



## To Analyze the Factors Affecting Downtime of Ready Mix Concrete Plant with the help of RII Method

<sup>1</sup>Mr. Santosh Suwarnkar, PG- Schelor- Civil [C & M], D Y Patil Institute of Engineering & Technology, Ambi.  
Pune.Savitribai Phule Pune University, Pune.

<sup>2</sup>Prof. Upendra R. Saharkar, Asst Professor, D Y Patil Institute of Engineering & Technology, Ambi. Pune.Savitribai  
Phule Pune University, Pune.

### Abstract

In Ready Mix Concrete we produce a Concrete for Construction Projects. Downtime is any moment when there is no machine in manufacturing. In order to help define trends in machine efficiency, downtime can be classified. As equipment failures and breakdowns are extremely noticeable, it gets a high amount of attention. To determine the factors causes for downtime or slow production of concrete plant along with mathematical model to find its downtime cost through case study. In this paper we are planning to conduct a survey to collect the data from various concrete plants so we design a simple questioner to conduct this survey. Relative Importance Index is a method use to find out the important factors and then we provide the rank for these factors. In this paper we also suggest the simple Maintenance log book for concrete plant

ISSN : 2348-5612 © URR



9 770234 856124

**Key Words:** - Downtime, Concrete Plant, Literature Study, Survey, Questioner Design, RII, Log Book

### 1. INTRODUCTION

Unexpected failures in equipment can result in expensive process flow interruptions, harm to equipment and loss of product. The time spent in downtime logging equipment can also be readily justified by the time-and money-saving advantages for the maintenance department and the organization as a whole. Literature survey is much helpful to decide which data have to collect and to decide the factors causes for downtime & model for downtime cost. The feedback COLLECTED from varies plant owner/ Plant operators has been analyzed using Microsoft Excel application to find RSS & Rank . Based on the content of the questionnaires, the analysis was divided into two sections: demographic and relative importance index analysis. Relative index analysis was selected in this study to rank the criteria according to their relative importance.

### 1. AIM & OBJECTIVE OF PAPER

To determine the factors causes for downtime or slow production of concrete plant Following are the objectives of this project,

- [1] To identify the various factors causes for downtime of construction equipment through literature review by using journals, papers, books, etc..
- [2] To design the questioner & collect the data from various concrete plant
- [3] Analysis the different factors which are the root cause of downtime of concrete plant as per its severity and likelihood with the help of RII and suggest the simple Log Book for maintenance.

### 2. LITERATURE REVIEW

A per M. Manikandan , M. Adhiyaman, K. C. Pazhani , elevate on benefits of implementing total Productivity as Construction Equipment is the key factor in successfully running the project. As per author there are two primary and secondary sources of information sources in this study. Primary sources of data include interview and questionnaire, these questionnaires and interviews consisted of open ended and closed ended items, while secondary sources were generated by checking relevant documents. The contribution of each of the factors to overall delays was examined and the ranking of the features was conducted in terms of their criticality as perceived by the respondents using the Relative Importance Index (RII), which was calculated using equation and the evaluation results are shown.



$$RII = \sum W / A * N (0 \leq RII \leq 1)$$

Where: W – is the weight provided by the participants to each variable and varies between 1 and 5 (where "1" is "highly disagree" and "5" is "highly agreed") ; A – Is the highest weight (i.e. 5 in this case) and; N – Is the total number of respondents.

**The author, Poonam P. Patil, Rohit R. Salgude,** focus on using a mathematical model in her paper to find out downtime cost of RMC, as per authors, Failure reasons for RMC Plant following are the failure reasons of RMC Plant- 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. For analysis of RMC plant the author use COX Model. This model gives the annual loss due to equipment failure.

**As per D. B. Phadatare & S. B. Charhate,** In maintenance, it is essential to maintain as many parts as possible in their initial form to guarantee safety and velocity of manufacturing. It involves inspection, adjustment and maintenance, major workshop repairs and overhauls, tiny field repairs and adequate machine layout. The overall equipment efficiency was improved with less idling, low machine breakdown and minimized crop accident that maximized productivity rate, optimized process parameter. The researcher divides the losses in Breakdown, Setup and adjustment Idling and Minor stoppage, Reduced Speed & Startup loss. The researcher comments on these losses like Loss Due to breakdown of equipment, Time lost due to adjustment in the equipment, Small stop losses occur when equipment stops for a short time as a result of interim problem, Minimized speed refers to the difference between design speed and actual operating speed, Some equipment requires warm up time and certain adjustment to obtain optimum output.

