

# Determination of Downtime Cost of Ready-Mix Concrete Plant and Transit Mixer

Poonam P. Patil, Rohit R. Salgude

**Abstract:** In today's scenario, construction equipment plants are essential for any construction projects and are also important for rapid progress and improvement in the quality of work. Breakdown and less productivity of equipment can increase the cost of construction project. Hence it is important that attempts to be made to increase the productivity of equipment. Earlier research has often addressed this fact, but it has rarely explained the causes and consequences of downtime. Thus this research paper highlights various causes of downtime of RMC plant and Transit Mixer. Also the downtime cost of RMC plant and Transit Mixer (TM) is determined by using mathematical model, COX Model and NUNALLY Model. These models are used to identify the downtime cost of equipment where COX Model gives the value by only taking into account of failure machine and not considering the impact, while the NUNALLY Model gives higher value due to considering the overall impact of failure machine on work.

**Index Terms:** Breakdown, Downtime, Construction Equipment.

## I. INTRODUCTION

In construction industry equipment is basic need of any construction project. There are different types of equipment available in construction area; hence selection of proper equipment is very important to control cost and time of project. For selection of proper equipment there should be knowledge of everything about equipment with its working principle. While considering the construction projects, there are different types of equipments needed for construction. Hence construction practitioners should have to be aware about equipments. These equipments are dedicated to bring ease and convenience for people to have in their work. It is essential for people and construction workers to improve their work and have convenience and improvement with the help of equipments. To get the maximum output of construction equipment, it requires regular maintenance. If proper care of equipment is not taken then there will be more chances of breakdown. Breakdown of equipment can affect the construction performance which leads to increase the cost and duration of project. Hence it is important to find out downtime of construction equipment. Downtime is define as, it is the any period of time when a machine is not in production. Breakdown of equipment creates the downtime in project. Downtime has to be monitor on regular basis for minimizing adverse effects..

## II. LITERATURE REVIEW

(James Monnot (2011) Original Equipment Manufacturer (OEM)s design construction equipment with Telematics systems that provide alerts before system failures to minimize downtime and reduce costs (A Shagluf (2013) Calibration is an important tool which helps to understand the machine and can control its performance. (Faaique Mohammed. O (2016) These risks cannot be avoided but can be reduced by proper strategic planning. (Madhav Prasad Nepal (2004) construction companies need to adopt proactive equipment management and maintenance programs to avoid the major impact of downtime on construction project performance.(D. B. Phadatare (2016) the overall equipment efficiency can be enhance be less idling, low machine breakdown and reducing accident in plants which maximized the productivity rate, modify process paramete.(Hamid Aadal (2013) managing plants and equipment in the construction industry is beneficial for different aspect of a construction project and especially it has significant positive effects on decreasing the time and cost of the projects and also increasing the quality of the project.

## III. RESEARCH OBJECTIVE

1. To identify various failure reasons of RMC Plant and Transit Mixer.
2. To determine downtime cost of RMC Plant and Transit Mixer..

## IV. RESEARCH METHODOLOGY

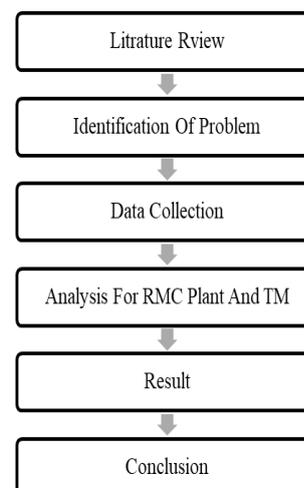


Figure.1 Research Methodology

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Poonam P. Patil, M. TECH. in Construction Engineering & Management from MIT-WPU, PUNE

Prof. Rohit R. Salgud, Assistant Professor, Department of Civil Engineering in MIT, PUNE

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## V. DATA COLLECTION

To carry out this research work the data was collected from RMC Plant, in Pune. Daily data collection was done in the month of December 2018- January 2019.

