tree			+	+			
61.	*Rosa brunonii*	Shrub							+
62.	*Rubus elipticus*	Shrub	Akhae	+					
63.	*Rubus lasiocarpus*	Shrub	Gulabri	+					
64.	*Rumex hastatus*	Herb		+	+				
65.	*Rumex nepalensis*	Herb	Albar	+					
66.	*Salix daphnoides*	Tree	Badoh		+	+			
67.	*Salix tetrasperma*	Tree	Badoh		+	+			
68.	*Salvia moorcroftiana*	Herb					+		
69.	*Solanum nigrum*	Herb	Makoh/ Kyangi	+			+		
70.	*Spiraea sorbifolia*	Shrub	Karnahe						+
71.	*Spiraea canescens*	Shrub	Lot						+
72.	*Tagetes minuta*	Herb					+		+
73.	*Thalictrum foliolosum*	Herb					+		
74.	*Thymus linearis*	Herb					+		
75.	*Trifolium minus*	Herb			+				
76.	*Trifolium pratense*	Herb			+				
77.	*Trifolium repens*	Herb			+				
78.	*Urtica dioica*	Shrub		+	+				
79.	*Valeriana hardwickii*	Herb					+		
80.	*Valeriana jatamansi*	Herb	Ain				+		
81.	*Verbascum thapsus*	Shrub					+		
82.	*Viburnum foetens*	Shrub				+			
83.	*Viola canescens*	Herb	Nephalu kaphool				+		
84.	*Yucca aloifolia*	Shrub							+
85.	*Abelia triflora*	Shrub							+

FAUNA

The domestic animals observed in the study area are mainly mammals, as listed. In absence of natural forest in the study area, wild animals in the study area are poor. Peacock can be easily seen in the study area even in villages. It is found as pet birds. A list of birds, reptiles, amphibians and rodents based on information gathered from local enquiries and Forest department is presented

Table-5.18: List of Domestic Fauna Observed in the Study Area

S.No.	Zoological Name	Common Name	Schedule
1.	*Bos indicus*	Cow	
2.	*Bubalus indicus*	Buffalo	
3.	*Boselaphustragocamelus*	Nilgai	III
4.	*Cains familieris*	Dog	
5.	*Capra hircus*	Goat	
6.	*Equus cabilus*	Horse	
7.	*Equus hermionus*	Ass	
8.	*Felis domesticus*	Cat	
9.	*Ovius polic*	Sheep	
10.	*Sus cristatus*	Pig	
11.	*Suborder ruminantia*	Camel	

Table-5.19: List of Birds, Reptiles, Amphibians and Rodents observed in the Study Area

Sl. No	Scientific Name	Common Name	Schedule
Birds			
1.	*Alcedo atthis*	CommonKingfisher	IV
2.	*Cucculus micropterus*	Indian Cuckoo	IV
3.	*Columba livia*	Rock Pigeon	IV
4.	*Corvus splendens*	House Crow	V
5.	*Eudynomys scolopacea*	Asian Koel	
6.	*Prinia hodgsonii*	Grey-breasted Prinia	
7.	*Pycnotus jacosus*	Red-whiskered Bulbul	IV
8.	*Ploceus philippinus*	Baya Weaver	
9.	*Pavo cristatus*	Peafowl	I
10.	*Polyplectron bicalearaturn*	Peacock pheasants	I
11.	*Streptopelia chinensis*	Spotted Dove	IV
Reptiles			
1.	*Calotes versicolor*	Garden lizard	
2.	*Varanus monitor*	Monitor lizards	

Sl. No	Scientific Name	Common Name	Schedule
Amphibian			
1	***Bufo malanostidus***	Toad	
2	*Rana cynophlyctis*	Frog	
3	*Rana tigrina*	Frog	
Rodent			
1	***Bandicota indica***	Bandicoot rat	
2	*Mus muscatus*	Mouse	
3	*Ratus ratus*	House rat	V
4	*Ratufa indica*	Squirrel	

Wildlife Sanctuary

There is no wildlife sanctuary along the 10 km corridor along the alignment.

Aquatic Ecology

Aquatic ecosystem is the most diverse in the world. It harbors a variety of plants and animals from primary producers to large consumers, intermittently occupied by plankton, insects, fishes etc. and aquatic biological diversity depends on the environmental quality of that ecosystem. Therefore to assess the possible impact of on the aquatic fauna, study was conducted in the influence zone to evolve appropriate mitigation measures.

From the baseline survey on existing aquatic environmental conditions in and around the proposed site on the river Yamuna and Tons the following data's were generated:

- Biological characteristics of river water
- Estimation of coliform organisms
- Inventorization of phytobenthos and Zoobenthos
- Present status of riverine fish fauna: Identification of fish species
- Migratory pattern, feeding and breeding grounds of the fish fauna
- Assessment of local catches during the field trips to asses the fish fauna.

Study Sites

Aquatic Study carried out at all the major rivers & ponds. Major aquatic ecological attributes are Tons River near Balua Village, Yamuna River near Purna Village, Karawati River near Chainage no. 740/23-24, Ojhla Nala near Ranibari Village, Khajuri River and Belvan River near Belvan Village. Jirgo River was dry, so no Ecological Sampling done in this river.

Assessment of Aquatic Fauna

Water sample was collected from surface of the stream with minimum disturbances. The collected samples were assessed for plankton, periphytons, phyto- and zoo benthos samples using standard methods (APHA 1992, 1998).

Plankton samples were collected using a tericot ring net and the periphyton were obtained by scraping of 3 cm^2 area of the boulders and preserved in 1 ml of Lugol's solution. **Benthic macro-invertebrates** were collected from the pebbles, cobbles and gravels form the surface collected up to 15 cm sediment depth at different elevations. All collected specimens were preserved in 8% formalin solution or 70 % alcohol and were identified up to generic level by using Pennak (1953), Ward and

Whipple (1959), Needham and Needham (1962), Trivedy and Goel (1984), Edington and Holdren (1995) and APHA (1992, 1998).

Fishes occurrence were determined by collecting samples using different fishing gears like cast net, scoop net, hand net, hook-line, pot and open local devices methods. Also visual observations in different habitats were made. Fishes were identified up to the species level with the help of keys of Jayaram (1981), Menon (1987) and Talwar and Jhingran (1997). IUCN red data list (2006) was compared to assess threatened, endangered and vulnerable species in the study area.

River Morphology

The river /stream morphology is a significant component that provides ecological stability as it helps to maintain flow. Hence, the morphology contributes to the biological integrity of the aquatic ecosystem, which has been assessed following the criteria described by Rosgen (1996). Yamuna river is near Purna Village. It had plenty of water. Tons River near Balua Village, Karawati River near Chainage no. 740/23-24, Ojhla Nala near Ranibari Village, Khajuri River and Belvan River near Belvan Village. These rivers adequate water in non-monsoon seasons. Jirgo River was dry, so no Ecological Sampling done in this river.

River bed comprises of sand, pebbles, gravels, cobbles. The bank side has excessive sand or silt. Khans and some greem herbaceous plant is very common on the both side of river bank.

Fig- 5.10 Showing the Flora near the river bank of Yamuna

Discussions

The biology of a system in terms of its macro and micro flora and fauna best indicates about the status of any ecosystem and acts as a source of early warning and enables one to take efficient control measures.

Planktons

The composition density and diversity of phytoplankton and zooplankton of a particular aquatic ecosystem are indicators of environmental stress. The biota of any

ecosystem thus informs about various physico-chemical characteristics of water such as pH, conductivity, nutrients, BOD, alkalinity etc. The water is polluted with only some agricultural wastes and thus has very low level of pollution which is indicated by the species composition of these micro organisms.

Macrophytes:
There was only limited number of macrophyte species present at the study site. Although this aspect could have indicated that the study site must be a polluted one but at the same time, the low density of these macrophytes is an indicative of low pollution level.

Benthos and Fishes:
The benthic fauna of the study site is represented by Insecta, Annelida and Mollusca. The high diversity of benthos is indicative of low pollution level at the study site. Similarly, major fish groups are represented by carps, catfishes. The diversity indices of benthos and fishes are an indicative of non-polluted status of the study site.

Rare and Endangered Species
In reference to Red Data Book of Botanical Survey of India and Wildlife (Protection) Act 1972, no endangered species of flora and fauna have been found during the study period.

Ecologically Sensitive Areas
There are no ecologically sensitive areas within the study area.

Macrophytes	
Habit	**Plants**
Free floating	*Eichhornia crassipes*
Rooted floating	*Marselliaquadrifoliata*
Submerged	*Hydrilla vertivilata*
Emergent	*Typha angustata, Colocasia* sp., *Polygonum* sp. (2 species), *Saccharum* sp., grasses
Dominant species	*Eichhornia crassipes*, *Polygonum*, *Saccharum* sp.

Aquatic sampling Results
[YAMUNA RIVER]

Phytoplankton					
COMMON SPECIES	**GROUP**	**%**		**DIVERSITY INDEX**	
		Up Stream	**Down Stream**	**Up Stream**	**Down Stream**
Rhizoclonium sp.	Chlorophyceae	15.2	17.4	3.2	2.7
Ankistrodesmus sp.					
Chlorella sp.					
Pediastrum sp.					
Chlosterium sp.					
*Spirogyra*sp.					
Scenedesmus sp.					
Staurastrum					
Pandorina sp.					
Peridinium sp.					
Selenastrum sp.					
Oocystis sp.					
Tetraedron sp.					
Kirchneriella sp.					

Phytoplankton					
COMMON SPECIES	GROUP	%		DIVERSITY INDEX	
		Up Stream	Down Stream	Up Stream	Down Stream
Cosmarium sp.					
Chlamydomonas sp.					
Navicula sp.	Bacillariophyceae	12.3	14.1		
Centronella sp.					
Synedira sp.					
Fragillaria sp.					
Melosira sp.					
Cyclotella sp.					
Gomphonema sp.					
Nitzeschia sp.					
Trabellaria sp.					
Amphora sp.					
Euglena vedinas sp.	Euglenaineae	7.6	8.2		
Lagerheimia					
Trachelomonas sp.					
Phacus sp.					
Aphanothece sp.	Cyanophyceae	10.0	9.0		
Anabaena sp.					
Microcystis sp.					
Phormidium sp.					
Synechosystis					
Spirullina sp.					
Merismopaedia sp.					

Zooplankton					
	Group	%		DIVERSITY INDEX	
		Up Stream	Down Stream	Up Stream	Down Stream
Vorticelia sp.	Protozoa	11.0	12.0	2.3	2.1
Paramecium					
Didinium					
Asplanchna	Rotifera	32.0	33.0		
Brachionus					
Euchlanis					
Lecana					
Polyarthra					
Rotaria					
Daphinia sp.	Cladocera	30.0	29.5		
Ceriodiaphnia cornusa					
Bosmina loniotris					
Daphinia lumphasia					
Daphnirosoma sp.					
Moina					
Mesocyclops Hyalimus	Copepoda	20.0	19.5		
Cyclops					
Microcyclops various					
Heliodiaptomus sp.					
Diaptomus					

Mesocydops.					
Nauplii	Crustacea	5.0	6.0		

Benthos				
Phylum	**%**		**Diversity Index**	
	Up Stream	**Down Stream**	**Up Stream**	**Down Stream**
Nematoda	2.2	2.1	3.0	2.7
Oligochaeta	14.7	13.2		
Decapoda	2.3	2.3		
Coleoptera	2.0	2.5		
Diptera	51.0	49.5		
Ephemeroptera	18.0	17.0		

[B] TONS RIVER
Phytoplankton

Common Species	**Group**	**%**		**Diversity Index**	
		Up Stream	**Down Stream**	**Up Stream**	**Down Stream**
Ankistrodesmus sp.	Chlorophyceae	14.7	15.3	**1.5**	1.6
Chlorella sp.					
Pediastrum sp.					
Eudorina					
Chlosterium sp.					
*Spirogyra*sp.					
Centronella	Bacillariophyceae	16.3	15.8		
Cyclotella					
Cyclotella sp.					
Diatoma					
Fragillaria sp.					
Melosira sp.					
Synedira sp.					
Navicula sp.					
Euglena vedinas sp.	Euglenophyceae	14.5	15.6		
Trachelomonas					
Phacus sp.					
Aphanothece sp.	Cyanophyceae	22.6	24.2		
Anabaena sp.					
Merismopaedia sp.					
Microcystis sp.					
Phormidium sp.					
Spirulina sp.					

Zooplnakton

Common Species	**Group**	**%**		**Diversity Index**	
		Up Stream	**Down Stream**	**Up Stream**	**Down Stream**
Verticelia sp.	Protozoa	6	7	1.1	1.1
Brachionus	Rotifera	11	12		
Keretella					
Polyarthavulgaris					
Daphinia sp.	Cladocera	24	23		
Bosminaloniotris					
Daphnirosoma sp.					
Mesocyclopshyalimus	Copepoda	15	14		

Cyclops					
Diaptomus					
Heliodiaptomus sp.					

Benthos

Phylum	%		Diversity Index	
	Up Stream	Down Stream	Up Stream	Down Stream
Nematoda	1.2	1.4	**0.3**	0.4
Oligochaeta	11.0	9.0		
Decapoda	3.0	3.0		
Coleoptera	3.3	3.2		
Hemiptera	2.3	2.2		
Lepidoptera	1.4	1.2		
Odonata	1.7	1.8		
Trichoptera	3.3	3.2		

[C] KARAWATI RIVER

Phytoplankton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Ankistrodesmus sp.	Chlorophyceae	11.7	12.1	1.4	1.2
Chlorella sp.					
Pediastrum sp.					
Eudorina					
Chlosterium sp.					
*Spirogyra*sp.					
Centronella	Bacillariophyceae	8.3	11.8		
Cyclotella					
Cyclotella sp.					
Diatoma					
Fragillaria sp.					
Melosira sp.					
Synedira sp.					
Navicula sp.					
Euglena vedinas sp.	Euglenophyceae	14.5	15.6		
Trachelomonas					
Phacus sp.					
Aphanothece sp.	Cyanophyceae	9.6	8.2		
Anabaena sp.					
Phormidium sp.					
Spirulina sp.					

Zooplnakton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Verticelia sp.	Protozoa	6	7	1.1	1.1
Brachionus	Rotifera	11	12		
Keretella					
Polyarthavulgaris					
Daphinia sp.	Cladocera	24	23		
Bosminaloniotris					
Daphnirosoma sp.					
Mesocyclopshyalimus	Copepoda	15	14		
Cyclops					

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Diaptomus					
Heliodiaptomus sp.					

Benthos

Phylum	%		Diversity Index	
	Up Stream	Down Stream	Up Stream	Down Stream
Nematoda	1.2	1.4	**0.3**	0.4
Oligochaeta	11.0	9.0		
Decapoda	3.0	3.0		
Coleoptera	3.3	3.2		
Hemiptera	2.3	2.2		
Lepidoptera	1.4	1.2		
Odonata	1.7	1.8		
Trichoptera	3.3	3.2		

[D] OJHLA NALA
Phytoplankton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Ankistrodesmus sp.	Chlorophyceae	2.5	3.3	**1.5**	1.7
Chlorella sp.					
Eudorina					
Chlosterium sp.					
Centronella	Bacillariophyceae	1.1	1.4		
Cyclotella					
Cyclotella sp.					
Diatoma					
Navicula sp.					

Zooplnakton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Verticelia sp.	Protozoa	4	3	1.1	1.1
Brachionus	Rotifera	3	2		
Daphinia sp.	Cladocera	4	5		
Bosminaloniotris					
Daphnirosoma sp.					
Cyclops					
Diaptomus					
Heliodiaptomus sp.					

Benthos

Phylum	%		Diversity Index	
	Up Stream	Down Stream	Up Stream	Down Stream
Hemiptera	2.3	2.2	**1.1**	**1.3**
Lepidoptera	1.4	1.2		
Odonata	1.7	1.8		
Trichoptera	3.3	3.2		

[E] KHAJURI RIVER
Phytoplankton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Ankistrodesmus sp.	Chlorophyceae	6.7	7.2	**1.7**	1.3
Chlorella sp.					
Pediastrum sp.					
*Spirogyra*sp.					
Centronella	Bacillariophyceae	5.1	5.8		
Cyclotella					
Synedira sp.					
Navicula sp.					
Euglena vedinas sp.	Euglenophyceae	14.4	12.6		
Trachelomonas					
Phacus sp.					
Aphanothece sp.	Cyanophyceae	12.6	14.2		
Anabaena sp.					
Merismopaedia sp.					
Microcystis sp.					
Phormidium sp.					
Spirulina sp.					

Zooplnakton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Verticelia sp.	Protozoa	6	7	1.1	1.1
Brachionus	Rotifera	11	12		
Keretella					
Polyarthavulgaris					
Daphinia sp.	Cladocera	24	23		
Bosminaloniotris					
Daphnirosoma sp.					
Mesocyclopshyalimus	Copepoda	15	14		
Cyclops					
Diaptomus					
Heliodiaptomus sp.					

Benthos

Phylum	%		Diversity Index	
	Up Stream	Down Stream	Up Stream	Down Stream
Nematoda	1.2	1.4	**0.3**	0.4
Oligochaeta	11.0	9.0		
Decapoda	3.0	3.0		
Coleoptera	3.3	3.2		
Hemiptera	2.3	2.2		
Lepidoptera	1.4	1.2		
Odonata	1.7	1.8		
Trichoptera	3.3	3.2		

[F] BELVAN RIVER
Phytoplankton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Chlorella sp.	Chlorophyceae	5.7	6.3	**1.1**	1.2
Chlosterium sp.					

*Spirogyra*sp.					
Centronella	Bacillariophyceae	11.3	12.8		
Cyclotella					
Cyclotella sp.					
Synedira sp.					
Navicula sp.					
Euglena vedinas sp.	Euglenophyceae	14.5	15.6		
Trachelomonas					
Phacus sp.					
Merismopaedia sp.					
Microcystis sp.					
Phormidium sp.					
Spirulina sp.					

Zooplnakton

Common Species	Group	%		Diversity Index	
		Up Stream	Down Stream	Up Stream	Down Stream
Brachionus	Rotifera	5	4		
Daphinia sp.	Cladocera	14	13		
Bosminaloniotris					
Daphnirosoma sp.					
Mesocyclopshyalimus	Copepoda	12	11		
Cyclops					
Diaptomus					
Heliodiaptomus sp.					

Benthos

Phylum	%		Diversity Index	
	Up Stream	Down Stream	Up Stream	Down Stream
Nematoda	1.2	1.4	0.4	0.5
Coleoptera	3.3	3.2		
Hemiptera	2.3	2.2		
Lepidoptera	1.4	1.2		
Odonata	1.7	1.8		
Trichoptera	3.3	3.2		

List of Fishes in the Study Area

Fish species reported in the area are listed .Main fishes are *Notopterusnotopterus, Catla catla, Labeo calbasu, Labeo rohita, Labeo bat, Mystus vittatus, Rita rita, Barbus spp*. and *Cirrinus raba*.

List of Fishes Reported In Yamuna in the Study Area

S. No.	Fish Species
1	*Notopterus notopterus*
2	*Catla catla*
3	*Labeo calbasu*
4	*Labeo rohito*
5	*Labeo bata*

S. No.	Fish Species
6	*Cirrihinus mrigala*
7	*Cirrihinus raba*
8	*Clarius batrachus*
9	*Wallago attu*
10	*Heteropneustres fossiliis*
11	*Mystus vittatus*
12	*Mystus aor*
13	*Hilra ilisha*
14	*Barbus spp.*
15	*Rita rita*

5.13 ECONOMIC DEVELOPMENT

Population

The project lies under the state of Uttar Pradesh**.** The total population of the state was 8.8 crores in 1971. It increased to 11.1 crores in 1981 and then reported to be 13.9 crores in 1991. The increase, in population in these two decades was almost identical at 25 per cent. As against this, the national population shows a declining trend from 25 per cent in 1971-81 to 23.8 percent in 1981-91. Since 1971-81 the decadal variation of U.P. population in percentage forms has remained higher than that of the national.

Urbanization

The pace of urbanization has been lower in the state. The level of urbanization has also been lower than most other states. The numbers of urban centers with more than one lakh population have grown slowly over last thirty years. The growth of urban centers with population less than five thousand have, on the other hand, have grown more significantly and these centers have grown in larger numbers in the western part of the state.

Economy

The per capita income of the U.P. state at Rs. 4787 in 1993-94 is one of the lowest in the country except Orissa (Rs. 4726) and Bihar (Rs. 3620). The per capita of the state in 1950-51 at Rs. 259 was very close to the national per capita income of Rs. 267, short by only Rs. 8 i.e. 3 per cent only. In 1995-96 this shortfall stood at Rs. 35.8 and is likely to go up. The average annual growth in total income of the state in the period between 1951-74 was always far less than the country. However, the population growth in the state being lower in the country during the period, the gap in the per capita income between the state and the country was constructed to some extent.

The post-1974 period was, however, marked by a significant improvement in the total income of the state. The state achieved a growth of 5-7 per cent per annum, which is higher than the national growth of 5.3 %. But this gain in higher growth rate of total income in the state was lost to the state due to increase in the growth rate of population from 1.8 per cent per annum in 1961-71 to 2.3 per cent in 1971-81 which is higher than the country's population growth rate of 2.2 percent.

The increasing trend of growth in income in the period following 1974 is likely to be replaced by an average annual growth of even less than 3 percent that is much lower that the country's growth rate of almost six per cent. This means that the shortfall in the states per capita income, which was 35 percent in 1994-95, is unlikely to change in recent time.

Thus the lower rate of growth in the total income of the state during the period 1951-74 was followed by high population growth in the last two decades. But the state is now faced with the reappearance of lower growth of income while the population growth remaining unchanged in foreseeable future.

The structure of state income shows that the contribution of primary sector has declined to 41 percent of the state income though the sector still sustain 73 percent of the total working force. This shows the continued pressure of working population in the primary sector. The share of secondary sector, on the other hand, has gone up to 20 percent of the total state income which now employ 9 percent of the total workers in the state. This percentage is the lowest among all the major Indian states except Bihar (4.6 percent in 1991 census), Madhya Pradesh (8.4 percent in 1991) and Orissa (7.5 percent in 1991). The share of tertiary sector has been more impressive from 25 percent in 1970-71 to 37 percent in 1994-95 and the percentage share of workers employed by this sector has risen from 15 percent to 18 percent in 1991. It thus shows that the U.P.'s growth has been more capital intensive than labours intensive, more urban based than rural based and the shift income from primary to other sectors is not accompanied by corresponding change in employment pattern.

Distinguishing feature of Uttar Pradesh's economy is its regional imbalances. In terms of economic indicators like agricultural productivity, infrastructure facilities, industrial growth, the Uttar Pradesh's economy can be categories into five regions; Western, Eastern, Central, Ruhelkhand and Hill. The Western Uttar Pradesh is agriculturally prosperous. It is relatively industrialized and has seen greater degree of urbanization. At the other end is Bundelkhand. Low agricultural growth, less number of industrial units, lesser gross value of industrial products marks touts his region as the least developed in the state.

Agriculture

Farming is the main occupation of three-quarters of the working population. Many peasants have farms that are too small for efficient agriculture. The main problem is the pressure of population on land sources. The soils are fertile and there is good rainfall over nearly all the region. Irrigation facilities bring water to about one-third of the cropped area. Wheat, rice, maize, millet, and pulses, such as beans, peas and lentils, are the major food crops. Uttar Pradesh is one of the country's major producers of sugar cane. Cotton, oilseeds, jute, potatoes, and tobacco are other important cash crops. As part of national and state projects for sericulture (the production of silk fibre), large-scale planting of mulberry trees is under way across the state. Mulberry trees provide food for the caterpillars of the silkworm moth.

Industries

Cotton mills were first established in Kanpur in 1869, making it one of the older factory cities of India. It has become one of the greatest industrial cities, with woolen and leather industries, cotton, flour, and vegetable-oil mills, sugar refineries, and chemical works.

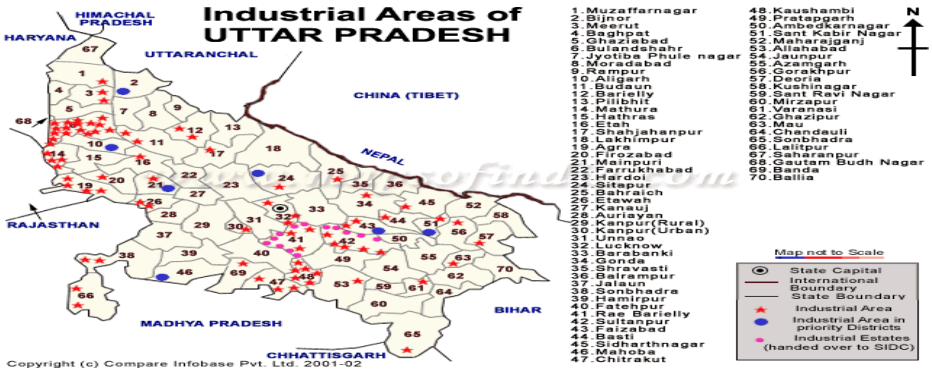


Fig- 5.11 Industrial areas of U.P.

The state government has established cement factories near Mirzapur, precision instrument factories around Lucknow, a chemical plant at Bareilly, and a diesel locomotive factory at Varanasi. It has also introduced fertilizer factories at Gorakhpur and Allahabad, telephone industries at Genda Naimi and Rae Bareli, electronics industries at Ghaziabad, and scooter factories at Lucknow, as well as an oil refinery at Mathura.

Mining

Uttar Pradesh does not have rich mineral resources. Mines and quarries produce limestone, silica, magnesite, and phosphatic shale. Soapstone, copper, lead, zinc, marble, and bauxite are also found in the state. Electricity produced by coal-burning power stations is the most important source of energy.

Tourism

Uttar Pradesh contains many famous tourist sites. They include ancient monuments, such as the Taj Mahal at Agra and the Mughal city of Fatehpur Sikri. Millions of pilgrims visit Allahabad and Varanasi to bathe in the waters of the Ganges River, which Hindus consider to be sacred.

Mining. Uttar Pradesh does not have rich mineral resources. Mines and quarries produce limestone, silica, magnesite, and phosphatic shale. Soapstone, copper, lead, zinc, marble, and bauxite are also found in the state. There are coalfields in Mirzapur district. Electricity produced by coal-burning power stations is the most important source of energy.

5.14 SOCIAL AND CULTURAL RESOURCES

Critical stretches

The sensitive social cultural receptors viz., temples, mosque, school and hospitals along the existing RoW of existing railway line and proposed track have been given in Strip Plan.

Educational Institutes and health center

The identification of educational institutes and health centres is important from design of noise barrier point of view. The educational institutes & health care centre adjacent to project railway line are given in Strip Plan.

5.14.1 SOCIAL ISSUES

Almost all social indicators of the state show that the state stands on 13th or 14th position among the sixteen major states. Bihar and in some cases Orissa, are the only two states which lag behind U.P. in terms of social development indicators like medical facilities, teacher-pupil ratio in primary schools, birth rate, death rate, infant mortality rate, literacy, per capita income, electrification of villages, per capita power consumption etc. Uttar Pradesh is often seen as a case study of development in a region of India that currently lag behind other parts of the country in terms of a number of important aspects of well being and social progress. Their region consists of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh. There are important differences between these four states. But the cause of social backwardness in these four different States, never the less, appear to have much in common and recent comparative research have pointed to many similarities in the social, cultural and even political makeup of these states which have contributed to their backwardness

Health-Life in Uttar Pradesh is short and uncertain. Female expects to less than 55 years and the under-file mortality rate is as high as 141 per thousands. In these respects Uttar Pradesh resembles Saharan Africa for with 53 years of life expectancy and 160 under five mortality rate. Among all major Indian states, Uttar Pradesh has the highest under five-mortality rate, the second highest crude death rate and the third lowest life expectancy figure. The number of maternal deaths per 100,000 live birth in the state estimated to be 931 in the mid 1980s. If a girl is born in Kerala she can expect to live 20 years longer than if she is born in Uttar Pradesh. The probability that she will die before the age of one is more than six times as high in Uttar Pradesh than in Kerala. According to the recent National Family Health survey, Uttar Pradesh comes second to Bihar among the major Indian states in terms of the incidence of under nutrition among children below the age of five. This corroborates as well as explain to a large extent the lower possibility of child survival in Uttar Pradesh.

Further, the demographic transition of U.P. has been slow. Among all the major Indian states, Uttar Pradesh has the highest birth rate and the highest fertility rate
Education-Four states identified as lagging behind other major states in terms of democratic transition turn out to be the four states with the lowest literacy level. The 1991 census indicates that the age literacy rate in these four states in the age group between 7 years and above ranges from 38 percent in Bihar to 44 percent in Madhya Pradesh.

Female literacy situation in Uttar Pradesh is dismal. Only one out of four in the 7+ age group was able to read and write in 1991. This figure go down to 19 per cent for rural areas, 11 percent for the scheduled castes, 8 per cent for scheduled castes in rural areas, and 8 per cent for the entire rural population in the most educationally backward districts. The 1981 census figures suggest that in Uttar Pradesh the crude female literacy rate among scheduled castes in rural Uttar Pradesh in 1981 was below 18 per cent in 18 out of Uttar Pradesh's 56 districts and below 2.5 per cent in a majority of districts.

In terms of more demanding criteria of educational attainment on the completion of primary or secondary education, in Uttar Pradesh, in 1992-93 only 50 percent of

literate males and 40 per cent of literate females could complete the cycle of eight years of schooling involved in the primary and middle stages. One other distinguishing feature of Uttar Pradesh education system is the persistence of high level of illiteracy in the younger age group. Within the younger age group, the illiteracy was endemic in rural. In the late 1980s, the incidence of illiteracy in the 10-14 age groups was as high as 32 per cent for rural males and 61 per cent for rural females, and more than two-thirds of all rural girls in the 12-14 age group never went to school.

The problems of education system is exacting. Due to public apathy the school are in disarray, privately run school are functional, but beyond the reach of ordinary people. The State government has taken programmes to make the population totally literate. There are special programmes like World Bank aided DPEP. Steps are being taken with the help of NGOs and other organizations to raise popular participation. At the level of higher education and technical education Uttar Pradesh has 16 general universities, 3 technical universities, one Indian Institute of Technology (Kanpur), one Indian Institute of Management (Lucknow), one Indian Institute of Information Technology and large number polytechnics, engineering institutes and industrial training institutes. This provides the State with firm basis for providing opportunities for higher education to its youth.

5.14.2 SOCIO-ECONOMIC PROFILE OF THE PROJECT AREA

The proposed DFC Corridor passes through 372 villages of 7 districts in Uttar Pradesh. These Districts are Chandauli, Mirzapur, Allahabad, Kaushambi, Fatehpur, Kanpur (Nagar) and Ramabainagar. The project area is located in the country's Central gangatic of Uttar Pradesh. The rivers and streams of the these districts jointly consist of the rivers of Yamuna and Ganga drainage basin The important crops of the zone are rice, wheat, maize, pearl millet, sorghum, barley, gram, pigeon pea, mooing, lentil, groundnut, rapeseed and mustard and sugarcane. Out of 392 km of total project length about 249 km is in parallel and about 143 km is in bypass stretch. (Table 5.20)

Table-5.20: Project Area: Salient Features

Section	Chainage km		Distribution of length (km)		Total			
	From	To	Para-llel	Bypass	Length	Districts	Villages	LA (Ha)
CPM Mughalsarai	672.65	680.28	8.00	0	8.00*	1	10	9
CPM Allahabad (E)	680.28	807.45	108.00	26	134.00	3	173	634
CPM Allahabad (W)	807.45	991.20	134.00	59.00	193.00	4	154	508
CPM Kanpur	991.20	1048	-	58.00	58.00	2	35	249
Total (MGS-BAU)			250	143.00	393.00	7	372	**1400**

*length of Villages of Mughalsarai yard is included

5.14.3 FINDINGS OF THE CENSUS AND BASELINE SURVEY

The census and socio-economic surveys have been carried out in all 372 affected villages in 7 districts (Chandauli, Mirzapur, Allahabad, Kaushambi, Fatehpur, Kanpur Nagar, Ramabainagar) of Uttar Pradesh. These survey was conducted between Sept.'11 to Dec'11 and remaining 14 villages were covered between Jun'12 to Jul'12. The census identified a total of 13034 project affected families comprising of 63968

persons. During the census survey, the data gathered from the census survey reveals that amongst the affected 13034 PAFs, the majority 95.64% will incur impact on agricultural land and 4.36% families incurring impact on their residential or commercial structures. Out of total 623 structures affected, 568 structures are residential or commercial, remaining 55 being CPRs.

The following section will analyze the key data findings of the census survey and impacts on the people along the project area.

