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# **2020 Solid Copper/Hollow Point 9mm/.40 S&W Wound Ballistics Test**



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# SUMMARY

- The 2020 Solid Copper/Hollow Point, 9mm/40S&W-Wound Ballistics Test was conducted by Viper Weapons Training LLC, and selected ballistics experts. The contract company ensured continuity, consistency and accuracy of all tests and generated this final report briefing. It was accomplished at the request of multiple sources as an overview and comparison test of numerous Solid Copper Rounds (SCR) and Hollow Points in 9mm and .40 S&W
- This presentation is a composite result of several tests all using the same protocols, test phases and grading criteria.
- Test results, briefings and reports will only be distributed to the units and ammunition manufacturers involved. No civilian or open release of this report/briefing will occur



# OVERVIEW

- Test Purpose and Focus
- Protocols
- Target Media Description
- 5 Phases of the Test
- 4 Grading Criteria
- Volume of Wound Index (VWI)
- Results
  - Pictures
  - Data Tables
- Acknowledgements



# TEST PURPOSE

- The 2020 Solid Copper/Hollow Point, 9mm/40S&W-Wound Ballistics Test is a comparative study of different types of defensive ammunition, conducted in 5 separate phases, using 4 grading criteria.
- No conclusions or selections were made
  - Raw data from each shot was averaged and may be used independently depending on the criteria desired by the receiving agency



# FOCUS

- The 2020 Test main focus was:
1. Measure 9mm and .40S&W wound channels from Solid Copper Rounds and Hollow points in multiple standardized media using the protocols and grading criteria previously established and reported on
  2. Compare Subsonic rounds



# PROTOCOLS

All phases and tests were conducted with numerous testers for quality control and multiple measurements. All ammunition was tested with at least 4 rounds fired per phase. All failures are included in the data with no "flyers" being removed.

The 5 phases mirrored what was accomplished during the 2016/17 Joint Agency Ballistic Test For Defensive Handgun Ammunition (available upon request). Comparison results from that test are included in this briefing to increase sample size.



# MEDIA

1. Calibrated IWBA 10% ordnance gelatin. (Phase 2/3)
  - Proper temperature verified and BB depth calibration accomplished immediately prior to shot
  - 1 16x6x6 inch block with a sideways block as a backstop
  - 22 inches of penetration can be measured.
  - A third block was added for the deepest penetrating rounds (38")
2. Single ¾ inch thick AA fir plywood panel IAW FBI / DoD protocols. (Phase 3 and 5)
3. Denim barrier consisting of layers of standardized material. (Phases 2-5)
4. Animal Tissue - 2 boneless hanging briskets  
7-8" thick (Average human male is 10" thick), 36±2 pounds, fat side out, back to back. (Phase 4/5)



# MEDIA DESCRIPTION

Calibrated IWBA FBI 10% ordnance gelatin (Phase 2/3)

- Gel is consistent and easy to use/measure. It allows for a comparative study to take place with results that can be replicated
- Gel is not designed to be a simulation of any human or animal tissue. Gel is a fluid and is non-compressible unlike human material
- Density and resistance are not similar to human tissue (as noted by 3 inches of BB penetration depth at calibration)
- Temporary Stretch Cavity does not represent any damaged or destroyed material
- Permanent cavity may be exaggerated by rounds causing compression such as fluid transfer or tumbling rounds (Solid Copper Rounds in this test)
- Recovered bullet diameter doesn't equal gel wound diameter because of rounds turning or fragmenting (which happened frequently) and some rounds cut through material while others push and compress allowing the gel to recover, which is similar to results in actual tissue
- Using gel as a standardized material for comparison is valid and comparing penetration depths is valuable but does not produce results similar to tissue penetration depths. Using gel for wound diameter size and volumes is extremely artificial and next to impossible to measure





# MEDIA DESCRIPTION

Animal Tissue consisting of 2 boneless cow briskets (Phase 4/5)

- Chosen after discussions with a forensic pathologist, other medical doctors and a butcher
  - There are four main types of human tissue: **muscle**, epithelial, connective and nervous. Cow brisket closely represents human muscle tissue and organs
- It is a compressible realistic consistent media
- 7-8" thick (Average human male is 10" thick), total weight  $36 \pm 2$  pounds, hanging fat side forward, back to back. Point side up on one and down on the other to provide equal thickness.
- The exit wounds from each of the 2 briskets are measured for min and max diameter. Those four measurements are averaged and then converted to a hole area



# 5 PHASES

The 2020 Solid Copper/Hollow Point, 9mm/40S&W-Wound Ballistics Test was conducted in 5 separate phases.

1. All rounds chronographed
2. Calibrated 10% ordnance gelatin IAW IWBA standards with a standard denim barrier
3. Calibrated 10% ordnance gelatin with a single  $\frac{3}{4}$  inch thick AA fir plywood panel and a standard denim barrier
4. Animal Tissue with a standard denim barrier
5. Animal Tissue with a single  $\frac{3}{4}$  inch thick AA fir plywood panel and a standard denim barrier



# PHASE 1-CHRONOGRAPH

- All rounds fired at least 6 times and chronographed
- Testing actual vs. advertised velocities, consistency and reliability
- All velocities averaged
- Noted in data tables as
  - **Box Velocity** (provided by manufacturer)
  - **Phase 1 Average Velocity** (tested)



## PHASE 2- IWBA 10% ordnance gelatin with a 4 layer denim barrier

1. All rounds fired at least 4 times into calibrated IWBA 10% ordnance gelatin with a standard 4 layer denim barrier
2. Recovered rounds inspected for failures, retained weight and overall dimensions
3. Testing Overall Penetration Depth
  - FBI standard 12” minimum and 18” desired
  - Noted in data tables as **Penetration**
4. Testing Overall Permanent Wound Cavity (**PWC**)
  - Measured in cubic inch volume. Wound diameter (noted in tables as **Diameter**) converted to area and multiplied by penetration depth in inches
  - Compressibility issues occur with many of the Solid Copper Rounds causing inflated unrealistic values
  - Noted in data tables as **PWC**



## **PHASE 3- IWBA 10% ordnance gelatin with Plywood & 4 layers of denim**

1. All rounds were fired at least 4 times into media
2. Calibrated IWBA 10% ordnance gelatin with a single  $\frac{3}{4}$  inch thick AA fir plywood panel IAW FBI / DoD protocols and a standard 4 layers of denim barrier
3. Recovered rounds inspected for failures, retained weight and overall dimensions
4. Testing Overall Penetration Depth after a domestic barrier
5. Testing Overall Permanent Wound Cavity
  - Measured in cubic inch volume
  - Compressibility issues occur with Solid Copper Rounds causing inflated unrealistic results
6. Testing Barrier Performance and Consistency



