PROTECTING PANELS FOR SPECIAL PURPOSE VEHICLES

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Abstract

Based on available materials, their own research results (numerical and experimental) shows effects of loads of various explosive on special vehicles. Such loads can occur during the fighting in the urban area and mountainous, as well as othe rs with limited space. There were presented directions of research and development works in results leading to increase the level of prot ection of human in special ve hicles against means of fighting, specific to peacekeeping and stabilization missions. Such means may also occur in regular combat operations.

Was presented selected results of experimental and model researches of the impact of after explosion shock waves on the hall, crew and inside equipment. Also prese nted the protective structures designed for s pecial purpose and transportation vehicles. While researches the protective structure was loaded by shock wave pressure generated by unconventional explosive charge (no cont act mine expression or improvised expl osive device). The paper also identifies the need and possibilities of selection the parameters of efficient panel, for the protected parts of the special or transportation vehicle, against potential threat.

The results of studies are qualitative in nature.

Keywords: *special vehicle, strain, structure protecting, investigations*

1. Introduction

One of the major problems in the construction of special purpose and transporting vehicles is to develop effective protection of people and internal equipment. This includes protection against conventional and unconventional mines. Widely known is that manufacturers do not publish all the information about the material, technology, methods and various measures increasing quality of that protection. This applies to both basic and additional covers. Information reaching from the areas of conflict is diverse. Mainly, this indicates that the works on the elements which increase the resistance to such charges are and must be continued almost without interruption.

Carrying structures of special purpose vehicles are exposed to:
- dynamic load resulting from the traffic on the roads and off-road,
- means of enemy destruction not causing and causing puncture of protection,
- charges resulting from the use of his arms, main and secondary.

In Fig. 1 and 2 presents selected for special tasks, conditions for use of vehicles with special highlighting the dangers and potential consequences.

Accordingly, the special vehicles are required to:
- set up resistance to the means of enemy destruction,
- good protection of the crew and interior equipment against mines and unconventional explosive charges,
- high mechanical resistance to dynamic loads,
- appropriate, desired geometries and shapes.

The paper presents developed and tested protective panels for special-purpose vehicle. Number of panels and their dimensions are selected individually according to the characteristics of the vehicle.

The main purpose of the panels is to increase resistance to explosives and to reduce the results of their impact by:

- take over part of the energy generated by explosion by deformation of the structure,
- reduction of projectile energy of a certain caliber or change the direction of projectile.

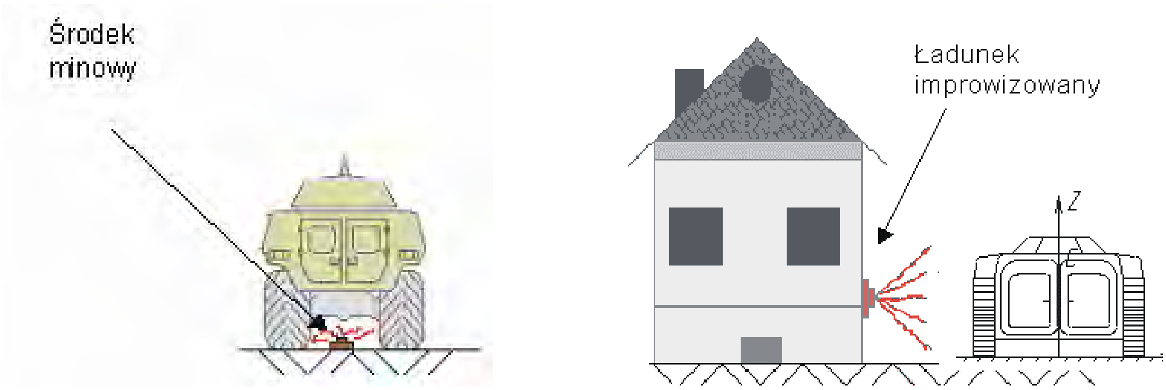


Fig. 1. Specific threads during operation

Fig. 2. Operation effect of means of destruction

2. Object of research

The object of study is shown in Fig. 3 protection panel with a characteristic structure, and complex geometry. Its structure of an innovative work has been developed on the basis of currently used construction and available data on the basis of assumptions. Performed two panels are essentially different thickness of wall joints of circular cross section.

