Environmental impact assessment Methods for a Project

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Abstract: **The broad utilization of resources to fulfill the need, have made the resources deficit and need for sustainable development have become significant. With the developing ecological concern, it has become extremely fundamental to survey and screen ecological effects of different highway projects at the time of finalizing the project. The current study was completed with a target of distinguishing and evaluating the ecological and financial effects happening due to the construction of section of 8-lane Greenfield Highway in Rajasthan. The environmental impact assessment is done by the network method. The natural status of the venture region was first availed from NHAI report of EIA. Then, at that point, the critical environmental and social factors liable to be influenced because of the venture was recognized. The effect network flowchart was prepared and the cause- condition-impact relationship was portrayed to recognize the primary, secondary, tertiary effects because of the undertaking for each of the environmental and socio-economic components. This network method was thus utilized to anticipate conceivable effect on every part of environment and socio- financial emerging due to this highway and the two frameworks (without relief and with alleviation) had made effects clearer and furthermore, help to give the appropriate moderation ventures as indicated by the need. This technique can be utilized for various projects to recognize and evaluate the impacts in better manner.**

Index Terms: EIA, Network method, Importance value, Delphi study, Impact score.

INTRODUCTION

Highway construction upgrades mobility and is basic to the financial development of a local area and a nation in general. Unfortunately, improperly arranged, planned, and developed roadways can worsen the states of poor people, and degrade the natural and financial condition. The normal unfavorable effects of highway construction incorporate harm of natural scene, living space and bio-diversity, destruction of cultural and social structure of affected communities, production of air and water contamination, and generation of noise and vibration. (Barrow C.J., 1997) To limit unfriendly ecological and financial effects, roadway framework should be worked to a great and kept up with to an exclusive requirement. This can be accomplished by coordinating natural contemplations into parkway improvement arranging, plan, and development.

The interaction comprises of three key components:

1. Distinguishing proof of the full scope of potential effects on the normal and financial climate.
2. Assessment and measurement of these effects.
3. Definition of measures to stay away from, relieve and make up for the expected impacts.

The above interaction which efficiently manages these components is called Environmental Impact Assessment (EIA). (Kamboj Nitin, 2017)

Public Highways are the arterial roads of the nation for movement between state of travelers and goods. They cross the length and width of the nation connecting the National and State capitals, significant ports and rail intersections and connection up with border roads and foreign highways. The complete length of NH (including expressways) in the nation at present is 1,32,499 kms. While Highways/Expressways establish just around 2% of the length, all things considered, they convey around 40% of the road traffic. (NHAI, 2021)

I. LITERATURE REVIEW

The environmental impact assessment process provides a formalized procedure for generating, collecting, analyzing and documenting information on all aspects of present status and possible impacts of a given project. (Canter L.W., 1996) In other words 'impact assessment' is an objective analysis conducted to identify and measure the likely economic, social, aesthetic, and environmental effects of the proposed action (activity or project) and the various reasonable alternatives. This requires the identification, measurement, and aggregation of the impacts to provide a total assessment. (Biswas M., 1987)

EIA integrates the environmental concerns in the developmental activities right at the time of initiating for preparing the feasibility report. In doing so, it can enable the integration of environmental concerns and mitigation measures in project development. EIA can often prevent future liabilities or expensive alterations in project design. (Yadav, January 2018)

The Ministry of Environment and Forests (MoEF) uses Environmental Impact Assessment Notification 2006 as a major tool for minimizing the adverse impact of rapid industrialization on environment and for reversing those trends which may lead to climate change in long run.

The notification provides for screening (determining whether or not the project or activity requires further environmental studies for preparation of EIA), scoping (determining the detailed and comprehensive Terms of Reference (TOR), addressing all relevant environmental concerns /questions for the preparation of an EIA Report), public consultation (ascertaining concerns of affected persons) and appraisal of project proposals (based on the public consultations and final EIA report). (MoEF, 2001)

The determination of environmental impact has to be focused on the following factors: population, human health, biodiversity

(with particular attention being paid to species and habitats protected under Council Directive 92/43/EEC and Directive 2009/147/EC), land, soil, water, air, climate change, material assets, cultural heritage and the landscape, and the interaction between these factors (CEU, 2014, 2011).

