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**.40S&W JHP performance through Bone Simulant plates
With Ballistic Gelatin backing**

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Abstract

Six different brands of premium Defensive and Law Enforcement hollowpoints were evaluated in .40S&W. Tested ammunition was Winchester Ranger-T 180gr SXT, Speer 180gr Short Barrel Gold Dot, Remington 165gr Golden Saber, Hornady 165gr FTX, Federal 165gr Hydra-Shok Tactical and Cor-Bon 140gr DPX.

The ammunition was fired from a Glock 22 handgun, through a bone simulant plate backed by 10% ballistic gelatin blocks. Of the six brands tested, **five of the ammunition types failed to expand** in the bone plate/gelatin target. The only hollowpoint that successfully expanded in the target was the Cor-Bon 140gr DPX. Dangerously excessive penetration in gelatin was noted for the bullets that failed to expand.

Introduction

Ballistic gelatin is an industry-standard medium used for evaluating the terminal performance of hunting and self-defense ammunition. Gelatin blocks offer many advantages in this role – it is a highly viscous liquid, offering a density close to that of human body fluids and the low-velocity characteristics of muscle tissue. It is a highly consistent material, which makes it very useful for making accurate measurements of damage done to the gelatin by a bullet penetrating *soft tissue only*.

The critical areas of the body are generally protected in some manner by the presence of bone immediately behind the skin. The large percentage of the vital areas of the chest that are protected by the rib cage and sternum make it desirable to simulate bone and then the soft tissue behind the bone. A priority of this report was in choosing a caliber and ammunition that was relevant to both civilian law enforcement and civilian gun owners. As such, .40S&W was chosen and premium Defensive and Law Enforcement JHPs from several manufacturers were selected as being broadly representative of what can be expected from this caliber.

Bone simulation was effected by placing a bone simulant plate, produced by Synbone AG of Switzerland, in front of blocks of 10% ballistic gelatin (Figure 1.) Tested plates were 6mm ($\frac{1}{4}$ ") thick and covered by a rubberized 'skin' layer. Product number of these plates is PR0114.G. Density for the tested samples came out to be 812 kg/m^3 and the failure mode for these was 'brittle' failure, similar to bone.

Tested ammunition included Winchester Ranger-T 180gr SXT, Speer 180gr Short Barrel Gold Dot, Remington 165gr Golden Saber, Hornady 165gr FTX, Federal 165gr Hydra-Shok Tactical and Cor-Bon 140gr DPX. A Glock 22 was utilized for this evaluation and all shots were fired from 10 feet distance, muzzle to gelatin block.

Figure 1. Bone simulant plate and ballistic gelatin block



Figure 2. Bone simulant plate



Results

Winchester Ranger-T 180gr SXT

Figure 3. Winchester Ranger-T 180gr SXT recovered bullet (Shot 1)

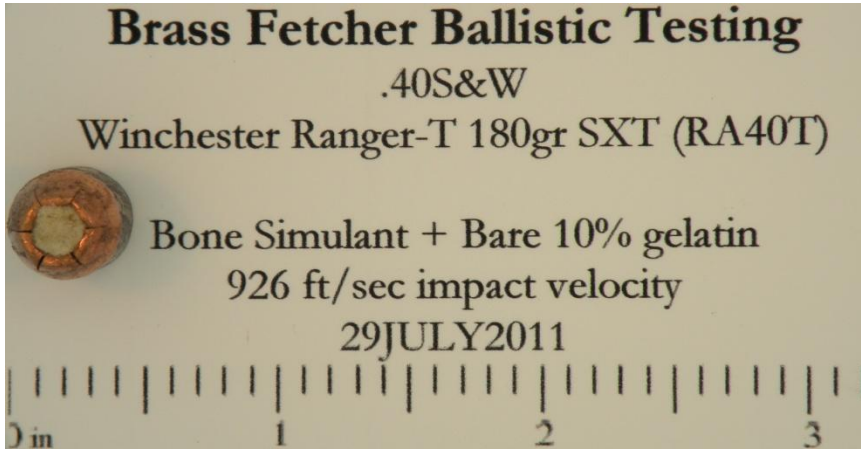


Figure 4. Winchester Ranger-T 180gr SXT recovered bullet (Shot 2)

