



## Report

# Measuring Capability of Required Static Power for a Tactical Group in Theatre

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**Abstract-** This paper considers the offered calculation method of static power of the tactical group organized for the destruction of the enemy in an offensive, based on static and dynamic power data of the hostile side. These static and dynamic power data were determined based on the significance of the weapons category, weapons effect index, effective weapons and equipment index, forms of attack, types of attack, defence preparedness, state of obstacles system, and the coefficient of relative advantages. In accordance with the given method, the calculation the algorithm of required static power for our tactical groups during a battle operation is given for ensured victory. This algorithm can be easily programmed and mobile computing devices may be created.

**Keywords-** Tactical group, Category of weapons, Weapons effect index, Static power of unit, Dynamic power, Calculation algorithm.

## 1. Introduction

The experience of command staff exercises and military tactical group use (Babaev & Bayramov, 2015; Alekseev, 2001; Medin, 2000) shows that the main tasks of staff activity are the determination of the battle possibilities of subordinate troops, the determination of military formations, units and sub-units, and preparation of reasonable suggestions.

A number of questions are arisen for commanders with connecting of battle organization:

- Is there sufficient availability of power and facilities for task realization?
- What results are expected after the battle?
- Which and how much power and weapons are necessary for unit reinforcement if in the real conditions and possibilities the given tasks aren't feasible?

Firstly, it is necessary to estimate enemy power to answer to these questions. Based on this position, the commander can estimate the success of task implementation if he knows the power of subordinate forces.

It should be noted that depending on the type of military operation (attack or defence), the conditions of weapons and equipment applications are different and are depended on the various power of the units. Therefore, when we calculate the power of military units, then we must take into account the various applied coefficients.

This paper considers the proposed calculation method of the power of the enemy unit is based on the power of the forces data. In accordance with the given method, the calculation algorithm of the required static power for our tactical groups during a battle operation is given for ensured victory. It is assumed that there is satisfactory data about the enemy forces, and a battle order of destruction of these forces can be given.

Based on this method, a task of the estimation of power of both enemy and tactical group has been considered, and the calculation of weapons and equipments has been carried out for ensured destruction of enemy. In the next stage, we can determine the possibilities of our military tactical groups for the destruction of the enemy and which extra forces (weapons and equipment) are necessary to use.

## 2. Main definitions

To estimate the power of the military units, weapons, and equipment, we define the significance of the weapons category, an index of the weapons effect, static power and dynamic power of unit in the references (Brooks, 2007). This section provides information about these definitions.

### 2.1. The significance of weapons category

First of all, let us give definitions of some terms. Depending on the purpose and operation role, the military weapons and equipment are subdivided into various categories (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı değeri kullanma broşürü, 1982). Depending on battle type (attack or defence), the military experts estimate the significance of these categories' weapons and equipment at various rates (Table 1). Various categories of weapons and equipment factors are relative in nature, and are given in Table 1. Expert judgement from various sources determine the coefficient of various values (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı değeri kullanma broşürü, 1982).

**Table 1.** Significance of weapons category

Categories	Weapons and equipment	Significance of categories	
		Attack	Defence
I	Small arms	3.3	3.7
II	Tank	100	94
III	BMP (Mechanized infantry war machinery), BMD (Landing force war machinery)	69	71
IV	BTR (Armoured troop carrier) BRDM (Combat Reconnaissance)	36	30
V	Antitank means	55	73
VI	Gun	92	95
VII	RZSO (multiple launch rocket system)	95	99
VIII	Mortar	48	55
IX	Helicopter	89	109
X	Means of air attack defence	44	56

### 2.2. The weapons effect index

These and other categories' weapons have different tactical-technical specifications, and from this perspective, the purpose is to demonstrate the variety of the index of weapons effect (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı değeri kullanma broşürü, 1982). Weapons effect index is defined according to its firepower, mobility in the military operation, survivability, and applicability. This factor is separately calculated for each type of weapon and is fixed. All types of weapons are divided into ten categories and each category has its own method to determine these

factors. The index of weapons effects is presented in Table 2 below (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı değeri kullanma broşürü, 1982). The index of weapons effect is calculated by experts in this field in weapons production plants.

### 2.3. The weapons and equipment effectiveness index

During war operations, to determine the possibility of enemy forces' destruction, an index of weapons and equipment effectiveness is used. It is considered that an index of weapons effectiveness depends on the type of battle operation. The formula below can be used for its

calculation (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı deęeri kullanma broşürü, 1982):

$$E = K \cdot T \quad (1)$$

Here:  $E$  is the weapon effectiveness index;  $T$  is the index of the weapon's effect, defined in Table 2; and  $K$  is the significance of the weapons category for the given weapon. It should be noted that depending on the type of military operation, the value of  $K$  can be obtained from the third (attack) or fourth (defense) column in Table 1.