5.14.4 PROJECT IMPACTS

The proposed project stretch will involve acquisition of about 1400 ha. of land of which approximately 89.35% is private land and rest is Govt. land. However, the project will require very less built-up area which includes residential, commercial or residence-cum commercial and community properties. At many built-up locations land width has been reduced to as less as 17 meters which has resulted in reducing impact on residential as well as commercial structures. Table 5.21 indicates that impact on residential, commercial and community properties has not been significant.

Table 5.21: Project Area: Loss of Land and impact on families

Section	**Private Land**			**PAFs (Nos.)**		**Govt. (in Ha) (%)**	**Total (In Ha.)**
	Agri. (Ha)	**Resi. /Com. (Sqm)**	**Commu-nity (Sqm)**	**Land (%)**	**Structure (%)**		
CPM Mughalsarai	8.21 (88.18%)	0(0%)	100 (0.01%)	287(93.79)	19(6.21)	1.1 (11.81%)	9 (100%)
CPM Allahabad (E)	597.41 (94.23%)	15,500 (0.24%)	400 (0.01%)	5428(95.34)	265(6.66)	35 (5.52%)	634 (100%)
CPM Allahabad (W)	433.56 (85.35%)	13500 (0.27%)	900 (0.02%)	5043(94.97)	267(6.03)	72 (14.17%)	508 (100%)
CPM Kanpur	207.7 (83.45%)	1800 (0.07%)	190 (0.01%)	1043(97.47)	17(2.53)	41 (16.47%)	249 (100%)
Sub Total	1246.88 (89.11%)	30,080(0. 22%)	150 (0.01%)	11801(95.40)	568(4.60)	149.1 (10.66%)	
Total (MGS-BAU)	**1250.57 (89.35%)**					**149.44 (10.65%)**	**1400** (100%)

Agricultural land:-

Table 5.22 presents extent of loss in terms of loss of area of agricultural land of each PAF. Analysis of the census data of each CPM stretches indicate that out of the total 12466 PAFs losing their agricultural land, about 89.72% PAFs will lose less than 0.15 Ha. of land, 8.54% will lose between 0.15 Ha. to 0.50 Ha., 1.64% will lose between 0.5 ha to 1 ha. of land and about 0.11% will lose over 1 ha. of land. As per the provisions of NRRP, all Khatehdars would have received the same (Rs. 20,000) ex-gratia irrespective of their extent of loss. The ex-gratia of Rs 20,000 will help land losers to find replacement value of land losing about 0.15 ha of land. Severity of Impact is adequately addressed by providing additional INR 15 per sq meter for additional land beyond 0.15 Ha.

Table 5.22: Parcel of Plot Affected of each PAFs

Section	Category of Affected Area of Agriculture Land in (Ha.)				Total
	0 - 0.15	0.15 - 0.5	0.5 - 1.0	More than - 1.0	
CPM Mughalsarai	226 (78.74%)	45 (15.68%)	14 (4.88%)	2 (0.70%)	287 (100%)
CPM Allahabad (E)	5208 (91.24%)	455 (7.97%)	40 (0.70%)	5 (0.09%)	5708 (100%)
CPM Allahabad (W)	4854 (89.43%)	460 (8.47%)	110 (2.03%)	4 (0.07%)	5428 (100%)
CPM Kanpur	897 (86.00%)	104 (9.97%)	39 (3.74%)	3 (0.29%)	1043 (100%)
Total (MGS-BAU)	11185 (89.72%)	1064 (8.54%)	203 (1.63%)	14 (0.11%)	12466 (100%)

Structures:–

Table 5.23 indicates the physical impact on the structures being acquired. Out of 623 structures under various categories about 90.21% of structures are losing more than 25% of its area. During census survey and consultations, it was established that losing more than 25% of structures may cause displacement of the people. Hence social assessment has categorized families losing more than 25% of area as displaced families. However actual displacement categories will be reassessed at the time of implementation.

Table-5.23: Assessment of Impact on Structures

Section	0-25%	25-50%	50-75%	75-100%	Total
CPM Mughalsarai	0	5 (35.71%)	1 (7.14%)	8 (57.14%)	14 (100%)
CPM Allahabad (E)	25 (8.80%)	23 (8.09%)	49 (17.25%)	187 (65.84%)	284 (100%)
CPM Allahabad (W)	32 (10.45%)	46 (15.03%)	69 (22.54%)	159 (51.90%)	306 (100%)
CPM Kanpur	4 (21.05%)	3 (15.79%)	1 (5.26%)	11 (57.89%)	19 (100%)
Total (MGS-BAU)	61 (9.79%)	77 (12.35%)	120(20.86%)	365 (61.24%)	623 (100%)

Identification of Small, Marginal and Landless farmers:-

Census and baseline survey has ascertained that about 1824 landowners have changed their status and become landless, marginal or small. Among small/ marginal / landless PAFs, 329 are landless, 674 are marginal and 821 are small after land acquisition for the DFC project. The landowners, who have been reduced to the status of small /marginal or landless as a result of DFCC land acquisitions, will be assisted as described in the Entitlement Matrix (based on the relevant provision of NRRP 2007). However; these numbers will be verified by the concern Revenue Department of the State Govt..

Table 5.24: Identification of Small and marginal farmers

Section	Total Land owners	General	Landless (l)	Small (s)	Marginal (m)	Total (s/m/l)*
CPM Mughalsarai	287 (2.30%)	287 (2.70%)	0	0	0	**0**
CPM Allahabad (E)	5708 (45.79%)	4726 (44.41%)	167 (50.76%)	172 (20.95%)	643 (95.40%)	**982 (53.84%)**
CPM Allahabad	5428	4658	155	600	15	**770**

Section	**Total Land owners**	**General**	**Landless (l)**	**Small (s)**	**Marginal (m)**	**Total (s/m/l)***
(W)	(43.54%)	(43.77%)	(47.11%)	(73.08%)	(2.23%)	**(42.21%)**
CPM Kanpur	1043 (8.37%)	971 (9.12%)	7 (2.13%)	49 (5.97%)	16 (2.37%)	**72 (3.95%)**
Total (MGS-BAU)	**12466 (100%)**	**10642 (100%)**	**329 (100%)**	**821 (100%)**	**674 (100%)**	**1824 (100%)**

Project Affected Families (PAFs) :-

Information given in Table 5.25 indicates that out of 568 affected families, about 48.77% are title-holders & 51.23% are non-title holders. During SIA, consultation was held with DFCCIL officers and villagers. It emerged that many displaced families are presently settled on Govt. land (Abadi or user etc.) and classified as 'squatters' (89%). While comparing land ownership with land plan & type, it has been observed these settlements are very old. The Entitlement Matrix has specific R&R provisions for such affected families.

Table 5.25: Project Affected Families (PAFs)

Section	**Titleholders**		**Non Titleholders (Squatters, Tenant & Kiosks)**				**Total**
	Resi	**Comm**	**Resi**	**Comm**	**Tenants**	**Kiosks**	
CPM Mughalsarai	0	0	4 (30.77%)	2	0	7 (53.85%)	**13 (100.00%)**
CPM Allahabad (E)	120 (45.98%)	5 (1.92%)	76 (29.12%)	48 (18.38%)	0	12 (4.60%)	**261 (100.00%)**
CPM Allahabad (W)	136 (48.75%)	9 (3.22%)	79 (28.32%)	34 (12.18%)	15 (5.38%)	6 (2.15%)	**279 (100.00%)**
CPM Kanpur	8 (53.33%)	0	7 (46.67%)	0	0	0	**15 (100.00%)**
Total (MGS-BAU)	264 (46.48%)	14 (2.46%)	166 (29.23%)	84 (14.79%)	15 (2.64%)	25 (4.40%)	**568 (100.00%)**

Displacement due to the Project:-

Information given in Table 5.26 indicates the families that will be displaced because of this project. The displacement is higher in Allahabad (East-236 and West -234). Though overall impact of the project is more on the land than on structures, it can't be ignored. The impact on residential structures is more compared to commercial structures covering both title holders & non-title holders. Lowest impact is noticed on structures of tenants (11 number) and kiosks (25 number) along DFC alignment. Most structures getting affected are pucca. Out of total 506 structures, 357 are pucca (71%), 87 are semi-pucca (17%) and 62 are kuccha type (12%).

Table 5.26: Project Displaced Families

Section	**Titleholders**		**Non Titleholders (Squatters, Tenant & Kiosks)**				**Total**
	Resi	**Comm**	**Resi**	**Comm**	**Tenants**	**Kiosks**	
CPM Mughalsarai	0	0	4 (30.77%)	2 (15.38%)	0	7 (53.85%)	**13 (100%)**
CPM Allahabad (E)	95 (40.25%)	5 (2.12%)	76 (32.20%)	48 (20.34%)	0	12 (5.09%)	**236 (100%)**
CPM Allahabad (W)	106	7	79	34	15	6	**247**

Section	Titleholders		Non Titleholders (Squatters, Tenant & Kiosks)				Total
	(42.92%)	(2.83%)	(31.98%)	(13.77%)	(6.07%)	(2.43%)	**(100%)**
CPM Kanpur	4 (36.36%)	0	7 (63.64%)	0	0	0	**11 (100%)**
Total (MGS-BAU)	205 (40.43%)	12 (2.37%)	166 (32.74%)	84 (16.57%)	15 (2.96%)	25 (4.93%)	**507 (100%)**

Impact on Community structures:-

SIA study identified 55 CPRs within the proposed ROW. Efforts were made to minimize the impact on these CPRs by reducing Corridor of impact (COI) to minimum (about 17 m). As a result, number of CPRs need relocation will be reduced (Table 5.27). Consultation with the community suggests that these facilities are used by people very often. Therefore these facilities will be replaced in consultation with the communities who are using it, irrespective of ownership of these CPRs. Enhancement of the CPRs along with environmental measures such as plantation of trees is being planned under EIA & EMP. Wherever required suitable boundary wall will be constructed to mitigate noise and vibration impact. All these community properties will be enhanced in consultation with community.

Table 5.27: Affected Community Properties Resources (CPRs)

Section	Temple	Mosque	Hospital	School	Others/Burial ground/Samadhi	Total
CPM Mughalsarai	0	0	0	0	1	1
CPM Allahabad (E)	11	2	0	3	7	23
CPM Allahabad (W)	8	1	3	1	14	27
CPM Kanpur	3	0	0	1	0	4
Total (MGS-BAU)	**22**	**3**	**3**	**5**	**22**	**55**

Above project imp[act affected CPRs will be relocated.

Socio-Economic Analysis of the PAFs and PAPs : Age-Sex Composition:-

In the families loosing agricultural land in the project, there are 35627 males (55.69%) and 28341 females (44.31%). It is noticed from Table 5.28 that the sex ratio for this stretch is female population is 795 against 1000 males, hence it is low..

Table 5.28: Age-Sex Composition

Type of Impact	0-6		6-15		15-18		18-45		45-59		59-Above		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Agricultu-ral land	691	526	2906	2060	3478	2477	19171	15703	3838	3323	3673	2948	33757	27037
Structure	122	106	325	210	173	117	899	631	213	133	138	107	1870	1304
Total	813	632	3231	2270	3651	2594	20070	16334	4051	3456	3811	3055	35627	28341

Source: Census Survey, 2011

Annual Income Patterns of the PAFs:-

Information collected during Census survey on income level of each PAFs indicates that PAFs are economically weak. It can be seen from Table 5.29 that out of total 13034 PAFs, about 43.6 % of total PAFs are earning less than 50,000. PAFs earning less than Rs 25,000 have been considered as people 'Below the Poverty line (BPL) which is about 15.19% of total PAFs.

Table 5.29: Total Annual Income

Section	Income Group (Rs.)				Total
	0 – 25000	25000 – 50000	50000 - 1 Lakh	above 1 Lakh	
CPM Mughalsarai	62	74	62	102	**300**
CPM Allahabad (E)	994	1544	1235	2196	**5969**
CPM Allahabad (W)	751	1769	1274	1913	**5707**
CPM Kanpur	173	314	317	254	**1058**
Total (MGS-BAU)	**1980**	**3701**	**2888**	**4465**	**13034**

Social Status of the Project Affected Families:-

Table 5.30 presents information about social status of PAFS. Out of total 13034 PAFs, about 33.21% are general and 42.42% are OBC. About 24.37% are schedule caste. SC population is significant because 2 out of 6 districts of the project area have high % of SC population. Project affected people do not include any tribal community.

Table-5.30: Social Status of the PAFS

Section	General	Schedule caste	Schedule Tribe	Other backward caste	Total
CPM Mughalsarai	143 (47.67%)	35 (11.67%)	0	122 (40.66%)	**300 (100%)**
CPM Allahabad (E)	2047 (34.29%)	1488 (24.93%)	0	2434 (40.78%)	**5969 (100%)**
CPM Allahabad (W)	1864 (32.66%)	1452 (25.44%)	0	2391 (41.90%)	**5707 (100%)**
CPM Kanpur	274 (25.90%)	202 (19.09%)	0	582 (55.01%)	**1058 (100%)**
Total (MGS-BAU)	**4328 (33.21%)**	**3177 (24.37%)**	**0**	**5529 (42.42%)**	**13034 (100%)**

Furthermore, the SIA established the proposed project will not impact any tribal groups in the project area. Moreover, the assessment found that there are no tribal specific habitations along the proposed DFC corridor. Therefore, this project triggers the Bank's operational policy (OP 4.12) on involuntary resettlement and not OP 4.10 on Indigenous Peoples (referred as tribal in Indian context).

Vulnerability

Table 5.31 presents number of PAPs under vulnerable categories as per NRRP 2007. Among the PAPs, there are 20714 vulnerable persons Out of these, 75.46% are people above the age of 50 years. Other significant categories are widows (11.94%) and unmarried girls above the age of 18 years (7.59%). This vulnerable PAPs will be supported by the DFC project within purview of Entitlement Matrix. They are entitled

for one time additional financial assistance equivalent to 300 300 days of minimum wages as per Entitlement Matrix.

Table-5.31: Vulnerability Status of the PAPs

Section	Project Affected Persons					Total
	Disabled / Orphan	Widow	Un Married Girls above 18 years	Abandoned Women	Persons above 50 years	
CPM Mughalsarai	31 (11.52%)	34 (12.64%)	44 (16.36%)	0	160 (59.48%)	269 (100%)
CPM Allahabad (E)	475 (5.17%)	1063 (11.58%)	761 (8.29%)	0	6883 (74.96%)	9182 (100%)
CPM Allahabad (W)	391 (6.93%)	690 (12.23%)	520 (9.22%)	0	4042 (71.63%)	5643 (100%)
CPM Kanpur	142 (2.53%)	686 (12.21%)	247 (4.39%)	0	4545 (80.87%)	5620 (100%)
Total (MGS-BAU)	1039 (5.02%)	2473 (11.94%)	1572 (7.59%)	0	15630 (75.46%)	20714 (100%)

Taking into account the socio-economic vulnerabilities of the PAFs, specific provisions in form of additional assistance have been incorporated in the RAP to ensure that they are not marginalized in the process of development. However, the actual number of these vulnerable people eligible for R&R support will be scrutinized by the implementing agencies. The NRRP 2007 defines vulnerable persons as 'disabled, destitute, orphans, widows, unmarried girls, abandoned women, persons above 50 yrs of age, who are not provided or cannot immediately be provided with alternate livelihood, and who are not otherwise covered as a part of family. The information provided in the above table shall be reconfirmed and beneficiaries will be identified for provision of R&R assistance through NGOs.

Education Status:-

Amongst the PAPs, there is a high degree of illiteracy in the project area. About one-fourth (22.48 %) PAPs are illiterate. Another 19.92 % of the PAPs are basic literates. About 17.42% of the total PAPs have studied up to the 8th standard school level (Table 5.32). Amongst PAPs, there are 6648 (10.39%) graduates in the area. Less number of professionally educated PAPs points to the lower level of opportunities in the project area. Since about 25% of the PAPs are illiterate, special efforts and attention would be required for communicating awareness about social issues resettlement and rehabilitation options, compensation and project related decisions.

Table-5.32: Education Status of PAPs

Section	Education level						Total
	Un Educated	Educated	8th	10th	Inter mediate	Graduate	
CPM Mughalsarai	592 (30.22%)	285 (14.55%)	207 (10.57%)	283 (14.45%)	307 (15.66%)	285 (14.55%)	1959 (100%)
CPM Allahabad (E)	6934 (24.31%)	5795 (20.31%)	5223 (18.31%)	3837 (13.45%)	3622 (12.69%)	3118 (10.93%)	28529 (100%)
CPM Allahabad (W)	6843 (24.86%)	5548 (20.16%)	5064 (18.40%)	3685 (13.39%)	3592 (13.05%)	2789 (10.14%)	27521 (100%)
CPM Kanpur	1510 (25.34%)	1109 (18.62%)	648 (10.87%)	1273 (21.36%)	963 (16.16%)	456 (7.65%)	5959 (100%)
Total	**15879 (24.82%)**	**12737 (19.92%)**	**11142 (17.42%)**	**9078 (14.19%)**	**8484 (13.26%)**	**6648 (10.39%)**	**63968 (100%)**

Occupational Background :-

Population or families in the project affected area are predominantly agriculturists. Approx. 32.56% of PAPs i.e., 20831 are house-wives engaged in some or other kind of domestic activities. This follos by students (20.9%). Among non-earners, students are 22.34%, house-wives 32.56%, and unemployed 6.18%. These categories make up for 61% of total number of PAPs.. Others are 19.41% cultivators, 12.23% labourers, 1.75% workers, 4.01% in jobs and 1.52% in business.

Table-5.33: Occupation Profile of PAPs

Section	Occupation profile(PAPs)								Total PAPs
	Service	**Business**	**Cultivator**	**Students**	**House Wife**	**Labour**	**Un-Employed**	**Workers**	
CPM Mughalsarai	63 (3.22%)	29 (1.48%)	352 (17.97%)	460 (23.48%)	650 (33.18%)	241 (12.30%)	124 (6.33%)	40 (2.04%)	**1959 (100%)**
CPM Allahabad (E)	948 (3.32%)	447 (1.57%)	5132 (17.99%)	6758 (23.69%)	9469 (33.19%)	3449 (12.09%)	1762 (6.18%)	564 (1.97%)	**28529 (100%)**
CPM Allahabad (W)	1241 (4.51%)	386 (1.40%)	5805 (21.09%)	5928 (21.54%)	8573 (31.15%)	3266 (11.88%)	1853 (6.73%)	469 (1.70%)	**27521 (100%)**
CPM Kanpur	312 (5.24%)	113 (1.90%)	1125 (18.88%)	1145 (19.21%)	2139 (35.90%)	870 (14.60%)	211 (3.54%)	44 (0.74%)	**5959 (100%)**
Total	**2564 (4.01%)**	**975 (1.52%)**	**12414 (19.41%)**	**14291 (22.34%)**	**20831 (32.56%)**	**7826 (12.23%)**	**3950 (6.18%)**	**1117 (1.75%)**	**63968 (100%)**

5.15 SUMMARY OF SENSITIVE RECEPTORS

The summary of sensitive receptors (10 Km Length as per strip Plan) including the number of trees within ROW given in chapter 4.

5.16 SUMMARY OF BASELINE DATA AND ENVIRONMENTAL, ECOLOGICAL AND SOCIAL SENSITIVITY OF THE PROJECT AREA

The primary and secondary data have been collected during field survey for preparing baseline environmental profile. The following are the sensitivity of the project based on the environmental, ecological and social point of view:-

1. The noise and vibration level due to the proposed track, specifically in detour location where the present levels are well within the limits.
2. Alignment at Fathepur detour is passing through a degree college (RituRaj Degree College) at Asti Bajiapti village (Km 945) as college is going to be directly impacted , this college has come up after notification of land acquisition under section 20A and award for the same has also been declared by the competent authority. The legal case has been filed in Hon'ble High Court and case is under process. Detour alignment may be shifted if found technically feasible.
3. Acquisition of fertile agriculture land in detour section.
4. Acquisition of residential structure in villages along the alignment.
5. Impact on accessibility due to the division of agriculture land in detour section.
6. Cutting of approximately 17000 nos. of trees, which fall within RoW, however impact on ecology of the area is not significant considering these are spread in approximate 400 km length.
7. Census survey identifies approximately 13034 PAFs and 63968 PAPs. Amongst PAFs PAFs, 329 have become landless, 674 Marginal or 821 small after acquisition of land by the project. Even though these numbers appear to be high, the actual impact in terms of displacement and loss of livelihood is low. Out of total

1400 ha. of land proposed to be acquired about 89% are private land) is required for the construction of the project. Average acquisition per family works out to be 1074 Sqm (0.10 Ha).

8. Number of displaced families is approximately 507. Approximately 1.29 families per kilometer are getting displaced for this project, which is fairly low.
9. Some squatters have been occupying government land(mainly Abadi/ 'Usar') for many years, however they do not possess patta land,
10. DFCCIL has further reduced land width from 40 meter to 17 meter in some built-up stretches resulting in minimizing displacement.

CHAPTER-6: ANALYSIS OF ALTERNATIVES

6.1 BACKGROUND AND APPROACH

The present 391.21 Km long alignment from Bhaupur to Mugalsarai is an important section of Delhi Howrah double line electrified main trunk route of Northern Central Railway connecting the Northern, Central and Eastern regions of the country. This section starts at Bhaupur station at km 1148.00 and ends at Ganj Khawaja near Mugalsarai at km 667. The entire stretch is in the State of Uttar Pradesh and passes through Kanpur Dehat, Kanpur Sadar, Fathepur, Kaushambi, Allahabad, Mirzapur and Chanduli Districts of Uttar Pradesh. There are number of Major cities and settlements all along the section and to avoid such heavily built up area, eight detours(Kanpur, Fathepur , Khaga ,Sirathu , Bhawari Allahabad, Manda and Mirzapur) have been proposed at these locations. Since the proposed DFC track generally runs on the left side of the IR tracks(Facing Mughalsarai to Bhaupur), proposed detours are not considered for the right side (RHS) of the IR network because of technical constrains and high cost of construction for underpass / flyover to the IR tracks. However, various alternatives have been analysed keeping in view environmental, social and technical parameters. The details of the parallel (261.00 Km) and detour locations (130.21) are given below in the table No. 6.1 and table 6.2. The alignment details covering the parallel and detour locations are presented in Figure 6.1. All the detours are on the left side (w.r.t. railway alignment from Mugalsarai to Bhaupur) (south side) of the railway track .All the parallel alignments are on the left hand side of the existing railway track.

Table-6.1: Locations of the Parallel Alignment

Sl. No.	From	To	P/D	End	start	Length (Km)
1	Kanpur Detour End	Fathepur Detour Start	parallel	1001.00	945.00	56.00
2	Fathepur Detour End	Khaga Detour Start	parallel	938.00	910.00	28.00
3	Khaga Detour End	Sirathu Detour Start	parallel	906.00	884.00	22.00
4	Sirathu Detour End	Bharwari Detour Start	parallel	880.00	867.00	13.00
5	Bharwari Detour End	Allahabad Detour start	parallel	861.00	841.00	20.00
6	Allahabad Detour End	Manda Detour Start	parallel	808.00	772.00	36.00
7.	Manda Detour End	Mirzapur Detour Start	Parallel	769.00	742.00	27.00
8.	Mirzapur Detour End	Section End (Ganj Khawaja near Mugalsarai)	parallel	726.00	667.00	59.00
Total parallel length						**261**

Table-6.2: Locations of the Detour Alignment

Sl. No.	From	To	P/D	Start	End	Detour Length(Km)
1.	Kanpur Detour Start	Kanpur Detour End	detour	1048.00	1001.00	48.41
2.	Fathepur Detour Start	Fathepur Detour End	detour	945.00	938.00	10.31
3.	Khaga Detour Start	Khaga Detour End	detour	910.00	906.00	4.24
4.	Sirathu Detour Start	Sirathu Detour End	detour	884.00	880.00	4.70
5.	Bharwari Detour Start	Bharwari Detour End	detour	867.00	861.00	7.78
6.	Allahabad Detour Start	Allahabad i Detour End	detour	808.00	841.00	29.97
7.	Manda Detour Start	Manda Detour End	detour	772.00	769.00	3.50
8.	Mirzapur Detour Start	Mirzapur detour End	detour	742.00	726.00	21.30
Total detour length						**130.21**

The objective of examining various alternatives was to screen the manifest features of the environment and to assess which of the alternative alignments are likely to have the most significant environmental impacts. Three alternatives i.e. parallel alignment, right side alignment and left side alignment have been considered along the critical area, where environmental and social impacts are significant.

Following activities were undertaken to find out the main environmental features of the above alignments:

- **Study of Project Documents**
  First task was to study the project documents to have the understanding of the project objectives, its main components, boundary etc.
- **Study of World Bank Safeguard Policy**
  World Bank has a detailed policy on environment. The policy for different levels of environmental activities has also been studied in order to take a decision regarding the preferred alignment.
- **Study of Laws and Regulations**
  All Laws and regulations enacted by the Government of India and the State of Uttar Pradesh that are relevant to rail construction and environment were closely examined.
- **Collection of Data from Secondary Sources**
  After understanding and examining the background information regarding the project and its environmental aspects from both, legal and policy standpoints, guidelines for such studies were developed and collection of data from relevant secondary sources data was undertaken. Data has on meteorology, demography, forests and related aspects, land use pattern, topography etc, has been collected.
- **Reconnaissance Survey of the Project Impact Zone**
  A team of environmental experts comprising of environmental scientist and environmental engineers were engaged to carry out a reconnaissance survey of the project road. Important environmental components along the corridor of the impact zones were identified. These included trees, wetlands, forests, public utilities, community resources, cultural sites, accident prone areas, etc. On the basis of background information, legal and policy positions, and other information, a checklist was prepared to conduct a screening exercise. In order to obtain the opinion of all stakeholders, discussions were also conducted with the local residents that may be affected by the project.
- **Analysis of Data and Screening Exercise**

The data collected were then compiled to develop the environmental scenario of the project area and to emphasize the sensitive components within that.
Project impacts on different environmental components have been identified through a scientific and valid procedure.

Following is a list of important ecosystem components that were identified as the valued ecosystem in the project route during the extensive field survey.

i. Plantation
ii. Disturbance of flora having fruit bearing and fodder capability;
iii. Disturbance of flora in identified protected/reserved forest;
iv. Disturbance to existing trees in the railway line.
v. Land Use
vi. Change in Land use due to conversion of agriculture / commercial and forest land into railway line.
vii. Impact on livelihood of the people due to change in land use.
viii. Agriculture Land
ix. Acquisition of agriculture land for widening;
x. Requirement of huge amount of soil for the construction of high embankments specially RUBs, and bridges and other major and minor bridges.
xi. Disturbance to Existing Hillocks if any
xii. The geometric improvement and widening needs to cut and disturb existing hilly area.
xiii. Trees within the corridor of Impact
xiv. Change in natural drainage system at locations of high embankments.
xv. Ground water quality and quantity;
xvi. Surface water quality and quantity;
xvii. Community Ponds; and
xviii. Irrigation canal, irrigation pond / reservoir.
xix. Religious and Cultural Structures
xx. Temples and Mosques;
xxi. Irrigation Units; and
xxii. Water bodies.

6.2 ANALYSIS OF ALTERNATIVES

The various alternatives for each detour considering parallel, right & left alignments taking into consideration of overall possibility are discussed below:-

6.2.1 Kanpur Detour

Kanpur is a major industrial city of Uttar Pradesh with heavily ribbon development along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.3

.Table-6.3: Issues related to Kanpur Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15-20 meter additional width is required	Proposed width is 60 meter	Proposed width is 60 meter	The detour is recommended on left side of the existing track.
2.	Acquisition of structures	About 2500 structures including commercial and industrial	Passing through agriculture land and crossing water bodies mainly canal and its distributaries ,three	Passing through Kanpur city again and river Ganga twice ,length will be long and more	Appropriate measures to mitigate noise and vibration shall be taken along

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
		units and 700 families will get affected.	religious structures get affected. Few structure are affected	structure get affected	the sensitive receptors. Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
3.	Issues of ROB	Construction of ROB at LC gate will displace about 200 houses	No such displacement	No such displacement, however crossing the existing tracks require more ROBs.	
4.	Technical constrains	Need modification of yard	Need additional bridges along the water bodies mainly canals., HT lines shall have to be shifted two times adding to the cost ,however major bridges are not required as alignment does not crossing Ganga and Arind rivers	Need more underpass	
5.	Public Opinion	Not favourable	Favourable as population displacement is minimum , however land losers are very apprehensive and asked more compensation	Not favourable	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors as these are all along the tracks	Impact are less as less structures are impacted, however introduction of detour will increase the noise levels ,	More impacts as industrial area on this side have already more pollution levels.	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as impact is less and land is available	Suitable as sufficient land is available along the track , however detour require more land due to increase in length.	
8.	Ecological impact such as tree cutting	Significant	Not significant ,and tree cutting is less in comparison to other option.	Significant as major bridge on river ganga cause impacts on aquatic ecology during construction.	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Less but houses are closed to the proposed line may have some vibration and noise impacts	Impact on receptors in the villages.	

6.2.2 Fathepur Detour

Fathepur is the important district of Uttar Pradesh and having ribbon commercial development along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.4

Table-6.4: Issues related to Fathepur Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15 meter additional width is required	Proposed width is 45-55 meter	Proposed width is 60 meter	The detour is recommended on left side of the existing track. However, alignment may be shifted to avoid displacement of under construction/running degree college near chainage 945 if found technically feasible., this college has come up after notification of land acquisition under section 20A and award for the same has also been declared by the competent authority. The legal case has been filed in Hon'ble High Court and case is under process, Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors. Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
2.	Acquisition of structures	About 150 structures and 50 families will be displaced	Passing through agriculture land and crossing Malaka and Kandhar minor canals , power line . ,part of rice/flour mills get impacted and few structure require shifting.	Passing through Fathepur town as crosses minimum ten roads, needs more underpasses.	
3.	Issues of ROB	RoB is required	No issue	Railway Flyover is required to cross the existing tracks.	
4.	Technical constrains	Need modification of yard	Need additional bridges along the water bodies and changing the alignment, HT lines shall have to be shifted two times .	Need more underpasses at road crossing locations	
5.	Public Opinion	Not favourable	Land losers are very apprehensive and need good communication strategies and ask employment and more compensation.	Not favourable	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors along the track	Impact on the surrounding villages due to construction of new track	More impacts as city limit extended on that side.	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available	Suitable as sufficient land is available	
8.	Ecological impact such as tree cutting	Significant as large no. of tree need to be cut	Not significant ,and tree cutting is less in comparison to other option.	significant , more no. of tree as long length of detour is required	
9.	Other impacts	Remaining houses will have problem of vibration and noise	Impact on receptors in the villages	Impact on receptors in the villages	

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
		pollution			

6.2.3 Khaga Detour

Khaga is a town along the existing track and numbers of commercial establishments as well as religious structure are existing along the railway track. Issues related to the detour as per various options are discussed in Table 6.5

Table 6.5
Issues related to Khaga Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15 meter additional width is required	Proposed width is 45-53 meter	Proposed width is 60 meter	The detour is recommended on left side of the existing track.. Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors. Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
2.	Acquisition of structures	About 35 structures and 30 families will be displaced	Passing through agriculture land and minimum structure are affected	Passing through agricultural and crossing highways	
3.	Issues of ROB	Two RoBs are required	Two RuB are involved	Rail flyover is required to cross the existing tracks.	
4.	Technical constrains	Need modification of yard	Only one minor bridge is required over Kanwar distributary	Need underpasses/RuBs at locations as highways crossing.	
5.	Public Opinion	Not favourable	Favourable and impacted persons seeks for compensation. ,	Not favourable as Khaga town on that site.	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors	Impact on the surrounding villages due to construction of new track	Impact are more due to highways crossing and settlements	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available	Suitable as sufficient land is available	
8.	Ecological impact such as tree cutting	Significant	Not significant ,and tree cutting is less in comparison to other option.	Not significant	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Impact on receptors in the villages	Less but houses are closed to the proposed line may have some vibration and noise impacts	

6.2.4 Sirathu Detour

Sirthu is a small town having number of commercial and residential of all along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.6.

