IMPROVISED EXPLOSIVE DEVICES IN CONFRONTATION WITH THE PROTECTION ARMOUR

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Abstract

The paper describes the risk for carrying structures of special vehicles used in the stabilization and peacekeeping missions. Presented map regions of t he world threatened by conflicts, which may be areas for fut ure international peacekeeping forces. Among the haz ards occurring in t he missions improvised explosives devices (IED) deserve special attention. Difficult to detect and identify, acting unpredictably, high-power is destruction.

Based on the available material and the results of their experimental studies are presented effects of explosives on special vehicles. It take s into acc ount the c ases of impact load during the fighting i n the urban area, desert and mountainous. The currently used i mprovised explosives devices and methods of their initiation are described. Presented used in vehicles ways to protect people and i nternal equipment against destruction factors of ex plosives. The effects of the influence of loads on vehicles are shown. The results of its own, both experimental and model tests are presented. The results of the analysis presented in the drawings and diagrams.

Carried out experimental researches have allowed t o obtain i nformation necessary to verify: rese arch object models in ter ms of assessing the level of deformation on the str ucture and size of dynamic load ac ting on crews of combat vehicles, and numerical model of the propagation of after explosion shock waves.

***Keywords**: combat vehicle, improved explosive devices, modelling*

1. Introduction

Improvised explosive device (IED) is a provisional land mine done of substitute materials, such as engineer and mining explosives, artillery shells, aviation bombs, torpedo warheads, mortar and hand grenades, bombs and other unexploded ordnance, etc.

Characteristics of improvised explosive devices:
- are hardly detectable because they are hidden and camouflaged,
- in any, unknown way can be detonated.

Figure 1 presents the structure of IED, in Fig. 2 ways to deploy them, while in Fig. 3 consequences of their impact on the vehicles involved in peacekeeping and stabilization operations. In Fig. 4 shows apply on the map areas of unrest and conflicts along with potential causes.

Fig. 1. Sample structures of IED [5]

Fig. 2. Sample deploy of IED [5]

Fig. 3. Effect of the impact of IED on vehicles of different classes [5]

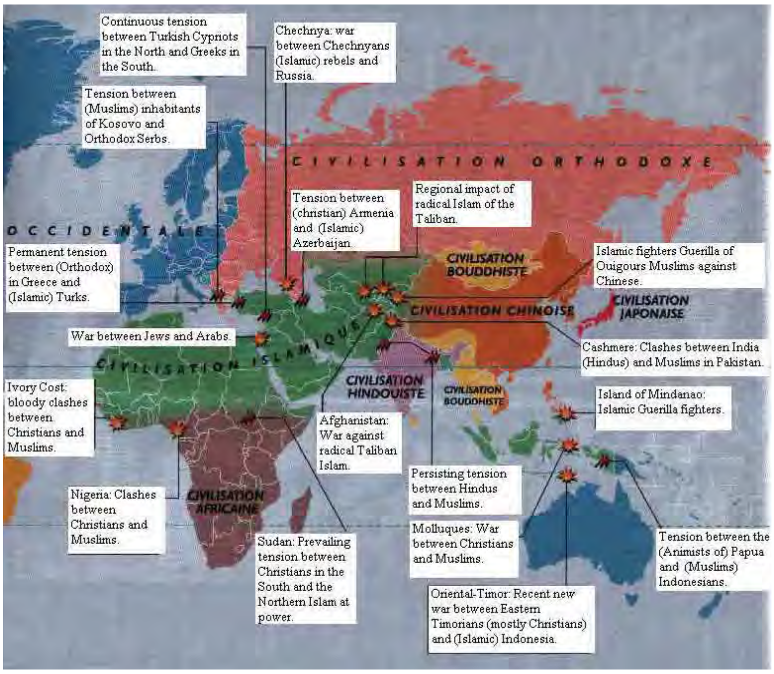

Fig. 4. Map of areas of risks [5]

2. Researches of IED impact on vehicles

In the constant rivalry between the structure of protection and generally understood bullet (mine, IED, grenades, etc.) is observed dominance of the projectile. It is therefore difficult to obtain effective protection. However, you can try to reduce the effects of shock. The paper presents selected results of experimental and numerical researches of IED impact on the carrying structure of vehicles.

2.1. Experimental researches

Researches testing vehicle resistance to loads of mines and IED are conducted in various scientific research centres. In Fig. 5 shows photographs of selected researches conducted by Timoney Technologies and Krauss-Maffei Wegmann.

Fig. 5. Experimental researches in the world: MRAP vehicle type (left), personal-terrain vehicle (right) [5]

2.1.1. Own research

In Fig. 6 shows a fragment of the test of the resistance of special military vehicles to mines and IED. In Fig. 7 effects of impact on their carrying structure are shown. A permanent deformation of the bottom plate of the hull and damage of internal equipment components can be observed.

In Fig. 8 shows the time course of pressure recorded at the selected point on the surface of the bottom of the vehicle from the ground side.

