UDC 355.6

O. Putro

METHODOLOGY FOR SCIENTIFICALLY BASED DETERMINATION OF FUEL CONSUMPTION FOR MILITARY TRUCKS USING THE EXAMPLE OF MAN TGM 13.320 IN THE SUBDIVISIONS OF THE NATIONAL GUARD OF UKRAINE

The method for determining the fuel consumption of military trucks is considered using the example of MAN TGM 13.320 trucks operated by units of the National Guard of Ukraine. A computational and analytical approach is proposed that takes into account design parameters and specific operating conditions. A comparison of analytical and empirical data showed similar results (23.8 l/100 km and from 22.8 l/100 km to 26 l/100 km), confirming the reliability of the model. The optimal speed of 70 km/h with a minimum fuel consumption of 22.9 l/100 km was determined. It is noted that the results obtained can be used to standardize fuel consumption and improve the logistical support of the National Guard units.

Keywords: *military motor transport, fuel consumption, logistical support, fuel and lubricants, forecasting, supply.*

Statement of the problem. In accordance with the Law of Ukraine "On the National Guard of Ukraine" [1] and other regulatory acts [2, 3], units and subunits of the National Guard of Ukraine (NGU) perform their designated functions in ensuring the defense of the state, carrying out a wide range of tasks related to the protection of sovereignty and territorial integrity. All operations conducted by the NGU are subject to detailed analysis in order to gain experience and improve capabilities.

In the current conditions of war, characterized by highly dynamic combat operations, the mobility of units, and their rapid movement, logistical support is of fundamental importance. In particular, military motor transport (MMT) is the main tool for delivering resources, evacuating personnel and equipment, and ensuring the readiness of units to perform their assigned tasks. Therefore, MAT must meet current requirements for passability, maneuverability, speed on dirt roads, survivability, and the ability to operate in off-road conditions.

Today, combat operations conducted in Ukraine in response to the aggressor's invasion are characterized by high intensity and rapid changes in the situation in the areas where tasks are performed. As Marta Pawelczyk [4] notes, the dynamics of modern conflicts require logistics systems to be flexible and adaptable to unpredictable conditions. The mobility of the National Guard units increases their dependence on the effective functioning of the VAT. In such conditions, vehicles must not only deliver fuel and lubricants (FL), ammunition, and food, but also maintain stable operation in difficult climatic, geographical, and road conditions, such as the sixth and seventh groups of operating conditions for NGU military wheeled vehicles [12]. This places additional demands on the tactical and technical characteristics of military vehicles, in particular their economy, reliability, and adaptability to various operating scenarios.

The high dynamics of combat operations and dependence on foreign equipment necessitate a scientific basis for logistics processes in the Armed Forces of Ukraine. The diversity of military equipment, despite increased capabilities, creates challenges related to maintenance, fuel and lubricant standardization, and adaptation to operating conditions. Determining fuel consumption rates for TGM and TGS series vehicles is a priority task, the solution of which will contribute to effective planning, resource management, and the fulfillment of combat missions. Further research should cover a wider range of logistical issues to ensure the sustainable functioning of the NGU in the conditions of modern warfare.

Analysis of recent research and publications. In order to develop scientifically based fuel consumption standards for military trucks, in particular MAN TGM 13.320, it is necessary to thoroughly study guiding documents, scientific research, and publications in the units of the National Guard of Ukraine. Their analysis makes it possible to identify relevant methods and initial data and to take into account the specific operating conditions in the context of modern combat operations.

Publications [14, 15] examine road, transport, and atmospheric and climatic conditions for vehicle operation and provide information on their classification and impact on fuel efficiency. These sources form the theoretical basis for understanding how external conditions affect the performance of the MAN TGM 13.320, especially in difficult conditions such as off-road driving.

The work [12] examines the classification of operating conditions for military wheeled vehicles of the National Guard of Ukraine. It identifies the sixth and seventh groups of operating conditions, which characterize the difficult climatic and road conditions typical of combat operations in Ukraine. The authors also propose methods for analytically determining fuel consumption, taking into account the specifics of the tasks performed by the NGU. These approaches are relevant for the MAN TGM 13.320, as they allow calculations to be adapted to real-life scenarios, such as driving through destroyed areas or rapid maneuvering during combat operations.

