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*Research Article*

# Cataloging Of Unit Replacement Based On Long Run Repair Average Cost Rate (ACR) Based On Weibull Distribution Model

**[1]Dr. K. UMAMAHESWARI [2]K. SUBRAHMANYAM [3]Dr.A. Mallikarjuna Reddy**

[1]Associate professor, Dept of humanities and sciences, Srinivasa Ramanujan institute of technology, Anantapur, Andhra Pradesh India.

[2]Dept of Mechanical Engineering, JNTUA college of Engineering, Anantapur, Andhra Pradesh India.

[3]Professor, Dept of Mathematics, Sri krishnadevaraya university, Anantapur, Andhra Pradesh India.

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**Abstract:** Large amounts of money are lost each year in the real-estate industry because of poor schedule and cost control, In Industry the investigated failure and repair pattern, reliabilities of generators, compressors, turbines, using simple statistical tools and simulation techniques. The repair duration is divided into the 1)Major repair 2)Minor repair ,In major repair having(repair hour greater than a threshold valve)and Minor repair having(repair hour less than (or)equal to threshold valve).This approach is mainly for Weibull distribution method. In Weibull analysis is a common method for failure analysis and reliability engineering used in a wide range of applications. In this paper, the applicability of Weibull analysis for evaluating and comparing the reliability of the schedule performance of multiple projects is presented, while the successive performance of multiple projects is presented ,while the successive repair times are increasing and are exposing to Weibull distribution ,under these assumptions ,an optimal replacement policy 'T' in which we replace the system ,when the repair time reaches T. It can be determined that an optimal repair replacement policy T* such that long run average cost and the corresponding optimal replacement policy T* can be determined analytically.

**Keywords:** Weibull distribution, Time, failure, repair.

## 1.Introduction:

In modern Industry, millions of rupees are being spent at high quality and reliability products. It requires optimal decisions to the maintenance problems of the systems, Weibull distribution is named waldos Weibull (1887 to 1979).It has very flexible and appropriate choice of parameters ,model many types of failure rate behavior ,This distribution can have three parameters such as scale, shape and location graphical and analytical methods include Weibull probability plotting & hazard plot .These methods are not very accurate but they have gave very fast results. The hydro- generators, compressors and turbines requires a special approach to repair and it is divided in to two types they are minor and major repairs.This approach is specially introduced by the Weibull distribution method. This method is used for the reliability analysis and the analysis is carried out the gearbox assembly analysis and the failure data in various operating conditions was taken from the logbooks of the vehicles. The objective of this study is to discuss and present the applicability of Weibull analysis for evaluating schedule performance using cost and performance indices. Under these assumptions, an optimal replacement policy T in which we replace the system when the repair time reaches T. It can be determined that an repair policy T* such that long run average cost per unit time is minimized and also derived an explicit expression of the long -run average cost and the optimal policy T* can be determined analytically .Numerical results are provided to support the theoretical results.

## 2.Weibull distribution:

Weibull distribution requires characteristic life and shape factor valves. Beta determines the shape of distribution.

$$\beta > 1 - failure\ rate\ is\ increasing$$

$$\beta < 1 - failure\ rate\ is\ decreasing$$

$$\beta = 1 - failure\ rate\ is\ constant$$

The Weibull distribution is the best choice to use analysis software product. If such a tool is not available data can be manually plotted a Weibull probability plot to determine if it follows a straight line.

**3.Assumptions:**

1)Assume time t=0.

2) If the system fails it should be immediately repaired by repairmen.

3)Time intervals between the completion of the (n-1) $^{th}$ repair and completion of the nth repair of system

4)$X_n$ and $Y_n$ are independent where n=1,2,3,4------------------

5) $X_n$ and $Y_n$ are possess a Weibull distribution model

6)$F_n(x)$ and $G_n(Y)$ are the distribution function of $X_n$ and $Y_n$ respectively

7) $E(X_n) = \int_0^\infty t\, dF\, x_n = 1/_\lambda$ and

8)$E(Y_n) = \int_0^\infty t\, du\, y_\eta = 1/_\mu$ , $\lambda, \mu > 0$

9)Assume repair time (working time) is at $\mu < T$ such that underling distribution is good fit to the data sets.

10.Assume that an optimal replacement policy 'T' is applied.

11.Let $C_f$ bet the repairable cost and $C_p$ be the un-repairable cost.

These above assumptions an explicit expression for the long run average cost per unit under the policy 'T' is considered and an optimal solution for T* which minimizes the long-run average cost per unit time.