The author **Karthik Prabhu.R, Sampath Kumar.K** , focus on the methodological approach used in this study is a quantitative descriptive design using question in person of questionnaire survey. This paper focus on various research papers to found out various factors involved in management of equipment like RMC, these factors are as follows, Equipment selection for construction, Equipment suitability for construction, Maintenance management for machine, Safety management for machine, Spare part management for machine, User training for operator of machine, Quality of materials use for preparation of concrete, Mix design for concrete, Dispatch time of concrete, Equipment condition on site, Nature of transit truck driver, Topography and weather condition where we installed our RMC.

**As per Juraj Drahnovsky,** Equipment maintenance is one of the most important components of production services management Determination of the category by the dominant influence, for example. Safety, environment, manufacturing, etc. Category determination by cost category Safety / Environment: cost of safety, cost of eliminating the implications of breakdowns, category Production: cost of repair, cost of production lost, cost of logistics, and other category: cost of repair, cost of logistics

### 3. DATA COLLECTION

Data collection enables a person or organization to answer relevant questions, evaluate outcomes, and predict future probabilities and trends. 25 questionnaires are to be distributed to technical persons, owner of Concrete mix plant in Pune- Pimpri Chinchawad area. To identify the practical factors which affect the productive of machines and also to find the various reasons of equipment breakdown, and also to find the remedial measure for same the questionnaire survey is conducted in which the following questions are included and we found the RII & Rank of all factors,



1] Nature of Participant- \_\_\_\_\_

2] Name of Company- \_\_\_\_\_

3] Name & Address of Company - \_\_\_\_\_

4] Name of Participant with Designation & Contact No. & e-Mail — \_\_\_\_\_

**A] General Information-**

Qn. No.	Questions To Be Ask	Dry mix Concrete Plant	Wet mix Concrete Plant	Mobile Concrete Plant	Stationary Concrete Plant
A1	Which Kind of plant do you have in your company?	4	7	6	16
A2	What is the Price of Plant?	19.50 Lacs	19.50 Lacs	19.50 Lacs	65 LACKS
A3	What is the Capacity of that Plant?	37 CuM/ Hr.	58.71 CuM/ Hr.	35.33 CuM/ Hr.	69.50 CuM/ Hr.
A4	What is the average production hour per day of Plant?	6 Hr.	6.64 Hr.	11 Hr.	8 Hr.

**B] Questions Based on Actual Plant Failure Related-**

Marks for Question is as per follows,

- 1) 1 – Strongly Disagree                      2) 2 - Disagree
- 3) 3 – Neither Agree Nor Disagree
- 4) 4 - Agree                                      5) 5 – Strongly Agree

Qn. No.	Questions Asked	Response					Remark	RII	Rank
		5	4	3	2	1			
B1	Does irregular maintenance affect the productivity of Plant?	19	6	0	0	0		0.952	1
B6	Does machine fail due to irregular maintenance?	15	10	0	0	0		0.920	2
B2	Does keeping checklist during inspection of plant reduce the frequency of breakdown?	15	9	1	0	0		0.912	3
B24	Does the proper inventory for material may reduce the failure of plant?	11	12	2	0	0		0.872	4
B23	Does the training to operator, labor may reduce the failure of plant?	7	16	1	1	0		0.832	5
Qn. No.	Questions Asked	Response					Remark	RII	Rank
		5	4	3	2	1			