Researching fuel efficiency using mathematical models is a common and effective approach to standardizing fuel consumption. Such models should combine ease of use, availability of source data, and the ability to take into account changes in operating conditions and vehicle parameters. The fuel consumption calculation method developed by Professor M. Govorushchenko [11] meets these requirements. Its advantage lies in the use of vehicle technical characteristics, namely engine displacement, weight, speed, and design parameters, which are easily obtained from reference literature. The methodology takes into account the average technical speed, weight of the vehicle, as well as operational and design features, which makes it suitable for accurate fuel consumption forecasting for MAN TGM 13.320. However, it has limitations: the model is based on ideal or average conditions, which may require adjustment for extreme scenarios, such as combat operations or driving under heavy loads.

Overall, the analysis of studies and publications provides sufficient data to select research methods and establish initial parameters for fuel consumption.

The purpose of the article is to develop scientifically based fuel consumption standards for military trucks using the example of MAN TGM 13.320 in the units of the National Guard of Ukraine, aimed at optimizing logistics support, in particular forecasting, planning, and managing the supply of fuel and lubricants in conditions of high combat dynamics.

Summary of the main material. Since the beginning of the full-scale invasion of Ukraine, partner countries and international organizations have been providing significant support to the Armed Forces of Ukraine, in particular the National Guard. One of the key areas of this assistance is the provision of modern military vehicles to the units. For example, the German company Rheinmetall supplies Ukraine with significant quantities of TGM and TGS series military trucks, which are specialized vehicles adapted to the requirements of the Ukrainian Armed Forces [5]. According to official sources, as of 2023, Ukraine had received several hundred such vehicles, which significantly strengthened its logistical capabilities [6]. These vehicles are characterized by high cross-country ability, modular design, and economy, making them a valuable asset for combat missions. In addition to the TGM and TGS series, Rheinmetall also supplies HX series vehicles, which have different technical characteristics and fuel requirements. Although this diversity of equipment increases operational flexibility, it also poses significant logistical challenges due to the different types of vehicles [7].

The main challenges can be classified as follows.

1. Diversity of transport. Different models of TMV (TGM, TGS, HX, etc.) have significantly different design parameters, which complicates the standardization of spare parts and lubricants. This necessitates the creation of a complex supply system covering various types of oils, lubricants, filters, and components.

2. Maintenance and repair. Timely maintenance is complicated by the lack of qualified specialists with experience working with foreign equipment. For example, Rheinmetall vehicles require specialized knowledge on the part of personnel, which is not always available in the field.

3. Standardization of lubricants and fuels. Different models of armored vehicles may require

specific types of lubricants, which complicates their interchangeability. This increases the risk of shortages of certain types of lubricants and fuels.

4. Tactical and technical characteristics. Differences in cross-country ability, load capacity, and fuel efficiency lead to a mismatch between the capabilities of the equipment and specific operating conditions, such as movement in swampy terrain or mountainous areas.

Such problems are not unique to Ukraine. Similar challenges arise in NATO countries, where the diversity of equipment complicates logistical support [7]. For example, a NATO logistics report [8] notes that equipment standardization is a key factor in improving operational efficiency. Therefore, Ukraine's experience can be valuable to the international military community.

Given the complexity of these issues, it is impossible to resolve them within the scope of a single article. Therefore, the author proposes to focus on determining fuel consumption rates for TGM and TGS series military trucks as a baseline indicator that is essential for logistical support.

Fuel consumption standards are the basis for:

– forecasting and planning supplies; accurate standards make it possible to determine the amounts of fuel needed to maintain central bases, stationary warehouses, field refueling points, and units;

– cost management; the rational use of fuel and lubricants is the official duty of NGU officials, which contributes to the conservation of resources;

– the effectiveness of the use of military vehicles; the accuracy of fuel consumption calculations ensures the reliability of combat missions, especially in conditions of rapid movement of units.