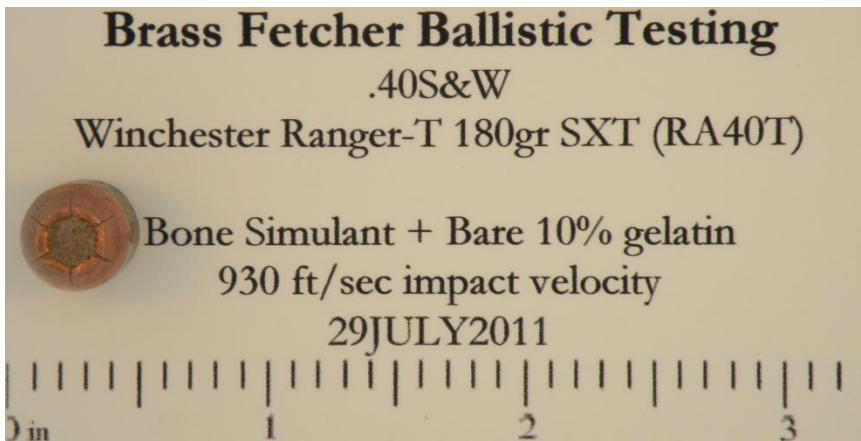
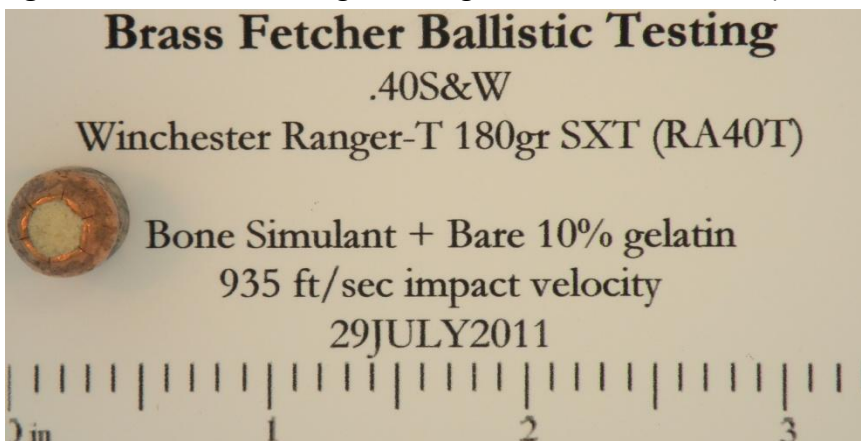


Figure 5. Winchester Ranger-T 180gr SXT recovered bullet (Shot 3)



Speer 180gr Short Barrel Gold Dot

Figure 6. Speer 180gr Short Barrel Gold Dot recovered bullet (Shot 1)

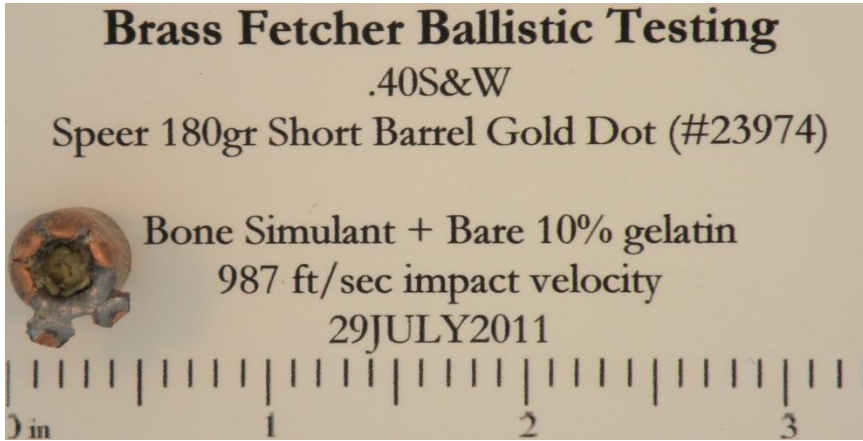


Figure 7. Speer 180gr Short Barrel Gold Dot recovered bullet (Shot 2)

