A PENETRATION MECHANICS DATABASE

By

Charles E. Anderson, Jr.
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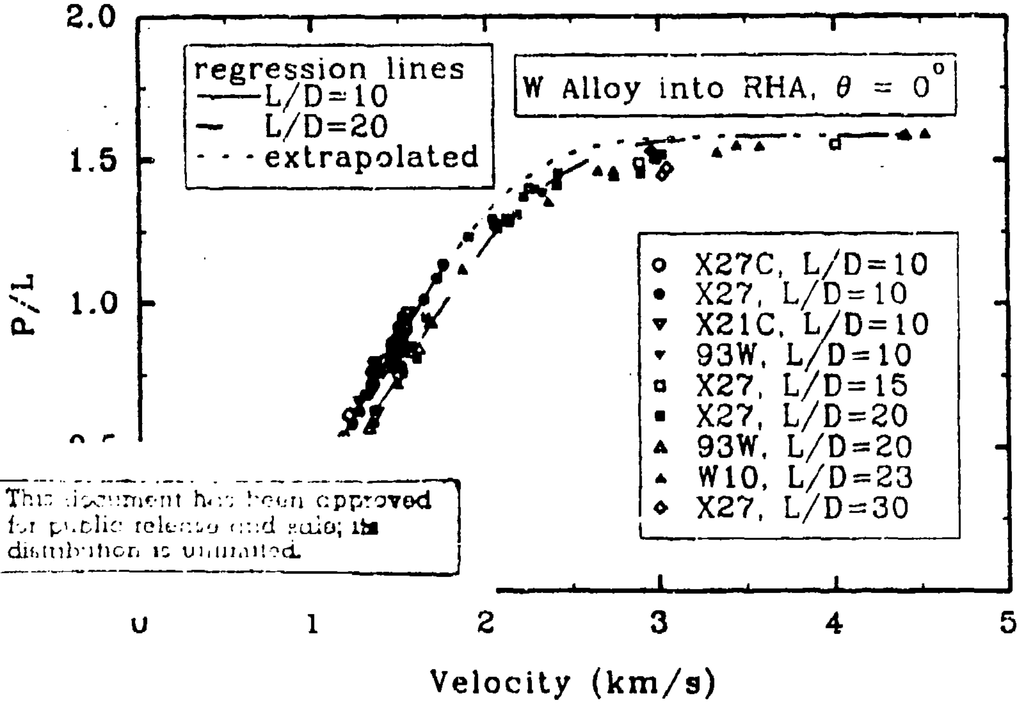
David L. Littlefield



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19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

A penetration mechanics database has been compiled that contains experimental results from a variety of researchers of different nationalities (German, French, English. Canadian, and American), during different decades (the 1960's to the 1990's), and with different purposes or objectives (space debris impact, armor design and evaluation, penetrator design and evaluation, and theoretical verification). The data fall naturally into three subgroupings: 1) penetration into semi-infinite targets, 2) perforation of finite-thickness targets, and 3) penetration from multiple impact (segmented rods). Data collection was primarily limited to experiments conducted against "generic" type targets, and emphasis was placed on data that would be more relevant to "heavy" armor issues. This diverse collection of data for metallic targets has been tabulated; data tables include the initial impact conditions, the projectile and target geometries and materials, and the measured response. Information on the materials, e.g., hardness or yield strength, along with impact information such as yaw has been tabulated if available. Graphical displays of the data have been used to summarize the data, and cross-plotting that combines data from different sources has also been provided.

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1.0 INTRODUCTION

A formidable amount of experimental data has been collected under the general discipline of terminal ballistics. Because a substantial quantity of these data is gathered to assess the response of a specific target or material, perhaps with or without design variations, much of these data are not formally reported. The data collected serves its intended purpose and then is relegated to a laboratory notebook, a desk drawer, or other repository where it is often forgotten, and seldom, if ever, retrieved.

There have been, however, a variety of terminal ballistic studies conducted over the years where the data are reported. Data are often documented, along with attendant analysis, in laboratory reports, conference proceedings, and in the open literature. It was decided that a collection of terminal ballistics data, gathered under one cover, could potentially be a very valuable resource to investigators. Such data could be used for comparison against newly collected data, as a resource for calibrating and validating analytical models, as an asset for numerical simulations in which the initial conditions and final response were available, and as a resource for fundamental studies of penetration mechanics.

Nevertheless, it is somewhat intimidating to tackle the collection and display of such experimental data. Several guidelines and restraints were established to provide an overall philosophy for data collection and to limit the scope to something that was manageable. Emphasis was placed on data that would be more relevant to "heavy" armor issues, although this was not an exclusive constraint. Further, it was decided that the data collection would be limited to experiments conducted against "generic" type targets, e.g., semi-infinite targets. Notably absent from the database are "light-armor" data, such as represented by the recently compiled database by Muldoon (1991). Projectile nose shape and material characteristics, in addition to kinetic energy, dominate the penetration mechanics of light-armor targets. For example, Muldoon has compiled data for a variety of armor-piercing bullets and fragment simulators.

The data collected in this report, for the most part, are considered "fundamental" in nature. Data collection focused on homogeneous metallic targets, and generally, there was a requirement that the data be reported in a laboratory report or conference proceedings; that is, the data have been formally reported in some publication.

It was concluded that a tabulation of the data would be the most useful format for researchers. Data tables include the initial impact conditions, the projectile and target geometries and materials, and the measured response. Information on the materials, e.g., hardness or yield strength, along with impact information such as yaw, is also tabulated if available. The tabulated data appear in the Appendices.

Graphical displays represent the most efficient and easiest way to assess what data are available in the tabulated database. Therefore, in addition to the tabulated data, summary graphs of the data are also presented. The summary graphs, provided in Section 2.0, are for each individual reference source. Sometimes, because of the quantity or the dissimilarity of data within a reference source, either several plots are used to summarize the data, or some of the data were not graphed. The data plotted in each figure are also cross-referenced in the Appendices. The last row for each column of data in the Appendices contains the figure number in Section 2.0 where the data are graphed.

The database contains experimental results from a variety of researchers of different nationalities (German, French, English, Canadian, and American), of different decades (the 1960's to the 1990's), and with different purposes or objectives (space debris impact, armor materials and evaluation, penetrator materials and evaluation, and theoretical verification). These different backgrounds and objectives have led to the data being reported in various ways by the original authors (e.g., tabulated raw data or graphed scaled data). This diverse collection of data from the referenced sources has resulted in our manipulation of the data into the selected format as described in the following paragraphs.

Data in the references are presented in either English (ft/s, inches, pounds, or grains) or metric units (m/s, mm or cm, grams). Data in English units have been converted to metric using the standard conversions, but this conversion can produce an unwarranted indication of accuracy. As an example, a reported velocity of 4680 ft/s may represent a value rounded to the closest 10 ft/s, but conversion to 1427 m/s implies closer accuracy than the original author was conveying. All conversions were made without any rounding of the resulting values.

Hardness or strength values for both target and penetrator materials were reported as Brinell Hardness Numbers (BHN's), Rockwell C (Rc) values, Vickers (Vk) values, or tensile strengths. Strengths are tabulated as BHN's in the database. The following equations were used to perform the necessary conversions:

$$BHN = 1.979 \cdot [TensileStrength(ksi)] + 11.24 \qquad (1)$$

$$BHN = 7.595 \cdot Rc + 63.86 \tag{2}$$

$$BHN = -14.29 + 1.038 \cdot Vk - 0.00014 \cdot Vk^2 \tag{3}$$

The conversion from tensile strength to Brinell is based upon a linear fit to data for steel in a steel vendor catalog[1] while the conversion to Brinell from Rockwell C is based on data in ASTM E-140.[2] The conversion from tensile strengths was used for all materials and tensile strengths, even those producing Brinell values below 100.

Penetrator parameters typically reported included mass, density, and dimensions. Some references, however, did not report all values. Missing values were calculated from the available data and were inserted in the tables.

The values of yaw in the data base represent the total misalignment of the axis of the penetrator with its trajectory in both the vertical and horizontal planes. In a few of the references where the misalignment angles in two orthogonal directions were reported, the total yaw angle was entered in the database, given by:

$$\delta = \tan^{-1}(\tan^2\beta + \tan^2\gamma)^{1/2} \tag{4}$$

where β and γ are the orthogonal yaw angles, and δ is the total yaw angle. In some referen' ·›, no yaw data were presented, and the entries for these are left blank in the tabulated database. Additional researchers reported that all yaws were less than some maximum allowable value, and these are so indicated in the database. Reported values of zero yaw are represented by 0.

The data fall naturally into subgroupings:

- Penetration into semi-infinite targets
- Perforation of finite-thickness targets
- Penetration from multiple impacts, e.g., segmented rods

The semi-infinite data can be further subdivided into two categories: the first is for experiments where the projectile erodes during target penetration; the second category represents rigid penetration. Although there were a few investigators who explicitly

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1. Jorgensen Steel, ***Steel, Aluminum Stock List and Reference Book,*** Earle M. Jorgensen Company, 1986.
2. ASTM E-140, *Standard Hardness Conversion Tables for Metals (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, and Knoop Hardness).*

investigated rigid-body penetration, it was decided not to subdivide into these two categories. This is because other investigators performed studies where the projectile eroded, such as an aluminum projectile into a steel target; and sometimes the projectile remained rigid, or semi-rigid, as represented by a steel projectile into an aluminum target. Further, the transition from rigid to eroding penetration is velocity dependent. Also, as an eroding projectile decelerates within a target, it can transition to rigid-body penetration. Readers should be aware that this phenomenon, not always discussed by the original authors, can occur. The data for finite-thickness targets are subdivided into two categories: residual velocity versus striking velocity ($V_r - V_s$) and limit-velocity (V_L) data. Although $V_r - V_s$ data can be used to obtain limit velocities, some of the reference sources provided only the limit-velocity data.

Data are contrasted and compared from different sources in Section 3.0. No attempt was made to perform an exhaustive analysis of the data; instead, the goal was to provide a reasonable, but relatively concise, graphical summary. More than 2300 data points have been compiled in this database. The distribution of the data by the three target types is:

- Semi-infinite 1460
- Finite thickness
  - $V_r - V_s$ 386
  - V_L 410
- Multiple (segmented) impact 71

We have been reasonably diligent in the collection of data, but we also realize that not all relevant data have been compiled. If we have missed or overlooked someone's data, it certainly was not intentional. Perhaps we will have the opportunity to re-issue the report sometime in the future, and at that time we can include data inadvertently overlooked, and include newly generated data.

Hopefully, researchers will find this compilation of data useful in their studies.

2.0 GRAPHICAL PRESENTATION OF THE DATA

2.1 Semi-Infinite Data

The semi-infinite target database contains experimental data from more than 30 different sources in the literature. Although a variety of projectile, target, and obliquity combinations are presented, the majority of the data are from impact experiments of heavy-metal alloy (tungsten, depleted uranium) projectiles into rolled homogeneous armor (RHA) at zero degrees obliquity. A significant quantity of results is also presented for penetration of steel projectiles into steel and aluminum targets. A few experimental results are presented for penetration of hard projectiles into soft targets, that is, rigid-body penetration.

An overview of the data found in the database can be found in Figs. 2.1.1 through 2.1.53. For most of the experiments, it was convenient to plot the penetration efficiency (P/L) as a function of the impact velocity (V), for given target and projectile materials, at various projectile aspect ratios L/D, and target obliquity angles θ. Although the value of P/L certainly varies with respect to many other variables, such as projectile hardness and diameter, only a weak dependence is observed under most conditions; consequently, these other dependencies are not depicted on the graphs. Unfortunately, yaw angles were not consistently reported in all of the experiments, so yaw angles are not presented on the plots.

In a few cases, the plotted parameters were changed to reflect more accurately the emphasis of a particular study. In some of the data from the GM Defense Laboratories, for example, P/L is shown as a function of L/D for different impact velocities (see Figs. 2.1.17 through 2.1.19). P/L is shown as a function of projectile cone angle or L/D (refer to Figs. 2.1.5 and 2.1.7) for the data from Brooks.

Results shown on the plots of P/L versus impact velocity are generally consistent with the anticipated trends in the data. At high velocities, for example, the penetration efficiency of projectiles with large aspect ratios should approach $\sqrt{\rho_p/\rho_t}$, where ρ_p and ρ_t are the projectile and target densities, respectively. This assumes, of course, the penetration event can be modeled as steady state, and the strengths of the target and projectile are negligible when compared to the penetration interface pressure. The data plotted in the graphs are consistent with this trend, as shown, for example, in Figs. 2.1.25 and 2.1.40. Furthermore, if the target resistance is larger than the projectile flow stress,

P/L for long rods should never exceed $\sqrt{\rho_p/\rho_t}$ at low velocities. This trend is evident in many of the graphs, including Figs. 2.1.32 - 2.1.33, and 2.1.52 - 2.1.53. For low L/D projectiles, on the other hand, for which the penetration event cannot be assumed steady state, P/L is not limited by $\sqrt{\rho_p/\rho_t}$. The data in the graphs are consistent with this observation (see Figs. 2.1.13, 2.1.20, 2.1.23, and 2.1.26). In addition, if the projectile flow stress is much larger than the penetration interface pressure, but the target resistance is smaller, the projectile penetrates as a rigid body. Under these conditions the penetration efficiency can also reach values much larger than $\sqrt{\rho_p/\rho_t}$. The data plotted in several graphs are in agreement with this observation, as illustrated in Figs. 2.1.5 - 2.1.7, 2.1.14, 2.1.21 - 2.1.22, and 2.1.24.

The data are categorized by projectile and target types in Tables 2.1.1 and 2.1.2. In the first table, the experiments are sorted by the L/D of the projectile and the target material, and in the second table, projectile materials are sorted by the target material used in the experiments. The figure numbers where the data can be found are identified in the tables. For brevity, the "2.1._" preface in the figure numbers has been omitted in the tables.

Table 2.1.1. Projectile *L/D's* and Target Materials in Semi-infinite Target Database, with Corresponding Figure Numbers

	Target Material									
Projectile L/D	Mg	Mild Al	Al	Hard Al	Mild Steel	Steel	Armor Steel	Pb	Pyrex	W Alloy
$L/D \le 1$		12, 17-18	17-18		19	23	2, 11, 20, 23, 25-26, 29		20	
$1 < L/D \le 5$		5, 7, 13-14, 17-18	13-14, 17-18, 49-50	3-4, 49-50	6, 15-16, 19	15-16, 37, 41, 48	6, 8-11, 29, 44-45, 48, 50-51			
$5 < L/D \le 10$		5, 17-18	17-18, 24, 43	1, 3, 21	19, 38	23, 24 37, 41	11, 23-29, 31-32, 34, 38, 44-47, 51-52	42		24
$10 < L/D \le 15$	35	17-18	17-18, 35-36	1, 21-22	19	35	11, 34, 40 44-45			
$15 < L/D \le 20$		17-18	18	31	19		25-26, 30, 33, 40, 53			
$20 < L/D \le 25$		18					25-26, 39			
$25 < L/D \le 30$							32, 40			
$L/D > 30$							25-26			

Table 2.1.2. Projectile and Target Materials in Semi-infinite Target Database, with Corresponding Figure Numbers

Projectile Material	Target Material: Mg	Mild Al	Al	Hard Al	Mild Steel	Steel	Armor Steel	Pb	Pyrex	W Alloy
Mg				1						
Mild Al		12, 13	13		16	16				
Al	35	13, 17	13, 17, 35	1, 3	16	16, 35, 37		42		
Hard Al		13	50	50	16		50			
Ti			36							
Sn				1						
Mild Steel		14, 18	14, 18		15, 19, 38	15				
Steel		5, 7	14, 36, 43, 49	31, 49		15, 23, 41, 48	8, 23, 26, 45, 48			
Hard Steel			49	21, 22, 49	38	48	26, 51			
WC					6		6, 8, 28		20	
TiC									20	
Ta				3-4						
W Alloy			24	3	38	24	2, 8, 11, 20, 24-25, 27, 29, 31-34, 38-40, 44, 46-47, 52-53		20	24
DU Alloy							9-10, 30, 32-33			
Au				1						

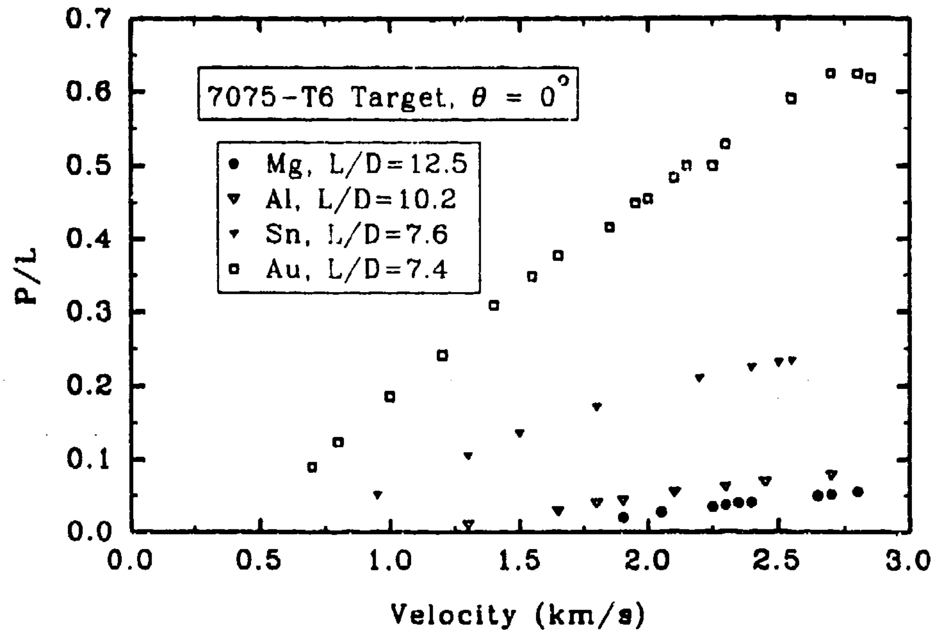

Fig. 2.1.1. Penetration Efficiency versus Impact Velocity, Allen and Rogers (1961)

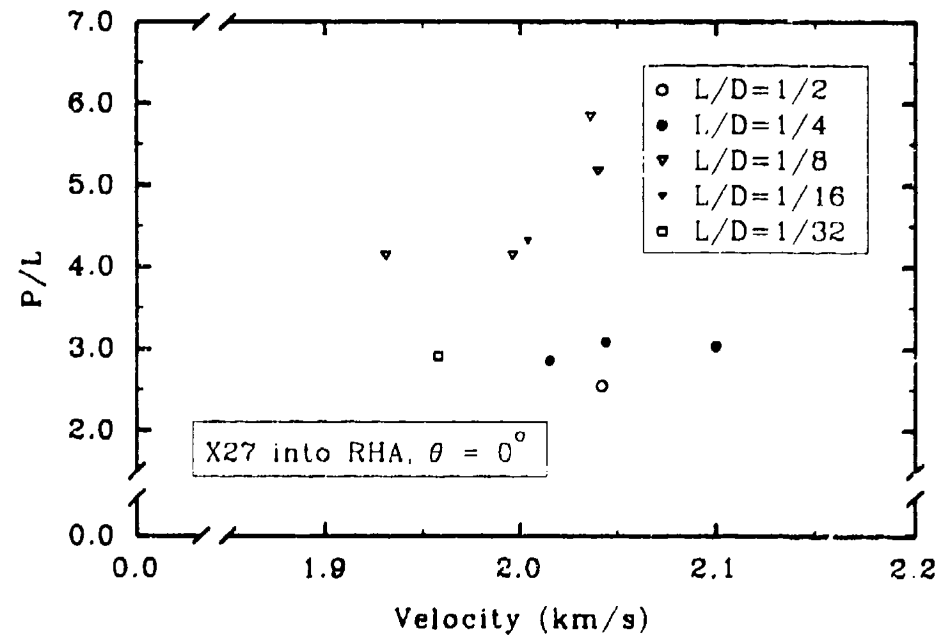

Fig. 2.1.2. Penetration Efficiency versus Impact Velocity, Bjerke *et al.* (1991)

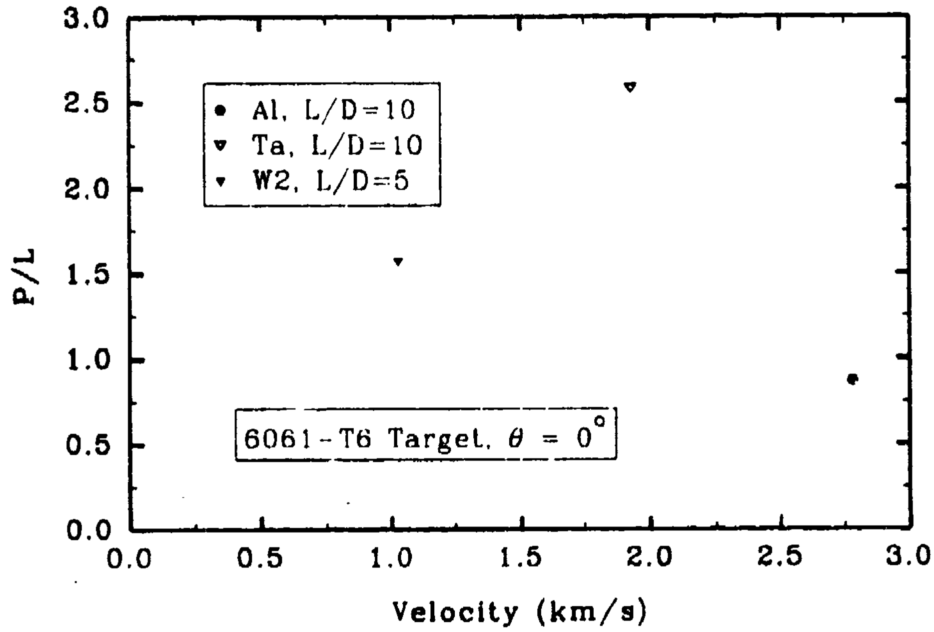

Fig. 2.1.3. Penetration Efficiency versus Impact Velocity, Bless *et al.* (1986)

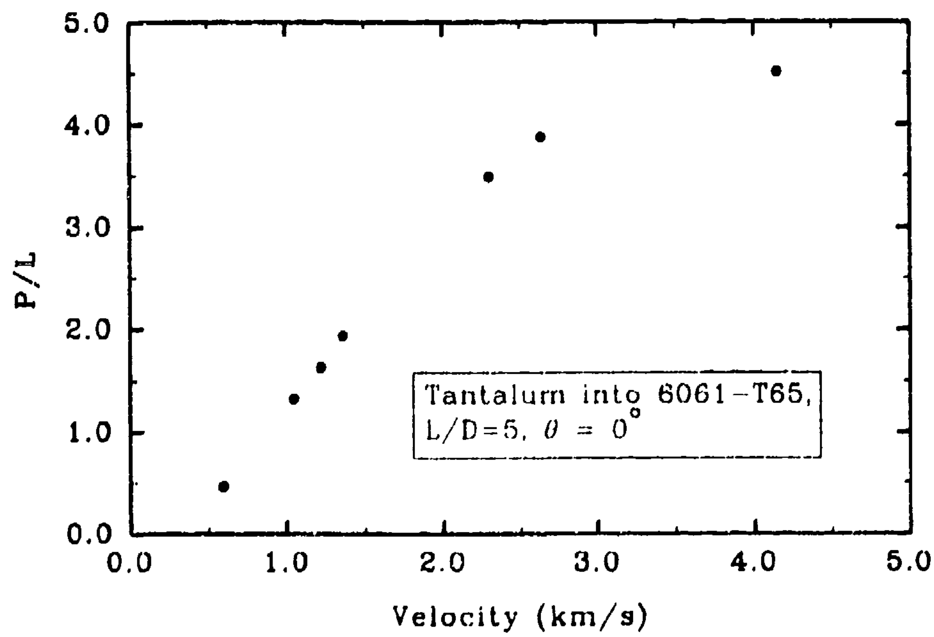

Fig. 2.1.4. Penetration Efficiency versus Impact Velocity, Bless *et al.* (1987)

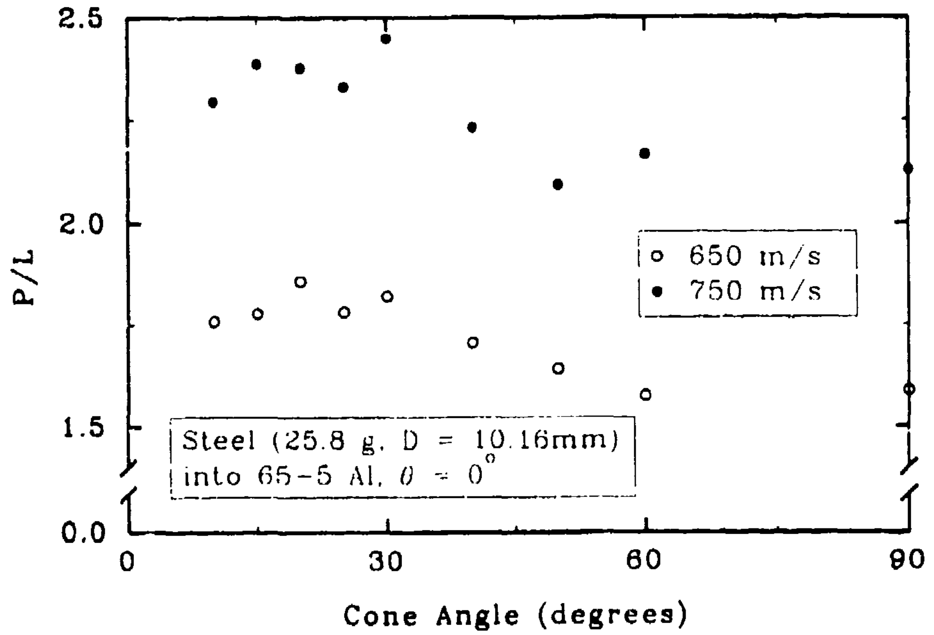

Fig. 2.1.5. Penetration Efficiency versus Projectile Cone Angle, Brooks (1973)

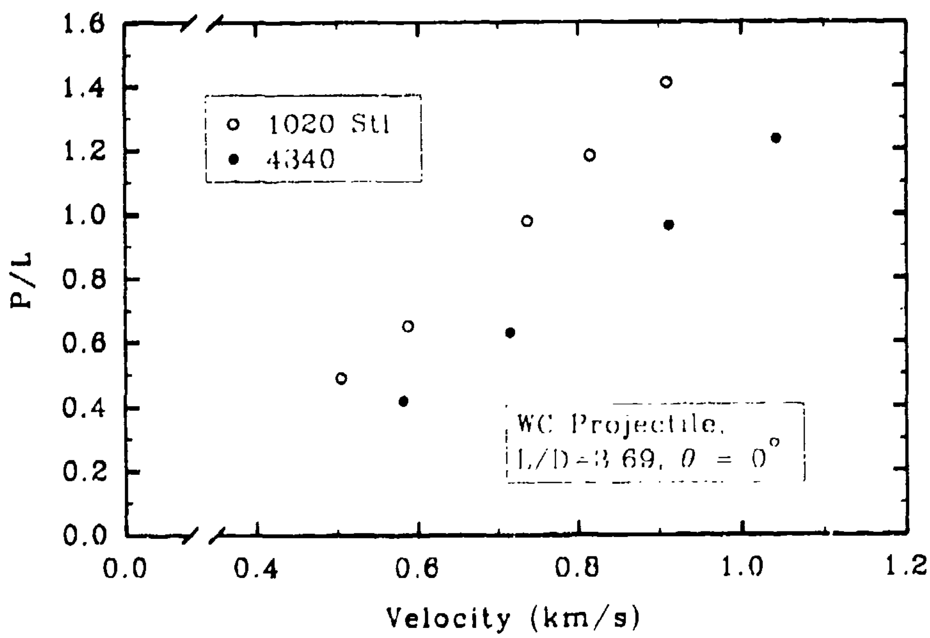

Fig. 2.1.6. Penetration Efficiency versus Impact Velocity, Brooks (1973)

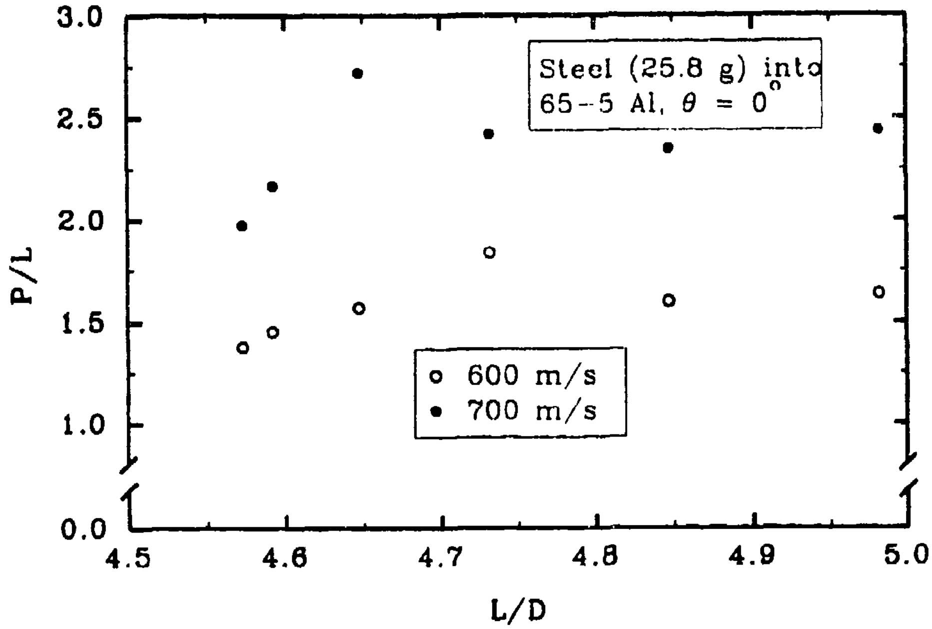

Fig. 2.1.7. Penetration Efficiency versus Projectile Aspect Ratio, Brooks (1973)

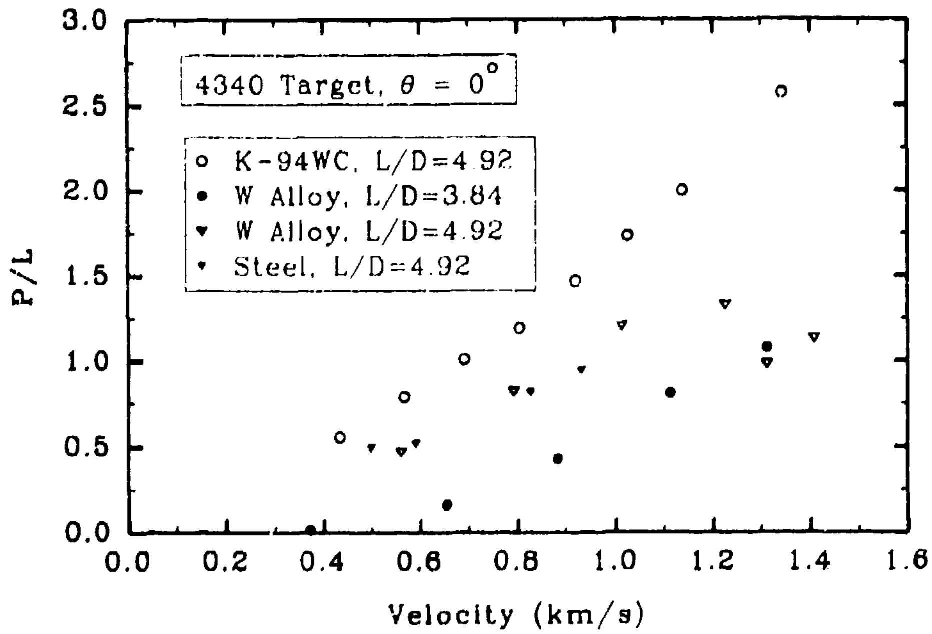

Fig. 2.1.8. Penetration Efficiency versus Impact Velocity, Brooks and Erickson (1971)

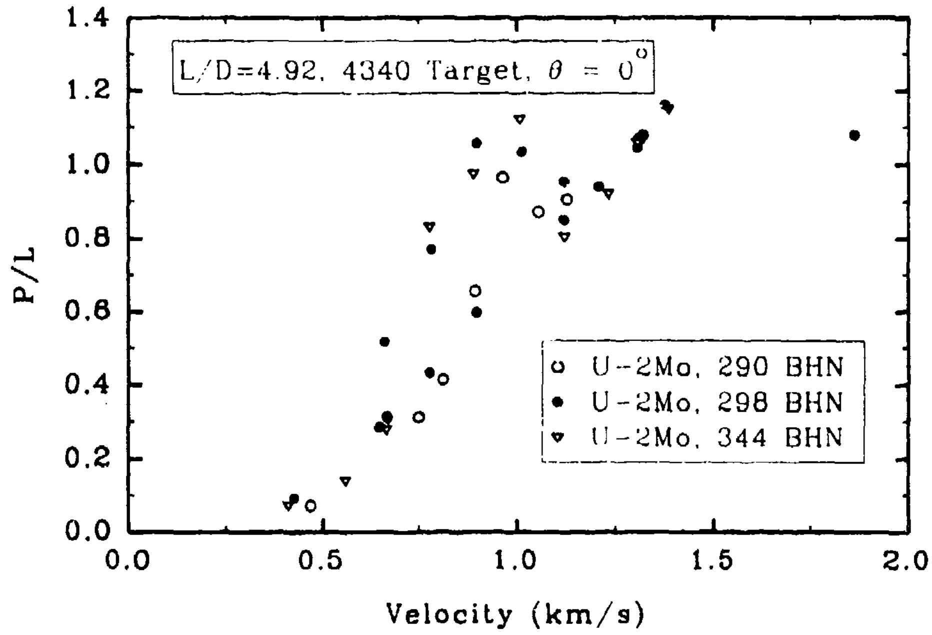

Fig. 2.1.9. Penetration Efficiency versus Impact Velocity, Brooks and Erickson (1971)

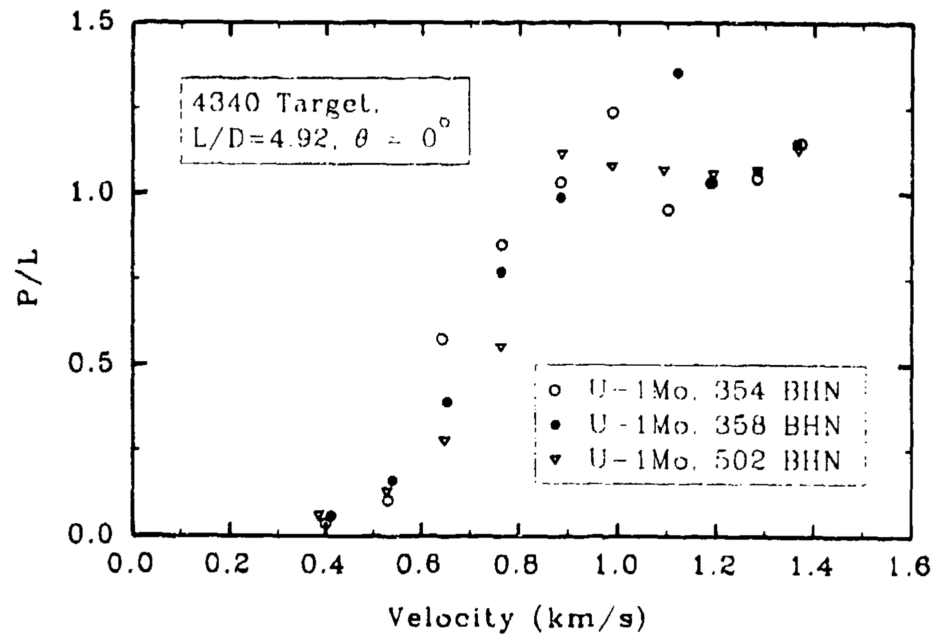

Fig. 2.1.10. Penetration Efficiency versus Impact Velocity, Brooks and Erickson (1971)

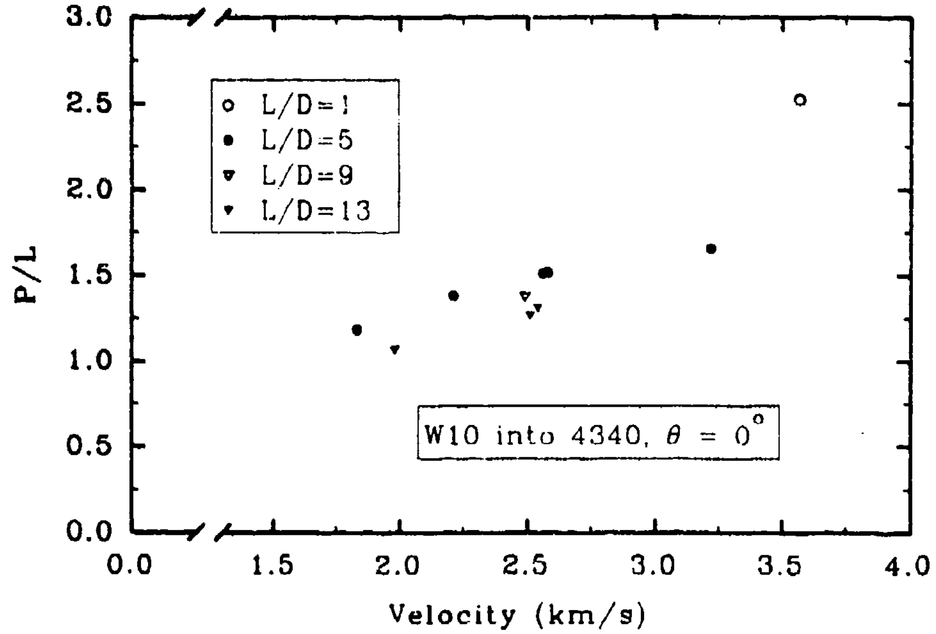

Fig. 2.1.11. Penetration Efficiency versus Impact Velocity, Charters *et al.* (1990)

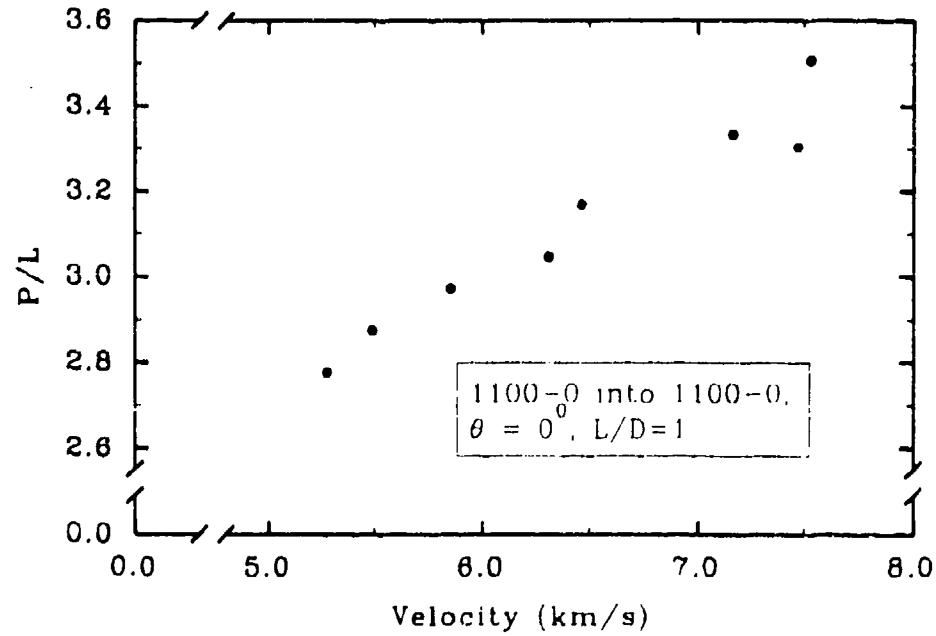

Fig. 2.1.12. Penetration Efficiency versus Impact Velocity, Christman (1965)

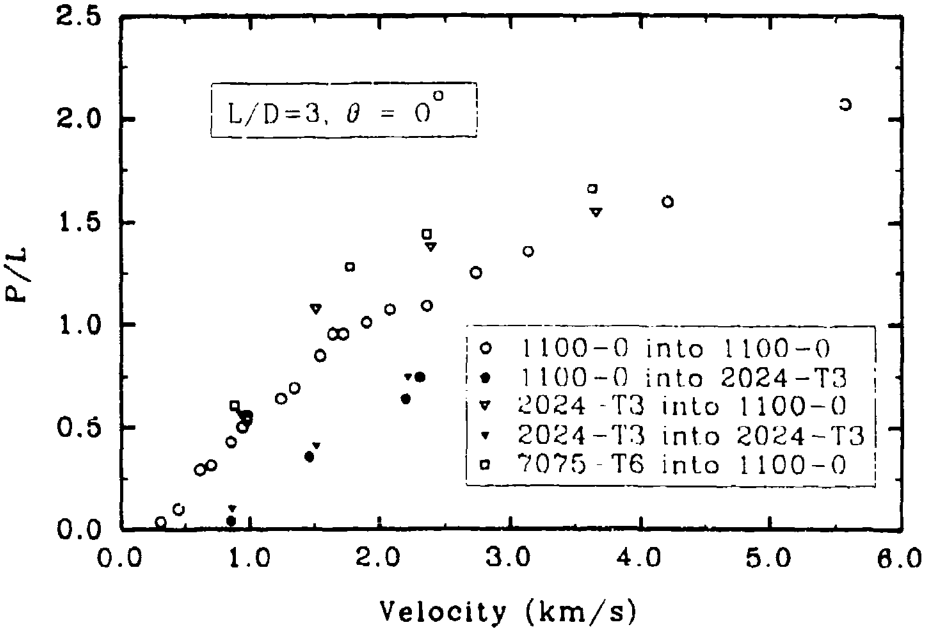

Fig. 2.1.13. Penetration Efficiency versus Impact Velocity, Christman and Gehring (1963)

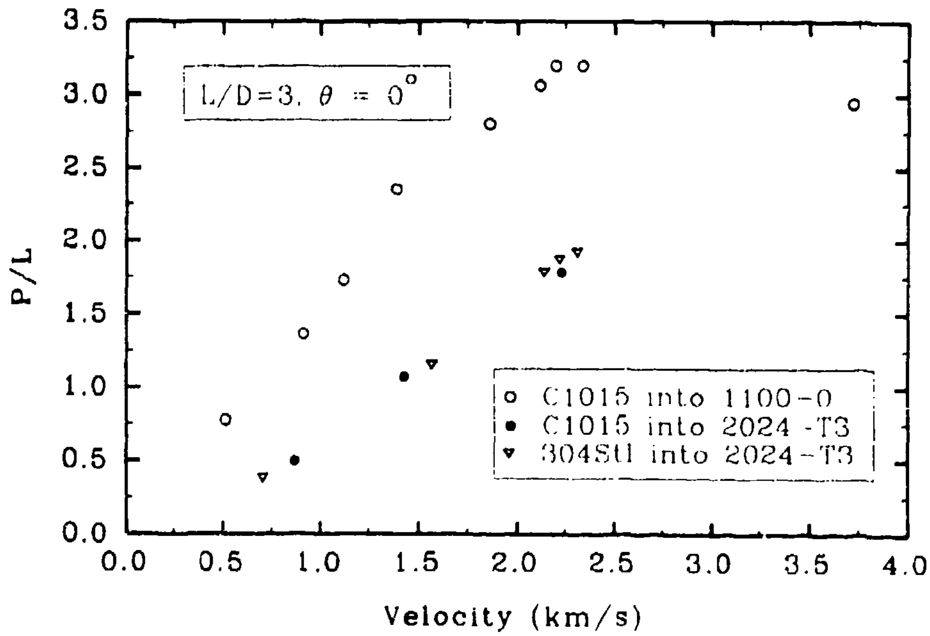

Fig. 2.1.14. Penetration Efficiency versus Impact Velocity, Christman and Gehring (1963)

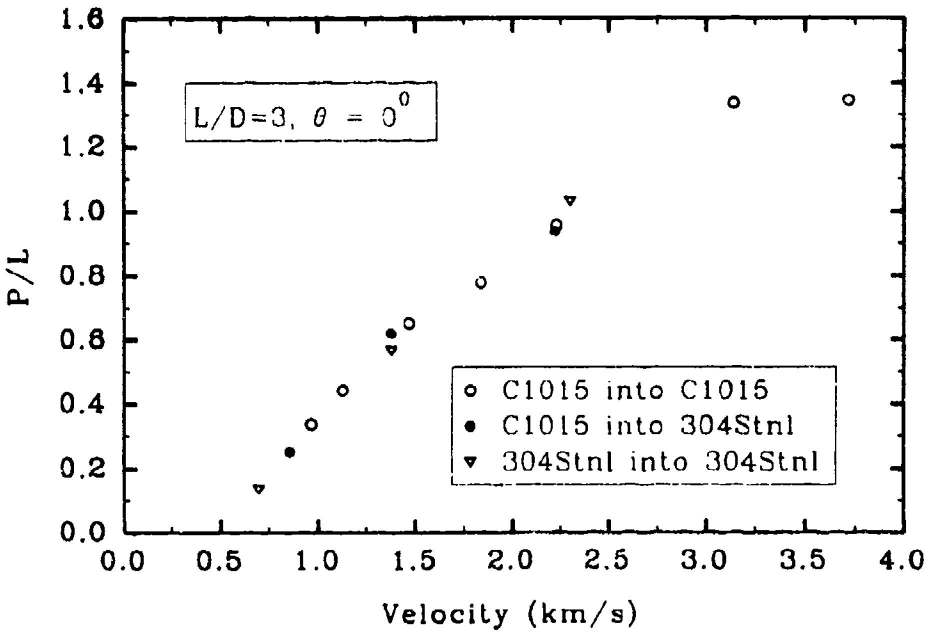

Fig. 2.1.15. Penetration Efficiency versus Impact Velocity, Christman and Gehring (1963)

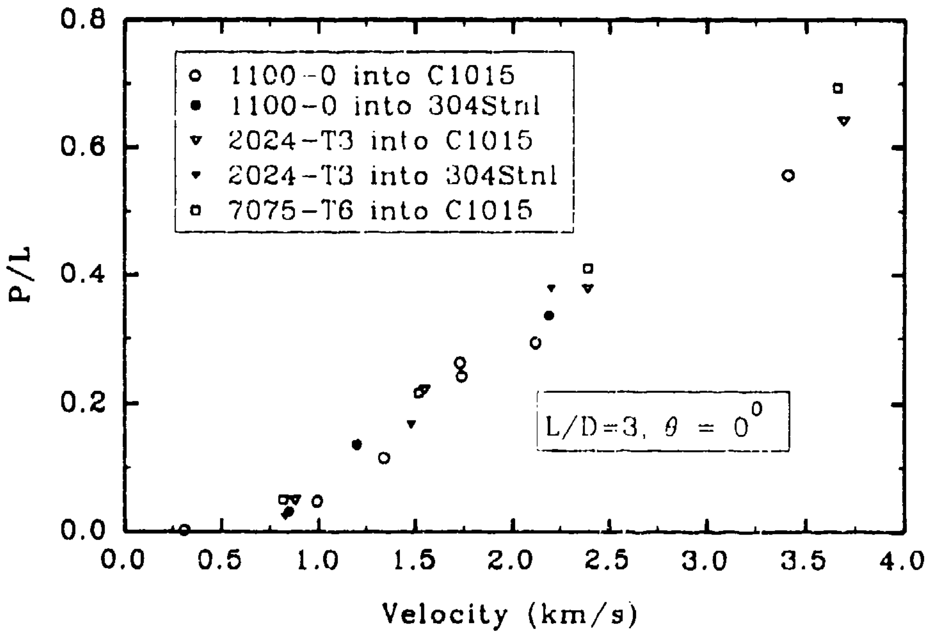

Fig. 2.1.16. Penetration Efficiency versus Impact Velocity, Christman and Gehring (1963)

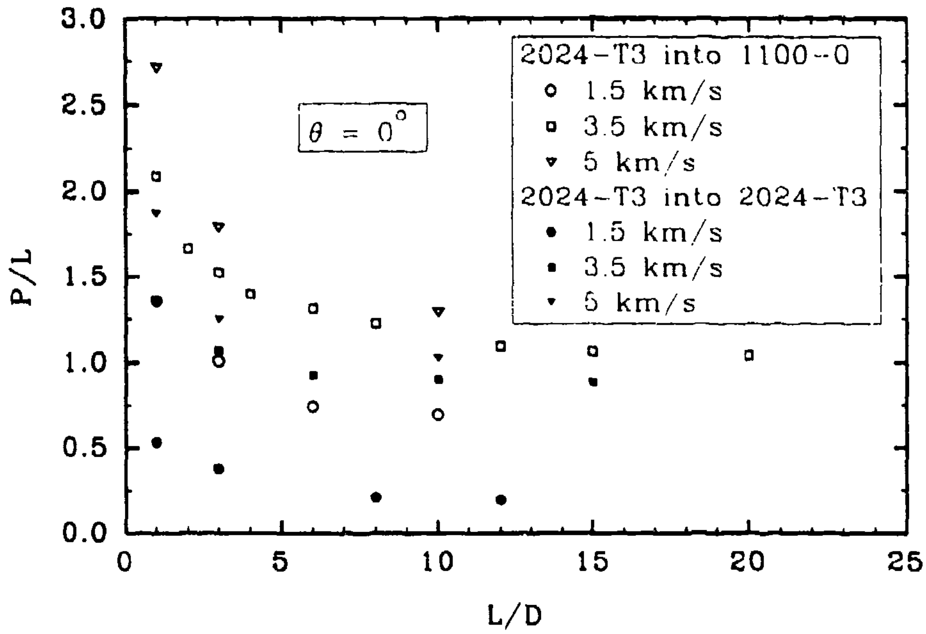

Fig. 2.1.17. Penetration Efficiency versus Impact Velocity, Christman and Gehring (1965)

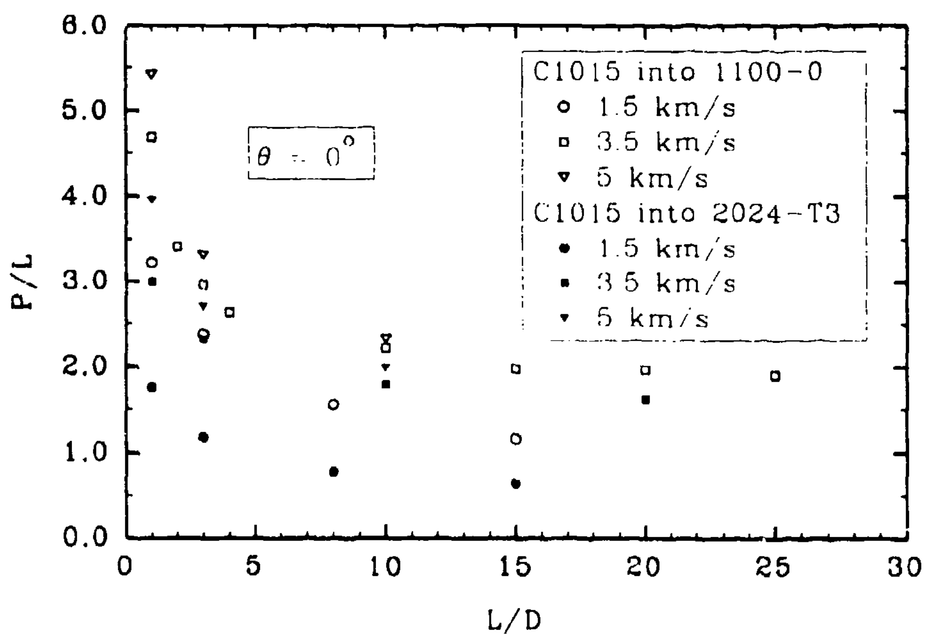

Fig. 2.1.18. Penetration Efficiency versus Projectile Aspect Ratio, Christman and Gehring (1965)

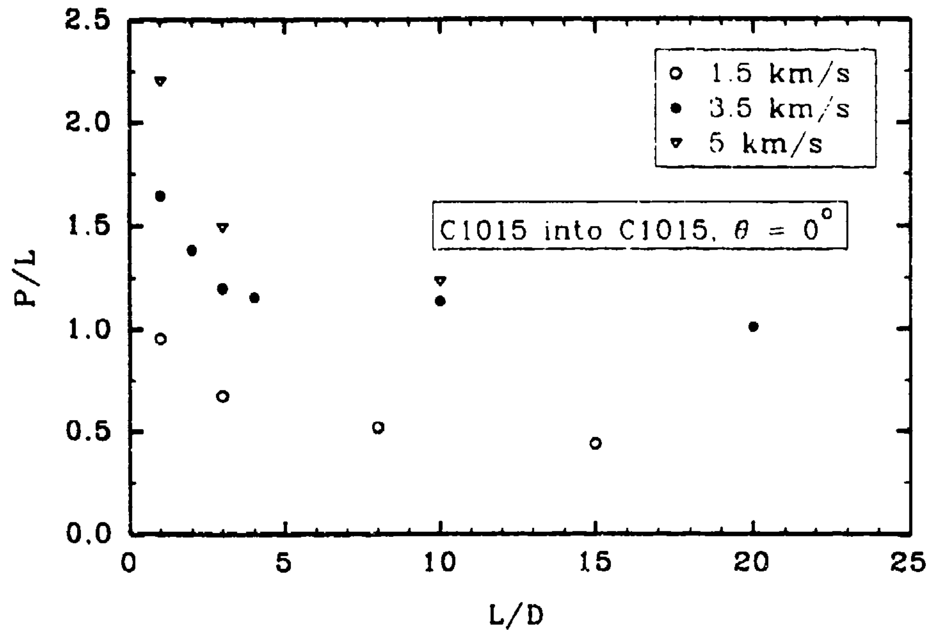

Fig. 2.1.19. Penetration Efficiency versus Projectile Aspect Ratio, Christman and Gehring (1965)

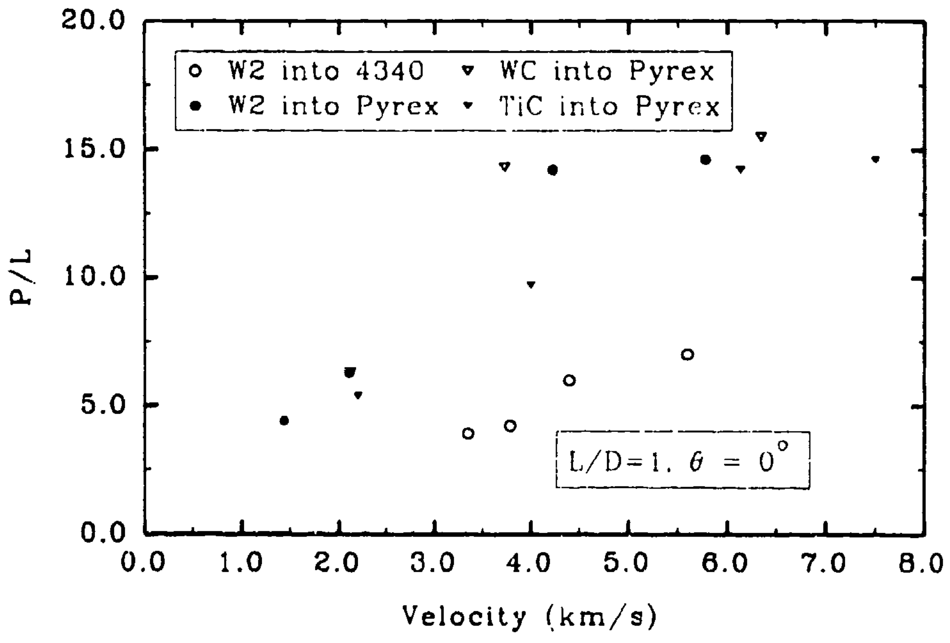

Fig. 2.1.20. Penetration Efficiency versus Impact Velocity, Cline *et al.* (1989)

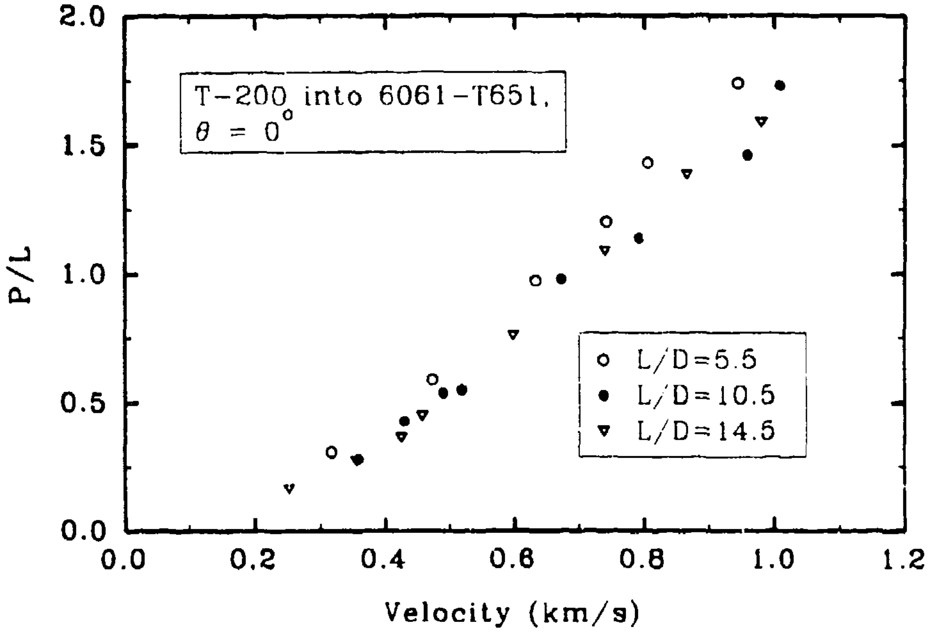

Fig. 2.1.21. Penetration Efficiency versus Impact Velocity, Forrestal *et al.* (1991)

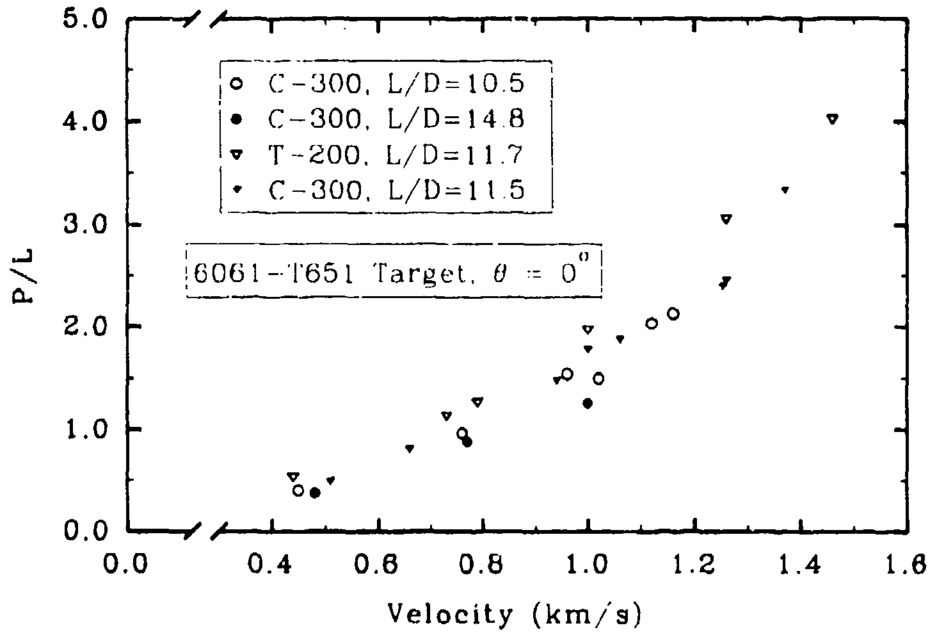

Fig. 2.1.22. Penetration Efficiency versus Impact Velocity, Forrestal *et al.* (1988)

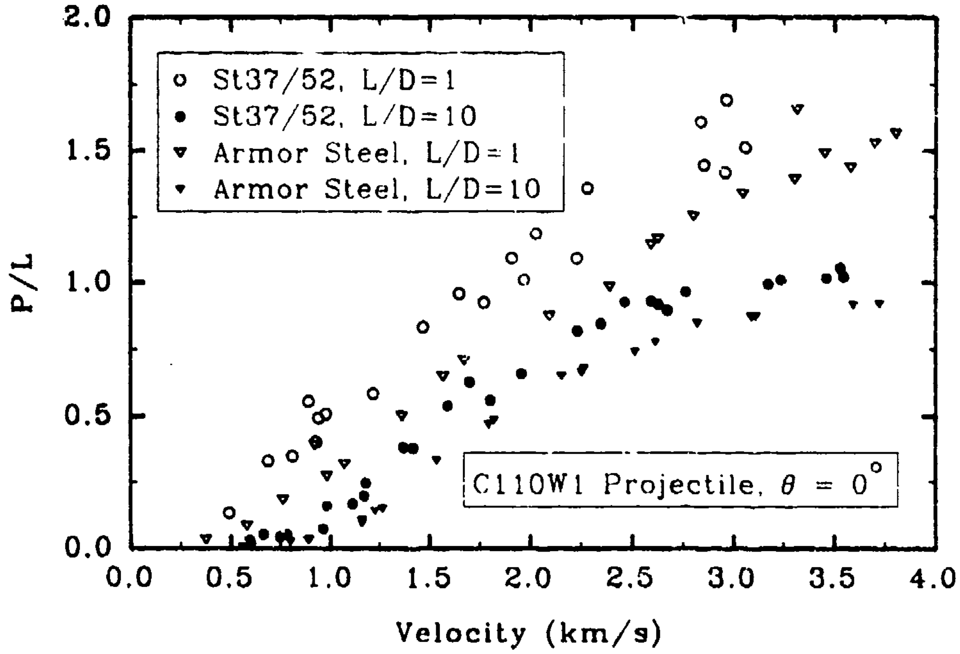

Fig. 2.1.23. Penetration Efficiency versus Impact Velocity, Hohler and Stilp (1991a)

