CBJ Tech AB

Bullet performance test

A side-by-side comparison of the 6.5x25 CBJ Ball vs. the 5.56x45 NATO against a realistic target, likely to be encountered in a combat situation

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Purpose

The purpose of this test is to compare the wound effect of the 6.5x25 CBJ with that of the 5.56x45 when fired at a simulated combatant under realistic conditions. Firing into a bare test medium, e.g. ordnance gelatin, ballistic soap etc., is not a realistic simulation of combat conditions, because in almost every case there will be barriers which the bullet has to penetrate before it can reach soft tissues and do damage. In today's warfare, not all combatants carry ballistic protection, even if the percentage that do increases. However, all combatants will at least be clothed and most will carry combat gear on their body, for example a weapon on the chest, magazine pouches, grenades, flashlight, harness etc. In fact, a soldier in full combat gear will have most points of the torso and abdomen covered with some piece of equipment. An illustrative example of such combatants is given in Figure 1.

Figure 1: Soldiers in full combat gear.

For a weapon to be reliably effective, it has to fire a bullet that can penetrate any equipment carried, and possibly ballistic protection, and still travel deep enough through soft tissue and bone to hit vital organs in order to reliably incapacitate.

In order to test bullet performance against a target which is both difficult to defeat as well as very likely to appear on the battlefield, we chose to simulate a uniformed combatant who carries a common ballistic protection and combat gear, and is shot through a pouch holding a filled magazine.

Test procedure

The test pack used for this simulation comprises five separate parts, which are as follows in order of the direction of the bullet:

1. A fabric magazine pouch which holds one layer of steel magazines (Swedish Carl Gustaf model 45B) filled with empty 9x19mm cases (no live ammunition for safety reasons), as is shown in Figure 2.
2. One layer of fabric straps simulating the harness to which the pouch would be attached.
3. Ballistic protection consisting of the NATO CRISAT panel, which is a 1.6mm grade 5 titanium plate in front of 20 layers of aramid (Kevlar).
4. A piece of heavy cotton cloth simulating the uniform jacket.
5. A 24x20x34cm (WxHxL) block of 10% ordnance gelatin shot at 4°C, simulating the combatant's body.

Figure 2: The pouch holding the filled magazines.

The different elements of the test pack are put together in the same manner as they would be carried in reality, which can be seen in Figure 3.