**4.Long-run average cost rate under policy 'T'**

Let Tn(n>2) be the time between the (n-1) the replacement and the nth replacement of the system under policy T. clearly {T1,T2,------------} from a renewal process and the inner arrival time between two consecutive replacements is called renewal cycle. According to renewal reward theorem ross [8], the long -run average cost rate under policy T is:

$$C(N)= \frac{\text{The expected cost incurred in a renewal cycle}}{\text{The expected length of the renewal cycle}}$$

$$C(T)= \frac{C_f\int_0^T f(t)dt + C_p\int_T^\infty f(t)\, dt}{\int_0^T tf(t)dt + T\int_T^\infty f(t)dt}$$

According into the above assumption the Weibull exponential distribution is

$G(x)=\lambda e^{-\lambda x}; x > 0$; $g(x)=1-e^{-}\lambda^{x}$

$F(x)=1-\exp\{-\alpha(\left(\frac{1-e^{-\lambda x}}{e^{-\lambda x}}\right)^\beta\}$ ,x>0,$\alpha, \beta, \lambda > 0$

Where $\alpha = 1, \beta = 1$

**5.Numerical results and discussions:**

5.1. The parameters are □=0.01681, $C_f$=500, C p=4, the long run average cost per unit time is calculated from the above expression.

| Time T | C(T) | Time T | C(T) | Time T | C(T) |
|---|---|---|---|---|---|
| 1 | 23.1268 | 34 | 12.5345 | 67 | 14.4345 |
| 2 | 19.234 | 35 | 12.6345 | 68 | 14.3345 |
| 3 | 18.3456 | 36 | 12.7345 | 69 | 14.2345 |
| 4 | 17.2345 | 37 | 12.8345 | 70 | 14.2345 |
| 5 | 16.2345 | 38 | 12.9345 | 71 | 14.2345 |
| 6 | 15.2345 | 39 | 13.0345 | 72 | 14.2345 |
| 7 | 14.2345 | 40 | 13.1345 | 73 | 14.2345 |
| 8 | 13.2345 | 41 | 13.2345 | 74 | 14.2345 |
| 9 | 12.2345 | 42 | 13.3345 | 75 | 14.3345 |
| 10 | 11.2345 | 43 | 13.4345 | 76 | 14.4345 |
| 11 | 10.2345 | 44 | 13.5345 | 77 | 14.5345 |
| 12 | 10.3345 | 45 | 13.6345 | 78 | 14.6345 |
| 13 | 10.4345 | 46 | 13.7345 | 79 | 14.7345 |
| 14 | 10.5345 | 47 | 13.8345 | 80 | 14.8345 |
| 15 | 10.6345 | 48 | 13.9345 | 81 | 14.9345 |
| 16 | 10.7345 | 49 | 14.0345 | 82 | 15.0345 |
| 17 | 10.8345 | 50 | 14.1345 | 83 | 15.1345 |
| **18** | **10.9345** | 51 | 14.2345 | 84 | 15.2345 |
| 19 | 11.0345 | 52 | 14.3345 | 85 | 15.3345 |
| 20 | 11.1345 | 53 | 14.4345 | 86 | 15.4345 |
| 21 | 11.2345 | 54 | 14.5345 | 87 | 15.5345 |
| 22 | 11.3345 | 55 | 14.6345 | 88 | 15.6345 |
| 23 | 11.4345 | 56 | 14.7345 | 89 | 15.7345 |
| 24 | 11.5345 | 57 | 14.8345 | 90 | 15.8345 |
| 25 | 11.6345 | 58 | 14.9345 | 91 | 15.9345 |
| 26 | 11.7345 | 59 | 15.0345 | 92 | 16.0345 |
| 27 | 11.8345 | 60 | 15.1345 | 93 | 16.1345 |
| 28 | 11.9345 | 61 | 15.0345 | 94 | 16.2345 |
| 29 | 12.0345 | 62 | 14.9345 | 95 | 16.3345 |
| 30 | 12.1345 | 63 | 14.8345 | 96 | 16.4345 |
| 31 | 12.2345 | 64 | 14.7345 | 97 | 16.5345 |
| 32 | 12.3345 | 65 | 14.6345 | 98 | 16.6345 |
| 33 | 12.4345 | 66 | 14.5345 | 99 | 16.7345 |