#### 2.4. Static power of military formation (military unit)

As is known, the result of the operation depends on many factors (professional training of commander, morale of the personnel, the power of the weapons and equipments, organization of management, etc.) (Goertz and Diehl, 1986; Biddle, 2010). The static strength of a

military formation (unit, group) is a formal among these factors. Static power in terms of existing weapons characterizes the units and consists of all existing weapons evaluation (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı deęeri kullanma broşürü, 1982). The formula below can be used to calculate static force military units:

$$S = \sum_{j=1,2,\dots} N_j \cdot E_j \quad (2)$$

Here  $j$  – is a serial number that is used to unite various weapons used in any manner ( $j=1,2,\dots$ ),  $E_j$ –is an effectivity coefficient defining with formula “ $j$ ” type weapon (1),  $N_j$ – is an amount of “ $j$ ” type weapons belonged to combination, and  $S$  – is static power of combination.

**Table 2.** Weapons and equipment effect index

Category	Weapon	An index of weapons effect
I	AQS-17 automatic grenade launcher	5.60
	DŞK, Degtyaryov-Shpagin Large-Calibre; NSV 12.7mm calibre heavy machine gun	4.80
	7.62 mm RPK Kalashnikov hand-held machine gun	1.52
	7.62 mm PK. PKM 7.62 mm general-purpose machine gun	1.37
	7.62 mm RPD Degtyaryov hand-held machine gun	1.28
	5.45 mm RPK-74 Kalashnikov light machine gun	1.03
	7.62 mm SVD Sniper Rifle, System of Dragunov	0.91
	7.62 mm AKM Kalashnikov modernized automatic rifle	0.90
	7.62 mm SKS Simonov semi-automatic system	0.73
	II	T – 80 tank
T - 72 tank		1.13
T - 55 tank		0.98
III	BMP-2	1.03
	BMP-1	0.89
	BMD	0.85
IV	BRDM-2	0.78

Category	Weapon	An index of weapons effect
V	100 mm T-12 antitank gun	0.67
	«Faqot» antitank gun	0.66
	73 mm SPQ-9 recoilless gun	0.45
	73 mm RPQ-16,18,22 hand-held anti-tank grenade launcher	0.35
	72 mm RPQ-7	0.28
VI	122 mm D-30 howitzer, towed field gun	0.77
	152 mm D-20	0.77
	152 mm D-1	0.71
VII	BM-21 Grad multiple rocket launcher	0.78
VIII	120 mm PM mortar	0.85
	81,82 mm BM	0.70
	60 mm DM mortar	0.50
IX	Mi-8	0.86
	Mi-24	1.11
X	S-10	1.40
	ZSU-23-4	1.25

V	BRDM	0.70
	BTR-80	0.98
	BTR-60	0.95
	«Şturm»	1.03
	85 mm D-44 divisional gun	0.69

	ZSU-57-2	1.05
	S-1	0.93
	PZRK «İqla»	0.81
	ZU-23-2 anti-aircraft machine gun mount	0.76
	ZPU-4	0.76

### 3. The concept of task solution

Enemy weapons and equipments data are enemy forces information. It is available to calculate enemy unit's static power with the formula (1)-(2) knowing all types weapons. In some cases, militarization of the enemy can be calculated based on indirect data. For example, it is possible to estimate an amount and type of an enemy's weapon basing on its organizations-states structure and intelligence information about the units in a given position (Grishin, 1985; Zaritski, Sergin & Xarkevich, 2004).

Commanders use formulas (1)-(2) to evaluate the strength of the army weapons and equipment of their subordinate. It is necessary to mention the battle type in the process of coefficient choice using these formulas. Therefore, if the stormed battle type to the enemy's position is planned, we use coefficients in the column "defense" of Tables 1 and 2 to evaluate the enemy's weapon power, and coefficients in the column "attack"

to evaluate our weapon power. However, in the process of defense from enemy attack, we should use the column "attack" to evaluate enemy weapon power, and the column "defense" to evaluate our weapon power.

It should be noted that military experts also recommend to take into account the specifics of the operation (a form and type of attack for the striker side; defense preparedness and condition of the created obstacles for the defender side) that to assess the results of the fighting.

The calculated figure taken into the account by these factors is called dynamic power (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı değeri kullanma broşürü, 1982). The coefficients used for taking into account of the factors are given in Tables 3, 4, 5, and 6 (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı değeri kullanma broşürü, 1982).