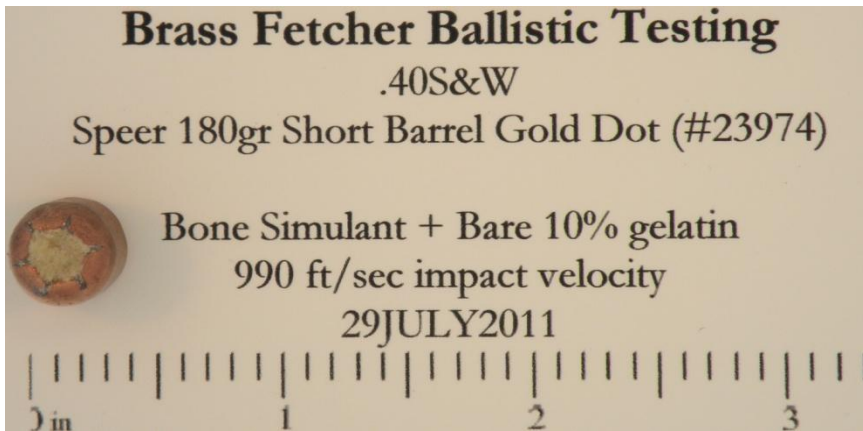
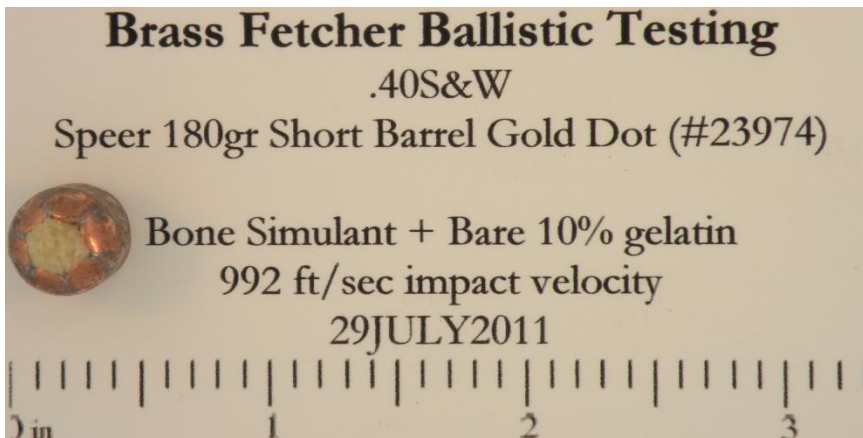


Figure 8. Speer 180gr Short Barrel Gold Dot recovered bullet (Shot 3)



Remington 165gr Golden Saber

Figure 9. Remington 165gr Golden Saber recovered bullet (Shot 1)

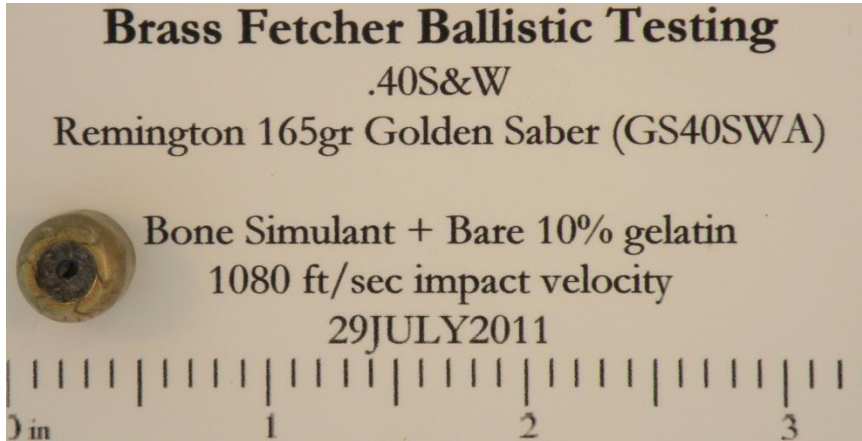


Figure 10. Remington 165gr Golden Saber recovered bullet (Shot 2)

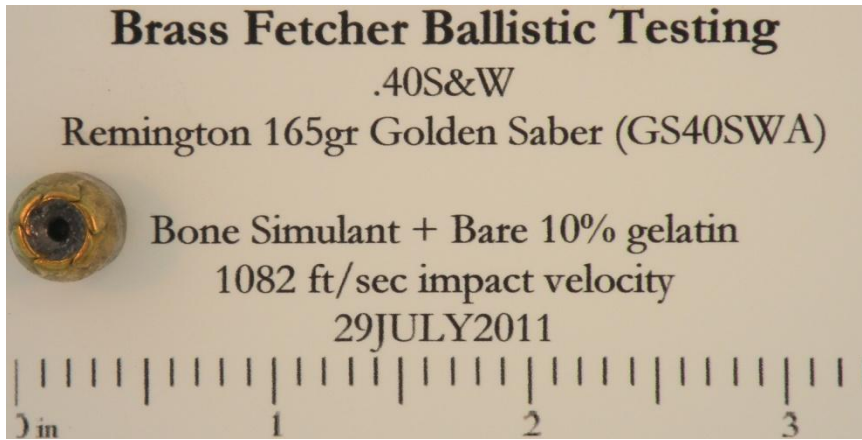
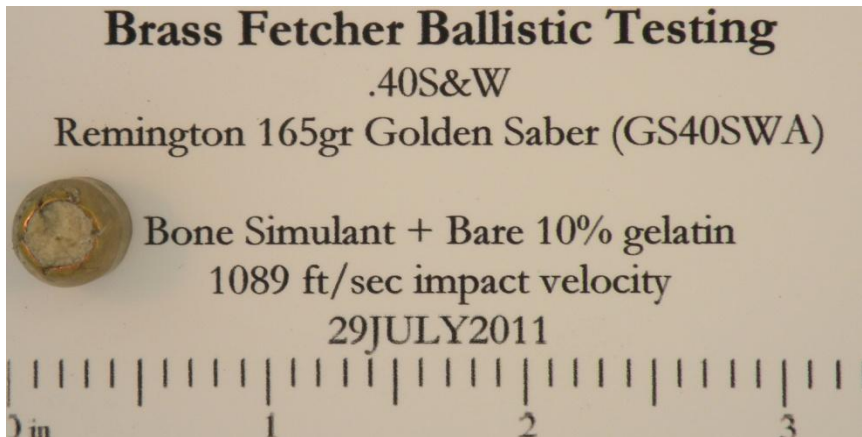


