

2023

INFRASTRUCTURE SECTOR

E - GUIDE

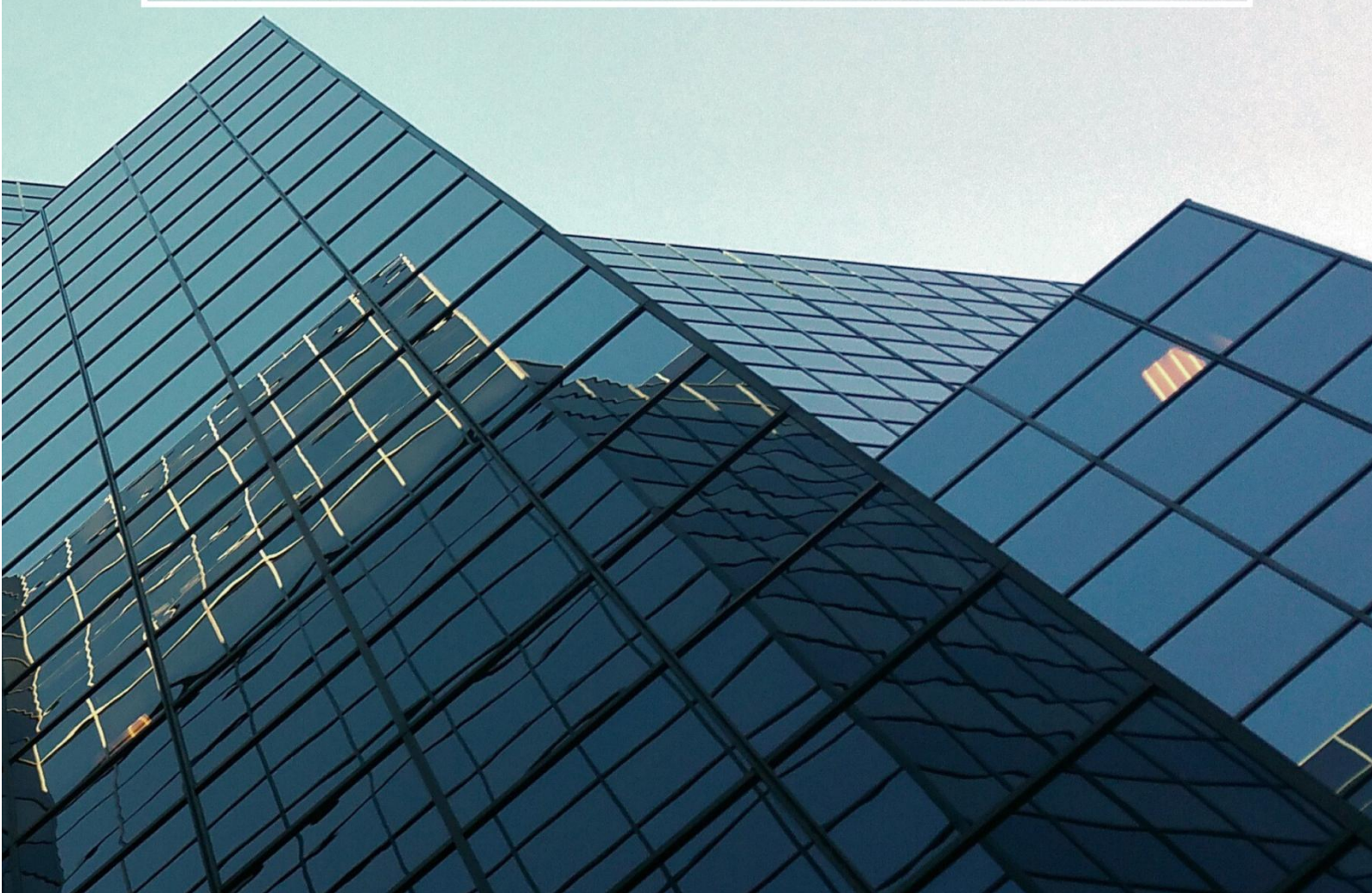




TABLE OF CONTENT

INDEX		Page No.
Preface		
How to use this e-guidebook for Infrastructure Sector		
Chapter 1	Introduction	
	1.1 Background	
	1.2 Post Environment Clearance Monitoring	
	1.3 About the e-guide	
Chapter 2	Sectoral Profile	
	2.1 Overview	
	2.2 Ports and Harbour	
	2.3 Highways	
	2.4 Industrial Estates	
	2.5 Building and Construction	
	2.6 TSDFs	
	2.7 CETPs	
Chapter 3	Environment Impacts of Each Sector	
	3.1 Background / Challenges	
	3.2 Land Impact	
	3.3 Water Impact	
	3.4 Air Impact	
	3.5 Biological Impact	
	3.6 Noise Impact	
	3.7 Solid Waste	
Chapter 4	Technological Solutions and Best Practices	
	4.1 Background	
	4.3 Best Practices	
	4.2 Technological advancement - Green Technology	
Chapter 5	Green Belt Development	
	5.1 Introduction	
	5.2 APTI definition and usage	
	5.3 Plant species sensitive to air pollutants	
	5.4 Plant species recommended	
	5.5 Criteria for green belt design	
	5.6 Miyawaki Technique	
Chapter 6	Post Environment Clearance Conditions	
	6.1 Background	
	6.2 General Conditions	
	6.3 Special Conditions	



	6.4	Standards for discharge of effluent	
	6.5	Hazardous Waste Management	
	6.6	Environmental Monitoring Program	
	6.7	Emergency Preparedness Plan	
Chapter 7	Summary		
References & Readings			
<i>Note: Further Reading and References is provided in each chapter</i>			



LIST OF FIGURES

Figure 1	<i>EIA Flowchart for Infrastructure Projects</i>	
Figure 2	<i>Figure 2: Sources of Environmental Impacts of Ports and Harbour</i>	
Figure 3	<i>Figure 3: Growth in India's Roads and Highways Sector</i>	
Figure 4	<i>Figure 4: IE's classification and Forms</i>	
Figure 5	<i>Figure 5: Forms of IE</i>	
Figure 6	<i>Figure 6: Hazardous Waste Treatment</i>	
Figure 7	<i>Figure 7 : General Working of a CETP</i>	
Figure 8	<i>Figure 8: Discharges from ships</i>	
Figure 9	<i>Figure 9: Solid Waste from Shipping activities</i>	
Figure 10	<i>Figure 10: Lead Pollution from Industrial Estates</i>	
Figure 11	<i>Figure 11: Waste Classification of IEs</i>	
Figure 12	<i>Figure 12: Pollution caused by construction dust in major cities in India</i>	
Figure 13	<i>Figure 13: Green Port Characteristics</i>	
Figure 14	<i>Figure 14: CSIR-CRRI produced frequency-based noise barriers</i>	
Figure 15	<i>Figure 15: Tools and Techniques for IE Planning</i>	
Figure 16	<i>Figure 16: Risk Based Industry Typology</i>	
Figure 18	<i>Precast Concrete Elements</i>	
Figure 19	<i>Miyawaki Technique</i>	
Figure 20	<i>Environmental Monitoring Program</i>	
Figure 21	<i>Emergency Preparedness Plan</i>	



LIST OF TABLES

Table 1	<i>Infrastructure Projects Requiring Prior Environmental Clearance</i>	
Table 2	<i>State/UT-wise number of Industrial Parks/ Estates/ Clusters/ Nodes (as on 1st Feb, 2021) entered on Industrial Information System (IIS) by Ministries/ State Govt.</i>	
Table 3	<i>Details of the Rules framed for handling of various solid wastes</i>	
Table 4	<i>Common Integrated Treatment, Storage & Disposal Facilities (TSDFs)</i>	
Table 5	<i>Major Environmental Parameters likely to be affected by cargo handling activities</i>	
Table 6	<i>Water Pollution Potential of Industries</i>	
Table 7	<i>Air Pollution Potential of Industries</i>	
Table 8	<i>Noise Ambient Air Quality Standards</i>	
Table 9	<i>Hazardous wastes from various sources at construction sites</i>	
Table 10	<i>Indicative Classification of Industries based on their Air and Water Pollution Potential</i>	
Table 11	<i>Focused Areas and Measured Outcomes for Indian Ports' 'Green Port Status'</i>	
Table 12	<i>1st Row of Plantations of Avenue Plantations</i>	
Table 13	<i>Species Recommended for 2nd and subsequent row of Avenue Plantations</i>	
Table 14	<i>Shade trees recommended for last (or the only) row in roadside avenues</i>	
Table 15	<i>The technical specification for planting along the Highways are as follows:</i>	
Table 16	<i>General Environmental Standards for Effluent Discharge</i>	



Table 17	<i>Precast Components</i>	
Table 18	<i>Type of moulds used for pre-casting various elements with various methods</i>	
Table 19	<i>Environment-Friendly, Energy Efficient, Cost-Effective Composite Materials/Products for Low Cost Housing</i>	
Table 20	<i>BMTPC developed technologies and production processes for commercial exploitation</i>	
Table 21	<i>General Air Emission Standards</i>	
Table 22	<i>APTI Index with categories</i>	
Table 23	<i>Species sensitive to dust</i>	
Table 24	<i>Drought Resistant Species</i>	

**LIST OF ABBREVIATIONS**

ABBREVIATION	DEFINITION
MOEFCC	<i>Ministry of Environment Forest and Climate Change</i>
EIA	<i>Environment Impact Assessment</i>
EAC	<i>Environment Appraisal Committee</i>
SEAC	<i>State Level Expert Appraisal Committee</i>
CSIR	<i>Council of Scientific & Industrial Research</i>
PARIVESH	<i>Pro-Active and Responsive facilitation by Interactive, Virtuous and Environmental Single-window Hub</i>
NPC	<i>National Productivity Council</i>
NEERI	<i>National Environmental Engineering Research Institute</i>
EC	<i>Environment Clearance</i>
PM	<i>Particulate Matter</i>
NABL	<i>National Accreditation Board for Testing and Calibration Laboratories</i>
GHG	<i>Greenhouse gases</i>
IIT	<i>Indian Institute of Technology</i>
NIT	<i>National Institutes of Technology</i>
HIRA	<i>Hazard identification and Risk Assessment</i>
AAQ	<i>Ambient Air Quality</i>
ETP	<i>Effluent Treatment Plant</i>
STP	<i>Sewage Treatment Plant</i>
EPA	<i>Environment Protection Act</i>
ERP	<i>Emergency Preparedness Plan</i>
TSDF	<i>The treatment, storage, and disposal facility</i>
NAAQS	<i>National Ambient Air Quality Standards</i>



GB	<i>Green Belt</i>
APTI	<i>Air Pollution Tolerance Index</i>
BMTPC	<i>Building Materials and Technology Promotion Council</i>



CHAPTER 1



BACKGROUND

The inception of Environmental Impact Assessment (EIA) in India began in the late 1970s, when the Planning Commission of India encouraged the Department of Science and Technology to assess river valley projects from an environmental perspective.

Later, in 1994, the Environment (Protection) Act, 1986, was amended to make EIA and Environmental Clearance (EC) mandatory for specific development projects. The process of environmental clearance applies to 39 types of projects and involves screening, scoping, and evaluating upcoming projects. Its primary objective is to evaluate the potential impact of the planned project on the environment and people while taking measures to mitigate or minimize these impacts.

The process of identifying the location for a proposed project involves ensuring compliance with existing siting guidelines. If an environmental clearance is required for the project and it is included in the notification schedule, an Environmental Impact Assessment (EIA) study is done, either directly by the proponent or through a consultancy.

The EIA Notification 2006 classifies projects into Categories A and B based on

1. Spatial extent of potential impacts
2. Potential impacts on human health, natural and man-made resources

Depending on the project category, the proponent submits an application for environmental clearance to either the Ministry of Environment and Forests (MoEF&CC) or the state government. The application includes the EIA report, Environment Management Plan (EMP), details of the public hearing, and the NOC obtained from the state regulators. The Appraisal Committees review the projects and make recommendations for their approval or rejection. The final decision on approval or rejection is made by the MoEF&CC.

A comprehensive EIA report with adequate data must identify, predict, and evaluate the project's environmental implications. The thoroughness and quality of the EIA report, along with the adherence to the prescribed procedures at each stage, significantly impact the chances of obtaining environmental clearance expeditiously.



POST ENVIRONMENT CLEARANCE MONITORING

The Ministry of Environment Forests and Climate Change in India grants Environmental Clearance (EC) to project proponents along with specific conditions that they must comply with. To ensure the effectiveness of suggested safeguards and make mid-course corrections if necessary, the MoEF&CC's Regional Offices (ROs) are responsible for monitoring the EC conditions.

Initially set up in 1986 with five ROs and a headquarters in New Delhi to monitor ongoing development projects, the ROs were further strengthened in 1988 with the addition of a sixth Regional Office in Chandigarh. This expansion was necessary due to the increasing workload related to various aspects of environmental management, including pollution control.

In order to enhance the efficiency of the Environmental Clearance process and ensure compliance, the MoEF&CC now requires project proponents to submit Post Environment Clearance Monitoring Reports every six months for a period of 5 years from the grant of EC. These reports are used to check the compliance status of industrial and development projects. The reports should include information on the status of compliance with stipulated environmental conditions, including data collected through monitoring efforts. The reports are to be submitted in hard copies and mailed to the respective Regional Office of MoEF&CC and the Zonal Office of CPCB/SPCB. This step aims to improve oversight and accountability in environmental management for projects in the country.

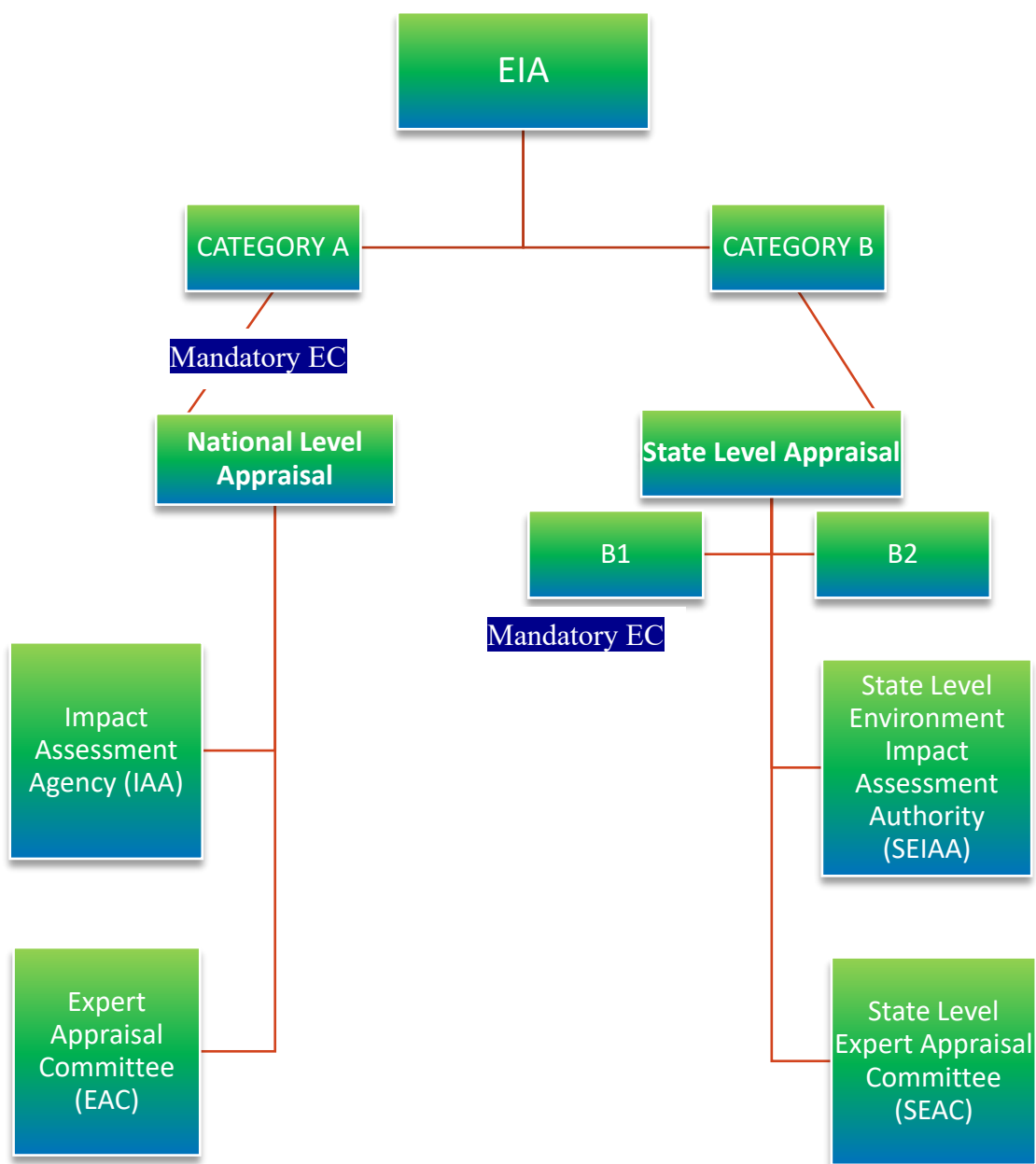


Figure 1: EIA Flowchart for Infrastructure Projects



ABOUT THE E-GUIDE



CHAPTER 2



Sectoral Profile

OVERVIEW

This chapter aims to give a brief overview of projects within the infrastructure sector of Indian economy. Sectoral profile aims to understand the nuances of the sectors within the economy. It will provide a comprehensive snapshot of a sector's current state and its potential future trajectories.

The sectoral profile will cover information such as:

Economic Contribution: This includes data on the sector's contribution to the overall economy, its share of the GDP (Gross Domestic Product), employment levels, revenue generation, and any other economic indicators.

Market Trends: Analysis of market trends, including growth patterns, supply and demand dynamics, market size, and potential opportunities and challenges.

Global and Local Context: Comparison of the sector's performance and characteristics at both national and international levels.

In this E-Guide the Infrastructure Sector has been divided into two sections which will cover :

SECTION A

1. Ports, Harbours
2. Highways
3. Industrial estates

SECTION B

1. Building and Construction projects
2. TSDFs
3. CETPs

**Table 1 Infrastructure Projects Requiring Prior Environmental Clearance**

LIST OF INFRASTRUCTURE PROJECTS REQUIRING PRIOR ENVIRONMENTAL CLEARANCE				
Project or Activity		Category with threshold limit		Conditions if any
		A	B	
7) Physical Infrastructure including Environmental Services				
7(c)	Industrial estates/ parks/ complexes/ areas, Export Processing zones, Special Economic Zones (EPZs), Special (SEZs), Biotech Parks, Leather Complexes	If at least one industry in the proposed industrial estate falls under the Category A, entire industrial area shall be treated as Category A, irrespective of the area. Industrial estates with area greater than 500 ha. and housing at least one Category B industry.	Industrial estates housing at least one Category B industry and area <500 ha. Industrial estates of area >500 ha. and not housing any industry belonging to Category A or B.	Special condition shall apply Note: Industrial Estate of area below 500 ha. and not housing any industry of category A or B does not require clearance. 2. If the area is less than 500 ha but contains building and construction projects less than 2000 hq, mtr. and or development area more than 50 ha it will be treated as activity listed at Serial No.8(a) or 8(a) in the Schedule, as the case may be]
7(d)	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	All integrated facilities having incineration & landfill or incineration alone	All facilities having land fill only	General Condition shall apply
7(e)	Ports, Harbours	< 5 million TPA of cargo handling capacity (excluding fishing harbours)	<5million TPA of cargo handling capacity and/or ports/ harbours <10,000TPA of fish handling capacity	General Condition shall apply Note: 1. Capital dredging inside and outside the ports or harbours and channels are included;



				3. Maintenance dredging is exempt provided it formed part of the original proposal; for which Environmental Management Plan (EMP) was prepared and environmental Clearance obtained]
7(h)	Common Effluent Treatment Plants (CETPs)	All projects		General Condition shall apply Note: Environmental clearance for CETPs setup for or within projects or activities which do not require environmental clearance are exempted, and if any of the existing or proposed member units of the said CETP produces or proposes to produce any product requiring environmental clearance, then the CETP shall need environmental clearance].
7(f)	Highways	i. New National High ways; ii. Expansion of National High ways greater than 30 KM, involving additional right of way greater than 20m involving land acquisition and passing through more than one State.	i. New State High ways; ii. Expansion of National / State Highways greater than 30 km involving additional right of way greater than 20m involving acquisition land	
8) BUILDING /CONSTRUCTION PROJECTS/AREA DEVELOPMENT PROJECTS AND TOWNSHIPS				
8(a)	Building and Construction projects		≥20000 sq.mtrs and <1,50,000 sq.mtrs. of built up area	The term “built up area” for the purpose of this notification the built up or covered area on all floors put together, including its basement



			≥50,000 sq. mtrs and <1,50,000 sq. mtrs. of built-up area	and other service areas, which are proposed in the building or construction projects. Note 1.- The projects or activities shall not include industrial shed, school, college, hostel for educational institution, but such buildings shall ensure sustainable environmental management, solid and liquid waste management, rain water harvesting and may use recycled materials such as fly ash bricks. Note 2.- “General Conditions” shall not apply.
8(b)	Townships and Area Development		Covering an area ≥ 50 ha and or built up area ≥1,50,000 sq .mtrs ≥ 1,50,000 sq. mtrs and <3,00,000 sq. mtrs built up area or covering an area ≥50 ha	A projects of Townships and Area Development Projects covered under this item shall require an Environmental Assessment Report and be appraised as Category ‘B1’ Project. Note.- General Conditions shall not apply.



PORT AND HARBOR SECTOR

With a coastline that stretches for 7,500 km, 200+ major and non-major ports, and a sizable network of navigable rivers, India has a sizable maritime industry. Approximately 95% of India's merchandise trade is done through sea ports.

The Indian Ocean region handles a significant portion of global maritime trade, including container traffic and energy trade. However, India's ports and shipping sector has not realized its full potential compared to neighbouring Asian and Middle Eastern countries. Despite the geographical advantages, the sector contributes only 1% to India's GDP. Various challenges, such as insufficient port infrastructure, inefficient cargo transport methods, limited hinterland connections, and underdeveloped coastal and inland shipping, have hindered the sector's growth.

Ports and harbours are consequently required to handle higher amounts of cargo throughputs of both raw materials and finished goods because maritime transport is both efficient and the sole way to transfer larger volumes of cargo across oceans. Therefore, the need to handle larger size ships and deploy cutting-edge cargo handling equipment frequently necessitates the extension of facilities at current ports as well as the creation of new ports and harbours.

Port and Harbour developing activities like dredging, reclamation, construction work, development of utilities and services, discharges from ships and waterfront industries, cargo operations, and other port related activities have detrimental impacts on the environment. These include air pollution, noise pollution, flood light effects, water pollution, contamination of bottom sediments, harm to marine ecology and fisheries, beach erosion and accretion, alteration of current patterns, waste disposal, oil spills and leaks, and hazardous gas emissions.

Major sources of the adverse environmental impacts on account of development of port and harbour projects can be categorized into the following types:

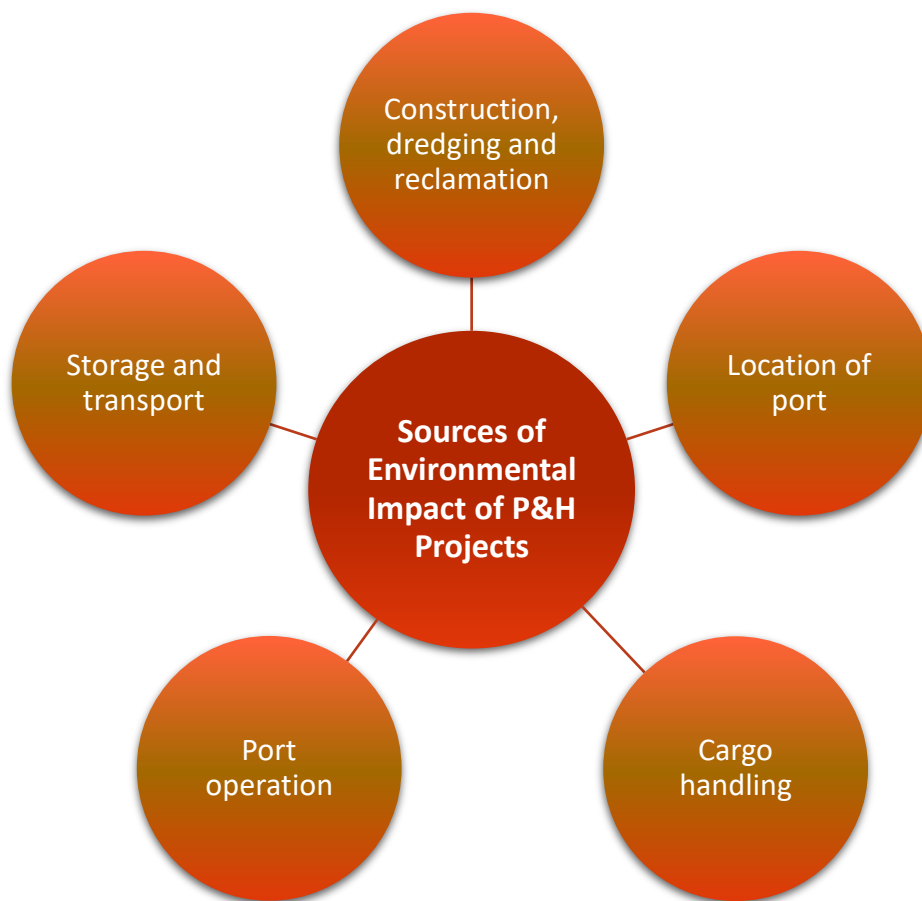


Figure 2: Sources of Environmental Impacts of Ports and Harbour

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<https://www.niti.gov.in/post-covid-economic-growth-will-come-through-indias-ports>

<https://www.ibef.org/research/case-study/india-s-maritime-sector>



HIGHWAYS

With 29Km/Day pace of NH Construction in FY 2021-22 and an overall 1.45 Lakh Km of total length of National Highways (as of Dec 2022) India possesses an extensive road network, ranking among the world's largest, with a total length exceeding 5.8 million kilometres. This network comprises approximately 2% National Highways, 3% State Highways, and the rest encompasses district and rural roads.

