

# Factors Contributing To Generation of Physical and Non-Physical Wastes In Road Projects

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## ABSTRACT

Roads are major contributors towards the GDP of any nation. The Indian economy's growth majorly depends on the road network. As the Indian road network carries a major population of passenger and freight traffic, development and expansion of this is vital for improving the living standards and fostering economic development. Even though the need for road infrastructure is critical, the road development industry faces many setbacks. Common problems like Land Acquisition, delay in obtaining Environment and Forest clearances and other regulatory approvals indicate a red signal before the project plans are put forth for execution. Lack of standardization in the various procedures at all phases in the project life cycle; diminish the interest of stakeholders in investing their time and money in road projects. The paper mainly discusses about absence of sustainable approach in managing the time, capital and material employed in the road projects by the stakeholders; who include the promoter, consultant and the road contractors. It is elaborated through certain factors that lead to Physical wastes (material wastes) and Non-Physical wastes (Schedule delay and Cost overrun). This

*paper discusses about sustainable approach that should be imbibed in the activities of all the stakeholders; through the provision of solutions for minimizing the major Physical and Non-Physical wastes that arises at all the phases of the road project.*

## 1.INTRODUCTION

An efficient transport system is a prerequisite for sustainable economic development in India. Roadways are the major elements that promote nation integration in the country. The roadways also play an important role of promoting the development of the backward regions and integrating them with the mainstream economy by opening them to trade and investment. An efficient road transport network becomes vital in order to increase productivity and enhancing the competitive efficiency of the economy in the world market. In addition, roads provide last-mile connectivity for other modes of transport such as ports, airports, railways and inland waterways and cater to operations of these modes in meeting the needs of transportation. The demand for road transport is affected by structural changes taking

place in the economy, this growth in demand has to be met by expanding domestic supply of road infrastructure. Investment in road transport must reflect the need to make up for existing capacity shortages and also to allow for growth in demand. According to the NHAI (National Highway Authority of India), the entire network is classified into five distinct categories and they are Expressways, National Highways (NH), State Highways (SH), Major District Roads (MDR), Rural and other district roads. National Highways which account for only 3 percent of the total road length in India carries around 40 percent of the road traffic.

#### ROAD LENGTH IN INDIA

Type of Roads	Length in Kilometers
Expressways	200
National Highways	92,851
State Highways	1,31,899
Major District Roads	4,67,763
Rural and Other roads	26,59,000

Source: NHAI[1]

#### Physical waste

Physical construction waste is defined as waste which arises from construction, restoration and demolition activities including land excavation, civil and building construction, site clearance and roadwork.

#### Defining Non-Physical Waste

The Non-physical waste normally occurs during the construction process. By contrast with material waste, non-physical wastes are the time and cost overrun for construction projects.

#### Study Objective

To avoid or minimize the physical and non-physical waste generation in road projects; which can help increase the profitability of the stakeholders in road projects, enhance investor confidence, completion of road project within stipulated time and cost, and promote overall sustainable economic growth of the nation.

## 2. LITERATURE REVIEW

**Lean Construction Eliminating the Waste** Lean construction, as defined by the nonprofit Lean Construction Institute (LCI), is a production management-based project delivery system emphasizing the reliable and speedy delivery of value. The goal is to build the project while maximizing value, minimizing waste and pursuing perfection for the benefit of all project stakeholders.

#### A Review of Construction Waste Cause Factors.

The paper identifies various causative factors of construction waste existing in construction field activities. The common causes of construction waste were identified from past research papers. The causes of construction waste are matrix and found that 63 waste factors existed in construction activities.

#### The Way Forward In Sustainable Construction: Issues and Challenges .

The nature of the industry are fragmented, unique and complex which always face chronic problems like time overrun (70% of projects), cost overrun (average 14% of contract cost), and waste generation (approximately 10% of material cost).

## 3. REPORT ON PRESENT INVESTIGATION

**Factors Contributing to Generation of Non-Physical waste**

- ❖ Land Acquisition problem
- ❖ Delay in Environmental Clearance
- ❖ Delay in Regulatory Approvals
- ❖ Lack of strong Rehabilitation and Resettlement (R & R) Policy.
- ❖ Inadequate furnishing of Detailed Project Report (DPR)
- ❖ Delay in availability of Capital
- ❖ Location and Connectivity to project sites
- ❖ Poor selection Consultant
- ❖ Lack of skilled and unskilled workers
- ❖ Frequent changes in Design and Specifications
- ❖ Contractual disputes/ Disputes in SPV
- ❖ Climatic Conditions

**Factors Contributing to Generation of Physical wastes**

- ❖ Improper procurement planning
- ❖ Workers mistakes during construction
- ❖ Wastage due to frequent design changes
- ❖ Lack of proper supervision
- ❖ Wastage due to theft
- ❖ Improper coordination among the staff
- ❖ Wastage of materials due to adverse climatic condition
- ❖ Site conditions
- ❖ Proper storage and handling
- ❖ Selection of equipment

