

# Assessment of labour Risk in High-Rise Building

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**ABSTRACT** - In the recent past the infrastructural development in India has been developing at a rapid rate. The infrastructural development plays a major role in the economic development of the country. There are several risks allied with the construction industry. Managing risks in construction projects has been recognized as a very important management process in order to achieve the project objectives in terms of time, cost, quality, safety and environmental sustainability. Project risk management has been intensively discussed in recent years. This paper aims to identify and analyze the risks associated with the development of construction projects from project stakeholder and life cycle perspectives in terms of human safety and its effect on time and cost. This can be done by calculating the productivity rate of the labors and also analyzing the organization needs from the work force. This research found that these risks are mainly related to contractors, labors who directly take part in the construction process. Among them, tight project schedule is recognized to have high influence on all project objectives maximally. In this study the survey has to be conducted with in various construction industries in Tamil Nadu and the opinion at various levels of management through the standard questionnaires are to be collected and the result are to be analyzed and aims at providing recommendations to overcome those risk mitigations.

**Keywords**—risk, risk management, construction projects, labour risk, human safety, productivity, life cycle perspectives.

## 1. INTRODUCTION

### 1.1 An Over View On Construction Industry

The construction industry is the second largest industry of the country after agriculture. It makes a significant contribution to the national economy and provides employment to large number of people. The use of various new technologies and deployment of project management strategies has made it possible to undertake projects of mega scale. In its path of advancement, the industry has to overcome a number of challenges. However, the industry is still faced with some major challenges, including housing, disaster resistant construction, water management and mass transportation. Recent experiences of several new mega-projects are clear indicators that the industry is poised for a bright future. It is the second homecoming of the civil engineering profession to the forefront amongst all professions in the country.

Construction industry, with its backward and forward linkages with various other industries like cement, steel bricks etc. catalyses employment generation in the country. According to Planning Commission the Infrastructure spending of the government is around 1500 USD million or Rs. 67,50,000/- for 11th and 12th year plan. Statistics over the period have shown that compared to other sectors, this sector of economic activity generally creates 4.7 times increase in incomes and 7.76 times increase in employment generation potentiality. Sustained efforts by the Indian construction industry and the Planning Commission have led to assigning the industry status to construction today. This means formal planning and above board financial planning will be the obvious destination of the construction sector in the country, with over 3.1 Cr persons employed in it. The key drivers of this growth are government investment in infrastructure creation and real estate demand in the residential and industrial sectors.

There are mainly three segments in the construction industry like real estate construction which includes residential and commercial construction; infrastructure building which includes roads, railways, power etc; and industrial construction that consists of oil and gas refineries, pipelines, textiles etc .The construction activity differs from segment to segment. Construction of houses and roads involves about 75% and 60% of civil construction respectively. Building of airports and ports has construction activity in the range of 40-50%. For industrial projects, construction component ranges between 15-20%. Within a particular sector also construction component varies from project to project.

## 2. CONCEPT OF RISK MANAGEMENT

### 2.1 Risk

*Risk* An uncertain event or condition that results from the work, having an impact that contradicts expectations. An event is at least partially related to other parties in a business.

Risk management is recognized as an integral part of good management practice. To be most effective, risk management should become part of an organization's culture. It should be integrated into the organization's philosophy, practices and business plans rather than be viewed or practiced as a separate program. When this is achieved, risk management becomes the business of everyone in the organization. Risk management enables continual improvement in decision-making. It is as much about identifying opportunities and avoiding or mitigating losses.

### 2.2 Major Human Risk In Construction Projects

- Inability to work.
- Unwillingness to work.
- Inadequate supervision while executing work activities.
- Insufficient labours.
- Effect of severe weather condition.
- Labour and contractors issues.
- Over time of work.

These are some of the major factors that causes damages and situation of risk in the construction site. There are several other factors that also involved in the factor causing the situation of risk. These factors are to be identified from technicians point of view and also from labours point of view so that the actual situation or the factors causing the risk are identified.