## PHASE 4-Animal Tissue with a 4 layer denim barrier

1. All rounds fired at least 6 times into Animal Tissue with a denim barrier
2. Rounds not recovered
  - No Penetration depths measured in this phase
3. Measuring Overall Wound dimensions
  - Exit wound channels from each of the two back-to-back briskets measured for min and max diameter then averaged. (4 measurements). Average diameter converted to hole area
  - Noted in data tables as **Av Hole Area**



## PHASE 5-Animal Tissue with a plywood and 4 layer denim barrier

1. All rounds were fired at least 6 times into Animal Tissue with a single  $\frac{3}{4}$  inch thick AA fir plywood panel and a denim barrier
2. Rounds not recovered
  - No Penetration depths measured in this phase
3. Measuring Overall Wound dimensions
  - Exit wound channels from each of the two back-to-back briskets measured for min and max diameter then the 4 measurements are averaged. Average diameter converted to hole area and recorded
  - Noted in data tables as **Av Hole Area**
4. Testing Barrier Performance and Consistency



# 4 GRADING CRITERIA

The 2020 test was graded using 4 criteria

1. Penetration Phase 2 data. Desired 18"  $\pm$  10% and a minimum of 12"
2. Consistency and Reliability
  - Standard Deviation for each shot tested within a Phase
  - Failure to function (Tumble, Failure to open, fragmentation and jacket separation). Both Fort Scott rounds are designed to Tumble. In all other rounds, tumbling is a failure
3. Barrier Performance
  - Ability to function through a simple domestic barrier
  - % lost from non-barrier shots to barrier shots from Phase 2/3 and Phase 4/5
4. Permanent Wound Cavity and Volume of Wound Index (VWI)
  - Measured in cubic inches for the Ballistics gel tests of Phase 2/3
  - Measured as average hole size from Phase 4/5 expressed in Area
  - Calculations made to produce a Volume of Wound Index (VWI)





# Volume of Wound Index (VWI)

- Due to Ballistics gel being a fluid and non-compressible, rounds that cause a compression will create a permanent wound cavity that is exaggerated. To better understand and grade/compare rounds that cause compression a non-compressible media is used
- IWBA gel (Phase 2/3) is a very consistent media for measuring Penetration depths
- Animal Tissue (Phase 4/5) is a very consistent and realistic media for measuring the wound area
- VWI was created by averaging the Penetration results from Phases 2/3 and multiplying it by the hole area from the tissue tests in Phases 4/5 (averaged together)
- This VWI represents the best calculation for comparative purposes by incorporating barrier and non-barrier data along with consistent and realistic medias



# RESULTS

- The 2020 Solid Copper/Hollow Point, 9mm/40S&W-Wound Ballistics Test documented all raw data from each shot in each phase
- Averages were calculated and reported
- No conclusions, rank ordering or choosing was accomplished
- All data was graded using the aforementioned 4 grading criteria
- Each agency may use the data as they see fit and can calculate any other grades they wish



# Phase 4/5 Description



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# Phase 4 Measuring 40S&W



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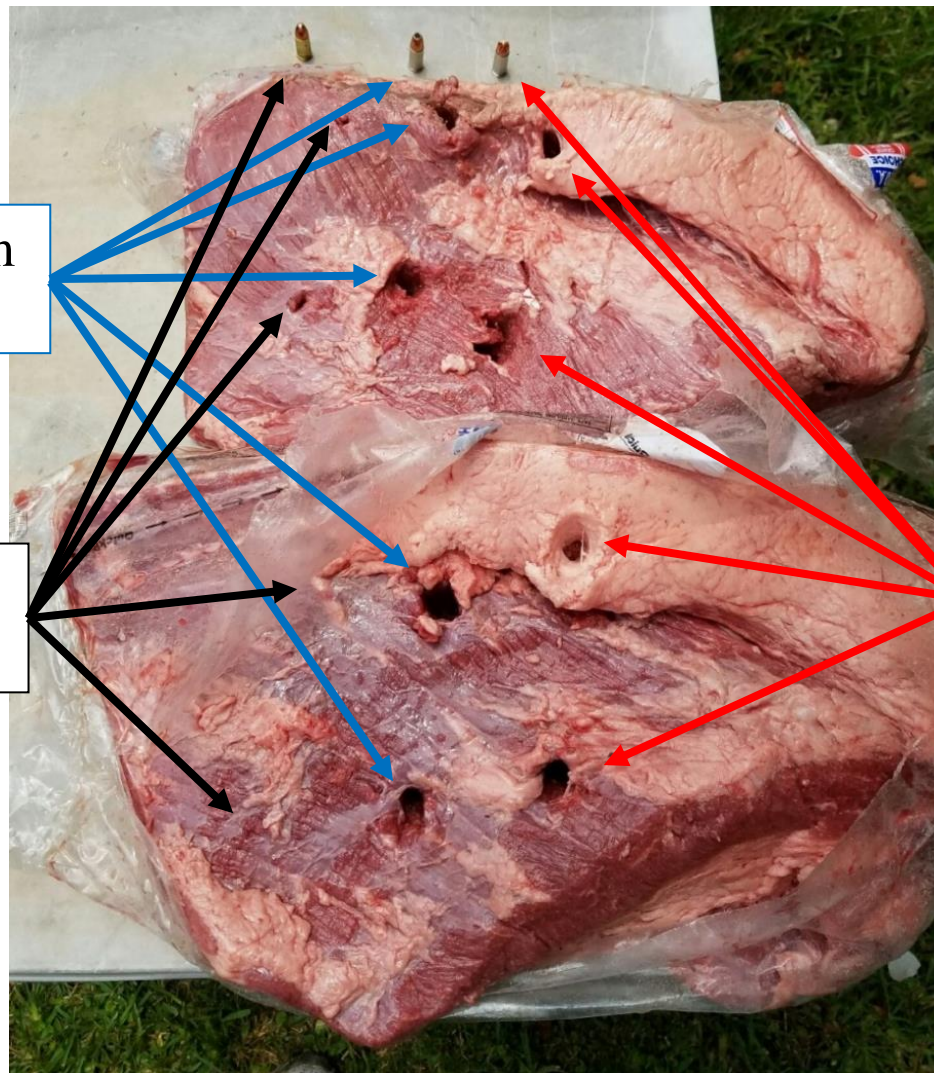


