THE HUMANITARIAN AND DEVELOPMENTAL IMPACT OF ANTI-VEHICLE MINES

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‘I welcomed the work carried out on anti-vehicle mines [in 2012] under the aegis of the Convention [on Certain Conventional Weapons]. I strongly urge High Contracting Parties to continue to explore all possible avenues for ensuring that these weapons no longer harm civilians, impede the delivery of humanitarian aid or obstruct social and economic development.’*

Ban Ki-moon
Secretary-General of the United Nations

* Geneva, Switzerland, 15 November 2012 – Secretary-General’s message to meeting of High Contracting Parties to Convention on Certain Conventional Weapons [delivered by Mr. Kassym-Jomart Tokayev, Director-General of the United Nations Office at Geneva (UNOG)]

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ប្រយ័ត្នគ្រាប់មីន!!
Danger!! Mines!!

LIST OF ABBREVIATIONS

APII
Amended Protocol II (to the CCW)

ADB
Asian Development Bank

ADS
Animal detection systems

APM
Anti-personnel mine

ASEAN
Association of Southeast Asian Nations

ATM
Anti-tank mine

AVM
Anti-vehicle mine

BIS
Basic impact survey

BLS
Baseline survey

CHA
Confirmed hazardous area

CCM
Convention on Cluster Munitions

CMAA
Cambodia Mine Action Authority

CMAC
Cambodia Mine Action Centre

CMVIS
Cambodia Mine Victim Information System

CCW
Convention on Certain Conventional Weapons

ERW
Explosive remnants of war

GGE
Group of Governmental Experts

GICHD
Geneva International Centre for Humanitarian Demining

ICRC
International Committee of the Red Cross

IDP
Internally displaced person

IED
Improvised explosive device

IHL
International humanitarian law

IMAS
International Mine Action Standards

IMSMA
Information Management System for Mine Action

KR
Khmer Rouge

MAC
Mine action centre

MACCA
Mine Action Coordination Centre of Afghanistan

MAG
Mines Advisory Group

MAPA
Mine Action Programme of Afghanistan

MAPU
Mine Action Planning Unit

MDD
Mine detection dog

MEIFCS
Mine and ERW Impact Free Community Survey

MOTAPM
Mines other than anti-personnel mines

MPV
Mine-protected vehicle

MRE
Mine risk education

MSP
Meeting of the States Parties

MTI
MineTech International

NGO
Non-governmental organisation

NMAA
National Mine Action Authority

NPA
Norwegian People's Aid

NSA
Non-state actor

PCM
Post-clearance monitoring

RDX
Research Department Explosive

RPG
Rocket-propelled grenade

SHA
Suspected hazardous area

SIPRI
Stockholm International Peace Research Institute

SPLA
Sudan People's Liberation Army

SPLM
Sudan People's Liberation Movement

TNT
Trinitrotoluene

UNAMA
United Nations Assistance Mission in Afghanistan

UNICEF
United Nations International Children's Emergency Fund

UNMAS
United Nations Mine Action Service

UTZ
Uzbekistan Railway

UXO
Unexploded ordnance

WFP
World Food Programme

EXECUTIVE SUMMARY

Anti-vehicle mines (AVMs) have always had a humanitarian impact, but their significance has often been overshadowed by the higher-profile topic of anti-personnel mines (APMs), and thus the need to address AVMs has been neglected. In some countries, AVMs now present a greater threat to civilian populations than APMs, yet they are often viewed as a marginal issue in international fora.

This publication seeks to depict the physical, social, economic and developmental impact of AVMs. AVMs are landmines designed to be triggered by vehicles rather than individual people. They can remain active for decades, and a number of them are difficult to detect with normal demining equipment and techniques. A reduction of the duration of the active life of AVMs, restrictions on the laying of AVMs outside perimeter marked areas, increased detectability and accurate recordkeeping should be promoted as immediate steps to limit the humanitarian and developmental impact of these weapons.

When aid and development vehicles, agricultural machinery, private cars and trucks and even large animals detonate AVMs, the consequences deploy far beyond the immediate death, injury and destruction. Fear of further accidents can have a devastating effect on supply networks in a number of ways. Past cases have shown that when AVMs are present, it can become prohibitively expensive to move resources to isolated communities; displaced people cannot return to their homes; refugee camps must be maintained for longer than necessary, draining funds away from reconstruction and rehabilitation projects; and local trade in goods and agricultural products is reduced or brought to a standstill. Thus, the indirect humanitarian impact of a single AVM accident can be many times greater than that of an APM.

While the impact of APMs can decrease over time as clearance efforts progress, this study found that in some instances the opposite trend is true for AVMs. Increased mechanisation of agriculture, increased use of transport vehicles and the development of new infrastructure are all positive signs of a recovering economy, but they also mean greater vulnerability to the threats presented by abandoned and forgotten, but nonetheless active, AVMs.

In Cambodia, a doubling of AVM casualties in recent years has overshadowed the decline in casualties from APMs. There have been numerous incidents where tractors loaded with ten or more people hitting AVMs in areas considered safe. As increased prosperity has led to growing mechanisation of farming, vehicles are now detonating AVMs in places that had, for years, been safe for foot traffic or non-mechanised agricultural practices.

ICRC vehicle damaged by an AVM in Angola. The accident resulted in five casualties.

In addition, as Afghanistan and South Sudan work to stabilize their societies and expand their economies, numerous infrastructural, agricultural and housing development projects in line with these goals have been hindered by the presence of AVMs.

Figures provided by affected states and news media reports make it clear that AVMs represent a significant and continuing humanitarian problem. However, poor reporting of incidents results in inconsistent statistics, hampering a better understanding of the scale of the problem and its on-going impact. To address this, it is essential that government and mine action personnel take steps to make reporting more reliable and able to distinguish between AVM and APM incidents.

AVMs are not subject to the same rules applied to APMs in International humanitarian law (IHL) In the absence of a more stringent legal framework regulating AVM use, much remains to be done in terms of the implementation of current provisions to ensure compliance with humanitarian principles and norms.

INTRODUCTION

This publication is based on a research project to assess the humanitarian and developmental impact of anti-vehicle mines. As the international community continues to explore the possible need and options for further legal regulation of AVMs,[1] there remains a demand for more rigorous analysis of the specific impact of AVMs on civilians and developing societies that are either in the midst of, or recovering from, conflict. This publication seeks to bridge this knowledge gap, highlight trends and shortcomings and offer recommendations.

The study found that the presence of AVMs, laid on roads, on roadsides and in fields not only continues to result in civilian deaths and injuries, but also has a number of permeating negative effects on communities and states as a whole. These effects include inhibiting humanitarian aid, delaying post-conflict recovery, and hampering development efforts in both the near and long-term. Furthermore, AVM presence causes fear and thus has an enduring ability to prevent populations from using land productively, using transport effectively and building infrastructure. The study proposes a number of recommendations, including:

1. Discussions on further regulating the use of AVMs to comply with existing IHL principles should continue.
2. Geographic coordinates of mines and minefields should be systematically recorded.
3. If AVM use cannot be deterred or prevented, States should explore ways of increasing detectability.
4. Civilian populations should be educated on the specific hazards posed by AVMs.
5. States should be encouraged to disaggregate their landmine data to better distinguish APMs and AVMs.
6. Reporting forms should be further standardized.

The study was carried out jointly by the Geneva International Centre for Humanitarian Demining (GICHD) and the Stockholm International Peace Research Institute (SIPRI). Its methodology involved gathering existing literature, legal documents and information (documentation, data and interviews) from mine action centres (MACs) and operators on the ground, conducting national AVM basic impact surveys (BIS) and fieldwork, and from soliciting expert advice. The study features case studies from Afghanistan, Cambodia and South Sudan.

1 Also commonly known as anti-tank mines (ATM) and mines other than anti-personnel mines (MOTAPM)

This publication provides a background to AVMs, with a section exploring technical aspects followed by an explanation of applicable legal frameworks. A global overview covers data availability, current usage, casualty data and impacts on development. The three case studies provide concrete examples of these findings. The conclusions identify trends and make recommendations based on the research.

Increased prosperity in northwestern Cambodia has led to a growing mechanisation of farming activities, including a higher number of tractors. These are detonating anti-vehicle mines in places that had, for years, been safe for foot traffic or non-mechanised agricultural practices. Eight Cambodian farmers were killed and one was critically injured on 3 February 2012, after their truck hit two anti-tank mines in Banteay Meanchey province. Seven of the farmers died instantly as the truck ran over the AVM; the eighth victim died later in hospital from the injuries sustained in the blast.

BACKGROUND

CHARACTERISTICS

An AVM is a type of landmine designed to damage or destroy vehicles, including tanks and armoured fighting vehicles. Compared to APMs, AVMs typically have a much larger explosive charge and a fuse designed to be triggered only by pressure akin to that of vehicles. Some AVMs are also manufactured with additional fusing systems, giving users the option of fitting anti-disturbance and anti-handling devices, triggered by countermeasures or when someone tampers with the mine or tries to remove it from the ground. AVMs are designed to damage or destroy hardware and to injure or kill vehicle crews and passengers.

Simplicity

While the technical design of AVMs has changed over time, the underlying concept remains the same: most are simple, adaptable and can be mass-produced at relatively low cost. A fusing mechanism responds to pressure or the proximity of a target and is connected to a large explosive charge. Simplicity brings low-cost reliability and therefore makes the weapon attractive and available to almost all armed forces, regardless of their budgets. Although more sophisticated electronic fuses are becoming available, their high cost has prevented widespread use. Whatever the type of AVM, they are still cheap relative to the weapon systems that they are designed to defeat.

Versatility

AVMs very effectively render ground unusable. They can be used to deny access to one area, to channel enemy forces into another desired area and to slow down an enemy's advance, giving time for defenders to marshal their forces and exposing enemy armour to more effective anti-armour fires. AVMs can be laid by hand, mechanically, remotely by aircraft and artillery or scattered by other systems from less than 500 metres. Different fuse systems respond to pressure, break wires, electric commands and a range of electrical and magnetic sensors. Many types of AVMs offer the option to fit different types of fuse providing more flexibility for military and non-state actors (NSA). Almost all AVMs can be booby-trapped using manufactured features or improvised devices to add further unpredictability to their use. Different types of AVMs may be buried, laid on the surface or placed at the roadside to increase their range and impact.

Lack of discrimination

AVMs are generally designed to discriminate between smaller targets (persons and sometimes smaller vehicles) and larger ones (larger vehicles and tanks).

They do so primarily by requiring more force to be applied to trigger them than would normally be associated with a person on foot. Most magnetic fuses respond only to the larger metallic-magnetic signature associated with a vehicle or tank. None of these systems can reliably discriminate between a military and a civilian target.

Longevity

Few AVMs have self-destruction, self-neutralisation mechanisms or self-deactivating feature designed to make them safe after a set period of time. Most AVMs continue to be dangerous to populations after conflicts have finished and for as long as the fusing mechanism and explosive fill remain functional. While climate, temperature and solar radiation all degrade the function of AVMs, some types, made from tough plastics and high quality internal components are likely to remain dangerous for very long periods of time – certainly years and in many cases several decades. Under the right conditions even metal cased mines from the Second World War have been found to be in excellent condition well into the 21st century.

An AVM on a road in Angola.

Features

Most AVMs are pressure-operated with a relatively simple mechanical fusing system initiating a main charge housed in a thin outer casing. Many use TNT or TNT/RDX as the main charge, though others occasionally use more powerful explosives or mixtures. Plastic casings are widely used for ease of manufacture and resilience, though wooden and metal casings are still found in older designs. Shock-resistant fuses are used to defeat explosive mine countermeasures and allow scattering. Booby-trapped AVMs incorporate integral anti-handling features to discourage hand lifting. Some AVMs contain very little metal, making them extremely difficult to detect with the metal detectors used during most mine clearance.

Although there have been many variations, the design of anti-vehicle blast mines has been largely dictated by the requirement for mechanical laying or scattering and efficient function. Cylindrical mines are most common, generally with a central pressure plate or fuse. This configuration was widely favoured by the major producers of landmines.

Employment

AVMs are normally buried flush to or just below the surface, to a depth of 50 mm; at greater depths the fuse may be too well protected by the soil to operate. In some countries, such as Cambodia and Afghanistan, AVMs were buried deep to prevent detection and a wooden pole was used to transfer the pressure from the ground level to the mine's pressure plate. Minefields are often laid with a mix of AVMs and APMs. In order to avoid sympathetic detonation, large AVMs are usually placed several metres apart. Typically, the mines would be laid in straight lines or zigzag 'clusters', where AVMs are surrounded by APMs. It is not uncommon for two or more mines to be stacked in the same hole to produce a more powerful blast that will penetrate armour. AVMs are also used by insurgent groups to deny routes, ambush security forces or terrorise communities; some have been and can be improvised or 'locally manufactured'.[2]

Typical operation

The AVM is armed by the insertion of the fuse assembly or the completion of the explosive train; some AVMs also incorporate an arming delay. Once armed, the AVM is set off when sufficient force is applied. With pressure fuses, activation normally results in the immediate detonation of the main charge.

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2 IHS Janes, *Mines & EOD Operational Guide – AT Blast Mines*, March 2014

Effect

Blast AVMs rely primarily on the shockwave produced by detonation of the high explosive. Small AVMs tend to achieve 'mobility kills' on armoured vehicles by damaging their running gear. Larger AVMs may destroy the vehicle and crew completely, particularly if they have detonated beneath the hull.

AVM Clearance

Minimum metal AVMs present the greatest challenge to clearance operations: slow manual excavation methods will be necessary if animal detection systems (ADS) or mechanical clearance systems are unavailable or unsuitable. The possibility of encountering anti-disturbance and anti-handling devices means that AVMs are usually destroyed on site or, if it is necessary to move them, are pulled remotely using a long line to keep clearance operators safe from any explosion. Clearance rates are affected by other factors such as soil type, vegetative cover and local climatic conditions.

Mechanical demining assets can significantly increase the rate of technical survey and clearance, but most are not designed to withstand repeated AVM detonations. Even if there is no critical damage to a machine, necessary repairs can be expensive and time-consuming, particularly when operating in remote locations. This creates 'down-time' that greatly increases the costs of such operations.

Following the use of mechanical demining equipment on roads, repair work may be required if the intervention has destroyed the road surface. Systems have been developed that, owing to their size, mass and protection, are capable of withstanding multiple AVM detonations without major damage. In practice, however, some of these systems are hard to use in the operating environments encountered in humanitarian demining because of their purchase price, high running costs, requirements for maintenance and the inadequate local infrastructure for transporting large machines. Locally manufactured machines are also used for clearance and some Mine Protected Vehicles (MPVs), armoured and designed to sustain an AVM blast, have been fitted with metal detection systems and ground penetrating radar.

Animal detection systems (ADS) are based on the ability of certain animals to detect the vapour emanating from landmines and other explosives. They can be speedy and cost effective when searching for AVMs under the right conditions, but they cannot normally be used in areas with dense vegetation and are easily affected by adverse weather conditions.

Several systems exist for rapidly dispensing mines to cover wide areas, as opposed to soldiers laying each one individually. Some AVMs are designed to be dropped from aircraft or fired by artillery, and they arm themselves once they land in the target area.

Off-route mines, also known as horizontal action mines, are designed to fire an explosively formed projectile into the side of the target vehicle. They are used as ambush mines or where the ground or road surface is not suitable for burying or concealing a mine. They typically employ a shaped charge to focus the explosive effect in order to pierce armour and the resulting over pressure within the vehicle has a devastating impact on the crew.

DEVELOPMENTS OF AVMs IN THE 20th CENTURY

Even before the deployment of the first tanks in 1916, similar devices had been developed for use against locomotives (e.g. by Confederate forces during the American Civil War).

The First World War saw the first use of AVMs by the Germans as a counter-measure against the first tanks introduced by the British. Initially, they were nothing more than a high explosive shell or mortar bomb buried upright with a special fuse. Later, purpose built mines consisting of a wooden box packed with explosives and triggered either remotely or by a pressure fuse were developed. By the end of the war, the Germans had developed mine-laying techniques including the laying of mine rows. AVMs accounted for up to 15 per cent of U.S. tank casualties during the final stages of the war.

The Soviet Union began developing AVMs in the early 1920s, and in 1924 produced its first AVM. The mine had a 1kg charge: enough to break the tracks of contemporary tanks. At the same time, in Germany, the first modern AVM, the ‘Tellermine’, entered service in 1929. It was a disc-shaped device, approximately 30cm wide, containing approximately 5kg of high explosives.

During the Spanish Civil War (1936–39), both sides used AVMs. Republican forces lifted mines placed by Nationalist forces and then used them against the Nationalists. This encouraged the development of anti-handling devices for AVMs. The Winter War between the Soviet Union and Finland (1939–40) also saw widespread use of AVMs, as did the Second World War. More sophisticated features, such as shaped charges, satchel charges and sticky bombs, were also developed.

The second battle of El Alamein (23 October to 4 November 1942) and the battle of Kursk (4 July to 23 August 1943) are two of the best examples of the use of landmines, particularly antitank mines, during the Second World War. In both cases, the defending forces relied on landmines to create a defensive barrier and to help determine the path the attacking forces would take. The principal difference lay in the ability of the defensive forces to hold their positions once the attacker had cleared the minefields. At the second battle of El Alamein, German forces under Field Marshal Erwin Rommel needed to hold off a much larger British force. In an effort to stop the British advance, Rommel ordered his engineers to put out 451,372 landmines. While the initial plan called for 30 per cent of the mines to be anti-personnel mines, available supplies limited the number of anti-personnel mines to only six per cent of the mines used. Surprisingly, 180,000 of the mines were British AVMs from a series of abandoned British minefields. While the Germans recovered some of the English mines for new minefields, two of the British minefields were incorporated directly into the Axis defences. In all, the Axis spent over three months preparing the minefields at El Alamein. Most, if not all, of the minefields were covered by artillery fire.[3]

AVMs used during the battles across North Africa and Europe more than 70 years ago still represent a threat. Egypt is continuously dealing with this legacy, but occasionally a reminder from the past makes headlines in the heart of Europe. For instance, in December 2011, a detonation tore a crater 10 meters wide next to a road between the towns of Gross Ossnig and Neuhausen, some 100 kilometres southeast of Berlin. The area had been a storage site for a nearby bridge construction project. Bomb disposal experts found two more mines nearby. They were too unstable to remove and had to be blown up in the same spot. Some 400 residents living within one kilometre of the area were evacuated and told to leave their doors and windows open to prevent the glass shattering from the shockwaves. The area was the scene of fighting in the Second World War because it was close to an airfield where newly-built Focke-Wulf combat aircraft tested their machine guns. The airfield was bombed several times. Elderly locals recalled that weapons and munitions were thrown in a bomb crater near the airfield. That might explain why the mines were found buried three or four meters deep – they were evidently discarded. If they had been planted to take out a tank, they would have been placed much closer to the surface.

3 *A dissertation in history – the development of landmine warfare* by Norman Edgar Youngblood IV, B.A, M.A (December 2002)

Modern AVMs are usually more advanced than simple containers full of explosives detonated by vehicle's pressure. The main advances since the Second World War have been:

- More powerful effective warheads (different explosive compounds and shaped charge effects).
- Use of non-ferrous materials making them harder to detect.
- New methods of deployment (from aircraft or using artillery).
- More sophisticated fuses (triggered by magnetic and seismic effects, or combinations of effects).
- Sophisticated 'anti-disturbance' devices to neutralise countermeasures and prevent or discourage tampering or removal.

Truck damaged by AVM explosion in Angola.

LEGAL FRAMEWORK

The use of AVMs is regulated by a set of IHL principles and rules, the vast majority of which are set out in treaties and represent legal obligations for States who are parties to those treaties. This chapter draws on a paper produced by the International Committee of the Red Cross (ICRC) entitled *'Rules of international humanitarian law applicable to anti-vehicle mines* and presented at the Meeting of Experts on Mines Other than Anti-Personnel Landmines within the framework of the Convention on Certain Conventional Weapons (CCW),[4] in April 2012.

Rules of customary international law

The rules of customary international law stem from the general practice accepted as law and are independent of other provisions established in international treaties. They may be applicable in international or non-international armed conflicts, or both, and are binding on both states and non-state actors.

The most significant principles of customary IHL applicable to AVMs are distinction and proportionality.

The ICRC study on customary international law details these rules as follows:[5]

- The principle of distinction requires parties to the conflict to distinguish between civilians and combatants and to direct attacks against combatants only.
- The principle of proportionality in attack prohibits attacks which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.

Additionally, the ICRC study recognises three specific customary rules which directly address landmines and which are applicable to both APMs and AVMs:

1. Care must be taken to minimise the indiscriminate effects of landmines.
2. Parties to the conflict are required, as far as possible, to record the placement of landmines.

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4 ICRC, *Rules of international humanitarian law applicable to anti-vehicle mines.* CCW/MSP/2012/WP.1 (2012)

5 ICRC 'Customary IHL Database', Rule 1, http://www.icrc.org/customary-ihl/eng/docs/v1_cha_chapter1_rule1 (accessed: 21 March 2014)

3. At the end of active hostilities, parties to the conflict that have used landmines must remove or otherwise render them harmless to civilians, or facilitate their removal.

Finally, the ICRC also recognises that 'parties to the conflict must allow and facilitate rapid and unimpeded passage of humanitarian relief for civilians in need, which is impartial in character and conducted without any adverse distinction, subject to their right of control'.[6]

Specific treaty rules

Additional Protocols to the Geneva Conventions

For States that are party to it, Additional Protocol I to the Geneva Conventions, applicable to international arms conflicts, sets out important limits on the use of AVMs, namely:

- Article 35 limits the right of parties to the conflict to choose any methods and means of warfare and prohibits the use of weapons and methods of warfare that can cause superfluous injury or unnecessary suffering.
- Article 51.5 prohibits indiscriminate attacks.
- Article 57.1 requires parties to take constant care to spare the civilian population and civilian objects.
- Article 57.2 requires parties to take all feasible precautionary measures in the choice of means and methods of attack in order to avoid, and in any event minimise, incidental loss of civilian life, injury to civilians and damage to civilian objects.

Subject to certain conditions, Article 70 requires parties to the conflict to allow and facilitate rapid and unimpeded passage of all relief consignments, equipment and personnel.