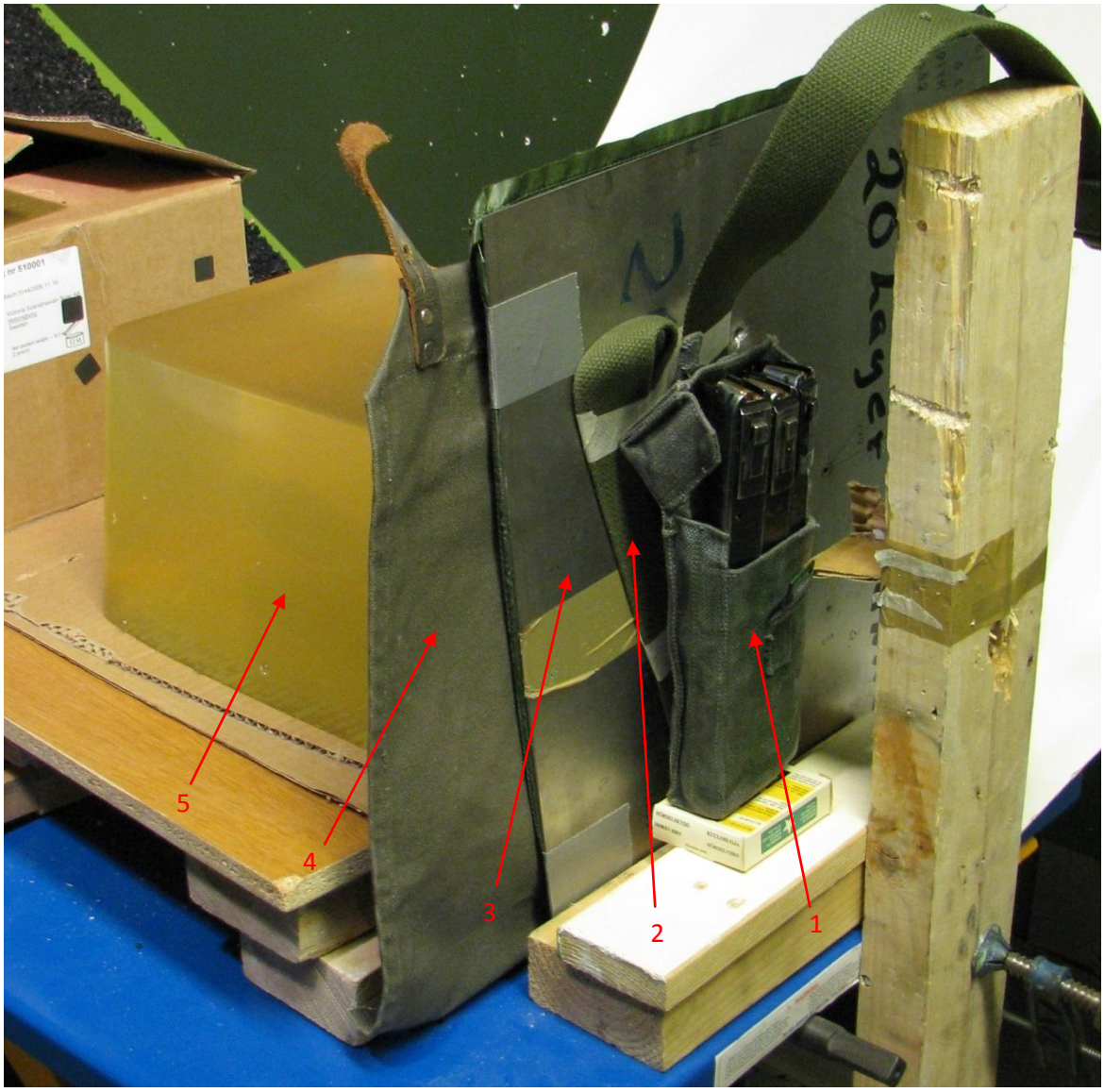

Figure 3: The complete test pack. 1: Magazine pouch 2: Straps 3: CRISAT panel 4: Uniform cloth 5: Ordnance gelatin block.

Against this test pack two shots were fired from a distance of 8 meters which were placed ca 4cm vertically offset from each other. The cartridges tested were as follows:

Shot 1: The 6.5x25 CBJ Ball cartridge shot from the CBJ MS, with a 200mm barrel.

Shot 2: The 5.56x45 SK5 cartridge, which is the official Swedish Ball service cartridge for the armed forces, which has a bullet consisting of a lead core and a steel penetrator enclosed by a full metal jacket, and is equivalent to the US M855 cartridge. The weapon used was a FN FNC with a 449mm barrel.

Results of shot 1 (6.5x25 CBJ):

The muzzle velocity was measured to 843m/s (using a BMC 21a chronograph from Werner Mehl Kurzzeitmesstechnik). The bullet pentrated the gear, ballistic protection and the entire block of gelatin (34cm) before exiting at the upper rear edge of the block. The effect of the bullet through its entire path is displayed in Figures 4-13.

