

# **Analysis of Downtime on the Main Gear of KAMAZ Vehicles in the Application of Dynamic Systems Maintenance and Current Repair**

**Vladimir Vladimirovich Lyandenburskiy**

Street Titov, 28, 440028 Penza, Russia

**Maxim Vladimirovich Nefedov**

Street Titov, 28, 440028 Penza, Russia

**Vyacheslav Nikolaevich Borovkov**

Street Titov, 28, 440028 Penza, Russia

Copyright © 2015 Vladimir Vladimirovich Lyandenburskiy, Maxim Vladimirovich Nefedov and Vyacheslav Nikolaevich Borovkov. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## **Abstract**

The application of dynamic systems maintenance and routine repairs on automotive enterprises, allows to optimize the transport process and to reduce the downtime of vehicles, in particular the amount of downtime on the main gear from component failure on one car, Park the car, and one day operation of KAMAZ vehicles.

**Keywords:** Analysis; idle time; a fault; a dynamic system; the main transmission

## **Introduction**

When conducting experimental research in the initial period as object adopted main gear trucks of the Russian production of KAMAZ.

The collection of statistical data required to analyze the main transmission

in general. The object of research (primary transfer) was considered as a system consisting of a body and its devices, representing the shafts, gears, bearings.

Research methodology assumed the registration of vehicle models, year of hire, mileage first operation, characteristics of the manifestation of failures during operation, identify possible causes of failure, as well as additional data that give an in-depth characterization of the detected failure of elements of the main transmission. To build dependencies it is necessary to analyze the random variable that will allow us to know the time [1].

On the proposed elements of the main transmission will create graphs for one car. First of all we are interested in how perspective dynamic system maintenance and current repair of vehicles based on the built-in diagnostics in comparison with the existing enterprises preventive service system [2, 3].

## Experimental study

Experimental data idle of the car depending on the system of prevention are presented in table 1.

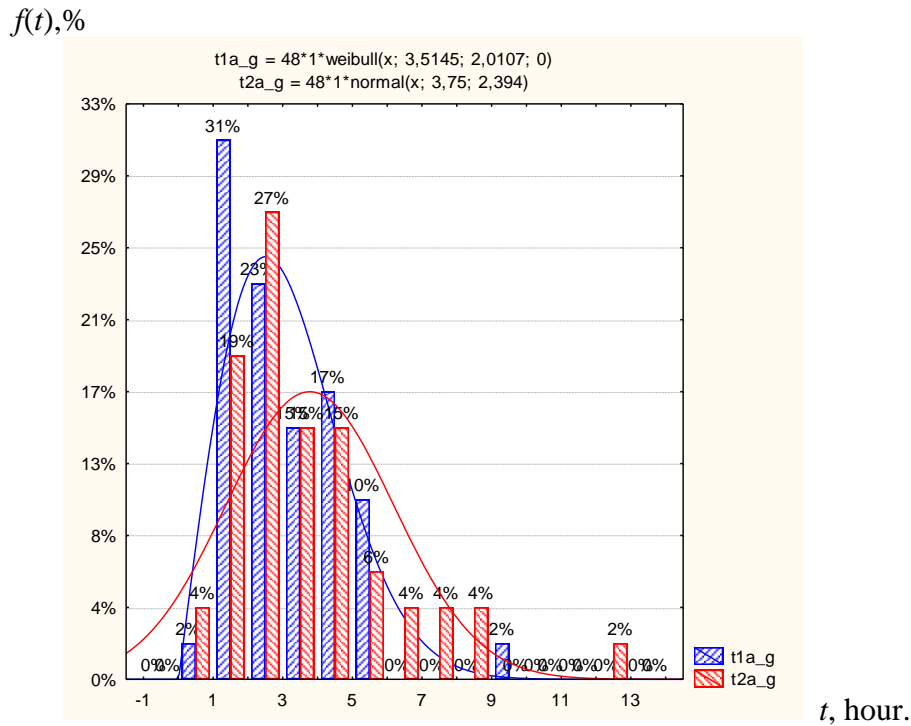
Table 1: The amount of downtime on the main gear from component failure on one car ( $t1a\_g$  - for the dynamic strategy,  $t2a\_g$  for preventive strategies), car Park ( $t1p\_g$  for probabilistic-logical strategies,  $t2p\_g$  for preventive strategies), one day ( $t1d\_g$  for probabilistic-logical strategies,  $t2d\_g$  for preventive strategies)

