

# Prediction of Climate Risk Management in Infrastructure Projects

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**Abstract**— Risk Management in Construction Project is playing important role to achieve successes of the Project. Risk is in everywhere and every project particularly in construction has innumerable risks occurring before construction and during construction period. Most of the risks are repeatedly occurring but the impact & probability of risk is varying. However, the climate risk may lead to impact the Time, Cost and losing an opportunity Cost of the project. This study is to create a model for risk data collection, risk analysis, risk interpretation with the combination of project schedule and cost, India climate is varying from states to states especially the annual number of raining days different from 10 to 130 days throughout India and its impact the construction schedule 3% to 36% on average, Temperature is verifying for winter (0C to 25C) and summer (25C to 50C) is also impact the productivity of project this will reflected in the Project Cost 1% to 10% on average. The History of Climate we can identify the Climate Risk, Environment Risk, impact the time and Cost. However, this paper is measuring and handling risks to help for upcoming construction projects.

**Keywords:** Risk Management, Climate, Time, Cost.

## I. INTRODUCTION

Predication of Risk Management is key to the Successes Projects can deliver in on time and within the Budget Cost. Risk is accruing everywhere and anywhere but the impact will be different form Project to Project Positive risk give opportunity to negative risk will impact the Project. In this paper we discussed about how to Predict the Climate Risk Management. Throughout India we have multiplicity of climates and different types of seasons - winter, monsoon, post-monsoon and summer, each Seasons affect the Project duration and Indirect cost of project, Mainly the rain fall seasons affecting Project by annually 10 to 130 days and its impact the construction schedule and Cost. Winter Season the temperature is verifying for winter (0C to 25C) and summer (25C to 50C) In some states, Cyclone affect in the Coastal Zone is High, This paper we analyse the risk impact based historical climate date and applied the Historical simulation statistical model to predict the climate risk management in infrastructure projects

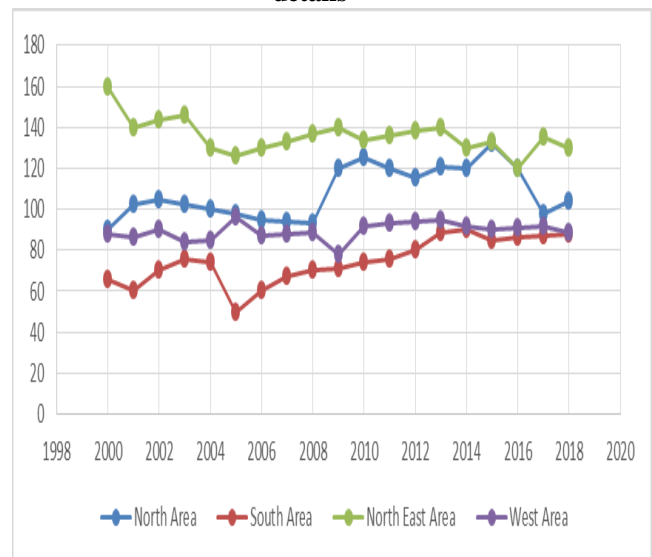
## II. DATA COLLECTION

Primary risk data collected from Climate impact on constructed in the period from 2000 to 2018. Collection of data was performed by the method of survey and

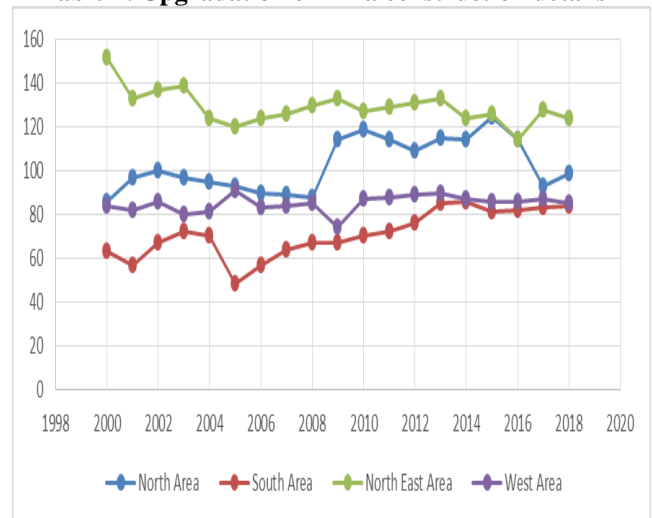
interviewing of engineers-in-charge in construction companies. The data were collected for zone wise North area, South area, North East area, and West area its further divide in to divided in three groups:

1. New infra construction (This new proposed and Construction projects of Bridge, bypass Road, Metro rail)
2. Upgradation infra Construction (2 lane to 4 lane road upgradation)
3. Renovation infra projects

**Table 1: New infra Construction climate impact details**



**Table 2: Upgradation of infra construction details**



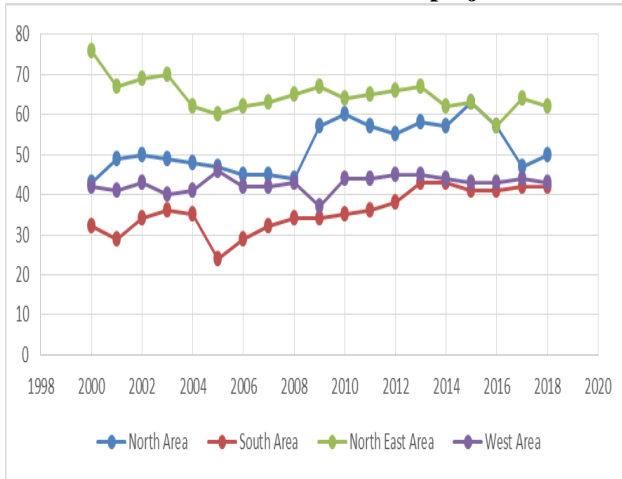
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**Table 3: Infrastructure renovation projects details**



**III. RISK IN INFRA PROJECTS**

Generally, infra construction risks were split into many ways, such as Indoor and outdoor risks. Climate condition, politics, natural calamities, and accidents are coming into the outdoor risk category. Local materials availability, labour productivity, efficiency of sub-contractor, relevant resources, and site conditions are all coming into the indoor risk. Many of the research experts are suggested some more risk factors in indoor and outdoor category, which is not included in the above list, based on their research survey and literature review. The aim of the work is to identify the most influencing risk factors for the projects

**IV. HISTORICAL SIMULATION**

Risk-factors values were observed for the historical simulation approach.  $Z_{m-n} \dots Z_m$ . The changing observed risk factors are denoted by  $X_{m-n+1} \dots X_m$ . The corresponding observation losses were computed with the help of loss operator.  $l_k = l_{[m]}(x_{m-k+1})$ ,  $k = 1, \dots, n$ ,

Where  $l_k$  – Loss (observed risk factor changes by the next time  $X_{m-k+1}$ )

Empirical VaR and ES were computed using loss distribution function at the different time limits are iid.

$$\widehat{VaR}_\alpha(L) = \widehat{q}_\alpha(F_{L^n}) = l_{[n(1-\alpha)]+1, n}$$

$$\widehat{ES}_\alpha(L) = \frac{\sum_{i=1}^{[n(1-\alpha)]+1} l_{i, n}}{[n(1-\alpha)] + 1}$$

where

$l_1, n \geq \dots \geq l_n$ ,  $n$  is the ordered sample.

Simultaneously, For 10 days, loss of historical values was observed in the name of value-at-risk and this aggregated data were formulated as given below.

$$l_k^{(10)} = l_{[m]} \left( \sum_{j=1}^{10} x_{m-n+10(k-1)+j} \right), \quad k = 1, \dots, [n/10],$$

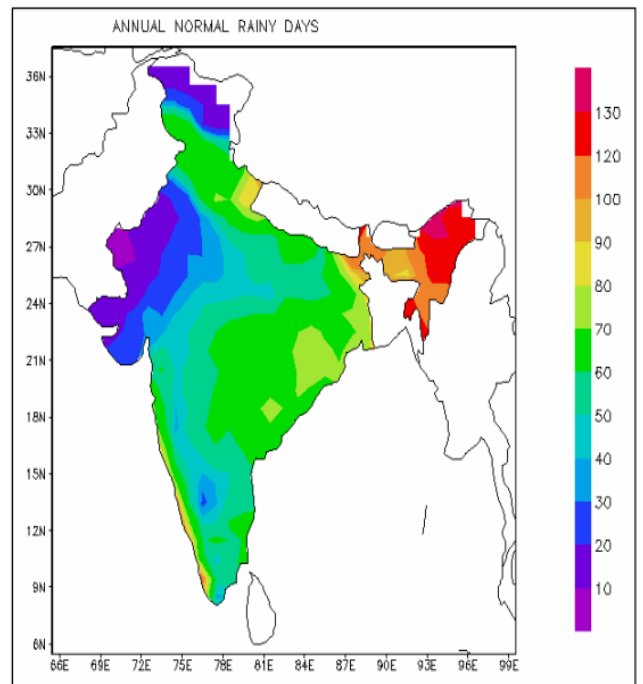
to compute the empirical VaR and ES. This approach is simple for execution and the components of dependence structure keeps in the form of risk-factor changes  $X_{m-k}$ . This approach is easy to implement and keeps the dependence structure between the components of the vectors of risk-factor changes  $X_{m-k}$ .

