| Photographs of Bullet - Etc. |
MEMORANDUM REPORT NO. 2673

AMMUNITION FOR LAW ENFORCEMENT: PART III, PHOTOGRAPHS OF BULLETS RECOVERED AFTER IMPACTING TISSUE SIMULANT

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The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.
A comprehensive study was conducted for the Department of Justice to determine what factors influence human incapacitation by handgun bullets. An evaluation of the effectiveness of nearly all commercial handgun bullets was made. As part of the study, each bullet was recovered after impacting and penetrating a tissue simulant target. This report is a supplement to the overall program methodology and results presented in a BRL Report entitled, "Ammunition for Law Enforcement: Part I, Methodology for Evaluating Relative Stopping Power."
Presented in this report are the photographs of bullets recovered after firing during this program.
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I. INTRODUCTION

In December 1972, the National Institute of Law Enforcement and Criminal Justice of the Law Enforcement Assistance Administration approved and funded a project, submitted by the Law Enforcement Standards Laboratory (LESL) of the National Bureau of Standards, to conduct a study of the terminal effects of police handgun ammunition. LESL late in 1973 contracted with the U.S. Army Ballistic Research Laboratories (BRL) to conduct the study and prepare a report of its findings. The purpose of the study was to provide federal, state and local law enforcement agencies with a criterion for use in selection of handgun ammunition; a criterion which considers not only the offensive capabilities of the ammunition, but also the safety factors concerning innocent bystanders. The purpose was not specifically to show that studies by previous investigators were invalid, but to bring the salient features of these previous studies together with a more detailed and updated description of the entire scenario to produce a unified approach to the problem which would allow an objective evaluation of handgun effectiveness.

To place the question of handgun effectiveness on the level of an objective approach, three primary terminal characteristics of handgun ammunition were studied:

1. Relative Incapacitation of Human Targets (i.e., relative stopping power).

2. Ricochet Hazards.


As the focus of the study was on commercially available handgun ammunition in the caliber range from 0.355 (9mm) through 0.45, an extensive laboratory investigation of all significantly different handgun bullets available to law enforcement agencies in the United States was conducted. This report deals with experiments performed for the relative incapacitation portion of the study from which the following data were extracted:

1A. Measurement of the formation and subsequent development of the temporary cavity produced in tissue simulant by each bullet as a function of striking velocity.

1B. Measurement of the general dynamic behavior of each bullet as it penetrated the tissue simulant, its stability, and deformation, as a function of striking velocity.
1C. Measurement of the impact velocity by factory loaded ammunition corresponding to each bullet under study when fired from various handguns currently used by law enforcement agencies.

The photographic data presented in the following section were gathered during Part 1B. The volume of the data generated for relative incapacitation requires that the results be presented in three separate reports as follows:

Ammunition for Law Enforcement: Part I, Methodology for Evaluating Relative Stopping Power and Results.

Ammunition for Law Enforcement: Part II, Data on Cavity Formation and Bullet Deformation During Penetration of Tissue Simulant.

Ammunition for Law Enforcement: Part III, Photographs of Bullets Recovered After Impacting Tissue Simulant.

II. PHOTOGRAPHIC RESULTS

During the conduct of the tests to evaluate the effectiveness of handgun bullets against personnel, each bullet was fired into a 30 cm long block of tissue simulant. For each test shot, the penetration of the bullet was recorded dynamically by both high-speed cinematography and flash x-ray photography. After each shot (when possible), the bullet was recovered from the tissue simulant and photographed. Presented on the following pages are these photographs.