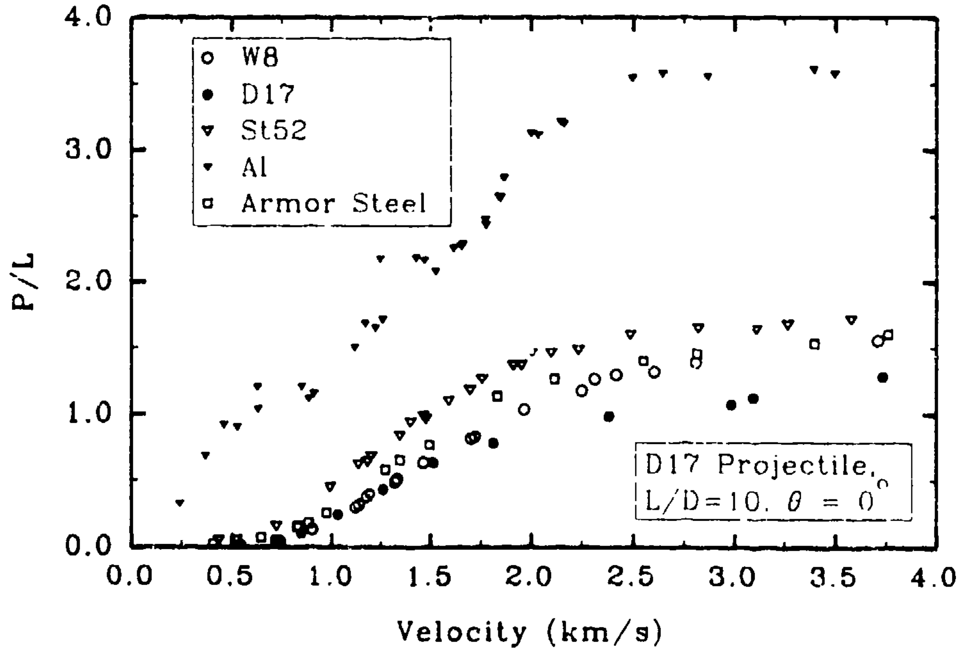

Fig. 2.1.24. Penetration Efficiency versus Impact Velocity, Hohler and Stilp (1991a)

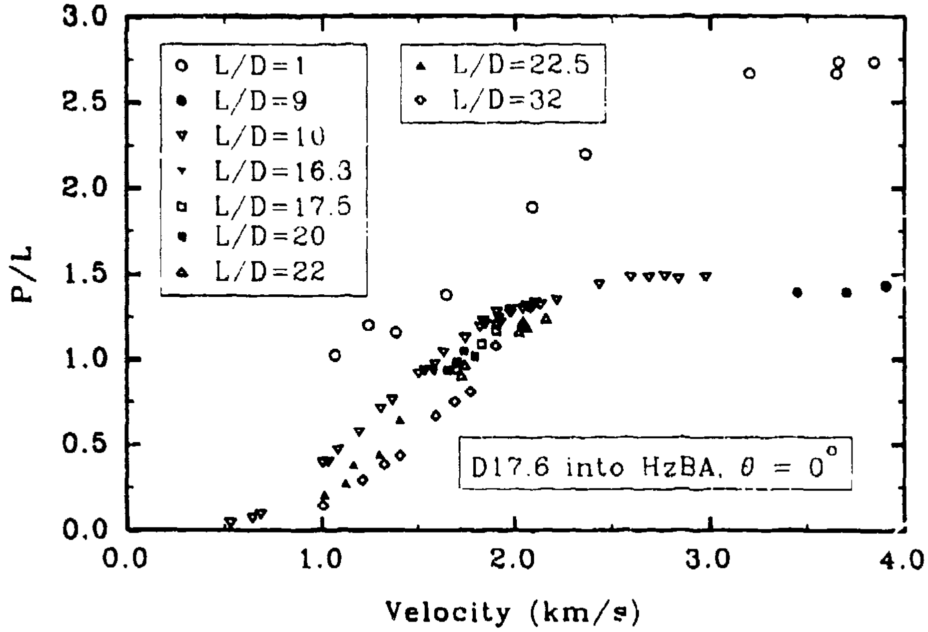

Fig. 2.1.25. Penetration Efficiency versus Impact Velocity, Hohler and Stilp (1991a)

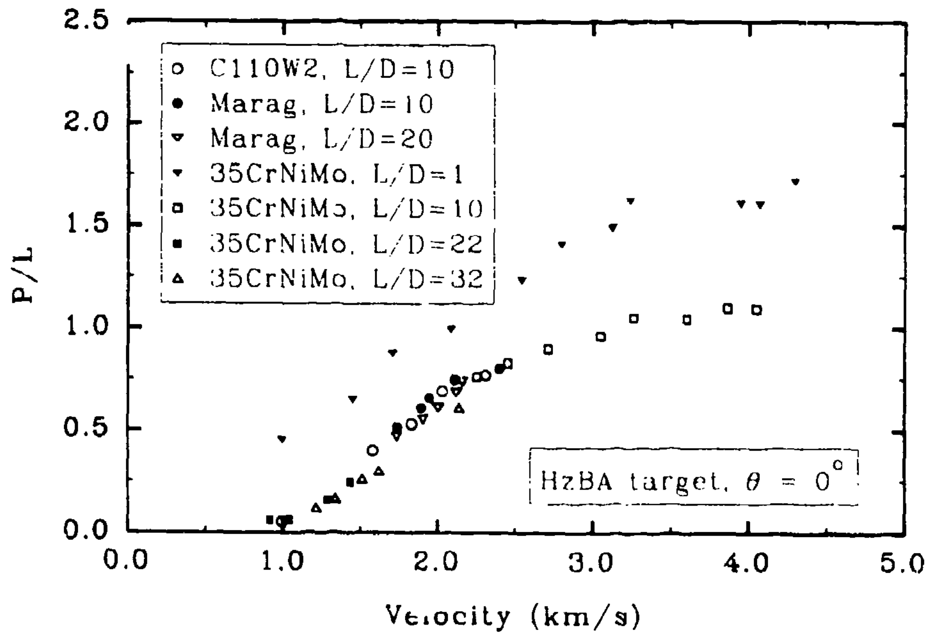

Fig. 2.1.26. Penetration Efficiency versus Impact Velc..ty, Hohler ana ..ip (1991a)

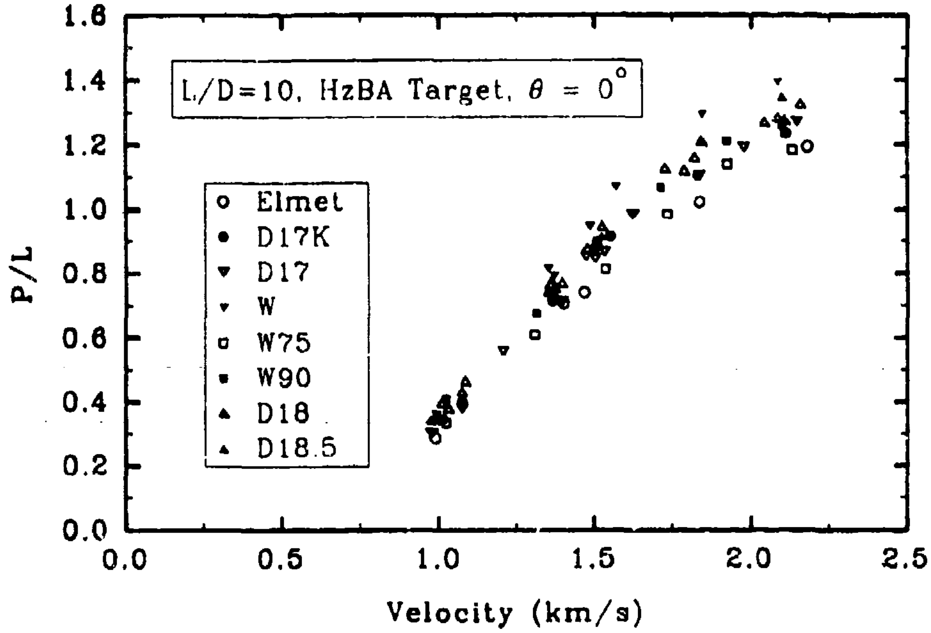

Fig. 2.1.27. Penetration Efficiency versus Impact Velocity, Hohler and Stilp (1991a)

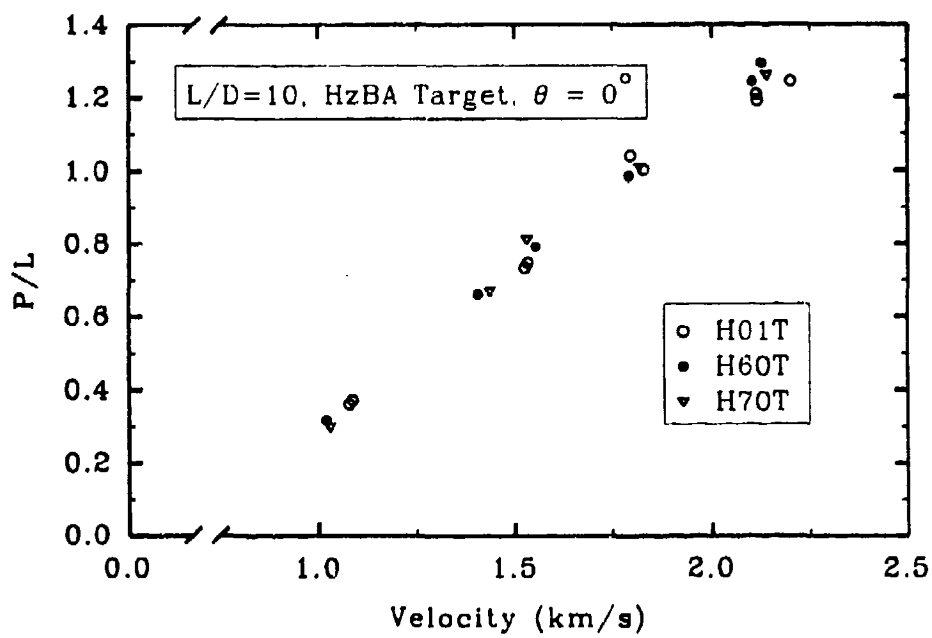

Fig. 2.1.28. Penetration Efficiency versus Impact Velocity, Hohler and Stilp (1991a)

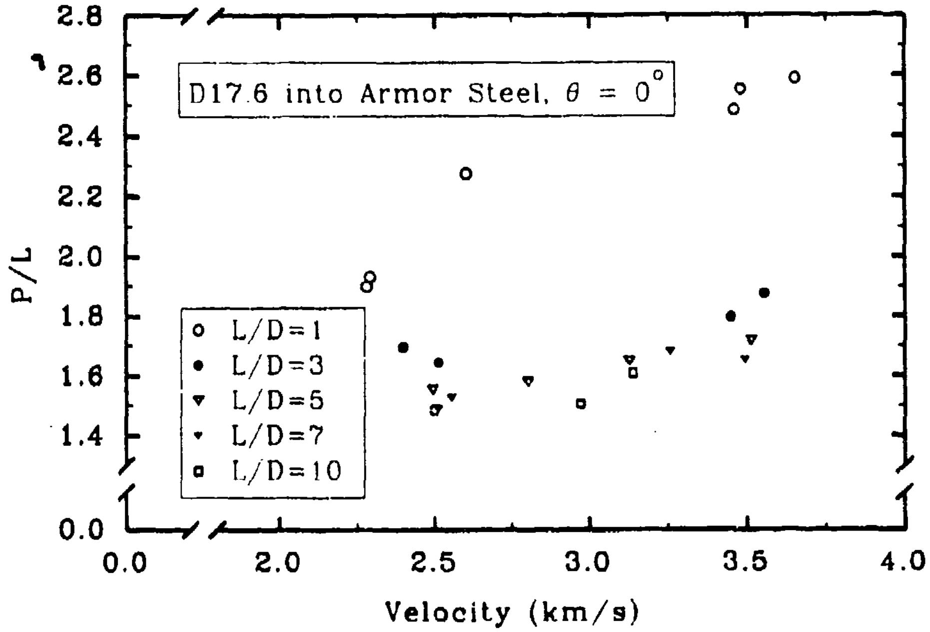

Fig. 2.1.29. Penetration Efficiency versus Impact Velocity, Hohler and Stilp (1991b)

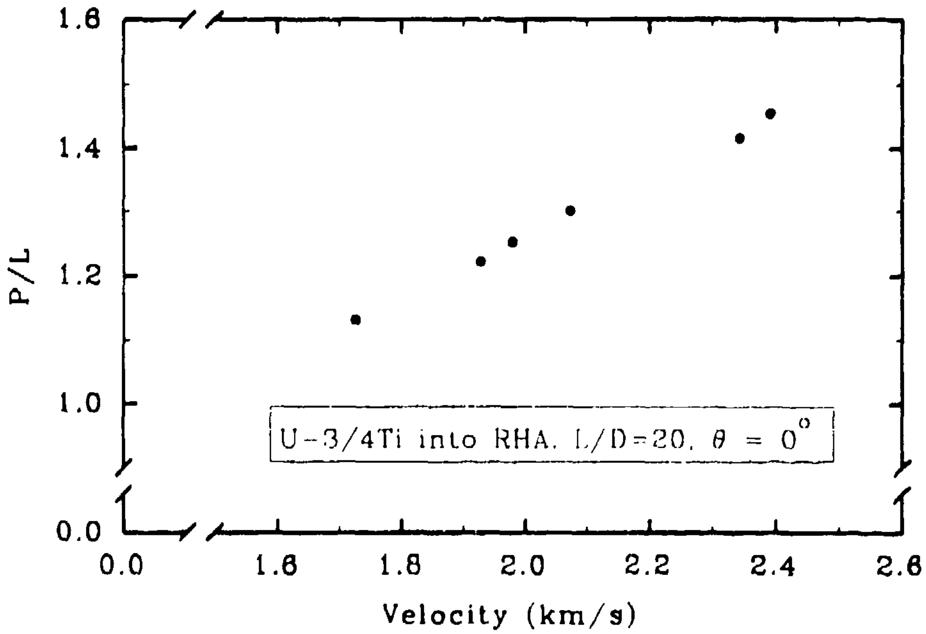

Fig. 2.1.30. Penetration Efficiency versus Impact Velocity, Keele *et al.* (1990)

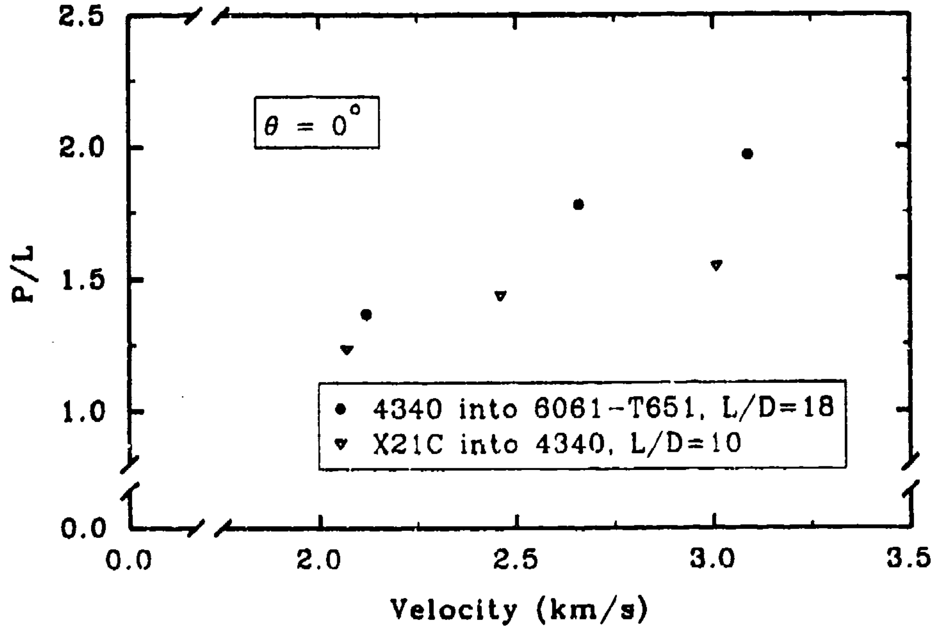

Fig. 2.1.31. Penetration Efficiency versus Impact Velocity, Luk and Piekutowski (1991)

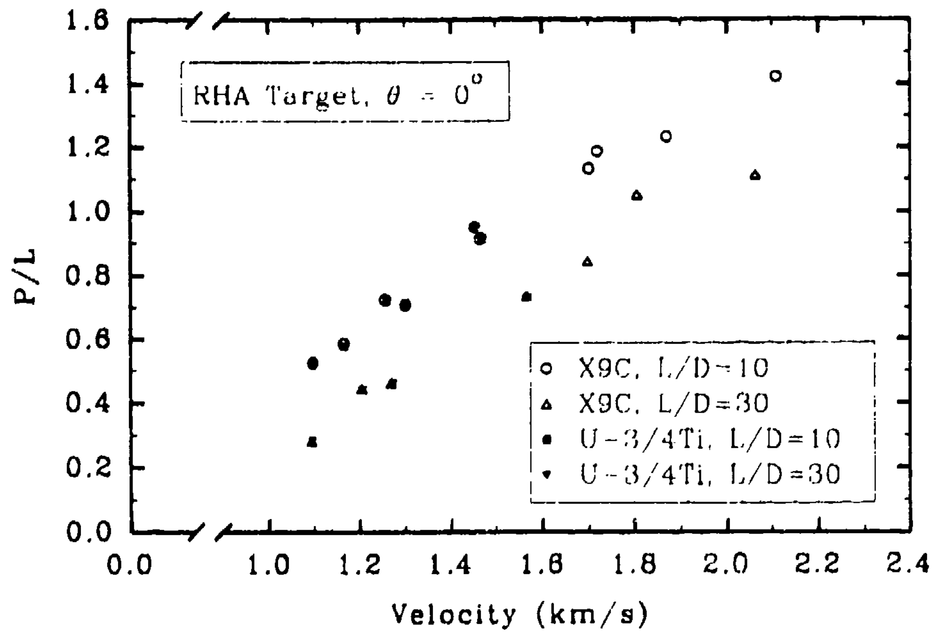

Fig. 2.1.32. Penetration Efficiency versus Impact Velocity, Magness (1990)

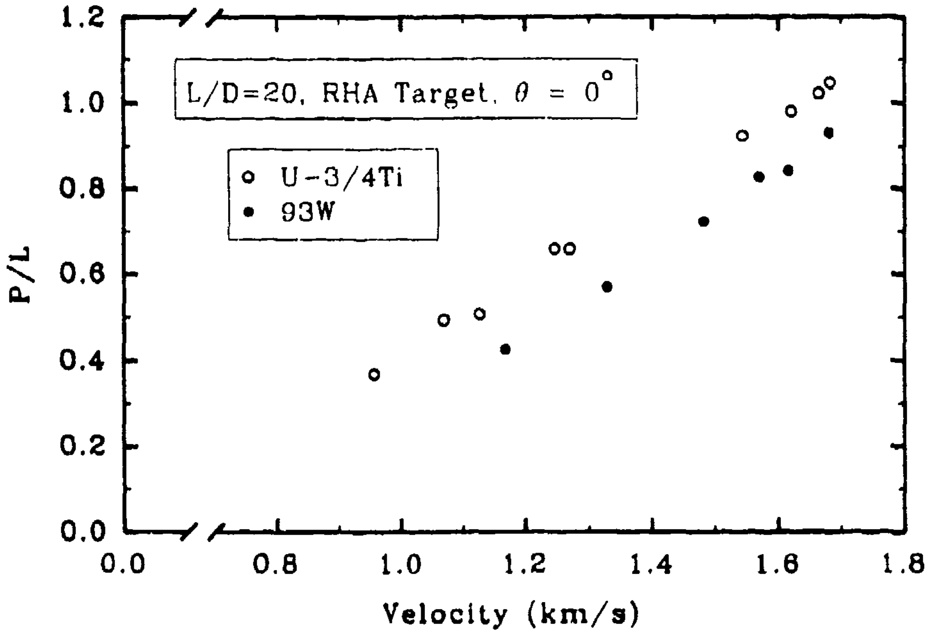

Fig. 2.1.33. Penetration Efficiency versus Impact Velocity, Magness and Farrand (1990)

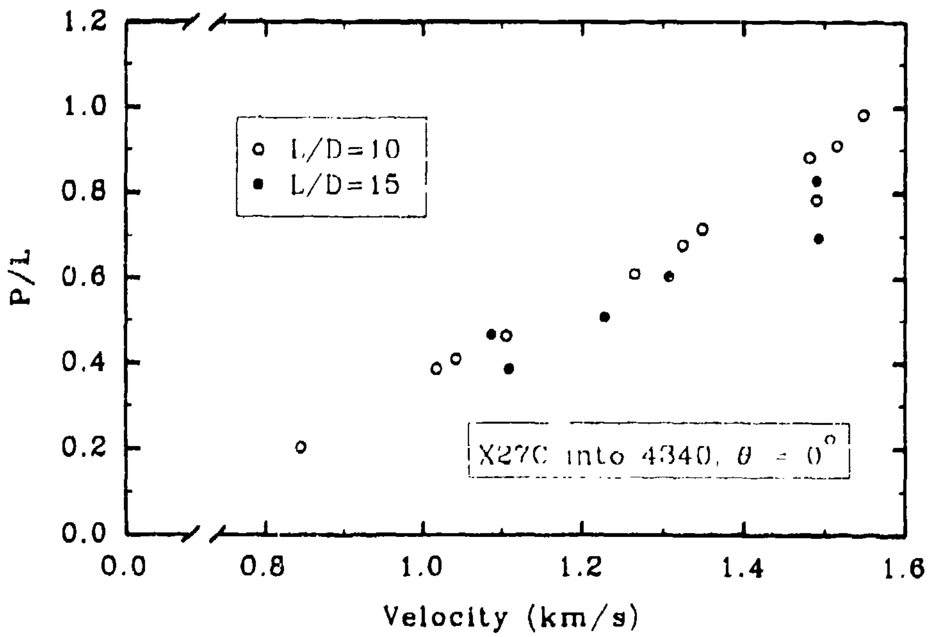

Fig. 2.1.34. Penetration Efficiency versus Impact Velocity, Morris and Anderson (1991)

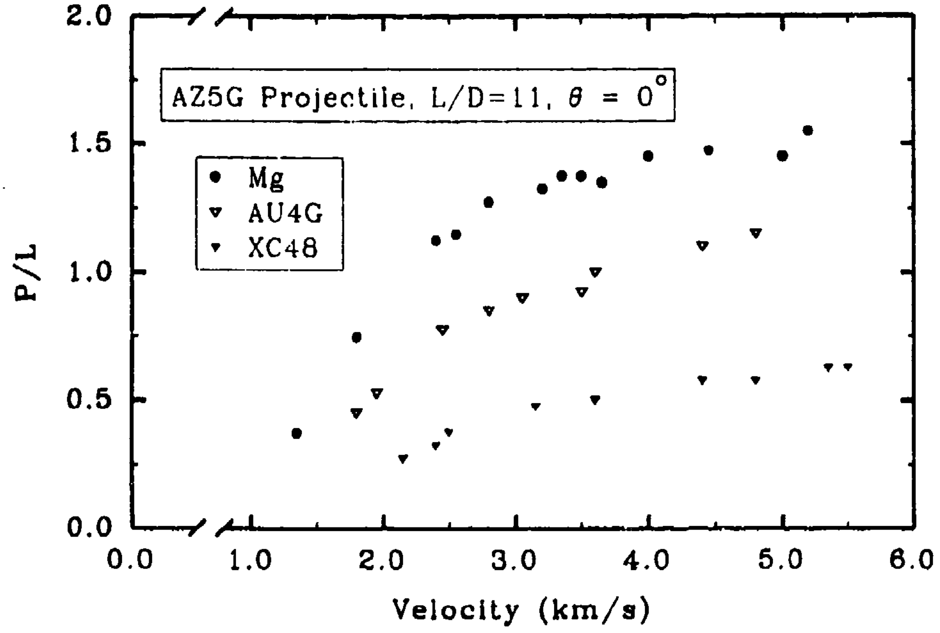

Fig. 2.1.35. Penetration Efficiency versus Impact Velocity, Perez (1982)

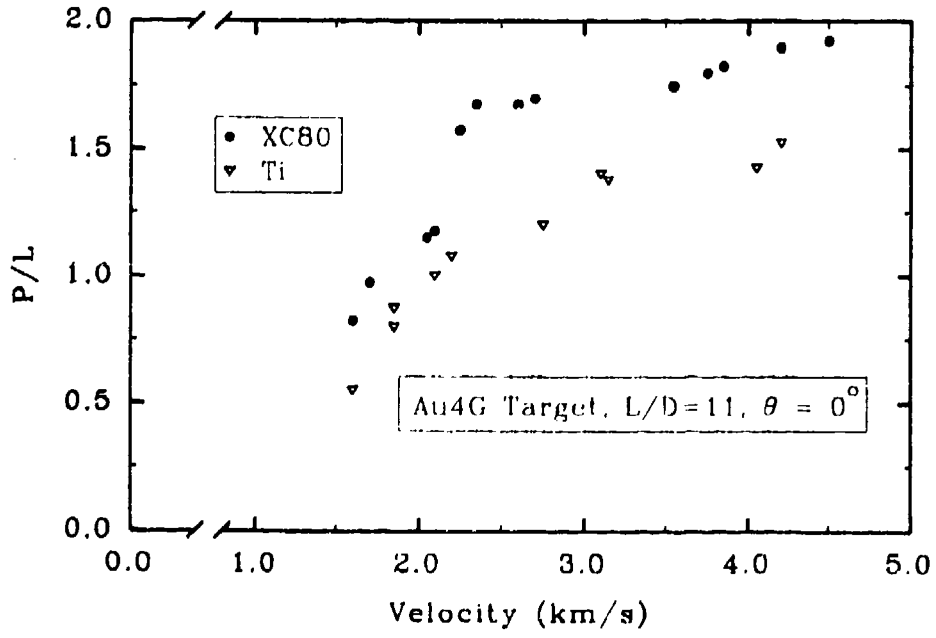

Fig. 2.1.36. Penetration Efficiency versus Impact Velocity, Perez (1982)

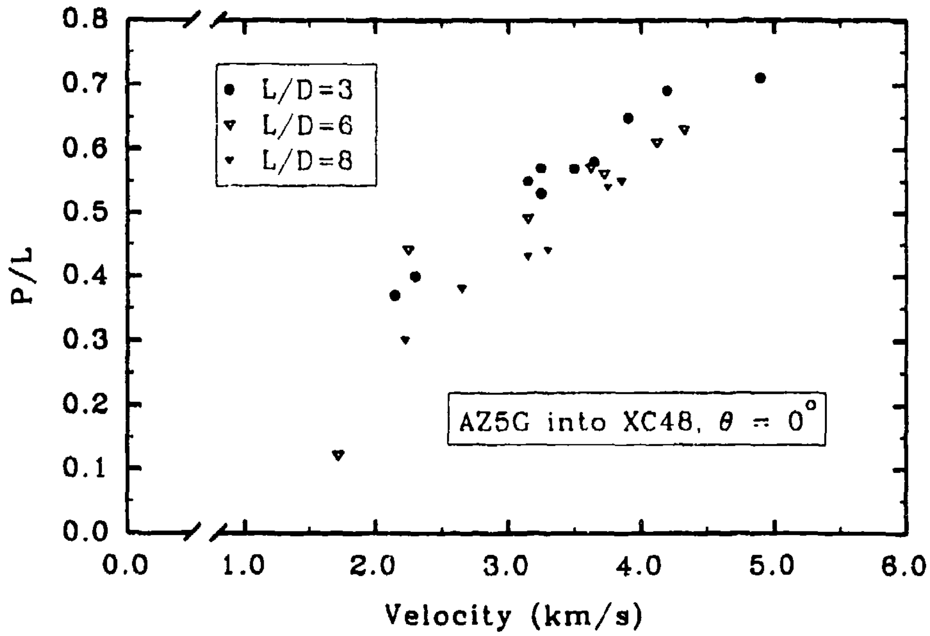

Fig. 2.1.37. Penetration Efficiency versus Impact Velocity, Perez (1982)

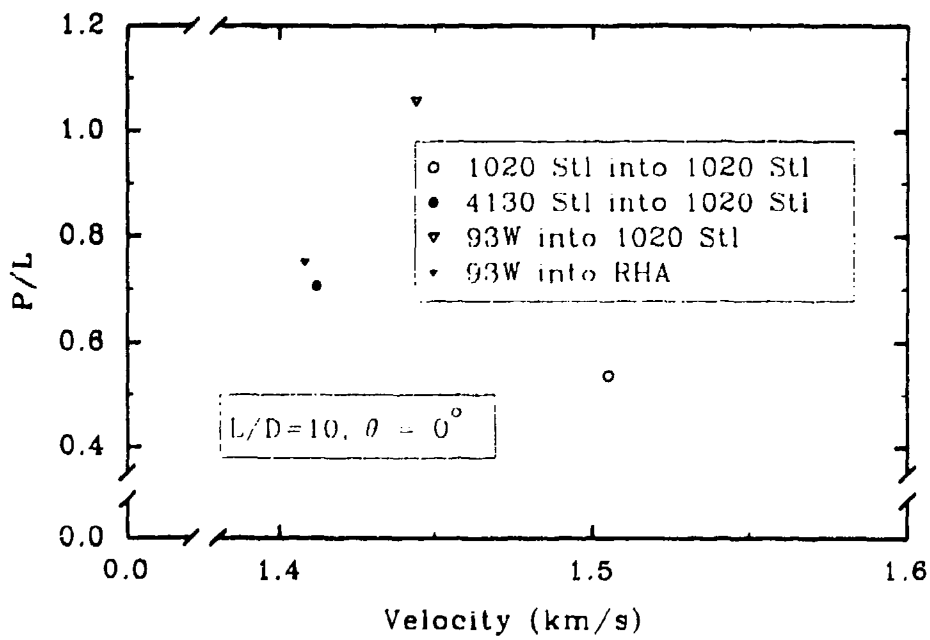

Fig. 2.1.38. Penetration Efficiency versus Impact Velocity, Rosenberg *et al.* (1990)

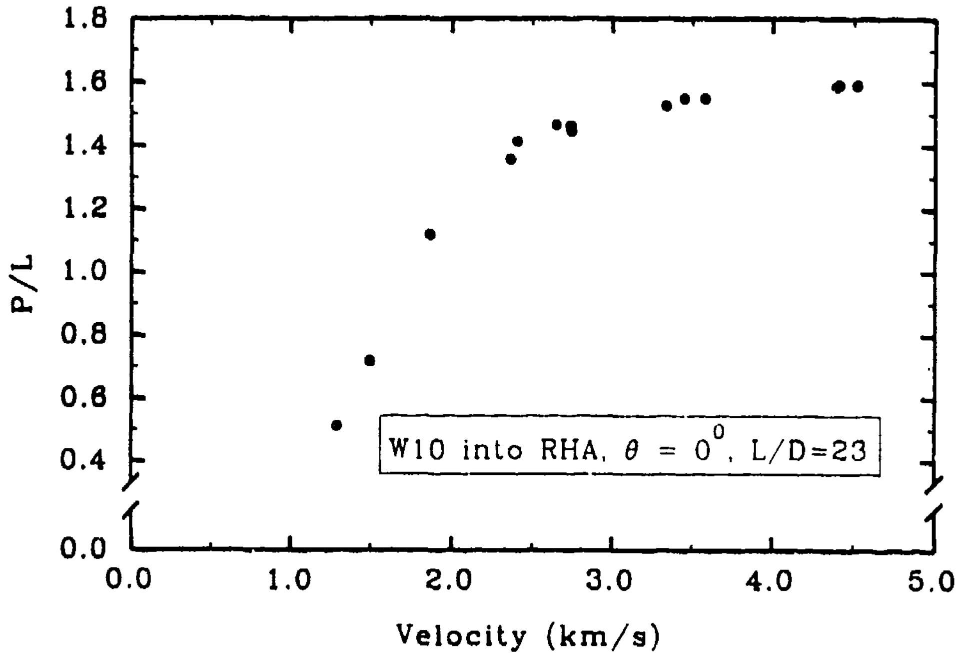

Fig. 2.1.39. Penetration Efficiency versus Impact Velocity, Silsby (1984)

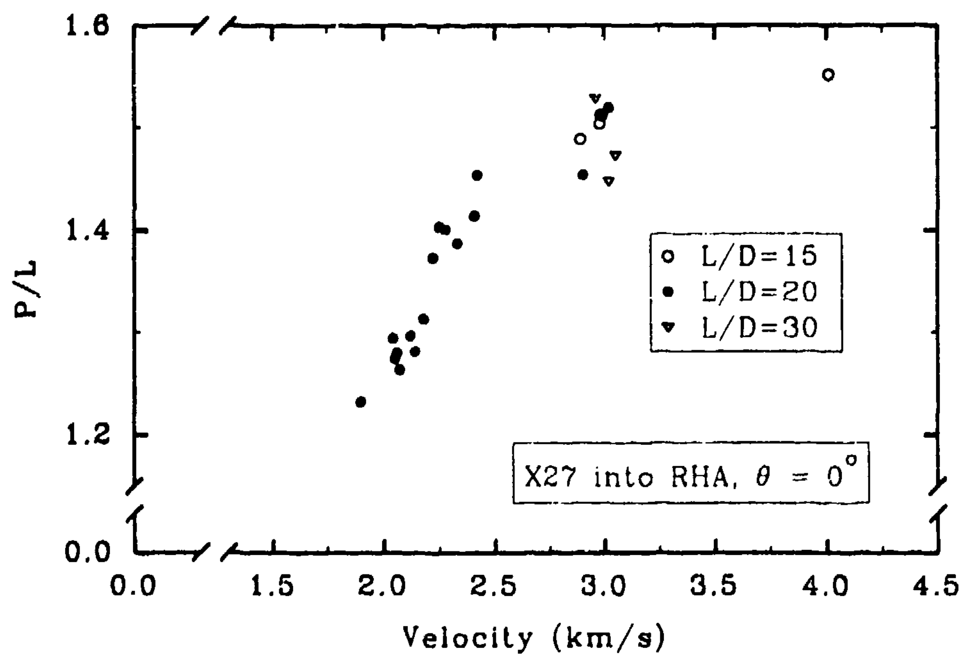

Fig. 2.1.40. Penetration Efficiency versus Impact Velocity, Sorensen *et al.* (1991)

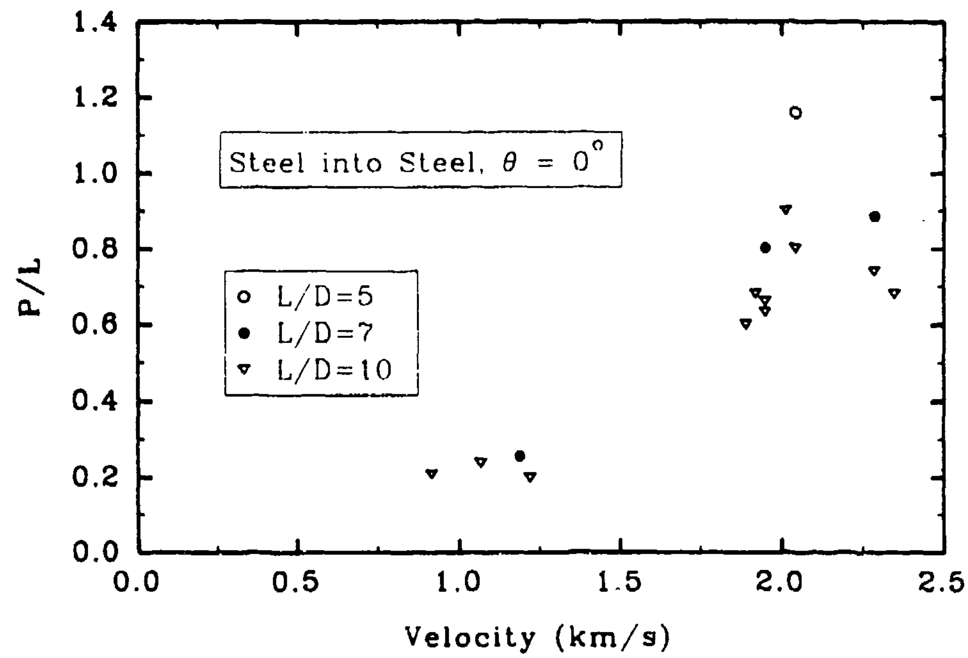

Fig. 2.1.41. Penetration Efficiency versus Impact Velocity, Tate (1967)

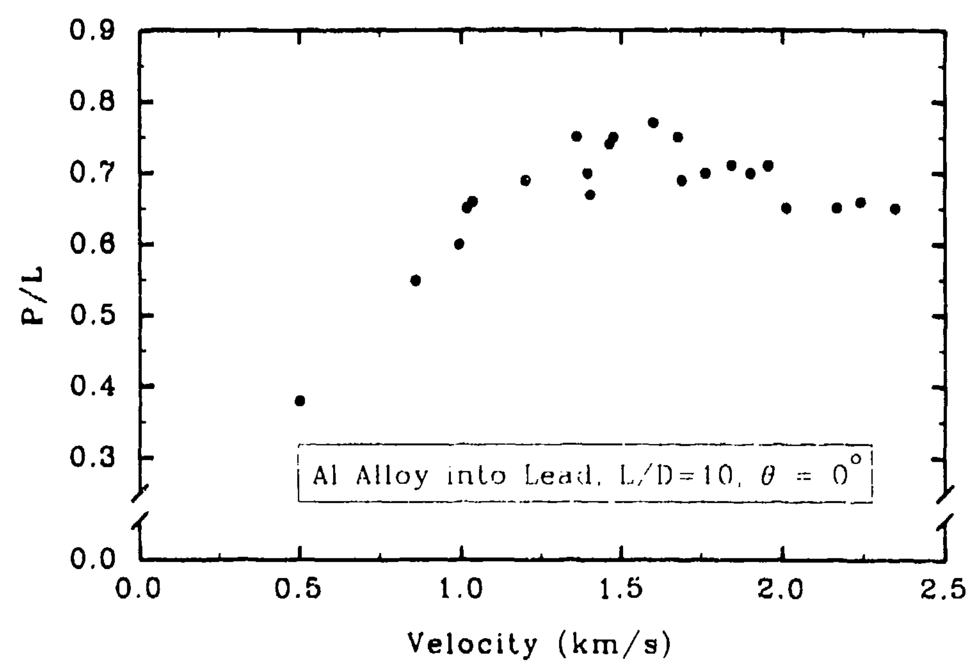

Fig. 2.1.42. Penetration Efficiency versus Impact Velocity, Tate (1969)

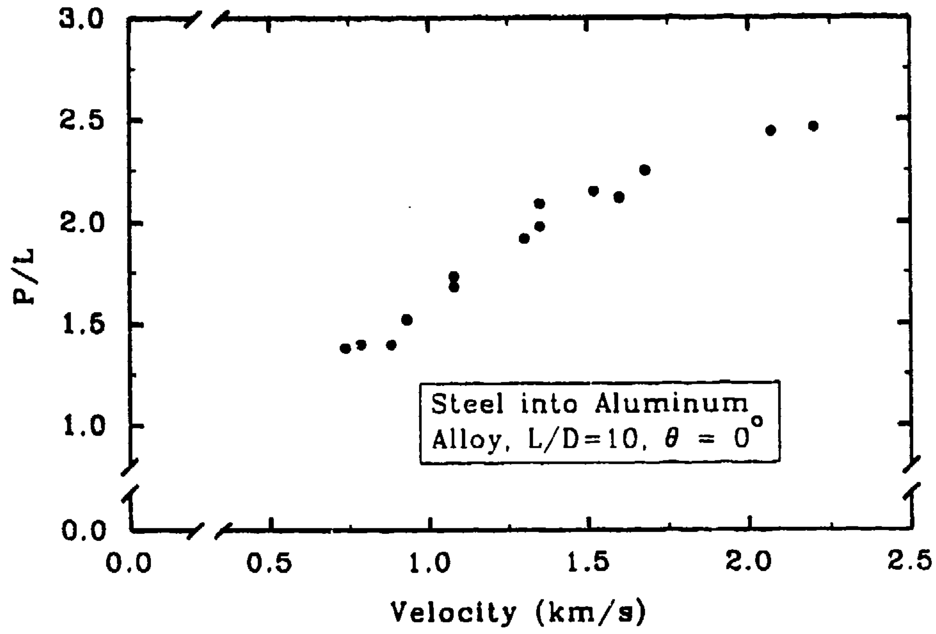

Fig. 2.1.43. Penetration Efficiency versus Impact Velocity, Tate (1969)

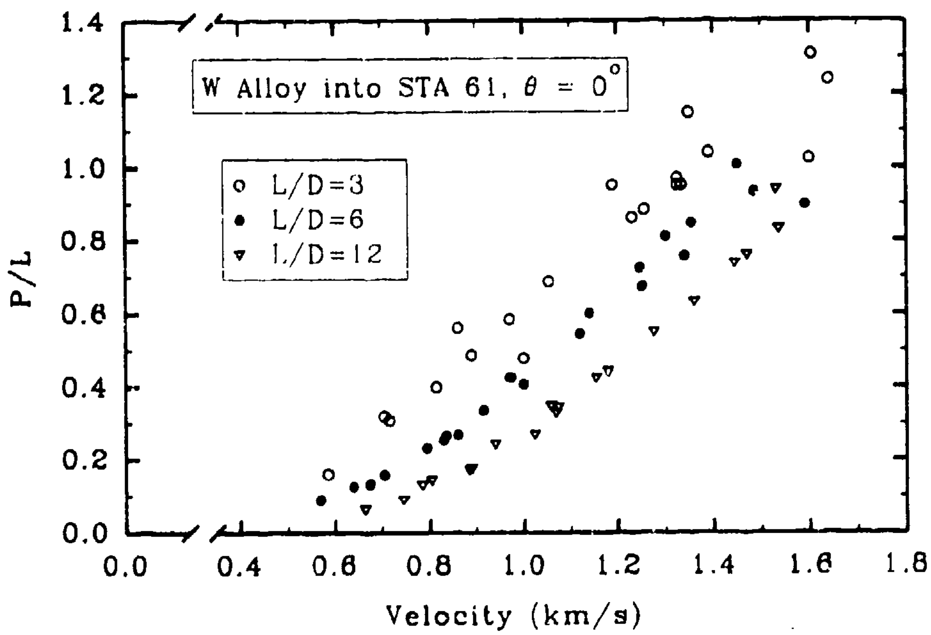

Fig. 2.1.44. Penetration Efficiency versus Impact Velocity, Tate *et al.* (1978)

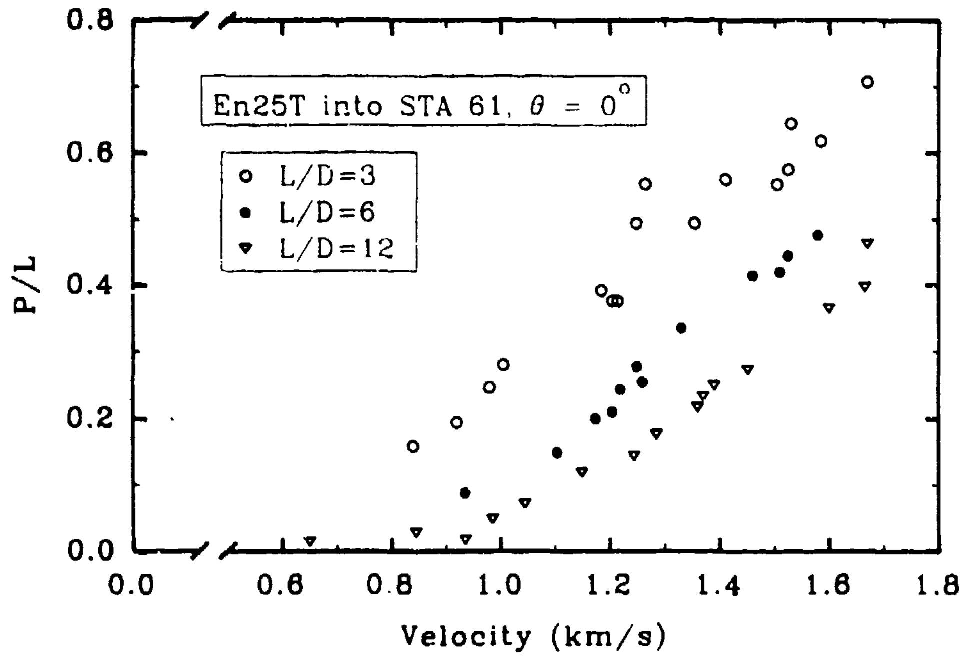

Fig. 2.1.45. Penetration Efficiency versus Impact Velocity, Tate *et al.* (1978)

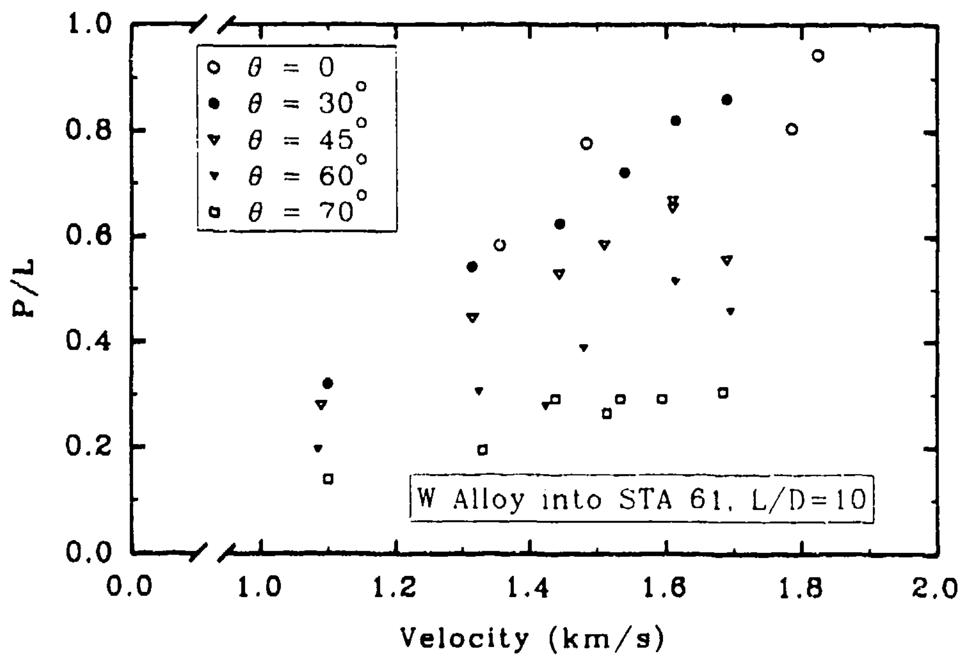

Fig. 2.1.46. Penetration Efficiency versus Impact Velocity, Tate *et al.* (1978)

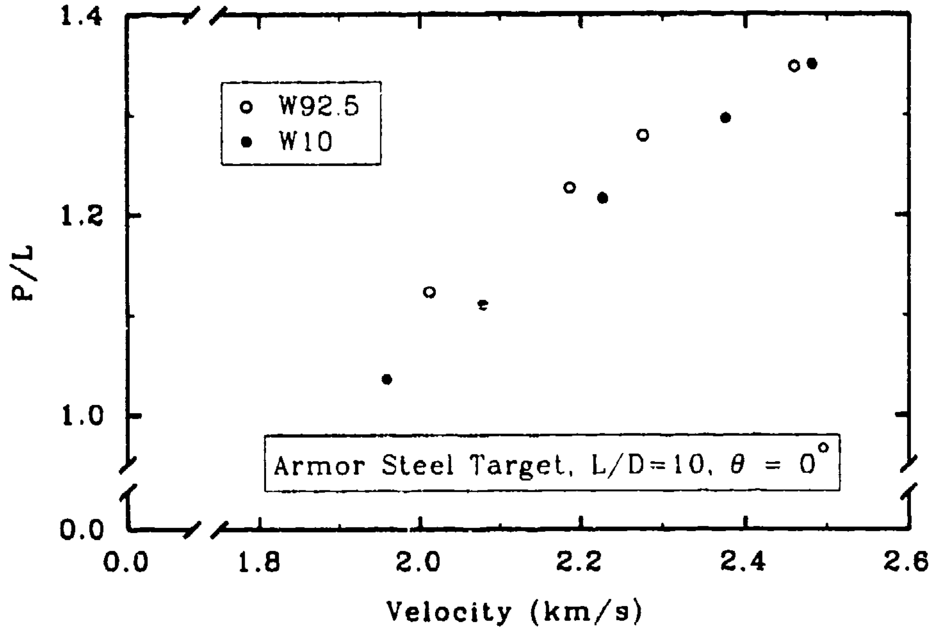

Fig. 2.1.47. Penetration Efficiency versus Impact Velocity, Wilkins *et al.* (1991)

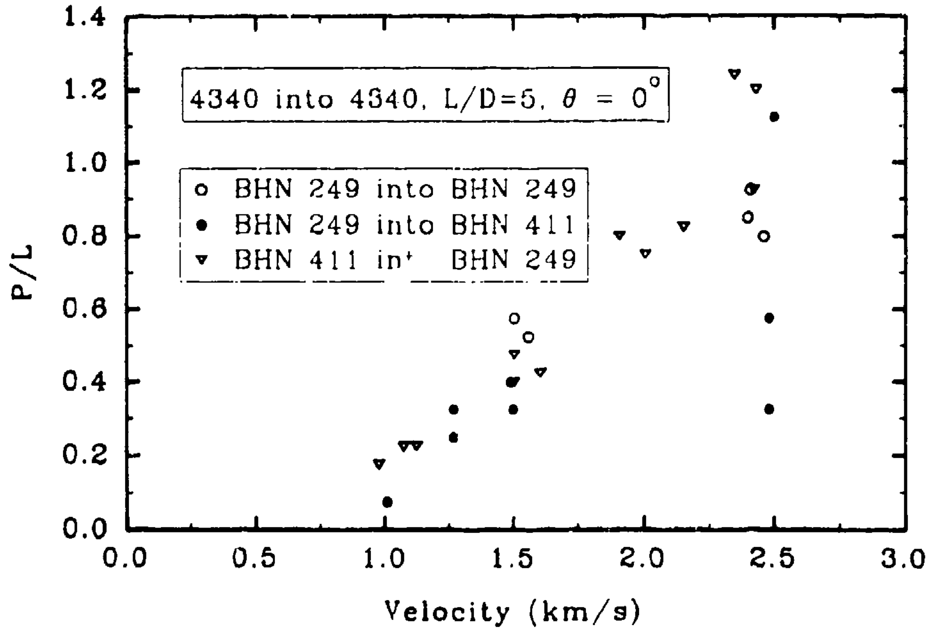

Fig. 2.1.48. Penetration Efficiency versus Impact Velocity, Wilson *et al.* (1989)

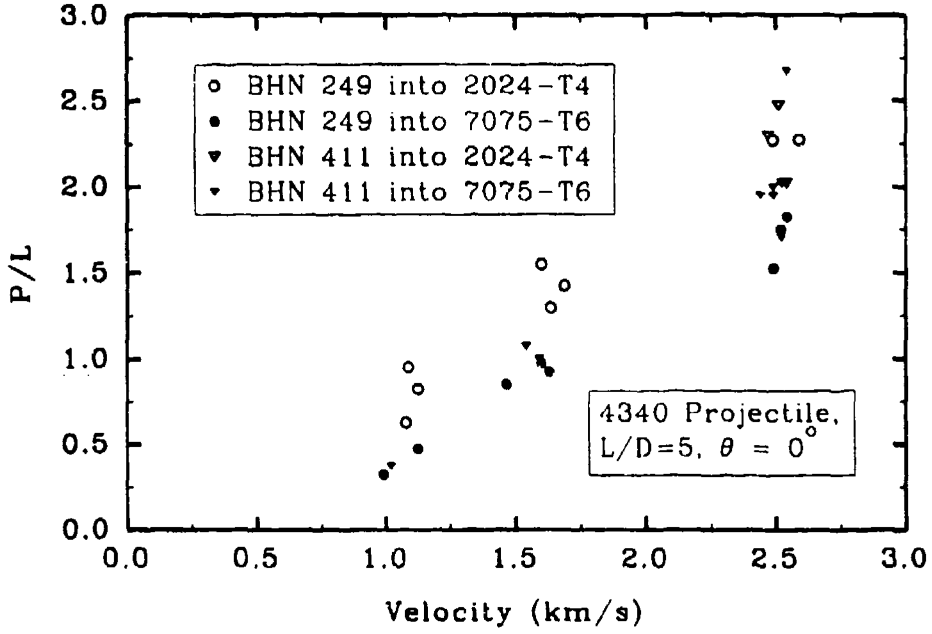

Fig. 2.1.49. Penetration Efficiency versus Impact Velocity, Wilson *et al.* (1989)

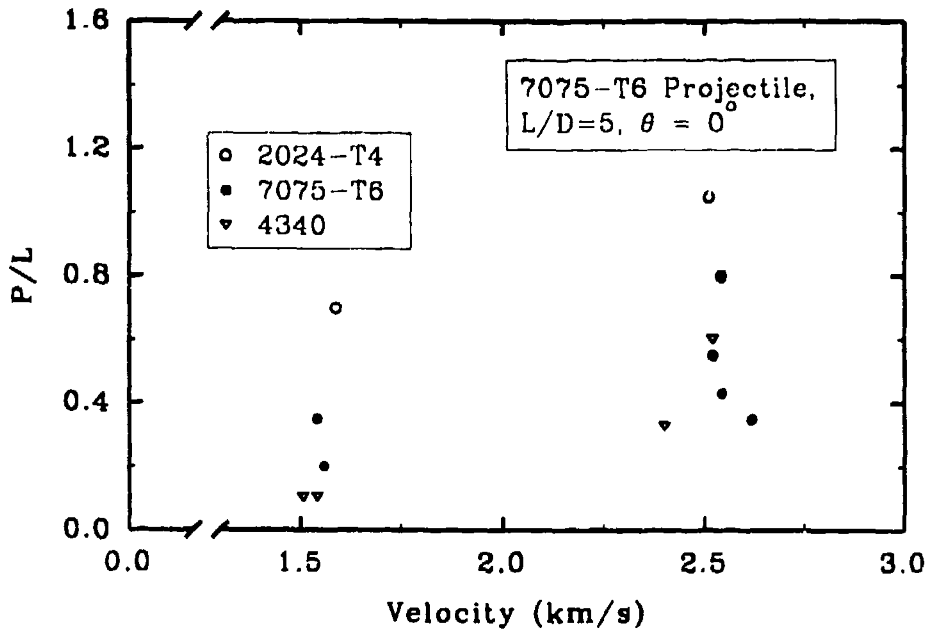

Fig. 2.1.50. Penetration Efficiency versus Impact Velocity, Wilson *et al.* (1989)

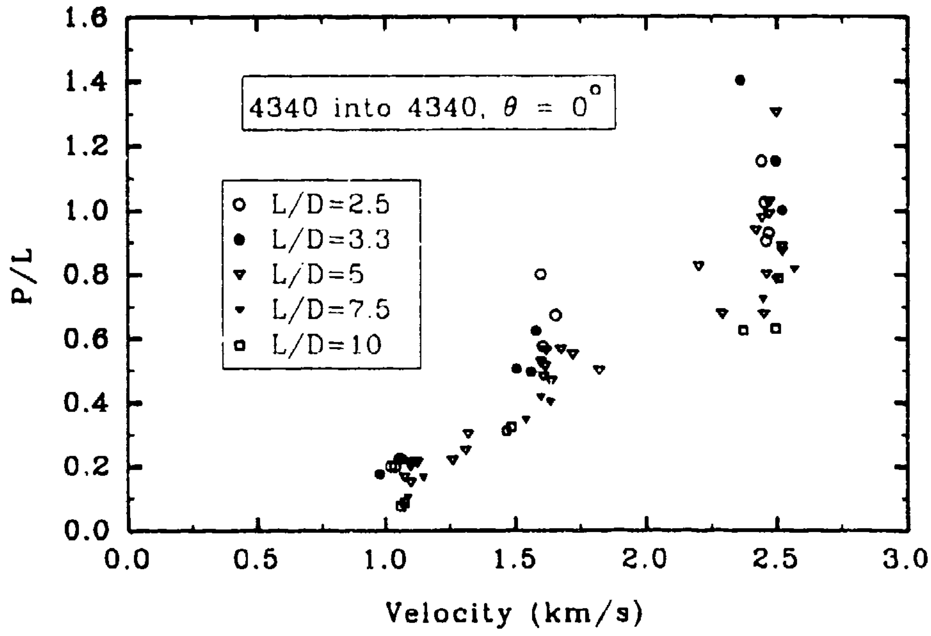

Fig. 2.1.51. Penetration Efficiency versus Impact Velocity, Wilson *et al.* (1989)

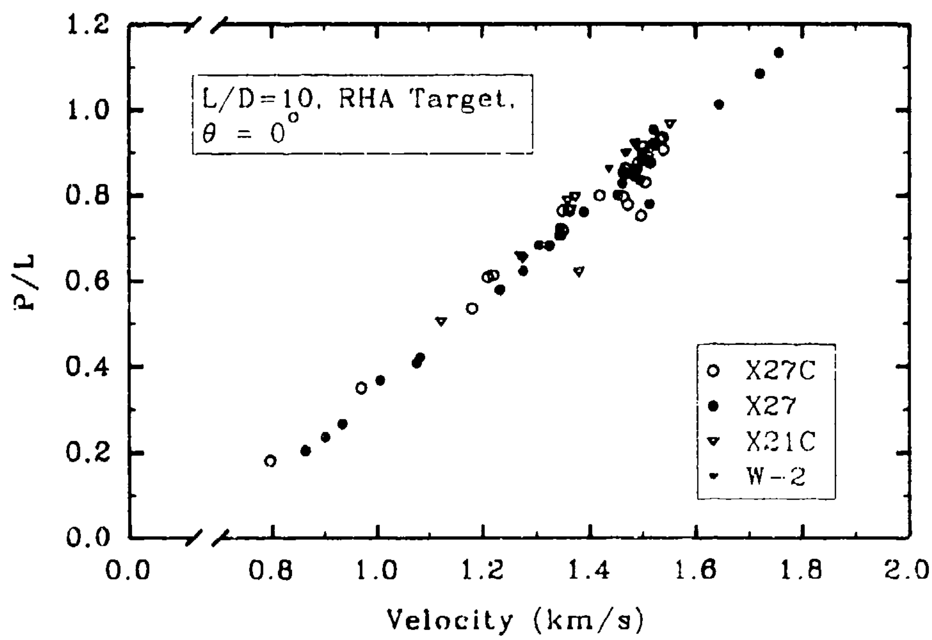

Fig. 2.1.52. Penetration Efficiency versus Impact Velocity, Woolsey (1990)

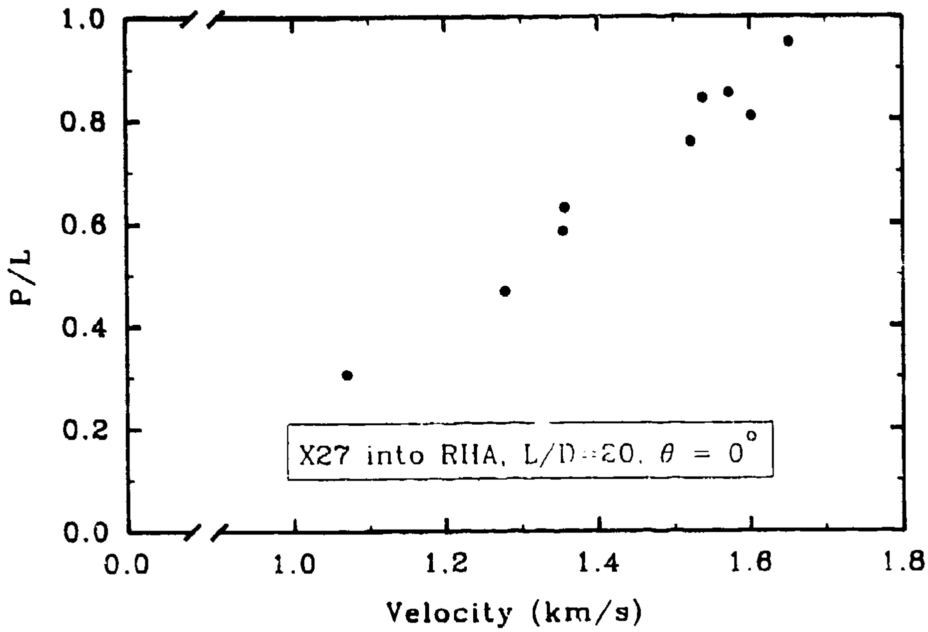

Fig. 2.1.53. Penetration Efficiency versus Impact Velocity, Woolsey (1991)

2.2 Finite-Thickness Data

The data tabulated for perforation of penetrators though finite thickness targets have been divided into two categories: residual-velocity and limit-velocity data. The residual-velocity data have been collected from five sources in the literature, and the limit-velocity data from six sources. Since residual-velocity tests are generally used to determine the limit velocity, many of the references in the two categories refer to the same series of tests. In the data collected from the experiments of Lambert (1978), for example, the residual-velocity data was used to determine the limit velocity.