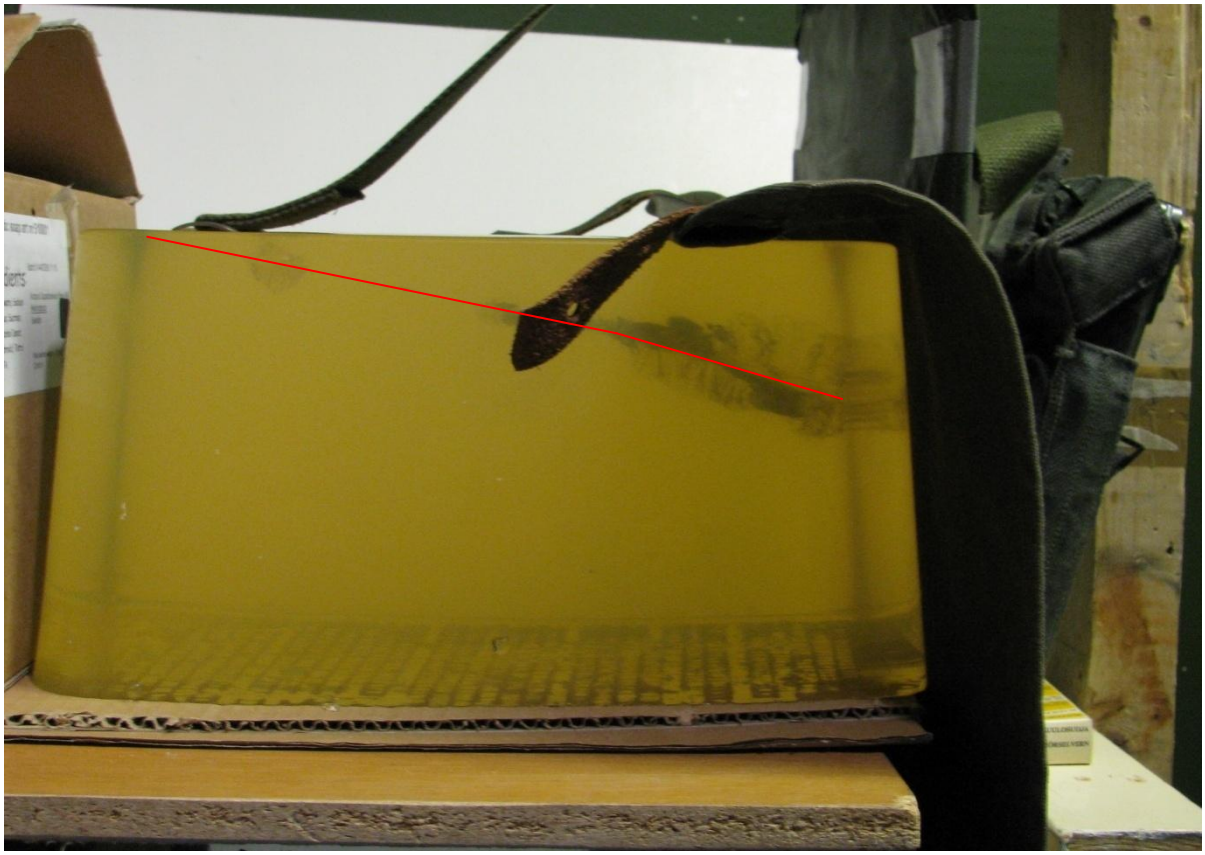

Figure 4: The entire test pack penetrated by the 6.5x25 CBJ Ball. The bullet path is illustrated by the red line.

Figure 5: Point of impact indicated by the red arrow.

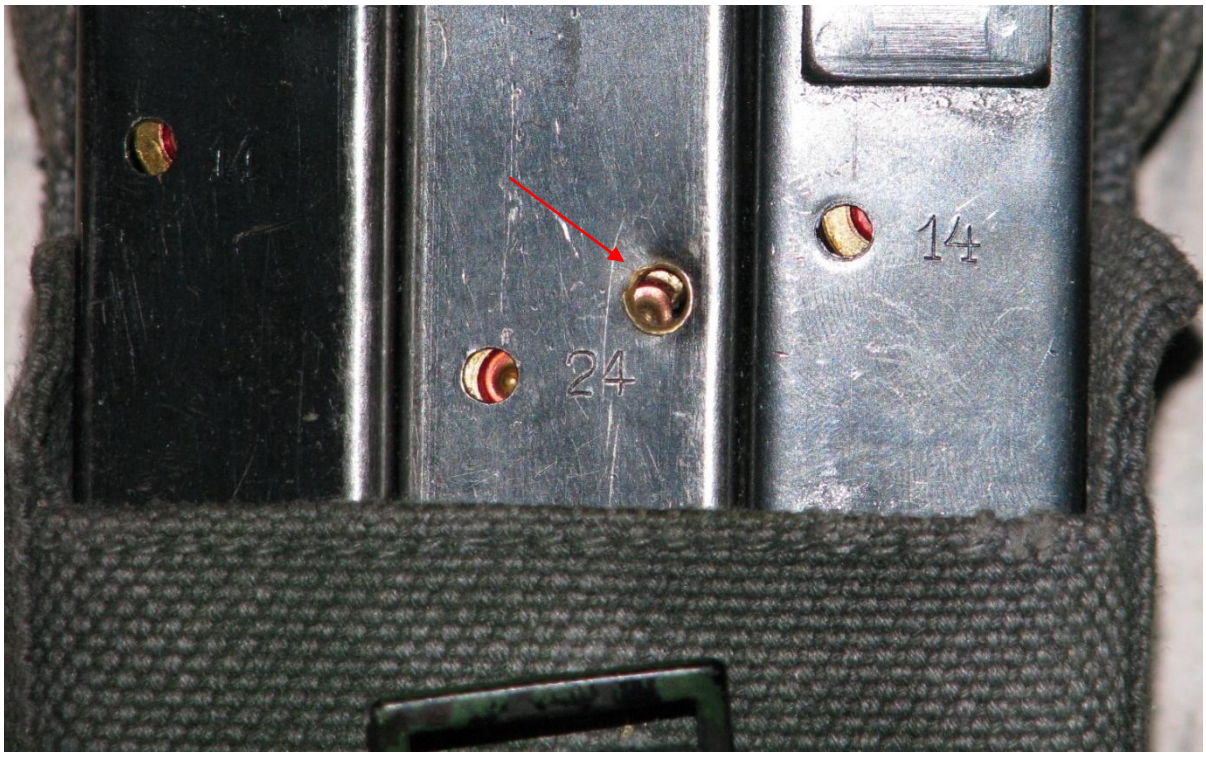

Figure 6: The entry hole in the magazine, indicated by the red arrow (magazine is partly extracted from the pouch).