As for non-international armed conflicts, Article 3 common to the Geneva Conventions prohibits acts of violence against the life and person of people taking no active part to hostilities. Additionally, within the framework of Additional Protocol II to the Geneva Conventions applicable to non-international armed

6 ICRC 'Customary IHL Database', Rule 55, http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule55 (accessed: 21 July 2014)

conflicts, Article 13 stipulates that the civilian population and individual civilians must not be the object of attack. In addition, Article 18.2 allows for humanitarian and impartial relief actions for the civilian population.

Amended Protocol II, Convention on Certain Conventional Weapons

AVMs themselves are not subject to a specific international convention, but are subject to specific rules found in Amended Protocol II (APII) to the CCW. APII specifically regulates the use of mines, booby-traps and other devices including 'mines other than anti-personnel landmines'.[7] Article 6(3) specifically deals with 'remotely delivered mines other than AP mines (MOTAPM)'. The article states that:

> '*It is prohibited to use remotely-delivered mines other than APMs, unless, to the extent feasible, they are equipped with an effective self-destruction or self-neutralization mechanism and have a back-up self-deactivation feature, which is designed so that the mine will no longer function as a mine when the mine no longer serves the military purpose for which it was placed in position.*'

Other rules provided by APII, and applicable to AVM, prohibit the use of mines designed to explode as a consequence of the presence of a commonly available metal detector[8] and the use of self-deactivating mines equipped with anti-handling devices capable of functioning after deactivation.[9] The transfer of mines is, in certain conditions, prohibited.[10] In addition, APII requires state parties to record all information concerning minefields[11] and, without delay after the cessation of active hostilities, to clear all mined areas.[12]

APII rules applicable to AVMs are weaker than those applicable to APMs. For instance, the rule on the prohibition of use of non-detectable mines applies only to APM.[13] Similarly, the requirement to place mines within a perimeter-marked area applies only to manually positioned APMs without self-destruction and self-neutralisation mechanisms.[14]

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7 Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices, as amended on 3 May 1996. APII entered into force in 1998 and has 100 state parties, http://www.unog.ch/80256EE600585943 /(httpPages)/3CE7CFC0AA4A7548C12571C00039CB0C?OpenDocument (accessed: 27 March 2014)
8 Art. 3.5 APII to the CCW
9 Art. 3.6 APII to the CCW
10 Art. 8.1 APII to the CCW
11 Art. 9 APII to the CCW
12 Art. 10 APII to the CCW
13 Art. 4 APII of the CCW
14 Art. 5 APII of the CCW

Recent developments in the legal framework applicable to AVMs in the context of CCW discussions

A number of states, international organisations and non-governmental organisations (NGOs) have continued to emphasise the widespread humanitarian problems caused by AVMs. New requirements related to the use of AVMs, especially in the areas of detectability, limitations on active lifetime[15] and perimeter marking, have been discussed within the framework of the CCW on different occasions. However, the discussions did not lead to a substantive change in the legal framework regulating AVMs.

At the Preparatory Committee for the Second Review Conference (2000–2001), a number of states proposed a new Protocol restricting the use of AVMs. However, an agreement was not reached in this context. Instead of adopting a new Protocol, an open-ended Group of Governmental Experts (GGE) was created, with a specific Working Group mandated to address the issue of AVMs. At these discussions a draft protocol on mines other than anti-personnel mines commanded a large measure of agreement but was opposed by a small number of States Parties.

Subsequently, at the Third Review Conference of the State Parties in 2006, several State Parties[16] committed themselves to implementing the provisions in the draft protocol on a national basis via a 'Declaration on Anti-Vehicle Mines'.[17] The commitments included: not using AVMs outside perimeter-marked areas if the mines are not detectable or not equipped with a self-destruction or self-neutralisation mechanism and also incorporates a back-up self-deactivating feature; not transferring AVMs in their possession unless certain conditions are satisfied, such as, meeting the detectability and active life standards set out in the declaration; and limiting AVM transfer to purposes of their destruction or development of and training in mine detection, mine clearance or mine destruction techniques.[18]

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15 For example ICRC, *Anti-vehicle mines: effects on humanitarian assistance and civilian populations*, presented at the Group of Governmental Experts of the States Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which may be deemed to be Excessively Injurious or to have Indiscriminate Effects, CCW/GGE/II/WP.9 (2002)

16 Albania, Australia, Bosnia and Herzegovina, Belgium, Bulgaria, Canada, Croatia, Denmark, El Salvador, Luxembourg, Estonia, France, Israel, Latvia, Lithuania, Netherlands, New Zealand, Norway, Republic of Korea, Romania, Serbia, Slovenia, The former Yugoslav Republic of Macedonia, United Kingdom of Great Britain and Northern Ireland and United States of America

17 Declaration on Anti-vehicle mines, CCW/CONF.III/WP.16/Amend.2

18 Ibidem

At the Fourth Review Conference, in December 2011, the AVM issue again featured in discussions. At the conference opening, the Secretary-General of the United Nations affirmed that progress in the area of AVMs would represent a significant improvement in IHL.[19] The State Parties decided to convene an open-ended Meeting of Experts, in 2012, to further discuss the implementation of IHL with regard to MOTAPM and to submit a report to the 2012 Meeting of the High Contracting Parties to the Convention.[20] At this Meeting of Experts on MOTAPM, a study by the ICRC[21] assessing the current status of IHL covering MOTAPM highlighted the many challenges resulting from the lack of agreement between the State Parties during previous discussions on this topic. In addition to the threats of AVMs discussed above, other areas of concern included the lack of information on implementation of article 6.3 of APII of the CCW and on the implementation of states' commitments and national policies, especially of those having committed to the declaration in 2006.

19 Summary Record of the First Meeting, Fourth review conference CCW, 2011, CCW/CONF.IV/SR.1

20 Final Document of the 4th Review Conference, 15 Dec. 2011 CCW/CONF.IC/4/Add.1

21 ICRC, *Rules of international humanitarian law applicable to anti-vehicle mines*, Convention on Certain Conventional Weapons Meeting of Experts on Mines other than Anti-personnel Mines (2012)

Although the meeting was conducted in a constructive atmosphere, a small number of states continued to insist as they had done in the 2002–2006 process that existing IHL regulation of AVMs was sufficient, if respected. Most states continued to stress that the humanitarian impact of AVMs called for stronger regulation.

At the 2011 Meeting of States Parties, the discussion remained divided and a proposal to continue work in the format of an expert meeting in 2013 was blocked by a small number of states. AVM under the title MOTAPM has remained on the agenda of CCW Meetings of States Parties. It was discussed at the 2013 MSP and is listed on the draft agenda for the 2014 MSP.

GLOBAL OVERVIEW

The full extent of AVM contamination around the world remains uncertain. Nevertheless, there is strong evidence that AVMs continue to affect civilian populations on a wide scale. In some states, the threat of AVMs is so extensive that its negative effects visibly permeate civil society, affecting infrastructure development and economic progress at many levels. For other states, the full extent and internal impact of AVM contamination is less clear due to unwillingness or inability to publically report on the threat. In some cases, news media provide a basic insight into the situation by reporting on the continued occurrence of AVM incidents and resulting civilian casualties.

This global overview section sets out the nature and specificity of available data on the presence of AVMs internationally. It is based on what can be discerned from open sources, as well as from the AVM basic impact survey (BIS) conducted in the context of this study. The section also discusses how AVMs are used internationally (both past and present), by looking at states that import AVMs or produce them for domestic use, and states with existing AVM stocks. Expanding on the comprehensive picture of the humanitarian and development impact of AVMs, this section also examines data on civilian AVM casualties and reporting procedures, as well as key development areas affected by AVMs.

CURRENT USE OF ANTI-VEHICLE MINES

AVMs were used extensively around the world throughout the 20th century and, in some countries, new mines are still actively being laid. Some of the world's many AVM fields function as actively monitored military defences. However, for the large majority of affected states, AVMs are unrecorded, unmonitored hazards from past conflicts. They are lost to the parties that once laid them and pose a continued threat to civilian populations.

AVMs are still widely produced and stockpiled by many countries. Around 30 countries are still believed to be producing AVMs,[22] though a number may have ceased active production (see Appendix for detailed AVM type listings by country). In addition, there are occasional international collaborations for the joint production of AVMs.

While there is some overlap in terms of where AVMs are produced and where they are used, for many states, AVMs are produced elsewhere and imported. For example, although the African continent is heavily contaminated by AVMs, other than Egypt and South Africa, no other African countries have manufactured them.

22 Janes Mines and Mine Clearance, 2011–2012

Pressure-fused mines target military vehicles and civilian objects and can be set off by any object that exceeds the design's pressure threshold. Some modern electronic fuses use a variety of sensors, such as seismic, magnetic influence and electronic including combined sensors, which enhance discrimination, allowing more selective targeting of military vehicles.[23] However, in terms of the AVMs that are currently affecting post-conflict and developing states, most are older designs with more conventional fusing frameworks.

This study found that the patterns associated with the intended military use of AVMs were actually quite rare in the case study countries of Afghanistan, Cambodia and South Sudan. This was due to the weapons being used by untrained or guerrilla forces. In these countries, combatants in general did not receive sufficient training in landmine warfare. Therefore, the laying of AVMs was done irregularly and often targeted areas and roads deemed important for enemy vehicles transporting supplies and troops. As a result, when making contamination assessments, mine action programmes in these countries are very careful not to rely too heavily on concepts involving traditional military strategies for laying AVMs.

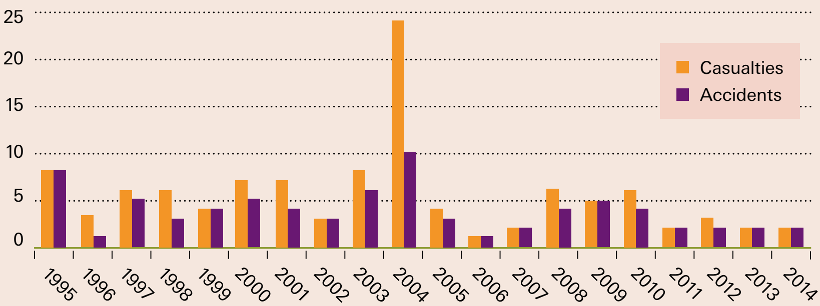
An additional challenge is that many of these AVM users kept no records of where the mines are laid as required by the CCW. In many cases, this is because they have neither the necessary training nor the resources to create and maintain maps or record emplacement coordinates. In other cases, sometimes belligerents did not believe keeping records of AVM locations was important, and sometimes they have seen keeping maps of the mines as a strategic vulnerability that could not be afforded in case the opposing force acquired them.

23 IHS Janes, *Mines & EOD Operational Guide – AT Blast Mines*, March 2014

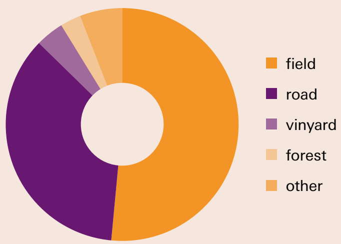
FIGURE 1 AVMs IN NAGORNO KARABAKH: PERSPECTIVE FROM A MINE ACTION OPERATOR[24]

The Nagorno Karabakh (NK) region between Armenia and Azerbaijan is home to approximately 150,000 inhabitants. During the war (1988–1994), mines were laid in NK by both countries near strategic positions, but remain until this day a danger to the civilian population. All of registered AVM victims in NK are males. However, the effects of this are felt more widely. Families often lose their only source of income when the male head of the family is involved in an accident. Secondary losses include the loss of farming and cultivating equipment, medical costs and years of financial debt.

Registred anti-vehicle mine accidents and casualties in NK and green zone, 1995–2014



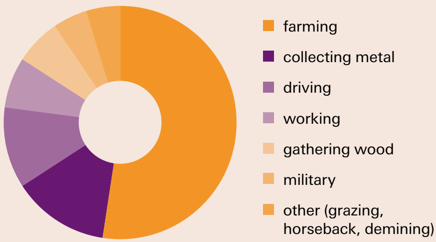
Areas of anti-vehicle mine accident, 1995–2014



Approximately 51% of AVM accidents occur in fields during cultivation or other farming activities. Around 36% of accidents take place on or near roads. Although fewer accidents occur in other locations, they nonetheless cause significant damage. For instance, vineyards and forests are sources of income for local populations. Accidents taking place in such locations can deter populations from using the areas and their surroundings.

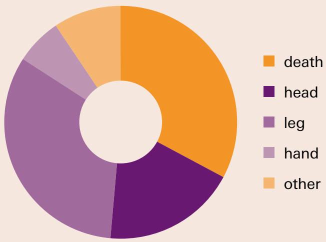
24 All of the information in this section is based on reports registered by The HALO Trust and refers to the post-war years from 1995 until the present. The information does not include every single AVM accident in Nagorno Karabakh, but does give a concrete representation of the situation.

Activity of the victim when the accident occurred, 1995–2014



Information from registered cases indicates that the vast majority of victims were carrying out economic, work-related activities when the accident occurred.

Results of anti-vehicle mine accidents, 1995–2014
(percentage of HALO registered cases)



Source: HALO Trust

Around 38% of accidents are fatal. Another 38% result in leg injuries, often leading to amputations. Head injuries account for 20% of accidents while hand injuries account for 7% of accidents. It is necessary to note that the victims typically suffer from a combination of the above-mentioned injuries.

AVAILABILITY AND NATURE OF DATA ON ANTI-VEHICLE MINE PRESENCE

State reports, historical records, databases, news media and other open sources form the basis of our understanding of the extent of AVM contamination worldwide. Although much information on AVM use and production is not released in the public domain, by using a variety of open sources, this study provides a basic understanding of the large number of states that have been, or continue to be, involved with AVMs. Reasons for this could be active military use or training, prior use on their territories, active or past production of AVMs, or because of continued reports of AVM related casualties (see Figure 2).

FIGURE 2 STATE INVOLVEMENT WITH AVMs AS REPORTED IN OPEN SOURCES

States are listed by the following sources for the specified reasons. See each source for more details.

1. Landmine Monitor report on 'The Humanitarian Impact of Anti-vehicle Mines', 2012, listing states with anti-vehicle mine casualties, new use of AVMs from 1999–2011, or past use of anti-vehicle mines prior to 1999.
2. Jane's Mines and Mine Clearance, 2008, listing states affected by anti-vehicle mines
3. Canadian Forces Mine Database, 2009, listing states with stocks of anti-vehicle mines for training, testing, or military use
4. News articles on recently found anti-vehicle mine contamination or recent anti-vehicle mine-related casualties, 2010–2014
5. Reported producers of anti-vehicle mines (historic and current) according to Jane's Mines and Mine Clearance, 2011–2012

Afghanistan[1,2,3,4]
Albania[1,2,5]
Algeria[1,3]
Angola[1,2,3]
Argentina[3,5]
Armenia[1,2,3]
Austria[5]
Australia[3]
Azerbaijan[1,2,3]
Bosnia and Herzegovina[1,2,3,4]
Belarus[1]
Belgium[5]
Brazil[3,5]
Bulgaria[3,5]
Burundi[1,3]
Cambodia[1,2,3,4]
Argentina[3,5]
Central African Republic[1]
Chad[1,2]
Chile[1,2,4,5]
China[2,3,5]
Colombia[1,4]
Croatia[1,2,3]
Cuba[1,2,3,5]
Cyprus[1,2,3]
Czech Republic[3,5]
Denmark[3]
Djibouti[1,2]
DR Congo[1,2,3]
Ecuador[1,2]
Egypt[1,2,3,4,5]
Eritrea[1,2,3]
Ethiopia[1,2]
France[3,5]
Finland[5]
Georgia[1,3]
Germany[1,3,4,5]
Greece[1]
Guatemala[1]
Gunea-Bissau[1,2]
Hungary[1,5]
India[1,3,4,5]
Iran[1,2,3,4,5]
Iraq[1,2,3]
Israel[1,2,3,5]
Italy[3,5]
Japan[3,5]
Jordan[1,2,3]
Kenya[1]
Kuwait[1,2,3]
Lao PDR[1,2,3]
Latvia[1]
Lebanon[1,2,3]
Lithuania[1]
Macedonia[1]
Mali[1,4]
Mauritania[1,2,3]
Liberia[1,2]
Libya[1,2,3,4]
Montenegro[5]
Morocco[1,3]
Mozambique[1,2,3]
Myanmar[1,2]
Namibia[1,2,3]
Nepal[1]
Netherlands[3,5]
Nicaragua[2]
Niger[1]
North Korea[2,3,5]
Norway[3]
Oman[1,2]
Pakistan[1,2,3,4,5]

Peru[25]	Slovakia[35]	Tajikistan[123]
Philippines[14]	Somalia[1234]	Thailand[124]
Poland[135]	South Korea[1235]	Tunisia[124]
Portugal[35]	South Africa[35]	Turkey[1345]
Romania[35]	South Sudan[14]	Uganda[12]
Russia[1235]	Spain[35]	United Kingdom[35]
Rwanda[23]	Sri Lanka[124]	United States[35]
Senegal[14]	Sudan[1234]	Vietnam[23]
Serbia[135]	Sweden[35]	Yemen[123]
Sierra Leone[3]	Switzerland[3]	Zambia[123]
Singapore[35]	Syria[134]	Zimbabwe[234]

Information is thus available to help identify which countries have AVMs on their territories. However, a number of hurdles or uncertainties remain, and these have made it thus far impossible to assess the full extent of global AVM contamination.

The first hurdle is the absence of public reporting in certain affected states. For example, in some countries, civil news media continue to report on the occurrence of suspected AVM-related casualties (both military and civilian), but the government does not provide information in the public domain on existing AVMs, and it is not known whether information on contamination and casualties is being collected in a systematic way. A second uncertainty is the inability of certain affected states to measure the extent of contamination due to the absence of mine laying records. In a few other cases, in addition to the absence of historical records, current AVM contamination in on-going conflicts goes unrecorded. A third uncertainty is that some states, while facing an evident AVM threat, have not yet been able to conduct a countrywide survey to determine its full extent. A fourth reason for uncertainty, at both global and national levels, is the undifferentiated nature of reporting mechanisms where national data does not differentiate between APMs and AVMs, but rather groups landmines together.

To gain a deeper understanding of these data availability and collection challenges, this study conducted a BIS of affected states. The survey assessed data collection practices surrounding AVM contamination and casualties, and also asked states to specify the impact on different aspects of development using a four-point scale.

The BIS results revealed a number of trends in the areas of contamination data and the nature of national data collection practices. A significant reason for uncertainty in contamination data is the fact that states did not adequately distinguish between AVMs and APMs across their data aggregation and reporting processes. The survey asked states to specify their knowledge of the extent of AVM contamination and provide estimates at varying levels of specificity. The survey found that among those states that reported continuing AVM contamination, only about half were able to provide an estimate of AVM presence in each of the requested categories. A common reason for the lack of an estimate, or uncertainty in a given estimate, was that nationally aggregated data did not differentiate between APMs and AVMs. The case study components helped the authors learn that there are a number of possible reasons for this lack of data differentiation, including the format of national survey processes, national data handling procedures and the format of reporting forms used to collect contamination and casualty information.

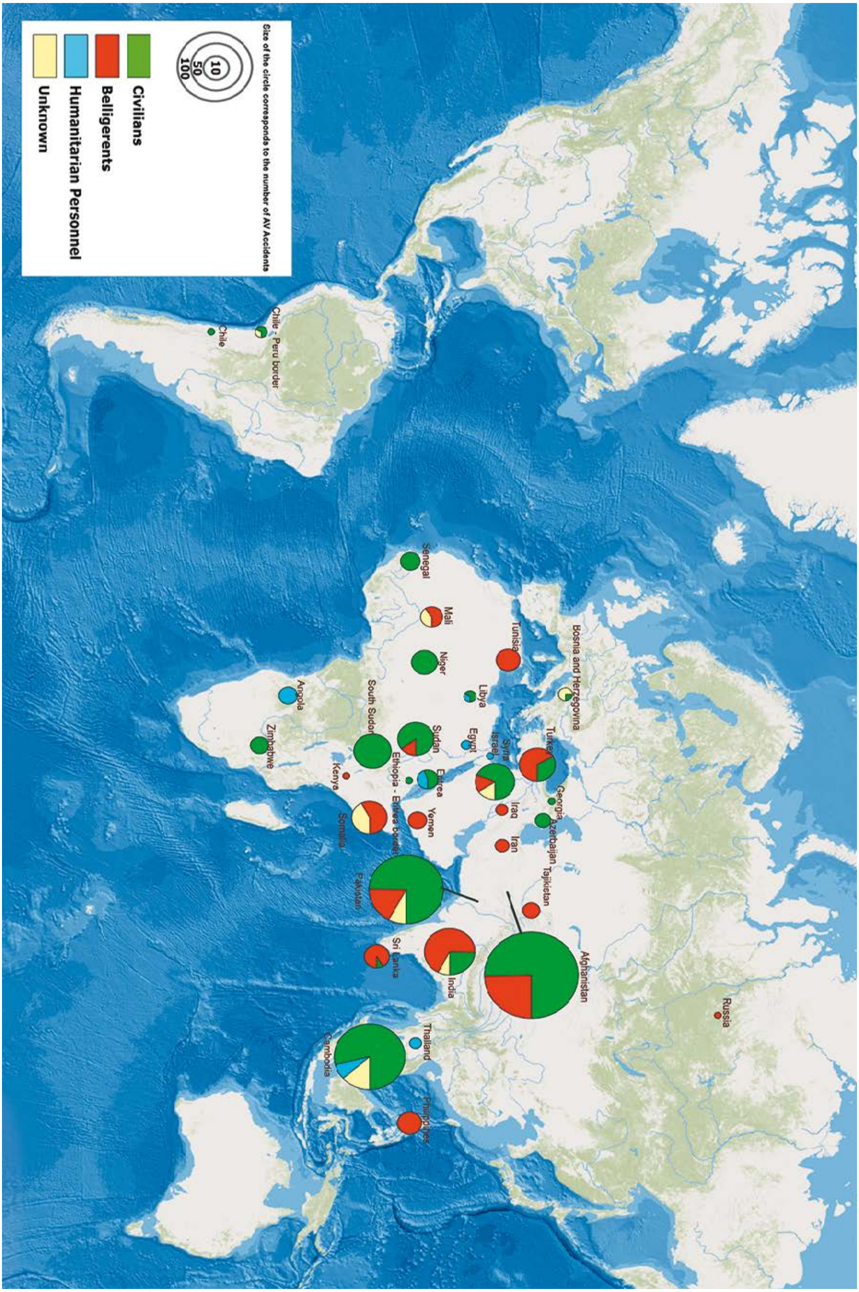
ANTI-VEHICLE MINE CASUALTY DATA

Although AVMs are designed to destroy armoured military vehicles, they continue to pose an indiscriminate threat, killing and injuring civilians driving standard motor vehicles, agricultural equipment and construction equipment. This section discusses globally available data on civilian casualties resulting from AVMs. Further details on the types and patterns in AVM casualties are discussed in the contexts of the country case studies.

