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"Health, Safety and Environment Management Plan in Construction"

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Abstract - In India the Construction industry is one the most integral industry and it also forms a vital role in contributing to the economy growth of the country. People of wide range ranging from skilled , unskilled to semi skilled are provided employment by this industry as this industry is very labor intensive .Despite this there has been many reported accidents , ill health problems and damage cause to the Environment during the execution phases of the construction works . Knowledge however for the management Plan for the Health , Safety. And the Environment Management Plan is limited in the Industry . The aim of the study is therefore aimed at finding the plans to be followed in real life at the sites , to find and analyze the deficiencies and also to suggest ways to mitigate them in the context of the Indian Industry .

While meeting the objective of the study for my case study two metro projects were studied one the Delhi metro project and the other one being the Mumbai Metro project . Both the projects were studied for their environment management plans which is being followed and the mitigation methods adapted by the authorities .The study aims at going through the literature reviews and to understand and see that whether the facts mentioned are being followed at the site and what are the things which is being lacked .

***Keywords*: Health, Environment Management plan, Occupational Health, Safety Management,NEPT**

1. INTRODUCTION

There has been a considerably good amount of growth in India's Construction Industry from the past years. With the increase in population there has been an directly an increase in the demand for the consumers from the commercial as well as the Residential sectors which in turn has increased the activities of Construction in and around the Country and there has been a rise in the urbanization. The workers are subjected to various fatalities when the work in risky areas in the construction site which had led to their health issues. The poor working conditions has always lead to increase in disabilities and at many places severe injuries at the site which indirectly effects the projects productivity and the overall performance of the project.

Environment has always been in threat with some or the other issues when there is an ongoing construction activities in and around the place, with the publication of ISO 14000 it has been spread among the companies for them to follow it and make proper EMS plans accordingly in order to safeguard the environment. With the increase in the awareness in the issues regarding the environment had lead to a change in the behavior in the minds of the promoters of the engineering projects and they have started their asking for the submission from the contractors for the efficient EMP accordingly. But this is not widely being seen as this culture is mostly seen in the large construction firms who can afford to dedicate much resources for this. The construction firm need not only take the schedule and budget of the owner as a threat but also should take the impact which their project might have on the environment as a threat and developing this attitude will surely help in maintaining the environment.

When there is a lack of proper EMS it may give rise to even small issues like release of hazardous substance or its spill which may have an adequate amount of impact on the health of the Environment and may pose a cost for its cleaning too. It has been seen that many of the companies do not consider Environment as an important issue this may due to a number of reasons like one being lack of awareness or the other can be they do refrain from bearing on the additional costs which is associated with the application and implementation of the EMS. Being as unorganized sector, the fatal injury rate for the construction industry is higher than the national average in this category for all industries.

1.1 ENVIRONMENT MANAGEMENT PLAN

The Environment Management Plan (EMP) would consist of all mitigation measures for each component of the environment due to the activities increased during the construction, operation and the entire life cycle to minimize adverse environmental impacts resulting from the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to Be taken in case of emergency such as accidents at the sites including fire. The detailed EMP for the complex is given below.

1.2 Environmental Management Plan

The Environment Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all contractors and subcontractors, including consultants, understand the potential environmental risks arising from the project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate mitigation actions to reduce adverse environmental impacts during its life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who will be in-charge of the responsibilities to manage the project site.

1.3. *The EMP is* generally

- Prepared in accordance with rules and requirements of the MoEF and CPCB/ SPCB
- To ensure that the component of facility are operated in accordance with the design
- A process that confirms proper operation through supervision and monitoring
- A system that addresses public complaints during construction and operation of the facilities and
- A plan that ensures remedial measures is implemented immediately.

The key benefits of the EMP are that it offers means of managing its environmental performance. There by allowing it to contribute to improved environmental quality. The other benefits include cost control and improved relations with the stakeholders.