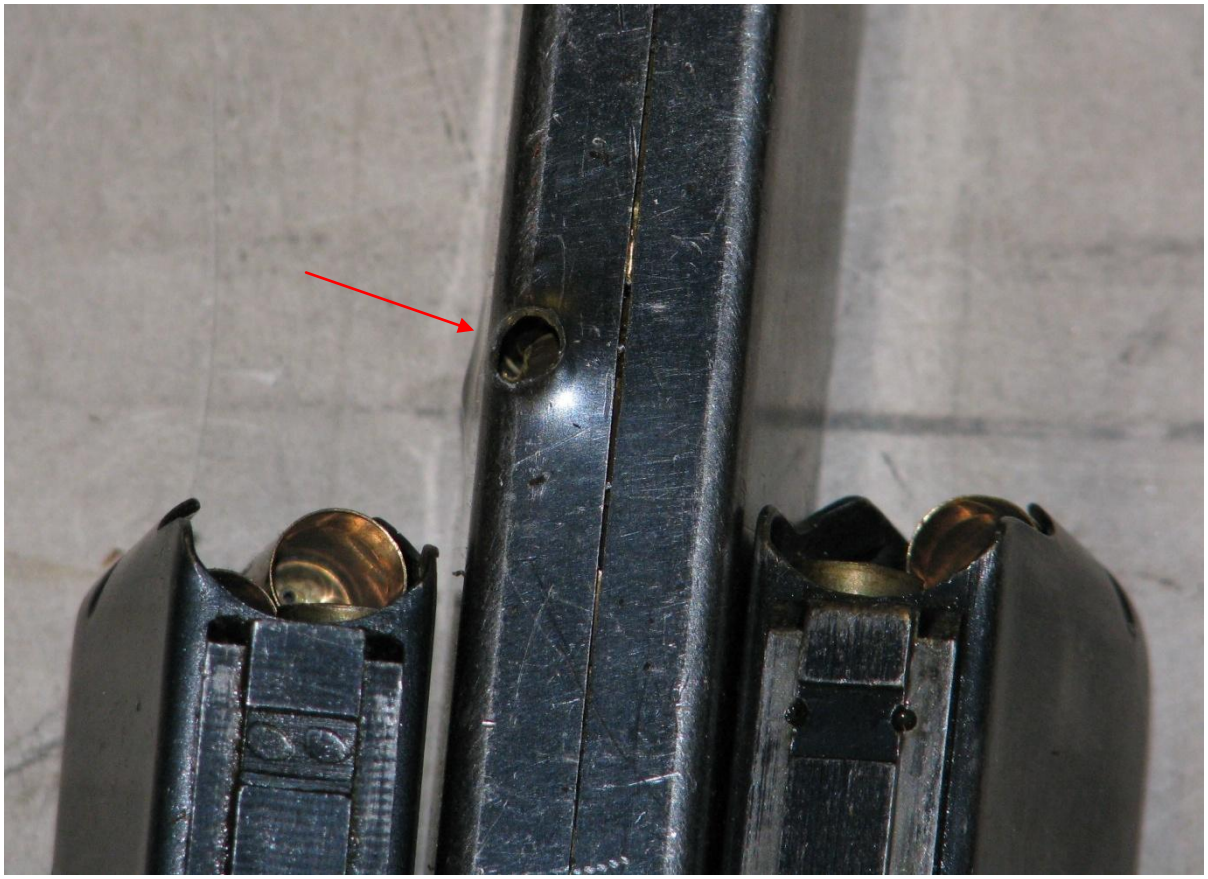

Figure 7: The exit hole in the magazine, indicated by the red arrow.

Figure 8: The bullet hole in the strap, indicated by the red arrow but barely visible.