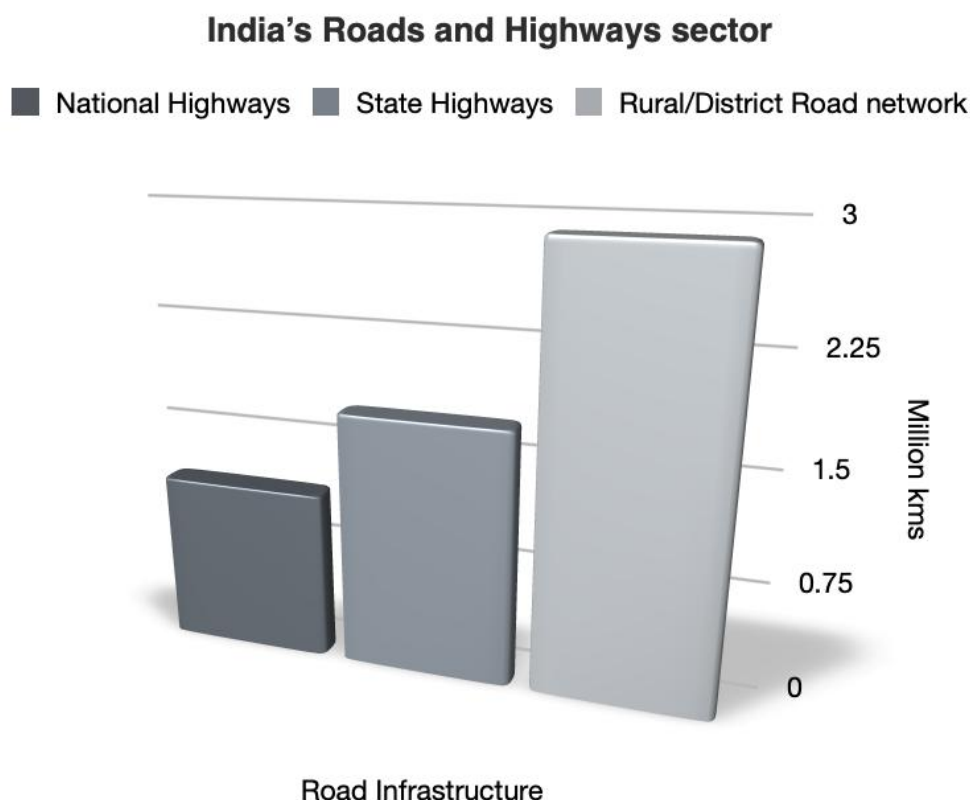


Figure 3: Growth in India's Roads and Highways Sector

The road system plays a vital role in transportation, facilitating the movement of goods and people. Notably, more than 64.5% of the country's freight is transported via roads, and a significant 90% of passenger traffic relies on this network for commuting.

National Highways (NH) play a very important role in the economic and social development of the country by enabling efficient movement of freight and passengers and improving access to market. They account for 2% of the total road network and carry over 40% of total traffic. The pace of NH construction has increased consistently due to the systematic push through corridor-based National Highway development approach, from about 12 km/ day in 2014-15 to about 29 km/ day in 2021-22.



Development of highway projects is generally intended to improve the economic and social welfare of the people. At the same time it may also create adverse impact on the surrounding environment. People and properties may be in the direct path of road works are affected. The environmental impact of highway projects include damage to sensitive eco-systems, soil erosion, changes to drainage pattern and thereby ground water, interference with wild life movement, loss of productive agricultural lands, resettlement of people, disruption of local economic activities, demographic changes and accelerated urbanization. Highway development and operation should, therefore, be planned with careful consideration of the environmental impact. To minimize these adverse effects that may be created by the highway development projects, the techniques of Environmental Impact Assessment (EIA) become necessary. Identification and assessment of potential environmental impact should be an integral part of the project cycle. It should commence early in the planning process to enable a full consideration of alternatives, and to avoid later delays and complications. Highway authorities should have a clearly designated staff member with overall responsibility for environmental matters and knowledge of environmental laws and regulations.

References & Readings

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INDUSTRIAL ESTATES

In India, the Industrial Estate IE Program began in 1952 with the establishment of the first estate in Hadapsar, Maharashtra. An IE is a tract of land that has been developed and subdivided into plots in accordance with a comprehensive plan, with provision for roads, transportation, and public services, with or without built-up advance factories, and occasionally with shared facilities.

Different industries have different resource requirements, such as water, power, and labour. So, Industrial estates typically offer well-developed infrastructure, electricity supply, water and sanitation facilities, telecommunications, and transportation networks. This infrastructure reduces the operational costs and challenges for industries setting up within the estate. Industrial estates often follow a zoning and planning approach, where different areas within the estate are designated for specific types of industries.

The secondary sector of the economy, which includes industries, contributes significantly to both the national GDP and the local economy of a city. Along with large-scale enterprises, there is significant opportunity for MSMEs to flourish in India. MSMEs have a greater labour-to-capital ratio, making them an important source of job creation. They provide about 8% of the country's GDP and produce more than 60% of industrial output. Industrial estates are particularly beneficial for SMEs that may lack the resources to establish infrastructure independently. Shared facilities and services in these estates help SMEs access essential resources at reduced costs.

State/regional/urban/local needs must be considered while selecting and building an IE. Furthermore, for the purposes of Environmental Impact Assessment (EIA) Notification, all industrial estates, parks, complexes, export processing zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, and Leather Complexes are classified as 'Industrial Estates.'



State/UT-wise number of Industrial Parks/ Estates/ Clusters/ Nodes (as on 1st Feb, 2021) entered on Industrial Information System (IIS) by Ministries/ State Govt. : Table 2

S. No.	Name of State/ UT	Number of Industrial Parks
1	Andhra Pradesh	400
2	Arunachal Pradesh	13
3	Assam	51
4	Bihar	64
5	Chandigarh	4
6	Chhattisgarh	51
7	Dadra & Nagar Haveli	4
8	Daman & Diu	2
9	Delhi	31
10	Goa	24
11	Gujarat	267
12	Haryana	35
13	Himachal Pradesh	64
14	Jammu & Kashmir	58
15	Jharkhand	131
16	Karnataka	539
17	Kerala	147
18	Madhya Pradesh	120
19	Maharashtra	728
20	Manipur	5
21	Meghalaya	9
22	Mizoram	2
23	Nagaland	6
24	Odisha	129
25	Puducherry	10
26	Punjab	63
27	Rajasthan	370
28	Tamil Nadu	213
29	Telangana	147
30	Tripura	28
31	Uttar Pradesh	219
32	Uttarakhand	41
33	West Bengal	14
	Total	3,989



TYPES OF IE

An IE can be classed based on the sponsor, location, or function it performs. The category's sub-divisions are not mutually exclusive, and estate may be meant to serve more than one purpose.

The following are the broad classification bases:

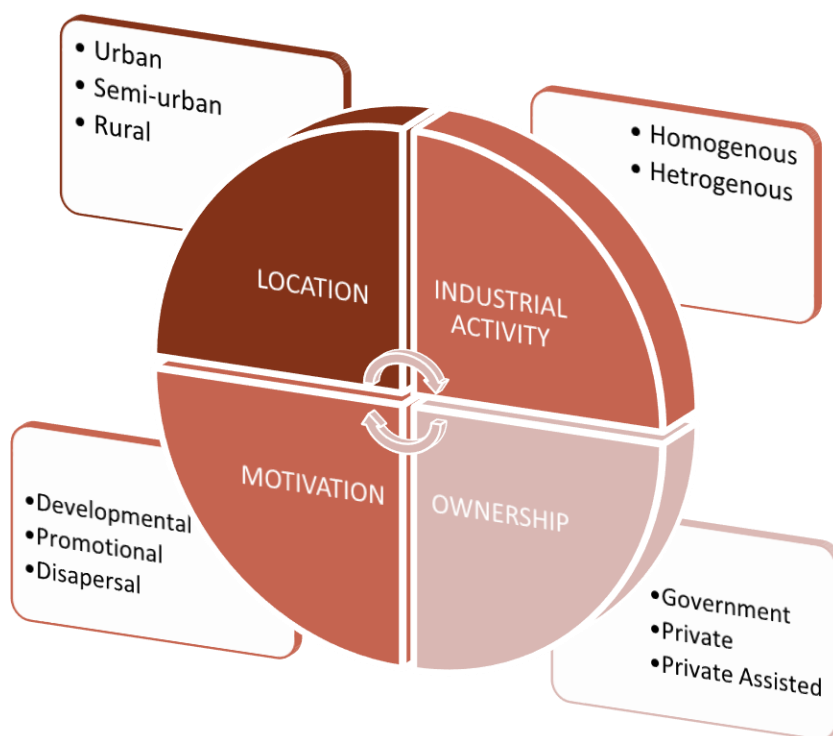


Figure 4: IE's classification

IE are referred in various forms in India, and include the following:

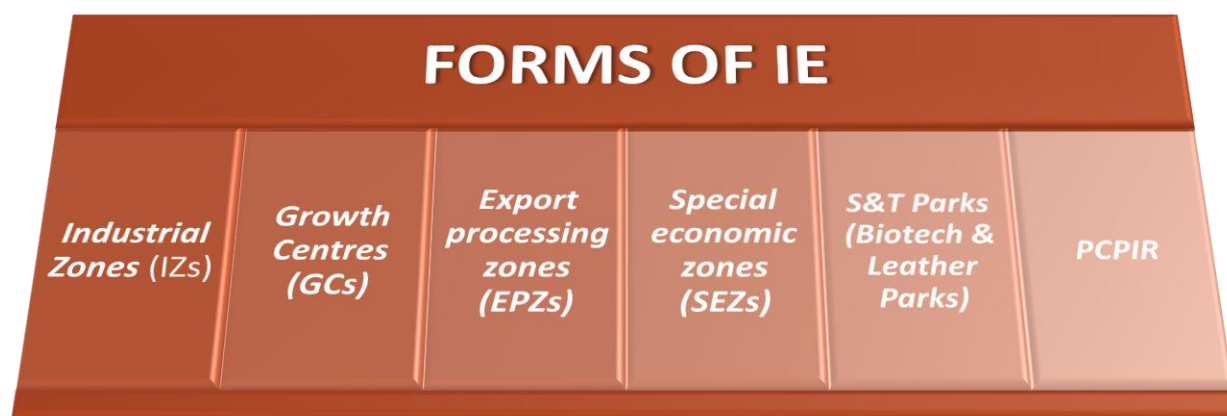


Figure 5: Forms of IE



- **Industrial areas** - An industrial area is a block of improved land that has been developed and subdivided into plots for the housing of industrial businesses and is available for sale or lease. Because of its size, it may be possible to take advantage of economies of scale in supplying infrastructure, which may be passed on to the tenants. The time saved in choosing a site and preparing the land is appealing to a prospective occupant.
- **Industrial Zones** - An industrial zone is just a section of undeveloped land set aside for industrial use. In most cases, it is established by municipal bylaw and is part of an urban development program.
- **Growth Centres** - In order to promote industrialization of backward areas, the central Government, in June 1988, announced the scheme for establishment 70 Growth Centres throughout the country. One of the important criteria for identification of a growth centre is that its sphere of influence should cover an area of about 400 to 800 hectares. Each growth centre would be bestowed with the best of infrastructural facilities to facilitate and promote industrial growth. The facilities for growth centres are:
 1. Proximity to railway station, national or state highways, or port
 2. Water, electricity, telecommunication, education and health facilities,
 3. Sufficient land
 4. Financing pattern of each growth centre is as:
 - Central Government : Rs. 10 Crores
 - State Governments : Rs. 5 Crores
 - Financial Institutions/Banks : Rs. 5 Crores
 - Market Borrowing : Rs. 10 Crores
- **Export processing zones (EPZs)** - Described by the International Labour Organization ILO as industrial zones with particular incentives, EPZs set up to attract foreign investors, where imported goods undergo some degree of processing before being re-exported. EPZs can be advantageous for an export-oriented manufacturing sector.
- **Special economic zones (SEZs)** - SEZs are specially designated geographical areas with more permissive economic laws than the country's centralized laws. A SEZ's sole objective is to develop the area covered by the special economic zone through specific economic policies to attract mass foreign investments. SEZs are governed exclusively by SEZ Acts and Notifications (SEZ Act 2005 and SEZ Rules 2006).



- **Science & Technology Parks (Biotechnology and Leather Parks)** – These are intended for technologically advanced industries, essentially offer the same kind of infrastructure as IEs but place an emphasis on the high-level support services needed for such activities, including technical consultancy through networking with local R&D institutions, advisory services on finance and venture capital, marketing, and the search for joint venture partners.
- **Petroleum, Chemical & Petrochemical Investment Regions** – PCPIR a form of Homogeneous IE, are a relatively new context of IEs that primarily focus on petroleum-based industries. It is a specially defined investment region with an area of approximately 250 km² designed for the creation of manufacturing facilities for local and export-led production in petroleum, chemicals, and petrochemicals, as well as the accompanying services and infrastructure. A PCPIR would include manufacturing units, public utilities, logistics, environmental protection measures, residential regions, and administrative services. Minimum processing area for the PCPIR will be about 40% of the total designated area, i.e., around 100 km². The processing area may or may not be contiguous. The PCPIR may include one or more SEZs, Industrial Parks or Growth Centres.

References & Readings

<https://pib.gov.in/PressReleaseDetailm.aspx?PRID=1695462>

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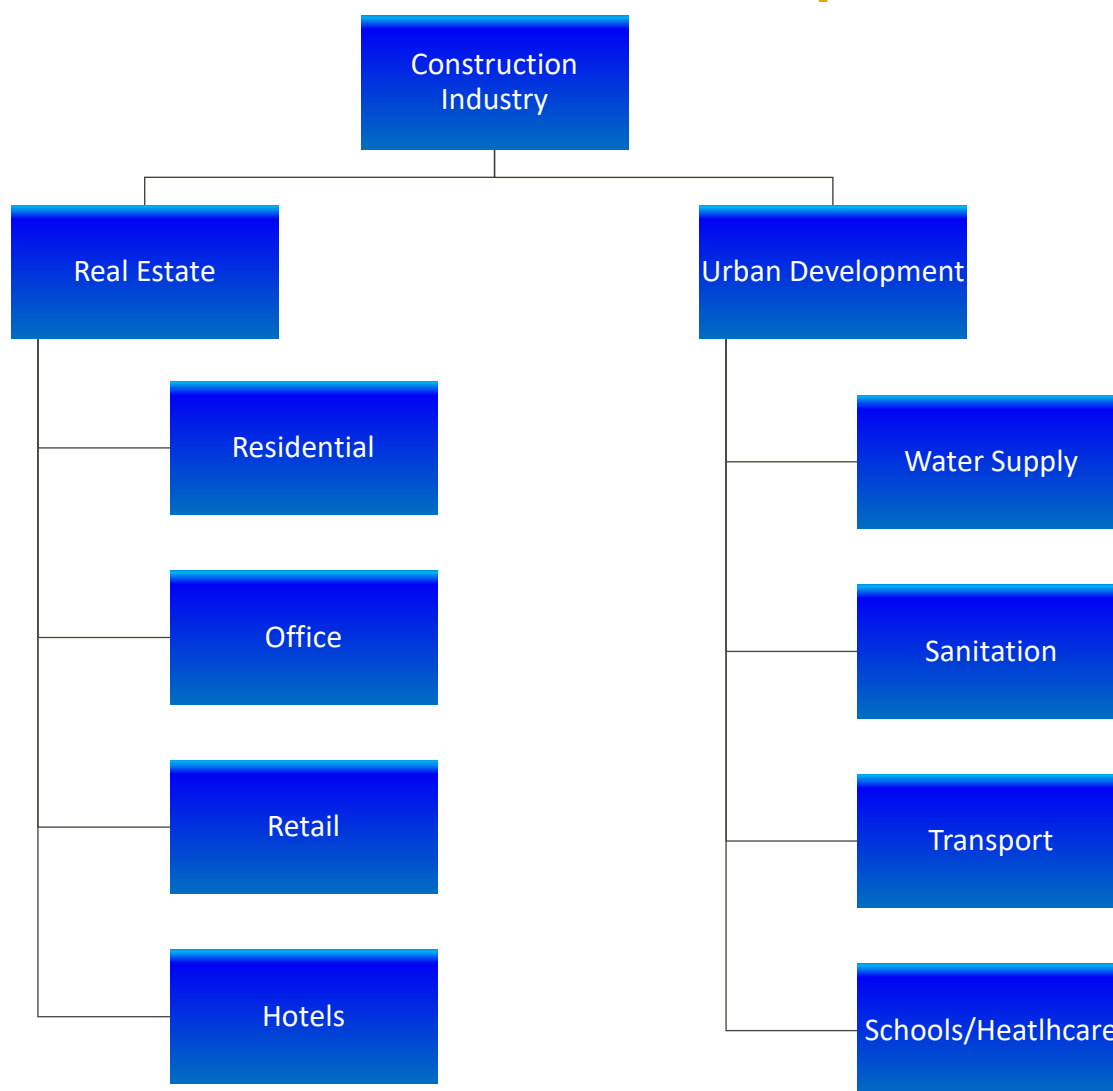
<https://pib.gov.in/PressReleaseDetail.aspx?PRID=1761135>



BUILDING CONSTRUCTION

The Indian construction industry drives the Indian economy. As solid infrastructure provides the foundation for all other projects, the Indian construction sector is responsible for accelerating the country's overall growth. In terms of value, the Indian construction industry is predicted to grow at a 15.7% CAGR to \$738.5 billion by 2022. It makes up 55% of the steel industry, 15% of the paint business, and 30% of the glass industry.

The Construction industry in India consists of the Real estate as well as the Urban development segment. United Nations projects India's population to be 1.64 Bn by 2047, of which nearly 0.82 Bn (~50%) shall be residing in urban areas.



The construction Industry in India is expected to reach \$1.4 Tn by 2025. Indian construction industry is rapidly growing at a rate of 9.2% as against the world average of 5.5%. The construction industry market in India works across 250 sub-sectors with linkages across sectors. 54 global innovative construction technologies identified under a Technology Sub-Mission of PMAY-U to start a new era in Indian construction technology sector.

According to A. B. Dutta I. Sengupta Authors of Article Environmental Impact Assessment EIA and Construction, published in International Research Journal of Environment Sciences, the Construction Industry is one of the largest industries globally, responsible for 23% of the air pollution, 40% of drinking water pollution, and 50% of landfill waste pollution, in addition to 50 percent of climate change gases. Therefore, every single activity that is associated with construction has some impact on the environment. Approximately 50 percent of the energy use in buildings is



devoted to producing an artificial indoor climate through heating, cooling, ventilation, and lighting.

Construction operations are frequently pursued without much regard for environmental considerations. This has put a strain on the country's limited natural resources. Unplanned and unsustainable urban development has put tremendous environmental strains on the ecosystem. Green cover and ground water resources have had to make way to quickly growing metropolitan areas.

Modern buildings in the urban built-ups have high levels of energy consumption because of requirements of air-conditioning and lighting. In this scenario it is necessary to critically assess the utilization of natural resources in these activities.

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<https://www.investindia.gov.in/team-india-blogs/indian-construction-industry-brief-summary>

<https://www.investindia.gov.in/sector/construction>

<https://gharpedia.com/blog/environmental-impact-assessment/>

<http://www.isca.me/IJENS/Archive/v3/i1/11.ISCA-IRJEvS-2013-226.pdf>

TSDf (TREATMENT, STORAGE, AND DISPOSAL FACILITY)

As per the EIA notification issued by the Ministry of Environment, Forests and Climate Change (MoEF&CC) S.O.1535, dated 14.09.2006 and its subsequent amendments, the proposed project falls under Project Activity 7(d) - Treatment, Storage and Disposal Facilities (TSDFs), Category 'A'.

TSD facilities include all integrated facilities with incineration and landfill or incineration alone. In the waste management chain, the treatment, storage, and disposal facility (TSDf) follows the generator and transporter. The TSDf facilitates the environmentally appropriate collection, transportation, storage, treatment, and disposal of hazardous waste.



The guidelines governing TSDFs are more strict than those governing generators or transporters. This includes both basic facility standards and unit-specific design and operational criteria. The general facility standards include provisions for good management in any facility that handles hazardous material. The technical standards for each unit are intended to avoid the release of hazardous waste into the environment.

Treatment facilities alter the character or composition of hazardous wastes, through an array of procedures (such as incineration or oxidation). Some waste treatment procedures allow garbage to be recovered and reused in production settings, while others significantly reduce the amount of hazardous waste.

Storage facilities hazardous waste is temporarily stored in storage facilities until it is processed or disposed of.

Disposal facilities permanently contain hazardous wastes. A landfill is the most prevalent type of disposal facility, where hazardous wastes are disposed of in specially engineered units that safeguard groundwater and surface-water resources.

TSDFs include facilities that have engaged in any of the following activities:

- Stored hazardous waste for greater than the allowed timeframes for generators of hazardous waste;
- Received hazardous waste from off-site;
- Treated hazardous waste;
- Disposed of hazardous waste (e.g., in a landfill, surface impoundment, or incinerator).

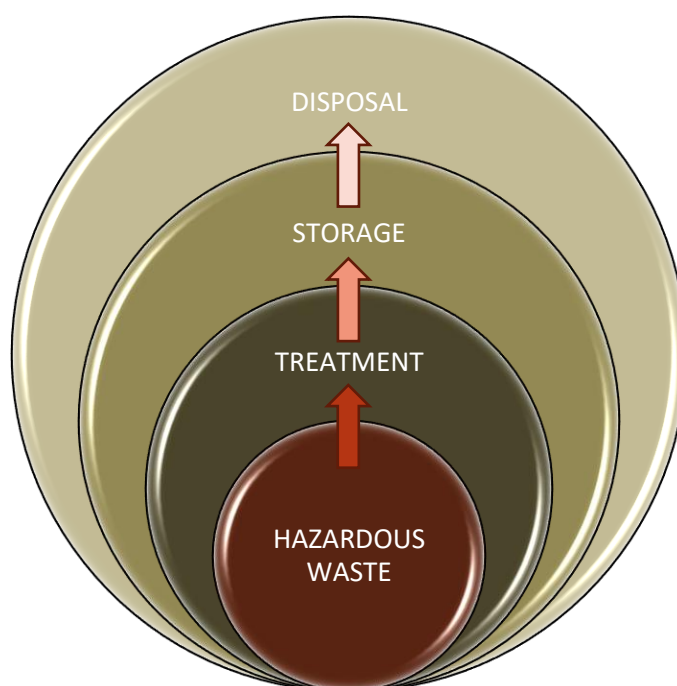


Figure 6: Hazardous Waste Treatment

A major concern about the hazardous wastes is that, they need to be disposed of in a secured manner in view of their toxic nature, environmental pollution and wide range of health hazards.