Fuel consumption rates are one of the most critical elements of logistics planning, as fuel accounts for a significant share of logistics costs in mechanized armies [8]. For example, TGM and TGS series vehicles (according to Rheinmetall) are economical, but their fuel consumption rates depend on operating conditions. Therefore, empirical determination of these standards for Ukrainian conditions is necessary for logistics optimization. In the author's opinion, determining fuel consumption standards is only the first step in solving the broader problem of the diversity of military equipment. Further research should analyze the unification of fuel and lubricants, the standardization of spare parts, and the training of specialists to service foreign equipment. In addition, it is important to take into account international experience, in particular NATO's approaches to managing a mixed fleet of equipment, which can be adapted to the needs of the NGU.

For example, a MAN TGM 13.320 military truck was selected, the appearance of which is shown in Figure 1, and the technical characteristics and design parameters collected by the author are given in Table 1.

To determine the fuel consumption rate, we will use a computational and analytical method.

Figure 1 – Exterior view of the MAN TGM 13.320

Table 1 – Technical specifications and design parameters MAN TGM 13.320

1 General Information	
Vehicle Brand Name	MAN
Model (modification) of Vehicle	TGM 13.320
Year of Manufacture	2023
Type of Transport	Cargo
Body Type	Specialized, onboard, covered
Fuel	Diesel
Ecological Level	Euro-6
Wheel configuration	4×4
Tires (size)	395/85R20

2 Dimensions and weight		
Name	Unit of measurement	Meaning
Height	mm	2946
Width	mm	2490
Wheelbase	mm	4250
Total weight	kg	14000
Equipped weight	kg	8000
Load capacity	kg	6000

3 Engine and transmission specifications		
Name	Unit of measurement	Meaning
Engine brand and type	–	D0836, inline 6-cylinder
Engine displacement	l	6.9
Maximum power	hp. (kW)	320 (235) at 2300 rpm
Maximum torque	N*m(kg*m)	1250 (128) at 1800 rpm
Number of valves per cylinder	pcs.	4
Cylinder diameter	mm	108
Piston stroke	mm	125
Transmission brand and type		MAN TipMatic 12 automatic transmission
Transmission ratios		12.33; 9.59; 7.44; 5.78; 4.57; 3.55; 2.7; 2.1; 1.63; 1.27; 1.0; 0.78
Main transmission ratio		4.83

The fuel consumption equation is as follows [11]:

$$Q = \frac{1}{\eta_i} \cdot [A \cdot i_t + B \cdot i_t^2 \cdot V_{VS} + C \cdot (G_V \cdot \psi + 0.077 \cdot d\mathrm{F} \cdot V_{VS}^2)], \quad (1)$$

where V_{vs} is the vehicle speed, km/h;

A, B, C are the constant coefficients;

η_i is the indicative engine efficiency coefficient;

i_t is the average gear ratio of the transmission;

ψ is the total road resistance coefficient of a vehicle;

dF is the drag factor, N·s2/m2;

G_v is the vehicle weight, H.

In the above formula, the fuel consumption constants A, B, and C depend on the design parameters and are calculated as follows:

$$A = \frac{381 \cdot V_{ed} \cdot i_{mt}}{H_{lh} \cdot \rho_{fd} \cdot r_d},$$

$$B = \frac{11 \cdot V_{ed} \cdot S_{ps} \cdot i_{mt}^2}{H_{lh} \cdot \rho_{fd} \cdot r_d^2},$$

$$C = \frac{100}{H_{lh} \cdot \rho_{fd} \cdot \eta_{te}}, \quad (2)$$

where V_{ed} is the engine displacement, l;

i_{mt} is the main transmission ratio;

r_d is the dynamic wheel radius, m;

S_{ps} is the piston stroke, m;

H_{lh} is the lower heat of combustion, kJ/kg;

ρ_{fd} is the fuel density, g/cm3 (kg/l);

η_{te} is the transmission efficiency.

In practical calculations to determine the dynamic radius of a wheel for radial tires, the following formula is used [11]:

$$r_d = (0.52 \cdot d_{rd} + 0.93 \cdot B_{pw}) = = (0.52 \cdot 508 + 0.93 \cdot 335.75) = = 576.41 \approx 0.58, \quad (3)$$

where r_d is the dynamic wheel radius, m;

d_{rd} is the rim diameter;

B_{pw} is the profile width (height).