1.4EMP includes four major elements

- Commitment & Policy: The management will strive to provide and implement the Environmental Management Plan that incorporates all issues related to air, water, land and noise.
- Planning: This includes identification of environmental impacts, legal requirements and setting environmental objectives.
- Implementation: This comprises of resources available to the Society, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.
- Measurement & Evaluation: This includes monitoring, counteractive actions and record keeping.

It is suggested that as part of the EMP, a monitoring committee would be formed by Indian Railway Welfare Housing Organisation comprising of the site in-charge/coordinator, environmental group representative and project implementation team representative. The committee's role would be to ensure proper operation and management of the EMP including the regulatory compliance

1.5. OBJECTIVES

- The study mainly focusses on the Environment management Plan made by the Delhi metro and also the Mumbai metro and to assess and analysis their management plan for the environment for the construction of the Metro Lines.
- The objective is to filter out the practices which are currently being employed for the EMP and its management in the sites of construction and how are they benefiting in maintaining the Environment Quality.
- The study aims to analyze the deficiencies and the find out and suggest ways to mitigate them during the operation phase.
- Also with the circulation of questionnaire the factors which have more impacts on the environment are being found out by voting from the professionals and the data is being analyzed as to what construction activities professional consider as a threat to the Environment.

2. LITERATURE REVIEWS

The study here shows that on the safety culture there is an impact due to the safety leadership at the workplace and it in turn improves the employee behavior and also their safety performance. In the work place for improving the safety culture, it requires employees and the management to get aligned to each other. For increasing the safety performance it is utmost important to improve the safety interactions within the organization.

It shows that the front line management has influence to a greater extend .in the organization its seen that how the behavior of the middle managers is influenced by the senior managers, and that the front line managers are influenced by the middle managers and the employees behavior is directly influenced by the behavior of the front line managers.

In Relation with the safety performances the competencies of the executives at the top positions can have an in depth effect. Another main and practical level which this report suggests is that guidelines are being provided for benefiting

the workplace by adapting the safety culture by the top level executives by the top level executives.

3. METHODOLOGY

Quantitative research method is basically characterized by the tangible data like the measurements which are physical in nature. It mainly involves asking questions taking reviews from the surveys conducted. So for my quantitative approach I aim to float a questionnaire among the professional belonging to the construction field and get reviews from them regarding the same. The main advantage of this method is that through set questions we can get reactions from quite a good set of questions and based on it can formulate our statistics and graphs.

Coming on to the second method of the research it's the Quantitative research approach. In this I basically incorporated the subjective knowledge of the subject which in followed in the real life situations. Here the organizations and also the individuals are viewed in a holistic manner rather than an isolated manner. In this method the literature reviews and the case studies were analyzed and data was obtained from both the analysis. Going through the case studies I got an insight as to the plans and the strategies formulated by the companies for implementing a particular plan in the construction activities. Thus this study gave the information through data collections, knowledge claim mentioned and also their descriptive programs

3.1RESEARCH APPROACH

A. The Collection of Sample:

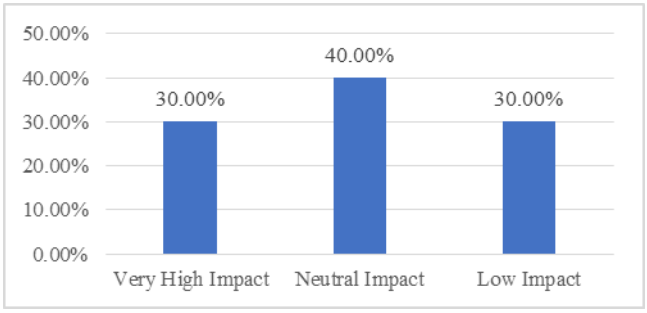
- For the quantitative study practitioners like Architects, Engineers will be surveyed who is or has been part of the construction Industry.