**4. RESULTS AND DISCUSSIONS**

The ten factors that contribute to generation of Physical wastes and twelve factors that contribute to generation of Non-physical wastes were identified

Factors identified that contributes to Physical & Non Physical Wastes

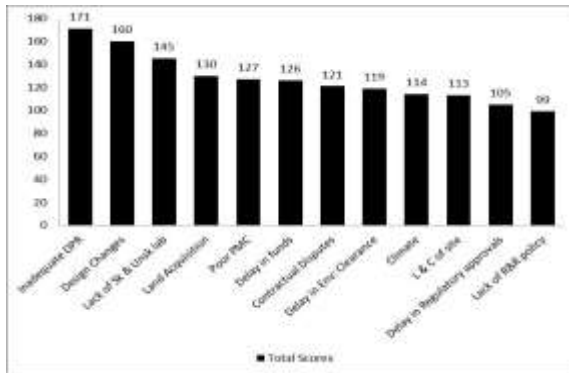
Sl.No:	Factors contributing to Physical Wastes	Factors contributing to Non-Physical Wastes
1	Improper Procurement Planning	Land Acquisition problem
2	Workers Mistakes	Delay in Environment Clearance
3	Frequent Design Changes	Delay in Regulatory Approvals
4	Theft/Vandalism	Lack of Strong R & R policy
5	Wrong selection of Equipment/Technology	Inadequate DPR
6	Site Condition	Delay in availability of funds
7	Lack of Proper Supervision	Location & Connectivity of project
8	Improper Coordination among Staff	Poor selection of PMC
9	Improper Storage and Handling facilities	Lack of Skilled & Unskilled labour
10	Adverse Climatic Conditions	Frequent Design Changes
11		Contractual Disputes
12		Adverse Climatic Conditions

The responses from the 42 respondents, which includes engineers working with contracting firms, consulting firms and developers; regarding the factors contributing to 10 Physical and 12 Non-physical factors were received. The data was analyzed and evaluated using SPSS software and Microsoft Excel. Descriptive method was used to analyze the questionnaire data.

**Factors Contributing to Generation of Non-Physical wastes**

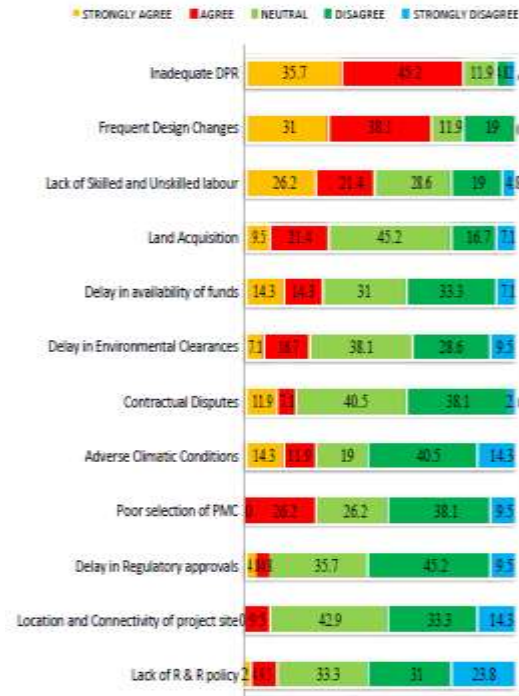
Descriptive Statistics of Non-physical waste factors

Factors Contributing to Generation of Non-Physical Wastes	Mean	Standard Deviation	Rank
Inadequate DPR	4.0714	0.9472	1
Frequent Design Changes	3.8095	1.08736	2
Lack of Skilled and Unskilled labour	3.4524	1.21379	3
Land Acquisition	3.09520	1.03145	4
Delay in availability of funds	3.0000	1.24939	5
Delay in Environmental Clearances	2.881	1.05730	6
Contractual Disputes	2.8333	1.01699	7
Adverse Climatic Conditions	2.7143	1.27424	8
Poor selection of PMC	2.6905	0.97501	9
Delay in Regulatory approvals	2.5000	0.91731	10
Location and Connectivity of project site	2.4762	0.86216	11
Lack of R & R policy	2.3571	1.03173	12



Total scores obtained by each variable Contributing to non-physical waste generation