# 9mm Phase 4, Brisket 1&2

Federal 9mm  
147 gr HST

Winchester  
9mm

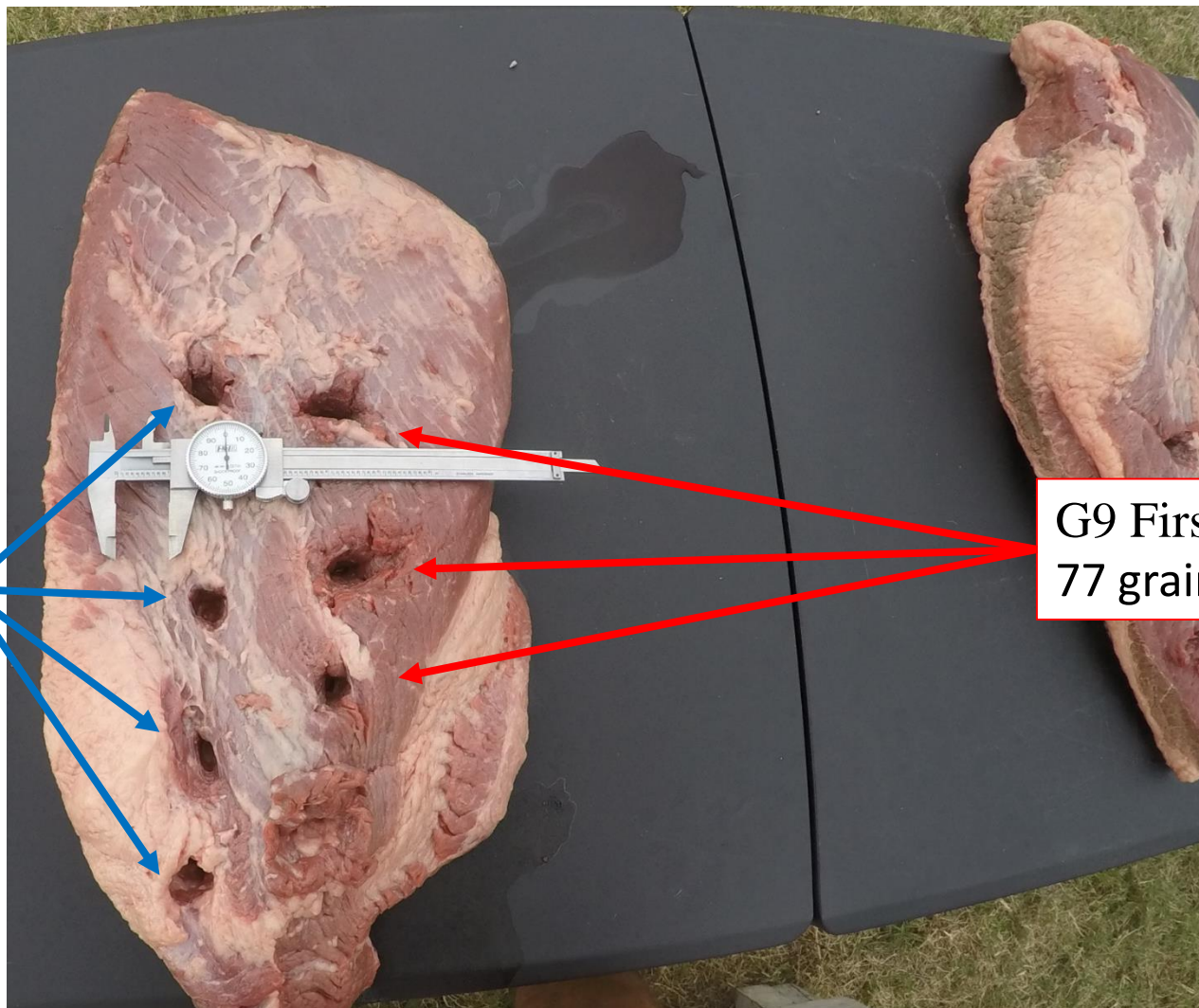
Lehigh Defense  
9mm XD +P







# 9mm Phase 4, Brisket 1&2

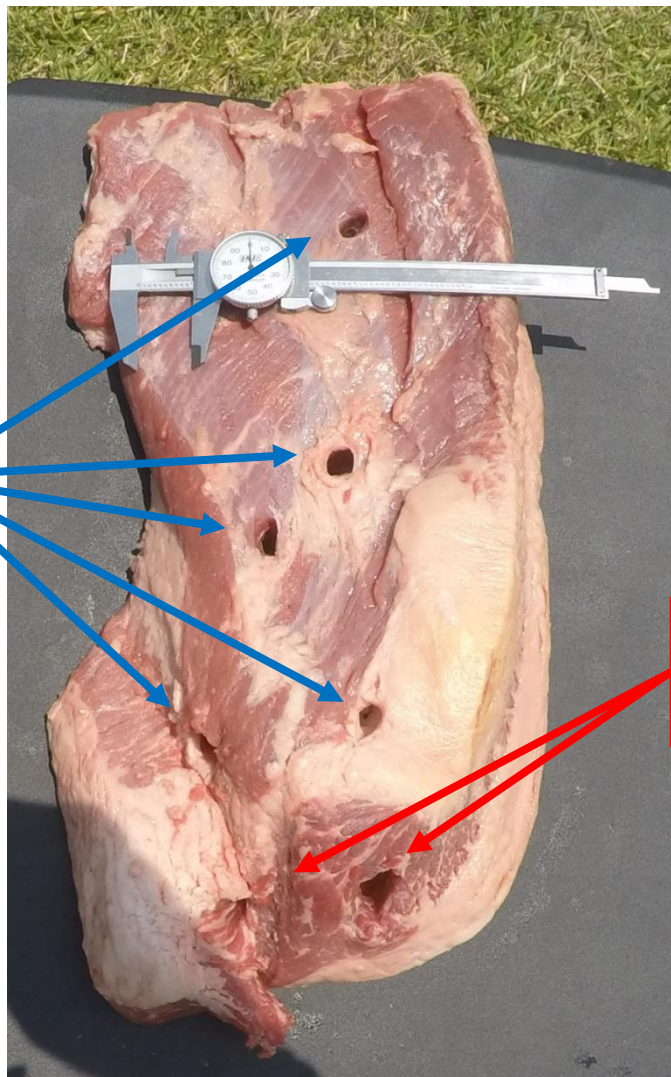


G9 APC  
77 grain

G9 First Response  
77 grain



# 9mm Phase 4, Brisket 2



G9 Woodsman +P  