B. The Collection of data

- In the initial stage I made a list of the probable impacts on the environment which could impact or leave an impact on the Environment in some or the other way.
- So then the impacts were formulated in the form of questionnaire and the respondents were asked to rate the same on the scale of 1 to 3 with,
    - being having a very high impact
    - being having a neutral Impact
    - being having a very low impact
- Majorly 9 main areas were analyzed for calculating which of the area has major impact as per the votes.
- The areas covered were Bio diversity , local issues , issues arising on the atmosphere , alterations of the solid , management of the wastes generated, management of the water usage , consumption and management of the Resources, impacts related to the transportation activities

4. Data collection from Various Builders and Contractors

Q. The Impact of emission of greenhouse gases during manufacturing and transporting of building materials.

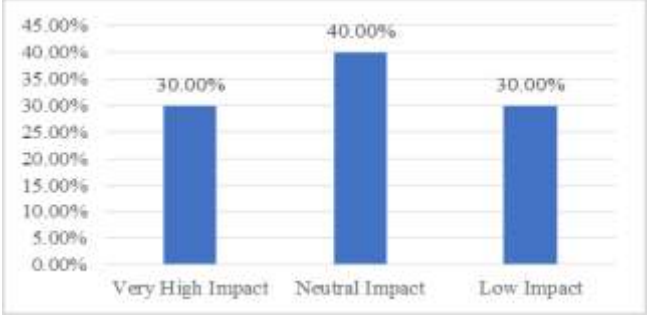


Graph No-1- Impact of emission of green house gases during manufacturing and transporting of building materials

	Answer	Count	Percent
1.	Very high Impact	06	60.00%
2.	Neutral Impact	03	30.00%
3.	Low Impact	01	10.00%
	Total	10	100%

Table No-1- Impact of emission of green house gases during manufacturing and transporting of building materials

Q. The Impact on environment due to the damage on the Air Quality.

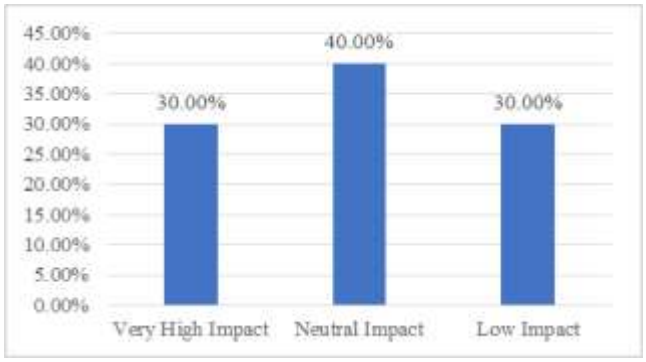


Graph No-2- Impact on environment due to the damage on the Air Quality

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	3	30.00%
3.	Low Impact	2	20.00%
	Total	10	100%

Table No-2-Impact on environment due to the damage on the Air Quality

Q. The Impact on environment due to water emitted from Excavations

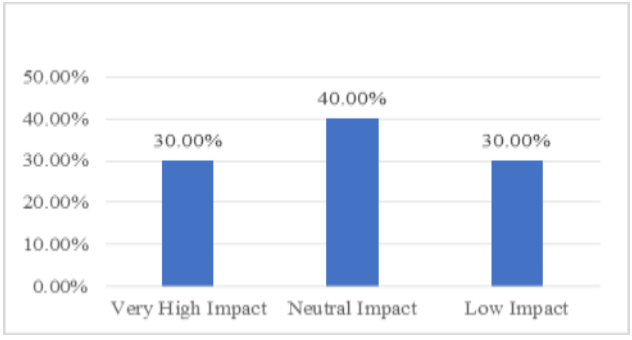


Graph No-03- The Impact on environment due to water emitted from Excavations

	Answer	Count	Percent
1.	Very high Impact	3	30.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	3	30.00%
	Total	10	100%