5.1 Data collection for failure reasons of RMC Plant and Transit Mixture The collection for identification of causes of failure of equipment the information was done through the literature review, interviews and discussion with the in-charge on RMC plant.

5.2 Data collection for RMC Plant and Transit Mixture

**Table 1**  
**Data Collection of RMC PLANT and TM**

|                                    | RMC Plant              | Transit Mixer          |
|------------------------------------|------------------------|------------------------|
| Actual Output Qty Per Month        | 77625 m <sup>3</sup>   | 2759.50 m <sup>3</sup> |
| Days/Month                         | 31                     | 26                     |
| Theoretical Output Qty Per Hour    | 60 m <sup>3</sup>      | 16 m <sup>3</sup>      |
| Theoretical Output Qty Per Month   | 18773.4 m <sup>3</sup> | 4160 m <sup>3</sup>    |
| Variance Or Deviation In Output    | 11010.9 m <sup>3</sup> | 30520.5 m <sup>3</sup> |
| Equivalent Loss Of Time In Days    | 183.51                 | 1907.531               |
| Average Duration Of Failure Per Tm | 2.96                   | 238.441                |
| Estimate % Of Downtime             | 12.33%                 | 733.666%               |
| Average Failure Frequency (Yearly) | 17.43                  | 9029.734               |

The data is collected in tabular format as shown in table 5.1. It is collected for total 62 days for month of December 2018 and January 2019 in terms of actual output quantity and actual working hour. Based on this production per hour is determine and compare with theoretical output for same working hours. For TM data is calculated for the distance of 15km from the plant.

## VI. DATA ANALYSIS

### 6.1.1 Failure reasons for RMC Plant

Following are the failure reasons of RMC Plant-

- T Health of the plant.
- Irregular maintenance of plant.
- No use of checklist on regular basis.
- Unawareness about plant.
- Gradually wear of machine.
- Failure due to force majeure.
- Lack of experts on plants.
- Improper maintenance of plant.
- Unavailability of records of machines maintenance.
- Due to improper segregation of material.
- Lack of commutation between the staff

### 6.1.2 Failure reasons for TM

- Tire bursting
- Accidents
- Site road condition
- Battery problem
- Due to improper visibility
- Due to lack of experience of driver
- Over burden stability
- Improper maintenance of TM

### 6.2 Analysis for RMC Plant and TM

The analysis for this research is done by using mathematical model, i.e. COX Model, NUNALLY Model [9]. Analysis is done on the basis of data collected in the December-18 and January-19 month.

#### 6.2.1 Data Analysis For RMC Plant

a) By using COX Model

This model gives the annual loss due to equipment failure.

COX MODEL= [Annual frequency of component failure] X [Average Duration Of Failure] X [Downtime Cost/unit.]

**Table 2**  
**Downtime Cost of RMC Plant by COX Model**

|                                   | COST/YEAR         | COST/HR      |
|-----------------------------------|-------------------|--------------|
| <b>BY COX MODEL DOWNTIME COST</b> | Rs. 1083129.107/- | Rs. 141.03/- |

b) By using NUNALLY Model

This model is used to assign the downtime cost of machine to a particular year.

NUNALLY MODEL= [Estimate % of downtime] X [Yearly Planned Hour of Operation] X [Hourly Cost of Replacement]

**Table 3**  
**Downtime Cost of RMC Plant by NUNALLY Model**

|                                       | COST/YEAR         | COST/HR       |
|---------------------------------------|-------------------|---------------|
| <b>BY NUNALLY MODEL DOWNTIME COST</b> | Rs. 16205558.47/- | Rs. 2110.10/- |

6.2.2 Data Analysis For Transit Mixer

a) By using COX Model

$$\text{COX MODEL} = [\text{Annual frequency of component failure}] \times [\text{Average Duration Of Failure}] \times [\text{Downtime Cost/unit.}]$$

**Table 4**  
Downtime Cost of TM by COX Model

|                                   | COST/YEAR        | COST/HR         |
|-----------------------------------|------------------|-----------------|
| <b>BY COX MODEL DOWNTIME COST</b> | Rs. 1614796806/- | Rs. 480594.29/- |