The data are arranged in the following sequence:

1. Manufacturers are listed alphabetically.

2. Within manufacturer, the data are presented from smallest to largest caliber.

3. Within caliber, the data are presented in the following order for construction type:
a. Full Jacket (FJ)
b. Full Metal Case (FMC)
c. Full Metal Jacket (FMJ)
d. Jacketed Hollow Point (JHP)
e. Jacketed Soft Point (JFP) (JSP)
f. Lead (L)
g. Lead Hollow Point (LHP)
h. Lead Round Nose (LRN)
i. Lubaloy
j. Metal Piercing (MP)
k. Round Nose (RN)
l. Semi-Wadcutter (SWC)
m. Wadcutter (WC)

4. Within construction type, the data are presented from smallest to largest mass in grains.
Figure 1  Effects of Striking Velocity on Bullet Deformation for HIGH PRECISION, .357 MAG, JHP, 110 GRAIN
Figure 2  Effects of Striking Velocity on Bullet Deformation for HIGH PRECISION, .38 SPECIAL, JHP, 158 GRAIN
Figure 3  Effects of Striking Velocity on Bullet Deformation for HORNADY, .357 MAG, JFP, 158 GRAIN
Velocity $= 342$ m/s

Velocity $= 290$ m/s

Figure 4  Effects of Striking Velocity on Bullet Deformation for HIGH PRECISION, .45 ACP, JHP, 170 GRAIN
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Velocity = 437 m/s

Velocity = 293 m/s

Velocity = 265 m/s

Velocity = 0 m/s
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Velocity = 375 m/s

Velocity = 0 m/s
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Figure 29 Effects of Striking Velocity on Bullet Deformation for SIERRA, .38 SPECIAL, JHP, 125 GRAIN

Velocity = 387 m/s
Velocity = 329 m/s
Velocity = 274 m/s
Velocity = 230 m/s
Velocity = 350 m/s

Velocity = 292 m/s

Velocity = 245 m/s

Velocity = 152 m/s

Figure 30 Effects of Striking Velocity on Bullet Deformation for SIERRA, .38 SPECIAL, JHP, 150 GRAIN
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Velocity = 374 m/s

Velocity = 356 m/s
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Velocity = 355 m/s

**Figure 33** Effects of Striking Velocity on Bullet Deformation for SIERRA, .41 MAG, JHP, 170 GRAIN
Velocity = 353 m/s

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Velocity = 369 m/s
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Velocity $= 475$ m/s  
Velocity $= 418$ m/s  
Velocity $= 328$ m/s  
Velocity $= 257$ m/s  
Velocity $= 133$ m/s

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Velocity = 476 m/s

Velocity = 328 m/s

Velocity = 317 m/s

Velocity = 291 m/s

Velocity = 230 m/s
Figure 45 Effects of Striking Velocity on Bullet Deformation for SMITH & WESSON, .38 SPECIAL, RN, 158 GRAIN

Velocity = 265 m/s
Velocity = 250 m/s

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Velocity = 453 m/s
Velocity = 439 m/s

Velocity = 380 m/s
Velocity = 369 m/s

Velocity = 297 m/s
Velocity = 267 m/s
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Velocity = 418 m/s
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Velocity = 513 m/s

Velocity = 416 m/s

Velocity = 405 m/s

Velocity = 336 m/s

Velocity = 312 m/s

Velocity = 308 m/s
Figure 56  Effects of Striking Velocity on Bullet Deformation for SPEER, .38, JSP, 160 GRAIN
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Velocity = 356 m/s

Velocity = 353 m/s

Velocity = 304 m/s

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Velocity = 460 m/s  Velocity = 374 m/s
Velocity = 319 m/s
Velocity = 283 m/s  Velocity = 189 m/s
Figure 66  Effects of Striking Velocity on Bullet Deformation for SPEER, .45, JHP, 225 GRAIN
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Velocity = 422 m/s

Velocity = 398 m/s

Velocity = 373 m/s

Velocity = 346 m/s

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Velocity = 418 m/s

Velocity = 379 m/s

Velocity = 351 m/s

Velocity = 301 m/s

Velocity = 279 m/s

Velocity = 241 m/s
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Velocity = 311 m/s

Velocity = 290 m/s

Velocity = 266 m/s
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Velocity = 478 m/s

Velocity = 411 m/s

Velocity = 216 m/s
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Velocity = 393 m/s
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Velocity = 488 m/s
Velocity = 395 m/s  Velocity = 360 m/s

Velocity = 351 m/s  Velocity = 319 m/s

Velocity = 253 m/s  Velocity = 221 m/s

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Velocity = 248 m/s

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Velocity = 391 m/s

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Velocity = 355 m/s
Velocity = 335 m/s

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