Table No-03- The Impact on environment due to water emitted from Excavations

Q. The Impact on environment due to water emitted from cleaning tools

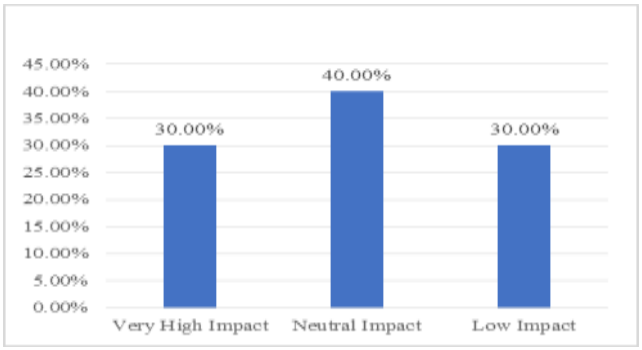


Graph No-04- The Impact on environment due to water emitted from cleaning tools

	Answer	Count	Percent
1.	Very high Impact	2	20.00%
2.	Neutral Impact	4	44.00%
3.	Low Impact	4	36.00%
	Total	10	100%

Table No-04- The Impact on environment due to water emitted from cleaning tools

Q. The Impact on environment due to waste generated through excavation.

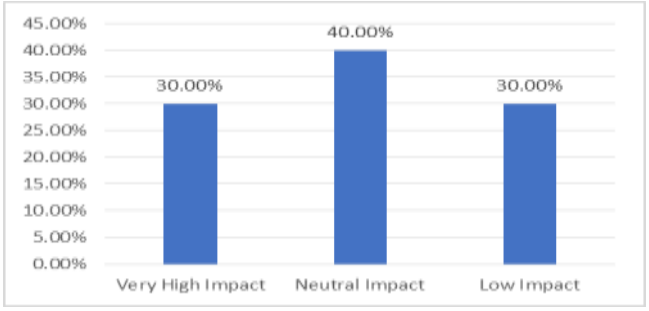


Graph No-05- Impact on environment due to waste generated through excavation.

	Answer	Count	Percent
1.	Very high Impact	4	40.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	2	20.00%
	Total	10	100%

Table No-05- Impact on environment due to waste generated through excavation.

Q. The Impact on environment due to waste generation during Execution (packing material waste, solid waste, etc)

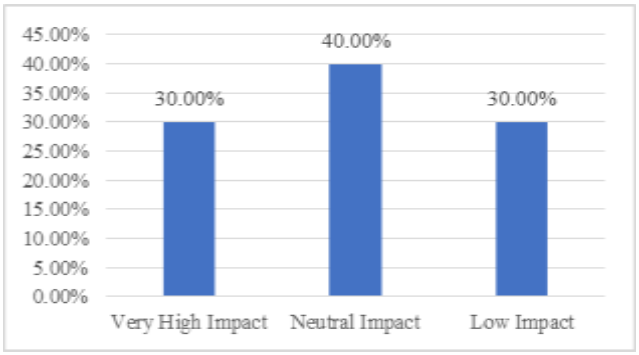


Graph No-06- The Impact on environment due to waste generation during Execution (packing material waste ,solid waste ,etc)

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-06- The Impact on environment due to waste generation during Execution (packing material waste , solid waste, etc)

Q. The Impact on Environment due to land use like deforestation/vegetation removal/Soil erosion

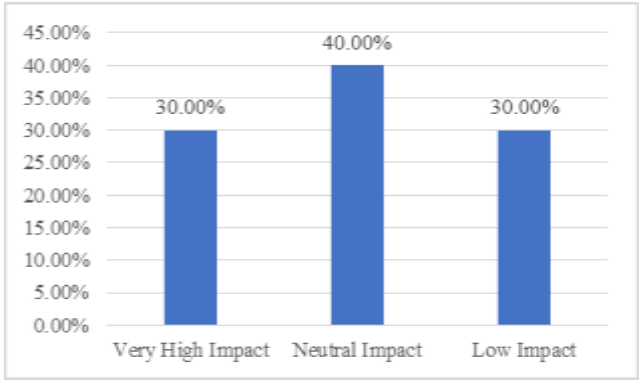


Graph No-07- Impact on Environment due to land use like deforestation/vegetation removal/Soil erosion

	Answer	Count	Percent
1.	Very high Impact	8	80.00%
2.	Neutral Impact	2	20.00%
3.	Low Impact	0	0.00%
	Total	10	100%

Table No-07-Impact on Environment due to land use like deforestation/vegetation removal/Soil .