**Table:1**. Valves of long run average cost run rate under policy ‘T;

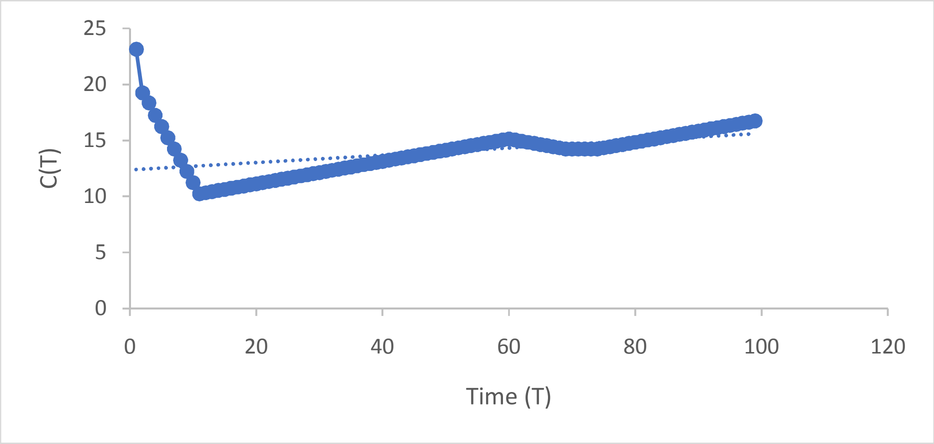


**Fig: 1**. Long run average cost rate against T

5.2. The parameters are □=0.065, $C_f$=200, Cp= 45, the long run average cost per unit time is calculated from the above expression.

| Time T | C(T) | Time T | C(T) | Time T | C(T) |
|---|---|---|---|---|---|
| 1 | 43.456 | 34 | 38.917 | 67 | 67.717 |
| 2 | 34.567 | 35 | 40.117 | 68 | 68.517 |
| 3 | 33.567 | 36 | 41.317 | 69 | 69.317 |
| 4 | 32.317 | 37 | 42.517 | 70 | 69.717 |
| 5 | 31.067 | 38 | 43.717 | **71** | **70.117** |
| 6 | 29.817 | 39 | 44.917 | 72 | 70.517 |
| 7 | 28.567 | 40 | 46.117 | 73 | 70.917 |
| 8 | 27.317 | 41 | 46.917 | 74 | 71.317 |
| **9** | **26.067** | **42** | 47.717 | 75 | 71.717 |
| 10 | 24.817 | 43 | 48.517 | 76 | 72.117 |
| 11 | 23.567 | 44 | 49.317 | 77 | 72.517 |
| 12 | 22.317 | 45 | 50.117 | 78 | 72.917 |
| 13 | 21.067 | 46 | 50.917 | 79 | 73.317 |
| 14 | 19.817 | 47 | 51.717 | 80 | 73.717 |
| 15 | 18.567 | 48 | 52.517 | 81 | 74.117 |
| 16 | 17.317 | 49 | 53.317 | 82 | 74.517 |
| 17 | 18.517 | 50 | 54.117 | 83 | 74.917 |
| 18 | 19.717 | 51 | 54.917 | 84 | 75.317 |
| 19 | 20.917 | 52 | 55.717 | 85 | 75.717 |
| 20 | 22.117 | 53 | 56.517 | 86 | 76.117 |
| 21 | 23.317 | 54 | 57.317 | 87 | 76.517 |
| 22 | 24.517 | 55 | 58.117 | 88 | 76.917 |
| 23 | 25.717 | 56 | 58.917 | 89 | 77.317 |
| 24 | 26.917 | 57 | 59.717 | 90 | 77.717 |
| 25 | 28.117 | 58 | 60.517 | 91 | 78.117 |

| | | | | | |
|---|---|---|---|---|---|
| 26 | 29.317 | 59 | 61.317 | 92 | 78.517 |
| 27 | 30.517 | 60 | 62.117 | 93 | 78.917 |
| 28 | 31.717 | 61 | 62.917 | 94 | 79.317 |
| 29 | 32.917 | 62 | 63.717 | 95 | 79.717 |
| 30 | 34.117 | 63 | 64.517 | 96 | 80.117 |
| 31 | 35.317 | 64 | 65.317 | 97 | 80.517 |
| 32 | 36.517 | 65 | 66.117 | 98 | 80.917 |
| 33 | 37.717 | 66 | 66.917 | | |

**Table 2: long run average cost valves (ACR)**

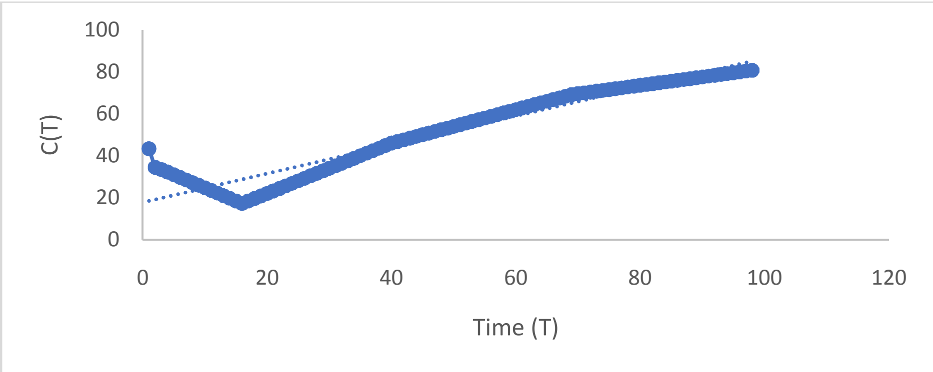


Fig 2: Long run average cost rate against Time(T)