II. WORK AREA DETAILS

Salient features of the project are as follow:

S. No.	Particular	Details
1	Project Name	Development of 8 lane (Greenfield highway) near Durjanpura village (Ch. 349.000) to near Banda Hera village (Ch. 392.800) Section of NH- 148 N (Total length 43.8 Km), Under BHARATMALA PRIYOJANA in the state of Rajasthan
2	Nature of Project	8-lane, access-controlled Greenfield Highway
3	Location of project section	Section shall start after Chambal River near Durjanpura village at Ch. 349.000 and ends near Banda Hera village at Ch. 392.800 in Kota district of Rajasthan State.
4	Geographical Coordinates	25°28'20.34"N, 76°12'41.81"E to 25°06'24.16"N, 76°03'26.03"E
5	Land details	Proposed highway follows plain and rolling terrain.
6	Water demand	About 2826072 KL water will be required during construction phase.
7	Sources of water	Tanker Supply through vendor having necessary permission
8	Nearest railway station	Ghataka Varana Railway Station- 6.2 km
9	Nearest State highway / National highway	Proposed alignment is crossing SH-37A, SH-70 and NH-76
10	Nearest airport	Jaipur Airport- Approx. 155.0 km
11	Seismic Zone	Proposed alignment falls under Seismic Zone II, which is considered low damage risk zone. Zone II is most stable and Zone - V is considered to be least stable. Proposed alignment is located in High Damage Risk Zone (Vb = 47m/s) as per Wind and Cyclone Hazard Classification of India.
12	Design Speed	120kmph
13	Right of Way	100m
14	Interchanges	3
15	Underpasses/Flyovers	Flyover-nil VUP-5 (Vehicular Under Pass) LVUP-6 (Light Vehicular Under Pass) SVUP-10 (Small Vehicular Under Pass)
16	Bridges	Major Bridges-8 Minor Bridges-29
17	Lighting	Lighting shall be provided at all interchanges, toll plazas/booths, bridges, overpasses/ underpasses *etc*. as specified in IRC SP:99-2013.
18	Total Cost	1827.31cr

III. METHODOLOGY

Methodology adopted for the EIA is explained below-

1. To establish the network tree diagram of environmental parameter that is influenced due to the construction and operation of this highway.
2. With the help of this network tree diagram impacts are divided into primary, secondary, tertiary and quaternary impacts.
3. The importance values are given to the primary impacts with help of book -Conducting Environmental Impact Assessment in Developing Countries (United Nations University, 1999).
4. To divide the importance value of primary impacts in secondary, tertiary, quaternary impact etc. so that sum remains the same, Delphi method is used.
5. Delphi study is conducted by 40 persons.
6. In questionnaire, Importance value is given to secondary, tertiary, quaternary impact etc. by everyone is totalled and mean is obtained.
7. Impact score (from ±1 to ± 5) is provided to environmental parameter based on construction and operation activities severity.
8. The product of impact score, probability of occurrence and importance value, obtains impact value that shows the impact of project on environment and socio economy.
9. There are two matrix of impact value are obtained-

a- When no mitigation is undertaken

b- When mitigation is undertaken

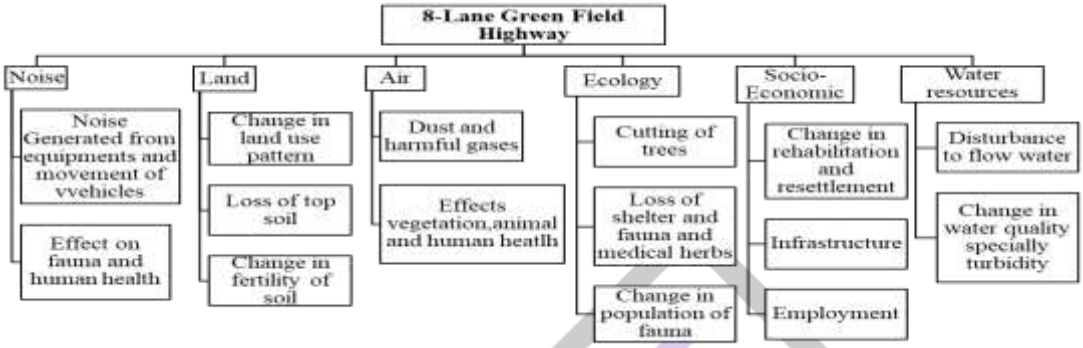
10. These two matrixes of impact values show that impact on environment can be reduced if proper mitigation steps are made and applied in construction and operation phase.
11. Lastly, the conclusions obtained from these matrixes are discussed and the mitigation steps are provided that should be followed to have a sustainable development.

