This is the fourth in a series of articles on bullet resistant vests by Deon du Plessis, MD of Bullet Proofing Technology (Pty) Ltd, in which he discusses the most common firearm threats in South Africa, and how those must be used to judge what is and isn't compliant to local standards. His business manufactures a wide range of body armour plates and vehicle armour, and supplies a number of other bullet resistant vest manufacturers.

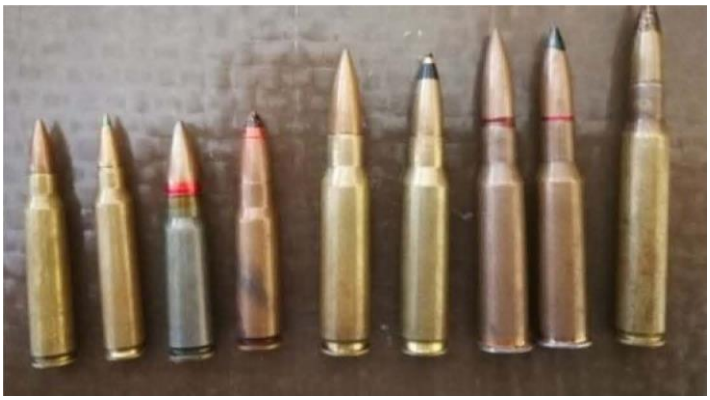
Every country is different, so our testing standards must reflect the situation here

Threat levels in South Africa

1 . Threat Levels in South Africa

The Threat Level regarding BRV's is an analysis of the typical guns and ammunition being used in the country or area in which the body armour will be used. It is an indication of what the types of guns and bullets are that the BRV could encounter This differs from country to country, time to time and even depends on the type of criminal or military threat applicable. In South Africa the main threat has always been mostly handguns (75%), and this has remained unchanged for the past 30+ years. What has, however, changed is that whereas in the years 1980 — 2010, the other 25% was mostly Soviet-sourced military guns such as the AK-47. This has **now changed to our own SAPS (R5) and SANDF (R4) 5,56 x 45 calibre rifles. The LM4 and LM5 civil variants of these guns are also commonly used by security companies. This** calibre of bullet (5,56 x 45 Ball) is now the most common rifle threat in South Africa, with the older AK-47s being encountered less.

The current threat scenario in South Africa is based on the analysis of the newest statistics regarding the guns and ammunition used in criminal acts.



Range ofsome rifle bullets used in specifications.

1. Standards

Our own Ballistic test standard for body armour in South Africa, "SANS 16582007 Ballistic Resistance of Body Armour", was based on our own threat scenario when last updated in 2007, but as our threat scenario has changed

since then, our SANS specification needs to be updated to reflect this, which is currently underway.

Table 1. Prevalence ofillegally used arms in South Africa

Calibre	Prevalence (%)	Grouping
.32	16,7	
.38	23,5	
9mm	19,6	75
.45 ACP	6	
All other handguns		
Shotguns		
.223 (5,56 x 45)	14,8	
AK-47 7,62 x 39		21,6%
All other rifles		

In each country this threat scenario is different and is a very good reason not to use specifications from the USA, Europe, UK, China, and Russia to specify the performance of body armour to be used in South Africa. Most of the internationally recognised specifications such as NIJ 0101, UK PSDB, German Technische Richtlinie, CEN prEN ISO 14876-2 and the Russia-GOST R 50744, are all very professional specifications, but none of them reflects our South African threat scenario as it currently is. The NIJ standard sets a very good testing protocol which is practical and repeatable and very good as a reference document for handgun armour, but it lacks severely in its coverage of the current high level (21 ,6%) of rifle threat in South Africa, which is mostly based on the 5,56 x 45 calibre bullets. This bullet type is not even included in the current version of the American NIJ standard at all!

So, what do we need to consider when deciding what our own Bullet Resistant Vests should be able to protect us against, which might not be specified in international specifications?

a) Our rifle threat level should include 5,56 x 45 Ball bullets (R4 and R5) at the correct velocities.