5.3. The parameters are □=0.095, $C_f$=150, Cp=30, the long run average cost per unit time is calculated from the expression.

| Time T | C(T) | Time T | C(T) | Time T | C(T) |
|---|---|---|---|---|---|
| 1 | 53.345 | 34 | 53.68 | 67 | 68.98 |
| 2 | 48.89 | 35 | 54.08 | 68 | 69.48 |
| 3 | 45.78 | 36 | 54.48 | 69 | 69.98 |
| 4 | 45.28 | 37 | 54.88 | 70 | 70.48 |
| 5 | 44.78 | 38 | 55.28 | 71 | 71.08 |
| 6 | 44.28 | 39 | 55.68 | 72 | 71.68 |
| 7 | 43.78 | 40 | 56.08 | 73 | 72.28 |
| 8 | 43.28 | 41 | 56.48 | 74 | 72.88 |
| 9 | 43.68 | 42 | 56.88 | 75 | 73.48 |
| 10 | 44.08 | 43 | 57.28 | 76 | 74.08 |
| 11 | **44.48** | **44** | 57.68 | 77 | 74.68 |
| 12 | 44.88 | 45 | 58.08 | 78 | 75.28 |
| 13 | 45.28 | 46 | 58.48 | 79 | 75.88 |
| 14 | 45.68 | 47 | 58.98 | 80 | 76.48 |
| 15 | 46.08 | 48 | 59.48 | 81 | 77.08 |
| 16 | 46.48 | 49 | 59.98 | 82 | 77.68 |
| 17 | 46.88 | 50 | 60.48 | 83 | 78.28 |
| 18 | 47.28 | 51 | 60.98 | 84 | 78.88 |

| | | | | | |
|---|---|---|---|---|---|
| 19 | 47.68 | 52 | 61.48 | 85 | 79.48 |
| 20 | 48.08 | 53 | 61.98 | 86 | 80.08 |
| 21 | 48.48 | 54 | 62.48 | 87 | 80.68 |
| 22 | 48.88 | 55 | 62.98 | 88 | 81.28 |
| 23 | 49.28 | 56 | 63.48 | 89 | 81.88 |
| 24 | 49.68 | 57 | 63.98 | 90 | 82.48 |
| 25 | 50.08 | 58 | 64.48 | 91 | 83.08 |
| 26 | 50.48 | 59 | 64.98 | 92 | 83.38 |
| 27 | 50.88 | 60 | 65.48 | 93 | 83.68 |
| 28 | 51.28 | 61 | 65.98 | 94 | 83.98 |
| 29 | 51.68 | 62 | 66.48 | 95 | 84.28 |
| 30 | 52.08 | 63 | 66.98 | 96 | 84.58 |
| 31 | 52.48 | 64 | 67.48 | 97 | 84.88 |
| 32 | 52.88 | 65 | 67.98 | 98 | 85.18 |
| 33 | 53.28 | 66 | 68.48 | | |

**Table 3: long - run average cost valves (ACR)**

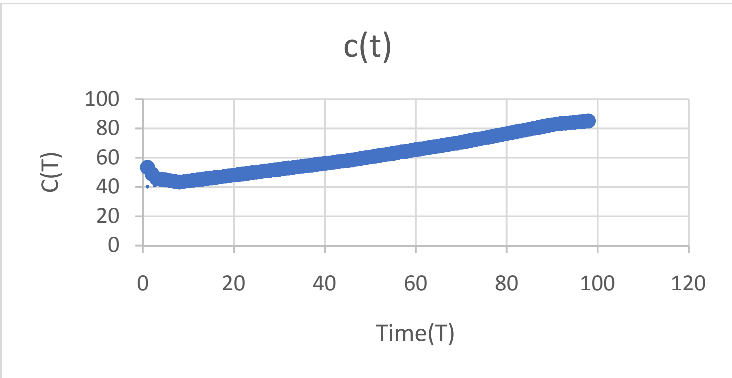


**Fig: 3**. Long run average cost rate against time (T)

Hence, we observed that the cost of repair and the $'\lambda'$ is increases and the Weibull distribution decreases. Thus, the parameter $'\lambda'$ the failure rate is positive, and negative is at the time(T).

**6.<u>Conclusion:</u> I**n this paper, we have considered the Weibull exponential failure model similarly we can use these assumptions all laws, However the work in this distribution is progression as well. The above results we find the long run average cost rate against vs time of Weibull distribution based on the all three analysis we treat best has average cost valve is 5.2.

**7.<u>References:</u>**

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