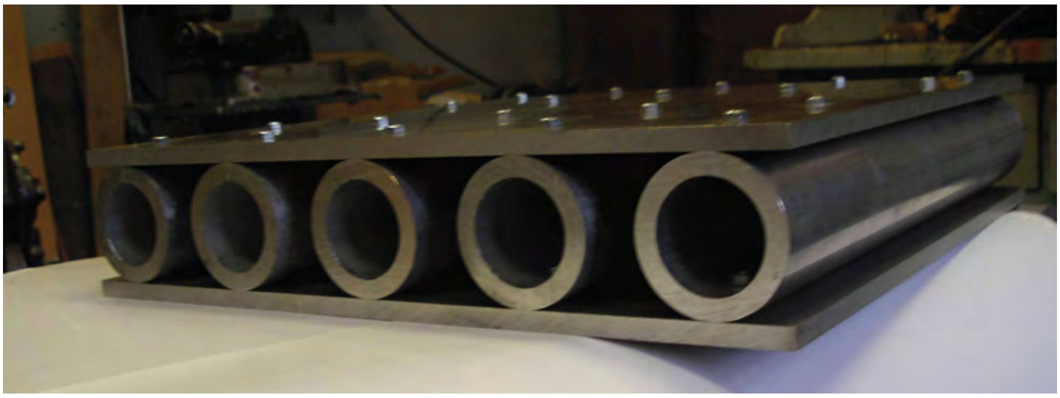


Fig. 3. Protection panel

3. Researches of protection panel

In pursuit of task was carried out research and testing as well as performed experimental studies (ranges) and the model tests.

3.1. Experimental researches

During the experimental researches panels were placed on not deformable foundation. They were subjected to impact of the explosive charge to given mass of configuration as in Fig. 4. In Fig. 5 shows the effect of test, elements distorted and permanently deformed by explosion.

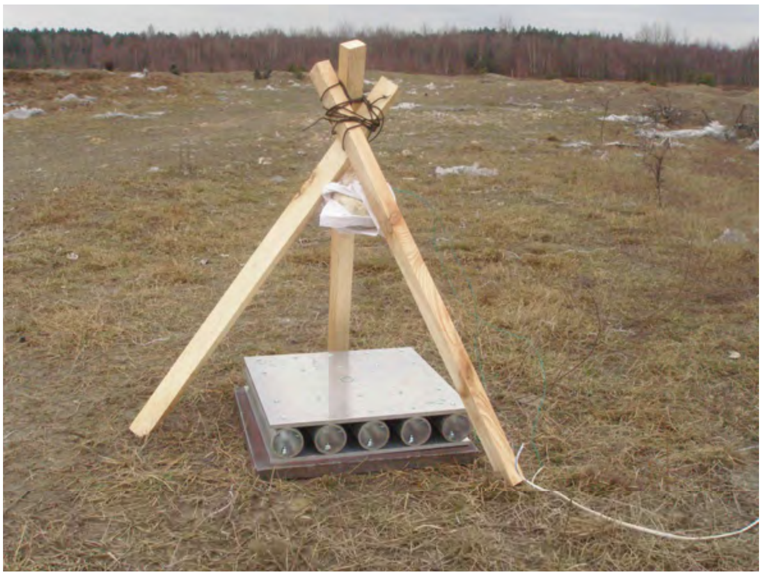


Fig. 4. The panel just before the explosion

Fig. 5. Deformed elements as a result of the explosion

3.2. Numerical model researches

Developed, using LS-DYNA program, models of panels differing parameters, in particular the wall thickness of pipe joints. In Fig. 6 the general layout of design model together with a fragmentation by elements is shown.
Models have been verified experimentally and found to sufficiently reflect the real objects.

Models of the panels were loaded by explosion. After explosion load model represents a shock wave. It is spreading with supersonic speed at the material stroke displacement (discontinuous) change of parameters (density, temperature, pressure) and speed. In developing a model of the load is assumed that the resulting explosion shock wave propagates in all directions and affects the surface structure of the barrier. On Fig. 7 shows an example of the wave pressure distribution in time for the established mass of explosive material and distance from the barrier. It should be noted that the model of the load, in quantitative terms, has been verified experimentally. His characteristic was referred to the load models used in the available, standard programs.