The Government of India thus promulgated rules for handling various types of wastes through MoEF&CC under the aegis of Environment (Protection) Act, 1986 during different periods, the details of which are given in the Table 3>

Solid Wastes	Year in which the Rules are framed	Details of Amended Rules
Hazardous Chemicals	1989	The Manufacture, Storage and Import of Hazardous Chemical rules , 1989
Municipal Solid Waste	2000	Solid Waste Management Rules, 2016.
Hazardous Wastes	2008	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
E-Waste	2011	E-Waste (Management) Rules, 2016.
Plastic Waste	2011	Plastic Waste Management Rules, 2016.
Battery waste	2001	Batteries (Management & Handling) Amendment Rules, 2010

Table 3: Details of the Rules framed for handling of various solid wastes

Table 4: Common Integrated Treatment, Storage & Disposal Facilities (TSDFs)



S.No.	States/UTs	Integrated TSDFs (with both SLF & Incinerator)	TSDFs with only Common Secured Landfills	TSDFs with Only Common Incinerator
1	Andhra Pradesh	1	1	0
2	DD&DNH	1	0	0
3	Delhi	1	0	0
4	Goa	1	0	0
5	Gujarat	2	7	2
6	Haryana	0	1	0
7	Himachal Pradesh	0	1	0
8	Jharkhand	1	0	0
9	Karnataka	1	2	7
10	Kerala	0	1	0
11	Madhya Pradesh	1	0	0
12	Maharashtra	3	1	0
13	Odisha	0	1	0
14	Punjab	1	0	0
15	Rajasthan	0	2	1
16	Tamil Nadu	1	1	0
17	Telangana	1	0	0
18	Uttar Pradesh	2	1	1
19	Uttarakhand	1	0	0
20	West Bengal	2	0	0
	Total	20	19	11

Source: CPCB website

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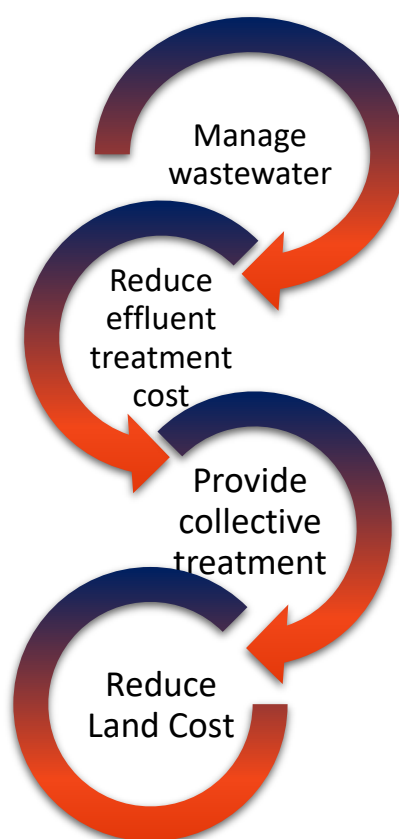
COMMON EFFLUENT TREATMENT PLANTS (CETPS)

Common effluent treatment plant (CETP) is a centralized facility that treats the wastewater generated by multiple industrial units located in a specific industrial cluster or area. Optimum working conditions for treatment of effluent to be at par with discharge standards is a major mandate for any CETP.

CETP effectiveness can be determined in terms of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), and oil and grease (O&G) concentrations removal efficiencies of treated effluent.

Due to their small size and scale of operations, Small Scale Industries (SSI) often find it challenging to develop and operate individual wastewater treatment plants. However, because SSI are typically located in industrial areas/estates, the concept of a Common Effluent Treatment Plant (CETP) for industrial cluster effluents has been devised to enable appropriate treatment through collaborative efforts. Monitoring and enforcing a CETP as a single pollution source is also simpler for regulatory bodies than monitoring a large number of ETPs of separate SSI units.

The primary purpose of a CETP is to treat and manage the wastewater generated by industries in an environmentally responsible and cost-effective manner.





According to CPCB research conducted in 2011-12 to determine the country's actual requirement for common effluent treatment plants, the country has 193 Common Effluent Treatment Plants (CETPs) serving 212 industrial areas/estates.

Here's how a CETP generally works:

Wastewater Collection: Industries in a particular industrial area channel their wastewater to the CETP.

Centralized Treatment: At the CETP, the combined wastewater from various industries undergoes a series of treatment processes. These processes might include physical, chemical, and biological treatment methods to remove pollutants, organic matter, and contaminants from the wastewater.

Treatment Processes: The exact treatment processes can vary depending on the nature of the industries in the area and the pollutants they generate. Common processes might include sedimentation, coagulation, flocculation, biological treatment (such as activated sludge process), and disinfection.

Effluent Quality: The goal of the CETP is to ensure that the treated wastewater, known as effluent, meets the environmental standards set by regulatory authorities before it is discharged into water bodies like rivers, lakes, or the sea.

Benefits:

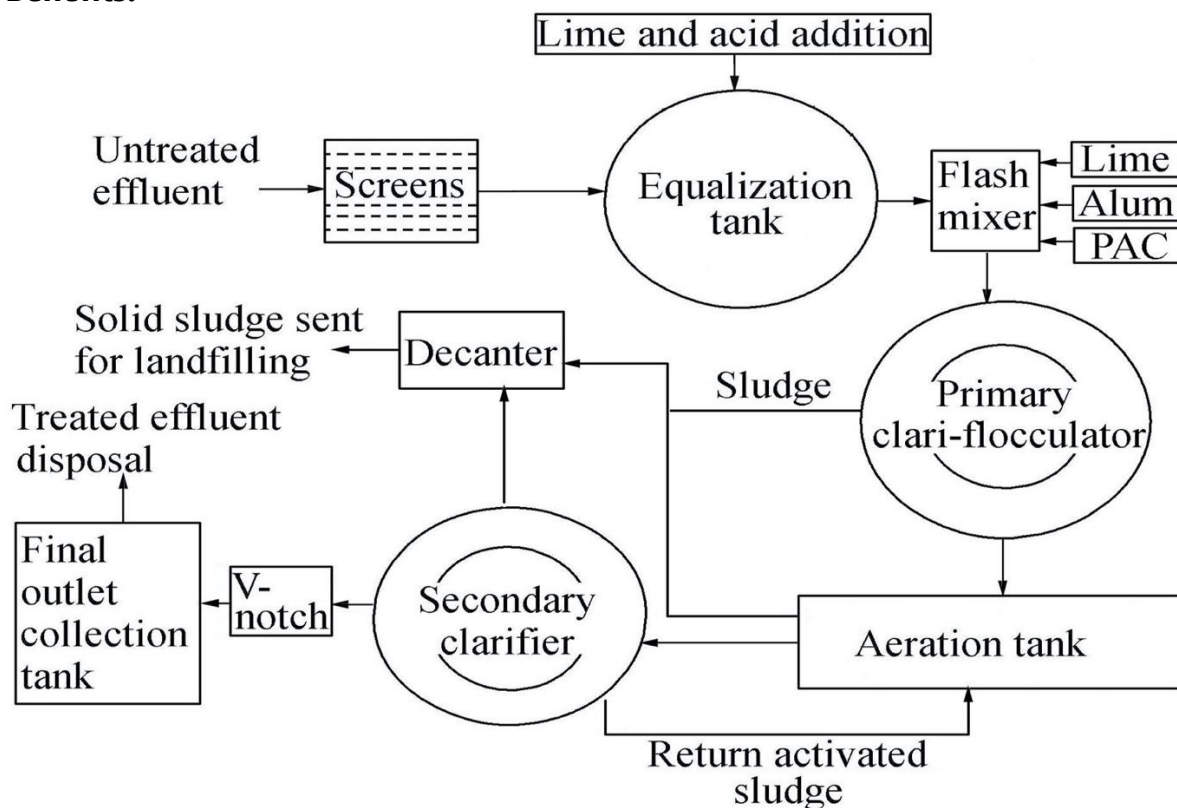


Figure 7 : General Working of a CETP



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CHAPTER 3



Environment Impacts

Background

Environmental impacts resulting from proposed developmental projects can be grouped into following categories namely direct, indirect or cumulative. The assessment impacts should not be considered in isolation rather should form an integral part of all stages of the EIA.

1. Direct impacts

Direct impacts arise when an activity interacts with an environmental, social, or economic component.

For example, a discharge of any industry or effluent from an Effluent Treatment Plant (ETP) into a river, for example, may result in a decrease in water quality in terms of high biological oxygen demand (BOD) or dissolved oxygen (DO) or an increase in water toxins.

2. Indirect impacts

Indirect environmental impacts are those that are not a direct result of the project and are often produced away from or as a result of a complex impact pathway. Indirect effects are frequently referred to as secondary or tertiary effects.

Secondary indirect affects, for example, may have an influence on aquatic flora in that water body, leading to a decline in fish population. A reduction in fishing harvests, which affects fishermen's revenue, is a third level impact. Such effects are classified as socioeconomic (third level). Indirect effects may also include growth-inducing effects and other consequences associated with caused changes in land use pattern or additional road network, population density, or growth rate. Air, water, and other natural systems, including the ecosystem, may be harmed as a result of the procedure.



ENVIRONMENT IMPACTS of PORTS & HABOUR SECTOR

Port development can cause adverse effects like land, water pollution, habitat loss, marine ecology damage, beach erosion, waste disposal, oil leakage, air pollution, noise, vibration, and flood light effects. Assessment of these impacts during construction and operational phases is crucial for mitigation measures and the preparation of an effective Environmental Management Plan. The impacts pertain to the different phases like location, construction and operation (ship traffic and cargo operations) of the port.

Land Impact

- **Drainage Patterns:** Port projects may involve altering land terrain, such as cutting high grounds and filling low areas, to create large port infrastructure, potentially affecting drainage patterns.
- **Coastline Changes:** Establishment of ports may cause coastline changes like erosion or accretion, intercepting oceanographic and littoral processes. Assessment of these impacts requires proper techniques and mathematical/physical model studies.
- **Ship Traffic and Discharges:** Impact due to dredging on aquifer and salt-water intrusion may cause environmental concerns on the land where they are unloaded and stored or when they are being transported.

Water Impact

- Breakwaters and landfills can cause stagnation of water, leading to eutrophication and coliform bacteria contamination.
- Capital dredging, pile driving, and construction work can cause sediment re-suspension, increased suspended solids, and reduced sunlight penetration. This can cause pollution to harbor waters due to increased turbidity and contaminants.
- Work vessels can cause oil spills, garbage discharge, and leakage of substances into water. Potential impacts include physical properties of water, disruption of bottom sediment organisms, wildlife habitat disruption, broken life cycles, soil erosion, and loss of native forage.
- Ship discharges, oily wastes, sewage, and other residues can also contribute to water pollution harming the aquatic biota.
- Maintenance dredging and disposal of dredged materials can also cause concern for pollution of harbour waters and disposal sites. If municipal or industrial effluent flows into a port, stagnant port water may deteriorate



through increase of phytoplankton and a decrease of dissolved oxygen, resulting from eutrophication of water, caused by effluents containing nutrient salts (chemical compounds including N and P). Anaerobic water leads to the generation of hydrogen sulphide (H_2S).

Possible discharges from ships that could be source(s) of water pollution are:

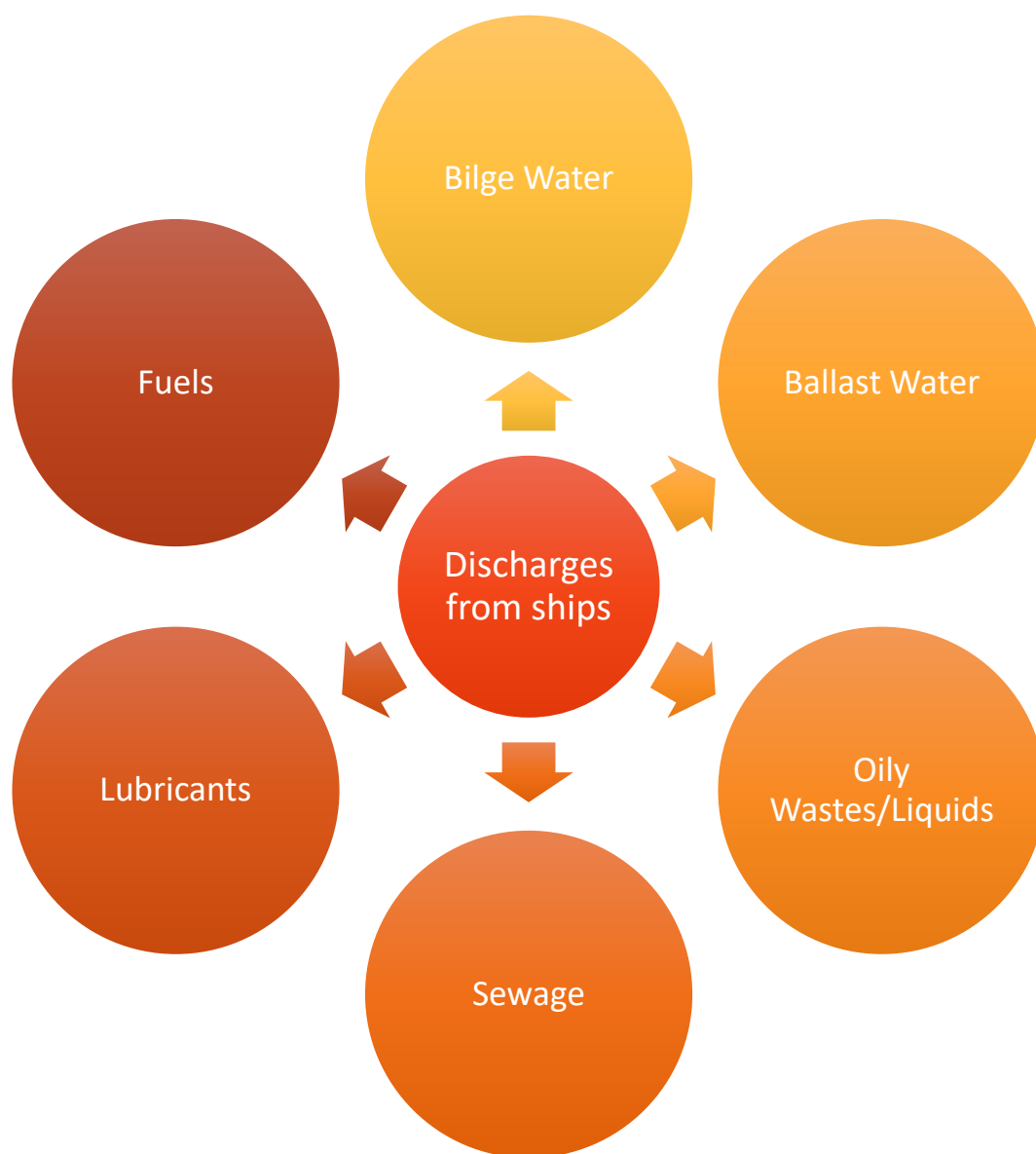


Figure 8: Discharges from ships

Once an oil or oily compound is discharged into water, it is spread on the surface by winds and currents, forming a thin layer. On the surface of seas in tropical or temperate zones, oils can be polymerized gradually by biodegradation and eventually form dense particles, which sink. Concentration of oily compounds in water is an important



indicator of water quality, particularly in recreational water areas. Repair docks may be a possible source of toxic or harmful materials such as anti-foulants, paints, or heavy metals.

Air Impact

- Port project's construction and operation can significantly impact ambient air quality due to dust emissions, cargo handling, and gas emissions from construction equipment.
- This includes accidental emissions, exposures, fumes, odors, hazardous airborne emissions, and water front industries. Changes in air quality parameters should be assessed using modeling techniques or empirical methods.
- The project's impact on the surrounding features up to 1 km is particularly significant. Predictions of fugitive dust emissions, point source emissions, port area emissions, traffic increases, and the impact on ambient air quality are also crucial.
- Existing activities and ongoing projects in the surrounding area should also be considered.

Biological Impact

- Port location impacts aquatic fauna and flora through changes in water quality, coastal hydrology, and bottom contamination. Land reclamation can damage bottom habitats and fishery resources. Deterioration of water quality leads to changes in aquatic biota and species.
- Mangroves and coral reefs are sensitive ecological organisms, prone to changes in flow, salinity, oil film, and silt. Degradation of these systems can lead to water pollution and contamination of bottom sediments, posing a significant threat to marine coastal ecology.
- Piles, concrete surfaces, and rubble mounds in water can create new habitats, potentially introducing undesirable species and potentially contaminating fishery and shellfishery resources through dredging or dumping.
- Leakage of oils, oily wastes and mixtures may directly cause damage to fishery resources, aquatic biota and coastal habitat. Biodegradation of oil also generates polymerized oil particles and toxic aromatic fractions using dissolved oxygen in the water, which indirectly cause damages to bottom biota and habitat. Both effects may damage marine and coastal ecology. Example: Flood light effect on turtles.

Illumination or Flood light Effect: Certain coastal stretches, which are ideal locations for nesting of endangered species like olive ridley turtles may have adverse impact due to the illumination or flood light effect associated with port activities.



Noise Impact

Construction activities can cause noise and vibration due to construction equipment, truck traffic, and work vessels, with cargo handling equipment and road traffic being major sources, potentially causing stress among locals.

Solid Waste

Cargo operations produce wastes such as the remains of bulk cargo storage, rubbish from unpacking, floating garbage and other wastes from daily activities.

Ships generate: (a) oily wastes such as bilge water, ballast water, washing water, lubricant oil and other residues in machinery space; (b) sewage and garbage; and (c) cargo residues such as wood bark. Discharges and spills of these wastes cause problems of oil pollution, floating garbage, unsanitary conditions, odour and other degradation of water quality.

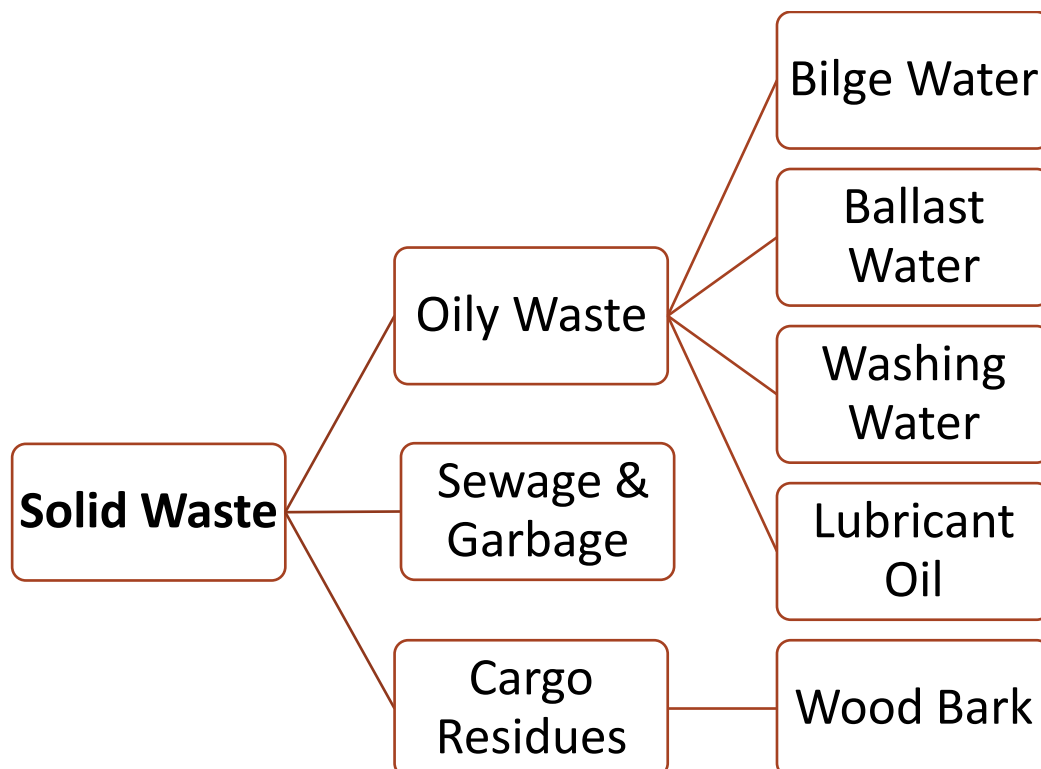


Figure 9: Solid Waste from Shipping activities



Cargo Impact

The environmental impact of cargo handling at ports and harbours is assessed based on cargo properties, volume, location, and prevailing meteorological and climatic conditions. The following list presents the potential environmental parameters likely to be affected.

Major Environmental Parameters likely to be affected by cargo handling activities

S.No.	Type of Cargo likely to be handled	Major Environmental Parameters likely to be affected by cargo handling activities	Areas of concern
1	Dry Bulk Cargo like metallurgical ores, coal and various types of coke, fertilizers, fertilizer raw materials, food grains etc.	Land, Air, Surface Water, Public utilities	Health, Cargo Dust & Leaching etc.
2	Liquid Bulk Cargo like Petroleum crude, finished petroleum products, natural gases like LPG & LNG etc.,	Land, Air, Surface Water, Harbor Water, Health, Public utilities	Collision, Spillages, Leakages, Explosion, fire etc.
3	Chemicals including hazardous cargoes etc.	Land, Air, Surface Water, Harbor Water, Health,	Leakages, Explosion, fire etc.
4	General cargoes (break bulk cargoes) bagged and unitized cargoes, machinery, project cargoes, manufactured products like iron and steel products, electrical and electronic equipment, cars and other vehicles, raw materials and finished items including consumer durables of various kinds etc.	Air, Surface Water, Harbor Water, Public utilities	Handling, Transportation etc.
5	Container cargoes	Public utilities	Container movements, CFS etc.

Table 5: Major Environmental Parameters likely to be affected by cargo handling activities



ENVIRONMENT IMPACTS of HIGHWAYS

Land Impact

- Highway projects require large quantum of land and causes disturbance to the existing land usage. Significant alteration in the land use pattern.
- Impact due to the removal of topsoil during highway construction and from storing, stockyards, workers camp etc.
- Impact on productive lands on selection of borrow areas
- Impact due to erosion and consequent modification of natural conditions
- Impact due to destabilization of slopes
- Impact due to diversion of natural surface water flows
- Impact due to construction of embankment leading to blocking of cross drainage and causing water logging
- Impact due to construction of bridges across, nallahs, streams, rivers/water bodies
- Impact on haul roads due to usage of heavy machinery for material transportation.

Water Impact

- Road construction activities that intersect drainage basins, generally modify the natural flow of surface water by concentrating flows at certain points and in many cases, increasing the speed of flow resulting in flooding, soil erosion, channel modification and siltation of streams.
- Impact on water table due to road drainage, excavation and construction of embankments and structures.
- Impact due to spillages and accidents of vehicles carrying chemicals especially if drinking water bodies are located within 500 meters in the u/s of the highway alignment
- Impact on water facilities such as, wells, hand pumps, tube wells etc falling along the highway alignment.
- Impact due to disposal of wastewater generated from the temporary project offices and temporary workers housing area.



Air Impact

- The immediate surroundings may have a greater impact. The existing surrounding features such as habitation, hospitals, schools, notified sanctuaries etc. up to 500 meters and impact on them should be addressed
- Impact due to dust generation from excavation of soil, cutting of embankment near to habitation, hospitals, schools, sanctuaries etc.
- Impact due to movement of heavy vehicles carrying construction materials in the haul roads
- Impact due to stone quarrying
- Impact due to dust generation from material handling, storage, operation of crushers and hot mix plants, movement of construction vehicles and construction activities
- Impact due to vehicular emissions from vehicles used for construction purpose
- Emission levels are expected to increase with the increase in vehicle numbers. Resulting in increase in vehicular emissions/pollutants load in atmosphere.

Biological Impact

- Impact due to removal of trees in the highway alignment
- Impact on forest resources, economically important plants including medicinal plants and threat to endangered species
- Impact on wildlife habitat and biodiversity due to change in land use
- Impact due to fragmentation of wildlife habitat and territories
- Impact due to changes in water quality, soil profile, noise, light and air pollution, which may affect the nature and character of habitats
- Pressure on habitats wildlife as a result of increased access provided by roads

Noise Impact

- Impact of noise during construction activity, due to operation of various equipment
- Impact of noise on the surrounding community due to vehicle movement
- Impact of noise on wild life from crossing road corridors and becoming the highway corridor a barrier to regular wild life travel routes
- Impact of vibrations during blasting activity, if any



ENVIRONMENT IMPACTS of INDUSTRIAL ESTATES

High-income countries have strict industrial estate regulations, but low- and middle-income countries, like South Asia and Africa, lack measures to protect surrounding communities from waste and by-products, such as lead contamination in groundwater systems.

The World Bank recommends industrial estates have effluent treatment centers, toxic waste disposal infrastructure, emissions standards, monitoring systems, and emergency preparedness plans. Proper precautions can reduce community and environmental impacts by isolating hazardous processes and ensuring safety and environmental standards. However, in many low- and middle-income countries, industrial estates lack proper waste treatment and disposal infrastructure, leading to lead pollution in surrounding air, soil, water, and food.