<b>B8</b>	Is workability of equipment dependent upon the skills of operator, helper?	<b>10</b>	<b>11</b>	<b>2</b>	<b>0</b>	<b>2</b>		<b>0.816</b>	<b>6</b>
<b>B15</b>	Gradually wear of machine is reason of failure of plant?	<b>4</b>	<b>16</b>	<b>5</b>	<b>0</b>	<b>0</b>		<b>0.792</b>	<b>7</b>
<b>B5</b>	Does the plant fail due to use of it's over limit?	<b>5</b>	<b>12</b>	<b>5</b>	<b>3</b>	<b>0</b>		<b>0.752</b>	<b>8</b>
<b>B3</b>	Does plant fail due to operator fault?	<b>3</b>	<b>14</b>	<b>6</b>	<b>1</b>	<b>1</b>		<b>0.736</b>	<b>9</b>
<b>B10</b>	Due to Lack of experts on plants, Plants may Failure?	<b>8</b>	<b>2</b>	<b>13</b>	<b>2</b>	<b>0</b>		<b>0.728</b>	<b>10</b>
<b>B12</b>	Unavailability of records of machines maintenance is reason for failure of	<b>1</b>	<b>16</b>	<b>7</b>	<b>0</b>	<b>1</b>		<b>0.728</b>	<b>11</b>
<b>B7</b>	Does lead distance affect the productivity of machine?	<b>3</b>	<b>13</b>	<b>3</b>	<b>5</b>	<b>1</b>		<b>0.696</b>	<b>12</b>
<b>B14</b>	Lack of commutation between the staff is reason of failure of plant?	<b>5</b>	<b>4</b>	<b>13</b>	<b>3</b>	<b>0</b>		<b>0.688</b>	<b>13</b>
<b>B20</b>	Does the non availability of Resources is the reason for failure of plant?	<b>4</b>	<b>10</b>	<b>6</b>	<b>2</b>	<b>3</b>		<b>0.680</b>	<b>14</b>
<b>B11</b>	Unawareness of new technology is reason for failure of plant?	<b>5</b>	<b>2</b>	<b>16</b>	<b>1</b>	<b>1</b>		<b>0.672</b>	<b>15</b>
<b>B9</b>	Does the age of plant factor affect the productivity?	<b>2</b>	<b>7</b>	<b>11</b>	<b>5</b>	<b>0</b>		<b>0.648</b>	<b>16</b>
<b>B22</b>	Does non availability of second supporting system of operation plant is the reason of failure of plant?	<b>1</b>	<b>4</b>	<b>18</b>	<b>1</b>	<b>1</b>		<b>0.624</b>	<b>17</b>
<b>B4</b>	Does plant fail due to helper fault?	<b>0</b>	<b>4</b>	<b>14</b>	<b>4</b>	<b>3</b>		<b>0.552</b>	<b>18</b>
<b>B13</b>	Due to improper segregation of material is reason of failure of plant?	<b>0</b>	<b>3</b>	<b>13</b>	<b>9</b>	<b>0</b>		<b>0.552</b>	<b>19</b>
<b>B21</b>	Does the location of plant is the reason of failure of plant?	<b>1</b>	<b>1</b>	<b>12</b>	<b>7</b>	<b>4</b>		<b>0.504</b>	<b>20</b>
<b>B16</b>	Does wedges for worker is the reason for failure of Plant?	<b>0</b>	<b>0</b>	<b>5</b>	<b>13</b>	<b>7</b>		<b>0.384</b>	<b>21</b>
<b>B19</b>	Does the quality of RMC problem is the reason of failure of plant?	<b>1</b>	<b>0</b>	<b>3</b>	<b>13</b>	<b>8</b>		<b>0.384</b>	<b>22</b>
<b>B17</b>	Does the competition is the reason for failure of Plant?	<b>0</b>	<b>0</b>	<b>4</b>	<b>12</b>	<b>9</b>		<b>0.360</b>	<b>23</b>
<b>B18</b>	Does the Political influence is the reason of failure of plant?	<b>0</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>17</b>		<b>0.288</b>	<b>24</b>

### Sign & Stamp of Respondent

Before giving the questionnaire to the expert personal, following information was described.