IV. IMPACT EVALUATION

In this section, we will discuss the processor that leads to the result, that whether construction and operation of expressway is beneficial for environmental and socio-economic point of view or not.

NETWORK METHOD

This method uses the matrix approach and extends it to include both the primary as well as the secondary impacts and further if possible. It is shown in the form of a tree called impact tree. This diagram is also called as reference or sequence diagram. Identification of direct, indirect along with short, long-term impact is a crucial and basic step of making an impact tree.
The impact tree diagram is as follows-



Importance value

The weight is attached to the environmental component (primary component) by the help of study conducted in United Nations University. (Biswas Asit, 1999)

Table: Importance value

S.NO.	Environmental Parameters	Importance Value
1	Ecology	200
2	Socio-Economics	175
3	Air	275
4	Water Resources	75
5	Land	150
6	Noise	75

Source: Conducting Environmental Impact Assessment in Developing Countries (United Nations University, 1999

Impact score

The predicted impacts are converted into impact score depending upon impact severity. A positive sign denotes a beneficial impact, while a negative sign denotes an adverse impact.

Table: Impact score

Severity	Impact Score
No impact	0
Negligible	±1
Minor (slight or short term)	±2
Moderate	±3
Major (irreversible or long term)	±4
Severe (permanent)	±5

Source: Conducting Environmental Impact Assessment in Developing Countries (United Nations University, 1999)

Delphi study

This Delphi study is conducted to provide the importance value to the sub parts of the environmental parameter (noise, land, air, ecology, socio-economic and water resource). In this method questionnaire is filled by 40 persons of different background. Then we obtain the importance value of subparts of environmental parameters.

Table: Importance value by Delphi method

S.NO.	Environmental Parameters	Importance Value
1	**ECOLOGY**	**200**
1.1	Cutting of tress	120
1.2	Loss of medicinal herbs and shelter of fauna	20
1.3	Change in population of fauna	60
2	**SOCIO-ECONOMICS**	**175**
2.1	Rehabilitation and resettlement	45
2.2	Infrastructure	50
2.3	Employment	50
2.4	Trade, commerce, accessibility and living standard	30
3	**AIR**	**275**
3.1	Dust and harmful gases	150
3.2	Vegetation, human and animal health	125
4	**WATER RESOURCES**	**75**
4.1	Disturbance to flow water	40
4.2	Change in turbidity and siltation	35
5	**LAND**	**150**
5.1	Change in land use pattern	50
5.2	Loss of top soil	75
5.3	Change in fertility of soil	25
6	**NOISE**	**75**
6.1	Noise generated from equipment and movement of vehicles	25
6.2	Effect on fauna and human health	50

ENVIRONMENTAL IMPACT MATRIX

In this section we will prepare the matrix in which a significant value (importance value) is attached to each environmental component based up on Delphi study. Individual impact scores can be calculated as the product of impact severity (impact score), probability of occurrence and importance value. These may be summed by row and/or column to gauge the net impact of the project on a particular environmental component or, conversely, the net effect of a single project activity on the environment as a whole.

In table, the matrix is prepared on the basis that no mitigation steps have been take place during the construction and operational phase to reduce the detrimental impact on environment.

In table, all the construction activities used in matrixes are alphabetically symbolized and are as follows-

A -Labour Camp Activities;
B -Quarrying;
C -Material Transport & Storage;
D -Earthwork;
E -Pavement Works;
F -Use of Construction Equipment;
G -Plantation;
H -Drainage Works;
I -Toll Plaza Construction;
J -Culvert & Bridge Construction;
K -Stripping of Topsoil;
L -Debris Generation;
M -Oil & Grease;
N -Construction in forest areas;
O -Vehicular Movement,
P -Toll Collection.

