Annex B – EPIDEMIOLOGICAL DATA ON AV MINE INCIDENTS

Epidemiological data are one of the prevalent sources for improving the knowledge of general mechanisms of AV mine incidents. They can include information on four main topics:

- Threats;
- Effects on the vehicle structure;
- Injuries; and
- Boundary conditions (for e.g. soil conditions, depth of burial).

This information can enhance threat analysis, design of vehicular protection systems and test standards by using it as a baseline for further investigations.

WTD 91 created a database on more than 230 military vehicular mine incidents of different nations with information on the threat conditions, effects on the vehicle and especially effects on the occupants beginning in 1990. Figure B.1 shows the number of incidents resulting in casualties and fatalities for the period of 1998 to 2006.

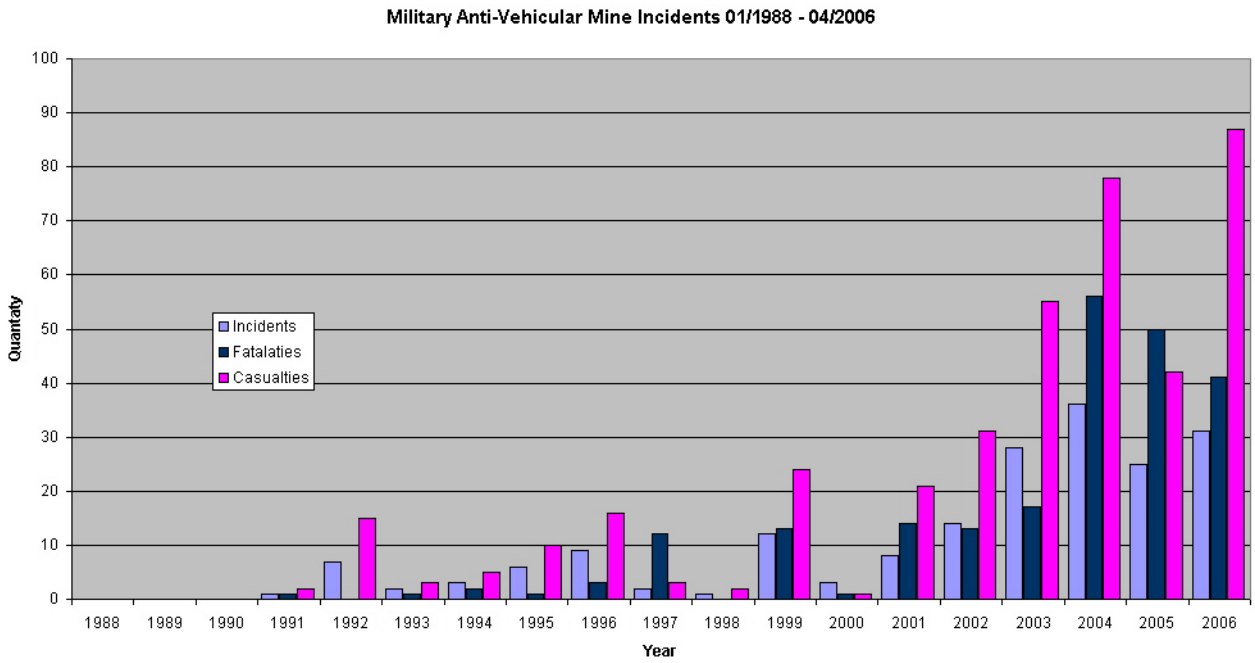

Figure B.1: Overview of Mine Incidents [WTD 91 Incident Database].

The press association of the Western world watched military conflicts where western armies were involved. Consequently the number of reported mine incidents increased during such conflicts (e.g. 1995 – 1996 former Yugoslavia, 2001 – today Afghanistan, 2003 – today Iraq). These data are used in the database. However, policies of restricted information influenced the database (Chechnya, Iraq 2004 – today). So the overall number of mine incidents is much higher than illustrated in the diagram. Besides, many nations did not and sometimes still do not want to share detailed data due to the risk of exposing the limits and Achilles' heels of their vehicular protection systems. Hence, only a limited number of comprehensive publications are available.

After the progress and distribution of internet technologies additional information on numerous AV mine incidents could be found in the World Wide Web. These data are mostly not authorized and published by press agencies, which were not familiar with the phenomena of such incidents. Therefore many incidents were described incorrect as well as only on a very low level of detail – e.g. incidents due to attacks with improvised explosive devices were sometimes described as mine incidents. In spite of this problem the analysis of the available data provides a good overview on some general topics, e.g. threat analysis and occupant safety.

The anti-personnel mine-ban convention in 1999 improved the awareness of the mine threat in the society of many nations outside the Western world, which caused an increasing number of publications of mine incidents. Furthermore some nations also took into account effects of the publication of such incidents and used them as a political tool to blame their opponent. Especially mine incidents in Asia (e.g. Sri Lanka and India/Pakistan) and Africa (e.g. Eritrea) were published more often due to these reasons. However, WTD 91 assumes that only at most 25% of all incidents are included in their database.

Additional exploratory data were published from a surgical point of view on injuries from antitank mine strikes in Southern Croatia from 1991 to 1995 [Radonić, 2004]. However, the hit vehicles seem to be quite unprotected against the antitank mine threat. The authors pointed out the high risk of fatalities due to antitank mine strikes and described the AIS and ISS level for the specific casualties and fatalities (42 victims including 12 fatalities). The average AIS was 3.67 ± 1.18 (casualties only: 2.9 ± 0.55) and the average ISS was 31.48 ± 20.23 (casualties only: 17.47 ± 7.6). Injuries to the brain were the most predominant fatal injury types (50%), followed by vessels injuries (33%) and massive thoracic injuries (16%). The very high portion of fatal brain injuries is most likely due to a lack of available restraint systems in old military vehicles and the seldom usage of these systems in military vehicles, which resulted in head impact with the vehicle roof. Most frequently the lower extremities were injured due to the mine strike. The authors relate the AIS and ISS levels with some of the relevant boundary conditions (crew position, vehicle type) but not with specific injury types. Furthermore the injury distribution is presented by a very rough classification of body regions. Although this paper provides a very good overview on antitank mine strikes from a surgical perspective, it is not possible to derive injury mechanisms and evaluate applicable injury models.

For improving the value of the available data exploration teams including biomechanical experts, engineers and threat analysts should investigate the incidents directly in the operational area. This approach is necessary to understand the load transfer mechanisms from surrounding, threat, vehicle structure and occupant in depth. Data which are reported by non-specialised soldiers in the field cannot guarantee the level of detail and the accuracy which is needed for this kind of analysis.

Examples for the analysis of mine incidents or comparable incidents are given by Medin et al. [Medin, 1997] and Dosquet et al. [Dosquet, 2004].

B.1 REFERENCES

Dosquet, F., Nies, O. and Lammers, C. (2004), Test Methodology for Protection of Vehicles Occupants against IED, in Proceedings of 18th Symposium of Military Aspects of Shock and Blast, Bad Reichenhall, Germany.

Medin, A., Axelsson, H. and Suneson, A. (1997), The reaction of the crew in an armoured personnel carrier to an anti-tank mine blast, A Swedish accident in Bosnia 1996, FOA Defence Research Establishment, Weapons and Protection Division, FOA-R-97-00458-310-SE, March, in Swedish.

Radonić, V., Giunio, L., Biočić, M., Tripković, A., Lukšić, B. and Primorac, D. (2004), Injuries from Antitank Mines in Southern Croatia, *in Military Medicine*, Vol. 169, April, pp. 320-324.