Fig. 6. Own experimental studies

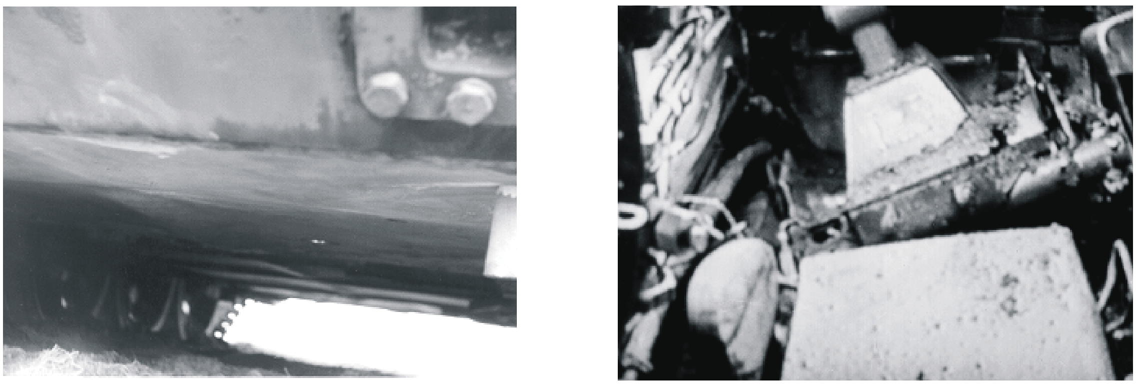

Fig. 7. Effect of explosion

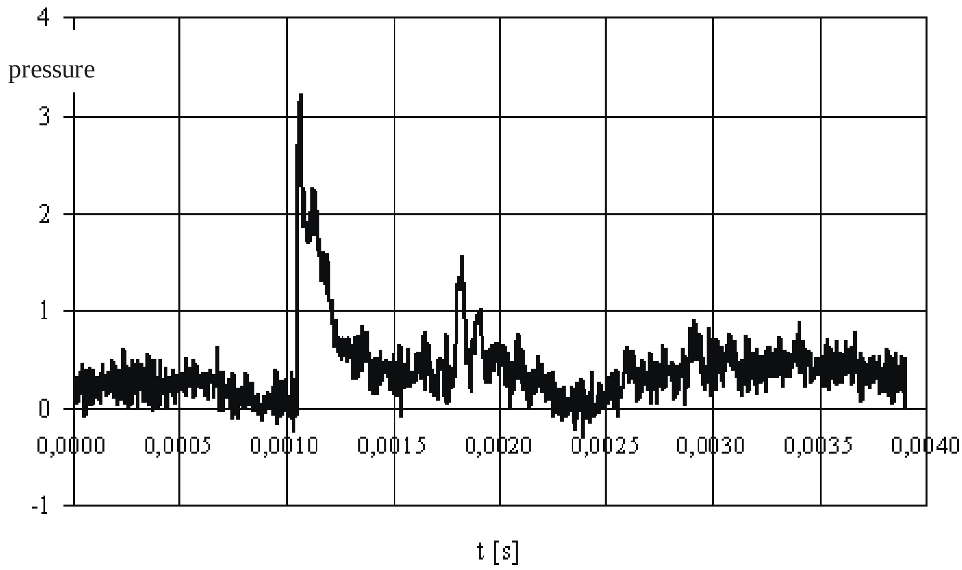

Fig. 8. Graph of pressure acting on the bottom of the vehicle in the selected point

2.2. Researches of numerical model

Load model was developed, which is after explosion shock wave spreading in a gaseous medium. The model includes the wave propagation in function of time, the loss of pressure after the front of the wave and depending on considered cases single or multiple reflection of the wave (in case of impact with the barrier in a highly limited space). Models of test objects, which are also verified experimentally developed. A good similarity between the mode and the real object was obtained.

Figures presented selected results of calculation. Thus, Fig. 9 shows the course of the pressure on the front of the shock wave generated by the IED placed above ground, with a set distance from the object, in certain moments of time.