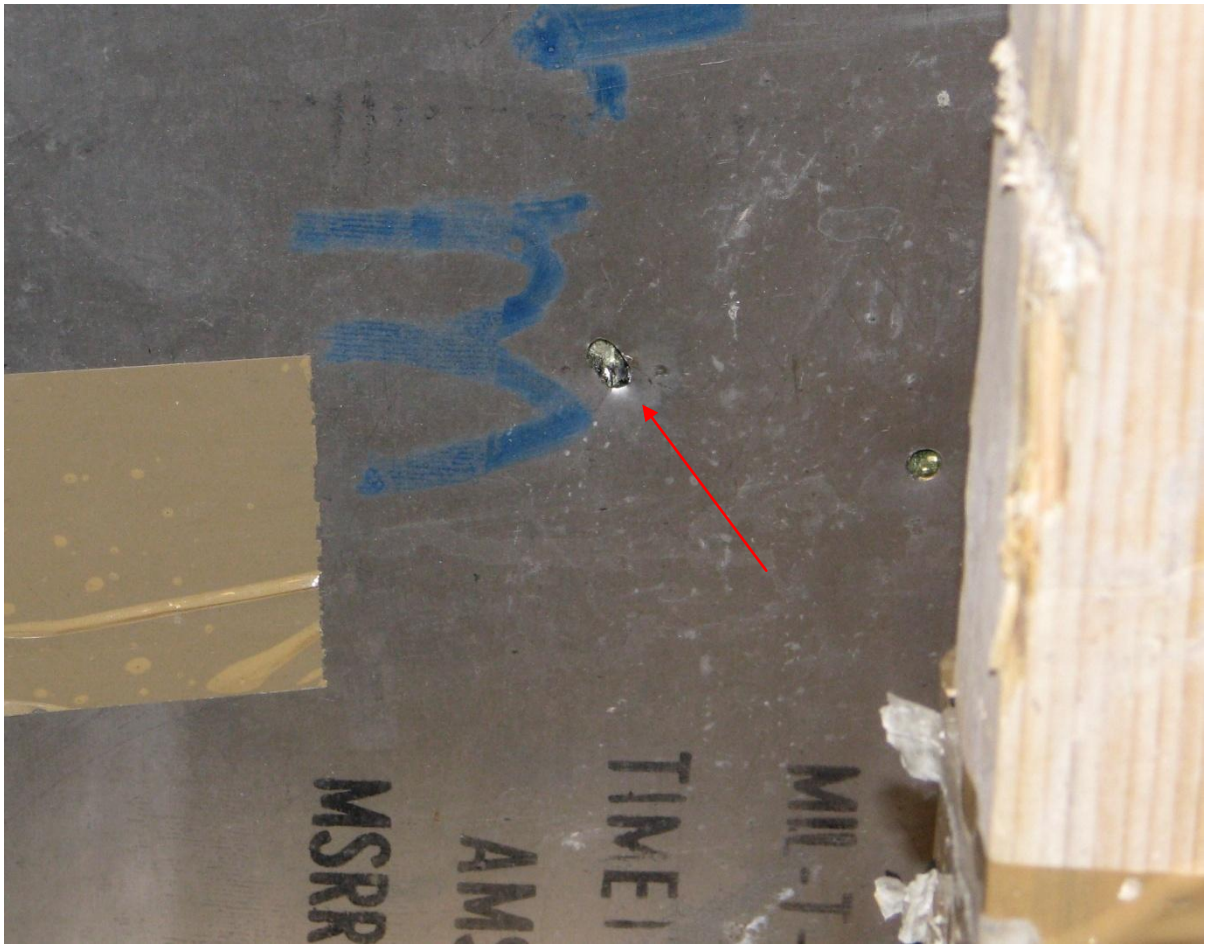

Figure 9: The entrance hole in the CRISAT panel, indicated by the red arrow.

Figure 10: The exit hole in the CRISAT panel.

Figure 11: The bullet hole in the uniform cloth.

Figure 12: The gelatin block (34cm) seen from the side, bullet direction is from right to left with the bullet path illustrated by the red line.