2.2.1 Residual-Velocity Data

The residual-velocity data are presented graphically in Figs. 2.2.1 through 2.2.12, and in tabular form in Appendix B. In most cases, it was convenient to plot the dimensionless residual velocity V_r/V_s as a function of the striking velocity V_s. In Fig. 2.2.6, however, V_r/V_s is shown versus projectile Brinell Hardness Number. Several independent variables were needed to identify a unique set of test conditions that correlated satisfactorily when plotted. These independent variables included projectile and target materials, the dimensionless target thickness t/L, the projectile aspect ratio L/D, and the target obliquity θ. Although the residual velocity certainly can vary with respect to many other variables, such as projectile hardness and diameter, only a slight dependence is observed under most conditions. Consequently, these variables are not shown explicitly on the graphs.

The overall trends exhibited in the residual-velocity plots are consistent with the expected results. For example, the presence of the target represents only a slight physical barrier to the projectile for thin targets impacted by high-velocity projectiles. In these cases, the residual velocity is very close to the striking velocity, as is depicted in all of the graphs. For low striking velocities or thick targets, on the other hand, the influence of the target becomes more pronounced, and the residual velocity decreases, as is also shown in the figures.

The majority of the data plotted in the graphs concerns experiments with steel or heavy-metal alloy projectiles penetrating steel targets. In most of these experiments, the target resistances are sufficiently large to induce at least partial erosion in the residual penetrators. In two of the plots (Figs. 2.2.1 and 2.2.12), however, residual-velocity data are shown for the perforation of hard steel penetrators into aluminum targets. In these experiments, the projectile experiences little or no deformation as it perforates the target.

Tables 2.2.1 and 2.2.2 show the figure numbers that contain data corresponding to various projectile and target types. Table 2.2.1 lists figure numbers for different projectile *L/D's* and target materials. In Table 2.2.2, figure numbers are shown for various projectile and target materials. In the tables, the figure numbers have been truncated; each of the figure numbers needs to be prefaced by "2.2._."

Table 2.2.1. Projectile *L/D's* and Target Materials in V_s - V_r Database, with Corresponding Figure Numbers

	Target Material		
Projectile *L/D*	Hard Al	Steel	Armor Steel
$L/D \le 5$			7, 11
$5 < L/D \le 10$		4-6	2-3, 8, 10-11
$10 < L/D \le 15$	1, 12		
$L/D \ge 15$			9, 11

Table 2.2.2. Projectile and Target Materials in V_s - V_r Database, with Corresponding Figure Numbers

	Target Material		
Projectile Material	Hard Al	Steel	Armor Steel
Steel		4-6	
Hard Steel	1, 12	5	7-11
W Alloy		5	
DU Alloy			2-3

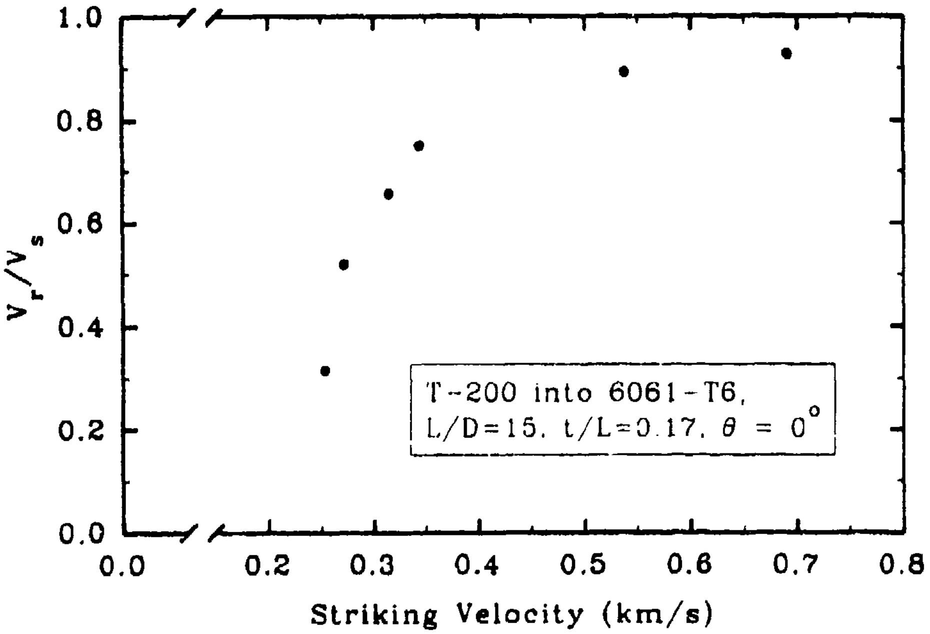

Fig. 2.2.1. Dimensionless Residual Velocity versus Striking Velocity, Forrestal *et al.* (1986)

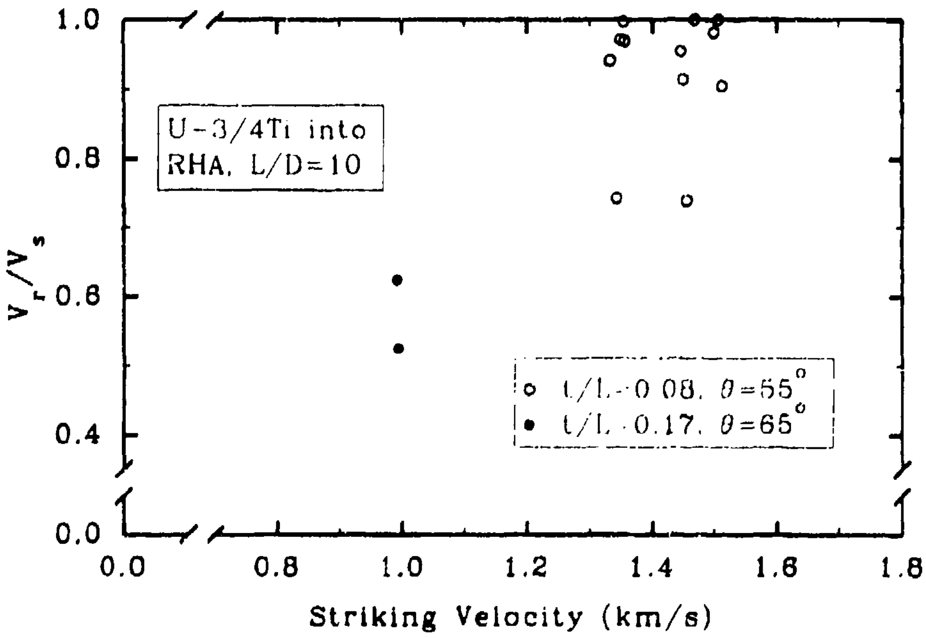

Fig. 2.2.2. Dimensionless Residual Velocity versus Striking Velocity, Fugelso (1980)

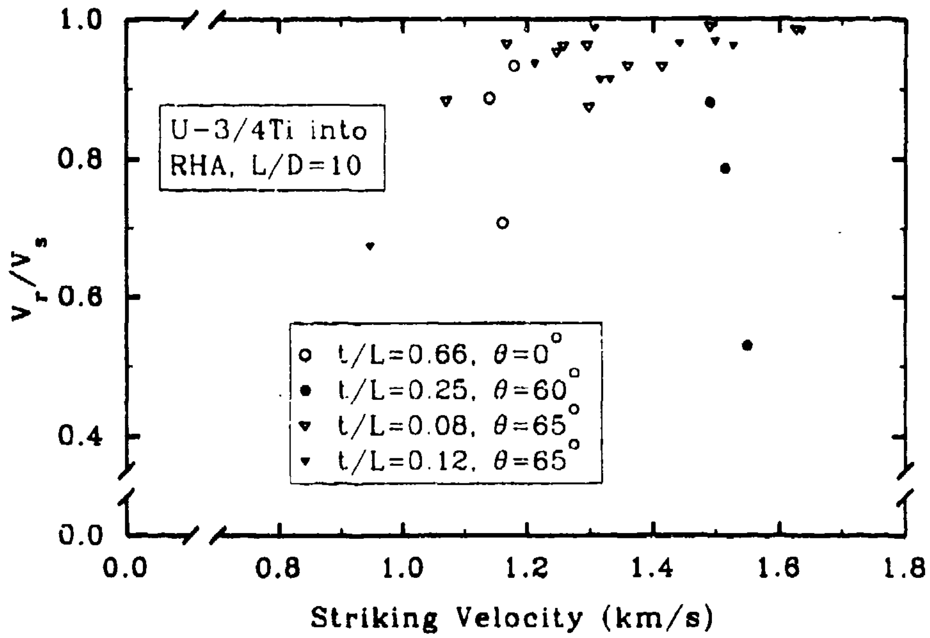

Fig. 2.2.3. Dimensionless Residual Velocity versus Striking Velocity, Fugelso and Taylor (1978)

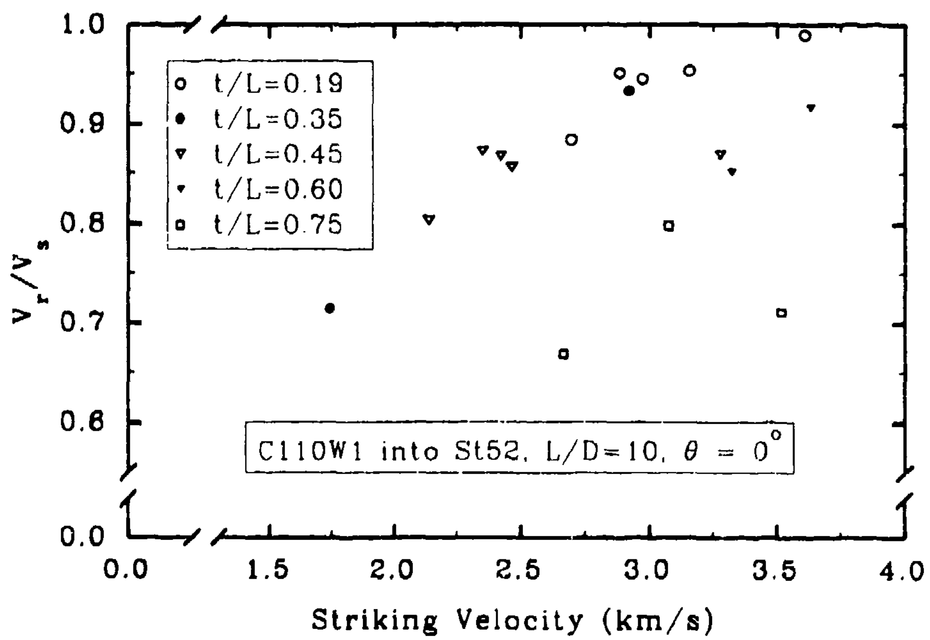

Fig. 2.2.4. Dimensionless Residual Velocity versus Striking Velocity, Hohler and Stilp (1991a)

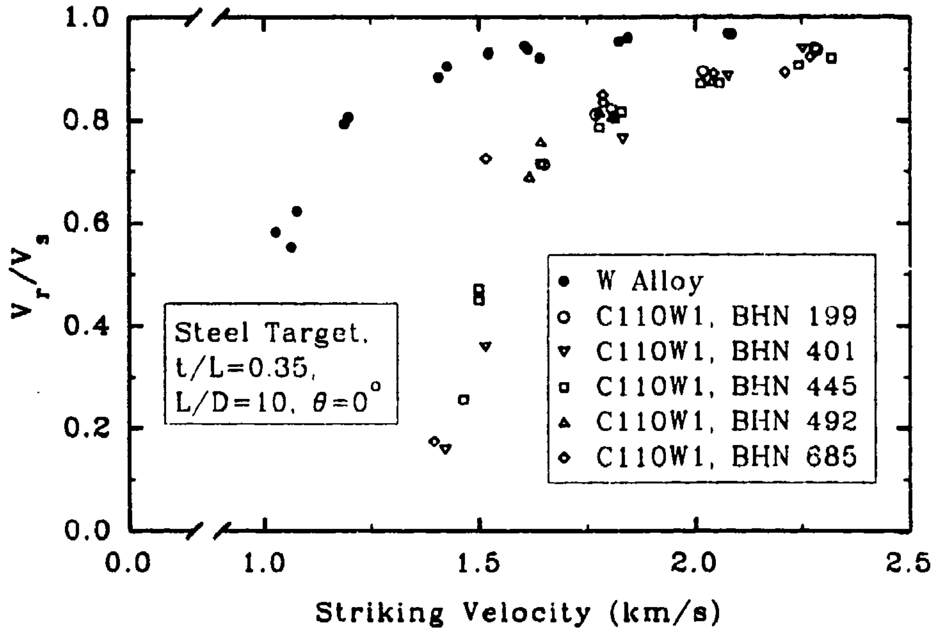

Fig. 2.2.5. Dimensionless Residual Velocity versus Striking Velocity, Hohler and Stilp (1991a)

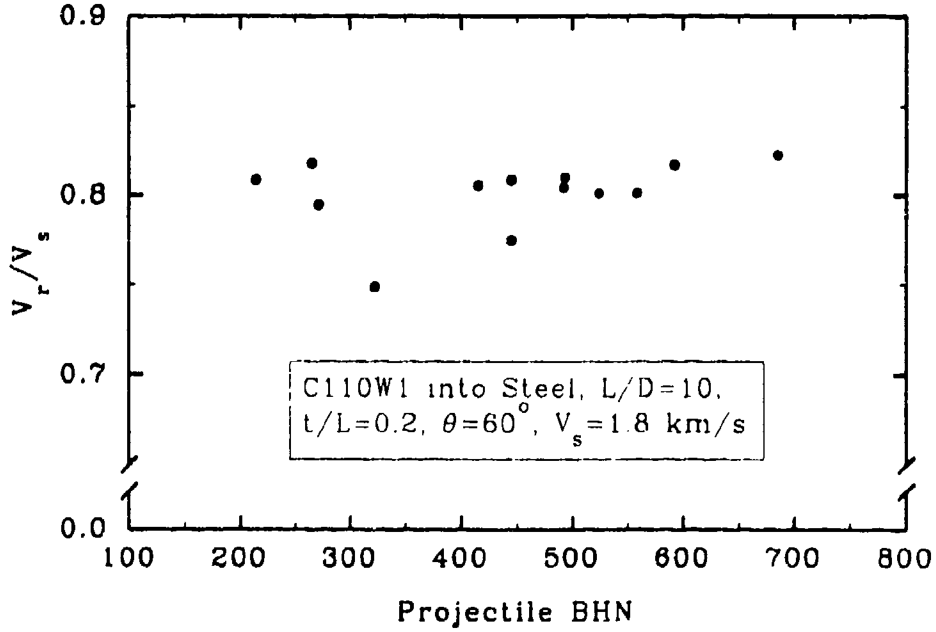

Fig. 2.2.6. Dimensionless Residual Velocity versus Projectile Brinell Hardness Number, Hohler and Stilp (1991a)

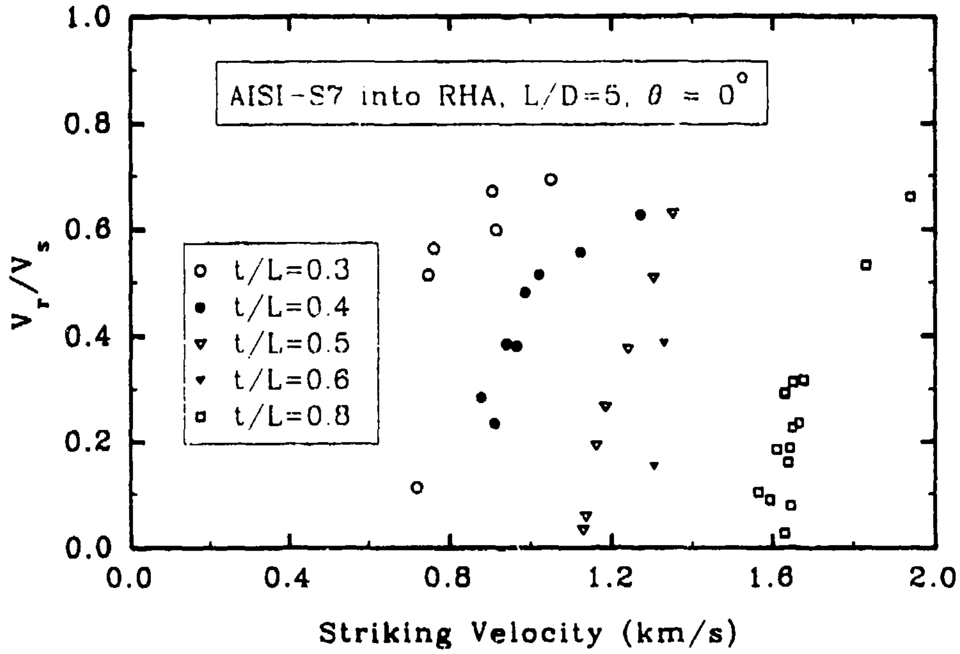

Fig. 2.2.7. Dimensionless Residual Velocity versus Striking Velocity, Lambert (1978)

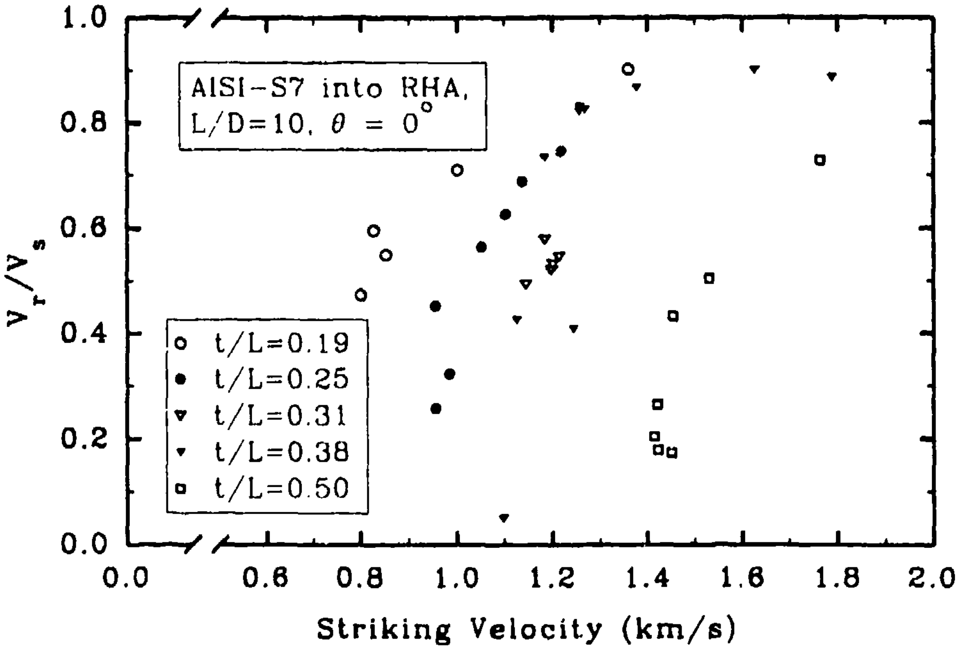

Fig. 2.2.8. Dimensionless Residual Velocity versus Striking Velocity, Lambert (1978)

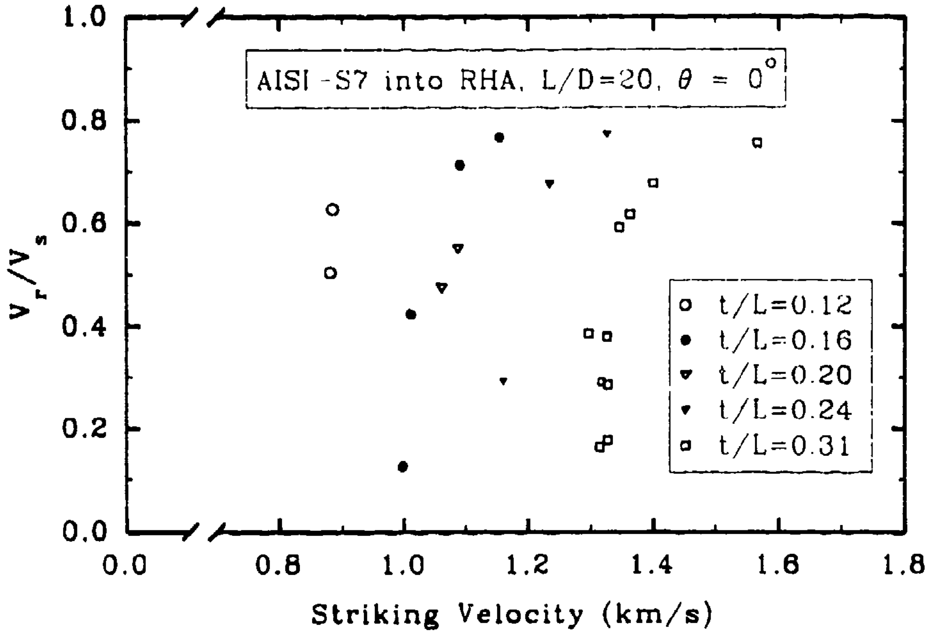

Fig. 2.2.9. Dimensionless Residual Velocity versus Striking Velocity, Lambert (1978)

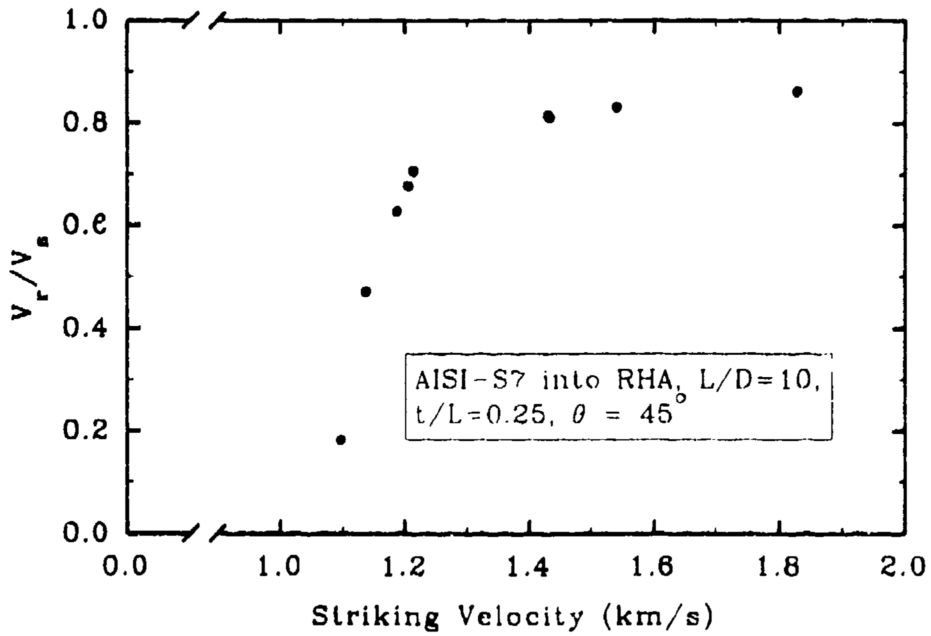

Fig. 2.2.10. Dimensionless Residual Velocity versus Striking Velocity, Lambert (1978)

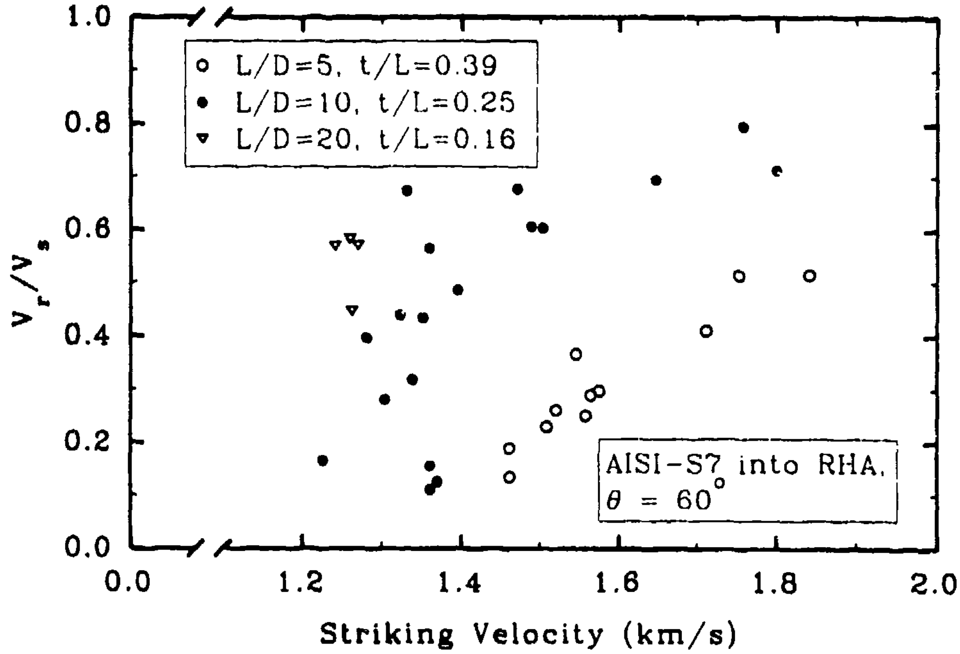

Fig. 2.2.11. Dimensionless Residual Velocity versus Striking Velocity, Lambert (1978)

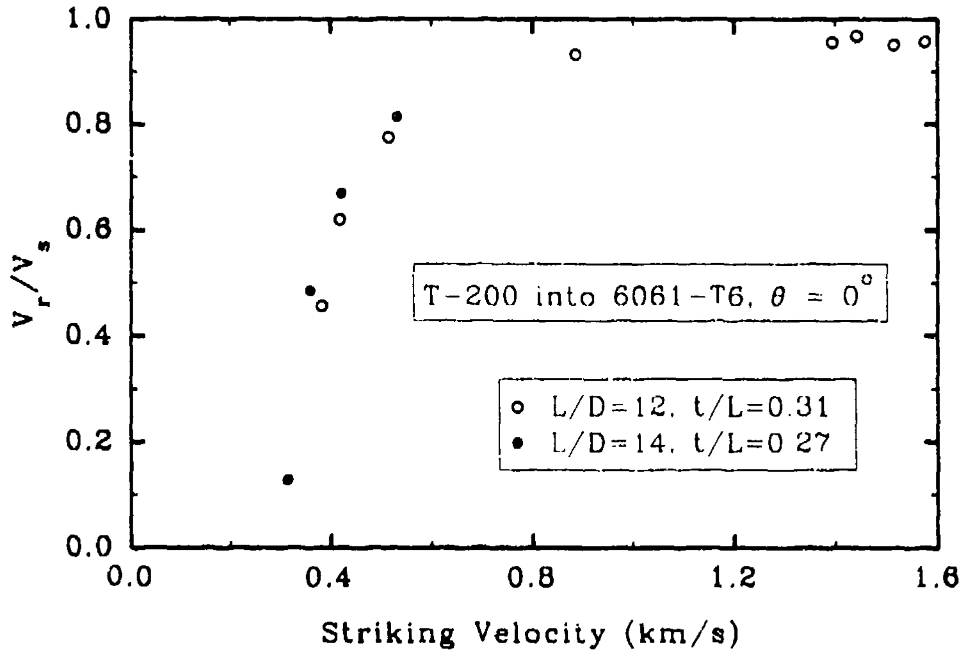

Fig. 2.2.12. Dimensionless Residual Velocity verses Striking Velocity, Rosenberg and Forrestal (1988)

2.2.2 Limit-Velocity Data

Graphs of limit velocity data from several references are shown in Figs. 2.2.13 through 2.2.30. In Appendix B, the data are presented in tabular form. In all of the graphs t/L is shown as a function of limit velocity for given projectile and target materials, projectile L/D, and target obliquity. The variation of t/L with respect to other independent variables was found to be minimal, with the exception of projectile yaw. Unfortunately, yaw was not consistently reported in all of the references, so it is not shown on the graphs.

The manner in which the limit velocity was determined varied for the different references. In the study by Lambert (1978), for example, V_r was plotted as a function of V_s for a given test sequence. These data were curve fitted to an equation of the form

$$V_r = a(V_s^p - V_L^p)^{1/p} \tag{5}$$

for the three unknowns a, p, and V_L. The limit velocity was assigned as the value fitted for V_L, corresponding to the intersection of this regression line with the ordinate axis. In other studies, the limit velocity was determined from the V_{50} method. In this method, a number of penetrators are fired at different velocities; typically, a minimum of six shots are required to determine V_{50}. V_{50} is determined from statistical analysis, and is assigned as the velocity for which the probability of target defeat is 50%. Unfortunately, the manner in which the limit velocity was determined was not consistently reported in all the references; thus, the calculation method does not appear in the tables or on the graphs. For the purposes of this report, we define V_{50} as equivalent to V_L.

In most of the figures, results from experiments with steel or heavy-metal alloy projectiles into steel targets are shown. Projectile erosion is anticipated at typical ordnance velocities for this projectile/target combination. A large number of shots are presented for target obliquities other than 0°, particularly in the data from Grabarek (1971) shown in Figs. 2.2.13 through 2.2.21.

Graphs of data are categorized in Tables 2.2.3 and 2.2.4 according to projectile and target types. Table 2.2.3 lists the figure numbers for various projectile L/D's and target materials. In Table 2.2.4, projectile and target materials are listed with figure numbers where the corresponding data can be found. Again, all figure numbers in the tables should be prefaced by "2.2._."

Table 2.2.3. Projectile *L/D's* and Target Materials in V_L Database, with Corresponding Figure Numbers

Projectile *L/D*	Target Material: Steel	Target Material: Armor Steel
$L/D \le 1$	22	23
$1 < L/D \le 5$		13-16, 18-20, 25, 30
$5 < L/D \le 10$	22, 24	13-17, 21, 23-24, 26-30
$10 < L/D \le 15$		16, 19-20, 28-29, 30
$15 < L/D \le 20$		13-21, 25
$L/D > 20$		16, 27

Table 2.2.4. Projectile and Target Materials in V_L Database, with Corresponding Figure Numbers

Projectile Material	Target Material: Steel	Target Material: Armor Steel
Steel	22	23
Hard Steel		13-14, 25-26
WC		15-16
W Alloy	24	18, 21, 24, 27-30
DU Alloy		17, 19-20, 29

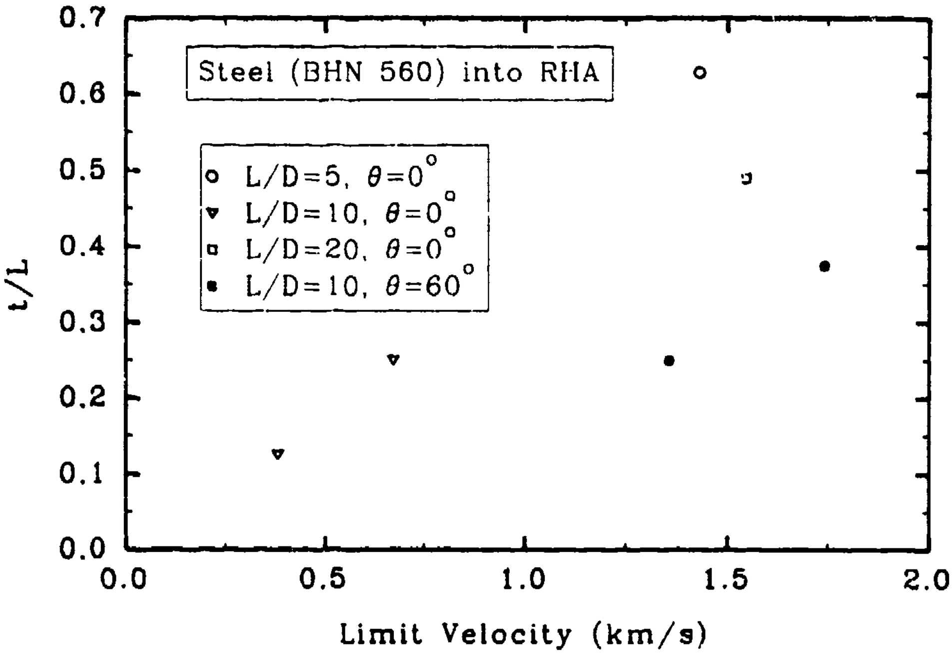

Fig. 2.2.13. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

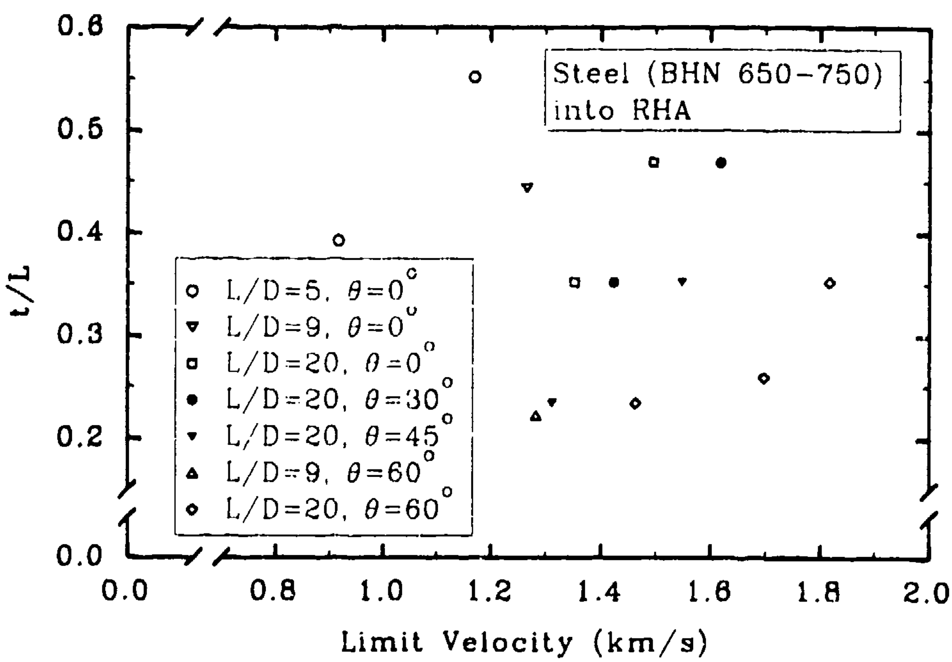

Fig. 2.2.14. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

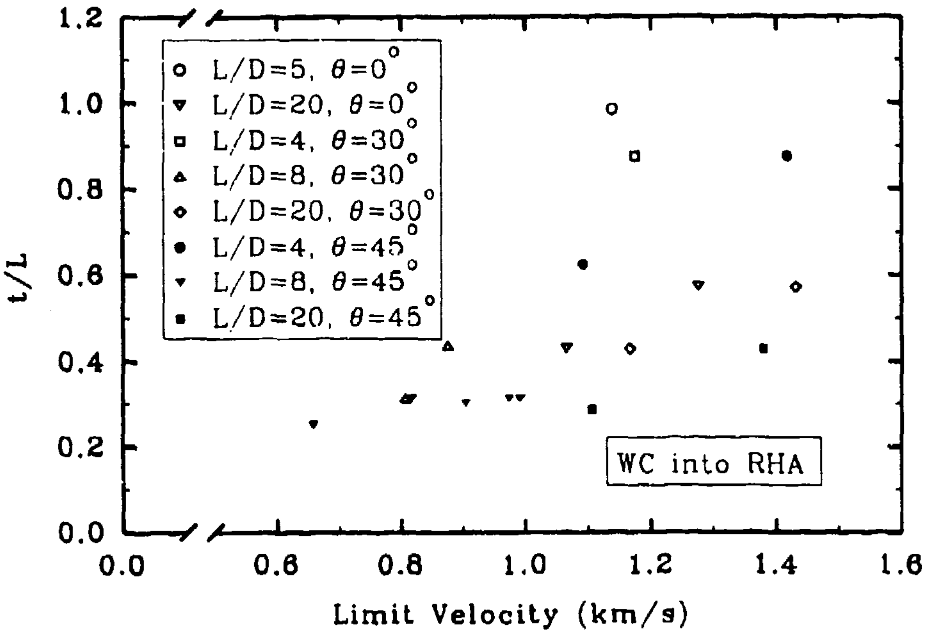

Fig. 2.2.15. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

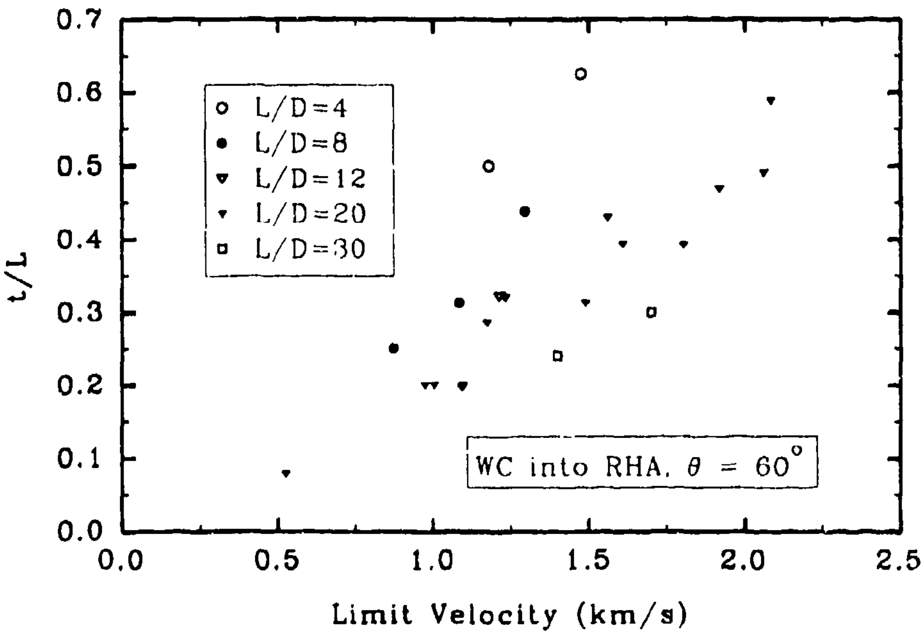

Fig. 2.2.16. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

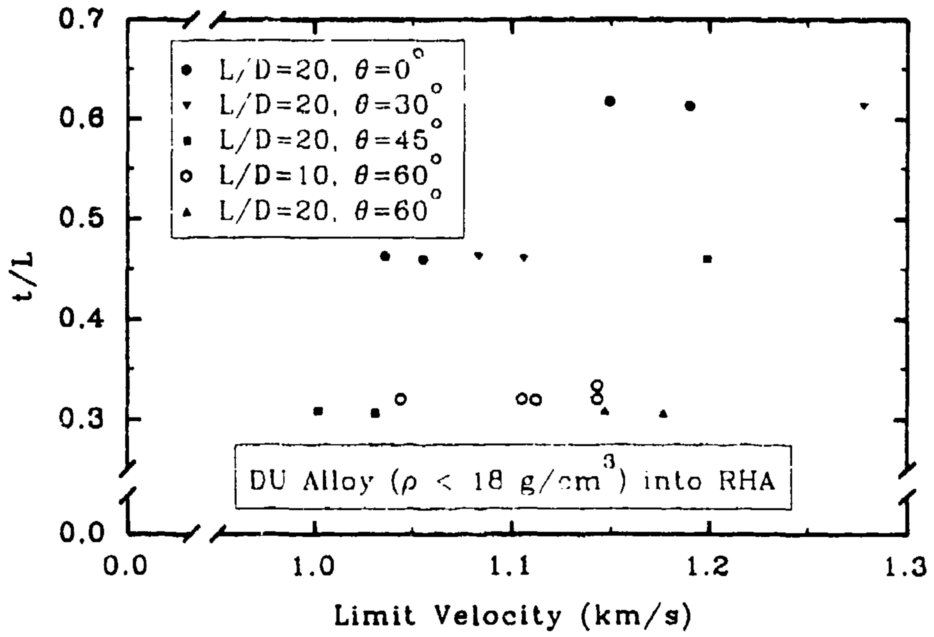

Fig. 2.2.17. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

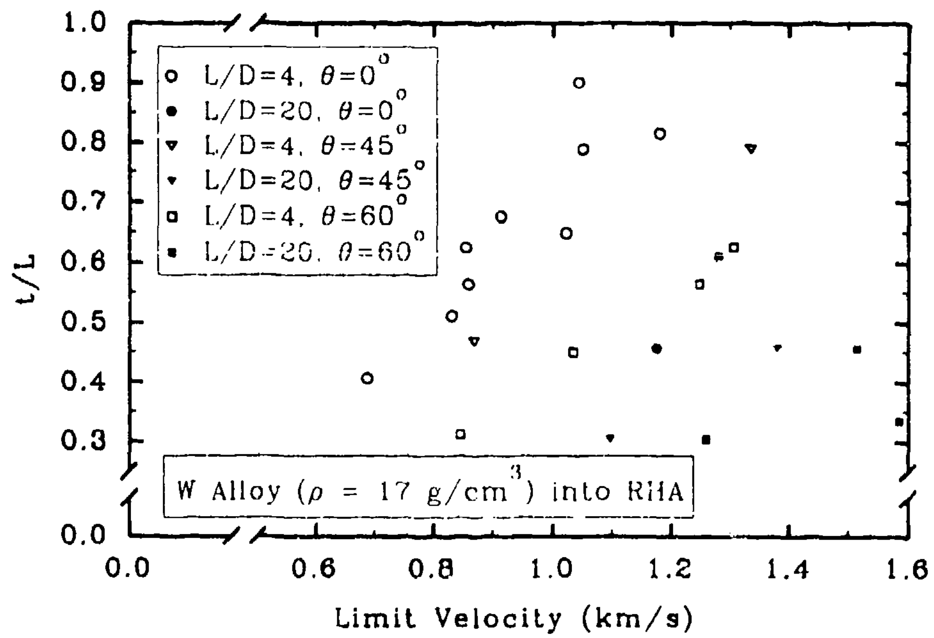

Fig. 2.2.18. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

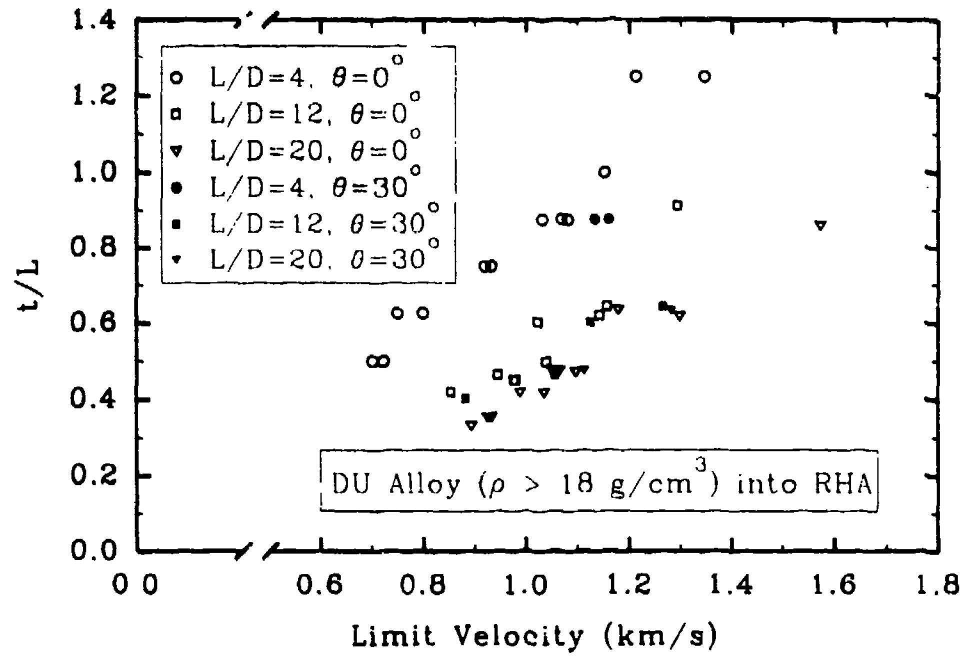

Fig. 2.2.19. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

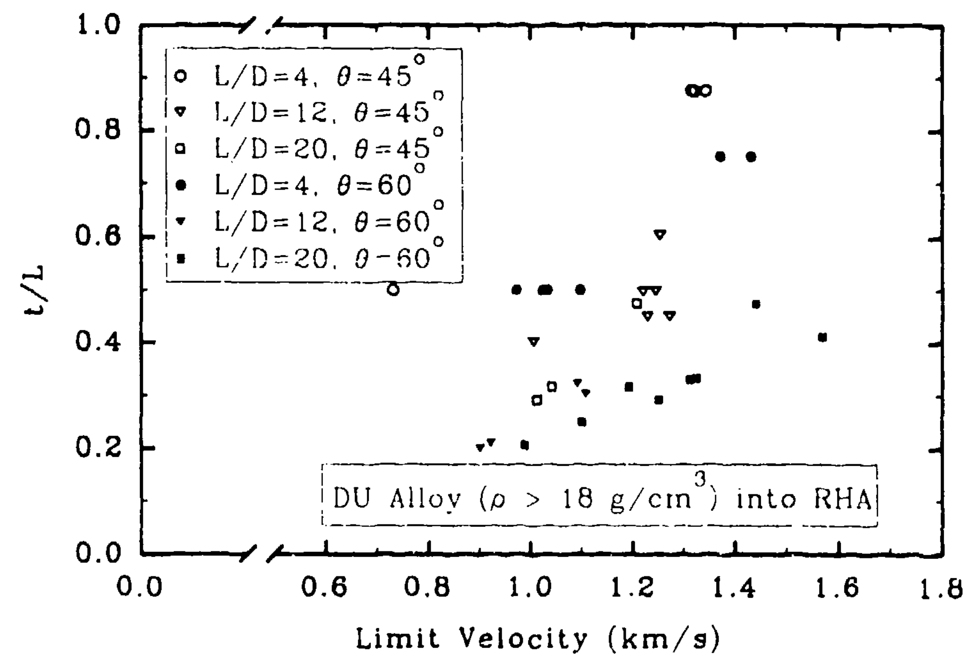

Fig. 2.2.20. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

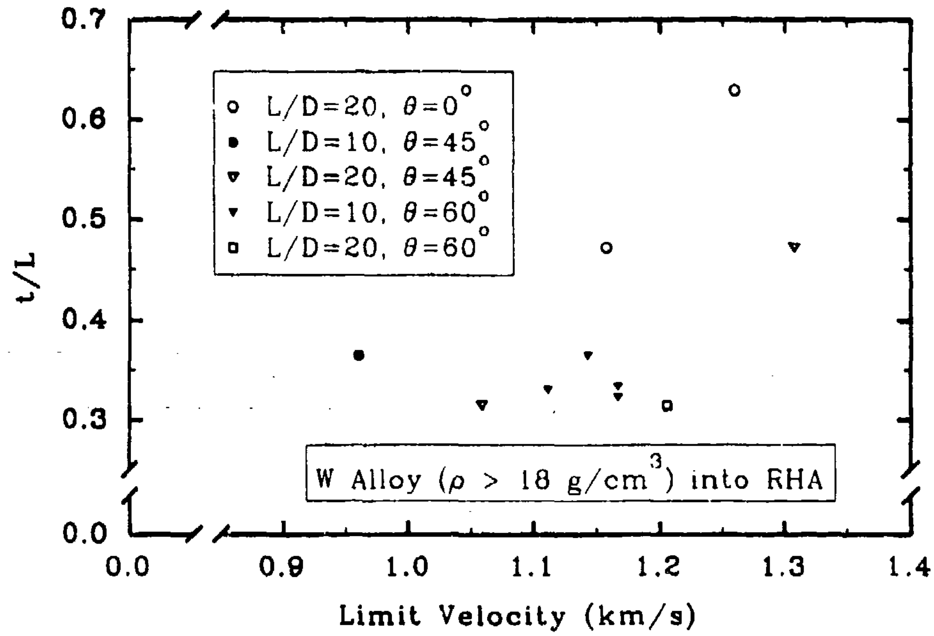

Fig. 2.2.21. Dimensionless Target Thickness versus Limit Velocity, Grabarek (1971)

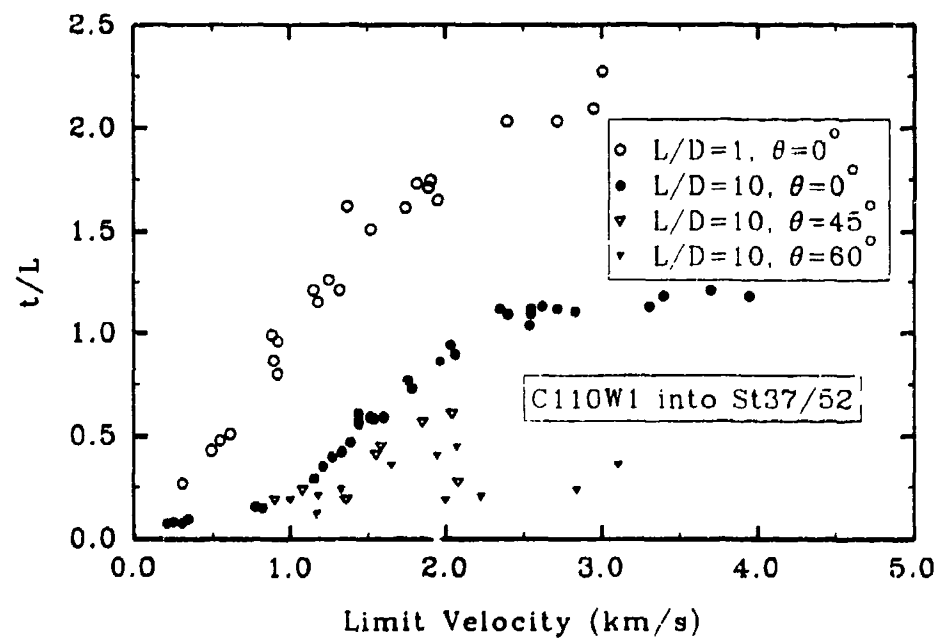

Fig. 2.2.22. Dimensionless Target Thickness versus Limit Velocity, Hohler and Stilp (1991a)

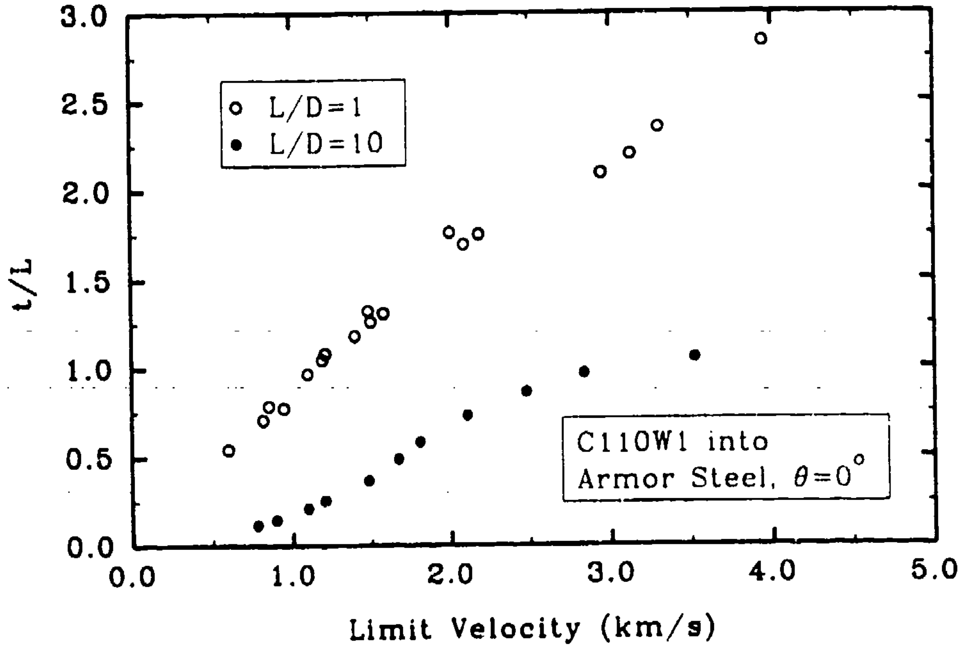

Fig. 2.2.23. Dimensionless Target Thickness versus Limit Velocity, Hohler and Stilp (1991a)

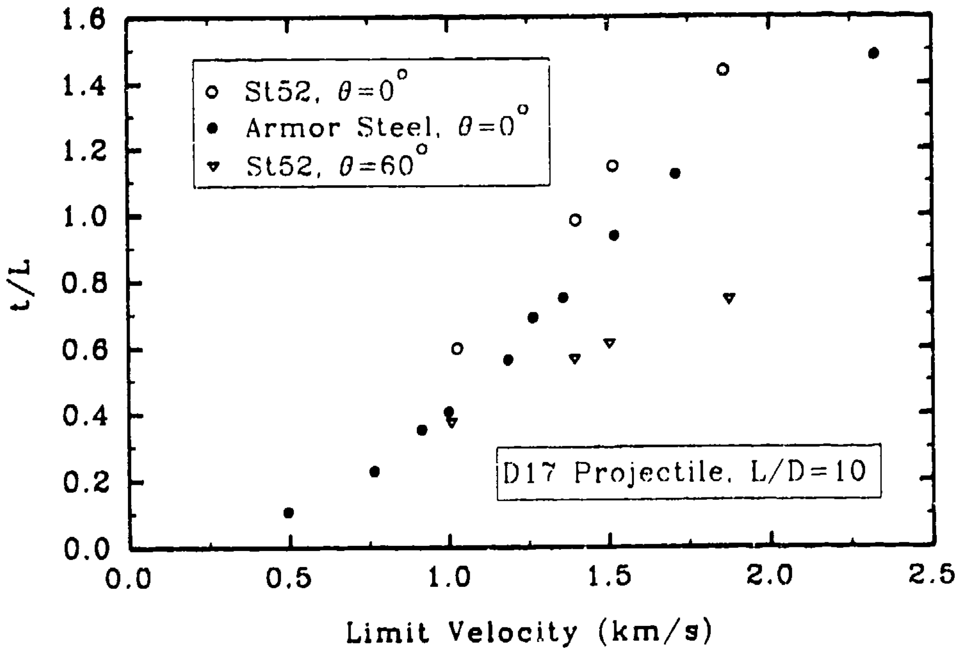

Fig. 2.2.24. Dimensionless Target Thickness versus Limit Velocity, Hohler and Stilp (1991a)

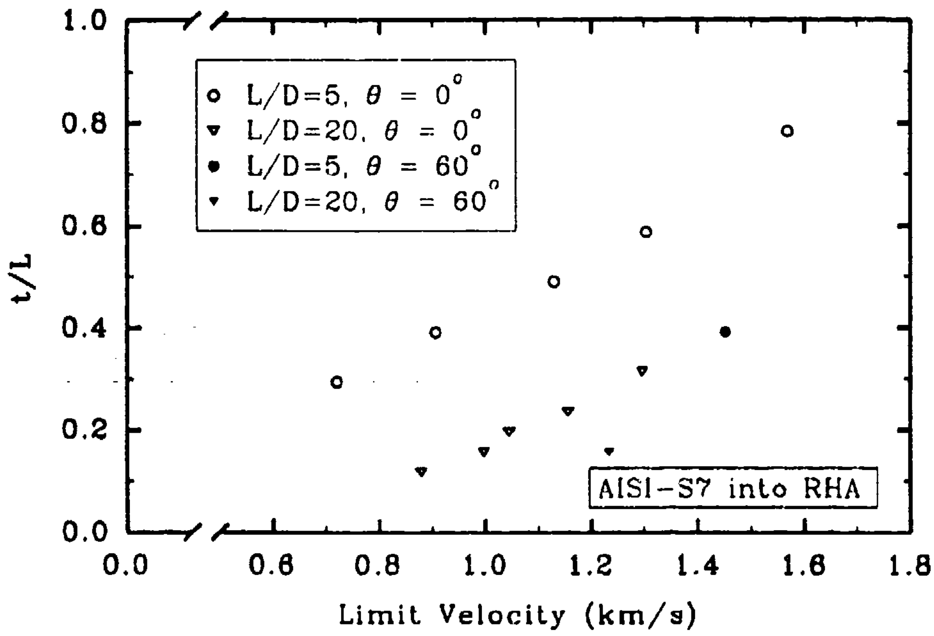

Fig. 2.2.25. Dimensionless Target Thickness versus Limit Velocity, Lambert (1978)

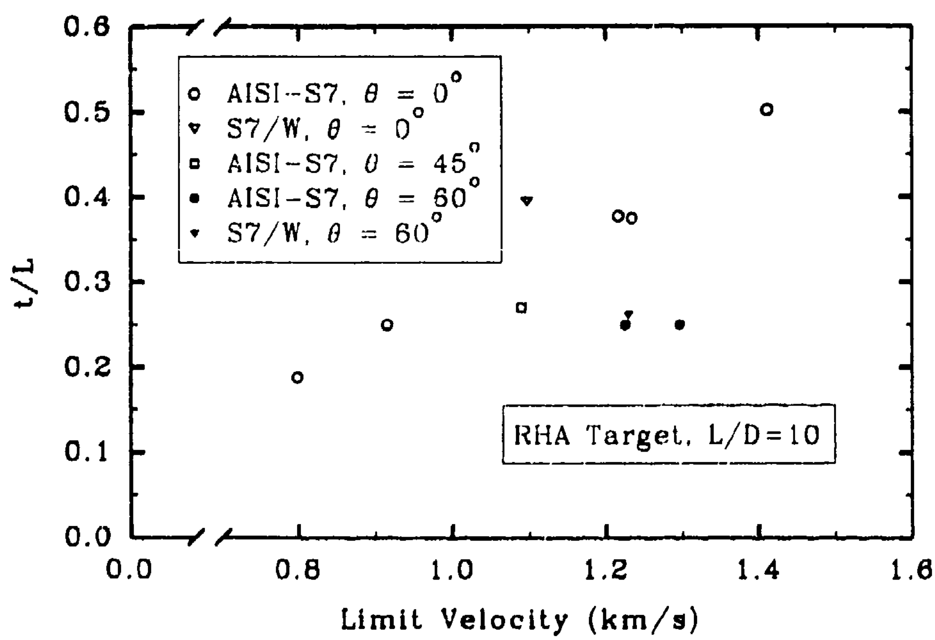

Fig. 2.2.26. Dimensionless Target Thickness versus Limit Velocity, Lambert (1978)

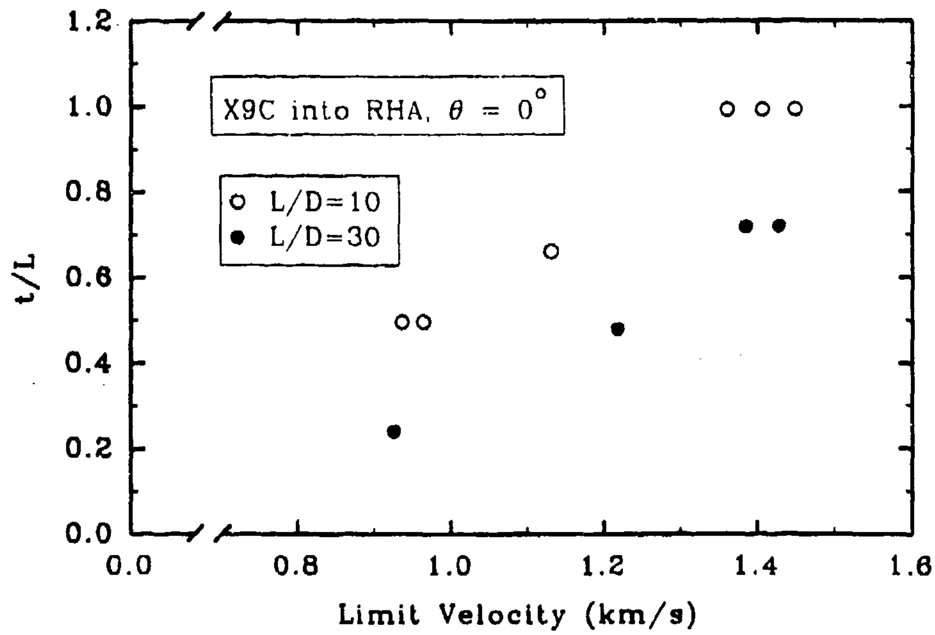

Fig. 2.2.27. Dimensionless Target Thickness versus Limit Velocity, Magness (1990)

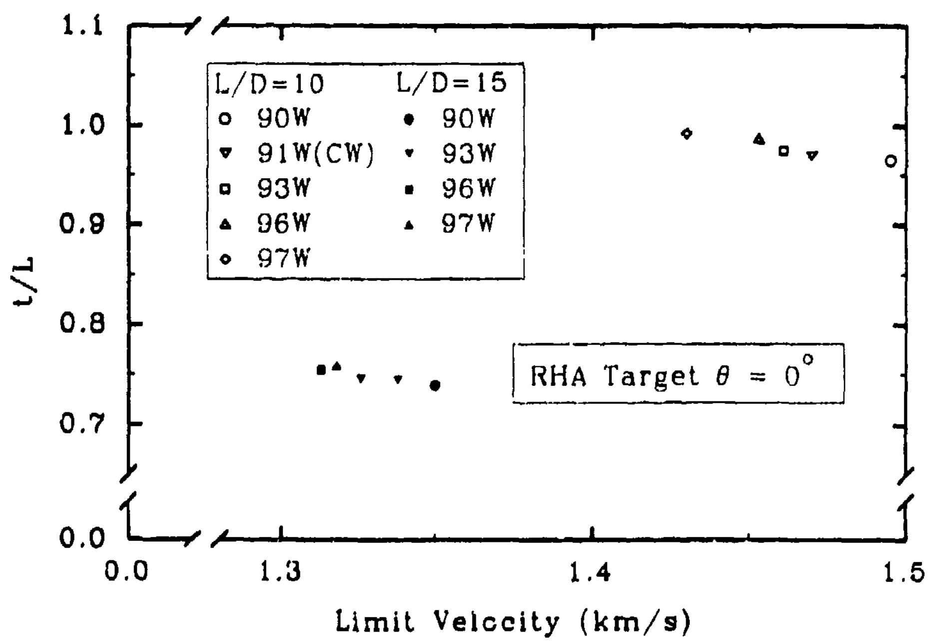

Fig. 2.2.28. Dimensionless Target Thickness versus Limit Velocity, Magness and Farrand (1990)

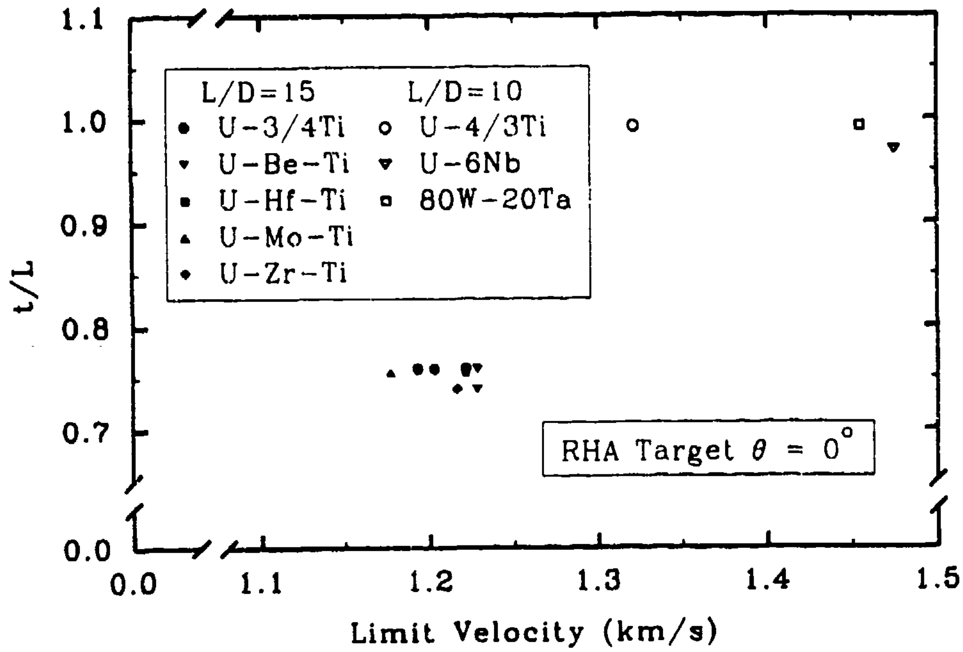

Fig. 2.2.29. Dimensionless Target Thickness versus Limit Velocity, Magness and Farrand (1990)

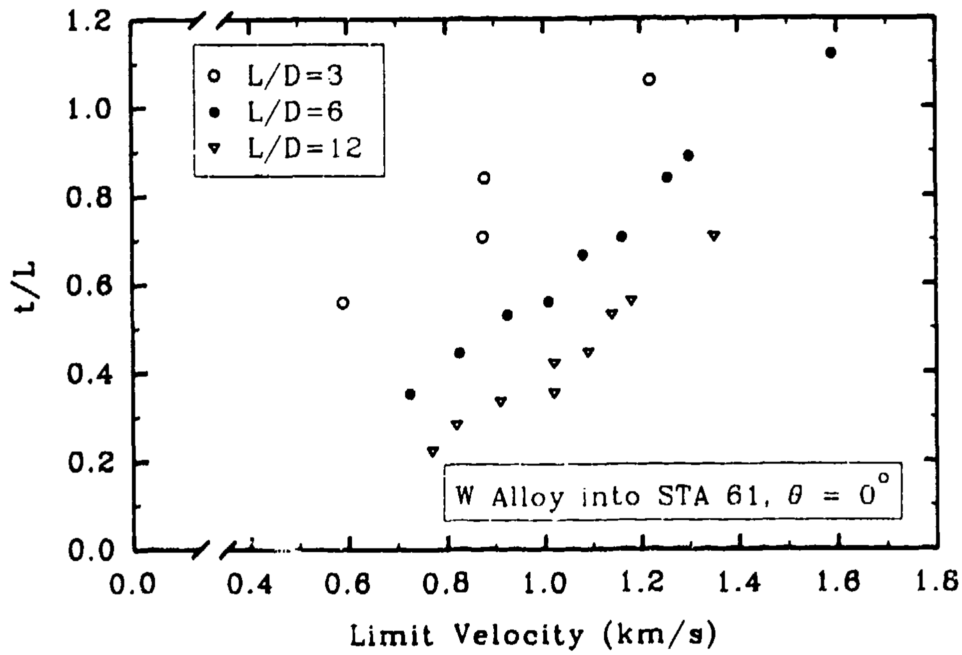

Fig. 2.2.30. Dimensionless Target Thickness versus Limit Velocity, Tate *et al.* (1978)

2.3 Multiple (Segmented) Impact Data

Data from more than 70 experiments of multiple (segmented) rod impact are presented graphically in Figs. 2.3.1 through 2.3.8, and are tabulated in Appendix C. The majority of the projectile/target types presented in the database are for tungsten alloy segmented penetrators impacting RHA or equivalent targets. Almost all of the projectiles were composed of $L/D = 1$ segments.