Figure 11. Remington 165gr Golden Saber recovered bullet (Shot 3)



Hornady 165gr FTX

Figure 12. Hornady 165gr FTX recovered bullet (Shot 1)

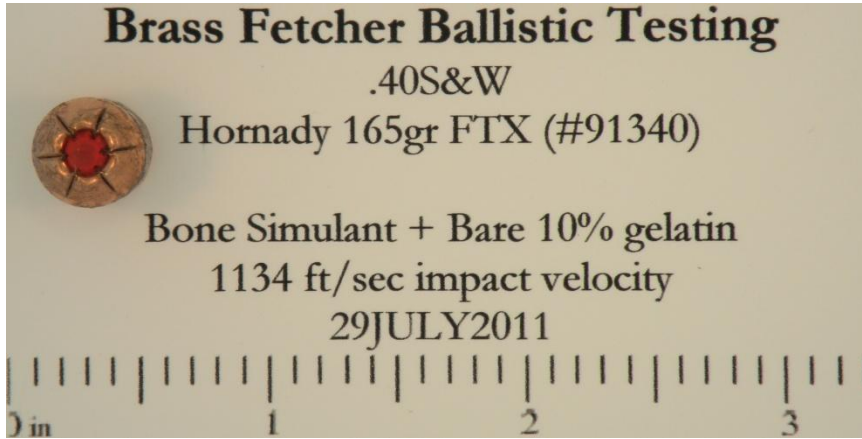


Figure 13. Hornady 165gr FTX recovered bullet (Shot 2)

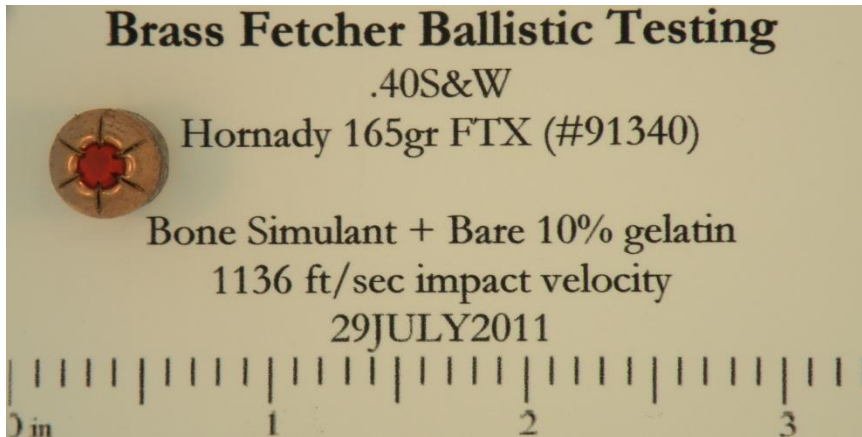
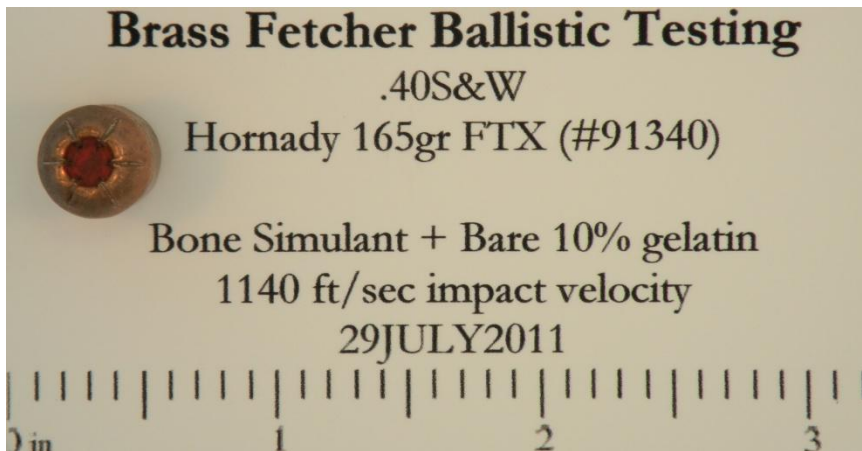


