

Environmental Risk Assessment For Residential Projects

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Abstract-The construction sectors are now a day's expanding rapidly with the different new sources, techniques but, if it not planned with consideration of environmental aspects, it would give significant negative impact to the surrounding environment. Construction is considered as one of the main reason of pollution in the nature. So for the awareness and proper utilization of resources in the residential projects regards to environmental effect of construction, needs to be enhanced. For this some management techniques are considered with environment management. In this management practices construction environmental management plans are prepared and for developing this Environmental Risk Assessment will be undertaken. In this paper the assessment of different construction aspects are taken .It may identifies some environmental impact factors by measuring environmental risk and finding their impact levels. Then further commenting on mitigation measures is required or not.

Keywords: Environmental Risk Assessment, Severity, Frequency, Environment impact Factor, Impact level.

I.INTRODUCTION

The construction sectors expanded rapidly in the 80's because of demand for the large number of residential houses. With this the new concept forms township projects. Construction is considered as one of the main source of environment pollution in the nature. Building construction and operations have massive direct and indirect effect on environment [1]. So awareness and proper utilization of resources in the residential projects regarding environmental effect of construction needs to be enhanced. For this some management techniques are considered with environment that is referred as Environmental Management. It is part of overall management system which consists of organized structure, planning, duties, practices, procedures and resources necessary for development, implementation, achievement and maintenance of the environmental policy. Construction Environmental Management Plan is an environmental management tool used to ensure that undue or reasonably avoidable adverse consequences of the construction, function and ceasing of a project are prevented and that the positive benefits of the projects are increased. It is an essential tool for ensuring that the mitigation of negative impacts and enhancement of positive impacts are carried out effectively during the project life cycle [2]. It is therefore intended that this is used in the spirit of continuous improvement and development, to help out in motivating best practices in environmental management, in a manner that acceptable, efficient and cost effective.

In developing the Construction Environmental Management Plan, an Environmental Risk Assessment will be undertaken. It is an essential step in the development of solutions for pollution problem and new environmental regulations. Environmental Risk Assessment is the identification and characterization of the nature of existing and potential adverse effects to humans and the environment resulting from exposure to environmental hazard. Risk is function of the probability of an event occurring and the degree of damage that would result should it

happen. Information from the environment assessment is required in order to conduct a risk assessment.

The risk assessment identifies all aspects of construction that could have an environmental impact and assesses the potential risk and impact of that activity on the environment.[3] Management controls are then devised to eliminate and/or minimize those identified impacts. Risk evaluating is the frequencies and consequences of risk occurrences of activity or exposure and generation of risks that arises from dangers, considering the adequacy of any existing controls, impacts and deciding whether or not the risk is acceptable.

The assessment is made at the site, local, area and regional level in Nasik. Special attention is paid to the site-wide and local levels when assessing impacts. In most assessments of environmental impact it is difficult to determine the quantitative value of the environmental change. So the semi-quantitative assessment considered which is based on scores.

In this paper the environmental risk assessment is identified with different environmental impacts or risks in construction by risk calculations. Then significance scoring is gives rating for each environmental aspect for finding risk rating.

II. METHODOLOGY

The main aim of this work is to find out the important factors causing environmental impacts in the construction projects in context particularly for environment risk. For this interview was taken. The interview invited respondents to rate the Frequency and severity of the environmental impact factors or risks using the five-point Likert Scale [4].

Determining the rate of environmental impacts depends on the probability of a frequency of occurrence and its severity of impact on the environment. Probability or frequency is a likelihood of construction activities potential being realized and initiating a series of impacts that could result in damage to the environment. The severity of the consequences is the extent of damage that could result from an impact on the environment.

With the Likert Scale the questionnaire survey is taken of eight major construction firms in Nasik. The mega residential projects townships are ongoing of these firms. In this firm respondents were from different level of organization and scale is use to determine the scoring of the important factors causing environmental risk. The twenty one questionnaire interview was carried out among this construction companies. The majority of these firms are operating in Residential and Commercial projects. The interviews were carried out among top-level managers with different areas of the companies. Top-level managers were selected for the interviews because they were assumed to have sufficient knowledge about the environmental management systems.

The factors considered in the study were identified from a literature review [1]. A total of 2 possible main factors and 12 sub factors, that were felt to have an effect on the environment of construction were determined. Similarly, the Sub-factors of these main factors were determined based on literature review and their impact rating were calculated according to the responses.

Respondents assign score from 0 to 5 for each main factors and sub factors according to their importance. A respondent refers Table 1 for assigning score to each main and sub factors at a time of questionnaire interview. Importance was decided on basis of expert talk opinion and discussion with the people who are actually in the field of management.

Table1. Likert Scale Used to Determine the Level of Frequency and Severity

Score	Severity	Frequency	Description
1	Insignificant	Minimal impact	Never
2	Minor	Short-term impact	Unlikely
3	Moderate	Significant impact	Possible
4	Major	Major short-term impact	Likely
5	Catastrophic	Major long-term impact	Always

Risk can be assessed and offered using matrices by working out probabilities and consequences in a qualitative manner or with quantitative values a risk matrix has been used to rank various risks in order of importance. A risk matrix is a table that includes several categories of probability, frequency, or likelihood for its rows and several categories of severity, consequences, or impact [4].