Table-6.6: Issues related to Sirathu Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15 meter additional width is required	Proposed width is 43-57 meter	Proposed width is 60 meter	The detour is recommended on left side of the existing track. Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors. Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
2.	Acquisition of structures	About 40 structures and 45 families will be displaced	Passing through agriculture land and HT line ,less structure.	Passing through agricultural settlements	
3.	Issues of ROB	RoB is required and major constraint due to congested stratch.	No issue	Rail Flyover is required to cross the existing tracks.	
4.	Technical constrains	Need modification of yard	Need additional bridges along the water bodies , HT line shall have to be shifted at one location adding to the cost	Need underpasses at locations and more impact to make Rail flyover and RoB over national highways(NH-2)	
5.	Public Opinion	Not favourable	Land losers are very apprehensive and need good communication strategies	Not Favourable	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors	Impact on the surrounding villages due to construction of new track	Impact are more due to existing national highways (NH-2)	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available	Suitable as sufficient land is available	
8.	Ecological impact such as tree cutting	More significant	Not significant ,and tree cutting is less in comparison to other option.	more significant as plantation along the NH may get impacted	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Impact on receptors in the villages	More due to houses are closed to the proposed line may have noise impacts	

6.2.5 Bharwari Detour

Bharwari is having settlements and religious structure all along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.7

Table-6.7: Issues related to Bharwari Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15 meter additional width is required	Proposed width is 43-55 meter	Proposed width is 60 meter	The detour is recommended on left side of the existing track. . Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors. Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
2.	Acquisition of structures	About 120 structures and 160 families will be displaced	Passing through agriculture land ,HT line ,few structure	Passing through agricultural and water bodies	
3.	Issues of ROB	ROB is involved	No such issue	RFO is required to cross the existing tracks.	
4.	Technical constrains	Need modification of yard and railway station	underpasses at road crossing	Need underpasses at no of locations	
5.	Public Opinion	Not favourable	Land losers are very apprehensive and need good communication strategies ,ask for employment and good compensation	Not favourable.	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors	Impact on the surrounding villages due to construction of new track	Impact on the surrounding villages due to construction of new track	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available .	Suitable as sufficient land is available .	
8.	Ecological impact such as tree cutting	Significant	Not significant ,and tree cutting is less in comparison to other option.	significant as length will be more on this side.	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Impact on receptors in the villages	Impact on receptors in the villages	

6.2.6 Allahabad Detour

Allahabad is one of the important city of Uttar Pradesh famous for Sangam and having historical importance with heavily ribbon development along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.8

.Table-6.8: Issues related to Allahabad Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15-20 meter additional width is required	Proposed width is 43-101 meter	Proposed width is 60 meter	The detour is recommended on left side of the existing track. Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors. Special attention shall be given on farmers who will lose fertile
2.	Acquisition of structures	Large no. of family and structure get affected	Passing through agriculture land and crossing water bodies , HT lines ,less structure	Passing through agricultural land and Settlements of suburban areas of Allahabad.	
3.	Issues of ROB	Construction of ROB at LC gate will	No issue	RFO is required to cross the existing tracks.	

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
		displace about 1500 houses			agriculture land for income restoration
4.	Technical constrains	Need modification of yards at Allahabad and Chhoki , new bridge close to the existing bridge	Major bridge on River Yamuna	Need underpasses at locations , major bridge on Ganga ,Space constraints	
5.	Public Opinion	Not favourable as large no of family and their livelihood get impacted.	Favourable as population displacement is minimum , .	Not favourable due to River Ganga and settlements	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors	Impact on the surrounding villages due to construction of new track	Impact are more due to river Ganga and dense settlements	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available	Suitable as sufficient land is available	
8.	Ecological impact such as tree cutting	Significant	Not significant ,and tree cutting is less in comparison to other option.	significant as river Ganga on that site and tree density is very high in that area.	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Impact on receptors in the villages , a hospital nr Km 839(projected on current chainage) get partial affected.	houses closed to the proposed line may have noise impacts	

6.2.7 Manda Detour

Manda is a town having heavy settlements along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.9

Table-6.9: Issues related to Manda Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15 meter additional width is required	Proposed width is 60 meter	Proposed width is 60 meter	The detour is recommended on right side of the existing track..
2.	Acquisition of structures	About 55 structures and 70 families will be displaced	Passing through agriculture land, less structures	Passing through agricultural and river Ganga	Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors.
3.	Issues of ROB	No issue	No issue	ROBs are required to cross the existing tracks.	
4.	Technical constrains	Need modification of yard	No constraint	Need underpasses at locations and major bridge at river Ganga	Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
5.	Public Opinion	Not favourable	Favourable	Not favourable as river Ganga close to that side and	

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
				heavy settlements	
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors	Impact on the surrounding villages due to construction of new track	Major issue due to proximity to river Ganga and more tree density	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available	Not Suitable as sufficient land is not available	
8.	Ecological impact such as tree cutting	Significant	Not significant, and tree cutting is less in comparison to other option.	significant	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Impact on receptors in the villages	Major impact due to River Ganga	

6.2.8 Mirzapur Detour

Mirzapur is an important city of Uttar Pradesh famous for carpet industries with heavily ribbon development along the existing railway track. Issues related to the detour as per various options are discussed in Table 6.10

Table-6.10: Issues related to Mirzapur Detour

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
1.	Land width	15 meter additional width is required	Proposed width is 45 to 100 meter . In Mirzapur detour one Stocking Yard ,one crossing station and one TSS are proposed which is not feasible in parallel alignment and require heavy displacement of existing structures as land width requirement at this area is up to 235 meter	Proposed width is 45 to 110 meter	The detour is recommended on left side of the existing track. Appropriate measures to mitigate noise and vibration shall be taken along the sensitive receptors. Special attention shall be given on farmers who will lose fertile agriculture land for income restoration
2.	Acquisition of structures	About 200 structures and 250 families will be displaced	Passing through agriculture land and crossing water bodies such as Madho nala, canal, Few Structure	Passing through agricultural and river ganga	
3.	Issues of ROB	No issue	No such displacement	ROBs are required to cross the existing tracks.	
4.	Technical constrains	Need modification of yard	Need additional bridges along the water bodies	Need underpasses at locations and major bridge on Ganga	
5.	Public Opinion	Not favourable	Land losers are very apprehensive and need good communication strategies	Not favourable	

Sl. No.	Issues	Parallel along existing IR track	On left side of existing IR track	On right side of existing IR track	Recommendation
6.	Environmental issues covering noise, vibration and impact on sensitive receptors	Noise and vibration impact on residential and sensitive receptors	Impact on the surrounding villages due to construction of new track	Major impacts due to proximity with Ganga	
7.	Site suitability for various facilities such as freight stations, electric substation etc.	Not suitable due to congestion along the track	Suitable as sufficient land is available .	Not Suitable as sufficient land is not available	
8.	Ecological impact such as tree cutting	Significant	Not significant ,and tree cutting is less in comparison to other option.	significant	
9.	Other impacts	Remaining houses will have problem of vibration and noise pollution	Impact on receptors in the villages.	Major impact due to Ganga.	

The Location of detours are shown in **Figure 6.1 to Figure 6.4**

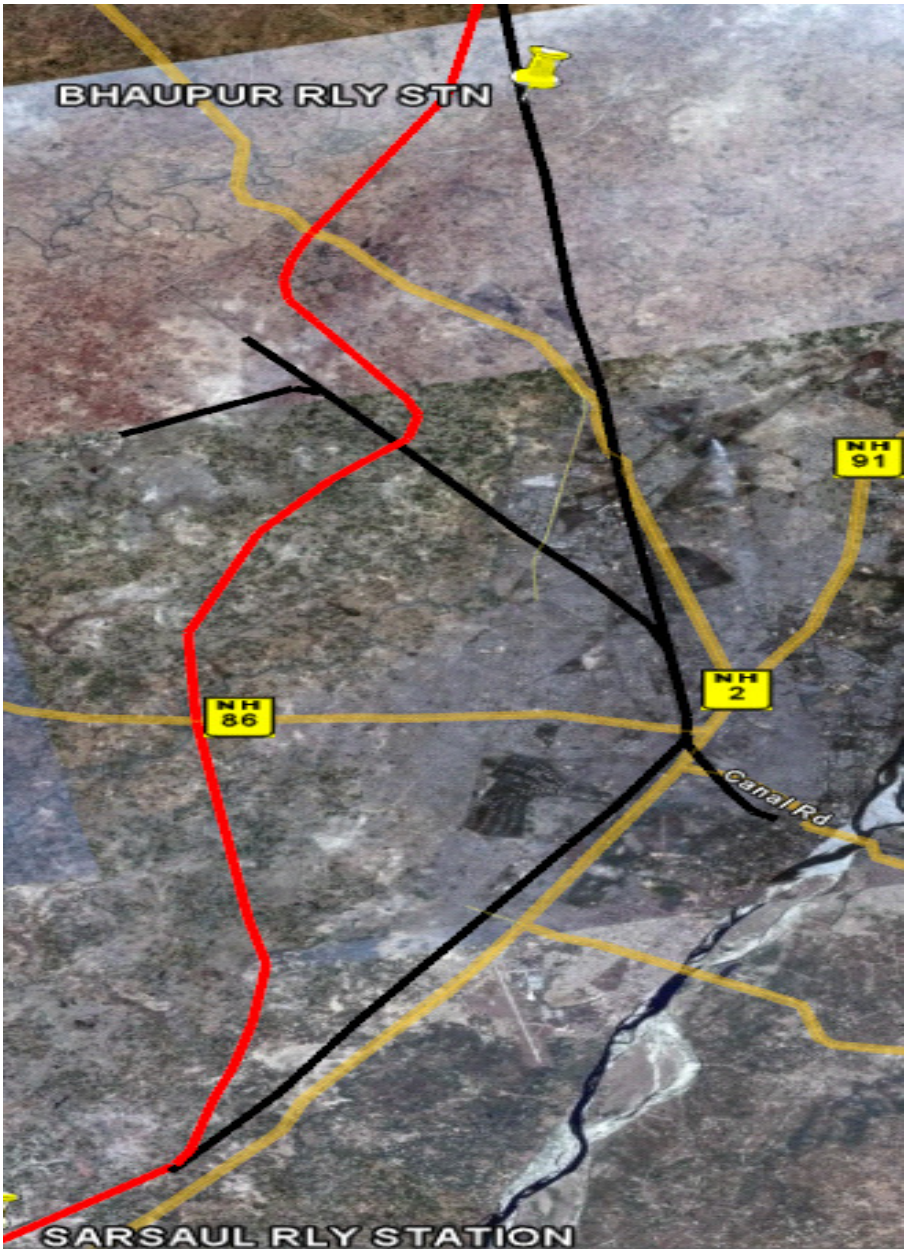


Figure-6.1: Kanpur Detour

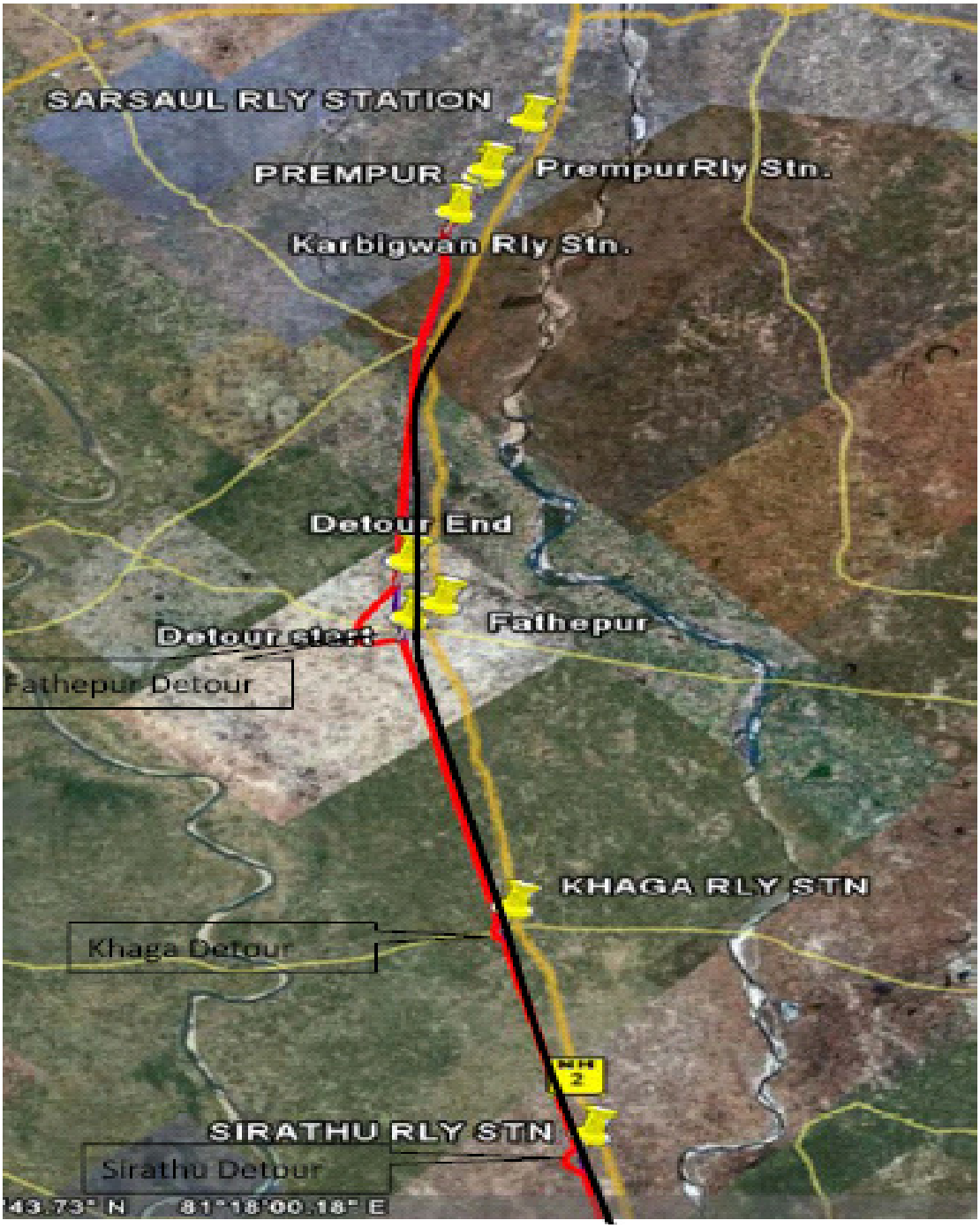


Figure-6.2: Fathepur , Khaga and Sirathu Detours

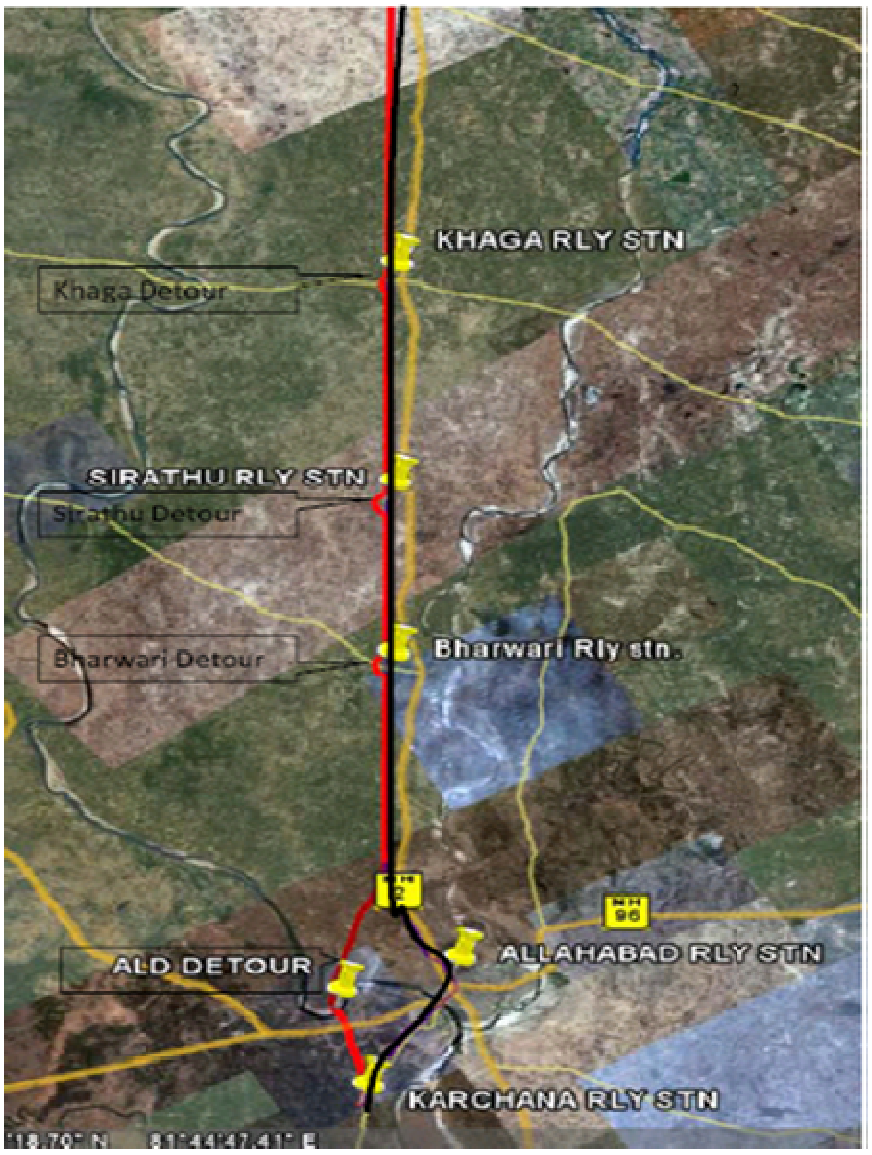


Figure-6.3: Allahabad Detour

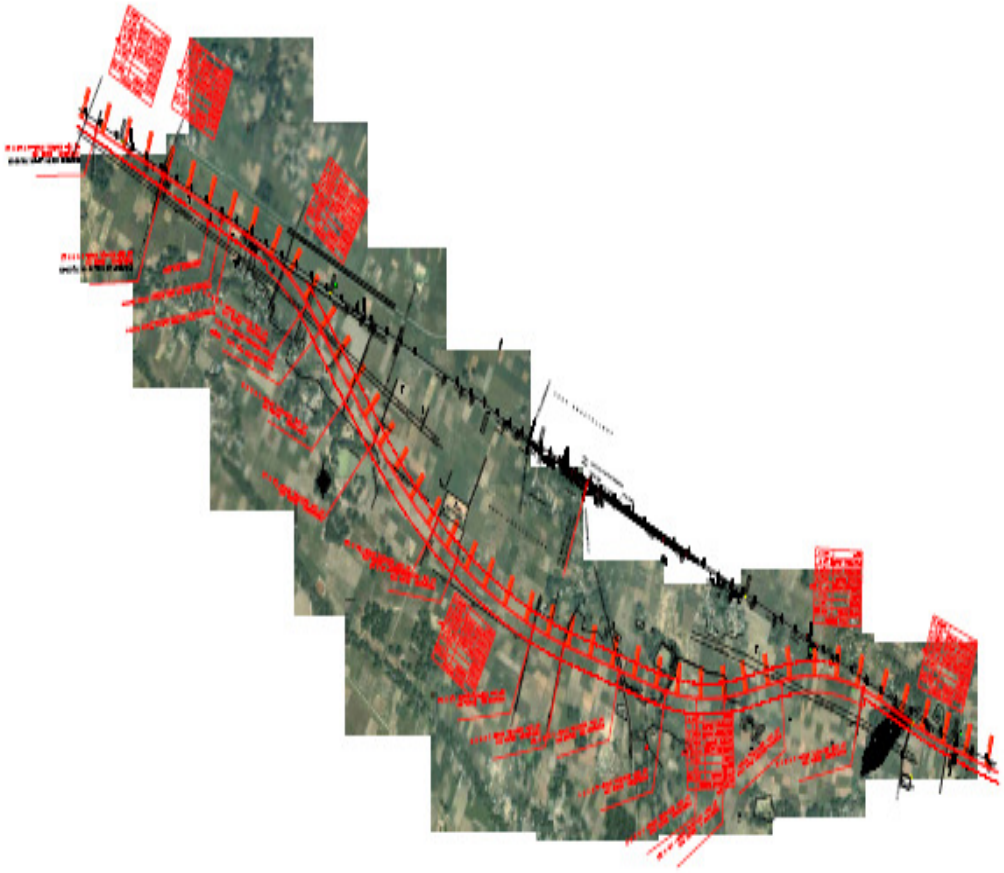


Figure-6.4: Manda Detour

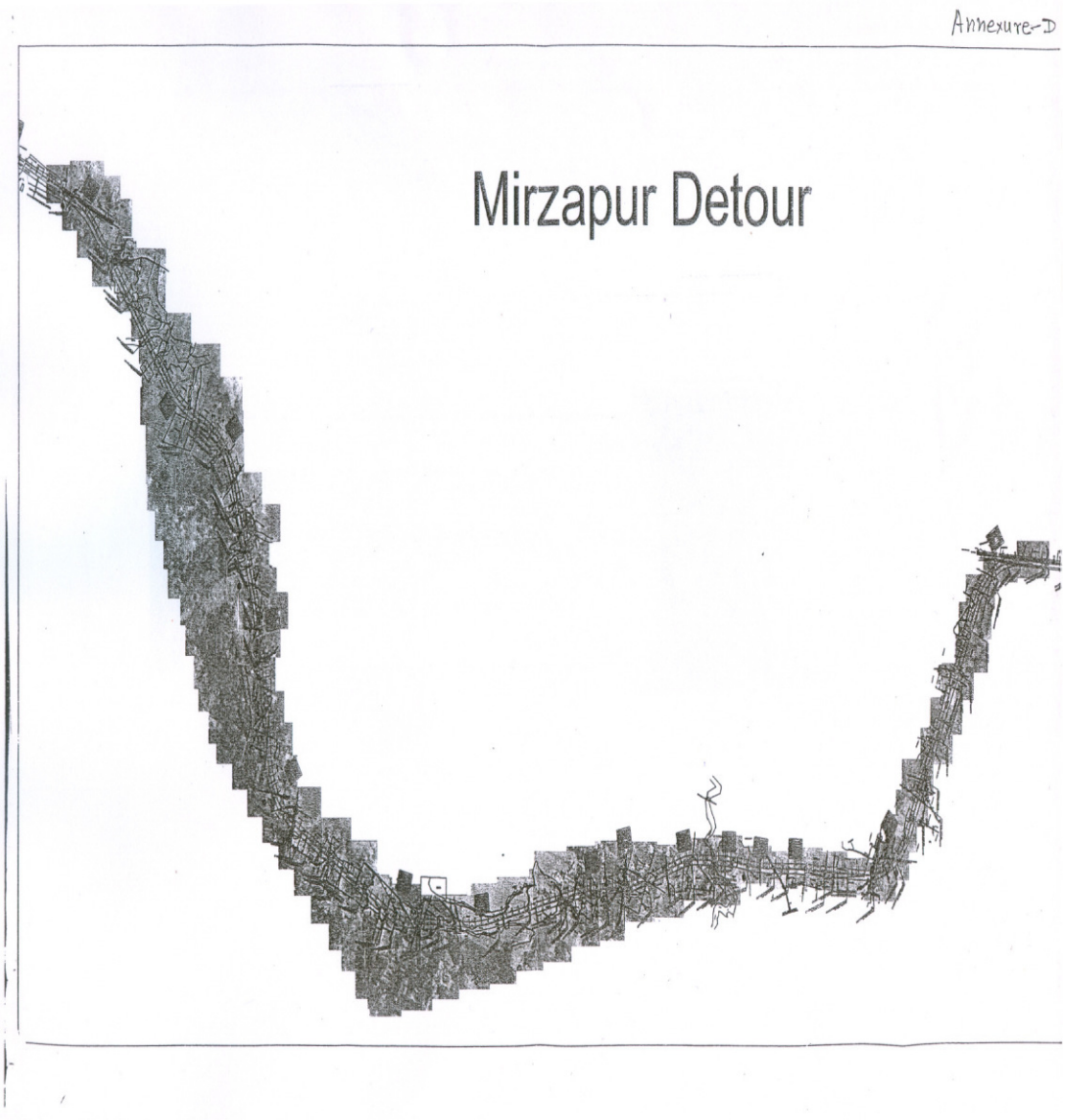


Figure-6.5 : Mirzapur Detour

CHAPTER-7: ENVIRONMENT IMPACT ASSESSMENT

7.1 INTRODUCTION

Environmental impact assessment involves prediction of potential impacts by the development of the project on the surrounding area. Based on the baseline environmental status described in earlier section and the proposed project activities, potential impacts have been assessed and predicted, and appropriate mitigation measures are suggested to avoid / reduce / compensate for the potential adverse impacts of the project and enhance its positive impacts. The impacts due to the development of the proposed Dedicated Freight Corridor have been assessed for the planning phase, construction phase and implementation phase.

7.2 IMPACT ASSESSMENT METHODOLOGY

To assess the impact of the project, a simple qualitative method that determines potential existence of impact has been employed. Thereby, the judgments related to the magnitude and importance of the impacts caused by the project is presented. This involves development of Matrix summarizes environmental impacts of the DFC project. The following parameters and scale is adopted for developing matrix. Parameters and scale of impact matrix is presented in Table 7.1.

Table-7.1: Parameter and Scale of Impact Matrix

Parameter (Significance)	**Scale**		**Remarks**	
	No impact	E	Positive (+)	Negative (-)
	Negligible impact	D	Positive (+)	Negative (-)
	Insignificant impact	C	Positive (+)	Negative (-)
	Relatively significant impact	B	Positive (+)	Negative (-)
	Significant impact	A	Positive (+)	Negative (-)

For the assessment of impacts, the following criteria is adopted

Scale A: If National Parks, Wildlife Sanctuaries or any designated natural reserve, protected species of any kind are directly affect.
Scale B: If large areas of forest, grassland, cultivable land or any natural environment for tourism are indirectly affected.
Scale C: If impacts are insignificant
Scale D: If impacts are negligible
Scale E: No impacts or not applicable to assessment.

Section below assesses the impacts following the above method.

7.3 DESCRIPTION OF EXPECTED IMPACTS

The description of impacts on natural resources is as follows:-

7.3.1 Impact on Topography and Geology

1) Planning Phase
   The project has been planned to minimize the impacts on topography by avoiding sensitive topographic features such as tunnels, rivers/hills etc. However, impacts due to high embankments are expected due to the project.
2) Construction Phase

- During construction phase changes in topography are envisaged due to the clearing of land, felling of trees, cutting and filling, and due to the construction of structures.

- Construction of railway embankment is also likely to cause aesthetic changes in the landscape. However, suitable landscaping and plantation activities, slope protection activities are envisaged to minimize the aesthetic impacts.
- Filling and cutting of land will be required in the detour stretches, where the track traverses through undulating topography. However, changes will be limited within RoW of the track hence overall impact will be localized.
- The project involves 30 million cubic meter earth work and 2 million cubic meter of ballast. These quantities will be required all along the project alignment of approximately 400 km. The material from borrow areas and quarries shall be obtained after getting the environmental clearances as per MoEF procedure. The borrow areas are site specific and will be selected after material testing by contractor. The environmental clearances shall be obtained for the same as per MoEF circular dated May 18, 2012. The borrow areas shall be closed as per the EC compliance requirements and as defined in EMP.
- No impact is envisaged on geology due to the project as borrow area shall not exceed the depth of 1.5m.

3) Operation Phase

- Since the alignment runs on high embankment, issues of access of local communities and storm water drainage are anticipated during the operation phase of the project. These impacts are minimized by providing adequate ROBs, RUBs, CD Works etc.

7.3.2 Impact on Soil

1) Planning Phase

- The high embankment in water bodies are avoided during the planning stage to minimize the soil erosion.

2) Construction Phase

- Clearing of land, cutting of trees, excavation of borrow areas are likely to trigger soil erosion. Movement of vehicle / machinery / equipments and working force is also likely to cause soil erosion.
- The detour section is likely to traverse through agricultural and forested areas which will require clearing of the land.
- Soil in the agricultural regions is fertile and consists of alluvial deposits. Thus, loss of fertile soil is likely to occur.
- Borrow areas will be required for the project. Most portion of the DFC is embankment. The borrow areas are likely to cause soil erosion and affect agricultural areas. Appropriate measures for borrow area management are suggested in Chapter-8.
- Pits can be formed due borrowing, which may cause harm to local residents in the vicinity.
- Debris generated due to dismantling of structures
- Oil spills from the operation of the diesel pumps and diesel storage, during transportation and transfer, parking places and diesel generator sets.
- Operation of the emulsion sprayer and laying of hot mix in service road
- Operation of the residential facilities for the labour and officers
- Storage and stock yards of bitumen and emulsion

3) Operation Phase

- Due to change in land use, impact is envisaged on soil during operation phase. However, the impacts are within the RoW.

7.3.3 Impact on Air Quality

1) Planning Phase

- Currently the cargo is transported by railway and road. It is estimated one litre of fuel can move 24 ton-km of freight by road, 85 ton-km by rail. Therefore, once the DFC is active in the area the consumption of fuel is likely to decrease which may subsequently decrease emission in the area. Moreover, proposed movement of freight trains would be by electricity, therefore, emissions are negligible. By planning the freight corridor, the overall ambient air quality will improve.

2) Construction Phase

- During the construction phase, the air quality is likely to be affected due to generation of dust from construction activities and gaseous emissions from construction vehicles. However, the impact will be localized, short-termed and reversible. The regular monitoring as per environmental monitoring plan shall be done to compare the air quality during baseline monitoring and monitored level during construction. The measures suggested shall be strictly complied to reduce the air pollution level.

3) Operation Phase

It is basically an eco-friendly project. By decreasing dependency on roads it will help to the cause of Green House effect.

- The movement of trucks during loading / unloading may have some impact near freight stations, however, these impacts are localized and concentrated in a specified area only.
- Plantation along the DFC is likely to improve the air quality of the area. During operation of electrified DFC, overall air quality of of the area is bound to improve.

7.3.4 Impact on Ground Water

1) Planning Phase

- No impact is envisaged on ground water in planning phase as water requirement is very nominal.

2) Construction Phase

- During construction phase pollution of groundwater is likely to occur due to seepage and runoff from construction site. However, the impact will be negligible. The total water requirement during construction period will be 3600 cubic meter per kilometre spread over the construction period of about 3 years. The daily requirement per kilometre length during the construction period will be 5000 litre and will be met through the local water supply. There will be no appreciable impact on ground water. The labour camp, which may be established during construction period, should have proper sanitation facilities and discharge of wastewater through soak pit. Hence, no impact is predicted on ground water quality.
- The impact on water resources due to the proposed project is tabulated in Table 7.2.

Table-7.2: Impact on Water Resources due to the Proposed Project

Impacts due to construction	Indicators	Remarks
Loss of water bodies	Area of water bodies affected	Not affected in parallel section
Loss of other water supply sources	Number of well affected	Some tube-well and hand pumps may be shifted / compensated
Alteration of drainage, run-off, flooding	No. of cross drainage channels	May have impact on detour section, sufficient cross drainage structures are proposed
Depletion of ground water recharge	Decrease in water table depth	Not appreciable impact as water requirement is not very high
Use of water supply for construction	Quantum of water used	Not significant

Contamination from fuel and lubricants	Nature and quantum of contaminations	Not significant
Contamination from improper sanitation and waste disposal in construction camp	Area of camp/disposal site and proximity to water bodies/channels	Proper sanitation facilities at construction camp will minimize it

3) Operation Phase

- No impact is envisaged on water quality during the post construction phase as no wastewater will be generated during operation. However, the facilities near the stations may release sewage water which shall be disposed in a properly designed treatment facilities.

7.3.5 Hydrological Condition (Rivers / Canal and Lakes)

1) Planning Phase

- No impact is envisaged on hydrological cycle during planning phase.
- There are two perennial rivers (Yamuna and Tonse) crossing the present alignment.
- The other rivers which cross the alignment are Pandu, Ojhla Khajuri, Balwan, Baharia and Jirgo. Besides these, a number of canals also cross the proposed alignment.

2) Construction Phase

- Drainage and flooding problem during construction due to stockpiling of materials, debris and construction of temporary approach road and yards would have impact of temporary nature.
- Local drainage may be affected during construction phase due to formation of embankments. The slope of project alignment is towards east. During the construction phase the embankment should be designed in such a way that the natural drainage pattern is not disturbed in order to avoid any water logging in the low lying area.
- Drainage pattern of the area may be studied in detail and suitable management plan may be prepared in the detailed design stage.

3) Operation Phase

- Local drainage is likely to be affected due to the formation of Railway Embankment. However, sufficient number of cross drainage structure will minimize the impact.

7.3.6 Flora

1) Planning Phase

- Tree plantation of local species is proposed during planning stage at appropriate places along the alignment.

2) Construction Phase

- The construction activity involving clearing of site, felling of trees, settlement of construction camps and office is likely to affect the flora of the area.
- The proposed alignment may cause cutting of approx.17000 trees. The major species present along the alignment are babool, neem, shisam, papal, mango, bargad, kanji, labhera, ashok, sirsa, guler, jamun, ber, eucalyptus, mahua and bel.
- Acquisition of the forest land and construction activity likely to disturb the habitat. However, the forest land having mainly babool plantation, there will be no specific impact in terms of habitat loss etc.
- The species likely to be affected do not fall under the rare, threatened and/or endangered category, and are common in distribution.

3) Operation Phase

- No impact envisaged on flora during post construction phase. However, development of the green belt is suggested near stations and maintenance of

plantation may be undertaken by Railway Dept. Plantation carried out along the alignment and as compensatory aforestation is likely to enhance the ecological condition of the area.