**V. CLIMATE RISK FACTORS**

The Climate risk factors were formulated by industrial experts and researchers. They were enumerated the risk from various projects such as highway, bridges, Railway projects, infrastructure projects etc. Environmental and geological risk factors are identified in zone-wise and formulated in table below. By this table, climate risk factors are influenced much in the duration of completion projects.

**Table 4: Details of climate risk factor in Zone-wise**

Climate Risk Factors	North Area	South Area	North East Area	West Area
Monsoon Rain Impacted days	30 to 45	60	130 to 90	90 to 60
Weather Impact	30 to 60	30	45 to 60	10
Total Impact days	105	75	150	90
Climate Risk factor	28%	20%	41%	24%



**VI. STATISTICS DIAGRAM**

From the assessment of weather chance, the main weather danger effect is diagnosed. The challenge achievement is affecting via risks. these risks are mentioned using records diagram. Engineering risks and non-engineering dangers are recognized. Prediction is viable to the engineering hazard and not

he facts Diagram representing the hazard assets affecting the challenge success is shown in figure X. This glide chart includes diverse threat factors, in which Engineering dangers are predictable and those non-engineering risks are non-predictable. The predictable elements ought to be forecasted during the sooner degree of the challenge



whereas the non-predictable factors contain uncertainties; this should additionally be expected for the a success of

entirety of the mission due to the fact those risks will affect the value, time, great of the undertaking.

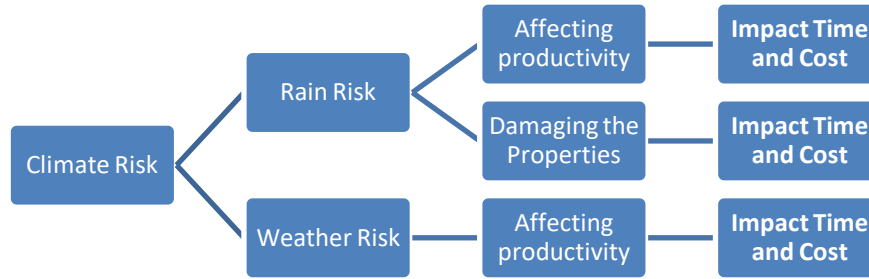


Fig 2: Climate risk flow chart

**VII. CLIMATE RISK MANAGEMENT TECHNIQUES & RESULTS**

Probability and impact (PI), Project Evaluation Review and Techniques (PERT) and Critical path method (CPM) are the market available risk management techniques. It is used widely by researcher and industrial experts. Historical data is required to asses the risk of the next project. The projected models have been shown the best output of historical simulation techniques at assessing the infrastructure projects of climate risk. Starting stage of the climate risk is call it as Predated Effective Duration (PED). Risk is vary by vary for each project. So, it is mandatory to identify the impact of each risk using simple regression model. It is a cost effective and error free tools for experts.

$$\text{Effective Duration} = PD \times \sum_{n=1}^n (RD_n + AD_n)$$

Where:

PD- Project Duration,

RD-Number of Rain Days;

AD- Productivity Affected Days

Climate Risk factor

Climate Risk Factor developed form the is predictable and unpredicted risk from the historical data. projects mainly rain days and productivity affecting

$$\text{Climate Risk factor} = \frac{ED}{PD} \text{ Where : ED- Effective Duration; PD- Project Duration}$$