Q. The Impact on Environment due to concrete release agent on soil

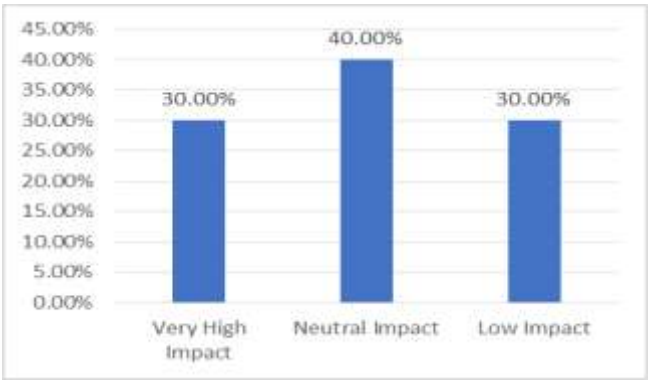


Graph No-08-Impact on Environment due to concrete release agent on soil

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-08-Impact on Environment due to concrete release agent on soil

Q. The Impact on Environment due to use of heavy machinery on Soil

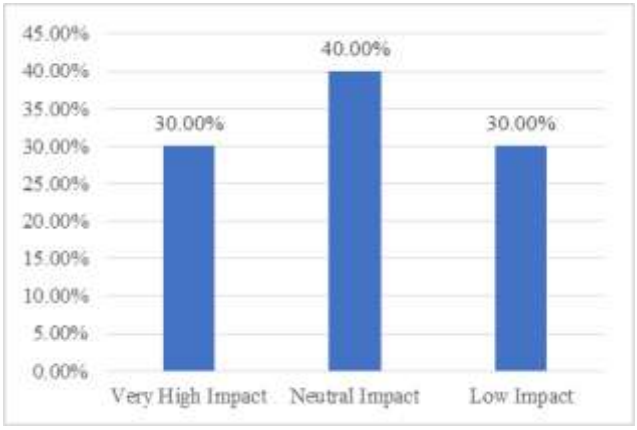


Graph No-09-Impact on Environment due to use of heavy machinery on Soil

	Answer	Count	Percent
1.	Very high Impact	4	40.00%
2.	Neutral Impact	5	50.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-09- Impact on Environment due to use of heavy machinery on Soil

Q. The Impact on Environment due to excess consumption of raw materials in construction activities

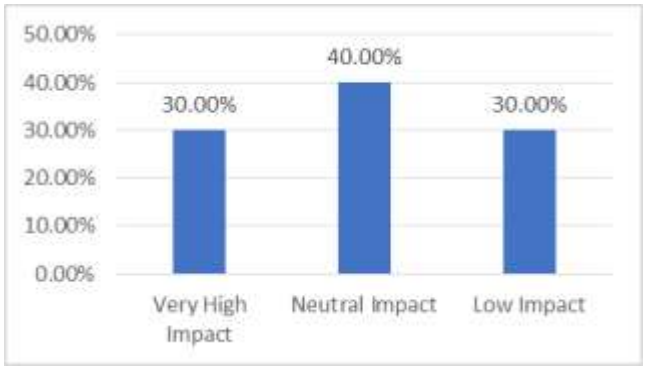


Graph No-10-Impact on Environment due to excess consumption of raw materials in construction activities.

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	3	30.00%
3.	Low Impact	2	20.00%
	Total	10	100%

Table No-10- Impact on Environment due to excess consumption of raw materials in construction activities.