For most of the data, it was convenient to plot the penetration efficiency P/L_c as a function of impact velocity, where L_c is the length of the parent (donor) rod given by

$$L_c = \sum_{i=1}^{n} L_i, \tag{6}$$

where L_i is the length of each segment and n is the total number of segments. Projectile and target materials, segment aspect ratio L/D, spacing ratio S/D, and obliquity angle are also presented on the graphs to identify the impact conditions. The variation of P/L_c with respect to other independent variables, such as projectile diameter or hardness, was usually found to be insignificant. A few experiments were performed at identical impact velocities, but with variable segment spacing. For these cases, it was convenient to plot P/L_c as a function of spacing ratio S/D, where S is the spacing between segments.

Orphal and Franzen (1990) reported a series of reverse ballistic experiments where targets of finite thickness were shot into suspended segmented rods. The number of segments necessary to perforate the target was reported. Consequently, in the graphs of these data, the length of the parent rod L_c was based on the total number of segments used in perforating the target, rather than the original total number of segments. This convention was also used for the data reported in Appendix C that applies to targets of finite thickness.

Results from the experiments are in general agreement with the anticipated trends. For example, the penetration efficiency of a segmented rod is greater than the corresponding parent rod (see Figs. 2.3.2, 2.3.5, and 2.3.8). This increase is the result of the enhanced penetration efficiency observed for small aspect ratio ($L/D \approx 1$) projectiles (refer to Fig. 2.1.25, for example). The magnitude of the increase, however, is very sensitive to the spacing ratio S/D. Larger spacing ratios, for example, permit independent penetration of each individual segment. Figs. 2.3.1 through 2.3.8 all show evidence of increasing P/L_c with S/D. Some of the graphs, however, exhibit reductions in P/L_c at large spacing ratios. Figure 2.3.2, for instance, indicates that P/L_c reaches a maximum at a value of S/D close to two, but decreases at larger spacing ratios. This decrease may be the result of segment misalignment, which is more likely to occur in segmented projectiles with large spacing. In the absence of any misalignment, P/L_c should saturate at large spacing ratios.

There is also evidence that the specific details of the connection method may have an effect on the performance of segmented rods. For example, penetrators used in experiments reported by Sorenson, *et al.* (1991), were connected using a threaded aluminum carrier tube, with either air or fiberglass epoxy as a spacing material. The tests by Charters, *et al.* (1990), on the other hand, used no carrier tube, but employed tungsten rods of reduced diameter to connect the segments. The effect of different connection schemes on the performance of segmented rods is not well understood at this time, and is a topic of ongoing research efforts.

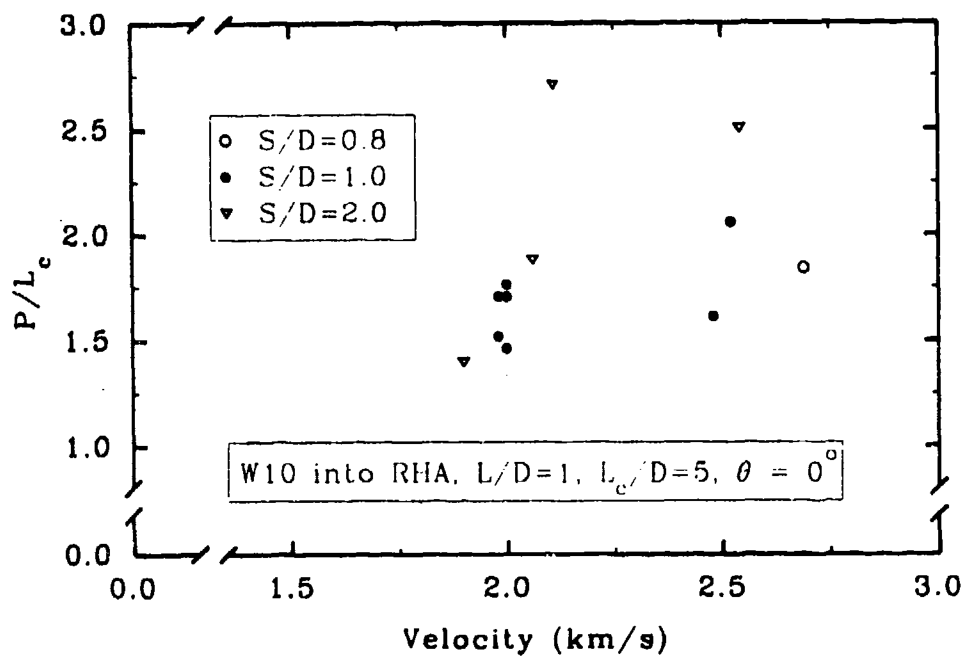

Fig. 2.3.1. Penetration Efficiency versus Impact Velocity, Charters *et al.* (1990)

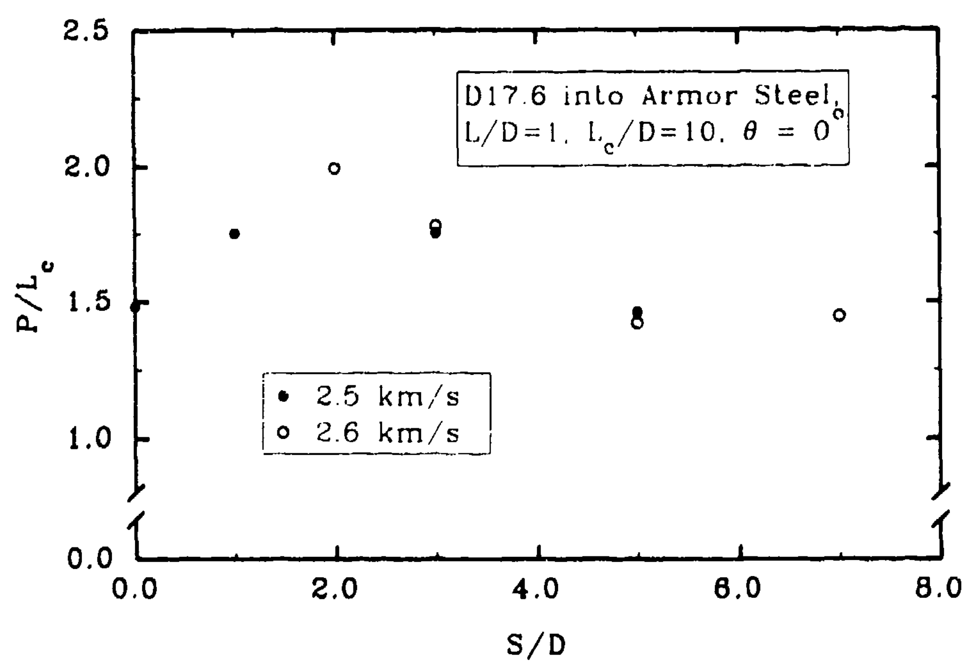

Fig. 2.3.2. Penetration Efficiency versus Spacing Ratio, Hohler and Stilp (1991b)

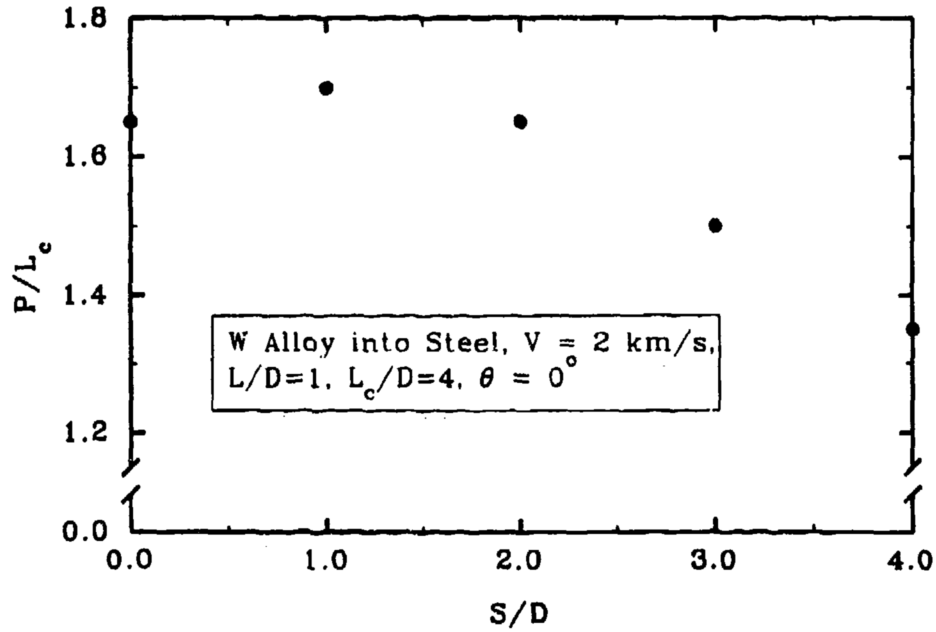

Fig. 2.3.3. Penetration Efficiency versus Spacing Ratio, Naz and Lehr (1990)

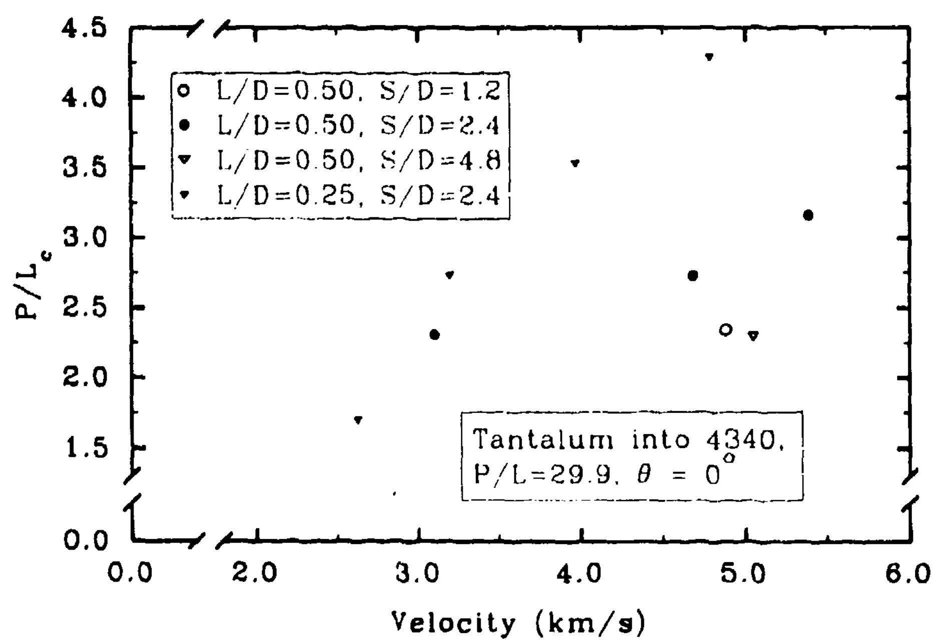

Fig. 2.3.4. Penetration Efficiency versus Impact Velocity, Orphal and Franzen (1990)

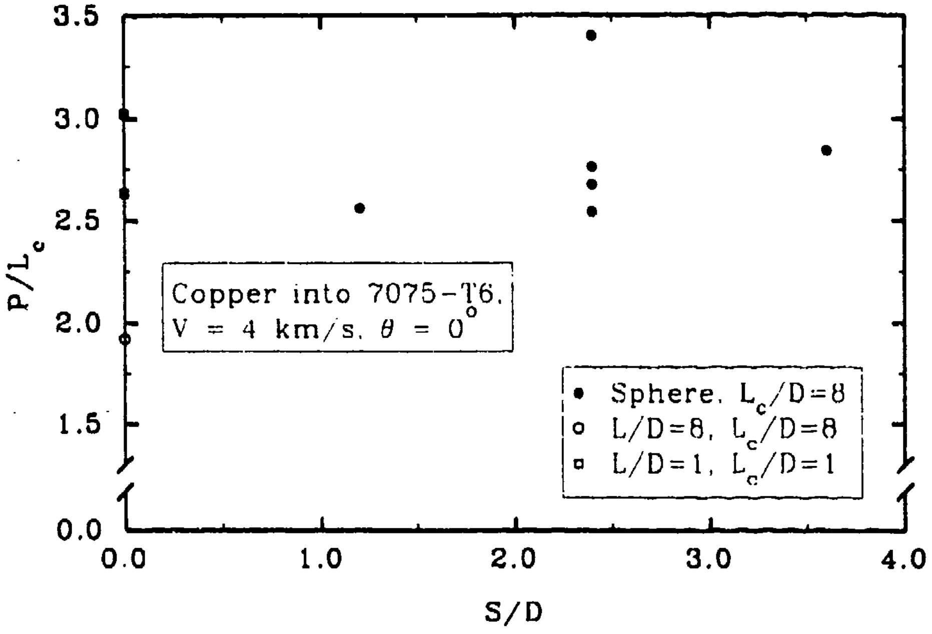

Fig. 2.3.5. Penetration Efficiency versus Spacing Ratio, Orphal and Franzen (1990)

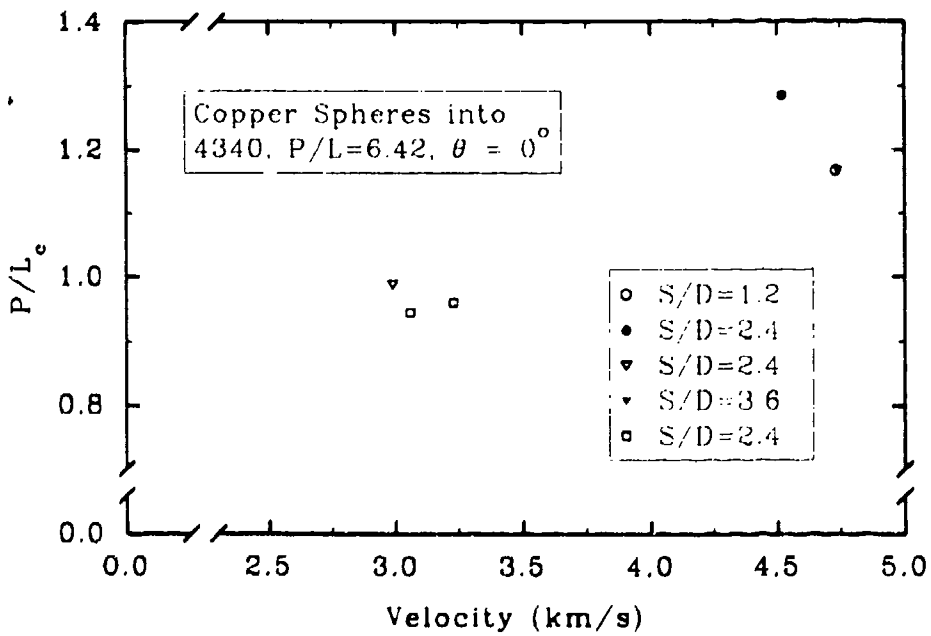

Fig. 2.3.6. Penetration Efficiency versus Impact Velocity, Orphal and Franzen (1990)

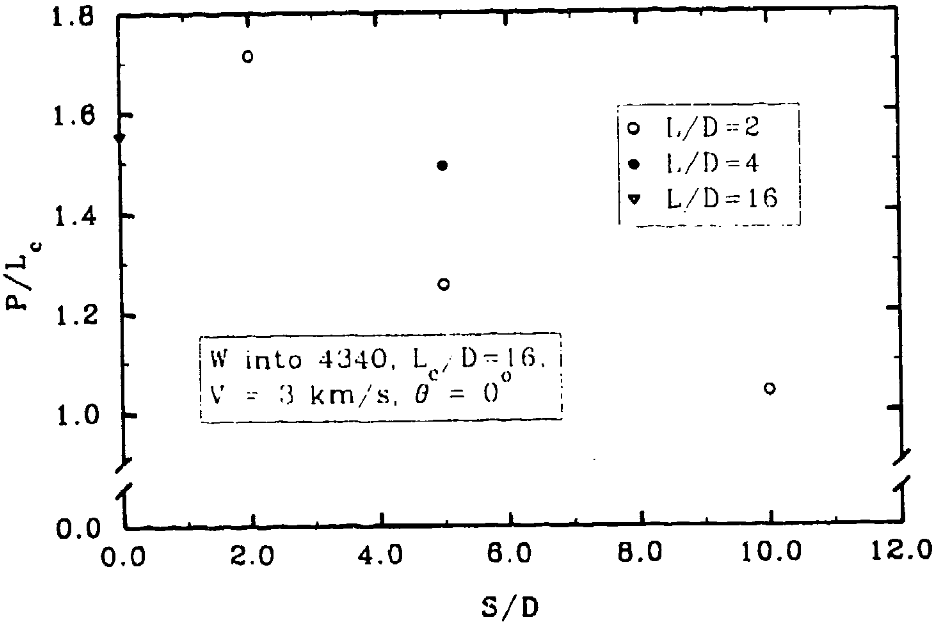

Fig. 2.3.7. Penetration Efficiency versus Spacing Ratio, Orphal and Franzen (1990)

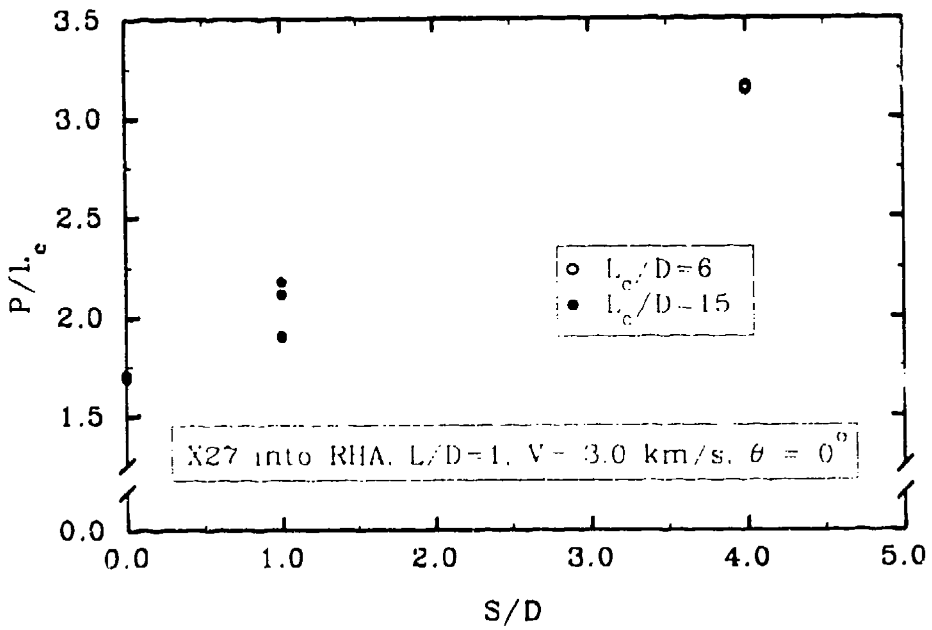

Fig. 2.3.8. Penetration Efficiency versus Spacing Ratio, Sorenson *et al.* (1991)

3.0 DATA COMPARISONS (CROSS-PLOTS)

3.1 Semi-Infinite Data

A considerable portion of the data presented in the semi-infinite target database describes results from experiments of tungsten alloy projectiles penetrating armor steel targets. Shown in Fig. 3.1.1 is a plot of penetration efficiency P/L as a function of impact velocity for tungsten alloy projectiles of various aspect ratios impacting armor steel targets at 0°obliquity. Regression lines are also plotted for each L/D to illustrate the trends evident in the data. It is apparent from the figure that P/L for long-rod projectiles ($L/D \geq 10$) at large impact velocities approaches the steady-state hydrodynamic limit, given by $(\rho_p/\rho_t)^{1/2}$, which has a numerical value of about 1.5 for this projectile/target combination. The penetration efficiency of small aspect ratio projectiles, on the other hand, is not limited by the steady-state hydrodynamic limit, and continually increases with impact velocity.

Variations in alloy composition for tungsten projectiles have only a slight effect on the performance of the penetrator. Shown in Fig. 3.1.2 is penetration efficiency as a function of impact velocity for tungsten alloy long-rod projectiles with varying alloy composition. For a fixed aspect ratio, the data correlates very well and is relatively independent of the exact composition of the alloy.

Figure 3.1.1 clearly illustrates the penetration efficiency *(P/L)* of chunky *(L/D = 1)* projectiles is significantly greater than P/L for very long penetrators at high velocities. Small aspect ratio projectiles, however, require a larger quantity of kinetic energy to achieve the same depth of penetration. This tendency is illustrated graphically in Fig. 3.1.3, where a different dimensionless depth of penetration—penetration scaled by kinetic energy—is shown as a function of impact velocity. S_p is the static tensile strength of the projectile, and M is the mass. The graph clearly indicates that for penetrators of a given mass, longer projectiles penetrate deeper than shorter projectiles at almost every impact velocity. Moreover, for a given initial kinetic energy, the optimum velocity that maximizes depth of penetration is much smaller for the large aspect ratio projectiles. As already mentioned, these data are for monolithic steel targets.

The experimental results also consistently indicate that penetration efficiency varies appreciably with projectile density, but not significantly with projectile strength. This trend is not observed, however, if the projectile flow stress becomes exceedingly large or the impact velocity is small, i.e., rigid-body penetration; an example of rigid-body penetration is shown in Fig. 2.1.21. Shown in Fig. 3.1.4 is P/L versus impact velocity for projectiles with densities greater than 18 g/cm^3 penetrating RHA. When the aspect ratio is held constant, the data for tungsten alloy projectiles correlates very consistently with the data for depleted uranium (DU) penetrators. At velocities below about 1.5 km/s, however, the DU projectiles outperform the tungsten penetrators by approximately 10% in P/L.

Although projectile density contributes significantly to a determination of the penetration depth, target density has a considerably weaker influence. In fact, target hardness influences penetration depth significantly more than target density in the conventional ordnance velocity regime. In Fig. 3.1.5, P/L is plotted as a function of impact velocity for penetrators and targets of identical materials. The softer aluminum alloy (1100-0) and steel (C1015) combinations, for example, exhibit deeper penetrations at any given velocity than the respective harder materials.

Multiple nonlinear regression analyses have been performed to develop a simple relation that correlates reasonably well with the majority of results found in the database. The correlation was restricted mainly to the penetration of long-rod eroding projectiles at small yaw angles into steel targets at 0° obliquity. Consequently, the data for rigid or small aspect ratio projectiles, or targets other than steel, have been neglected. Regression analysis was used to yield the relation:

$$\frac{P}{L} = 1.121\left(\frac{\rho_p}{\rho_t}\right)^{0.3704} \tanh\left[0.01750\left(\frac{L}{D}\right)^{-0.3020}\left(\frac{\rho_p V^2}{S_t}\right)^{1.137}\right], \tag{7}$$

$$\frac{L}{D} \geq 10, \quad \delta < 3°, \quad \theta = 0°,$$

$$\frac{\rho_p V^2}{S_p} > 20, \quad \rho_t = 7.85 g/cm^3$$

where S_t and S_p are the static tensile strengths of the target and projectile, respectively. The restriction on the dimensionless parameter $(\rho_p V^2/S_p)$ is used to exclude penetration by rigid projectiles. The coefficient of determination for this correlation is $r = 0.9838$. At small velocities, Eq. (7) tends to zero as required, whereas at large velocities, Eq. (7) approaches an asymptotic limit. It is certainly possible to force this asymptotic limit to match the theoretical hydrodynamic limit. However, the inclusion of this constraint yields a correlation with a larger standard deviation, so the equation was not presented. Although the restrictions on Eq. (7) appear to be quite extensive, the majority of projectile/target combinations currently in the database satisfies all of the criterion. Note the projectile strength does not appear in Eq. (7). Projectile strength has only a minor effect on the penetration depth within the specified constraints.

It is well known that yaw has a detrimental effect on penetration. Plotted in Figs. 3.1.6 and 3.1.7 are penetration efficiency as a function of yaw for tungsten alloy projectiles penetrating RHA targets at 0° obliquity. The aspect ratios are given as 10 and 20 for the data in Figs. 3.1.6 and 3.1.7, respectively. A velocity correction was applied, using Eq. (7), to adjust the data for slight variations in impact velocity to the common reference velocities given in the figures.

In Figs. 3.1.8 and 3.1.9, the penetration efficiency is shown as a function of yaw angle for 4340 steel projectiles impacting 4340 steel targets at 0° obliquity. Fig. 3.1.8 shows P/L versus yaw for $L/D = 5$ projectiles at different impact velocities, and in Fig. 3.1.9 P/L is shown versus yaw for projectiles of various aspect ratios at a fixed impact velocity. A velocity correction was again used for the data in these graphs to correct P/L for small variations in velocity. A different relationship than Eq. (7) was used for the correction, however, due to the small aspect ratios of the projectiles as well as the small values for the parameter $\rho_p V^2/S_p$ (typically about 15 for these data).

An assumption frequently made is that penetration begins to decrease when the yaw angle becomes sufficiently large as to induce crater wall dragging of the projectile tail. Therefore, implicit to a determination of the effect of yaw on penetration is the knowledge of crater diameter. Figure 3.1.10 shows the dimensionless crater diameter as a function of initial velocity for tungsten alloy projectiles impacting RHA. Crater diameter varies significantly with velocity and projectile diameter, for given projectile and target materials. The variation with projectile length, however, does not appear to be appreciable. The large quantity of scatter present in the data is probably the result of several sources. For instance, numerical simulations have shown that crater diameter is very sensitive to the strength of the target material. The large spread in d/D for a given impact velocity may be partly the result of variations in target strength, even though all the targets are classified as "armor" steel. Moreover, crater diameter can vary with projectile density or yaw angle. These variables are not presented explicitly on the graphs.

Based on the assumption that penetration decreases after the initiation of crater wall dragging, penetration should decrease—for a given impact velocity—with increasing yaw as the aspect ratio increases. Moreover, for projectiles of fixed aspect ratio, penetration should degrade more rapidly with increasing yaw as the velocity decreases. This second tendency is based on the observation that low-velocity impacts produce smaller diameter craters than high-velocity impacts. Given the limited quantity of data plotted on the graphs, Figs. 3.1.6 through 3.1.9 appear to be reasonably consistent with these hypotheses.

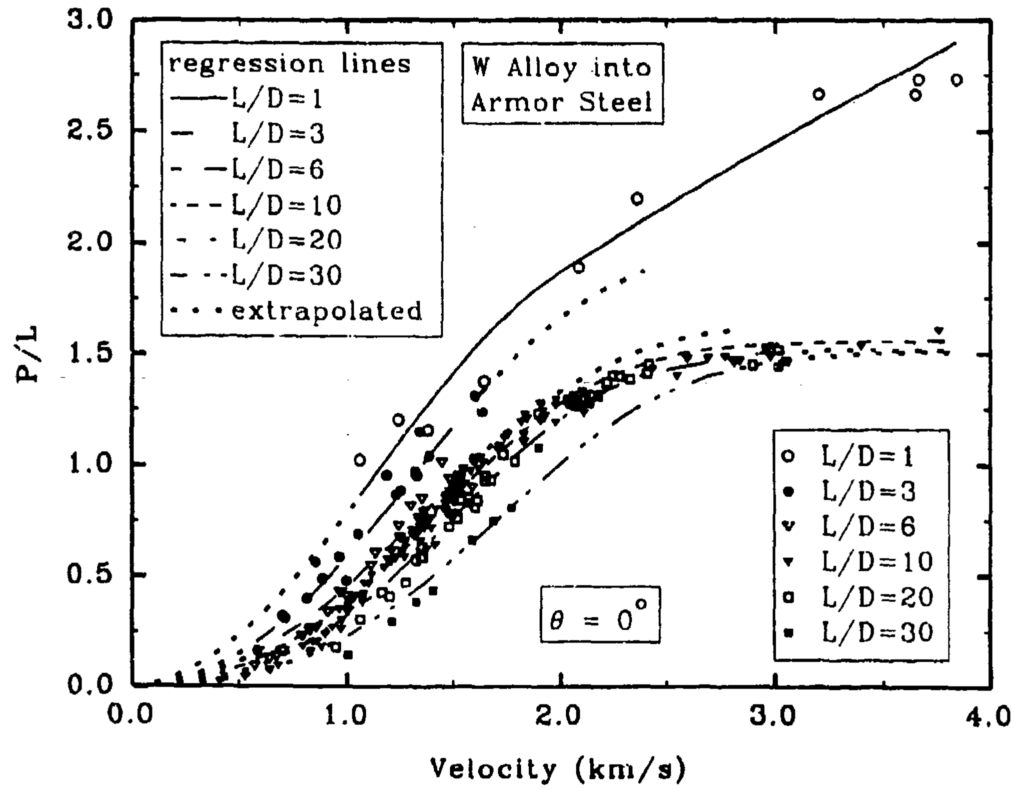

Fig. 3.1.1. Penetration Efficiency versus Impact Velocity

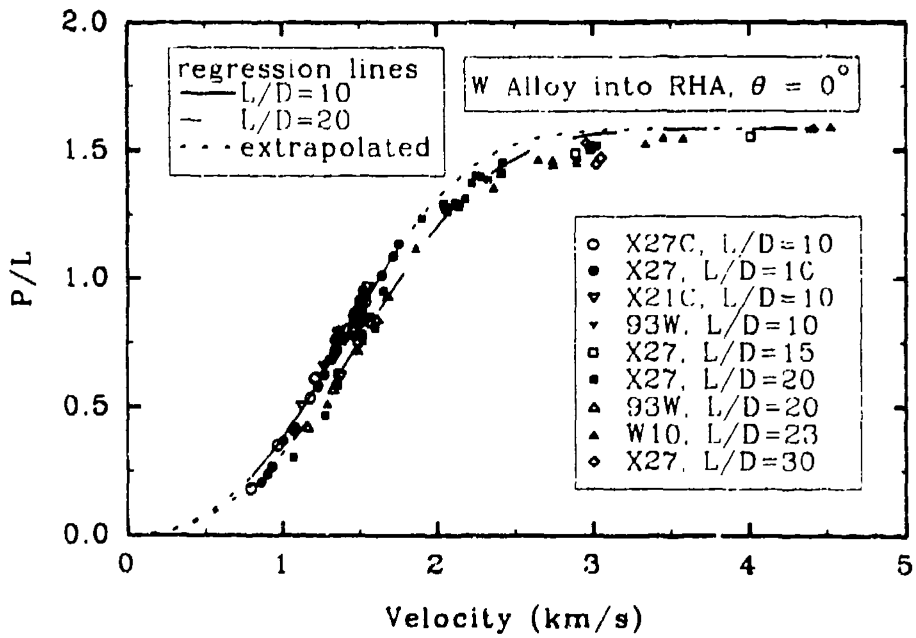

Fig. 3.1.2. Penetration Efficiency versus Impact Velocity

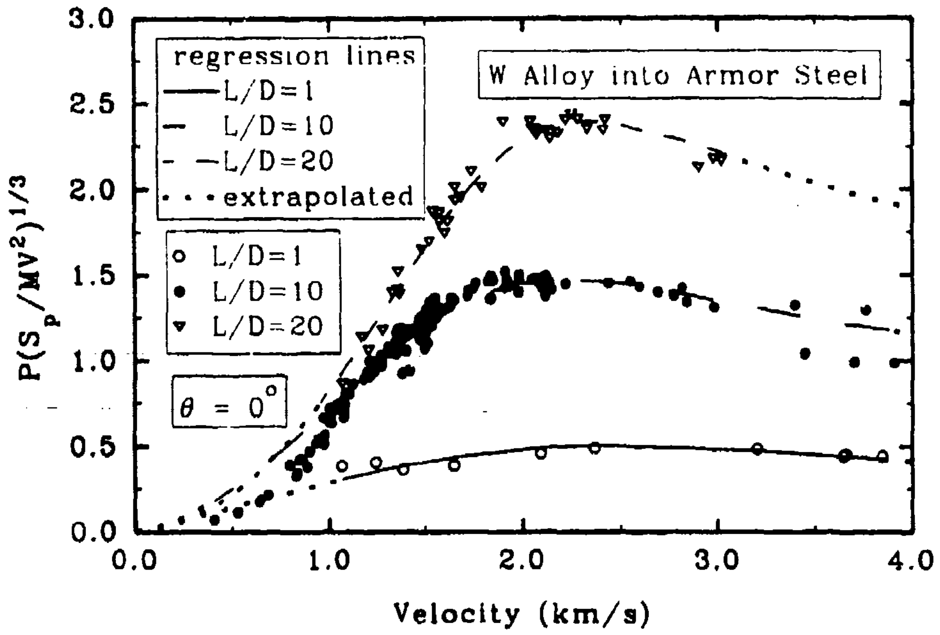

Fig. 3.1.3. Kinetic Energy-Scaled Penetration versus Impact Velocity

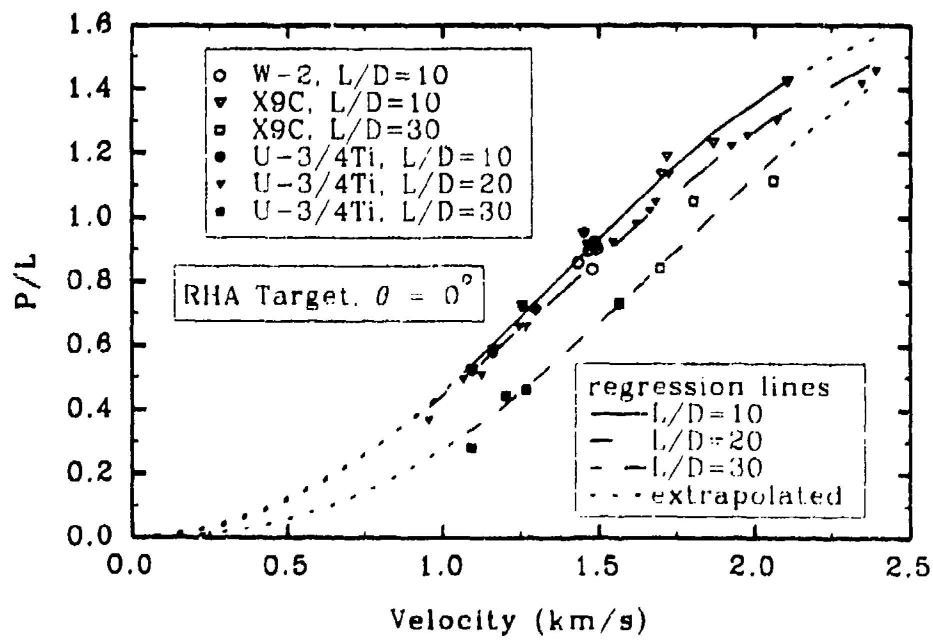

Fig. 3.1.4. Penetration Efficiency versus Impact Velocity

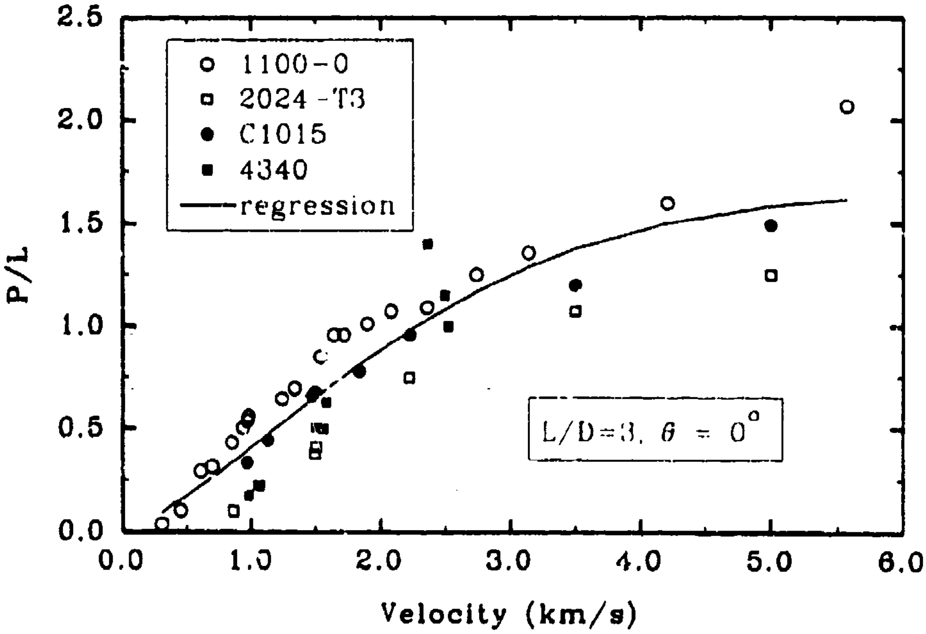

Fig. 3.1.5. Penetration Efficiency versus Impact Velocity for Projectiles and Targets of Identical Material

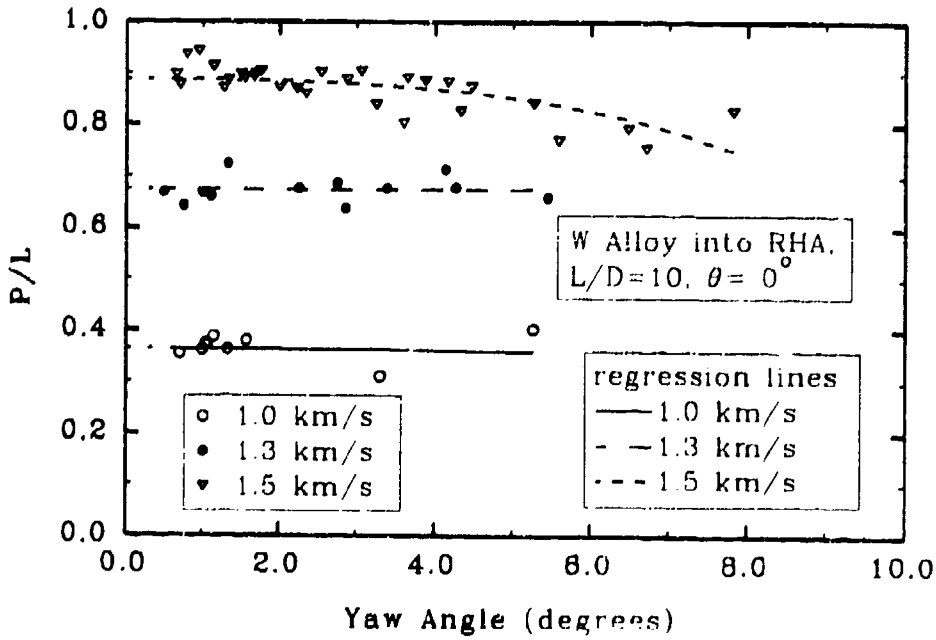

Fig. 3.1.6. Penetration Efficiency versus Yaw

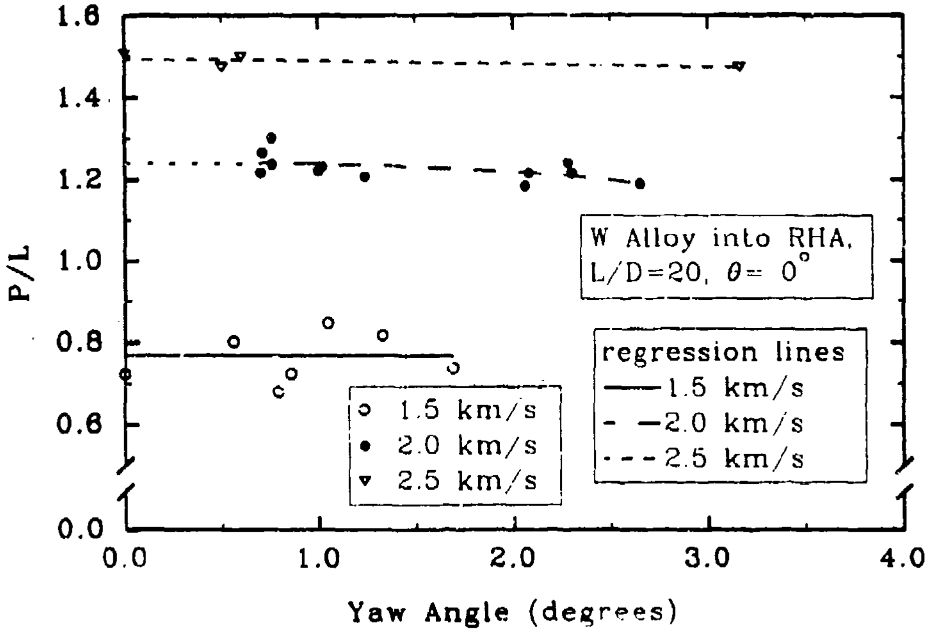

Fig. 3.1.7. Penetration Efficiency versus Yaw

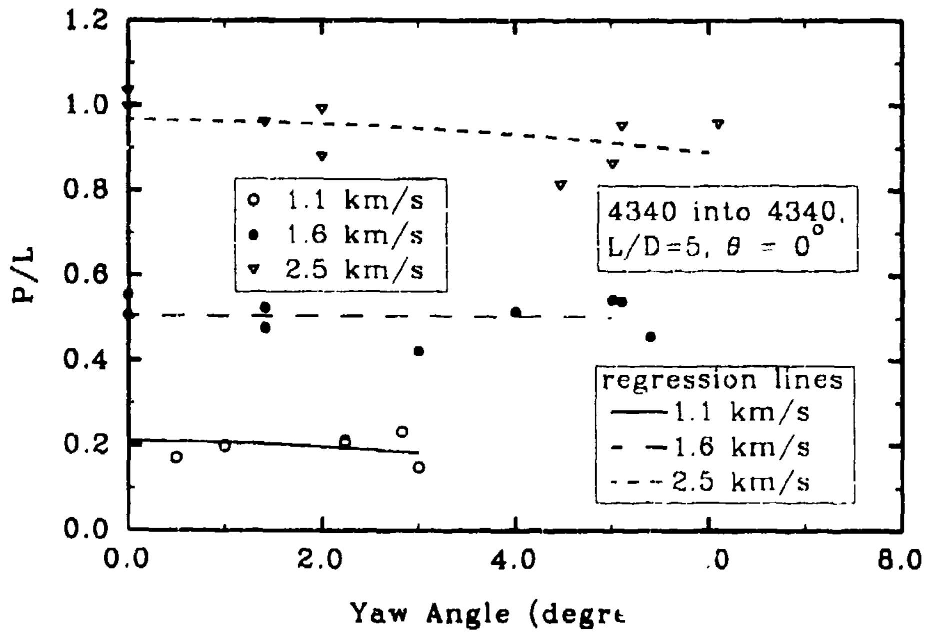

Fig. 3.1.8. Penetration Efficiency versus Yaw

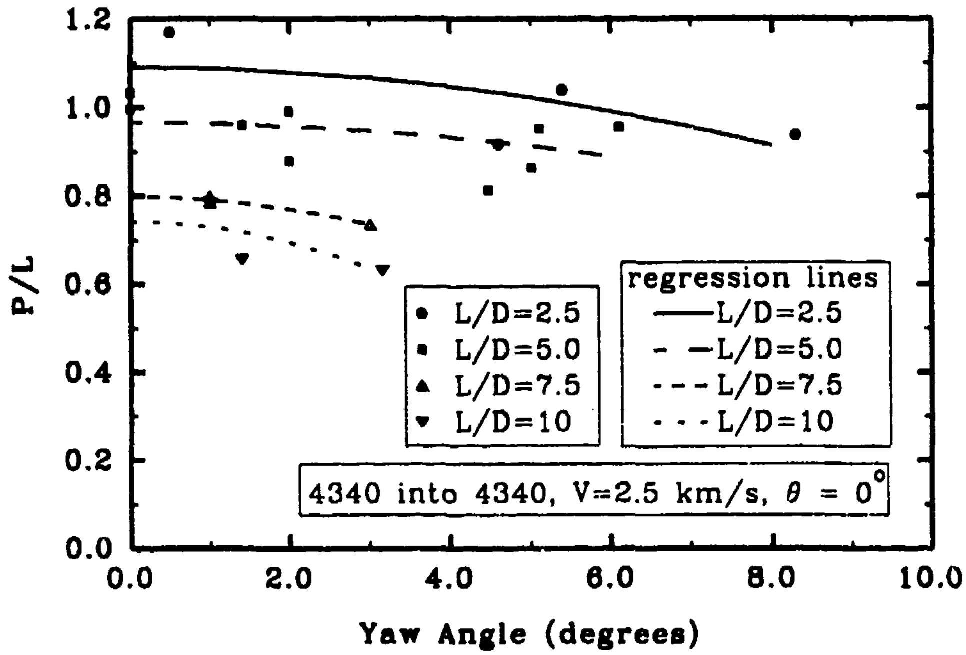

Fig. 3.1.9. Penetration Efficiency versus Yaw

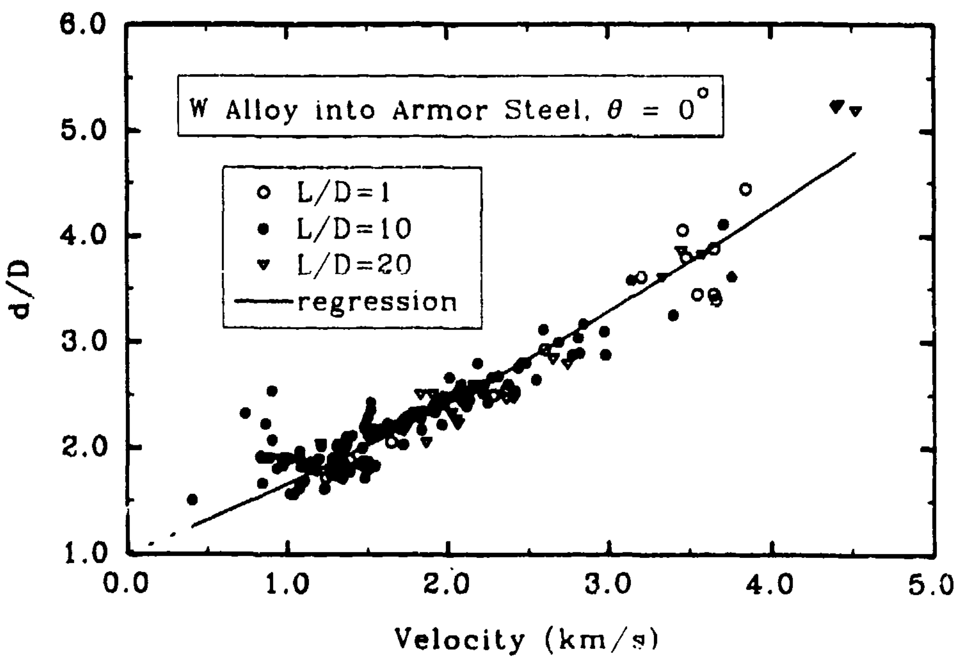

Fig. 3.1.10. Dimensionless Crater Diameter versus Impact Velocity

3.2 Finite-Thickness Data

Cross-plots for the finite thickness data have been subdivided into residual-velocity and limit-velocity data. Frequently, the residual-velocity results have been used by researchers to determine the limit velocity for a given projectile/target combination. Variations in limit and residual velocities are presented for various projectile and target configurations. The effect of obliquity angle on projectile performance is also plotted for finite-thickness targets.

3.2.1 Residual-Velocity Data

The majority of data in the $V_s - V_r$ database contains results from penetration experiments of tungsten alloy or steel penetrators impacting RHA, or equivalent targets. Shown in Fig. 3.2.1 is the dimensionless residual velocity V_r/V_s as a function of striking velocity. The data have been fitted to Eq. (5) using nonlinear regression analysis. The limit velocity is the intersection of the regression line with the ordinate axis. In Fig. 3.2.1, the limit velocities corresponding to the three regression lines are 721, 1145, and 1277 m/s, respectively.

Residual velocity data for different projectile/target configurations are shown in Figs. 3.2.2 and 3.2.3. In Fig. 3.2.2, V_r/V_s is shown as a function of striking velocity for targets with different hardnesses. The corresponding limit velocities are 1097, 1210, and 1392 m/s, respectively. The slightly lower limit velocity for the data corresponding to V_L = 1097 m/s, even though the target plate is thicker, is the result of a tungsten cap used on the penetrator in the test series. The increased density and strength of the cap improves the performance of the projectile. The hardness of the penetrator, on the other hand, has only a minimal effect on the limit and residual velocities under these test conditions. In the data corresponding to V_L = 1392 m/s, for example, penetrators of several different hardnesses were evaluated. In fact, the residual velocity is quite often independent of hardness for impacts of eroding projectiles. However, if the projectile penetrates as a rigid body or, alternatively, if the target is excessively thin, the residual velocity can be strongly dependent on the projectile hardness. In Fig. 3.2.3, the dimensionless residual velocity is shown as a function of striking velocity for rigid-body impact. The limit velocities are 246, 312, and 356 m/s, respectively.

Although the data presented in Fig. 3.2.2 demonstrate that under certain conditions the residual velocity is independent of projectile hardness, the length of the residual penetrator can be dependent on its hardness. Shown in Fig. 3.2.4 is the normalized consumed penetrator length as a function of V_r/V_s for projectiles of various hardnesses. The normalized consumed projectile length $(L_o - L_r)/t$ can be interpreted as the length of penetrator consumed per unit thickness of target. In Fig. 3.2.5, the normalized residual penetrator length L_r/L_o is shown as a function of V_r/V_s. As is evident from the two figures, the length of the residual projectile increases with V_r/V_s. Note, however, even at high residual velocities, that a significant portion of the projectile is still consumed (almost 50% for even the hardest penetrators when V_r/V_s is 0.9). Fig. 3.2.5 clearly indicates the residual projectile length increases with hardness.

Residual mass of the penetrator also tends to be dependent on projectile hardness. Shown in Fig. 3.2.6 is the normalized residual projectile mass M_r/M_o as a function of V_r/V_s. The normalized residual mass, in general, approaches higher values than L_r/L_o for given values of L/D, t/L, and V_r/V_s. This is result of "mushrooming" by the projectile nose during penetration, which increases the diameter of the nose, and thus increases the residual projectile mass for a given residual length.

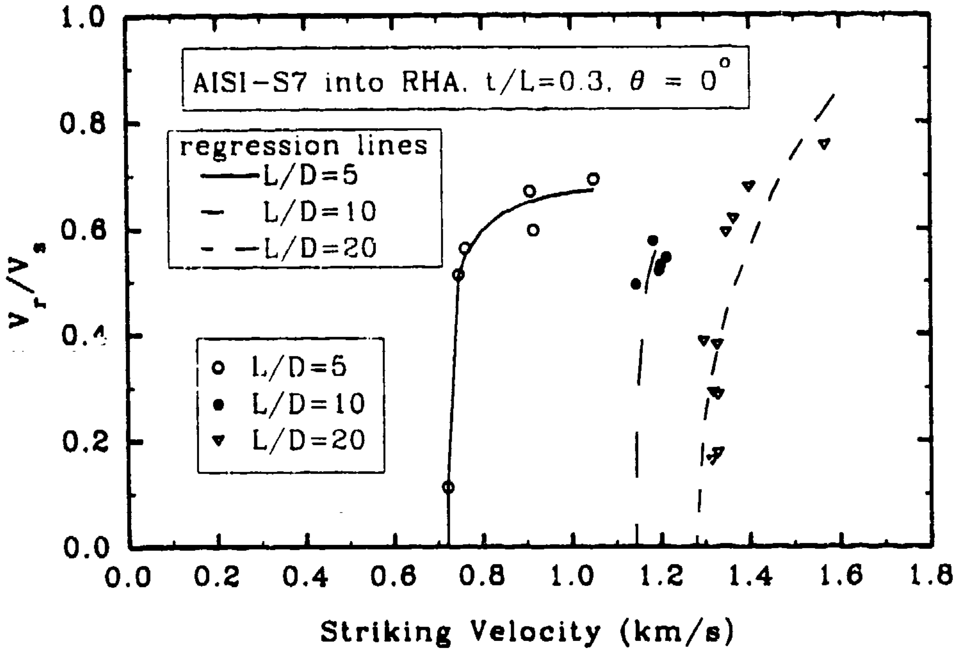

Fig. 3.2.1. Dimensionless Residual Velocity versus Striking Velocity

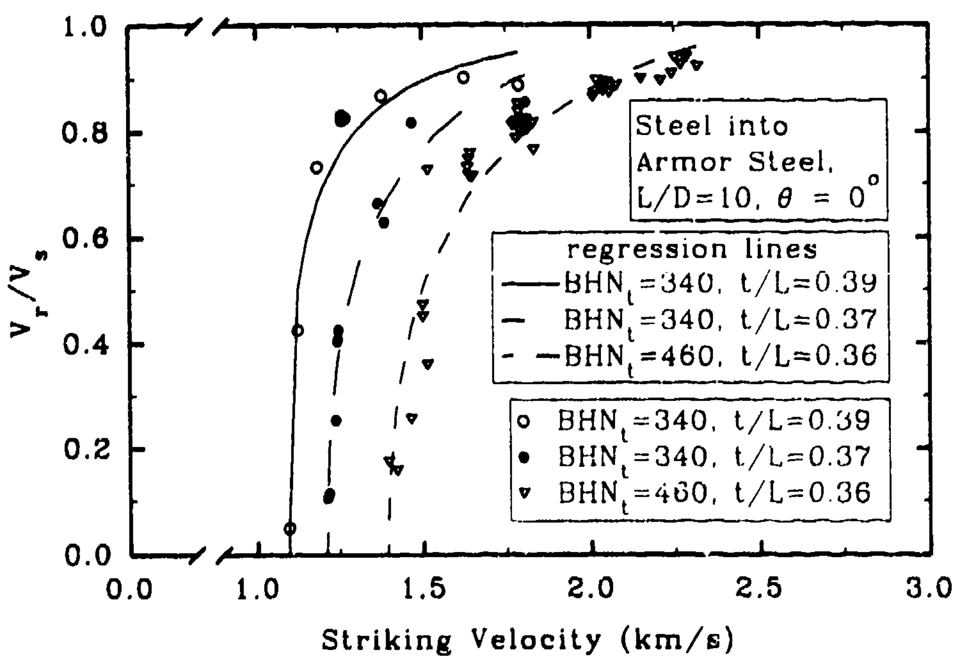

Fig. 3.2.2. Dimensionless Residual Velocity versus Striking Velocity

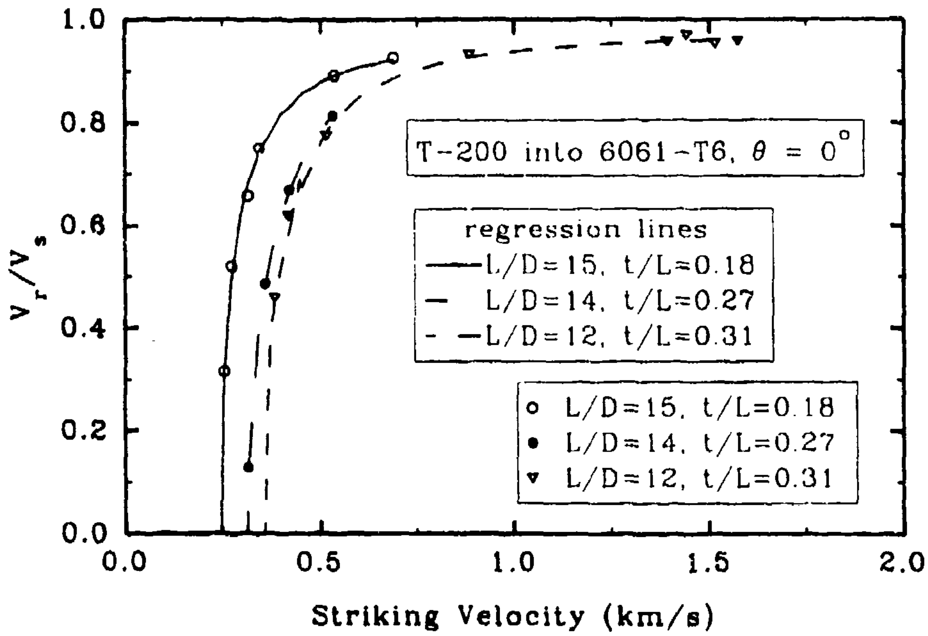

Fig. 3.2.3. Dimensionless Residual Velocity versus Striking Velocity

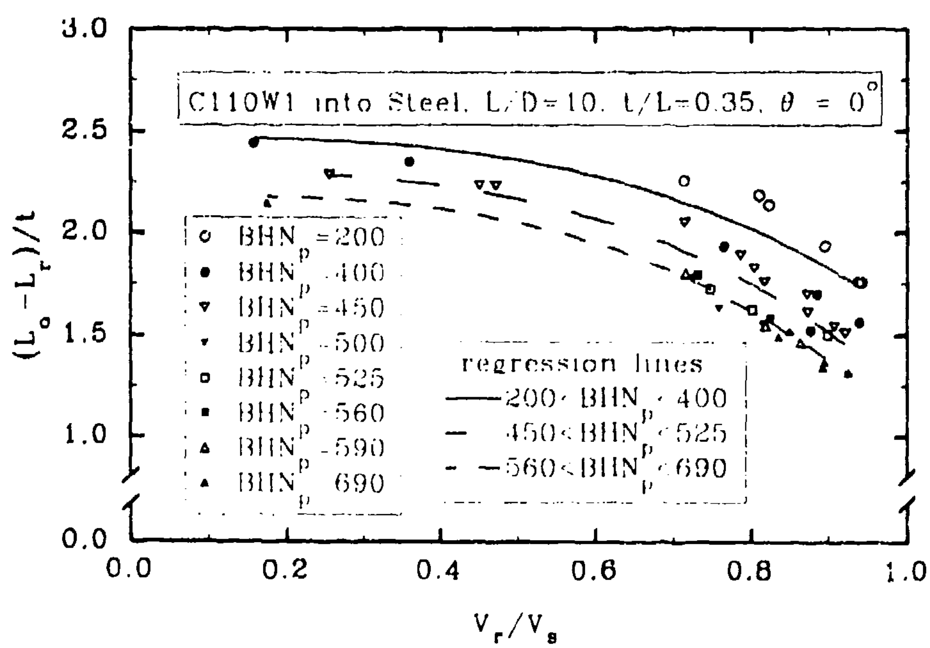

Fig. 3.2.4. Normalized Consumed Projectile Length versus Dimensionless Residual Velocity

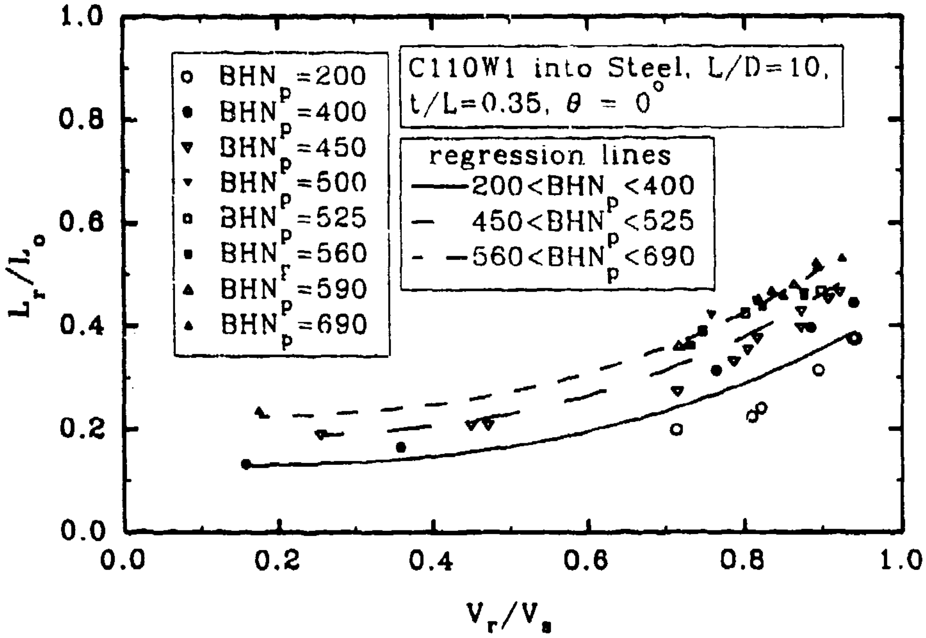

Fig. 3.2.5. Normalized Residual Projectile Length versus Dimensionless Residual Velocity

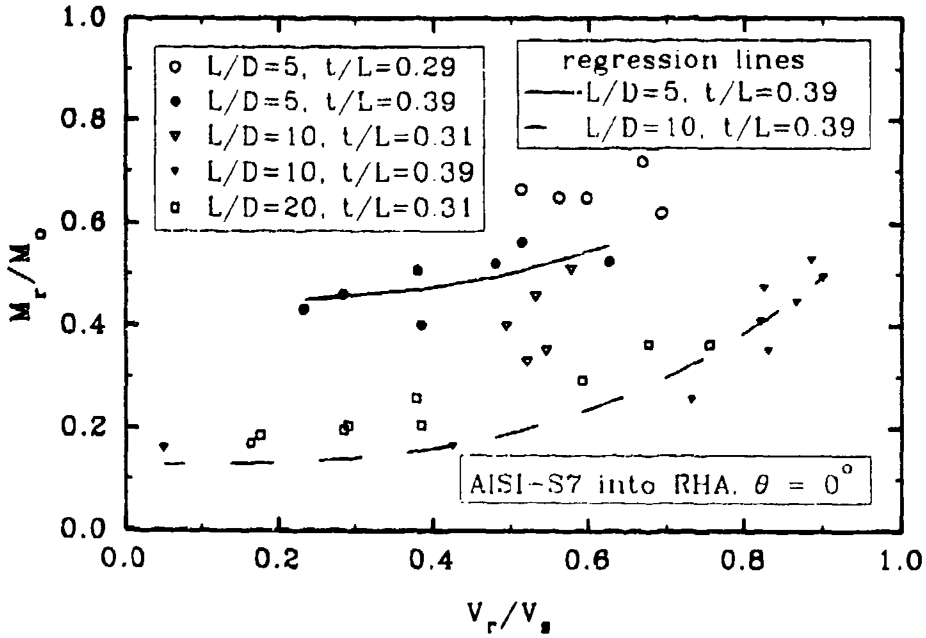

Fig. 3.2.6. Normalized Residual Projectile Mass versus Dimensionless Residual Velocity

3.2.2 Limit-Velocity Data

In the V_L database, the majority of results was obtained from penetration experiments of tungsten alloy or steel projectiles impacting armor steel targets at several obliquity angles. Shown in Fig. 3.2.7 is the dimensionless target thickness t/L as a function of limit velocity for projectiles of various aspect ratios. Results from steel projectiles of various hardness impacting armor steel targets at 0° obliquity are shown. The curves are similar in most respects to the curves for P/L versus V for semi-infinite targets, and Eq. (7) is plotted on the figure for $L/D = 10$ to illustrate this tendency. In general, the dependence of t/L on V_L for finite thickness targets is similar to the dependence of P/L on V for corresponding semi-infinite targets. The values of P/L, however, are slightly smaller than t/L for a given set of test conditions. This is the result of reduced target resistance near the rear surface (breakout region) for finite-thickness targets.