124 gr

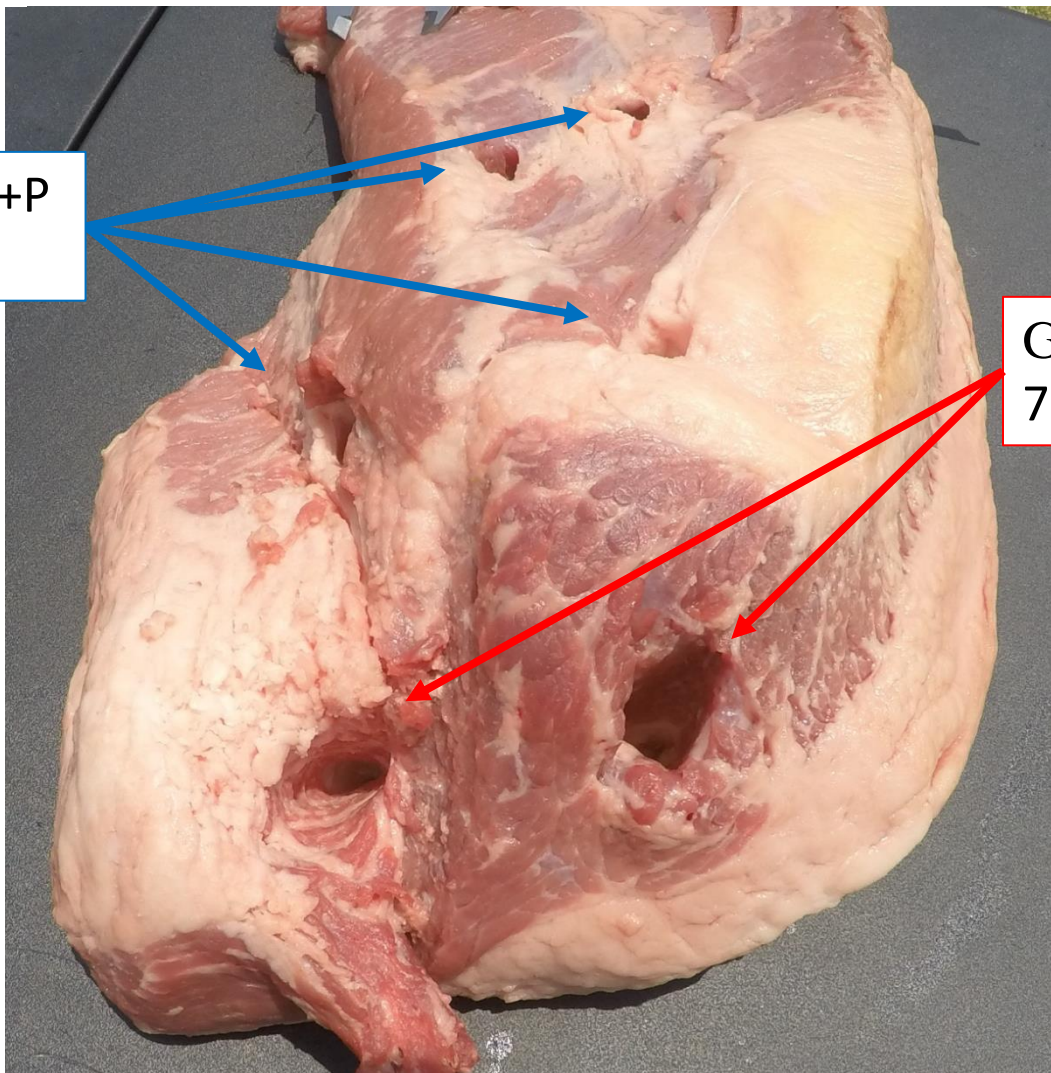
G9 APC  
77 grain





# 9mm Phase 4, Brisket 2

G9 Woodsman +P  
124 gr

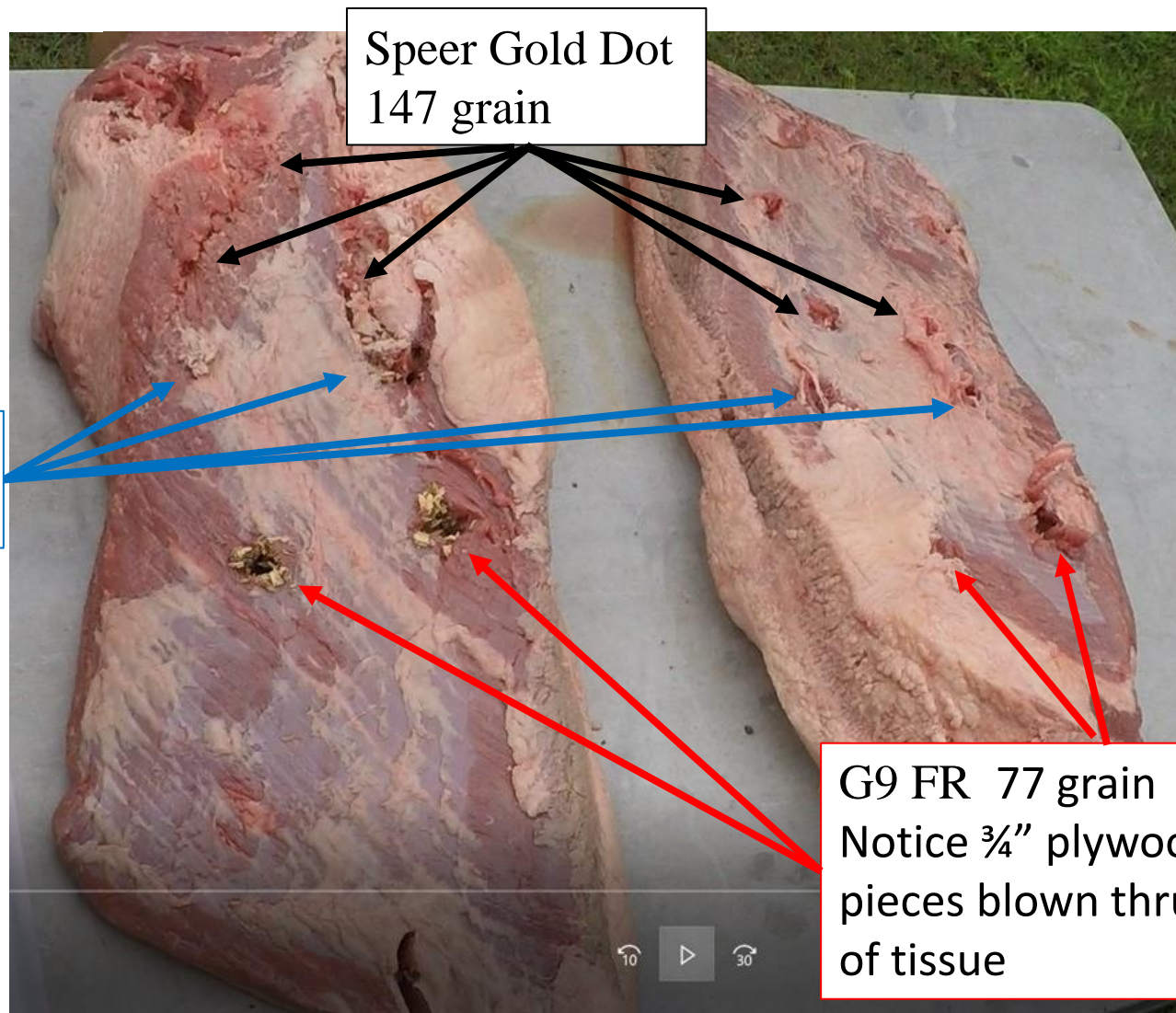


G9 APC  
77 grain





# 9mm Phase 4, Brisket 1&2



Speer Gold Dot  
147 grain

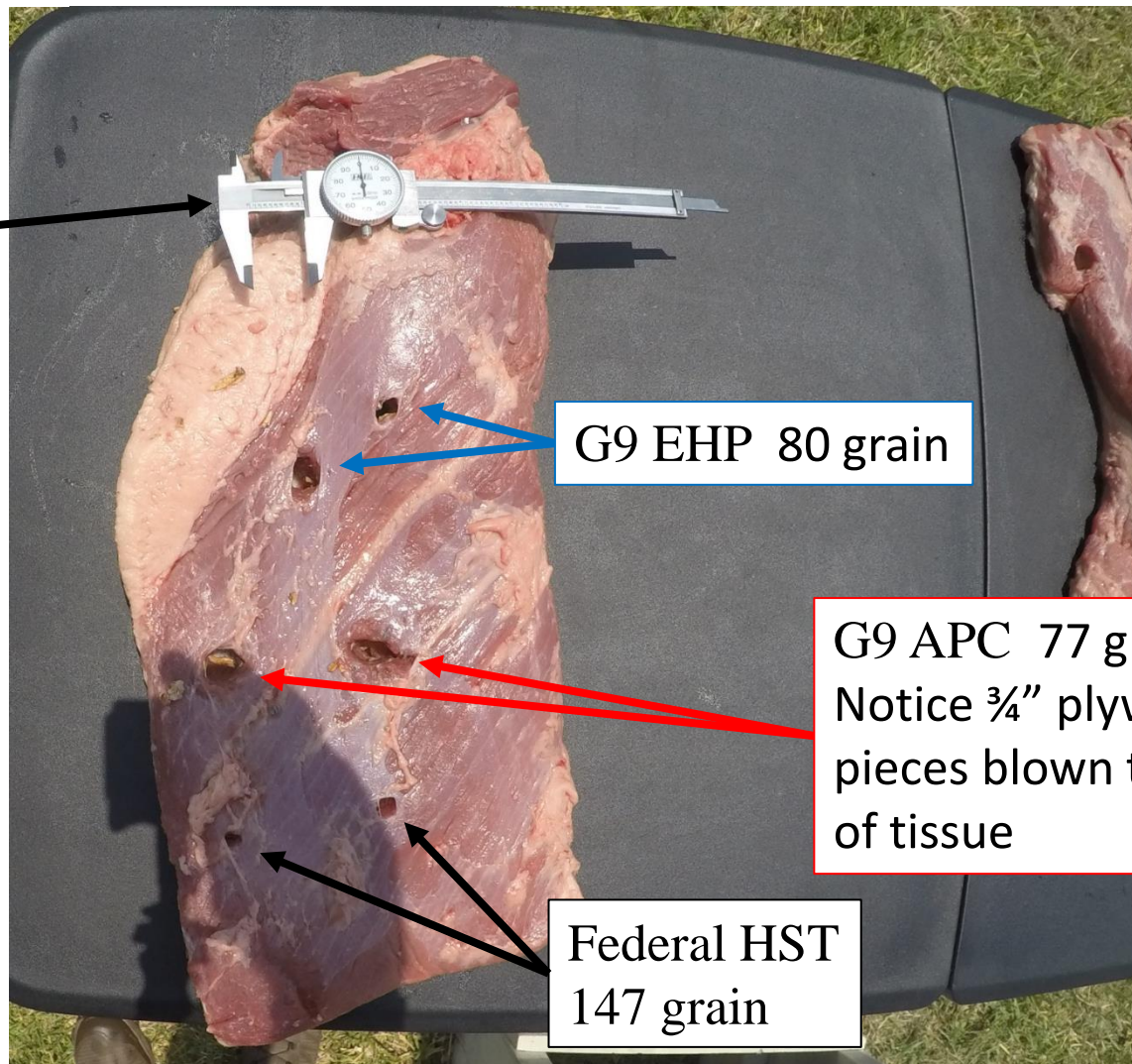
Underwood  
90 grain +P+