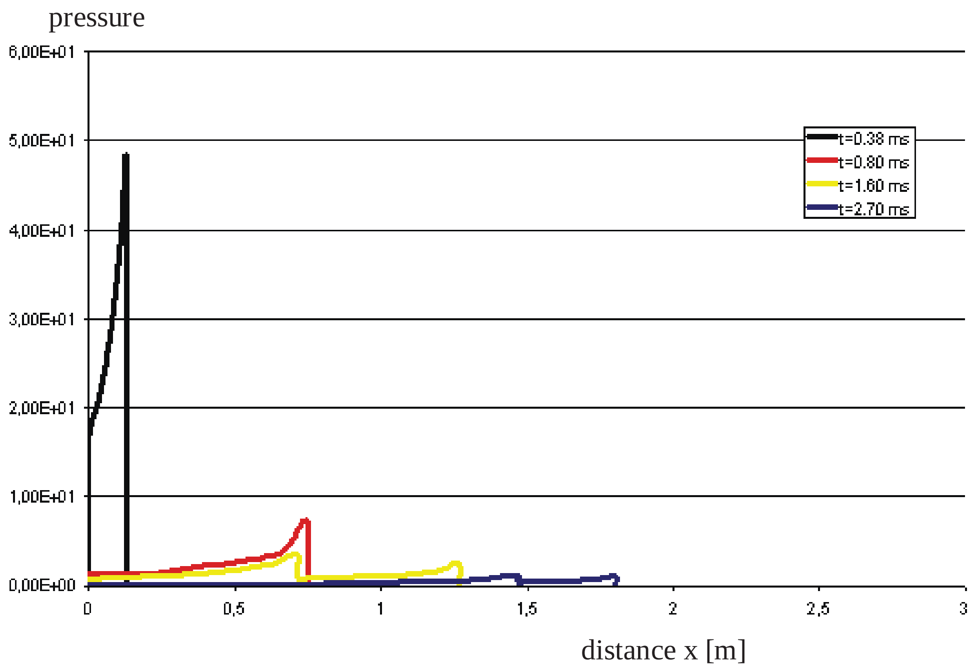

Fig. 9. The course of pressure on the front of shock wave

On Fig. 10 shows the effect of the impact of the explosive charge placed on the ground, deformation of the vehicle hull side panels.

While, in Fig. 11 shows the deformation of the bottom plate of the vehicle body as a result of the impact of load placed in the ground.

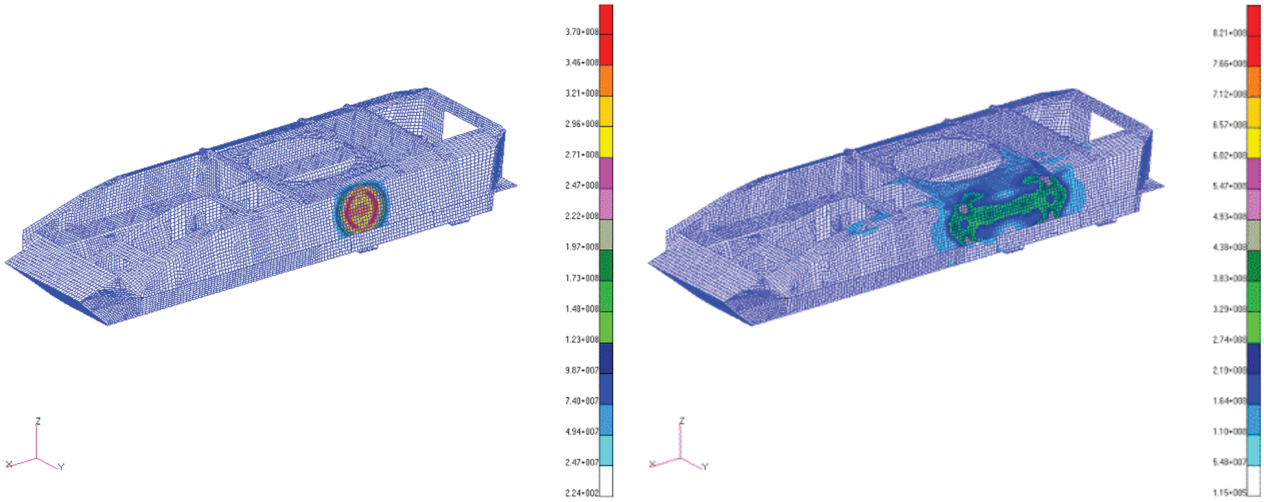

Fig. 10. Deformation of the side panels of the vehicle hull in certain moments of time

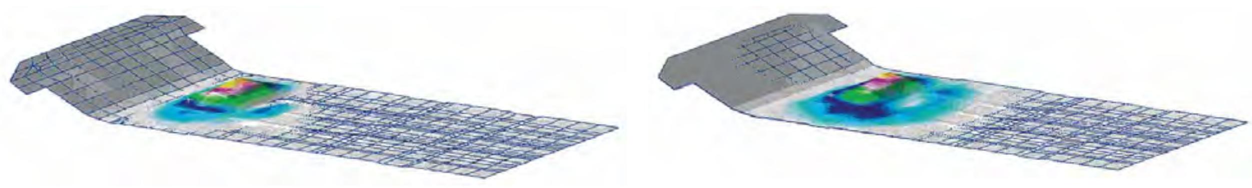

Fig. 11. Deformation of the bottom of the vehicle hull at selected moments of time

3. Conclusions and recommendations

Carried out experimental researches have allowed obtaining and gathering information necessary to verify:

- research object models in terms of assessing the level of deformation on the structure and size of dynamic load acting on crews of combat vehicles,
- numerical model of the propagation of after explosion shock waves.

Obtained model tests results confirm the possibility of shaping the impact resistant of combat vehicles hull through the proper formation of their shapes, dimensions and geometric parameters of the overall system design.

Presented research methodology allows:

- determine the pressure distribution along the surface of the test structure,
- assess impact resistance of self-supporting combat vehicles hall,
- assess the effects of explosive charges on vehicles at the stage of design or upgrade their supporting structures,
- the design or the modernization of carrying structure of combat vehicles with increased impact resistance.

Literature

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