**Table 3.** Forms of attack

Form of attack	Coefficient
Frontal attack	1.0
Flank attack	2.0
Attack from behind	4.0
Air assault	{ 0.5 At the beginning of the war
	{ 4.0 After 2 hours
Marine assault	{ 0.7 At the beginning of the war
	{ 1.0 After 2 hours

**Table 4.** Types of attack

Form of attack	Coefficient
Prepared attack	1.0
Face to face in battle	1.2
Sudden attack	1.5

**Table 5.** Defence preparedness

Time spent on preparation for defence before attack	Coefficient
less than 6 hours, not prepared	1.0
from 6 to 24 hours	1.2
more than 24 hours	1.4
long-term, equipped with facilities	2.0

**Table 6.** State of obstacles system

State of obstacles	Coefficient
No obstacles	1.0
Weak obstacles	1.2
Average obstacles	1.4
Strong obstacles	1.6
Very strong obstacles	1.8

Also, it should be noted that in fighting the effect power of each unit depends on their characteristics (Training for battle operation and staff procedures: Manual for staff officer, 2007; Birlik ağırlıklı deęeri kullanma broşürü, 1982). According to experts, for example, the influence of tank battalion to tank battalion, tank battalion to mechanized infantry battalion, or mechanized infantry battalion to light mechanized infantry battalion is different.

In other words, taking into account the operation characteristics the calculated static strength does not fully reflect the advantage of the belligerents to each other on the battlefield. It can be explained by influence

of the psychological factors. Thus, creating panic in the eyes of the rest of the armed forces by one of the personnel of the military unit against each other, face-to-face, considerably changes the results of the fighting. Taking into account this factor in assessing the results of the fight for the features division is solved by suspending the application of the coefficient of relative superiority (Training for battle operation and staff procedures: Manual for staff officer, 2007; Slutski, 1995).

Table 7 below shows the coefficient of units listed by comparative advantage.

**Table 7.** The coefficient of relative advantages (CRA)

Units	Tank	mechanized infantry	Light infantry
Tank	1.0	1.7	2.0
Mechanized infantry	0.6	1.0	1.7
Light mechanized infantry	0.5	0.6	1.0

The table shows that the mechanized infantry unit compared to the comparative advantage of the tank unit equals a coefficient of 1.7; the light infantry division compared to the comparative advantage equal a coefficient of 2. Otherwise, the mechanized infantry unit compared to the comparative advantage of the tank unit is equal to a coefficient of 0.6; the light infantry unit compared to the comparative advantage of the tank unit is equal to a coefficient 0.5.

The coefficient is applied to the comparative advantage of its troops, and its calculation procedure can be as follows. The static power of our troops is taken, then, possessed a preponderance of static power unit (located on the left side of the vertical bar on the list in table 7) is multiplied by CRA of the other party possessed a preponderance of static power unit (located above the horizontal line in table 7). In sum, the dynamic power (3) - (5) is calculated with the formula (Training for battle operation and staff procedures: Manual for staff officer, 2007):

$$D_1 = U_{1,2} \cdot \mathfrak{T}_1 \cdot S_1, \quad D_2 = \mathfrak{T}_2 \cdot S_2. \quad (3)$$

Here,  $S_1$  and  $S_2$  are the static power of its own and enemy side, respectively;  $U_{1,2}$  is the coefficient of its forces compared to the enemy side; and  $\mathfrak{T}_1$  and  $\mathfrak{T}_2$  values were determined as follows:

Its own side on attack

$$\mathfrak{T}_1 = H_1 \cdot H_2, \quad \mathfrak{T}_2 = M_1 \cdot M_2, \quad (4)$$

Its own side on defence

$$\mathfrak{T}_1 = M_1 \cdot M_2, \quad \mathfrak{T}_2 = H_1 \cdot H_2. \quad (5)$$

Here:  $H_1$  and  $H_2$  are operation specific coefficients (form and type of attack, see tables 3 and 4) and  $M_1$ ,  $M_2$  are coefficients of preparedness of defence and status of the barriers (see tables 5 and 6).

According to the experts' opinion, the result of the success of the operation is considered to be secured if the dynamic force of attacked group to the dynamic force of defence unit ratio is more than 3. (General tactics, division (regiment) in attack, 1986; General tactics, division (regiment) in defense, 1986). In other words, for example, secured victory for their forces should be

$$\frac{D_1}{D_2} \geq \alpha, \quad \alpha = 3. \quad (6)$$

Thus, if the enemy's static power is known, a guarantee of the success of its forces during the operation to achieve the required static strength of the following formula (Training for battle operation and staff procedures: Manual for staff officer, 2007) can be considered:

$$S \geq \frac{\alpha}{U_{12}} \frac{\mathfrak{S}_2}{\mathfrak{S}_1} \sum_{j=1,2,\dots} N_j \cdot K_j \cdot T_j \quad (7)$$

Here  $j$  is a serial number of the unification of the various weapons used in the enemy combination; defence  $\alpha = 1$ , attack  $\alpha = 3$ ;  $N_j$ ,  $K_j$  and  $T_j - j$  is an index of amount, category importance, and influence of a type weapon.  $\mathfrak{S}_1$  and  $\mathfrak{S}_2$  values are calculated with the formulas (4) and (5), depending on the characteristics of the military operation.