7.3.7 Fauna

1) Planning Phase
- No impact envisaged on fauna in planning phase as there is no wildlife sanctuary / national park is falling in the proposed alignment.

2) Construction Phase
- Nilgai-Boselaphus tragocamelus is the most common wildlife found in the study area. Construction activity is likely to affect the movement of the animal. However, to compensate, sufficient number of underpasses are provided at the detour section.
- Felling of trees is likely to affect the avifauna. However, the impact is not significant.
- Any construction near water bodies may impact the aquatic life. However no major water bodies are significantly affected due to this project.
- The impact on habitat is likely to be permanent, as the DFC will fragment the area which will restrict the movement of animals on either side.

3) Post Construction Phase
- The movement of freight train is likely to restrict the movement of animal on either side of the track, specifically in the detour section.
- Possibilities of collision of domestic animals with freight train.
- Disturbance of domestic animals due to the noise produced during the passage of trains.

7.3.8 ASI Protected Monuments

No ASI protected monument is going to be affected by the project alignment.

7.3.9 Other Sensitive Structures

A number of sensitive structures will be impacted as described in Table 4.1 Sensitive receptors include school, hospitals and religious structures. Some of the sensitive receptors need to be completely shifted) and some are impacted due to noise and vibration at the time of railway operation Appropriate mitigation measures shall be undertaken as suggested in Chapter-8

7.3.10 Impact due to Construction of Freight Station, Electric-sub Stations, various Signaling Facilities etc.

No major impact is expected because these facilities are planned on barren / a griculture land along the alignment and limited land is required for their construction. However, safety features shall be provided along these structures as per the railway manual and safety norms. Photographs of sites for proposed Junction, Crossing Stations and TSS are given as Figure no. 2.5 to 2.16 in this report.

7.4 ENVIRONMENTAL MATRIX

Based of the potential impacts on natural resources in planning construction and operation phase an impact matrix has been created. The scale of impact is discussed above under individual parameter with mitigation measures. The Environmental Impact Matrix for pre-construction and construction stages are provided in **Table 7.3** and **7.4**.

Most of the impacts are localized and temporary in nature, except those related to noise and vibration during the operation phase.

Table 7.3: Impact Matrix (Pre-Construction & Construction Stage)

No.	Items	Overall Evaluation on the Project	Pre-construction Stage			Construction Stage											
			Surveying of Planned Areas and Sites	Selection of the Project Location and Sites	Land Acquisition and Resettlement	Extraction of Building Materials (stones, aggregates, sand, soil, etc.) at Quarries and Borrow Areas	Earth Moving: Cutting and Filling of the Construction Works	Preparation of Construction Plants, and Warehouses, Work Camps, etc.	Operation of Construction Plants, Machines and Vehicles for Construction Works	Construction Works for railway line and related structures						Localized Employment Opportunities of the Construction Works	Localized Business Opportunities Related to the Construction Works
										(A) Construction Works for Railway Lines and Installation of Related Facilities (signals, rails, etc.)	(B) Construction Works for ICDs and Freight Logistic Parks	(C) Construction Works for Stations (Terminal, Junction and Crossing)	(D) Construction Works for ROBs and RUBs	(E) Construction Works for Bridges	(F) Construction Works for Tunnels		
1	Topography and Geology	C/D	D	D	D	B	B	C	C	B	C	B	B	C	E	E	B
2	Soil	C/D/E	D	D	E	B	B	C	C	C	C	B	D	D	E	E	E
3	Groundwater	D/E	D	D	C	D	D	D	D	D	D	D	D	D	E	E	E
4	Hydrological Condition	D/E	E	E	E	D	E	D	D	D	D	D	D	C	E	C	C
5	Fauna, Flora and Biodiversity	D	D	C	C	C	C	D	C	C	D	D	D	D	E	D	D
6	Protected Areas / sanctuaries	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D
7	Landscape	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D
8	Local Meteorological Conditions	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D
9	Global Warming	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D

Table 7.4 Environmental Impact Matrix (Post Construction Phase)

No.	Project Activities / Items of the Environment Subject to Positive / Negative Changes	Logistic conditions of goods, raw materials, agro & industrial products	Traffic condition of roads	Operation & maintenance of railway lines & related structures	Employment opportunities (whole country / local level)	Freight oriented business opportunities	Passenger oriented business opportunities	Promoting development of surrounding areas	Increase in settlers & vision to the project area
1	Topography and Geology	D	D	D	C	C	C	C	C
2	Soil	D	D	E	E	E	C	C	C
3	Groundwater	D	D	C	D	D	D	D	D
4	Hydrological Condition	C	C	C	D	C	D	D	C
5	Coastal and Marine Environment	E	E	E	E	E	E	E	E
6	Fauna, Flora and Biodiversity	D	C	C	C	C	D	C	C
7	Protected Areas / sanctuaries	D	D	D	D	D	D	D	D
8	Landscape	D	D	D	D	D	D	D	D
9	Local Meteorological Conditions	D	D	D	D	D	D	D	D
10	Global Warming	D	D	D	D	D	D	D	D

Table 7.5: Scaling of Impacts on Natural environment due to DFC project

S.No.	Natural Environment Contents	Scaling	Reasons (during construction phase)	Reasons (after-construction phase)
1	Topography and Geology	B/ C/D-	C-During construction marginal changes in geology are likely to take place because of excavation, construction of bridges etc. 2) No significant change in Topography is expected.	B-: No significant change is expected except at Borrow area which shall be closed as per Guidelines suggested in Ch8.
2	Soil Erosion	C/D	C-During construction marginal effect on soil because of erosion is likely to take place due to the loss of upper crust of soil in the local area. The impact will be marginal only since the project is linear in nature.	D-: No significant change is expected. .
3	Ground water	D	D- No significant impact is likely to occur	D- Only marginal impact is supposed to be felt.
4	Hydrological Condition	D	D- It will have only marginal impact as no river or big water body is affected.	D-It is likely to have no significant impact.
5	Costal and Marine Environment	E	E- Non Existent	E Non Existent.
6	Fauna, Flora and bio diversity	D	1) Loss of marginal herbal cover is eminent so it will have impact	D- Only marginal impact is supposed to be felt.
	Protected areas, Natural/ecological reserves and sanctuaries	D	(1) D-: No Impact is likely to be felt as no such area is getting directly affected.	(1) D-: No Impact is likely to be felt.
8	Landscape	D	(1) D-: No Impact is likely to be felt.	(1) D-: No Impact is likely to be felt.
9	Local meteorological condition	D	D- No significant impact is likely to occur	D- No significant impact is likely to occur
10.	Global Warming	D/B	D-No significant impact is likely to occur	Positive impact as shifting of freight transportation from road to rail will decrease the emission of greenhouse gaseous
11.	Air Pollution	E	Negligible	Positive impact due to shifting of freight transport from road to rail as rail transport requires six times less fuel as compared to road

7.5 IDENTIFICATION, PREDICTION & EVALUATION OF IMPACTS DUE TO VIBRATION

Vibrations are a complex phenomenon. Railway vibrations are generated by motion of heavy loads on tracks. Vibrations become more complex as speeds of motion change. Further complications are introduced by complex scenarios of multiple trains running in the same or opposite directions to each other. Vibrations require a medium for their transmission. Any variation in the medium present between the track and point of impact plays a significant role and complicates the assessment further.

Most studies in other developed countries have ignored the variation due to multiple factors. Types of trains, speeds have always been considered by them. However impact of variations in medium (ground) between the track and point of impact has mostly not been included in these studies. It did not bring great inaccuracy in their estimations and predictions since a wide strip on both sides of the track was of only one kind / medium. They did not have the variety of the magnitudes as seen in India. The advantage of this simplicity was easy use of formulas and correlations in those studies.

We have included factor of variations in this medium in our studies and therefore been able to follow an assessment of impact that is more close to the ground scenario along the corridor.

In our study we have depended heavily on live data from real vibrations caused by trains. From this data we have picked up the highest vibration generating trains / speeds / loads / grounds and situations. These are all live values and are not estimations. Having picked up these values, graphical extrapolation is used to estimate the vibration levels for train speeds of 100 Km / Hr. Thereafter standard mathematical calculations have been applied to estimate the vibration levels due to multiple trains running together.

Chapter 5 provided a detailed justification for using Japanese As standards JIS Z8735 and JIS 1510 and further explored the Laws relating to factory act, labor laws and laws for occupational health for co-relating norms. We have however not found any standards or limits relating to building vibrations or human annoyance due to vibrations. Most these laws cover are the whole body or hand arm vibrations caused by tools and equipment used by the workers. So remained aligned to Japanese standards quoted above and have used Db as units of measurements. This unit also helps in calculating combined effect of two adjacent vibration levels by way of simple formula. The formula used is

$$\mathbf{Lmax_{eq} = Lmax_{\ track\ 1} - Lmax_{track2} + Lmax_{\ track\ 3}}$$

As No of variables existing in this study are over a dozen we have not used co-relational equations to estimate as we expected it to introduce mathematical errors in the calculations. Instead we depended on Real time values and graphical assessment and extrapolation.

Methodology The study has following steps:

1 Identification of Impacts of Freight trains. having different kinds of wagons.
2 Identification of category of train (wagons) causing highest vibrations.
3. Identification of impact of train speeds on vibrations
4. Identification of impact of train axel loads on vibrations
5 Identifying Highest vibration level from above data
6. Extrapolating this highest level of vibration for train speed of 100 Km / Hr
7. Calculation of change in this value of vibration of single train due to

presence of multiple trains running together

8. Purifying this highest value for any effects of medium variation between the track and measurement point
9. Predicting the Maximum vibrations for plain route and for populated areas
10. Transposing vibration levels so estimated on to Sensitive Receptors identified and predicting the impact..

Identification of Impacts:

Identified several kind of impacts from the data collated in previous chapters Typical these impacts could be of following types

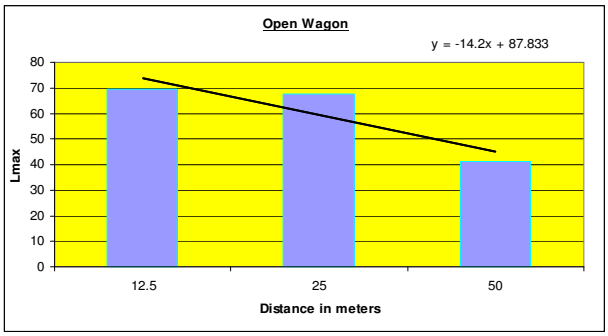
I. **Impacts in Plane areas ie** travel of Vibration; reverberations at 90 degree to the track will affect all the buildings, archeological Monuments, inmates of the building. These variations in vibrations could be due to following factors;
   - Distances from the track
   - Speed and
   - Axel loads
   - Train Crossings

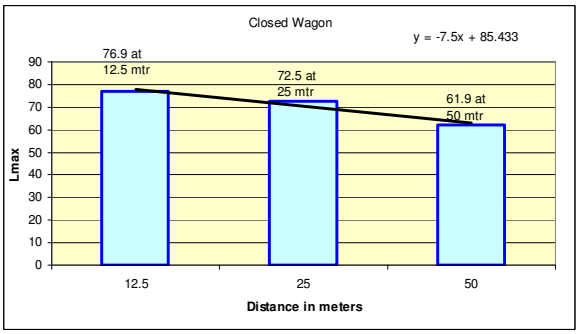
II. **Impacts due to train crossings i.e.** trains while crossing each other or while running parallel to each other in 2 or more numbers cause overall vibrations to increase or reduce. This aspect is to be taken into consideration for estimating maximum impacts in each of the above two situations.

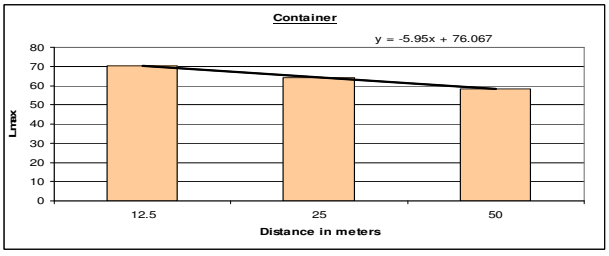
III. **Impacts in Populated Areas i.e.** travel of Vibrations, reverberations through the variety of ground conditions existing between the track and point of measurement / impact assessment. Varieties existing included mix of plain, embankment, hard standing platform of building floors, and roads.

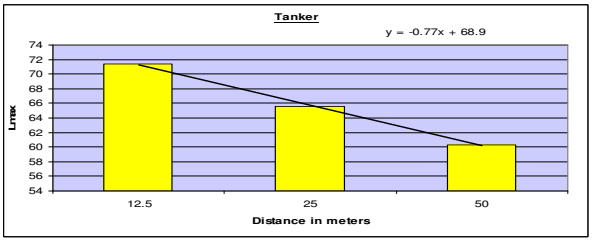
7.5.1 Impacts in Plain areas vis a vis distances from the track

The existing distance based vibration levels being generated by the trains is compared running on the existing tracks. For the four categories of freight trains considered by us, the levels of vibrations generated in plane areas are provided in the figures 7.1 to 7.4 below.





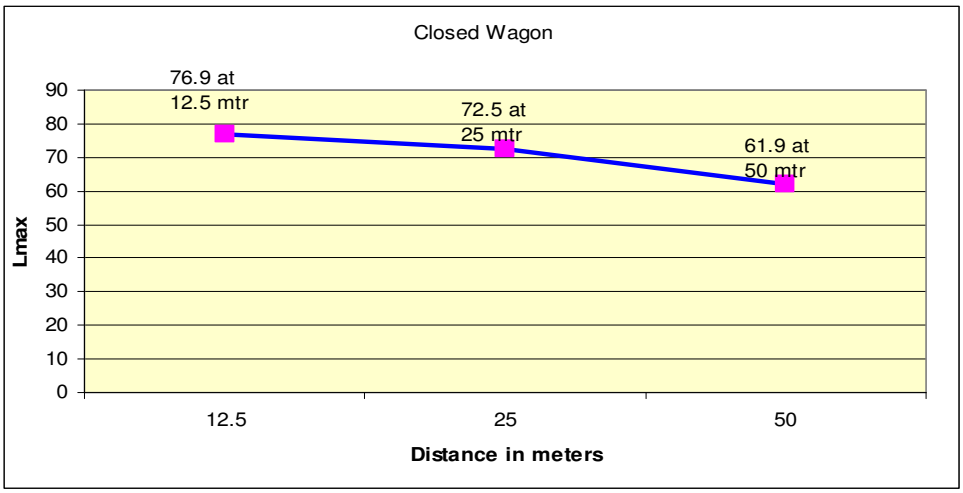




From the graphs above, the highest vibration levels of all the categories of train for one distance (say 12.5 or 25 or 50 meters) as the upper limit for that distance, for estimating the impact at 90 degree to the track. This is tabulated below.

Distance	Maximum dB
12.5	76.9
25	72.5
50	61.9

These values for all the three distances coincidentally correspond to only one categories of freight train that is **Closed Wagon**; Graph for this is produced in Fig-7.5 below:



7.5.2 **Impacts with speed and axel load** were also similarly evaluated. These were identified for

- maximum speeds of trains in each category as well as for
- maximum vibration in these categories and are as placed below:

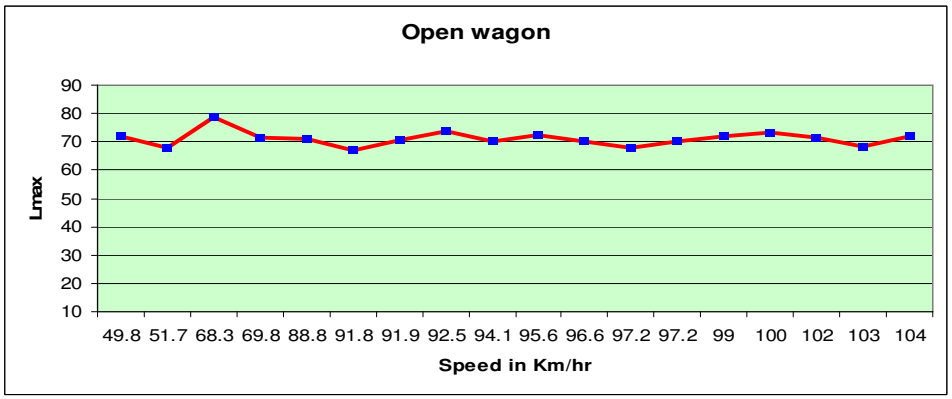


Fig- 7.6

The single occurrence of high vibrations of above 78 dB level looks to be an isolated occurrence in the graph so this isolation is to be eliminated to purify the data. Purifying the above graph the new graph is as below: The highest vibration in this case has come down substantially.

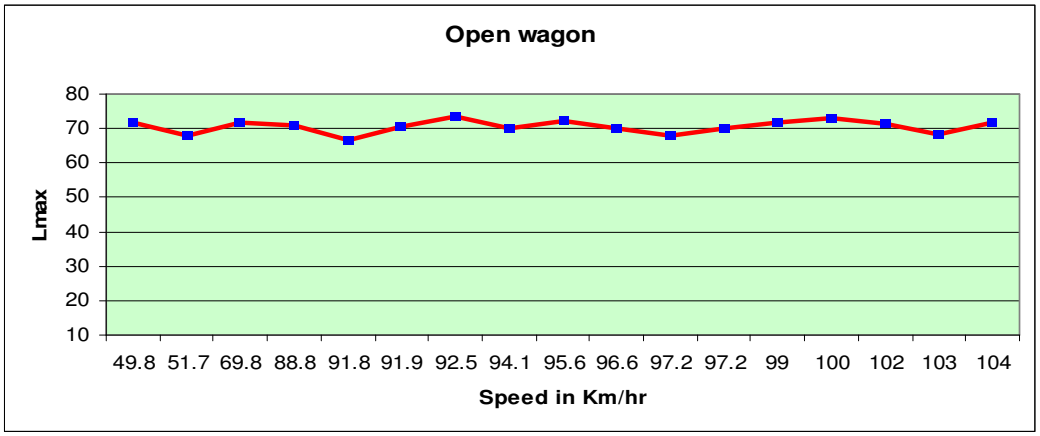


Fig- 7.7

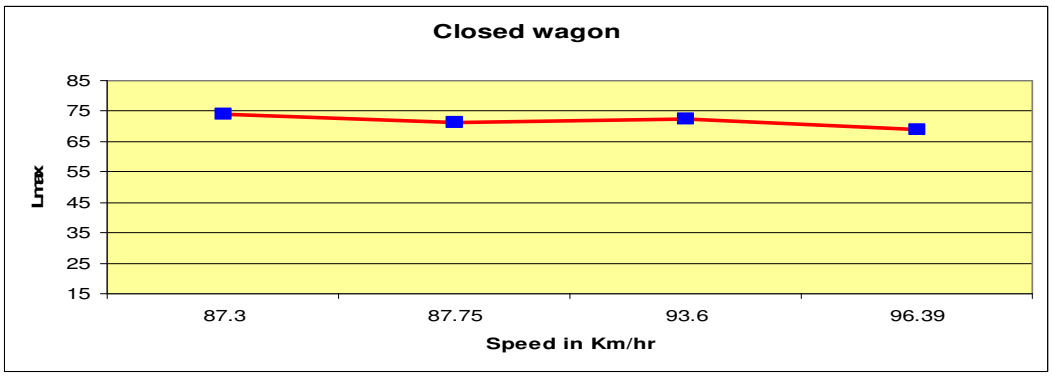


Fig- 7.8

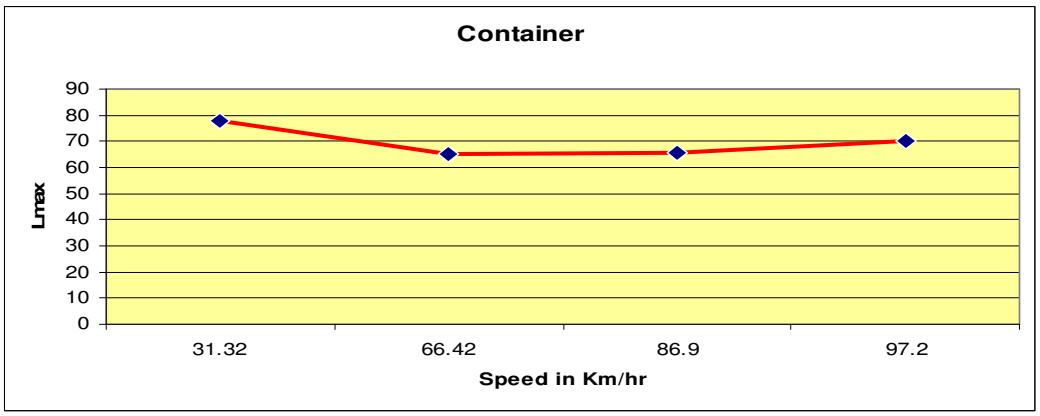


Fig- 7.9

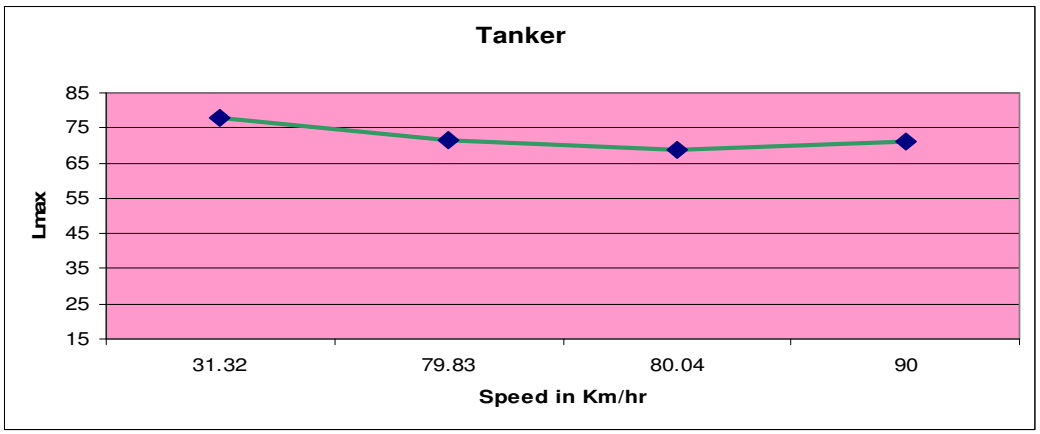


Fig- 7.10

Patterns Identified Here plotted two kinds of patterns:-

1. Relating to Vibration levels corresponding to the maximum speed of the train considered in each category and
2. The maximum vibration levels in each category irrespective of speed

Both these patterns are depicted in the figure below:

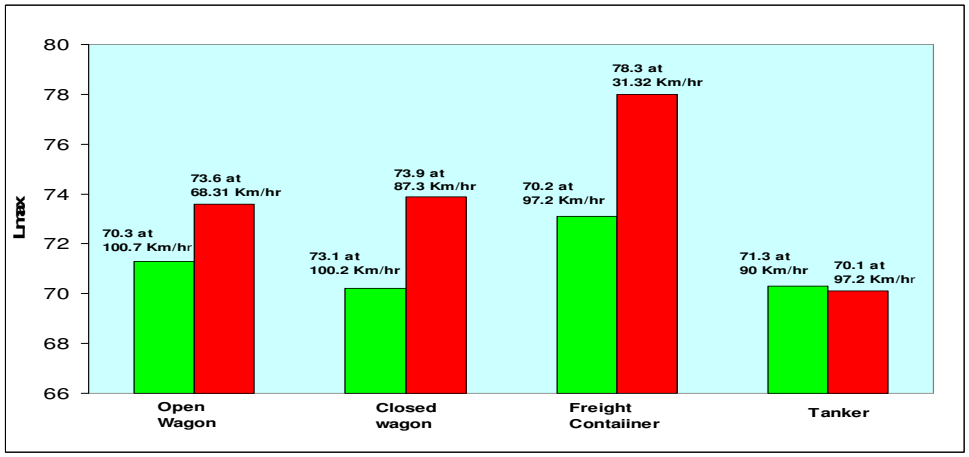


Fig- 7.11

It is apparent that the maximum vibrations are not occurring on maximum speeds but at other speeds. Highest vibrations were found to occur for closed wagons and Containers. The total variations across train categories however are of the order of 8-10 dBs

7.5.3 Impacts of Two Train Crossings

The data available includes several occasions of crossings of trains. These are in the form of Passenger – Passenger crossing (P-P), Passenger – Freight crossing (P-F), Freight – Passenger Crossing (F-P) and Freight – Freight crossing (F-F). These crossings are representation of similar crossing likely to take place on DFC on parallel tracks. F-F crossing is representation of similar crossing on detours. it is observed that the maximum vibration for two trains crossing occurred at 12.5 was 71.8 dB.

7.5.3.1 Impacts in populated areas on residential / commercial / Industry/ Social structure. It is quite possible to generate charts for residential/ industrial / commercial complexes including sensitive receptors. However it will not be completely appropriate to use these graphs for assessing impacts on other buildings etc along the track. The variation will be due to dis-similarities of the grounds between the railway track and point of measurement for different structures considered for estimation of impacts. Additionally impact of vibration caused by road traffic and other movements in corresponding locations may further complicate the estimation. The impact on sensitive receptors are calculated and presented in table 7.6.

7.5.4 Prediction of Impacts

The Vibration measurements carried out fall into two groups broadly: For the portion of corridor that will run parallel to the existing track and portion of the corridor that will go through the detours. Parallel track, running of the trains will engage maximum of four parallel tracks. Of these two would be occupied by the freight trains and two by Passenger trains. The corridor will be completely together and will be parallel to the existing track. Average distance between the centre of passenger and freight trains is expected to be 23 meters

The levels of vibration on 2 tracks have been examined in previous section. Since the 3rd track scenario was not available for actual evaluation in locations where trains were running at reasonable speeds, we have mathematically calculated the same. Vibrations on parallel tracks for trains running together on these tracks have also been evaluated below.

Of all possibilities, maximum vibrations will be generated by the various combinations of trains running on 3 closest tracks as these trains have maximum influence of individual vibrations on each other. From the graphs of two trains crossing each other as placed in previous section, we notice the highest Vibration Level for two train crossed is 78.1 dB for Passenger – Freight combination. This is however very much below the levels caused by single freight train running on the nearer track. The reason for this phenomenon to occur is the fact that both the trains are running opposite to each other and are therefore canceling effect of vibration waves generated by them individually.

7.5.5 Calculations

Check for vibrations for 100 Km/Hr train speed:

By examining the trend of change in Vibration Levels with the increase in speed in the graphs in previous sections we notice that in most cases the vibration levels reduce with increase in speed except for the Freight Containers. We have extrapolated this trend of vibration of freight container & estimated the **vibration level at 100 km/hr to be 74 dB**. This however is lower than the maximum vibration level for single freight train being considered by us and therefore not relevant.

Check for multiple train running:

From the measurements and graphs as discussed earlier the maximum level of Vibrations occurring for any Freight container Train on any track and at 12.5 mts from the center of the concerned track (Container) = **78.3 dB**

The Mathematically Attenuated value calculated for vibration at 35 meters in reference to the train running on the 3rd track = **75.8 dB** (Refer variation of vibrations with distance for containers)

Combined effect of these two Vibration Levels at the same measurement location that is 12.5 meters from the nearer track can be calculated as follows.

$$\mathbf{Lmax_{eq} = Lmax_{\ track\ 1} - Lmax_{track2} + Lmax_{\ track\ 3}}$$

In the light of this discussion for predictions, **78.3 dB** as highest vibrations for freight trains have been used in our calculations below.

Predicted Vibration Levels for multiple trains running together– These estimations workout as below.

On DFC side of parallel Track

1. On the freight corridor side, two freight trains running in opposite directions with a gap of 5 meters from each other.

   - Highest value of Vibration level by one freight train = **78.3dB**
   - This level attenuated to 17.5 mts for second freight train = **74.5 dB**.

   For these trains running in opposite directions, resultant level is difference of the 2 vibration levels.

   $$Lp_{F\text{-}F} = 10*LOG\ (10^{(78.3/10)}-10^{(74.5/10)}) = 75.9\ dB.$$

2. One freight train running closer to the 12.5 mts measurement point in the same direction from a passenger train 10 mts away

   - Highest value of Vibration level by one freight train = **78.3**
   - Highest value of Vibration level of passenger train attenuated to 35mtrs = **75.9**

   Since both the trains are running in same direction the relevant level will be addition of the two levels

   $$Lp_F + Lp_{Psngr} = 10*LOG\ (10^{(78.3/10)} + 10^{(75.9/10)}) = 80.2$$

3. A Freight train running on the 2nd track farther from the 12.5 meter measurement point and a passenger train running opposite to its direction in the third track.

   - Highest value of Vibration Level of Passenger train attenuated to 35 meters = **75.9**
   - Highest Value of Vibration level by one Freight train attenuated to 20 meters = **74.5**

   Since the trains are running in opposite directions. Therefore, resultant value is difference of the 2 vibration levels.

   $$Lp_{F\text{-}P} = 10*LOG\ (10^{(75.9/10)}-10^{(74.5/10)}) = 70.3\ dB$$

4. The next scenario is for vibrations on parallel tracks for three trains running together on the first three Tracks.
   - Highest Value for the Vibration Level by Freight – Passenger in First and Second Track running in opposite direction: **75.9**
   - Highest Value of Vibration level by one Freight train running in 2nd track attenuated to 20 meters = **74.5**

   Since this is a scenario of parallel running of the trains in composite manner

   $$Lp_{F\text{-}F\text{-}P} = 10*LOG(10^{(76.02/10)}+10^{(75.94/10)}) = 78.2\ dB$$

On Passenger Track Side

5. On the other side of all four tracks the situation will be driven by passenger train in similar four possibilities. The evaluated highest Lmax for these four possibilities are:
   - 2 Passenger trains running on track 4 and 3 opposite to each other= **77.1 dB**

- 1 Passenger in track 4 and one freight on track 2 both in same direction=**79.8 dB**
- 1 Passenger on track 3 and one freight on track 2 both in opposite direction-**73.9 dB**
- 2 Passengers on track 4 and 3 and one freight on track 2 = **76.3 dB**

6. The other less effective combinations would be different mixes of trains running on, third and fourth tracks.

From all the above calculations we consider the worst case scenario for plain routes and select the maximum vibration levels as upper limit expected to be encountered , The maximum possible vibrations as calculated above = **80.2 dB. I**t occurs when 2 freight and one passenger trains run together on first 3 track of DFC track side.

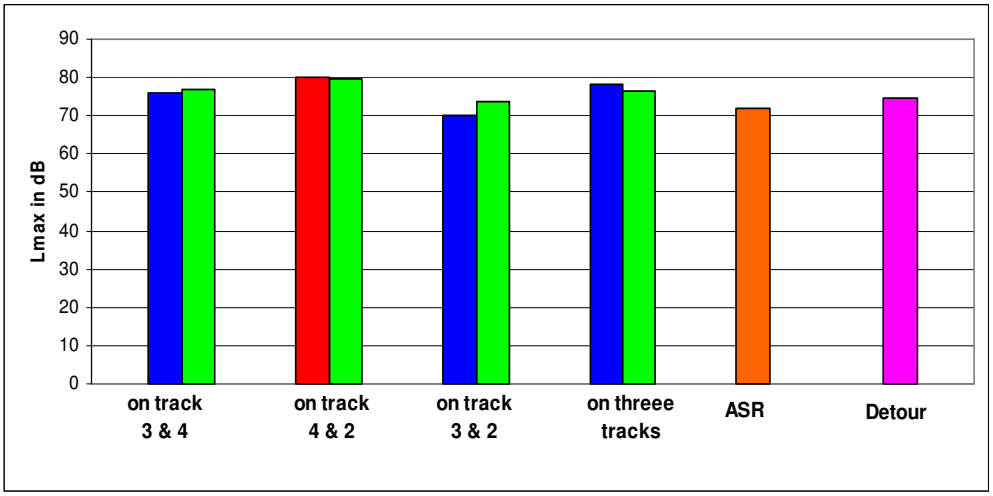


Fig- 7.12

Predicted highest Vibration Levels for the Detour track – These estimations workout as below

For the detour locations the scenario will always be two Freight trains crossing each other in opposite directions for which we have calculated highest Vibration level as **74.5 dB** at 12.5 meters measurement point, when the interfacing ground is plain ground.

However this value is lower than the highest Vibration Levels generated by running of Single Freight train.