Figure 14. Hornady 165gr FTX recovered bullet (Shot 3)



Federal 165gr Hydra-Shok Tactical

Figure 15. Federal 165gr Hydra-Shok Tactical recovered bullet (Shot 1)

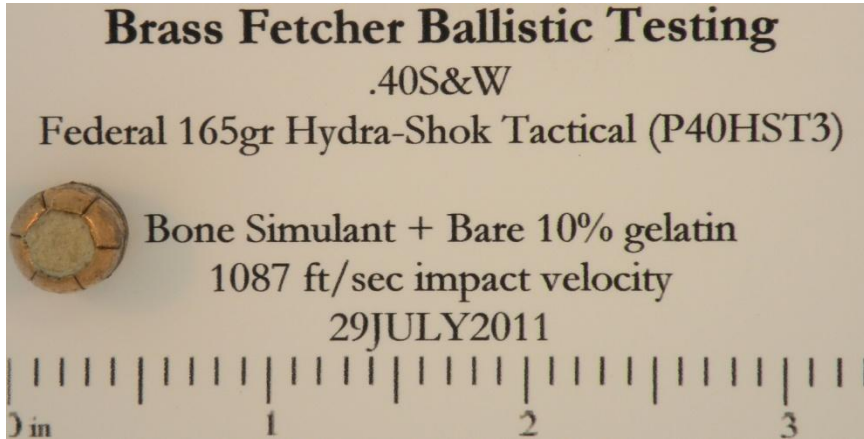


Figure 16. Federal 165gr Hydra-Shok Tactical recovered bullet (Shot 2)

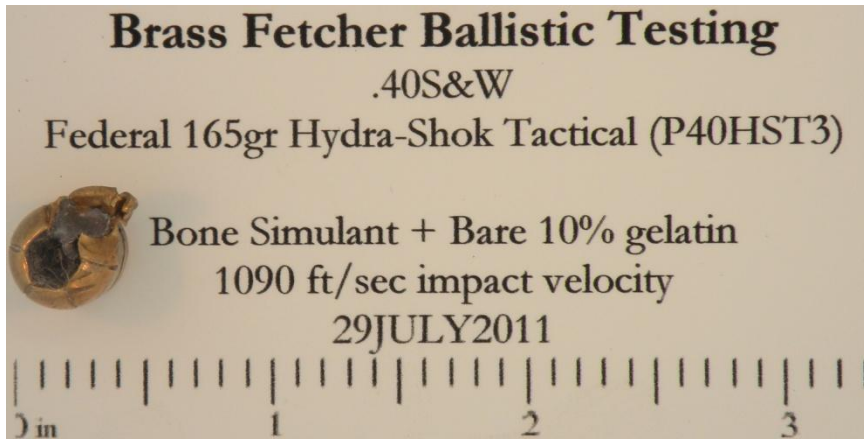
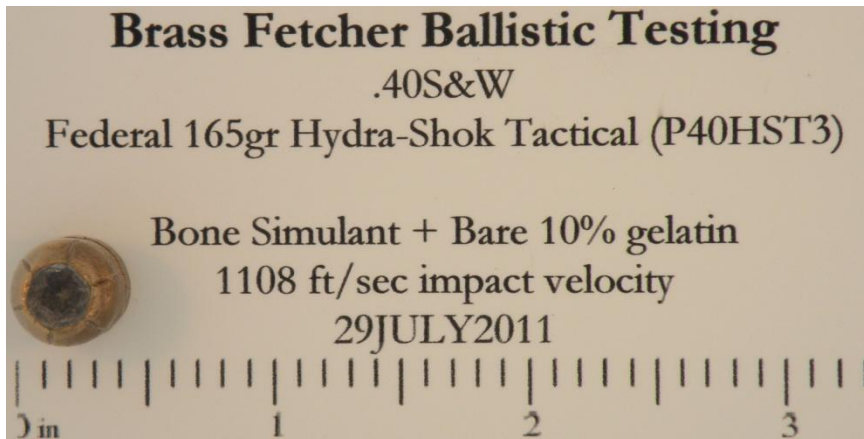


Figure 17. Federal 165gr Hydra-Shok Tactical recovered bullet (Shot 3)



Cor-Bon 140gr DPX

Figure 18. Cor-Bon 140gr DPX recovered bullet (Shot 1)