Although Fig. 3.2.7 indicates that the limit velocity decreases with decreasing L/D at a given value of normalized target thickness t/L, small aspect ratio projectiles require a larger quantity of kinetic energy to defeat a target of a given thickness at a fixed limit velocity. This is illustrated graphically in Fig. 3.2.8, where the kinetic energy-scaled target thickness is shown as a function of limit velocity for steel projectiles of various hardnesses and L/D. The target was armor steel at 0° obliquity. It is also evident from the figure that longer penetrators achieve a maximum in target thickness at a corresponding lower limit velocity, when the initial kinetic energy of the penetrator is held constant. Similar trends are also evident when the depth of penetration P is maximized, given a fixed initial kinetic energy, for semi-infinite targets (see Fig. 3.1.3).

It is also of fundamental and practical importance to determine the effect of target obliquity on the performance of projectiles. Shown in Fig. 3.2.9 is the dimensionless line-of-sight target thickness, $t/L \cos\theta$, as a function of obliquity angle θ for heavy-metal alloy projectiles at several aspect ratios. The limit velocity was held fixed at 1000 m/s. The line-of-sight thickness was selected as the appropriate measure of target performance at different obliquities rather than the actual thickness, since it is the line-of-sight thickness that represents the target thickness actually encountered by the projectile. The data shown on the graph were determined from the results of several regression analyses. These analyses were employed to determine the target thickness corresponding to a limit velocity of 1 km/s, while holding all other test conditions constant. The graph indicates the line-of-sight target limit thickness for a given projectile at fixed velocity tends to increase slightly with obliquity angle. This dependence, however, appears to be less sensitive as

L/D increases. This is consistent with an interpretation that entry and breakout effects become less and less important as the total target thickness becomes greater (as it does for longer *L/D* projectiles).

Figure 3.2.10 is another illustrative example of the effect of obliquity angle on line-of-sight target thickness. Shown in the figure is the normalized line-of-sight thickness as a function of *L/D* at several obliquity angles. The penetrators were tungsten and DU alloys with slightly higher densities than presented in Fig. 3.2.9. The target was armor steel, and the limit velocity was 1000 m/s. The variations in $t/L \cos\theta$ with θ for a given set of test conditions are small but, nevertheless, identifiable.

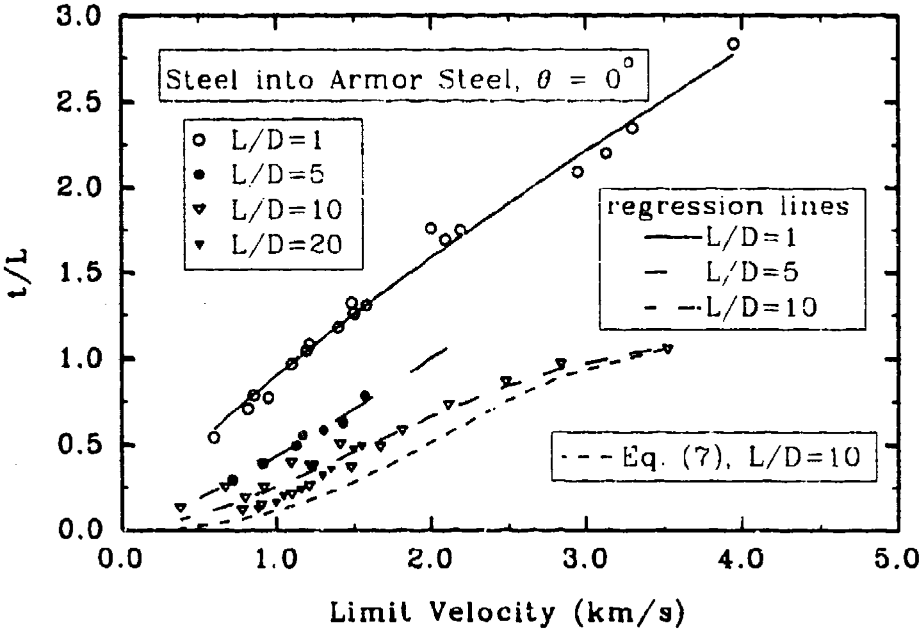

Fig. 3.2.7. Dimensionless Target Thickness versus Limit Velocity

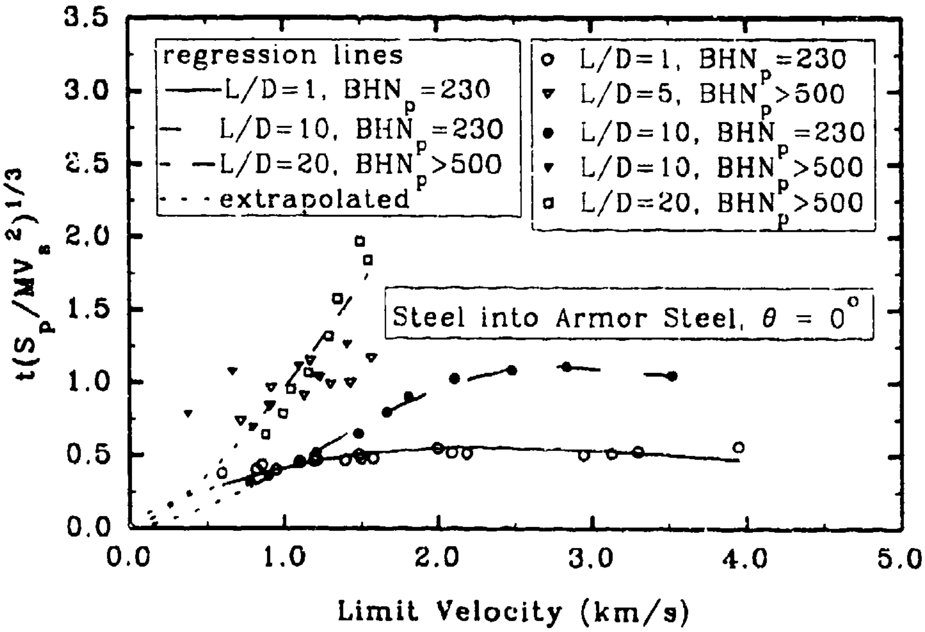

Fig. 3.2.8. Kinetic Energy-Scaled Target Thickness versus Limit Velocity

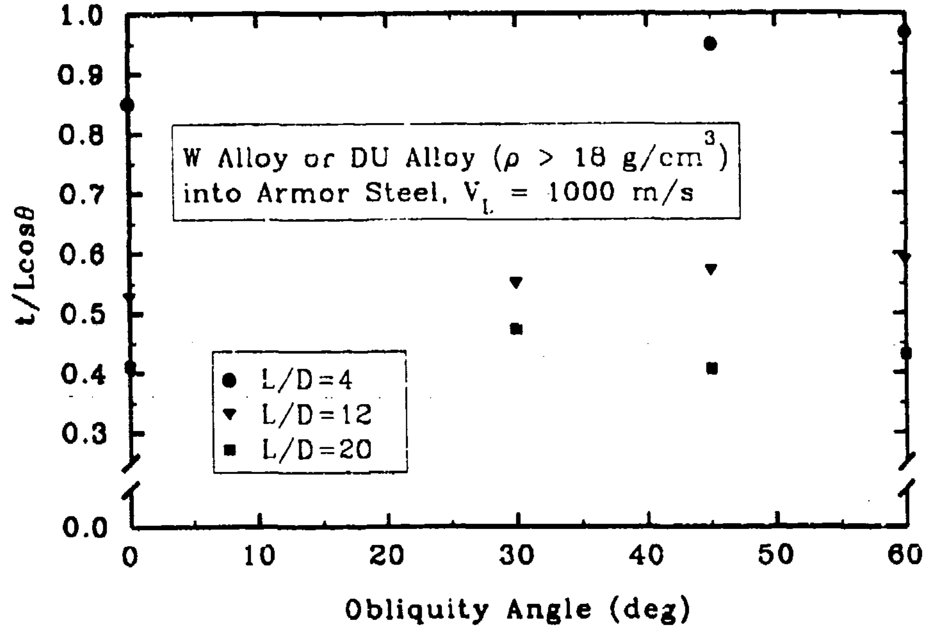

Fig. 3.2.9. Dimensionless Line-of-Sight Target Thickness versus Obliquity Angle

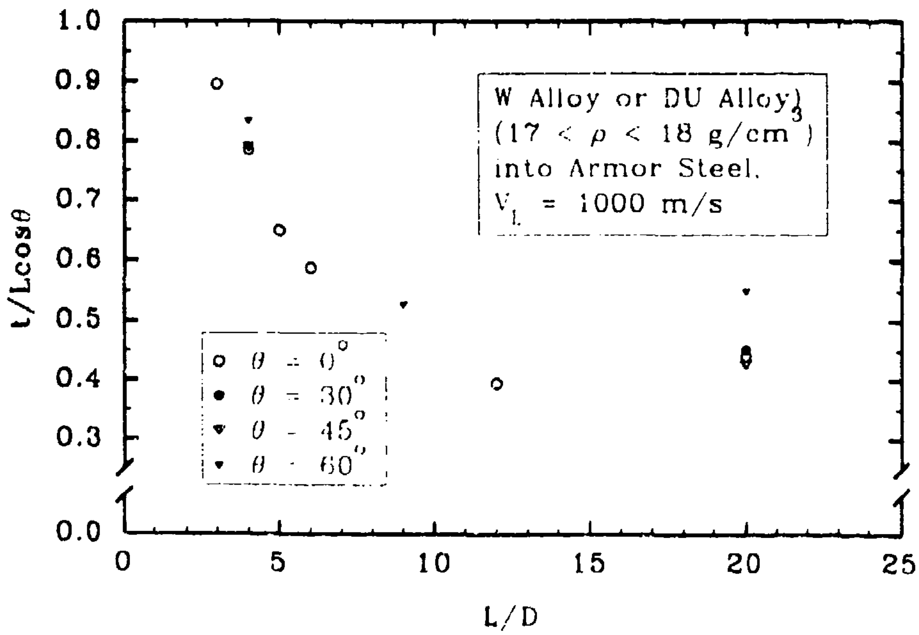

Fig. 3.2.10. Dimensionless Line-of-Sight Target Thickness versus Projectile Aspect Ratio

3.3 Multiple (Segmented) Impact Data

Due to the limited quantity of data in the Multiple Impact database, only a few graphs have been presented. Shown in Fig. 3.3.1 is the penetration efficiency P/L_c as a function of impact velocity for tungsten alloy segmented projectiles penetrating armor steel. The aspect and spacing ratios of the segments were unity, and the target obliquity was 0°. Only a few data points are shown on the graph. It is worth noting that P/L_c for a single-segment $L/D = 1$ projectile is about 2.0 for $V = 2$ km/s (see Fig. 3.1.1), which is larger than any of the 2 km/s datapoints shown on Fig. 3.3.1. Note that P/L_c can be interpreted as the average penetration efficiency of each individual segment in the projectile. Consequently, if P/L_c decreases with L_c/D, the addition of segments to a projectile results in an average decline in penetration efficiency for each individual segment. This decline may be the result of segment interference effects as the projectile penetrates the target.

However, due to the limited quantity of data presented on the graph, it is difficult to identify any definite conclusions except that P/L_c is a strong function of impact velocity, and P/L_c does not saturate to $(\rho_p/\rho_t)^{1/2}$ as do long-rod projectiles. Complicating data interpretation are the effects of the connecting elements between segments. Thus, caution must be exercised in drawing conclusions.

As was previously noted, the spacing ratio S/D appears to be a very sensitive parameter in determining P/L_c for segmented rods. Figure 3.3.2 shows the penetration efficiency P/L_c as a function of impact velocity at several spacing ratios for segmented ($L/D = 1$) projectiles. The penetration efficiency increases with S/D and impact velocity, as already noted in Section 2.3.

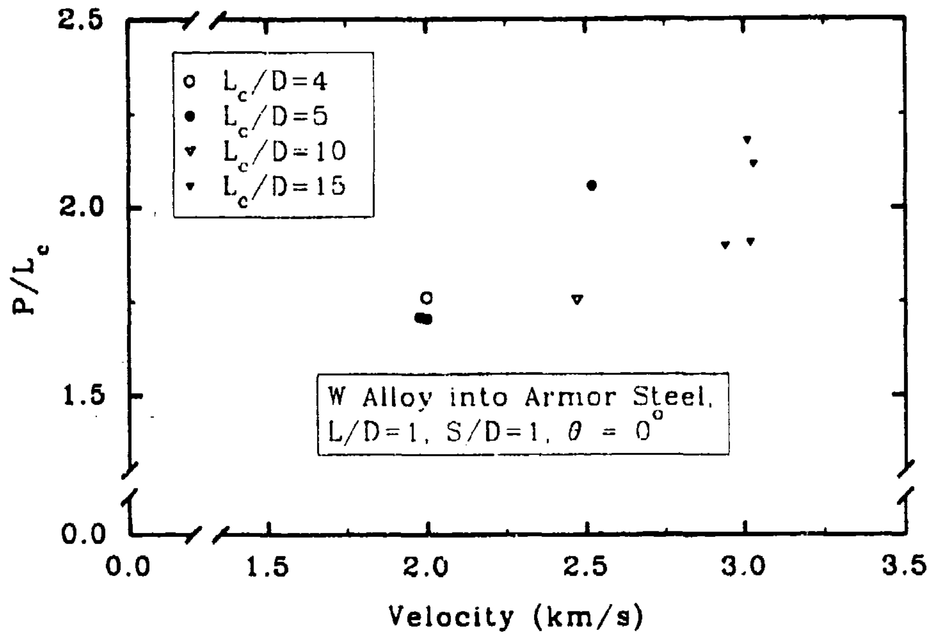

Fig. 3.3.1. Penetration Efficiency versus Impact Velocity

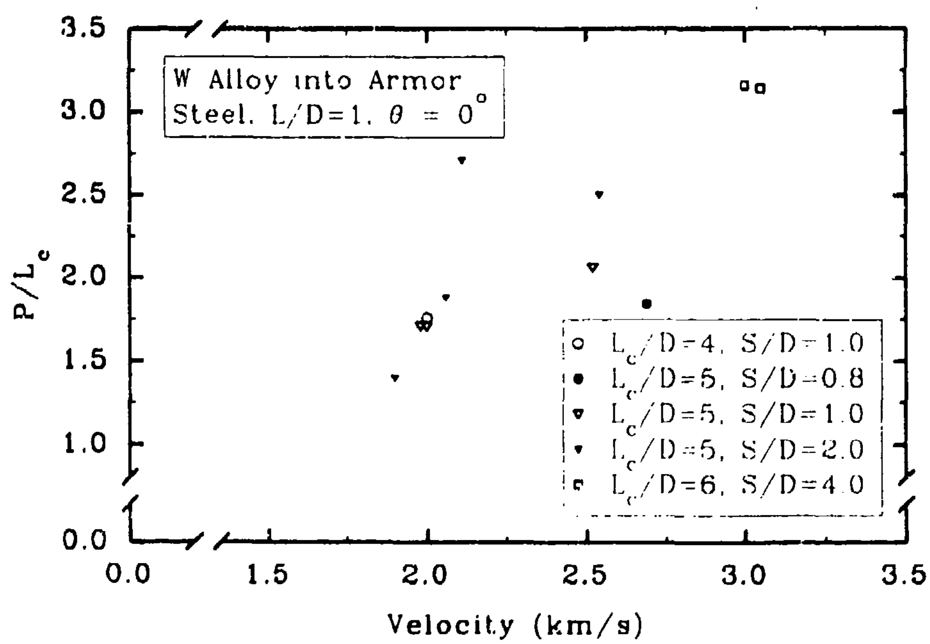

Fig. 3.3.2. Penetration Efficiency versus Impact Velocity

4.0 ACKNOWLEDGEMENTS

Often, because of either the quantity of data or the lack of space, experimental data are only summarized graphically in papers or articles; the data are not tabulated. The authors wish to express their extreme gratitude to V. Hohler and A. Stilp, of the Ernst-Mach-Institut, and P. Woolsey, of the U. S. Army Materials Technology Laboratory, for providing all of their data in tabular form. The experiments from both organizations are well-documented, and represent a wealth of fundamental data. We are particularly indebted to Drs. Hohler and Stilp, whose data have become a "standard" reference source in the terminal ballistics research community, for tabulating 759 data points and assisting us in this database effort. Finally, the authors want to acknowledge the dedication of Ms. T. Miller in typing of this manuscript. Her willingness to make the numerous changes and modifications, the painstaking work in creating and checking the tabulated data, and her attention to detail are reflected in the quality and appearance of the manuscript.

5.0 NOMENCLATURE

a, p	Regression Parameters
BHN	Brinell Hardness Number
d	Crater Diameter
D	Projectile Diameter
L	Projectile Length
M	Projectile Mass
n	Number of Segments
P	Penetration Depth
Rc	Rockwell C Hardness Value
S	Segment Spacing
t	Target Thickness
V	Velocity (with no subscript – Impact Velocity)
Vk	Vickers Hardness Number

Subscripts

c	parent
L	limit
o	original
p	projectile
r	residual
s	striking
t	target

Greek Symbols

α	Square Root of Density Ratio
β, γ	Orthogonal Yaw Angles
δ	Total Yaw Angle
θ	Target Obliquity Angle
ρ	Density

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APPENDIX A

SEMI-INFINITE DATA

Appendix A Contents

Allen and Rogers (1961)

Test No.							
PROJECTILE							
L (mm)	7.96	7.96	7.96	7.96	7.96	7.96	7.96
D (mm)	0.635	0.635	0.635	0.635	0.635	0.635	0.635
L/D	12.54	12.54	12.54	12.54	12.54	12.54	12.54
M (g)	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Mat'l	Mg	Mg	Mg	Mg	Mg	Mg	Mg
Supplier							
ρ (g/cm³)	1.74	1.74	1.74	1.74	1.74	1.74	1.74
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1900	2050	2250	2300	2350	2400	2650
Yaw (deg)							
RESULTS							
P (mm)	0.16	0.21	0.28	0.29	0.32	0.32	0.39
d (mm)							
Vol (cm³)							
SCALING							
P/αL	0.20	0.27	0.35	0.37	0.40	0.41	0.50
P/L	0.020	0.027	0.035	0.037	0.040	0.041	0.050
d/D							
P/d							
Figure No.	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1

Allen and Rogers (1961)

Test No.							
PROJECTILE							
L (mm)	7.96	7.96	8.01	8.01	8.01	8.01	8.01
D (mm)	0.635	0.635	0.787	0.787	0.787	0.787	0.787
L/D	12.54	12.54	10.18	10.18	10.18	10.18	10.18
M (g)	0.004	0.004	0.011	0.011	0.011	0.011	0.011
Mat'l	Mg	Mg	Al	Al	Al	Al	Al
Supplier							
ρ (g/cm^3)	1.74	1.74	2.70	2.70	2.70	2.70	2.70
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2700	2800	1300	1650	1800	1900	2100
Yaw (deg)							
RESULTS							
P (mm)	0.41	0.44	0.08	0.23	0.31	0.34	0.43
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.52	0.56	0.08	0.23	0.32	0.35	0.44
P/L	0.051	0.055	0.010	0.028	0.039	0.043	0.054
d/D							
P/d							
Figure No.	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1

Allen and Rogers (1961)

Test No.							
PROJECTILE							
L (mm)	8.01	8.01	8.01	5.40	5.40	5.40	5.40
D (mm)	0.787	0.787	0.787	0.711	0.711	0.711	0.711
L/D	10.18	10.18	10.18	7.59	7.59	7.59	7.59
M (g)	0.011	0.011	0.011	0.016	0.016	0.016	0.016
Mat'l	Al	Al	Al	Sn	Sn	Sn	Sn
Supplier							
ρ (g/cm^3)	2.70	2.70	2.70	7.30	7.30	7.30	7.30
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2300	2450	2700	950	1300	1500	1800
Yaw (deg)							
RESULTS							
P (mm)	0.49	0.55	0.62	0.27	0.57	0.73	0.92
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.50	0.56	0.63	0.17	0.35	0.45	0.57
P/L	0.061	0.069	0.077	0.051	0.105	0.135	0.170
d/D							
P/d							
Figure No.	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1

Allen and Rogers (1961)

Test No.							
PROJECTILE							
L (mm)	5.40	5.40	5.40	5.40	4.67	4.67	4.67
D (mm)	0.711	0.711	0.711	0.711	0.635	0.635	0.635
L/D	7.59	7.59	7.59	7.59	7.35	7.35	7.35
M (g)	0.016	0.016	0.016	0.016	0.029	0.029	0.029
Mat'l	Sn	Sn	Sn	Sn	Au	Au	Au
Supplier							
ρ (g/cm^3)	7.30	7.30	7.30	7.30	19.30	19.30	19.30
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2200	2400	2500	2550	700	800	1000
Yaw (deg)							
RESULTS							
P (mm)	1.13	1.21	1.24	1.26	0.42	0.58	0.87
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.70	0.75	0.77	0.78	0.16	0.22	0.33
P/L	0.209	0.224	0.230	0.233	0.090	0.124	0.186
d/D							
P/d							
Figure No.	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1

Allen and Rogers (1961)

Test No.							
PROJECTILE							
L (mm)	4.67	4.67	4.67	4.67	4.67	4.67	4.67
D (mm)	0.635	0.635	0.635	0.635	0.635	0.635	0.635
L/D	7.35	7.35	7.35	7.35	7.35	7.35	7.35
M (g)	0.029	0.029	0.029	0.029	0.029	0.029	0.029
Mat'l	Au	Au	Au	Au	Au	Au	Au
Supplier							
ρ (g/cm^3)	19.30	19.30	19.30	19.30	19.30	19.30	19.30
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1200	1400	1550	1650	1850	1950	2000
Yaw (deg)							
RESULTS							
P (mm)	1.13	1.44	1.63	1.76	1.94	2.10	2.13
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.43	0.55	0.62	0.67	0.74	0.80	0.81
P/L	0.242	0.309	0.349	0.377	0.416	0.450	0.455
d/D							
P/d							
Figure No.	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1

Allen and Rogers (1961)

Test No.							
PROJECTILE							
L (mm)	4.67	4.67	4.67	4.67	4.67	4.67	4.67
D (mm)	0.635	0.635	0.635	0.635	0.635	0.635	0.635
L/D	7.35	7.35	7.35	7.35	7.35	7.35	7.35
M (g)	0.029	0.029	0.029	0.029	0.029	0.029	0.029
Mat'l	Au	Au	Au	Au	Au	Au	Au
Supplier							
ρ (g/cm^3)	19.30	19.30	19.30	19.30	19.30	19.30	19.30
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2100	2150	2250	2300	2550	2700	2800
Yaw (deg)							
RESULTS							
P (mm)	2.26	2.34	2.34	2.47	2.76	2.91	2.91
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.86	0.89	0.89	0.94	1.05	1.11	1.11
P/L	0.483	0.500	0.500	0.528	0.590	0.624	0.624
d/D							
P/d							
Figure No.	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1	2.1.1

Allen and Rogers (1961)

Test No.	
PROJECTILE	
L (mm)	4.67
D (mm)	0.635
L/D	7.35
M (g)	0.029
Mat'l	Au
Supplier	
ρ (g/cm^3)	19.30
Nose	
BHN	
Elong (%)	
TARGET	
Mat'l	7075-T6
Thick (mm)	---
ρ (g/cm^3)	2.80
BHN	
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	2850
Yaw (deg)	
RESULTS	
P (mm)	2.89
d (mm)	
Vol (cm^3)	
SCALING	
$P/\alpha L$	1.10
P/L	0.618
d/D	
P/d	
Figure No.	2.1.1

Bjerke, Zukas, and Kimsey (1991)

Test No.	194	206	207	208	216	204	221
PROJECTILE							
L (mm)	12.95	6.35	6.35	6.35	3.17	3.17	3.17
D (mm)	29.13	25.40	25.40	25.40	25.40	25.4	25.4
L/D	0.44	0.25	0.25	0.25	0.12	0.12	0.12
M (g)	150.40	55.60	55.60	55.60	27.60	27.60	27.60
Mat'l	X-27	X-27	X-27	X-27	X-27	X-27	X-27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.27	17.27	17.27	17.27	17.27	17.27	17.27
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	363	363	363	363	363	363	363
Elong (%)	9.7	9.7	9.7	9.7	9.7	9.7	9.7
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	259	259	259	259	259	259	259
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2042	2100	2044	2015	1931	2040	2036
Yaw (deg)	4.30	4.00	1.20	3.80	3.00	7.40	2.30
RESULTS							
P (mm)	33.00	19.30	19.60	18.10	13.10	16.4	18.5
d (mm)	66.0	49.8	51.8	55.9	37.3	39.4	41.9
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.718	2.049	2.081	1.922	2.786	3.488	3.935
P/L	2.548	3.039	3.087	2.850	4.132	5.174	5.836
d/D	2.266	1.961	2.039	2.201	1.469	1.551	1.650
P/d	0.500	0.388	0.378	0.324	0.351	0.416	0.442
Figure No.	2.1.2	2.1.2	2.1.2	2.1.2	2.1.2	2.1.2	2.1.2

Bjerke, Zukas, and Kimsey (1991)

Test No.	222	217	219
PROJECTILE			
L (mm)	3.17	1.6	0.79
D (mm)	25.4	25.4	25.4
L/D	0.12	0.06	0.03
M (g)	27.60	13.80	6.80
Mat'l	X-27	X-27	X-27
Supplier	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.27	17.27	17.27
Nose	Flat	Flat	Flat
BHN	363	363	363
Elong (%)	9.7	9.7	9.7
TARGET			
Mat'l	RHA	RHA	RHA
Thick (mm)	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85
BHN	259	259	259
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	1996	2004	1958
Yaw (deg)	2.00	10.40	12.60
RESULTS			
P (mm)	13.1	6.9	2.3
d (mm)	41.4	29.5	27.9
Vol (cm^3)			
SCALING			
$P/\alpha L$	2.786	2.907	1.963
P/L	4.132	4.313	2.911
d/D	1.630	1.161	1.098
P/d	0.316	0.234	0.082
Figure No.	2.1.2	2.1.2	2.1.2

Bless, Piekutowski, Yoon, and Sternberg (1986)

Test No.	4-451	4-453	6-771
PROJECTILE			
L (mm)	71.35	49.23	24.89
D (mm)	7.13	4.92	4.98
L/D	10	10	5
M (g)	7.73	15.56	9.01
Mat'l	Al	Ta	W2
Supplier			
ρ (g/cm^3)	2.71	16.6	18.6
Nose			
BHN			
Elong (%)			
TARGET			
Mat'l	6061-T6	6061-T6	6061-T6
Thick (mm)	---	---	---
ρ (g/cm^3)	2.71	2.71	2.71
BHN			
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	2780	1930	1030
Yaw (deg)			
RESULTS			
P (mm)	62	127	39
d (mm)			
Vol (cm^3)			
SCALING			
$P/\alpha L$	0.869	1.042	0.598
P/L	0.869	2.579	1.567
d/D			
P/d			
Figure No.	2.1.3	2.1.3	2.1.3

Bless, Rosenberg, and Yoon (1987)

Test No.							
PROJECTILE							
L (mm)	24.5	24.5	24.5	24.5	24.5	24.5	24.5
D (mm)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
L/D	5.0	5.0	5.0	5.0	5.0	5.0	5.0
M (g)	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Mat'l	Ta	Ta	Ta	Ta	Ta	Ta	Ta
Supplier							
ρ (g/cm^3)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Nose							
BHN							
Elong (%)							
TARGET							
Mat'l	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	600	1050	1220	1360	2300	2640	4150
Yaw (deg)							
RESULTS							
P (mm)	11.3	32.5	40	47.5	85.5	95	110.5
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.186	0.536	0.660	0.783	1.410	1.567	1.822
P/L	0.461	1.327	1.633	1.939	3.490	3.878	4.510
d/D							
P/d							
Figure No.	2.1.4	2.1.4	2.1.4	2.1.4	2.1.4	2.1.4	2.1.4

Brooks (1973)

Test No.							
PROJECTILE							
L (mm)	59.79	53.24	49.91	47.85	46.46	44.63	43.43
D (mm)	10.16	10.16	10.16	10.16	10.16	10.16	10.16
L/D	5.88	5.24	4.91	4.71	4.57	4.39	4.27
M (g)	25.80	25.80	25.80	25.80	25.80	25.80	25.80
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Supplier							
ρ (g/cm^3)	7.80	7.80	7.80	7.80	7.80	7.80	7.80
Nose	10° Cone	15° Cone	20° Cone	25° Cone	30° Cone	40° Cone	50° Cone
BHN							
Elong (%)							
TARGET							
Mat'l	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al
Thick (mm)							
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
BHN	38	38	38	38	38	38	38
Elong (%)	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	762	743	760	769	793	771	752
Yaw (deg)							
RESULTS							
P (mm)	137.20	127.00	118.6	111.5	113.8	99.6	90.9
d (mm)	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Vol (cm^3)		11.01	11.08	11.16	12.04	11.08	9.85
SCALING							
$P/\alpha L$	1.367	1.422	1.416	1.389	1.460	1.330	1.247
P/L	2.295	2.385	2.376	2.330	2.449	2.232	2.093
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	13.504	12.500	11.673	10.974	11.201	9.803	8.947
Figure No.	2.1.5	2.1.5	2.1.5	2.1.5	2.1.5	2.1.5	2.1.5

Brooks (1973)

Test No.							
PROJECTILE							
L (mm)	42.54	40.59	59.79	53.24	49.91	47.85	46.46
D (mm)	10.16	10.16	10.16	10.16	10.16	10.16	10.16
L/D	4.19	4.00	5.88	5.24	4.91	4.71	4.57
M (g)	25.80	25.80	25.80	25.80	25.80	25.80	25.80
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Supplier							
ρ (g/cm^3)	7.80	7.80	7.80	7.80	7.80	7.80	7.80
Nose	60° Cone	90° Cone	10° Cone	15° Cone	20° Cone	25° Cone	30° Cone
BHN							
Elong (%)							
TARGET							
Mat'l	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al
Thick (mm)							
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
BHN	38	38	38	38	38	38	38
Elong (%)	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	775	759	650	645	661	654	670
Yaw (deg)							
RESULTS							
P (mm)	92.2	86.4	105.2	94.7	92.7	85.3	84.6
d (mm)	10.2	10.2	10.16	10.16	10.16	10.16	10.16
Vol (cm^3)	10.63	9.90		7.95	8.08	7.80	8.06
SCALING							
P/αL	1.292	1.268	1.049	1.060	1.107	1.062	1.085
P/L	2.167	2.129	1.759	1.779	1.857	1.783	1.821
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	9.075	8.504	10.354	9.321	9.124	8.396	8.327
Figure No.	2.1.5	2.1.5	2.1.5	2.1 5	2.1.5	2.1.5	2.1.5

Brooks (1973)

Test No.							
PROJECTILE							
L (mm)	44.63	43.43	42.54	40.59	37.44	37.44	37.44
D (mm)	10.16	10.16	10.16	10.16	10.16	10.16	10.16
L/D	4.39	4.27	4.19	4.00	3.69	3.69	3.69
M (g)	25.80	25.80	25.80	25.80	37.70	37.70	37.70
Mat'l	Steel	Steel	Steel	Steel	WC	WC	WC
Supplier							
ρ (g/cm^3)	7.80	7.80	7.80	7.80	14.72	14.72	14.72
Nose	40° Cone	50° Cone	60° Cone	90° Cone	30° Cone	30° Cone	30° Cone
BHN							
Elong (%)							
TARGET							
Mat'l	65-S Al	65-S Al	65-S Al	65-S Al	1020 Stl	1020 Stl	1020 Stl
Thick (mm)							
ρ (g/cm^3)	2.77	2.77	2.77	2.77	7.80	7.80	7.80
BHN	38	38	38	38	125	125	125
Elong (%)	35.0	35.0			28.0	28.0	28.0
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	658	646	633	622	504	588	737
Yaw (deg)							
RESULTS							
P (mm)	76.2	71.4	67.1	64.5	18.3	24.4	36.6
d (mm)	10.16	10.16	10.2	10.2	10.2	10.2	10.2
Vol (cm^3)	7.70	7.23	6.65	6.05		2.10	3.23
SCALING							
$P/\alpha L$	1.017	0.980	0.940	0.947	0.356	0.474	0.712
P/L	1.707	1.644	1.577	1.589	0.489	0.652	0.978
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	7.500	7.028	6.604	6.348	1.801	2.402	3.602
Figure No.	2.1.5	2.1.5	2.1.5	2.1.5	2.1.6	2.1.6	2.1.6

Brooks (1973)

Test No.							
PROJECTILE							
L (mm)	37.44	37.44	37.44	37.44	37.44	37.44	50.62
D (mm)	10.16	10.16	10.16	10.16	10.16	10.16	10.16
L/D	3.69	3.69	3.69	3.69	3.69	3.69	4.98
M (g)	37.70	37.70	37.70	37.70	37.70	37.70	25.80
Mat'l	WC	WC	WC	WC	WC	WC	Steel
Supplier							
ρ (g/cm^3)	14.72	14.72	14.72	14.72	14.72	14.72	7.80
Nose	30° Cone	30° Cone	30° Cone	30° Cone	30° Cone	30° Cone	Dbl Con
BHN							
Elong (%)							
TARGET							
Mat'l	1020 Stl	1020 Stl	4340	4340	4340	4340	65-S Al
Thick (mm)							
ρ (g/cm^3)	7.80	7.80	7.85	7.85	7.85	7.85	2.77
BHN	125	125	302	302	302	302	38
Elong (%)	28.0	28.0	17.5	17.5	17.5	17.5	35.0
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	815	910	582	715	912	1042	756
Yaw (deg)							
RESULTS							
P (mm)	44.2	52.8	15.7	23.6	36.1	46.2	123.2*
d (mm)	10.2	10.2	10.16	10.16	10.16	10.16	10.16
Vol (cm^3)	3.97	4.92	1.38	2.03	3.21	4.13	10.23
SCALING							
$P/\alpha L$	0.859	1.027	0.306	0.460	0.704	0.901	1.450
P/L	1.181	1.410	0.419	0.630	0.964	1.234	2.434
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	4.350	5.197	1.545	2.323	3.553	4.547	12.126
Figure No.	2.1.6	2.1.6	2.1.6	2.1.6	2.1.6	2.1.6	2.1.7

Brooks (1973)

Test No.							
PROJECTILE							
L (mm)	49.25	48.08	47.22	46.66	46.46	50.62	49.25
D (mm)	10.16	10.16	10.16	10.16	10.16	10.16	10.16
L/D	4.85	4.73	4.65	4.59	4.57	4.98	4.85
M (g)	25.80	25.80	25.80	25.80	25.80	25.80	25.80
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Supplier							
ρ (g/cm^3)	7.80	7.80	7.80	7.80	7.80	7.80	7.80
Nose	Dbl Con	Dbl Con	Dbl Con	Dbl Con	Dbl Con	Dbl Con	Dbl Con
BHN							
Elong (%)							
TARGET							
Mat'l	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al	65-S Al
Thick (mm)							
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
BHN	38	38	38	38	38	38	38
Elong (%)	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	755	785	862	785	766	611	615
Yaw (deg)							
RESULTS							
P (mm)	115.6	116.3	128.5	101.1	91.7	82.6	78.7
d (mm)	10.16	10.16	10.2	10.2	10.2	10.2	10.2
Vol (cm^3)	9.68	9.67	12.04	10.37	10.24	6.74	6.44
SCALING							
$P/\alpha L$	1.399	1.441	1.622	1.291	1.176	0.972	0.952
P/L	2.347	2.419	2.721	2.167	1.974	1.632	1.598
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	11.378	11.447	12.648	9.951	9.026	8.130	7.746
Figure No.	2.1.7	2.1.7	2.1.7	2.1.7	2.1.7	2.1.7	2.1.7

Brooks (1973)

Test No.				
PROJECTILE				
L (mm)	48.08	47.22	46.66	46.46
D (mm)	10.16	10.16	10.16	10.16
L/D	4.73	4.65	4.59	4.57
M (g)	25.80	25.80	25.80	25.80
Mat'l	Steel	Steel	Steel	Steel
Supplier				
ρ (g/cm^3)	7.80	7.80	7.80	7.30
Nose	Dbl Con	Dbl Con	Dbl Con	Dbl Con
BHN				
Elong (%)				
TARGET				
Mat'l	65-S Al	65-S Al	65-S Al	65-S Al
Thick (mm)				
ρ (g/cm^3)	2.77	2.77	2.77	2.77
BHN	38	38	38	38
Elong (%)	35.0	35.0	35.0	35.0
Obliq (deg)	0	0	0	0
IMPACT				
V (m/s)	671	631	615	613
Yaw (deg)				
RESULTS				
P (mm)	88.4	74.2	67.80	64.00
d (mm)	10.2	10.2	10.2	10.2
Vol (cm^3)	7.28	6.13	6.00	6.29
SCALING				
P/αL	1.096	0.936	0.866	0.821
P/L	1.839	1.571	1.453	1.378
d/D	1.000	1.000	1.000	1.000
P/d	8.701	7.303	6.673	6.299
Figure No.	2.1.7	2.1.7	2.1.7	2.1.7

Brooks and Erickson (1971)

Test No.	D-1	D-2	D-3	D-4	D-5	D-6	D-7
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	30.90	30.90	30.90	30.90	30.90	30.90	30.90
Mat'l	K-94 WC	K-94 WC	K-94 WC	K-94 WC	K-94 WC	K-94 WC	K-94 WC
Supplier	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam
ρ (g/cm^3)	14.72	14.72	14.72	14.72	14.72	14.72	14.72
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	427	427	427	427	427	427	427
Elong (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	434	568	691	805	920	1027	1138
Yaw (deg)							
RESULTS							
P (mm)	24.1	34.3	44.0	52.0	64.0	75.5	87.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.404	0.575	0.738	0.872	1.073	1.266	1.459
P/L	0.553	0.787	1.010	1.194	1.469	1.733	1.997
d/D							
P/d							
Figure No.	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8

Brooks and Erickson (1971)

Test No.	D-10	G-1	G-2	G-3	G-4	G-5	A-5
PROJECTILE							
L (mm)	43.56	34.00	34.00	34.00	34.00	34.00	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	3.84	3.84	3.84	3.84	3.84	4.92
M (g)	30.90	36.40	36.40	36.40	36.40	36.40	36.40
Mat'l	K-94 WC	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier	Kennam	Wickham	Wickham	Wickham	Wickham	Wickham	Wickham
ρ (g/cm³)	14.72	17.36	17.36	17.36	17.36	17.36	17.36
Nose	Ogive	Flat	Flat	Flat	Flat	Flat	Ogive
BHN	427	227	227	227	227	227	227
Elong (%)	0.0	2.0	2.0	2.0	2.0	2.0	2.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1343	373	655	884	1113	1311	561
Yaw (deg)							
RESULTS							
P (mm)	112.0	0.5	5.5	14.5	27.5	36.5	20.3
d (mm)							
Vol (cm³)							
SCALING							
$P/\alpha L$	1.878	0.010	0.109	0.287	0.544	0.722	0.313
P/L	2.571	0.015	0.162	0.426	0.809	1.074	0.466
d/D							
P/d							
Figure No.	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8

Brooks and Erickson (1971)

Test No.	A-6	A-7	A-8	A-9	A-14	B-1	B-2
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	36.40	36.40	36.40	36.40	36.40	39.20	39.20
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	U-2Mo	U-2Mo
Supplier	Wickham	Wickham	Wickham	Wickham	Wickham		
ρ (g/cm^3)	17.36	17.36	17.36	17.36	17.36	18.70	18.70
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	227	227	227	227	227	344	344
Elong (%)	2.0	2.0	2.0	2.0	2.0	23.0	23.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	793	1013	1227	1408	1311	411	561
Yaw (deg)							
RESULTS							
P (mm)	35.6	52.3	57.9	49.0	42.5	3.0	6.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.550	0.807	0.894	0.756	0.656	0.045	0.089
P/L	0.817	1.201	1.329	1.125	0.976	0.069	0.138
d/D							
P/d							
Figure No.	2.1.8	2.1.8	2.1.8	2.1.8	2.1.8	2.1.9	2.1.9

Brooks and Erickson (1971)

Test No.	B-3	B-4	B-5	B-6	B-7	B-8	B-9
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	39.20	39.20	39.20	39.20	39.20	39.20	39.20
Mat'l	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo
Supplier							
ρ (g/cm^3)	18.70	18.70	18.70	18.70	18.70	18.70	18.70
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	344	344	344	344	344	344	344
Elong (%)	23.0	23.0	23.0	23.0	23.0	23.0	23.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	667	777	891	1008	1121	1232	1306
Yaw (deg)							
RESULTS							
P (mm)	12.0	36.1	42.4	48.8	35.0	40.0	46.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.178	0.537	0.631	0.726	0.521	0.595	0.684
P/L	0.275	0.829	0.973	1.120	0.803	0.918	1.056
d/D							
P/d							
Figure No.	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9

Brooks and Erickson (1971)

Test No.	B-10	C-1	C-2	C-3	C-4	C-5	C-6
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	39.20	39.20	39.20	39.20	39.20	39.20	39.20
Mat'l	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo
Supplier							
ρ (g/cm^3)	18.70	18.70	18.70	18.70	18.70	18.70	18.70
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	344	298	298	298	298	298	298
Elong (%)	23.0	0.0	0.0	0.0	0.0	0.0	0.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1386	427	647	669	778	899	1013
Yaw (deg)							
RESULTS							
P (mm)	49.9	4.0	12.4	13.4	18.9	26.0	45.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.742	0.059	0.184	0.199	0.281	0.387	0.669
P/L	1.146	0.092	0.285	0.308	0.434	0.597	1.033
d/D							
P/d							
Figure No.	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9

Brooks and Erickson (1971)

Test No.	C-7	C-8	C-9	C-10	E-3	E-4	E-5
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	39.20	39.20	39.20	39.20	39.20	39.20	39.20
Mat'l	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo
Supplier							
ρ (g/cm^3)	18.70	18.70	18.70	18.70	18.70	18.70	18.70
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	298	298	298	298	298	298	298
Elong (%)	0.0	0.0	0.0	0.0	12.0	12.0	12.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1121	1208	1320	1863	661	781	898
Yaw (deg)							
RESULTS							
P (mm)	37.0	41.0	47.0	47.0	22.5	33.50	46.00
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.550	0.610	0.699	0.699	0.335	0.498	0.684
P/L	0.849	0.941	1.079	1.079	0.517	0.769	1.056
d/D							
P/d							
Figure No.	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9

Brooks and Erickson (1971)

Test No.	E-7	E-9	E-10	F-6	F-2	F-7	F-8
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	39.20	39.20	39.20	39.20	39.20	39.20	39.20
Mat'l	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo
Supplier							
ρ (g/cm^3)	18.70	18.70	18.70	18.70	18.70	18.7	18.7
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	298	298	298	290	290	290	290
Elong (%)	12.0	12.0	12.0	22.0	22.0	22.0	22.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1121	1306	1377	470	668	749	812
Yaw (deg)							
RESULTS							
P (mm)	41.50	45.50	50.50	3.10	13.60	13.6	18.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.617	0.677	0.751	0.046	0.202	0.202	0.268
P/L	0.953	1.045	1.159	0.071	0.312	0.312	0.413
d/D							
P/d							
Figure No.	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9

Brooks and Erickson (1971)

Test No.	F-3	F-9	F-10	F-4	F-5	J-1	J-2
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	39.20	39.20	39.20	39.20	39.20	38.80	38.80
Mat'l	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-2Mo	U-1Mo	U-1Mo
Supplier							
ρ (g/cm^3)	18.7	18.7	18.7	18.7	18.7	18.50	18.50
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	290	290	290	290	290	354	354
Elong (%)	22.0	22.0	22.0	22.0	22.0	24.0	24.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	896	966	1058	1128	1311	400	532
Yaw (deg)							
RESULTS							
P (mm)	28.5	42.0	38.0	39.5	46.5	1.5	4.5
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.424	0.625	0.565	0.588	0.692	0.022	0.067
P/L	0.654	0.964	0.872	0.907	1.067	0.034	0.103
d/D							
P/d							
Figure No.	2.1.9	2.1.9	2.1.9	2.1.9	2.1.9	2.1.10	2.1.10

Brooks and Erickson (1971)

Test No.	J-3	J-4	J-5	J-6	J-7	J-8	J-9
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	38.80	38.80	38.80	38.80	38.80	38.80	38.80
Mat'l	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo
Supplier							
ρ (g/cm^3)	18.50	18.50	18.50	18.50	18.50	18.50	18.50
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	354	354	354	354	354	354	354
Elong (%)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	644	765	884	988	1101	1189	1284
Yaw (deg)							
RESULTS							
P (mm)	25.0	37.0	45.0	54.0	41.5	45.0	45.5
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.374	0.553	0.673	0.808	0.621	0.673	0.680
P/L	0.574	0.849	1.033	1.240	0.953	1.033	1.045
d/D							
P/d							
Figure No.	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10

Brooks and Erickson (1971)

Test No.	J-10	K-1	K-2	K-3	K-4	K-5	K-6
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	38.80	38.80	38.80	38.80	38.80	38.80	38.80
Mat'l	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo
Supplier							
ρ (g/cm^3)	18.50	18.50	18.50	18.50	18.50	18.50	18.50
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	354	502	502	502	502	502	502
Elong (%)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1373	386	529	648	763	885	987
Yaw (deg)							
RESULTS							
P (mm)	50.0	2.5	5.5	12.0	24.0	48.5	47.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.748	0.037	0.082	0.179	0.359	0.725	0.703
P/L	1.148	0.057	0.126	0.275	0.551	1.113	1.079
d/D							
P/d							
Figure No.	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10

Brooks and Erickson (1971)

Test No.	K-7	K-8	K-9	K-10	L-1	L-2	L-3
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	38.80	38.80	38.80	38.80	38.80	38.80	38.80
Mat'l	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo
Supplier							
ρ (g/cm^3)	18.50	18.50	18.50	18.50	18.50	18.50	18.50
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	502	502	502	502	358	358	358
Elong (%)	24.0	24.0	24.0	24.0	26.0	26.0	26.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1093	1193	1284	1367	412	540	654
Yaw (deg)							
RESULTS							
P (mm)	46.5	46.0	46.5	49.0	2.5	7.0	17.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.695	0.688	0.695	0.733	0.037	0.105	0.254
P/L	1.067	1.056	1.067	1.125	0.057	0.161	0.390
d/D							
P/d							
Figure No.	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10

Brooks and Erickson (1971)

Test No.	L-4	L-5	L-7	L-8	L-9	L-10	H-1
PROJECTILE							
L (mm)	43.56	43.56	43.56	43.56	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86	8.86	8.86	8.86	8.86
L/D	4.92	4.92	4.92	4.92	4.92	4.92	4.92
M (g)	38.80	38.80	38.80	38.80	38.80	38.80	16.40
Mat'l	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	U-1Mo	Steel
Supplier							Monark
ρ (g/cm^3)	18.50	18.50	18.50	18.50	18.50	18.50	7.80
Nose	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive	Ogive
BHN	358	358	358	358	358	358	684
Elong (%)	26.0	26.0	26.0	26.0	26.0	26.0	5.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	294	294	294	294	294	294	294
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	764	884	1121	1191	1284	1364	499
Yaw (deg)							
RESULTS							
P (mm)	33.5	43.0	59.0	45.0	46.5	50.00	21.50
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.501	0.643	0.882	0.673	0.695	0.748	0.495
P/L	0.769	0.987	1.354	1.033	1.067	1.148	0.494
d/D							
P/d							
Figure No.	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.10	2.1.8

Brooks and Erickson (1971)

Test No.	H-2	H-4	H-5
PROJECTILE			
L (mm)	43.56	43.56	43.56
D (mm)	8.86	8.86	8.86
L/D	4.92	4.92	4.92
M (g)	16.40	16.40	16.40
Mat'l	Steel	Steel	Steel
Supplier	Monark	Monark	Monark
ρ (g/cm^3)	7.80	7.80	7.80
Nose	Ogive	Ogive	Ogive
BHN	684	684	684
Elong (%)	5.0	5.0	5.0
TARGET			
Mat'l	4340	4340	4340
Thick (mm)			
ρ (g/cm^3)	7.85	7.85	7.85
BHN	294	294	294
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	591	828	931
Yaw (deg)			
RESULTS			
P (mm)	22.50	35.50	41.00
d (mm)			
Vol (cm^3)			
SCALING			
P/αL	0.518	0.818	0.944
P/L	0.517	0.815	0.941
d/D			
P/d			
Figure No.	2.1.8	2.1.8	2.1.8

Charters, Menna, and Piekutowski (1990)

Test No.	0690	0687	0688	0707	0762	0800	0806
PROJECTILE							
L (mm)	58.63	58.50	58.50	42.32	27.70	27.70	5.54
D (mm)	4.51	4.50	4.50	4.60	5.54	5.54	5.54
L/D	13.00	13.00	13.00	9.20	5.00	5.00	1.00
M (g)	16.01	16.00	16.00	11.98	12.24	12.30	2.20
Mat'l	W10	W10	W10	W10	W10	W10	W10
Supplier	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam
ρ (g/cm^3)	17.10	17.10	17.10	17.10	17.10	17.10	17.10
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	275	275	275	275	275	275	275
Elong (%)	20.0	20.0	20.0	20.0	20.0	20.0	20.0
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	344	344	344	344	344	344	344
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1980	2510	2540	2490	1830	2580	3570
Yaw (deg)	2.24	3.16	1.41	4.47	7.21	5.53	24.60
RESULTS							
P (mm)	62.5	74.1	76.6	58.1	32.8	42.0	14.0
d (mm)							
Vol (cm^3)	2.69	6.11	7.29	4.62		6.65	2.98
SCALING							
P/αL	0.722	0.858	0.887	0.930	0.802	1.027	1.712
P/L	1.066	1.267	1.309	1.373	1.184	1.516	2.527
d/D							
P/d							
Figure No.	2.1.11	2.1.11	2.1.11	2.1.11	2.1.11	2.1.11	2.1.11

Charters, Menna, and Piekutowski (1990)

Test No.	0866	0867	0868
PROJECTILE			
L (mm)	27.70	27.70	27.70
D (mm)	5.54	5.54	5.54
L/D	5.00	5.00	5.00
M (g)	11.42	11.45	11.40
Mat'l	W10	W10	W10
Supplier	Kennam	Kennam	Kennam
ρ (g/cm³)	17.10	17.10	17.10
Nose	Flat	Flat	Flat
BHN	275	275	275
Elong (%)	20.0	20.0	20.0
TARGET			
Mat'l	4340	4340	4340
Thick (mm)			
ρ (g/cm³)	7.85	7.85	7.85
BHN	344	344	344
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	2210	2560	3220
Yaw (deg)	4.95	10.92	5.70
RESULTS			
P (mm)	38.2	41.8	45.9
d (mm)			
Vol (cm³)			
SCALING			
P/αL	0.934	1.022	1.123
P/L	1.379	1.509	1.657
d/D			
P/d			
Figure No.	2.1.11	2.1.11	2.1.11

Christman (1965)

Test No.	D-1005	D-1006	D-1010	D-1016	D-1007	D-1011	D-1015
PROJECTILE							
L (mm)	3.45	3.45	4.04	4.14	3.45	4.04	4.14
D (mm)	3.45	3.45	4.01	4.11	3.45	4.01	4.11
L/D	1.00	1.00	1.01	1.01	1.00	1.01	1.01
M (g)	.087	.0876	.1379	.1487	.0876	.138	.1492
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Supplier							
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	25	25	25	25
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	24	24	27	27	27
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	7470	7165	6463	5854	7530	6311	5488
Yaw (deg)							
RESULTS							
P (mm)	11.4	11.5	12.8	12.3	12.1	12.3	11.9
d (mm)	21.3	20.8	23.4	24.3	21.2	22.6	21.3
Vol (cm^3)	2.60	2.58	3.30	2.74			2.80
SCALING							
P/αL	3.304	3.333	3.168	2.971	3.507	3.045	2.874
P/L	3.304	3.333	3.168	2.971	3.507	3.045	2.874
d/D	6.174	6.029	5.835	5.912	6.145	5.636	5.182
P/d	.535	.553	.547	.506	.571	.544	.559
Figure No.	2.1.12	2.1.12	2.1.12	2.1.12	2.1.12	2.1.12	2.1.12

Christman (1965)

Test No.	**D-10172**
PROJECTILE	
L (mm)	4.14
D (mm)	4.11
L/D	1.01
M (g)	.1496
Mat'l	1100-0
Supplier	
ρ (g/cm^3)	2.72
Nose	Flat
BHN	25
Elong (%)	
TARGET	
Mat'l	1100-0
Thick (mm)	---
ρ (g/cm^3)	2.72
BHN	26
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	5274
Yaw (deg)	
RESULTS	
P (mm)	11.5
d (mm)	21.2
Vol (cm^3)	
SCALING	
P/αL	2.778
P/L	2.778
d/D	5.158
P/d	.542
Figure No.	2.1.12

Christman and Gehring (1963)

Test No.	A-456	A-457	A-469	A-480	A-481	A-491	A-492
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.203	.205	.205	.205	.205	.205	.205
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Supplier							
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	25	25	25	25
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	25	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	940	933	1900	2080	1720	1640	2360
Yaw (deg)	7	5	11	14	14	14	12
RESULTS							
P (mm)	4.8	4.8	9.6	10.2	9.1	9.1	10.4
d (mm)	5.80	5.80	9.10	10.4	8.4	8.4	12.2
Vol (cm^3)	.09	.09	.47	.65	.37	.35	1.00
SCALING							
P/αL	.504	.504	1.008	1.071	.955	.955	1.092
P/L	.504	.504	1.008	1.071	.955	.955	1.092
d/D	1.827	1.827	2.866	3.276	2.646	2.646	3.843
P/d	.828	.828	1.055	.981	1.083	1.083	.852
Figure No.	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13

Christman and Gehring (1963)

Test No.	A-498	A-499	A-504	A-557	A-565	A-568	D-556
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.205	.205	.205	.208	.208	.208	.208
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Supplier							
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	25	25	25	25
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	25	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	696	452	1340	850	1240	1540	3140
Yaw (deg)	13	0	13	2	15	4	4
RESULTS							
P (mm)	3.0	1.0	6.6	4.1	6.1	8.1	12.9
d (mm)	5.60		7.60	5.6	6.6	8.1	15.0
Vol (cm^3)	.05		.27	.07	.2	.31	1.6
SCALING							
$P/\alpha L$	.315	.101	.693	.430	.640	.850	1.354
P/L	.315	.101	.693	.430	.640	.850	1.354
d/D	1.764	.000	2.394	1.764	2.079	2.551	4.724
P/d	.536		.868	.732	.924	1.000	.860
Figure No.	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13

Christman and Gehring (1963)

Test No.	D-557	D-585	D-590	A-547	A-548	A-549	A-563
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.205	.205	.205	.208	.208	.208	.208
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Supplier							
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	25	25	25	25
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	2024-T3	2024-T3	2024-T3	2024-T3
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.77	2.77	2.77	2.77
BHN	25	25	25	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	5570	4210	2740	2310	854	1460	2200
Yaw (deg)	6	16	12	7	3	12	12
RESULTS							
P (mm)	19.7	15.2	11.9	7.1	.41	3.4	6.1
d (mm)	23.40	19.6	13.20	8.4	4.1	5.8	8.1
Vol (cm^3)	6.00	3	1.20	.25		.08	.2
SCALING							
P/αL	2.068	1.596	1.249	.752	.043	.360	.646
P/L	2.068	1.596	1.249	.745	.043	.357	.640
d/D	7.370	6.173	4.157	2.646	1.291	1.827	2.551
P/d	.842	.776	.902	.845	.100	.586	.753
Figure No.	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13	2.1.13

Christman and Gehring (1963)