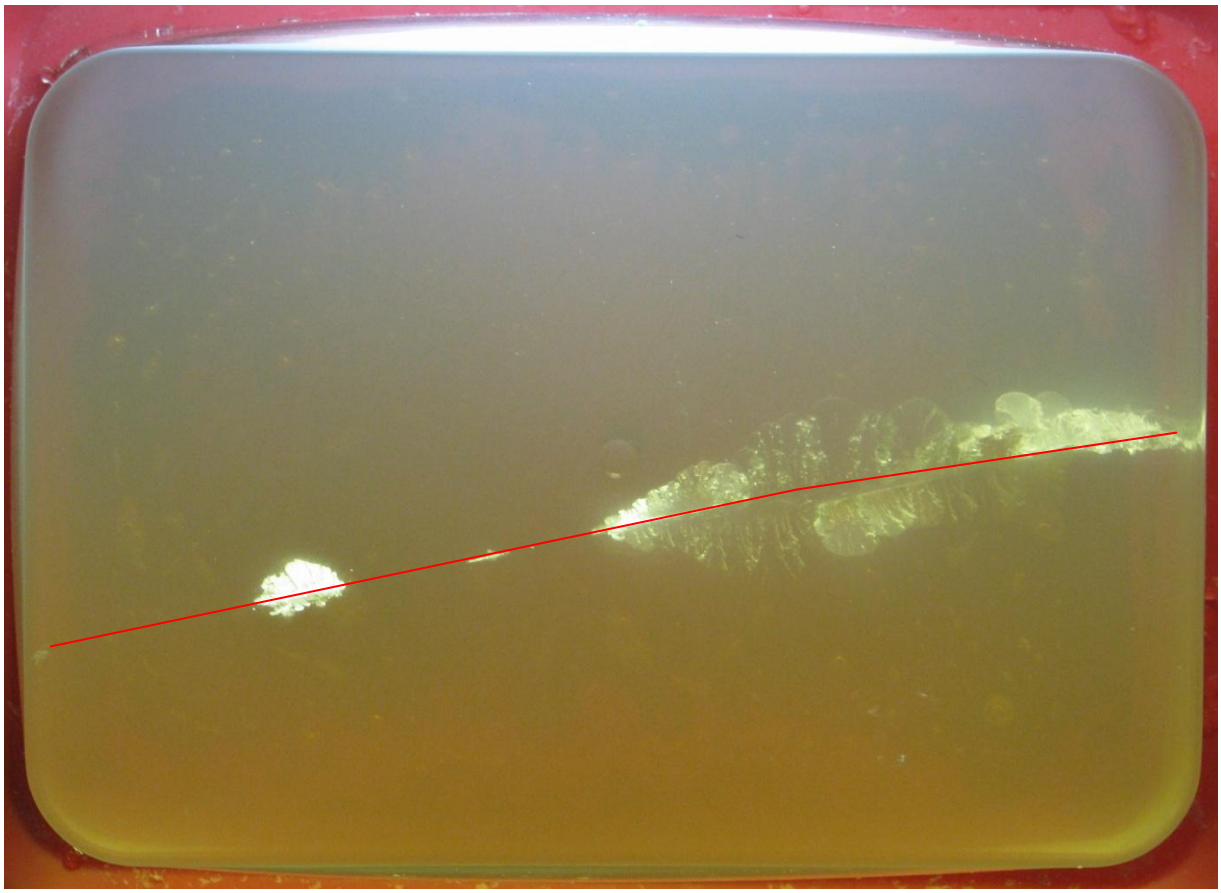

Figure 13: The gelatin block seen from above, bullet direction is from right to left. The bullet path is shown by the red line.

Results of shot 2 (5.56x45)

The muzzle velocity was measured to 917m/s, and the point of impact was 40mm straight below that of the 6.5x25 CBJ Ball. When passing the magazine, the 5.56 bullet fragmented resulting in severe damage of the magazine, the rear of the pouch and the straps behind it. Parts of the bullet penetrated the 1.6mm titanium plate of the CRISAT, but were stopped by the layers of Kevlar and hence did not enter the gelatin at all. The effect of the 5.56 bullet along its path is displayed in Figures 14-24.

Figure 14: The test pack after being shot with the 5.56x45.

Figure 15: The point of impact is indicated by the red arrow.

Figure 16: The severe damage to the equipment after the bullet has fragmented.

Figure 17: Exit hole in the magazine pouch of 1: 5.56x45 and 2: 6.5x25 CBJ Ball as is indicated by the red arrows.

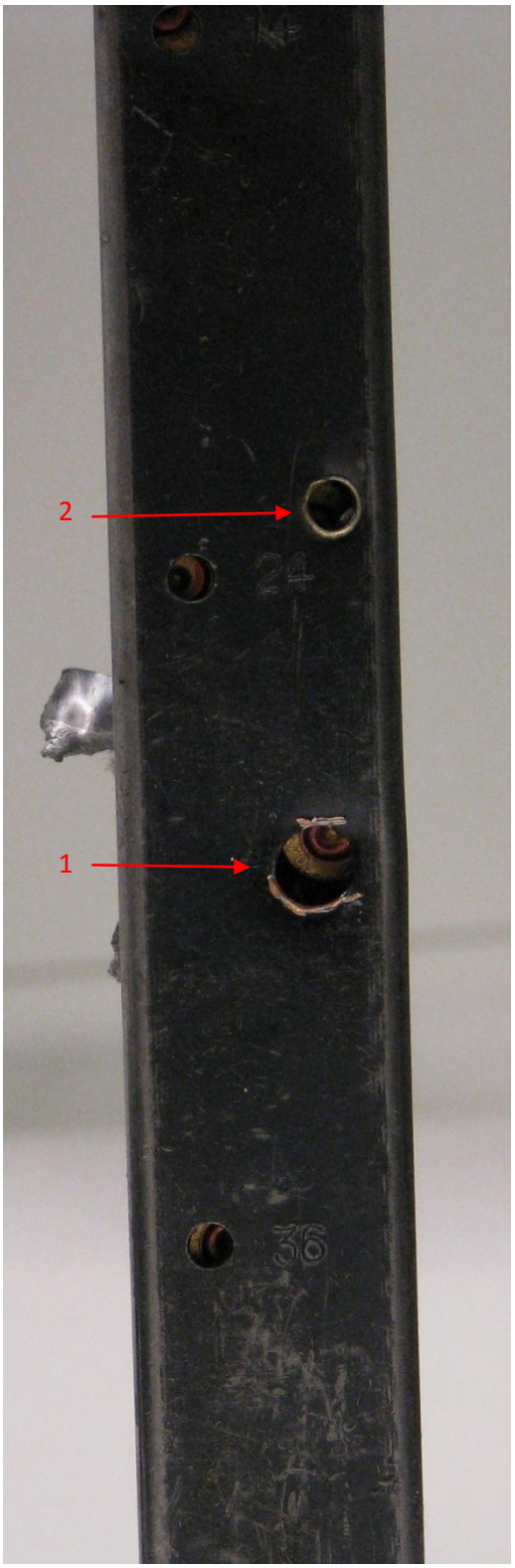

Figure 18: Entry hole in the magazine of 1: 5.56x45 and 2: 6.5x25CBJ Ball as is indicated by the red arrows.