Table: Impact matrix without mitigation

Environmental parameters	Importance value	Impacting actions																Probability	Impact score
		Construction phase														Operational phase			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
Cutting of tress	120	-1				-5				-3			-1		-5			1	-1800
Loss of medicinal herbs and shelter of fauna	20	-1				-3				-1			`		-3			0.7	-112
Change in population of fauna	60	-2													-4			0.3	-108
SOCIO-ECONOMICS	**175**																		**+1109**
Rehabilitation and resettlement	45					-2										+3		1	+45
Infrastructure	50															+3		0.8	+120
Employment	50	+2	+2	+1	+1	+1			+1	+1	+2				+1	+3	+2	0.8	+680

Environmental parameters	Importance value	Impacting actions																Probability	Impact score
		Construction phase														Operational phase			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
Trade, commerce, accessibility and living standard	30		+2		+1	+2					+1				+2	+3		0.8	+264
AIR	275																		-3450
Dust and harmful gases	150	-1	-2	-2	-1	-1	-2								-1	-4	-1	1	-2250
Vegetation, human and animal health	125	-1	-2	-2			-1								-1	-4	-1	0.8	-1200
WATER RESOURCES	75																		-244
Disturbance to flow water(siltation and erosion)	40										-3		-1					1	-160

Environmental parameters	Importance value	Impacting actions																Probability	Impact score
		Construction phase														Operational phase			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
Change in water quality specially turbidity	35										-2		-1					1	-84
LAND	150																		-1290
Change in land use pattern	50					-4				-1		-3	-1		-2	-3	-1	1	-450
Loss of top soil	75				-2	-3				-1			-1		-3		-1	0.8	-660

Change in fertility of soil	**25**					**-3**	**-1**							**-1**	**-3**		**-1**	**0.8**	**-180**
NOISE	**75**																		**-200**
Noise generated from equipment and movement of vehicles	**25**			**-1**		**-1**	**-1**									**-1**		**0.8**	**-80**
Effect on fauna and human health	**50**			**-1**		**-1**	**-1**									**-1**		**0.6**	**-120**
Total	**950**	**-340**	**-372**	**-510**	**-206**	**-1284**	**-470**	**0**	**+40**	**-444**	**-86**	**-150**	**-305**	**- 20**	**-1216**	**-403**	**-300**		**-6095**

In table, the matrix is prepared on the basis that mitigation has not been taken place during the construction and operational phase to reduce the detrimental impact on environment.

Table: Impact matrix with mitigations

Environmental parameters	**Importance value**	**Impacting actions**																**probability**	**Impact score**
		Construction phase														**Operational phase**			
		A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**		
ECOLOGY	**200**																		**-526**
Cutting of tress	**120**		**-1**			**-3**		**3**		**-1**					**-2**			**1**	**-480**
Loss of medicinal herbs and shelter of fauna	**20**		**-1**			**-1**		**2**		**-1**			`		**-1**			**0.7**	**-28**
Change in population of fauna	**60**														**-1**			**0.3**	**-18**
SOCIO-ECONOMICS	**175**																		**1364**
Rehabilitation and resettlement	**45**		**3**			**-2**										**3**		**1**	**180**
Infrastructure	**50**														**1**	**3**		**0.8**	**160**

Environmental parameters	Importance value	Impacting actions																probability	Impact score
		Construction phase														Operational phase			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
Employment	50	2	2	1	1	1		2	1	1	2				1	3	2	0.8	760
Trade, commerce, accessibility and living standard	30		2		1	2					1				2	3		0.8	264
AIR	275																		-1350
Dust and harmful gases	150		-2	-1		-1	-1	3								-4	-1	1	-1050
Vegetation, human and animal health	125		-2	-1				4								-4	-1	0.8	-300
WATER RESOURCES	75																		-160
Disturbance to flow water(siltation and erosion)	40										-3		-1					1	-160
Change in water quality specially turbidity	35																	1	