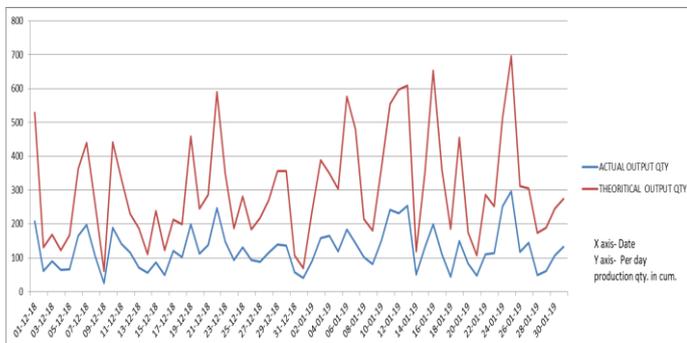
b) By using NUNALLY Model

$$\text{NUNALLY MODEL} = [\text{Estimate \% of downtime}] \times [\text{Yearly Planned Hour of Operation}] \times [\text{Hourly Cost of Replacement}]$$

**Table 5**  
Downtime Cost of TM by NUNALLY Model

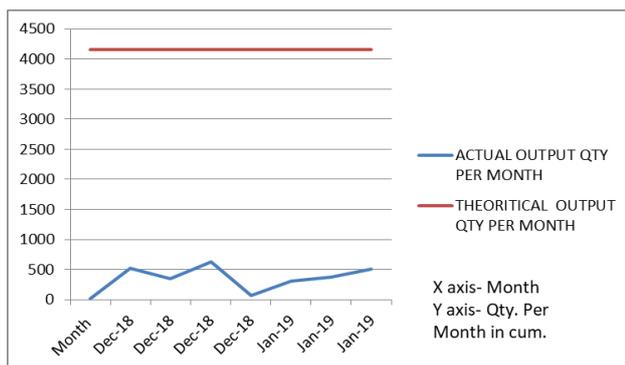
|                                       | COST/YEAR         | COST/HR      |
|---------------------------------------|-------------------|--------------|
| <b>BY NUNALLY MODEL DOWNTIME COST</b> | Rs. 18488379.81/- | Rs.5502.49/- |

VII. RESULT



FIGUR 2. COMPARISON OF OUTPUT OF RMC PLANT

Figure.2 shows comparison of actual output and theoretical output of plant also it is seen that the actual output quantity of RMC plant is very much less then theoretical output quantity.



Figur 3. Comparison of Output of Transit Mixer

Figure 3 shows comparison of actual output and theoretical output of TM also it is seen that the actual output quantity of TM is very much less then theoretical output quantity.

VIII. CONCLUSION

From the above analysis it is seen that cost which calculated by COX model is lesser then NUNALLY model. And also the speed of construction projects is mostly depend upon productivity of construction equipment. For month of December 2018 and January 2019 the calculated cost for RMC Plant and TM is given below in table 6. Also to minimize downtime cost it is very important to carry out the regular maintenance of construction equipment.

Table 6 Comparative downtime cost

| Sr. No. | Machine       | Model                    |                          |
|---------|---------------|--------------------------|--------------------------|
|         |               | COX Model                | NUNALLY Model            |
| 1       | RMC PLANT     | Rs. 10,83,129.107 / year | Rs. 1,62,05,558.47/ year |
| 2       |               | Rs. 141.03/hour          | Rs. 2,110.10/hour        |
| 3       | TRANSIT MIXER | Rs. 61,15,20,684/ year   | Rs. 1,13,77,464.5/year   |
| 4       |               | Rs. 1,82,000.20/ hour    | Rs. 3,386.15/hour        |

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### AUTHORS PROFILE



**Poonam P. Patil**, M. TECH at MIT-WPU, PUNE  
Department of Construction Engineering & Management.  
Email- poonampatil30@gmail.com



**Prof. Rohit R. Salgude** Assistant Professor, Department  
of Civil Engineering in MIT, PUNE  
Email- rohit.salgude@mitpune.edu.in