To determine coefficients *A*, *B*, and *C*, technical characteristics and design parameters were used, and average values were adopted:

H_{lh}= 44 000 kJ/kg; ρ_{fd}= 0.83, g/cm3 (kg/l); η_{te}= 0.81;

A = 0.6; *B* = 0.018; *C* = 0.0034.

On the one hand, to determine the fuel consumption of a MAN TGM 13.320 vehicle using a computational and analytical method when substituting standard values corresponding to ideal operating conditions, a linear fuel consumption rate can be obtained. This is also a practical requirement for the NGU divisions. So, if V_{VS} = 50 km/h *A*, *B*, *C* accordingly 0.6; 0.018; 0.0034; η_i = 0.43; i_t =1; ψ = 0.026; *d*F = 2.55; G_v = 80000, one has as follows:

$$Q = \frac{1}{0.43} \cdot \left[\begin{matrix} 0,6 \cdot 1 + 0.018 \cdot 1^2 \cdot 50 + 0.0034 \cdot \\ \cdot (80000 \cdot 0.026 + 0.077 \cdot 2.55 \cdot 50^2) \end{matrix} \right] =$$

$$= \frac{23.8}{100} \text{km.} \quad (4)$$

The author collected information from several departments of the National Guard of Ukraine where the specified vehicle is operated and compared it with the obtained value (Figure 2).

The diagram shows that the fuel consumption calculated analytically is 23.8 l/100 km. This figure is very close to the empirical data obtained in the divisions, which vary in the range from 22.8 l/100 km to 26 l/100 km. This coincidence indicates that the analytical method is adequate for estimating fuel consumption in real conditions. The proximity of theoretical and practical data confirms the reliability of the chosen approach. The average value of empirical data is 24.2 l/100 km, which is only 1 % higher than the analytically calculated consumption (23.8 l/100 km). Such a slight deviation (0.4 l/100 km) emphasizes the high accuracy of the analytical method. The data obtained is of great practical importance for the NGU departments. It can be used to establish a linear fuel consumption rate for the MAN TGM 13.320 vehicle.

On the other hand, this means that the calculations can serve as a reliable basis for predicting fuel consumption, taking into account possible fluctuations in real operating conditions. This result confirms that the objectives of this article have been achieved.

Fuel consumption in the specific operating conditions in which NGU vehicles operate is significantly influenced by: vehicle speed, engine efficiency indicator, weighted average gear ratio, total road resistance coefficient, drag coefficient, vehicle weight [15].

The speed of the MAN TGM 13.320 vehicle is considered in the range from 10 km/h to 100 km/h due to the fact that it is equipped with an electronic system that limits the maximum engine speed, which ensures movement at a maximum speed of 100 km/h. Speed is the main input variable that characterizes the response of the "vehicle-driver" system to external influences. Average speed is an indicator that can be determined and taken into account [13, 14].