**Percentages of respondents rating the non-physical factors**

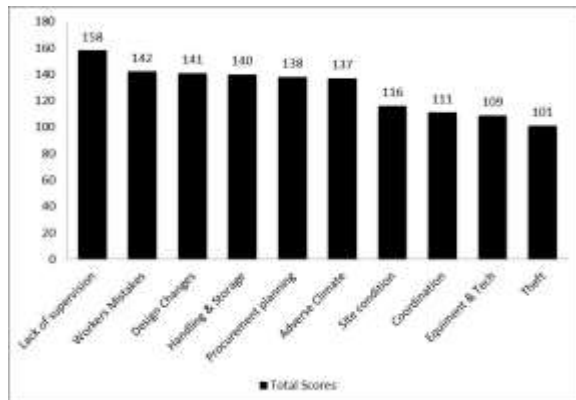


Percentages of respondents rating the non-physical factors

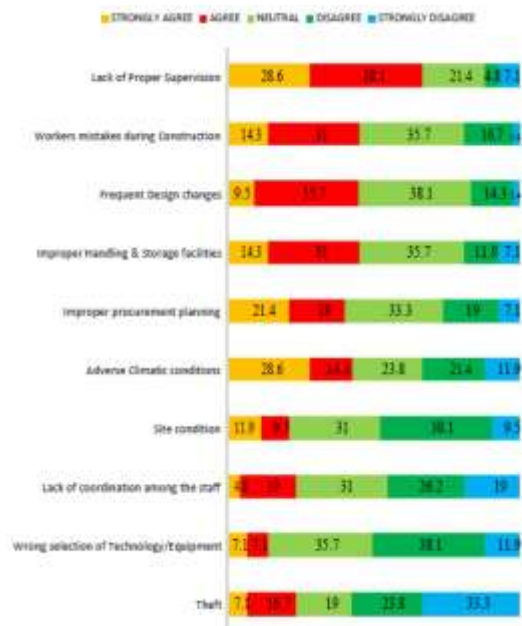
**Factors Contributing to Generation of Physical wastes**

Descriptive Statistics of Physical waste factors

Factors Contributing to Physical Wastes	Mean	Standard Deviation	Rank
Lack of Proper Supervision	3.7619	1.14358	1
Workers mistakes during Construction	3.3810	1.01097	2
Frequent Design changes	3.3571	0.93238	3
Improper Handling & Storage facilities	3.3333	1.09693	4
Improper procurement planning	3.2857	1.21546	5
Adverse Climatic conditions	3.2619	1.39790	6
Site condition	2.7619	1.14358	7
Lack of coordination among the staff	2.6429	1.14384	8
Wrong selection of Technology/Equipment	2.5952	1.03734	9
Theft/Vandalism	2.4048	1.30775	10



Total scores obtained by each variable  
Contributing to physical waste generation



Percentages of respondents rating the physical factors

### 5. CONCLUSIONS

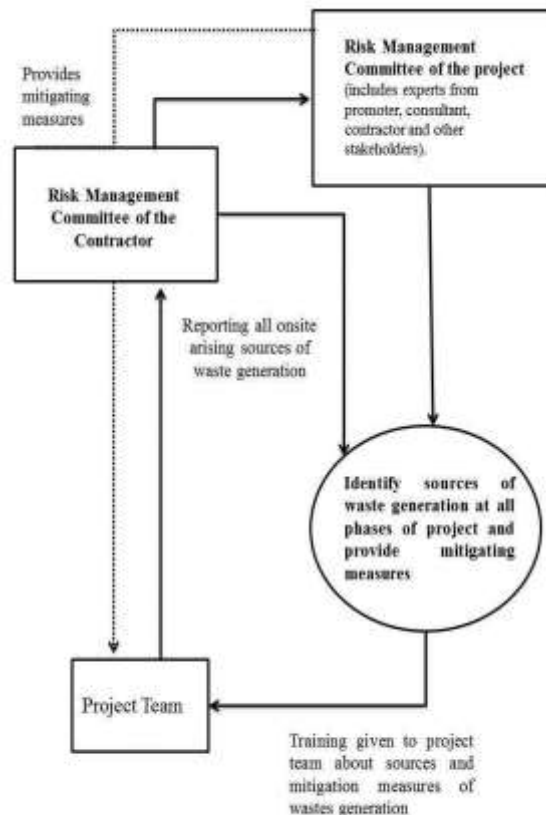
After the evaluation of the twelve factors that contribute to generation of Non-physical wastes and ten factors that lead to generation of Physical wastes, a few dominant factors have been identified on the basis that they are

above average of their respective means, and are as shown in Table

#### Dominant Physical and Non-Physical factors

Sl No:	Factors Contributing to generation of Non- Physical wastes	Factors Contributing to generation of Physical wastes
1	Inadequate DPR	Lack of Proper Supervision
2	Frequent Design Changes	Workers mistakes during Construction
3	Lack of Skilled and Unskilled labour	Frequent Design changes
4	Land Acquisition	Improper Handling & Storage
5	Delay in availability of funds	Improper Procurement Planning
6	Delay in Environmental Clearances	
7	Contractual Disputes	





Overall framework for waste minimization in road projects

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