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The Lethality Ratio of Anti-vehicle Mines

The *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on Their Destruction* (Anti-personnel Mine Ban Convention or APMBC) brought AP mines to the forefront of many people's minds. Anti-vehicle mines, however, remain the most lethal mines today, and they are not banned under international conventions.

by Armen Harutyunyan

Since the signing of the *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on Their Destruction* (Anti-personnel Mine Ban Convention or APMBC) in 1997, the issue of AP landmines has received much needed international attention. Over the past 15 years, the vast majority of governments have signed and ratified the APMBC. Most of those who have not adopted it formally claim to not have used or produced AP mines. More recently, in the late 2000s, cluster munitions came into the spotlight, culminating in the *Convention on Cluster Munitions*, which more than 100 countries adopted in 2008. While two dedicated treaties exist banning the use of AP mines and cluster munitions, anti-vehicle mines remain largely unregulated in most countries for use in armed conflicts.[1]

Despite the relative low numbers of AV mines laid in Sudan, their impact on affected populations seems much greater than that of AP mines.

The Vital Few

Most online resources present data on civilian and demining casualties by dividing incidents based on the devices that caused them. This usually compels readers to examine the causes of higher number of incidents and make conclusions as to which devices are the most lethal. While this is one of the methods to measure the impact caused by various explosive devices, it does not necessarily reveal which devices have higher hit rates or lethality rates. This type of information is crucial to decide where to focus mine action assets in order to address immediate humanitarian threats.

Perhaps another way to look at the scale of a mine problem is to compare the ratio of the average number of devices found over a period of time against the number of incidents and casualties caused by a particular type of device over the same time frame. This type of lethality ratio analysis allows comparison between the two most important data sets in mine clearance and can be used as an additional tool in the decision-making process.

Lethality ratio analysis of mine related incidents in a number of countries indicates that AV mines do not account for the majority of mine and other explosive remnants of war incidents. However, they certainly are the most lethal considering the fewer numbers in which they are usually laid. This theory of more effect by fewer emplacements broadly resembles the Pareto Principle, or the law of the vital few. The Pareto Principle points out that for some events, 80 percent of the effects come from 20 percent of causes. The analysis of the lethality ratios of AV mines in Afghanistan, Angola, Cambodia and Sudan (now Sudan and South Sudan) indicates that the law of the vital few can be applicable to mine action. Theoretically, if managers focus their attention on resolving those 20 percent of the vital few, they should eliminate a larger share of their problems.

Anti-vehicle Mines in Sudan

In the territory of the former country of Sudan, fewer numbers of AV mines are found than AP landmines. An average of 24 percent of all mines cleared in Sudan between 2002 and 2011 were AV mines.[2] Despite the relative low numbers of AV mines laid in Sudan, their impact on affected populations seems much greater than that of AP mines. Not only do AV mines cause a higher ratio of injuries and deaths per incident, they also have greater impact on blockage of areas for the civilian population. Even after years of mine clearance and 45,000 km (27,962 mi) of road assessment and verification, the Information Management System for Mine Action indicates that road blockage (which is mostly caused by anti-tank minefields) remains one of the most common impacts of mines on the remaining affected communities in Sudan.[3] Applying the introduced lethality ratio method to Sudan from 2005–2011, one AV mine incident occurred for every 141 AV mines found in Sudan (141:1). The AP mine ratio is 382:1, i.e., one incident per 382 AP mines found. In other words, each AV mine is 2.7 times more likely to cause an incident than each AP mine. As seen in Table 3, the statistics for the casualties are even more dramatic, where each 31st (31:1) AV mine caused death or injuries to a person, against the 446:1 ratio of an AP mine. This makes each AV mine in Sudan 14.4 times more likely to maim or kill a person than each AP mine.[4]

Types of Blockage	Number of Communities
Roads	44
Pasture Land	37
Rain Fed Agricultural Land	11
Housing Area	7
Water Source	5
TOTAL	**104**

Table 1. Blockage types caused by AT mines in Sudan.

Device	Device found per 1 mine accident	Devices found per casualty	Device found per death	Device found per injured
AP mines	382:1	446:1	1606:1	618:1
AV mines	141:1	31:1	86:1	48:1

Table 2. Lethality ratios—number of devices found per number of incidents and casualties in Sudan between 2005–2011.

Situation in Other Mine-affected Countries

Sudan is not the only country with such a high AV mine hit rate. Tables 3, 4 and 5 present a snapshot of the most recent situations in three of the most mine-affected countries: Afghanistan, Angola and Cambodia.

In Afghanistan, AV mines represented only around 5 percent of all mines found in 2011, yet they accounted for more than 37 percent of the mine casualties registered during the same year.[5] Again, as in Sudan, an AV mine is more than 10 times more likely to cause death or injury than an AP mine.