Table2. Risk Matrix

Level of Consequence	Description		Level of Frequency	Description	
1	Insignificant	X	1	Never	= probability
2	Minor		2	Unlikely	
3	Moderate		3	Possible	
4	Major		4	Likely	
5	Catastrophic		5	Always	

5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5

Consequences

The outcome matrix will give discern probable environmental impact levels for each common environmental impact in residential construction projects. The significant rating of a risk that is found in the literature is the product of the probability of occurrence and the consequence or net effect of that event shown, in Eq.1

$$R = F \times S \quad (1)$$

where R denotes the importance rating of a environmental impact level in a construction project; F is the frequency of occurrence, ranging from 1 to 5 which '1' is the least frequent and '5' is the extremely frequent; and S is the severity of impacts on the environment, ranging from 1 to 5 which '1' is the not sever and '5' is the extremely sever [1].

III. DISCUSSION AND RESULTS

A management panel was interviewed to rank the severity and frequency of some common environmental impacts in the different residential projects in Nashik. The responded gives scores to impact factors with five point Likert scale. By taking twenty one questionerrie surveys (n=21). They were having an experience of at list 2 years. The ranking of the level of severity and frequency is given by the calculations of scores. Then factors according to their

average scores of impacts are calculated with frequency of occurrence and severity of impact by the respondents as shown in Table3.

Table3. Calculation for the average of Common Environmental impacts Assessments of impact/risk factor (Natural Resources Impact).

Environmental Impact Factors		Frequency of Occurrence (F)	Severity Of Impact (S)	Impact level/Significant Rating (R=FxS)
Natural Resources Impact	Transportation fuel Resources	3.048	2.86	8.73
	Energy Consumption on Site	2.952	2.90	8.56
	Raw Materials Consumption on site	2.619	2.33	6.10
	Electricity Consumption	2.952	2.62	7.74
	Total Impact level			38.86

Table4. Calculation for the average of Common Environmental impacts Assessments of impact/risk factor (Ecosystem Impact).

Environmental Impact Factors		Frequency of Occurrence (F)	Severity Of Impact (S)	Impact level/Significant rating (R=FxS)
Ecosystem Impact	Noise pollution	2.67	3.14	8.38
	Dust Generation with Construction Machinery	2.57	2.71	6.96
	Land pollution	2.48	2.48	6.15
	Air pollution	2.52	2.67	6.72
	Operations with Vegetation Removal	3.19	3.00	9.57
	Toxic generation at site	1.86	1.90	3.53
	Green House Gas Emission	1.57	1.29	2.03
	Vibration Generation with Construction Machinery	2.24	2.48	5.56
	Total Impact level			48.89

With the assessment of risk is carried out by calculated risk assessment table. Risk Assessment is major part in the construction environment management plan and it will assess risk

qualitatively or quantitatively also. It may conduct at every stage of construction. So that at every level of construction and at every aspect risk may measure and finding impact level with risk assessment and proper mitigation may use to reduce it.

The managerial approach may develop in the construction industry so that proper planning will enhance positive impact and reduce negative impact on environment. This may be achieved by conducting Environmental Risk Assessment. These are aimed at ensuring that the contractor maintains adequate control over the project which helps to minimize the extent of impact during construction also ensure appropriate restoration of areas affected by construction and prevent long term environmental degradation. Also it having specification about identifying those construction activities that have a detrimental impact on the environment with the risk assessment then detailing the mitigation measures that will need to be taken, and the procedures for their implementation and establishing the reporting system to be undertaken during the construction.

The Impact level/Significant ratings are calculated for two major and twelve sub factors. After calculating impact level for all main and sub factors having a highest value of impact levels are the most important risk factor.

The first five highest significant ratings are Operations with Vegetation Removal are most effective impact factor that may harm the surrounding environment of construction projects.

Second is Transportation Resources are the resources that consume natural energy which will impact on environment.

Third is Energy consumption on Site this is the factor that usage of energy shows. It may impact on natural environment of project.

Fourth is Noise pollution by the different equipments used in construction activities may generate noise that may impact on environment.

Then fifth is Electricity Consumption in construction project is one of the important aspects which will consider in construction. The electricity is use as resource and consumes to give energy and affect environment.

IV. CONCLUSION

In this research the environmental risk assessment is identified with different environmental impacts or risks in construction by risk calculations. Then significance scoring is given rating for each environmental aspect for finding risk rating by Likert scale. The environmental risk assessment is assessing the different impact factors. Those factors are responsible for affecting construction project. They may recommend for further mitigation. Also this study investigated the environmental impacts due to construction processes in residential buildings in order of their impact levels. An interview with a panel group was conducted to determine the frequency and severity of the environmental impacts in the construction activities by giving rating or scoring them.

The significant rating or Impact Level is finding out for different risk factors. The results demonstrate that Operations with Vegetation Removal, Transportation Resources, Energy consumption on Site, Noise pollution, Electricity Consumption are the most risky environmental impacts on construction sites. The Major impact is not acceptable further mitigation required for this impact level. Operations with Vegetation Removal, Transportation Resources, Energy consumption on Site, Noise pollution, Electricity Consumption for this impact factors continuous monitoring, further mitigation is required.

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