Therefore predicted highest vibration levels for the detour portions = **74.5dB** at 12.5 meters from nearer track for freight containers. These being below the vibrations estimated for parallel track, remain irrelevant. Please refer the graph below

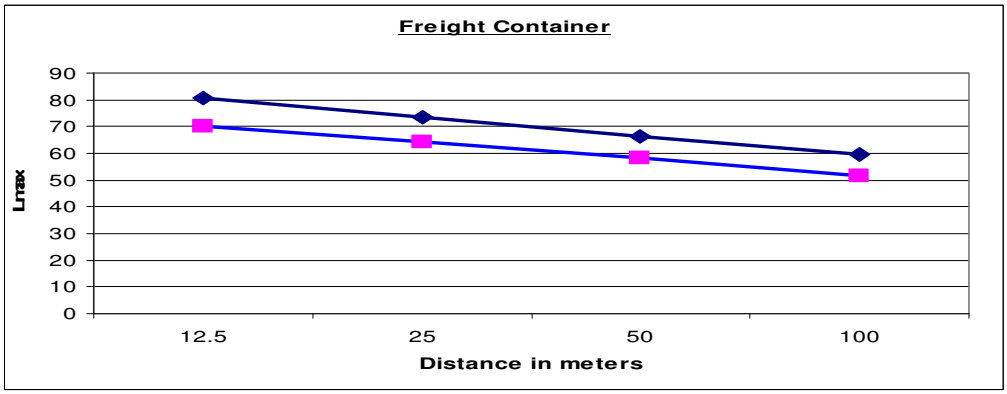
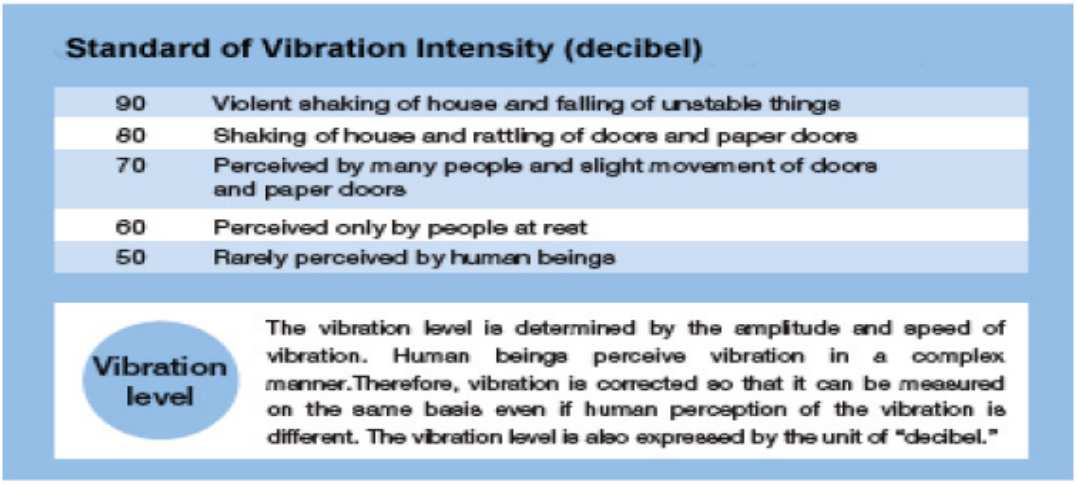


Fig- 7.13

7.5.6 Evaluation of Impact

Based on the predicted values, evaluation of the impacts has been carried out in following steps:

1. We have examined the Japanese standards for Permissible Vibration values in Habituated and Plane areas. The pictorial information in this regard which also includes the level of complaints received by procure department of railway vibration in 2006 is displayed below;



Standard of Vibration Intensity (decibel)

90	Violent shaking of house and falling of unstable things
80	Shaking of house and rattling of doors and paper doors
70	Perceived by many people and slight movement of doors and paper doors
60	Perceived only by people at rest
50	Rarely perceived by human beings

Vibration level

The vibration level is determined by the amplitude and speed of vibration. Human beings perceive vibration in a complex manner.Therefore, vibration is corrected so that it can be measured on the same basis even if human perception of the vibration is different. The vibration level is also expressed by the unit of "decibel."

From the extract above it is apparent that standards 70 dB vibration level defines the acceptability criteria in general, however in densely habituated areas the lower level will have to be allowed based on these criteria the permissible limits for vibrations are provided below.

As worked out in the prediction process above, various highest vibration levels likely to occur in different portions of the DFC are as below:

Plain route: 80.2 as against permissible levels of 70dB

Populated areas 80.2 as against permissible levels of 65dB

Therefore vibration levels have to reduced by

10.2 dBs - for Plain areas
15.2 dBs - Populated areas
10.2 to 15.2 dBs - plain / SR area

7.5.7 Prediction of Impacts on Sensitive Receptors

Prediction of Impacts on Sensitive Receptors based on the methodology described above has been carried out. The SRs have been identified during survey of the track alignment. From these listed receptors, those falling within the track alignment have been eliminated as they would require removal replacement or shifting. The balance receptors have been listed and predicted levels have been estimated. These details are given in **Table 7.6**.

Table 7.6: List of sensitive Receptors and Predicted Vibration Levels on them

S.N.	Type of Receptors	Name	Location/ Chainage	Parallel / detour	Distance from the centerline of the DFCC alignment (Meter)	Side (w.r.t Mugalsarai to Bhaupur	Predicted max Vibration before mitigation
1.	Religious	Temple	Prartapur /689	Parallel	25	L	86
2	Hospital	Govt. Hospital	Prathapur/689	Parallel	90	R	52
3	Hospital	PHC	Chunar/704	Parallel	30	L	82
4	Educational	School	Mirzapur/736	Detour	60	L	66
5	Educational	School	Mirzapur/738	Detour	80	L	55
6	Religious	Vindhachal	Vindhychal/744	Parallel	120	R	48
7	Educational	Junior High school	Mahendra/751	Parallel	60	R	68
8	Educational	School	Gopipua/755	Parallel	60	R	68
9	Religious	Temple	mandi/777	Parallel	90	R	52
10	Hospital	Hospital	Kachra/1091	Parallel	85	R	50
11	Educational	Public school	Bojha/832	Detour	45	L	76
12	Educational	Degree College	Bharwari/805	detour	40	L	74
13	Hospital	Govt. Hospital	Quiderpur/839	Detour	30	R	78
14	Educational	School	Quiderpur/839	Detour	40	R	77
15	Religious	Mosque	Manuri/843	Parallel	25	L	86
16	Hospital	Hospital	Kasnia/857	Parallel	90	R	52
17	Educational	Degree College	Asti Bajiapti/945	detour	5	L	90
18	Religious	Small Temple	Nihalpur/878	Parallel	25	L	86
19	Religious	Temple	Rampur/938	Parallel	30	L	84
20	Educational	School	Mithapur/939	Parallel	100	R	50
21	Educational	School	Hasanpur/965	Parallel	60	R	68
22	Educational	School	Subhali/1004	Detour	45	R	58
23	Educational	Insititute	Tokharpur/1020	Detour	40	R	57
24	Educational	School	Anupur/1045	Detour	45	R	58

7.6 PREDICTION AND EVALUATION OF IMPACTS ON NOISE ALONGSIDE RAILWAY LINES

The detailed railway noise survey was conducted at 23 locations along the existing railway track as well as detour locations. The result shows that during train operation

along the railway track the noise level always exceeds the statutory limit; however, at detour locations the noise levels are less and within the statutory limits. For the prediction purposes, the highest noise level i.e. 95 dB(A) recorded at 12.5m from the centre of the existing track used as a reference for maximum noise level prediction. The Leq noise level recorded at 12.5 m is around 75 dB(A) from the centre of the track is taken as reference for Leq noise level prediction.

Examination of Prediction Method

1) Railway Noise

Regarding railway noise generated by conventional trains (local trains, express trains and limited express trains), main causes include (1) traction movements, (2) structures and (3) machines equipped to the train. Among them, the traction movement contributes to the generation of noise greatly.

Several types of prediction equations were proposed for various types of railway track structures, such as the elevation, embankment and cutting.

Therefore, prediction was carried out applying the actual data of railway noise level, running speed (V) of trains, and the distance from center of the nearest railway track (D).

Based on the obtained the data of railway noise, the empirical equation was extracted by using a simple regression and correlation analysis. The following equation is used for noise prediction.

Assuming V is constant, D is only one variable, and the empirical equation is shown below. A predicted railway noise level is shown in the below table.

$$L_2 = L_1 - 20 \text{ Log } D_2/D_1 \qquad \text{---------- (1-1)}$$
$$L_{Aeq} = 10 \text{ Log } (10^{N1/10} + 10^{N2/10} + 10^{N3/10} + \text{.....})/T$$

Where,

L_1 and L_2 are the noise levels at D_1 and D_2 distance.

N_1, N_2, N_3 are the noise pressure levels at a different time interval. T is the number of reading.

Reference: JICA Study on DFCC Corridor

1) Condition of Prediction

Following conditions are assumed:

- Type of traction: electrified traction (electric locomotive)
- Running operation: 150 trains/direction/day with the same time interval (approximately one train for every five minutes)
- Maximum running velocity: 100 km/h
- Majority of the existing railway line structures is the embankment structures with approximately 2 to 5 m high from the ground level at the site.
- Railway noise and vibration generation level due to planned dedicated freight train; remains the same as the existing freight train,
- DFCC plan would have various factors contributing to reduction in railway noise.

2) Prediction and Evaluation Points

a) Sites along the existing railway lines within the parallel sections of the DFCC Project.

b) Sites along the planned detour routes where no railway noise was observed as a reference point of the background level monitoring.

Prediction and Evaluation Results

1) Prediction of Railway Noise Levels

Estimated noise levels (L_{Aeq}) were evaluated by comparing with (i) the ambient noise standard in India, (ii) existing ambient noise levels at SR and (iii) existing railway noise at SR.

The noises level predicted are presented in **Table 7.7**.

Table 7.7: Prediction of Noise Level on Sensitive Receptors

S.N.	Type of Receptors	Name	Location/ Chainage	Parallel / detour	Distance from the centerline of the	Side (w.r.t Mugalsarai	Predicted max Noise level dB(A)	Predicted Leq Noise LeveldB(A)
1.	Religious	Temple	Prartapur /689	Parallel	25	L	88.98	68.98
2	Hospital	Govt. Hospital	Prathapur/689	Parallel	90	R	77.85	57.80
3	Hospital	PHC	Chunar/704	Parallel	30	L	87.40	67.40
4	Educational	School	Mirzapur/736	Detour	60	L	81.37	61.37
5	Educational	School	Mirzapur/738	Detour	80	L	78.87	58.87
6	Religious	Vindhachal	Vindhychal/744	Parallel	120	R	75.35	55.35
7	Educational	Junior High school	Mahendra/751	Parallel	60	R	81.37	61.37
8	Educational	School	Gopipua/755	Parallel	60	R	81.37	61.37
9	Religious	Temple	mandi/777	Parallel	90	R	77.85	57.85
10	Hospital	Hospital	Kachra/1091	Parallel	85	R	78.10	56.50
11	Educational	Public school	Bojha/832	Detour	45	L	83.87	63.87
12	Hospital	Govt. Hospital	Quiderpur/839	Detour	30	R	87.40	67.40
13	Educational	School	Quiderpur/839	Detour	40	R	84.90	64.90
14	Religious	Mosque	Manuri/843	Parallel	25	L	88.98	68.98
15	Educational	College	Bharwari/805	Detour	40	R	84.90	64.90
16	Hospital	Hospital	Kasnia/857	Parallel	90	R	77.85	57.85
17	Educational	Degree College	Asti Bajiapti/945	detour	5	L	Falling in alignment	Falling in alignment
18	Religious	Small Temple	Nihalpur/878	Parallel	25	L	88.98	68.98
19	Religious	Temple	Rampur/938	Parallel	30	L	87.40	67.40
20	Educational	School	Mithapur/939	Parallel	100	R	76.93	56.93
21	Educational	School	Hasanpur/965	Parallel	60	R	81.37	61.37
22	Educational	School	Subhali/1004	Detour	45	R	83.87	63.87
23	Educational	Insititute	Tokharpur/1020	Detour	40	R	84.9	64.90
24	Educational	School	Anupur/1045	Detour	45	R	83.87	63.87

Analysis of Evaluated Results

The noise levels have been predicted at all the sensitive receptors located up to 100 m from the centre of the proposed track. The predicted noise level shows that noise level is considerably high at all the locations up to 100 m from the centre of the track. However, no barrier has been considered during the prediction, therefore, the actual noise level may be less due to attenuation of noise

Railway lines are located in the urban area and city area, the existing noise levels are already higher, and it is recommended that DFCC alignment should avoid the urban and city areas not to increase the noise levels.

Although in the detour routes the impacts to residents would be small, the railway noise would be newly added to the residents' life, and the appreciate mitigation measures should be prepared for residences along the railway line.

In the detour section, where the additional impact of the noise is large, it is suggested to adopt necessary mitigation measurement such as providing the green belt and establishing soundproof walls in the Detailed Design stage.

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CHAPTER-8: MEASURES FOR THE MITIGATION OF ENVIRONMENTAL IMPACTS

8.1 DESCRIPTION OF MITIGATION MEASURES

The mitigation measures to mitigate the negative impacts due to the development of proposed DFC on various parameters of the environment during various phases of the project are described hereunder.

8.1.1 Topography and Hydrology of the project influenced area was surveyed and mitigation measures are suggested in this chapter. Topography of the project affected area and hydrology will be maintained.

8.1.2 Mitigation Measures of Land Environment

Land acquisition, soil erosion and contamination of soil have emerged as major sources of land impact especially in urban areas and nearby watercourses. Due to the proposed project aimed at enhancing the efficiency of rail transport system, which will result in economic growth in the region over time.

Table- 8.1

Sl. No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
1.	Change in topography	Marginal impact	• Due to embankment raising	• Balancing culverts will be provided
2.	Change in geology	Direct, long term, negative impact	• Extraction of materials (borrow earth, coarse & fine aggregates)	• No blasting is envisaged • Quarry redevelopment plan need to be enforced
3.	Change in seismology	No negative impact	-	• Cross drainage structures are checked and complied with the seismological settings of the region
4.	Change in land environment			
a.	Loss of land	Direct, long term negative impact	• Land acquisition change in land use pattern	• Land acquisition to be minimized with provision of retaining walls
b.	Generation of debris	Negative impact	• May contaminate air, water and land, if not disposed properly	• Disposed properly to avoid contamination
c.	Soil erosion	Moderate, direct, long term negative impact	• Slopes and spoils near the bridges • Construction of new bridges and culverts • Quarry and borrow areas	• Embankment protection • For Emb, ht.>3 m stone pitching, • Emb ht. < 3m. turfing • Residual spoil need to be disposed properly • silt fencing need to be provided, • quarries need to be reclaimed
5.	Contamination of soil	Direct, long term negative impact	• Scarified bitumen wastes • Oil & diesel spills • Emulsion sprayer and lying of hot mix • Production of hot mix and rejected materials • Residential facilities for the labor and officers • Routine and periodical maintenance	• Hazardous Waste (Management and Handling Rules, 1989) to be enforced. • Oil interceptor will be provided for accidental spill of oil and diesel • Rejected material will be layed in village roads or as directed by engineer • Septic tank will be constructed for waste disposal
6.	Soil quality monitoring	-	• Effectiveness / shortfall (if any) • Any unforeseen impact	• Measures will be revised & improved to mitigate / enhance environment due to any unforeseen impacts

- Plantation programme will be carried out to improve the aesthetic look of the construction area. The plantation all along the railway line will be carried out to improve aesthetic along the existing as well as detour locations.

8.1.3 Mitigation Measure for Borrow Area Management

Borrow areas will be finalized either form the list of locations recommended by DPR consultants or new areas identified by contractor. The finalization of locations identified by DPR consultant or identified by contractor depends upon the formal agreement between landowners and contractor and its suitability from civil engineering as well as environmental consideration. Meeting the guidelines/notifications as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the contractor. Borrow area will be selected by contractor in consultation with DFCCIL & local authority.

Besides this certain precautions have to be taken to restrict unauthorized borrowing by the contractor. No borrow area shall be opened without permission of the Engineer/EO. The engineer in addition to the established practices, rules and regulation will also consider following criteria before approving the Borrow areas.

To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer. Redevelopment of the borrow areas to mitigate the impacts will be the responsibility of the contractor. The contractor shall evolve site-specific redevelopment plans for each borrow area location, which shall be implemented after the approval of the Engineer-in-Charge.

To ensure that the spills, which might result from the transport of borrow and quarry materials do not impact the settlements, it will be ensured that the excavation and carrying of earth will be done during day-time only. The unpaved surfaces used for the haulage of borrow materials will be maintained properly. Borrowing of earth shall be carried out at locations recommended as follows:

Non-Cultivable Lands: Borrowing of earth will be carried out up to a depth of 2.0 m from the existing ground level. Borrowing of earth shall not be done continuously. Ridges of not less than 8m width shall be left at intervals not exceeding 300 m. Small drains shall be cut through the ridges, if necessary, to facilitate drainage. Borrow pits shall have slopes not steeper than 1 vertical in 4 horizontal.

Productive Lands: Borrowing of earth shall be avoided on productive lands. However, in the event of borrowing from productive lands, under circumstances as described above, topsoil shall be preserved in stockpiles. The conservation of topsoil shall be carried out as described in section of this chapter. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.

Elevated Lands: At locations where private owners desire their fields to be leveled, the borrowing shall be done to a depth of not more than 2 m or up to the level of surrounding fields.

Borrow pits along Roadside: Borrow pits shall be located 5m away from the toe of the embankment. Depth of the pit should be such that the bottom of the pit shall not fall within an imaginary line of slope 1 vertical to 4 horizontal projected from the edge of the final section of the bank. Borrow pits should not be dug continuously. Ridges of

not less than 8 m width should be left at intervals not exceeding 300 m. Small drains should be cut through the ridges to facilitate drainage.

Borrow pits on the riverside: The borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood.

Community / **Private Ponds**: Borrowing can be carried out at locations, where the private owners (or in some cases, the community) desire to develop lands (mostly low-lying areas) for pisciculture purposes and for use as fishponds.

Borrow Areas near Settlements: Borrow pit location shall be located at least 1.0 km from villages and settlements. If unavoidable, they should not be dug for more than 30 cm and should be drained.

After identification of borrow areas based on guidelines. Contractor will fill reporting format as under and submit the same for approval to the "Engineer" Once approved the contractor will adhere to the recommendation for borrow area to the satisfaction of Engineer.

a) In no case the depth of borrow area should exceed 2m from the existing ground level.
b) Borrow pits slope should be maintained, no steeper than 1 Vertical: 2 Horizontal.
c) Water pooling to be avoided/managed so that NO disease spread due to water stagnation.
d) Precautionary measures as the covering of vehicles will be taken to avoid spillage during transportation of borrow area.
e) The unpaved surfaces used for the haulage of borrow materials should be maintained properly for dust suppression.
f) Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction facility is operating at the place of deposition, to minimize dust pollution.
g) During rains appropriate measures to be taken to minimize soil erosion, silt fencing to be provided as directed by Engineer/EO.

The Contractor will keep record of photographs of various stages i.e., before using materials from the location (pre-project),for the period borrowing

activities construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.

8.1.4 Mitigation Measures to Minimize Soil Erosion

1) Construction Phase

- Suitable protection measures consisting of bio-engineering techniques such as plantation of grass and shrubs, may be provided to control erosion. The measures shall be applied along the slopes at high embankment where bridges will be constructed.
- Borrow areas may be finalized in concern with ecological sensitivity of the area. Agriculture land may not be sued as borrow areas. Priority may be given to degraded area for excavation of borrows material. Rehabilitation of borrow area may be taken under the project.
- Construction work may be avoided during rainy season to evade erosion and spreading of loose material.
- Top soil removed from agricultural land may be stored separately in enclosed areas with proper bund and utilized during plantation or refilling of excavated area.

- Selection of borrow areas may be done considering the waste land available in the district. Agricultural areas may be not used as borrow areas.
- A separate borrow area management plan may be made providing location, ownership details, timing of borrowing and rehabilitation measures.

2) Post-Construction Phase

- No impact is envisaged on soil during post implementation phase.

8.1.5 Measures for Chance / Archeological importance finding:

Any Chance finding of archeological importance shall be reported to ASI as Ancient Monument and archaeological sites and remain (Amended & validation) acts, 2010 and would be notified/surrendered to the Competent Authority Chunar region shall be specifically taken care during excavation.

8.1.6 Mitigation Measures to Improve the Ambient Air Quality

1) Pre Construction Phase

The dust generation due to pre-construction activities will be temporary in nature and localized and will be effectively countered by sprinkling of water.

2) Construction Phase

During the construction stage, there are two major sources: the first one is construction activities at working zones, which cause primarily dust emission and second are from operation of the construction plant, equipments and machinery, which causes gaseous pollutants. The specific measures include:

- Locating Plant at a significant distance from nearest human settlement in the predominant down wind direction.
- Vehicles delivering fine materials like soil and fine aggregates shall be covered to reduce spills on existing roads.
- Water will be sprayed on earthworks, temporary haulage and diversions on a regular basis.
- Batch type hot mix plants fitted with the bag filter / cyclone and scrubber will be installed for the reduction of the air pollution.
- Pollution control systems like water sprinkling and dust extractors and cover on conveyors will be installed for the crushers.
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the emission levels conform to the SPCB/CPCB norms.
- Air pollution monitoring plan has been delineated for construction phase separately for checking the effectiveness of the mitigation measures adopted during the construction phase of the Contract
- Air quality monitoring shall be conducted during construction period as per CPCB norms. The location and frequency of air monitoring is covered in Chapter-9.
- Impact on air quality is likely to be temporary and reversible.

3) Operation Phase

- Air quality of the area is likely to be improved as reduction in emissions due to shifting of freight from road transportation to railway transportation.
- Plantation along the DFC is likely to improve the air quality of the area.

8.1.7 Mitigation Measures on Water Quality

Due to the proposed project there will be some direct and indirect long term impacts on the water resources. Table below presents the major adverse impacts on the water resources and the mitigation measures taken.

Table- 8.2

Sl. No.	Item	Impact	Impact (Reason)	Mitigation/Enhancement
1.	Loss of water bodies	Not significant as no major water bodies is fully affected	• Part or acquisition of source of water	• Land acquisition to be minimized with provision of retaining walls • Relocation of ground / surface water sources
2.	Alternation of cross drainage	Very low impact	• One major bridge over existing causeway • Widening of minor bridges and culverts	• Construction of new bridges and bridging of existing causeways, there will be an improvement in the drainage characteristics of the project area
3.	Runoff and drainage	Direct impact	• Siltation of water bodies • Reduction in ground recharge • Increased drainage discharge	• Silt fencing to be provided • Recharge well to be provided to compensate the loss of previous surface • Continuous drain is provided, unlined in rural area and lined in urban areas.
4.	Water requirement for project	Direct impact	• Water requirement for construction activity. • Water requirement of labour	• Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. This is required to avoid depletion of water resources.
5.	Water Quality			
a.	Increased sedimentation	Direct impact	• Increased sediment laden run-off alter the nature & capacity of the watercourse	• Guidelines for sediment control to be enforced
b.	Contamination of water	Direct adverse impact	• Scarified bitumen wastes • Oil & diesel spills • Emulsion sprayer and laying of hot mix • Production of hot mix and rejected materials • Residential facilities for the labour and officers • Routine and periodical maintenance	• Hazardous Wastes (Management & Handling) Rules, 1989 to be enforced • Oil interceptor will be provided for accidental spill of oil and diesel • Rejected material will be used for village roads or as directed by engineer • Septic tank will be construction for waste disposal
6.	Water quality monitoring	-	• Effectiveness / shortfall (if any) • Any unforeseen impact	• Measures will be received & improved to mitigate / enhance environment due to any unforeseen impact

8.1.8 Water Quality

a. Contamination of water

- Oil interceptor will be provided at plant site and material trucks lay byes.
- Construction work close to the streams or water bodies will be avoided during monsoon.
- The discharge standards promulgated under the Environmental Protection Act, 1986 will be strictly adhered to. All wastes arising from the project will be disposed off in a manner that is acceptable to the State Pollution Control Board (SPCB).

- All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 will be adhered to.
- Construction labourers' camps will be located at least 1000m away from the nearest habitation.
- Unless otherwise authorized by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the workplace suitably approved by the local medical health or municipal authorities will be made.
- All approach roads to rivers and other surface water bodies need to be closed permanently to avoid vehicle washing and to avoid major pollution sources. This applicable to all areas including the secondary construction sites.
- Automotive service centers will be discouraged from establishing along the corridors with out installing preventive measures against petroleum and oil contamination.
- Water quality shall be monitored regularly near the construction site.

8.1.9 Noise Environment – Mitigation Measures

Environmental noise particularly railway noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency and speed of the trains.

Table- 8.3

Sl. No.	Item	Impact	Impact (Reason)	Mitigation / Enhancement
1	Sensitive receptors	Direct impact	• Increase in noise pollution	• Noise barrier to be provided
2	Noise pollution (pre-construction)	Direct impact, short duration	• Man, material and machinery movements • Establishment of labor camps onsite offices, stock yards and construction plants	• Area specific and for short duration • Machinery to be checked & complied with noise pollution regulations. • Camps to be setup away from the settlements, in the down wind direction.
3	Noise Pollution (Construction Stage)	Marginal impact	• stone crushing, asphalt production plant and batching plants, diesel generators etc • Community residing near to the work zones	• Camps to be setup away from the settlements, in the down wind direction. • Noise pollution regulation to be monitored and enforced. • Temporary as the work zones will be changing with completion of construction
4	Noise Pollution (Operation Stage)	Marginal impact	• due to increase in traffic (due to improved facility)	• will be compensated with the uninterrupted movement of heavy and light vehicles till the facility reaches the level of service C.
5	Noise Pollution Monitoring	-	• Effectiveness / shortfall (if any) Any unforeseen impact	• Measures will be revised & improved to mitigate/ enhance environment due to any unforeseen impact.

8.1.10 Sensitive Receptors – Mitigation Measures

School, college, hospital, water body, religious structure located within ROW & outside ROW that are close to the DFC project have been identified and mitigation measures have been suggested in the following tables 8.4 & 8.5.

Table- 8.4: List of Sensitive Receptors within ROW

Sr. No.	Chainage	Name of the Receptor	Impact	Mitigation Measure
1	681.890-681.990	Pond	Direct	Relocation
2	683.215-685.765	Temple1, pond1	Direct	Relocation
3	683.765-685.115	Temple	Direct	Relocation
4	690.420-691.150	Pond	Direct	Relocation
5	693.870-694.540	Burial ground	Direct	Relocation
6	696.500-697.450	Pond	Direct	Relocation
7	712.300-712.400	School	Direct	Relocation
8	754.580-755.080	Temple	Direct	Relocation
9	758.820-759.380	Burial ground	Direct	Relocation
10	759.380-760.100	Pond	Direct	Relocation
11	760.100-760.470	Pond	Direct	Relocation
12	760.470-761.490	Temple	Direct	Relocation
13	761.88-763.24	Pond-5	Direct	Relocation
14	764.200-765.150	Pond-2	Direct	Relocation
15	778.480-779.675	Pond	Direct	Relocation
16	779.955-782.450	Temple1, Mosque2	Direct	Relocation
17	782.450-783.700	Pond	Direct	Relocation
18	782.670-782.900	Burial ground-2	Direct	Relocation
19	787.915-790.085	Pond	Direct	Relocation
20	796.500-796.820	Temple	Direct	Relocation
21	798.340-799.320	Pond-2	Direct	Relocation
22	801.150-801.890	Pond	Direct	Relocation
23	803.210-804.290	Pond	Direct	Relocation
24	806.820-807.430	Pond	Direct	Relocation
25	Manda detour	Pond-2	Direct	Relocation
26	Mizapur detour	School	Direct	Relocation
27	808-848	Water body-12	Direct	Relocation
28	838-848	Hospital-1	Direct	Relocation
29	858-868	Water body-31, school-1	Direct	Relocation
30	878-888	Water body-2	Direct	Relocation
31	888-898	Religious-3	Direct	Relocation
32	898-918	Water body-17	Direct	Relocation
33	918-928	Religious-2	Direct	Relocation
34	938-948	Water body-9	Direct	Relocation
35	948-958	Religious -2	Direct	Relocation
36	958-968	Religious-2, school-1	Direct	Relocation
37	968-978	Religious-4, school-1, water body-5	Direct	Relocation
38	978-988	Religious-3, water	Direct	Relocation

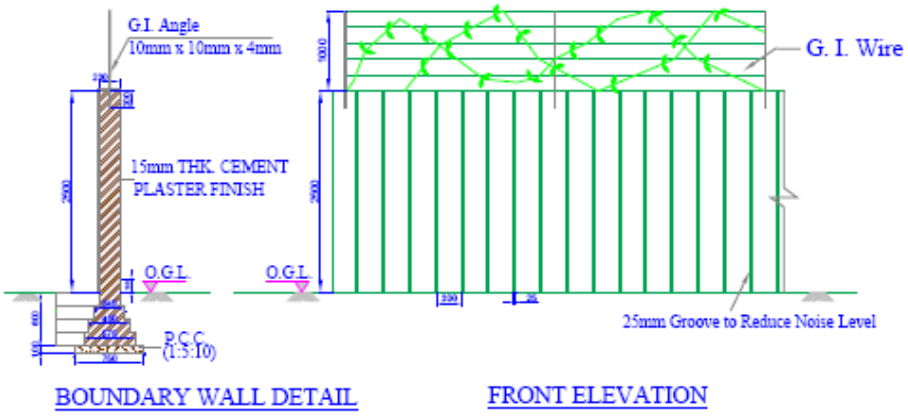
Sr. No.	Chainage	Name of the Receptor	Impact	Mitigation Measure
		body-1		
39	988-998	religious	Direct	Relocation

Table 8.5 : List of Sensitive Receptors outside ROW

Sl. No.	Chainage (km)	Name of Receptor	Distance from the proposed track (m)	Impact	Mitigation / Enhancement
1.	692	Hospital	90	Direct impact, high noise level	Noise barrier shall be created of 120 m length as per the conceptual drawing shown below
2.	704	Health Center	30	Direct impact, high noise level	Noise barrier shall be created of100 m length as per the conceptual drawing shown below
3.	736	School	45	Direct impact, high noise level	Noise barrier will be created of 60 m length as per the conceptual drawing shown below
4.	738	School	45	Direct impact, high noise level	Noise barrier will be created of 40 m length as per the conceptual drawing shown below
5.	751	School	60	Direct impact, high noise level	Noise barrier will be created of 50 m length as per the conceptual drawing shown below
6.	755	School	60	Direct impact, high noise level	Noise barrier will be created of 60 m length as per the conceptual drawing shown below.
7.	795	Hospital	85	Direct impact, high noise level	Noise barrier shall be created of 100 m length as per the conceptual drawing shown below
8.	805	Degree college	40	Direct impact, high noise level	Noise barrier shall be created of 120 m length as per the conceptual drawing shown below
9.	839	Govt .hospital	30	Direct impact, high noise level	Relocation
10.	839	School	40	Direct impact, noise level high	Noise barrier shall be created of 120 m length as per the conceptual drawing shown below
11.	843	Religious	25	Direct impact, high noise level	Relocation

Sl. No.	Chainage (km)	Name of Receptor	Distance from the proposed track (m)	Impact	Mitigation / Enhancement
12.	857	Hospital	38m from IR track	Direct impact, high noise level	relocation
13	1004	School	45	Direct impact, high noise level	Noise barrier will be created of 40 m length as per the conceptual drawing shown below
14	1020	Institute	40	Direct impact, high noise level	Noise barrier will be created of 100 m length as per the conceptual drawing shown below
15	1045	Primary School	45	Direct impact, high noise level	Noise barrier will be created of 40 m length as per the conceptual drawing shown below.

Fig- 8.1 : A Typical Design of Noise Barrier



8.1.11 Mitigation Measures for Noise during Construction Phases

- Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90dB(A). If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with noise shields.
- Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
- Workers in the vicinity of high noise levels will be provided earplugs, helmets and will be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift.
- During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the engineer will ask the site engineer to take suitable steps of restricting the work hours even further or use an alternative roller.
- Proposed tree and shrub plantations planned for avenue plantation especially close to settlements, may form an effective sound buffer during the operation stage.
- People will be convinced / educated to prevent sensitive land uses from developing up adjacent to the project corridors.

8.1.12 Mitigation Measures for Hydrological Condition (Rivers and Lakes)

There are two perennial rivers, *Yamuna* & *Tonse* which are crossed by DFC alignment.

Bridges & culverts are planned for crossing of alignment over rivers, water channels. Bridges are proposed for two perennial rivers *Yamuna* & *Tonse*.

1) Construction Phase

- Provision of temporary drainage arrangement due to construction activities must be made by contractor and suitable and strict clause must be incorporated in general conditions of the contract document for its effective implementation.
- Silt fencing may be provided near water bodies.
- Proper drainage may be planned in the area to avoid water logging.

2) Implementation Phase

- Local drainage is likely to be affected due to formation of Railway Embankment.

- Cross drainage structures shall be provided at appropriate locations.