Lead Pollution from Industrial Estates

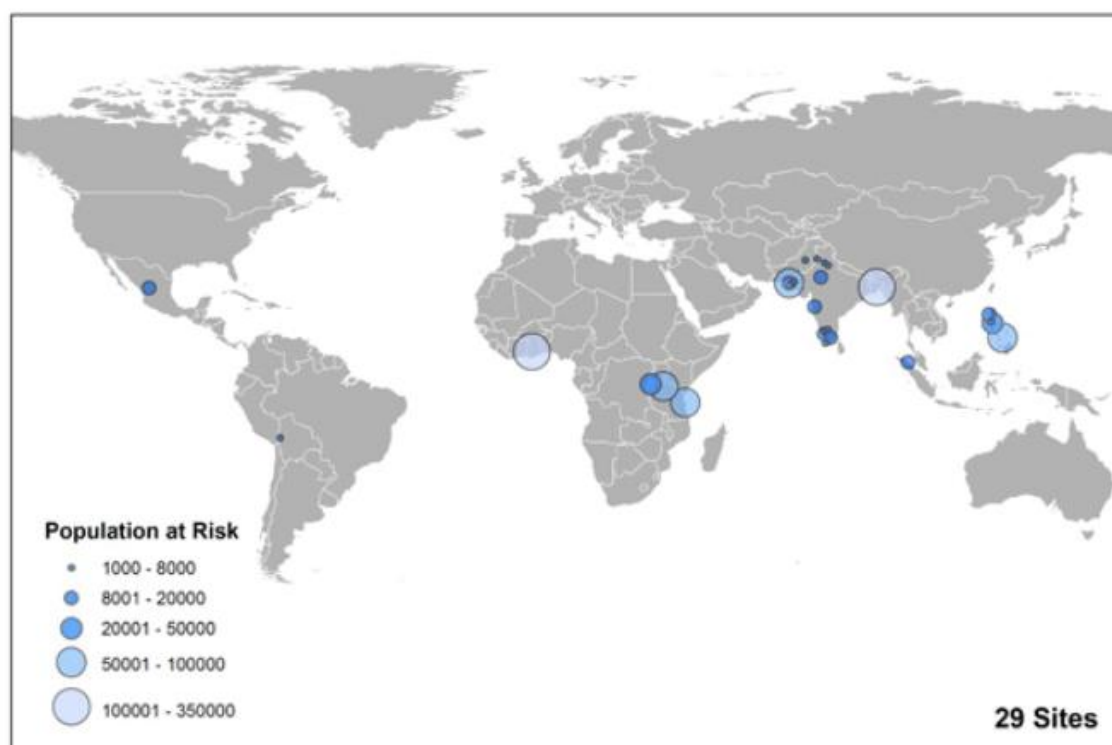


Figure 10: Lead Pollution from Industrial Estates

(Populations estimates are preliminary and based on an ongoing global assessment of known polluted sites)

Source: <https://www.worstpolluted.org>



Land Impact

Impacts caused due to activity on the land environment include:

- Compaction of soils by earth moving equipment
- Erosion and modification of surface
- Over exploitation of agricultural soils due to future development in a zone sensitive to erosion
- Irreversible salinization and acidification of mangrove swamp soils
-

Water Impact

The construction phase would involve water requirements for the following activities

- site preparation: Involves levelling for infrastructure development and removal of vegetation. Water is required for dust settlement, consolidation, compaction and curing.
- Construction of building infrastructure involves water for construction activities and domestic and other water requirements for labour and staff onsite.

Table 6: Water Pollution Potential of Industries

Industry Category	Description	Impact Potential*
W1	Industry with ≥ 25 kld discharge of effluents (irrespective of organic load) that are not easily bio-degradable ($BOD/COD \leq 0.4$) or toxic or having TDS generation more than 10,000 mg/l	Very High
	Industry with 100-500 kld discharge of non-toxic effluents with organic load of > 100 kg/d with BOD/COD ratio = 0.4-0.7)	
	Industry with > 500 kld of discharge of non-toxic effluents (irrespective of organic load) that are less bio-degradable ($BOD/COD=0.4-0.7$)	
W2	Industry with 100-500 kld discharge of non-toxic effluents with organic load of < 100 kg/day with $BOD/COD \leq 0.7$	High



	Industry with >500 kld discharge of non-toxic effluents (irrespective of organic load) that are less biodegradable (BOD/COD ratio of >0.7)	
	Industry with ≥ 25 kld discharge of effluents (irrespective of organic load) having TDS generation >5,000 mg/l but $\leq 10,000$ mg/l	
W3	Industry with 25-500 kld of non-toxic effluents that are easily biodegradable or less biodegradable (BOD/COD ratio of > 0.7)	Medium to High
	Industry with ≥ 25 kld discharge of effluents (irrespective of organic load) having TDS generation $\leq 5,000$ mg/l	
W4	Industry with <25 kld discharge of effluents that are easily biodegradable (BOD/COD ratio of > 0.7) and non-toxic	Low

* impact potential considered without pollution control equipment in operation

Air Impact

Construction phase of IEs would involve site clearances and preparation, infrastructure development, building construction and other related activities which significantly impact ambient air quality.

- Construction machineries pose a special threat to air quality. It is estimated that construction machineries emit toxic pollutants and are sources of fine particulate matter (PM_{2.5}, which lodges deeply in the human lung) and oxides of nitrogen (NO_x), a key ingredient in the formation of ground-level ozone and urban smog.
- Operational phase would involve emission from vehicular movement and diesel generators.
- The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment.
- Dusts include brick and silica dusts, wood dust from joinery and other woodworking and from earthmoving and other vehicle movements within the site.
- Asbestos- containing dust especially during the demolition of buildings is very harmful. It is a difficult task to separate these wastes.

**Table 7: Air Pollution Potential of Industries**

Industry Category	Impact Potential*
A1	> 7 Km
A2	5 to 7 Km
A3	2 to 5 Km
A4	< 2 Km

* impact potential considered without pollution control equipment in operation

Noise Impact

During the construction phase of the IE site, the following source of noise pollution is expected:

- Construction equipment

During operational phase the following sources of noise pollution is expected:

- Diesel generator operations
- Increase in transport noise from within the site from nearby roads.

Table 8: Noise Ambient Air Quality Standards

Area code	Category of area	Limits in db (A) Leq	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence zone	50	40

(Source: Noise pollution (Regulation and control) Rules, 2000)

Here,:

- Day time refers to 6.00 a.m. - 10.00 p.m.
- Night time refers to 10.00 p.m. - 6.00 a.m.



- Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area, which is declared as such by the competent authority.
- Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.

dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

L_{eq} : It is an energy mean of the noise level over a specified period.

Solid Waste

The construction phase waste will comprise of excavated and demolition material while operational phase waste may comprise of domestic, commercial and biomedical wastes, depending upon the type of the project.

Building construction leads to generation of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets plastic, paper etc. as waste. The different types of wastes need to be handled as per their needs and regulatory requirements.

Type of wastes, which are generated, can be classified into four categories.

1. Construction or demolition waste, i.e., massive and inert waste
2. Municipal waste, i.e., biodegradable and recyclable waste
3. Hazardous waste,
4. E-waste

Wastes generated in operational phase on IEs can be classified as:

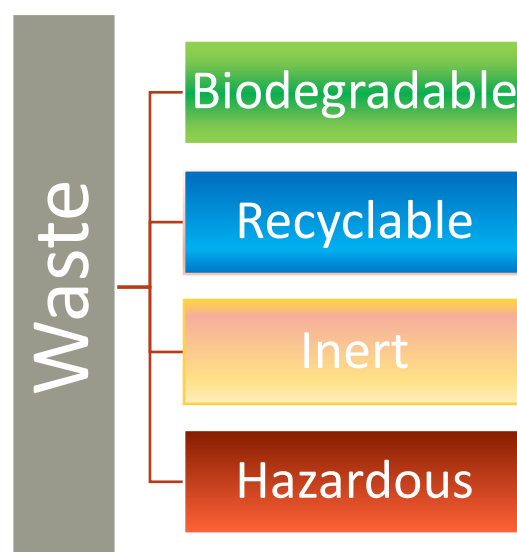


Figure 11: Waste Classification of IEs



List of Hazardous wastes from construction projects :

Table 9: Hazardous wastes from various sources at construction sites

S. No.	Hazardous wastes	Sources
1	Asbestos Products	Insulation, Tiles Etc
2	Flammable Liquids	Fuels And Heating Oils And Other Volatile / Such As Coolants, Grease, Centering Oil, Formwork Oil
3	Tar And Tar Products	Bitumen, Felt, Water Proofing Compounds etc.
4	Wood Dust	
5	Lead Containing Products	Paints, Pigments, Dyes And Primers
6	Chemicals	Admixtures, Sealants, Adhesives Solvents
7	Product Packaging	Cement Bags, Cartons, Containers, Plastic Covers etc.
8	Batteries	All Types
9	Electronic Waste	Computer Products, Circuit Boards, Electronic Parts, Solder Dross, Weld Waste.
10	Electronic Ballasts, PCBS, Transformer, Capacitors	Lead Cable, Oil Filled / Gel Filled Cables
11	Mercury Containing equipment	Lamps And Tubes, Mercury Switches, Relays, Regulators, Thermostats, Thermometers, Manometers And Debris Containing Mercury



12	Plastics, Acrylics, Silica, PVC	
13	Lamps	Fluorescent Lamps, Halogen Lamps, Arc Lamps, UV Lamps, High Pressure Sodium Lamps, , Neon Lamps, Incandescent Lamps.

Table 10: Indicative Classification of Industries based on their Air and Water Pollution Potential

S. No.	Industries	Air Pollution Potential	Water Pollution Potential
1	Thermal Power Plants – Coal or coke based $\geq$ 200/210 MW	A1	W2
2	Thermal Power Plants – Coal or coke based $<$ 200/210 MW	A3	W2
3	Oil Refinery, Petroleum Refining	A1	W1
4	Petrochemicals	A1	W1
5	Integrated Iron and Steel	A1	W1
6	Fertilizer	A1	W1
7	Cement – large/medium	A2	W4
8	Pesticides – Technical grades	A2	W1
9	Sugar	A3	W2
10	Paint (excluding formulation)	A2	W2
11	Organic Chemicals	A2	W2
12	Leather Tannery a) Chrome Tanneries / Combined Chrome and Vegetable Tanneries b) Vegetable Tanneries	A4	W1

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ENVIRONMENT IMPACTS of **Building and Construction**

The construction industry contributes to 45-50% of comprehensive power consumption, 50% of all-inclusive water usage, and 60% of the total usage of unprocessed or raw materials, primarily by overriding resources and producing contaminants and waste.

Land Impact

Land impacts from B&C projects include:

- Compaction of soils by earth moving equipment
- Direct loss in the form of removal of trees. Due to implementation of projects felling of trees significantly affect the ecosystem. The loss of trees leads to higher degree of soil erosion.
- Over exploitation of agricultural soils due to future development in a zone sensitive to erosion
- Irreversible salinization and acidification of mangrove swamp soils

Water Impact

- During construction, activities such as grading and demolition create pollutants that can leave the site and harm waterways.
- Sediment is one of the most serious pollutants. Stormwater pours over loose soil on a building site, as well as other materials and items stored outside, when it rains. As runoff flows across the site, pollutants such as:
 - Chemicals
 - Debris
 - Loose soil
 - Sediment
 - Spilled fluids



Can be transported to nearby storm drains or directly into local creeks, lakes, and reservoirs.

- The pH of concrete wash water is incredibly high – typically 12 to 13. Thus, preventing concrete wash water from entering waterways is essential.
- Construction sites utilise about 17% of their water for direct functions, while 25% corresponds to indirect activities. When leaks, poor sanitary and hydraulic installations, and unsatisfactory project designs occur on a construction site, its runoff may pollute the water bodies.

Top uses of water at constructions sites:

1. Drinking water
2. Supplying onsite facilities
3. Concrete Batching
4. Grouting
5. Hydro-demolition
6. Drilling and piling
7. Landscaping and pond filling
8. Chlorination
9. Soakaway testing
10. Dust suppression

Air Impact

- Construction phase would involve site clearances and preparation, infrastructure development, building construction and other related activities
- Operational phase would involve emission from vehicular movement and diesel generators, and negligible emissions from sewage and solid waste handling and disposal.
- The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment.
- The loss of trees leads reduced the ambient air quality since trees act as adsorbent of air pollutants.
- Dusts include brick and silica dusts, wood dust from joinery and other woodworking and from earthmoving and other vehicle movements within the site.
- Asbestos- containing dust especially during the demolition of buildings is very harmful. It is a difficult task to separate these wastes.
- Construction machineries pose a special threat to air quality. It is estimated that construction machineries emit toxic pollutants and are sources of fine particulate matter (PM_{2.5}, which lodges deeply in the human lung) and oxides



of nitrogen (NO_x), a key ingredient in the formation of ground-level ozone and urban smog.

- During the construction phase the operation of HEMM (heavy earth-moving machinery) will generate noise, dust with different toxic gas that might degrade the nearby wildlife habitat

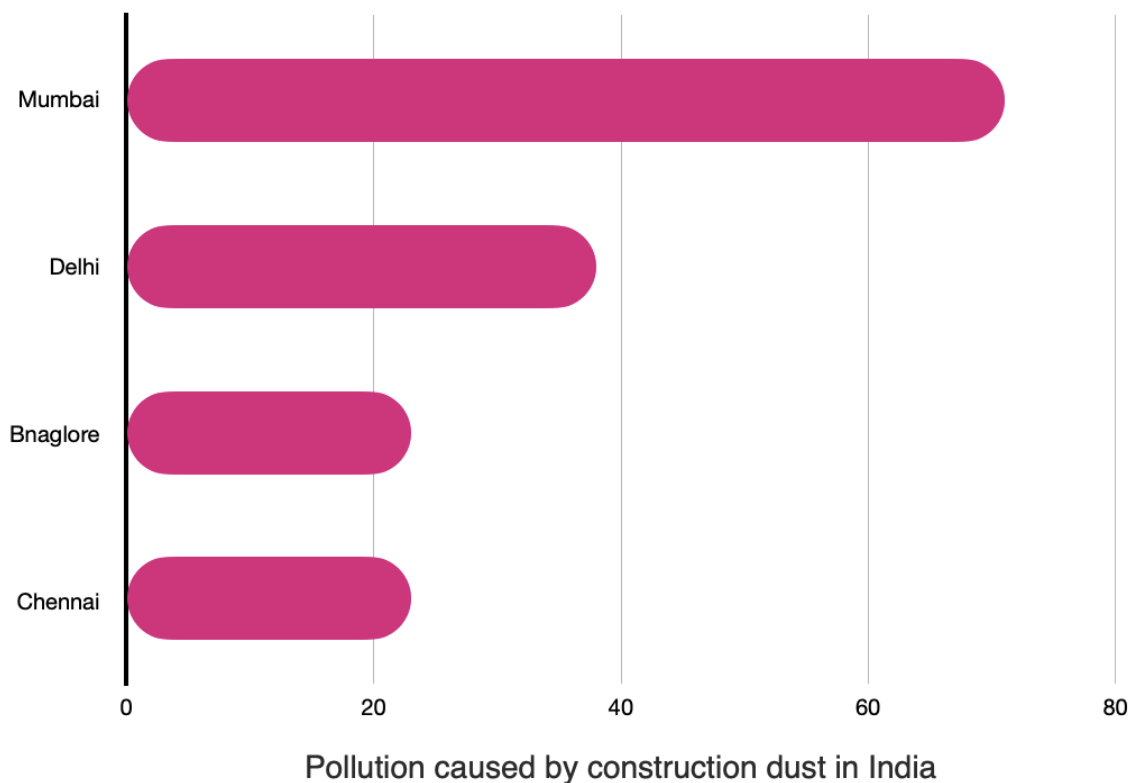


Figure 12: Pollution caused by construction dust in major cities in India

Noise Impact

- During the construction phase of the site, the following source of noise pollution is expected:
 1. Construction equipment
- During operational phase the following sources of noise pollution is expected:
 1. Diesel generator operations
 2. Increase in transport noise from within the site from nearby roads.
- The impact of noise on wild animals is a contentious issue. Loud noise interferes with the communication systems of wild animals, brings out a 'flight or fight' response, and interferes with the behaviour of both predator and prey.



- During construction phase, the equipment used for construction will be the main noise sources which will have temporary and reversible impact on the noise level of the area.
- Whereas after the completion of the project the regular movement of vehicles will also generate noise that have adverse impact on the ambient noise levels.
- The reduction in number of trees, especially in or near congested market places will enhance the raising of noise level.

Biological Impact

B&C projects has several impacts on the flora fauna of the ecosystem. These are as follows:

- Direct loss of habitat at intersection locations particularly on account of damage to the existing vegetation due to construction activities and transport.
- Degradation of habitat quality due to construction activities and construction camps, use of water resources.
- Interference of noise generated due to construction and transport to the communication systems of the wildlife.
- Lighting effect from the vehicles during their movements will affect the wildlife which will result behavioural change, collision of animals and road kills.
- Fragmentation to the forest and other important habitat areas may reduce home range and cause isolation of the wildlife species. Decline in wildlife population, their flow and movement.
- Injury and accidents to a lesser extent as the project has largely elevated tracks leading to mortality of wildlife.
- Reduced access to summer and winter ranges of ungulates, breeding sites and nesting habitats of birds.
- Change in the micro habitat. Species living in that particular area either perish or shift their presence to the nearest available habitat which causes a temporary imbalance in the community level.

Solid Waste

Depending on the type of project, construction phase waste consists of excavated and demolition material, whereas operational phase trash consists of domestic, commercial, and biomedical wastes. The various sorts of garbage must be treated in accordance with their needs and regulatory requirements. It is not possible to dispose of all types of waste onto the land; they must be handled with according to their nature and qualities. Building construction leads to generation of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets plastic, paper etc. as waste.



Type of wastes, which are generated, can be classified into four categories.

1. Construction or demolition waste, i.e., massive and inert waste
2. Municipal waste, i.e., biodegradable and recyclable waste
3. Hazardous waste,
4. E-waste

Construction and Demolition Waste

The construction and demolition waste includes debris, concrete (often recycled and reused at the site), steel and other metals, pallets, packaging and paper products, fluorescent tubes, wood beams, joists, studs, baseboards, cabinets and cupboards, railings, brick, doors and casings, interior windows, bathroom fixtures, light fixtures, ceiling grid and tile, furnishings, replant trees, shrubs.

Municipal Solid Waste

Waste generated by users- Domestic wastes food leftovers, vegetable peels, plastic, house sweepings, clothes, ash, etc. commercial waste generally comprises of paper, cardboard, plastic, wastes like batteries, bulbs, tube lights etc.

Hazardous Waste

Paints, cleansers, lubricants, batteries, and insecticides are examples of potentially dangerous products if improperly disposed. Construction and demolition hazardous wastes include centering oil, formwork oil, tar and tar products (bitumen, felt, waterproofing compounds, etc.), wood dust from treated wood, lead-containing products, chemical admixtures, sealants, adhesive solvents, explosives and related products and equipment used in excavation, acrylics, and silica, among others

E-waste

Various types of electrical and electronic wastes generated in the building, which includes PC in case of offices and homes, machine components at construction sites.

Major Pollutants at Construction Sites:

- **Construction dust**
 - Construction and demolition operations contribute to windblown dust problems—sometimes called fugitive dust—onto nearby roadways which can remain in the air for days or even weeks.
- **PM 2.5**
 - construction sites comes from the diesel engine exhausts of diesel generators, vehicles and heavy equipment.
- **Noxious vapours**



- from oils, glues, thinners, paints, treated woods, plastics, cleaners and other hazardous chemicals that are widely used on construction sites, also contribute to air pollution.
- **C&D Waste:**
 - The waste comprising of building materials, debris and rubble resulting from construction, re-modelling, repair and demolition of any civil structure. Construction industry in India generates about 10-12 million tons of waste annually.

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CHAPTER 4



Best Practices

PORT SECTOR

India's Green Port Initiative

Green Ports Policy has been proposed by India's Ministry of Ports, Shipping, and Waterways to support initiatives, which include cutting carbon emissions, increasing the use of renewable energy, maximizing water utilization, and improving solid waste management at major ports. The policy also aims to enhance green cover, electrify vehicles and port equipment, and establish green ammonia bunkers and refuelling facilities at major ports across India by 2035.

A "green port" is a responsible port that prioritizes energy efficiency, waste management, and pollution reduction to minimize the environmental impact of port operations. Ports can prioritize environmental sustainability by taking steps to reduce the carbon emissions and protect the local ecosystem through green practices.

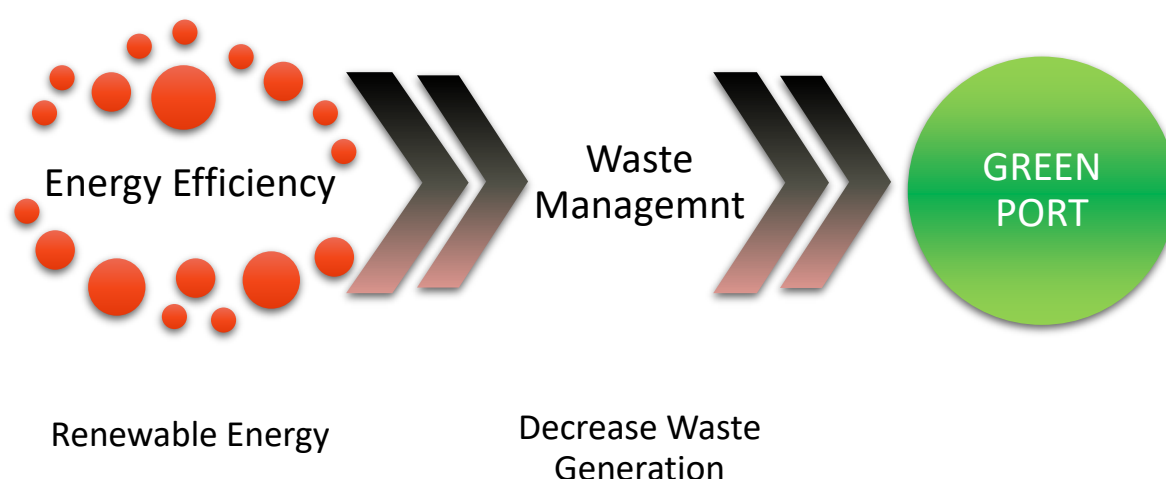


Figure 13: Green Port Characteristics



'Project Green Ports' has two elements one is 'Green Ports Initiatives' related to environmental issues and the second is 'Swachh Bharat Abhiyaan' (GOI, 2016). This Project includes the following actions:

- Construction and monitoring plans for environmental protection;
- Securing necessary equipment for the monitoring of environmental pollution;
- Procuring dust eliminating and suppressing system;
- Establishing wastewater treatment plant, sewage plant, and garbage disposal plants;
- Establishing renewable energy production projects in the ports;
- Improving Oil Spill Response (OSR) facilities;
- Control and prohibit waste disposal into the sea.

Primary targets

The following focus areas and targeted outcomes have been identified for Indian ports to attain the 'green' port status:

S. No.	Focused Areas	Measured Outcomes															
1	Green House Gas (GHG) emissions	• Calculate the baseline level for GHG emissions (Scope 1, and 2) as of 2021. • Reduce the Scope 1, Scope 2 emissions by 20% by 2025 below from 2021 levels, and 40% by 2030 below from 2021 levels. • Port authorities shall ensure that minimum 60% supplied power are sourced from renewable sources by 2025. Port authorities shall strive to provide 100% green power by 2030.															
2	Pollution control	• Reduce the pollution levels over their 2021 levels <table> <tr> <th>Pollutants</th><th>Targets to be achieved by 2025</th><th>Targets to be achieved by 2030</th></tr> <tr> <td>NO_x</td><td>25%</td><td>50%</td></tr> <tr> <td>Non-methane volatile organic compounds</td><td>15%</td><td>30%</td></tr> <tr> <td>PM₁₀</td><td>25%</td><td>50%</td></tr> <tr> <td>PM_{2.5}</td><td>25%</td><td>50%</td></tr> </table>	Pollutants	Targets to be achieved by 2025	Targets to be achieved by 2030	NO _x	25%	50%	Non-methane volatile organic compounds	15%	30%	PM ₁₀	25%	50%	PM _{2.5}	25%	50%
Pollutants	Targets to be achieved by 2025	Targets to be achieved by 2030															
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PM _{2.5}	25%	50%															



		<table border="1"> <tr> <td>Black Carbon</td><td>40%</td><td>80%</td></tr> </table>	Black Carbon	40%	80%
Black Carbon	40%	80%			
		WHO Air quality guideline values for PM_{2.5} is 5 µg/m³, for PM₁₀ is 15 µg/m³, NO₂ is 10 µg/m³ and for SO₂ is 40 µg/m³. These targets may be considered as absolute target values for every ports.			
3	Biodiversity	- Port operators to achieve 'Zero bio-diversity loss' by 2025 - Port operators to achieve Zero waste, Zero Waste to Landfill, Zero Incineration, Zero Unauthorized Disposal, Zero Effluent Discharge by 2030 50% Reduction by 2025 and 100% by 2030 in Water Pollution by shipping companies or any related third party			
4	Resource utilization	- Port operators to recycle and reuse 50% of their water consumption by 2025 - Port operators to create provisions for rainwater harvesting within the port premises by 2025 - Port Operators to implement Sewage Treatment Plant within the port - Port operators to ensure at least 20% reduction in water consumption from its 2021 values by 2025.			
5	Productivity driven by automation	Port operators and authority will identify options and implement solutions to enhance levels of automation in select port activities that will enhance productivity and help achieve outcomes 1-4.			
SOURCE: Draft Green Port Policy for Indian Ports_Version 04					

Table 11: Focused Areas and Measured Outcomes for Indian Ports' 'Green Port Status'



Harit Sagar 2023

Harit Sagar outlines guidelines for India's Major Ports to achieve Green Ports. These guidelines aim to reduce carbon emissions and achieve sustainability through focused Green Interventions. They will guide decision-making and promote sustainable materials, practices, and technologies. India pledges to reduce emission intensity per unit GDP by 45% by 2030 and achieve 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources.