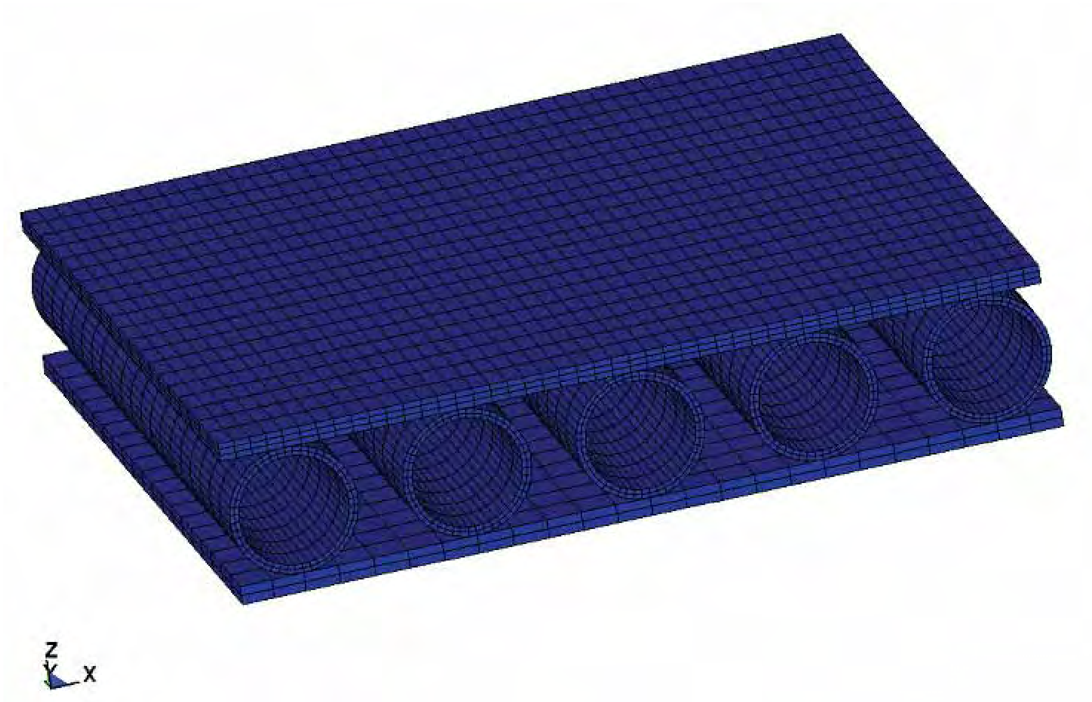


Fig. 6. Model of protecting panel

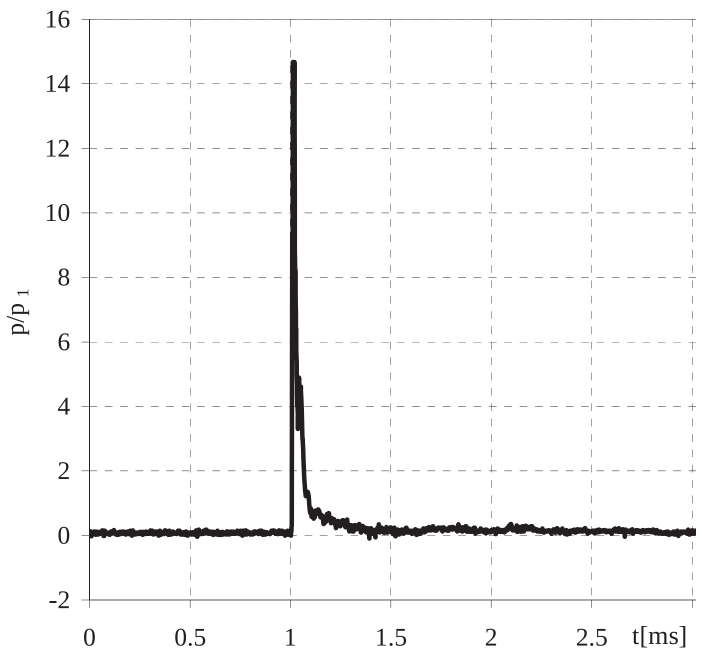
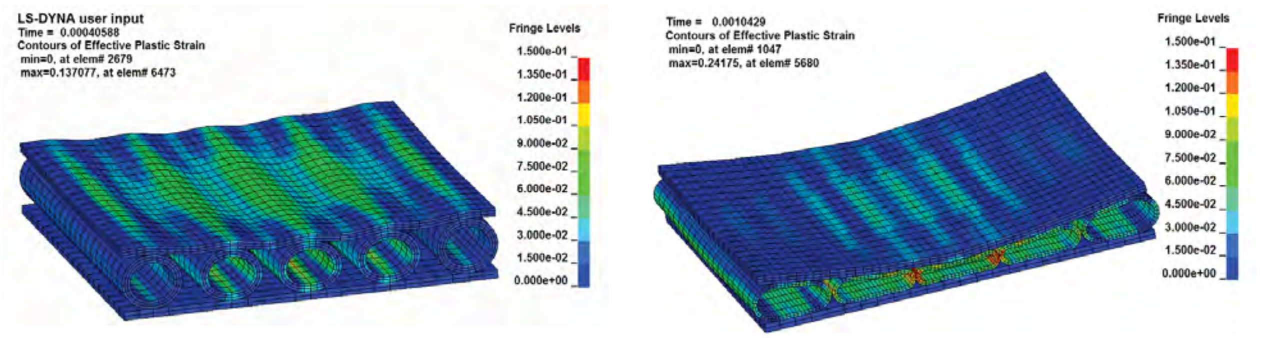