Q. The Impact on Environment due to excess electricity/fuel consumption

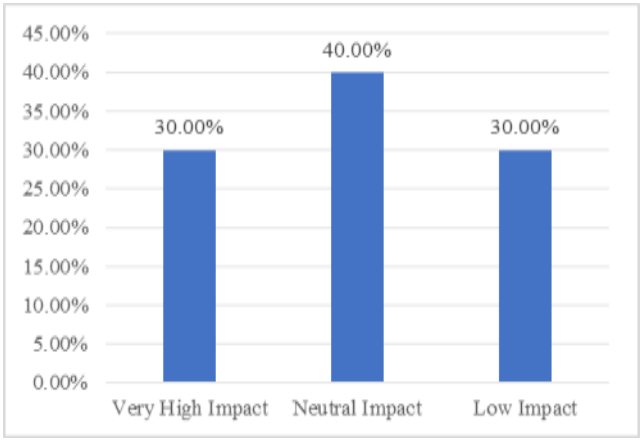


Graph No-11-Impact on Environment due to excess electricity/fuel consumption.

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-11- Impact on Environment due to excess electricity/fuel consumption.

Q. The Impact on Environment due to dust generation in earthwork.

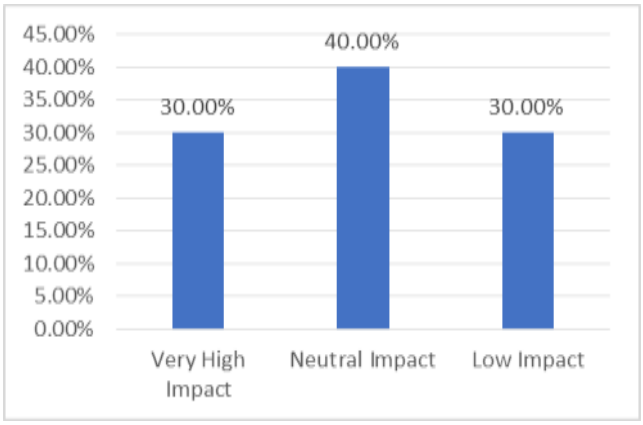


Graph No-12- Impact on Environment due to dust generation in earthwork.

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	3	30.00%
3.	Low Impact	2	20.00%
	Total	10	100%

Table No-12- Impact on Environment due to dust generation in earthwork.

Q. The Impact on Environment due to dust generation in cutting operation.

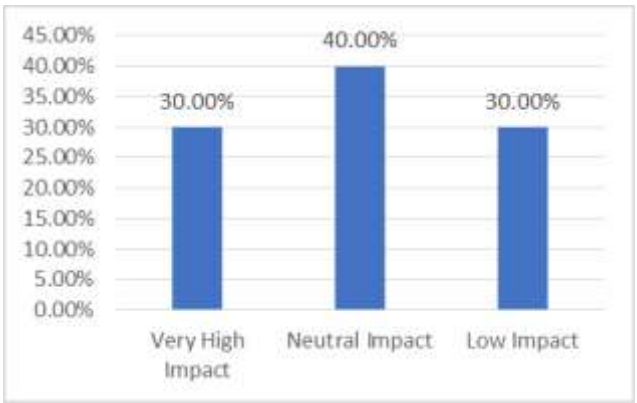


Graph No-13- Impact on Environment due to dust generation in cutting operation.

	Answer	Count	Percent
1.	Very high Impact	5	50.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-13- Impact on Environment due to dust generation in cutting operation.

Q. The Impact on Environment due to noise and Vibration generation.

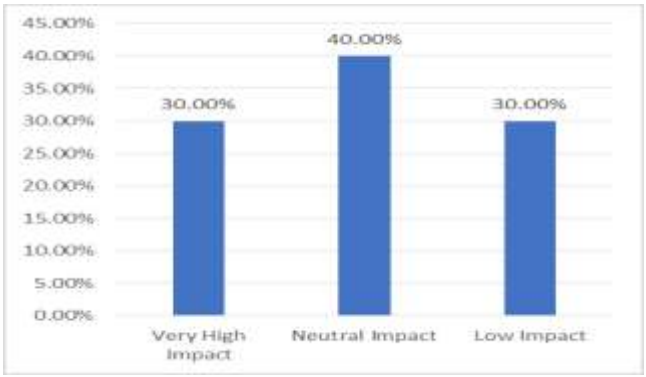


Graph No-14- Impact on Environment due to noise and Vibration generation.