Duration

Climate Risk Cost

$$\text{Climate Risk Cost} = CRF \times IC$$

Where: CRF-Climate Risk Factor; IC- Project Indirect Cost

**VIII. PREDICTION CLIMATE RISK TIME AND COST**

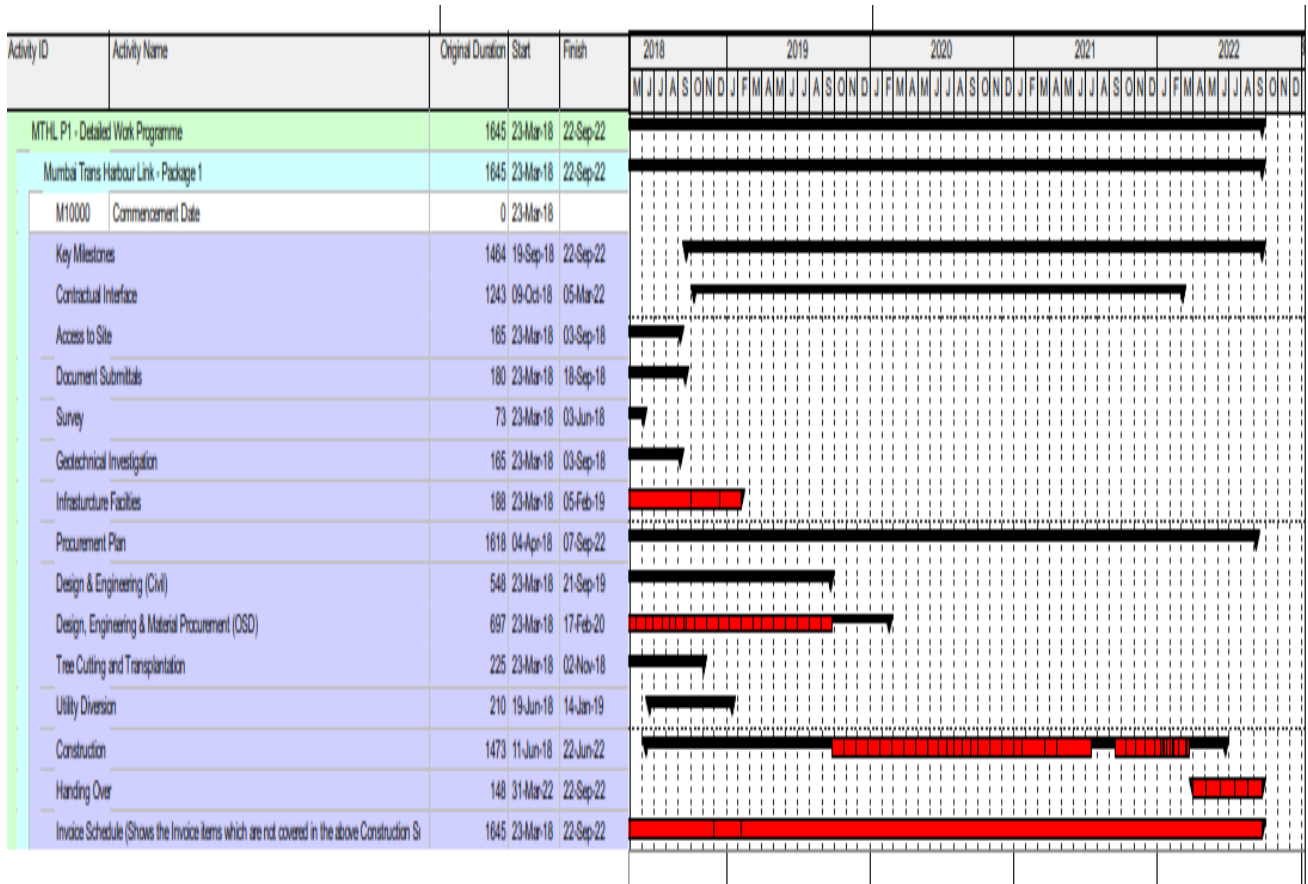
The Historical Simulation applied various infrastructure Project and predicted Climate Risk factor effective Project duration based on the past project data demonstration in tables