Principles of Green Port Guidelines:

1. Ensuring Sustainability (Socio-Economic & Environmental) in Port Development through the design of resilient infrastructure that is ecologically friendly and aligns with local energy dynamics by employing the best available carbon neutral and environmentally friendly technology.
2. Using ecosystem dynamics in port building, operation, and maintenance in accordance with the 'Working with Nature' model, with the goal of reducing impact on biotic components of the harbour ecosystem.
3. Increasing the use of clean energy in port operations. Developing port capabilities for greener fuel storage, handling, and bunkering, such as green hydrogen, green ammonia, green methanol / ethanol, and so on.
4. Refuse, Reduce, Reuse, Repurpose, and Recycle (5R idea) to achieve zero waste discharge from Port activities.
5. Encourage stakeholders to use environmental reporting to communicate environmentally responsible behaviour. Increase communication about environmental improvements made by ports.
6. Encourage monitoring using Environmental Performance Indicators to track objectively recognizable progress in environmental Port practices.
7. Using the Eliminate, Reduce, and Control (ERC) approach to safeguard the local community, ecology, and environment in and around port regions, reduce carbon and other hazardous emissions. Carbon intensity will be reduced by 30%



per ton of cargo handled from current levels (baseline FY 2022-23) by 2030, and 70% by 2047.

Focus Areas for Implementation:

The focus areas for improving the sustainability of the Port ecosystem include implementing best practices, adopting resilient designs, and introducing environmentally friendly technologies. These include the following:

Effluent Discharge:

Effluent discharge from ships calling at ports must be rigorously monitored in accordance with the IMO (MARPOL Annex-IV) /DG Shipping Rules.

To meet IMO emission regulations, ships equipped with Exhaust Gas Cleaning Systems should switch to closed-loop mode of operation if equipped with hybrid scrubbers, whilst boats equipped with open-loop scrubbers must switch to compliant fuel.

Any discharge of wastewater/bilge water/oily bilge/wastewater generated by ships is forbidden in Port waters.

Ships stopping at the Port must declare the kind (as defined by MARPOL) and approximate quantity of garbage on board and seek assistance from the Port in disposing of it.

Waste Management:

All Ports shall provide shore reception facility, with approved vendors, for discharging the waste by ships calling at ports as per the Indian legislation.

Environment Management:

All ports must have approved Environment Management Guidelines, an Environment Management Plan, and a dedicated Environment Cell to examine and monitor environmental compliance.



Environment Cell, a dedicated unit of competently qualified professionals for sustainable and environmentally friendly Port operation, to provide suggestions for management and effective execution of environmental compliance.

All ports must conduct an independent annual environment audit by a credible body, and the report must be posted on the port's website by April 30th of each year.

Green Cover:

By carrying out effective plantation, developing landscapes, ports must expand the green area cover to capture fugitive emissions and reduce noise created in the port environs. Green belt will assist in -

- Retaining soil moisture.
- Erosion control and coastal protection.
- Supporting the biological diversity.
- Recharging ground water and act as Carbon Sink.

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HIGHWAYS

Green Highways

The objective is to develop eco-friendly National Highways with participation of multiple stakeholders for economic growth and development in a sustainable manner. The focus areas include:

- Reducing the impact of air pollution and dust as trees and shrubs are known to be natural sink for air pollutants
- Provide shade on glaring hot roads during summer
- Reduce the impact of noise pollution caused due to increase in vehicular movement
- Arrest soil erosion at the embankment slopes
- Prevent glare from the headlight of incoming vehicles
- Moderate the effect of wind and incoming radiation

Green Highways can be achieved through implementing suitable Plantation Scheme for the geographical area. The plantation has been broadly classified into two categories:

1. Tree planting along the Highways Turfing with grasses and shrub/ herb.
2. Planting on medians/special landscapes/embankment slopes.

Best Practices for Green Highways:

- A study on the local flora and vegetative cover native to these sections must be carried out as part of the field surveys to enable a choice of the suitable species for particular section.
- Region-wise specific choices must be made with the help of local experts from the Forest department and Horticulture department.



- The selection of species must be strictly done as per the guidelines or as per the recommendation of adjoining forest department with site specific native species.
- Before starting any plantation, the local forest department shall be consulted for ensuring compliance to any regulation in force that may affect raising, maintenance, and harvesting of the raised plantation.
- Monitoring Agency to monitor progress of planting and status of plantations on continuous basis. This agency shall carry out the site visit for field verification. It will examine the reports and send feedback and action points to planting agency, nodal agency and will send a comprehensive report with recommendation to NHAI/MoRTH.

Selection of Tree Species for roadside plantations:

One of the most significant components of soft landscaping is plantation. In majority of the enhancement plans, trees, bushes, and climbers have been utilised to enhance the gentle natural ambience against harsh elements. The planting species are chosen based on physical growth features of trees such as form and shape, foliage pattern, growth rate, branching pattern, soil qualities and strip circumstances such as water logged places, and so on.

The selection of plant types and planting arrangement shall be based on the following considerations:-

- Aim and objective of plantation
- Shape and size (size and spread) of the canopy
- Texture and colour of foliage/flower/fruits in different seasons and stages of growth.
- Adaptability and suitability to agro-climatic regions/zones
- Growth rate (slow/fast) average age of maturity and replacement cycle
- After care and maintenance required for sustenance and growth
- Economic and other social /recreational benefits

Plantation Pattern

The road landscape can be developed holistically, dividing the project corridor into homogenous sections based on similarity in width, soil conditions, climate, and topography. Field surveys can help study local flora and vegetation cover, and plantation patterns suitably determined. Plantation pattern can be:

- The first row along the Highways of small to medium sized ornamental trees.



- Subsequent rows depending on the availability of width can comprise of ornamental and/or shade bearing species, of more height than those in the first row.
- In rural sections the last row can be of shade bearing tall trees.

Planting of shrubs in the median

Herbaceous species can be planted as ground cover in the median, landscapes, and embankment slopes.

Table 12, 13 and 14 list a few species, which can generally be planted throughout India.

Table 12: 1st Row of Plantations of Avenue Plantations

S. No.	Soil	Botanical Name	Local Name
1.	Loamy	Delonix regia	Gulmohar
		Cassia fistula	Amaltas
		Bauhinia sps.	Kachnar
		Cassia nodosa	Cassia
		Jacaranda mimosaefolia	Jacaranda
		Peltophorum ferrugineum	Peltophorum
2.	Water logged condition	Terminalia arjuna	Arjun
		Syzygium curminii	Jamun
		Cordia dicotma	Lasoda
3	Alkaline soils	Terminalia arjuna	Arjun
		Pongamia pinata	Kanji
		Albizia lebbek	Kala Siris

Table 13: Species Recommended for 2nd and subsequent row of Avenue Plantations

S. No.	Soil	Botanical Name	Local Name
1.	Loamy	Melia azadiracta	Bakain
		Pongamia pinata	Kanji
		Gravillea robusta	Silver Oak
		Albizia lebbek	Kala siris
		Dalbergia sissoo	Shisham
		Terminalia arjuna	Arjuna

Table 14: Shade trees recommended for last (or the only) row in roadside avenues

S. No.	Soil	Botanical Name	Local Name
1.	Loamy	Ficus religiosa	Peepal
		Ficus infectoria	Paker



		Madhuca indica	Mahua
		Mangifera indica	Mango
		Azadirachta indica	Neem
		Tamarindus indica	Imli
		Syzynium cumini	Jamun
		Dalbergia sisso	Shisam
2.	Sandy	Azadirachta indica [at ph up to 8.5]	Neem
3.	Alkaline soils	Pongamia pinnata [upto 9.0 ph]	Kanji
		Terminalia arjuna	Arjun
		Syzynium cuminii	Jamun
4.	Water logged condition	Terminalia arjuna	Arjun

Technical Specification

Table 15: The technical specification for planting along the Highways are as follows:

(i) Ornamental plants except last row

Distance from embankment	1.0 mt. away from the toe of the embankment
Spacing between plant to plant	3 mts.
Spacing between rows	3 mts.
Size of the pits Normal soil	60 x 60 x 60 cms
Water logged areas	mounds with height varying depending on the water level
No. of plants per km	333
Height of the plant	1.5m to 2m

(ii) Shade plants (Last row)

Distance from the preceding row	3 mts.
Spacing between plant to plant [12 mts.	12 mts.
Size of the pits Normal soil	60 x 60 x 60 cms
Water logged areas	Mounds
No. of plants per km	84
Height of the plant	More than 2m

Tree Transplantation



There may be times when a mature tree must be cut down to make way for the construction of a road, a building, or another structure. It would be preferable to save this plant by transplanting it to a suitable location.

When the tree is dormant or less active in the winter, it should be heavily clipped, leaving a naked structure of huge branches. A trench 40 to 50 cm broad and 1 to 2 m deep should be dug around the stem, depending on the size of the specimen, severing all the roots, big and little, in the process.

Noise Barriers

Noise barriers are generally composed with rockwool fiberwool of various densities and thicknesses as the inside material and aluminum perforated sheets front and back of the panel as the exterior material. Noise barriers are not often designed based on their distressing frequency. The frequency-based noise barrier design reduces noise the most when compared to all existing designs at the same cost.

CSIR-CRRI devised and produced frequency-based noise barriers capable of arresting three frequencies of sound waves -

1. Low (<200Hz)
2. Medium (200-1k Hz)
3. High (1k-20k Hz)

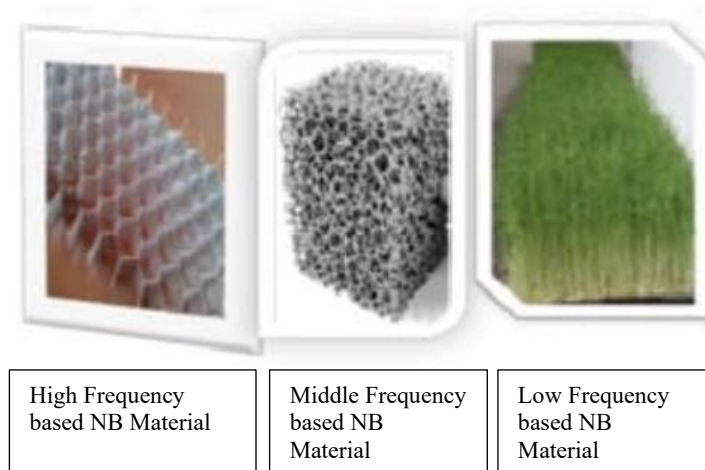


Figure 14: CSIR-CRRI produced frequency-based noise barriers

These noise barriers would significantly reduce noise levels (approximately 38 decibels) and improve the quality of life in noise-sensitive locations. Noise barriers can be simply installed on flyovers, traffic crossroads, and other locations where noise pollution and high frequency sounds are exceptionally prevalent.

Major Application:

Noise barriers can be used to reduce noise levels alongside high speed expressways, rural highways, flyovers and urban areas.

Impact of the Technology:

Transportation infrastructure development has resulted in increased noise levels in cities and regional corridors over the previous two decades.

Residents of nearby communities are subjected to noise levels that exceed statutory limits for prolonged periods of time. Increased exposure to vehicle noise has resulted in health hazards such as hearing loss, sleep disruption, hypertension, and other complications. The noise barriers designed would dramatically reduce noise levels, consequently increasing the quality of life in noise-affected areas.

Other Best Practices

- To reduce traffic congestion and pollution, all entry/exit/access points on highway must be adequately built.
- Vegetative foliage shall be grown on embankments/slopes and slopes remaining after cutting to prevent soil erosion.



- Wherever possible, turfing using bio-engineering techniques and the use of biodegradable geotextiles should be considered for the protection of embankment slopes.
- Slopes should be protected by providing frames, dry stone pitching, masonry retaining walls, and the planting of grass and trees according to site conditions.
- Silt fencing must be installed along the water bodies where construction is taking place. Steep-heavy cuts must be avoided.
- Cut and fill work must be completed strictly in accordance with the design drawings proposed at the time of project appraisal.
- A sufficient number of underpasses and culverts to serve as cross drainage structures must also be supplied.
- Along the bridges, a sidewalk must be provided.
- Underpasses or foot over bridges for human and animal passages with guard railings/watch towers, service roads, and street lightings, among other things, shall be provided.
- To avoid road accidents, speed breakers/rumble strips must be built at the specified places of animal movements.

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INDUSTRIAL ESTATES

Economic development in developing nations is primarily accomplished through IE, where many of these SMEs are gathered. The regional clustering of SMEs in IE promotes the creation of favourable conditions for Eco-Industrial Networks. The goal of an integrated approach to the development of ecologically sustainable IE should be to minimize hazards at the critical stages of establishment and management:

- Site selection
- Planning
- Development
- Administration

Site Selection, Planning and Development

The various tools and techniques that can be used for the IE Planning are :

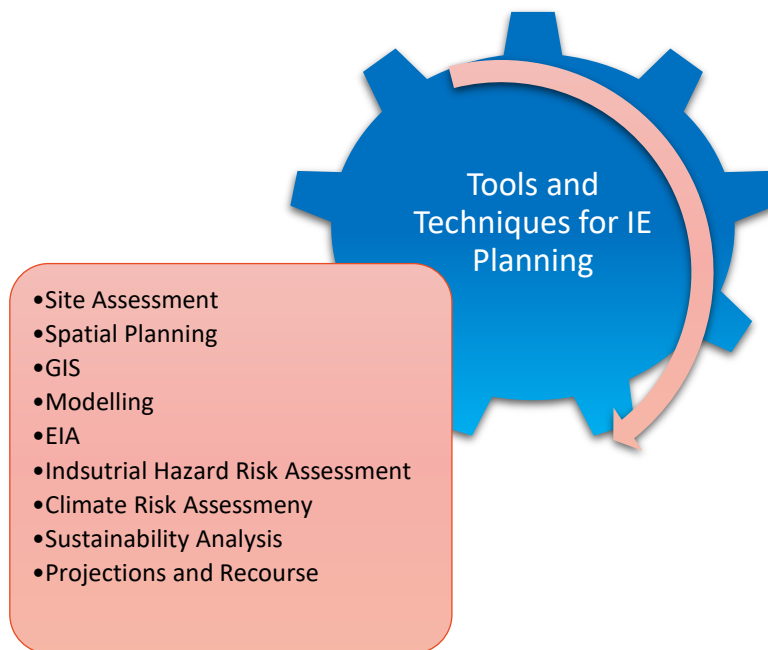


Figure 15: Tools and Techniques for IE Planning

IE site planning and development necessitates a comprehensive approach to ensure its long-term viability, which comprises effective components like as spatial planning, infrastructure planning, risk-based planning and environmental management techniques, utilization of resources and management etc. The following critical features must be included in the IEs' master site plan:

- Integrated infrastructure with emphasis on environmental management utilities
- Optimal utilization of available land, natural resources
- Conservation of important natural features
- Use of renewable energy sources, energy conservation measures
- Traffic management including public transport
- Disaster management
- Inclusion of social infrastructure like housing and allied requirements

Risk based land use planning

When choosing a location for new industrial estate, the varying levels of risk associated with diverse industrial uses must be evaluated. Municipalities use conventional planning and zoning to identify land uses permitted or prohibited zone-wise, however it may be useful to separate higher risk industries from both other industries and other land uses. The development of industrial parks for these purposes may lead to better site planning and disaster response..



However, care must be made to avoid possibly worsening circumstances as a result of the domino effect of "knock-on" occurrences involving many high-risk industries in the same location. The deployment of suitable buffer zones within such industrial parks is especially crucial, and site-specific risk evaluations are preferred.

The following industry typology is proposed to aid planning authorities in enhancing their industrial land use classification within plans, based on the chemicals produced.

- Type 1: Industries presenting no major risks
- Type 2: Industries presenting some risk (e.g. producers or users of benzene, ammonia)
- Type 3: Industries presenting moderate risk (e.g. producers or users of hydrogen chloride, liquefied petroleum gas, or gasoline)
- Type 4: Industries presenting high risk (e.g. producers or users of chlorine or ethylene oxide)

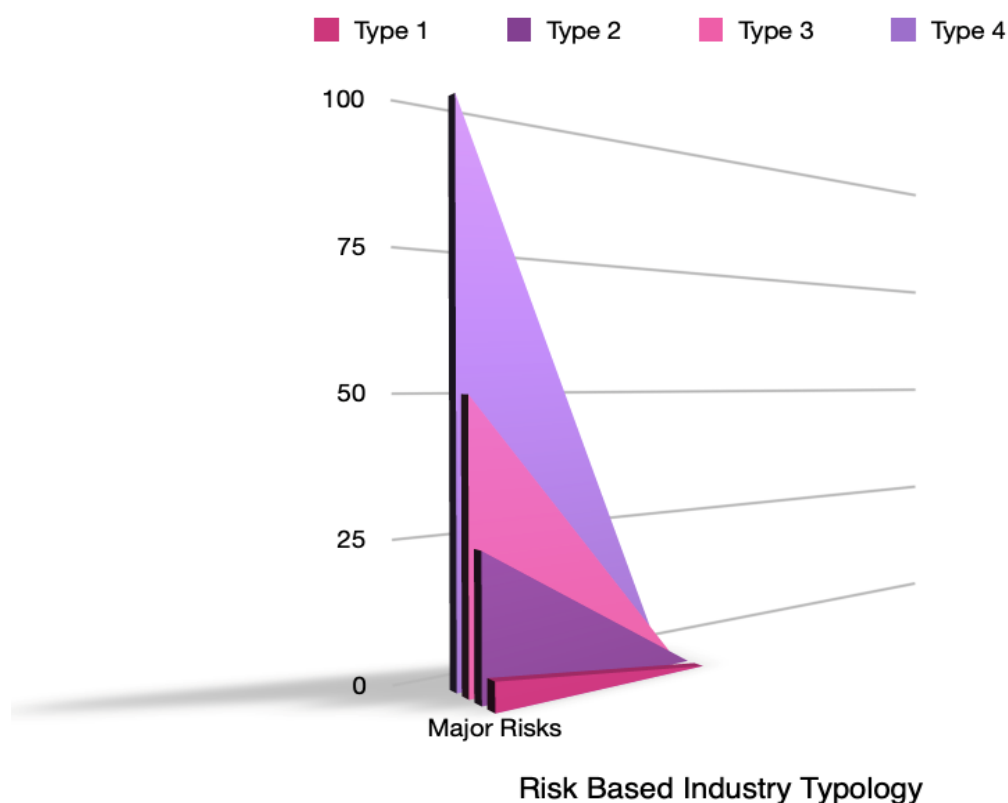


Figure 16: Risk Based Industry Typology

This risk-based typology should be incorporated in the defining of industry classes for planning reasons. The assessment must take into account not just safety problems, but



also environmental consequences and nuisances (noise, glare, odour, traffic, and aesthetic impact).

Sewage and dry waste disposal

Pump houses and treatment plants should be planned to minimize pipe runs while avoiding nuisance and odours, and have a capacity equivalent to the water supply for the area.

Trade effluents which do not conform to acceptable standards must be treated by the factory before entering the system or shall be rated to the common treated facility.

MSW must be stored safely and collected regularly.

Alternatives like recycling of waste, composting of organic waste (source of biogas) should be encouraged.

An integrated approach to the estate's environmental sustainability is recommended.

Environment Management

Ecologically sensitive estate planning, construction and management will be based on EIAs of the estate project as such and of individual enterprises and will

- Maintain or restore parts of the original natural area where possible (this will also contribute to the site's attractiveness) and preserve natural drainage systems
- Use environmentally sensitive construction methods and all locally viable methods to design energy-efficient sites (passive solar heating, tree shade, etc)
- Arrange buildings as compactly as possible from a technical and economic point of view to save on infrastructure and transport:
- Develop a transport management system for factory staff and goods.
- Establish a comprehensive system for wastewater treatment, solid waste management and prevention of air pollution.
- Use water resources as efficiently as possible (recycle wastewater where possible).
- Encourage environmentally sustainable production methods.

Air quality management

- Determination of ventilation coefficient, as a measure of assimilative potential
- Listing of all air polluting industries



- Studying the industries for the pollutant control system including its efficiency & reliability
- Establishment of pollution load from each point source
- Inventory of vehicles (line sources) and establishing pollution load contribution by considering emission factors
- Determination of areas for locating monitoring stations, where maximum ground level concentrations are likely to occur.
- Determination of relative share of the industries at sensitive locations for arriving at the degree of control efficiency/ control technologies

Wastewater management

In an IE, wastewater will be generated from various industries. The main advantage of industries to be located within the IE is the common treatment facility. The wastewater generated from various industries can be managed by a CETP within the IE. The CETP becomes one of the basic amenities that are offered to the industries by an IE. The feasible approaches in the wastewater management through a CETP are listed below:

- Preliminary treatment at individual level to meet influent limits of a common treatment facility
- Common/combined treatment facility for further treatment
- Re-cycling of treated waters for beneficial uses or disposal through marine outfall.

Advantages of common treatment facility

- Homogenization of wastewaters
- Relatively better hydraulic stability
- Advantage through scale of operation.
- Professional control over treatment can be affordable
- Offers great relief to small units, which are of main concern in terms of treatment
- Eliminates multiple discharges in the area, provides opportunity for better management of wastewater, i.e., proper treatment, disposal

Municipal solid waste and sludge

The activities associated with the management of solid wastes from the start of waste generation to final disposal can be grouped into the six functional elements:

- Waste generation;
- Waste handling and sorting, storage, and processing at the source;
- Waste collection;
- Sorting, processing and transformation;



- Transfer and transport; and
- Disposal

Sorting waste components is a key stage in solid waste treatment and storage at the source. Because of public health issues and aesthetic considerations, on-site storage is critical.

The collection functional element includes not only the collecting of solid waste and recyclable products, but also the conveyance of these commodities after collection to the point where the collection vehicle is emptied. This location could be a materials processing facility, a transfer station, or a landfill.

Sorting, processing, and transformation of solid waste materials encompasses the recovery of sorted materials, processing of solid waste, and transformation of solid waste, all of which take place predominantly in areas remote from the source of trash generation. Sorting comprises bulky item separation, waste component separation by size using screens, manual waste component separation, and ferrous and non-ferrous metal separation.

Waste processing can be undertaken to recover conversion products and energy. The organic fraction of Municipal Solid Waste (MSW) can be transformed by a variety of biological and thermal processes like aerobic composting and incineration.

Waste transformation is undertaken to reduce the volume, weight, size or toxicity of waste without resource recovery. Transformation may be done by a variety of mechanical (e.g. shredding), thermal (e.g. incineration without energy recovery) or chemical (e.g. encapsulation) techniques.

All the residual materials from material recovery facilities (MRFs), residue from the combustion of solid waste, rejects of composting, or other substances from various solid waste processing facilities are disposed by landfilling.

Wherever possible, generation of sludge should be minimized. Sludge must be treated, and if toxic metals are present, the sludge must be stabilized.

Hazardous waste management

In case of IEs comprising of industries that generate hazardous waste, management of the same becomes essential. The principle steps that are to be followed in the effective management of hazardous waste are:

- Segregation of waste into hazardous / non-hazardous
- Exploring recovery, re-use, renovation and re-cycle
- Categorization of waste in to:



- Incinerable waste
 - Non-incinerable waste
- Incinerable waste to hazardous waste incineration facility, in accordance to the guidelines, disposal of slag into TSDF
- Non-incinerable waste – pre-treatment, secured landfill site, collection of leachate and its treatment, regular monitoring to check integrity of the liners.