G9 FR 77 grain  
Notice  $\frac{3}{4}$ " plywood barrier  
pieces blown thru 3.5"  
of tissue



# 9mm Phase 5, Brisket 1&2

Micrometer  
Set to 1"



G9 EHP 80 grain

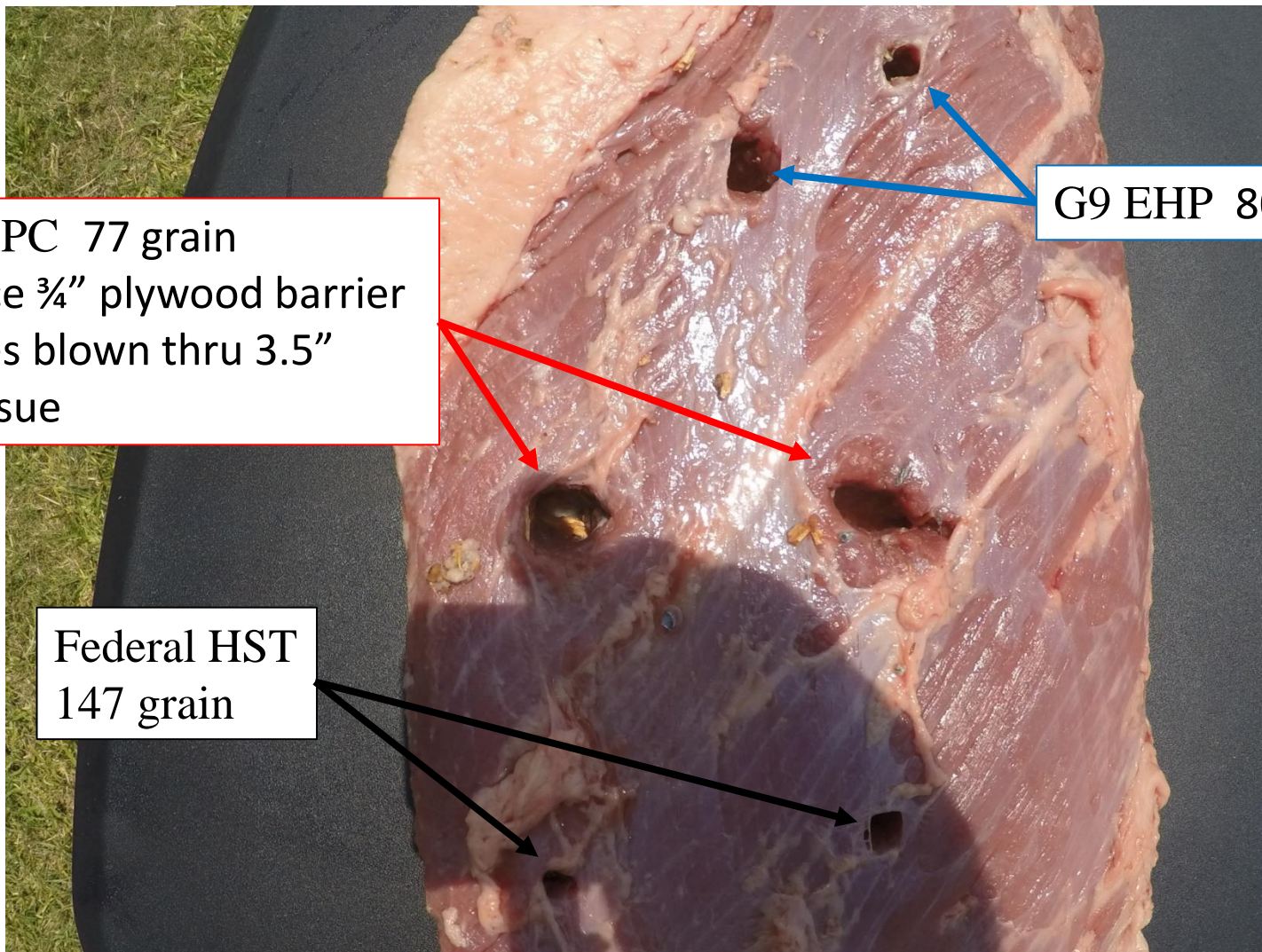
G9 APC 77 grain  
Notice  $\frac{3}{4}$ " plywood barrier  
pieces blown thru 3.5"  
of tissue