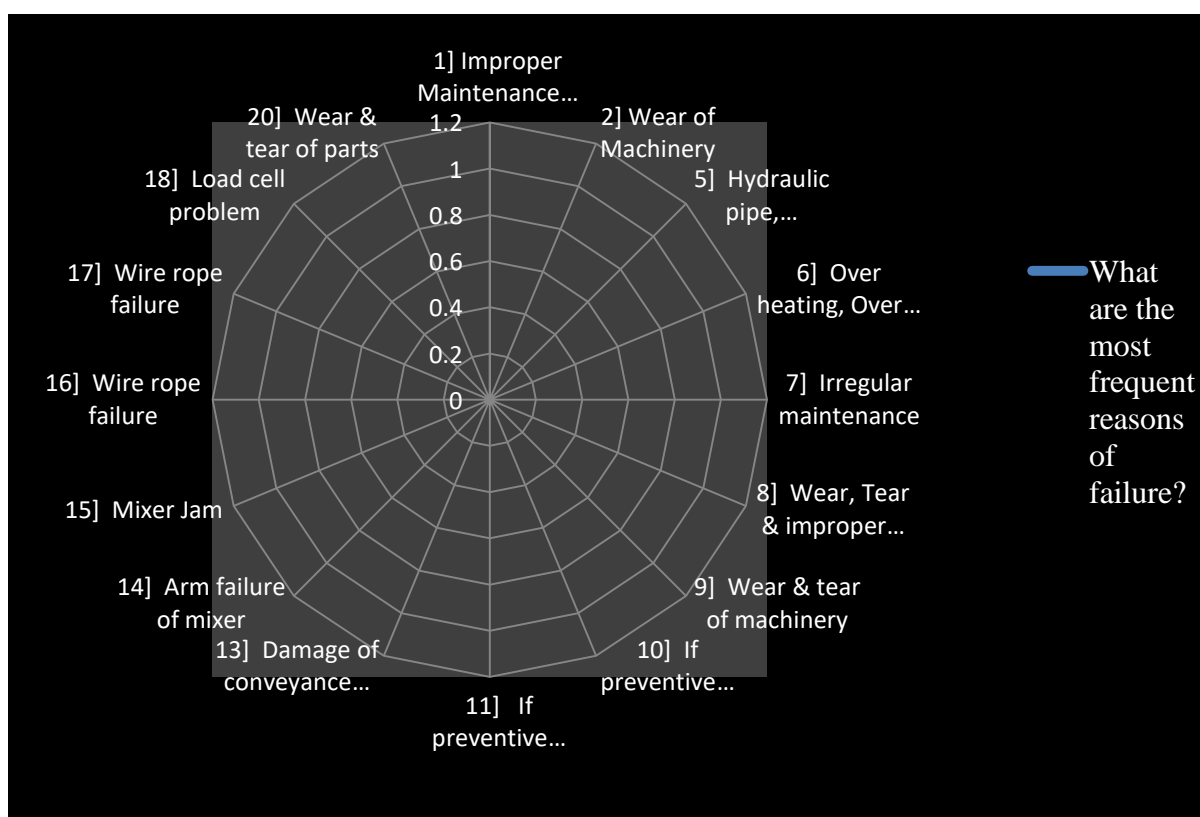


- ✓ The personal just have to give rating by making tick into the box.
- ✓ Each question carries only one answer
- ✓ Use five point scale Etc.
- ✓ Respondent must give his/her opinion or suggestion for minimization of downtime.

**SAMPLE CALCULATION FOR RII—**

<b>RII Calculation</b>	<b>RANK</b>
$\frac{(5*19+4*6+3*0+2*0+1*0)}{(5*25)}$	<b>1</b>
<b>= 0.952</b>	

**C] General Views of Plant Operator/Owner/Respondent**



**Chart No.- 1 Radar Chart for frequent reasons of failure by Respondent**

From the above calculation we found that maintenance is very important for making our plant more profitable. But from the above we found following factors also,

Irregular maintenance of plant, Training to operator, labor, Beyond the use of plant, Unavailability of proper recording system, Lead distance of plant & transit mixer, materials, Lack of communication between plant, Non Availability of recourses some time, Unawareness of new technology, Age of plant, Non availability of second supporting system of operation plant, Quality of RMC



As well as most frequent reasons of failure of plant as per owner/plant operators are,

Improper Maintenance of Plant, Lack of knowledge of machinery, Hydraulic pipe, Compressor, Overheating, over loading, oil level, Wear, Tear & improper maintenance, Damage of conveyance belt, Arm failure of mixer, Mixer Jam, Wire rope failure, Load cell problem, Electric circuit issue.

#### 4. PROPOSED MAINTENANCE LOG SHEET

We prepare a simple checklist for plant which is as follows,

CONCRETE PLANT MAINTENANCE LOG					
Plant No.- _____			Plant Location _____		
Size: _____	Capacity: _____		Date: _____		
Model Number: _____			Serial Number: _____		
<b>Operating Instructions:</b>					
<b>Using Instruction--</b>					
<b>Cleaning Instruction--</b>					
Name of Person Performing Maintenance	What Kind of Maintenance Done	Which Kind of Parts Change?	Number of Parts & Price	Total Price of Parts	