	Answer	Count	Percent
1.	Very high Impact	5	40.00%
2.	Neutral Impact	4	40.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-14- Impact on Environment due to noise and Vibration generation.

Q. The Impact on Environment due to road traffic caused by vehicular movement around construction site.

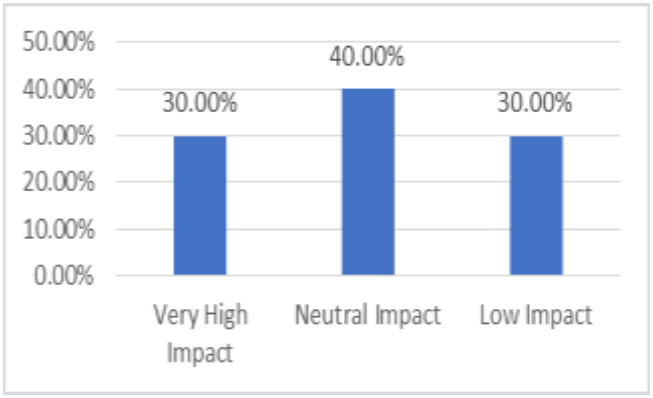


Graph No-15-Impact on Environment due to road traffic caused by vehicular movement around construction site.

	Answer	Count	Percent
1.	Very high Impact	3	30.00%
2.	Neutral Impact	5	50.00%
3.	Low Impact	2	20.00%
	Total	10	100%

Table No-15- Impact on Environment due to road traffic caused by vehicular movement around construction site.

Q. The Impact on Environment due to interception of water bodies.



Graph No-16- Impact on Environment due to interception of water bodies.

	Answer	Count	Percent
1.	Very high Impact	7	70.00%
2.	Neutral Impact	2	20.00%
3.	Low Impact	1	10.00%
	Total	10	100%

Table No-16- Impact on Environment due to interception of water bodies.

5. Discussion on Safety Management

1) Housekeeping

Its an act where accidents and all the injuries are avoided by keeping the working environment free from any wastes which are unnecessary.

- The employer needs to maintain a register formatted by the employer and keep a track that the depots, camps of the labor, toilets , the site offices and the stores and keep a track whether the cleaning activities is being carried at the site or not.
- To avoid the surrounding areas from the excavation activities and all necessary barricading and the fencing of full height needs to be provided in and around the site.
- No Blockages needs to be provided and there needs to be a provision of passage ways and stairways an the emergency exits and the stations needs to be kept unobstructed and in a working order.
- The road needs to be kept free for the movement of vehicles and so the road should be kept cleared from materials like bricks, concrete, pipes and steel.
- The contractor will be penalized if the road has any kind of spillage which may harm or cause a danger to the traffic.

2) Working at the Height

- Platform for Working : basically provided to give an access to the person at the place of his work. The necessary equipment's needs to be arranged which may include the cradle , trestle, platforms which are mobile, scaffolds and stairway wherever needed.
- Planning : proper planning needs to be carried out to see whether the working at the height is supervised appropriately , planned properly for the emergency and for the rescue operations.
- The conditions of the worker needs to be kept on mind and it needs to be seen that the weather conditions prevailing do not cause a damage to the person working in the open.
- The competency also needs to kept in mind for the person who has been employed to work at height and necessary training needs to be given to them.
- Throwing of materials from the height needs to be avoided as it may cause danger to the person who are working at the ground level.