Test No.	A-463	A-470	A-500	A-505	A-506	A-507	D-586
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.205	.205	.205	.205	.205	.205	.205
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Supplier							
ρ (g/cm³)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	25	25	25	25
Elong (%)							
TARGET							
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.60	7.60	7.60	7.60	7.60	7.60	7.60
BHN	110	110	110	110	110	110	110
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1730	1740	310	1340	996	2120	3410
Yaw (deg)	10	15	8	12	11	10	8
RESULTS							
P (mm)	2.5	2.3	.0	1.1	.5	2.8	5.3
d (mm)	7.6	7.1		6.6	3.6	9.6	11.4
Vol (cm³)	.05	.05	0	.03		.13	.27
SCALING							
P/αL	.439	.404	.004	.193	.079	.491	.930
P/L	.262	.241	.002	.115	.047	.294	.556
d/D	2.394	2.236	.000	2.079	1.134	3.024	3.591
P/d	.329	.324		.167	.125	.292	.465
Figure No.	2.1.16	2.1.16	2.1.16	2.1.16	2.1.16	2.1.16	2.1.16

Christman and Gehring (1963)

Test No.	A-545	A-546	A-550	A-508	A-512	A-519	D-603
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.205	.208	.208	.211	.211	.211	.211
Mat'l	1100-0	1100-0	1100-0	2024-T3	2024-T3	2024-T3	2024-T3
Supplier							
ρ (g/cm^3)	2.72	2.72	2.72	2.77	2.77	2.77	2.77
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	125	125	125	125
Elong (%)							
TARGET							
Mat'l	304 Stnl	304 Stnl	304 Stnl	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.90	7.90	7.90	2.72	2.72	2.72	2.72
BHN	145	145	145	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	850	1200	2190	938	1510	2390	3660
Yaw (deg)	12	8	9	3	17	7	13
RESULTS							
P (mm)	.3	1.3	3.2	5.3	10.2	13.1	14.7
d (mm)	3.3	5.8	8.4	5.8	7.9	11.9	16.3
Vol (cm^3)		.02	.10	.13	.40	.78	2.60
SCALING							
$P/\alpha L$	.054	.233	.573	.551	1.061	1.363	1.529
P/L	.031	.136	.336	.556	1.071	1.375	1.543
d/D	1.039	1.827	2.646	1.827	2.488	3.748	5.134
P/d	.091	.224	.381	.914	1.291	1.101	.902
Figure No.	2.1.16	2.1.16	2.1.16	2.1.13	2.1.13	2.1.13	2.1.13

Christman and Gehring (1963)

Test No.	A-554	A-555	A-556	A-510	A-514	A-518	D-604
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.211	.211	.211	.211	.211	.211	.211
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Supplier							
ρ (g/cm³)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	25	25	25	25	25	25	25
Elong (%)							
TARGET							
Mat'l	2024-T3	2024-T3	2024-T3	C1015	C1015	C1015	C1015
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.77	2.77	2.77	7.60	7.60	7.60	7.60
BHN	125	125	125	110	110	110	110
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	860	1510	2220	880	1550	2390	3690
Yaw (deg)	12	14	3	4	12	5	2
RESULTS							
P (mm)	1.0	3.9	7.1	.46	2.1	3.6	6.1
d (mm)		6.60	7.90	3.8	6.6	9.1	11.9
Vol (cm³)		.10	.19		.04	.15	.35
SCALING							
P/αL	.101	.409	.745	.080	.365	.626	1.061
P/L	.101	.409	.745	.048	.220	.378	.640
d/D		2.079	2.488	1.197	2.079	2.866	3.748
P/d		.591	.899	.121	.318	.396	.513
Figure No.	2.1.13	2.1.13	2.1.13	2.1.16	2.1.16	2.1.16	2.1.16

Christman and Gehring (1963)

Test No.	A-551	A-553	A-561	A-509	A-513	A-520	D-617
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.211	.211	.211	.215	.215	.215	.215
Mat'l	2024-T3	2024-T3	2024-T3	7075-T6	7075-T6	7075-T6	7075-T6
Supplier							
ρ (g/cm³)	2.77	2.77	2.77	2.80	2.80	2.80	2.80
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	125	125	125	145	145	145	145
Elong (%)							
TARGET							
Mat'l	304 Stnl	304 Stnl	304 Stnl	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.9	7.9	7.9	2.72	2.72	2.72	2.72
BHN	145	145	145	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	830	2200	1480	880	1770	2360	3630
Yaw (deg)	15	5	10	5	10	5	3
RESULTS							
P (mm)	.2	3.6	1.6	5.8	12.2	13.7	15.8
d (mm)	3.30	7.90	6.40	5.6	7.9	10.7	16.8
Vol (cm³)		.10	.03	.12	.39	.74	2.20
SCALING							
P/αL	.041	.638	.284	.600	1.262	1.418	1.635
P/L	.024	.378	.168	.609	1.281	1.438	1.659
d/D	1.039	2.488	2.016	1.764	2.488	3.370	5.291
P/d	.070	.456	.250	1.036	1.544	1.280	.940
Figure No.	2.1.16	2.1.16	2.1.16	2.1.13	2.1.13	2.1.13	2.1.13

Christman and Gehring (1963)

Test No.	A-515	A-517	A-521	D-618	A-474	A-475	A-476
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.215	.215	.215	.215	.59	.59	.59
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	C1015	C1015	C1015
Supplier							
ρ (g/cm^3)	2.80	2.80	2.80	2.80	7.60	7.60	7.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	145	145	145	145	110	110	110
Elong (%)							
TARGET							
Mat'l	C1015	C1015	C1015	C1015	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.60	7.60	7.60	7.60	2.72	2.72	2.72
BHN	110	110	110	110	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1520	2390	820	3660	1390	915	1120
Yaw (deg)	13	14	10	10	15	5	6
RESULTS							
P (mm)	2.1	3.9	.5	6.6	22.4	13.0	16.5
d (mm)	7.60	8.6		11.4	7.1	5.1	5.8
Vol (cm^3)	.05	.12		.36	.8	.24	.41
SCALING							
$P/\alpha L$	.356	.675	.083	1.142	1.407	.816	1.036
P/L	.216	.409	.050	.693	2.352	1.365	1.732
d/D	2.394	2.709		3.591	2.236	1.606	1.827
P/d	.271			.579	3.155	2.549	2.845
Figure No.	2.1.16	2.1.16	2.1.16	2.1.16	2.1.14	2.1.14	2.1.14

Christman and Gehring (1963)

Test No.	A-497	A-502	A-559	A-566	A-567	D-589	A-523
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.619	.590	.626	.626	.626	.590	.619
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm^3)	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	2024-T3
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.77
BHN	25	25	25	25	25	25	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1860	514	2200	2120	2340	3720	1430
Yaw (deg)	16	2	8	10	10	15	10
RESULTS							
P (mm)	26.7	7.4	30.5	29.2	30.5	28.1	10.2
d (mm)	9.10	3.30	10.70	10.70	12.40	19.00	5.60
Vol (cm^3)	1.20	.06	2.70	2.30	2.80	7.90	.19
SCALING							
$P/\alpha L$	1.677	.465	1.916	1.834	1.916	1.765	.646
P/L	2.803	.777	3.202	3.066	3.202	2.950	1.071
d/D	2.866	1.039	3.370	3.370	3.906	5.984	1.764
P/d	2.934	2.242	2.850	2.729	2.460	1.479	1.821
Figure No.	2.1.14	2.1.14	2.1.14	2.1.14	2.1.14	2.1.14	2.1.14

Christman and Gehring (1963)

Test No.	A-544	A-562	A-479	A-493	A-494	A-495	A-558
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.626	.626	.590	.620	.590	.590	.626
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm³)	7.60	7.60	7.60	7.60	7.60	7.60	7.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	2024-T3	2024-T3	C1015	C1015	C1015	C1015	C1015
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.77	2.77	7.60	7.60	7.60	7.60	7.60
BHN	125	125	110	110	110	110	110
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2230	870	1470	1840	970	1130	2230
Yaw (deg)	10	10	16	3	12	12	4
RESULTS							
P (mm)	17.0	4.7	6.2	7.4	3.2	4.2	9.1
d (mm)	7.1		7.6	7.9	5.8	6.4	9.4
Vol (cm³)	.56	.05	.14	.30	.05	.08	.50
SCALING							
P/αL	1.077	.298	.651	.777	.336	.441	.955
P/L	1.785	.493	.651	.777	.336	.441	.955
d/D	2.236		2.394	2.488	1.827	2.016	2.961
P/d	2.394			.937	.552	.656	.968
Figure No.	2.1.14	2.1.14	2.1.15	2.1.15	2.1.15	2.1.15	2.1.15

Christman and Gehring (1963)

Test No.	D-587	D-588	A-528	A-529	A-543	A-534	A-538
PROJECTILE							
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.600	.600	.619	.619	.626	.623	.623
Mat'l	C1015	C1015	C1015	C1015	C1015	304 Stnl	304 Stnl
Supplier							
ρ (g/cm^3)	7.60	7.60	7.60	7.60	7.60	7.90	7.90
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	180	180
Elong (%)							
TARGET							
Mat'l	C1015	C1015	304 Stnl	304 Stnl	304 Stnl	2024-T3	2024-T3
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.60	7.90	7.90	7.90	7.90	2.77	2.77
BHN	7.6	145	145	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3140	3720	860	1380	2220	707	1570
Yaw (deg)	12	14	14	15	16	10	14
RESULTS							
P (mm)	12.7	12.8	2.4	5.9	8.9	3.6	11.0
d (mm)	11.9	13.5	6.4	6.9	8.6		5.6
Vol (cm^3)	.91	1.30	.04	.15	.40		.26
SCALING							
$P/\alpha L$	1.333	1.370	.257	.632	.953	.224	.684
P/L	1.333	1.344	.252	.619	.934	.378	1.155
d/D	3.748	4.252	2.016	2.173	2.709		1.764
P/d	1.067	.948	.375	.855	1.035		1.964
Figure No.	2.1.15	2.1.15	2.1.15	2.1.15	2.1.15	2.1.14	2.1.14

Christman and Gehring (1963)

Test No.	A-539	A-540	A-541	A-531	A-532	A-542
PROJECTILE						
L (mm)	9.525	9.525	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00	3.00	3.00
M (g)	.623	.623	.623	.623	.623	.623
Mat'l	304 Stnl	304 Stnl	304 Stnl	304 Stnl	304 Stnl	304 Stnl
Supplier						
ρ (g/cm^3)	7.90	7.90	7.90	7.90	7.90	7.90
Nose	Flat	Flat	Flat	Flat	Flat	Flat
BHN	180	180	180	180	180	180
Elong (%)						
TARGET						
Mat'l	2024-T3	2024-T3	2024-T3	304 Stnl	304 Stnl	304 Stnl
Thick (mm)	---	---	---	---	---	---
ρ (g/cm^3)	2.77	2.77	2.77	7.90	7.90	7.90
BHN	125	125	125	145	145	145
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	2140	2220	2310	696	1380	2300
Yaw (deg)	15	16	17	3	13	13
RESULTS						
P (mm)	17.0	17.8	18.3	1.3	5.4	9.8
d (mm)	6.9	7.1	7.9	5.1	6.6	9.1
Vol (cm^3)	.50	.50	.60		.12	.45
SCALING						
$P/\alpha L$	1.057	1.107	1.138	.136	.567	1.029
P/L	1.785	1.869	1.921	.136	.567	1.029
d/D	2.173	2.236	2.488	1.606	2.079	2.866
P/d	2.464	2.507	2.316	.255	.818	1.077
Figure No.	2.1.14	2.1.14	2.1.14	2.1.15	2.1.15	2.1.15

Christman and Gehring (1963)

Test No.	A-436	A-440	A-441	A-452
PROJECTILE				
L (mm)	9.525	9.525	9.525	9.525
D (mm)	3.175	3.175	3.175	3.175
L/D	3.00	3.00	3.00	3.00
M (g)	.203	.203	.203	.203
Mat'l	1100-0	1100-0	1100-0	1100-0
Supplier				
ρ (g/cm^3)	2.72	2.72	2.72	2.72
Nose	Flat	Flat	Flat	Flat
BHN	25	25	25	25
Elong (%)				
TARGET				
Mat'l	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72
BHN	25	25	25	25
Elong (%)				
Obliq (deg)	0	0	0	0
IMPACT				
V (m/s)	310	980	610	976
Yaw (deg)	9	5	15	3
RESULTS				
P (mm)	.36	5.3	2.8	5.1
d (mm)				6.4
Vol (cm^3)		.1		.1
SCALING				
P/αL	.038	.556	.294	.535
P/L	.038	.556	.294	.535
d/D				2.016
P/d				.797
Figure No.	2.1.13	2.1.13	2.1.13	2.1.13

Christman and Gehring (1965)

Test No.	Fig. 5	Fig. 5	Fig. 5	Fig. 5	Fig. 5	Fig. 5	Fig. 5
PROJECTILE							
L (mm)	11.68	15.09	18.08	23.77	27.81	33.53	4.5
D (mm)	2.92	2.51	2.26	1.98	1.85	1.68	4.5
L/D	4.00	6.01	8.00	12.01	15.03	19.96	1.00
M (g)	.200	.200	.200	.200	.200	.200	.200
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Supplier							
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
Nose	Flat	Flat	flat	Flat	Flat	Flat	Flat
BHN	125	125	125	125	125	125	125
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	25	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3500	3500	3500	3500	3500	3500	1500
Yaw (deg)							
RESULTS							
P (mm)	16.3	19.8	22.1	25.9	29.5	34.8	6.1
d (mm)							
Vol (cm^3)	1.99	2.08	2.09	1.89	1.86	1.83	
SCALING							
$P/\alpha L$	1.383	1.300	1.211	1.080	1.051	1.028	1.343
P/L	1.396	1.312	1.222	1.090	1.061	1.038	1.356
d/D							
P/d							
Figure No.	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17

Christman and Gehring (1965)

Test No.	Fig. 5	Fig. 5	Fig. 5	Fig. 5	Fig. 5	Fig. 5	Fig. 5
PROJECTILE							
L (mm)	4.5	9.52	21.08	4.5	7.16	9.52	9.52
D (mm)	4.5	3.18	2.11	4.5	3.58	3.18	3.18
L/D	1.00	2.99	9.99	1.00	2.00	2.99	2.99
M (g)	.2	.2	.2	.2	.2	.2	.200
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
ρ (g/cm^3)							
BHN	2.77	2.77	2.77	2.77	2.77	2.77	2.77
Elong (%)	Flat	Flat	Flat	Flat	Flat	Flat	Flat
	125	125	125	125	125	125	125
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	25	25	25	25	25
Obliq (deg)							
	0	0	0	0	0	0	0
IMPACT							
V (m/s)	5000	5000	5000	3500	3500	3500	1500
Yaw (deg)							
RESULTS							
P (mm)	12.2	17.0	27.2	9.4	11.9	14.5	9.6
d (mm)							
Vol (cm^3)	2.96	4.51	5.22	1.56	1.78	1.88	
SCALING							
t/αL	2.687	1.770	1.279	2.070	1.647	1.509	.999
t/L	2.711	1.786	1.290	2.089	1.662	1.523	1.008
t/(D cos θ)							
Figure No.	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17

Christman and Gehring (1965)

Test No.	Fig. 5	Fig. 5	Fig. 6	Fig. 6	Fig. 6	Fig. 6	Fig. 6
PROJECTILE							
L (mm)	15.09	21.08	4.50	9.52	21.08	4.50	9.52
D (mm)	2.51	2.11	4.50	3.18	2.11	4.50	3.18
L/D	6.01	9.99	1.00	2.99	9.99	1.00	2.99
M (g)	.200	.200	.200	.200	.200	.200	.200
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Supplier							
ρ (g/cm³)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	125	125	125	125	125	125	125
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.72	2.72	2.77	2.77	2.77	2.77	2.77
BHN	25	25	125	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1500	1500	5000	5000	5000	3500	3500
Yaw (deg)							
RESULTS							
P (mm)	11.2	14.7	8.4	11.9	21.6	6.1	10.2
d (mm)							
Vol (cm³)			1.49	1.48	1.35	.63	.62
SCALING							
P/αL	.735	.691	1.867	1.250	1.025	1.356	1.071
P/L	.742	.697	1.867	1.250	1.025	1.356	1.071
d/D							
P/d							
Figure No.	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17

Christman and Gehring (1965)

Test No.	Fig. 6	Fig. 6	Fig. 6	Fig. 6	Fig. 6	Fig. 6	Fig. 6
PROJECTILE							
L (mm)	15.09	21.08	27.81	4.50	9.52	18.08	23.77
D (mm)	2.51	2.11	1.85	4.50	3.18	2.26	1.98
L/D	6.01	9.99	15.03	1.00	2.99	8.00	12.01
M (g)	.200	.200	.200	.200	.200	.200	.2
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Supplier							
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	125	125	125	125	125	125	125
Elong (%)							
TARGET							
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
BHN	125	125	125	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3500	3500	3500	1500	1500	1500	1500
Yaw (deg)							
RESULTS							
P (mm)	14.0	19.1	24.6	2.4	3.6	3.8	4.6
d (mm)							
Vol (cm^3)	.57	.54	.45				
SCALING							
P/αL	.928	.906	.885	.533	.378	.210	.194
P/L	.928	.906	.885	.533	.378	.210	.194
d/D							
P/d							
Figure No.	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17	2.1.17

Christman and Gehring (1965)

Test No.	Fig. 7	Fig. 7	Fig. 7	Fig. 7	Fig. 7	Fig. 7	Fig. 7
PROJECTILE							
L (mm)	4.5	9.52	21.08	4.5	7.16	9.52	11.68
D (mm)	4.5	3.18	2.11	4.5	3.58	3.18	2.92
L/D	1.00	2.99	9.99	1.00	2.00	2.99	4.00
M (g)	.6	.6	.6	.6	.6	.6	.6
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm^3)	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	25	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	5000	5000	5000	3500	3500	3500	3500
Yaw (deg)							
RESULTS							
P (mm)	24.4	31.5	49.0	21.1	24.4	28.2	30.7
d (mm)							
Vol (cm^3)	12.99	17.22	17.16	6.55	6.74	7.14	6.93
SCALING							
$P/\alpha L$	3.196	1.950	1.370	2.764	2.009	1.746	1.549
P/L	5.422	3.309	2.324	4.689	3.408	2.962	2.628
d/D							
P/d							
Figure No.	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18

Christman and Gehring (1965)

Test No.	Fig. 7	Fig. 7	Fig. 7	Fig. 7	Fig. 7	Fig. 7	Fig. 7
PROJECTILE							
L (mm)	21.08	27.81	33.53	38.74	4.50	9.52	18.08
D (mm)	2.11	1.85	1.68	1.55	4.50	3.18	2.26
L/D	9.99	15.03	19.96	24.99	1.00	2.99	8.00
M (g)	.6	.6	.6	.6	.6	.6	.6
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm³)	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0	1100-0
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.72	2.72	2.72	2.72	2.72	2.72	2.72
BHN	25	25	25	25	25	25	25
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3500	3500	3500	3500	1500	1500	1500
Yaw (deg)							
RESULTS							
P (mm)	46.7	54.9	65.9	73.7	14.5	22.6	28.2
d (mm)							
Vol (cm³)	6.69	5.99	7.16	7.01			
SCALING							
P/αL	1.306	1.164	1.158	1.121	1.899	1.399	.919
P/L	2.215	1.974	1.965	1.902	3.222	2.374	1.560
d/D							
P/d							
Figure No.	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18

Christman and Gehring (1965)

Test No.	Fig. 7	Fig. 8	Fig. 8	Fig. 8	Fig. 8	Fig. 8	Fig. 8
PROJECTILE							
L (mm)	27.81	4.50	9.52	21.08	4.50	9.52	21.08
D (mm)	1.85	4.50	3.18	2.11	4.50	3.18	2.11
L/D	15.03	1.00	2.99	9.99	1.00	2.99	9.99
M (g)	.6	.6	.6	.6	.6	.6	.600
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm³)	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	1100-0	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.72	2.77	2.77	2.77	2.77	2.77	2.77
BHN	25	125	125	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1500	5000	5000	5000	3500	3500	3500
Yaw (deg)							
RESULTS							
P (mm)	32.3	17.8	25.7	41.7	13.5	22.1	37.8
d (mm)							
Vol (cm³)		4.52	4.43	4.59	2.02	1.79	1.60
SCALING							
P/αL	.685	2.353	1.606	1.177	1.784	1.381	1.067
P/L	1.161	3.956	2.700	1.978	3.000	2.321	1.793
d/D							
P/d							
Figure No.	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18

Christman and Gehring (1965)

Test No.	Fig. 8	Fig. 8	Fig. 8	Fig. 8	Fig. 8	Fig. 9	Fig. 9
PROJECTILE							
L (mm)	33.53	4.5	9.52	18.08	27.81	4.5	9.52
D (mm)	1.68	4.5	3.18	2.26	1.85	4.5	3.18
L/D	19.96	1.00	2.99	8.00	15.03	1.00	2.99
M (g)	.600	.600	.600	.600	.600	.600	.600
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm^3)	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Nose	Flat	Flat	Fiat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	2024-T3	2024-T3	2024-T3	2024-T3	2024-T3	C1015	C1015
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	7.83	7.83
BHN	125	125	125	125	125	110	110
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3500	1500	1500	1500	1500	5000	5000
Yaw (deg)							
RESULTS							
P (mm)	54.6	7.9	11.2	14.0	17.8	9.9	14.2
d (mm)							
Vol (cm^3)	1.52					2.02	2.68
SCALING							
$P/\alpha L$	.969	1.044	.700	.461	.381	2.200	1.492
P/L	1.628	1.756	1.176	.774	.640	2.200	1.492
d/D							
P/d							
Figure No.	2.1.18	2.1.18	2.1.18	2.1.18	2.1.18	2.1.19	2.1.19

Christman and Gehring (1965)

Test No.	Fig. 9	Fig. 9	Fig. 9	Fig. 9	Fig. 9	Fig. 9	Fig. 9
PROJECTILE							
L (mm)	21.08	4.50	7.16	9.52	11.68	21.08	33.53
D (mm)	2.11	4.50	3.58	3.18	2.92	2.11	1.68
L/D	9.99	1.00	2.00	2.99	4.00	9.99	19.96
M (g)	.600	.600	.600	.600	.600	.600	.600
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Supplier							
ρ (g/cm³)	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	110	110	110	110	110	110	110
Elong (%)							
TARGET							
Mat'l	C1015	C1015	C1015	C1015	C1015	C1015	C1015
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.83	7.83	7.83	7.83	7.83	7.83	7.83
BHN	110	110	110	110	110	110	110
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	5000	3500	3500	3500	3500	3500	3500
Yaw (deg)							
RESULTS							
P (mm)	25.9	7.4	9.9	11.4	13.5	23.9	33.8
d (mm)							
Vol (cm³)	2.65	.91	1.16	1.09	1.09	1.06	.86
SCALING							
P/αL	1.229	1.644	1.383	1.197	1.156	1.134	1.008
P/L	1.229	1.644	1.383	1.197	1.156	1.134	1.008
d/D							
P/d							
Figure No.	2.1.19	2.1.19	2.1.19	2.1.19	2.1.19	2.1.19	2.1.19

Christman and Gehring (1965)

Test No.	Fig. 9	Fig. 9	Fig. 9	Fig. 9
PROJECTILE				
L (mm)	4.50	9.52	18.08	27.81
D (mm)	4.50	3.18	2.26	1.85
L/D	1.00	2.99	8.00	15.03
M (g)	.600	.600	.600	.600
Mat'l	C1015	C1015	C1015	C1015
Supplier				
ρ (g/cm^3)	7.83	7.83	7.83	7.83
Nose	Flat	Flat	Flat	Flat
BHN	110	110	110	110
Elong (%)				
TARGET				
Mat'l	C1015	C1015	C1015	C1015
Thick (mm)	---	---	---	---
ρ (g/cm^3)	7.83	7.83	7.83	7.83
BHN	110	110	110	11C
Elong (%)				
Obliq (deg)	0	0	0	0
IMPACT				
V (m/s)	1500	1500	1500	1500
Yaw (deg)				
RESULTS				
P (mm)	4.3	6.4	9.4	12.2
d (mm)				
Vol (cm^3)				
SCALING				
P/αL	.956	.672	.520	.439
P/L	.956	.672	.520	.439
d/D				
P/d				
Figure No.	2.1.19	2.1.19	2.1.19	2.1.19

Cline, Gogolewski, and Reaugh (1989)

Test No.							
PROJECTILE							
L (mm)	7.60	7.60	7.60	7.60	15.20	7.60	7.60
D (mm)	7.60	7.60	7.60	7.60	7.60	7.60	7.60
L/D	1.00	1.00	1.00	1.00	2.00	1.00	1.00
M (g)	6.40	6.40	6.40	6.40	12.80	6.40	6.40
Mat'l	W2	W2	W2	W2	W2	W2	W2
Supplier							
ρ (g/cm³)	18.54	18.54	18.54	18.54	18.54	18.54	18.54
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	363	363	363	363	363	800	800
Elong (%)							
TARGET							
Mat'l	4340	4340	4340	4340	4340	Pyrex	Pyrex
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	2.23	2.23
BHN	330	330	330	330	330		
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3350	3790	4400	5600	1910	1440	2110
Yaw (deg)							
RESULTS							
P (mm)	29.6	31.9	45.6	53.2	24.3	33.4	47.9
d (mm)							
Vol (cm³)							
SCALING							
P/αL	2.534	2.731	3.904	4.555	1.040	1.524	2.186
P/L	3.895	4.197	6.000	7.000	1.599	4.395	6.303
d/D							
P/d							
Figure No.	2.1.20	2.1.20	2.1.20	2.1.20	2.1.20	2.1.20	2.1.20

Cline, Gogolewski, and Reaugh (1989)

Test No.							
PROJECTILE							
L (mm)	7.60	7.60	7.60	7.60	7.60	7.60	7.60
D (mm)	7.60	7.60	7.60	7.60	7.60	7.60	7.60
L/D	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M (g)	6.40	6.40	4.90	4.90	4.90	2.30	2.30
Mat'l	W2	W2	WC	WC	WC	TiC	TiC
Supplier							
ρ (g/cm^3)	18.54	18.54	14.24	14.24	14.24	6.62	6.62
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	800	800	800	800	800	800	800
Elong (%)							
TARGET							
Mat'l	Pyrex	Pyrex	Pyrex	Pyrex	Pyrex	Pyrex	Pyrex
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.23	2.23	2.23	2.23	2.23	2.23	2.23
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4230	5780	2120	3730	6340	2200	4000
Yaw (deg)							
RESULTS							
P (mm)	107.9	111.0	47.9	108.7	117.8	41.0	73.7
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	4.924	5.065	2.494	5.660	6.134	3.131	5.628
P/L	14.197	14.605	6.303	14.303	15.500	5.395	9.697
d/D							
P/d							
Figure No.	2.1.20	2.1.20	2.1.20	2.1.20	2.1.20	2.1.20	2.1.20

Cline, Gogolewski, and Reaugh (1989)

Test No.		
PROJECTILE		
L (mm)	7.60	7.60
D (mm)	7.60	7.60
L/D	1.00	1.00
M (g)	2.30	2.30
Mat'l	TiC	TiC
Supplier		
ρ (g/cm³)	6.62	6.62
Nose	Flat	Flat
BHN	800	800
Elong (%)		
TARGET		
Mat'l	Pyrex	Pyrex
Thick (mm)	---	---
ρ (g/cm³)	2.23	2.23
BHN		
Elong (%)		
Obliq (deg)	0	0
IMPACT		
V (m/s)	6130	7500
Yaw (deg)		
RESULTS		
P (mm)	107.9	111.0
d (mm)		
Vol (cm³)		
SCALING		
P/αL	8.240	8.477
P/L	14.197	14.605
d/D		
P/d		
Figure No.	2.1.20	2.1.20

Forrestal, Brar, and Luk (1991)

Test No.	2037	1961	1960	1916	1914	1915	2059
PROJECTILE							
L (mm)	74.68	74.68	74.68	74.68	74.68	74.68	74.68
D (mm)	7.11	7.11	7.11	7.11	7.11	7.11	7.11
L/D	10.50	10.50	10.50	10.50	10.50	10.50	10.50
M (g)	23.36	23.34	23.34	23.43	23.40	23.44	23.32
Mat'l	T-200	T-200	T-200	T-200	T-200	T-200	T-200
Supplier	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco
ρ (g/cm^3)	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	6061T651	6061T651	6061T651	6061T651	6061T651	6061T651	6061T651
Thick (mm)							
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	359	430	490	519	673	792	959
Yaw (deg)	1.20	0.20	0.70	3.44	1.22	3.16	1.12
RESULTS							
P (mm)	21.00	32.00	40.00	41.00	73.00	85.0	109.0
d (mm)	7.1	7.1	7.1	7.1	7.1	7.1	7.1
Vol (cm^3)	0.83	1.27	1.59	1.63	2.90	3.37	4.33
SCALING							
P/αL	0.164	0.249	0.312	0.320	0.569	0.662	0.849
P/L	0.281	0.428	0.536	0.549	0.978	1.138	1.460
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	2.954	4.501	5.626	5.767	10.267	11.955	15.331
Figure No.	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21

Forrestal, Brar, and Luk (1991)

Test No.	1912	2041	2040	1936	1931	1928	1932
PROJECTILE							
L (mm)	74.68	73.66	73.66	73.66	73.66	73.66	73.66
D (mm)	7.11	5.08	5.08	5.08	5.08	5.08	5.08
L/D	10.50	14.50	14.50	14.50	14.50	14.50	14.50
M (g)	23.32	11.76	11.72	11.75	11.76	11.74	11.82
Mat'l	T-200	T-200	T-200	T-200	T-200	T-200	T-200
Supplier	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco
ρ (g/cm^3)	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	6061T651	6061T651	6061T651	6061T651	6061T651	6061T651	6061T651
Thick (mm)							
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1009	253	357	425	457	599	740
Yaw (deg)	1.02	0.82	0.41	2.34	1.72	0.94	0.45
RESULTS							
P (mm)	129.0	12.0	20.0	27.0	33.0	56.0	80.0
d (mm)	7.1	5.1	5.1	5.1	5.1	5.1	5.1
Vol (cm^3)	5.12	0.24	0.41	0.55	0.67	1.14	1.62
SCALING							
P/αL	1.005	0.095	0.158	0.213	0.261	0.442	0.632
P/L	1.727	0.163	0.272	0.367	0.448	0.760	1.086
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	18.143	2.362	3.937	5.315	6.496	11.024	15.748
Figure No.	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21

Forrestal, Brar, and Luk (1991)

Test No.	1933	1935	2044	1956	1922	1957	1920
PROJECTILE							
L (mm)	73.66	73.66	39.12	39.12	39.12	39.12	39.12
D (mm)	5.08	5.08	7.11	7.11	7.11	7.11	7.11
L/D	14.50	14.50	5.50	5.50	5.50	5.50	5.50
M (g)	11.85	11.74	12.09	12.07	12.00	12.07	12.08
Mat'l	T-200	T-200	T-200	T-200	T-200	T-200	T-200
Supplier	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco
ρ (g/cm^3)	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	6061T651	6061T651	6061T651	6061T651	6061T651	6061T651	6061T651
Thick (mm)							
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	866	980	318	473	634	743	806
Yaw (deg)	1.08	1.00	3.13	2.20	0.90	2.30	0.81
RESULTS							
P (mm)	102.0	117.0	12.0	23.0	38.0	47.0	56.0
d (mm)	5.1	5.1	7.1	7.1	7.1	7.1	7.1
Vol (cm^3)	2.07	2.37	0.48	0.91	1.51	1.87	2.22
SCALING							
$P/\alpha L$	0.806	0.924	0.179	0.342	0.565	0.699	0.833
P/L	1.385	1.588	0.307	0.588	0.971	1.201	1.431
d/D	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P/d	20.079	23.031	1.688	3.235	5.345	6.610	7.876
Figure No.	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21	2.1.21

Forrestal, Brar, and Luk (1991)

Test No.	1918
PROJECTILE	
L (mm)	39.12
D (mm)	7.11
L/D	5.50
M (g)	12.09
Mat'l	T-200
Supplier	Vasco
ρ (g/cm^3)	8.00
Nose	Hemi
BHN	
Elong (%)	
TARGET	
Mat'l	6061T651
Thick (mm)	
ρ (g/cm^3)	2.71
BHN	
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	945
Yaw (deg)	1.49
RESULTS	
P (mm)	68.0
d (mm)	7.1
Vol (cm^3)	2.70
SCALING	
$P/\alpha L$	1.012
P/L	1.738
d/D	1.000
P/d	9.564
Figure No.	2.1.21

Forrestal, Okajima, and Luk (1988)

Test No.	6-1358	6-1357	6-1360	6-1355	6-1362	6-1359	6-1403
PROJECTILE							
L (mm)	74.70	74.70	74.70	74.70	74.70	74.70	95.00
D (mm)	7.10	7.10	7.10	7.10	7.10	7.10	6.40
L/D	10.52	10.52	10.52	10.52	10.52	10.52	14.84
M (g)	23.30	23.30	23.30	23.30	23.30	23.30	23.70
Mat'l	C-300	C-300	C-300	C-300	C-300	C-300	C-300
Supplier	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi/cut
BHN	637	637	637	637	637	637	637
Elong (%)							
TARGET							
Mat'l	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN	125	125	125	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	450	760	960	1020	1120	1160	480
Yaw (deg)							
RESULTS							
P (mm)	30.0	72.0	115.0	112.0	152.0	159.0	36.0
d (mm)							
Vol (cm³)							
SCALING							
P/αL	.236	.566	.905	.881	1.196	1.251	.223
P/L	.402	.964	1.539	1.499	2.035	2.129	.379
d/D							
P/d							
Figure No.	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22

Forrestal, Okajima, and Luk (1988)

Test No.	6-1404	6-1405	6-1366	6-1365	6-1372	6-1364	6-1370
PROJECTILE							
L (mm)	95.00	95.00	82.90	82.90	82.90	82.90	82.90
D (mm)	6.40	6.40	7.10	7.10	7.10	7.10	7.10
L/D	14.84	14.84	11.68	11.68	11.68	11.68	11.68
M (g)	24.00	23.70	24.90	24.90	24.70	24.70	24.70
Mat'l	C-300	C-300	T-200	T-200	T-200	T-200	T-200
Supplier	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Hemi/cut	Hemi/cut	3CRH ogv	3CRH ogv	3CRH ogv	3CRH ogv	3CRH ogv
BHN	637	637	427	427	427	427	427
Elong (%)							
TARGET							
Mat'l	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN	125	125	125	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	770	1000	440	730	790	1000	1260
Yaw (deg)							
RESULTS							
P (mm)	84.00	119.00	44.00	94.00	105.00	163.00	253.00
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.520	.736	.312	.666	.744	1.155	1.793
P/L	.884	1.253	.531	1.134	1.267	1.966	3.052
d/D							
P/d							
Figure No.	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22

Forrestal, Okajima, and Luk (1988)

Test No.	6-1371	6-1342	6-1329	6-1344	6-1334	6-1564	6-1561
PROJECTILE							
L (mm)	82.9	81.8	81.8	81.8	81.8	81.8	81.8
D (mm)	7.1	7.1	7.1	7.1	7.1	7.1	7.1
L/D	11.68	11.52	11.52	11.52	11.52	11.52	11.52
M (g)	24.80	23.80	23.70	23.60	23.70	24.10	24.10
Mat'l	T-200	C-300	C-300	C-300	C-300	C-300	C-300
Supplier	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco	Vasco
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	3CRH ogv	Conical	Conical	Conical	Conical	Conical	Conical
BHN	427	637	637	637	637	637	637
Elong (%)							
TARGET							
Mat'l	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651	6061-T651
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN	125	125	125	125	125	125	125
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1460	510	660	940	1000	1060	153
Yaw (deg)							
RESULTS							
P (mm)	333.0	40.0	66.0	121.0	145.0	153.0	196.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	2.360	.287	.474	.869	1.042	1.099	1.408
P/L	4.017	.489	.807	1.479	1.773	1.870	2.396
d/D							
P/d							
Figure No.	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22	2.1.22

Forrestal, Okajima, and Luk (1988)

Test No.	6-1336	6-1353
PROJECTILE		
L (mm)	81.80	81.80
D (mm)	7.10	7.10
L/D	11.52	11.52
M (g)	23.70	23.70
Mat'l	C-300	C-300
Supplier	Vasco	Vasco
ρ (g/cm^3)	7.85	7.85
Nose	Conical	Conical
BHN	637	637
Elong (%)		
TARGET		
Mat'l	6061-T651	6061-T651
Thick (mm)	---	---
ρ (g/cm^3)	2.71	2.71
BHN	125	125
Elong (%)		
Obliq (deg)	0	0
IMPACT		
V (m/s)	1260	1370
Yaw (deg)		
RESULTS		
P (mm)	201.0	273.0
d (mm)		
Vol (cm^3)		
SCALING		
$P/\alpha L$	1.444	1.961
P/L	2.457	3.337
d/D		
P/d		
Figure No.	2.1.22	2.1.22

Hohler and Stilp (1991a)

Test No.	664	661	663	928	2230	2957	651
PROJECTILE							
L (mm)	5.5	5.5	5.5	5.5	5.5	5.5	9.2
D (mm)	5.5	5.5	5.5	5.5	5.5	5.5	9.2
L/D	1	1	1	1	1	1	1
M (g)	1.03	1.03	1.03	1.03	1.03	1.03	4.8
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	135	180	180	180	135
Elong (%)	25	25	25	22	22	22	25
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	686	940	2964	928	2230	2957	892
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	1.8	2.7	9.3	2.2	6	7.8	5.1
d (mm)	8	8.8	16	8.6	13.5	16.5	15.2
Vol (cm^3)	0.08	0.13	1.47	0.1	0.58	1.15	0.6
SCALING							
$P/\alpha L$	0.327	0.491	1.691	0.400	1.091	1.418	0.554
P/L	0.327	0.491	1.691	0.400	1.091	1.418	0.554
d/D	1.455	1.600	2.909	1.564	2.455	3.000	1.652
P/d	0.225	0.307	0.581	0.256	0.444	0.473	0.336
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	629	650	652	653	667	668	670
PROJECTILE							
L (mm)	9.2	9.2	9.2	9.2	9.2	9.2	9.2
D (mm)	9.2	9.2	9.2	9.2	9.2	9.2	9.2
L/D	1	1	1	1	1	1	1
M (g)	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	135	135	180	180	180
Elong (%)	25	25	25	25	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1647	2030	2280	2836	812	1770	2854
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	8.8	10.9	12.5	14.8	3.2	8.5	13.3
d (mm)	19.6	22.5	25.3	29.2	14.5	20.1	27.7
Vol (cm^3)		2.99	4.25	6.56	0.41	1.75	5.06
SCALING							
$P/\alpha L$	0.957	1.185	1.359	1.609	0.348	0.924	1.446
P/L	0.957	1.185	1.359	1.609	0.348	0.924	1.446
d/D	2.130	2.446	2.750	3.174	1.576	2.185	3.011
P/d	0.449	0.484	0.494	0.507	0.221	0.423	0.480
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	671	654	655	676	672	722	677
PROJECTILE							
L (mm)	9.2	12	12	12	12	12	12
D (mm)	9.2	12	12	12	12	12	12
L/D	1	1	1	1	1	1	1
M (g)	4.8	10.65	10.65	10.65	10.65	10.65	10.65
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	135	135	135	180	180	180
Elong (%)	22	25	25	25	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3058	977	1469	1910	491	1218	1970
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	13.9	6.1	10	13.1	1.6	7	12.1
d (mm)	29.3	20.4	24.4	29.1	14.2	21.4	28.8
Vol (cm^3)	5.93	1.41	3.19	5.85	0.15	1.78	5.63
SCALING							
$P/\alpha L$	1.511	0.508	0.833	1.092	0.133	0.583	1.008
P/L	1.511	0.508	0.833	1.092	0.133	0.583	1.008
d/D	3.185	1.700	2.033	2.425	1.183	1.783	2.400
P/d	0.474	0.299	0.410	0.450	0.113	0.327	0.420
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	754	862	858	859	850	826	853
PROJECTILE							
L (mm)	25	25	25	25	25	25	25
D (mm)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
L/D	10	10	10	10	10	10	10
M (g)	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	135	135	180	180	180
Elong (%)	25	25	25	25	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1180	3236	3548	3528	965	1171	2596
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	6.1	25.3	25.5	26.3	1.8	4.9	23.2
d (mm)	5.4	9.5	10.1	10.7	5.1	5.6	7.3
Vol (cm³)		1.69	2.07	2.17	0.015	0.105	0.85
SCALING							
P/αL	0.244	1.012	1.020	1.052	0.072	0.196	0.928
P/L	0.244	1.012	1.020	1.052	0.072	0.196	0.928
d/D	2.160	3.800	4.040	4.280	2.040	2.240	2.920
P/d	1.130	2.663	2.525	2.458	0.353	0.875	3.178
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	855	856	744	900	899	873	868
PROJECTILE							
L (mm)	25	25	43	43	43	43	43
D (mm)	2.5	2.5	4.3	4.3	4.3	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	0.96	0.96	4.9	4.9	4.9	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	135	135	135	135	135
Elong (%)	22	22	25	25	25	25	25
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3172	3459	985	1369	1697	2231	2762
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	24.8	25.4	6.9	16.4	27	35.3	41.4
d (mm)	8.9	9.2	8.5	8.8	9.7	11.9	14.3
Vol (cm^3)	1.32	1.7			1.68	2.7	5.15
SCALING							
$P/\alpha L$	0.992	1.016	0.160	0.381	0.628	0.821	0.963
P/L	0.992	1.016	0.160	0.381	0.628	0.821	0.963
d/D	3.560	3.680	1.977	2.047	2.256	2.767	3.326
P/d	2.787	2.761	0.812	1.864	2.784	2.966	2.895
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	828	844	830	835	845	836	746
PROJECTILE							
L (mm)	43	43	43	43	43	43	54
D (mm)	4.3	4.3	4.3	4.3	4.3	4.3	5.4
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	4.9	4.9	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	135
Elong (%)	22	22	22	22	22	22	25
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	595	1115	1801	1957	2629	2673	663
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	1.3	7.2	24	28.3	39.5	38.5	2.7
d (mm)	7	8 8	10.5	11	13	13.5	9.6
Vol (cm^3)	0.024		1.72			4.16	0.108
SCALING							
$P/\alpha L$	0.030	0.167	0.558	0.658	0.919	0.895	0.050
P/L	0.030	0.167	0.558	0.658	0.919	0.895	0.050
d/D	1.628	2.047	2.442	2.558	3.023	3.140	1.778
P/d	0.186	0.818	2.286	2.573	3.038	2.852	0.281
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	903	848	846	847	831	898	897
PROJECTILE							
L (mm)	54	54	54	54	54	54	54
D (mm)	5.4	5.4	5.4	5.4	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	180	180	180	180	180
Elong (%)	25	25	22	22	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1589	2463	747	783	1419	2348	2552
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	29.1	50	2.2	2.7	20.4	45.7	47.1
d (mm)	12	17.8	10.5	10.7	11.9	14.5	17
Vol (cm³)		10.3	0.092	0.118	2	5.9	8
SCALING							
$P/\alpha L$	0.539	0.926	0.041	0.050	0.378	0.846	0.872
P/L	0.539	0.926	0.041	0.050	0.378	0.846	0.872
d/D	2.222	3.296	1.944	1.981	2.204	2.685	3.148
P/d	2.425	2.809	0.210	0.252	1.714	3.152	2.771
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1082	1081	1085	1084	1083	1086	1087
PROJECTILE							
L (mm)	25	25	25	25	25	25	25
D (mm)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
L/D	10	10	10	10	10	10	10
M (g)	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	600	1161	1820	2252	2513	3087	3593
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	0.2	2.3	12.1	16.6	18.5	21.8	22.9
d (mm)	2.7	5.1	5.7	6.4	6.4	7.4	8.4
Vol (cm^3)	0.0006	0.03	0.21	0.34	0.44	0.72	0.99
SCALING							
$P/\alpha L$	0.008	0.092	0.484	0.664	0.740	0.872	0.916
P/L	0.008	0.092	0.484	0.664	0.740	0.872	0.916
d/D	1.080	2.040	2.280	2.560	2.560	2.960	3.360
P/d	0.074	0.451	2.123	2.594	2.891	2.946	2.726
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1088	1074	1072	1073	1071	1068	1067
PROJECTILE							
L (mm)	25	43	43	43	43	43	43
D (mm)	2.5	4.3	4.3	4.3	4.3	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	0.96	4.9	4.9	4.9	4.9	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3722	560	800	888	897	1263	1535
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	23	0.3	1.1	1.3	1.4	6.4	14.2
d (mm)	8.8	5.2	6.1	7.4	7.8	8.4	9.1
Vol (cm^3)	1.15	0.003	0.017	0.029	0.035	0.34	0.65
SCALING							
$P/\alpha L$	0.920	0.007	0.026	0.030	0.033	0.149	0.330
P/L	0.920	0.007	0.026	0.030	0.033	0.149	0.330
d/D	3.520	1.209	1.419	1.721	1.814	1.953	2.116
P/d	2.614	0.058	0.180	0.176	0.179	0.762	1.560
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1069	1070	1066	1075	1076	1077	1078
PROJECTILE							
L (mm)	43	43	43	43	54	54	54
D (mm)	4.3	4.3	4.3	4.3	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2154	2264	2820	3108	594	1160	1225
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	27.9	29.1	36.5	37.6	0.6	5.7	7.6
d (mm)	10.3	10.7	12.7	12.8	6.4	12	11.2
Vol (cm^3)	1.58	1.75	3.02	3.92	0.01	0.419	0.625
SCALING							
P/αL	0.649	0.677	0.849	0.874	0.011	0.106	0.141
P/L	0.649	0.677	0.849	0.874	0.011	0.106	0.141
d/D	2.395	2.488	2.953	2.977	1.185	2.222	2.074
P/d	2.709	2.720	2.874	2.938	0.094	0.475	0.679
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1079	1080	1308	1290	1307	1327	1339
PROJECTILE							
L (mm)	54	54	5.5	5.5	5.5	5.5	5.5
D (mm)	5.4	5.4	5.5	5.5	5.5	5.5	5.5
L/D	10	10	1	1	1	1	1
M (g)	9.7	9.7	1.03	1.03	1.03	1.03	1.03
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	
Thick (mm)	---	---	---	---	---	---	
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	
BHN	295	295	295	295	295	295	
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	
IMPACT							
V (m/s)	1793	2614	762	1670	2390	3451	3580
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	25.2	42	1	3.9	5.4	8.2	7.9
d (mm)	11.9	15.3	7.1	10.8	13	16.5	16.9
Vol (cm³)	2	5.34	0.02	0.21	0.59	1.3	1.3
SCALING							
P/αL	0.467	0.778	0.182	0.709	0.982	1.491	1.436
P/L	0.467	0.778	0.182	0.709	0.982	1.491	1.436
d/D	2.204	2.833	1.291	1.964	2.364	3.000	3.073
P/d	2.118	2.745	0.141	0.361	0.415	0.497	0.467
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1332	1335	1342	1310	1305	1304	1306
PROJECTILE							
L (mm)	5.5	5.5	5.5	9.2	9.2	9.2	9.2
D (mm)	5.5	5.5	5.5	9.2	9.2	9.2	9.2
L/D	1	1	1	1	1	1	1
M (g)	1.03	1.03	1.03	4.8	4.8	4.8	4.8
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3700	3804	3313	374	983	1361	2593
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	8.4	8.6	9.1	0.3	2.5	4.6	10.5
d (mm)	17.5	17.1	19.3	9.5	14.2	16.5	24.1
Vol (cm³)	1.4	1.4	1.8	0.011	0.22	0.8	3.2
SCALING							
$P/\alpha L$	1.527	1.564	1.655	0.033	0.272	0.500	1.141
P/L	1.527	1.564	1.655	0.033	0.272	0.500	1.141
d/D	3.182	3.109	3.509	1.033	1.543	1.793	2.620
P/d	0.480	0.503	0.472	0.032	0.176	0.279	0.436
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1338	1337	1317	1336	1302	1301	1303
PROJECTILE							
L (mm)	9.2	9.2	9.2	9.2	12	12	12
D (mm)	9.2	9.2	9.2	9.2	12	12	12
L/D	1	1	1	1	1	1	1
M (g)	4.8	4.8	4.8	4.8	10.65	10.65	10.65
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2627	2800	3046	3302	579	1072	1566
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	10.7	11.5	12.3	12.8	1	3.8	7.8
d (mm)	23.7	25.5	26.2	27.5	13.4	19.2	24.4
Vol (cm^3)	3.3	3.7	4.8	5.3	0.07	0.63	2.7
SCALING							
$P/\alpha L$	1.163	1.250	1.337	1.391	0.083	0.317	0.650
P/L	1.163	1.250	1.337	1.391	0.083	0.317	0.650
d/D	2.576	2.772	2.848	2.989	1.117	1.600	2.033
P/d	0.451	0.451	0.469	0.465	0.075	0.198	0.320
Figure No.	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23	2.1.23

Hohler and Stilp (1991a)

Test No.	1309	25	2408	2409	2654	2410	2653
PROJECTILE							
L (mm)	12	15	28	28	28	28	28
D (mm)	12	15	2.8	2.8	2.8	2.8	2.8
L/D	1	1	10	10	10	10	10
M (g)	10.65	20.5	2.93	2.93	2.93	2.93	2.93
Mat'l	C110W1	C110W1	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	7.85	7.85	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	294	294	294	294	294
Elong (%)			8	8	8	8	8
TARGET							
Mat'l	Ger Arm St	Ger Arm St	W8	W8	W8	W8	W8
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	388	388	388	388	388
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2095	922	741	904	1122	1139	1181
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	10.5	5.8	1.2	3.7	8.5	8.9	10.6
d (mm)	26.7	30.5	6.5	7.1	5.1	5.2	5
Vol (cm^3)	4.6	2.8	0.03	0.09	0.19	0.2	0.23
SCALING							
$P/\alpha L$	0.875	0.387	0.029	0.090	0.206	0.216	0.257
P/L	0.875	0.387	0.043	0.132	0.304	0.318	0.379
d/D	2.225	2.033	2.321	2.536	1.821	1.857	1.786
P/d	0.393	0.190	0.185	0.521	1.667	1.712	2.120
Figure No.	2.1.23	2.1.23	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	2414	2652	2415	2419	2599	2597	2650
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	W8	W8	W8	W8	W8	W8	W8
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	388	388	388	388	388	388	388
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1320	1334	1465	2313	2604	2809	3710
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	13.6	14.2	17.8	35.4	36.8	38.9	43.6
d (mm)	5.4	5.3	5.6	7.5		8.5	11.5
Vol (cm^3)	0.36	0.37	0.4	1.05		1.68	3.64
SCALING							
$P/\alpha L$	0.330	0.345	0.432	0.859	0.893	0.944	1.058
P/L	0.486	0.507	0.636	1.264	1.314	1.389	1.557
d/D	1.929	1.893	2.000	2.679		3.036	4.107
P/d	2.519	2.679	3.179	4.720		4.576	3.791
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	2966	2968	2969	2965	2967	2411	2412
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	W8	W8	W8	W8	W8	D17	D17
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	17	17
BHN	388	388	388	388	388	294	294
Elong (%)						8	8
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1702	1721	1966	2250	2416	715	848
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	22.9	23.3	28.9	33	36.2	1.4	2.8
d (mm)	6.1	5.7	6.2	6.8	7.1	5.4	5.7
Vol (cm^3)	0.507	0.528	0.611	1.031	1.167	0.025	0.059
SCALING							
$P/\alpha L$	0.556	0.565	0.701	0.801	0.879	0.050	0.100
P/L	0.818	0.832	1.032	1.179	1.293	0.050	0.100
d/D	2.179	2.036	2.214	2.429	2.536	1.929	2.036
P/d	3.754	4.088	4.661	4.853	5.099	0.259	0.491
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	2413	2416	2418	2420	2456	2655	2657
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Suppiier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	D17	D17	D17	D17	D17	D17	D17
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	17	17	17	17	17	17	17
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1195	1514	1815	2382	1033	1260	544
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	11.2	17.8	21.8	27.5	6.8	12.2	0.5
d (mm)	5.9	7	7.4	8.6	5.1	5.1	3.8
Vol (cm^3)	0.224	0.459	0.63	1.536	0.128	0.294	0.006
SCALING							
$P/\alpha L$	0.400	0.636	0.779	0.982	0.243	0.436	0.018
P/L	0.400	0.636	0.779	0.982	0.243	0.436	0.018
d/D	2.107	2.500	2.643	3.071	1.821	1.821	1.357
P/d	1.898	2.543	2.946	3.198	1.333	2.392	0.132
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	2598	2651	2600	1770	1771	1757	1758
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm³)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	D17	D17	D17	St52	St52	St52	St52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	17	17	17	7.85	7.85	7.85	7.85
BHN	294	294	294	180	180	180	180
Elong (%)	8	8	8	22	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3093	3733	2985	1137	1400	1910	2004
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	31.5	36	30	17.4	26.3	38.3	40.8
d (mm)	10.5	13	9.8	5.1	5.8	7	7.5
Vol (cm³)	2.497	5.271	2.12	0.4	0.58	1.24	1.48
SCALING							
$P/\alpha L$	1.125	1.286	1.071	0.422	0.638	0.930	0.990
P/L	1.125	1.286	1.071	0.621	0.939	1.368	1.457
d/D	3.750	4.643	3.500	1.821	2.071	2.500	2.679
P/d	3.000	2.769	3.061	3.412	4.534	5.471	5.440
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1760	1761	1759	1762	1763	1774	1724
PROJECTILE							
L (mm)	28	28	28	28	28	28	60
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	6
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	28.83
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Elong (%)	22	22	22	22	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2100	2484	2820	3107	3263	3578	434
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	41	44.7	46.2	46	47	48	2.7
d (mm)	8.2	9	10	11	11.1	12	11.6
Vol (cm^3)	1.87	2.61	3.4	3.2	5.28	6.2	0.16
SCALING							
P/αL	0.995	1.085	1.121	1.116	1.141	1.165	0.031
P/L	1.464	1.596	1.650	1.643	1.679	1.714	0.045
d/D	2.929	3.214	3.571	3.929	3.964	4.286	1.933
P/d	5.000	4.967	4.620	4.182	4.234	4.000	0.233
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1723	1682	1683	1681	1684	1680	1685
PROJECTILE							
L (mm)	60	60	60	60	60	60	60
D (mm)	6	6	6	6	6	6	6
L/D	10	10	10	10	10	10	10
M (g)	28.83	28.83	28.83	28.83	28.83	28.83	28.83
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Elong (%)	22	22	22	22	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	523	722	723	993	1183	1201	1346
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	3.3	9.18	9.3	27	38.4	40.8	50
d (mm)	12.8	11.6	11.6	11.6	12.4	11.8	12.5
Vol (cm^3)	0.52	1.22	1.29	2.88	4.24	4.67	5.51
SCALING							
P/αL	0.037	0.104	0.105	0.306	0.435	0.462	0.566
P/L	0.055	0.153	0.155	0.450	0.640	0.680	0.833
d/D	2 133	1.933	1.933	1.933	2.067	1.967	2.083
P/d	0.258	0.791	0.802	2.328	3.097	3.458	4.000
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1686	1719	1688	1689	1720	1721	1806
PROJECTILE							
L (mm)	60	60	60	60	60	60	60
D (mm)	6	6	6	6	6	6	6
L/D	10	10	10	10	10	10	10
M (g)	28.83	28.83	28.83	28.83	28.83	28.83	28.83
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Elong (%)	22	22	22	22	22	22	22
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1464	1478	1591	1696	1756	1912	2232
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	59.2	57.7	66	70.8	75.7	82	89
d (mm)	13.5	12.8	13.5	14	14.5	16.5	18.2
Vol (cm^3)	6.62	6.74	7.8	8.82	10.14	12.3	16.8
SCALING							
$P/\alpha L$	0.670	0.653	0.747	0.802	0.857	0.929	1.008
P/L	0.987	0.962	1.100	1.180	1.262	1.367	1.483
d/D	2.250	2.133	2.250	2.333	2.417	2.750	3.033
P/d	4.385	4.508	4.889	5.057	5.221	4.970	4.890
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1743	2948	2949	2950	2951	2952	2953
PROJECTILE							
L (mm)	60	28	28	28	28	28	28
D (mm)	6	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	28.83	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	St52	Al	Al	Al	Al	Al	Al
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	2.85	2.85	2.85	2.85	2.85	2.85
BHN	180	83	83	83	83	83	83
Elong (%)	22						
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1952	886	460	1170	1660	1244	1772
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	82	31.2	25.7	47	64	60.9	69.1
d (mm)	16	4	3	4.8	6.4	4.8	6.7
Vol (cm^3)	12.66	0.53	0.16	0.99	1.93	0.9	2.24
SCALING							
$P/\alpha L$	0.929	0.456	0.376	0.687	0.936	0.891	1.010
P/L	1.367	1.114	0.918	1.679	2.286	2.175	2.468
d/D	2.667	1.429	1.071	1.714	2.286	1.714	2.393
P/d	5.125	7.800	8.567	9.792	10.000	12.688	10.313
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	2954	2956	2957	2958	2960	2961	2964
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Al	Al	Al	Al	Al	Al	Al
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.85	2.85	2.85	2.85	2.85	2.85	2.85
BHN	83	83	83	83	83	83	83
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1775	1838	2148	2645	2868	3392	3495
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	68	74.1	89.8	100	99.5	101	100
d (mm)	6.2	6.3	7.7	9.7	10.1	12.7	13.2
Vol (cm^3)	2.34	2.32	3.69	6.3	7.29	12.16	12.46
SCALING							
P/αL	0.994	1.084	1.313	1.462	1.455	1.477	1.462
P/L	2.429	2.646	3.207	3.571	3.554	3.607	3.571
d/D	2.214	2.250	2.750	3.464	3.607	4.536	4.714
P/d	10.968	11.762	11.662	10.309	9.851	7.953	7.576
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1948	1949	1950	1951	1952	1953	1957
PROJECTILE							
L (mm)	60	60	60	60	60	60	28
D (mm)	6	6	6	6	6	6	2.8
L/D	10	10	10	10	10	10	10
M (g)	28.83	28.83	28.83	28.83	28.83	28.83	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Al	Al	Al	Al	Al	Al	Al
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.85	2.85	2.85	2.85	2.85	2.85	2.85
BHN	75	75	75	75	75	75	75
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	630	1652	849	1468	1848	2162	2494
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	62	136.1	72.1	129.5	158.2	191.9	99.1
d (mm)	7.5	13.8	8.8	12.2	14.7	16.8	8.2
Vol (cm^3)		17.7	5.8	15.4	29.8	41.5	5.7
SCALING							
$P/\alpha L$	0.4 23	0.929	0.492	0.884	1.080	1.310	1.449
P/L	1.033	2.268	1.202	2.158	2.637	3.198	3.539
d/D	1.250	2.300	1.467	2.033	2.450	2.800	2.929
P/d	8.267	9.862	8.193	10.615	10.762	11.423	12.085
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	4681	4679	4678	4677	4665	4667	4672
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Al	Al	Al	Al	Al	Al	Al
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.85	2.85	2.85	2.85	2.85	2.85	2.85
BHN	77	77	77	77	77	77	77
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	240	369	527	627	1117	1221	1258
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	9.1	19.1	25.2	33.6	42.1	46.2	48
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.133	0.279	0.369	0.491	0.616	0.676	0.702
P/L	0.325	0.682	0.900	1.200	1.504	1.650	1.714
d/D							
P/d							
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	4669	4670	4685	4686	4687	4683	4673
PROJECTILE							
L (mm)	28	28	28	28	28	28	28
D (mm)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Al	Al	Al	Al	Al	Al	Al
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.85	2.85	2.85	2.85	2.85	2.85	2.85
BHN	77	77	77	77	77	77	77
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1427	1525	1865	2000	2036	912	1615
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	61.1	58.2	78	87.4	87.2	32.2	63
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.893	0.851	1.141	1.278	1.275	0.471	0.921
P/L	2.182	2.079	2.786	3.121	3.114	1.150	2.250
d/D							
P/d							
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	2530	2532	2541	2815	2617	4166	4169
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.03	12.03	12.03	12.03	12.03	12.03	12.03
Mat'l	C110W2	C110W2	C110W2	C110W2	C110W2	Marag	Marag
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	217	217	217	217	217	445	445
Elong (%)						10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	997	1579	1831	2029	2312	1737	1945
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	3	23.2	30.8	40.2	44.5	29.8	38.1
d (mm)	12	13	13.7	14.3	15.2	15.7	17.2
Vol (cm^3)	0.42	2.24	3.2	4.5	5.8	2.52	3.59
SCALING							
P/αL	0.052	0.400	0.531	0.693	0.767	0.514	0.657
P/L	0.052	0.400	0.531	0.693	0.767	0.514	0.657
d/D	2.069	2.241	2.362	2.466	2.621	2.707	2.966
P/d	0.250	1.785	2.248	2.811	2.928	1.898	2.215
Figure No.	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26

Hohler and Stilp (1991a)

Test No.	4167	4170	4168	4107	4108	4105	4109
PROJECTILE							
L (mm)	58	58	58	116	116	116	116
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	20	20	20	20
M (g)	12.03	12.03	12.03	24.05	24.05	24.05	24.05
Mat'l	Marag	Marag	Marag	Marag	Marag	Marag	Marag
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	445	445	445	445	445	445	445
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1890	2109	2400	1733	1904	2000	2117
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	35.3	43.2	46.6	54.2	64	70.8	79.4
d (mm)	18.5	20	20.3	18.1	21.7	22.6	23.8
Vol (cm^3)	3.32	4.67	5.64	4.38	5.74	7.03	8.27
SCALING							
$P/\alpha L$	0.609	0.745	0.803	0.467	0.552	0.610	0.684
P/L	0.609	0.745	0.803	0.467	0.552	0.610	0.684
d/D	3.190	3.448	3.500	3.121	3.741	3.897	4.103
P/d	1.908	2.160	2.296	2.994	2.949	3.133	3.336
Figure No.	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26