#### SIMPLE MAINTENANCE LOG

Daily checking all parameters

Parameters	1	2	3	4	5	6
Check engine oil						
Check pump oil						
Clean garden hose screen						
Inspect machine						
Clean vacuum tank						
Spray blower inlet with lubricant						
Check drive system						
Check pulleys and belts for wear						
Check high pressure hoses for charging						
Check all nuts and bolt for tightness						
Inspect control office						



Parameters	1	2	3	4	5	6
Inspect and clean vacuum relief valve						
Clean vacuum tank						
Flu shall Ingredient with water & Chemical						
Check Admixture Tank						
Check All Sieves						
Check all Resources						
Check Electric Circuits						
Check Weighing Balance						

## 5. CONCLUSION

From the literature reviews it's clear that the Downtime is the single biggest cause of lost manufacturing time for most producers. From survey & RII methods we can say that, training to helper & operator is important, over production than recommendations, lead distance, record keeping for maintenance, political & location aspects etc. If all concrete plants follow this check list the life of span of plant increase as well as downtime of plant may reduce without doubt. It is observed that most of the failure reasons of equipment are due to improper and irregular maintenance of equipment. So it can be reduced by planning a proper maintenance schedule. It is also noted that there should be a qualified operator to operate any sort of equipment so that a qualified or trained operator can manage the equipment effectively with maximum machine performance. After proper analysis the we prepare a simple maintenance log sheet which can use on any concrete plant site to maintain the plant in proper condition for increasing the life of plant and profitability of plant.

## 6. REFERENCE

- [1] Bostjan Gomiscek, Damjan Maletič at.el. ,”The role of maintenance in improving company’s competitiveness and profitability: A case study in a textile company”, Journal of Manufacturing Technology Management, Vol. 25, No. 4, pp.441 - 456
- [2] Aadal hamid, fard ali bagheri, rad kiyanoosh golchin, al. Et., “impact of plants and equipment management in construction industry of iran”, research journal of applied sciences, engineering and technology 7(11): 2371-2375, 2014 doi:10.19026/rjaset.7.538 issn: 2040-7459; e-issn: 2040- 7467 © 2014
- [3] Chodwadia niraj, pimlikar sunil “downtime cost of construction equipment”. K.s.r. college of engineering, tiruchengode tamil nadu icsee feb. 2011
- [4] Gangane kalpana, patil dipak “downtime cost of equipment used in a construction industry” international journal on future revolution in computer science & communication engineering issn: 2454-4248volume: 3 issue: 12, page no.271 – 277
- [5] Manikandan m., prof. Adhiyaman m., dr.pazhani k. C., “a study and analysis of construction equipment management used in construction projects for improving productivity” international research journal of engineering and technology (irjet) volume: 05 issue: 03 |



mar-2018 e-issn: 2395-0056 p-issn: 2395-0072.

- [6] Naskoudakis Ilias, Petroutsatou Kleopatra, “A Thematic Review of the Main Research on Construction Equipment over Recent Years” *Periodica Polytechnica Architecture* 47(2), pp. 110-118, 2016 DOI: 10.3311/PPar.10384 Creative Commons Attribution research article Received 09 December 2016.
- [7] Phadatare D. B., Charhate S. B., “Impact Of Construction Equipment’s On Building Site Productivity”, *International Journal of Civil Engineering and Technology (IJCIET)* Volume 7, Issue 4, July-August 2016, pp. 513–520 Article ID: IJCIET\_07\_04\_047 Available online.
- [8] Fuerst Michael, Vorster Michael, Hicks Donald “A Model for Calculating Cost of Equipment Downtime and Lack of Availability in Directorates of Engineering and Housing” USACERL TECHNICAL REPORT P-91/16 March 1991.
- [9] Poonam P. Patil, Rohit R. Salgude, “Determination of Downtime Cost of Ready-Mix Concrete Plant and Transit Mixer”, *International Journal of Innovative Technology and Exploring Engineering (IJITEE)* ISSN: 2278-3075, Volume-8 Issue-9, July 2019.p.p.- 3105-3108.
- [10] Juraj drahňovský,” equipment categorization as a basis to improve the organization of maintenance”, 10.2478/v10186-012-0008-3 2012, volume 20, special number, p.p- 21-25
- [11] Karthik Prabhu.R 1, Sampath Kumar.K,” A Review On Factors Involved In Equipment Quality And Management In Ready Mix Concrete”, *International Research Journal Of Engineering And echnology (Irjet)*, Volume: 05 Issue: 02 | Feb-2018, E-Issn: 2395-0056, P.P.-577-581