### 2.3 Lean Approach

In the recent past 'Lean Construction' - a philosophy based on the 'Lean Manufacturing' approaches undertaken in the automotive industry has been applied to reduce wastes and increase efficiency in construction practices. The objective of Lean Construction is to design a production system that will deliver a custom product instantly on order but maintain no intermediate inventories. Applied to construction, 'Lean' changes the way work is done throughout the delivery process. Current construction techniques attempt to optimize the project activity by activity and pay little attention to how value is created and flows to the customer.

### 2.4 Work Sampling

Labor productivity has a major impact on whether a construction project is completed on time and within budget. Therefore, it is important for construction managers to improve the conditions that affect labor productivity on their jobsites. Work sampling is a method that evaluates the amount of productive, supportive, and non-productive time spent by the trade workers engaged in performing their assigned work activities. It also helps identify any trends affecting labor productivity. Construction companies are constantly searching for ways to improve labor productivity. Since labor is one of the greatest risks in a construction contract it must be controlled and continuously improved. The construction company with the most efficient operations has a greater chance to make more money and deliver a faster construction project to the project owner. There are several factors that affect labor productivity on a jobsite such as weather conditions, workers' skill level, overcrowding of work crews, construction methods used, and material delivery/ storage/ handling procedures.

**Table 2.1 work sampling model**

Date		12-sep-13						
Time	Labour	No of labour	Time Consumed (in hrs)	Total Time Consumed	Man-days	Team Observation	Reason for NVA	Impact
08:00:00								
09:00:00	Skilled	15	0.5	7.5	1	NVAN	Minor Resources	4.1%
10:00:00	Skilled	190	0.5	95	12	NVA	Water & restroom	4.1%
11:00:00								
13:00:00	Skilled	190	1	190	24	NVA	Lunch	8.2%
14:00:00								
15:00:00	Skilled	190	0.5	95	12	NVA	Water & restroom	4.1%
16:00:00								
17:00:00								
18:00:00	Skilled	190	0.5	95	12	NVA	Snacks & Tea	4.1%
19:00:00	Skilled	55	2	110	14	NVA	Lighting	4.8%
20:00:00	Skilled	190	0.5	95	12	NVA	Snacks	4.1%
21:00:00	Skilled	20	0.5	10	1	NVAN	Minor Resources	4.1%
22:00:00	Skilled	190	0.5	95	12	NVA	Water & restroom	4.1%
23:00:00								
00:00:00								
<b>Total</b>					100			
<b>Total Man-day per day</b>					285			
<b>Waste % on crew</b>					36%			

\*VA- valuable activities NVA- non valuable activities NVAN-non valuable activities by labour.