Good environmental practices

- Encourage the use of vapor recovery systems to reduce VOC emissions
- Encourage the use of sulphur recovery systems where considered feasible
- Encourage the use of low NOx burners
- Encourage the recovery and recycle of oily wastes
- Encourage the regeneration and reuse of spent catalysts and solvents
- Encourage the recycling of cooling water and the reuse of wastewaters
- Institute segregation of stormwater from process wastewater
- Encourage the use of non-chrome additives to cooling water
- Institute spill prevention and control measures
- Include properly designed storage facilities for hazardous chemicals and wastes, including provision for containment of contaminated water in case of fire

Environmental management systems for IEs

EMS is an action framework for practical environmental plans, defining policy, performance objectives, enforcement mechanisms, and stakeholder roles and responsibilities within and outside the IE. Some of the specific management elements, which contribute to improving environmental performance, are

- Well-defined operating standards and realistic targets set internally
- Regular review of environmental performance and monitoring. e.g., audits
- Programmes on training and awareness on environmental risks
- Effective incident reporting and investigation
- Effective contingency planning for accidents, spills and fires
- Reporting systems within the estate, and with the public

In order to avoid the conflict of responsibilities of IE managers as developers, promoters, regulators and providers of essential services, it is essential to establish 'Environment Management Cell' (EMC) in each IE. The role of such EMC would be to conduct environmental monitoring, track performance targets, monitor and check the growth of industries within the estate, correlating it with the carrying capacity limits, conduct R&D for developing clean technologies and information dissemination to different stakeholders.

Monitoring and reporting



IEs should encourage units to analyse monitoring data, review it at regular intervals, and compare it with the operating standards so that any necessary corrective actions can be taken

IEs should maintain a record of accidental releases of pollutants to the environment and should take appropriate corrective action to be better prepared for future occurrences.

ECO-INDUSTRIAL PARKS

An EIP is a community of manufacturing and service organizations collaborating to improve environmental and economic performance by managing environmental and resource challenges such as energy, water, and materials. Working together, the business community seeks a collective benefit bigger than the sum of industrial benefits and the company would receive if it only optimized its individual performance. An EIP's purpose is to increase the economic performance of member enterprises while reducing their environmental effect.

The aforementioned description, as well as many other similar ideas of industrial zones, business parks, industrial districts, and IE, are primarily concerned with the performance optimization and environmental control of industries inside the designated borders. Fostering a feeling of community among enterprises and neighbouring communities is one of the social benefits that should normally come from EIP development (Klee and Williams, 1999).

The EIP strategy provides a wide range of measurements and instruments to help individual companies and IEs/parks enhance their environmental performance.

Industry-specific requirements

All the individual industries are required to comply with industry-specific minimal national standards. However, when a homogenous IE/complex proposes to take a single clearance for all the industries which come up in their IE/complex, in such case entire IE/complex will be treated as a single entity to comply with the standards prescribed by the regulatory authorities.

When the industries send their effluents to CETPs, then CETP effluent standards will apply

If sector-specific standards are not notified, the general standards for all the relevant pollutants will be applicable. The general standards for the effluent discharge and emissions are given in the below Table:

**Table 16: General Environmental Standards for Effluent Discharge**

S.No	Parameter	Inland Surface Water	Public Sewers	Land for Irrigation	Marine / Coastal Areas
		(A)	(B)	(C)	(D)
1	Suspended Solids mg/l, max.	100	600	200	For Process Wastewater For cooling water effluent 10 % above total suspended matter of influent
2	Particle size of suspended solids	Shall pass 850 micron IS Sieve	-	-	Floatable solids, solids max 3 mm Settleable solids, max 856 microns
3	4 pH value	5.5 – 9.0	5.5 – 9.0	5.5 – 9.0	5.5 – 9.0
4	Temperature	Shall not exceed above the receiving water temperature			Shall not exceed 5°C above the receiving water temperature
5	Biochemical Oxygen Demand (3 days at 27°C); mg/l max.	30	350	100	100



6	Chemical Oxygen Demand, mg/l, max	250	-	-	250
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Some modern industrial estates incorporate eco-friendly and sustainable practices, focusing on waste management, energy efficiency, and green technologies to minimize their environmental footprint.

Examples: There are several well-known industrial estates in India, such as the Hiranandani Industrial Estate in Mumbai, Peenya Industrial Estate in Bangalore, and the Adityapur Industrial Area in Jharkhand.

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BUILDING CONSTRUCTION

The building industry is recycling waste, but significant reductions need to be achieved through reuse and adaptation. Green buildings integrate factors like climate, building orientation, daylighting opportunities, and economic guidelines, focusing on the interrelationships between building elements and function.

Implementing new building concepts can lead to significant construction cost savings, particularly in areas such as natural resource conservation. Measures that are relatively easy to implement can result in savings to natural resources in the following areas:

- Lower energy costs, by monitoring usage
- Installing energy-efficient lamps and fixtures, using occupancy sensors to control lighting fixtures
- Lower water costs, by monitoring consumption and reusing stormwater and/or construction wastewater where possible
- Lower site-clearing costs, by minimizing site disruption and movement of earth and installation of artificial systems
- Lower landfill dumping costs and associated hauling charges, through reuse and recycling of construction and demolition debris
- Lower materials costs, with more careful purchase and reuse of resources and materials
- Possible earnings from sales of reusable items removed during building demolition

Technology Sub-Mission(TSM)



TSM enables the preparation and adoption of layout designs and building plans suitable for various geo-climatic zones and helps the states and cities to deploy disaster-resistant and environment-friendly technologies.

The Sub-Mission work on following aspects:

- Design & Planning
- Innovative technologies & materials
- Green buildings using natural resources and
- Earthquake and other disaster resistant technologies and designs. Simple concept of designs ensuring adequate sunlight and air should be adopted.

Global Housing Technology Challenge-India (GHTC-India) identifies and mainstream the best construction technologies available globally that are rapid, sustainable, green and disaster-resistant. It includes 54 innovative proven construction technologies, some are:

Precast Construction Technology

Precast construction Technology is a system of casting concrete in a reusable mould or "form" which is then treated in a controlled environment, conveyed to the construction site and lifted to the place.

Precast Construction Technology consists of various precast elements such as walls, beams, slabs, columns, staircase, landing and some customized elements that are standardized and designed for stability, durability and structural integrity of the building.

Precast residential building construction involves design, strategic yard planning, lifting, handling and transportation of precast elements. This technology is suitable for construction of high rise buildings resisting seismic and wind induced lateral loads along with gravity loads.

The building framing is planned in such a way that maximum number of repetitions of moulds is obtained. These elements are cast in a controlled factory condition. The factory is developed at or near the site which provides an economical solution in terms of storage and transportation.

Types of precast elements:

Two main types of precast concrete elements, namely precast reinforced concrete elements and precast pre-stressed concrete elements are used as per the details given below:

- i. Precast reinforced concrete elements:



These shall consist of reinforcement bars and/or welded wire meshes within the elements to provide the structural strength as per requirement of the component such as façade walls, beams, columns, slabs, staircases and parapet wall

ii. Precast pre-stressed concrete elements:

These shall consist of pre-stressing tendons within the elements to provide a predetermined force needed to resist external loadings and cracks such as hollow core slabs, beams and planks.

Precast elements:

Table 17: Precast Components

Sr. No	Precast Components	Typical Sizes
1	Wall Panels	Sizes of panels may vary as per requirement
2	Hollow Core Slabs	
3	Beams	
4	Staircase	
5	Columns	

**Wall Panels****Parapet Beams****Staircase****Hollow core slab****Pod Element****Figure 18: Precast Concrete Elements; Source: BMTPC**

Moulds:

Moulds for precast elements shall be of steel and concrete. For design of the moulds for various elements, special importance should be given to easy de-moulding and assembly of the various parts. At the same time rigidity and strength and water tightness of the mould are also important taking into consideration forces due to pouring of green concrete and vibration. The type of moulds used for pre-casting various elements with various methods is given below :

Table 18: Type of moulds used for pre-casting various elements with various methods



Sr. No	Mould type	Typical Sizes
1	Conventional moulds	Ribbed slabs, beams, window panels, box type units and special elements
2	Tilting moulds	Exterior wall panels where special finishes are required on one face or for sandwich panels
3	Long line prestressing beds	Double tees, ribbed slabs, piles and beams
4	Prestressing bed with Extrusion machine	Hollow core slabs and hollow core non load bearing wall



Conventional Mould



Tilting Mould



Extrusion Machine

Source: BMTPC

Precast or Prefabricated concrete construction

The system which includes those buildings where the majority of structural components are standardized and produced in controlled environment at a factory or manufacturing site in a location away from the proposed building and then transported to the site for assembly.



By and large, conventional building technologies like burnt bricks, steel and cement are high in cost, utilise large amount of non-renewable natural resources like energy, minerals, top-soil, forest cover etc. These increase dependence on external materials and manpower, harm the local economy and are generally polluting in nature.

The materials and technologies chosen for construction must, in addition to functional efficiency, fulfil some or more of the following criterion, for the cause of sustainability and a better quality environment:

- non endanger bio-reserves and be non-polluting;
- be self-sustaining and promote self-reliance.
- recycle polluting waste into usable materials
- utilise locally available materials
- utilise local skills, manpower and management systems
- benefit local economy by being income generating
- utilise renewable energy sources
- be accessible to the people
- be low in monetary cost

Table 19: Environment-Friendly, Energy Efficient, Cost-Effective Composite Materials/Products for Low Cost Housing

Product	Raw Material Source	Materials for production	Applications
BAMBOO MAT BOARD	Bamboo grass species (Meleannca baccifera)	Bamboo, polymeric resin, chlorinated hydrocarbons and boron and cashew nut shell liquid	Flooring, walling, structural membrane, false ceiling, door/window frames.
BAGASSE COMPOSITE PANEL/BOARD	Sugar industry	General purpose, polyester resin, methyl ethyl ketone and cobalt napthenate	For variety of building and furniture applications. Properties closely resemble with the wood but lighter in weight. Stackable and can be easily



			chiselled and sawed.
JUTE POLYESTER COMPOSITE	Jute industry (Jute plant is grown in several developing countries)	Woven jute fibres, and polyester amide polyol as interfacing agent	Chip boards, roofing sheets, door shutters, partition panels and door/window frames.
COIR COMPOSITE BOARD	Coconut – Plantation in Coastal Regions	Core fibres, mineralized water, cashew nut shell liquid, para formaldehyde	Medium Density Fibre boards, can be used as wood substitute for paneling, cladding, surfacing and partitioning and door/window shutters.
BAMBOO-RICE HUSK COMPOSITE	Rice mills, bamboo plants (grass)	Rice husk, bamboo mat, cashew nut shell liquid and phenolic resin	Temporary shelters, warehouses, false ceilings, Insulation, partition and stage settings, industrial and domestic floorings.
CELLULAR LIGHT WEIGHT CONCRETE BLOCK	Fly Ash from coal based power generating plants	Fly Ash, cement, sand, water and foaming agent	Concrete blocks, densities ranging from 400 kg/m ³ to 1800 kg/m ³ . Filler walls. In-situ cellular walls & partitions. Very good insulation at roof tops for reduction of heat load in buildings.
FLY ASH POLYMER COMPOSITE	Ash from coal-based power generating plants	Fly ash, polymeric material	Partitions, door shutters, roofing sheets.



BLAST FURNACE SLAG COMPOSITE	Waste from steel plants	Blast furnace slag, polymeric resin, laminating material	Partitions and interior finishing on walls.
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https://www.bmtpc.org/DataFiles/CMS/file/Environment_friendly_technologies.pdf

CELLULAR LIGHTWEIGHT CONCRETE

Cellular Lightweight Concrete (CLC) has been used in over 40 countries over the past 25 years to produce over hundred thousand houses and apartments, apart from schools, hospitals, industrial and commercial buildings.

CLC is an air-cured lightweight concrete with flyash as a major ingredient, that can be produced at large project sites just like traditional concrete, utilising equipment and moulds normally used for traditional concreting. It is especially suitable in India for low-rise loadbearing constructions and for partitioning work in multistorey blocks.

Benefits of CLC Blocks/Panels:

- Tremendous weight reduction
- High thermal insulation
- Optimal fire rating
- Substantial material saving:
- No gravel used
- Little cement
- Less steel in structure and foundation
- Easy and fast production
- No primary energy and reduced transportation costs
- Boon for remote areas with only sand availability.



Source: *BMTPC*

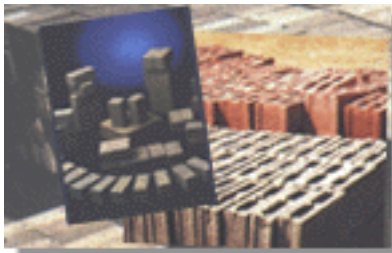


Nature of Pollution

Fly ash causes severe pollution of air and water, and its disposal gobbles up large tracts of land. Well planned programmes for proper management of fly ash are therefore being undertaken to enhance the use of fly ash in various applications, so that our already perilously imbalanced environment can be protected.



Recycling of Fly Ash



Bricks, Portland pozzolana cement, blocks, tiles, light weight aggregates and hollow blocks are produced utilising fly ash as raw material. Mechanised manufacture of fly ash lime bricks is a major thrust area. The twofold aim is to utilise bulk quantities of fly ash and help bridge the huge shortfall of bricks and other building materials required by the constantly rising construction activity.

Advantages of fly ash bricks:

- Several loadbearing grades
- Savings in mortar, plastering
- Smart looking brickwork



Table 20: BMTPC developed technologies and production processes for commercial exploitation

S. No.	Description of Technology Developed	Raw Material	Status	Joint Developer
1	Laminated splint lumber panel doors and door frames from rubber wood (2000)	Rubber wood Phenol Formaldehyde resin	Product tested Under consideration for licensing	Jambhekar Management Consultant Pvt.Ltd., Thane
2	Veneer laminated lumber panel door and doors frame from poplar wood (IS 14616:1999) (1998)	Poplar wood, Phenol Formaldehyde resin	Product tested Under consideration for licensing	Jambhekar Management Consultant Pvt.Ltd., Thane
3	Extended Polyster - Red Mud Polymer Composite Door Shutter (1998)	Red Mud, Extended Polystyrene	Product tested As substitute to timber	CBRI, Roorkee & Regional Research Laboratory, Bhopal
4	Paint based on Flyash and other wastes (1999)	35% Flyash for primers, 18% Flyash for enamel China clay, hardner	Product tested As substitute to conventional paints	Regional Research Laboratory, Bhopal



5	Glass Ceramic products for Floor Tiles using wastes (three types) from Aluminium industry (2001)	Red Mud, Flyash, Spent pot lining	Product tested Pilot Demonstration Plant is likely to set up at BHEL	Jawahar Lal Nehru Aluminium Research, Development & Design Centre, Nagpur
6	Light weight Mineral-wood Door Shutter (1998)	Metallurgical slag, Phenol Formaldehyde resin	Product tested As substitute to timber	Regional Research Laboratory, Bhopal
7	Building Materials from Marble industry waste (1999)	Marble dust, cement, gypsum	Marble dust can be used in making masonry cement, autoclaved cellular concrete blocks, gypsum blocks, gypsum plaster board, colour wash, distemper Products tested	Central Building Research Institute, Roorkee
8	Cementitious Binder and building blocks from Acetylene plant waste (1995)	Cement, sand, fine aggregates	Final product tested Many entrepreneur are interested in setting up a commercial plant	Central Building Research Institute and Building Centre Roorkee



9	Rigid PVC - Plastic waste, Final product Foam Board and Stabiliser, inert tested Sheet (2000) fillers, elastomeric Under modifiers, consideration compatibilizers for licensing	Central Building Research Institute, Roorkee
Source: BMTPC		

Sustainable Construction Practices to Mitigate Dust Pollution

All construction sites generate high levels of pollution and this can carry for large distances over a long period of time. As per the Delhi Pollution Control Committee (DPCC) officials, 30 percent of air pollution is caused due to dust which emanates from construction sites.

Use of Prefabricated Materials

Prefabricated construction materials can significantly reduce dust generation during construction. These materials are manufactured off-site and transported to the construction site, minimising on-site dust generation.

Dust Control Measures

Implementing dust control measures such as covering construction materials, using water sprays to suppress dust, and installing dust screens can help reduce construction dust pollution.

Green Construction Techniques

Incorporating green construction techniques, such as using recycled materials and energy-efficient designs, can contribute to reducing the overall environmental impact of construction activities.



CHOICE OF CONSTRUCTION TECHNOLOGIES REGION WISE RECOMMENDED TECHNOLOGIES FOR HOUSING IN DIFFERENT GEO-CLIMATIC ZONES IN URBAN AREAS

Read More:

<https://www.bmtpc.org/DataFiles/CMS/file/pick%20your%20construction.pdf>

Green Buildings

The appearance of a Green Building will be similar to any other building. However, the difference is in the approach, which revolves round a concern for extending the life span of natural resources; provide human comfort, safety and productivity. This approach results in reduction in operating costs like energy and water, besides several intangible benefits. Some of the salient features of a Green Building are:

- Minimal disturbance to landscapes and site condition
- Use of Recycled and Environmental Friendly Building Materials
- Use of Non-Toxic and recycled/recyclable Materials
- Efficient use of Water and Water Recycling
- Use of Energy Efficient and Eco-Friendly Equipment
- Use of Renewable Energy
- Indoor Air Quality for Human Safety and Comfort
- Effective Controls and Building Management Systems

The Green Building Movement by the Indian Green Building Council (IGBC) part of Confederation of Indian Industry (CII) has rating systems such as:

- US based LEED certification managed by CII focuses on 5 factors : Energy savings, water efficiency, CO₂ emissions reduction, improved indoor environmental quality and stewardship of resources and sensitivity to their impacts.
- National Rating System - GRIHA initially conceived and developed by TERI (The Energy & Resource Institute) has criteria categorized into
 - (i) Site Planning during building planning and construction stage
 - (ii) Water Conservation
 - (iii) Energy Efficiency
 - (iv) Waste Management
 - (v) Environment for good health and wellbeing.



Smart Designing Methods

- Use of latest technologies such as *BIM (Building Information Modelling)* can help estimate requirement of materials at every stage. This reduces the chances of over ordering of materials which may then end up becoming waste.
- Designing *Insulation* for the entire project can help prevent in energy loss. This can be done by using materials with good insulation properties, using insulating materials over standard elements and adapting the concepts of cool roofs. This helps in reducing the demand for energy required for regulating temperatures.
- Smart placement of windows throughout the structure can further help in avoiding energy loss. This would be achieved as the windows could provide sufficient sunlight reducing the dependency on artificial light. Also, the correct configuration of the windows thickness wise could also help add insulation within the project.
- Designs should also integrate systems such as *net metering, rainwater harvesting, waste management* among others. Having integrated these systems should help to reduce the overall footprint of the structure. This would also reduce several costs during the life-cycle of the project.
- Adding *trees, plants, gardens* to the project would help improve the air quality in and around the project.
- Design should also account for the *reuse of grey water* for purposes of domestic purposes and or irrigation of plant life within the project. This helps reduce the demand of water.

Eco-friendly building design

- Eco-friendly design includes the use of recycled materials, (which produce less CO₂ in the manufacturing process), structural durability and long-term plans for energy and waste production.
- Smart appliances, solar panels and even the inclusion of natural light must be considered alternatives to ensure a building's design is eco-friendly.

Use of harvested rainwater during construction

- Construction practices are heavily dependent on the use of water for purposes such as curing of concrete, preparation processes and cleaning. Using water harvested from the rain for construction practices can help conserve the local water resource.

Green construction practices

Use of quieter, fuel-efficient tools and machines, as well as recycling and reusing materials where possible to reduce waste.

Limit fuel usage

Proper maintenance of tools and equipment which require fuel is key to limiting how much they need. Leaving them running idle is wasteful and should be avoided. There



are also technologies available to manage maintenance and replacing parts more cost-effectively.

Reduce noise

To reduce noise pollution, construction managers should consider different processes which use quieter equipment, or a quieter process to achieve the same result. Metal-on-metal impact can be reduced by using rubber panels or covers and barriers erected around noisier sites to help reduce their impact. Some tools can also be fitted with silencers.

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ENVIRONMENTAL IMPACT MITIGATION MEASURES

Land Environment

Attention must be paid to avoid areas prone to landslides, soil erosion, subsidence, fertile agricultural lands etc.

The erosion potential of alternatives should be carefully examined and the one involving least disturbance to the natural ground should be preferred.

In case of flood prone areas and/or areas with very flat slopes, hydrological surveys have to be conducted before alignment finalization. Inputs derived from these surveys such as the need for provision of culverts/bridges or other cross/roadside drainage structures should be considered.

In hilly areas, specific geological studies should be conducted to avoid locations vulnerable for landslides.

Drainage improvements to avoid water logging and flooding due to disturbance of natural drainage pattern should be considered

Possibility of storing and reuse topsoil by separating topsoil from subsoil during the initial excavation should be considered

Engineering measures for slope protection and erosion prevention should be considered.

The stored topsoil should be spread back to restore the productivity of the exhausted borrow areas/ the accumulated top soil should be utilized for developing median plantation and for raising turfs in the embankment slopes



Drainage improvements for prevention of soil erosion and siltation of watercourses should be planned. Slope stabilization techniques and erosion control measures should be planned especially for the projects undertaken in hilly areas, such as increasing vegetation, sausage walls/ gabions (IRC: SP: 48 – 1998), bally benching (IRC: SP: 48- 1998), check dams etc

Water Environment

Labour camps should not be located near to water bodies. No discharge from such establishments should follow their path into nearby water bodies.

Dumping of debris in or nearby water bodies should be strictly avoided.

All the waste generated from construction site should be collected, stored and disposed in environmentally suitable manner. Standards for discharge of effluents is given in Chapter 6.

Appropriate drainage arrangements with catch drains and catch pits should be planned to prevent the spillage of chemicals and fuels reaching the water bodies

Water flow speed control should be exercised to check surface runoff's and silt loads during infrastructure construction activities.

Silt screens and sediment traps to be made before out-letting to water bodies to minimize turbidity and silting in local water bodies

Air Environment

Planting tall leafy vegetation as green belts around sites and human settlements

Water sprinkling and transporting construction materials with tarpaulin coverage during the construction stage.

During the sub-grade construction, sprinkling of water should be carried out on regular basis during the entire construction period especially in the winter and summer seasons.

Special attention should be given sites close to sensitive areas such as schools, hospitals and urban areas. As soon as construction is over the surplus earth should be utilized properly and in no case, loose earth should be allowed to pile up.



All the vehicles used during the construction stage to have valid PUC certificate

Provision of air pollution control systems in stone crushers to meet the suspended PM value at distance of 40 meters less than 600 micrograms/Nm³.

The stone crushing units should adopt the following pollution control measures:

Dust containment cum suppression system for the equipment

Construction of wind breaking walls

Construction of the metalled roads within the premises

Regular cleaning and wetting of the ground within the premises

Growing of a green belt along the periphery

Hot mix units, if used on site, should be equipped with requisite air pollution equipment to meet the prescribed standard of MoEFCC and SPCBs

Integration with the local government awareness campaign programmes on good practices of vehicle maintenance etc. to reduce the air emissions

Table 21: General Air Emission Standards

S.NO	PARAMETER	CONCENTRATION NOT TO EXCEED (MG/NM ³)
1	Particulate matter	150
2	Total Fluoride	25
3	Asbestos	4 fibres/cc ad dust should not be more than 2mg/Nm ³
4	Mercury	0.2
5	Chlorine	15
6	Hydrochloric acid vapour and mist	35
7	Sulphuric acid mist	50
8	Carbon monoxide	1%
9	Lead	10
Source: CPCB		

Noise Environment

Provision for stationary machines and equipment with acoustic enclosures and silencers, during the construction stage



Development of bypass roads to avoid road alignment through noise sensitive areas

Adoption of proper surface design and maintenance

Provision of noise barriers.

Prediction model outputs justifying the selection of type of the noise barrier and thickness of the noise barrier etc.

Planting tall leafy and dense vegetation between roads and noise sensitive areas

Provision of mandatory acoustic enclosure /acoustic treatment of room for stationary DG sets (5KVA and above). The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB (A) insertion loss for meeting the ambient noise standards, whichever is on the higher side. The DG set should be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A)

Biological Environment

Tree plantation plan to compensate the trees cut should be prepared as per the government norms.

Possibility of tree transplantation should be examined

Identification of sensitive natural environments in the early planning stage so that alternative routes can be examined

Provision of wildlife underpass and hydraulic structure.

Compensate the loss of forest coverage by appropriate plantation programme. Survival rate of plants must be included in the contract specifications so as to ensure that the compensatory plantation achieves its objective

Development of green belt consisting of a variety of trees would help to enrich ecology of the area and add to aesthetics.