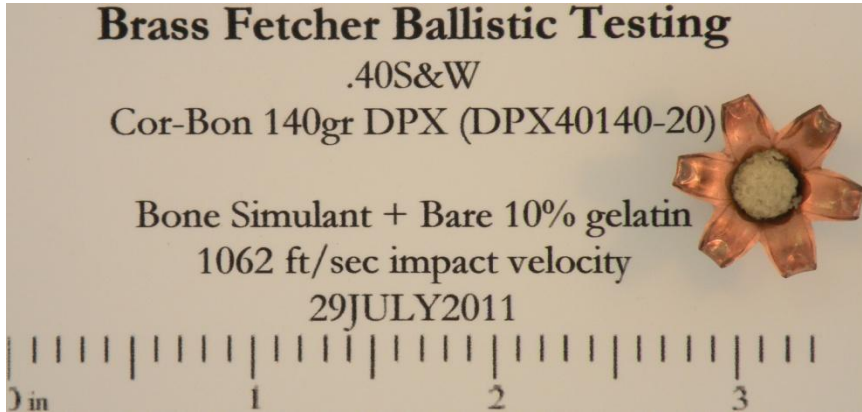


Figure 19. Cor-Bon 140gr DPX recovered bullet (Shot 2)

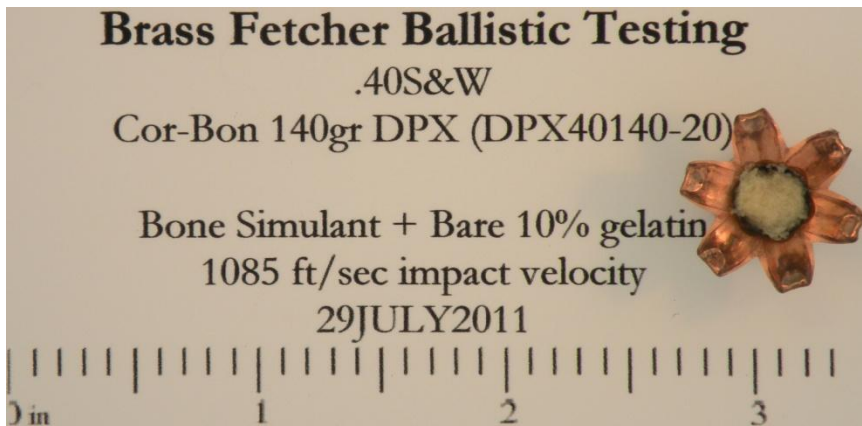
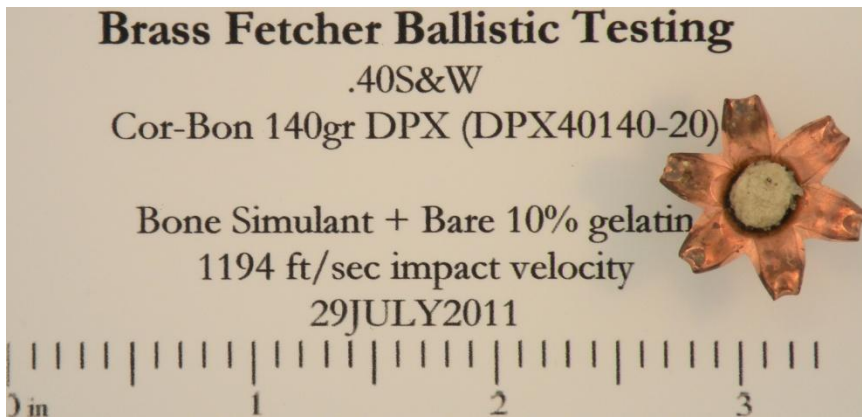


Figure 20. Cor-Bon 140gr DPX recovered bullet (Shot 3)



Relevance to the Tactical Situation

Figure 21. Adult Male rib cage with circulatory system visible (0 degree obliquity)