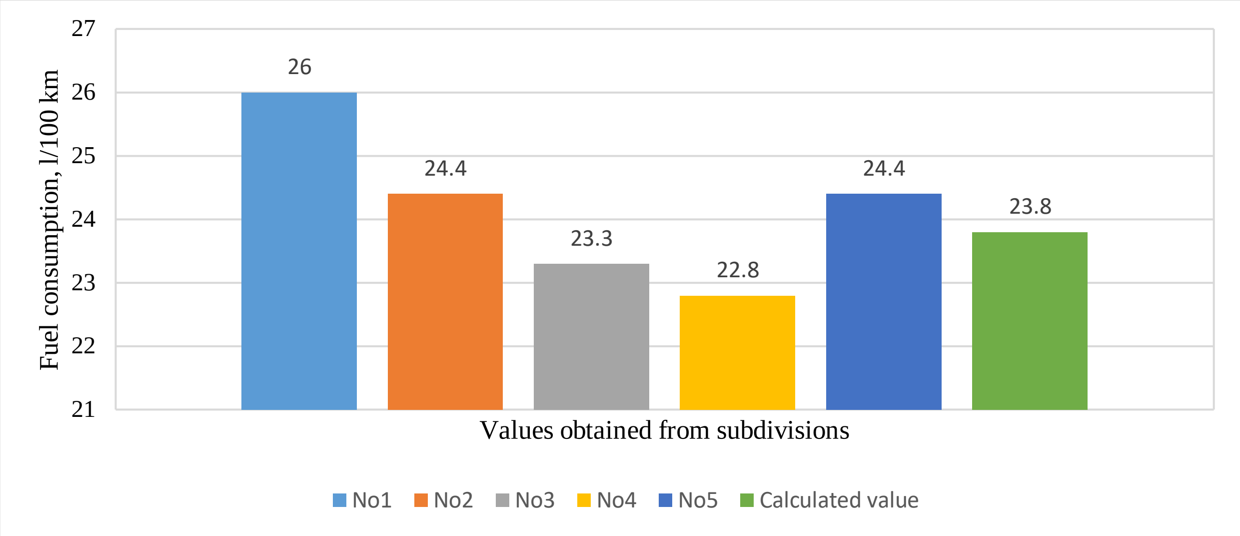

Figure 2 – Comparison of linear fuel consumption values for MAN TGM 13.320

The indicative engine efficiency coefficient is set at 0.43, which corresponds to the average value.

The average gear ratio of the transmission is calculated using the formula

$$i_t = (K_S \cdot V_{\max} \cdot i_{ogr})/V_{VS}, \quad (5)$$

where K_S is the speed ratio equal to the ratio of the rotational speed at maximum torque to the rotational speed at rated (maximum) engine power;

i_{ogr} is the overdrive gear ratio.

For MAN TGM 13.320 vehicles $K_S = 1800/2300 \approx 0.78$; $i_{ogr} = 0.78$. Calculated values of i_t for speeds ranging from 10 km/h to 100 km/h are shown in Table 2.

The coefficient of total road resistance to vehicle movement is calculated using the formula

$$\psi = 0{,}01 V_{\max}/V_{VS}. \quad (6)$$

Calculated values of ψ for speeds ranging from 10 km/h to 100 km/h are also shown in Table 2.

The dependence of fuel consumption on the speed of the MAN TGM 13.320 vehicle is shown in Figure 3.

The fuel consumption of the MAN TGM 13.320 military truck has a clear non-linear dependence on speed. It decreases sharply with increasing speed from 10 km/h (106.6 l/100 km) to 70 km/h (22.9 l/100 km), reaching a minimum, and then increases to a speed of 100 km/h (26.2 l/100 km). This corresponds to a parabolic curve, which is typical for describing fuel consumption as a function of speed. The lowest fuel consumption (22.9 l/100 km) is achieved at a speed of 70 km/h. This speed ensures the most efficient operation of the MAN D0836 engine at the optimum speed, load, and aerodynamic drag of the vehicle. In the speed range from 10 km/h to 30 km/h, fuel consumption is significantly higher (e.g., 106.6 l/100 km at 10 km/h) due to the low efficiency of the engine at low revs, the high average gear ratio of the transmission, and friction losses. At speeds above 70 km/h, consumption increases due to increased aerodynamic drag, which is proportional to the square of the speed. For the MAN TGM 13.320, this becomes a significant factor limiting fuel efficiency.

Table 2 – Calculated values for MAN TGM 13.320 vehicle

V_{vs}	10	20	30	40	50	60	70	80	90	100
η_i	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
i_t	7.91	3.95	2.64	1.98	1.58	1.32	1.13	0.99	0.88	0.79
ψ	0.1100	0.0550	0.0367	0.0275	0.0220	0.0183	0.0157	0.0138	0.0122	0.0110
dF	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Q	106.60	54.00	37.00	29.20	25.20	23.40	22.90	23.30	24.40	26.20