In Angola, AV mines represented 11 percent of all mines found in 2010, yet they accounted for 31 percent of mine casualties during the same year. Each AV mine was four times more likely to cause death or injury than each AP mine.

Device	Casualties	Devices found	Devices per casualty
AP mines	17	24,317	1,430:1
AV mines	10	1,088	**109:1**

Table 3. Lethality ratio of AP and AT mines in Afghanistan, 2011.[5,6]

Device	Casualties	Devices found	Devices per casualty
AP mines	9	7,552	839 :1
AV mines	4	857	**214 :1**

Table 4. Lethality ratio of AP and AV mines in Angola, 2010.[7]

In Cambodia the situation in 2010 appears to be the most dramatic. AV mines constituted only 2 percent of mines found during 2010, but accounted for more than 55 percent of all registered casualties across the country. The lethality ratio in Cambodia reveals that every 11th AV mine killed or maimed a person and that AV mines are 58 times more likely to cause a casualty than AP mines.

Device	Casualties	Devices found	Devices per casualty
AP mines	63	40,320	640:1
AV mines	78	831	**11:1**

Table 5. Lethality ratio of AP and AV mines in Cambodia, 2010.[8]

Observations

Most national and international mine action organizations have continued treating all mines and ERW as equally dangerous for those who live in mine/ERW-contaminated areas without necessarily giving a higher clearance priority to AP mines. Some believe AV mines create a greater problem to vulnerable populations as well as to humanitarian agencies delivering aid.[9] Various sources indicate that the number of mine casualties resulting from AV mines is usually lower than casualties caused by AP mine incidents. For example, the *Landmine and Cluster Munition Monitor* reports that in 2010, out of 1,650 identified mine-related casualties worldwide, AV mines caused around 23 percent.[10] The analysis of incident information in this article reiterates the magnitude of the problem that AV mines pose for mine-affected countries.

While most of the analyzed country data only covers a short period of time, three thoughts arise when examining the statistics produced by the lethality ratio method described previously.

First, mine clearance organizations should pay more attention to the causes of incidents in their areas of operation when prioritizing minefields for clearance. While theory in mine action does not always find a justified practical use, hypothetically, if some of the money and effort in clearing 103 AP mines in Sudan was used to clear the same number of

AV mines in Sudan, at least three people could have been saved from death or injury. It is usually easier and cheaper to clear AP mines than to clear AV mines.[11] However, in some countries, getting rid of the majority of AV mines first might save more lives and prevent more injuries. Perhaps a Pareto-like rule could have a wider application within mine action when prioritizing which tasks to complete first.

Second, the absence of a prohibition on the use of AV mines in the APMBC downplays their humanitarian impact. The APMBC did not cover AV mines due to a debate at the time that military use of AV mines outweighs the potential humanitarian impact that they might cause.[11] This debate continued in the CCW from 2000 to 2006 during negotiations to regulate mines other than anti-personnel landmines but failed because of similar disagreements. In 2011, CCW States Parties initiated expert talks on this issue again at which certain states continued to question the humanitarian impact of mines other than anti-personnel landmines. From 1999 to 2010 the *Landmine and Cluster Munition Monitor* identified more than 5,000 AV mine casualties; more than 75 percent were civilians.[12] The available data leaves no doubt about the scale of the humanitarian impact of AV mines. The AV mine lethality ratio is more likely to increase if its use is not regulated or prohibited.

Third, the APMBC's success might become overshadowed if the sides of different ongoing or possible future armed conflicts decide to use AV mines more frequently, as AP mines are becoming more difficult to obtain. While this is just a theoretical assumption without sufficient existing evidence, the possibility of this assumption becoming a reality is already being discussed.[11]

Conclusion

Continuing to clear AP mines is important. However, when analyzing mine action-related information, consider that while the AV mines are laid in fewer numbers (as frequently indicated by the number of mines found during mine clearance worldwide), they cause multiple deaths and injuries per incident. As seen in the recent study by the Geneva International Centre for Humanitarian Demining, the average number of casualties per AV mine incident is twice the average number of victims per AP mine incident.[13] Furthermore, as frequently taught during various ERW safety training sessions, the proximity of areas that could have been of strategic importance to one of the conflicting sides is one of the first things to be aware of when in recent combat areas. These are areas where AV mines are often laid, typically including routes, roads and bridges—vital infrastructure that people will use many years after a conflict ends. These two factors greatly contribute to the high lethality ratio of AV mines, which is certainly the case of AV mine lethality in Afghanistan, Angola, Cambodia and Sudan.

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