8.1.13 Mitigation Measures for Flora

1) Construction Phase

- Felling of trees must be undertaken only after obtaining clearance from the Forest Dept.-forest areas, Railway Dept and local bodies outside forest area.
- Trees falling outside the RoW should not be felled.
- Compensation must be provided before initiating construction activity.
- Fruit bearing trees shall be compensated including 5 years fruit yield.
- Labor camps and office site shall be located outside and away from the forest area.

2) Post Construction Phase

- No impact envisaged on flora during post construction phase however, development of green belt is suggested near stations and maintenance of plantation may be undertaken by Railway Dept. The plantation carried along alignment and as compensatory afforestation is likely to enhance the ecological condition of the area.

8.1.14 Mitigation Measures for Fauna

1) Construction Phase

- Crossing passages must be made for animal movement by provision of under pass followed with some plantation so that it resembles with the habitat.
- Water bodies may be developed inside forest areas, as the birds prefer water bodies.
- Borrow areas can be also developed as ponds with grasses and shrubs planted around it.
- Silt fencing may be used near water bodies to avoid runoff into the water bodies.
- Construction activity may be avoided during night hours in forest area.
- Poaching must be strictly banned in the forest area. It may be ensured by the contractor that no hunting or fishing is practiced at the site by any of the worker and that all site personnel are aware of the location., value and sensitivity of the wildlife resources.
- Awareness programme on Environment and Wildlife Conservation may be provided to the work force. Forest Act and Wildlife Act may be strictly adhered to.

2) Post Construction Phase

- Animal underpasses made for animals near forest area must be camouflaged to match the surrounding environment with plantation of shrubs and trees.
- Fencing may be provided along DFC in areas to avoid collision, wherever feasible.

8.1.15 Landscape

1) Construction Phase

- Landscaping Plan may be formulated for restoration, leveling and landscaping of the area once construction activities are over. This can involve the following:-
- The stockpiles may be designed such that the slope does not exceed 1:2 (vertical to horizontal) and the height of the pile to be restricted to 2 m.
- Stockpiled topsoil may be used to cover the disturbed areas and cut slopes. The top soil shall be utilized for redevelopment of borrow areas, landscaping along slopes, incidental spaces etc.
- Incorporation of suitable and effective contractual clauses for rehabilitation and restoration of borrow areas and other temporary works and landscaping it with surrounding area immediately after its use.
- Landscaping of surrounding area with plantation, ornamentals plants may be planted near station.

2) Post Construction Phase

- No impact envisaged on landscape in operation phase, however the green belt development is suggested.

8.1.16 Mitigation Measures for Vibration

In order to mitigate the negative impacts due to noise and vibration the impact area are divided in three broad categories;

- Areas identified in Reconnaissance Survey as sensitive residential commercial industrial or social sites.
- Areas identified as reference locations for carrying out measurements of vibrations along EDFC
- Areas having buildings and structures within existing or proposed railway land.
- Buildings and structures of importance for ASI or other similar agency

For all these target locations following scheme shall be applied.

i. Targets falling within the ROW - Pick out and exclude all such target locations from consideration of mitigation measures.
ii. Targets located at distances falling in no impact zone are also isolated from the list of locations requiring mitigation measures. For this trend line of attenuation of vibrations with distance for each type of location has been established. Using this trend distance for permissible vibration level has been identified. All locations farther to this distance have been isolated from assessment of mitigation measures.
iii. Targets that have special character due to their historical or archeological or communal importance. Such targets have to be considered in special manner irrespective of level of impacts assessed in their case.

The following general mitigation measures are recommended.
It has been found that the vibration levels originate at the interaction of rail and wheel because of various factors which include the following

- The construction of Wagons
- Condition of Wagons , rails and wheels
- Design , engineering , superiority in terms of track support systems, soil conditions and embankment heights

Efficient Track and wheel maintenance:- Effective maintenance of track and wheel can reduce up to 10 dB(A) noise and vibration levels. The Condition of the rails and wheels- If not maintained in good condition. Some maintenance procedures that are particularly effective at avoiding increases in ground-borne vibration are:

- Rail grinding on a regular basis. Rail grinding is particularly important for rail that develops rail irregularities which in their turn cause impacts and low frequency excitation.
- Wheel truing to re-contour the wheel, provides a smooth running surface, and removes wheel flats. The most dramatic vibration reduction results from removing wheel flats and out of roundness.
- Implement vehicle reconditioning programs, particularly when components such as suspension system, brakes, wheels, and slip-slide detectors will be involved.
- Install wheel-flat detector systems to identify vehicles which are most in need of wheel truing. These systems are becoming more common on railroads and intercity passenger systems, but are relatively rare on transit systems.
- Install wheel geometry measurement devices (e.g. laser based systems installed at entrance of depot) with possibility of detecting out of soundness, difference of wheel diameter of wheels on the same axle, wheel wear. (**Vibration reduces more than 10 dB)**

Therefore a reduction of up to **7.5dB** Vibrations could be achieved as compared to highest Vibration level measured on existing tracks. Therefore
predicted vibration levels will come down by around 7.5 dBs through maintenance efficiency and planning alone.

The DFCC has already designed to operate on elevated embankment of 2mtrs of more. This means that there will be at least 1 meter additional height all along the corridor due to embankment. Researches and studies have shown the height of embankment increases the attenuation rate by **1- 2 dBs** per meter height of embankment. Therefore at least **1- 2dBs** (for one meter additional height of embankment) will be reduced for entire corridor, In portions of track where there is no embankment currently this reduction will be for 2 meter height and will be around 2-3 dBs. Therefore taking a conservative estimate, this inbuilt measure will provide reduction of Vibration levels by **2dBs**.

Considering all the above conditions, it is concluded that the Overall vibrations will be reduced by a total of 10 dB.

As discussed earlier in the evaluation process maximum vibrations permissible on any site is

Plain route or detour upto: 70dB
Receptors: upto 65 dB

Resilient Fasteners: Resilient fasteners are very common fastening equipment used in modern track constructions. We believe these must also be included in design of track installation by DFCC. If so these become another existing resource that will help mitigate the impacts of vibrations. These fasteners are used to fasten the rail to concrete track slabs. Standard resilient fasteners are rather stiff in the vertical direction, usually in the range of 40 kN/mm (dynamic stiffness), although they do provide vibration reduction compared to classical rigid fastening systems.

Fig. 8.2: Typical Fastner for vibration control

Special fasteners with vertical dynamic stiffness in the range of 8 kN/mm will reduce vibration by as much as 15 dB at frequencies above 30 Hz. (Conservatively these could **reduce vibrations by 5 to 10 dBs). Fig- 8.1** shows a typical resilient fastner.

Rail and base plate pads for rail resilient rail fasteners, used on trams, subways, light rail and main lines.Therefore this resource alone will be able to take care of the balance mitigation of track vibrations. We therefore feel that no additional mitigation measures are required to be instituted.Rail and base-plate pads for rail resilient rail fasteners, used on trams, subways, light rail and main lines can further reduced the vibration level.

8.1.17 ROBs & RUBs

Number of ROBs & RUBs are proposed for replacing existing and new LCs. Some RUBs are proposed along the alignment for facilitating crossover for humans and cattles. Actual number of ROB / RUB in lieu of LCs will be decided at the time finalization of project.

8.1.18 Cross drainage

Cross drainage will be provided for proper drainage system and avoidance of water accumulation both for .

8.1.19 Mitigation measures for CPRs

This has been adequately addressed in RAP.

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CHAPTER-9: PUBLIC CONSULTATION & DISCLOSURE

9.1 INTRODUCTION

The Public Consultation meetings for the proposed Eastern Dedicated Freight Corridor were conducted in the affected villages during March-April 2011 and again during July-August, 2011. The villages were selected which were environmentally sensitive and may be affected due to the proposed project. The overall objective of public consultation was to provide information to the stakeholders and collect feedback on environmental issues from them at village level.

9.2 OBJECTIVES OF PUBLIC CONSULTATIONS

Public consultations intend at obtaining people's participation. It is an ongoing process which can improve communication, interaction and joint decision making between different stakeholders. Through public participation, all parties become better informed about the range of views on proposals and issues. Most importantly, a good public participation process will result in better decisions that are more sensitive and responsive to public concerns and values.

It is widely acknowledged that public participation processes should vary according to the size, complexity and level of interest in any one issue, policy or plan.

The broad objectives of Public Consultation Meetings were as follows:

- To understand the view of the people affected
- To identify all major environmental characteristics of the villages to enable planning and implementation.
- To resolve the issue related to environment i.e. water, soil, air, pollution and vibration
- Disseminate information to the lowest possible hierarchy of the social system

9.3 METHODOLOGY OF ORGANIZING MEETINGS

These meetings were organized at village level through the project office of DFCC at Kanpur and Allahabad. Project officers of DFCC have been working in the project area since long and have fairly a good idea of the issues involved at village level. Moreover, the technical drawings, maps and other

papers of the alignments were readily available with them and these could be used while disseminating information and answering questions of the stakeholders. They have developed a network of field functionaries and these field functionaries have established good rapport with the villagers and stakeholders.

The details of the identification of villages, participants, and methodology for conducting the meetings and issues emerged during the meetings are briefly described in **Table 9.1** below:

A. Selection of villages :

S.No	MEETING VENUE	VILLAGES COVERED
1	Pahadi Bhojpur (Panchayat Bhavan)	Bhojpur Pahadi,Pachokhara
2	Mohanpur (Panchayat Bhavan)	Mohanpur,Bhilgo,Jhinjura
3	Devpur Patkoli	Devpur, Chapgahna,Adhwar
4	Baiji Mukundpur (Primary School)	Baji Mukundpur
5	Bhiskuni (Primary School)	Bhiskuni,Launiya,Barkachakala
6	Bondary (Primary School)	Bondary,Halka Parendi,Tegrahi

S.No	MEETING VENUE	VILLAGES COVERED
7	Sirsi Baghel (Panchayat Bhawan)	Sirsi Baghel
8	Maghgawan (Temple)	Maghgawan,Chandipur,Lakhmapur
9	Ranibari (Primary School)	Ranibari,Gopalpur,Rajapur
10	Deoria (Shivji Temple)	Deoria,Gorakhpur Kundadeeh,Karhat
11	Achitpur Puraini (Panchayat Bhavan)	Achitpur,Puraini,Jadhavpur,Karhat Kundadee
12	Jamalpur (Shivji temple)	Jamalpur, Jadhopur Kundadeeh,Jairampur
13	Bhabhuar (Primary School)	Bhabhuar,Boikurthpur,Narayanpur,Pasahi
14	Barjeevanpur (Panchayat Bhavan)	Barjeevanpur,Baighpur
15	Daraa (Primary School)	Darra,Bhupti,Pratappur,Bahadurpur
16	Dixitpur (Shiv Shankari Devi Temple)	Dixitpur Bela
17	Kailahat (Panchayat Bhavan)	Kailahat
18	Bhareta (Dhui Baba Temple)	Bhareta
19	Jamui (Primary School)	Jamui
20	Phulwariya (Primary School)	Phulwaria
21	Samaspur (Primary School)	Samaspur,Dhaurara,Bhaurahi
22	Chakedi (Primary School)	Bajapur,Madhavpur,Campatpur
23	Kurustikula (Primary School)	Kurusti Kala,Daulatpur,Neelamparpur
24	Ekari (Pradhan House)	Ekari
25	Haswa (Primary School)	Haswa,Bakshpur Keshvpur,Veerapur,Chaudhpur
26	Daniyalpur (Junior HighSchool)	Daniyalpur,Kamalipur,Fathepur
27	Sangaon (Panchayat Bhavan)	Sangaon,Jaisinghpur,Bahrampur,Bargadi ypaur
28	Musaidpur (Primary School)	Musaidpur Teksari
29	Emaadpur (Pradhan'House)	Emaadpur Paigapur
30	Malaka (Primary School)	Malaka
31	Sathariyaon (Primary School)	Suthariyon
32	Asti (Near Masjid)	Asti Parshurampur
33	Korai (Primary School)	Korai,Budhaiyapur
34	Hardaupir (Primary School)	Hardaurpur,Bhatraha
35	Umrauni (Primary School)	Umrauri
36	Vasavankheda (Primary School)	Vasavankheda,Dariyapur
37	Aung (Panchayati Bhavan)	Aung Khadra
38	Mamrezpur (Primary School)	Mamrezpur
39	Behta (Pradhan House)	Chakki behat,Kuberpur
40	Hasanpur	Hasnpur

B. METHODOLOGY OF CONDUCTING THE MEETING

At the outset, the consultant team and project manager of DFCC introduced themselves and welcomed all esteemed guests.

The Environment specialist introduced the subject of Environment like air, water, noise, vegetation plantation and trees, bio-diversity, birds, animals etc and possible or likely impact of the new track on environment. She invited the participants to air their views frankly in the context of their villages.

The stakeholders one by one were presenting their point of view and sometimes their misconceptions about the project were being answered by
the consultant team and the project manager. The views and concerns expressed by the participants were recorded by the consultant team.

During the meeting and deliberations some participants were very much out spoken and wanted that project should not pass through village/villages. The team members therefore gave all information and shared their concerns and requested them to offer their suggestions to make the project environment friendly. The records of the participants covers gender, profession etc. of the participants has been done. It requires special mention here that few participants were apprehensive to reveal their identity.

a. ISSUES AND CONCERNS EMERGED FROM THE CONSULTATION

The issues and concerns shared and mitigation suggested in a tabulated form are given Tables below:

Table- 9.2

S. No.	DATE	VENUE	NUMBER OF PARTICIP-ANTS	ISSUES SHARED	MITIGATION MEASURES	REMARKS
1.	22-03-11	Primary School, Bajah, Tehsil Allahabad, Dist. Allahabad	44	• The adjoining land to the portion which would be acquired would not be of any use to the farmer. • Noise level if increases due to this additional track, would affect the educational activity in existing 15 – 20 inter and degree colleges. • Safety of students would be affected. • Vibration would be there which would affect children in the schools,	Wall for the safety of children as well as noise.	Protective wall recommended
2.	22-03-11	Primary School Ismailpur Kotwa	56	• Participants asked for a crossing at Ismailpur, Manuri. • Cutting down of trees would affect environment badly. There are number of trees which would be lost hence more than the number which would be cut should be grown.	It was suggested that new trees should be fruit bearing trees.	Cutting of trees will be minimum & where unavoidable. Local species for better survival recommended
3	23-03-11	Primary School Beohara Tehsil Karchana, Dist Allahbad	43	• Noise Pollution would increase. • Number of accidents would increase, birds, animals and human being would hit by the trains. • Way to go to fields is required.	• Underpass to go to the farming land. • Trees plantation should be done. • Barricading / Boundary wall for protection of community is required.	Underpass, tree plantation recommended High embankment will be a deterrant.

S. No.	DATE	VENUE	NUMBER OF PARTICIP-ANTS	ISSUES SHARED	MITIGATION MEASURES	REMARKS
				• Cutting down of trees would affect environment badly. • Provision for watering fields should be provided.		
4	23-03-11	Primary School ChakpuremiyanKhurd	37	• Noise Pollution would increase. • Cattle run over would increase. • Irrigation facility would be required for across line fields. • Outlet for Clogged water is required. • Cutting down of trees would affect environment badly. • Canal water would get affected.	Green belt would serve dual purpose to curb noise and it would replace cut down trees also.	Green belt will be provided
5	23-03-11	Primary School Champat-pur	41	• Cutting down of trees would affect environment badly. • Noise Pollution would increase. • Irrigation facility would be required for both the sides. • More heat would be generated due to more number of trains running.	• Boundary wall for the safety of human beings and animals should be constructed • Underpass is required.	High embankment will act as deterrant Underpass will be provided at convenient place
6	24-03-11	Baswar	37	• Noise & Air Pollution would increase. • Cutting down of trees would affect environment badly. • Risk for the security of children, women and cattle would increase.	• Boundary wall for the safety of human beings and animals. • Sampark Marg is required for to and fro of traffic.	High embankment will act as deterrant Underpass / crossing provision will be at convenient place
7	24-03-11	Pipalgaon	19	Noise pollution.	• Wall for the safety of children as well as noise. • Over bridge at railway crossing	High embankment will act as deterrant ROB/RUB is planned at railway crossing as per railway norms
8	24-03-11	Lakanpur	32	• Cutting down of trees would affect environment badly.	• Tree plantation • Underpass for livestock and tractor etc.	Tree plantation & underpass at convenient place
9	25-03-11	Primary School Manpur	33	• Rate of accident would increase due to increase in number of rail tracks. • Proposed track is going from Chilvilla and Nahvai and Tikri Gram Sabha's school would come in between both the rail tracks. It would pose threat to the security of school children. • Noise pollution would increase.	• Barricading would minimize the risk for accidents. • Provision of water flow for the fields was requested by the villagers.	Fear allayed for increase in accident. School recommended for relocation. Noise will not increase

S. No.	DATE	VENUE	NUMBER OF PARTICIP-ANTS	ISSUES SHARED	MITIGATION MEASURES	REMARKS
						because DFC is electrified track.
10	25-03-11	Primary School Kukhuri	19	•Loss of plantation as Trees would be chopped. •Noise level would go higher. •If freight carriers would go uncovered (as per current situation) it would increase air pollution.	Tree plantation close to track is required.	Tree plantation planned
11	25-03-11	Middle School Baksandi	-	•Meeting did not held as no villager came to attend the meeting.	Nil	-
12	26-03-11	Middle School Dhumai	9	•Way to cross over track is required, •Cutting of trees would affect rains in the area.	•ROB •Underpass •Green Belt	These are planned
13	26-03-11	Primary School Sadko	23	•Cutting of trees would affect rains in the area. •Proposed track would divide agricultural land of many farmers. Going to other side of track would be a problem. •Normal life would be disrupted. Due to noise. •Vulture and Gorriya are getting extinct. Migratory birds would not come due to high level of noise as they get frightened by loud voices.	•ROB is required. •Tree plantation. ➔ Boundary wall •The existing underpass has a problem of water clogging during monsoon. Therefore some alternative to this problem is required. •Quality of previously constructed boundary wall was bad, it should be monitored	.ROB, tree plantationplanned Condition of underpass will be looked into Protection wall if necessary
14	25-03-11	Garai	10	•Project is very good and it is in the benefit of country.	Nil	-
15	27-03-11	Middle School Nagiyamai	86	•Noise pollution. •Cracks in the houses and other buildings due to vibration.	Green belt to curb noise and vibration.	planned
16	27-03-11	Middle School, Govindpurgoriy	23	•Vibration and noise level is high due to the existing track if it increases further it would affect the day to day life •For irrigation purpose taking water across rail track would be a problem for villagers. •Water clogging would be a problem. •Way to go to Govindpurgoriy is required.	•ROB •Box Bridge should be built to take cattle from one side of the track to another •Alternative for clogged water should be provided.	ROB/ RUB planned Drainage will be provided
17	28-03-11	Primary School Nidhiyaon	51	•Migratory birds would be affected due to cutting down of trees. •Cutting of trees would affect rains in the area. •Proposed track would divide agricultural land of many farmers. Going to other side of track would	•Boundary wall along with rail track is required to protect human and animal life. •Tree plantation in lieu of cut down trees. •Crossover	High embankment will help. Protection wall will be provided case to case basis. Underpass at

S. No.	DATE	VENUE	NUMBER OF PARTICIP-ANTS	ISSUES SHARED	MITIGATION MEASURES	REMARKS
				be a problem. •Accident rate is already higher.	bridge/underpass to go to other side of track.	convenient place Fear about accident allayed.
18	28-03-11	Community Center, Bidanpur	21	•Primary and Middle Bidanpur Schools would come closure hence an underpass is required. •ROB is required at Bidanpur station due to four lane track. Unsafe for animals and human beings. •Cutting down of trees would have an impact on rain and birds.	•Boundary wall along with rail track is required to protect human and animal life. •Tree plantation in lieu of cut down trees.,	High embankment will help. However protection wall can be considered on case to case basis dependin upon criticality. Tree plantation planned
19	28-03-11	Primary School Tikardeh, Block Sirathu, Dist. Kaushambi	18	•Due to train track on both sides normal life would be affected •Vibration would increase.	Boundary wall to protect school.	High embankment will help
20	29-03-11	Primary, Middle School Giras	22	•Cutting of trees would create problems. •Way to go to other side is required.	•Tree plantation to reduce noise effect and it would work as fencing. •Request for underpass has come from villagers.	Tree plantation planned Underpass at convenient place may be considered.
21	29-03-11	Middle School JalapurBori	36	•There would be lot of cutting down of trees. •Way to go to other side is required. •Subway at Pannoi link road was requested as it is very busy traffic road.	•Tree plantation is required. •ROB/ Underpass.	Tree plantation planned Underpass / ROB as per railway may be considered
22	30-03-11	Primary School Balkaranpur	37	•Fruit bearing trees would be lost. •Track should be built with a technique which can minimize the effect of vibration.	•Barricading to save village population Tree plantation to control dust, noise and smoke •Over bridge to cross track.	People are pro-national development and very much willing to have this project.
23	30-03-11	Raidehmafi, Tehsil Chayal, Dist. Kaushambi	18	•No environmental issue was discussed. •People are worried for compensation only.	Nil	-
24	30-03-11	Chillasahbaji	21	•Trees would cut down. •School, hospital and village would not remain secure. Accidents would increase. •Underpass at Chillashahbaji and Danyalpur is requested by the group.	•Green belt is required. •Over bridge is required. •Barricading to protect community, hospital and school is required.	Green belt planned Overbridge / underpass at convenient place may be considered. High embankment will help
25	31-03-11	Primary School Kukri	51	•Environment would get polluted due to cutting down of trees. •Over bridge at Kukra is requested by the group as traffic to Lokipur goes via this area. •Outlet for clogged water	Greenbelt and ROB is required.	Green belt planned ROB as per railways may be considered depending upon traffic

S. No.	DATE	VENUE	NUMBER OF PARTICIP-ANTS	ISSUES SHARED	MITIGATION MEASURES	REMARKS
				near existing bridge is not there hence it should be taken care off. •Noise would affect school which is close by.		Noise barrier may be considered
26	31-03-11	Pambhipur	19	•Degree College Rani Chandra PrabhaMahavidayalaya would be affected by the noise.	Green belt to absorb noise close to Degree College.	Green belt planned
27	31-03-11	Primary School Sujrahi, Fatehpur	20	•Primary health center is in Hardoo and not in Khaga hence more time would be taken to reach there in case of emergency.	Underpass is required to avoid closing of rail gate to reach faster for medical help.	Underpass at convenient place may be considered
28	31-03-11	Puraian	37	•Cattle run over would increase. •Environment would get polluted due to cutting down of trees.	•Barricading •Greenbelt	High embankment will help Green belt planned
29	01-04-11	Primary School, Mahmoodpur, Manuari	21	•Construction of over bridge would affect the Manuri market.	Underpass	Underpass at convenient place may be considered
30	01-04-11	Primary School Saidsarawan	26	•No environmental issue was raised by the group. •Group was worried for the compensation money and improper way of measurement of their houses by the concerned department.	•ROB or Underpass at Saiyed Sarawan •People were upset because majority people have houses on Gram Sabha land hence they would be compensated for the houses and not for the land	-

The above meetings were conducted by Ms.Anju Sharma and Mr.Jitendera Pandey from Advantage India and DFCCIL officials

Table- 9.3

Sl. No.	Date	Meeting Venue	Attendance	Issues raised by Community
1	22.3.11	PahadiBhojpur (PanchayatBhawan)	29	Air and noise pollution while construction affects health of community people. Also problems related to irrigation water,
2.	22.3.11	Mohanpur (PanchayatBhawan)	44	Loss of tubewell,boring well, Inter college near track and noise pollution. Culverts are required for flow of rain water.
3.	2.3.11	Devpur Pathkaulii	33	Air ,water and noise pollution, fear of death of animals, loss of land causes livelihood. The land is very fertile and all types of vegetables are produced in the area
4.	23.3.11	BaijiMukundpur (Primary School)	52	Loss of agricultural land, water exit to be provided, noise pollution, primary school near by line, problems for animals , railways crossings to be made. Sahara India has taken the deserted land for high price and the rail goes through fertile land, villagers require more price for their land.
5.	23.3.11	Bhiskuni (Primary School)	28	Noise pollution. To avoid vibration sound proof wall to be constructed. trees to be planted , destruction of jungle in nearby areas, water exit to be provided, fencing to be provided against loss of animals
6.	24.3.11	Boundary (Primary	46	(1) Pollution, Air Pollution, Noise /

Sl. No.	Date	Meeting Venue	Attendance	Issues raised by Community
		School)		Primary school is very near to track
7.	24.3.11	SirsiBaghel (PanchayatBhawan)	19	(2) Air Pollution nearly 400 trees will be cut down as they are coming on the proposed track.
8.	24.3.11	Maghgawan (Temple)	72	(3) Noise Pollution, ND Convent School very near to railway track.
9.	24.3.11	Ranibari (Primary School)	49	• Major problem is of Noise pollution as school is about 70-80 mtrs. and ANM, Center is just 20 meters from proposed railway track.
10.	25.3.11	Deoria (Shivji Temple)	43	• Issue of noise pollution, soil pollution. • A underpass passage is required in place of crossing as it is closed for long hour.
11.	25.3.11	AchitpurPuraini(PanchayatBhawan)	41	• A hamlet of this village called Jadhopur will be covered by railway track from three sides and on one side is a canal so there might be a problem of water logging which could lead to pollution, so proper arrangement for drainage system while putting new track.
12.	25.3.11	Jamalpur (Shivji Temple)	13	• Since the railway track is not close to the proposed railway track, so they do not have any issues related to environment.
13.	26.3.11	Bhabhuar (Primary School)	47	As the village is close to Ahrora Road railway station, the major issue was of noise pollution, people demanded of a boundary wall. • Secondly they demanded for proper drainage of water. • Provision of ramp near the village for people to reach railway station.
14.	26.3.11	Barjeevanpur (PanchayatBhawan)	35	• People raised the issues of Noise, Air & soil pollution.
15.	26.3.11	Darra (Primary school)	32	• Issues of Air, noise and soil pollution were raised by community. • A underpass near Block hut PP is required. • A under pass near already existing underpass is required and the height of previous underpass should be increased. A crossing is demanded 500 metres west from PP Block hut which will connect the village to Fattepur, BaigpurBijuka, Rupandha, Parsiya, Bahiliachak.
16.	27.3.11	Dixitpur (Shiv Shankari Devi Temple)	25	• There were no issues related to environment • A underpass is demanded near Shiv Shankari Devi Temple as it is very famous and most of the people reach there by crossing the railway track which results into lot of accidents.
17.	27.3.11	Kailahat (PanchayatBhawan)	46	• Issue of water pollution was raised, there is an pond which is very close to newly proposed track. • Issue of noise pollution was also raised. • The present crossing near village remains closed for long-time, so people demanded for an underpass so that there animals can pass through. • A underpass near Mandir is required to go for their field work and for irrigation purpose.
18.	27.3.11	Bharheta (Dhui Baba Temple)	13	• Railway track is away from the village the only issue was of a underpass near the primary school as children face problems in crossing the railway track.
19.	28.3.11	Jamui (Primary school)	80	• Noise pollution was the main issue, people demanded of a wall along with the market. • Secondly a underpass is required at the previously existing underpass and also the arrangement to avoid the water logging at underpass.
20.	28.3.11	Phulwariya (Primary school)	16	• The pollution due to water logging during rainy season was main issue, as there is no proper drainage system, because of this water is collected and gives stinking smell.

Sl. No.	Date	Meeting Venue	Attendance	Issues raised by Community
21.	28.3.11	Samaspur (Primary school)	27	• Village is away from railway track, there main concern was that of air pollution as many trees will be cut down during the construction of railway tracks.
22	29.3.11	Chakedi (Primary School)	17	• Proposed track is about 1 km. from the village; the major issue related to environment was that of air pollution as cutting of trees can cause a imbalance. • Underpass between Bajapur&Alavalpur • Underpass between level crossing 53, 54 connecting Chakedi and chaksada. • Underpass between Champatpur&Bhaisahi.
23.	29.3.11	Kurustikula (Primary School)	24	• Major issue was of air pollution and ecological imbalance due to cutting down of trees. • Underpass connecting AjmabadBhaisahi and MirpurKurusti is required. • Underpass near Daulatpur for going through & irrigation purpose.
24.	29.3.11	Ekari (Pradhan's House)	37	• Village is very close to railway track near about 25 mtrs. 50 people raised the issue of noise pollution. • People proposed for fencing along the railway track. • A underpass near existing underpass needed.
25.	30.3.11	Haswa (Primary School)	33	• Railway track is near to village so issue of noise pollution was raised. • Cutting of trees was big concern. • A under pass at 1 km west from Gate no.44. • A underpass at 1 km east from gate no.44
26.	30.3.11	Daniyalpur (Junior High School)	16	• Since the proposed track is about 1.5km from the village so the major issues raised by the community were air pollution due to cutting down of trees and during construction where heavy vehicles and machinery will be used. • An underpass required in west of Asma, Babarpur, Daniyalpur. • Fencing along with railway track near the village ie about 1 km.
27.	30.3.11	Sangaon (PanchayatBhawan)	25	• Major issue were of Air pollution and soil pollution, people feel that the dust during construction of railway track would be dangerous for both crops as well as people. So there should be proper arrangement of water tankers who will time to time sprinkle the water on the way to avoid the fly of dust.
28.	31.3.11	Musaidpur (Primary School)	32	• Major problem was Air pollution due to cutting down of trees. • Soil pollution was also a issue as during construction of railway track. • An underpass was demanded between Musaidpur and Teksari.
29.	31.3.11	Emaadpur (Pradhan'sHouse)	19	• Major issue was of noise pollution as railway track is very close to village. • Provision of underpass between Emaadpur Chakroad and Balramdaspurwa as there is about 50 Bighas of agricultural land on other side of railway track. • Underpass near Mustaini for the cattle to pass and also for water for irrigation purpose.
30.	31.3.11	Malaka (Primary School)	10	• Major issue raised was that of air & noise pollution as the machineries and vehicles used during construction will pass through the village and dust will be a big problem. So there should be provision of sprinkling of water on the roads. • Underpass near malaka minor.
31.	1.4.11	Sathariyaon (Primary school)	43	• Major issue was of Noise pollution as the newly proposed railway track is very close to the village.

Sl. No.	Date	Meeting Venue	Attendance	Issues raised by Community
				• People also raised the issue of Air pollution due to cutting down the trees. • An underpass near railway station was demanded, so that people could reach there easily. • Underpass on the chakroad which joins Bandhasagar Road. • People also demanded fencing or barricading near village to avoid any accident.
32	1.4.11	Asti (near Masjid)	30	• Major issue was of noise pollution people demanded of construction of wall near madarsa and masjid. • People also demanded of underpass near Syed Baba mazaar, since its a religious place and a Urs is held every year and a large gathering is held.
33.	1.4.11	Korai (Primary School)	40	• Air pollution due to cutting down of trees was major issue. • Noise pollution will also increase. Dust will result into damage to the nearby fields and will also cause pollution. • Road joining Korai&Kurusti Kala Station is coming under the land acquired for new track, so a provision for road should be made by railways. • An underpass near Budhaiyapur 947/20 which will connect with Shivor, ChatwapurBilandpur, Umrapur, Bhairavpur, Bakandha.
34.	2.4.11	Hardaurpur (Primary School)	35	• Noise pollution was the main issue people demanded of a boundary wall near Primary school of avoid noise pollution. • Proper drainage system to avoid water pollution. • Fencing along with the village ie about 300 metres. • Underpass 100 metres east from Hardaurpur village crossing and height of old underpass to be increased.
35.	3.4.11	Umrauni (Primary School)	10	• As the village is for from the proposed railway track, so there were no issue related to environment.
36.	3.4.11	Vasavankheda (Primary School)	37	• Main issue was on noise pollution as the proposed railway track is about 50-60 metres from village. • People also raised the issue of soil pollution and damage to crops during the construction of track. • People also said that with the new track becomes operational the number of passenger trains on other track would increase and the quantity of garbage thrown which includes disposable glasses plates, polypacks of chips and eatables will also cause lots of pollution.
37.	15.4.11	Aung (PanchayatBhawan)	19	• People had no issues related to environment except the cutting down of trees. • Demanded a underpass 1 km from village towards Kanpur.
38.	15.4.11	Mamrezupr (Primary School)	37	• Major environment related issues were of noise pollution and air pollution .Underpass near 962 kms store connecting Radi to Rewari.
39.	15.4.11	Behta (Pradhan's House)	06	• No Major issue related to environment. • Demanded a underpass connecting ChakKinaka and SaraiSahzad.
40.	16.4.11	Hasanpur	14	• Railway track is very close to the village so major issue was of noise pollution and vibration. • People demanded barricading along the village. • Underpass near poles 962/21 & 962/22. • People also raised the issue of about 1 Bigha land of Muslim graveyard being acquired by railways, they

Sl. No.	Date	Meeting Venue	Attendance	Issues raised by Community
				wanted the same to be spared.