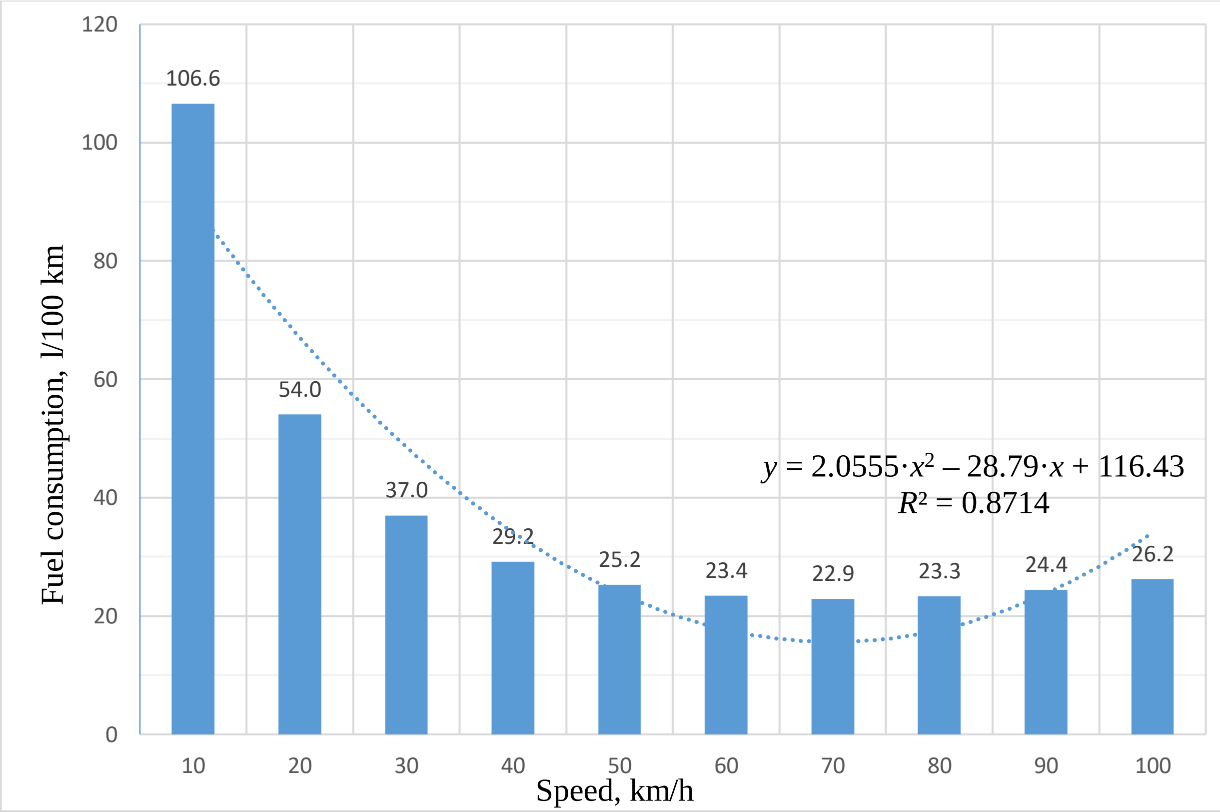

Figure 3 – Fuel consumption of MAN TGM 13.320 vehicle depending on speed

The dependence of fuel consumption on speed is approximated by a parabolic curve with a high coefficient of determination. This indicates that the model explains 87.14 % of the variation in fuel consumption and is reliable for forecasting.

The study proves that the optimal speed for the MAN TGM 13.320 is 70 km/h with a minimum fuel consumption of 22.9 l/100 km. The nonlinear dependence and high accuracy of the model confirm the scientific validity of the results, which can be applied for the efficient use of fuel and lubricants in the units of the National Guard of Ukraine.

Conclusions

Thus, the article confirms the need for a scientifically based approach to determining fuel consumption rates for military trucks in the National Guard units. The high dynamics of combat operations, the mobility of units, and the variety of vehicles, such as the MAN TGM 13.320, emphasize the role of logistical support, in particular, accurate forecasting and planning of fuel and lubricant supplies.