Federal HST  
147 grain





# 9mm Phase 5, Brisket 1



G9 APC 77 grain  
Notice  $\frac{3}{4}$ " plywood barrier  
pieces blown thru 3.5"  
of tissue

G9 EHP 80 grain

Federal HST  
147 grain





# 40S&W Phase 4



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# PENETRATION 9mm

1. Phase 2 Penetration data for a desired 18"  $\pm 10\%$  and a minimum of 12"
2. Penetration with Barrier was calculated in Phase 3
3. Phase 2 and 3 penetration depths were averaged for the VWI calculation

## RESULTS:

1. All of the 9mm SCR exhibited 16-34.0 inches in Phase 2. All of the Hollow Points had 15.5 inches or less except for one that only surpassed that distance due to Failure-to-Expand
2. Phase 3 Barrier Penetration from the Solid Copper Rounds yielded 14.8-33.0 inches, while the Hollow Points displayed 4.6-16.5 inches





# **PENETRATION .40 S&W**

1. Phase 2 Penetration data for a desired 18"  $\pm 10\%$  and a minimum of 12"
2. Penetration with Barrier was calculated in Phase 3
3. Phase 2 and 3 penetration depths were averaged for the VWI calculation

## **RESULTS:**

1. All of the .40 SCR exhibited >18.0 inches in Phase 2 (Fort Scott failed to tumble). All of the Hollow Points had 8.0-18 inches
2. Phase 3 Barrier Penetration from the Solid Copper Rounds yielded >17.6 inches (Fort Scott failed to tumble), while the Hollow Points displayed 6.7-17.6 inches



# CONSISTENCY/RELIABILITY

Consistency and Reliability was graded in each phase and between phases to determine the effects of barriers.

- Standard Deviation for each shot tested within a Phase
- Failure to Function (tumble, failure to open, fragmentation and jacket separation)
- Comparison of Phase 2/3 data for Barrier effectiveness
- Comparison of Phase 4/5 data for Barrier effectiveness

## RESULTS:

1. All the SCRs (except the Fort Scott which had a very high failure rate) exhibited similar consistent results with shot-to-shot deviations less than 10% and Barriers reducing effectiveness by approximately 5%. No Failures-to-Function were noted on any SCR shots other than the Fort Scott which consistently failed.
2. Hollow Points exhibited erratic results with shot-to-shot deviations exceeding 50% and Barriers reducing effectiveness by approximately 20%. Multiple Failure-to-Function were noted and averaged approximately 30% matching previous tests. (Fragmentation, Failure to expand, tumbling, jacket separation)



# BARRIER PERFORMANCE

## Barrier performance

- Percent decrease from non-barrier shots to barrier shots from Phase 2/3 and Phase 4/5

## RESULTS:

1. SCRs exhibited similar reliable and consistent results with shot-to-shot deviations minimally effected by the barriers used. The barriers reduced effectiveness by approximately 5%. No Failures-to-Function (i.e. tumbling) were noted on any shots with or without barriers, except for the Fort Scott rounds.
2. Hollow Points had increased Failure-to-Function (increased failure to expand, fragmentation and turning) during the barrier tests and exhibited reduced effectiveness by approximately 20%.





# PWC / VWI

## Permanent Wound Cavity (PWC) and Volume of Wound Index (VWI)

- Measured in cubic inches (ci) for the ballistics gel tests of Phase 2/3
- Measured as average hole size from Phase 4/5. Average diameters converted to Area
- Some Solid Copper Rounds (SCR) display exaggerated huge Permanent Wound Cavities (PWC) in ballistics gel. They create a compression that expands fluids more than actual tissue. Measured PWCs from Phase 2/3 gel tests are available in the attached tables. However, comparing gel PWCs between Solid Copper Rounds and Hollow points results in unrealistic data favoring the SCRs
- To display a realistic result VWI is calculated using only the penetration depths in the Phase 2/3 gel tests (averaged together) and the wound areas from tissue in Phases 4/5 (averaged together)



# VOLUME of WOUND INDEX

## RESULTS:

- 9mm SCRs exhibited a VWI of 5.0-16.7 inches
- .40 S&W SCRs exhibited a VWI of 5.1-20.8 inches
- 9mm Hollow Points had a VWI of 1.9-5.9 inches
- .40 S&W Hollow Points had a VWI of 4.1-8.2 inches



# SUBSONICS

- Subsonic ammunition was one of the 3 main focus areas
- Multiple Hollow Point and 1 Solid Copper Round (SCR) tested are subsonic.
  - 1 SCR (Black Hills Honey Badger 125 grain Subsonic)
- The Black Hills achieved the deepest penetration in both Phase 2 and 3 and recorded the lowest degradation do to barriers
  - The increase of some penetration depths of the hollow points was solely the result of Failure to Expand causing the rounds to behave similar to Full Metal Jacket (FMJ) rounds
- The Black Hills 125 grain had a zero failure rate as compared to approximately 30% for the hollow points
- The Black Hills round recorded the largest subsonic 9mm wound area in both Phase 4/5 and recorded the largest subsonic 9mm VWI of 6.7 compared to 4.2-5.9 for the subsonic 9mm hollow points tested. The subsonic .40 S&W hollow points had a VWI of 4.1-8.2