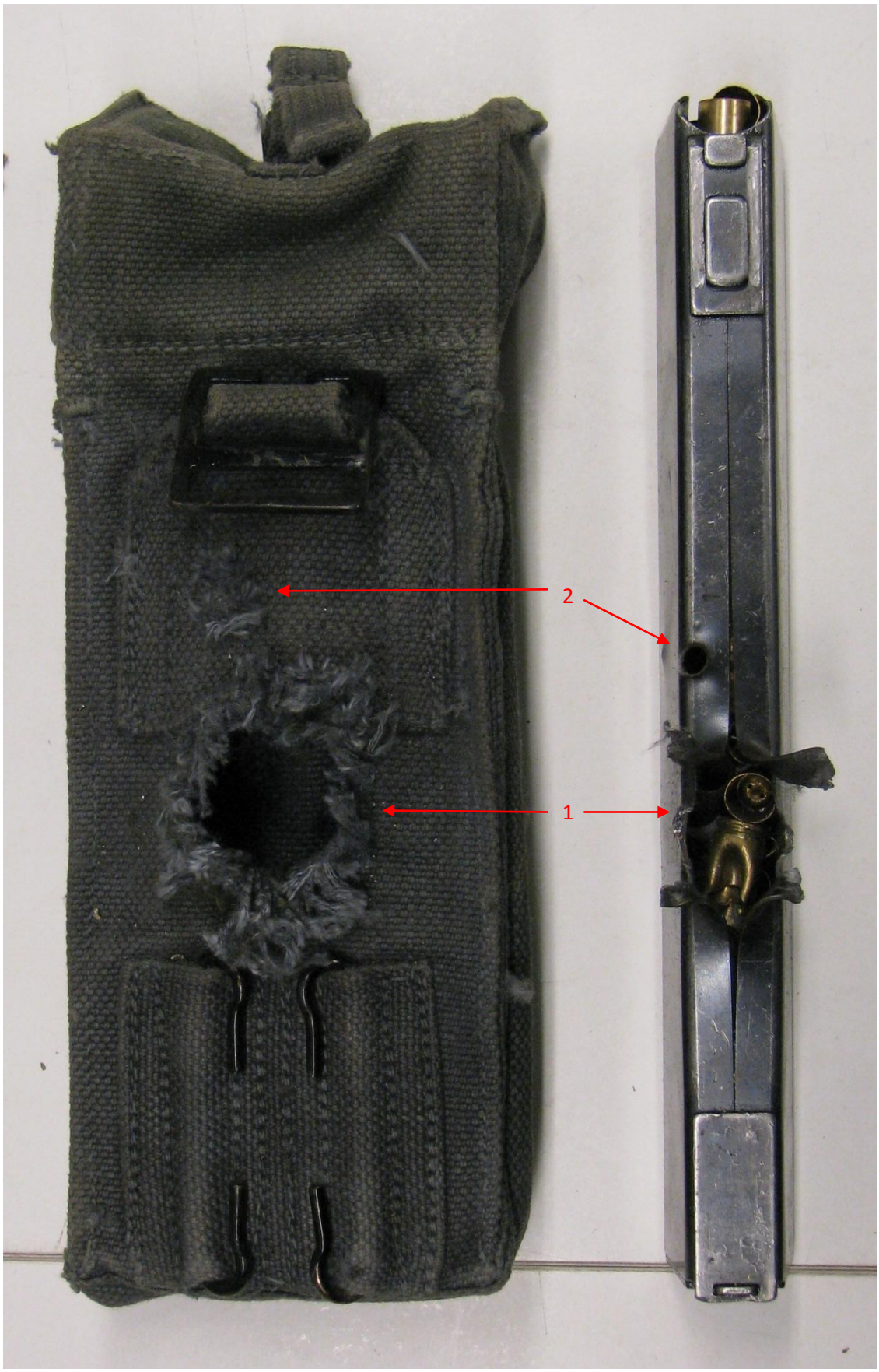

Figure 19: Exit holes of 1: 5.56x45 and 2: 6.5x25 CBJ Ball as is indicated by the red arrows.

Figure 20: Damage to the straps behind the magazine pouch clearly visible.

Figure 21: The impact of parts of the 5.56 bullet in the 1.6mm titanium plate.