Beyond the reporting efforts of international networks like ICBL, current knowledge of civilian casualties caused by AVMs comes from two primary sources: (i) coverage of incidents by the news media; and (ii) figures provided by states (typically only from those with established mine action programmes). The sources themselves vary greatly from state to state. The study found that while both sources of information help to provide a rough indication of the impact of AVMs on civilians, both remain incomplete.

A significant number of AVM-related civilian casualties continue to be reported in the news media. As a part of this study, the research team collected news items on AVM casualties and recent contamination discoveries (January 2010 – May 2014). Casualty incident news items were included either because the reporter specifically identified the accident as AVM-related or because the signatures described in the article were strongly indicative of an AVM-related accident. A total of 190 incidents and 725 casualties were recorded during this time period.

FIGURE 3 NEWS REPORTS OF AVM DISCOVERIES AND CASUALTIES, 2010–2014



© GICHD – SIPRI

It is important to recognise that, for a number of reasons, news media reports probably only provide a small part of the full picture of the impact on casualties. Importantly, AVMs are often used in open countryside rather than in densely populated or built-up areas. Open countryside is usually occupied by small rural communities using the land for agriculture or other related purposes. Given that the majority of rural populations in developing countries are not regularly covered by the media, it is unlikely that deaths or injuries from mines in these areas would make it into national news unless the incident was particularly large or significant (e.g. a bus). Even in cases where accidents are reported, journalists are not always able to distinguish an AVM incident from other weapons, sometimes terming an event as a roadside explosion or even mistakenly as a rocket-propelled grenade (RPG) or IED attack. Further confusion can result from the fact that the explosion of an AVM can cause most traces of the item to disappear.

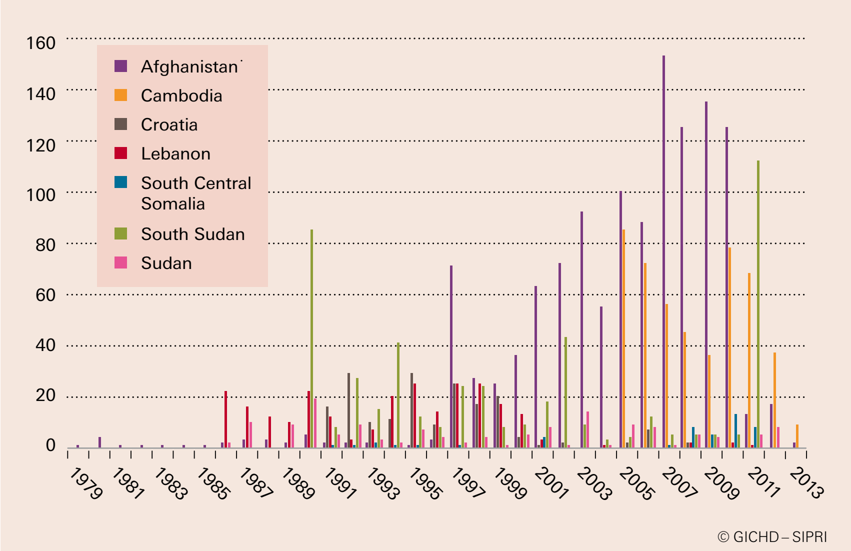
State reporting about AVM-related civilian casualties is an even more important data resource, yet it remains insufficient on a number of levels. In the most severe cases, states with suspected casualties resulting from AVMs release no information at all, and it is unknown whether the government systematically collects casualty information.

In other cases, state reporting on AVM-related civilian casualties is actively conducted as a part mine action programmes, but reporting remains incomplete due to an inability to cover or access all areas of the country. In some cases, reporting is incomplete because of the nature of data collection procedures and too much 'freedom' for authors describing incidents. This issue is illustrated in more depth in the case studies where mine action personnel can enter a number of terms into a victim or incident report (e.g. AVM, anti-tank mine, AT, ATM, etc.), making it difficult to later sift out aggregated AVM statistics from a national database.

Another important reason why national AVM casualty counts are likely to be incomplete is the lack of historical records of such casualties during periods of conflict. The BIS asked states to provide total civilian casualty counts from AVMs on a year-by-year basis for as far back as their records could go. In nearly all cases, casualty counts in earlier years were significantly lower than those from more recent years. In particular, for many states, annual casualty counts rose significantly upon the establishment of a mine action programme: the increase in casualty figures is due to better data collection rather than an actual increase in casualties.

Figure 4 shows the total numbers of AVM-related civilian casualties from states responding to the BIS. For the reasons described here, the majority of states noted in their responses that actual casualty figures (versus recorded casualty figures) are likely to be significantly higher.

FIGURE 4 INCOMPLETE AVM CASUALTIES REPORTED BY STATES THAT PARTICIPATED IN THE BIS



DEVELOPMENTAL IMPACT OF ANTI-VEHICLE MINES

Study findings show that the negative impact of AVMs has a significant potential to increase precisely when a state is progressing in its post-conflict recovery and development efforts. This effect is made dramatically worse by low metal content AVMs. This section briefly describes these trends, and illustrates them in further detail in the Afghanistan, Cambodia and South Sudan case studies.

Due to higher pressure thresholds, AVMs are unlikely to be triggered by people on foot or non-mechanised farming, as APMs are. When displaced communities begin to return to areas mined during conflict, any threats from APMs or explosive remnants of war (ERW) quickly become apparent during resettlement or subsistence farming; AVMs are more likely to go unnoticed and pose a latent threat to future development efforts.

This increasing development impact of AVMs can best be explained using a concept of various *triggers* that occur as a state moves from a situation of conflict to one of active economic development. Such triggers include the return of internally displaced persons (IDPs) to contaminated land, followed by construction efforts involving heavy machinery; the transition from subsistence farming using manual labour to mechanised farming with tractors or heavy ploughs; increases in the number of vehicles per capita for both farming and transportation; or development close to newly cleared roads.

FIGURE 5 DEVELOPMENT ‘TRIGGERS’ INCREASING THE IMPACT OF LATENT AVMs

Conflict or initial post conflict situation	Development triggers leading to increases in AVM casualties or contamination discoveries
Communities displaced during conflict; area mined or contaminated by ERW	Return of population or newly settling IDPs followed by construction efforts involving heavy machinery
Subsistence farming or livestock herding	Mechanised farming
Population uses few vehicles	More vehicles used for both farming and transportation
Roads cleared to width of only 8m during emergency humanitarian demining	Development occurs in newly accessible areas
Old roads, mined during conflict, followed by overgrowth of these roads from lack of use	Development of this land for agriculture or infrastructure

Low metal content AVMs have been shown to significantly increase these effects. They are a greater long-term hazard to, and inhibitor of, developmental progress than low metal content APMs. This is due to the greater likelihood of these mines being overlooked until a state begins to advance in the use of mechanised construction or farming.

Through the BIS, states reported a wide variety of ways in which AVMs had had an impact on communities and development efforts. The survey provided a number of components of development to select from, as well as an option to describe further unlisted components. States were then asked to rank the impact of AVMs on these as un-significant, moderate, severe or very severe. Figure 6 shows the components of development which states ranked as suffering the most severe impacts from AVMs. There was a strong correlation between the scores for restoration of land for agriculture, getting roads back into use and restoring land for grazing livestock.

FIGURE 6 THE TOP IMPACT AREAS OF AVMs ON COMPONENTS OF DEVELOPMENT AS IDENTIFIED BY 10 STATES

States were asked to indicate whether AVMs had had a negative impact on a list of components of development.

The following scoring system was used to calculate the results: no significant impact: 0 points; moderate impact: 1 point; severe impact: 2 points; very severe impact: 3 points.

The results below combine states' responses and demonstrate each aspect's total score.

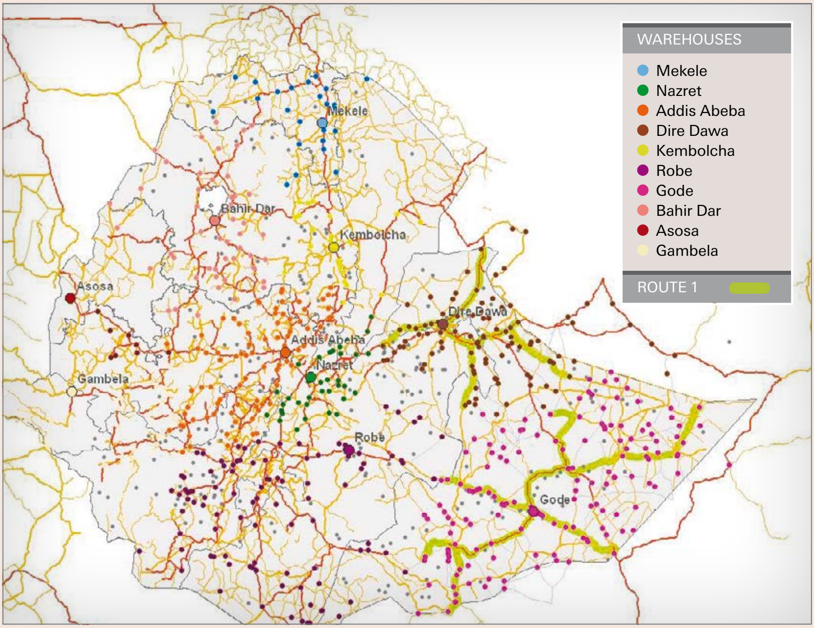
Aspect	Score
Restoration of land for agriculture	17
Road reconstruction	16
Restoration of land for grazing livestock	15
Road access for construction	15
New roads	14
Road access for returning refugees	14
Road access for humanitarian aid	13
Development of new land for agriculture	13
Bridge reconstruction	13
Power grid reconstruction	12

Farmer's truck following an AVM accident in Angola.

QUANTIFYING THE IMPACT OF AVMs ON TRANSPORT COSTS AND TIME

On average, World Food Progamme (WFP) assists 80 million people per year in over 75 different countries, distributing food to victims of war, civil conflict and natural disasters. To accomplish this, the WFP has developed logistics resources and expertise that are unparalleled in the humanitarian sector and are often called on by other humanitarian organisations. On any given day, WFP operates an average of 5,000 trucks worldwide; land transport is its most common delivery method (95.5 per cent of its 4 million metric tonnes of food is delivered by road). When roads to remote locations are blocked by flooding, landslides or AVMs, airdrops are often the only viable alternative, but they can cost up to 100 times more per kg/km. When a number of road options are available, new techniques using Geographic Information Systems allow delivery costs using different routes to be simulated and quantified.

FIGURE 7 DELIVERY ROUTES



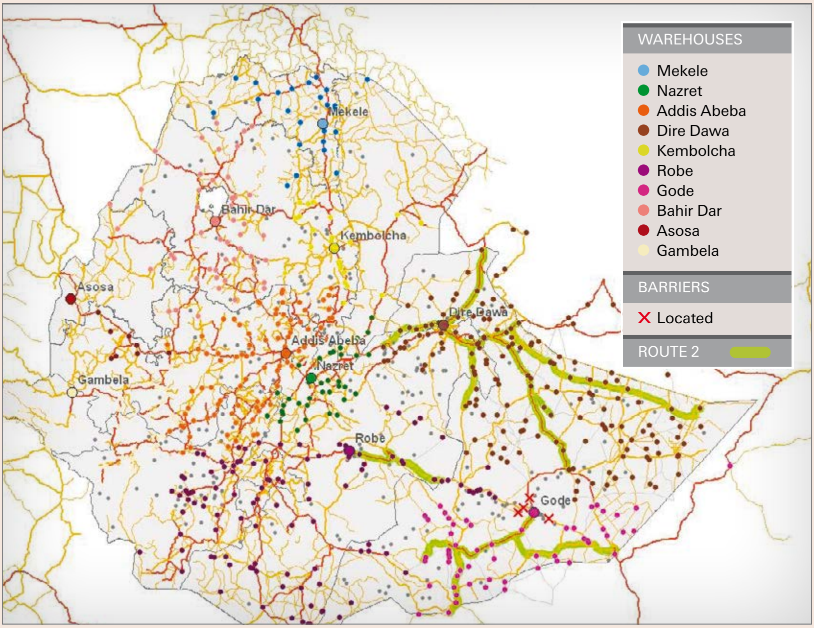
Source: WFP

WFP first experimented with this method in Ethiopia in 2007. Having compiled an extensive geographic database of roads, warehouses and delivery points, it was able to simulate road closures and quantify changes in travel time, just as a standard car navigation system can pick one route over another. Results based on hypothetical data are displayed below:

Figure 7 shows the optimal allocation of delivery points (small dots) to a number of warehouses (large dots) throughout Ethiopia. In this configuration, overall travel time to all delivery points is minimised. In the Somali region of Ethiopia (southeast) total travel time to delivery points from their respective nearest warehouses (Dire Dawa and Gode) amounts to 1,050 hours, or an average of 5 hours per delivery.

Figure 8 illustrates hypothetical AVMs (shown as red crosses) laid on routes leading out of Gode. Only one road, leading southwest, is left open and the effect on the allocation of delivery points to warehouses is significant;

FIGURE 8 DELIVERY ROUTES WITH HYPOTETHICAL AVMs



Source: WFP

to remain as efficient as possible, most of Gode's previous delivery points must be reallocated to either Dire Dawa or Robe. This translates into an increase in total travel time of 300 hours, or an increase in travel costs of approximately 30 per cent.

This example goes some way towards showing the concrete cost effects of AVMs on the delivery of relief aid. Further research using this technique is warranted in order to carry out a quantitative cost-benefit analysis of AVM clearance.

CASE STUDIES

AFGHANISTAN

As foreign troops begin to withdraw from Afghanistan after over a decade of conflict, and as the government works to stabilise the country, its efforts continue to be challenged by insurgent activity and unrest in many regions. At the same time, Afghanistan is pursuing economic progress and development as its population works to resettle and rebuild. The government is taking on new infrastructure projects such as railroads linking the country with its neighbours, and there are new foreign investment projects in sectors such as mineral extraction that will bring in much needed national income.

Landmines, both AVM and APM, continue to affect these attempts to regain stability and move beyond the country's difficult past. A new survey process has revealed that AVMs are present in the majority of the remaining landmine-contaminated areas. Across Afghanistan, the need for land is increasing. This study illustrates how AVMs contribute to prolonging poverty by denying access to land and transport, and by perpetuating the state of civil unrest that continues to affect Afghans, the surrounding region and the international community.

Afghanistan became a State Party to the Mine Ban Treaty in 2003 and is in the process of developing national implementation legislation.[25] It signed the CCW in April 1981, but has never ratified the Convention, and so is not a party to the CCW or its protocols.

The Mine Action Coordination Centre of Afghanistan (MACCA), the Department of Mine Clearance under the Afghan National Disaster Management Authority, and HALO Trust provided instrumental support in assembling this case study.

At least 18 people were killed and seven others were injured in two landmine explosions in Shena Rai area of Afghanistan, in July 2012. The first accident occurred when a car on its way from Chaman to Spin Boldak hit an AVM. A truck carrying 25 people was sent to rescue the victims, but it too detonated an AVM. The fatalities included women and children.[26]

25 Landmine Monitor, Afghanistan Country Profile, Mine Ban Policy, page updated as of 2 October 2012, http://www.the-monitor.org/index.php/cp/display/region_profiles/theme/1552

26 Source: http://paktribune.com/news/Landmine-blasts-kill-18-near-Chaman-border-251314.html

Overview of anti-vehicle mine presence

Given the vast areas of land that have been contaminated since 1979, landmines continue to have an impact on the country at large. Although APMs significantly outnumber AVMs, the majority of land affected by mines in Afghanistan includes AVMs. Accordingly, in implementing the Mine Ban Treaty in Afghanistan, the government reported that the presence of many high priority AVM-contaminated areas required a focus on both AVMs and APMs.[27]

As of 2013, there were 4,876 landmine and ERW hazards covering over 544 square kilometres of Afghanistan. These hazards are located in 1,688 communities, 244 districts and 33 provinces, directly affecting 1,313,341 people. These hazards are summarised in Afghanistan's request for an extension of the deadline for completing the destruction of APMs in mined areas, in accordance with Article 5 of the Mine Ban Treaty.[28]

FIGURE 9 REMAINING CONTAMINATION AS OF THE END OF MARCH 2013[29]

Contamination types	Number of hazards	Area of hazards (sq km)
AVM field	1,423	301.41
APM field	3,255	211.79
Battlefield/ERW	198	31.74
Total	4,876	544.94

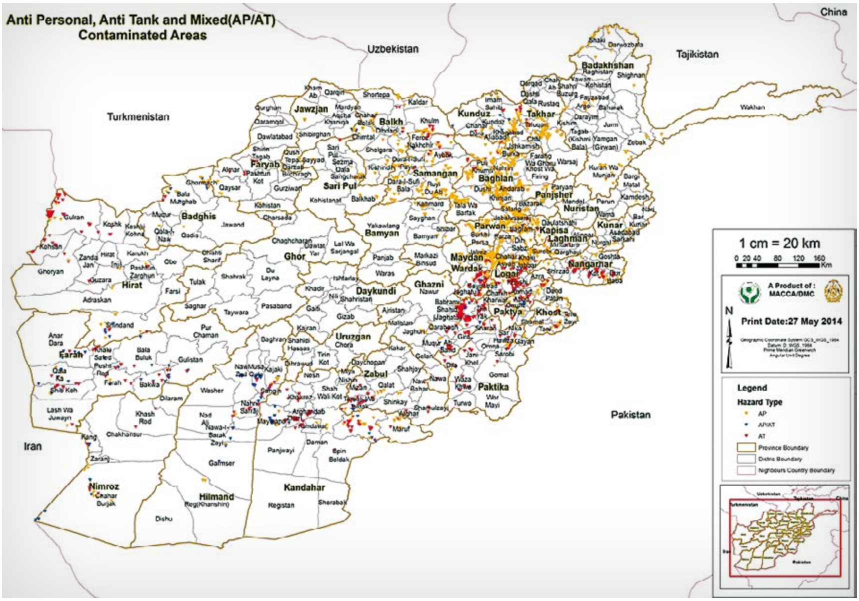
Source: MAPA

The vast majority of AVMs in Afghanistan were laid by the Mujahedeen against the forces of the former Soviet Union during its decade-long occupation (1979–88).[30] Owing to the Mudjahedeen's guerrilla-style resistance, many mines were laid in irregular and sporadic ways, and most minefields were not recorded.

27 Government of the Islamic Republic of Afghanistan, Request for an extension of the deadline for completing the destruction of APMs in mined areas in accordance with Article 5 under the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of APMs and on Their Destruction, 31 August 2012, http://www.macca.org.af/macca/?page_id=171, p. 7
28 Mine Action Coordination Centre of Afghanistan Ottawa Proposal YR 1 and YR 2
29 MAPA Annual Report 1391, http://www.macca.org.af/en/MAPA_Reports.html, p. 33
30 Interview with HALO Trust, March 2014

AVM contamination in Afghanistan is distributed in regional concentrations due to the nature of the Soviet conflict, as is described in greater detail later. The central region has the greatest number of AVM fields. However, the amount of land affected by AVMs is greatest in the south due to more scattered and widespread use of AVMs across large areas. The eastern and northern regions are notably less affected by AVMs than other regions due to the nature of the conflict during the Soviet occupation.[31]

FIGURE 10 CURRENT AVM AND APM PRESENCE IN AFGHANISTAN



Source: MACCA

National data collection system

The picture of landmine contamination in Afghanistan is changing, not necessarily because more mines are being laid, but rather because the data is improving through further assessments. Starting in 1993, Afghanistan conducted non-technical surveys of landmine contamination, but for different reasons (including both methodological issues and obstacles faced by surveyors), they were unable to capture a comprehensive national picture of contamination.

31 Mine Action Coordination Centre of Afghanistan Ottawa Proposal YR 1 and YR 2, p. 33

The first baseline data-set was provided by the 2003 Landmine Impact Survey. A second attempt was made in the form of the 2009 Polygon survey.

In 2012, because landmine accidents were still occurring in areas thought to be clear on the basis of the earlier surveys, Afghanistan began conducting a new survey with a more comprehensive methodology. The Mine and ERW Impact Free Community Survey (MEIFCS) goes far beyond the reach of past surveys by visiting every community in Afghanistan, rather than only the communities noted as affected in the current database. This survey process was due to be to complete in early 2014. However, efforts have been significantly slowed as surveyors encountered large numbers of communities not listed in national census data. MEIFCS reports showed that out of the 32,500 communities listed in the base census, only 13,000 had so far been surveyed, yet another 18,000 communities had been surveyed which were not in the base census.[32] These challenges mean that Afghanistan will clearly need more time to complete the survey.

The current survey effort is being conducted using the country's standard Hazard Report form, which allows surveyors to differentiate between AVM, APM and ERW threats and whether they are new or known hazards. The Mine Action Coordination Centre of Afghanistan (MACCA) manages these reports within the Information Management System for Mine Action (IMSMA). Regional survey teams collect data on mines and ERW and send them to the national authority. Regional offices and community liaison teams also report to MACCA based on routine data collection visits and procedures.

MACCA reports that AVMs have consistently posed identification challenges throughout the various national survey efforts. The presence of APMs is often much more visible, as incidents involve both humans and livestock, thus alerting communities to the threat. However, MACCA reports that people can often be found using the land concealing AVMs as part of their residence or for shallow farming without knowledge of their presence.[33] Only when construction or use of farming vehicles uncover or set off an AVM are civilians alerted to their presence.

