Determination of maintainability for Dacia 1304, 1,9 D utility vehicle

A Budiul Berghian, T Vasiu and C Birtok Baneasa

Politehnica University of Timisoara, Department of Engineering and Management, 5 Revolution Street, Hunedoara, 331128, Romania

E-mail: adina.budiul@fih.upt.ro

Abstract. The study analyses the ability to be maintained or rehabilitation of Dacia 1304, 1,9D utility vehicle. The paper comprises the determination of its maintainability using the Weibull++8 specialized software.

1. Introduction

Maintainability is defined by: "The ability of a device under conditions of use to be maintained or restored to perform its specified function when maintenance is made under imposed conditions with prescribed procedures and remedies. It is the design and installation parameter, facility and safety with which maintenance can be performed.

Maintainability is a design consequence and maintenance represents the way to operate through running operations to restore the system to the optimal parameters [1]. Maintainability is related to conception activities and maintenance is located in the operation.

Maintainability as a design feature must provide:

- as an element, subsystem and system to be maintained with a prescribed probability in operation by maintenance activities;
- establishing the size and frequency of maintenance activities;
- Establishing the maintenance costs, respectively the level of expenses generated by this activity, which does not exceed the approved level on the total product.

The maintenance of appliances and systems greatly influences their usability and reliability. Maintenance must be characterized by the requirement for the restoration time, from interrupt to functioning, to be less than the specified (predetermined) time interval.

If it is noted with $\tau'$ the time for restoration (repair) and $\tau$ maintenance time, then:

- the ability of repair (restoration) = $P(\tau' \leq t_i)$;
- capacity for maintenance = $P(\tau'' \leq t_i)$;

in which $\tau'$ and $\tau''$ are random sizes and $(t_i, t_i)$ are the value of time that the repair and maintenance must be performed under the required conditions.

Industrial experience shows that it normally follows a lognormal distribution function. Distribution laws are mathematical expressions used to model over time the phenomena of good functioning and restoration.

Their determination is based on the processing of data obtained from exploitation. Once established, the level of maintenance can be determined at any time.
2. Determination of Maintainability for Dacia 1304 1,9D utility vehicle

The restoration time of the Dacia 1304 is the result of the quality characteristics under the conditions of operation, maintenance, etc. In order to establish the law on the distribution of favorable running [2] and repaired time, a statistical observation is organized [3].
For this, an 8-month observation program has been developed that includes data on: the times at which changes occur in the state or behavior of the entity, the timing of function after the last repair, the time of the interruption of operation, the moment of reversion operation, time of fall, moment of recommissioning after removal of causes of fall [4].

After processing the data obtained from running of Dacia 1304 utility vehicle using the Weibull ++8 specialized software, have been obtained the following results presented in graphic form in Figures 3, 4, 5 and 6.

Certification on real maintainability of the studied utility vehicle complies with the Lognormale distribution law can be seen in Figure 1, respectively the correlation coefficient are ρ=0.965079. Thus, mathematical expression of the maintainability distribution law for Dacia 1304, 1,9D is:

\[
M(\tau) = 1 - \int_{0}^{\tau} \frac{1}{x\sigma\sqrt{2\pi}} e^{-\frac{(\log x - \mu)^2}{2\sigma^2}} dx
\]

(1)

**Figure 3.** Graphic of maintainability depending on time in cartesian coordinates
**Figure 4.** Graphic of maintainability depending on time

**Figure 5.** Graphic of rehabilitation rate depending on time
3. Conclusions
As far as maintenance is concerned, it is found that it complies with the lognormal distribution law. The time maintainability chart (Figure 4) shows that the service activity of the van is well established.

It is noted that the maintenance rate increases rapidly in approx. 5 hours. This means that the probability of restoring the car after the failure is approaching 1 during this time.

Regardless of mechanical or electrical problems in operation, they will be repaired within 5 hours at most.

References
[1] Roman I 1971 Product Availability, Reliability and Maintainability in Production Quality and Metrology
[2] Budiul Berghian A and Vasiu T 2015 Determination of Reliability for Dacia 1304, 1,9D, utility vehicle, IOP Conf. Ser.: Mater. Sci. Eng. 85 012007
[3] Budiul Berghian A and Vasiu T 2008 Reliability and maintainability of industrial entities. Theory and applications, Publishing House: Editura "INFOMIN" Deva, Romania
[4] ***STAS 8174/1-77, Reliability. Terminology