The above meetings were conducted by Mr. Harmendra Pal Singh, Mr. K.Bhaskaran and Mr. Ashish from Advantage India and DFCCIL officials.

PUBLIC CONSULTATION MEETINGS (MUGALSARIA SECTION KM 676-667)

Table- 9.4

Sl. No.	Date	Meeting avenue	Attendance	Issues raised by Community
1	16-9-2011	Shiv Mandir , Village covered Jeonathpur,daulatpur	29	No major problems of Environment related issues. Villagers suggested building one over bridge for crossing. Also they demanded facilities for proper drainage of water. Most of the villagers had the apprehension of accidents to animals suggested for fencing near the track.
2.	16-9-2011	PanchayatBhawan-Heshanpur Village covered Sindhitali ,Heshanpur	44	Heshanpur primary school is within 100 mtr range and Sunseer school is within 50 mtr range. One primary health center also within 100 mtr range. So major problem of noise pollution. Water logging problems to be sorted out. Precautions to be taken to avoid accidents. Various bodies are taking the agriculture land for various purposed and villagers are disturbed by this. Those who are travelling in passenger trains are throwing plastic items to agriculture lands and this creates problems. Vibration from the existing track also a major concern for villagers. Insurance to be provided for villagers Those who are losing fertile agricultural land to be given jobs in railways. Accidents cases are increasing and precautionary measures to be taken while construction of new track Concession to be provided to family members of those who are giving their land.
3.	16-9-2011	Primary School-Jaffarpur	33	Primary school near to track. Villagers fear of noise pollution and vibration. Participation of farmers are required while fixing compensation. More compensation for landless farmers. Many irregularities in land records and villagers are suffering due to this. Precautionary measures to be taken to avoid dust pollution while running train. NOC gett Farmers will not give any land until rehabilitation and job for workers to be provided. There are around 60 people who attended the meeting and shared their opinions.. They have the concern that through public consultation meeting the authorities taking their consent for taking their land etc.
4.	16-9-2011	Middle School, Nasirpurpatan	52	School near to track, so problems of noise pollution Water exits to be provided Loading and unloading of coal for factories creates air pollution Nala to be provided from Matkutta to Nasirpurpatan and this will be connected to next village for easy flow of

Sl. No.	Date	Meeting avenue	Attendance	Issues raised by Community
				water. Possibility of train accidents As there is enough land for railways, the middle school to be shifted to some other place . Because of dust pollution villages are suffering from many diseases. Crossing to be provide near Patparai
5.	17-9-2011	In front of Gayatri Medical Store Sareshwer	28	Two schools (primary and middle) are near to track. So steps to be taken to avoid noise pollution Accident cases are increasing. Precautions to be taken while construction of new railway line Two small temples (Boodhimai temple and Shakti maimandir) ,and one Kabaristan are near to track and need shifting.

The above meetings are conducted by Mr.K.Bhaskaran and Mr.Vinay Sharma from Advantage India and DFCCIL officials.

C. SUGGESTIONS BY COMMUNITY

1. Adequate number of trees to be planted to avoid the ecological imbalance which could arise due to cutting of trees as they are the major part of our environment and plays a vital role in our life.
2. Provision should be made to remove the dead animals from the railway track as it could result into air pollution. Also measures should be taken for protection of animals like fencing etc in major places like those villages where Track is Parallel and close to village for about 0.5 to 1.5 Km.
3. Underpasses should be constructed in such a way that there should not be the problem of water logging as the underpasses on the old track has no provision of proper drainage especially during rainy season and floods.
4. There should be provision of tankers of sprinkle the water on the roads used by Construction Company during the construction of track to avoid flow of heavy dust in air..
5. Provision of walls near schools & hospitals to avoid noise pollution.
6. Fencing & Barricading at the places where track is close to the village.
7. Water tanks should be constructed to avoid drinking water problems
8. Measures to be taken not to damage agriculture while construction of railway line
9. Majority of the people want to know clear cut rules for compensation
10. Chakroad,Nali and Canal should not be finished. Existing facility for irrigation and pathway etc.should be maintained.
10. Ground water level due to the proposed track may go down and community people are suggesting not to use the existing water channels for construction activities.

D. SUMMARY AND MAJOR FINDINGS

Generally people are more concerned about compensation and job in railways. Environment is not on their priority list. At most of the places stakeholders raised the issue of increased noise level and suggested that the boundary wall near the rail track, schools, hospitals and habitations should be constructed.

In some villages issues on safety of children were raised by the villagers and according to them due to the proposed project accidents would increase, birds, animals and human beings would be hit by the trains. Migratory birds may not pass

this way due to high level of noise as they get frightened by loud voices. Villagers suggested that there should be sufficient underpasses/over bridges to cross the track for their field work and also to avoid accidents of animals etc.

There were suggestions from many villagers that walls near the track should be constructed to protect animals, human lives and for reducing the noise level. Boundary wall was a major suggestion.

Majority of the people are confused and worried about the compensation. They want to know clear cut rules for compensation. People are confused because land was measured three times and each time markings were done differently.

There are many farmers (for example in village Beohara and Masika from Karchana Tehsil, Allahabad District, village Baswar, 90% people in the Champatpur village would lose major portion of their land etc.) who are losing major portion of their agricultural land and the remaining piece of land is very small so much so that it cannot be used for farming. Hence on voluntary basis railway should take it over and compensate for the same.

Land which is close to rail track and left in the form of strip would be of no use due to mini stones which would fly as train passes by. Hence on voluntary basis railway should take it away and compensate for the same.

In majority cases oldest male member in the family has the ownership of the land and it is undivided property of four to six brothers and as per the rule only one person would get the job. It would create disharmony among families. Therefore at many places it was suggested that instead of one job it should be offered on the basis of family members or number of dependents.

In several villages people suggested that compensation should be according to the quality of land.

Unemployment will increase due to increase in number for landless people. Job announcement of Railway Minister should be clarified and assured. This job offer should be given with in one month after land acquisition. Process of offering jobs in the railway as per rail minister's order should not be delayed. It should be offered to people according to their ability with in one month of compensation disbursement.

People require time to relocation after getting money in lieu of land acquired.
During the DFCC project construction local labour should be employed from affected villages. People from many villages (Baswar etc.,) have expressed that local labour and machinery like Tractor etc.should be employed in the project.

Some people have occupied Gram Sabha land. They should not get the compensation for that land and instead Gram Sabha should get that amount so that some development of the village could be done. People were concerned for the Gram Sabha land that who would be getting the compensation money for that land.

Some people have suggested that there is no village on Naini – Karchana link road sand therefore new line could go by the side of central railway.

Generally people have struggled to submit their papers for compensation. Some of them have not submitted the papers as yet. For some people expenses for preparing and depositing papers for their land is more costly than the amount of compensation therefore they do not want to submit their papers.

Photographs of Public Consultation Meetings

Fig- 9.1 Meeing at Sadar Teshsil

Fig- 9.2 Meeting at Chunar Tehsil

Fig-9.3 Meeting at Fathehpur Tehsil

Fig-9.4 Meeing at Fathehpur teshsil

Fig-9.5 Meeing at Fathehpur teshsil

Fig-9.6 Meeting at Sirathu Tehsil

Fig-9.7 Meeting at Sirathu Tehsil

Fig-9.8 Pubic Consultation Meeting at Mughalsarai Section

F-g-9.9 Pubic Consultation Meeting at Mughalsarai Section

Fig-9.10 Pubic Consultation Meeting at Mughalsarai Section

Fig-9.11 Meeting at Bindaki

Fig-9.12 Meeting at Khaga Tehsil

Fig-9.13 Meeting at Khaga Tehsil

Fig- 9.14 Meeting at Chayal Tehsil

Fig- 9.15 Meeting at Chayal Tehsil

Fig-9.16 Meeting at Karchan Tehsil

Fig-9.17 Meeting at Meja Tehsil

Fig-9.18 Meeting at Allahabad Tehsil

CHAPTER-10 - ENVIRONMENT MANAGEMENT PLAN

10.1 INTRODUCTION

Environmental Management Plan is an implementation plan to mitigate and offset the potential adverse environmental impacts of the project and enhance its positive impacts. Based on the environmental baseline conditions, planned project activities and impacts assessed earlier, this section enumerates the set of measures to be adopted in order to minimize adverse impacts. The process of implementing mitigation and compensatory measures, execution of these measures, agencies responsible for the implementation of these measures and indicative costs are discussed in this chapter.

The project has overall positive impacts by providing a competitive, cost effective, congestion free reliable mode of dedicated freight service. It will certainly reduce the load on the roads and facilitate fast transfer of goods. Railway being an eco-friendly mode will also enhance or at least will not degrade the environmental quality.

The development of DFC entails civil work, including excavation, filling, construction of RUB/ROB, bridge and cross drainage structures, and utility shifting etc., which are likely to cause adverse impacts on natural and social environment. The impacts can not be fully avoided; however, appropriate mitigation measures are suggested to minimize and compensate the potential adverse impacts and enhance positive impacts. Most of the impacts are temporary in nature and are limited to the construction phase. These impacts can potentially be minimized and managed by proper planning and execution. The environmental management plans includes activities for pre-construction phase, construction phase and operation phase.

10.2 ENVIRONMENTAL MANAGEMENT PROCESS

Environmental management is based on the potential impacts assessed for the project. Assessment of potential impacts is based on the review of secondary data substantiated by site visits – environmental monitoring, public consultation, household survey and discussion with concerned Govt. Dept. The implementation of Environmental Management Plan (EMP) requires the following:-

- An organizational structure
- Assign responsibilities
- Define timing of implementation
- Define monitoring responsibilities

10.3 EMP DURING CONSTRUCTION & OPERATION

The project activities will be executed in a phased manner, pre-construction phase, construction phase and operation phase. The major activities to be undertaken are described below.

10.3.1 Construction Phase

The environmental issues during construction stage generally involve equity, safety and public health issue. The contractor is required to comply with the laws with respect to environment protection, pollution prevention, forest conservation, resettlement and safety and any other applicable law. Environmental pollution during the construction phase will be less but control of pollution during this phase is of considerable importance. The EMP is an executable part of project, and the activities are to be guided, controlled, monitored and managed as per the provision provided. Following activities require attention during construction phase.

1. Land Acquisition / Diversion Plan

Acquisition of land is indispensable for construction of DFC. The proposed alignment traverses through settlement and agricultural areas. Total land requirement for the project is 1400Ha and most of the land likely to be acquired for the project is agricultural land.

- At the outset as a part of the Land Acquisition Plan, the Right of Way (RoW) along the entire DFC alignment has to be established and
- confirmed from the State Forest, Agriculture and Land Revenue Departments.
- Diversion of forest land will be carried in compliance to Forest Conservation Act, 1980 if found during land acquisition survey.
- The acquisition of land and private property shall be carried out in accordance to the Resettlement Action Plan (RAP).

It has to be ensured that all R & R activities including the payment of the compensation may be reasonably completed before construction activities starts, on any section of the DFC. No construction work will start before total compensation has been paid to the PAPs. This will be as per RAP.

2. Utility Shifting Plan

There are some utility services along the proposed DFC alignment such as electric lines, telephone lines, cable line, pipe lines etc which may be shifted on consultation with the concerned department before commencement of construction activity. There are road crossing with the DFC. Construction of bridges will be required to maintain their utility. These structures will be shifted in consultation with the concerned departments.

Removal of trees shall be responsibility of the Contractor who will obtain necessary permit for tree felling, and its proper disposal of woods. Felled trees shall be the property of the Contractor.

3. Construction / Labour Camp Management

- During the construction phase, the construction / labor camp will be located along the project area. Large numbers of labour are likely to move into the project area. A proper Construction Camp Development Plan has to be formulated to control degradation of the surrounding landscape due to the location of the proposed construction camp. The contractor must provide, construct and maintain necessary living condition and ancillary facilities. These must be included in contract documents provided to the contractor.

- Sufficient supply of potable water must be provided at camps and working sites. If the drinking water is obtained from the intermittent public water supply, then storage tanks must be provided. All water supply storage may be at lest 15 m away from the toilets or drains.
- Adequate and clean washing and bathing facilities must be provided that also have sufficient drainage.

- Adequate sanitary facilities may be provided within every camp. The place must be cleaned daily and maintain strict sanitary conditions. Separate latrine must be provided for women. Adequate supply of water must also be provided.
- The contactor must ensure that there is proper drainage system to avoid creation of stagnant water bodies.
- Periodic health checkup may be conducted. These activities may be provided by the construction contractor in consultation with State Public Health Department.
- At every camp, first aid facilities with suitable transport must be provided to take injured or ill person to the nearest hospital.
- Adequate supply of fuel in the form of kerosene or LPG may be provided to construction labours, to avoid felling of trees for cooking and other household activities. No open fires may be allowed in camps.
- The sites should be secured by fencing and proper lighting.
- The construction contractor may ensure that all construction equipments and vehicle machinery may be stored at a separate place / yard. Fuel storage and refilling areas may be located 500 m away from the water bodies and from other cross drainage structures.
- All the construction workers should be provided with proper training to handle potential occupation hazards and on safety and health which include the following:-
    - Environmental awareness programme
    - Medical surveillance
    - Engineering controls, work practices and protective equipment
    - Handling of raw and processed material
    - Emergency response

- Construction / labour camps may be located away from forest areas, settlements, cultural heritage and historical sites and water bodies and dry river beds.
- It should be ensured by the construction contractor that the camp area is cleared of the debris and other wastes after the completion of construction. On completion of construction, the land should be restored back to its original form.

4. Borrow Area Management Plan

An appropriate Borrow Area Management Plan will be formulated to control the degradation of the surrounding landscape due to the excavation work. The national standard which applies to the manual borrowing of earth is the IRC-10:1961.

- Borrowing of earth shall not be done continuously. Slopes of edges shall be maintained not steeper than 1:4.
- Top soil (15 cm) from all areas may be preserved in stockpiles and utilized for redevelopment of borrow/quarry areas.
- Borrow pit should be developed as far as possible from the river side, where the inner edge of any borrow pit should be not less than 15 m away from the toe bank. As per as the borrow pits on the rear on landside are considered, it is to be avoided. Where it is unavoidable a berm, at least 25 m wide should be left between borrow pits and toe bank. The toe of the bank on the rear side should have a cover of 0.75 m to 1.25 m over the saturation line drawn at a slope of 1:6 from the high flood level on the river side.
- Borrowing of earth shall not be carried out on productive land. In the event that such an occasion arises, the contractor has to obtain permission from the supervising engineer.
- Sources of borrow areas will be identified by the construction contractors.
- No borrow area will be opened without the prior permission from the local administrative bodies like Village Panchayats, State Department of Irrigation, Agriculture and State Pollution Control Boards etc.

- Reclamation of borrow area should be mandatory and must be included in the agreement made with the construction contractor.
- Borrow pits may be located at least 1 km away from the villages and settlements.
- All borrow pits may be reclaimed: -
    - The quarry and borrow area should be reclaimed back. The pits formed should be backfilled by construction waste and site should be stabilized.
    - Spoils may be dumped with an overlay of stocked piled top soil with respect to MoEF/SPCB guidelines.
    - Borrow and quarry pits can be also be developed as ponds and be used for aquaculture as per local requirement. These can also serve as perk or picnic spots.
    - Landscaping of borrow and quarry area may be done, and the grasses, shrubs and tree species may be planted around the reclaimed area. Ornamental plants can also be planted on the access route.
    - Reclamation of borrow area may included in the agreement of the construction contractor.

5. Public Health and Safety

The contractor is required to comply with all the precautions required for the safety of the workmen. The contractor must comply with all regulation regarding scaffolding, ladders, working platform, excavation, etc.

- The contractor must supply safety goggles, helmets, earplugs and masks etc. to the workers and staff.
- Adequate precaution must be taken to prevent dander from electrical equipments. Necessary light and fencing must be provided to protect the public.
- All machines and equipments used for construction purposes must conform to relevant Indian Standards (IS) codes. This equipment must be free from patent defects, in good working condition, regularly inspected, and properly maintained as per IS provisions.
- All labourers working on mixing of asphaltic material, cement, lime mortars, concrete etc should be provided with protective footwear and protective goggles. Workers involved in welding work should be provided with welder's protective eye shields.
- No men below the age of 18 years or women of any age will be employed to work with paint products containing lead in any form. Face masks must be supplied to workers when they use any form of spray paint or work with surfaces that have been dry rubbed and scrapped with lead paint.
- All reasonable measures must be taken to prevent any damage to the public from fire, floods, etc.
- All necessary steps must be taken to prompt first aid treatment for injuries that may be sustained during the course of work.
- The contractor must conform to all anti malarial instructions, including filling up of borrow pits.
- Work that affects the use of side roads and existing accesses must not be taken without providing adequate provision.
- On completion of the works, all the temporary structures may be cleared away, all rubbish disposed, excreta and disposal pits or trenches filled in and effectively sealed off and the entire site left clean and tidy.
- To control dust in working area regular water sprinkling shall be done to avoid dust related deceases such as silicosis. **The silicosis exposure reduction strategy is given in Annexure 10.1.** Mask shall be provided to workers who are engaged in in stone ballast preparation.

6. Green Belt

The green belt has been recommended as one of the major components of the EMP which will further enhance the environmental quality through:

1. Mitigation of air pollution problems
2. Attenuation of noise level
3. Maintain the Green area and improve aesthetics.

It is most important to chalk out a long-term approach to keep the air in the area clean. One such measure is using the plants for absorbing and trapping the air pollutants. The hypothesis that trees are important particulate sinks is supported by evidence obtained from studies dealing with diverse particulate matter including pollen, salt, precipitation, dust and other unspecified particles. As far as gaseous pollutants are concerned, substantial evidence is available to support the fact that plants in general, and trees in particular, function as sinks for gaseous pollutants. This is achieved through various physiological processes occurring within the plant system.

The gaseous pollutants are transferred from the atmosphere to vegetation by the combined forces of diffusion and flowing air movement. Once the gaseous pollutants come in contact with the plants, they may be bound or dissolved on exterior surface or taken up by the plants via stomata. If the surface of the plant is wet and if the gas is water soluble, the former process can be very important. As a matter of fact, plants act as bio filters for the air pollutants and play a major role in safeguarding the environment and controlling the increasing level of air and noise pollution.

A. Preparation of the Plantation Area

A green belt will be proposed along the alignment. Plantation site should be cleared from all wild vegetation. Suitable soil and water conservation measures will be adopted, if required. Since planting area is large, it should be divided into blocks inter-linked by paths laid out in such a way that every tree is accessible for all post plantation care. The planting arrangement and size should be based on the optimum use of the available land and quantum of irrigation water.

A tree requires sufficient space below and above the ground to spread its roots and branches. However, spacing varies with the type of trees, soil fertility, available moisture and purpose of plantation.

B. Preparation of Pits and Sapling Transplantation

The location of each pit should be marked according to the design and distance of the plantation. The size of the pits may vary with the type of trees. While digging the pit, care should be taken to place the topsoil on one side and bottom soil on the other side. Dug-out soil and pit should be exposed to weather for two to three months. After exposing to the weather, the pit should be filled two-third to three-fourth height with a mixture of topsoil and decayed farmyard manure.

Planting of the tree should be done with a suitable between each. While planting the trees, care should be taken that the installation structure should be difficult to see through the foliage when seen from a point outside the green envelop. For preventing the horizontal dispersion of the pollutants, the trees should be planted in alternate rows in a straight line. Tree trunks are free from foliage up to a height of 2 – 3 meters, it is advisable to grow shrubs in front of tree so as to provide coverage to the open portion.

C. Time of Plantation

Plantation should be done two weeks after the rain starts, as the trees benefit from the seasonal rains. It is advisable to avoid planting during the dry season, as this will require watering. It is advantageous to plant trees on cloudy days.

D. Protection of Greenbelt

- No pruning or lopping of branches should be done within the greenbelt for at least 10 - 15 years
- Gap filling in the greenbelt should be done in the same season to avoid future gaps.
- Protection of young plants from the ravages of cattle, sheep and goat and other animals.
- Timely replacements of damaged plant and thereafter care is important.

E. Selection of Tree Species

Plants possess a large surface area and their leaves exhibit an efficient pollutant trapping mechanism. The effectiveness of plants to control pollution depends upon the physiological, morphological traits such as leaf epidermis, size, leaf orientation, internal enzyme system, etc. Systematic screening of plants for their ability to tolerate pollutant need be undertaken. For pollution abatement purposes tree species should be fast growing, wind firm, unpalatable to animals, hardy and pollutants tolerant/resistant. It is recommended that local species shall be preferred for plantation. A List of some local plant species for greenbelt plantation purpose is given in Table below. It is recommended to use local species for better survival rate.

List of Tree Species for Green Belt Plantation

Sl. No.	Botanical Name	Common Name
1	*Alstonia scholaris*	Chattiyan
2	*Mimusops elengi*	Bakul
3	*Cassia fistula*	Amaltas
4	*Bauhinia purpurea*	Khairwal
5	*Zizyphus mauaritiana*	Ber
6	*Cassia siamea*	Senna
7	*Ficus religiosa*	Peepal
8	*Albizia lebbeck*	Siris
9	*Pongamia pinnata*	Karanj
10	*Polyalthia longifolia*	Ashok
11	*Diospyros melanoxylon*	Tendu
12	*Ailanthus excelsa*	Mar Maharakha
13	*Melia azedarach*	Bakain
14	*Tamarindus indica*	Imli
15	*Terminalia arjuna*	Arjuna
16	*Azadirachta Indica*	Neem
17	*Grevillea robusta*	Savukkamaram
	Shrubs & Grasses	
1	*Calotropis gigantea*	Akand
2	*Nyctanthus arboriristis*	Harsighar
3	*Nerium indicum*	Kaner

F. Plantation for Noise Pollution Control

Trees having thick and fleshy leaves with petioles flexible and capacity to withstand vibration are suitable. Heavier branches and trunks of the trees also deflect or refract the

sound waves. The density, height and width are critical factors in designing adequate noise screen with vegetation.

Combination of trees and shrubs together appears to be the best system for combating pollution. The following species are suggested for noise pollution:

- *Alstonia scholaris*
- *Azadirachta indica*
- *Melia azedarach*
- *Grevillea robusta*
- *Tamrindus indica*
- *Terminalia arjuna*

Varied plantation techniques and types will reduce noise unequally. In addition to this, it is also relies on categories of plant to block noise. Some type of trees with varying heights block noise better than trees forming a straight line, which can reduce noise up to 3.48%. The formation of plant of different heights planted such that they stand highest to lowest in straight line will have best noise blocking. Port line can reduce noise up to 4.39%. The formation of plant from the highest to lowest in alternate formation will have the best noise reduction in the fifth line which is 7.63% (Chakree, 1989).

10.3.2 Operation Phase

During operation phase, the noise and vibration control along the sensitive and residential area is most important. Regular monitoring will be done for these parameters, and appropriate measures as suggested in the report shall be implemented.

10.4 ENVIRONMENTAL MANAGEMENT PLAN & RESPONSIBILITIES

Table 10.1 presents summary of Environmental Management Plan (EMP) with the objective to minimize adverse environmental impacts as discussed. The table covers all possible environmental issues involved in the project and the necessary mitigation measures. Taking appropriate mitigation measures for the construction phase is the responsibility of the construction contractor, and of the construction projects' Environmental Engineer who will supervise the implementation of the EMP.

The mitigation measures during the operation phase will be implemented by Environmental Management Unit (DFCCIL) of Railway Dept / DFCCIL, which includes an Environmental In-Charge who will supervise the implementation of EMP. Thus, the overall responsibility of the implementation of mitigation measures will be with the Construction Contractor during the construction phase and with the Railway Dept during operation phase. The details of Environmental Management Programme and Environmental Management Unit (DFCCIL) are discussed in the subsequent paragraphs.

Table 10.1: Environmental Management Plan

S. No.	Environmental Issue	Action to be Taken	Implementa-tion By	Supervision By
Pre-construction phase				
1.	Removal of Trees	Trees are likely to be felled in the existing and acquired area for the proposed corridor The forest land along the railway line is likely to be acquired for the project will be compensated by providing value of land as per Net Present Value (NPV)	Construction Contractor to obtain permission, felling and disposal of woods; plan &	DFCCIL

S. No.	Environmental Issue	Action to be Taken	Implementa-tion By	Supervision By
		Double area of land may be provided for Forest Dept for carrying Compensatory afforestation. Compensation may be provide for plantation of trees Double area of land may be provided for Forest Dept for carrying Compensatory afforestation. Compensation may be provided for plantation of trees	implementat-ion of afforestation	
2	Land Acquisition /Division	Ownership of land within the ROW and at Junction station should be confirmed Number of Project Affected Persons (PAPs) to be identified Resettlement Action Plan to be prepared for the PAPS and provide compensation in compliance with National Resettlement and Rehabilitation (R&R) policy Information dissemination and community consultation	DFCCIL/ NGOs as collaborating agency	Revenue Dept / DFCCIL
3.	Relocation OF Cultural and Religious Properties	Religious structures to be shifted only after public consensus. Relocation should be complete before construction work is taken up.	Construction Contractor	DFCCIL
Construction Phase				
1.	Soil	Suitable protection measures consisting of bio-engineering techniques such as plantation of grasses and shrubs & check dams, may be provided to control erosion. Borrow areas may be finalized in concern with ecological sensitivity of the area. Agriculture land may not be used as borrow area. Priority may be given to degraded area for excavation of borrow material. Rehabilitation of borrow area may be taken under the project. Construction work may be avoided during rainy season to evade erosion and spreading of loose material. Top soil removed from agricultural land may be stored separately in a enclosed (bund) areas and utilized during plantation or refilling of excavated area.	Construction Contractor / DFCCIL	DFCCIL
2	Water Bodies	Provision of temporary drainage arrangement due to construction activities must be made by Contractor and suitable and strict clause must be incorporated in General Conditions of Contract document for its effective implementation. Silt fencing may be provided near water bodies	Construction Contractor	DFCCIL

S. No.	Environmental Issue	Action to be Taken	Implementa-tion By	Supervision By
		Proper cross drainage structure may be planned at the crossing of the canal in consultation with Irrigation Department Proper drainage may be planned in the area to avoid water logging		
3.	Flora	Felling of trees must be undertaken only after obtaining clearance from the Forest Dept. forest areas, Railway Dept and local bodies outside forest areas Trees falling outside the ROW should not be felled. Compensation must be provided before initiating construction activity. Fruit bearing trees may be compensated including 5 years fruit yield. Labour Camps and office site may be located outside & away from Forest area Green belt development may be undertaken in the wasteland near railway line to enhance esthetic and ecological value. Social forestry may be practiced for success of the plantation. Local people can be involved in plantation and maintenance of plantation as part of the project in consultation with Forest Department.	Construction contractor	DFCCIL
4	Fauna	Crossing passages must be made for wildlife near forest areas such as under pass followed with some plantation so that it resembles with the habitat of wildlife and facilitate crossing of wildlife in forest area. Ponds may be developed inside forest areas as the birds prefer water bodies. Borrow areas can be also developed as ponds with grasses and shrubs planted around it. Silt fencing may be used near water bodies to avoid runoff into the water bodies. Construction activity may be avoided during night hours in forest area. Poaching must be strictly banned in the Forest area. It may be ensured by the Contractor that no hunting or fishing is practiced at the site by any of the worker and that all site personnel are aware of the location, value and sensitivity of the wildlife resources. Awareness program on Environment and Wildlife Conservation may be	Construction Contractor	DFCCIL

S. No.	Environmental Issue	Action to be Taken	Implementa-tion By	Supervision By
		provided to the work force. Force Act and Wildlife Act may be strictly adhered to.		
5	Chance find	The state of Uttar Pradesh is rich in heritage & archaeological structures. Hence 'chance find' may be possible during construction. Such cases are to be dealt in accordance to ASI Act.	Constrction Contractor	DFCCIL
Pollution monitoring				
1.	Air	Adequate dust suppression measures such as regular water sprinkling on construction sites, haul & unpaved roads particularly near habitation must be undertaken to control fugitive dust. Plantation activity may be undertaken at the construction sites Workers may be provided with mask to prevent breathing problems Trucks carrying soil, sand and stone may be duly covered to avoid spilling. Low emission construction equipment, vehicles and generator sets may be used Plants, machinery and equipment should be handled so as tom minimize generation of dust. All crusher used in construction should confirm to relative dust emission devises Air quality monitoring may be conducted at construction sites.	Construction Contractor	SPCB / DFCCIL
2.	Water	Silt fencing may be provided near water bodies to avoid spillage of construction material. Discharge of waste from construction / labour camp into water bodies may be strictly prohibited. Construction methodologies with minimum or no impact on water quality may be adopted, disposal of construction wastes at designated sites and adequate drainage system may be provided. Project design may take care of irrigational canal and proper culverts may be proved so that irrigation setup is not disturbed Construction activity may be prohibited during	Construction Contractor	SPCB / DFCCIL
3.	Soil	Asphalt emullsifier must be handled with caution and any leakage detected must be immediately rectified. Construction work should not be done during rainy season to avoid	Construction Contractor	DFCCIL

S. No.	Environmental Issue	Action to be Taken	Implementa-tion By	Supervision By
		erosion and spreading of loose material Top soil removed during excavation work should be utilized stored separately in an enclosed (bund) area and should be utilized during plantation or refilling of excavated area.		
4.	Solid Waste	Construction work must be carried in such a way that minimum or no solid waste is generated at construction site. Extra earth material produced may be utilized for refilling of borrow areas. Rainy season may be avoided to minimize spreading of loose materials. Solid waste management may be framed for camp areas. Dustbins may be provided in the Camps. Proper sanitation facilities must be provided in Camp by the Contractor.	Construction Contractor	SPCB / DFCCIL
5.	Noise & Vibration	Modern technologies producing low noise may be used during construction. Construction equipment's and vehicles must be in good working condition, properly lubricated and maintained to keep noise within permissible limits. Temporary noise barriers installed at settlements and forest area, if required Noise barrier shall be provided at the locations specified in Chapter-8. Plantation may be carried at the work site. Head phones, ear plugs to be provided to the workers at construction site. Noise level monitoring must conducted during construction phase. All vehicles, equipment and machinery used in construction should be fitted by exhaust silencers. Equipments should be maintained regularly and soundproof gadgets should be used. Temporary sound barriers should be installed near sensitive locations near settlements and Forest area, of required Provision of ear-plugs to heavy machinery operators Plantation along the DFC should be maintained.	Construction Contractor	SPCB / DFCCIL
6.	Land	Plantation must be carried to control	Construction	DFCCIL

S. No.	Environmental Issue	Action to be Taken	Implementa-tion By	Supervision By
	Subsidence	erosion	Contractor	
7.	Bottom Sediment	Silt fencing may be provided to avoid runoff into the river. Construction activity should be taken in dry season to avoid spreading of construction material and minimize impact on water quality	Construction Contractor	DFCCIL
Operation Phase				
1.	Maintenance Plantation	Provision for maintenance of plantation must be made for at least three years. Plantation may be taken to replace dead sapling. Survey of survival of plants may be taken annually. Lopping of branches may be undertaken to remove obstruction, if any	DFCCIL	DFCCIL
2.	Air Quality	Plantation should be conduct and maintained along DFC. Green belt development with proper specifies should be undertaken on priority basis. AAQ monitoring at all Junction station sites and along DFC under the guidance of SPCB	DFCCIL	SPCB
3.	Water Quality	Waste Collection facility should be provide at all Junction station Proper drainage system should be provided at all Junction station Water quality monitoring at the Junction station stations under the directives of SPCB	DFCCIL	SPCB
4.	Noise & Vibration	Noise and Vibration monitoring may be conducted in operation phase at Sensitive Receptors (SRs).	DFCCIL	SPCB

10.5 ENVIRONMENTAL MONITORING

The environmental monitoring shall be undertaken during construction and operation phases as per the following details:

Table 10.2: Proposed Monitoring Programme

Construction Phase

S. No.	Environmental Component	Parameter	Standards	Location	Frequency	Implementation	Supervision
1	Air Quality	PM2.5, RPM, CO, NOx, Sox	CPCB standards	Stretch of DFC in progress near settlements and junctions stations. Minimum ten appropriate locations shall be covered along the alignment	3 times in a year (once in every season except monsoon) during construction period	DFCCIL through contractors	DFCCIL
2	Water Quality	As per IS:10500 standards	CPCB standards	Near water bodies and construction camps	Once in three months during construction period	DFCCIL through contractors	DFCCIL
3	Noise	Noise level on dB (A) scale	CPCB standards	Junction & stations and settlements along DFC. Minimum ten appropriate locations shall be covered along the alignment	4 times in a year (once in every season during construction period	DFCCIL through contractors	DFCCIL
4	Soil Quality	Parameters are NPK, Sodium Absorption Ratio, Oil & Grease	CPCB Standards	Junction & stations and settlements along DFC. Minimum ten appropriate locations shall be covered along the alignment	Once in a year during construction period	DFCCIL through contractors	DFCCIL
Operation Phase							
1	Noise	Noise level on dB(A) scale	CPCB standards	Junction & stations and SR along DFC . Minimum ten appropriate locations shall be covered along the alignment	4 times in a year (once in three months)	DFCCIL through contractors	DFCCIL
2	Vibration level	Vibration on dB scale respectively	-	Junction & stations and SR along DFC Minimum ten appropriate locations shall be covered along the alignment	4 times in a year (once in three months)	DFCCIL through contractors	DFCCIL
3	Plantation	Survival rate	Survival rate may be calculated annually	At compensatory afforestation site and along DFC	Annually for 3 years	DFCCIL through contractors	DFCCIL

10.6 ORGANIZATIONAL FRAMEWORK

The proposed project will be implemented by DFCC through its Environmental Management Unit (DFCCIL). The DFCCIL will be coordinating with the field level implementing agencies such as the Engineer (Supervision Consultant), Contractor and field level DFCC officials. Role and responsibilities of important officials is mentioned below.