Environmental parameters	Importance value	Impacting actions																probability	Impact score
		Construction phase														Operational phase			
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		
LAND	150																		-470
Change in land use pattern	50					-4		1		-1		-3	-1			3		1	-250
Loss of top soil	75					-3		1	1	-1			-1					0.8	-180
Change in fertility of soil	25					-3		1										0.8	-40
NOISE	75																		-50
Noise generated from equipment and movement of vehicles	25															-1		0.8	-20
Effect on fauna and human health	50															-1		0.6	-30
Total	950	+ 80	- 371	- 210	+ 64	- 966	- 150	+ 1448	+ 100	- 204	- 16	- 150	- 150	0	- 144	- 353	- 170		-1192

The matrix of table, shows that if we will take the mitigation measures then impact will get reduced. By making two matrixes, project alternatives can be systematically compared and possible mitigation measures can be explored. In addition, this method can draw attention to the most significant impacts in the matrix, as revealed by individual cell scores. This procedure can also be used to identify negative impacts on environmental components that surpass a critical threshold. Such instances will have to be addressed through mitigation or project alternatives.

VI RECOMMENDATION AND CONCLUSION

RECOMMENDATION

The negative impacts, identified from the impact assessment studies done earlier, can be minimized by adopting appropriate mitigation measures. In order to reduce these impacts the following environment management plan is recommended.

MITIGATION MEASURES DURING CONSTRUCTION PHASE

The principal mitigation measure in the construction phase is strict application of standard specifications for erosion and sediment control, including routine inspections. The trees to be cut will be kept at the minimum level by modifying alignments, eccentric and concentric widening. No construction vehicle will be allowed to enter into the dense vegetation area.

a. During construction, proper care will be exercised to avoid additional loss/cutting of trees.
b. Construction camp will be sited at least 2 km away from the forest area or away from huge habitations.
c. To balance the ecological loss, compensatory afforestation will be done as per the clearance condition laid down by the forest department.
d. No significant wildlife is reported in the project area and hence, there will be no impact on wildlife.

LAND ENVIRONMENT

Mitigation Measures

a. Excavated earth materials should be re-used to the maximum extent in site preparation.
b. Asphalt wastes, debris and other wastes material should be disposed of in environmentally safe area.
c. Indiscriminate dumping would be avoided.
d. Labor and construction camps should be constructed at the approved sites and away from operation road.
e. indiscriminate settlement of workers should be avoided.
f. Haul roads and construction site should be adequately maintained and should not be directly connected to main roads, wherever possible.
g. Construction activities should be kept confined to the PROW only.

SOIL ENVIRONMENT

Mitigation measures to avoid impacts on soil

a. The proposed ROW boundary will be peg marked at site and movement of vehicles and equipment will be restricted within proposed ROW only.
b. The bituminous drums/tanks and oils would be stored by providing impervious raised platform with catch-pits around the platform to avoid any chance of contamination of soil in case of spillage
c. Proper handling of spent wash from equipment and vehicle service station by providing catch-pits and soak-pits around the service station to avoid contamination of land adjacent to those sites.

Mitigation measures at Borrow Areas

a. Borrow materials for construction will be taken only from approved borrow areas. To operate borrow areas on private land; land-owner' s written consent will be obtained.
b. Borrow area will be selected as per Indian Road Congress Guidelines IRC SP: 10.
c. No earth will be borrowed from within the proposed ROW.
d. The borrow area will be located preferably on non-productive, barren lands, raised lands, waste lands and environmental considerations will be met with.
e. The borrow pits will not be dug within 800m of town or village settlement.
f. After completion of material extraction, no scar will be left unattended. The borrow area will be suitably rehabilitated either by backfilling it or by dressing the sides of the borrow pit to create slope consistent to the adjoining land. Bottom of the pits will be graded towards natural outfalls to prevent water accumulation.
g. All trees located within borrow area will be preserved.
h. The quarry material will be procured from licensed sites only, which operate with proper licenses from Department of Mines and Geology. The quarry site shall be suitably rehabilitated after use as per requisite instruction from Dept. of Mines and Geology.