Table 5: Impact of Climate risk

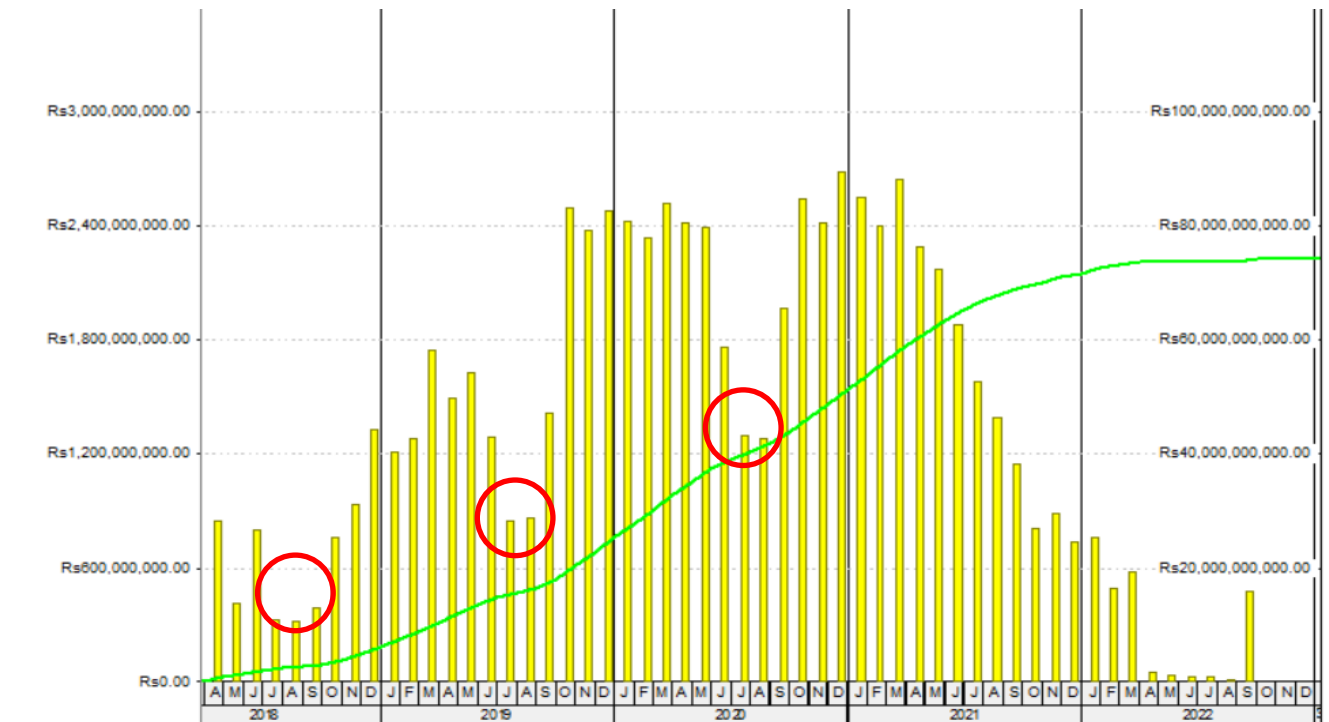
S. No	Project	Location	Project Duration in days	Predated Effective Duration Climate Risk in days	Climate Risk factor in duration	Climate Risk Cost of Project
1	Mumbai Trans Harbour Link (MTHL)	Mumbai	1643	1328	19.2%	3.45%
2	Mumbai Metro line 3	Mumbai	1643	1328	19.2%	2.30%
3	Eastern Peripheral Expressway (NE II)	Delhi	910	880	3.3%	0.16%
4	Bangalore Metro Rail Phase-2	Bangalore	1640	1415	13.7%	1.64%
5	Amaravaticonic bridge location	Vijayawada	730	640	12.3%	0.74%

Based on the above predication the west zone Project is having high impact for climate rick in mainly the Marian Project of Mumbai Trans Harbour Link Project is having high impact on the project duration is 19.2% and Cost 3.45%, for the Climatic risk of monsoon season of June, July and August Raining days is high and High tide is frequently high so Marian work productivity is fully affect so the predated Effective Duration project is 1328 days, The Project Implementation Programme is developed and shuffled the resources of marine to Land area and demobilised the rental barges and own barge send to other Project so it's helped to minimised risk cost.

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**Fig 3: MTHL Project Implementation Programme**



**Fig 4: Expendicher cash flow**

## IX. CONCLUSION

Prediction of Climate Risk Management is help for the identified the quantum of risk & impact of time and cost of project, it's given solution to identify the rooted cost of risk make innovation method to mitigation to reduce the risk of the Project duration and Cost. The Climatic risk factors which will help to identify the effective construction duration and Climate Risk Cost of Project to complete the Project On time and Within the Budgeted cost. This study has shown that by how to predict the Climate risk based on the historical simulation and correlated with Cost and Time of Project to mitigate the complex projects of result an effective climate risk management plan can be conducted

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- 6 IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308 A STUDY OF VARIOUS FACTORS AFFECTING RISK MANAGEMENT TECHNIQUES IN CONSTRUCTION PROJECT: A CASE STUDY OF INDIA Shuaibu Saminu<sup>1</sup>, Raj Prasad<sup>2</sup>, V. Thamilarasu<sup>3</sup> <sup>1</sup>PG Student, Department of Civil Engineering, SRM University, Chennai, India <sup>2</sup>Assistant Professor, Department of Civil Engineering, SRM University, Chennai, India <sup>3</sup>Professor, Department of Civil Engineering, SRM University, Chennai, India