Over the past 18 years, the Mine Action Programme of Afghanistan (MAPA) has cleared almost two-thirds of all the suspected hazards discovered to date, including all known contamination within urban areas. However, many areas of the country are still inaccessible due to on-going conflicts and the absence of usable roads. New hazards are discovered every year due to: (i) on-going conflicts;

32 Interview with Mine Action Coordination Centre of Afghanistan, March 2014

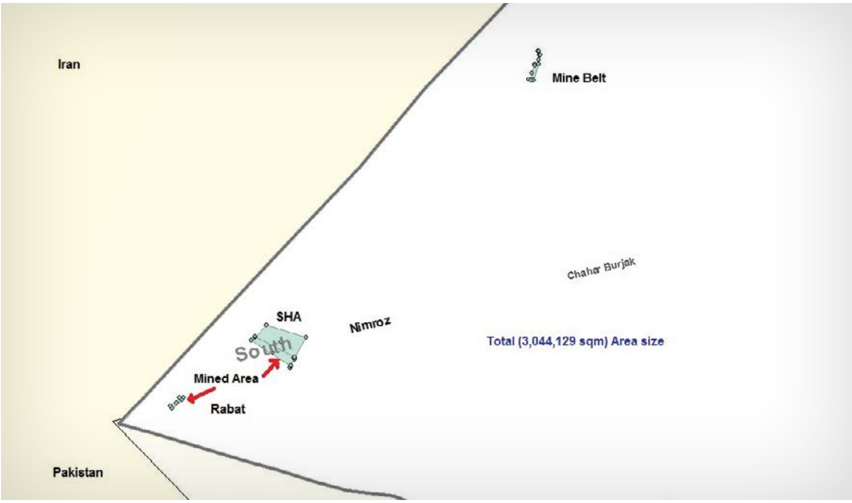
33 Interview with Mine Action Coordination Centre of Afghanistan, Directorate of Mine Clearance, March 2014

(ii) survey teams gaining access to previously insecure areas, and; (iii) the return or resettlement of IDPs to new or abandoned communities. As a result, the number of remaining suspected hazardous areas (SHA) including AVMs, APMs and ERW has continued to grow for over a decade, despite the clearance achievements.[34]

The MACCA map below depicts evidence of this growing picture of contamination with a newly identified AVM and APM mixed minefield discovered in December 2013. These newly identified hazards in Nimroz province in Southern Afghanistan were reported to and surveyed by the Mine/ERW Impact Free Community Survey (MEIFCS). This was the first time mine action teams visited this area since its contamination. Reportedly, these mines were laid over 3 million square meters in 1993-1994 by the Iranian army inside the Afghan soil. Mines are mainly AVMs with APMs used as fuses, and many of the mines were made visible via soil erosion. MACCA reports that these mines have caused a number of civilian casualties.[35]

Accident to a local vehicle in the newly discovered AVM and APM contaminated area of Nimroz province.

34 MAPA 2008-2013 Strategy, http://macca.org.af/en/mapa_plans.html
35 Email communication with MACCA, Area Manager, Regional Office Kandahar, 13 March 2014



MACCA map depicting the location of the recently discovered AVM-APM mixed minefield covering roughly 3 million square m.

APMs being used as fuses for AVMs throughout the contaminated area.

APMs and AVMs exposed by soil movements in Nimroz province in December 2013.

History of anti-vehicle mine use

The proliferation of AVMs in Afghanistan began with the Mujahedeen guerrilla resistance to the Soviet Union's invasion in 1979 and occupation until 1988. The Mujahedeen used AVMs against Soviet troops in attempts to disrupt the movements of tanks and convoys. While the Soviet Union used APMs liberally, they did not often resort to the use of AVMs because the Mujahedeen possessed or used few heavy vehicles other than those captured from the Soviets themselves.

The landmines used by the Mujahedeen were acquired from foreign countries with an interest in defeating the Soviet Union. The United States in particular channelled many weapons, including AVMs, to the Mujahedeen through Pakistan. The Pakistanis were charged with ensuring the delivery of mines through supply channels along its long and porous border with Afghanistan. AVMs including M19 mines from the United States, TC6 mines from Italy and P2 mines from Pakistan were channelled to the Mujahedeen in this way. The Mujahedeen also received support from Iran as YM-II and YM-III AVMs were supplied to forces operating from the western province of Herat.

The nature of the Soviet Union's occupation of Afghanistan helps to explain the pattern of AVM contamination across the country. The Soviet Union's main command and control centre operated out of Kabul, which is why the Mujahedeen concentrated on laying AVMs, both in belts and irregularly, around the city. There were three main security belts around the city, the third of which extended far south.[36]

In addition to mine concentrations in the centre of the country, due to the extensive assistance to the Mujahedeen via Pakistan, skirmishes were also common in the southern regions of Afghanistan, as the Soviets sought to disrupt supply channels and starve Mujahedeen forces. The unique flatness of the terrain in the south made it suitable for vehicles and mine laying. In order to create barriers against Soviet advances, the Mujahedeen would lay AVMs in wide, dispersed and often irregular formations. The southern region of Afghanistan remains the area most widely contaminated by AVMs. Current landmine contamination in Loghar province, located south of Kabul, leading to Pakistan and an important trade route, consists of 85 per cent AVM contamination.[37]

Similar interactions and AVM-laying occurred to a lesser extent in the western regions, as the Soviets sought to starve the Mujahedeen of Iranian assistance. To this day, there remains significant AVM contamination near the Iranian border as well as in Herat province.

When the Soviet Union withdrew from Afghanistan in 1989, many predicted that the communist government of Afghanistan, known as the Najibullah regime, would fall within a matter of months. However, these predictions failed to account for the fact that the regime remained well equipped with military hardware and resources provided by the Soviet Union.

Najibullah's government continued to survive, largely by holding on to a reduced territory, concentrating on urban areas and keeping main communication routes open.[38] During this period of resistance, mine laying was being carried out by both the Najibullah regime and the Mujahedeen, who were also fighting amongst themselves by this time.[39]

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36 Interview with HALO Trust, March 2014

37 Ibidem

38 Clements, Frank. Conflict in Afghanistan: A Historical Encyclopedia. ABC-CLIO, Santa Barbara, 2003. P. XXV

39 HALO Trust Afghanistan, http://www.halotrust.org/where-we-work/afghanistan

All defending forces laid landmines to protect their main supply routes (particularly the road north from Kabul to the old Soviet border), their airfields, military posts around key towns, and the actual front lines. The geography of the conflict meant that different factions frequently mined the same areas at different times.[40]

FIGURE 11 COMMON AVMs FOUND IN AFGHANISTAN, BY MANUFACTURING COUNTRY

TC/6	Italy	Minimum metal
MK7	United Kingdom	Metal casing
M19	United States	Minimum metal
TM-46	Russia	Metal casing
TM-57	Russia	Metal casing
TM-62	Russia	Metal casing
YM-II	Iran	Minimum metal
YM-III	Iran	Minimum metal
P2 MK2	Pakistan	Minimum metal
P3 MK1	Pakistan	Minimum metal

Source: MACCA

Most recently, AVMs were also laid by the Taliban and the Northern Alliance.[41] The Afghan government reports that after the fall of the pro-Soviet regime, extensive and indiscriminate use of APM and AVM continued as the Taliban, having developed into a significant politico-religious force, clashed with the Northern Alliance.[42] In 2008, dozens of landmines were discovered in Arghandab District, in the southern province of Kandahar, where fighting occurred between Taliban insurgents and the Afghan army backed by international forces.

40 HALO Trust Afghanistan, http://www.halotrust.org/where-we-work/afghanistan

41 Ibidem

42 Government of the Islamic Republic of Afghanistan, Request for an extension of the deadline for completing the destruction of anti-personnel mines in mined areas in accordance with Article 5 under the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, 31 August 2012, http://www.macca.org.af/macca/?page_id=171, p. 4

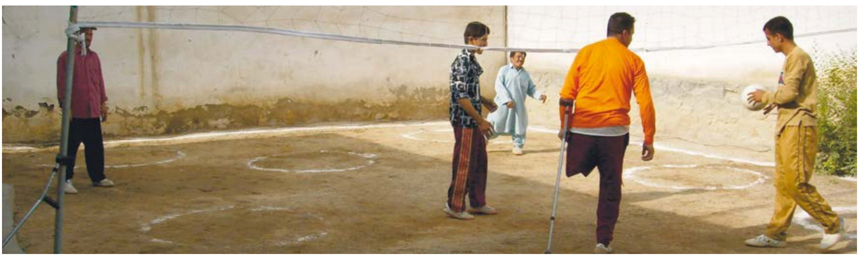
The Afghan Ministry of Defence reported that the Taliban had laid landmines – AVM and APM – on roads and footpaths in Arghandab District, despite a stated commitment not to use APMs.[43]

A significant proportion of the mines used in the Afghan conflicts were minimum metal AVMs, often made of plastic casings with only a small amount of metal used for the fusing. This fact, combined with disorganised use of the mines and a lack of record-keeping, has contributed to the severity of the challenges faced by mine action efforts in Afghanistan.

Casualties from anti-vehicle mines

Afghanistan's system for collecting data on casualties from landmines and ERW relies on a network of a variety of actors, ranging from hospitals and clinics to community centres and schools. The actual data collection is conducted by MACCA's regional offices, and the process is supported by the Afghan Red Crescent Society.[44] In practice, this means that mine action personnel may be dispatched directly to an accident, if it is promptly reported, or alternatively, they will visit places such as health clinics to collect the data in batches. In all cases, mine action personnel are required to fill out a Victim Form specifying the details of the case.

MACCA reports that its database contains records of more than 1,200 civilian casualties, between 1979 and 2013, directly attributable to AVMs.[45] MACCA underlines that these numbers are drastically incomplete due to poor record keeping during the Soviet Union's invasion, the ensuing Afghan civil war, and even today as many areas of the country remain inaccessible to mine action personnel for security reasons.

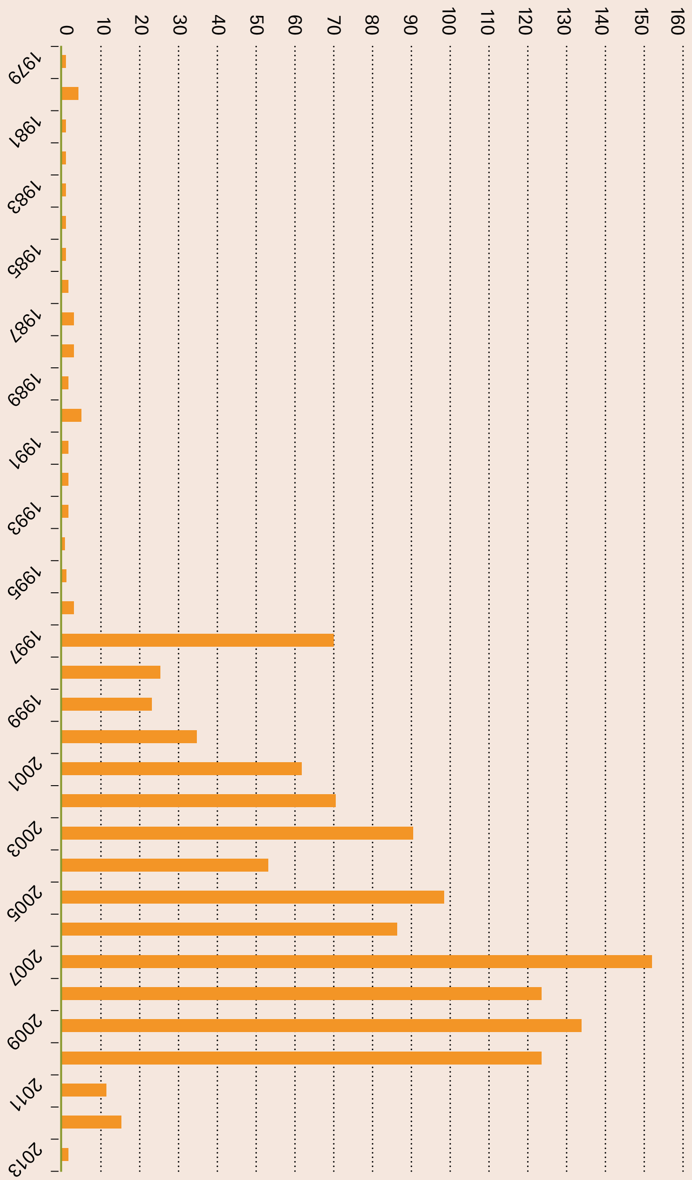


43 Afghanistan: Landmines impede civilians' return to volatile Arghandab », Irin News, 22 June 2008, http://www.irinnews.org/report/78869/afghanistan-landmines-impede-civilians-return-to- volatile-arghandab

44 Interview with Mine Action Coordination Centre of Afghanistan, 9 March 2014

45 SIPRI-GICHD AVM Basic Impact Survey Responses from Mine Action Coordination Centre of Afghanistan

FIGURE 12 AFGHANISTAN'S REPORTED AVM CASUALTY DATA AS OF SEPTEMBER 2013, WITH EARLY RECORDS SHOWING INCOMPLETE FIGURES



Source: MACCA

In addition to a lack of security and inaccessibility, there are further reasons why Afghanistan's national casualty figures are incomplete. In many cases, victims of a landmine or ERW incident may be transported to better health facilities in nearby Iran or Pakistan. MACCA reports that this is likely to be a common trend given the heavy mine contamination near the Iranian and Pakistani borders. When this happens, casualty data does not make it back to Afghan health clinics and MACCA's regional offices do not collect it. Another cultural reason for possible missing data is that if victims of a mine accident are killed rather than injured – which is often the case with AVM incidents – Afghan families will often immediately hold a funeral and enter the familial grieving process without contacting authorities to investigate. MACCA suspects that much data goes uncollected for this reason.[46]

Casualties from AVMs are still occurring across Afghanistan today, especially in the most heavily mined central, southern and western regions. While much of the area surrounding Kabul has been demined, Loghar province, in the south of the central region, remains heavily contaminated by AVMs, and tractor drivers are common AVM victims due to the growing agricultural activity in this region. In the southern regions, Kuchi nomadic families traversing the desert landscape are common victims of AVMs. The families use large mules and camels to travel or transport goods, the patriarch often leading an animal while his family rides on top. The weight of the animal carrying passengers or goods is often enough to trigger AVMs.

A significant civilian casualty factor that is relatively unique to Afghanistan is the use of pressure-plated improvised explosive devices (PP-IEDs). In February and July 2012, the UN Assistance Mission in Afghanistan (UNAMA) reported that armed groups in Afghanistan were deploying large numbers of these explosive devices.[47] In 2011, UNAMA reported that the majority of PP-IEDs are designed to detonate from approximately 10 kg of pressure and frequently contain up to 20 kg of explosive, more than twice that of a standard AVM. As a result of this design, these explosive weapons 'effectively act as a massive anti-personnel landmine with

46 Interview with Mine Action Coordination Centre of Afghanistan, 9 March 2014

47 UNAMA, 'Afghanistan, Annual Report 2011, Protection of Civilians in Armed Conflict,' February 2012, p. 3, www.reliefweb.int/sites/reliefweb.int/files/resources/UNAMA POC 2011 Report_Final_Feb 2012.pdf; and 'Afghanistan Mid-year Report on Protection of Civilians in Armed Conflict: 2012,' July 2012, www.ohchr.org/Documents/Countries/AF/UNAMAMidYearReport2012.pdf; reported by Landmine Monitor, Afghanistan Country Profile, Mine Ban Policy, page updated as of 2 October 2012, http://www.the-monitor.org/index.php/cp/display/region_profiles/theme/1552

the capability of destroying a tank; civilians who step or drive over these IEDs have no defence against them and little chance of survival. Additionally a significant number of IEDs are encountered with explosive weight of approximately 2–4kg specifically designed to maim or kill individuals on foot.'[48]

In 2012, UNAMA documented 913 civilian casualties (393 civilian deaths and 520 injured) from PP-IEDs. In 2013, use of PP-IEDs resulted in 557 civilian casualties (245 civilian deaths and 312 injured), a decline of 39 per cent. While the decrease is noted, UNAMA reports that the human cost of PP-IED attacks in 2013 remained high. PP-IEDs were detonated in public areas used by civilians such as roads, markets, government offices, schools and bus stations. UNAMA reaffirmed in its 2013 report that PP-IEDs are indiscriminate and reinforced its call to end their use.[49]

Developmental impact of anti-vehicle mines

Across Afghanistan, the need for land is increasing. Decades of conflict and unrest have devastated the country, with landmines continuing to deny access to valuable land and resources. The agricultural sector is particularly important to Afghanistan's recovery and growth – agriculture is the main source of livelihood and subsistence for roughly 75 per cent of the Afghan population, and a crucial component to enhance food security and drive economic growth for the entire country.[50]

Across numerous sectors, the Government reported in its 2012 Mine Ban Treaty Article 5 Extension Request that the socio-economic impact of landmine contamination remains severe:

> '*The presence of landmines resulted in reducing crop production, increasing transportation costs, and adding obstacles to repatriation and rehabilitation. Furthermore, about 8,300 public buildings such as schools, health facilities and factories were unusable due to the presence of mines.*

48 UNAMA, 'Afghanistan Mid-year Report on Protection of Civilians in Armed Conflict: 2012,' July 2012, pp. 13-14, www.ohchr.org/Documents/Countries/AF/UNAMAMidYearReport 2012.pdf; reported by Landmine Monitor, Afghanistan Country Profile, Mine Ban Policy, page updated as of 2 October 2012, http://www.the-monitor.org/index.php/cp/display/region_ profiles/theme/1552

49 UNAMA, 'Afghanistan, Annual Report 2011, Protection of Civilians in Armed Conflict,' February 2012, p. 3

50 USAID, Afghanistan, Agriculture, http://www.usaid.gov/afghanistan/agriculture

More than 228 sq km of productive agricultural land had been blocked due to the presence of landmines. The productivity lost due to this blockage was estimated to be valued at USD 11.5 million per year. Landmines laid on and around roads – placed by warring factions to disrupt and prevent rival forces from advancing – led to severe restrictions to transportation, making the delivery and movement of goods more difficult and costly; there was an estimated loss of more than USD 26 million due to increased transportation costs and extended travel times.'[51]

Some experts and community leaders have warned that the full extent of the AVM threat in Afghanistan has yet to be realised. It has been suggested that the greatest intensity of AVM use was on village-level roads. Many of these areas are not yet being reached by aid agencies because the general security situation makes it too risky. As one observer reported, 'The main roads have never really been the issue, it's the smaller ones, especially those that didn't see much in the way of Kabul government/Soviet control. On these roads they used AVMs as a nuisance, for protection, to deny them to the enemy.'[52]

FIGURE 13 MACCA RATED THE FOLLOWING AREAS AS SUFFERING 'VERY SEVERE' EFFECTS DUE TO AVMs IN THE BIS

Road access for humanitarian aid
Road access for health care
Road access for refugee return
Road access for construction
Housing reconstruction
Road reconstruction and new road construction
Bridge reconstruction
New housing construction
Restoration of land for agriculture and development of new agriculture areas
Restoration of land for grazing livestock

51 Government of the Islamic Republic of Afghanistan, Request for an extension of the deadline for completing the destruction of anti-personnel mines in mined areas in accordance with Article 5 under the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, 31 August 2012, http://www.macca.org.af/macca/?page_id=171, p. 4

52 Anti-vehicle mines: Understanding the impact and managing the risk. Landmine action, p. 17, http://www.landmineaction.org/resources/AVMs%20Understanding%20the%20impact%20and%20managing%20the%20risk(1).pdf

Beyond denying access to land for agriculture, AVMs continue to affect Afghan develop efforts across a number of other areas. The following examples detail ways that AVMs have affected resettlement efforts, national infrastructure development, and natural resource development.

Impact Example 1: Missed low-metal anti-vehicle mines in Jebrail

A recent example in Jebrail, a suburb of Herat City in western Afghanistan, underlines the severe challenge that minimum metal AVMs pose to civilians attempting to resettle and develop land. Between 1979 and 1989, the Mujahedeen laid many AVMs in the area, namely Iranian copies of the US M19 and the Italian TC6. From 1990 to 2008, when the conflict was over, various humanitarian demining agencies carried out clearance in the area, finding and destroying 116 AVMs. After clearance, Jebrail became increasingly populated with returnees and IDPs from Herat City and nearby Iran, and the area was actively developed with new housing and infrastructure projects. However, during this time, occupants found that many minimum metal AVMs had been missed by clearance operations.

Between 2010 and 2013, HALO Trust conducted a re-clearance of Jebrail; a task covering 2,386,723m^2. HALO reported facing numerous challenges during this work, all compounded by the minimum metal content and low detectability threshold of the AVM types in the area. Additional challenges included: the area's construction

Demining efforts in Jebrail.

boom and the inability to conduct mechanical clearance over in large areas; the unexpectedly large amounts of scrap metal creating false signals; the underground infrastructure (incl. water pipes and electricity cables) which precluded the use of mechanical excavation (and metal detectors in the case of electricity cables) and required careful manual excavation; and electrical currents which interfered with detectors, requiring full manual excavation or mechanical clearance.

Upon completion of its operations, HALO had discovered an additional 11 AVMs that had been missed by earlier clearance efforts. Part of HALO's success could be attributed to novel detection methods, such as ground penetrating radar and custom built machinery for mechanical clearance – advances that HALO and other deminers across Afghanistan have been forced to develop in the face of the threat of minimum metal mines. Dealing with minimum metal AVMs in Afghanistan has been described as a process of constant learning and evolution. As a result of clearance efforts in Jebrail, a reported 22,215 families will benefit from immediate use of the area, and an additional 69,655 as indirect beneficiaries in the local area.

Impact Example 2: Northern Afghanistan railway project

AVMs have posed major challenges for large-scale infrastructure development in Afghanistan. Since 2010, Afghanistan has engaged in cooperative international projects to develop rail systems connecting Afghanistan with the rest of the region. Afghanistan's central location gives it the potential to become an important hub for the transportation of goods to Central Asia, Pakistan, Southeast Asia and Europe. Railway projects are seen as a way to provide a more reliable and cost-effective option than road transport, helping Afghanistan unlock its mineral and agricultural wealth and lift more of its regions out of poverty.