**Table 2.2 Percentage Of Activities**

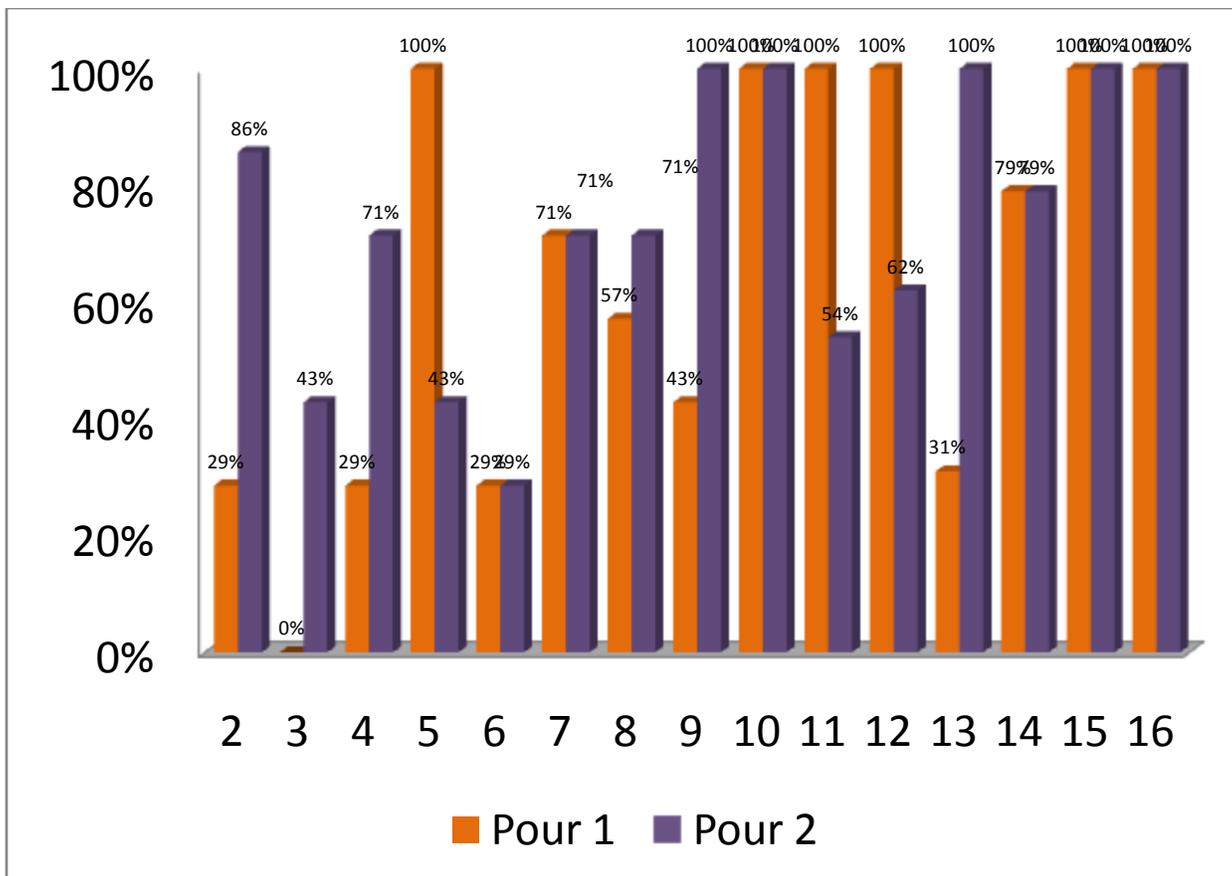
S.no	Activities	Percentage
1	Value activities	65%
2	Non value activities	34%
3	Non value activities by labours	1%

## 2.5 Last Planner System

Better planning improves productivity by reducing delays, getting the work done in the best constructability sequence, matching manpower to available work, coordinating multiple interdependent activities, etc. The relationship is obvious and very powerful. One of the very most effective things you can do to improve productivity is to improve planning.

**Table 2.3 Last planner log sheet**

PREVIOUS POUR DATE		31/8/2013													
DATE OF LOGSHEET		9/4/2013													
POUR1, 12TH LEVEL															
Front line Plan Monitoring Sheet (7 Days)															
Sl No.	Activity Description	TOWER9 - Typical Floor											Labour Strength		Remarks
		FLAT NO	FLATA												
		RM	SD	ED	BR1	BR2	BR3	KITC	HALL	TOILET	LIFT & SC-1				
1	Marking	P	2-Sep	2-Sep	2-Sep	P	A								
		A	2-Sep	2-Sep	2-Sep										
2	Bracket Fixing along with hand rail and walkway plate (including removal from below floor)	P	2-Sep	2-Sep		Carpenter	65	56							
		A	2-Sep	2-Sep		Barbender	70	62							
3	Bracket Fixing along with hand rail and walkway plate (including removal from below floor)	P	3-Sep	3-Sep								3-Sep			
		A	3-Sep	3-Sep								3-Sep			
4	Tying of Reinforcement for inner walls	P	3-Sep	3-Sep											
		A	3-Sep	3-Sep											
5	Tying of Reinforcement for inner walls	P	4-Sep	4-Sep								4-Sep			
		A													
6	Striking of Internal panels	P	2-Sep	2-Sep											
		A	2-Sep	2-Sep											
7	Striking of Internal panels	P	3-Sep	3-Sep								3-Sep			
		A	3-Sep	3-Sep								3-Sep			
8	Fixing of Electrical Boxes and wall conduiting	P	4-Sep	5-Sep	4-Sep	4-Sep	4-Sep	5-Sep	5-Sep	5-Sep	5-Sep				
		A													
9	Tying of beam lintels along with additional bars in opening.	P	5-Sep	5-Sep											
		A													
10	Shifting & fixing of wall internal panels along with slab	P	4-Sep	4-Sep	4-Sep			4-Sep		4-Sep					
		A													