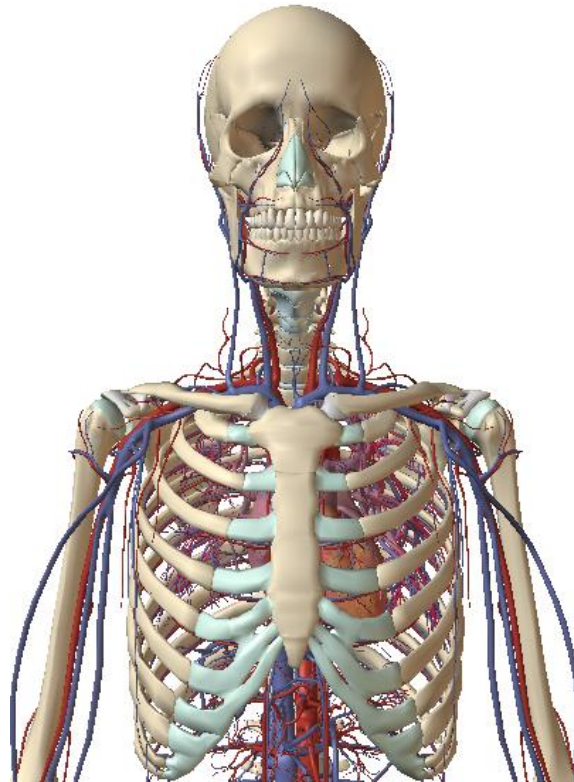


Figure 21 shows a 'head-on' view of the human weapon system. Note the size of heart relative to the rib cage and sternum.

Figure 22. Adult Male rib cage with circulatory system visible (30 degree obliquity)

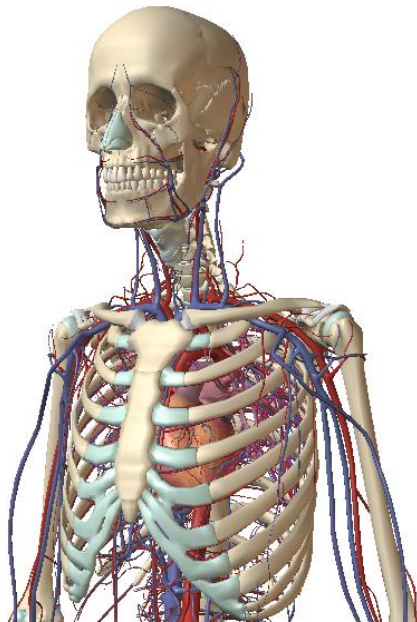


Figure 22 shows the adversary turned at a 30 degree angle to represent the Weaver shooting stance.

Figure 23. Percentage of Circulatory System shielded by rib cage (Adult Male, 0 degree obliquity)

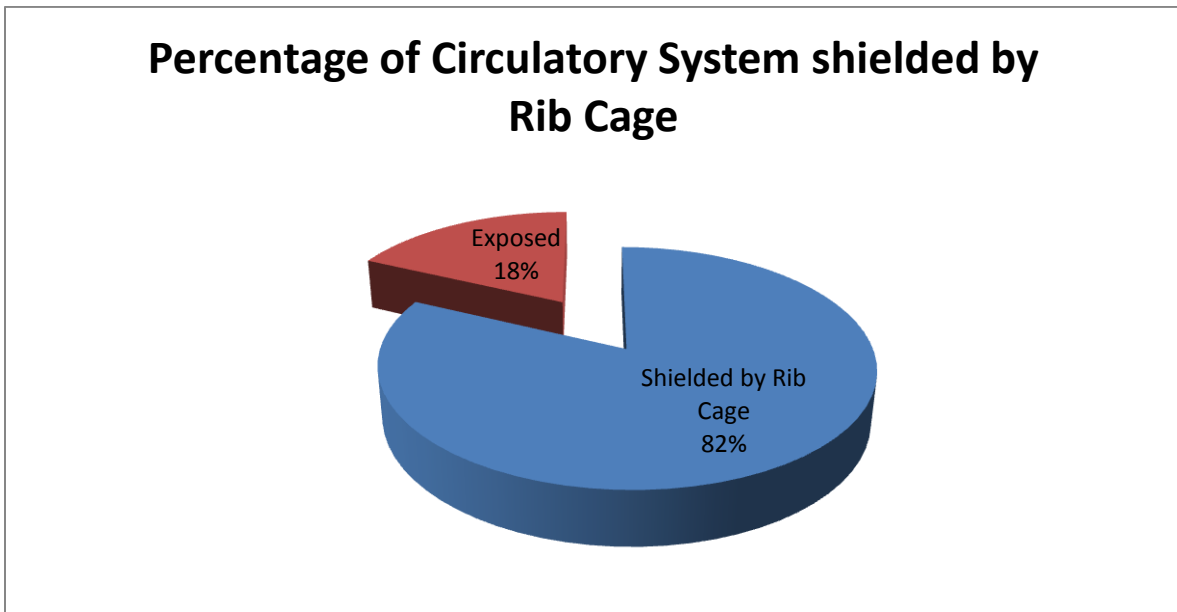
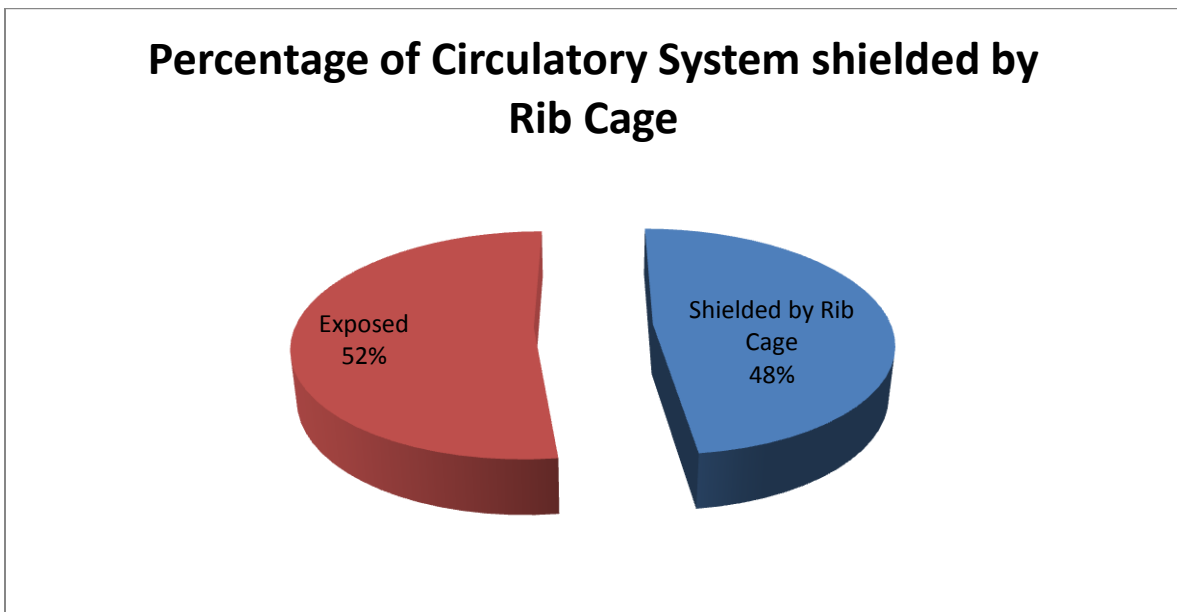