The Hairatan-Uzbekistan rail project was the first substantial common-carrier railroad project in Afghanistan. Construction started in January 2010 and the 75 km rail link in now operational, connecting Hairatan on the Uzbekistan-Afghan border to the city of Mazar-i-Sharif in northern Afghanistan. The project began under the auspices of the Afghan Ministry of Public Works and was planned, developed by and contracted to Uzbekistan Railways (UTY). The project's estimated cost was USD 170 million, of which USD 165 million was provided by the Asian Development Bank (ADB). The remaining USD 5 million was provided by the Afghan Government. The Hairatan-Uzbekistan project is part of the transport strategy and action plan of the Central Asia Regional Economic Cooperation Programme and aims to boost freight volumes and the profile of Afghanistan as a transit hub.[53]

53 Hairatan-Uzbekistan Rail Project, Afghanistan. http://www.railway-technology.com/projects/hairatanuzbekistanra/

Late into the execution of the project, AVM, APM and ERW were discovered. The initial assessment revealed a 3 sq km area of contamination at an estimated cost of USD 3 million to clear, which came close to matching Afghanistan's national contribution to the project.[54]

This pattern has been repeated in other infrastructure development projects, particularly with AVMs due their low detectability in Afghanistan. MACCA contacted development projects throughout the country in 2013 and found that a number were in hazardous areas. Out of 430 registered development projects in Afghanistan (roads, bridges, dams, rail, agriculture, electricity expansion), 71 of these projects are affected by mines and ERW, and at least 21 are heavily affected by AT mines, consisting of roughly 225 square kilometres of land.[55]

As a result, MACCA actively encourages a sustainable and continuous process in communication with the development sector; otherwise, as in the case of the railway project, the country suffers huge financial losses that it cannot afford.[56] While Afghans hope that the new MEIFCS survey process will help mitigate the number of collisions between development efforts and landmines, due to the nature of AVMs, their widespread use in the country and the low-metal content of the types used in Afghanistan, uncertainty over the possible presence of AVM will remain.

Impact Example 3: Copper mine near Anyak

AVMs are also inhibiting Afghanistan's efforts to tap into its own natural resources. In particular, mining for minerals is considered the future of Afghanistan, with hope that projects will lead to many jobs, electricity and new infrastructure.

The Aynak copper deposit in Loghar Province was discovered in 1974 and is estimated to contain 11.3 million tonnes of copper. The project is expected to provide a significant boost to the Afghan economy. The Ministry of Mines of the Islamic Republic of Afghanistan contracted a Chinese company (MCC) to develop and extract copper from the mine.[57] In addition to operating the copper mine and

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54 Interview with Mine Action Coordination Centre of Afghanistan Director, April 2013

55 Interview with MACCA, March 2014

56 Interview with Mine Action Coordination Centre of Afghanistan Director, April 2013

57 Government of the Islamic Republic of Afghanistan, Request for an extension of the deadline for completing the destruction of APMs in mined areas in accordance with Article 5 under the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of APMs and on Their Destruction, 31 August 2012, http://www.macca.org.af/macca/?page_id=171, p. 4

paying large taxes to the Afghan government (USD 350–450 million per year), the Chinese company also planned to build homes benefiting approximately 400 villagers in the area. The project itself will indirectly benefit 30,000 people through jobs and infrastructure.[58]

At the outset of the project, the ministries involved did not adequately consult with MACCA, as previous national surveys (LIS and Polygon Survey) had not captured contamination information in that area. Six months into the work, the Chinese company contacted MACCA to report mine contamination. Surveys later revealed large areas affected by both APMs and AVMs, including MK7 and TC6. Work had to be delayed and extra costs were incurred. While the mining project itself will continue, because of the extent of landmine contamination – including AVMs – that needed to be cleared, the planned homes were not built, due to insufficient funds.[59]

Conclusion

As Afghanistan works to stabilise its society and strengthen its economy through important new infrastructure projects such as rail networks and mineral resource development, AVMs have had a demonstrated impact on these projects at many levels. AVMs also continue to deny access to valuable land for the country's agriculture-dependent population. On top of this, civilian casualties from AVMs continue to occur in the context of housing development, use of vehicles or construction machinery, and within Afghanistan's migrating nomadic communities.

Minimum metal AVM weapons have particularly contributed to prolonging the negative impacts of past conflicts on today's humanitarian and developmental efforts. Mines which have evaded surveys, and even clearance operations, have forced Afghanistan and donors to spend extra time and resources developing more effective clearance methods to tackle this challenge in the country's unique environmental conditions. These factors all contribute to the severe and multifaceted impact of AVMs in Afghanistan.

58 Interview with Mine Action Coordination Centre of Afghanistan, 9 March 2014
59 Ibidem

CAMBODIA

While still bearing a heavy burden of contamination by landmines and ERW from its past, Cambodia is in the midst of an important phase of infrastructure and economic development as it seeks to become a fully integrated member of the Association of Southeast Asian Nations (ASEAN) and the international community.

Beyond increasing agricultural production in many different areas, Cambodia is seeking to rehabilitate land formerly mined or covered with ERW in order to carry out large infrastructure projects and attract foreign direct investment. Mine clearance is thus seen as essential for the economic development of sectors including tourism, irrigation and energy production.[60]

As Cambodia pursues these development goals, the threat of AVMs has grown. The increase in the number of farmers using mechanical tractors, civilians using vehicles and workers using heavy construction equipment has led to a stark increase in the number of AVM-related civilian casualties in recent years, so much so that this total now surpasses the number of APM casualties.

Cambodia has banned mines other than anti-personnel mines in national law by choosing not to disaggregate APM and AVM types in its national legislation implementing the AP Mine Ban Treaty.[61] Cambodia is party to both the AP Mine Ban Treaty and the CCW APII prohibiting mines, booby-traps and other devices.

The Cambodia Mine Action Authority (CMAA) and the Cambodia Mine Action Centre (CMAC), as well as other international organisations working to address the country's demining challenge, including HALO Trust and the Mines Advisory Group (MAG), provided instrumental support in assembling this case study.

A 45 year-old male, his son aged 13 and daughter aged 12 were killed when their buffalo-cart loaded with wood ran over an old AVM in northwestern Cambodia's Oddor Meanchey province in July 2013. The family had been returning from the forest where they had been collecting wood to build a house. The two buffalo were also killed.[62]

60 Interview with Cambodia Mine Action Authority, 8 July 2013
61 Ibidem
62 Source: http://english.cntv.cn/20130731/104241.shtml

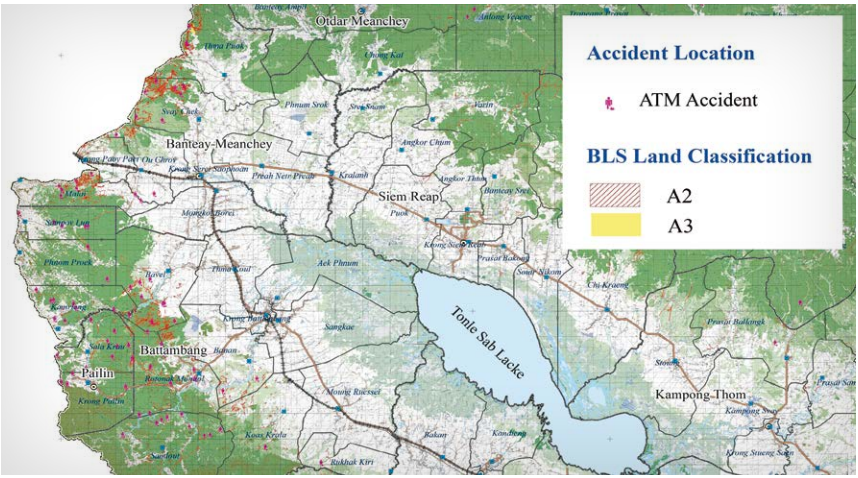
Overview of anti-vehicle mine presence

Cambodia's heavy contamination by landmines and ERW is the result of the protracted regional and internal conflicts that engulfed it for over 30 years. Even after 20 years of demining, contamination still poses a heavy humanitarian and economic burden on the country.

AVM contamination is concentrated in, but not limited to, the northwestern region of the country, with the most affected province being Battambang.[63] Other provinces severely affected by AVMs include Banteay Meanchey and Pailin. The extensive contamination in the rice and cassava producing regions along the Cambodia-Thailand border has served as a great impediment to agricultural expansion there.[64]

It is reported that 21,582 AVMs, 930,826 APMs, and 2,184,797 ERW have been recovered and destroyed since mine action started in Cambodia in 1992. In the last five years, there have been 324 casualties resulting from APMs, 750 from ERW (including cluster munitions) and 283 from AVMs.[65] Although the number of AVMs is significantly lower than the number of APMs in Cambodia, in recent years there have been more casualties per annum resulting from AVMs than from APMs.

FIGURE 14 MAP OF THE NORTHWESTERN REGION OF CAMBODIA WHERE AVM CONTAMINATION IS MOST SEVERE, 2008–2012



Source: Cambodia Mine Action Authority

63 Interview with Cambodia Mine Action Centre, 8 July 2013

64 Ibidem

65 Statement by Cambodia on MOTAPM at Convention on Certain Conventional Weapons, Meeting of States Parties, November 2012

National data collection system and AVM data handling

Cambodia is in the process of finalising a new national baseline survey (BLS) aggregated from local knowledge and incident data. Figures 14 and 15 illustrate its findings as of mid-2013. The survey found that over 68 square kilometres of land is suspected to contain AVMs alone and over 300 square kilometres of land is contaminated by mixed AVM and APM minefields.

Local knowledge and reported incidents form the basis for the national BLS. Because this method relies on knowledge of contamination through sightings or past incidents, the BLS process is particularly prone to missing AVMs. Communities can be unaware of AVMs if vehicles never cross their land, and for this reason there are still frequent incidents in areas outside those marked in the BLS.[66]

66 Interview with Cambodia Mine Action Centre, 8 July 2013

FIGURE 15

BASELINE SURVEY RESULTS SHOWING AVM CONTAMINATION (A3) AND MIXED ANTI-VEHICLE AND ANTI-PERSONNEL CONTAMINATION (A2) AS OF MID-2013

Province	A2 polygons	A2 Area (sqm)	A3 polygons	A3 Area (sqm)	Total A2+A3 polygons	Total A2+A3 Area (sqm)
Banteay Meanchey	1,964	117,266,635	225	10,711,640	2,189	127,978,274
Battambang	1,270	114,030,557	374	13,588,010	1,644	127,618,566
Kampong Cham	10	609,092	246	12,789,719	256	13,398,811
Kampong Speu	3	201,573	2	1,459	5	203,031
Kampong Thom	53	5,049,094	6	179,660	59	5,228,754
Kampot			2	105,409	2	105,409
Kandal	1	7,017	1	1,340	2	8,357
Kratie	37	4,713,076	179	16,145,818	216	20,858,894
Mondul Kiri	24	3,213,279	6	722,724	30	3,936,003
Oddar Meanchey	278	19,023,088	190	8,706,347	468	27,729,434
Pailin	105	7,970,859	47	2,127,178	152	10,098,037
Phnom Penh	4	493,594	4	190,335	8	683,929
Preah Vihear	62	5,005,258	12	573,189	74	5,578,447
Pursat	59	6,284,064	4	30,330	63	6,314,394
Siemreap	145	12,061,854	4	215,252	149	12,277,106
Sihanoukville			1	55,585	1	55,585
Svay Rieng	83	8,568,009	35	2,043,340	118	10,611,348
Takeo	2	100,092			2	100,092
Total	4,100	304,597,137	1,338	68,187,332	5,438	372,784,469

Source: Cambodia Mine Action Authority

History of anti-vehicle mine use

Under the leadership of Pol Pot, the Khmer Rouge (KR) ruled Cambodia from 1975 to 1979. Its policies lead to mass famine and genocide of the Cambodian people. Even whilst in power, the KR deployed a limited number of AVMs around the areas of Phnom Penh, Battambang and Banteay Meanchey as a defence against possible anti-regime revolts and to protect itself from brewing tensions with Vietnam.

The true proliferation of landmines in Cambodia did not begin until 1979 when Vietnam eventually invaded Cambodia, overthrew the KR and occupied the country for the next decade. As Vietnam intervened, the KR retreated to, and fought to defend, base camps along the northwestern border near Thailand. During this time, the KR began using AVMs to surround their strongholds for defensive purposes. The KR also mined tracks and roads used by the new Cambodian government and Vietnamese troops, typically to cut off access to ammunition and to disrupt the transportation of other supplies between Vietnamese military bases. With the gradual success of these tactics, the KR moved to the offensive

Yellow posts marking recently cleared AVMs (TM-46) and APMs at a HALO Trust demining site in Battambang province.

use of AVMs, such as laying them in relatively open spaces in dense forest (where vehicles had to pass) and in proximity to water sources.[67]

Vietnam also used AVMs as defensive weapons against the KR, keeping some (but not complete) records of their use, and even marking some minefields before later withdrawing from Cambodia. After the Vietnamese military had pushed the KR out of Cambodia and across the border to Thailand, in 1984–85, it used AVMs as defensive weapons in attempts to prevent the KR from returning to the country. The Vietnamese used forced labour of up to 100,000 people to lay a barrier minefield along the 750 km-long Cambodia-Thailand border. This infamous mine belt became known as the K5. Most of the mines in the belt are APMs, with a smaller number of AVMs spread throughout. The KR ultimately stole many of the K5 mines and then used them against the Vietnamese forces that laid them.[68]

Even after the Vietnamese withdrawal, internal fighting between factions within Cambodia continued, as did the laying of AVMs. The Cambodian national army distributed AVMs to regional commanders to use freely in their respective regions. There were no reports, records or verification back to the capital concerning use.[69]

The types of AVMs most commonly used in Cambodia were the TM 46 (both Chinese and Russian versions), TM 57 and TM 62. The KR mainly acquired its AVMs from China; the Cambodian government from the Soviet Union and East Germany; and Vietnam from Czechoslovakia. Russian-made TM 46 AVMs are found throughout northern regions of Cambodia, and the Chinese TM 46 is the most commonly found AVM type in the country as a whole.[70]

There are very few records of the deployment of AVMs during Cambodia's decades of conflict. The old indications recorded for localisation, such as 'along the road' or 'near the big tree' largely disappeared due to changes in the landscape from deforestation and the disappearance of old roads. By the time the refugees returned to their land after the end of the conflict, old roads were often hidden by thick vegetation, leaving people with no sense of where to expect contamination. Furthermore, there are few maps or records documenting the locations of old roads.[71]

67 Interview with HALO Trust Cambodia, 11 July 2013
68 Ibidem
69 Ibidem
70 Interview with Cambodia Mine Action Centre, 8 July 2013
71 Interview with HALO Trust Cambodia, 11 July 2013

An AVM at a HALO Trust demining site found with several APMs positioned directly on top of it.

Common tactics and configurations of AVMs in Cambodia included: (i) several AVMs stacked on top of each other in order to destroy tanks rather than temporarily immobilise them; (ii) a single AVM augmented by APMs around or directly on top of it in order to increase sensitivity and to protect it; (iii) AVMs laid in close proximity in the shape of a triangle to increase the chance of capturing a vehicle manoeuvering around a single mine; and (iv) an AVM buried deep in the ground with an upright stick between the mine and the ground, sensitising the mine while avoiding detection. This was a reactive KR tactic when they discovered that Vietnamese deminers detected and removed AVMs deployed at a shallower depth. Deminers have also found improvised AVMs made using other types of explosives.[72]

Casualties from anti-vehicle mines

AVM casualties are on the rise and have outnumbered casualties from APMs in recent years. There were 908 recorded AVM-related civilian casualties between 2000 and mid-2013, compared to only 242 during the twenty years between 1979 and 1999.[73] While this stark rise and contrast can be partially attributed

72 Interview with MAG, 8 July 2013; Interview with Cambodia Mine Action Centre, 8 July 2013

73 AVM Basic Impact Survey Conducted by GICHD and SIPRI, 2013 and Cambodia Mine Victim Information System Olap Cube

to poor data collection in early years, there is a chance that it reflects reality to a certain extent: most civilians in northwestern Cambodia were forced out of their villages when the KR occupied and mined the area during the 1980s, and civilians have only returned to these areas in large numbers in more recent years. Even more recently, farmers have begun to employ mechanized farming equipment at greater levels, thereby disturbing AVMs that have previously gone unnoticed.

In Cambodia, the most common civilian activities at the time of AVM incidents have been travelling and farming, with travellers far outnumbering all other categories (Figure 16). Drilling into the occupational categories of these travellers (Figure 17), the large majority of travellers are farmers, drivers and children.

Many AVM casualty incidents in Cambodia occur due to the increased use of small tractors known as rotavators. These vehicles are used in farming by attaching a plough, and as a means of local transport by exchanging the plough with a trailer bed. In this configuration, this off-road-capable vehicle is used for transporting workers out to the fields, family transportation, or transporting goods from farms to markets or to export centres.

A rotavator in Battambang district of Cambodia.

An example of this type of accident occurred in September 2012, when seven people riding in the trailer bed of the rotavator were killed by the blast of a TM 46 AVM. The driver was severely injured but survived, which is a common pattern because the rotavator driver's seat sticks out in front of the trailer and back wheels, which normally trigger the mine due to the heavy load of people or goods carried in the trailer.

In this case, the driver was transporting seven of his relatives back from a market near another village, and the group included three of his children. The incident occurred in the middle of a road that had been used by these communities for many years. Villagers are still not sure why the incident occurred, but speculated that the mine may have shifted during the rainy season. The BLS had identified the road and the surrounding area as safe given that the area had previously been cleared in 1993–95. The BLS result had been shared with the affected village in 2012. The incident highlighted a gap in the existing methodology in identifying AVM contaminated land, as well as in mine risk-awareness communication to local populations.[74] Following the incident, CMAC cleared 2,000m of the road. Authorities in Cambodia attest that the country requires mine risk-awareness education specifically for AVMs, but it is currently not conducted.

A similar accident occurred in November 2010, again with a TM 46, when 13 people riding on a rotavator trailer, along with a load of chillies, were killed as the driver steered slightly off the road to avoid a pothole. Only the driver survived the incident.[75]

Accidents such as these have resulted in a very specific fear of AVMs in the region. Communities are more confident that APMs have been cleared, but suspect that there may be unknown AVMs in the area and are afraid to expand agricultural production. Families in the Battambang village grow rice and vegetables (cassava, corn and sesame), and they affirm that once land surrounding the village is cleared of mines, they intend to use it to expand their production of crops.[76]

Casualty data collection and AVM data handling in Cambodia

Cambodia has a very robust data collection system to gather, analyse and learn from casualty data. The system could provide a good example to other states and enabled this study's research team to better understand the specific impact of AVMs in the region given the level of detail in reporting. The Cambodia Mine

74 Interview with AVM survivor, 10 July 2013
75 Ibidem
76 Ibidem

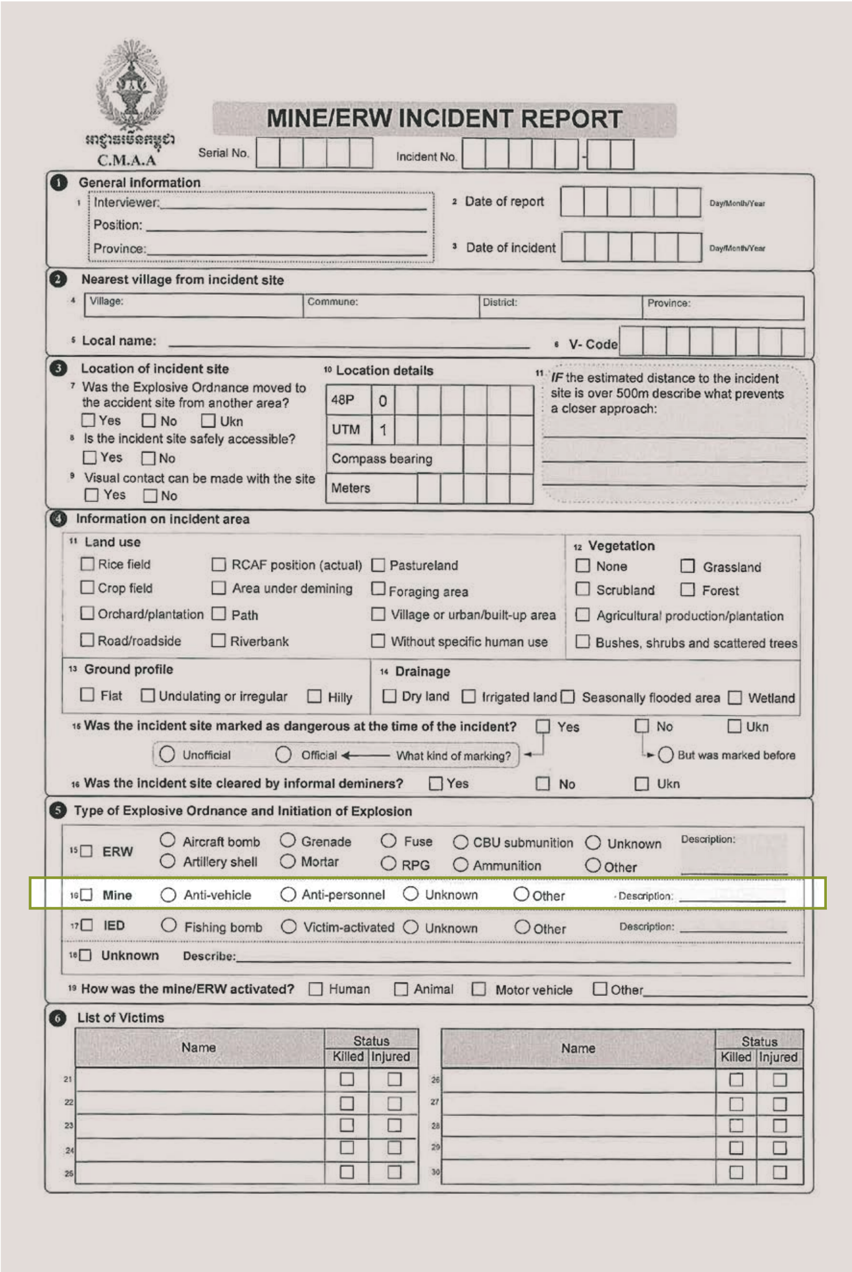
Victim Information System (CMVIS) was established in 1995 by the Cambodian Red Cross, with funding from UNICEF and Handicap International. The system was later handed over to Cambodian authorities in 2008, which transferred it to the Information Management System for Mine Action (IMSMA) in 2011.[77]

The official process for reacting to an accident begins with a Red Cross volunteer reporting to the area to collect basic information on the event and victims. A CMAA field officer then conducts follow-up interviews with survivors and witnesses, fills in the standard forms for the CMVIS database and informs demining operators of the accident. The CMVIS team then reviews the data and may ask the field officer questions for clarification or verification.[78] The goal is always to flesh out all details of the accident, including what the victim was doing at the time, his or her occupation and other personal details. These details are loaded into the CMVIS database and publically distributed in the form of monthly reports and OLAP Cubes on the CMVIS website.