<b>№ п/п</b>	<b>t1a_g</b>	<b>t2a_g</b>	<b>t1p_g</b>	<b>t2p_g</b>	<b>t1d_g</b>	<b>t2d_g</b>
1	0,63	0,47	12,32	25,2	0,31	0,09
2	0,72	0,53	14,87	49,07	0,33	0,12
3	0,91	0,62	38,87	55,53	0,33	0,36
4	0,93	0,67	39,29	58,51	0,47	0,45
5	1,1	0,94	49,08	71,09	0,67	0,69
6	1,29	1,09	50,81	72,78	0,72	0,93
7	1,3	1,18	51	75,2	0,76	0,94
8	1,55	1,23	58,41	79,7	0,85	1
9	1,61	1,29	64,45	83,4	0,99	1,05
10	1,74	1,62	68,99	84,42	1,02	1,05
<b>№ п/п</b>	<b>t1a_g</b>	<b>t2a_g</b>	<b>t1p_g</b>	<b>t2p_g</b>	<b>t1d_g</b>	<b>t2d_g</b>
11	1,75	1,65	69,37	86,71	1,08	1,21
12	1,78	2,18	81	88,46	1,26	1,27
13	1,92	2,35	81,41	88,89	1,31	1,28
14	2,08	2,39	85,31	91,06	1,44	1,32
15	2,14	2,44	86,09	91,51	1,5	1,43
16	2,17	2,55	88,65	94,1	1,65	1,51
17	2,18	2,85	91,53	94,58	1,68	1,54
18	2,28	3,06	92,69	100,52	1,68	1,64
19	2,3	3,09	93,18	100,74	1,72	1,65

<b>20</b>	2,33	3,11	95,98	106,86	1,74	1,72
<b>21</b>	2,34	3,26	97,09	110,98	1,74	1,74
<b>22</b>	2,36	3,3	97,48	120,44	1,79	1,93
<b>23</b>	2,36	3,36	99,88	123,46	1,8	1,96
<b>24</b>	2,71	3,37	107,35	124,9	1,9	1,97
<b>25</b>	2,85	3,37	110,44	130,56	2,11	1,97
<b>26</b>	2,86	3,4	110,84	140,8	2,23	2,03
<b>27</b>	2,86	3,4	121,31	142,55	2,34	2,11
<b>28</b>	3,03	3,46	126,98	161,1	2,36	2,31
<b>29</b>	3,14	3,51	131,59	169,89	2,39	2,52
<b>30</b>	3,26	3,85	133,3	171,75	2,44	2,6
<b>31</b>	3,39	3,88	134,11	178,68	2,46	2,63
<b>32</b>	3,53	3,98	149,82	178,99	2,68	2,66
<b>33</b>	3,69	4,22	152,42	184,56	2,71	3,13
<b>34</b>	3,7	4,38	162,37	187,23	2,81	3,14
<b>35</b>	3,74	4,61	164,29	201,33	2,91	3,22
<b>36</b>	4,27	4,66	172,93	213,7	3,26	3,46
<b>37</b>	4,28	4,68	176,68	215,58	3,39	3,56
<b>38</b>	4,3	4,88	177,77	215,8	3,94	3,65
<b>39</b>	4,35	5,34	207,2	219,81	4,07	3,82
<b>40</b>	4,77	6,21	208,48	242,98	4,14	3,99
<b>41</b>	4,88	6,25	213,66	246,87	4,22	4,02
<b>42</b>	4,92	6,85	238,27	247,42	4,48	4,82
<b>43</b>	5,14	7,03	239,73	266,8	4,53	4,82
<b>44</b>	5,35	7,08	264,8	268,1	4,55	5,06
<b>45</b>	5,48	7,81	270,16	276,29	5,09	5,08
<b>46</b>	5,87	9,4	305,3	283	5,1	5,26
<b>47</b>	7,11	9,86	314,39	286,72	5,23	5,51
<b>48</b>	7,5	10,69	430,24	564,25	5,24	6,5
Mean	3,10	3,75	158,52	181,56	2,93	3,27
<b>№ n/π</b>	<b>t1a_g</b>	<b>t2a_g</b>	<b>t1p_g</b>	<b>t2p_g</b>	<b>t1d_g</b>	<b>t2d_g</b>
Medium square deviation StdDv	1,65	2,39	86,15	118,08	1,83	1,95
The coefficient variations v	0,58	0,31	0,56	0,32	0,57	0,31