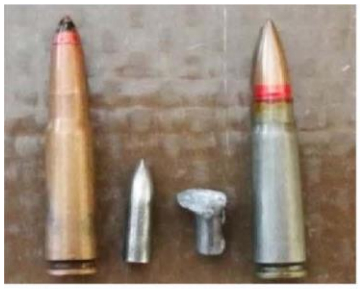
b) Our rifle threat level should still include 7,62 x 39 Ball bullets (AK-47) at the correct velocities, as this is still a very real threat in South Africa.

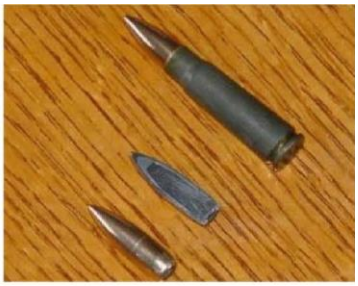
c) The NIJ Standard specifies 6 x test shots per hard armour plate, while most of the other standards specify 3 x shot. To this author's knowledge, the most rifle shots ever to impact a body armour plate in an actual case was 3 x shots, so maybe 6 x shots is unreasonable, depending on the implication of this on weight and/or price.

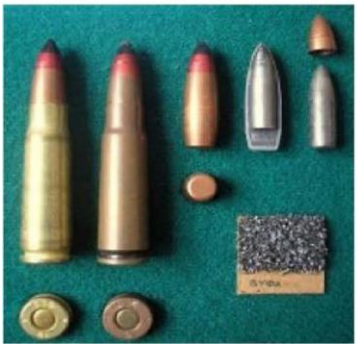
d) Our own SANS Standard is only a Ballistic Testing standard and is not compulsory. This means that anybody may (and does) sell body armour in South Africa that either complies to no standard, or complies some other country's standard, or, worst of all, complies to their own homemade standard, which is actually no standard at all, but just a misrepresentation to sell sub-standard BRVs to uninformed users. Foremost of these is what has jokingly become known as the "Boksburg Standard", used by many suppliers of steel-based body armour plates to sell their own so-called Level Ill, Level IV and Level 5 standard products, which are not official or recognised anywhere.

e) Refer to the bullet types encountered in South Africa. A good example of this is the case of the AK47 common or Ball bullet. The Soviets needed to make this bullet as cheaply as possible, so the core of the bullet is mild steel, and not lead as in most other bullets. This has the drawback that it causes less damage to human tissue as the mild steel core is too hard to "mushroom", thereby not concentrating all its energy in the target or body. This makes it a less effective "killing" bullet, but it still causes injuries which require hospitalisation, which is its main purpose. Due to its hardness and less mushrooming effect, it is, however, a more penetrating bullet of modern UHMWPE "Ultralight" armour plates. This same bullet is also a very common sporting calibre, for which commercial ammunition with a lead core is used. It now happens that some suppliers, particularly those supplying imported plates, use the lead-cored AK-47 bullets for their testing, while our locally found,

Soviet or Chinese sourced AK-47 bullets used by the criminals have mild steel cores, which are not so easy to stop on lightweight armour plates. This difference between the Western-sourced vs. the Eastern sourced types of AK-47 bullets therefore needs to be well considered and taken note of.







7,62 x 39mm (AK-47)
Low cost, low velocity
•Mild Steel core
in Ball bullet •
Hardened Steel core
in API bullet

1. Ballistic Testing

While researching, developing, and drafting the American NIJ Standard from 1960 to 1975. The American Government NILECJ organisation (predecessor of the NIJ) developed a ballistic test protocol based on a lot of field study of actual cases. By duplicating them in the test laboratories and evaluating testing systems and equipment, they set the testing protocol used by most standards for testing of body armour today. They based their system on using a large and heavy block of nonhardening oil-based modelling clay (Plastilina as they call it in the Standard). The block should be at least 61 Omm x 610mm x 140mm of solid clay in a metal or wood box. The weight of this block is at least 88kg, more or less what a human weighs. This clay should have a very specific composition so that its hardness falls within precise parameters when tested in accordance with the requirements of the NIJ Standard. This calibration or hardness verification should be performed every time when performing a test.