Hohler and Stilp (1991a)

Test No.	4110	4834	4829	4830	4833	4836	4831
PROJECTILE							
L (mm)	116	12	12	12	12	12	12
D (mm)	5.8	12	12	12	12	12	12
L/D	20	1	1	1	1	1	1
M (g)	24.05	10.65	10.65	10.65	10.65	10.65	10.65
Mat'l	Marag	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	445	540	540	540	540	540	540
Elong (%)	10	11	11	11	11	11	11
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2156	992	1450	1709	2085	2538	2800
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	85.8	5.4	7.8	10.5	11.9	14.8	16.9
d (mm)	21.1	18.6	22.5	24.3	27.5	31	32.8
Vol (cm^3)	9.11	0.65	2	3.1	4.8	7.1	9.1
SCALING							
$P/\alpha L$	0.740	0.450	0.650	0.875	0.992	1.233	1.408
P/L	0.740	0.450	0.650	0.875	0.992	1.233	1.408
d/D	3.638	1.550	1.875	2.025	2.292	2.583	2.733
P/d	4.066	0.290	0.347	0.432	0.433	0.477	0.515
Figure No.	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26

Hohler and Stilp (1991a)

Test No.	4837	4838	4875	4877	4878	4879	4885
PROJECTILE							
L (mm)	12	12	12	12	12	12	12
D (mm)	12	12	12	12	12	12	12
L/D	1	1	1	1	1	1	1
M (g)	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Mat'l	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	540	540	540	540	540	540	540
Elong (%)	11	11	11	11	11	11	11
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3122	3236	3532	3760	3945	4069	4291
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	17.9	19.5			19.3	19.3	20.6
d (mm)	37	36	37	39	41	41.5	43
Vol (cm³)	11.8	12.8	13.7	14.3	16	16.8	20.1
SCALING							
P/αL	1.492	1.625			1.608	1.608	1.717
P/L	1.492	1.625			1.608	1.608	1.717
d/D	3.083	3.000	3.083	3.250	3.417	3.458	3.583
P/d	0.484	0.542			0.471	0.465	0.479
Figure No.	2.1.26	2.1.26	--	--	2.1.26	2.1.26	2.1.26

Hohler and Stilp (1991a)

Test No.	5137	5141	5142	5143	5145	5146	5151
PROJECTILE							
L (mm)	108	108	108	108	157	157	157
D (mm)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
L/D	22	22	22	22	32	32	32
M (g)	16	16	16	16	23.3	23.3	23.3
Mat'l	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	540	540	540	540	534	534	534
Elong (%)	11	11	11	11	11	11	11
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	253	253	253
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1038	915	1285	1433	1337	1213	1511
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	6.6	6.2	17.2	26.6	25.7	18.7	41.2
d (mm)							
Vol (cm^3)	0.45	0.25	1.07	1.66	1.77	1.28	2.77
SCALING							
P/αL	0.061	0.057	0.159	0.246	0.164	0.119	0.262
P/L	0.061	0.057	0.159	0.246	0.164	0.119	0.262
d/D							
P/d							
Figure No.	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26

Hohler and Stilp (1991a)

Test No.	5152	5160	4865	4866	4867	4868	4882
PROJECTILE							
L (mm)	157	157	54	54	54	54	54
D (mm)	4.9	4.9	5.4	5.4	5.4	5.4	.4
L/D	32	32	10	10	10	10	10
M (g)	23.3	23.3	9.7	9.7	9.7	9.7	9.7
Mat'l	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo	35CrNiMo
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	534	534	540	540	540	540	540
Elong (%)	11	11	11	11	11	11	11
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	253	253	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1619	2133	2251	2456	2714	3046	3260
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	47.5	95.6	41	44.7	48.6	52	56.8
d (mm)			13.5	15.4	15.5	17	18
Vol (cm^3)	2.83	6.3	3.5	4.5	5.4	7.1	9.7
SCALING							
$P/\alpha L$	0.303	0.609	0.759	0.828	0.900	0.963	1.052
P/L	0.303	0.609	0.759	0.828	0.900	0.963	1.052
d/D			2.500	2.852	2.870	3.148	3.333
P/d			3.037	2.903	3.135	3.059	3.156
Figure No.	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26	2.1.26

Hohler and Stilp (1991a)

Test No.	4881	4883	4884	5121	5122	5123	5124
PROJECTILE							
L (mm)	54	54	54	58	58	58	58
D (mm)	5.4	5.4	5.4	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	9.7	9.7	9.7	12.03	12.03	12.03	12.03
Mat'l	35CrNiMo	35CrNiMo	35CrNiMo	steel	steel	steel	steel
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	540	540	540	644	644	442	442
Elong (%)	11	11	11				
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3602	3863	4052	1141	1032	1617	1437
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	56.6	59.3	59.2	12	10	26	18.9
d (mm)	18.5	19.5	21.5				
Vol (cm³)	12.3	15.4	17.4	0.89	0.58	2.13	1.6
SCALING							
$P/\alpha L$	1.048	1.098	1.096	0.207	0.172	0.448	0.326
P/L	1.048	1.098	1.096	0.207	0.172	0.448	0.326
d/D	3.426	3.611	3.981				
P/d	3.059	3.041	2.753				
Figure No.	2.1.26	2.1.26	2.1.26	--	--	--	--

Hohler and Stilp (1991a)

Test No.	5125	1772	1773	1767	1766	1765	1764
PROJECTILE							
L (mm)	58	28	28	28	28	28	28
D (mm)	5.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	12.03	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	steel	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	7.85	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	442	294	294	294	294	294	294
Elong (%)		8	8	8	8	8	8
TARGET							
Mat'l	HzB,A	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1000	1273	1497	2117	2549	2814	3397
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	5.6	16.3	21.5	35.4	39.2	40.8	43
d (mm)		4.9	5.2	6.7	7.4	8.1	9.1
Vol (cm^3)	0.4	0.26	0.4	0.97	1.35	1.89	2.36
SCALING							
$P/\alpha L$	0.097	0.396	0.522	0.859	0.951	0.990	1.044
P/L	0.097	0.582	0.768	1.264	1.400	1.457	1.536
d/D		1.750	1.857	2.393	2.643	2.893	3.250
P/d		3.327	4.135	5.284	5.297	5.037	4.725
Figure No.	--	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1775	1730	1734	1733	1732	1731	1791
PROJECTILE							
L (mm)	28	60	60	60	60	60	60
D (mm)	2.8	6	6	6	6	6	6
L/D	10	10	10	10	10	10	10
M (g)	2.93	28.83	28.83	28.83	28.83	28.83	28.83
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm³)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3760	407	646	829	835	885	1348
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	45	1.2	4.3	8.9	9.4	10.7	39.2
d (mm)	10.1	9		11.5	11.4	11.4	11.2
Vol (cm³)	3.46	0.05	0.42	0.98	1	1.12	3.05
SCALING							
P/αL	1.092	0.014	0.049	0.101	0.106	0.121	0.444
P/L	1.607	0.020	0.072	0.148	0.157	0.178	0.653
d/D	3.607	1.500		1.917	1.900	1.900	1.867
P/d	4.455	0.133		0.774	0.825	0.939	3.500
Figure No.	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24	2.1.24

Hohler and Stilp (1991a)

Test No.	1792	1735	2512	2934	2531	2594	2618
PROJECTILE							
L (mm)	60	60	58	58	58	58	58
D (mm)	6	6	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	28.83	28.83	23.74	23.74	23.74	23.74	23.74
Mat'l	D17	D17	Elmet	Elmet	Elmet	Elmet	Elmet
Supplier							
ρ (g/cm^3)	17	17	15.5	15.5	15.5	15.5	15.5
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	246	246	246	246	246
Elong (%)	8	8					
TARGET							
Mat'l	Ger Arm St	Ger Arm St	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1835	975	990	1403	1468	1836	2182
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	68	15.5	16.6	41	42.9	59.2	69.1
d (mm)	13	11	11.2	12.6	12.7	14	15.7
Vol (cm^3)	6.63	1.31	1.6	3.55	3.86	6.4	10
SCALING							
$P/\alpha L$	0.770	0.176	0.204	0.503	0.526	0.726	0.848
P/L	1.133	0.258	0.286	0.707	0.740	1.021	1.191
d/D	2.167	1.833	1.931	2.172	2.190	2.414	2.707
P/d	5.231	1.409	1.482	3.254	3.378	4.229	4.401
Figure No.	2.1.24	2.1.24	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2757	2913	2792	2919	2800	2819	2438
PROJECTILE							
L (mm)	58	58	58	58	58	58	60
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	6
L/D	10	10	10	10	10	10	10
M (g)	26.5	26.5	26.5	26.5	26.5	26.5	28.83
Mat'l	D17K	D17K	D17K	D17K	D17K	D17K	D17
Supplier							
ρ (g/cm^3)	17.3	17.3	17.3	17.3	17.3	17.3	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	284	284	284	284	284	284	303
Elong (%)	3.5	3.5	3.5	3.5	3.5	3.5	8
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1076	1367	1511	1554	1830	2113	979
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	23.1	41.4	52	53	63.9	71.4	18
d (mm)	11	11.8	12.2	12.3	13.2	14	11.4
Vol (cm^3)	2.14	3.7	4.3	4.71	6.57	9.4	1.88
SCALING							
$P/\alpha L$	0.268	0.481	0.604	0.616	0.742	0.829	0.204
P/L	0.398	0.714	0.897	0.914	1.102	1.231	0.300
d/D	1.897	2.034	2.103	2.121	2.276	2.414	1.900
P/d	2.100	3.508	4.262	4.309	4.841	5.100	1.579
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2905	2903	2909	2911	2430	3140	2920
PROJECTILE							
L (mm)	58	58	58	58	60	87	58
D (mm)	5.8	5.8	5.8	5.8	6	8.7	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.04	26.04	26.04	26.04	28.83	87.88	26.04
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	303	303	303	303	303	303	303
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1001	1076	1208	1367	1399	1475	1503
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	20	22	32.3	42.2	42.8	74	49
d (mm)	11	11.4	11.7	12.2	12.7	19	12.5
Vol (cm^3)	1.91	2.1	2.73	3.73	4.14	15.19	4.49
SCALING							
$P/\alpha L$	0.234	0.258	0.378	0.494	0.485	0.578	0.574
P/L	0.345	0.379	0.557	0.728	0.713	0.851	0.845
d/D	1.897	1.966	2.017	2.103	2.117	2.184	2.155
P/d	1.818	1.930	2.761	3.459	3.370	3.895	3.920
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2533	2924	2538	2604	2619	2789	2791
PROJECTILE							
L (mm)	58	58	58	58	58	116	116
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	20	20
M (g)	26.04	26.04	26.04	26.04	26.04	52.08	52.08
Mat'l	D17	D17	D17	D17	D17	D17	D17
Supplier							
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	303	303	303	303	303	303	303
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1534	1624	1836	1978	2147	951	1203
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	50.2	57	64	69	73.7	20.6	47.2
d (mm)	12.6	12.9	13.5	14	14.8	11	11.8
Vol (cm^3)	4.75	5.61	7.14	8.3	10.02	2	3.84
SCALING							
P/αL	0.588	0.668	0.750	0.808	0.863	0.121	0.276
P/L	0.866	0.983	1.103	1.190	1.271	0.178	0.407
d/D	2.172	2.224	2.328	2.414	2.552	1.897	2.034
P/d	3.984	4.419	4.741	4.929	4.980	1.873	4.000
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2810	2440	2787	2917	2433	2796	2925
PROJECTILE							
L (mm)	116	60	60	60	60	60	60
D (mm)	5.8	6	6	6	6	6	6
L/D	20	10	10	10	10	10	10
M (g)	52.08	32.73	32.73	32.73	32.73	32.73	32.73
Mat'l	D17	W	W	W	W	W	W
Supplier							
ρ (g/cm^3)	17	19.3	19.3	19.3	19.3	19.3	19.3
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	303	433	433	433	433	433	433
Elong (%)	8	0.15	0.15	0.15	0.15	0.15	0.15
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1363	992	1025	1354	1373	1487	1570
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	67.3	21.6	24.4	48.8	47.5	56.7	64
d (mm)	11.8	10.9	11	12.1	12.2	12.5	12.9
Vol (cm^3)	5.4	2	2.2	4.11	4.34	5.1	5.84
SCALING							
P/αL	0.394	0.230	0.259	0.519	0.505	0.603	0.680
P/L	0.580	0.360	0.407	0.813	0.792	0.945	1.067
d/D	2.034	1.817	1.833	2.017	2.033	2.083	2.150
P/d	5.703	1.982	2.218	4.033	3.893	4.536	4.961
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2593	2821	3226	3230	3235	3238	3242
PROJECTILE							
L (mm)	60	60	58	58	58	58	58
D (mm)	6	6	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	32.73	32.73	23.74	23.74	23.74	23.74	23.74
Mat'l	W	W	W75	W75	W75	W75	W75
Supplier							
ρ (g/cm^3)	19.3	19.3	15.5	15.5	15.5	15.5	15.5
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	433	433	250	250	250	250	250
Elong (%)	0.15	0.15	22	22	22	22	22
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1846	2089	1024	1310	1538	1736	1926
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	77.4	83.5	19.3	35.3	47.1	57	66
d (mm)	14	14.8	11	11.8	12.5	13.2	13.7
Vol (cm^3)	8.5	10.48	1.709	3.172	4.717	6.132	8.037
SCALING							
P/αL	0.823	0.888	0.237	0.433	0.578	0.699	0.810
P/L	1.290	1.392	0.333	0.609	0.812	0.983	1.138
d/D	2.333	2.467	1.897	2.034	2.155	2.276	2.362
P/d	5.529	5.642	1.755	2.992	3.768	4.318	4.818
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	3246	3227	3231	3236	3239	3243	3247
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	23.74	26.04	26.04	26.04	26.04	26.04	26.04
Mat'l	W75	W90	W90	W90	W90	W90	W90
Supplier							
ρ (g/cm^3)	15.5	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	250	260	260	260	260	260	260
Elong (%)	22						
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2134	1014	1314	1500	1713	1925	2100
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	68.5	20	39.2	50.5	61.9	70.2	73
d (mm)	14.2	11	11.8	12.3	13	13.5	14.1
Vol (cm^3)	8.691	2.168	3.877	5.139	6.888	8.464	9.223
SCALING							
$P/\alpha L$	0.840	0.234	0.459	0.592	0.725	0.822	0.855
P/L	1.181	0.345	0.676	0.871	1.067	1.210	1.259
d/D	2.448	1.897	2.034	2.121	2.241	2.328	2.431
P/d	4.824	1.818	3.322	4.106	4.762	5.200	5.177
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	3225	3234	3240	3245	2439	2907	2914
PROJECTILE							
L (mm)	58	58	58	58	60	58	58
D (mm)	5.8	5.8	5.8	5.8	6	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	27.57	27.57	27.57	27.57	30.52	27.57	27.57
Mat'l	D18	D18	D18	D18	D18	D18	D18
Supplier							
ρ (g/cm^3)	18	18	18	18	18	18	18
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	303	303	303	303	303	303	303
Elong (%)	7.5	7.5	7.5	7.5	7.5	7.5	7.5
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1032	1506	1842	2159	990	1011	1354
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	22	51.8	70.1	76.9	20.7	23	43
d (mm)	11	12.5	13.5	14.3	11	10.8	11.6
Vol (cm^3)	2.266	5.133	8.283	10.123	1.98	1.9	3.52
SCALING							
P/αL	0.250	0.590	0.798	0.876	0.228	0.262	0.490
P/L	0.379	0.893	1.209	1.326	0.345	0.397	0.741
d/D	1.897	2.155	2.328	2.466	1.833	1.862	2.000
P/d	2.000	4.144	5.193	5.378	1.882	2.130	3.707
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2431	2534	2539	2816	2985	2894	2893
PROJECTILE							
L (mm)	60	58	58	58	58	58	58
D (mm)	6	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	30.52	27.57	27.57	27.57	27.57	27.57	27.57
Mat'l	D18	D18	D18	D18	D18	D18	D18
Supplier							
ρ (g/cm³)	18	18	18	18	18	18	18
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	303	303	303	303	303	303	303
Elong (%)	7.5	7.5	7.5	7.5	7.5	7.5	7.5
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1399	1478	1789	2109	1086	1526	1728
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	46.1	50.8	64.9	73.8	26.9	54.8	65.3
d (mm)	12.1	12.1	13	14	11	12.2	12.8
Vol (cm³)	4.19	4.5	7	9.3	2.28	4.8	6.4
SCALING							
$P/\alpha L$	0.507	0.578	0.739	0.840	0.306	0.624	0.744
P/L	0.768	0.876	1.119	1.272	0.464	0.945	1.126
d/D	2.017	2.086	2.241	2.414	1.897	2.103	2.207
P/d	3.810	4.198	4.992	5.271	2.445	4.492	5.102
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2892	2758	2915	2794	2801	2820	2441
PROJECTILE							
L (mm)	58	58	58	58	58	58	60
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	6
L/D	10	10	10	10	10	10	10
M (g)	27.57	27.57	27.57	27.57	27.57	27.57	31.37
Mat'l	D18	D18	D18	D18	D18	D18	D18.5
Supplier							
ρ (g/cm^3)	18	18	18	18	18	18	18.5
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	303	303	303	303	303	303	308
Elong (%)	7.5	7.5	7.5	7.5	7.5	7.5	4.5
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2046	1075	1359	1514	1820	2087	976
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	73.5	25	44.3	51.5	67.2	74.4	20.4
d (mm)	13.5	10.5	11.7	12.4	13.5	14.8	11.1
Vol (cm^3)	8.78	2.3	3.75	4.56	6.75	9.3	2.22
SCALING							
$P/\alpha L$	0.837	0.285	0.504	0.586	0.765	0.847	0.221
P/L	1.267	0.431	0.764	0.888	1.159	1.283	0.340
d/D	2.328	1.810	2.017	2.138	2.328	2.552	1.850
P/d	5.444	2.381	3.786	4.153	4.978	5.027	1.838
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2908	2435	2916	2432	2535	2540	2817
PROJECTILE							
L (mm)	58	60	58	60	58	58	58
D (mm)	5.8	6	5.8	6	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	28.34	31.37	28.34	31.37	28.34	28.34	28.34
Mat'l	D18.5	D18.5	D18.5	D18.5	D18.5	D18.5	D18.5
Supplier							
ρ (g/cm^3)	18.5	18.5	18.5	18.5	18.5	18.5	18.5
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	308	308	308	308	308	308	308
Elong (%)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1023	1357	1364	1377	1525	1849	2101
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	23.9	44.8	45.1	45.2	53	69.9	78.1
d (mm)	10.8	12.3	11.8	12.3	12.4	13.5	14.2
Vol (cm^3)	2.03	4.01	3.67	4.4	4.56	7.23	9
SCALING							
P/αL	0.268	0.486	0.507	0.491	0.595	0.785	0.877
P/L	0.412	0.747	0.778	0.753	0.914	1.205	1.347
d/D	1.862	2.050	2.034	2.050	2.138	2.328	2.448
P/d	2.213	3.642	3.822	3.675	4.274	5.178	5.500
Figure No.	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27	2.1.27

Hohler and Stilp (1991a)

Test No.	2764	2795	2806	2814	2809	2765	2797
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	22.21	22.21	22.21	22.21	22.21	22.67	22.67
Mat'l	H01T	H01T	H01T	H01T	H01T	H01T	H01T
Supplier							
ρ (g/cm³)	14.5	14.5	14.5	14.5	14.5	14.8	14.8
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	1400	1400	1400	1400	1400	1345	1345
Elong (%)	very low	very low	very low	very low	very low	very low	very low
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1087	1532	1829	2114	2200	1079	1525
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	21.6	43.3	58.2	70	72.2	21	42.5
d (mm)	11	11.6	12	12.4	12.5	11	12
Vol (cm³)	1.7	3.8	5.3	7.5	8.3	1.8	3.98
SCALING							
P/αL	0.274	0.549	0.738	0.888	0.916	0.264	0.534
P/L	0.372	0.747	1.003	1.207	1.245	0.362	0.733
d/D	1.897	2.000	2.069	2.138	2.155	1.897	2.069
P/d	1.964	3.733	4.850	5.645	5.776	1.909	3.542
Figure No.	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28

Hohler and Stilp (1991a)

Test No.	2807	2808	2442	2436	2537	2803	2811
PROJECTILE							
L (mm)	58	58	60	60	60	58	58
D (mm)	5.8	5.8	6	6	6	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	22.67	22.67	22.89	22.89	22.89	20.68	20.68
Mat'l	H01T	H01T	H60T	H60T	H60T	H60T	H60T
Supplier							
ρ (g/cm^3)	14.8	14.8	13.5	13.5	13.5	13.5	13.5
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	1345	1345	883	883	883	883	883
Elong (%)	very low	very low	very low	very low	very low	very low	very low
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1796	2115	1020	1407	1552	1792	2102
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	60.4	69	19.1	39.6	47.5	57.2	72
d (mm)	12.7	13.5	11.5	12.6	12.8	13.3	14.3
Vol (cm^3)	5.8	8.9	2	3.7	4.6	5.9	8.5
SCALING							
P/αL	0.758	0.866	0.243	0.503	0.604	0.752	0.947
P/L	1.041	1.190	0.318	0.660	0.792	0.986	1.241
d/D	2.190	2.328	1.917	2.100	2.133	2.293	2.466
P/d	4.756	5.111	1.661	3.143	3.711	4.301	5.035
Figure No.	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28

Hohler and Stilp (1991a)

Test No.	2813	2443	2444	2799	2804	2812	4845
PROJECTILE							
L (mm)	58	60	60	58	58	58	9
D (mm)	5.8	6	6	5.8	5.8	5.8	9
L/D	10	10	10	10	10	10	1
M (g)	20.68	22.89	22.89	20.68	20.68	20.68	10.07
Mat'l	H60T	H70T	H70T	H70T	H70T	H70T	D17.6
Supplier							
ρ (g/cm^3)	13.5	13.5	13.5	13.5	13.5	13.5	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	883	806	806	806	806	806	406
Elong (%)	very low	very low	very low	very low	very low	very low	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2126	1029	1436	1530	1819	2139	1067
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	75	17.9	40	47	58.5	73	9.2
d (mm)	14.5	11.5	12.9	12.7	13.9	15	
Vol (cm^3)	8.6	1.9	3.97	4.14	6	8.4	0.9
SCALING							
$P/\alpha L$	0.986	0.227	0.508	0.618	0.769	0.960	0.683
P/L	1.293	0.298	0.667	0.810	1.009	1.259	1.022
d/D	2.500	1.917	2.150	2.190	2.397	2.586	
P/d	5.172	1.557	3.101	3.701	4.209	4.867	
Figure No.	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28	2.1.28	2.1.25

Hohler and Stilp (1991a)

Test No.	4846	4847	4844	4843	4841	4849	4850
PROJECTILE							
L (mm)	9	9	9	9	9	9	9
D (mm)	9	9	9	9	9	9	9
L/D	1	1	1	1	1	1	1
M (g)	10.07	10.07	10.07	10.07	10.07	10.07	10.07
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1244	1385	1648	2093	2368	3203	3550
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	10.8	10.4	12.4	17	19.8	24	
d (mm)	15.5	17	18.5	22	23	32.5	31
Vol (cm^3)	1.4	2.1	2.9	4.8	7.1	12.3	14.2
SCALING							
$P/\alpha L$	0.801	0.772	0.920	1.261	1.469	1.781	
P/L	1.200	1.156	1.378	1.889	2.200	2.667	
d/D	1.722	1.889	2.056	2.444	2.556	3.611	3.444
P/d	0.697	0.612	0.670	0.773	0.861	0.738	
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	--

Hohler and Stilp (1991a)

Test No.	4851	4852	4888	4859	4860	4871	4862
PROJECTILE							
L (mm)	9	9	9	41.7	41.7	41.7	41.7
D (mm)	9	9	9	4.17	4.17	4.17	4.17
L/D	1	1	1	10	10	10	10
M (g)	10.07	10.07	10.07	10.02	10.02	10.02	10.02
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3650	3663	3845	1909	2065	2217	2436
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	24	24.6	24.6	49.9	54.7	56	59.8
d (mm)	31	30.5	40	10	10.6	10.5	11.5
Vol (cm^3)	14.6	15.3	17.5	2.6	3.3	3.7	4.7
SCALING							
P/αL	1.781	1.825	1.825	0.799	0.876	0.897	0.958
P/L	2.667	2.733	2.733	1.197	1.312	1.343	1.434
d/D	3.444	3.389	4.444	2.398	2.542	2.518	2.758
P/d	0.774	0.807	0.615	4.990	5.160	5.333	5.200
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	4861	4870	4869	4864	4863	5002	5003
PROJECTILE							
L (mm)	41.7	41.7	41.7	41.7	41.7	36	36
D (mm)	4.17	4.17	4.17	4.17	4.17	4	4
L/D	10	10	10	10	10	9	9
M (g)	10.02	10.02	10.02	10.02	10.02	7.96	7.96
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2595	2690	2772	2839	2980	3703	3906
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	61.6	61.6	62	61.2	61.8	50	51.5
d (mm)	13	12.5	12	13.2	12	14.5	14.4
Vol (cm^3)	6.3	6.2	6.8	7.1	8.3	7	8.1
SCALING							
$P/\alpha L$	0.987	0.987	0.993	0.980	0.990	0.928	0.955
P/L	1.477	1.477	1.487	1.468	1.482	1.389	1.431
d/D	3.118	2.998	2.878	3.165	2.878	3.625	3.600
P/d	4.738	4.928	5.167	4.636	5.150	3.448	3.576
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	5004	5126	5127	5128	5130	3228	3229
PROJECTILE							
L (mm)	36	58	58	58	58	58	58
D (mm)	4	5.8	5.8	5.8	5.8	5.8	5.8
L/D	9	10	10	10	10	10	10
M (g)	7.96	26.96	26.96	26.96	26.96	26.96	26.96
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3449	684	641	528	1034	1005	1306
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	50	5.3	4.1	2.4	23.2	22.8	40.8
d (mm)	11.5					11	11.7
Vol (cm^3)	5.9	0.45	0.35	0.15	2.1	2.092	3.624
SCALING							
P/αL	0.928	0.061	0.047	0.028	0.267	0.263	0.470
P/L	1.389	0.091	0.071	0.041	0.400	0.393	0.703
d/D	2.875					1.897	2.017
P/d	4.348					2.073	3.487
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	3233	3237	3241	3244	2899	2910	2912
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.96	26.96	26.96	26.96	26.96	26.96	26.96
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1502	1632	1909	2134	1085	1195	1365
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	52.9	60	74	76.5	27	33.2	43.9
d (mm)	12.3	12.7	13.6	14.2	10.6	11	11.7
Vol (cm^3)	4.973	6.068	8.612	9.398	2.2	2.86	3.56
SCALING							
$P/\alpha L$	0.609	0.691	0.852	0.881	0.311	0.382	0.505
P/L	0.912	1.034	1.276	1.319	0.466	0.572	0.757
d/D	2.121	2.190	2.345	2.448	1.828	1.897	2.017
P/d	4.301	4.724	5.441	5.387	2.547	3.018	3.752
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	2918	2898	2971	2897	2900	2922	2974
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.96	26.96	26.96	26.96	26.96	26.96	26.96
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm³)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1533	1535	1584	1742	1819	1837	1846
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	54	54.2	56.2	65	69	70.9	69.9
d (mm)	12.3	12.2	12.6	13.3	13.4	13.5	13.6
Vol (cm³)	4.79	4.74	5.23	6.6	6.99	7.03	7.21
SCALING							
P/αL	0.622	0.624	0.647	0.748	0.795	0.816	0.805
P/L	0.931	0.934	0.969	1.121	1.190	1.222	1.205
d/D	2.121	2.103	2.172	2.293	2.310	2.328	2.345
P/d	4.390	4.443	4.460	4.887	5.149	5.252	5.140
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	2972	2976	2975	2977	2896	2973	2927
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.96	26.96	26.96	26.96	26.96	26.96	26.96
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1919	1930	1980	1982	2046	2083	2106
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	72	70.5	73.5	75	75	75.2	77.3
d (mm)	14	14.2	14.4	14.3	14.5	14.6	14.6
Vol (cm^3)	7.43	7.95	8.75	8.83	8.97	9.3	9.75
SCALING							
$P/\alpha L$	0.829	0.812	0.846	0.864	0.864	0.866	0.890
P/L	1.241	1.216	1.267	1.293	1.293	1.297	1.333
d/D	2.414	2.448	2.483	2.466	2.500	2.517	2.517
P/d	5.143	4.965	5.104	5.245	5.172	5.151	5.295
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	4096	4098	4104	4103	4342	4458	4099
PROJECTILE							
L (mm)	101.5	101.5	101.5	101.5	94.5	102.14	116
D (mm)	5.8	5.8	5.8	5.8	5.8	6.27	5.8
L/D	17.5	17.5	17.5	17.5	16.29	16.29	20
M (g)	47.17	47.17	47.17	47.17	43.92	55.48	53.92
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm³)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq ( )	0	0	0	0	0	0	0
IMPACT							
V (m/s)	700	1700	1828	1906	1700	1582	1653
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	95.3	99.2	110.5	118	92.5	94	108
d (mm)	12.7	12.8	14.5	14.5		14.8	12.6
Vol (cm³)	8.48	9.62	12.46	13.58		10.73	9.92
SCALING							
P/αL	0.627	0.653	0.727	0.776	0.654	0.615	0.622
P/L	0.939	0.977	1.089	1.163	0.979	0.920	0.931
d/D	2.190	2.20[illegible]	2.500	2.500		2.360	2.172
P/d	7.504	7.750	7.621	8.138		6.351	8.571
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.[illegible]	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	4102	4919	4136	4138	4172	4163	4164
PROJECTILE							
L (mm)	116	124	125.86	125.86	107.8	107.8	107.8
D (mm)	5.8	6.2	5.8	5.8	4.9	4.9	4.9
L/D	20	20	21.7	21.7	22	22	22
M (g)	53.92	65.86	58.5	58.5	35.76	35.76	35.76
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1790	1737	1725	1740	2023	2048	2049
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	118	129.6	113.3	121.3	124.4	131.1	130.2
d (mm)	13.5	14	12.5	12.7	11.4	11.1	12.2
Vol (cm^3)	12.12	14.8	10.4	11.62	10.55	11.52	11.66
SCALING							
$P/\alpha L$	0.679	0.698	0.601	0.644	0.771	0.812	0.807
P/L	1.017	1.045	0.900	0.964	1.154	1.216	1.208
d/D	2.328	2.258	2.155	2.190	2.327	2.265	2.490
P/d	8.741	9.257	9.064	9.551	10.912	11.811	10.672
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	4157	4171	5131	5135	5154	5155	5133
PROJECTILE							
L (mm)	107.8	107.8	110.25	110.25	110.25	110.25	110.25
D (mm)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
L/D	22	22	22.5	22.5	22.5	22.5	22.5
M (g)	35.76	35.76	36.57	36.57	36.57	36.57	36.57
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2063	2162	1015	1299	1164	1403	1126
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	127.8	133.4	22.9	48.5	42	70.8	30
d (mm)	10.9	12.7					
Vol (cm^3)	10.51	12.31	1.51	2.77	2.77	4.52	1.91
SCALING							
$P/\alpha L$	0.792	0.826	0.139	0.294	0.254	0.429	0.182
P/L	1.186	1.237	0.208	0.440	0.381	0.642	0.272
d/D	2.224	2.592					
P/d	11.725	10.504					
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stiip (1991a)

Test No.	5136	5149	5150	5156	4402	4459	4460
PROJECTILE							
L (mm)	156.8	156.8	156.8	156.8	163.2	163.2	163.2
D (mm)	4.9	4.9	4.9	4.9	5.1	5.1	5.1
L/D	32	32	32	32	32	32	32
M (g)	52.01	52.01	52.01	52.01	58.65	58.65	58.65
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	406	406	406	406	406	406	406
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A	HzB,A
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	255	255	255	255	255	255	255
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1007	1213	1325	1407	1590	1690	1771
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
RESULTS							
P (mm)	22.4	46	60.1	67.9	108.1	122	131.6
d (mm)					12.3	11.3	11.7
Vol (cm^3)	1.5	3.38	4.8	5.5	9.37	11.65	10.8
SCALING							
$P/\alpha L$	0.095	0.196	0.256	0.289	0.442	0.499	0.539
P/L	0.143	0.293	0.383	0.433	0.662	0.748	0.806
d/D					2.412	2.216	2.294
P/d					8.789	10.796	11.248
Figure No.	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25	2.1.25

Hohler and Stilp (1991a)

Test No.	**4461**
PROJECTILE	
L (mm)	163.2
D (mm)	5.1
L/D	32
M (g)	58.65
Mat'l	D17.6
Supplier	
ρ (g/cm³)	17.6
Nose	Flat
BHN	406
Elong (%)	10
TARGET	
Mat'l	HzB,A
Thick (mm)	---
ρ (g/cm³)	7.85
BHN	255
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	1903
Yaw (deg)	<1
RESULTS	
P (mm)	175.5
d (mm)	13.6
Vol (cm³)	14.91
SCALING	
P/αL	0.718
P/L	1.075
d/D	2.667
P/d	12.904
Figure No.	2.1.25

Hohler and Stilp (1991b)

Test No.	6536	6537	6545	6524	6517	6516	6538
PROJECTILE							
L (mm)	5.8	5.8	5.80	5.80	5.80	5.80	17.40
D (mm)	5.8	5.8	5.80	5.80	5.80	5.80	5.80
L/D	1.00	1.00	1.00	1.00	1.00	1.00	3.00
M (g)	2.70	2.70	2.70	2.70	2.70	2.70	8.09
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.60	17.60	17.60	17.60	17.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	397	397	397	397	397	397	397
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TARGET							
Mat'l	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	290	290	290	290	290	290	290
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2281	2291	2602	3459	3480	3652	2305
Yaw (deg)							
RESULTS							
P (mm)	11.0	11.2	13.2	14.4	14.8	15.0	---
d (mm)	14.5	14.5	17.0	23.5	22.0	22.5	---
Vol (cm^3)	1.5	1.5	1.9	3.8	3.8	4.3	4.1
SCALING							
P/αL	1.267	1.290	1.520	1.658	1.704	1.727	---
P/L	1.897	1.931	2.276	2.483	2.552	2.586	---
d/D	2.500	2.500	2.931	4.052	3.793	3.879	---
P/d	0.759	0.772	0.776	0.613	0.673	0.667	---
Figure No.	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29	---

Hohler and Stilp (1991b)

Test No.	6539	6559	6576	6569	6543	6540	6573
PROJECTILE							
L (mm)	17.40	17.40	17.40	17.40	29.00	29.00	29.00
D (mm)	5.80	5.80	5.80	5.80	5.80	5.80	5.80
L/D	3.00	3.00	3.00	3.00	5.00	5.00	5.00
M (g)	8.09	8.09	8.09	8.09	13.49	13.49	13.49
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.60	17.60	17.60	17.60	17.60	17.60	17.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	397	397	397	397	397	397	397
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TARGET							
Mat'l	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	290	290	290	290	290	290	290
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2400	2513	3448	3555	2494	2803	3128
Yaw (deg)							
RESULTS							
P (mm)	29.5	28.6	31.2	32.6	45.0	45.8	47.8
d (mm)	14.0	15.0	20.0	22.0	16.5	17.0	22.5
Vol (cm^3)	4.9	4.9	10.4	11.2	7.3	10.1	15.2
SCALING							
$P/\alpha L$	1.132	1.098	1.198	1.251	1.036	1.055	1.101
P/L	1.695	1.644	1.793	1.874	1.552	1.579	1.648
d/D	2.414	2.586	3.448	3.793	2.845	2.931	3.879
P/d	2.107	1.907	1.560	1.482	2.727	2.694	2.124
Figure No.	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29

Hohler and Stilp (1991b)

Test No.	6575	6577	6556	6508	6621	6609	6619
PROJECTILE							
L (mm)	29.00	40.60	40.60	29.40	29.40	42.00	42.00
D (mm)	5.80	5.80	5.80	4.20	4.20	4.20	4.20
L/D	5.00	7.00	7.00	7.00	7.00	10.00	10.00
M (g)	13.49	18.88	18.88	7.17	7.17	10.24	10.24
Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.60	17.60	17.60	17.60	17.60	17.60	17.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	397	397	397	397	397	397	397
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TARGET							
Mat'l	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	290	290	290	290	290	290	290
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3513	2553	2511	3257	3494	2500	2973
Yaw (deg)							
RESULTS							
P (mm)	49.8	62.0	60.4	49.4	48.6	62.3	63.2
d (mm)	22.0	17.5	16.5	14.0	15.5		13.0
Vol (cm^3)	19.1	11.2		7.9	8.6	4.8	7.3
SCALING							
$P/\alpha L$	1.147	1.020	0.994	1.122	1.104	0.991	1.005
P/L	1.717	1.527	1.488	1.680	1.653	1.483	1.505
d/D	3.793	3.017	2.845	3.333	3.690	---	3.095
P/d	2.264	3.543	3.661	3.529	3.135	---	4.862
Figure No.	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29	2.1.29

Hohler and Stilp (1991b)

Test No.	**6620**
PROJECTILE	
L (mm)	42.00
D (mm)	4.20
L/D	10.00
M (g)	10.24
Mat'l	D17.6
Supplier	
ρ (g/cm³)	17.60
Nose	Flat
BHN	397
Elong (%)	10.0
TARGET	
Mat'l	Ger Stl
Thick (mm)	---
ρ (g/cm³)	7.85
BHN	290
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	3140
Yaw (deg)	
RESULTS	
P (mm)	67.5
d (mm)	15.0
Vol (cm³)	9.4
SCALING	
$P/\alpha L$	1.073
P/L	1.607
d/D	3.571
P/d	4.500
Figure No.	2.1.29

Keele, Rapacki, and Bruchey (1990)

Test No.	1240	1241	1242	1243	2044	2045
PROJECTILE						
L (mm)	266.7	266.7	266.7	266.7	266.7	266.7
D (mm)	13.33	13.33	13.33	13.33	13.33	13.33
L/D	20.01	20.01	20.01	20.01	20.01	20.01
M (g)	730.00	730.00	730.00	730.00	730.00	730.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
Supplier						
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60
Nose	Flat	Flat	Flat	Flat	Flat	Flat
BHN	437	437	437	437	437	437
Elong (%)	20.0	20.0	20.0	20.0	20.0	20.0
TARGET						
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85
BHN	269	269	269	269	269	269
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	1979	2344	2074	2391	1927	1725
Yaw (deg)	3.47	2.22	.44	1.18	2.15	.82
RESULTS						
P (mm)	334.0	377.5	347.0	388.0	326.0	302.0
d (mm)	28.60	30.20	25.40	29.40	27.80	25.00
Vol (cm^3)						
SCALING						
$P/\alpha L$	.814	.920	.845	.945	.794	.736
P/L	1.252	1.415	1.301	1.455	1.222	1.132
d/D	2.146	2.266	1.905	2.206	2.086	1.875
P/d	11.678	12.500	13.661	13.197	11.727	12.080
Figure No.	2.1.30	2.1.30	2.1.30	2.1.30	2.1.30	2.1.30

Luk and Piekutowski (1991)

Test No.	4-0995	4-0992	4-0997	4-1046	4-1044	4-1048
PROJECTILE						
L (mm)	68.58	68.58	68.58	45.7	45.7	45.7
D (mm)	3.81	3.81	3.81	4.57	4.57	4.57
L/D	18	18	18	10	10	10
M (g)	6.2	6.2	6.2	13.69	13.69	13.69
Mat'l	4340	4340	4340	X21C	X21C	X21C
Supplier						
ρ (g/cm^3)	7.81	7.81	7.81	17.65	17.65	17.65
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN						
Elong (%)						
TARGET						
Mat'l	6061-T651	6061-T651	6061-T651	4340	4340	4340
Thick (mm)	229	229	229	152	152	152
ρ (g/cm^3)	2.71	2.71	2.71	7.81	7.81	7.81
BHN						
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	2120	2660	3090	2070	2460	3101
Yaw (deg)	1.0	3.5	0.5	3.9	10.3	3.8
RESULTS						
P (mm)	93.7	122.1	134.9	56.2	65.5	70.5
d (mm)	7.60	10.75	11.48	9.71		13.89
Vol (cm^3)	4.25	11.08	13.96	4.16		10.68
SCALING						
$P/\alpha L$	0.805	1.049	1.159	0.818	0.953	1.026
P/L	1.366	1.780	1.967	1.230	1.433	1.543
d/D	1.995	2.822	3.013	2.125		3.039
P/d	12.329	11.358	11.751	5.788		5.076
Figure No.	2.1.31	2.1.31	2.1.31	2.1.31	2.1.31	2.1.31

Magness (1990)

Test No.							
PROJECTILE							
L (mm)	106.00	106.00	106.00	106.00	106.00	106.00	106.00
D (mm)	3.53	3.53	3.53	3.53	3.53	3.53	3.53
L/D	30.03	30.03	30.03	30.03	30.03	30.03	30.03
M (g)	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Mat'l	X9C	X9C	X9C	X9C	X9C	X9C	X9C
Supplier							
ρ (g/cm³)	18.60	18.60	18.60	18.60	18.60	18.60	18.60
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1094	1204	1269	1566	1165	1300	1465
Yaw (deg)							
RESULTS							
P (mm)	29.8	47.0	49.0	77.8	30.1	36.2	46.8
d (mm)							
Vol (cm³)							
SCALING							
P/αL	.183	.288	.301	.477	.382	.460	.594
P/L	.281	.443	.462	.734	.588	.707	.914
d/D							
P/d							
Figure No.	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32

Magness (1990)

Test No.							
PROJECTILE							
L (mm)	76.80	76.80	76.80	76.80	106.0	106.0	106.0
D (mm)	7.68	7.68	7.68	7.68	3.53	3.53	3.53
L/D	10.00	10.00	10.00	10.00	30.03	30.03	30.03
M (g)	65.00	65.00	65.00	65.00	19.00	19.00	19.00
Mat'l	X9C	X9C	X9C	X9C	U-3/4Ti	U-3/4Ti	U-3/4Ti
Supplier							
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60	18.60
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1701	1869	2108	1096	1206	1273	1567
Yaw (deg)							
RESULTS							
P (mm)	58.0	63.1	72.8	30.0	46.8	48.8	77.2
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.736	.801	.924	.184	.287	.299	.473
P/L	1.133	1.232	1.422	.283	.442	.460	.728
d/D							
P/d							
Figure No.	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32

Magness (1990)

Test No.						
PROJECTILE						
L (mm)	51.2	51.2	51.2	76.8	76.8	76.8
D (mm)	5.12	5.12	5.12	7.68	7.68	7.68
L/D	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	19.00	19.00	19.00	19.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
Supplier						
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN						
Elong (%)						
TARGET						
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86
BHN						
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	1165	1300	1469	1096	1259	1455
Yaw (deg)						
RESULTS						
P (mm)	29.6	36.5	46.8	40.0	55.40	73.30
d (mm)						
Vol (cm^3)						
SCALING						
$P/\alpha L$	.376	.463	.594	.339	.469	.620
P/L	.578	.713	.914	.521	.721	.954
d/D						
P/d						
Figure No.	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32

Magness and Farrand (1990)

Test No.							
PROJECTILE							
L (mm)	121.50	121.50	121.50	121.50	121.50	121.5	121.5
D (mm)	6.08	6.08	6.08	6.08	6.08	6.08	6.08
L/D	19.98	19.98	19.98	19.98	19.98	19.98	19.98
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
Supplier							
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60	18.60
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	371	371	371	371	371	371	371
Elong (%)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	957	1069	1127	1248	1271	1544	1621
Yaw (deg)							
RESULTS							
P (mm)	44.7	60.0	61.6	80.0	80.0	112.2	119.1
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.239	.321	.329	.428	.428	.600	.637
P/L	.368	.494	.507	.658	.658	.923	.980
d/D							
P/d							
Figure No.	2.1.33	2.1.33	2.1.33	2.1.33	2.1.33	2.1.33	2.1.33

Magness and Farrand (1990)

Test No.							
PROJECTILE							
L (mm)	121.5	121.5	123.8	123.8	123.8	123.80	123.80
D (mm)	6.08	6.08	6.19	6.19	6.19	6.19	6.19
L/D	19.98	19.98	20.00	20.00	20.00	20.00	20.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	93W	93W	93W	93W	93W
Supplier							
ρ (g/cm^3)	18.60	18.60	17.60	17.60	17.60	17.60	17.60
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	371	371	381	381	381	381	381
Elong (%)	24.0	24.0	13.0	13.0	13.0	13.0	13.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1665	1683	1168	1329	1482	1571	1616
Yaw (deg)							
RESULTS							
P (mm)	124.1	127.1	52.6	70.5	89.4	102.3	104.2
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.664	.680	.284	.380	.482	.552	.562
P/L	1.021	1.046	.425	.569	.722	.826	.842
d/D							
P/d							
Figure No.	2.1.33	2.1.33	2.1.33	2.1.33	2.1.33	2.1.33	2.1.33

Magness and Farrand (1990)

Test No.	
PROJECTILE	
L (mm)	123.80
D (mm)	6.19
L/D	20.00
M (g)	65.00
Mat'l	93W
Supplier	
ρ (g/cm^3)	17.60
Nose	Hemi
BHN	381
Elong (%)	13.0
TARGET	
Mat'l	RHA
Thick (mm)	---
ρ (g/cm^3)	7.85
BHN	
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	1680
Yaw (deg)	
RESULTS	
P (mm)	115.2
d (mm)	
Vol (cm^3)	
SCALING	
$P/\alpha L$	.621
P/L	.931
d/D	
P/d	
Figure No.	2.1.33

Morris and Anderson (1991)

Test No.	1	2	5	6	7	9	10
PROJECTILE							
L (mm)	81.7	81.5	107.2	107.1	107.2	81.7	81.7
D (mm)	8.18	8.18	7.16	7.16	7.16	8.18	8.18
L/D	9.99	9.96	14.97	14.96	14.97	9.99	9.99
M (g)	73.3	73.0	74.2	73.8	74.2	73.4	73.4
Mat'l	X27C	X27C	X27C	X27C	X27C	X27C	X27C
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	360	360	360	360	360	360	360
Elong (%)	8.5	8.5	8.5	8.5	8.5	8.5	8.5
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1017	1106	1109	1087	1228	1265	1324
Yaw (deg)	1.05	1.15	2.22	1.14	1.04	2.86	5.45
RESULTS							
P (mm)	31.5	37.8	41.4	50.0	54.4	49.8	55.4
d (mm)	12.8	13.8	11.2	12.2	12.6	14.5	
Vol (cm^3)							
SCALING							
P/αL	.259	.312	.260	.314	.341	.410	.456
P/L	.386	.464	.386	.467	.507	.610	.678
d/D	1.565	1.687	1.564	1.704	1.760	1.773	
P/d	2.461	2.739	3.696	4.098	4.317	3.434	
Figure No.	2.1.34	2.1.34	2.1.34	2.1.34	2.1.34	2.1.34	2.1.34

Morris and Anderson (1991)

Test No.	11	14	18	24	25	27	28
PROJECTILE							
L (mm)	81.60	81.50	107.10	81.70	81.80	81.60	81.60
D (mm)	8.18	8.18	7.16	8.18	8.18	8.18	8.18
L/D	9.98	9.96	14.96	9.99	10.00	9.98	9.98
M (g)	73.00	72.80	74.20	73.40	73.40	73.10	73.20
Mat'l	X27C	X27C	X27C	X27C	X27C	X27C	X27C
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	360	360	360	360	360	360	360
Elong (%)	8.5	8.5	8.5	8.5	8.5	8.5	8.5
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1481	1490	1307	845	1042	1348	1515
Yaw (deg)	1.5	6.47	2.03	2.31	1.58	3.39	.65
RESULTS							
P (mm)	71.9	63.8	64.5	16.5	33.5	58.4	74.2
d (mm)	14.0		12.6	13.6	12.8	14.7	15.0
Vol (cm^3)							
SCALING							
P/αL	.592	.526	.405	.136	.275	.481	.611
P/L	.881	.783	.602	.202	.410	.716	.909
d/D	1.711		1.760	1.663	1.565	1.797	1.834
P/d	5.136		5.119	1.213	2.617	3.973	4.947
Figure No.	2.1.34	2.1.34	2.1.34	2.1.34	2.1.34	2.1.34	2.1.34

Morris and Anderson (1991)

Test No.	29	30	31
PROJECTILE			
L (mm)	81.70	107.10	107.10
D (mm)	8.18	7.16	7.16
L/D	9.99	14.96	14.96
M (g)	73.5	74.1	74.3
Mat'l	X27C	X27C	X27C
Supplier	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.4	17.4	17.4
Nose	Hemi	Hemi	Hemi
BHN	360	360	360
Elong (%)	8.5	8.5	8.5
TARGET			
Mat'l	4340	4340	4340
Thick (mm)	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86
BHN	264	264	264
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	1548	1492	1490
Yaw (deg)	.95	5.67	2.56
RESULTS			
P (mm)	80.3	74.4	88.6
d (mm)	15.00	13.30	13.40
Vol (cm^3)			
SCALING			
P/αL	.661	.467	.556
P/L	.983	.695	.827
d/D	1.834	1.858	1.872
P/d	5.353	5.594	6.612
Figure No.	2.1.34	2.1.34	2.1.34

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	Mg	Mg	Mg	Mg	Mg	Mg	Mg
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	1.74	1.74	1.74	1.74	1.74	1.74	1.74
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1350	1800	2400	2550	2800	3200	3350
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.301	0.602	0.903	0.923	1.024	1.064	1.104
P/L	0.375	0.750	1.125	1.150	1.275	1.325	1.375
d/D							
P/d							
Figure No.	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	Mg	Mg	Mg	Mg	Mg	Mg	AU4G
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	1.74	1.74	1.74	1.74	1.74	1.74	2.7
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3500	3650	4000	4450	5000	5200	1800
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	1.104	1.084	1.164	1.184	1.164	1.244	0.450
P/L	1.375	1.350	1.450	1.475	1.450	1.550	0.450
d/D							
P/d							
Figure No.	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	AU4G	AU4G	AU4G	AU4G	AU4G	AU4G	AU4G
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1950	2450	2800	3050	3500	3600	4400
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.525	0.775	0.850	0.900	0.925	1.000	1.100
P/L	0.525	0.775	0.850	0.900	0.925	1.000	1.100
d/D							
P/d							
Figure No.	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	AU4G	XC48	XC48	XC48	XC48	XC48	XC48
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.7	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4800	2150	2400	2500	3150	3600	4400
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	1.150	0.469	0.554	0.639	0.810	0.853	0.980
P/L	1.150	0.275	0.325	0.375	0.475	0.500	0.575
d/D							
P/d							
Figure No.	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35	2.1.35

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	XC80	XC80	XC80	XC80
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	XC48	XC48	XC48	AU4G	AU4G	AU4G	AU4G
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	2.7	2.7	2.7	2.7
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4800	5350	5500	1600	1700	2050	2100
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.980	1.066	1.066	0.484	0.572	0.674	0.689
P/L	0.575	0.625	0.625	0.825	0.975	1.150	1.175
d/D							
P/d							
Figure No.	2.1.35	2.1.35	2.1.35	2.1.36	2.1.36	2.1.36	2.1.36

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	XC80	XC80	XC80	XC80	XC80	XC80	XC80
Supplier							
ρ (g/cm^3)	7.85	7.85	7 85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Fiat
BHN							
Elong (%)							
TARGET							
Mat'l	AU4G	AU4G	AU4G	AU4G	AU4G	AU4G	AU4G
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2250	2350	2600	2700	3550	3750	3850
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.924	0.982	0.982	0.997	1.026	1.056	1.070
P/L	1.575	1.675	1.675	1.700	1.750	1.800	1.825
d/D							
P/d							
Figure No.	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	11	11
M (g)							
Mat'l	XC80	XC80	Ti	Ti	Ti	Ti	Ti
Supplier							
ρ (g/cm^3)	7.85	7.85	4.5	4.5	4.5	4.5	4.5
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	AU4G	AU4G	AU4G	AU4G	AU4G	AU4G	AU4G
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4200	4500	1600	1850	1850	2100	2200
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	1.114	1.129	0.426	0.620	0.678	0.775	0.833
P/L	1.900	1.925	0.550	0.800	0.875	1.000	1.075
d/D							
P/d							
Figure No.	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	11	11	11	11	11	3	3
M (g)							
Mat'l	Ti	Ti	Ti	Ti	Ti	AZ5G	AZ5G
Supplier							
ρ (g/cm³)	4.5	4.5	4.5	4.5	4.5	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	AU4G	AU4G	AU4G	AU4G	AU4G	XC48	XC48
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	2.7	2.7	2.7	2.7	2.7	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2750	3100	3150	4050	4200	2150	2300
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm³)							
SCALING							
$P/\alpha L$	0.930	1.084	1.065	1.104	1.181	0.631	0.682
P/L	1.200	1.400	1.375	1.425	1.525	0.370	0.400
d/D							
P/d							
Figure No.	2.1.36	2.1.36	2.1.36	2.1.36	2.1.36	2.1.37	2.1.37

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	3	3	3	3	3	3	3
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	XC48	XC48	XC48	XC48	XC48	XC48	XC48
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3150	3250	3250	3500	3650	3900	4200
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.938	0.972	0.904	0.972	0.989	1.108	1.177
P/L	0.550	0.570	0.530	0.570	0.580	0.650	0.690
d/D							
P/d							
Figure No.	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	3	6	6	6	6	6	6
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	XC48	XC48	XC48	XC48	XC48	XC48	XC48
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4900	1725	2250	3150	3625	3725	4125
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	1.211	0.205	0.750	0.836	0.972	0.955	1.040
P/L	0.710	0.120	0.440	0.490	0.570	0.560	0.610
d/D							
P/d							
Figure No.	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37

Perez (1982)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	6	8	8	8	8	8	8
M (g)							
Mat'l	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G	AZ5G
Supplier							
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	XC48	XC48	XC48	XC48	XC48	XC48	XC48
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4325	2225	2650	3150	3300	3750	3850
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	1.074	0.512	0.648	0.733	0.750	0.921	0.938
P/L	0.630	0.300	0.380	0.430	0.440	0.540	0.550
d/D							
P/d							
Figure No.	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37	2.1.37

Rosenberg, Marmor, and Mayseless (1990)

Test No.					
PROJECTILE					
L (mm)	80.00	80.00	80.00	80.00	80.00
D (mm)	8.00	8.00	8.00	8.00	8.00
L/D	10.00	10.00	10.00	10.00	10.00
M (g)	31.60	31.60	71.40	71.40	71.40
Mat'l	1020 Stl	4130 Stl	W (93%)	W (93%)	W (93%)
Supplier					
ρ (g/cm³)	7.85	7.85	17.75	17.75	17.75
Nose	Flat	Flat	Flat	Flat	Flat
BHN	112	499	413	413	413
Elong (%)					
TARGET					
Mat'l	1020 Stl	1020 Stl	1020 Stl	RHA	HH Stl
Thick (mm)	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85
BHN	112	112	112	212	269
Elong (%)					
Obliq (deg)	0.0	0.0	0.0	0.0	0.0
IMPACT					
V (m/s)	1505	1412	1444	1408	1417
Yaw (deg)					
RESULTS					
P (mm)	43.00	56.50	84.50	60.00	51.00
d (mm)					
Vol (cm³)					
SCALING					
$P/\alpha L$	0.538	0.706	0.702	0.499	0.424
P/L	0.538	0.706	1.056	0.750	0.638
d/D					
P/d					
Figure No.	2.1.38	2.1.38	2.1.38	2.1.38	--

Silsby (1984)

Test No.	R12-1929	R12-1928	VKG-5833	VKG-5841	VKG-5840	VKG-5835	VKG-5834
PROJECTILE							
L (mm)	155.78	155.83	155.83	121.79	121.79	155.83	155.83
D (mm)	6.87	6.82	6.83	5.28	5.35	6.76	6.7
L/D	22.68	22.85	22.82	23.07	22.76	23.05	23.26
M (g)	100.01	98.58	98.63	46.2	47.28	96.96	95.16
Mat'l	W10	W10	W10	W10	W10	W10	W10
Supplier	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam
ρ (g/cm^3)	17.3	17.3	17.3	17.3	17.3	17.3	17.3
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	352	352	352	352	352	352	352
Elong (%)	10.6	10.6	10.6	10.6	10.6	10.6	10.6
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	270.4	270.4	231.6	231.6	231.6	231.6	270.4
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1291	1494	1865	2365	2409	2653	2742
Yaw (deg)	0	0	.7	.6	.5	.7	.5
RESULTS							
P (mm)	80.0	112.0	174.5	165.2	172.3	228.5	228.0
d (mm)	12.5	12.0	14.0	13.0	13.2	19.2	18.7
Vol (cm^3)	10.0	12.0	27.0	22.0	24.0	66.0	63.0
SCALING							
P/αL	.346	.484	.753	.914	.954	.988	.986
P/L	.514	.719	1.120	1.356	1.415	1.466	1.463
d/D	1.820	1.760	2.050	2.462	2.467	2.840	2.791
P/d	6.400	9.333	12.464	12.708	13.053	11.901	12.193
Figure No.	2.1.39	2.1.39	2.1.39	2.1.39	2.1.39	2.1.39	2.1.39

Silsby (1984)

Test No.	VKG-5843	VKG-5838	VKG-5839	VKG-5842	VKG-5837	VKG-5836	VKG-5844
PROJECTILE							
L (mm)	121.79	155.83	155.83	121.79	155.75	155.83	121.69
D (mm)	5.15	6.80	6.75	5.27	6.69	6.86	5.24
L/D	23.65	22.92	23.09	23.11	23.28	22.72	23.22
M (g)	43.86	97.82	96.73	46.02	94.94	99.54	45.41
Mat'l	W10	W10	W10	W10	W10	W10	W10
Supplier	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam
ρ (g/cm^3)	17.3	17.3	17.3	17.3	17.3	17.3	17.3
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	352	352	352	352	352	352	352
Elong (%)	10.6	10.6	10.6	10.6	10.6	10.6	10.6
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	231.6	270.4	231.6	270.4	270.4	231.6	231.6
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2746	3335	3449	3580	4398	4415	4525
Yaw (deg)	2.4	2.6	2.6	.2	4.7	2.5	2.2
RESULTS							
P (mm)	176.3	237.9	241.5	188.6	246.9	248.1	193.7
d (mm)	15.0	24.5	26.0	20.1	34.9	36.0	27.2
Vol (cm^3)	31.0	112.0	128.0	60.0	236.0	253.0	113.0
SCALING							
$P/\alpha L$	.976	1.029	1.045	1.044	1.069	1.073	1.073
P/L	1.448	1.527	1.550	1.549	1.585	1.592	1.592
d/D	2.913	3.603	3.852	3.814	5.217	5.248	5.191
P/d	11.753	9.710	9.288	9.383	7.074	6.892	7.121
Figure No.	2.1.39	2.1.39	2.1.39	2.1.39	2.1.39	2.1.39	2.1.39

Sorensen, Kimsey, Silsby, Schleffler, Sherrick, and de Rosset (1991)

Test No.	6261	6289	6290	6291	6296	6297	6298
PROJECTILE							
L (mm)	250.00	125.00	151.40	198.40	125.00	125.00	151.40
D (mm)	8.33	8.33	7.57	6.60	8.33	8.33	7.57
L/D	30.01	15.01	20.00	30.06	15.01	15.01	20.00
M (g)	262.00	124.00	130.00	135.00	124.00	124.00	130.00
Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.30	17.30	17.30	17.30	17.30	17.30	17.30
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	385	385	385	385	385	385	385
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	269	269	269	269	269	269	269
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2960	2890	2900	3020	2980	2990	2980
Yaw (deg)	3.20	.54	3.41	.82	1.02	1.39	1.56
RESULTS							
P (mm)	382.00	186.00	220.00	287.00	188.00	189.00	229.00
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.029	1.002	.979	.974	1.013	1.019	1.019
P/L	1.528	1.488	1.453	1.447	1.504	1.512	1.513
d/D							
P/d							
Figure No.	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40

Sorensen, Kimsey, Silsby, Schleffler, Sherrick, and de Rosset (1991)

Test No.	6299	6313	6314	6315	6316	6317	6328
PROJECTILE							
L (mm)	151.4	151.4	190.5	198.4	151.4	151.4	190.5
D (mm)	7.57	7.57	9.53	6.6	7.57	7.57	9.53
L/D	20.00	20.00	19.99	30.06	20.00	20.00	19.99
M (g)	130.00	130.00	256.00	135.00	130.00	130.00	256.00
Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.3	17.3	17.3	17.3	17.3	17.3	17.3
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	385	385	385	385	385	385	385
Elong (%)	10.00	10.00	10.0	10.0	10.0	10.0	10.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	269	269	269	269	269	269	269
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3020	2420	2180	3050	2410	2330	2140
Yaw (deg)	2.22	.00	2.65	2.83	3.16	.60	2.06
RESULTS							
P (mm)	230.0	220.0	250.0	292.0	214.0	210.0	244.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.023	.979	.884	.991	.952	.934	.863
P/L	1.519	1.453	1.312	1.472	1.413	1.387	1.281
d/D							
P/d							
Figure No.	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40

Sorensen, Kimsey, Silsby, Schleffler, Sherrick, and de Rosset (1991)