# DATA TABLE DEFINITIONS

- **Round-** All rounds tested. Listed by caliber with grain weight included
- **Velocity-** From manufacturer and Phase 1 tested velocity (slide 11)
- **Penetration-** Average inches of penetration thru gel (Phase 2/3) (slide 12 and 13)
- **Diameter-** Largest permanent diameter in gel (Phase 2/3) Averaged over all shots for that round in that phase
- **PWC-** Permanent Wound Cavity volume converting **Diameter** to area ( $A = \pi r^2$ ) and multiplied by **Penetration** (average penetration depth). This is artificially large due to two reasons
  1. Using the largest diameter
  2. The rounds that cause compression create an exaggerated wound channel in non-compressible gel
- **Av Hole Area-** Phase 4/5 (slide 14 and 15) tissue test measurements of average diameter of exit wound from each brisket averaged together and then converted to area ( $A = \pi r^2$ )
- **VWI-** Volume of Wound Index (slide 17) Average Area from Phase 4/5 multiplied by average Penetration from Phase 2/3
  - Includes data from realistic tissue, consistent to measure gel penetration and barriers

# 9mm RESULTS

VIPER WEAPONS TRAINING 2020		WOUND BALLISTICS DATA			PHASE 1	PHASE 2			PHASE 3			PHASE 4	PHASE 5		VWI
Caliber	Round	Box	Pistol	Average		Gelatin / Denim			Gelatin / Plywood / Denim			Tissue / Denim	Tissue / Plywood / Denim		Av Pen x
Type		Velocity		Velocity		Penetration	Diameter	PWC	Penetration	Diameter	PWC	Av Hole Area	Av Hole Area		Av Area
9mm															
FMJ	Winchester FMJ 124 gr	1140	Sig P 226 / Glock 17	1140		22+	0.4	N/A	22+	0.38	2.7 ci	0.14		0.12	undet Pen
Frangible	G2 RIP 92 gr	1265	Glock 17	1295		4/14	0.4	1.8 ci	3.5/12.5	0.38	1.8 ci	0.15		0.13	1.85
Frangible	Glaser Blue +P 80 gr	1500	Glock 17	1465		6.0	Frag	N/A	5.5	Frag	N/A	Did Not Exit (DNE)		Did Not Exit (DNE)	undet Area
	HP CorBon +P 115 gr	1350	Glock 17	1300		9.5	0.6	2.7 ci	7.0	0.5	1.4 ci	0.3		0.16	1.9
	HP Federal HST 147 gr	1000	Sig P 226 / Glock 17	1005		15.2	0.6	4.3 ci	15.5	0.5	3.0 ci	0.42		0.35	5.9
	HP Hornady C Duty +P 135 gr	1115	Glock 17	1120		14.5	0.5	2.9 ci	13.5	0.5	2.7 ci	0.35		0.31	4.6
	HP OATH Tango 110 gr	1200	Glock 17	1150		5.3	0.8	2.7 ci	4.6	0.8	2.3 ci	Did Not Exit (DNE)		Did Not Exit (DNE)	undet Area
	HP Remington GS +P 124 gr	1180	Glock 17	1170		13.0	0.6	3.7 ci	12.0	0.5	2.4 ci	0.25		0.17	2.6
	HP Remington GS 147 gr	990	Glock 17	980		17.0	0.6	4.8 ci	16.0	0.5	3.1 ci	0.3		0.25	4.5
	HP Sig Sauer V 124 gr	1165	Sig P 226 / Glock 17	1150		13.8	0.6	3.9 ci	16.5	0.4	2.1 ci	0.4		0.35	5.7
	HP Speer GD +P 124 gr	1220	Glock 17	1200		15.3	0.5	3.0 ci	14.2	0.4	1.8 ci	0.24		0.16	2.9
	HP Speer GD 147 gr	985	Glock 17	970		15.5	0.6	4.4 ci	14.6	0.5	2.9 ci	0.36		0.32	5.1
	HP Underwood Max Exp 105 gr	1175	Glock 17	1160		10.3	0.8	5.2 ci	11.0	0.7	4.2 ci	0.5		0.41	4.8
	HP Winchester Ranger T 147 gr	990	Glock 17	1000		14.5	0.6	4.1 ci	16.0	0.4	2.0 ci	0.3		0.25	4.2
Poly	Interceptor ARX +P 65 gr	1695	Glock 17	1680		12.5	0.9	7.9 ci	12.5	0.8	6.3 ci	0.6		0.5	6.9
SCR	Black Hills HB +P 100 gr	1300	Glock 17	1310		16.5	0.7	6.3 ci	14.8	0.7	5.7 ci	0.47		0.41	6.9
SCR	Black Hills Subsonic 125 gr	1050	Glock 17	1040		17.5	0.6	4.9 ci	17.0	0.6	4.8 ci	0.41		0.37	6.7
SCR	Fort Scott 80 gr	1350	Sig P 226 / Glock 17	1405		19.5	0.4	2.5 ci	18.8	0.4	2.4 ci	0.27		0.25	5.0
SCR	G9 EHP 80 gr	1480	Glock 17	1405		17.5	1.1	16.6 ci	17.0	1.0	13.3 ci	0.69		0.66	11.6
SCR	G9 First Response 77 gr	1550	Glock 17	1540		19.5	1.2	22.0 ci	19.0	1.1	18.1 ci	0.75		0.73	14.2
SCR	G9 APC 77 gr	1550	Glock 17	1555		19.5	1.2	22.0 ci	19.5	1.2	22.1 ci	0.75		0.76	14.7
SCR	G9 Woodsman +P 124 gr	1250	Glock 17	1260		34.0	0.7	13.1 ci	33.0	0.7	12.7 ci	0.5		0.5	16.7
SCR	Underwood XD +P 65 gr	1800	Glock 17	1760		16.5	1.1	15.7 ci	15.5	1.0	12.2 ci	0.65		0.63	10.2
SCR	Underwood XD 90 gr	1400	Sig P 226 / Glock 17	1480		16.0	0.8	8.0 ci	15.2	0.7	5.8 ci	0.6		0.47	8.3
SCR	Underwood XD +P 90 gr	1475	Sig P 226 / Glock 17	1505		16.7	0.9	10.6 ci	16.0	0.8	8.0 ci	0.6		0.6	9.8
SCR	Underwood XD +P+ 90 gr	1550	Glock 17	1585		17.5	1.0	13.7 ci	17.0	0.9	10.8 ci	0.65		0.65	11.2