Importantly, Cambodia's casualty data reporting system calls upon operators to specify whether the type of mine was an AVM or APM by checking the appropriate box in the victim report form, allowing the CMAA to better understand the increasing number of casualties that AVMs are causing. However, the procedure does not require identification of the type of AVM which caused the incident, leaving some ambiguity on which models and which features of the mines may be to blame in different areas.

CMVIS costs approximately USD 100,000 per year to operate. The CMAA reports that this is the minimum level of resources needed to run a network that allows the CMVIS to capture relevant casualty data throughout the country and better target clearance efforts.[79]

77 Interview with Cambodia Mine Action Authority, 9 July 2013
78 Ibidem
79 Ibidem



ក្រមការរៀបចំមីន
C.M.A.A

MINE/ERW INCIDENT REPORT

Serial No. ______ Incident No. ______

1 General information

1 Interviewer: ______
Position: ______
Province: ______

2 Date of report ______ Day/Month/Year
3 Date of incident ______ Day/Month/Year

2 Nearest village from incident site

4 Village: ______ Commune: ______ District: ______ Province: ______
5 Local name: ______ 6 V- Code ______

3 Location of incident site

7 Was the Explosive Ordnance moved to the accident site from another area?
☐ Yes ☐ No ☐ Ukn
8 Is the incident site safely accessible?
☐ Yes ☐ No
9 Visual contact can be made with the site
☐ Yes ☐ No

10 Location details

48P	0						
UTM	1						
Compass bearing							
Meters							

11 *IF* the estimated distance to the incident site is over 500m describe what prevents a closer approach:

4 Information on incident area

11 Land use
☐ Rice field ☐ RCAF position (actual) ☐ Pastureland
☐ Crop field ☐ Area under demining ☐ Foraging area
☐ Orchard/plantation ☐ Path ☐ Village or urban/built-up area
☐ Road/roadside ☐ Riverbank ☐ Without specific human use

12 Vegetation
☐ None ☐ Grassland
☐ Scrubland ☐ Forest
☐ Agricultural production/plantation
☐ Bushes, shrubs and scattered trees

13 Ground profile
☐ Flat ☐ Undulating or irregular ☐ Hilly

14 Drainage
☐ Dry land ☐ Irrigated land ☐ Seasonally flooded area ☐ Wetland

15 Was the incident site marked as dangerous at the time of the incident? ☐ Yes ☐ No ☐ Ukn
○ Unofficial ○ Official ← What kind of marking? → ○ But was marked before

16 Was the incident site cleared by informal deminers? ☐ Yes ☐ No ☐ Ukn

5 Type of Explosive Ordnance and Initiation of Explosion

15 ☐ ERW ○ Aircraft bomb ○ Grenade ○ Fuse ○ CBU submunition ○ Unknown Description:
○ Artillery shell ○ Mortar ○ RPG ○ Ammunition ○ Other

16 ☐ Mine ○ Anti-vehicle ○ Anti-personnel ○ Unknown ○ Other Description: ______

17 ☐ IED ○ Fishing bomb ○ Victim-activated ○ Unknown ○ Other Description: ______

18 ☐ Unknown Describe: ______

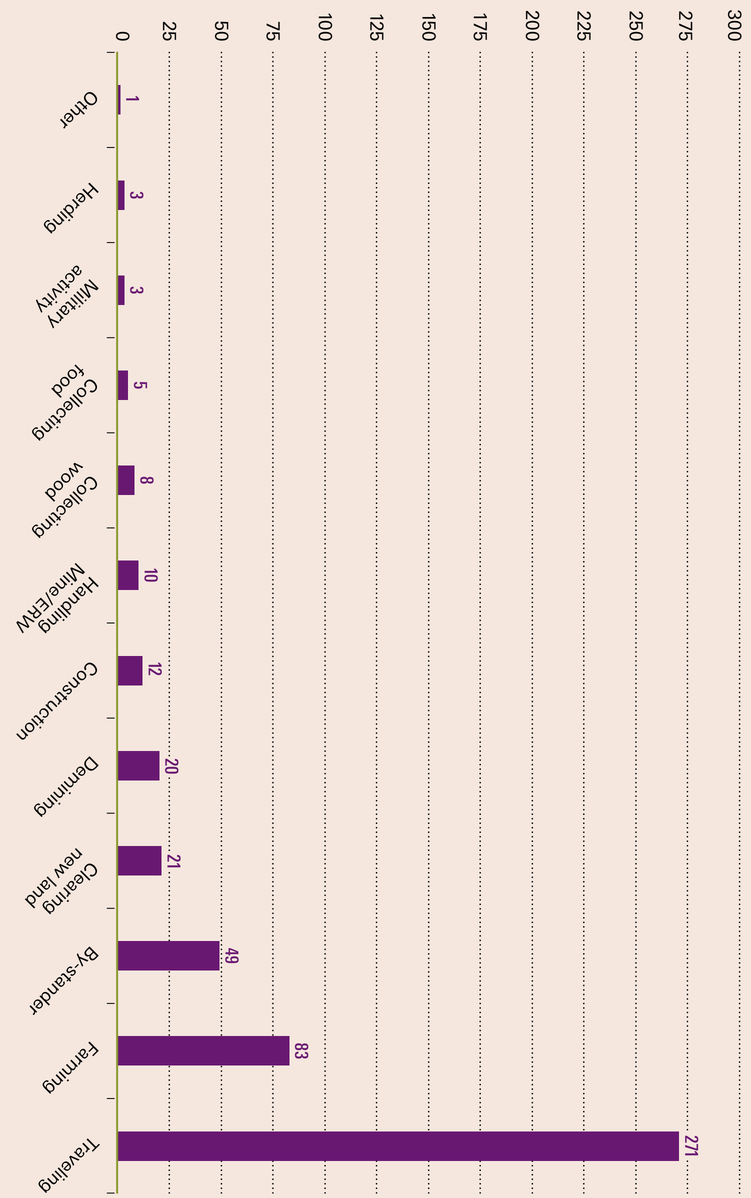
19 How was the mine/ERW activated? ☐ Human ☐ Animal ☐ Motor vehicle ☐ Other ______

6 List of Victims

	Name	Status: Killed	Status: Injured		Name	Status: Killed	Status: Injured
21		☐	☐	26		☐	☐
22		☐	☐	27		☐	☐
23		☐	☐	28		☐	☐
24		☐	☐	29		☐	☐
25		☐	☐	30		☐	☐

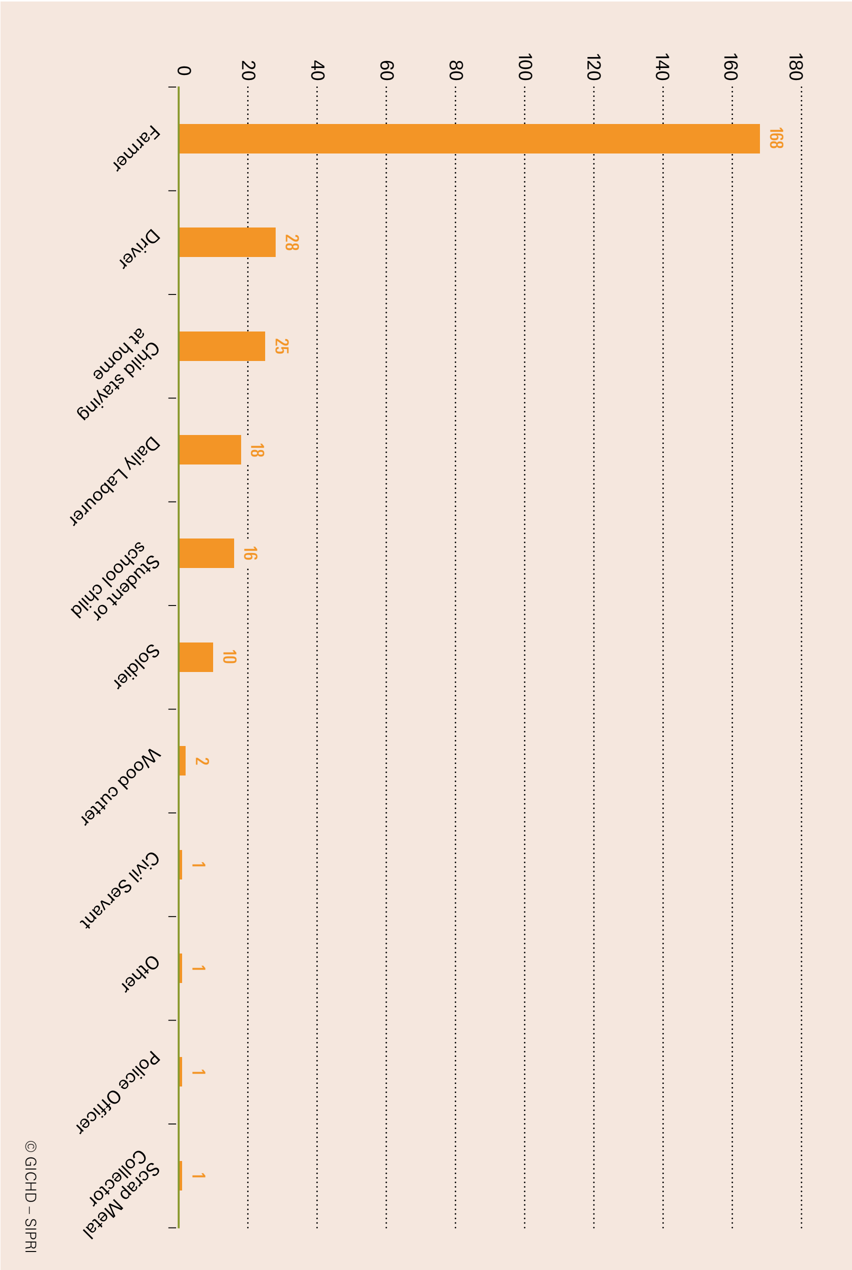
Cambodia's Mine and ERW Incident Report that allows for easy distinction of AVM incident from APM incidents.

FIGURE 16 AVM VICTIMS BY ACTIVITY AT THE TIME OF THE ACCIDENT, 2005–2013 (assembled with CMVIS data)



© GICHD – SIPRI

FIGURE 17 OCCUPATIONS OF VICTIMS CATEGORISED AS TRAVELLING AT THE TIME OF AVM ACCIDENTS, 2005–2013 (assembled with CMVIS data)



Despite the CMVIS system's extensive coverage, there is still a perception that not all incidents get recorded, especially because injuries and deaths can be reported much later when clearance teams come to an area marked in the BLS. Cambodia's ambition is to have national coverage of mine victim reporting, and the Cambodian mine action authorities believe that a common terminology between internal ministries will be necessary to achieve nationwide mine data coverage.[80]

Developmental impact of anti-vehicle mines

The robust and detailed casualty data collection system in Cambodia has allowed authorities to observe a distinct increase in AVM-related incidents in recent years. The details associated with the data show that the increase is largely due to increased development throughout the country, primarily in the agricultural sector.

Beyond the casualties themselves, the mere observation of the increase in AVM incidents by local communities is inhibiting development progress in several ways. In the northwest, observing the rise in incidents involving tractor users has increased the perceived threat of AVM contamination. Some local communities choose to stick to using the less effective tools of cows and manual labour to farm their land even if this means smaller yields. Another example is that many farming operations in the region rely on villagers renting tractors to conduct farm work, and some suppliers are not willing to rent equipment to farmers in AVM contaminated areas.[81]

The Mine Action Planning Unit (MAPU) is responsible for post-clearance monitoring (PCM). The CMAA trains all PCM staff and has designed a standard questionnaire. MAPU has three staff dedicated to PCM in northwestern Battambang, a province heavily contaminated by AVMs. PCM of 725 plots of land cleared in 2011 took place between October 2012 and February 2013, and results showed that by far the most common use of new land is for agriculture. Ten years ago, PCM staff reported the most common use of cleared land was for resettlement of refugees and IDPs.[82]

Throughout the Cambodian government, AVM clearance is beginning to be seen as an increasingly important development requirement. While APMs remain a clearance priority due to international treaty obligations, as Cambodia's national strategy is to expand exports (particularly rice) to new overseas markets (such as Europe's), AVM clearance is seen as an obstacle that must be surmounted in order to reach the country's production targets.[83]

80 Interview with Cambodia Mine Action Authority, 9 July 2013
81 Interview with UNDP, 8 July 2013
82 Interview with Cambodia Mine Action Authority, National Project Officer, 10 July 2013
83 Interview with MAG, 8 July 2013

Beyond agriculture, AVM contamination has also presented obstacles to large-scale projects such as the expansion of irrigation and power schemes. The Government of Cambodia requires all prospective large-scale construction projects to first survey the land for contamination. The company involved must pay for the survey, and this factor has occasionally deterred potential foreign investors.[84]

AVMs also have an influence on Cambodia's tourism sector, which has begun to grow thanks to recent years of stability in the country. Authorities say they take pains to inform those of the estimated three to four million visitors per year who rent cars or drivers about the risks of AVMs and other types of ERW. There is a pervasive fear that any tourist involvement in an incident in Cambodia might have a lasting and severe impact on the sector.[85]

In terms of clearance, demining operators are beginning to see a marked increase in requests to clear AVM threats. MAG, an international NGO focused mainly on APM clearance in Cambodia, reports an increase in requests from local communities to clear AVMs as reactions to increased AVM incidents in their areas. MAG reports that accidents involving AVMs primarily occur in areas without APMs, as people are unaware of mine contamination.

MAG runs clearance operations incorporating manual, mechanical and Mine Detection Dog (MDD) techniques. The large vehicles that MAG uses to clear dense vegetation cannot be used in areas with AVMs given that an AVM would damage the machine, and donors therefore will not allow the risk. Beyond this challenge, MAG states that AVMs deployed together with APMs are the most expensive to clear as it requires clearance in stages, using multiple methods and techniques.[86]

Conclusion

Overall, as Cambodia works to recover from its past and toward greater integration with the regional and international community, the presence of AVMs has been shown to be a factor significantly slowing processes of recovery and growth. AVMs continue to elude Cambodia's comprehensive survey efforts given that some communities do not become aware of their presence until it is too late. Despite the fact that the number of AVMs in Cambodia is significantly lower than the number of APMs, in the past few years, AVMs have killed more civilians than APMs.

84 Interview with Cambodia Mine Action Authority, National Project Officer, 10 July 2013
85 Interview with Cambodia Mine Action Centre, 8 July 2013
86 Interview with Mines Advisory Group, 8 July 2013

Beyond this threat, with villages choosing to avoid mechanised farming out of fear of hitting an AVM, and cases of foreign investment in the country's infrastructure projects being deterred, Cambodians can point to a variety of reasons – other than casualty counts – for their decision to make AVMs illegal in their country and prevent these weapons from affecting future generations.[87]

SOUTH SUDAN

South Sudan gained its independence from Sudan on 9 July 2011, but only after a decades-long civil war which took the lives of two million people. The Comprehensive Peace Agreement signed between the Sudan People's Liberation Movement (SPLM) and the Government of Sudan, in January 2005, included the right of Southern Sudan to conduct a referendum on its independence.

Peace has nonetheless been fragile in South Sudan, partly caused by tensions with the north, and partly by internal fragmentation. On 15 December 2013, South Sudan relapsed into conflict. Fighting between the government forces and opposition groups caused over 1,000 deaths and displaced some 738,000 people internally in addition to 130,400 people who fled to neighbouring states. The situation in the country remains volatile despite the signing of a cessation of hostilities agreement on 23 January 2014.[88]

87 Interview with Cambodia Mine Action Authority, 12 July 2013

88 UNHCR spokesperson Melissa Fleming, press briefing, 14 Feb. 2014, Palais des Nations in Geneva, http://www.unhcr.org/52fdfcad9.html

As the world's newest sovereign state, South Sudan faces tremendous political and economic challenges. The economy, which is extremely dependent on oil revenues, has been vulnerable to conflicts over the use of Sudan's pipelines and oil export facilities.[89] In parts of South Sudan, up to 90 per cent of the households depend primarily on agriculture and livestock for their subsistence.[90]

Although by no means the only cause of instability and underdevelopment in South Sudan, landmine contamination further challenges state-building and development efforts. Both APMs and AVMs have been used extensively in South Sudan, and over 30 different models of AVMs have been found in the country to date. This variation and unpredictability in the contamination deepens the challenge of clearance and recovery. This chapter focuses specifically on the AVM presence in the country and analyses the impact of contamination on civilian life, development efforts and clearance operations. As a newly sovereign state, South Sudan has acceded to the AP Mine Ban Treaty, but has not yet joined the CCW or the Convention on Cluster Munitions (CCM).

The South Sudan National Mine Action Authority, United Nations Mine Action Centre and a number of mine action operators including the Norwegian People's Aid (NPA), Mine Tech International (MTI), G4S and Mechem provided instrumental support in assembling this case study.

A bus carrying civilians exploded after it drove over an AVM in Juba, South Sudan,in October 2011. The accident resulted in 20 fatalities, including four children.[91]

Overview of anti-vehicle mine presence

South Sudan is heavily contaminated by landmines and ERW, with widespread presence of both APMs and AVMs. All ten states in South Sudan are contaminated by AVMs to various degrees, though Eastern Equatoria, Central Equatoria and

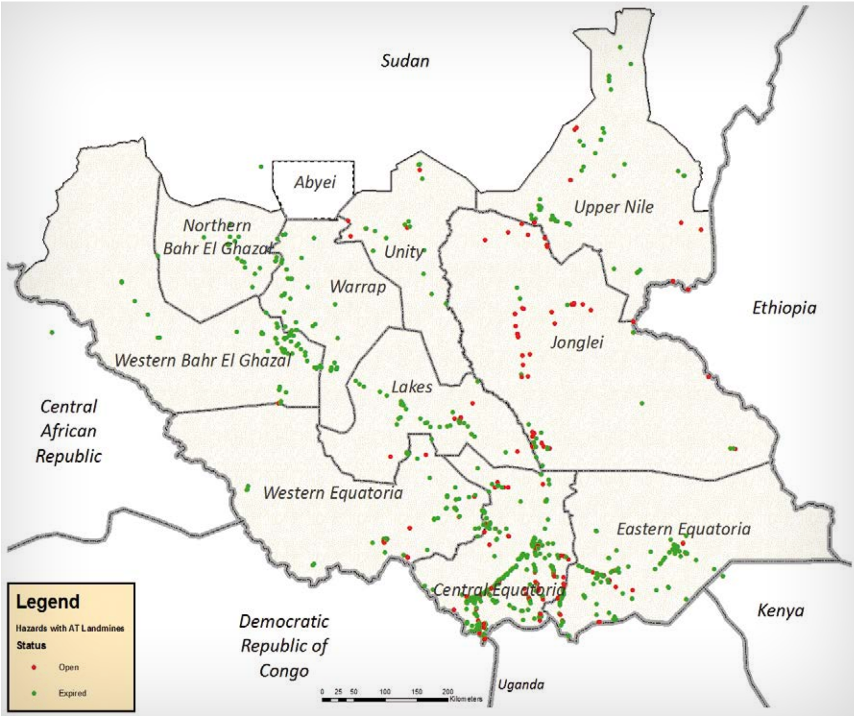
89 The Guardian, 'South Sudan: in numbers', http://www.theguardian.com/global-development/datablog/2012/jul/09/south-sudan-in-numbers-key-statistics

90 African Development Bank, *South Sudan: An Infrastructure Action Plan. A Program for Sustained Strong Economic Growth*, 2013, p. 132

91 Source: http://reliefweb.int/report/south-sudan-republic/un-says-bus-mine-blast-south-sudan-killed-20

Jonglei are especially affected. Some northern regions of South Sudan are also heavily contaminated by AVMs, given that many were laid as Sudanese government forces retreated from Southern Sudan.[92]

FIGURE 18 IDENTIFIED AVM HAZARDS IN SOUTH SUDAN, AS OF SEPTEMBER 2013



Source: South Sudan NMAA

The UN Mine Action Service (UNMAS) is currently responsible for coordinating demining in South Sudan, together with the developing South Sudan National Mine Action Authority (NMAA), and constantly finds new areas to clear. In 2012, the majority of the new tasks involved AVMs. Due to the expansion in the number of hazardous zones, and new information coming in from clearance operations, UNMAS does not know the full extent of South Sudan's contamination.[93]

92 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013
93 Ibidem

No maps or records of landmine contamination were kept during the Sudanese civil war.[91] Mine clearance therefore depends on local knowledge and mine encounters, including incidents. IDPs and refugees returning to South Sudan often find mines upon their resettlement, and mine incidents and casualties are still frequent.[95]

UNMAS and the Government of Sudan commissioned a landmine impact survey in South Sudan in 2003 (then still a part of Sudan) in order to assist in setting priorities for mine clearance for the newly established national mine action programme. The survey, carried out between 2005 and 2009, showed that states in the future South Sudan consisted of a range of low to medium and highly affected communities. The impact survey was not fully comprehensive in its coverage, due to difficulties in accessing certain areas, partly because of insecurity. Importantly for this study, the survey did not make a distinction between AVMs and other types of landmines.[96]

When the 2005 Peace Agreement was signed, many roads in South Sudan were impassable due to landmines, especially AVMs. Roads leading to Uganda, Kenya, the Democratic Republic of Congo and Ethiopia were all mined, causing major obstacles for returning refugees and IDPs, as well as for delivery of emergency aid and other resources. So far, 22,000 km of roads have been cleared of landmines, including most of the country's major roads. However, smaller roads are still contaminated and, as a result, many rural communities remain isolated. As an example, three roads in Eastern Equatoria state are still not in use due to AVMs. Even some roads in Central Equatoria state (where the capital Juba is located) are contaminated with AVMs.[97]

Reports of the continued use of mines (both APM and AVM) in South Sudan continue to surface, though the exact users remain unclear. Recent reports have pointed to use of AVMs by rebel forces in Unity state and Jonglei state in the areas of Khorflus and Khorwai. One particular report pointed to use by the South Sudan Liberation Army (SSLA) – a rebel faction – that reportedly laid mines in Unity state.[98]

94 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013
95 Interview with South Sudan National Mine Action Authority, Juba, 4 Nov. 2013
96 Survey Action Center, *Landmine Impact Survey: Republic of Sudan*, 2010, http://www.sac-na.org/pdf_text/sudan/SDN_FinalReport.pdf
97 Interview with South Sudan National Mine Action Authority, Juba, 4 Nov. 2013
98 Landmine Monitor, South Sudan Country Profile, Mine Ban Policy (updated 25 November 2013) http://www.the-monitor.org/index.php/cp/display/region_profiles/theme/3190

CONTINUED USE OF AVMs IN SOUTH SUDAN AS REPORTED IN LANDMINE MONITOR[99]

A number of reports have surfaced in recent years regarding the possible continued laying of landmines, including AVMs.