**Fig 2.1 Floor level Vs Percentage Work Completed**

From the graph it is incurred that the completion of the work within the cycle time is in increasing order but not with in the specified time of completion. An average of 70% of the planned completion of the work are carried out in every cycle time. This shows that 30% of the remaining work are completed with extra time or extended time of completion. It is inferred that there should be a constrain for the labours to finish the work completely within the stipulated time.

It is in the recent trend of economy that the real estate company or the builders want to finish the project as for as possible so that the consumer will satisfied and the margin of profit will rise. The companies are in a look of finishing the project on before hand by continues and fast working. This greatly affects the labours in several aspects such as mental stress, health problems etc. If the workers are likely to act as per the companies needs there should be a situation of risk occurs. This create situation of damage or even cause loss of life.

**2.6 Productivity**

Productivity in the sense the amount of work done by the in a work man day or in a hour. Different companies having different productivity rate. Construction companies are constantly searching for ways to improve labor productivity. Since labor is one of the greatest risks in a construction contract it must be controlled and continuously improved. The construction company with the most efficient operations has a greater chance to make more money and deliver a faster construction project to the project owner. There are several factors that affect labor productivity on a jobsite such as weather conditions, workers’ skill level, overcrowding of work crews, construction methods used, and material delivery/ storage/handling procedures . Several methods exist for measuring and analyzing worker productivity. In this study video visual of the progress of work is monitored using the cctv cam recording system. This helps greatly in watching the progress of work without any obstructions. Since the camera is located in the highest elevation points such as tower crane.

Productivity is simply the ratio of overall quantity of work done to the ratio of quantity of labours who take part in the completion of the work in one day or one cycle time.

$$\text{PRODUCTIVITY} = (\text{total work done} / \text{number of labours involved})$$

In this study both the productivity rate of concrete work and the steel work are calculated as the structure was a typical shear wall structure. The labours involved in this category are carpenter and the bar benders. They are accompanied by the helpers so as to help the work force in the completion of the work within the stipulated time. The shear wall structure of the typical block 9 be filled with 2950 sq.m of formwork and 20.59 tons of rebar work. Each block of the typical floor 9 is to be filled with same amount of resource materials as mentioned. The concrete is prepared in the site itself where a RMC plant was located. Necessary peptalk and safety precautions are provided for the labours every day before going for work by technicians and the concerned officers. These are necessarily done to increase the productivity rate.

A meeting was held with the general manager of the contractor in question to describe the procedures of the work sampling study. The data collection method was described as well as the type of information that could be extrapolated during the analysis phase. After the general manager was familiar with the process and the information that could be obtained from a work sampling study, an objective was determined. The contractor wanted to have a baseline of the labor productivity for the company's profit centers.

**Table 2.4 Quantities Of Work To Done**

S.no	Resource	Amount
1	Form work	2950 sq.m
2	Steel	20.59 tons

**Table 2.5 Labour strength of block 9, pour of concrete 1**

Sl.no	Floor	Carpenters	Bar benders
1	12	304	502
2	13	620	835
3	14	408	464
4	15	328	400
5	16	256	325
6	17	320	361

**Table 2.6 Labour strength of block 9, pour of concrete 2**

Sl.no	Floor	Carpenters	Bar benders
1	11	365	682
2	12	411	607
3	13	404	426
4	14	408	460
5	15	269	390
6	16	243	325
7	17	272	358

The above tables shows the total amount of workers worked in each floors to accomplish the cycle time project. It is clear that the above work force worked in each floors only completed the work. Their productivity rate only be used or consumed for the completion of the block 9 of the project. There is a great fluctuation in the amount of workers employed in the construction process in every floor. Thus the productivity rate of the workers will be increased due to shortage of labours. This increase in productivity falls on the head of the concerned labours employed to complete the project within the stipulated time.