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# 40 S&W RESULTS

VIPER WEAPONS TRAINING 2020		WOUND BALLISTICS DATA			PHASE 1	PHASE 2			PHASE 3			PHASE 4	PHASE 5		VWI
Caliber	Round	Box	Pistol	Average		Gelatin / Denim		Gelatin / Plywood / Denim			Tissue / Denim	Tissue / Plywood / Denim		Av Pen x	
Type		Velocity		Velocity		Penetration	Diameter	PWC	Penetration	Diameter	PWC	Av Hole Area	Av Hole Area		Av Area
40 S&W															
FMJ	Winchester FMJ 180 gr	1020	Glock 22	1005		22+	0.4	N/A	22+	0.4	N/A	0.14		0.16	undet Pen
Frangible	G2 RIP 115 gr	1080	Glock 22	1100		5/11.5	0.5	2.6 ci	5/11.2	0.4	1.4 ci	0.2	Did Not Exit (DNE)		undet Area
Frangible	Glaser Blue 115 gr	1400	Glock 22	1355		7.0	Frag	N/A	6.5	Frag	N/A	Did Not Exit (DNE)		Did Not Exit (DNE)	
	HP Federal HST 180 gr	1000	Glock 22	1000		18.0	0.6	5.1 ci	17.6	0.6	5.0 ci	0.49		0.43	8.2
	HP Hornady C Duty 175 gr	1010	Glock 22	1020		17.9	0.6	5.0 ci	17.2	0.6	4.9 ci	0.4		0.4	7
	HP OATH Tango 125 gr	1250	Glock 22	1225		8.0	0.8	4.0 ci	6.7	0.8	3.4 ci	Did Not Exit (DNE)		Did Not Exit (DNE)	
	HP Remington GS 165 gr	1150	Glock 22	1145		15.3	0.5	3.0 ci	17.2	0.4	2.2 ci	0.3		0.2	4.1
	HP Remington GS 180 gr	1015	Glock 22	1020		17.2	0.6	4.9 ci	16.4	0.5	3.9 ci	0.44		0.36	6.7
	HP Sig Sauer V 165 gr	1090	Glock 22	1100		16.5	0.6	4.7 ci	16.1	0.6	4.6 ci	0.45		0.41	7.0
	HP Speer GD 165 gr	1050	Glock 22	1060		14.3	0.7	5.5 ci	16.0	0.5	3.1 ci	0.3		0.24	4.1
	HP Speer GD 180 gr	1025	Glock 22	1040		16.0	0.6	4.5 ci	15.1	0.6	4.3 ci	0.45		0.41	6.7
	HP Underwood Max Exp 140 gr	1050	Glock 22	1060		8.5	1.0	6.7 ci	9.5	0.9	6.0 ci	0.69		0.58	5.7
	HP Winchester Ranger T 180 gr	990	Glock 22	1000		13.5	0.7	5.2 ci	12.7	0.6	3.6 ci	0.42		0.36	5.1
SCR	Fort Scott 125 g	1320	Glock 22	1290		22.0	0.5	4.3 ci	20.8	0.4	2.6 ci	0.2		0.28	5.1
SCR	G9 EHP Range Limiter 80 gr	1625	Glock 22	1640		19.0	1.3	25.2 ci	18.5	1.2	20.9 ci	0.78		0.76	14.4
SCR	G9 EHP 95 gr	1460	Glock 22	1445		19.0	1.0	14.9 ci	18.7	0.9	11.9 ci	0.7		0.66	12.8
SCR	G9 1st Response 90 gr	1450	Glock 22	1450		19.2	1.1	18.2 ci	19.0	1.0	14.9 ci	0.75		0.74	14.2
SCR	G9 APC 90 gr	1450	Glock 22	1460		19.2	1.1	18.2 ci	19.1	1.1	18.2 ci	0.75		0.75	14.4
SCR	G9 Woodsman 130 gr	1300	Glock 22	1315		33.0	0.8	15.8 ci	32.0	0.8	16.1 ci	0.65		0.63	20.8
SCR	G9 1st Response 77 gr A	1700	Glock 22	1685		19.8	1.5	35.0 ci	19.7	1.5	34.8 ci	0.87		0.85	17.0
SCR	G9 APC 77 gr A	1700	Glock 22	1690		20.0	1.5	35.3 ci	20.0	1.5	35.3 ci	0.88		0.86	17.4
SCR	G9 1st Response 77 gr B	1700	Glock 22	1680		20.0	1.1	19 ci	20.2	1.1	19.2 ci	0.71		0.69	14.1
SCR	G9 APC 77 gr B	1700	Glock 22	1690		20.5	1.1	19.5 ci	20.5	1.1	19.5 ci	0.72		0.7	14.6
SCR	Underwood XD 100 gr	1500	Glock 22	1510		18.0	1.0	14.1 ci	17.6	0.9	11.2 ci	0.69		0.64	11.8
SCR	Underwood XD 115 gr	1400	Glock 22	1425		18.5	0.9	11.8 ci	18.1	0.9	11.5 ci	0.63		0.58	11.1

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# ADDITIONAL COMMENTS

- Minimal testing was done with non-standard barrel lengths.
  - Glock 19 with stock 4.02” barrel. Solid Copper Rounds (SCR) exhibited a reduced muzzle velocity of approximately 50-70 fps.
  - Glock 17/22 with KKM Threaded 5.03” barrel. Used during the subsonic tests. SCRs exhibited a muzzle velocity increase of approximately 50-70 fps
  - Glock 34/35 with KKM Threaded 5.85” barrel. SCRs exhibited a muzzle velocity increase of approximately 120-160 fps
  - Phase 4 tissue tests showed a corresponding increase in hole area with an increase in muzzle velocity with the Solid Copper Rounds
- All testers remarked at the low recoil the Solid Copper Rounds exhibited. Both in single shot and during our full magazine rapid fire test for feed reliability. Muzzle rise and felt recoil were noticeably reduced while using the SCR.



# ACKNOWLEDGEMENTS

- There are so many people to credit with the amount of data that was measured and calculated in this report presentation. People involved in this test came from multiple police departments, a local gun store and 2 training schools. One local grocery store chain gave a great discount on the brisket used in Phases 4 and 5. The tests were accomplished at 2 outdoor ranges
- No ammunition manufacturers were allowed to attend any test. They were only allowed to provide ammunition and nothing else
- A very special thanks to all the volunteers who helped set up, tear down, measure, re-measure, document, calculate and check all the data. Only through their diligent thorough work could this much accurate data be generated
- There are no conclusions in this test. Testing was accomplished only to provide quantifiable raw data on a large scale with an enormous sample size on multiple realistic media





# CONTACT US

Please contact us for questions or follow-on testing

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