Table 10.3: Roles and Responsibilities of Officers

Officer	Responsibility
General Manager (DFCCIL)	• Overview of the project implementation • Ensure timely budget for the EMP. • Coordination with different state level committee, to obtain regulatory clearances. • Participate in state level meetings • Monthly review of the progress. • Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation
Chief Project Manager (DFCC)	• Overall responsible for EMP implementation • Coordination with PIU Staff (DFCCIL & DFCC). • Responsible for obtaining regulatory Clearances • Review of the progress made by contractors • Ensure that BOQ items mentioned in EMP are executed as per Contract provisions.
APM (Environment)	• Assisting CPM in overall implementation of EMP • Review of periodic reports on EMP implementation and advising Project Director in taking corrective measure. • Conducting periodic field inspection of EMP implementation • Assisting GM (DFCCIL) to reporting various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Preparing environmental training program and conducting the same for field officers and engineers of contractor.
Engineer (Supervision Consultant)	• Act as an “Engineer” for supervising EMP implementation • Responsible for maintaining quality of EMP envisioned in detail Project Report • Maintaining progress reports on EMP implementation • Periodic reporting to PIU-DFCC about the status of EMP implementation • Work in close coordination with Asst. Project Manager (package unit) and contractor.
Deputy Chief Project Manager	• Conducting need-based site inspection and preparing compliance reports and forwarding the same to the Environmental Management Unit (DFCCIL) • Programming necessary training program on environmental issues.

Officer	Responsibility
Asst. Project Manager (Env)-designated	• Working as site-representative of APM(Env) • Conducting regular site inspection to all onsite and offsite works • Maintaining records of all necessary statutory compliance, to be obtained from contractor. • Maintaining records of EMP implementation including photographic records • Attending environmental and social training programs • Preparing periodic reports on EMP implementation and forwarding to EE
Environment & Safety Manger of Contractor	• As detailed below

For ensuring that EMP is implemented as per provision in the document, Contractor shall nominate a qualified and experienced Manager from the commencement to completion of the project.

The responsibilities of Environment & Safety Manager of Contractor will include the following:

- Directly reporting to the Project Manager of the Contractor;
- Discussing various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly;
- Prepare Contractor's Checklist, traffic management plan and safety plan as part of their Work Program;
- Ensure Contractor's compliance with the ESMF stipulations and conditions of statutory bodies;
- Assist the project manager to ensure social and environmentally sound and safe construction practices;
- Conducting periodic environmental and safety training for contractor's engineers, supervisors and workers along with sensitization on social issues that may be arising during the construction stage of the project;
- Preparing a registers for material sources, labour, pollution monitoring results, public complaint/grievance redress, and as directed by the Engineer;
- Assisting the DFCC on various environmental monitoring and control activities including pollution monitoring; and
- Preparing and submitting monthly/bio-monthly reports to DFCC on status of implementation safeguard measures.
- Will be responsible for getting and maintaining the approvals or clearance for various departments and Environmental officer.

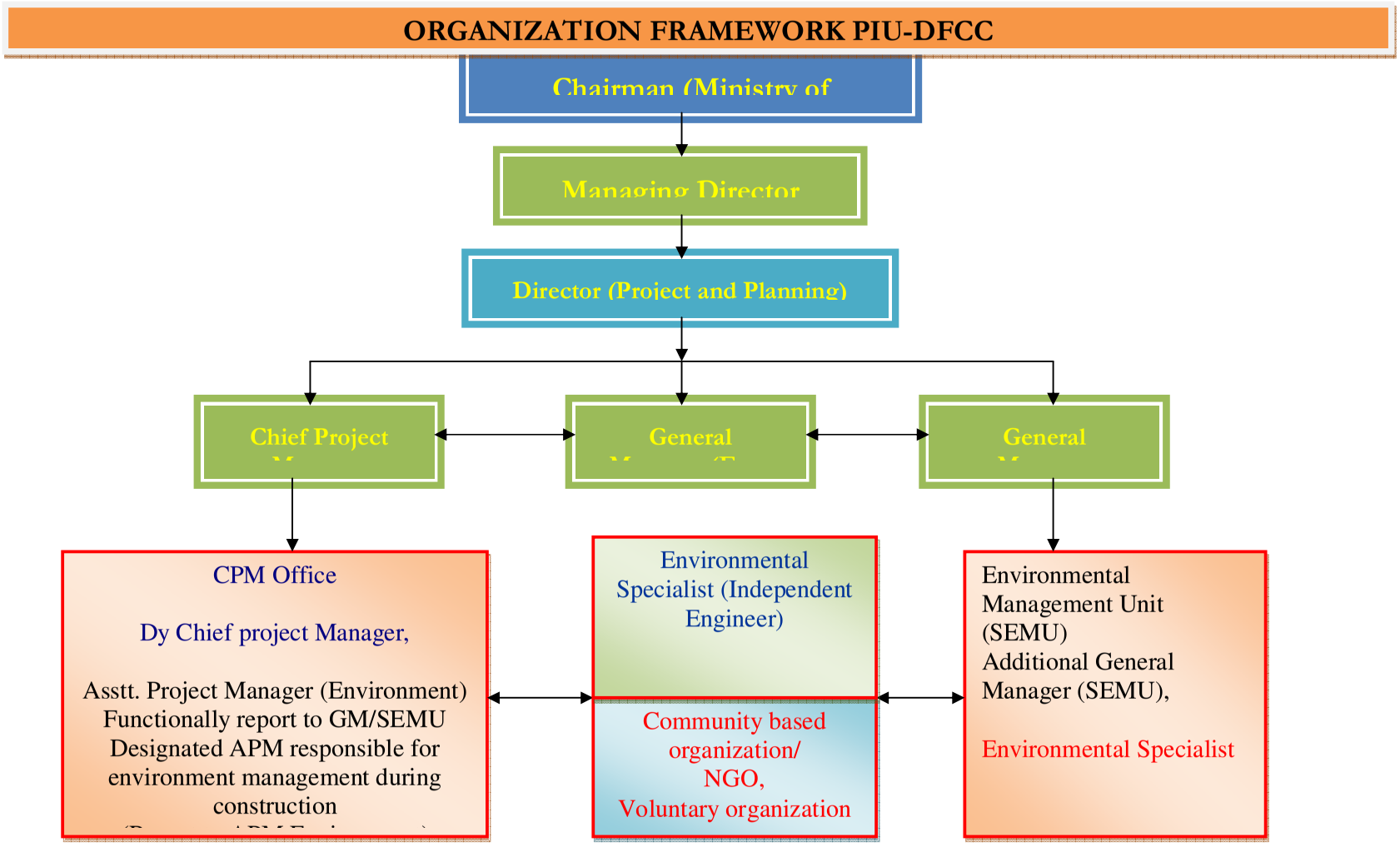
ORGANIZATION FRAMEWORK PIU-DFCC
Chairman (Ministry of
Managing Director
Director (Project and Planning)
Chief Project
General
General
CPM Office
Dy Chief project Manager,
Asstt. Project Manager (Environment)
Functionally report to GM/SEMU
Designated APM responsible for environment management during construction
Environmental Specialist (Independent Engineer)
Community based organization/ NGO, Voluntary organization
Environmental Management Unit (SEMU)
Additional General Manager (SEMU),
Environmental Specialist

Fig- 10.1

10.7 ENVIRONMENTAL BUDGET

The cost of compliance of environmental issues must be included in the Bill of Quantity for the implementation of EMP, although most of the aspects will be covered under the head engineer such as:

- Embankment
- Shine boards along construction sites
- Noise barrier
- Underpass for animals
- Culverts for irrigation canals

However, there are issues that are independently covered under the Environmental Budget such as plantation along DFC, monitoring, enhancement measures, noise barrier, sanitation facility at labour camp, and solid waste disposal at site. The shifting and enhancement cost of sensitive receptors such as temple, majar, school, hospital etc shall be covered in R & R under community development. Mitigation measures proposed in the EMP will be implemented by the contractor. The works to be undertaken by the contractor have been quantified and the quantities included in the respective BOQ items such as earth works, slope protection, noise barriers, road safety features and shrub plantation.

Provisional quantities have also been included for additional measures that may be identified during construction and for site fencing, which will depend on the contractors work methods and site locations. Items and quantities have also been included for enhancement measures.

More general environmental management measures to be followed by the contractor have been included in the specifications and in this EMP. These cannot be quantified and are to be included in the contract rates.

The budgetary provisions for the implementation of the environmental management plan of the project are presented in **Table 10.4**.

Table 10.4: Cost Estimates for Environmental Management

Sl. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
A. PRE-CONSTRUCTION PHASE						
1.	Tree Felling Permission	Number	100	18,148	18,14,800	Covered under regulatory clearances
2.	Forest Clearance and land diversion cost	Ha	-	0.998 Ha	10,00,000	Covered under forest clearances
3.	Comensatory Afforestation and 7 years maintenance Cost			LS	1,00,000	
4.	Acquisition of land required for acquisition	Ha	-	1400.00	-	Covered under project cost
5.	Utility Shifting	-	-	LS	55,00,00,000	Covered under regulatory clearances, engineering cost
6	CPR shifting	-	-	LS	10,00,000	Under RAP budget
Sub-total					**55,39,14,800**	
B. CONSTRUCTION PHASE						
1.	**Mitigation Measures other than Good Engineering practices**					
1.1	Oil interceptors	Number	6000	2	72,000	Will be provided near storage, vehicle repair section in construction camp
1.2	Soak pits for construction camp	Number	7000	20	1,40,000	
2.	**Tree Plantation and Protection**					
2.1	**Avenue plantation including compensatory plantation**					
2.1.1	Plantation and maintenance of saplings for 3 years	Number	600	35000	2,10,00,000	
2.1.2	Half brick circular tree guard	Number	600	35000	2,10,00,000	
3.	**Monitoring of Environmental Attributes during Construction Phase**					
3.1	Monitoring of Air Quality	Per sample	7000	60	4,20,000	3 x 10 x 2
3.2	Monitoring of Water Quality	Per sample	5000	80	4,00,000	4 x 10 x 2
3.3	Monitoring of Noise Level	Per sample	5000	80	4,00,000	4 x 10 x 2
3.4	Monitoring of Soil Quality	Per sample	6000	10	60,000	1 x 10
Sub-total					**4,23,04,000**	
C. ITEMS COVERED UNDER THE RAP BUDGET						
1.	Relocation of private properties			LS	1,00,00,000	
2.	Relocation of private water points (wells,			LS	50,00,000	

Sl. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
	tanks, water taps and hand pumps)					
3.	Relocation of graveyards, statues, motor sheds			LS	1,00,00,000	
4.	Relocation of other community assets including temples, majar, mosque, school etc.			LS	1,20,00,000	Covered under RAP Budget
Sub-total					**3,70,00,000**	
D. OPERATION PHASE						
1.	Monitoring of Noise Level	Per sample	5000	80	4,00,000	Per year recurring cost
2.	Monitoring of vibration Level	Per sample	7000	80	5,60,000	Per year recurring cost
3.	Noise mitigation measures in form of noise barrier at sensitive receptors	Per running metre	6500	1200	78,00,000	
Sub-total					**87,60,000**	
E. GOOD ENGINEERING PRACTICES						
1.	Dust suppression			LS	16,50,000	Covered under contractors quoted rate under construction cost
2.	Erosion control measures (Turfing / Pitching / Seeding & Mulching)			LS	20,00,000	
3.	Provision of cross drainage & side drainage structures			LS	20,00,000	
4.	General borrow area management and maintenance of haul road related to borrow areas			LS	75,00,000	
5.	Air / noise pollution control measures in construction equipments			LS	1,00,000	
6.	Management and disposal of scarified waste bituminous material			LS	1,00,000	
7.	Provision of informatory signs			LS	8,00,000	
8.	Cattle crossings			LS	10,00,000	
9.	Management of quarries			LS	3,50,00,000	
10.	Redevelopment of borrow area			LS	15,00,000	
11.	Construction camp management cost			LS	80,00,000	
12.	Safety measures for workers			LS	10,00,000	
Sub-total					7,86,50,000	

Sl. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)	Remarks
F. TRAINING & MANPOWER						
1.	Training	Number	100000	4	4,00,000	Twice in a year during construction period
2.	Provision of environmental expert	Number	100000	24	24,00,000	
Sub-total					28,00,000	
Grand Total					**72,34,28,800 Say, 723.4 million**	

----------End of the Report----------

Annexure- 10.1

Specification Addendum

Silica Exposure Reduction Strategies for Dedicated Freight Corridor – EDFC Project

PART 1 – GENERAL APPLICATION

1.1 Description

A. This addendum specifies minimum environmental health and safety equipment, practices and procedures to minimize exposures to airborne silica dust during quarry operations, stone crushing, transport, and site construction. The scope of this section is limited to dust controls and employee protection in these environments.

B. This addendum shall take precedence over overlapping requirements in the Technical Specification unless otherwise stated.

C. This document is an integral part of the contract and the contractor has the responsibility to fully implement it. Any request to deviate from any specified requirement shall be made in writing to the project sponsor.

D. This addendum supplements all local, regional and national laws and regulations concerning the location, environmental emissions, and occupational safety in these operations. If regulatory requirements are more stringent, or require more frequent verification than outlined in this standard, then the regulatory provisions shall take precedence and become the de facto requirement in that jurisdiction.

E. Contractor(s) shall provide a copy of the licensing documentation (NOC/ Consent to Establish) for each facility from where they purchase crushed stone including each quarry, stone crusher mill, and hot mix plant indicating they meet all applicable requirements.

1.2 General Site Requirements Quarries:

- Operator must establish a reliable source of water with adequate capacity and pressure to run all dust suppression systems at the quarry site;
- Operator must establish a reliable source of power for all mechanical equipment at the stone quarry site;
- Residential areas and temporary employee housing must be located a minimum of 100 meters from any quarrying operations;
- Stone drilling, cutting and conveying operations shall be equipped with either continuous wet suppression system or dry dust collectors designed and operated per minimum requirements below.
- Dust controls in quarries must include water fed compressed air drilling equipment, enclosed screens; enclosed transfer points, covered conveyors, and chutes.
- Wet the surface of rock materials with a hose before blasting operations.

1.3 General Site Requirements Stone Crusher Mills and Hot Mix Plants:

A. Contractor shall submit a detailed plan for any temporary stone crusher or hot mix plant sites intended to be utilized for this project. The plan shall show adjacent areas within 100 meters and depict all structures and roadways. All temporary sites must meet all requirements specified in this addendum and must obtain a Consent to Establish/ (NOC) from the applicable authorities.

B. Temporary or permanent stone crusher sites or hot mix plants must meet all of the following requirements:

- Site must be at least 250 meters from National and State Highways and 500 meters from schools, educational institutions and religious places.
- Establish green belt zone as required by applicable local requirements;
- Residential areas and temporary employee housing must be located a minimum of 200 meters from any stone crushing equipment or operations;
- Operator must establish a reliable source of water with adequate capacity and pressure to run all dust suppression systems installed at the stone crusher site;
- Operator must establish a reliable source of electricity for powering all mechanical equipment and pollution controls installed at the stone crusher site;
- Crushing, screening, and conveying operations shall be equipped with either continuous wet suppression system or dry dust collectors designed and operated per minimum requirements below.
- Crushing, screening, and conveying operations must be enclosed with sheet metal or other rigid material. Do not use cloth or plastic enclosures.
- Roadways inside the crusher mill shall be metalled, paved or otherwise treated with chemical suppressants for dust suppression.
- Waste dust materials from stone crushing operations shall be stored in closed containers or closed structures.
- Lorries exiting the site must be cleaned with shovel and broom to minimize dust being tracked off site.
- Minimize drop heights to storage piles;
- Windbreak walls that are at least six times longer than its height shall be in place.
- Regularly remove and safely dispose of waste materials (rock dust) from the plant site in covered lorries;
- Fugitive emissions including emissions from stockpiles, conveyors and other areas shall be minimized as far as practicable. Emissions from these sources shall be substantially free from visible dust emission.

1.4 General Site Requirements Construction Sites:

The following requirements shall be implemented during the following operations:

- Stockpiling;
- Earth moving/ earth works, grading, and leveling;
- Transfer from stock pile to work site;
- Final placement; and
- Laying the track.

- Operator must establish a reliable source of water with adequate capacity and for all dust suppression required at the construction site;
- Regularly remove and safely disposing of waste materials (rock dust) from the site in covered lorries;
- Waste dust materials from stone crushing operations if used for fill shall be covered within 4 hours;
- Minimize spillage of raw materials. Promptly clean up all spillage and accumulations of dust.

- Fugitive emissions including emissions from stockpiles and other areas shall be minimized as far as practicable. Emissions from these sources shall be substantially free from visible dust emission.

1.5 General Environmental Protection:

The Contractor shall take steps to protect the environment and surrounding populations from silica dust hazards. Ensure that the water required for dust suppression operations is sourced from a supply that will not impact the quality or availability of water in the surrounding environment. Follow all State requirements for siting criteria and obtain consent from applicable state pollution control board. Ensure that emissions, surface discharges and site closure practices shall comply with all applicable laws including but not limited to:

- The water (prevention and control of pollution) act 1974; no. 6 of 1974.
- The air (prevention and control of pollution) act, 1981; no. 14 of 1981.

Part 2 - Technical Requirements to Minimize Airborne Dust Emissions

2.1 General

The handling of raw materials, products, wastes or by-products should be carried out as to minimize the release of airborne dust. Use Table 1 below for guidance in employing dust suppression methods.

Table 1: Feasible Control Measures for Open Dust Sources

Fugitive Emission Control Measure

Source	Enclosures	Wet Suppression	Chemical Stabilization	Green Belt	Surface Cleaning	Wind Break Walls
Unpaved roadways and staging areas		X	X			
Storage piles	X	X	X			X
Stone crushing operations	X	X		X	X	X
Paved roadways and staging areas					X	
Exposed areas	X	X	X	X		X
Batch drop operations	X	X				X
Continuous drop operations	X	X				X

2.2 Wet Methods: Water spray Dust Suppression Systems for Stone Crushing Mills

Details of system components for all stone crusher facilities:

A. Minimum number and locations of pressure spray nozzles:
- 1 nozzle on the top of the crusher
- 2 nozzles at the delivery point of crushing material
- 1 nozzle on the bottom of the vibrator screen or rotary screen
- 2 nozzles within the storage hopper
- 1 nozzle at the delivery point of raw materials
- 1 nozzle at the bottom of the dust hopper

B. A water pump with adequate motor horsepower and discharge pressure as required for optimal performance of spray nozzles.

C. Covered water storage tank, with a manhole type maintenance provision. The cover should prevent atmospheric dust from entering the tank. The tank can be located at the ground level. Water from a bore well or other source could be pumped to fill the tank periodically.

D. Centrifugal monoblock type self-priming pump capable of delivering 3 to 5 kg/cm^2 pressure and 72 liters per minute.

E. 100 stainless steel mesh online water filter with two parallel cells. Parallel cells should be set up in order for to allow connections to be reversed such that one cell undergoes backwash cleaning while the other cell is in operation. Only filtered water should be supplied to the spray nozzles.

F. Chemical surfactants or wetting agents may be added to water used in the spraying systems.

G. All spraying systems used for dust suppression shall be maintained in good condition. The flow rate and operating pressure of the spraying liquid/solution shall be sufficient to suppress dust emissions from the corresponding sources. The spraying system shall be able to cover the areas of emission points concerned.

H. All water spray equipment shall be operational during all stone crushing operations at the site.

I. No domestic showers, sprinklers, or other general water spray devices may be substituted for pressure misting nozzles. Nozzles may be hollow cone, solid cone or fan type.

2.3 Dry Methods: Dust Extraction Systems for Stone Crusher Mills/ Hot Mix Plants

Details of system components:

A. Minimum requirements for dry dust capture and collection systems:
- Hood or enclosure to capture emissions;
- Dust collector that separates particulates (e.g. centrifugal dust collectors); and
- Duct to transport particulates in air stream from dust collector to air pollution control device (e.g. baghouse).

B. Capture hoods shall be installed over all crusher units and screens. Enclosures shall surround all sources of dust to the extent possible.

C. Dust collector shall be connected in-line via an enclosed duct to a cyclone and baghouse for dust removal.

D. Air handling system shall be a suitable size to prevent the escape of untreated airborne dust. Maintain minimum airflow as per design. A minimum draft velocity of 1 meter/ second shall be maintained through all open hoods.
E. Inspect bag filters routinely and at least once per month for damage and clean, repair or replace as needed.

2.4 Dust Containment Enclosures for Stone Crusher Mills and Hot Mix Plants:

Particulate emissions shall be controlled by installing dust containment enclosures at the following locations:

A. Primary crusher discharge area
   Enclosure shall cover discharge areas to all conveyor belts or secondary crusher.
B. Vibratory screen
   All vibratory screens shall be totally enclosed. Screen houses shall be rigid and reasonably dust tight with self-closing doors or close-fitted entrances and exits for access. Where conveyors pass through the screen house, flexible covers should be installed at entries and exits of the conveyors to the housing.
C. Conveyor belts (optional)
   The enclosures should be complete from all the four sides and roof. There should not be any open windows/openings etc. Any opening should be kept closed during operation. The gaps should be sealed using gaskets or wool type packing etc. Crusher enclosures shall be rigid and be fitted with self-closing doors and close-fitting entrances and exits. Where conveyors pass through the crusher enclosures, flexible covers should be installed at entries and exits of the conveyors to the enclosure.
D. Inlet hopper
   The inlet hopper shall be enclosed on three sides.
E. Rotary dryer
   The plant rotary dryer in a hot mix plant.

Malfunctioning or breakdown of equipment leading to abnormal emissions shall be dealt with promptly. In any case, the abnormal emission due to equipment failure shall be stopped as soon as practicable. The dust collection system shall be routinely inspected and maintained in good condition and shall be used as required. The owner shall conduct an inspection of the dust control system at least once per month.

2.5 Minimize Fugitive Dust From Roadways and Stock Piles

Minimize fugitive dust emissions from all sites where crushed rock is stored. Particulate emissions from unpaved roads and stock piles shall be controlled with the application of suitable compounds to minimize the control of dust. Petroleum-based products, waste oils or other waste products shall never be used for this purpose. Acceptable compounds for this purpose include:

- Acrylic polymers;
- Solid recycled asphalt;
- Chloride compounds (calcium chloride and magnesium chloride);
- Lignin compounds (lignin sulfate and lignin sulfonate powders);
- Natural oil resins (soybean oil); and
- Organic resin emulsions.

Contractor shall provide a product information sheet prepared by the manufacturer or distributor indicating the chemical composition, application instructions, and other environmental, safety and health considerations 30 days in advance of its intended application to Engineer's Representative. The product information shall be reviewed and approved in writing before the contractor proceeds to apply it on the project site.

2.6 Minimize Fugitive Dust From Heavy Equipment and Road Transport Vehicles

Minimize fugitive dust emissions from all vehicles when loading, unloading and operating vehicles on project sites, staging areas, or stone crusher mills. Settled dust and particulate emissions from lorries used to transport stone or waste products generated in stone crushing operations, and other heavy construction vehicles, shall be minimized in accordance with the following practices:

Lorries shall be filled with the material using wet methods. Load waste fine materials and powders onto tankers or closed trucks through a lengthy sleeve attached to the spout to minimize drop height and dust release.

Lorries once filled with stone or other waste materials shall be covered before leaving the site. A single layer impermeable tarp shall be placed over the entire load and secured with rope or other tension bar.

Designate a decontamination area that is required to be used by all vehicles before exiting the site. This area shall be covered with an impervious tarp. Use wet methods to wipe all accessible exterior surfaces of vehicles and tires.

Impose strict speed limits for all vehicles operating on service roads, loading areas, or staging areas.

2.7 Minimize Fugitive Dust During Rock Quarry Operations

Particulate emissions shall be controlled during drilling, blasting, loading, and hauling with wet methods using surfactants applied in either water or foam spray.

Dust controls for stone drilling shall use water fed into the compressed air to suppress the dust.

2.8 Work Practices for Reducing Employee Exposures

This section pertains to all activities with potential for dust exposure to workers employed in quarries, stone crusher units, hot mix plants, and construction sites.

Use wet methods where feasible to reduce dust emissions from working surface or equipment.

Use a gentle spray or mist to moisten settled dust particles. When washing large quantities of dust from a surface, increase the water force only after pre-wetting all the dust with a gentle spray. Use only the minimum amount of water needed to get the job done without creating runoff.

Rewet surfaces as necessary to control dust.

Part 3 - Technical Requirements for Worker Medical Surveillance

3.1 General

This section pertains to workers employed in quarries, stone crusher units, and hot mix plants.

3.2 Medical Monitoring

Medical monitoring shall be conducted for each worker before the start of work and at Least at annually thereafter. Examination shall as a minimum meet requirements as set forth below:

Examination
1. The employer shall ensure that all medical examinations and procedures are performed by a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

2. Persons employed under the licensed physicians may administer the pulmonary function testing, chest x-ray or other testing procedures required by this section if adequately trained by an appropriate academic or professional institution.

3. A physical examination directed to the pulmonary system, including a chest x-ray to be administered and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV(1)). Interpretation and classification of chest roentgenograms shall be conducted in accordance with ILO classification system. Interpretation of the chest x-ray shall be conducted under the ILO Classification of Radiographs of Pneumoconiosis by a reader trained under this protocol. Evaluate chest x-ray for possible tuberculosis because people exposed to silica have increased susceptibility.

Report from Medical Examination: A report must be submitted from all medical examinations conducted within the last 12 months to document compliance with this medical surveillance requirement for each worker employed in quarries and stone crusher units. Submit, at a minimum, for each worker the following:

Name and Employee Identification Number

Physician's Written Opinion from examining physician including at a minimum the following:

- Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to silica.
- A statement that the worker may wear a negative pressure respirator or any recommended limitations on the worker or on the use of personal protective equipment such as respirators.
- Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from dust exposure.

3.3 Record Keeping

1. The employer shall establish and maintain accurate records of medical surveillance to include the physician's written opinion on each employees health status.
2. Records shall be maintained for at least the duration of the contract period.
3. A copy of the each employee's records must be provided to the affected employee who has undergone the medical surveillance stipulated above within 30 days of the date of the examination.

Part 4 - Requirements for Employee Training

4.1 General

A. This section pertains to all workers employed in quarries, stone crusher units, hot mix plants, and any construction workers using powered tools or equipment to cut, grind, core, or drill concrete or masonry materials. The training provided under this section shall be provided to workers at no cost to these employees and in a language understood by workers at each training program. The course shall be taught by an environmental health and safety specialist with adequate education, experience and training.

B. Incorporate general information about silica dust hazards in all orientation and site training sessions covering health or safety aspects.

4.2 Training Topics

The employer shall provide training on the following topics to all employees prior to their assignment to jobs where the employer will be conducting these operations during this project:

A. The potential health hazards of exposure to airborne silica dust including silicosis, tuberculosis, lung cancer, chronic obstructive lung disease (COPD) and decreased lung function.

B. Methods used by the employer to control employee exposures to airborne silica dust including wet or dry methods for stone crushing, drilling, cutting, local exhaust ventilation systems, and isolation of the process from employees by means of distance, enclosure, or other means, as applicable.

C. Proper use and maintenance of dust reduction systems, including the safe handling and disposal of waste materials.

D. The importance of good personal hygiene and housekeeping practices when working in proximity to silica dust including:

- Not smoking tobacco products; appropriate methods of cleaning up before eating, and appropriate methods of cleaning clothes.
- Avoiding, to the extent practical, activities that would contribute significantly to exposure to airborne dusts.

Part 5 – WORKER PROTECTION

5.1 General

Contractors shall supply respirators and other specified safety equipment to all workers employed in quarries, stone crusher units, hot mix plants, and any construction workers

using powered tools or equipment to cut, grind, core, or drill concrete or masonry materials as described below:

A. Do not eat, drink, smoke, chew gum or smoke tobacco in the work area. To eat, drink, chew, or smoke, workers shall follow the procedures described below and leave the work area.

B. Provide workers with a clean source of water for a facility to wash hands and face with soap and water. This should be done before eating, smoking or drinking and at the end of the day before going home. Hand washing facilities shall be set up adjacent to the work area.

C.Engineering and work practice controls must be used whenever the possibility exists
that employees may be exposed to silica including during stone crushing and construction operations.

D. The use of compressed air, dry sweeping, or any cleaning method that would cause
Elevated silica dust air concentrations are prohibited.

5.2 Respiratory Protection

Minimum Respiratory Protection: Require that the minimum level of respiratory protection used be Respirator Class FFP3 under European standard EN 143 or N99 under the U.S. National Institute for Occupational Safety and Health (NIOSH) classification. Respirators shall be single use disposal respirators for dusts or reusable half-face air-purifying respirators with high efficiency particulate air filters.

Require that a respirator be worn by anyone in a Work Area at all times during any operation. Do not allow the use of surgical masks or other types of disposable respirators not specified above for any purpose.

Fit testing shall be conducted on any reusable air-purifying respirator assigned to the worker.

Only assign respirators to workers medically approved to wear negative pressure respirators as
per the physicians written opinion following an annual medical examination as per the requirements in Part 3 of this addendum.

5.3 Protective Equipment

Do not allow workers to leave the work place wearing any clothing or equipment worn during the work shift. Provide the following:

A). Eye Protection: Provide eye protection as needed for the type of work being performed.
B). Shoes: Provide shoes to all workers and require that they be worn at all times in the Work Area.
C). Hearing protection: Provide all workers at all quarries, stone crushing sites, and hot mix plants and all other workers exposed to loud noise with ear plugs or other suitable hearing protection.

Part 6 - EMISSION AND AMBIENT AIR LIMITS

6.1 General

Contractors shall conduct all required emissions monitoring as required to prove compliance with all applicable State Pollution Control Board Regulations and the limits specified within this section. This section applies to all permanent and temporary stone crushing mills and hot mix plants.

6.2 Suspended Particulate Matter (SPM)

The Suspended Particulate Matter (SPM) at a distance of 40 meters from a stone crusher unit in a cluster should be less than 600 microgrammes per cubic metre (ug/Nm^3). The concentration of total particulate matter in any contained emissions to air, for example the bag filter exhaust air outlet, shall not exceed 150 microgrammes per cubic metre (150 ug/Nm^3). The introduction of dilution air to achieve the emission concentration limits shall not be permitted.

Monitoring of the 24-hour average concentration of the total suspended particulate and/or respirable suspended particulate in ambient air shall be conducted at the site boundary and/or any other locations to be agreed by the Authority. SPM sampling shall conform to the United State Environmental Protection Agency's Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-volume Method) and shall be conducted at a frequency of not less than once every 6 months.

Part 7 – Chain-of-custody for Crushed Stone

7.1 General

Contractor shall maintain records of suppliers for each load of crushed stone brought to the construction site with the procedures as outlined below. Such records shall be collected at a central location at least monthly during the duration of the project and be available for inspection by Engineer's Representative.

7.2 Supplier Validation

Contractor shall maintain records of all suppliers and all internally sourced supplies of crushed stone brought to the construction site to include:

- Name of supplier;
- Location of stone crusher operation;
- Location and name of the quarry;
- Proof of registration and consent from the applicable Mining Department;
- Proof of registration and consent for operation from applicable Pollution Control Board;
- The supplied material size and quantity (by weight or volume);
- Date and specific location material was brought to site.

Part 8 – Restoration of temporary stone crusher sites

8.1 General

This section applies to the removal of any temporary stone crusher sites established and used during the duration of the project. During operation all temporary operations shall meet the requirements specified in Parts 1 and 2 above.

8.2 Equipment removal

Temporary equipment shall be cleaned before being taken down and prepared for off site transport. Clear off all temporary structures and garbage.

8.3 Site restoration

Remove all debris and visible accumulations of dust from ground surfaces. Cover all bare soil surfaces with vegetation or pavement to reduce exposure to residual silica dust.

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