3) Slipping and falling hazards

- To make the working place safe the nails which may be protruding or and other sharp projections shall be avoided.
- The working platforms at the heights on which the labors would be working needs to be kept free from oil and water to avoid any person from slipping while working.
- Necessary safety equipment's needs to be provided according to the working environment for preventing any damage to the persons employed.
- Safety nets needs to be provided at the sites where ever suitable.

4) Machinery for the construction activities

- The certificate of self-worthiness needs to be obtained for all the equipment's which are being planned to be used at site.
- The equipment's to be used needs to be in good mechanical conditions and the certificate for the same needs to be produced by the supplier.
- The conditions of the equipment's needs to be visually examined , the date of purchase needs to be seen , safety check needs to be carried out for the critical components and a checklist needs to be maintained for its examination.

5.1. Occupational Health of the Workers

1) The Workers physical fitness

- Medical examination of the employees needs to be done and the record also needs to be kept by them.
- No entry shall be permitted at the site in case the person is under the influence of any alcohol or drugs.

2) Medical facilities

- An health center needs to be arranged at the construction site which might be static or may be mobile and to be maintained in good condition. A qualified medical officer to be appointed at the center.
- Provision needs to be kept for the ambulance van and also arrangement needs to done with a hospital which might be the nearest for transportation of ambulance incase there occurs any serious accidents.
- A first aid box for every 100 workers needs to be kept arranged and at the disposal incase when they are required in emergencies.

3) Illumination and the Lighting arrangement

- If the work is being carried out in the tunneling work then the contractor is liable to provide the necessary system for the ventilation and care should be taken that the flow of fresh air is not $6m^3/min$ for each of the worker who has been employed in the underground and also the free flow of the air should not be less than 9m/min.
- In the working environment the level of oxygen need not be less than 19.5 %.
- As per the requirement of the client the contractor is liable to provide the illustrated requirement.
- Also there needs to be conducted monthly checks for the lux level at the site and needs to be send to the client of all the locations and report for the same needs to be maintained.

4) Radiation

- The substances and the apparatus which are probable of emitting radiations needs to be checked as per the regulations set by the government.
- The areas where the apparatus are placed needs to be have the necessary notices and barriers for warning signs as per the regulations.
- The storage of the apparatus needs to be done strictly as per the norms specified for the same by the government.
- Needs to be taken that the employees are not directly exposed to the radiation.

6. CONCLUSIONS

- The Study through the questionnaire mainly focused on the impacts caused on the Environment though the various construction activities being carried out .Through the study we got to know the views of the professionals like architects and engineers who have been working in the field and have quite an insight about the field and also came to to know as to how much importance do they give to the various impacts affecting the environment.

- The Study showed that of the total 16 impacts identified, the top impacts which were agreed upon by the professionals are , the removal of vegetation, the effect on the air quality, generation of noise, Management of water at the site, Management of the waste generated, management of the soil, Management plan for the diversion of traffic, management plan for the machinery mobilization.

- The result indicates that for the Green cover management the respondents gave the maximum preference as it had a major impact on the environment. So now I plan to study the metro projects at two different geographical locations and see that how are these factors being countered in their execution and what are the mitigation steps being taken by the respective authorities to counter the same.

7. RECOMMENDATIONS

- The Government needs to take steps in implementing the steps required for the sustainable construction which does not cause much impact to the environment as it has become a rising concern and the steps to be followed needs to become a mandatory concern. There are rules being implemented by the governments but to take steps at the right time is more important like we have seen in the case of Mumbai Metro case the permissions were taken but the trees were cut right before monsoon which left many birds homeless and this being the concern activists were seen protesting the metro rail construction as many trees were being cut for making way for the line.

- So I believe that the government and the authorities needs to come up and bring about some legislations and codes which incorporates all the environment factors and it needs to implemented throughout the countries Construction sites so that there is not further interference due to the stakeholders being involved. Before the work is being executed the activities o the construction needs to be subjected to the assessment of environmental impacts so that the potential impacts can be countered at an early stage.

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