AMBIENT AIR QUALITY

Mitigation Measures

Adopting proactive site planning approach and other mitigation measures can mitigate problem associated with dust generation and gaseous emissions and its impacts on sensitive receptors. The section falling near sensitive receptors and settlements need special attention for controlling dust as well as gaseous emission. By observing environmental regulation regarding use of vehicles, crusher plants and asphalt mixing plant will also keep the air pollution within acceptable limit. Impact on air quality during construction

phase is temporary and site specific and is difficult to quantify on an objective level. Proper Environment Management Plan can mitigate the impact to a large extent.
Following measures are suggested to mitigate the impact on air quality during construction:
Mitigation Measures for Mobile Source Emissions
a. All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms.
b. All the vehicles carrying construction material will be covered. Vehicles and machinery will be regularly checked as per the NAAQ standard. Mixing equipment will be well sealed and equipped with dust control removal devices.
c. Idling of delivery trucks or other equipment should not be permitted during periods when they are being unloaded or are not in active use;

NOISE ENVIRONMENT
Mitigation Measures
All noise generating equipment will be installed sufficiently away from settlement areas.

a. The main stationary noise producing sources such as generator sets shall be provided with an acoustic shield around them. These can either be a brick masonry structure or any other physical barrier which is effective in adequate attenuation of noise levels. A three meter high enclosure made up of brick and mud with internal plastering of a non-reflecting surface will be very effective in these regards.
b. The plants and equipment used for construction will strictly conform to CPCB standards.
c. Vehicles and equipment used will be fitted with silencer and maintained accordingly.
d. Noise to be monitored as per monitoring plan and if the noise level at any time is found to be higher, then immediate measure to reduce noise in that area will be ensured.

IMPACT ON WATER USE
Mitigation Measures
a.Avoid wastes of water from existing sources.
b.Rainwater harvesting structure should be constructed at the settlement area,
c.Borrows should be re-developed as a water catchment area. The unlined roadside drains in rural stretches should be connected to water bodies like nalas/ rivers/ drains near the culverts and bridges.

WATER RESOURCES
Mitigation Measures
a. Adequate drains facilities (longitudinal, median and chute drains) should be provided along the road to facilitate the stability of road carriageway. It prevents soil erosion also.
b. Existing drainage and cross drainage (CD) structures should be duly augmented, wherever necessary, to accommodate high discharges to avoid flooding and formation of water pool.
c. Adequate new drainage and cross drainage (CD) structures should be provided for smooth runoff to avoid water stagnation.
d. Inspection of existing drainage spouts before the on-set of monsoon.
e. Adequate facilities of drainage at construction site and camp in order to avoid stagnant water pools that also lead to soil erosion and incidence of diseases.

SURFACE WATER RESOURCES
Mitigation Measures
The above-mentioned problems associated with foundation works can be managed through the proposed Mitigation measures:
a.The bridge construction works will be carried out only during lean period when water flow in the canal is minimum.
b.The bed of the canal will be cleared from all excavated soils and debris immediately after completion of foundation works.
c.All water and liquid wastes arising from construction activities will be properly disposed off and will not be discharged into any water body without adequate treatment.
d.Littering or unauthorized discharge will not be permitted.
e.Permission of the engineer and the concern regulatory authorities will be obtained for disposal of the waste at the designated disposal point.
f.The stream course and drain will be kept free from any dumping of solid wastes and earth materials.
g.The fill and debris materials will be stored away from water bodies and only on the designated sites along the construction zones.

GROUND WATER RESOURCES
Mitigation Measures
The Contractor will arrange their water demand from separate sources so as not to interfere with the normal public water supply. Water from surface water source will be used for construction works with requisite permission from concerned Irrigation Department. However, when the surface water is not available during lean period, approved bore-well from Central Ground Water Authority may be used with prior permission from the competent authority.