This clay block is not an exact replica of the human body but serves as a practical and repeatable simulant. It has the secondary advantage that any shock transferred to the clay (body simulant) leaves a dent in the clay, which can be measured as an indication of the force or 'Blunt Trauma" transferred to the body. The maximum dent depth is then also specified as a conformance requirement of the body armour or BRV. This method thereby assures that the body armour can stop the bullet and also absorb the majority of the force of the bullets impacting the armour.

A very important part of the ballistic testing is also to ensure that the bullets used comply to the requirement regarding type, weight and velocity. The velocity of each bullet is therefore measured on every shot to ensure compliance. This is very important as it is very easy to download ammunition to travel at lower velocities than those specified, which is based on what is real in the actual world outside the laboratory. The length of the gun barrel also has a very big influence on the bullet velocity.

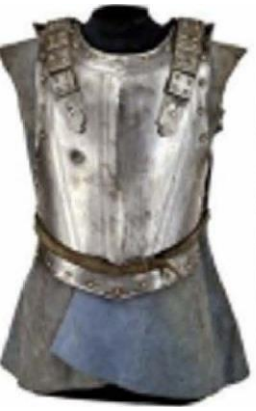
As a good example which is very relevant in South Africa, let's discuss the case of the R4, R5 and steel-based.

Bullet Resistant vests

armour plates. The R4 and R5 guns are very similar, except that the R5's barrel is shorter than that of the R4. The muzzle velocity of same standard 55gn FMJ bullet fired from an R4 is typically 955m/s while it is only 775m/s when fired from an R5 rifle. This bullet is extremely effective in penetrating armour steel at velocities higher than 930m/s, such as when fired from an R4 rifle. It in fact takes a 9mm thick armour steel plate of 500HBN to stop this bullet. When this same bullet is fired from an R5 rifle, the lower muzzle velocity (shorter barrel) means that even 6mm thick armour steel of the same 500HBN hardness will stop the bullet.

Presenting a ballistic test report, does not mean that all body armour manufactured by this company will pass ballistic testing. The SAPS, SANDF and Correctional Services require random 1/100 ballistic testing on all BRVs supplied to them, which has a cost implication, but does provide surety to the users and covers the company managers and buyers legally. All other test reports presented are merely test reports on BRVs or components as presented for testing. If any buyers wish to obtain surety that the products work, the best way is to make it a supply condition that one or more delivery samples should be randomly selected by the user or independent witnessing authority for inspection and ballistic testing, witnessed by the same independent authority. Armscor QC does this function for the SAPS, SANDF and Correctional Services, at a fee of course.

Testing then



1. Testing authorities

There are not many registered and recognised ballistic testing facilities in South Africa. It is, however, necessary to perform ballistic testing at one of the few recognised facilities to ensure that the testing and measuring is done correctly and that the buyer knows what they are paying for, as well as to ensure thar the user can trust his/her life to the product they are wearing. The recognized testing facilities in South Africa are: -

a) SABS Ballistic Laboratories. Unfortunately they do not have all the ammunition types available, but they can do commercial testing correctly against most threat levels.

b) Armscor Quality Control. They do not have their own test facilities but can and do professional ballistic testing witnessing on other ballistic test ranges.

c) Armscor Armour Development. They are the experts in armour development and testing in South Africa, but unfortunately do not currently have a ballistic testing facility for body armour testing. They can, however, do test witnessing at any of the other ballistic test laboratories.

d) Private development and testing ranges of body armour manufacturers. Many of the renowned and established body armour manufacturers have their own ballistic test laboratories where they can test correctly. These are currently BBA, Sirdicks, Pasadena, BPT and ZebraSun.

e) Private SANAS-accredited ballistic test laboratory. Currently BPT is the only SANAS-accredited ballistic test laboratory in South Africa. They can perform commercial ballistic acceptance and verification tests for users and manufacturers requiring certified testing results to SANS 1658:2007 (Body Amour), ENI 523 (Structures) and STANAG 4569 (vehicles) Standards.

f) Firing ranges are very prevalent all over South Africa, but these are registered as "firing ranges" and not as body armour testing facilities. These are 2 x very different requirements.

Testing now