Regeneration of rare plants of economic importance including medicinal plants

Conservation plan for conservation and protection of flora and fauna, wildlife migratory species and medicinal plants



Miscellaneous mitigation measures

- Examine in detail the proposed site with reference to possible impact of infrastructure covering water supply, pipelines, roads, storm water drainage, sewerage, power, temporary waste storage facilities, treated wastewater disposal (land/sewer/surface water bodies), common facilities, etc.
- Environmental condition scenarios shall be developed based on industrial activities and pollution potentials.
- In case of any scheduled fauna, conservation plan should be provided.
- Details of traffic density vis-à-vis impact on the ambient air.
- Impact of the developmental activity on drainage of the area and the surroundings.
- Impact of the project on the AAQ of the area. Details of the model used and the input data used for modelling should also be provided. The air quality contours may be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.
- Mathematical modelling for calculating the dispersion of air pollutants and ground level concentration along with emissions from boilers
- Cumulative impact on regional supportive capacity shall be studied in terms of population density, water supply, sewerage, storm water drainage, power supply, educational facilities, medical facilities, public transport, traffic, housing for EWS, and community facilities, etc.
- Details on positive and negative impacts, direct and indirect impacts, induced impacts.
- Project activities and impacts shall be represented in matrix form with separate matrices for pre and post mitigation scenarios.
- Traffic management plan including parking and loading/unloading areas may be described. Traffic survey should be carried out on week days and weekends and also analyse the anticipated traffic increase.
- Odour mitigation plan may be described. Also make provision of green cover as a measure for mitigation of dust and noise and buffer between habitation and industry.
- Rain water harvesting proposals should be made with due safeguards for groundwater quality. Maximize recycling of water and utilization of rain water.
- Proposed measures for occupational safety and health of the workers.
- Impact of the project on local infrastructure of the area such as road network and whether any additional infrastructure would need to be constructed and the agency responsible for the same with time frame.
- Details of greenbelt including details of species, width of plantation, planning schedule, etc. within the boundary around the IE.



Analysis of alternative resources and technologies

- Comparison of alternate sites considered and the reasons for selecting the proposed site. Conformity of the site with the prescribed guidelines in terms of CRZ, river, highways, railways, etc.
- Evaluate alternative disposal modes of effluent and solid wastes, from the point of view of disposal points and associated impacts.
- All kind of resources both renewable and non-renewable shall be taken into account.
- Details on improved technologies.

Environmental monitoring program

- Proposed post-project monitoring programme to ensure compliance to the approved Management Plan including administrative and technical organizational structure.
- Appropriate monitoring network has to be designed and proposed for regulatory compliance and to assess the residual impacts, if any.



CHAPTER 5



Green Belt Development

5.1 Introduction

A Green Belt (GB) planted with the right plants can absorb pollution from a variety of sources, including those not removed by air pollution control devices. Plants form a surface capable of absorbing pollutants and forming sinks for pollutants in green belts. To develop a sustainable green belt around any polluted place, it is very important to identify tree species that are capable of biologically monitoring emissions and can endure emissions.

India is a vast country with diverse agro-climates suitable for different plant species. Plant species must be selected for cultivation based on the agroclimatic conditions. In accordance with CPCB (Central Pollution Control Board) guidelines, there are 15 agroclimatic regions, which are further divided into 68 subzones based on annual rainfall, climate, and soil types.

To be used in a Green Belt, a plant should have the following characteristics:

- (a) Plant species tolerant to dust and pollution.
- (b) A fast growth rate that allows the canopy to develop quickly.
- (c) Strong branches to ensure they have ability to withstand storms
- (d) A large leaf size to enhance pollutant retention.
- (e) Dense foliage to trap pollutants more effectively.
- (f) A relatively high level of tolerance for insects and diseases,
- (g) A high tolerance for soil compaction and nutrient stress
- (h) An extended longevity of the GB itself.

Among the above conditions, dust tolerance is of significant requirement for developing GB (CPCB, 2000). APTI measures plant species' tolerance to air pollution.



5.2 APTI definition and its usage

APTI stands for Air Pollution Tolerance Index (APTI) and it reflects a plant's ability to tolerate air pollution. Plants with higher APTI can act as a source of pollution alleviation, whereas plants with lower APTI can be an indicator of air pollution level and are sensitive to air pollution, and their growth is hampered by the presence of pollutants (Singh & Rao, 1983).

APTI is estimated as (Randhi & Reddy, 2012):

$$APTI = \frac{[A(T + P) + (R)]}{10}$$

where,

A = Ascorbic acid content (mg g⁻¹) (dry weight),

T = Total chlorophyll content (mg g⁻¹),

P = leaf extract pH, and R = RWC (%).

Plants which have a higher Air Pollution Tolerance Index (APTI) can be used effectively as 'bio-indicators' of air pollutants and thus, be a tool for effective mitigation.

Accordingly, studies (Randhi and Reddy, 2012) have categorised APTI as follows:

Table 22: APTI Index with categories

APTI Index	Categories
<1	Very sensitive
1-16	Sensitive
17-29	Intermediate
30-100	Tolerant



5.3 Plant species sensitive to air pollutants

According to studies on plant sensitivity to higher concentrations of pollutants like NO_x, SO_x, CO₂, CO, and Particulate Matter (cement dust and fly ash) hamper plant growth (CPCB 2000, Radhapriya; Gopalakrishnan; Malini; & Ramachandran 2012, Kaur; Bakshi; Bhardwaj; & Verma 2019; Randhi & Reddy, 2012). A further analysis of the studies indicated that the following plants/shrubs/trees are sensitive to dust, as shown in **Table 6.3**

Table 23: Species sensitive to dust

Scientific Name	Common Name
<i>Zea mays</i>	Maize
<i>Syzgium cumini</i>	Jamun, Guava Plum
<i>Psidium guajava</i>	Guava
<i>Triticum aestivum</i>	Bread Wheat
<i>Calotropis procera</i>	Rubber bush, Calotrope, Apple of Sodom, giant milkweed
<i>Cassia fistula</i>	Golden Shower Tree, Indian Laburnum, Pudding Pipe Tree
<i>Dalbergia sisso</i>	North Indian Rosewood
<i>Withania somnifera</i>	Ashwagandha, winter cherry
<i>Glycine max</i>	Soyabean
<i>Abelmoschus esculantus</i>	Okra
<i>Brassica campestris</i>	Field Mustard
<i>Citrus aurantium</i>	Bitter Orange
<i>Delonix regia</i> Raffin	Gulmohar tree

Source: (CPCB 2000, Radhapriya; Gopalakrishnan; Malini; & Ramachandran 2012, Kaur; Bakshi; Bhardwaj; & Verma 2019; Randhi, Reddy 2012)



5.4 Plant Species recommended for leather industries

India encompasses a variety of agroclimatic zones suitable for different types of plant species. Depending on the zones and subzones of India, along with their soil types assist in selecting plant species for cultivation suitable to agro-climates.

According to scheme (PROBES-75, Appendix A), there are 15 agro-climatic regions. Each of these regions is further divided into 68 sub-zones. based on detailed characteristic features, such as natural resources, typologies (land productivity level, relative pressure on land and environmental factors etc).

The nature of plant-air pollutant interactions and sensitivity indicated by plants brings out the mutations under which plants are to function as scavengers of air pollutants. Other limitations for growing plants are the climatic conditions and soil characters. Of these, the latter get modified when plants are cultivated and grown under care, e g A standard horticultural practice involves planting of saplings in pits of substantial dimensions. i.e. 1 m x 1 m x 1 m for big trees and almost half of these dimensions for smaller trees and shrubs.

Characters of plants including shapes of crowns considered necessary for effecting absorption of pollutant and removal of dust particles are as follows:

For absorption of gases

1. Tolerance towards pollutants in question.
2. Longer duration of foliage.
3. Freely exposed foliage through
 - a) Adequate height of crown
 - b) Openness of foliage in canopy
 - c) Big leaves (long and broad laminar surfaces)
 - d) Large number of stomatal apertures
 - e) Stomata well-exposed

Choice of Plants for Green Belts

Plant species suitable for removal of particulate matter and gaseous pollutants differ then their morphological characteristics sizes and shapes of crowns periodic phenomena like leaf-shedding, also contribute to plant efficiency for pollution abatement.

For removal of suspended particulate matter

1. Height and spread of crown
2. Leaves supported on firm petioles,
3. Abundance of surfaces on bark and foliage, through
 - a. Roughness of bark,
 - b. Epidermal outgrowths on petioles.
 - c. Abundance of axillary hairs,
 - d. Hairs or scales on laminar surfaces.
 - e. Stomata protected (by wax, arches/rings, hairs, etc

**Table 24: Drought Resistant Species**

Tree species	Common Name	Tree species	Common Name
Prosopis cineraria	Khejri	Azadirachta indica	Neem
Capparis deciduas	Kiari , Caperbrush	Diospyros melanoxylon	Tendu
Tamarix aphylla		Ougeinia oojeinensis	
Acacia tortillas		Commiphora caudata	
Zizyphus nummularia	Jungli Ber	Bauhinia variegata	Kachnar
Prosopis juliflora	Kikar	Eucalyptus tereticornis	
Tecomella undulata	Rugtora/Wavy leafed Tufmella	Pongamia Pinnata	Karanj
Colophospermum mopane		Casia siamea	
Salvadora oleoides		Anacardium occidentale	Cashew
Acacia aneura		Holoptelia integrifolia	
Parkinsonia aculeate		Acacia catechu	Katha
Dichrostachys cineraria		Boswellia serrata	Lobaw
Acacia holosericea		Butea monosperma	Palash
Borassus flabellifera	Tar	Cassee fistula	Amaltas
Grewia tenax	Falsa	Albizia amara	
Commiphora wightii	Guggal	Dalbergia latifolia	Eastern Rose wood
Acacia seyal		Erythrina Indica	Coral Tree
Eucalyptus camaldulensis	Eucalyptus	Ficus bengalensis	Banyan
Hardwickia binnata		Ficus religiosa	Peepal
Pithecelobium dulce	Jungle Jalebi	Santalum album	Sandal
Celtis australis		Syzgium cuminii	Clove
Acacia albida		Terminalia alata	
Albizia lebbek	Shirish	Madhuca latifolia	Mahua
Acacia nilotica	Babul	Acacia auriculiformis	



Acacia ferruginea		Terminalia bellirica	Harad
Casuarina equisetifolia	Jhar	Dendrocalamus strictus	Lathi Baans
Leucaena leucocephala	Subabul	Moringa oleifera	Drumstick
Melea azedirach		Terminalia arjuna	Arjun
Sesbania grandiflora			
Tamarindus indica	Imli		
Wrightia Tinctoria			
Morus indica/alba	Mulberry		
Ailanthus excelsa			

Source : Manual on norms and standards for EC of large construction projects-MoEFCC

References & Readings

Programme Objective Series : PROBES/75/1999-2000; GUIDELINES FOR DEVELOPMENT OF GREENBELTS by CPCB

<https://cpcbenvvis.nic.in/scanned%20reports/PROBES-75%20Guidelines%20For%20Developing%20Greenbelts.pdf>



5.5 Criteria for Green Belt design

According to the guidelines of CPCB and MoEF&CC (CPCB, 2000 and MoEF&CC, n.d.) the following criteria should be considered when developing green belt:

1. A total of 1500-2000 trees will be planted per hectare in the cement plant, on the approach roads and on the premises of the township.
2. To create a barrier between the project and the surrounding area, the greenbelt should consist of rows of trees.
3. Depending on the availability of land, a greenbelt with 5m width will be developed on the cement plant premises.
4. 33% of the total plant area is to be used for developing the green belt.
5. A nursery will be established to raise 100,000 saplings every year for plantations.
6. It is proposed to plant medium-height trees (7-10m) and shrubs (5m) in the green belt.
7. A boundary wall will also be planted with creepers to increase its insulation capacity.
8. The greenbelt around the industry wall will be developed keeping in view of the following objectives:
 - Staggered planting of trees in a row.
 - Shorter trees will be planted in the first row and the taller trees in the outer row around the project area.
 - Since tree trunks have little foliage, shrubs are a good option for covering these areas.
 - Sufficient spacing will be maintained between the trees to facilitate effective height of the greenbelt.
 - A greenbelt should be developed using native plants of fast growth with large leaf indexes and a canopy.

The green belt development plan should include at least 1500 trees per hectare. Plantation information must include plant species, planting width, and planning schedule. The green belt shall be developed around the project boundary. In addition, a scheme for greening the roads used for the project shall also be included.



5.6 Miyawaki technique - conservation of urban forests and biodiversity

Green belts can be developed by creating mini forests. These forests are created using the Miyawaki technique (also known as Potted Seedling Method). Developed by Akira Miyawaki, this method gained popularity over the years. This Japanese technique creates mini forests. Native samples are planted close together, and soil fertility is improved by mulching. It allows sunlight only to reach the top, allowing plants to grow upward, rather than sideways. As a result, plants compete for light, space, and water (Manuel 2020).

Consequently, the plantation becomes 30 times denser, grows ten times faster, and becomes maintenance-free in three years. Plantations can grow in 20-30 years using this unique method. It reduces temperatures, improves air quality, and sequesters CO₂ (Mathur, 2019, Nargi, 2019, Sivabalan, Krishnan, and Nithila 2021).

Using this technique, Dalmia Bharat Group established a High-Density plantation in their Kadapa mine to enhance the biodiversity of the neighborhood. Their unique method was coupled with environmentally friendly practices and a hectare of land was developed without pesticides or fertilizers (Dalmia, 2020-2021).



Figure 19: Miyawaki Technique



CHAPTER 6



Environment Conditions

Ports and Harbours

General Conditions:

I. Statutory Compliance

1. Construction activity shall be carried out strictly according to the provisions of CRZ Notification, 2011 and the State Coastal Zone Management Plan as drawn up by the State Government. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.
2. A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained.
3. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Coast Guard, Civil Aviation Department shall be obtained, as applicable by project proponents from the respective competent authorities.

II. Air quality monitoring

1. The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM₁₀ and PM_{2.5} in reference to PM emission, and SO₂ and NO_x in reference to SO₂ and NO_x emissions) within and outside the project area at least at four locations, covering upwind and downwind directions.
2. Appropriate Air Pollution Control (APC) system shall be provided for all the dust generating points including fugitive dust from all vulnerable sources, so as to comply prescribed emission standards.
3. Shrouding shall be carried out in the work site enclosing the dock/proposed facility area. This will act as dust curtain as well achieving zero dust discharge from the site. These curtain or shroud will be immensely effective in restricting disturbance from wind in affecting the dry dock operations, preventing waste dispersion, improving working conditions through provision of shade for the workers.



4. Dust collectors shall be deployed in all areas where blasting (surface cleaning) and painting operations are to be carried out, supplemented by stacks for effective dispersion.
5. The Vessels shall comply the emission norms prescribed from time to time.
6. Diesel power generating sets proposed as source of backup power should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low sulphur diesel. The location of the DG sets may be decided with in consultation with State Pollution Control Board.
7. A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 05 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D./ competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.

III. Water quality monitoring

1. The Project proponent shall ensure that no creeks or rivers are blocked due to any activities at the project site and free flow of water is maintained.
2. Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality. Silt curtains shall be used to contain the spreading of suspended sediment during dredging within the dredging area.
3. No ships docking at the proposed project site will discharge its on-board waste water untreated in to the estuary/ channel. All such wastewater load will be diverted to the proposed Effluent Treatment Plant of the project site.
4. Measures should be taken to contain, control and recover the accidental spills of fuel and cargo handle.
5. The project proponents will draw up and implement a plan for the management of temperature differences between intake waters and discharge waters.
6. Spillage of fuel / engine oil and lubricants from the construction site are a source of organic pollution which impacts marine life. This shall be prevented by suitable precautions and also by providing necessary mechanisms to trap the spillage.



7. Total fresh water use shall not exceed the proposed requirement as provided in the project details. Prior permission from competent authority shall be obtained for use of fresh water.
8. Sewage Treatment Plant shall be provided to treat the wastewater generated from the project. Treated water shall be reused for horticulture, flushing, backwash, HVAC purposes and dust suppression.
9. A certificate from the competent authority for discharging treated effluent/untreated effluents into the Public sewer/ disposal/drainage systems along with the final disposal point should be obtained.
10. No diversion of the natural course of the river shall be made without prior permission from the Ministry of Water resources.
11. All the erosion control measures shall be taken at water front facilities. Earth protection work shall be carried out to avoid erosion of soil from the shoreline/boundary line from the land area into the marine water body.

IV. Noise quality monitoring

1. Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Officer of the Ministry as a part of six-monthly compliance report.
2. Noise from vehicles, power machinery and equipment on-site should not exceed the prescribed limit. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipments.
3. Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating personnel shall be implemented as mitigation measures for noise impact due to ground sources.
4. The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation

1. Provide solar power generation on roof tops of buildings, for solar light system for all common areas, street lights, parking around project area and maintain the same regularly;
2. Provide LED lights in offices and project areas.

VI. Waste management

1. Dredged material shall be disposed safely in the designated areas.
2. Shoreline should not be disturbed due to dumping. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring reports.



3. Necessary arrangements for the treatment of the effluents and solid wastes must be made and it must be ensured that they conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986.
4. The solid wastes shall be managed and disposed as per the norms of the Solid Waste Management Rules, 2016.
5. Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Waste Management Rules, 2016.
6. A certificate from the competent authority handling municipal solid wastes should be obtained, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from project.
7. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination.
8. Oil spill contingency plan shall be prepared and part of DMP to tackle emergencies. The equipment and recovery of oil from a spill would be assessed. Guidelines given in MARPOL and Shipping Acts for oil spill management would be followed. Mechanism for integration of terminals oil contingency plan with the overall area contingency plan under the co-ordination of Coast should be covered.

VII. Green Belt

1. Green belt shall be developed in area as provided in project details with a native tree species in accordance with CPCB guidelines.
2. Top soil shall be separately stored and used in the development of green belt.

VIII. Marine Ecology

1. Dredging shall not be carried out during the fish breeding and spawning seasons.
2. Dredging, etc shall be carried out in the confined manner to reduce the impacts on marine environment.
3. The dredging schedule shall be so planned that the turbidity developed is dispersed soon enough to prevent any stress on the fish population.
4. While carrying out dredging, an independent monitoring shall be carried out through a Government Agency/Institute to assess the impact and necessary measures shall be taken on priority basis if any adverse impact is observed.
5. A detailed marine biodiversity management plan shall be prepared through the NIO or any other institute of repute on marine, brackish water and fresh water ecology and biodiversity and submitted to and implemented to the satisfaction



of the State Biodiversity Board and the CRZ authority. The report shall be based on a study of the impact of the project activities on the intertidal biotopes, corals and coral communities, molluscs, sea grasses, sea weeds, sub-tidal habitats, fishes, other marine and aquatic micro, macro and mega flora and fauna including benthos, plankton, turtles, birds etc. as also the productivity. The data collection and impact assessment shall be as per standards survey methods and include underwater photography.

6. Marine ecology shall be monitored regularly also in terms of sea weeds, sea grasses, mudflats, sand dunes, fisheries, echinoderms, shrimps, turtles, corals, coastal vegetation,
7. Mangroves and other marine biodiversity components including all micro, macro and mega floral and faunal components of marine biodiversity.
8. The project proponent shall ensure that water traffic does not impact the aquatic wildlife sanctuaries that fall along the stretch of the river.

XI. Environment Responsibility

1. The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest /wildlife norms/ conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the MoEF&CC as a part of six-monthly report.
2. A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.
3. Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.
4. Self-environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

X. Miscellaneous

1. The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at



their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

2. The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.
3. The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.
4. The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal.
5. The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.
6. The criteria pollutant levels namely; PM_{2.5}, PM₁₀, SO₂, NO_x (ambient levels) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.
7. The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.
8. The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.
9. The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Expert Appraisal Committee.
10. No further expansion or modifications in the project shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC).
11. Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.
12. The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory under the provisions of the Environmental (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.



13. The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.
14. The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.
15. The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.
16. Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
17. This issues with the approval of the Competent Authority.

Specific Conditions:

- i. Construction activity shall be carried out strictly according to the provisions of the CRZ Notification, 2011. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.
- ii. All the recommendations and conditions specified by the Maharashtra State Coastal Zone Management Authority (MCZMA) vide letter No CRZ 2020/CR 65/TC 4 dated 1st December 2020 shall be complied with.
- iii. Consent to Establish/Operate for the project shall be obtained from the State Pollution Control Board as required under the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974.
- iv. The Project proponent shall ensure that no creeks or rivers are blocked due to any activities at the project site and free flow of water is maintained.
- v. No underwater blasting is permitted.
- vi. Necessary approvals to be taken during implementation and commissioning from statutory bodies concerned.



- vii. Shoreline should not be disturbed due to dumping. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring report.
- viii. A continuous monitoring programme covering all the seasons on various aspects of the coastal and marine environs needs to be undertaken by a competent organization available in the State or by entrusting to the National Institutes/renowned Universities such as SACON or University of Mumbai with rich experiences in marine science aspects. Monitoring should include sea weeds, sea grasses, mudflats, sand dunes, fisheries, mangroves and other marine biodiversity components as part of the management plan.
- ix. Continuous online monitoring of air and water covering the total area shall be carried out and the compliance report of the same shall be submitted along with the 6 monthly compliance reports to the regional office of MoEF&CC.
- x. Sediment concentration should be monitored fortnightly at source and disposal location of dredging while dredging.
- xi. Spillage of fuel / engine oil and lubricants from the construction site are a source of organic pollution which impacts marine life, particularly benthos. This shall be prevented by suitable precautions and also by providing necessary mechanisms to trap the spillage.
- xii. Necessary arrangements for the treatment of the effluents and solid wastes/ facilitation of reception facilities under MARPOL must be made and it must be ensured that they conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986. The provisions of Solid Waste Management Rules, 2016. E- Waste Management Rules, 2016, and Plastic Waste Management Rules, 2016 shall be complied with.
- xiv. Dredging, etc will be carried out in the confined manner to reduce the impacts on marine environment. Dredged material shall be disposed safely in the designated areas as per CWPRS recommendations, and in no case shall be disposed in the marine environment.
- xv. Dredging shall not be carried out during the fish breeding season.
- xvi. While carrying out dredging, an independent monitoring shall be carried out by Government Agency/Institute to check the impact and necessary measures shall be taken on priority basis if any adverse impact is observed.
- xvii. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring report.
- xviii. The schedule of implementation for the recommendations of the rapid risk assessment report, disaster management plan and safety guidelines shall be prepared and submitted to the Ministry within 3 months. All the recommendations mentioned in the rapid risk assessment report, disaster management plan and safety guidelines shall be implemented in time bound



manner. The compliance to the recommendations as per schedule shall be submitted along with 6 monthly compliance reports to the regional office of MoEF&CC. Necessary arrangement for general safety and occupational health of people should be done in letter and spirit.

- xix. As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 30th September, 2020, the project proponent shall abide by all the commitments made by them to address the concerns raised during the public consultation. The project proponent shall initiate the activities proposed by them, based on the commitment made in the public hearing, and incorporate in the Environmental Management Plan and submit to the Ministry. All other activities including pollution control, environmental protection and conservation, R&R, wildlife and forest conservation/protection measures including the NPV, Compensatory Afforestation etc, either proposed by the project proponent based on the social impact assessment and R&R action plan carried out during the preparation of EIA report or prescribed by EAC, shall also be implemented and become part of EMP.

References & Readings

<https://164.100.213.216/E-Sign/Esign/ECL AUTH 738988 IA MH NCP 210987 2006.pdf>



HIGHWAYS

General Conditions:

- i. Cut and fill works shall be carried out strictly in accordance with the design drawings proposed at the time of appraisal of the project.
- ii. Sidewalk shall be provided along the bridges.
- iii. The drain shall be at least 1m away from the toe of the embankment of the road adopting IRC guidelines. Longitudinal drains shall be provided all along the project road to ensure proper drainage of the area. In addition, adequate number of under passes and culverts to act as cross drainage structures shall also be provided.
- iv. Blasting shall be carried out during fixed hours (preferably during mid-day) or as permitted by the concerned authority. The timing shall be made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions.
- v. Rain water harvesting including oil and grease trap shall be provided as prescribed by CGWB guidelines. Water harvesting structures shall be located at every 500m along the road. Vertical drain type rainwater harvesting structures shall be set up to minimize surface runoff losses of rainwater.
- vi. The embankments/slopes and the slopes left after cutting shall be provided with vegetative growth to avoid soil erosion.
- vii. Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water. The non-usable bitumen spoils shall be disposed off in a deep trench providing clay lining at the bottom and filled with soil at the top (for at least 0.5m)
- viii. Construction camps shall be proposed 500 m away from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for stockyards for construction materials shall be identified at least 1000m from water sources. Garbage tanks and sanitation facilities will be provided at camps.
- ix. Further attention of project proponent is drawn towards the following Acts/ Regulations' Statutes/ Guidelines issued from time to time:
 - i. All the Indian Road Congress (IRC) guidelines wherever applicable may be followed, Provisions related to tree cutting as contained in the Forest (Conservation) Act, 1980 and related rules of the respective state.
 - ii. Dust Mitigation Measures stipulated for Construction and Demolition Activities as provided in the amendment Notification GSR 94(E) dated 25.01.2018 of MoEF&CC.