- In Unity state, there were several reports of AVM use in 2011, claiming multiple casualties including in May, August, September, and October. *[Landmine Monitor, South Sudan Country Profile, Mine Ban Policy, Updated 25 November 2013.]*
- In June 2011 the Southern Sudan Mine Action Authority expressed concern at new civilian deaths from what seemed to be newly-laid AP and AVMs. *[Statement of South Sudan, Mine Ban Treaty Standing Committee on Mine Clearance, Geneva, 23 June 2011.]*
- A representative of the UN Mine Action Office (UNMAO) Southern Sudan told media that evidence indicates rebel militia groups were laying mines and said, 'We've seen an increase in mine incidents and mine accidents over the past six months or so and in many areas we think there are a lot of alleged cases of re-mining. We can't prove it because we haven't seen it but anecdotal evidence indicates that these are newly laid, not old mines.' *[Maggie Flick, 'Landmines in Southern Sudan,' Huffington Post, 4 June 2011, citing an interview with Tim Horner, Deputy Director of the UNMAO in Southern Sudan.]*
- In August 2011, five people were killed and 21 seriously injured in two separate AVM incidents. The governor of Unity state condemned the mine use, which it said was carried out by rebels led by James Gai Yoach, who have broken away from SSLA following the acceptance of a cease-fire agreement with the government of South Sudan. *[Bonifacio Taban Kuich, 'Landmines kill 5 and injure 21 in South Sudan's Unity state,' Sudan Tribune (Bentiu), 23 August 2011.]*
- In November 2011, a UN Mine Action and Coordination Centre (UNMACC) representative told media that routes leading into and out of the state capital Bentiu were suspected to be mined. *['Relentless Use of Landmines in South Sudan Sparks Fear,' Voice of America, 21 November 2011.]*
- In December 2011, a UNMACC representative said that it was increasing efforts to unblock aid and trade routes in Unity state because 'the re-mining has shut down most of the state.' *['Amputees reap bitter fruits of separation in Sudan state,' mysinchew.com, 17 December 2011.]*

99 Condensed from Landmine Monitor (updated 25 November 2013) http://www.the-monitor.org/index.php/cp/display/region_profiles/theme/3190

- In 2011 and 2012, the ICBL expressed concern at ‘alarming reports’ of new landmine use by NSAGs in South Sudan, but noted it was not possible to determine who was responsible or whether AP mines in addition to AVMs had been laid. *[Statement of ICBL, Mine Ban Treaty Standing Committee on the General Status and Operation of the Convention, Geneva, 20 June 2011. Ibid., 25 May 2012.]*

- In January 2012, a former senior SSLA member interviewed by Amnesty International admitted that their forces had laid AVMs on Unity state roads expected to be used by SPLA forces, but denied that SSLA forces had laid AP landmines. According to the former SSLA member, ‘We had some landmines but we kept many of them back. We sent intelligence guys to lay down anti-tank mines, and then attract SPLA forces to them.’ *[Amnesty International, ‘South Sudan: Overshadowed Conflict,’ 28 June 2012, p. 23.]*

- The Small Arms Survey documented newly-laid Chinese manufactured T-72 AVMs, reportedly laid by the South Sudan Liberation Army (SSLA) around Mayom in Unity state. *[Small Arms Survey, Sudan Human Security Baseline Assessment, ‘Anti-tank and anti-personnel mines in Unity and Jonglei states,’ 5 March 2012.]*

- In June 2013, a resident in Sudan’s White Nile state told a South Sudan media outlet that ‘armed rebels’ planted landmines in an area from Wadakona, a village in South Sudan’s Upper Nile state to the border with Sudan’s White Nile state. After a farmer died when his tractor hit a mine, the listener said, ‘People are now avoiding using vehicles for fear of landmines.’ *[‘Landmines kill and maim civilians on Sudan – South Sudan border’: source,’ Radio Tamazuj, 19 June 2013.]*

- The NMAA conducted a fact-finding mission in June–July 2013 to engage with civil authorities in the states of Jonglei, Upper Nile, Unity, and Western Bahr El Ghazal. The NMAA engaged in discussions with the Governor and the Deputy Governor as well as the Sector and Division Commanders from the SPLA. Both the civil authorities as well as the SPLA denied allegations of being involved in new mine laying activities. However, the SPLA confirmed that new mines had indeed been laid by rebel forces in Unity state and also in Jonglei state in the areas of Khorflus and Khorwai. *[UNMAS has been unable to independently verify the allegations due to access restrictions to the alleged sites. Email from Lance Malin MBE, UNMAS, 14 October 2013.]*

National data collection system and AVM data handling

The national data collection system is a collaborative effort by several international demining operators reporting to UNMAS, which manages the Information Management System for Mine Action (IMSMA). Regional survey teams collect data on mines and UXO that they then send to the national authority. Community liaison teams also report to UNMAS based on the results from MRE programmes. UNMAS feeds the data into IMSMA. To facilitate local ownership of the database, UNMAS is currently training South Sudan National Mine Action Authority (NMAA) staff on how to use the software and reporting mechanisms.

The most accurate information on contamination comes from completion reports. Demining operators write a completion report on each task, which they then submit to IMSMA. Reports specify the type of mine and the location, either identifying the location of a single mine (in case of a spot task) or a mine field (in case of a polygon task), and list the number of AVMs, APMs and UXO destroyed.[100]

Mine action operators in South Sudan aim to distinguish AVMs from APMs in their survey, clearance and incident reporting. However, the reports submitted by demining organisations vary in their level of detail. Some only report clearance at the polygon level, without providing the coordinates of the individual mines cleared. While some organisations do provide this information, because of this variation it is not possible to provide a map of all AVMs cleared in the country. In addition, some of the reporting forms in use allow for free text entry in areas of the form identifying the type of hazard – this variation can make it more difficult to later sift out information regarding the specific types (APM versus AVM) or models of landmines encountered from the larger database.

100 Interview with G4S Juba, 5 Nov. 2013

The information submitted in incident reports also varies depending on what information is available to the investigator. UNMAS reports that it is standard practice to try to identify the type of device and determine if there are more hazards around the site of the incident. However, the device type may not always be identifiable, e.g. if there is nothing left of the device or if an investigation was not possible due to inaccessibility.

According to one operator, unless one sees a mine or an incident, it is difficult to differentiate between different kinds of contamination, and basic training may be required to identify the correct type of munition, e.g. distinguishing an AVM from a RPG.[101] However, in the case of a detonation, deminers may be able to tell that an AVM caused an incident based on signature characteristics, such as the crater size and the presence of mine remnants.

The survey and hazard form, which is completed before a clearance task, is often based on local reports and knowledge, and untrained interviewees may not be able to distinguish different devices from one another. Therefore, the most accurate reports identifying devices are those completed post-clearance by demining operators.[102]

For these reasons and uncertainties, national AVM data in South Sudan remains incomplete, and data that is available on both contamination and incidents provides low estimates.

History of anti-vehicle mine use

AVMs were used by both sides during the Second Sudanese Civil War (1983–2005), which was fought by Sudanese government forces and the south's opposition army, the SPLA, whose political wing is now in government in South Sudan.

AVMs were mainly used in South Sudan as part of guerrilla warfare. The SPLA used AVMs as a defensive weapon, in particular to impede road access to Sudanese government forces. The SPLA would place AVMs along transport routes, around their bases and in other strategic locations. Both belligerents would typically lay AVMs along the contested 'buffer zone' running between their opposing military bases. Very few tanks were used in Sudan during the war

101 Interview with Mechem, Juba, 5 Nov. 2013.

102 Interview with United Nations Mine Action Service (IMSMA section), Juba, 5 Nov. 2013; Interview with G4S Juba, 5 Nov. 2013.

(around 20 in total) and the SPLA had none. AVMs were instead aimed at destroying the support vehicles carrying supplies and other logistics during the conflict. AVMs were considered an important weapon in this asymmetric conflict, especially for the militarily weaker SPLA.

FIGURE 19 TYPES OF ANTI-VEHICLE MINES FOUND IN SOUTH SUDAN

AKS	TM 47
AT, TYPE 72MT	TM 56
AVM-72	TM-44
GS MK IV	TM-46 & TMN-46
GS MK VC	TM-57
M12	TM-59
M15	TM-62M
M4	TM-62P
M46	TM46
M6 SERIES, HE	TMA-5 & TMA-5A
MK 5 H.C.	TYPE 59
MK 5(V), EP	UKA-63
MK 7, MK 7/1, MK 7/4 & MK 7/7	VS-AT4
MK-4	VS2.2 AT
PMA-5	YAM-10
PRBM 3	YAM-5
PRM-3 pressure plate	YAM-5K
TC-6, MODEL	YM III

Source: South Sudan NMAA and UNMAS

Demining operators have commonly reported that mines were seemingly laid arbitrarily, with little patterns and very few records. This matches with reports that during the conflict, the Sudan People's Liberation Army (SPLA) had weak logistical support, and soldiers travelling on foot would often carry mines on their heads in stacks and distribute them irregularly.[103] In some cases, different types of mines were often directly connected to one another on the ground (e.g. using a tripwire) so detonating one mine would set off the other.[104]

G4S operators in South Sudan have reported often finding AVMs located around bridges, as well as in typical ambush locations afforded by geographic features, where they were placed to strike a convoy. Operators also report that some mines were left in forests and elsewhere when foot soldiers found carrying them became too difficult.[105]

MTI also reports finding AVMs on roads or close to roads, close to bridges and in landscapes suitable for defensive positions.[106] They have also commonly found AVMs beyond roads. Mines laid at checkpoints, for example, were left behind when the checkpoints moved. Other cases include finding AVMs surrounding bases of the belligerent groups, which could migrate and leave the mines behind. Even on the outskirts of Juba, close to the airport, farmers found AVMs when they started to cultivate the land. Mines are also found on old, overgrown roads, and although this AVM contamination has a more limited impact at the moment, it could cause problems in the future if such land is later developed.[107]

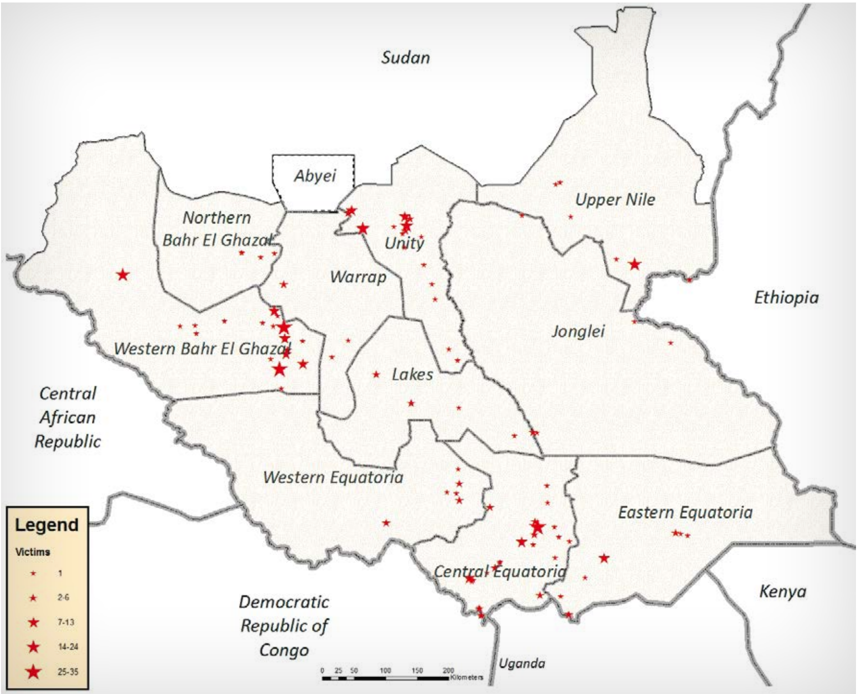
A unique feature of the mine contamination in South Sudan is the wide variety of AVMs present, with over 30 different types found to date. The most commonly found AVMs in South Sudan include types from China, Russia, Italy, Belgium and the UK. The acquisition routes of these weapons, for both the SPLA and the Sudanese government are unclear. The SPLA's supply included, but may not have been limited to, weapons captured from the Sudanese government. The Sudanese government might have had a more stable source of supply, possibly from China.

103 Interview with Mining Technologies International, Juba, 5 Nov. 2013
104 Interview with South Sudan National Mine Action Authority, Juba, 4 Nov. 2013
105 Interview with G4S Juba, 5 Nov. 2013
106 Interview with Mining Technologies International, Juba, 5 Nov. 2013
107 Interview with G4S Juba, 5 Nov. 2013

Casualties from anti-vehicle mines and casualty data

Prior to the 2011 independence referendum, the number of AVM casualties reported was relatively low in South Sudan when compared to other states with similar levels of contamination. UNMAS and the Sudanese authorities' national strategy was to primarily target road clearance. This benefitted the clearance of AVMs and is likely to have had an impact on lowering the number of AVM incidents. Although this demining strategy has undoubtedly shown results in the past decade, the financial costs of these operations have also been significant.

FIGURE 20 AVM CASUALTIES IN SOUTH SUDAN, AS OF SEPTEMBER 2013



This map shows recorded civilian casualties in South Sudan from 2004 to 2013. Authorities have emphasised that this data set is incomplete, especially in the northern states, due to ongoing conflict and the inaccessibility of certain areas. Source: NMAA

Since the beginning of mine action activities in South Sudan in 2004, national authorities have recorded 482 civilian casualties due to AVMs. They emphasise, however, that reported numbers of casualties are likely to be significantly less than the actual number, given that much of the country remains inaccessible to reporting efforts due to security concerns.

During 2007–10, the NMAA reported only a handful of casualties per year, but in 2011 this increased to 112 reported AVM victims. That year, following increased tensions after the referendum, some 400,000–500,000 people moved into and across South Sudan.[108] This great increase in casualties was most likely simply due to these large population movements as people fled conflict zones, with many refugees from the South Kordofan and Blue Nile states in Sudan fleeing into South Sudan.

AVM incidents continue to take lives and injure civilians in South Sudan. Towards the end of 2013, there was, for example, an AVM incident in the area of Bentiu town in the north, close to the border with Sudan.[109]

South Sudan employs a cooperative process for reporting on landmine incidents and collecting information. Following every landmine incident, the mine action operator closest to the location is sent to the site. The operator fills in an incident form and UNMAS staff follow-up on the incident with an investigation, including a visit to the site and interviews with survivors and witnesses.[110] Non-fatal victim reports from AVM incidents are rare, since there are normally few survivors.[111]

Although all UNMAS teams are capable of conducting investigations concerning landmines incidents, UNMAS sometimes cannot visit certain sites due to security concerns and inaccessibility due to heavy rains or remoteness. Furthermore, UNMAS does not have effective access to certain border areas. Parts of Jonglei state, for example, cannot be investigated, and incident report forms are only useful when trained personnel have access to the site.[112] For these reasons, UNMAS suspects that a number of AVM or APM related casualties go unreported each year.

Developmental impact of anti-vehicle mines

AVM presence in South Sudan poses challenges to development in a number of areas. Up to this point, the country's low population density and lower levels of mechanized agriculture partially explain South Sudan's low casualty figures relative to the extent of mine contamination. The AVM threat may become even greater as the country's population grows, the movement of people increases, the number of vehicles grows and as roads are used more frequently. As such, it is possible that the number of AVM incidents will rise as development progresses in South Sudan.[113]

108 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013
109 Interview with South Sudan National Mine Action Authority, Juba, 4 Nov. 2013
110 Ibidem
111 Interview with Mining Technologies International, Juba, 5 Nov. 2013
112 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013
113 Interview with G4S Juba, 5 Nov. 2013

FIGURE 21 NMAA RATED THE FOLLOWING AREAS AS SUFFERING 'VERY SEVERE' EFFECTS DUE TO AVMs IN THE BIS

Road access for humanitarian aid
Road access for refugee return
Restoration of land for grazing livestock
Development of new areas for energy resource exploration

Key areas suffering from the impact of anti-vehicle mines

Resettlement and movement of people

Landmine contamination has affected the movement and resettlement of IDPs and refugees in South Sudan. In the 2008 landmine impact survey, 247,562 IDPs and refugees were expected to resettle in Central Equatoria state alone.[114] After South Sudan gained independence in 2011, there was a sudden influx of Sudanese refugees from Sudan's South Kordofan and Blue Nile states. Large movements of returnees continued in 2013.[115] Since mid-December 2013, renewed conflict in South Sudan has internally displaced 738,000 people, and a further 130,400 have fled to neighbouring countries, primarily Ethiopia, Kenya, Sudan and Uganda.[116]

Although data is incomplete, AVM incidents in South Sudan do at least partly correlate to an increase in the movement of large groups of people. The stark increase from five AVM casualties in 2010 to 112 AVM casualties in 2011 can be partially attributed to the swell in population movements that year as a result of the referendum. Looking toward the future, as IDPs from the most recent eruption of conflict in the country look to resettle, they may, for example, start to use old or smaller roads, and will be at risk of triggering AVMs that have not yet been documented due to inaccessibility or renewed mine laying.

114 *Landmine Impact Survey – Sudan: Central and Western Equatoria States*, July 2008, p. 14, http://www.sac-na.org/pdf_text/sudan/GE_Report_Jul08.pdf
115 UNHRC, South Sudan, http://www.unhcr.org/pages/4e43cb466.html (accessed: 25 Feb. 2014)
116 UNHCR spokesperson Melissa Fleming, press briefing, 14 Feb. 2014, Palais des Nations in Geneva, http://www.unhcr.org/52fdfcad9.html

Agriculture and food production

The UN Food and Agriculture Organization (FAO) states that South Sudan is enormously rich in natural resources, and with 95 percent of the population dependent on them for survival, it has significant potential for sustainable growth through agriculture. However, FAO's satellite land cover survey showed that just 4.5 percent of the available land was currently under cultivation.[117]

Currently, much rural sector activity in South Sudan is focused on low-input, low-output subsistence agriculture instead of production for markets.[118] Mine clearance priorities are access to water and firewood collection, land for cultivation and transport to remote villages. In the short term, most of the cleared land will be used for subsistence farming of crops such as cassava, maize, peanuts and other vegetables[119] As this farming is most commonly done by hand in South Sudan, there are many cases where villagers have lived in AVM-contaminated land without detonating an AVM. However, in the longer term, when farming shifts from manual to mechanical tools and vehicles, this co-existence will no longer be possible.

AVMs also affect other areas of development and livelihood in the country. In Eastern Equatoria state (along the Torit road to Katri), minefields containing AVMs have hampered the development of tea plantations, timber production and sugarcane plantations. The limited timber sector in South Sudan could expand, and possibly make a more significant contribution to the economy, were it not for AVM contamination in these off-road areas that are more difficult to survey and clear.[120] Dinka communities in northern areas including Jonglei and the Upper Nile are cattle herders and live off their livestock – they have repeatedly stated that they worry about mines as cattle have been known to activate AVMs.[121]

Foreign Direct Investment

The presence of AVMs in South Sudan has been a deterrent to Foreign Direct Investment in various sectors. Before even starting to plan a project, investors must get verification and a certificate from the NMAA that the area of interest has

117 Food and Agriculture Organization of the United Nations, 'South Sudan naturally endowed for sustainable growth through agriculture,' http://www.fao.org/news/story/en/item/81693/icode/

118 African Development Bank, *South Sudan: An Infrastructure Action Plan. A Program for Sustained Strong Economic Growth*, 2013, p. 131

119 Interview with Mining Technologies International, Juba, 5 Nov. 2013

120 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013

121 Interview with G4S Juba, 5 Nov. 2013

been cleared of landmines. Known contamination has affected road development, building of power lines and the extractive industries.

Smaller foreign investment projects are particularly prone to being put off by AVMs, given the smaller budgets typically involved. For example, an Indian company expressed an interest in developing a sugar field, together with a refinery, in the border area between Eastern Equatoria and Jonglei states, but the investors pulled out due to landmine contamination that included AVMs.[122]

In terms of major resource extraction projects, gold exploration in Eastern Equatoria is one area that has been affected by mine contamination.[123] This state has therefore been listed as one of the priority areas in the national clearance strategy, as fear of mines remains a deterrent against new investments in gold prospecting.[124] Oil and gas companies, on the other hand, are better prepared for potential contamination and have their own deminers.