### Results and discussion

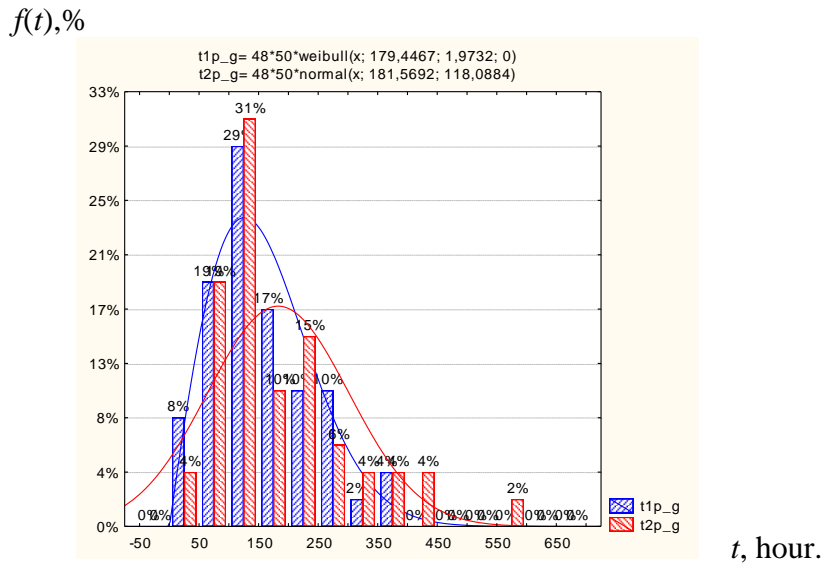
The schedule of values downtime (figure 1) along the main transmission failure item on a vehicle formed by using a measure of time.



- 1 - for the dynamic system maintenance and current repair of motor vehicles;
- 2 - for preventive system

Figure 1: Distribution of idle time on the box changes gear from component failure on one car

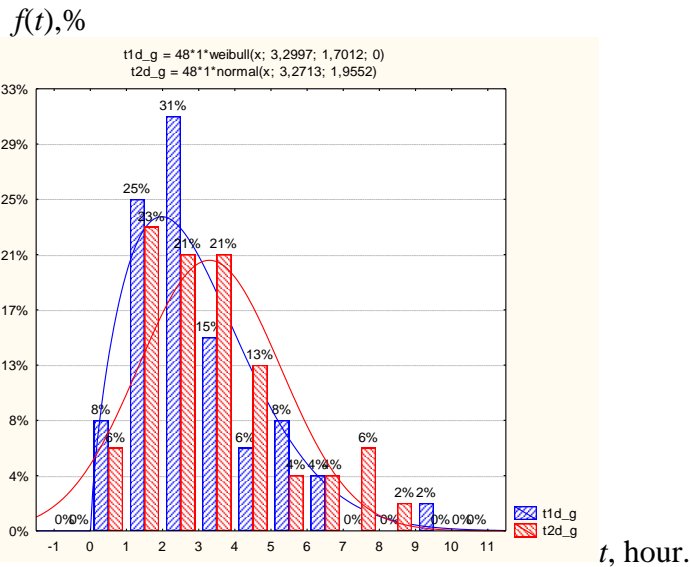
In the park of cars for which the experiment was conducted, the total downtime was following dependencies (figure 2, 3).



1 - for the dynamic system maintenance and current repair of motor vehicles;  
 2 - for preventive system

Figure 2: Distribution of idle time on the box changes gear to failure of the item on the entire fleet of subjects

Currently the company uses preventive maintenance strategy for data suggested by the manufacturer. The standards are adjusted according to the "Provisions for maintenance and repair of rolling stock of road transport".



1 - for the dynamic system maintenance and current repair of motor vehicles;  
 2 - for preventive system

Figure 3: Distribution of downtime on the main gear to failure of an item on one day of operation in the park subjects

## **Conclusion**

Introduced dynamic system maintenance and current repair of vehicles substantially improves performance by reducing downtime by 16-26 % for the main gear in comparison with the existing enterprise preventive system maintenance vehicles.

## **References**

- [1] Lyandenburskiy V.V., Fundamentals of scientific research: a training manual / V.V. Lyandenburskiy, A.V. Bazhenov, V.V. Konovalov. Penza: PGUAS, 2013, 388 p.
- [2] Lyandenburskiy V.V., Probabilistic-logical method of Troubleshooting car: monograph / V.V. Lyandenburskiy, A.I. Tarasov - Penza, PGWS 2013. 220 p.
- [3] Lyandenburskiy V.V., Analysis of idle time on the injectors when using probabilistic-logical method of Troubleshooting for KAMAZ trucks / V.V. Lyandenburskiy, E. O. Kulakov, E.K. Moryakov // Internet-journal "SCIENCE" in 2014. No. 1 <http://naukovedenie.ru/PDF/25TVN614.pdf> (free). SAP. From the screen. Lang. eng., eng. <http://dx.doi.org/10.15862/25TVN614>

**Received: January 14, 2015; Published: February 23, 2015**