

EXECUTIVE SUMMARY

Four kinetic-energy non-lethal weapon (KENLW) projectiles were evaluated for impact severity:



40 mm BIP2 (standard)
Security Devices International Inc. (SDI)



40 mm eXact iMPact
Defense Technology

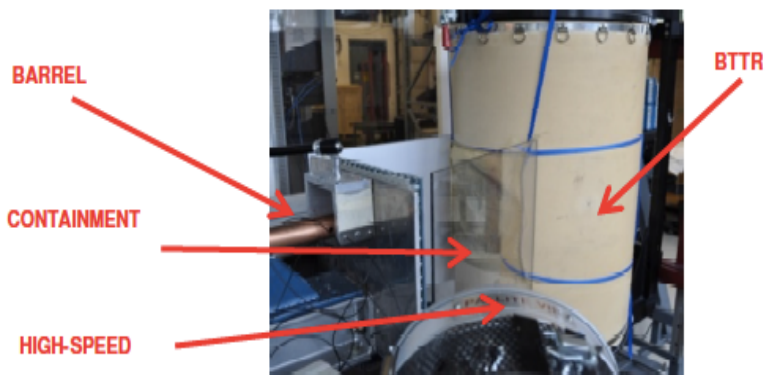


37 mm AR-1 Impact Baton
Police Ordnance Company Inc.



40 mm rubber baton (4557)
Combined Tactical Systems.

The test setup included a compressed air powered cannon, a velocity gate and a blunt torso trauma rig (BTTR) to measure chest deflection/time history. Upon firing of the system, the projectile was accelerated down the barrel, through the velocity gate and out of the barrel for a free-flight distance of approximately 30 cm (freeflight) before striking the target. The BTTR was comprised of a flexible cylindrical membrane designed to reproduce the impact response (stiffness) of the human chest (sternum). A non-contact laser transducer located behind the target location was used to measure the dynamic deflection of the membrane as a result of a projectile impact.



The laser transducer signal was recorded by a data acquisition system sampling data at 100 kHz. The data was then post processed using a 1 kHz lowpass digital filter. During the impact, the membrane deflection was recorded with respect to time. The velocity at which the membrane deformed was derived from the deflection measurements. Both parameters (chest deflection and velocity) were used to calculate the viscous criterion (VC). VC is an indicator of injury severity. A higher VC value indicates a higher injury risk.

Testing was conducted at five different impact velocities. A retardation value of 0.5 m/s per m was used for all the projectiles to determine the standoff distance from the measured velocity. A 2nd order polynomial fit was used to define the correlation between VC and standoff distance for each projectile. The root-mean-square deviation (RMSD) was calculated to quantify the VC difference between the five KENLW projectiles. The RMSD was evaluated using 8 VC values derived from the curve fitting equations using standoff distances between 30 and 100 m. The projectile having the lowest impact force response (BIP standard) was used as the reference to calculate RMSD.

In comparison with the standard BIP, the 40 mm eXact iMPact exhibited higher peak VC (RMSD=0.12) followed by The AR-1 Impact Baton (RMSD=0.40) and 40 mm 4557 rubber baton (RMSD=0.97) for a given standoff distance.