RAINWATER HARVESTING

Mitigation measures

Detailed hydrological survey will be conducted and adequate drainage facilities provided to discharge the run-off to existing catchments area.

a. Provision of recharge pits, in the design to recharge ground water, in the urban area.
b. Longitudinal road-side drains on both sides of the road and out fall should be nearby culverts/ bridges on nalas/ rivers/ drains.
c. All the construction preparatory activities for culverts, bridges and other structure will be carried out during dry seasons.
d. Water for construction will be arranged by the contractor from the existing sources.
e. Minimum use of water from existing sources for construction purpose will be ensured promoted at construction site/camps to minimize likely impacts on other users.

SOCIAL ASPECTS

Mitigation Measures

Religious and cultural properties should be suitably relocated, if fully affected.

WORKER' S CAMP

Mitigation Measures

a. Temporary camps should be constructed at designated sites with adequate sanitation, drinking water supply.
b. Proper accommodation will be provided in the locality for the migrant construction engineers.
c. It should be ensured that the workers are provided with adequate ancillary facilities i.e. sanitation at camps, drinking water, lavatories, first aid facilities and temporary electrification (if possible).
d. It will be ensured through contract agreement that the construction workers are provided fuel for cooking to avoid cutting of trees for fuel wood.
e. Regular cleanliness at camps.

ECOLOGY

Mitigation measures

This is the step where specific sensitive habitats can be avoided to the extent practicable. The mitigation goal is to avoid ecologically sensitive areas and limit encroachments. Any measures to minimize the amount of new highway construction in the alignment selection process will mitigate against adverse impacts.

Specific mitigations in the planning and design phase include the following:

a. Avoid fragmentation of forest cover or other contiguous habitats
b. Utilize existing non-forest lands and transportation corridors.

HEALTH AND SAFETY

Mitigation measures

a. The plants and equipment will be installed sufficiently away from settlements.
b. All the construction equipment and vehicles will conform to the emission standards stipulated by the CPCB.
c. Safe working techniques will be followed and all the workers will be trained.
d. All the workers will be provided with proper personal safety equipment at construction site.
e. Proper traffic management will be ensured at the construction zone.
f. An Emergency Response System in case of any incidents will be developed and implemented.
g. Periodical health check facility for workers will be provided at camp sites.
h. Placement of warning signals for the protection of the site personnel at various sites, e.g., safety sign should be appropriately posted at various places at site to advice workers regarding wearing of PPE.
i. Barricade/fencing/displaying of warning sign by way of red flags/tape/lighting/paint etc. should be provided at the construction site.

SOLID WASTE GENERATION

Mitigation Measures

a. Minimization of waste generation for disposal (via reduction/recycling/re-use)
b. Segregating waste materials according to type to facilitate re-use and recycling
c. Separation of inert construction and demolition materials for either re-use on-site or use as material fill
d. During demolition works, segregating materials at source as far as practical

CONCLUSION

This study has focused on evaluation of environmental and socio-economic impacts occurring due to the expressway. The EIA study has been undertaken with an objective of identifying and subsequently quantifying the environmental and socio-economic parameter of expressway project likely to be affected favourably or adversely. The following are the conclusion of the study according to the environmental parameters discussed in two matrices-

Ecology- The total impact score without mitigation is -2020 and with mitigation it reaches to -526. The impact has reduced by 1494 but even though impacts are effecting our environment badly, so to make it very positive we have to take few more steps that may be out of budget of project or take long time to complete the project.

Socio-economic - The total impact score without mitigation is +1109 and with mitigation it reaches to +1364. The mitigation steps discussed in recommendation are sufficient to enhance the positive impacts. The positive impacts are here mainly due to the employment increased during and after project completion. There is a increase of +255 scores after the mitigation.

Air - The total impact score without mitigation is -3450 and with mitigation it reaches to -1350. The reduction of 2100 score has taken place but it is not sufficient enough. Its negative impacts can be reduce more by using the BS VI fuels in whole country

from now instead of 2020(as stated by Gov.) and vehicle emission control devices. The only solution is to upgrade the fuel and vehicles running on road. This step will surely reduce the impacts in long term.

Land - The mitigation steps bring the score from -1290 score to -470 score i.e. reduction of 820 score. Its impact can' t be reduced more than this because we have to construct the road on land and that land may be agricultural, commercial, or forest etc.

Noise – Its impact is very marginal in comparison to other factors.

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