

ANTI-RAM PROTECTION OF METRO TERRITORY

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ABSTRACT

The analysis has shown that present technical means of external protection of metro stations against acts of unlawful interference with the use of vehicles do not respond fully to existing threats. A device for blocking unauthorized access to the

territory adjacent to the station is offered. Anti-ram defensive pillar of original design can withstand a blow in case of attempt of a breach of a car with cargo of 20 tons at a speed of 40 km / h. It is an additional resource for strengthening safety and security measures at metro at the time of an emergency.

Keywords: metro, station, outside area, transport safety, transport security, anti-ram means, an act of unlawful interference.

Background. After a series of terrorist acts in the Moscow metro [1], a special attention is paid to equipping underground railway lines with engineering and technical means and systems of transport safety and security [2]. The establishment of such systems requires an integrated scientific approach, analysis of used means and methods regarding their adequacy to existing threats.

Transport security is a state of protection of transport infrastructure facilities and vehicles from acts of unlawful interference.

The act of unlawful interference is a wrongful action (inaction), including a terrorist act, threatening safe operation of the transport complex, which entails damage to life and health of people, material damage or created a threat of such consequences [3].

In accordance with requirements for transport safety and security [6] besides installation of special control equipment metro should prevent penetration to its facilities of violators, including with the use of motor vehicles, self-propelled equipment and machines.

Blocking of unauthorized passage of vehicles on the territory adjacent to metro stations is necessary first of all to prevent terrorist attacks using explosives on board. This type of terrorist attack is especially dangerous, as using vehicles it is possible to transport to transport infrastructure facilities explosives weighing several hundred kilograms, and that is a

threat of partial or complete destruction of infrastructure, death of a large number of people [7].

Objective. The objective of the author is to present a new device to protect metro stations against unauthorized access.

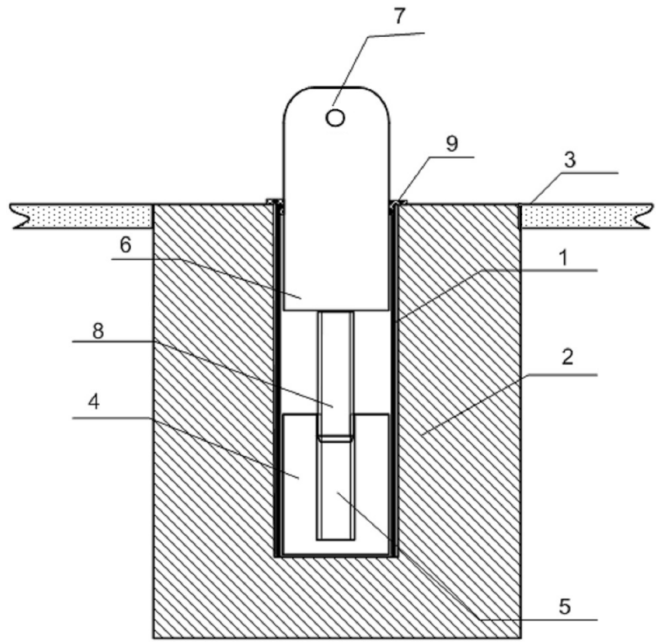
Methods. The author uses engineering methods, evaluation approach, comparison.

Results. Protection of metro against penetration of attackers with the use of vehicles can be achieved by installing next to the stations technical means of protection, blocking unauthorized passage to the territory adjacent to them.

However, the composition of technical means with which metro should organize protection against penetration of attackers with vehicles is not stipulated by regulations. Selection of ways of protection is made by metro structures independently.

As a result, for example, in the Moscow metro protection against unauthorized passage of vehicles consists of installation near stations of anti-parking metal bars or barriers in the form of concrete hemispheres.

The main purpose of these means is to restrict unauthorized parking. Analysis of characteristics of anti-parking columns and concrete hemispheres installed near stations of the Moscow Metro, shows that such barriers are not able to stop most of the cars, especially «SUV» class, not to mention the trucks.



Pic. 1. Anti-ram protective device.



According to the author, one of the solutions to the problem could be equipping places of likely passage to metro stations with blocking devices, which should meet requirements laid down in view of the specifics of the metro, such as:

- possibility to prevent uncontrolled passage and ramming breakthrough in the safety zone near metro station of vehicles weighing up to 20 tons;
- positioning guarantees of device reliability expressed in full independence of device from external power systems, hydraulic, pneumatic lines, etc.;
- possessing guaranteed functions of lowering / lifting of the blocking element of the device necessary to provide controlled passage to the station for: 1) ambulances, rescuers, police involved in the emergency response at the station; 2) technological transport, carrying out supply of goods within the life of station;
- be small-sized, given the shortage of available space near metro stations;
- be safe for pedestrians.

The author's analysis of characteristics of existing barrier devices with movable blocking element has shown that they for some items do not meet the above requirements. These devices use for lowering / lifting of the blocking elements electric, hydraulic or pneumatic actuators, for which electricity is required. In case of emergency at the metro station when the electricity is usually cut off, it is not possible to lower protective elements of devices and machines to let cars of emergency services move to station.

The author developed anti-ram protective devices (ARPD) corresponding to the mentioned requirements (Pic. 1).

ARPD consists of the following elements:

- body 1 mounted in the concrete foundation 2, which is arranged at the level of asphalt pavement 3;
- blocking element consisting of a cylindrical base 4, in the central part of which there is a hole with a thread 5, and barrier column 6, having at the top a mounting opening 7 and at the bottom screw element 8 with a thread;
- rubber O-ring 9;
- installation tool (not shown in picture).

The device blocks passage of vehicles with movable barrier column. It is mounted in places of possible passage of vehicles to the metro station.

The requirement in terms of complete independence of device from external systems is implemented through the use of a mechanical actuator of lowering the barrier column. Lowering is performed manually by screwing into steel base by inserting the installation tool into the hole on the body and rotation of the column clockwise. A column has in its lower part screw element with a thread, which enters into a hole located in the body of the base, lowering the structure. In reverse rotation «unscrewing» comes the rise of the column.

The requirement in respect of safety to pedestrians is realized in ARPD through the shape

of the barrier column, rounded at the top and having no sharp corners and projectures.

The requirement regarding possibility of travel to the station of technological transport and emergency services, is easy to implement in performing device's function of lowering / lifting of the barrier column.

As a result, full-scale experiment found that ARPD protects against ramming breakthrough with vehicles weighing up to 20 tons at a speed of 40 kilometers per hour. Full-scale experiment was carried out by ramming attack on ARPD with laden vehicle «KAMAZ».

Conclusion. Application of the proposed in the article promising technological solutions will increase the degree of protection of metro stations against offenders with vehicles. Anti-ram protective devices are suitable for other modes of transport – for example, in transport safety systems of railway stations and airports.

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