**Table 2.7 Form work and reinforcement productivity**

Sl.no	Form work		Reinforcement work	
	Pour1	Pour2	Pour1	Pour 2
1	1.7	2.0	26	27
2	1.9	2.4	30	27
3	1.6	3.3	27	35
4	3.0	3.4	46	35
5	2.4	4.7	34	44
6	2.7	4.0	34	24
7	4.9	6.2	31	35
8	3.8	5.3	36	35
9	4.3	5.2	43	46
10	5.3	6.3	49	28
11	4.9	5.4	45	27
12	6.4	3.3	27	32
13	1.1	3.7	35	32
14	4.2	3.8	30	30
15	4.6	6.4	34	35
16	7.6	8.1	42	42
17	5.3	7.8	38	38

The table shows the productivity rate of each the carpenters and the bar benders in each floor that the average rate of productivity for each labour concerned with the work are calculated. But it is noted that the productivity rate of the company was not achieved as the average productivity rate of each labour in the work concerned are low. There may be several problems that may cause or stops the worker. The worker available in the work for a day will not be available on another or next day or the forth coming cycle work as there is a increase in the productivity rate of the work concerned.

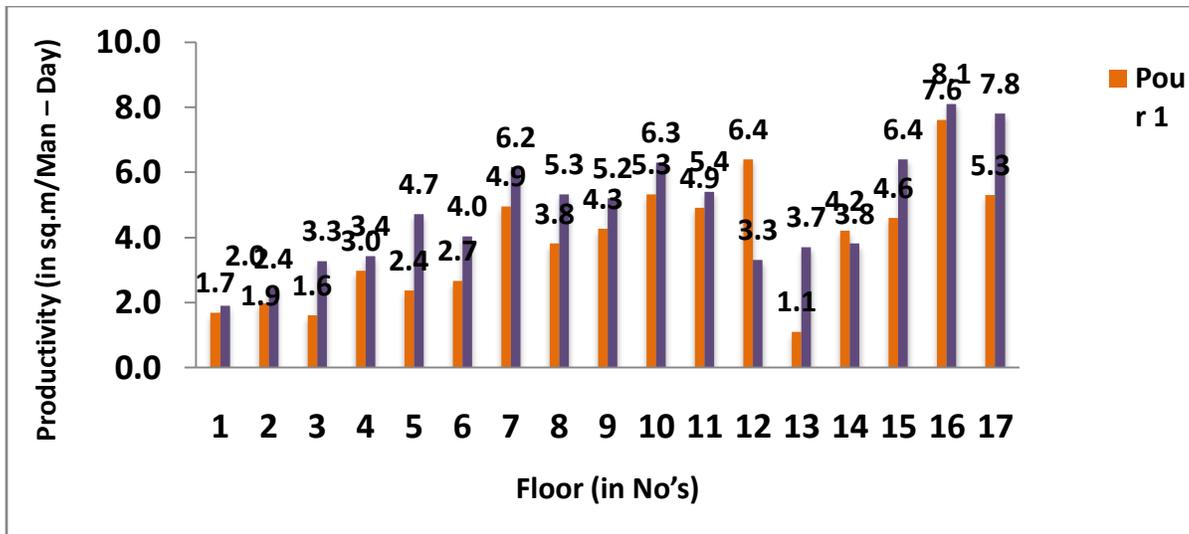


Fig 2.2 Floor level Vs Formwork productivity

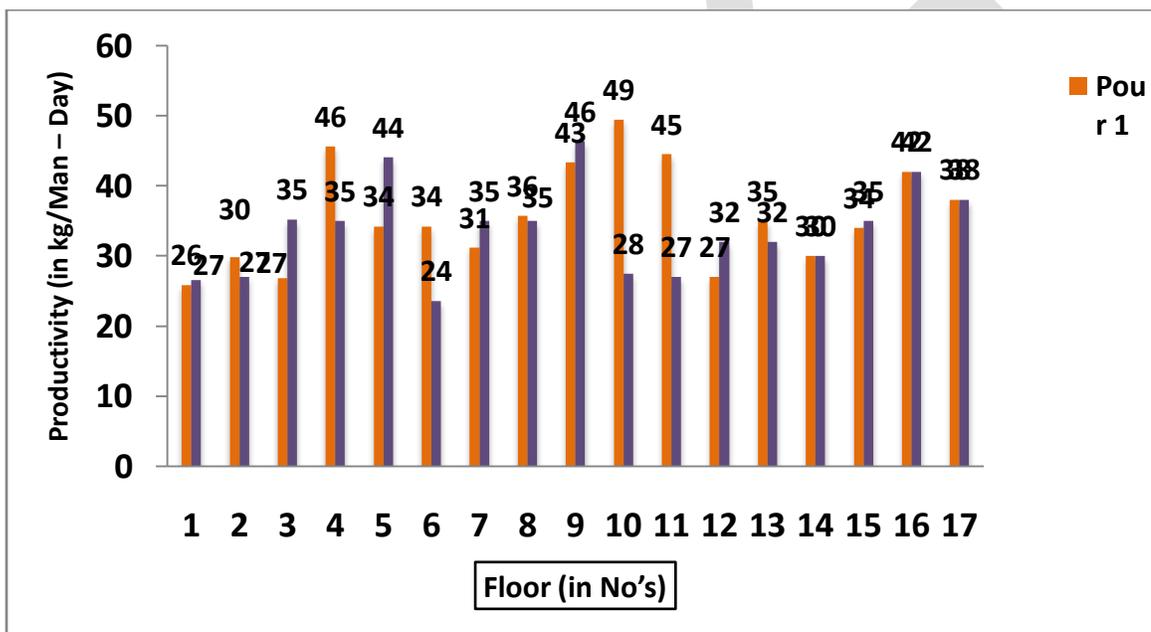


Fig 2.3 Floor level Vs Rebar productivity

This shows that the average productivity rate of the form work fixing and reinforcement work. The average productivity rate displays that the companies productivity rate was not achieved so as to complete the project within the stipulated time and also to achieve the calculate margin of profit. In the economic point of view it recognised that people may want the facility as for as possible so that they can satisfied. It is why Honda maze car selling at a rapid rate than any other cars. As because the delivers of the car will be done as soon as possible after the order and also comfortable in the economic point of view. In the same way the building and real estate industries also in need of satisfying the market needs so that they can get the marginal profit. It is not possible to achieve the target with the use of available resources. The availability of resources also less. So the only way of achieving the target is through increasing the labour productivity of the available labour.

There is a matter of concern that these increased labour productivity will create several risk factors that affects the labours concerned directly or indirectly. This also may cause the situation of accident due to increased productivity rate. This may affects the entire course of the project and may cause even loss of life and injuries to the workforce concerned.

## CONCLUSION

The increase in the economic development of the country greatly influences in creating the demand and requirement. The construction industries are in the view of satisfying the needs of the customers and to achieve large margin of profits can readily agree with short completion of the work. This can greatly affects the labour force by increasing their productivity rate of work. As there is shortage in the availability of the construction labours the companies assign the work on available labour and impose them to work faster to complete the project in stipulated time. On the other hand this may create mental disturbance for the labours working in the site due to increased productivity and increased time of work. For working of long hours the labours may consume drugs like pan masala, cigarette, and some times even consume liquor during the course of work. This leads to poor quality of work and makes the labour lazy by diverting their concentration over the construction process. The study shows a great decrease in the availability of labour for work when the floor level goes on increasing. This may create the situation of risk and causes severe consequences in forms of collapse of structure, damage, time waste, injuries, loss of life, waste of money.

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