In general, as South Sudan moves to develop its economy, AVM contamination exists as yet another risk with the potential to deter private sector investment across these various industries.[125]

Infrastructure

Road clearance has been a top priority for UNMAS in South Sudan, with approximately 22,000 km of roads cleared over years of collaborative efforts. The landmine threat on roads in South Sudan is primarily caused by AVMs rather than APMs. The Juba-Bentiu road was previously closed due to AVMs, but has now been cleared, as is the case with many major roads in South Sudan.[126] Before the outbreak of renewed conflict, clearance of all major roads in Eastern Equatoria was due to be completed in 2014, with the next priority being to clear side roads.[127]

Road clearance has had a positive impact on many levels, facilitating access to more demining and aid, opening up trade and travel opportunities, and bringing access to education and healthcare to rural communities. In addition, the national railway line, connecting Babonosa in Sudan with Wau in South Sudan, was cleared of landmines in 2007 and is now open again for traffic.[128]

122 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013
123 Interview with G4S Juba, 5 Nov. 2013
124 Interview with South Sudan National Mine Action Authority, Juba, 4 Nov. 2013
125 Interview with G4S Juba, 5 Nov. 2013
126 Interview with United Nations Mine Action Service, Juba, 4 Nov. 2013
127 Ibidem
128 Interview with South Sudan National Mine Action Authority, Juba, 4 Nov. 2013

Despite progress made along main roads, South Sudan is still faced by AVM threats both alongside some major roads, as well as throughout smaller peripheral road networks. In the early years of clearance, emergency humanitarian demining clearance standards called for the clearing all major roads connecting key towns to a width of 8 m. In 2004–05, clearance standards issued by UNMAS changed to a width of 20–25 m in order to capture more of the contamination and allow for possible development alongside roads.[129]

There have been a number of incidents alongside roads that were only cleared to a width of 8 m, and demining operators frequently find more AVMs next to cleared roads. NPA responded to a clearance request when a road construction company's bulldozer detonated an AVM whilst laying a new road surface.[130] Mechem staff reported on an AVM incident in which a bus detonated the mine on a road from Bentiu to Nhialdiu in Unity state in August 2011. The victims were aware of the contamination, but had no choice but to use the road as there was no alternative route.[131]

New use of AVMs also presents a continued threat as reports of new mine laying occasionally surface. In June 2013, a resident in Sudan's White Nile state told a South Sudan media outlet that 'armed rebels' planted landmines in an area from Wadakona, a village in South Sudan's Upper Nile state to the border with Sudan's White Nile state. After a farmer died when his tractor hit a mine, the listener said, 'People are now avoiding using vehicles for fear of landmines.'[132]

A closer look at the impact of anti-vehicle mines on communities in South Sudan

The following examples are of sites visited by this study's research team, which illustrate both the use and impact of AVMs.

Site visit 1: Lobonok

The research team visited a clearance site operated by NPA outside the town of Lobonok, in an area home to approximately 600 people. The area was contaminated with North Korean ATM 72 mines, and the site had been identified because of an AVM accident involving a bulldozer that had been widening the road

129 Interview with Mechem, Juba, 5 Nov. 2013
130 Interview with NPA, 4 November 2013
131 Interview with Mechem, Juba, 5 Nov. 2013
132 'Landmines kill and maim civilians on Sudan – South Sudan border,' Radio Tamazuj, 19 June 2013 via Landmine Monitor South Sudan Country Profile

to Lobonok. The area had previously been part of one of the SPLA's last major strongholds, and the road leading through a valley landscape was a good tactical setting for AVMs. AVMs were laid along the road, as well as in areas that would have allowed the enemy convoy to pass around an ambush point.

The mine action operators reported that members of the community had been very eager to use the land. Farmers had even risked their lives by planting crops in areas still under clearance to take advantage of the fact that the land had been cleared of vegetation and tilled during demining.[133]

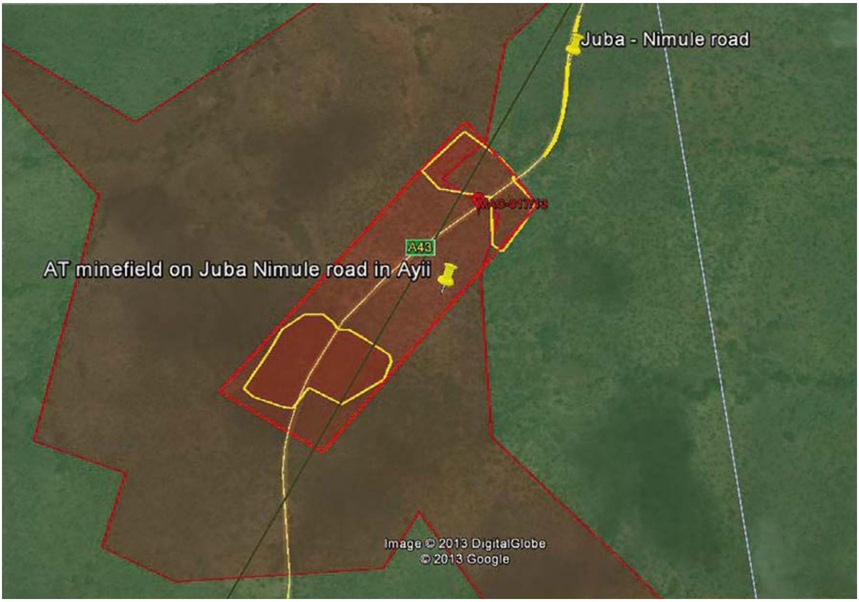
An NPA landmine clearance site near Lobonok containing North Korean ATM 72 mines.

Site visit 2: Ayii

A second site visited during the investigation was near the Juba-Nimule highway, a major road between the capital and Uganda. AVMs were found near a former Sudanese Armed Forces base. Eight of the mines were found by a family in their cassava plantation just a few meters from the highway. It was reportedly a fairly common occurrence for villagers to find AVMs after having used the land for

133 Interview with NPA, 4 November 2014

quite some time without incident. So far, there has been little reported impact when the AVMs are found off the road like this given that heavy machinery is not commonly used. However, as communities develop and start to use vehicles and mechanised farming equipment, the presence of AVMs could have more serious consequences.



The estimated boundaries of a suspected AVM field off of a major road leading from Juba into Uganda.

Site visit 3: Kuda

A third site visited during the study was the larger village area of Kuda, with a population of approximately 7,000 people. YM III AVMs were found in a defensive formation around a former SPLA base. The low metal content of these mines had clearly been problematic because the mines had been missed by a previous clearance operation in this area in 2008. UNMAS and NMAA are currently investigating this particular incident. In Kuda, as in many areas throughout South Sudan, the mines were laid in very close proximity to the villagers, with one actually having been found just outside the front door of a home. Villagers reported that a major reason why so few people had returned to resettle this area after the conflict ceased was due to the extensive contamination.

A MineTech International demining site in Kuda with suspected AVM presence.
The red posts indicate boundaries marking mine presence.

A MineTech International demining site in Kuda with suspected AVM presence.
Demining personnel use the red posts to indicate the boundaries of mine presence.

Conclusion

South Sudan re-entered a period of civil conflict in early 2014, and it is not yet clear how long the instability may last, nor how much of the progress the country has made in terms of rebuilding, mine clearance and development might be undone. Up until now, the greatest impact of AVMs on South Sudan has been its burden on key road networks. The country therefore heavily prioritised major routes for clearance, and achieved great progress through the collective efforts of mine action personnel in the country. In spite of this progress, South Sudan continues to suffer from AVM incidents, with civilian casualties occurring on rural roads and alongside both major and periphery routes. In 2014, as communities displaced by the recent violence are forced to move along possibly unfamiliar paths, they will likely be at an increased risk to becoming victims of the still pervasive threat of AVMs in the country.

South Sudan continues to experience the negative impacts of AVMs in areas ranging from distributing humanitarian aid to resettlement and to agriculture and animal husbandry. The country has little public infrastructure and a great deal of subsistence farming is currently conducted by hand. The possibility exists, therefore, that South Sudan has yet to experience the full impact of its AVM contamination, as some rural communities still manage to coexist with mines. Future infrastructure development projects or the increased use of mechanised farming practices may yet reveal remaining AVM contamination and this could slow South Sudan's efforts to stabilise, progress in its development and eventually prosper.

CONCLUSIONS AND RECOMMENDATIONS

Findings from this study show that the humanitarian and developmental impact of AVMs can increase in the aftermath of a conflict as a state progresses towards recovery. Factors in post-conflict development, such as the return and resettlement of populations, the gradual increase in the number of civilian vehicles for transport and farming, and new state infrastructure projects using heavy equipment, have all been hampered or inhibited by the presence of AVMs.

The significance of the negative impact of AVMs on stability and development should not be understated. In Cambodia, successful development is needed to sustain the country's recovery from previous decades of conflict. In Afghanistan, poverty continues to fuel insurgent uprisings that threaten stability both domestically and regionally. In South Sudan, civil unrest has caused the country to slide back into conflict. While AVMs are certainly not the only challenge faced by these states, the data and examples collected in the context of this study demonstrate that residual AVM contamination is a significant factor inhibiting a more accelerated recovery and development process.

There is already a great deal of evidence available to demonstrate the negative humanitarian and developmental impact of AVMs on civilians, and this study has found that even this data remains significantly incomplete. Both the global overview and country case study investigations brought forth the fact that data gaps exist for a variety of reasons. In over half of the states surveyed in the context of this study, many states could not provide certain estimates of AVM contamination and casualty data simply because it was not effectively differentiated from APM data. There have also been historic lapses in contamination and casualty data collection due to conflict. To this day, sometimes surveyors are not able to gather data because they either cannot access insecure areas or because the AVM contamination goes unnoticed by communities without vehicles living in their midst.

Despite these difficulties, even more can be done to mitigate the impact of these weapons on civilians, as well as improve AVM data collection practices as detailed in the observations and recommendations below. This information stream will continue to inform and build the international community's understanding of the significant negative impact of AVMs on civilians and states and how to effectively act in addressing this unequivocal challenge.

GENERAL OBSERVATIONS AND RECOMMENDATIONS

Observation 1	Recommendation 1
AVMs are in many ways similar in design, function and impact to APMs, yet they are subject to different obligations under international law. Furthermore, their usage could contradict a number of humanitarian principles, including those of distinction and proportionality.	Discussions should continue on further regulating the use of AVMs to comply with existing IHL principles.

Observation 2	Recommendation 2
The case studies described in this report concurred that AVM contamination is much more likely to be missed by survey efforts than APM contamination. This is mainly due to the fact that rural populations in developing countries are less likely to trigger AVMs, as they are less likely to be using vehicles or heavy equipment. This AVM hazard thus becomes more of a risk for these countries in the long-term, with AVM contamination surfacing later to impede development and poverty reduction efforts.	States Parties to the CCW should abide by the requirement to record the geographic coordinates of mines and minefields, i.e. in APII of the CCW. In addition, further restrictions, including a prohibition, on the laying of AVMs outside perimeter marked areas would provide a clear cut and effective means to reduce the impact of AVMs on civilians.

Observation 3	Recommendation 3
Low metal AVMs are often missed by standard surveys, especially when planted alone. Despite deminers' best efforts in a number of countries, many of these mines are still missed by modern clearance methods and continue to pose a great hazard to civilians attempting to develop their land.	If AVM production cannot be deterred or prevented, states should explore ways of ensuring that AVMs produced in the future include measures to enable detectability by humanitarian demining teams, including a minimum metal content specification.

Observation 4	Recommendation 4
Mine risk education specific to AVMs is not conducted in certain countries.	Civilian populations should be educated on the specific hazards posed by the types of AVMs found in their countries, including factors such as usage strategies and characteristics that might caution civilians developing new areas of land and enable their identification.

OBSERVATIONS AND RECOMMENDATIONS RELATING TO DATA COLLECTION

Observation 5	Recommendation 5
There is a limited amount of information specific to AVMs in the public domain. States tend to report on and discuss landmine issues collectively, rather than differentiating between AVMs and APMs.	Greater emphasis should be placed on the distinction between APMs and AVMs, especially considering the existing differences in legal provisions concerning them and the different technical hazards they pose. States should be encouraged to disaggregate their landmine data according to type of contamination, as recommended in the International Mine Action Standards (IMAS). In addition, states should also make these figures available to the public in order to inform open and public debate on the impact of this type of weapon.

Observation 6	Recommendation 6
As found in the case studies of this research, AVM data sometimes cannot be aggregated, not because it is not being collected, but rather because the information cannot be easily extracted from the database of collection forms. The reasons for this seem to be due to the fact that personnel are free to use their own words: 'anti-vehicle mine,' 'anti-tank mine,' 'AT,' 'ATM,' etc. Therefore, when a staff member attempts to aggregate data by searching the database, not all of the reports on hazards or victims emerge.	Both Hazard Reporting Forms and Victim Reporting Forms should be further standardised. There should be a decrease in the reliance on 'free-text entry' for identifying weapon types. A better practice might be to include boxes to check (as Cambodia's forms demonstrate), so that AVM data can be easily aggregated, tracked and reported to the public and the international community.

Observation 7	Recommendation 7
The case studies revealed that it is not easy to determine which AVM features may be causing the greatest negative impact (e.g. size, metal content, fusing structures, etc.). This is because it is not a common practice for states to include the model of the mines in their national reporting systems. While Hazard Report Forms and Victim Report Forms allow personnel to enter whether the mine is an AVM or an APM, some country forms do not include a field for identifying the model of the mine involved in an incident. In countries such as South Sudan, where a wide variety of foreign landmines have been used, it becomes difficult to understand the detailed impact of specific AVM types or characteristics.	It should become standard practice for government and mine action personnel to enter the mine model (if known) in Hazard Reports, Completion Reports and Victim Reports, using a standardised notation format so that the information can be sifted from the database. As this dataset grows, it will allow the international community to gain a better understanding of the details or characteristics of the effects of specific AVM types in order to help mitigate their effects on civilians.

APPENDIX

ANTI-VEHICLE/TANK MINE TYPES AND MANUFACTURING COUNTRIES AS OF 2011[134]

Important note: This list is historic and should not be deemed absolute or complete. The majority of the mines are now no longer in production and several of the countries listed have banned the production of mines altogether.

Mine	Type
Albania	
MKTBT	Anti-Tank Blast
MKT Mod 72	Anti-Tank Blast
Austria	
ATM 6	Anti-Tank Off route
ATM-7	Anti-Tank Off route
ATM-75, Model 67	Anti-Tank Blast
ATM 96	Anti-Tank Shaped Charge
ATM 2000E (Pz Mi 88) and ATM 2000	Anti-Tank Shaped Charge
AVC 100	Anti-Vehicle Directional Fragmentation
AVC 195	Anti-Vehicle Directional Fragmentation
Argentina	
FMK-3	Anti-Tank Blast
FMK-5	Anti-Tank Blast
Belgium	
PRB M3/A1	Anti-Tank Blast
PRB-111	Anti-Tank Blast
Brazil	
AC NM AET1	Anti-Tank Blast
T-AB-1 (AT)	Anti-Tank Blast
Bulgaria	
PTM-80P	Anti-Tank Blast
TM-62M PZ (TM-62P3)	Anti-Tank Blast
TMD-1	Anti-Tank

134 Source: IHS Jane's Mines and Explosive Ordnance Disposal © 2011 IHS www.ihs.com/products/janes

Chile	
Cardoen Anti-Tank	Anti-Tank Blast
MAT 84-F5	Anti-Tank Blast
MP-APVL 83-F4	Anti-Tank Fragmentation
China	
SATM	Anti-Tank Shaped Charge
Type 72 'Non metallic'	Anti-Tank Blast
Type 72 'Metallic'	Anti-tank Blast
Type 84	Anti-Tank Shaped Charge
Cuba	
AT Mine	Anti-Tank Blast
Former Czechoslovakia	
Na-Mi-Ba	Anti-Tank Blast
PT Mi-Ba	Anti-Tank Blast
PT Mi-Ba-II	Anti-Tank Blast
PT Mi-Ba-III	Anti-Tank Blast
PT Mi-D	Anti-Tank Blast
PT Mi-K	Anti-Tank Blast
PT Mi-P	Anti-Tank Shaped Charge
TQ-Mi	Anti-Tank Blast
Czech Republic	
PD Mi-PK	Anti-Tank Off Route
PT Mi-D1 & PT Mi-D1M	Anti-Tank Shaped Charge
PT Mi-U	Anti-Tank Shaped Charge
Egypt	
FBM	Anti-Tank Blast
M/71	Anti-Tank Blast
M/80	Anti-Tank Blast
T-93	Anti-Tank Shaped Charge
TC/6	Anti-Tank Blast
France	
HPD	Anti-Tank
Finland	
MSM MK2 (PM-87)	Anti-Tank Blast
TM-65 & TM-65/77	Anti-Tank Blast
Germany	
AT2	Anti-Tank Shaped Charge
DM 11 (AT)	Anti-Tank Blast
DM 21	Anti-Tank Blast
MIFF	Anti-Tank Shaped Charge
PARM 1	Anti-Tank Off Route Shaped Charge
PARM 2	Anti-Tank Off Route Shaped Charge

Germany *(cont.)*	
PM-60	Anti-Tank Blast
Riegel Mine 43	Anti-Tank Blast
Tellermine 35	Anti-Tank Blast
Tellermine 42	Anti-Tank Blast
Tellermine 43	Anti-Tank Blast
Hungary	
HAK-1	Anti-Tank Shaped Charge
UKA-63	Anti-Tank Shaped Charge
India	
Adrushy	Anti-Tank Blast
Mine Anti-tank 'Non-Detectable' 1A	Anti-Tank Blast
Mine Anti-tank 'Non-Detectable' 3A	Anti-Tank Blast
International	
ARGES (MACPED)	Anti-Tank Off Route
ATIS	Anti-Tank Blast
Iran	
M19	Anti-Tank Blast
YM-II	Anti-Tank Blast
YM-III	Anti-Tank Blast
Israel	
No 6	Anti-Tank Blast
Italy	
BAT/7	Anti-Tank Shaped Charge
MAT/5	Anti-Tank Blast
MAT/6	Anti-Tank blast
MATS/1.4	Anti-Tank Blast
MATS/2	Anti-Tank Blast
MATS/2.6	anti-Tank Blast
SB-MV/1	Anti-Tank Shaped Charge
SBP-04	Anti-Tank Blast
SBP-07	Anti-Tank Blast
TC/2.4	Anti-Tank Blast
TCE/6	Anti-Tank Blast
VS-3.6	Anti-Tank Blast
VS-AT4 and VS-AT4-EL	Anti-Tank Blast
VS-HCT	Anti-Tank Shaped Charge
VS-HCT2	Anti-Tank Shaped Charge
VS-HCT4	Anti-Tank Shaped Charge
VS-SATM1	Anti-Tank Shaped Charge

Japan	
Type 63 (AT)	Anti-Tank Blast
Type 93	Anti-Tank Blast
Korea, North	
ATM-44	Anti-Tank Blast
ATM-46N	Anti-Tank Blast
ATM-72	Anti-Tank Blast
ATM-74	Anti-Tank Blast
Korea, South	
K441 and K442	Anti-Tank Shaped Charge
M19	Anti-Tank Blast
Montenegro	
TMM-1	Anti-Tank
Netherlands	
NR 25	Anti-Tank Blast
NR 26 and NR 26C1	Anti-Tank Blast
Type 2, T40	Anti-Tank Blast
Pakistan	
P2 Mk 2 (AT)	Anti-Tank Blast
Peru	
MGP-30	Anti-Tank Blast
MGP-31	Anti-Tank Blast
Poland	
Kasia 100	Anti-Tank Off Route
Kasia 170	Anti-Tank Off Route
Kasia 2 x 100	Anti-Tank Off Route
MN-111	Anti-Tank Shaped Charge
MN-121	Anti-Tank Shaped Charge
MN-123	Anti-Tank Blast
MPB	Anti-Tank Off Route
MPP-B 'Wierzba'	Anti-Tank Blast
Portugal	
M453	Anti-Tank Blast
Romania	
MAT-62B	Anti-tank blast
MC-71	Anti-Tank Shaped Charge
MAT-76	Anti-Tank Blast
Russian Federation	
PGMDM/PTM-1S/PTM-1G	Anti-Tank Blast
PMK-1	Railway Mine
PTM-3	Anti-Tank Shaped Charge
TM-46/TMN-46	Anti-Tank Blast

Russian Federation *(cont.)*	
TM-57	Anti-Tank Blast
TM-62B	Anti-Tank Blast
TM-62M	Anti-Tank Blast
TM-72	Anti-Tank Shaped Charge
TM-83	Anti-Tank Off Route
TM-89	Anti-Tank Shaped Charge
TMD-44	Anti-Tank Blast
TMD-B	Anti-Tank Blast
TMK-2	Anti-Tank Shaped Charge
Serbia	
TMM-1	Anti-Tank
Singapore	
STM-1	Anti-Tank Blast
Slovakia	
PT Mi-Ba	Anti-Tank Blast
South Africa	
Intelligent Horizontal Mine	Anti-Tank Off Route
No 8	Anti-Tank Blast
'Non-metallic' anti-tank mine 'Malapa'	Anti-Tank Blast
Spain	
C-3-A/B	Anti-Tank Blast
Sweden	
FFV -16 (Fordonsmina 14)	Anti-Tank Off Route
FFV -028 (Stridsvagnsmina 6)	Anti-Tank Shaped Charge
Model 41-47	Anti-Tank Blast
Model 47	Anti-Tank Blast
Model 52	Anti-Tank Blast
Turkey	
M19	Anti-Tank Blast
United Kingdom	
Adder, Addermine	Anti-Tank Off Route
Barmine	Anti-Tank Blast
Mk 5	Anti-Tank Blast
Mk 7	Anti-Tank Blast
United States	
BLU-91/B 'Gator'	Anti-Tank Shaped Charge
M1A1	Anti-Tank Blast
M6A2	Anti-Tank Blast
M7A2	Anti-Tank Blast
M15	Anti-Tank Blast

United States *(cont.)*	
M19	Anti-Tank Blast
M21 'heavy anti-tank mine'	Anti-Tank Shaped Charge
M24	Anti-Tank (HEAT warhead)
M75	Anti-Tank Shaped Charge
RAAM (M70)	Anti-Tank Shaped Charge
SLAM	Anti-Tank Off Route
Former Yugoslavia	
KB-PTM (Ababeel)	Anti-Tank Shaped Charge
TMA-1A	Anti-Tank Blast
TMA-2	Anti-Tank Blast
TMA-3	Anti-Tank Blast
TMA-4	Anti-Tank Blast
TMA-5	Anti-Tank Blast
TMD-1/2	Anti-Tank Blast
TMM-1	Anti-Tank Blast
TMRP-6	Anti-Tank Shaped Charge
TMRP-7	Anti-Tank Shaped Charge

p 1: HALO Trust
p 4: Alun McDonald
p 9: Carl Montgomery
p 11: HALO Trust
p 17: Carl Montgomery
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p 43: HALO Trust
p 52: MACCA
p 53: MACCA
p 54: MACCA
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p 87: Alun McDonald
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