Figure 24. Percentage of Circulatory System shielded by rib cage (Adult Male, Weaver stance)



We see that there is a good chance that a shot to the upper chest will encounter some bone prior to impacting with soft tissue. Given the 48% odds of engaging an attacker through bone if they have taken a fighting stance prior to the shot, it greatly benefits a shooter of jacketed hollowpoints if the JHP expands after contact with a bone.

Table 1.

Cartridge	Impact Velocity (ft/sec)	Surface Area (in ²)	Penetration Depth in 10% gelatin (inch)
Cor-Bon 140gr DPX	1062	0.311	12.2
Cor-Bon 140gr DPX	1194	0.291	10.6
Cor-Bon 140gr DPX	1085	0.356	11.4
Winchester Ranger-T 180gr SXT	926	0.126	20.0 +
Winchester Ranger-T 180gr SXT	935	0.126	20.0 +
Winchester Ranger-T 180gr SXT	930	0.126	20.0 +
Speer 180gr Short Barrel Gold Dot	992	0.182	20.0 +
Speer 180gr Short Barrel Gold Dot	987	0.126	20.0 +
Speer 180gr Short Barrel Gold Dot	990	0.126	20.0 +
Remington 165gr Golden Saber	1089	0.126	20.0 +
Remington 165gr Golden Saber	1080	0.126	20.0 +
Remington 165gr Golden Saber	1082	0.126	20.0 +
Hornady 165gr FTX	1140	0.126	20.0 +
Hornady 165gr FTX	1134	0.126	20.0 +
Hornady 165gr FTX	1136	0.126	20.0 +
Federal 165gr Hydra-Shok Tactical	1087	0.126	20.0 +
Federal 165gr Hydra-Shok Tactical	1090	0.163	20.0 +
Federal 165gr Hydra-Shok Tactical	1108	0.126	20.0 +

Summary

Of the six cartridge types tested, only the Cor-Bon 140gr DPX expanded reliably after impacting the bone simulant and ballistic gelatin. The wounding mechanism of a jacketed hollowpoint is the crushing of tissue through bullet expansion. Failing this, the lethality of a JHP is oftentimes lower than a full metal jacket which wounds through tumbling. FMJ bullet shapes lend themselves more readily to tumbling than a JHP that failed to expand – though many of the unexpanded JHPs did tumble, it was far too deep into the track to have influenced the lethality of the bullet to any extent.

It is notable that the velocity of the bullet at impact did not seem to play a significant role in expansion, because all of the tested 165gr bullets that failed had one or more shots that impacted at a higher velocity than the Cor-Bon 140gr DPX bullet, which expanded 100% of the time. Similar effects have been observed in 9x19mm Luger and .45ACP calibers but that is beyond the scope of this document.