Fig. 7. Load model – example

In Fig. 8 examples of the test results of two panels of different thickness between the side walls g_i of pipe joints, assuming that $g_1 > g_2$ are shown. In Fig. 9 shows the displacement of selected nodes of the panel.



panel g_1 *panel g_2*

Fig. 8. Deformation as a result of explosive loads

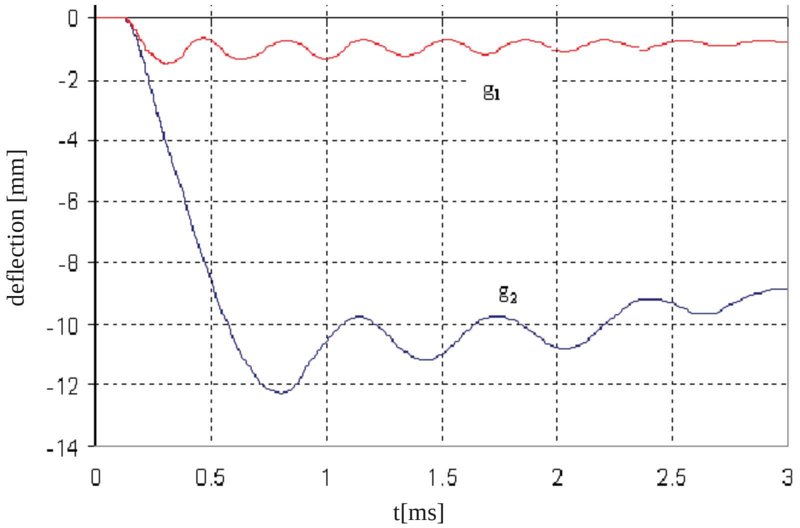
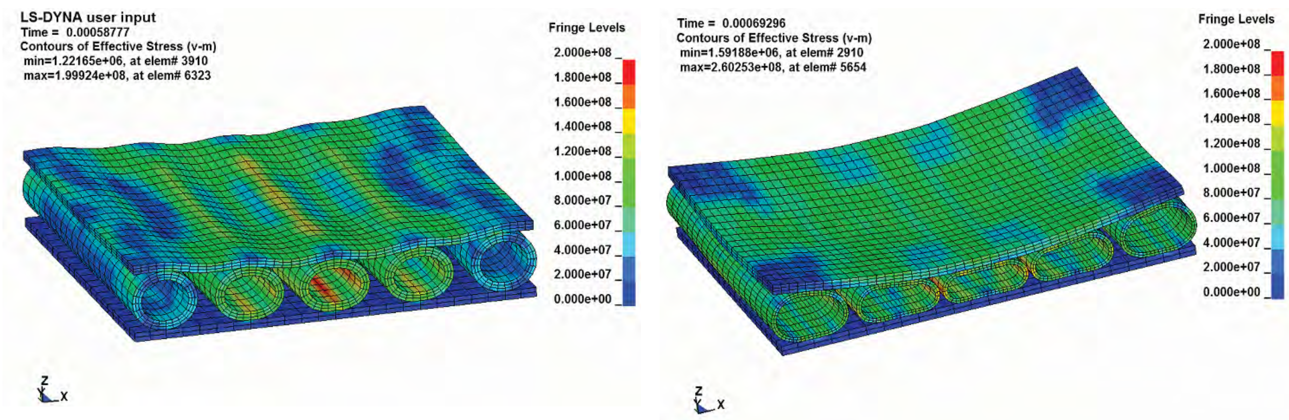


Fig. 9. The vertical displacement of selected nodes of panels



panel g_1 *panel g_2*

Fig. 10. Reduced stress in the elements of the panels

4. Conclusion

The results of studies are qualitative in nature. Are interesting and encourage further achievements. It is important that the characteristic parameters of the panels can be selected appropriately for each protected area of the hull and chassis of the vehicle. It should take into account such as the geometry of the hull, the probability to occur the load, type and weight of explosive.

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