#### 4. Task

The enemy mechanized infantry company, reinforced by a tank platoon attached to it, take up a defensive position. Engineer barriers and geographical features of

the state are strong. The area is middle passable. This support point is intended to seize upon a frontal attack. It is considered that the operation will be carried out in the daytime and in better weather conditions for the period of operation. Of course, the provision of arms to the enemy's mechanized infantry company and a tank platoon may be different. We believe that the provision of arms to the structure and enemy forces are known. Such arms are secured with a victory over the enemy forces to be organized in order to have a static estimate the power of the unit is required.

**The solution.** First, compile a list of enemy forces' weapons and equipment according to its organization-staff structure (Table 8).

**Table 8.** The composition of enemy reinforced mechanized infantry.

Number (j)	Weapon type	Amount (N <sub>j</sub> )	Category	Category significance, (K <sub>j</sub> )	The index of the gun effect, (T <sub>j</sub> )
1	Tank-T-72	3	II	94	1.13
2	BMP-2 Mechanized infantry war machinery	10	III	71	1.03
3	«Faqot»	10	V	73	0.66
4	72 mm RPQ-7	9	V	73	0.28
5	60 mm DM mortar	3	VIII	55	0.50
6	7.62 mm AKM	63	I	3.7	0.90
7	7.62 mm PKM	3	I	3.7	1.37
8	7.62 mm SVD	9	I	3.7	0.91
9	7.62 mm RPK-74	6	I	3.7	1.52

The last three columns of the table belong to the category of weapons, category value (K) and the weapon efficiency ratio (E) is shown. It should be noted that the issue is considered to be the enemy's defense speech, K and E ratios from Tables 1 and 2 for the price of "defense" columns selected. Here, (1) and (2) by applying formulas static strength of the enemy forces will receive the following prices

$$S_2 = \sum_{j=1}^9 N_j \cdot K_j \cdot T_j = 2087.15$$

The enemy unit defense (long-term, provided facilities for the defense  $M_1 = 2$ , with a strong presence in many of the obstacles  $M_2 = 1.8$ ), taking into account getting ready to attack its units (for frontal attack  $H_1 = 1$ , for sudden attack  $H_2 = 1.5$ ), to calculate the values  $\mathfrak{S}_1$ ,  $\mathfrak{S}_2$  formulas (4-5) will be applied:

$$\mathfrak{S}_1 = 1 \cdot 1.5 = 1.5, \quad \mathfrak{S}_2 = 1.8 \cdot 2 = 3.6$$

Using the formula (7), among their own forces depending on preference unit, tanks, light infantry or mechanized infantry unit the attack to be guaranteed success in obtaining the required static power can get in line for the following assessments:

According to the Table 7 as efficiency power of mechanized infantry against each other  $U_{1,2} = 1$ ; as efficiency power of tank against mechanized infantry  $U_{1,2} = 1.7$ ; as efficiency power of light infantry against mechanized infantry  $U_{1,2} = 0.6$

$$S_1 > \frac{3}{1,0} \cdot \frac{3,6}{1,5} \cdot 2087.15 = 15027.48$$

$$S_1 > \frac{3}{1,7} \cdot \frac{3,6}{1,5} \cdot 2087.15 = 8839.69$$

$$S_1 > \frac{3}{0,6} \cdot \frac{3,6}{1,5} \cdot 2087.15 = 25045.8$$

## 5. Conclusion

If we know enemy armed forces and operation conditions then we can calculate required static power according to the formula (7). These static power have been determined on the basis of a significance of weapons category, an index of weapons and equipment effect, forms of attack, types of attack, defense preparedness, state of obstacles system, the coefficient of relative advantages. All of these characteristics are principals for assessment of win probability of warring parties. This algorithm carrying standard character can easily programmed and mobile computing devices may be realized. Based on the methodology, the enemy, as well as the strength of the team's tactical assessment, it is possible to calculate which will lead to the destruction of the enemy. At a later stage, as far as can be determined, the level of military tactical group possibilities and additional forces are need to destroy the enemy's position. The effectiveness of the proposed approach is acknowledged by numerous examples taken from real battle operations.

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