Figure 22: The back of the CRISAT panel. The Kevlar has been strained, but the bullet did not penetrate.

Figure 23: The uniform cloth behind the CRISAT panel. As can be seen, no part of the bullet has penetrated.

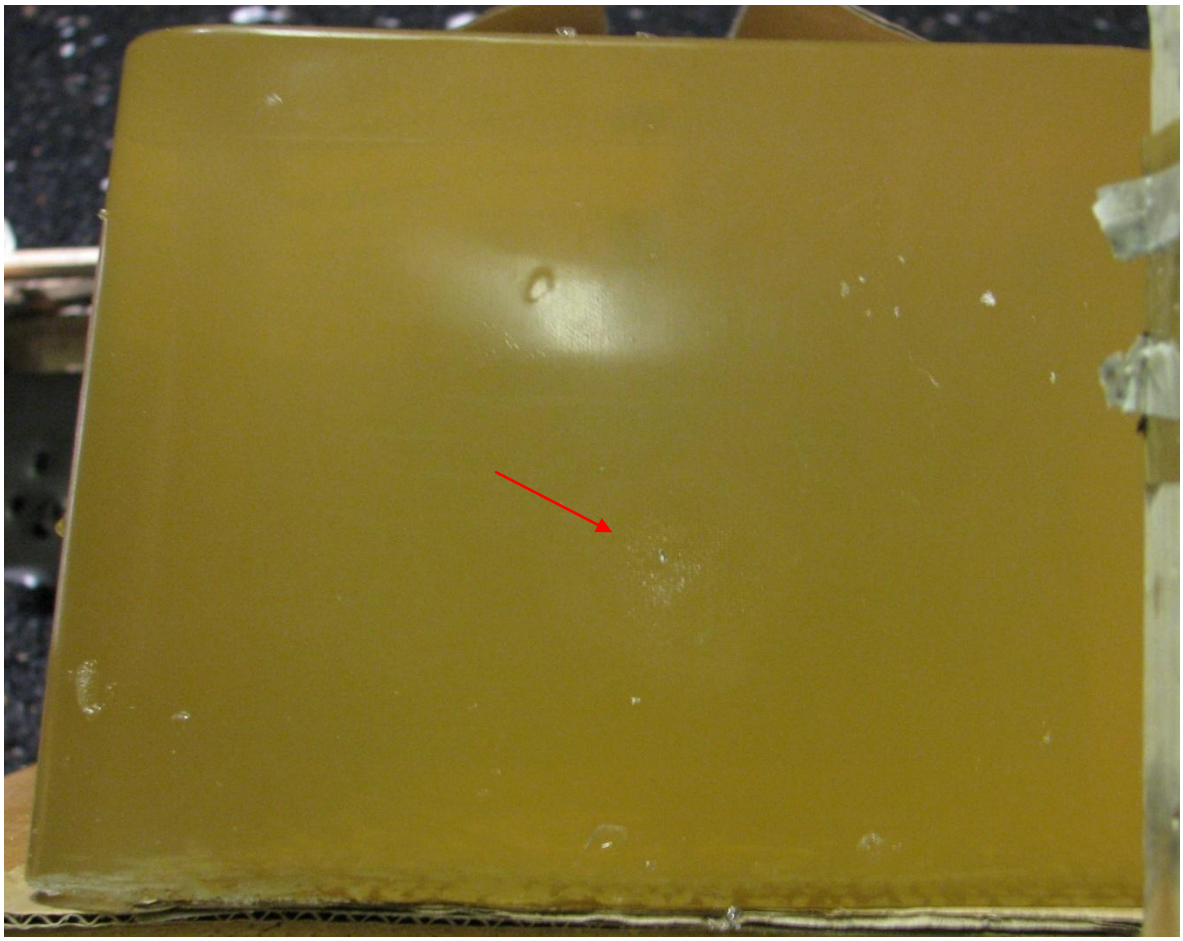

Figure 24: The face of the gelatin block. A slight indentation mark can be seen, as is indicated by the arrow.

Conclusion

No bullet fired from any hand held weapon will instantaneously and reliably incapacitate a person without regard to where it hits. But provided the shot is correctly placed, the bullet has to have the potential to incapacitate, where potential means penetration. It doesn't really matter much how fast it travels, or how many joules of energy it carries, a bullet cannot hurt what it does not reach and to reliably incapacitate a determined adversary quickly it has to penetrate deep enough to disrupt vital organs, and this after defeating any obstacle in its path. In this side-by-side test, we have shown that in a scenario very likely to appear in real-world combat, the 5.56x45 may fail by wasting its energy on thrashing the obstacles, causing only bruising to the actual intended target. The 6.5x25 CBJ Ball however confidently penetrates all intermediate obstacles, and causes a wound deep enough to reach vital organs from any angle in order to achieve rapid incapacitation of the target.