The use of a computational and analytical method made it possible to determine the fuel consumption rate for the MAN TGM 13.320. The analytical result (23.8 l/100 km) at a speed of 50 km/h under ideal conditions demonstrates proximity to the empirical data (from 22.8 l/100 km to 26 l/100 km) obtained in the units of the National Guard of Ukraine. The fuel consumption of the MAN TGM 13.320 has a nonlinear dependence on speed, which corresponds to a parabolic curve. The lowest consumption (22.9 l/100 km) is achieved at a speed of 70 km/h. The approximation of the dependence of fuel consumption on speed by a parabolic equation with a coefficient of determination of 87.14 % indicates the high accuracy of the model. This allows the results obtained to be used for reliable forecasting of fuel consumption in various operating conditions typical for combat operations in Ukraine.

The results of the study are of practical importance for optimizing the logistical support of the National Guard of Ukraine. The determined fuel consumption rates for the MAN TGM 13.320 contribute to accurate forecasting of fuel and lubricant requirements, rational use of resources, and increased reliability of vehicles in the dynamic conditions of modern warfare.

Further research should focus on solving a wider range of logistical problems, namely the unification of fuel and lubricants, the standardization of spare parts for different types of vehicles, and the training of specialists to service foreign equipment. Adapting international experience, in particular NATO approaches, could strengthen the capabilities of the Ukrainian National Guard in managing a mixed fleet of vehicles.

References

1. *Zakon Ukrainy "Pro Natsionalnu hvardiiu Ukrainy" № 876-VII* [Law of Ukraine about the National Guard of Ukraine activity no. 876-VII]. (2014, March 13). *Vidomosti Verkhovnoi Rady Ukrainy*. Retrieved from: http://surl.li/qeqja (accessed 10 May 2025) [in Ukrainian].

2. *Zakon Ukrainy "Pro natsionalnu bezpeku Ukrainy" № 2469-VIII* [Law of Ukraine about National Security of Ukraine activity no. 2469-VIII]. (2018, June 21). *Vidomosti Verkhovnoi Rady Ukrainy*. Retrieved from: http://surl.li/tlrtp (accessed 10 May 2025) [in Ukrainian].

3. *Nakaz Ministerstva vnutrishnikh sprav Ukrainy "Pro zatverdzhennia Polozhennia pro zabezpechennia Natsionalnoi hvardii Ukrainy palno-mastylnymy materialamy" № 85* [Order of the Ministry of Internal Affairs of Ukraine on Approval of the Regulation on Fuel and Lubricants Supply for the National Guard of Ukraine activity no. 85]. (2018, February 6). Retrieved from: http://surl.li/lhknqr (accessed 10 May 2025) [in Ukrainian].

4. Pawelczyk M. (2018). Contemporary challenges in military logistics support. *Security and Defence Quarterly*, no. 20 (3). Retrieved from: https://surl.li/xkaosd (accessed 11 May 2025) [in English].

5. Rheinmetall (2023). A powerful partner at Ukraine's side. Retrieved from: https://surli.cc/wmwkds (accessed 11 May 2025) [in English].

6. The Defense Post (2022). Rheinmetall sends 26 logistics trucks to Ukraine. Retrieved from: https://surl.li/htizde (accessed 11 May 2025) [in English].

7. Transport Simple (2023). Managing a mixed fleet: Challenges and solutions. Retrieved from: https://surl.li/lydoys (accessed 11 May 2025) [in English].

8. NATO (2020). NATO logistics handbook. Retrieved from: https://www.nato.int/ (accessed 12 May 2025) [in English].

9. US Army (2023). Sustaining multidomain operations: The logistical challenge. Military Review. Retrieved from: https://surl.li/khyekz (accessed 12 May 2025) [in English].

10. Rheinmetall: Ein starker Partner an der Seite der Ukraine. Retrieved from: https://surl.li/ljjrsf (accessed 12 May 2025) [in English].

11. Hovorushchenko M. Ya., Turenko A. M. (2004). *Systemotekhnika proiktuvannia transportnykh mashyn* [Systems Engineering of Transport Vehicle Design]. Kharkiv : KhNADU [in Ukrainian].