- iii. Provisions for use of Fly ash as building material in the construction as per stipulated under Fly Ash Notification of September, 1999 and amended as on 27 August, 2003 and 25 January, 2016.
- iv. Provisions for management of construction and demolition activities related thereto as contained in Construction and Demolition Waste Management Rules, 2016.
- x. Cut and fill works shall be carried out strictly in accordance with the design drawings proposed at the time of appraisal of the project.
- xi. The drain shall be at least 1m away from the toe of the embankment of the road adopting IRC guidelines. Longitudinal drains shall be provided all along the project road to ensure proper drainage of the area. In addition, adequate number of under passes and culverts to act as cross drainage structures shall also be provided.
- xii. Blasting shall be carried out during fixed hours (preferably during mid-day) or as permitted by the concerned authority. The timing shall be made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions.
- xiii. Rain water harvesting including oil and grease trap shall be provided as prescribed by CGWB guidelines. Water harvesting structures shall be located at every 500m along the
- xiv. road. Vertical drain type rainwater harvesting structures shall be set up to minimize surface runoff losses of rainwater.
- xv. The embankments/slopes and the slopes left after cutting shall be provided with vegetative growth to avoid soil erosion.
- xvi. Construction spoils including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such materials must be secured so that they shall not leach into the ground water. The non-usable bitumen spoils shall be disposed of in a deep trench providing clay lining at the bottom and filled with soil at the top (for at least 0.5m)
- xvii. Construction camps shall be proposed 500 m away from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for Stockyards for construction materials shall be identified at least 1000m from water sources. Garbage tanks and sanitation facilities will be provided at camps.

Compliance Reporting

(a) The project proponent shall submit online six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change and also upload the same, including results of monitored data, on their company website.



Specific Conditions:

1. Project alignment should be managed in such a way to save the Heritage/old trees supposed to be affected by the proposed alignment
2. Faunal bio-diversity study has to be conducted and a report shall be submitted along with 6 monthly compliance report.
3. The proponent shall obtain Forest Clearance for diversion of forest land as per Forest (Conservation) Act, 1980. Proponent shall submit an undertaking that work on non-forestry land may only be executed up to such point (to be selected by the user agency) on either side of forest land if it is explicitly certified by the user agency that in case approval under the Forest (Conservation) Act, 1980, for diversion of forest land is declined, it is technically feasible to execute the project along an alternate alignment without involving diversion of forest land. Details of all such stretches along with alternate alignment identified to bypass the forest land should be explicitly provided in the proposal seeking approval under the Forest (Conservation) Act, 1980 and the EIA Notification, 2006.
4. EMP be revised to the extent that provisions are made in EMP for erection of watch towers (at intervals suggested by concern DFO) and engagement of patrolling team for patrolling along the road stretches passing through forest area for monitoring the crossing of animals through these roads, initially for first 5 years at the project cost.
5. 'Commencement of work in non-forest land will not confer any right to NHAI for granting approval under the Forest (Conservation) Act, 1980.
6. In borrow pits, the depth of the pit shall be regulated such that the sides of the excavation will have a slope not steeper than 1:2, from the edge of the final section of bank. Soil erosion checking measures shall be carried out. A general guideline for Borrow area operation and rehabilitation given in Annexure 3.3 of the EIA report shall be followed.
7. Quarry areas shall be barricaded during mining operations. The abandoned quarry shall be developed as water reservoirs with proper fencing around quarry area.
8. In all the construction sites within 150m of the nearest habitation, noisy construction work such as crushing, concrete mixing will be stopped during the night time between 10.00 pm to 6.00 am. No noisy construction activities will be permitted around educational institutions/health centres (silence zones) up to a distance of 100 m from the sensitive receptors. All plants and equipment used in construction shall strictly conform to the (CPCB/SPCB noise standards.
9. The proponent shall obtain permission from the competent authorities for tree felling along the proposed alignment.
10. Rain water harvesting pit shall be at least 3 - 5 m above the highest ground water table.



Green Belt

- ii. Green belt development (tree plantation) in lieu of the trees being felled in non-forest land should be carried out by the State forest department as deposit work and not by the private contractor. Green belt must be developed using exclusively native species including significant number of Ficus trees. No exotic species to be used for the same. A comprehensive plan for plantation shall be prepared in consultation with state forest department (executing agency) including the costs involved. Such compensatory plantation will be over and above the compensatory afforestation to be carried in lieu of the diversion of forest land, if any.
- iii. The proponent shall obtain permission from the competent authorities for tree felling along the proposed alignment.
- iv. Project alignment should be managed in such a way to save the Heritage/old trees supposed to be affected by the proposed alignment.
- v. Afforestation using compensatory plantation in the ratio of 1:10 shall be carried out. Native tree species shall be provided as per the IRC Guidelines on Landscaping and Tree Plantation (IRC: SP:21-2009). Effort should be made to plant native trees and Ficus species on both sides of the alignment. Special attention shall be given for protecting giant trees, and locally important trees (having cultural importance) and should be identified chainage wise.

Water Environment

- vi. No Ground water shall be extracted and used. Approval/permission of concerned authority shall be obtained before drawing surface water from canal or any other sources.
- vii. Rain water harvesting pit shall be at least 3 - 5 m above the highest ground water table.
- viii. In borrow pits, the depth of the pit shall be regulated such that the sides of the excavation will have a slope not steeper than 1:2, from the edge of the final section of bank. Soil erosion checking measures shall be carried out. Details for Borrow area operation and rehabilitation given in EIA report shall be followed.
- ix. Quarry areas shall be barricaded during mining operations. The abandoned quarry shall be developed as water reservoirs with proper fencing around quarry area. Details for Quarry area operation and rehabilitation given the EIA report shall be followed.
- x. While constructing the over bridges as proposed over major water bodies efforts should be made to avoid construction of pillars in beds of water bodies.



Pollution Control/Safety

- xi. In all the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing will be stopped during the night time between 10.00 pm to 6.00 am. No noisy construction activities will be permitted around educational institutions/health centres (silence zones) up to a distance of 100 m from the sensitive receptors. All plants and equipment used in construction shall strictly conform to the CPCB/SPCB noise standards.
- xii. Traffic Control Devices/Road Safety Devices/ Roadside Furniture including various types of cautionary, informatory, regulatory as mandatory signboards, road markers, studs, etc. shall be provided at appropriate locations all along the project stretch in accordance with the specifications laid down in Manual of Specifications and Standards for Expressways (IRC: SP:99-2013) and IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:79, IRC:103 and Section 800 of MORTH Specifications.
- xiii. Prepare the traffic prediction report for complete project (including all packages of this project) considering the cumulative impact of the traffic on the environment and submit to the Ministry and concerned Regional Office within 3 months.
- xiv. All the major, minor bridges and culverts should not affect the drainage systems. Flood plains of the rivers/ drainage systems are not to be disturbed.
- xv. As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 30th September, 2020, the project proponent shall abide by all the commitments made by them to address the concerns raised during the public consultation. The project proponent shall initiate the activities proposed by them, based on the commitment made in the public hearing, and incorporate in the Environmental Management Plan and submit to the Ministry. All other activities including pollution control, environmental protection and conservation, R&R, wildlife and forest conservation/protection measures including the NPV, Compensatory afforestation etc., either proposed by the project proponent based on the social impact assessment and R&R action plan carried out during the preparation of EIA report or prescribed by EAC, shall also become part of EMP and shall be implemented.
- xvi. Proponent shall keep the finish road level sufficiently elevated from ground level with provision of railing on both sides to restrict animal crossing in order to avoid the possibility of wildlife injury/death. Animal underpasses, watch tower, water holes and other mitigation measures proposed shall be constructed in supervision of forest department. Animal underpasses should be as stated in 3.8.22 ii, iii, iv
- xvii. Proponent shall keep the finish road level sufficiently elevated from ground level with provision of railing on both sides to restrict animal crossing in order to avoid the possibility of wildlife injury/death. Major water bodies have been observed in the vicinity of the proposed road alignment & may be potential



- human elephant conflict points, appropriate no. of animal safe passages as per the guideline framed by the Wildlife Institute of India and in consultation with Chief Wildlife Warden.
- xviii. No Ground water shall be extracted and used, Approval/permission shall be obtained before drawing surface water from canal or any other sources.

References & Readings

<https://164.100.213.216/E-Sign/Esig/ECL AUTH 284K31 IA KA MIS 75227 2018.pdf>

<https://environmentclearance.nic.in/writereaddata/Form-1A/EC/051020211EC10-44-2020.pdf>



BUILDING AND CONSTRUCTION

General Conditions:

- The Ministry of Environment and Forest has made it mandatory to obtain environmental clearances for construction projects having covered built-up area greater than 20,000 sq.m.
- Construction material at the site and on the vehicles that carry them should be properly covered.
- Keeping the ground at construction sites wet to let the dust settle and inhibit it from spreading.
- Setting barriers around construction site and covering mounds of sand with dust barrier sheets.
- The construction companies are being asked to submit reports on the current status of construction and steps being taken by them to comply with the ministry of environment and forests guidelines, 2010, on prevention of dust and garbage accumulation on their construction sites
- Littering or obstruction to public drains, water bodies, traffic and direct dumping of construction and demolition (C&D) waste in landfill sites should not be done.
- According to the C&D Waste Management Rules, 2016. The system should contain proper collection of segregated C&D waste from the generator, proper transportation of waste, storage of waste followed by proper processing of waste into recycled or reusable products that have market value and where minimal rejects are produced which get disposed in designated landfills.

References & Readings

<https://www.airveda.com/blog/Pollution-due-to-construction-Is-it-solvable>

**Table General Standards For Discharge Of Effluents**

S. No	Parameter	Standards			
		Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
		(a)	(b)	(c)	(d)
1	Color & odour	*	—	*	*
2	Suspended solids mg/l, Max	100	600	200	1. For process waste water-100 2. For cooling water effluent 10% above total suspended matter of influent
3	Particle size of suspended solids	Shall pass 850 Micron IS sieve	—	—	1. Floatable solids max. 3 mm
4	pH Value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	2. Settleable solids max. 850 microns 5.5 to 9.0
5	Temperature	Shall not exceed 5 ⁰ C above the receiving water temperature	—	—	Shall not exceed 5 ⁰ C above the receiving water temperature
6	Oil and grease mg/ l Max.	10	20	10	20
7	Total residual chlorine mg/l Max.	1.0	—	—	1.0
8	Ammonical Nitrogen (as N), mg/l Max.	50	50	—	50
9	Total Kjeldahl nitrogen (as NH ₃), mg/l Max.	100	—	—	100
10	Free ammonia (as NH ₃), 5.0 mg/l Max.	—	—	—	5.0



11	Bio-chemical oxygen demand (3 days at 27 ⁰ C), mg/l max.	30	350	100	100
12	Chemical oxygen demand, mg/l max.	250	—	—	250
13	Arsenic (as As), mg/l max.	0.2	0.2	0.2	0.2
14	Mercury (as Hg), mg/ l max.	0.01	0.01	—	0.01
15	Lead (as Pb), mg/l max.	0.1	1.0	—	2.0
16	Cadmium (as Cd), mg/l max.	2.0	1.0	—	2.0
17	Hexavalent chromium (as Cr +6), mg/l max.	0.1	2.0	—	1.0
18	Total chromium (as Cr), mg/l max.	2.0	2.0	—	2.0
19	Copper (as Cu), mg/l max.	3.0	3.0	—	3.0
20	Zinc (as Zn), mg/l max.	5.0	15	0.05	15
21	Selenium (as Se), mg/l max.	0.05	0.05	—	0.05
22	Nickel (as Ni), mg/l max.	3.0	3.0	—	5.0
23	Cyanide (as CN), mg/l max.	0.2	2.0	0.2	0.2
24	Fluoride (as F), mg/l max.	2.0	15	—	15
25	Dissolved phosphates (as P), mg/l max.	5.0	—	—	—
26	Sulphide (as S), mg/l max.	2.0	—	—	5.0
27	Phenolic compounds (as C ₆ H ₅ OH), mg/l max.	1.0	5.0	—	5.0



28	Radioactive materials: a. Alpha emitter micro curie/ml b. Beta emitter micro curie/ml	10 ⁻⁷ 10 ⁻⁶	10 ⁻⁷ 10 ⁻⁶	10 ⁻⁸ 10 ⁻⁷	10 ⁻⁷ 10 ⁻⁶
29	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30	Manganese (as Mn), mg/l	2	2	—	2
31	Iron (as Fe), mg/l	3	3	—	3
32	Vanadium (as V), mg/l	0.2	0.2	—	0.2
33	Nitrate nitrogen, mg/l	10	—	—	20
*All efforts shall be made to remove colour and unpleasant odour as far as practicable					
These standards shall be applicable for industries, operations or processes other than those industries, operations or process for which standards have been specified of the Environment Protection Rules, 1989					
Source: G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986					



Pollution Element and Applicable Legislation

S. No.	Pollution Element	Applicable Laws
1	Air	National Ambient Air Quality Standards (NAAQS), Central Pollution Control Board Notification (CPCB), dated 18th November 2009 under The Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987.
2	Noise Level	Noise Pollution (Regulation and Control) Rules, 2000 under Environment (Protection) Act, 1986.
3	DG Set Noise	Environment (Protection) second Amendment Rules vide GSR 371(E), dated 17th May 2002 at serial no.94 and its amendments vide GSR No 520(E) dated 1st July 2003; GSR 448(E), dated 12th July 2004; GSR 315(E) dated 16th May 2005; GSR 464(E) dated 7th August 2006; GSR 566(E) dated 29th August 2007 and GSR 752(E) dated 24th October 2008; G.S.R. 215 (E), dated 15th March, 2011 under the Environment (Protection) Act, 1986)
4	Water	Water (Prevention and Control of Pollution) Act, 1974 and as amended in 2003 (General Standards for Discharge of Environmental Pollutants from CPCB).
5	Waste	
5.1	Hazardous Waste	Hazardous & other Wastes (Management & Transboundary Movement) Rules, 2016 and Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2008 under Environment (Protection) Act, 1986
5.2	E-Waste	E-Waste (Management) Rules, 2022 to become effective from 1 st April 2023 under Environment (Protection) Act, 1986
5.3	Solid Waste	Solid Waste Management Rules, 2016.
5.4	Bio Medical Waste	Bio-Medical Waste Management Rules, 2016 under Environment (Protection) Act, 1986
5.5	Plastic Waste	Plastic Waste Management Rules, 2016 under Environment (Protection) Act, 1986
5.6	Battery Waste	Battery Waste Management Rules, 2022, under Environment (Protection) Act, 1986
5.7	Construction & Demolition Waste	C&D Waste Management Rules 2016 and latest Guidelines issued by Central Pollution Control Board
6	Environment Clearance	Environment (Protection) Act, 1986.

Source: CPCB



Hazardous Waste Management

The SCHEDULE I of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 includes a tabulated list of processes that generate hazardous wastes [See rule 3 (1) (17) (i)]. The hazardous waste created by leather tanneries and chromium containing residue and sludge is listed in item 30, 30.1.

PROCEDURE FOR MANAGEMENT OF HAZARDOUS AND OTHER WASTES

The responsibilities of the occupier for the management of hazardous and other wastes are outlined in the provided information:

- 1. Prevention, Minimization, Reuse, Recycling, Recovery, and Safe Disposal:** The occupier must follow steps to manage hazardous and other wastes, including preventing waste generation when possible, minimizing waste production, promoting reuse of materials, recycling where applicable, recovering resources from waste, and ensuring safe disposal of waste.
- 2. Safe and Environmentally Sound Management:** The occupier is responsible for managing hazardous and other wastes in a manner that is safe and environmentally sound. This includes taking necessary precautions to protect human health and the environment during waste handling and disposal.
- 3. Sending Waste to Authorized Users or Disposal Facilities:** The hazardous and other wastes generated in the establishment of the occupier must be sent or sold to an authorized actual user or disposed of in an authorized disposal facility. This ensures that the waste is managed properly by authorized entities.
- 4. Containment and Safety Measures:** The occupier must take all necessary steps to manage hazardous and other wastes in a way that contains contaminants, prevents accidents, and limits their impact on human beings and the environment.

These responsibilities are designed to ensure that hazardous and other wastes are managed in a manner that minimizes risks to human health, the environment, and promotes sustainable waste management practices.



PACKAGING, LABELLING, AND TRANSPORT OF HAZARDOUS AND OTHER WASTES

1. Hazardous waste handlers and treatment facility operators must package wastes safely based on guidelines issued by the Central Pollution Control Board (CPCB) and label them using Form 8.
2. Labels for hazardous waste containers should be non-washable, weatherproof, and easily visible.
3. Transportation of hazardous and other wastes must comply with relevant rules under the Motor Vehicles Act and CPCB guidelines.

Overall, the aim is to ensure safe handling, storage, and transport of hazardous wastes to prevent harm to human health and the environment.

References & Readings

Hazardous And Other Wastes (Management and Transboundary Movement) Rules, 2016

<https://cpcb.nic.in/displaypdf.php?id=aHdtZC9IV01fUnVsZXNfMjAxNi5wZGY>





Environmental Monitoring Programme

General Regular monitoring of environmental factors is essential to assess the status of the surrounding environment during the planned project's construction and operating phases.

A thorough understanding of the existing baseline environmental conditions, combined with data from the monitoring program, will serve as an indicator of any deterioration in environmental conditions caused by the proposed project. To protect the environment, appropriate mitigating measures can then be implemented.

Environmental monitoring is a crucial tool for assessing the effectiveness of mitigating measures.

Any EIA is only conducted for a limited time, and the baseline data gathered cannot capture all modifications caused by natural or human activity. As a result, constant monitoring of environmental factors is required to track changes in environmental quality. The following are the goals of the environmental monitoring program:

1. Verification of the efficacy of planned decisions
2. Evaluation of the efficacy of operational methods
3. Identifying any deviations from the current/expected baseline circumstances
4. Verification of the effectiveness of additional mitigating measures taken if necessary.

According to the MoEF&CC guidelines, regular monitoring of environmental parameters, as well as compliance with various conditions mentioned in the EC letter, must be submitted to the MoEF&CC and SPCB to ensure effective implementation of various mitigation measures, as well as limiting pollution caused by the proposed project's various activities.

Along with the baseline data, a regular monitoring program will serve as an indicator of worsening in environmental conditions caused by the planned project's construction and operation.

The monitoring program will be implemented not just at the project site, but also throughout the planned project's 10-kilometer research region.



Figure 20:: Environmental Monitoring Program

References & Readings

<https://environmentclearance.nic.in/writereaddata/Form-1A/EC/041620181AKIIndiaPvtLtdEC.pdf>

Green Book by CPCB 7th Edition Pollution Control Law Series 2021



Emergency Preparedness Plan

Introduction

Emergency preparedness plan involves identifying the potential risks and hazards of selected infrastructure sites

Risk is a potential that a chosen action or activity may lead to a loss of human or property. Risk assessment is a step for Risk Management. Risk assessment is determination of qualitative and quantitative value of risk related to a situation or hazard.

Hazard is a situation that poses a level of threat to life health or environment. Disaster is a natural or man-made hazard resulting in an event of substantial extent causing significant physical damage or destruction or loss of life or drastic change in environment.

Risk assessment involves the following:



Figure 21: Emergency Preparedness Plan

On-Site Emergency Plan

An onsite emergency is caused by an accident or hazard that takes place within the plan area and the effects are confined to the site.

The onsite emergency plan consists of following key elements:

- Planning as per hazard analysis
- Preventive measures



- Emergency response procedure
- Recovery procedure

Planning

1. Mapping of hazard vulnerable area.
2. There shall be Disaster Management Cell in place.
3. The disaster management cell have following members to share the responsibility:
 - Site Controller (Administrator of complex)
 - Incident Controller (Asstt. Administrator)
 - Personal Manager
 - Communication Officer
 - Fire Officer
 - Security Officer
 - Engineering In-charge
 - Fire pump attendant
 - First Aid Team

Preventive Measures

EARTHQUAKE:

The projects of Seismic zone-IV area should be given special attention through structural design of foundation, elements of masonry, timber, plain concrete, reinforced concrete, pre-stressed concrete, and structural steel. All applicable guidelines should also be followed in this regard to ensure safety of the building.

FLOODING:

To avoid flooding or water logging in the area due to the existing nearby drain & canal, the site must be raised and elevated suitably.

Proper designing of drainage system for domestic as well as storm water shall be done. All the rainwater must be diverted to rainwater harvesting pits & recharge the ground water and extra water to be diverted in sewer line of area.

**FIRE AND LIFE SAFETY:**Safety Precautions:

- Smoking must be prohibited.
- Ventilation must be sufficient to cope with the maximum expected vapor levels.
- Storage tank vents to atmosphere should be sized for fire-heated emergency vapor release.
- Electrical equipment must be explosion-proof to meet national electrical code requirements.
- Dry chemical extinguishers should be accessible for small fires. An adequate supply of hand-held and wheeled types should be available.
- Hydrants should be strategically placed with adequate hoses.
- Small spills should be remediated with sand, earth, or other non-combustible absorbent material, and the area then flushed with water. Larger spills should be diluted with water and diked for later disposal.
- Lighting should be grounded. Tall vessels and structures should be fitted with lightning conductors that are securely grounded.

HANDLING AND STORAGE OF CHEMICALS:

- Shall be kept away from heat, sparks, and flame. Keep away from sources of ignition.
- Store in a tightly closed container.
- Shall be stored in a cool, dry, well-ventilated area away from incompatible substances.
- Storage & handling area shall be readily accessible with safety showers, fire extinguishers and other fire-fighting equipment, water hydrants with spray nozzle and
- other emergency equipment such as chemical proof suits and respiratory apparatus.
- Spills / Leaks: Spills will be absorbed with inert material (e.g. vermiculite, sand or earth), they will be placed in suitable container.
- All sources of ignition shall be removed, and a spark-proof tool shall be used. Ventilation shall be provided and a vapor suppressing foam shall be used to reduce vapors.



- Hazardous materials must be stored in a separate safety storage room, shall be kept away from sources of ignition.
- In case of fire outbreak due to sodium sulphide use flooding quantities of water, foam or dry powder as extinguishing agents.
- Sulphuric acid is not flammable or combustible. However, fires may result from the heat generated by contact of concentrated sulphuric acid with combustible materials.
- In case of fire outbreak use dry chemical or carbon dioxide extinguishers or water spray to cool fire-exposed containers. Do not use water directly on acid as a violent reaction may occur resulting in spattering of the acid.

Off-Site Management Plan

If an accident take place in the tannery unit and its effect are felt outside the tannery unit

area, the situation thus created is called an offsite emergency.

The main objectives of the off-site emergency plan are:-

- i. To save lives and injuries.
- ii. To prevent or reduce property losses and
- iii. To provide for quick resumption of normal situation or operation.

Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 prescribes for the constitution of the State Crisis Group as apex body at the State Level to deal with major chemical accidents and to provide expert guidance for handling major chemical accidents and for the constitution of District and Local Crisis Groups.

Risk assessment is most essential before preparing any off site emergency plan. Mock exercises on Off-site plan should be carried out at least once in a year to train the employees, up to date the plan, observe and rectify deficiencies.

References & Readings

<https://environmentclearance.nic.in/DownloadPfdFile.aspx?FileName=d41B89VMEw1guDCie4j9IM5N+u2izgm6EL1fmb1IJXCiWhxpNVDxXR1b2/df2rtNkOqOwSElIkdTga+y/LIBYxuFblfpDCyY7Ykr3qyvJcs=&FilePath=93ZZBm8LWEXfg+HAIQix2fE2t8z/pgnoBhDIYdZCzxXmG8GliH6H9UP1HygCn3pc6cozY6ep7R3LypBLCViIFVlc4CqzCG0mJyK0ayAJaE=>



Summary

It is necessary for India to overcome deficiencies in its infrastructure sector and improve service quality in both urban and rural areas. Most importantly, India must utilize the full potential of its growing urban economy in order to raise its contribution to the national GDP.

The project proponent can use this e-guide to ensure compliance with the project's environmental clearance conditions. E-guide will give understanding of the sectoral guidance and provide an evaluation of effective environmental enforcement and compliance programs.

Regular environmental monitoring is essential to fill the gaps left by EIAs, track the actual impacts during project implementation, and verify the effectiveness of planning decisions and mitigation efforts. It allows for timely adjustments and corrective actions to safeguard the environment effectively.