12. Shasha I. K., Nikorchuk A. I., Shapovalov O. I., Putro O. O. (2024). *Ekspluatatsiini vlastyvosti transportnykh zasobiv* [Operational Properties of Vehicles]. Kharkiv : NA NGU [in Ukrainian].

13. Kaidalov R. O., Strashnyi I. L., Kalatynets O. V. (2024). *Metody porivnialnoho otsiniuvannia viiskovykh vantazhnykh avtomobiliv za tiahovoiu dynamichnistiu* [Methods of Comparative Evaluation of Military Trucks by Traction Dynamics]. *Zbirnyk naukovykh prats Natsionalnoi academii Natsionalnoi hvardii Ukrainy*. Kharkiv : NA NGU, vol. 2 (44), pp. 69–78 [in Ukrainian].

14. Strashnyi I. L., Horbunov A. P. (2014). *Ekspluatatsiini vlastyvosti avtomobiliv* [Operational Properties of Automobiles]. Kharkiv : Academy of Internal Troops of the Ministry of Internal Affairs of Ukraine [in Ukrainian].

15. Sakhno V. P., Bezborodova H. B., Maiak M. M., Sharai S. M. (2004). *Avtomobili. Tiahovoshvydkisni vlastyvosti ta palyvna ekonomichnist* [Automobiles. Traction-Speed Characteristics and Fuel Efficiency]. Kyiv : KVITs [in Ukrainian].

The article was submitted to the editorial office on 22 May 2025

УДК 355.6

О. О. Путро

МЕТОДОЛОГІЯ НАУКОВО ОБҐРУНТОВАНОГО ВИЗНАЧЕННЯ ВИТРАТИ ПАЛЬНОГО ДЛЯ ВІЙСЬКОВИХ ВАНТАЖНИХ АВТОМОБІЛІВ НА ПРИКЛАДІ MAN TGM 13.320 У ПІДРОЗДІЛАХ НАЦІОНАЛЬНОЇ ГВАРДІЇ УКРАЇНИ

Подано методологію науково обґрунтованого визначення витрати пального військових вантажних автомобілів на прикладі автомобіля MAN TGM 13.320, що експлуатується у підрозділах Національної гвардії України. Актуальність дослідження зумовлена зростаючою потребою в оптимізації норм витрати пального в умовах інтенсивних бойових дій, складних умов експлуатації та різноманітного парку автомобільної техніки Національної гвардії України.

Метою статті є обґрунтування аналітичного підходу до визначення витрати пального з урахуванням конкретних експлуатаційних та конструктивних параметрів сучасних військових вантажівок. Дослідження базується на аналізі нормативних документів, наукових джерел та технічних даних автомобіля MAN TGM 13.320.

Запропонований розрахунково-аналітичний метод ураховує основні конструктивні характеристики автомобіля, зокрема об'єм двигуна, передатні числа трансмісії, повну масу та аеродинамічний опір. Аналітичні результати було порівняно з емпіричними даними, одержаними у підрозділах Національної гвардії України, де експлуатуються ці автомобілі. Порівняння показало близькі значення: аналітично визначена витрата пального становила 23,8 л/100 км при швидкості 50 км/год, тоді як отримані дані коливалися у межах 22,8–26,0 л/100 км.

У ході дослідження встановлено нелінійну параболічну залежність між швидкістю руху автомобіля і витратою пального, мінімум якої (22,9 л/100 км) спостерігається при швидкості 70 км/год, що відповідає оптимальному режиму роботи двигуна MAN D0836. Отримана залежність пояснює 87,14 % варіації у витраті пального, що підтверджує адекватність і достовірність запропонованої моделі.

Розроблений підхід створює практичне підґрунтя для встановлення науково обґрунтованих норм витрати пального військових автомобілів, а також для підвищення ефективності планування, прогнозування та управління процесами забезпечення у логістичній системі Національної гвардії України.

Ключові слова: *військовий автомобільний транспорт, витрата пального, логістичне забезпечення, пально-мастильні матеріали, прогнозування, постачання.*

Putro Oleksandr – Senior Lecturer of the Department of Logistics of Units, National Academy of the National Guard of Ukraine

http://orcid.org/0000-0002-3433-4637