Test No.	2395	2396	2398	2399	2401	2402	2403
PROJECTILE							
L (mm)	380.00	380.00	300.00	300.00	300.00	300.00	380.00
D (mm)	19.00	19.00	15.00	15.00	15.00	15.00	19.00
L/D	20.00	20.00	20.00	20.00	20.00	20.00	20.00
M (g)	2035.00	2035.00	1020.00	1020.00	1020.00	1020.00	2035.00
Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.30	17.30	17.30	17.30	17.30	17.30	17.30
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	385	385	385	385	385	385	385
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.00
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	269	269	269	269	269	269	269
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2050	2070	2220	2120	2250	2280	2060
Yaw (deg)	2.28	2.30	1.0	2.08	1.02	1.24	.76
RESULTS							
P (mm)	484.0	480.0	412.0	389.0	421.0	420.0	486.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.858	.851	.925	.873	.945	.943	.862
P/L	1.274	1.263	1.373	1.297	1.403	1.400	1.279
d/D							
P/d							
Figure No.	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40	2.1.40

Sorensen, Kimsey, Silsby, Schleffler, Sherrick, and de Rosset (1991)

Test No.	2410	2413	6260
PROJECTILE			
L (mm)	380.00	300.00	125.00
D (mm)	19.00	15.00	8.33
L/D	20.00	20.00	15.01
M (g)	2035.00	1020.00	124.00
Mat'l	X27	X27	X27
Supplier	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.30	17.30	17.30
Nose	Flat	Flat	Flat
BHN	385	385	385
Elong (%)	10.0	10.0	10.0
TARGET			
Mat'l	RHA	RHA	RHA
Thick (mm)	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85
BHN	269	269	269
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	1900	2040	4010
Yaw (deg)	.76	.71	3.69
RESULTS			
P (mm)	468.0	388.0	194.0
d (mm)			
Vol (cm^3)			
SCALING			
$P/\alpha L$	.830	.871	1.045
P/L	1.232	1.293	1.552
d/D			
P/d			
Figure No.	2.1.40	2.1.40	2.1.40

Tate (1967)

Test No.	679	680	686	690	692	696	701
PROJECTILE							
L (mm)	63.50	63.50	31.75	63.50	63.50	63.50	63.50
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	10.00	10.00	5.00	10.00	10.00	10.00	10.00
M (g)	15.60	15.70	7.97	15.40	15.40	15.40	15.40
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2012	2043	2043	2348	2286	915	1067
Yaw (deg)							
RESULTS							
P (mm)	57.2	50.8	36.8	43.2	47.0	13.2	15.2
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	0.901	0.800	1.159	0.680	0.740	0.208	0.239
P/L	0.901	0.800	1.159	0.680	0.740	0.208	0.239
d/D							
P/d							
Figure No.	2.1.41	2.1.41	2.1.41	2.1.41	2.1.41	2.1.41	2.1.41

Tate (1967)

Test No.	702	703	704	706	707	708	722
PROJECTILE							
L (mm)	63.50	44.45	44.45	44.45	63.50	63.50	63.50
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	10.00	7.00	7.00	7.00	10.00	10.00	10.00
M (g)	15.40	10.70	10.70	10.70	15.40	15.40	15.40
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1220	1189	2287	1951	1951	1890	1921
Yaw (deg)							
RESULTS							
P (mm)	12.70	11.40	39.40	35.60	41.90	38.10	43.20
d (mm)							
Vol (cm³)							
SCALING							
P/αL	0.200	0.256	0.886	0.801	0.660	0.600	0.680
P/L	0.200	0.256	0.886	0.801	0.660	0.600	0.680
d/D							
P/d							
Figure No.	2.1.41	2.1.41	2.1.41	2.1.41	2.1.41	2.1.41	2.1.41

Tate (1967)

Test No.	**723**
PROJECTILE	
L (mm)	63.5
D (mm)	6.35
L/D	10.00
M (g)	15.40
Mat'l	Steel
Supplier	
ρ (g/cm³)	7.85
Nose	Flat
BHN	
Elong (%)	
TARGET	
Mat'l	Steel
Thick (mm)	----
ρ (g/cm³)	7.85
BHN	
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	1951
Yaw (deg)	
RESULTS	
P (mm)	40.1
d (mm)	
Vol (cm³)	
SCALING	
P/αL	0.631
P/L	0.631
d/D	
P/d	
Figure No.	2.1.41

Tate (1969)

Test No.							
PROJECTILE							
L (mm)	63.5	63.5	63.5	63.5	63.5	63.5	63.50
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	5.43	5.43	5.43	5.43	5.43	5.43	5.43
Mat'l	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy
Supplier							
ρ (g/cm³)	2.7	2.7	2.7	2.7	2.7	2.7	2.70
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	59	59	59	59	59	59	59
Elong (%)							
TARGET							
Mat'l	Lead	Lead	Lead	Lead	Lead	Lead	Lead
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	11.20	11.20	11.20	11.20	11.20	11.20	11.2
BHN	27	27	27	27	27	27	27
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	500	860	994	1018	1036	1201	1360
Yaw (deg)							
RESULTS							
P (mm)	24.1	34.9	38.1	41.3	41.9	43.8	47.6
d (mm)	16.5	17.1	20.3	22.9	20.3	22.9	26.0
Vol (cm³)	2.69	3.26	4.35	4.99	4.67	6.53	8.6
SCALING							
P/αL	0.773	1.119	1.222	1.325	1.344	1.405	1.527
P/L	0.380	0.550	0.600	0.650	0.660	0.690	0.750
d/D	2.598	2.693	3.197	3.606	3.197	3.606	4.094
P/d	1.461	2.041	1.877	1.803	2.064	1.913	1.831
Figure No.	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42

Tate (1969)

Test No.							
PROJECTILE							
L (mm)	63.50	63.50	63.50	63.50	63.50	63.50	63.50
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	5.43	5.43	5.43	5.43	5.43	5.43	5.43
Mat'l	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy
Supplier							
ρ (g/cm^3)	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	59	59	59	59	59	59	59
Elong (%)							
TARGET							
Mat'l	Lead	Lead	Lead	Lead	Lead	Lead	Lead
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	11.2	11.2	11.2	11.2	11.2	11.2	11.20
BHN	27	27	27	27	27	27	27
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1393	1402	1463	1476	1598	1677	1689
Yaw (deg)							
RESULTS							
P (mm)	44.4	42.5	47.0	47.6	48.9	47.6	43.8
d (mm)	28.6	27.9	31.8	29.2	32.4	33.0	33.0
Vol (cm^3)	9.2	8.0	10.9	10.6	11.6	12.8	13.5
SCALING							
$P/\alpha L$	1.424	1.363	1.507	1.527	1.568	1.527	1.405
P/L	0.699	0.669	0.740	0.750	0.770	0.750	0.690
d/D	4.504	4.394	5.008	4.598	5.102	5.197	5.197
P/d	1.552	1.523	1.478	1.630	1.509	1.442	1.327
Figure No.	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42

Tate (1969)

Test No.							
PROJECTILE							
L (mm)	63.50	63.50	63.50	63.50	63.50	63.50	63.5
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10
M (g)	5.43	5.43	5.43	5.43	5.43	5.43	5.43
Mat'l	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy
Supplier							
ρ (g/cm^3)	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	59	59	59	59	59	59	59
Elong (%)							
TARGET							
Mat'l	Lead	Lead	Lead	Lead	Lead	Lead	Lead
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	11.20	11.20	11.20	11.20	11.20	11.20	11.2
BHN	27	27	27	27	27	27	27
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1762	1844	1902	1957	2012	2168	2241
Yaw (deg)							
RESULTS							
P (mm)	44.4	45.1	44.4	45.1	41.3	41.3	41.9
d (mm)	36.2	34.9	38.1	37.5	40.0	45.1	43.20
Vol (cm^3)	13.9	16.2	16.8	18.9	17.8	23.4	22.00
SCALING							
$P/\alpha L$	1.424	1.447	1.424	1.447	1.325	1.325	1.344
P/L	0.699	0.710	0.699	0.710	0.650	0.650	0.660
d/D	5.701	5.496	6.000	5.906	6.299	7.102	6.803
P/d	1.227	1.292	1.165	1.203	1.033	0.916	0.970
Figure No.	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42	2.1.42

Tate (1969)

Test No.							
PROJECTILE							
L (mm)	63.5						
D (mm)	6.35						
L/D	10	10	10	10	10	10	10
M (g)	5.43						
Mat'l	Al Alloy	Vibrac St	Vibrac St	Vibrac St	Vibrac St	Vibrac St	Vibrac St
Supplier							
ρ (g/cm^3)	2.70						
Nose	Flat	7.85	7.85	7.85	7.85	7.85	7.85
BHN	59						
Elong (%)							
TARGET							
Mat'l	Lead	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	11.2	2.7	2.7	2.7	2.7	2.7	2.7
BHN	27						
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2348	738	786	884	930	1080	1080
Yaw (deg)							
RESULTS							
P (mm)	41.3						
d (mm)	45.70						
Vol (cm^3)	22.10						
SCALING							
P/αL	1.325	0.809	0.821	0.821	0.891	1.015	0.985
P/L	0.650	1.380	1.400	1.400	1.520	1.730	1.680
d/D	7.197						
P/d	0.904						
Figure No.	2.1.42	2.1.43	2.1.43	2.1.43	2.1.43	2.1.43	2.1.43

Tate (1969)

Test No.							
PROJECTILE							
L (mm)							
D (mm)							
L/D	10	10	10	10	10	10	10
M (g)							
Mat'l	Vibrac St	Vibrac St	Vibrac St	Vibrac St	Vibrac St	Vibrac St	Vibrac St
Supplier							
ρ (g/cm^3)							
Nose	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN							
Elong (%)							
TARGET							
Mat'l	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy	Al Alloy
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.7	2.7	2.7	2.7	2.7	2.7	2.7
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1300	1350	1350	1520	1600	1680	2070
Yaw (deg)							
RESULTS							
P (mm)							
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.126	1.161	1.226	1.261	1.243	1.320	1.431
P/L	1.920	1.980	2.090	2.150	2.120	2.250	2.440
d/D							
P/d							
Figure No.	2.1.43	2.1.43	2.1.43	2.1.43	2.1.43	2.1.43	2.1.43

Tate (1969)

Test No.	
PROJECTILE	
L (mm)	
D (mm)	
L/D	10
M (g)	
Mat'l	Vibrac St
Supplier	
ρ (g/cm^3)	
Nose	7.85
BHN	
Elong (%)	
TARGET	
Mat'l	Al Alloy
Thick (mm)	---
ρ (g/cm^3)	2.7
BHN	
Elong (%)	
Obliq (deg)	0
IMPACT	
V (m/s)	2200
Yaw (deg)	
RESULTS	
P (mm)	
d (mm)	
Vol (cm^3)	
SCALING	
P/αL	1.443
P/L	2.460
d/D	
P/d	
Figure No.	2.1.43

Tate, Green, Chamberlain, and Baker (1978)

Test No.	**67**	**50**	**51**	**53**	**54**	**68**	**55**
PROJECTILE							
L (mm)	22.60	22.60	22.60	22.60	22.60	22.60	22.60
D (mm)	7.49	7.49	7.49	7.49	7.49	7.49	7.49
L/D	3.02	3.02	3.02	3.02	3.02	3.02	3.02
M (g)	16.8	16.8	16.8	16.8	16.8	16.8	16.8
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	815	890	1230	1325	1335	1390	1640
Yaw (deg)							
RESULTS							
P (mm)	9.0	11.0	19.5	21.5	21.5	23.5	28.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.270	.330	.584	.644	.644	.704	.839
P/L	.398	.487	.863	.951	.951	1.040	1.239
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	38	34	36	28	29	30	37
PROJECTILE							
L (mm)	28.3	28.3	28.3	28.3	28.3	28.3	28.3
D (mm)	9.45	9.45	9.45	9.45	9.45	9.45	9.45
L/D	2.99	2.99	2.99	2.99	2.99	2.99	2.99
M (g)	33.7	33.7	33.7	33.7	33.7	33.7	33.7
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	585	705	970	1000	1255	1325	1600
Yaw (deg)							
RESULTS							
P (mm)	4.5	9.0	16.5	13.5	25.0	27.5	29.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.108	.215	.395	.323	.598	.658	.694
P/L	.159	.318	.583	.477	.883	.972	1.025
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	39	110	109	108	100	99	112
PROJECTILE							
L (mm)	28.30	35.70	35.70	35.70	35.70	35.70	35.70
D (mm)	9.45	11.91	11.91	11.91	11.91	11.91	5.94
L/D	2.99	3.00	3.00	3.00	3.00	3.00	6.01
M (g)	33.70	67.70	67.70	67.70	67.70	67.70	16.80
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1605	715	860	1055	1190	1350	830
Yaw (deg)							
RESULTS							
P (mm)	37.0	11.0	20.0	24.5	34.0	41.0	9.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.886	.209	.379	.465	.645	.778	.171
P/L	1.307	.308	.560	.686	.952	1.148	.252
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	111	106	104	105	33	22	35
PROJECTILE							
L (mm)	35.70	35.70	35.70	35.70	45.00	45.00	45.00
D (mm)	5.94	5.94	5.94	5.94	7.49	7.49	7.49
L/D	6.01	6.01	6.01	6.01	6.01	6.01	6.01
M (g)	16.80	16.80	16.80	16.80	33.70	33.70	33.70
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1000	1250	1450	1590	570	675	705
Yaw (deg)							
RESULTS							
P (mm)	14.5	24.0	36.0	32.0	4.0	6.0	7.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.275	.455	.683	.607	.060	.090	.105
P/L	.406	.672	1.008	.896	.089	.133	.156
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	21	20	23	31	32	75	74
PROJECTILE							
L (mm)	45.00	45.00	45.00	45.00	45.00	56.70	56.70
D (mm)	7.49	7.49	7.49	7.49	7.49	9.45	9.45
L/D	6.01	6.01	6.01	6.01	6.01	6.00	6.00
M (g)	33.70	33.70	33.70	33.70	33.70	67.70	67.70
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	860	1120	1300	1340	1485	640	795
Yaw (deg)							
RESULTS							
P (mm)	12.0	24.5	36.5	34.0	42.0	7.0	13.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.181	.369	.549	.512	.632	.084	.155
P/L	.267	.544	.811	.756	.933	.123	.229
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	73	72	71	92	70	76	77
PROJECTILE							
L (mm)	56.70	56.70	56.70	56.70	56.70	56.70	56.70
D (mm)	9.45	9.45	9.45	9.45	9.45	9.45	9.45
L/D	6.00	6.00	6.00	6.00	6.00	6.00	6.00
M (g)	67.70	67.70	67.70	67.70	67.70	67.70	67.70
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	835	915	970	975	1140	1245	1355
Yaw (deg)							
RESULTS							
P (mm)	15.0	19.0	24.0	24.0	34.0	41.0	48.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.179	.227	.287	.287	.406	.490	.573
P/L	.265	.335	.423	.423	.600	.723	.847
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	88	87	86	82	83	84	85
PROJECTILE							
L (mm)	56.70	56.70	56.70	56.70	56.70	56.70	56.70
D (mm)	4.72	4.72	4.72	4.72	4.72	4.72	4.72
L/D	12.01	12.01	12.01	12.01	12.01	12.01	12.01
M (g)	16.8	16.8	16.8	16.8	16.8	16.8	16.8
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	745	885	1070	1180	1275	1470	1535
Yaw (deg)							
RESULTS							
P (mm)	5.0	9.5	18.5	25.0	31.0	43.0	47.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.060	.113	.221	.299	.370	.514	.561
P/L	.088	.168	.326	.441	.547	.758	.829
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	16	17	10	11	12	14	15
PROJECTILE							
L (mm)	71.4	71.4	71.4	71.4	71.4	71.4	71.4
D (mm)	5.94	5.94	5.94	5.94	5.94	5.94	5.94
L/D	12.02	12.02	12.02	12.02	12.02	12.02	12.02
M (g)	33.7	33.7	33.7	33.7	33.7	33.7	33.7
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	665	805	1025	1075	1360	1445	1530
Yaw (deg)							
RESULTS							
P (mm)	4.5	10.0	19.0	24.5	45.0	52.5	67.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.043	.095	.180	.232	.427	.498	.636
P/L	.063	.140	.266	.343	.630	.735	.938
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44

Tate, Green, Chamberlain, and Baker (1978)

Test No.	61	60	62	63	64	49	45
PROJECTILE							
L (mm)	89.90	89.90	89.90	89.90	89.90	22.60	22.60
D (mm)	7.49	7.49	7.49	7.49	7.49	7.49	7.49
L/D	12.00	12.00	12.00	12.00	12.00	3.02	3.02
M (g)	67.70	67.70	67.70	67.70	67.70	7.70	7.70
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	En25T	En25T
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	7.8	7.8
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	785	890	940	1060	1155	1205	1215
Yaw (deg)							
RESULTS							
P (mm)	11.5	15.5	21.5	31.0	38.0	8.5	8.5
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.087	.117	.162	.234	.286	.376	.376
P/L	.128	.172	.239	.345	.423	.376	.376
d/D							
P/d							
Figure No.	2.1.44	2.1.44	2.1.44	2.1.44	2.1.44	2.1.45	2.1.45

Tate, Green, Chamberlain, and Baker (1978)

Test No.	47	46	48	45	24	44	26
PROJECTILE							
L (mm)	22.60	22.60	22.60	28.30	28.30	28.30	28.30
D (mm)	7.49	7.49	7.49	9.45	9.45	9.45	9.45
L/D	3.02	3.02	3.02	2.99	2.99	2.99	2.99
M (g)	7.70	7.70	7.70	15.50	15.50	15.50	15.50
Mat'l	En25T	En25T	En25T	En25T	En25T	En25T	En25T
Supplier							
ρ (g/cm³)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm³)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1265	1505	1525	840	920	980	1250
Yaw (deg)							
RESULTS							
P (mm)	12.5	12.5	13.0	4.5	5.5	7.0	14.0
d (mm)							
Vol (cm³)							
SCALING							
P/αL	.553	.553	.575	.159	.194	.247	.495
P/L	.553	.553	.575	.159	.194	.247	.495
d/D							
P/d							
Figure No.	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45

Tate, Green, Chamberlain, and Baker (1978)

Test No.	102	103	101	42	19	41	18
PROJECTILE							
L (mm)	35.7	35.7	35.7	45.0	45.0	45.0	45.0
D (mm)	5.94	5.94	5.94	7.49	7.49	7.49	7.49
L/D	6.01	6.01	6.01	6.01	6.01	6.01	6.01
M (g)	7.7	7.7	7.7	15.5	15.5	15.5	15.5
Mat'l	En25T	En25T	En2[illegible]	En25T	En25T	En25T	En25T
Supplier							
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1205	1510	1580	935	1175	1220	1250
Yaw (deg)							
RESULTS							
P (mm)	7.5	15.0	17.0	4.0	9.0	11.0	12.5
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.210	.420	.476	.089	.200	.244	.278
P/L	.210	.420	.476	.089	.200	.244	.278
d/D							
P/d							
Figure No.	2.1.4[illegible]	[illegible].1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45

Tate, Green, Chamberlain, and Baker (1978)

Test No.	40	81	80	79	78	89	90
PROJECTILE							
L (mm)	45.00	56.70	56.70	56.70	56.70	56.70	56.70
D (mm)	7.49	9.45	9.45	9.45	9.45	4.72	4.72
L/D	6.01	6.00	6.00	6.00	6.00	12.01	12.01
M (g)	15.50	31.10	31.10	31.10	31.10	7.70	7.70
Mat'l	En25T	En25T	En25T	En25T	En25T	En25T	En25T
Supplier							
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1525	1105	1260	1330	1460	1285	1450
Yaw (deg)							
RESULTS							
P (mm)	20.0	8.5	14.5	19.0	23.5	10.0	15.5
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.444	.150	.256	.335	.414	.176	.273
P/L	.444	.150	.256	.335	.414	.176	.273
d/D							
P/d							
Figure No.	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45

Tate, Green, Chamberlain, and Baker (1978)

Test No.	91	3	2	1	5	7	6
PROJECTILE							
L (mm)	56.70	71.40	71.40	71.40	71.40	71.40	71.40
D (mm)	4.72	5.94	5.94	5.94	5.94	5.94	5.94
L/D	12.01	12.02	12.02	12.02	12.02	12.02	12.02
M (g)	7.70	15.50	15.50	15.50	15.50	15.50	15.50
Mat'l	En25T	En25T	En25T	En25T	En25T	En25T	En25T
Supplier							
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1665	650	845	985	1150	1360	1600
Yaw (deg)							
RESULTS							
P (mm)	22.5	1.0	2.0	3.5	8.5	15.5	26.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.397	.014	.028	.049	.119	.217	.364
P/L	.397	.014	.028	.049	.119	.217	.364
d/D							
P/d							
Figure No.	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45

Tate, Green, Chamberlain, and Baker (1978)

Test No.	13	66	57	60	59	55	5104
PROJECTILE							
L (mm)	71.40	89.90	89.90	89.90	89.90	89.90	72.00
D (mm)	5.94	7.49	7.49	7.49	7.49	7.49	6.00
L/D	12.02	12.00	12.00	12.00	12.00	12.00	12.00
M (g)	15.50	31.10	31.10	31.10	31.10	31.10	34.60
Mat'l	En25T	En25T	En25T	En25T	En25T	En25T	W alloy
Supplier							
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1670	935	1045	1245	1370	1390	1355
Yaw (deg)							1.5
RESULTS							
P (mm)	33.0	1.5	6.5	13.0	21.0	22.5	42.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.462	.017	.072	.145	.234	.250	.395
P/L	.462	.017	.072	.145	.234	.250	.583
d/D							
P/d							
Figure No.	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.45	2.1.46

Tate, Green, Chamberlain, and Baker (1978)

Test No.	5101	5112	5113	4501	4502	4503	4504
PROJECTILE							
L (mm)	72.00	72.00	72.00	72.00	72.00	72.00	72.00
D (mm)	6.00	6.00	6.00	6.00	6.00	6.00	6.00
L/D	12.00	12.00	12.00	12.00	12.00	12.00	12.00
M (g)	34.60	34.60	34.60	34.60	34.60	34.60	34.60
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	150	150	150	150	150	150	150
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	0	0	0	30	30	30	30
IMPACT							
V (m/s)	1485	1785	1825	1100	1315	1445	1540
Yaw (deg)	2.0	11.0	4.5	.5	1.0	1.0	.5
RESULTS							
P (mm)	56.0	58.0	68.0	23.0	39.0	45.0	52.0
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.527	.546	.640	.216	.367	.423	.489
P/L	.778	.806	.944	.319	.542	.625	.722
d/D							
P/d							
Figure No.	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46

Tate, Green, Chamberlain, and Baker (1978)

Test No.	4505	4506	4525	4526	4527	4528	4535
PROJECTILE							
L (mm)	72.00	72.00	72.00	72.00	72.00	72.00	72.00
D (mm)	6.00	6.00	6.00	6.00	6.00	6.00	6.00
L/D	12.00	12.00	12.00	12.00	12.00	12.00	12.00
M (g)	34.6	34.6	34.6	34.6	34.6	34.6	34.6
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	130	130	130	130	130	130	130
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	30	30	45	45	45	45	45
IMPACT							
V (m/s)	1615	1690	1090	1315	1445	1510	1610
Yaw (deg)	1.5	2.0	.5	1.0	.5	2.5	1.5
RESULTS							
P (mm)	59.0	62.0	20.0	32.0	38.0	42.0	47.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.555	.583	.188	.301	.357	.395	.442
P/L	.819	.861	.278	.444	.528	.583	.653
d/D							
P/d							
Figure No.	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46

Tate, Green, Chamberlain, and Baker (1978)

Test No.	4529	4530	4201	4202	4203	4204	4205
PROJECTILE							
L (mm)	72.0	72.0	72.0	72.0	72.0	72.0	72.0
D (mm)	6.00	6.00	6.00	6.00	6.00	6.00	6.00
L/D	12.00	12.00	12.00	12.00	12.00	12.00	12.00
M (g)	34.6	34.6	34.6	34.6	34.6	34.6	34.6
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	130	130	130	130	130	130	130
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	45	45	60	60	60	60	60
IMPACT							
V (m/s)	1610	1690	1085	1325	1425	1480	1615
Yaw (deg)	2.0	5.0	2.0	3.5	3.0	.5	1.0
RESULTS							
P (mm)	48.0	40.0	14.0	22.0	20.0	28.0	37.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.452	.376	.132	.207	.188	.263	.348
P/L	.667	.556	.194	.306	.278	.389	.514
d/D							
P/d							
Figure No.	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46

Tate, Green, Chamberlain, and Baker (1978)

Test No.	4206	4513	4514	4515	4537	4516	4517
PROJECTILE							
L (mm)	72.00	72.00	72.00	72.00	72.00	72.00	72.00
D (mm)	6.00	6.00	6.00	6.00	6.00	6.00	6.00
L/D	12.00	12.00	12.00	12.00	12.00	12.00	12.00
M (g)	34.60	34.60	34.60	34.60	34.60	34.60	34.60
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
Supplier							
ρ (g/cm^3)	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	60	60	60	60	60	60	60
ρ (g/cm^3)	7.8	7.8	7.8	7.8	7.8	7.8	7.8
BHN							
Elong (%)							
Obliq (deg)	60	70	70	70	70	70	70
IMPACT							
V (m/s)	1695	1100	1330	1440	1515	1535	1595
Yaw (deg)	2.5	2.0	2.5	2.0	2.5	.5	1.5
RESULTS							
P (mm)	33.0	10.0	14.0	21.0	19.0	21.0	21.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.310	.094	.132	.198	.179	.198	.198
P/L	.458	.139	.194	.292	.264	.292	.292
d/D							
P/d							
Figure No.	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46	2.1.46

Tate, Green, Chamberlain, and Baker (1978)

Test No.	4518
PROJECTILE	
L (mm)	72.00
D (mm)	6.00
L/D	12.00
M (g)	34.60
Mat'l	W alloy
Supplier	
ρ (g/cm^3)	17.0
Nose	Flat
BHN	
Elong (%)	
TARGET	
Mat'l	STA 61
Thick (mm)	60
ρ (g/cm^3)	7.8
BHN	
Elong (%)	
Obliq (deg)	70
IMPACT	
V (m/s)	1685
Yaw (deg)	1.5
RESULTS	
P (mm)	22.0
d (mm)	
Vol (cm^3)	
SCALING	
$P/\alpha L$	.207
P/L	.306
d/D	
P/d	
Figure No.	2.1.46

Wilkins, Gibbons, Hohler, Stilp, and Cozzi (1991)

Test No.	6894	6895	6902	6906	6901	6896	6897
PROJECTILE							
L (mm)	75.00	75.00	75.00	75.00	50.00	50.00	50.00
D (mm)	7.50	7.50	7.50	7.50	5.00	5.00	5.00
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	58.30	58.30	58.30	58.30	16.90	16.90	16.90
Mat'l	W92.5	W92.5	W92.5	W92.5	W-10	W-10	W-10
Supplier	Hertel	Hertel	Hertel	Hertel	Kennam	Kennam	Kennam
ρ (g/cm^3)	17.59	17.59	17.59	17.59	17.20	17.20	17.20
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	409	409	409	409	381	381	381
Elong (%)	16.1	16.1	16.1	16.1	11.8	11.8	11.8
TARGET							
Mat'l	Ger RHA	Ger RHA	Ger RHA	Ger RHA	Ger RHA	Ger RHA	Ger RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	390	390	390	390	390	390	390
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2012	2186	2276	2460	1959	2079	2227
Yaw (deg)							
RESULTS							
P (mm)	84.2	92.0	95.9	101.1	51.8	55.5	60.8
d (mm)	20.0	21.0	20.0	21.0	12.0	13.0	13.0
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.750	0.819	0.854	0.901	0.700	0.750	0.821
P/L	1.123	1.227	1.279	1.348	1.036	1.110	1.216
d/D	2.667	2.800	2.667	2.800	2.400	2.600	2.600
P/d	4.210	4.381	4.795	4.814	4.317	4.269	4.677
Figure No.	2.1.47	2.1.47	2.1.47	2.1.47	2.1.47	2.1.47	2.1.47

Wilkins, Gibbons, Hohler, Stilp, and Cozzi (1991)

Test No.	6900	6898
PROJECTILE		
L (mm)	50.00	50.00
D (mm)	5.00	5.00
L/D	10.00	10.00
M (g)	16.90	16.90
Mat'l	W-10	W-10
Supplier	Kennam	Kennam
ρ (g/cm^3)	17.20	17.20
Nose	Flat	Flat
BHN	381	381
Elong (%)	11.8	11.8
TARGET		
Mat'l	Ger RHA	Ger RHA
Thick (mm)	---	---
ρ (g/cm^3)	7.85	7.85
BHN	390	390
Elong (%)		
Obliq (deg)	0	0
IMPACT		
V (m/s)	2376	2482
Yaw (deg)		
RESULTS		
P (mm)	64.80	67.50
d (mm)	13.0	14.0
Vol (cm^3)		
SCALING		
$P/\alpha L$	0.876	0.912
P/L	1.296	1.350
d/D	2.600	2.800
P/d	4.985	4.821
Figure No.	2.1.47	2.1.47

Wilson, Foster, Jones, and Gillis (1989)

Test No.	77	78	79	58	59	60	61
PROJECTILE							
L (mm)	63.50	63.50	63.50	47.63	47.63	47.63	47.63
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	10.0	10.0	10.0	7.5	7.5	7.5	7.5
M (g)	15.79	15.79	15.79	11.84	11.84	11.84	11.84
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2507	1060	1076	1599	1542	1636	2567
Yaw (deg)	1.0	2.2	0.0	2.0	1.4	3.6	1.0
RESULTS							
P (mm)	49.99	4.83	5.58	19.83	16.51	19.05	38.86
d (mm)	13.49	14.22	12.70	11.09	13.49	12.70	14.22
Vol (cm^3)							
SCALING							
P/αL	.787	.076	.088	.416	.347	.400	.816
P/L	.787	.076	.088	.416	.347	.400	.816
d/D	2.124	2.239	2.000	1.746	2.124	2.000	2.239
P/d	3.706	.340	.439	1.788	1.224	1.500	2.733
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	62	63	64	65	2	4	6
PROJECTILE							
L (mm)	47.63	47.63	47.63	47.63	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	7.50	7.50	7.50	7.50	5.00	5.00	5.00
M (g)	11.84	11.84	11.84	11.84	7.89	7.89	7.89
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2495	2446	1088	1149	1720	1820	2200
Yaw (deg)	1.0	3.0	2.0	2.2	4.0	3.0	1.0
RESULTS							
P (mm)	37.28	34.29	4.83	7.87	17.42	15.85	26.16
d (mm)	13.48	14.27	14.99	14.99	11.13	11.89	15.09
Vol (cm³)							
SCALING							
$P/\alpha L$	.783	.720	.101	.165	.549	.499	.824
P/L	.783	.720	.101	.165	.549	.499	.824
d/D	2.123	2.247	2.361	2.361	1.753	1.872	2.376
P/d	2.766	2.403	.322	.525	1.565	1.333	1.734
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	7	8	9	10	12	13	80
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	47.63
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	9.53
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	7.89	7.89	7.89	26.67
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2290	2460	2450	2470	1310	1320	1608
Yaw (deg)	3.2	1.0	2.2	0.0	3.6	2.8	1.4
RESULTS							
P (mm)	21.39	25.37	21.41	32.51	7.90	9.50	22.86
d (mm)	15.09	17.48	14.30	12.95	11.13	12.29	18.26
Vol (cm^3)							
SCALING							
$P/\alpha L$	.674	.799	.674	1.024	.249	.299	.480
P/L	.674	.799	.674	1.024	.249	.299	.480
d/D	2.376	2.753	2.252	2.039	1.753	1.935	1.916
P/d	1.417	1.451	1.497	2.510	.710	.773	1.252
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	81	82	83	84	85	86	87
PROJECTILE							
L (mm)	47.63	47.63	47.63	47.63	47.63	47.63	47.63
D (mm)	9.53	9.53	9.53	9.53	9.53	9.53	9.53
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	26.67	26.67	26.67	26.67	26.67	26.67	26.67
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1674	1637	2520	2497	2520	1100	1260
Yaw (deg)	5.0	5.4	2.0		5.0	3.0	1.8
RESULTS							
P (mm)	26.92	22.23	42.16	61.98	41.40	7.11	10.41
d (mm)	19.05	19.05	21.34	23.11	24.13	19.81	19.05
Vol (cm^3)							
SCALING							
$P/\alpha L$	.565	.467	.885	1.301	.869	.149	.219
P/L	.565	.467	.885	1.301	.869	.149	.219
d/D	1.999	1.999	2.239	2.425	2.532	2.079	1.999
P/d	1.413	1.167	1.976	2.682	1.716	.359	.546
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	88	89	90	91	92	93	94
PROJECTILE							
L (mm)	47.63	63.50	63.50	63.50	63.50	63.50	63.50
D (mm)	9.53	12.70	12.70	12.70	12.70	12.70	12.70
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	26.67	63.14	63.14	63.14	63.14	63.14	63.14
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1076	1615	1599	1618	2419	2470	2442
Yaw (deg)	0.5	0.0	1.4	0.0	1.4	0.0	2.0
RESULTS							
P (mm)	7.87	32.51	33.27	35.56	59.44	62.68	61.90
d (mm)	17.53	24.61	25.40	25.40	29.36	31.75	30.15
Vol (cm^3)							
SCALING							
$P/\alpha L$	.165	.512	.524	.560	.936	.987	.975
P/L	.165	.512	.524	.560	.936	.987	.975
d/D	1.839	1.938	2.000	2.000	2.312	2.500	2.374
P/d	.449	1.321	1.310	1.400	2.025	1.974	2.053
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	**95**	**96**	**97**	**46**	**47**	**48**	**49**
PROJECTILE							
L (mm)	63.50	63.50	63.50	31.75	31.75	31.75	31.75
D (mm)	12.70	12.70	12.70	9.53	9.53	9.53	9.53
L/D	5.00	5.00	5.00	3.33	3.33	3.33	3.33
M (g)	63.14	63.14	63.14	17.78	17.78	17.78	17.78
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1108	1125	1100	1505	1561	1580	978
Yaw (deg)	2.2	2.2	1.0	3.0	0.0	3.6	4.1
RESULTS							
P (mm)	13.48	13.48	12.70	16.00	15.74	19.81	5.59
d (mm)	25.40	25.40	23.80	18.29	18.26	18.26	16.00
Vol (cm^3)							
SCALING							
$P/\alpha L$	.212	.212	.200	.504	.496	.624	.176
P/L	.212	.212	.200	.504	.496	.624	.176
d/D	2.000	2.000	1.874	1.919	1.916	1.916	1.679
P/d	.531	.531	.534	.875	.862	1.085	.349
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	50	51	52	53	54	55	56
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	9.53	9.53	9.53	9.53	9.53	12.70	12.70
L/D	3.33	3.33	3.33	3.33	3.33	2.50	2.50
M (g)	17.78	17.78	17.78	17.78	17.78	31.57	31.57
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1051	1064	2360	2520	2495	1655	1599
Yaw (deg)	2.0	0.0	4.1		3.6	1.0	2.0
RESULTS							
P (mm)	7.11	7.11	44.45	31.75	36.58	21.34	25.40
d (mm)	17.53	17.53	22.23	23.83	22.35	24.61	24.61
Vol (cm^3)							
SCALING							
P/αL	.224	.224	1.400	1.000	1.152	.672	.800
P/L	.224	.224	1.400	1.000	1.152	.672	.800
d/D	1.839	1.839	2.333	2.501	2.345	1.938	1.938
P/d	.406	.406	2.000	1.332	1.637	.867	1.032
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	14	15	16	18	19	22	23
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	249	249	249	249	249	249	249
Elong (%)	23.5	23.5	23.5	23.5	23.5	23.5	23.5
TARGET							
Mat'l	4340	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	2.80	2.80	2.80	2.80	2.80	2.80
BHN	411	144	144	144	144	144	144
Elong (%)	16.6	8.9	8.9	8.9	8.9	8.9	8.9
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2500	2470	2520	1542	2540	2520	2490
Yaw (deg)	4.0	0.0	7.6	2.0	5.0	8.6	1.4
RESULTS							
P (mm)	35.69	81.74	53.98	34.11	84.91	64.29	63.50
d (mm)	14.30	15.88	15.88	11.10	15.88	15.88	15.06
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.124	1.025	1.015	.642	1.597	1.209	1.194
P/L	1.124	1.716	1.700	1.074	2.674	2.025	2.000
d/D	2.252	2.501	2.501	1.748	2.501	2.501	2.372
P/d	2.496	5.147	3.399	3.073	5.347	4.048	4.216
Figure No.	2.1.48	2.1.49	2.1.49	2.1.49	2.1.49	2.1.49	2.1.49

Wilson, Foster, Jones, and Gillis (1989)

Test No.	127	128	156	157	107	108	110
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	7.89	2.82	2.82	2.82
Mat'l	4340	4340	4340	4340	7075-T6	7075-T6	7075-T6
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	2.80	2.80	2.80
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	144	144	144
Elong (%)	16.6	16.6	16.6	16.6	8.9	8.9	8.9
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.8	2.8	2.8	2.8	2.8	2.8	2.8
BHN	144	144	144	144	144	144	144
Elong (%)	8.9	8.9	8.9	8.9	8.9	8.9	8.9
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2490	2440	1020	1590	1561	1542	2544
Yaw (deg)	3.9	2.2	5.0		8.3	6.8	4.0
RESULTS							
P (mm)	61.90	61.90	11.89	31.75	6.35	11.10	13.69
d (mm)	17.45	15.88	17.45	11.10	16.66	15.88	19.05
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.164	1.164	.224	.597	.200	.350	.431
P/L	1.950	1.950	.374	1.000	.200	.350	.431
d/D	2.748	2.501	2.748	1.748	2.624	2.501	3.000
P/d	3.547	3.898	.681	2.860	.381	.699	.719
Figure No.	2.1.49	2.1.49	2.1.49	2.1.49	2.1.50	2.1.50	2.1.50

Wilson, Foster, Jones, and Gillis (1989)

Test No.	112	113	149	119	120	121	132
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	2.82	2.82	2.82	7.89	7.89	7.89	7.89
Mat'l	7075-T6	7075-T6	7075-T6	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	2.80	2.80	2.80	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	144	144	144	249	249	249	249
Elong (%)	8.9	8.9	8.9	23.5	23.5	23.5	23.5
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
BHN	144	144	144	144	144	144	144
Elong (%)	8.9	8.9	8.9	8.9	8.9	8.9	8.9
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2520	2618	2540	990	1467	2540	2490
Yaw (deg)	1.0	1.1	1.5	2.0	1.4	2.0	2.2
RESULTS							
P (mm)	17.50	11.10	25.40	10.31	26.97	57.94	48.41
d (mm)	18.24	15.88	13.49	17.45	11.10	16.66	14.27
Vol (cm^3)							
SCALING							
P/αL	.551	.350	.800	.194	.507	1.090	.911
P/L	.551	.350	.800	.325	.849	1.825	1.525
d/D	2.872	2.501	2.124	2.748	1.748	2.624	2.247
P/d	.959	.699	1.883	.591	2.430	3.478	3.392
Figure No.	2.1.50	2.1.50	2.1.50	2.1.49	2.1.49	2.1.49	2.1.49

Wilson, Foster, Jones, and Gillis (1989)

Test No.	133	134	135	141	25	26	28
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	7.89	7.89	7.89	7.89
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	249	249	249	249	411	411	411
Elong (%)	23.5	23.5	23.5	23.5	16.6	16.6	16.6
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.8	2.8	2.8	2.8	7.85	7.85	7.85
BHN	144	144	144	144	249	249	249
Elong (%)	8.9	8.9	8.9	8.9	23.5	23.5	23.5
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2520	1600	1630	1125	978	1125	2429
Yaw (deg)	9.1	1.0	11.2	1.0	10.9	11.1	5.1
RESULTS							
P (mm)	55.55	30.94	29.36	15.06	5.54	7.14	38.07
d (mm)	15.88	10.31	12.70	16.66	11.10	9.53	15.88
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.045	.582	.552	.283	.174	.225	1.199
P/L	1.750	.974	.925	.474	.174	.225	1.199
d/D	2.501	1.624	2.000	2.624	1.748	1.501	2.501
P/d	3.498	3.001	2.312	.904	.499	.749	2.397
Figure No.	2.1.49	2.1.49	2.1.49	2.1.49	2.1.48	2.1.48	2.1.48

Wilson, Foster, Jones, and Gillis (1989)

Test No.	29	30	31	32	33	34	35
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	7.89	7.89	7.89	7.89
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	249	249	249	249	249	249	249
Elong (%)	23.5	23.5	23.5	23.5	23.5	23.5	23.5
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2421	2348	2152	2005	1907	1505	1505
Yaw (deg)	5.1	3.2	1.4	2.2		4.0	5.0
RESULTS							
P (mm)	29.34	39.37	26.16	23.77	25.37	15.06	12.67
d (mm)	15.06	14.30	13.49	13.49	14.30	11.91	11.91
Vol (cm^3)							
SCALING							
$P/\alpha L$	.924	1.240	.824	.749	.799	.474	.399
P/L	.924	1.240	.824	.749	.799	.474	.399
d/D	2.372	2.252	2.124	2.124	2.252	1.876	1.876
P/d	1.948	2.753	1.939	1.762	1.774	1.264	1.064
Figure No.	2.1.48	2.1.48	2.1.48	2.1.48	2.1.48	2.1.48	2.1.48

Wilson, Foster, Jones, and Gillis (1989)

Test No.	36	43	44	98	99	101	102
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	2.82	2.82	2.82	2.82
Mat'l	4340	4340	4340	7075-T6	7075-T6	7075-T6	7075-T6
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	2.80	2.80	2.80	2.80
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	144	144	144	144
Elong (%)	16.6	16.6	16.6	8.9	8.9	8.9	8.9
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	249	249	249	249	249	249	249
Elong (%)	23.5	23.5	23.5	23.5	23.5	23.5	23.5
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1606	1076	978	1506	1542	2520	2400
Yaw (deg)	3.0	2.8	2.2	2.0	5.7	11.3	6.0
RESULTS							
P (mm)	13.46	7.11	5.59	3.30	3.30	19.05	10.41
d (mm)	11.91	12.70	12.70	12.70	11.94	12.70	16.00
Vol (cm^3)							
SCALING							
P/αL	.424	.224	.176	.174	.174	1.005	.549
P/L	.424	.224	.176	.104	.104	.600	.328
d/D	1.876	2.000	2.000	2.000	1.880	2.000	2.520
P/d	1.130	.560	.440	.260	.276	1.500	.651
Figure No.	2.1.48	2.1.48	2.1.48	2.1.50	2.1.50	2.1.50	2.1.50

Wilson, Foster, Jones, and Gillis (1989)

Test No.	38	39	40	41	42	129	150
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.[illegible]	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	7.89	7.89	7.89	7.89
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	249	249	249	249	249	249	249
Elong (%)	23.5	23.5	23.5	23.5	23.5	23.5	23.5
TARGET							
Mat'l	4340	4340	4340	4340	4340	2024-T4	2024-T4
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	2.77	2.77
BHN	249	249	249	249	249	79	79
Elong (%)	23.5	23.5	23.5	23.5	23.5	16.0	16.0
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1505	1561	2409	2398	2458	2510	2540
Yaw (deg)	5.0	5.1	6.1	1.5	4.5	2.5	4.2
RESULTS							
P (mm)	18.24	16.64	29.34	26.95	25.37	78.56	64.29
d (mm)	12.70	11.91	15.09	15.09	16.66	20.62	19.84
Vol (cm^3)							
SCALING							
$P/\alpha L$	.574	.524	.924	.849	.799	1.470	1.203
P/L	.574	.524	.924	.849	.799	2.474	2.025
d/D	2.000	1.876	2.376	2.376	2.624	3.247	3.124
P/d	1.436	1.397	1.944	1.786	1.523	3.810	3.240
Figure No.	2.1.48	2.1.48	2.1.48	2.1.48	2.1.48	2.1.49	2.1.49

Wilson, Foster, Jones, and Gillis (1989)

Test No.	153	143	144	145	147	122	123
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	2.82	2.82	2.82	2.82	7.89	7.89
Mat'l	4340	7075-T6	7075-T6	7075-T6	7075-T6	4340	4340
Supplier							
ρ (g/cm^3)	7.85	2.80	2.80	2.80	2.80	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	144	144	144	144	249	249
Elong (%)	23.5	8.9	8.9	8.9	8.9	23.5	23.5
TARGET							
Mat'l	2024-T4	2024-T4	2024-T4	2024-T4	2024-T4	2024-T4	2024-T4
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	2.77
BHN	79	79	79	79	79	79	79
Elong (%)	16	16	16	16	16	16	16
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2470	2470	2510	2542	1590	2490	1637
Yaw (deg)		4.6	2.7	9.1	3.0	3.6	3.2
RESULTS							
P (mm)	73.03	86.51	33.27	25.40	22.23	72.21	41.28
d (mm)	20.62	17.45	17.45	16.66	12.70	19.84	13.49
Vol (cm^3)							
SCALING							
$P/\alpha L$	1.366	2.710	1.042	.796	.696	1.351	.772
P/L	2.300	2.725	1.048	.800	.700	2.274	1.300
d/D	3.247	2.748	2.748	2.624	2.000	3.124	2.124
P/d	3.542	4.958	1.907	1.525	1.750	3.640	3.060
Figure No.	2.1.49	--	2.1.50	2.1.50	2.1.50	2.1.49	2.1.49

Wilson, Foster, Jones, and Gillis (1989)

Test No.	131	136	137	138	139	140	24
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.89	7.89	7.89	7.89	7.89	7.89	7.89
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	249	249	249	249	249	249	249
Elong (%)	23.5	23.5	23.5	23.5	23.5	23.5	23.50
TARGET							
Mat'l	2024-T4	2024-T4	2024-T4	2024-T4	2024-T4	2024-T4	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.77	2.77	2.77	2.77	2.77	2.77	7.85
BHN	79	79	79	79	79	79	411
Elong (%)	16	16	16	16	16	16	16.60
Obliq (deg)	0	0	0	0	0	0	0.0
IMPACT							
V (m/s)	2590	1600	1690	1088	1080	1125	2500
Yaw (deg)	5.4	1.8	0.0	4.1	2.0	2.2	4.0
RESULTS							
P (mm)	72.21	49.20	45.24	30.15	19.84	26.19	35.69
d (mm)	21.41	13.49	13.49	11.10	10.31	11.89	14.30
Vol (cm^3)							
SCALING							
P/αL	1.351	.921	.846	.564	.371	.490	1.124
P/L	2.274	1.550	1.425	.950	.625	.825	1.124
d/D	3.372	2.124	2.124	1.748	1.624	1.872	2.252
P/d	3.373	3.647	3.354	2.716	1.924	2.203	2.496
Figure No.	2.1.49	2.1.49	2.1.49	2.1.49	2.1.49	2.1.49	2.1.48

Wilson, Foster, Jones, and Gillis (1989)

Test No.	**117**	**126**	**125**	**111**	**124**	**154**	**69**
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	47.63	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	12.70
L/D	5.00	5.00	5.00	5.00	5.00	7.50	2.50
M (g)	7.89	7.89	7.89	7.89	7.89	11.84	31.57
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.60	16.60	16.60	16.60	16.60	16.60	16.60
TARGET							
Mat'l	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	7075-T6	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	2.80	2.80	2.80	2.80	2.80	2.80	7.85
BHN	144	144	144	144	144	144	411
Elong (%)	8.90	8.90	8.90	8.90	8.90	8.90	16.60
Obliq (deg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IMPACT							
V (m/s)	1542	2490	2520	2520	2540	2470	1022
Yaw (deg)	0.0	5.0	1.4		0.0		5.0
RESULTS							
P (mm)	34.11	63.50	64.29	53.98	84.91	81.74	6.35
d (mm)	11.10	15.06	15.88	15.88	15.88	15.88	21.34
Vol (cm^3)							
SCALING							
P/αL	0.642	1.194	1.209	1.015	1.597	1.025	0.200
P/L	1.074	2.000	2.025	1.700	2.674	1.716	0.200
d/D	1.748	2.372	2.501	2.501	2.501	2.501	1.680
P/d	3.073	4.216	4.048	3.399	5.347	5.147	0.298
Figure No.	2.1.49	2.1.49	2.1.49	2.1.49	2.1.49	--	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	70	57	68	66	67	71	73
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	63.50
D (mm)	12.70	12.70	12.70	12.70	12.70	12.70	6.35
L/D	2.50	2.50	2.50	2.50	2.50	2.50	10.00
M (g)	31.57	31.57	31.57	31.57	31.57	31.57	15.79
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.60	16.60	16.60	16.60	16.60	16.60	16.60
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.60	16.60	16.60	16.60	16.60	16.60	16.60
Obliq (deg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IMPACT							
V (m/s)	1039	1608	2442	2452	2458	2470	1467
Yaw (deg)	1.0	1.0	0.5	5.4	4.6	8.3	0.0
RESULTS							
P (mm)	6.35	18.23	36.58	32.51	28.70	29.46	19.81
d (mm)	20.57	24.58	27.69	30.23	28.70	29.46	11.18
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.200	0.574	1.152	1.024	0.904	0.928	0.312
P/L	0.200	0.574	1.152	1.024	0.904	0.928	0.312
d/D	1.620	1.935	2.180	2.380	2.260	2.320	1.761
P/d	0.309	0.742	1.321	1.075	1.000	1.000	1.772
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	74	72	75	76
PROJECTILE				
L (mm)	63.50	63.50	63.50	63.50
D (mm)	6.35	6.35	6.35	6.35
L/D	10.00	10.00	10.00	10.00
M (g)	15.79	15.79	15.79	15.79
Mat'l	4340	4340	4340	4340
Supplier				
ρ (g/cm^3)	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat
BHN	411	411	411	411
Elong (%)	16.60	16.60	16.60	16.60
TARGET				
Mat'l	4340	4340	4340	4340
Thick (mm)	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85
BHN	411	411	411	411
Elong (%)	16.60	16.60	16.60	16.60
Obliq (deg)	0.0	0.0	0.0	0.0
IMPACT				
V (m/s)	1467	1486	2372	2495
Yaw (deg)	5.0	1.6	1.4	3.2
RESULTS				
P (mm)	19.81	20.57	39.62	39.99
d (mm)	13.46	13.46	16.00	14.27
Vol (cm^3)				
SCALING				
P/αL	0.312	0.324	0.624	0.630
P/L	0.312	0.324	0.624	0.630
d/D	2.120	2.120	2.520	2.247
P/d	1.472	1.528	2.476	2.802
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51

Woolsey (1990)

Test No.	87-89-1	87-89-2	87-87-3	87-89-4	87-89-5	87-89-6	87-98-7
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.871	7.871	7.871	7.871	7.871	7.871	7.871
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.4	65.4	65.4	65.4	65.4	65.4	65.4
Mat'l	X27C	X27C	X27C	X27C	X27C	X27C	X27C
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.35	17.35	17.35	17.35	17.35	17.35	17.35
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	358	358	358	358	358	358	358
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1501	1505	1464	1472	1468	1464	1469
Yaw (deg)	1.14	4.33	7.82	3.60	1.55	4.17	2.87
RESULTS							
P (mm)	71.9	65.3	62.7	61.3	67.9	67.1	67.8
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.615	.558	.536	.524	.580	.574	.580
P/L	.913	.829	.796	.779	.862	.852	.861
d/D							
P/d							
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	87-89-8	87-89-9	87-89-10	87-89-11	87-89-12	87-89-13	87-89-14
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.87	7.87	7.87	7.87	7.87	7.87	7.87
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.4	65.4	65.4	65.4	65.4	65.4	65.4
Mat'l	X27C	X27C	X27C	X27C	X27C	X27C	X27C
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.35	17.35	17.35	17.35	17.35	17.35	17.35
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	358	358	358	358	358	358	358
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1419	1362	1350	1349	1180	1210	1220
Yaw (deg)	4.68	4.14	4.27	1.33	5.27	2.36	2.20
RESULTS							
P (mm)	62.9	60.1	56.5	60.0	42.1	47.9	48.3
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.538	.514	.483	.513	.360	.409	.413
P/L	.799	.763	.718	.762	.535	.608	.613
d/D							
P/d							
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	87-89-15	87-89-16	87-89-17	87-89-18	87-89-19	87-89-20	25-90-1
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.87	7.87	7.87	7.87	7.87	7.87	7.87
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.4	65.4	65.4	65.4	65.4	65.4	65.4
Mat'l	X27C	X27C	X27C	X27C	X27C	X27C	X27C
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.35	17.35	17.35	17.35	17.35	17.35	17.35
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	358	358	358	358	358	358	358
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1538	1539	1533	1491	1511	1497	1516
Yaw (deg)	3.06	4.47	2.54	3.88	3.65	6.71	1.70
RESULTS							
P (mm)	73.7	71.4	73.2	69.1	70.8	59.2	71.7
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	.630	.610	.626	.591	.605	.506	.613
P/L	.936	.907	.930	.878	.899	.752	.911
d/D							
P/d							
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	25-90-2	25-90-3	25-90-4	25-88-3	25-88-4	25-88-5	25-88-6
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.871	7.871	7.871	7.87	7.87	7.87	7.87
L/D	10.00	10.00	10.00	10.01	10.01	10.01	10.01
M (g)	65.400	65.400	65.400	65.500	65.500	65.500	65.500
Mat'l	X27C	X27C	X27C	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.35	17.35	17.35	17.33	17.33	17.33	17.33
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	358	358	358	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1513	796	970	1512	1499	1520	1520
Yaw (deg)			1.06	5.59	1.67	1.76	.79
RESULTS							
P (mm)	69.0	14.2	27.5	61.3	70.2	72.5	75.0
d (mm)					18.00	18.50	19.10
Vol (cm^3)							
SCALING							
$P/\alpha L$	.590	.121	.235	.524	.600	.620	.641
P/L	.876	.180	.349	.779	.892	.921	.953
d/D					2.287	2.351	2.427
P/d					3.900	3.919	3.927
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	28-88-1	28-88-10	28-88-11	28-88-12	28-88-13	28-88-14	28-88-2
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.87	7.87	7.87	7.87	7.87	7.87	7.87
L/D	10.01	10.01	10.01	10.01	10.01	10.01	10.01
M (g)	65.500	65.500	65.500	65.500	65.500	65.500	65.500
Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.33	17.33	17.33	17.33	17.33	17.33	17.33
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1076	1325	1306	1347	1390	1344	1083
Yaw (deg)	.70	1.11	2.26	1.00	.90	2.75	1.00
RESULTS							
P (mm)	32.1	53.6	53.7	55.5	59.8	56.9	33.1
d (mm)	12.7	13.7	13.7	13.5	14.0	15.5	13.2
Vol (cm^3)							
SCALING							
$P/\alpha L$	.275	.458	.459	.475	.511	.487	.283
P/L	.408	.681	.682	.705	.759	.723	.420
d/D	1.614	1.741	1.741	1.715	1.779	1.970	1.677
P/d	2.528	3.912	3.920	4.111	4.271	3.671	2.508
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	28-88-3	28-88-4	28-88-5	28-88-6	28-88-7	28-88-8	28-88-9
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.87	7.87	7.87	7.87	7.87	7.87	7.87
L/D	10.01	10.01	10.01	10.01	10.01	10.01	10.01
M (g)	65.500	65.500	65.500	65.500	65.500	65.500	65.500
Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.33	17.33	17.33	17.33	17.33	17.33	17.33
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	863	902	934	1276	1233	1231	1343
Yaw (deg)	3.09	2.50	3.30	.75	.90	1.10	.50
RESULTS							
P (mm)	16.1	18.5	20.9	49.1	45.6	45.5	55.4
d (mm)	17.5	16.3	14.2	15.0	12.7	12.7	14.0
Vol (cm^3)							
SCALING							
$P/\alpha L$	.138	.158	.179	.420	.390	.389	.474
P/L	.204	.235	.265	.624	.579	.578	.704
d/D	2.224	2.071	1.804	1.906	1.614	1.614	1.779
P/d	.920	1.135	1.472	3.273	3.591	3.583	3.957
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	33-88-1	33-88-12	33-88-17	33-88-18	33-88-19	33-88-3	33-88-7
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	78.74	78.74
D (mm)	7.87	7.87	7.87	7.87	7.87	7.87	7.87
L/D	10.01	10.01	10.01	10.01	10.01	10.01	10.01
M (g)	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.33	17.33	17.33	17.33	17.33	17.33	17.33
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1495	1490	1469	1511	1453	1498	1486
Yaw (deg)	5.27	2.23	.70	2.00	3.25	1.34	1.27
RESULTS							
P (mm)	65.8	67.8	66.9	69.4	62.9	69.6	67.5
d (mm)	14.7	14.7	14.7	14.2	14.5	14.7	17.5
Vol (cm^3)							
SCALING							
$P/\alpha L$	.563	.580	.572	.594	.538	.595	.577
P/L	.836	.861	.850	.881	.799	.884	.857
d/D	1.868	1.868	1.868	1.804	1.842	1.868	2.224
P/d	4.476	4.612	4.551	4.887	4.338	4.735	3.857
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	33-88-9	22-89-1	22-89-4	23-89-2	23-89-3	77-89-1	77-89-2
PROJECTILE							
L (mm)	78.74	78.74	78.74	78.74	78.74	77.98	77.98
D (mm)	7.87	7.87	7.87	7.87	7.87	7.80	7.80
L/D	10.01	10.01	10.01	10.01	10.01	10.00	10.00
M (g)	65.5	65.5	65.5	65.5	65.5	64.94	64.94
Mat'l	X27	X27	X27	X27	X27	X21C	X21C
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.33	17.33	17.33	17.33	17.33	17.73	17.73
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	366	366
Elong (%)	4.0	4.0	4.0	4.0	4.0	10.8	10.8
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1462	1007	1756	1644	1720	1364	1270
Yaw (deg)	2.35	1.33	1.95	2.31	.75	.85	1.62
RESULTS							
P (mm)	65.1	28.9	89.3	79.7	85.4	59.6	51.1
d (mm)	15.7						
Vol (cm^3)							
SCALING							
$P/\alpha L$	.557	.247	.764	.682	.730	.509	.436
P/L	.827	.367	1.134	1.012	1.085	.764	.655
d/D	1.995						
P/d	4.146						
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.[illegible]	2.1.52	2.1.52

Woolsey (1990)

Test No.	77-89-3	77-89-4	77-89-5	77-89-6	77-89-7	77-89-8	29-88-1
PROJECTILE							
L (mm)	77.98	77.98	77.98	77.98	77.98	77.98	76.96
D (mm)	7.80	7.80	7.80	7.80	7.80	7.80	7.70
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	64.94	64.94	64.94	64.94	64.94	64.94	65.2
Mat'l	X21C	X21C	X21C	X21C	X21C	X21C	W-2
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.73	17.73	17.73	17.73	17.73	17.73	18.63
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	366	366	366	366	366	366	349
Elong (%)	10.8	10.8	10.8	10.8	10.8	10.8	3.1
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1373	1380	1359	1275	1122	1551	1437
Yaw (deg)	1.33	7.83	2.14	3.00	1.75	.66	1.58
RESULTS							
P (mm)	62.0	48.3	61.3	50.7	39.2	75.3	66.2
d (mm)							14.5
Vol (cm^3)							
SCALING							
P/αL	.529	.412	.523	.433	.335	.643	.559
P/L	.795	.619	.786	.650	.503	.966	.860
d/D							1.884
P/d							4.566
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	29-88-2	29-88-3	29-88-4	29-88-5	42-88-2	42-88-6	42-88-7
PROJECTILE							
L (mm)	76.96	76.96	76.96	76.96	76.96	76.96	76.96
D (mm)	7.696	7.696	7.696	7.696	7.696	7.696	7.696
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.200	65.200	65.200	65.200	65.200	65.200	65.200
Mat'l	W-2	W-2	W-2	W-2	W-2	W-2	W-2
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	18.63	18.63	18.63	18.63	18.63	18.63	18.63
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	349	349	349	349	349	349	349
Elong (%)	3.1	3.1	3.1	3.1	3.1	3.1	3.1
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	264	264	264	264	264	264	264
Elong (%)							
Obl (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1485	1481	1488	1494	1485	1484	1472
Yaw (deg)	2.61	5.62	2.30	5.55	2.57	1.03	1.87
RESULTS							
P (mm)	71.1	64.7	70.4	69.4	70.6	70.8	69.3
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.600	.546	.594	.586	.596	.598	.585
P/L	.924	.841	.915	.902	.917	.920	.900
d/D							
P/d							
Figure No.	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52	2.1.52

Woolsey (1990)

Test No.	**42-88-15**

PROJECTILE

L (mm)	76.96
D (mm)	7.70
L/D	10.00
M (g)	65.20
Mat'l	W-2
Supplier	Teledy
ρ (g/cm^3)	18.63
Nose	Hemi
BHN	349
Elong (%)	3.1

TARGET

Mat'l	RHA
Thick (mm)	---
ρ (g/cm^3)	7.86
BHN	264
Elong (%)	
Obliq (deg)	0

IMPACT

V (m/s)	1467
Yaw (deg)	1.03

RESULTS

P (mm)	69.1
d (mm)	
Vol (cm^3)	

SCALING

P/αL	.583
P/L	.898
d/D	
P/d	

Figure No. 2.1.52

Woolsey (1991)

Test No.	T82-89-1	T82-89-3	T82-89-4	T26-90-1	T26-90-2	T26-90-4	T26-90-5
PROJECTILE							
L (mm)	124.46	124.46	124.46	124.46	124.46	124.46	124.46
D (mm)	6.22	6.22	6.22	6.22	6.22	6.22	6.22
L/D	20.01	20.01	20.01	20.01	20.01	20.01	20.01
M (g)	65.10	65.10	65.10	65.10	65.10	65.10	65.10
Mat'l	X-27	X-27	X-27	X-27	X-27	X-27	X-27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.33	17.33	17.33	17.33	17.33	17.33	17.33
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	264	264	264	264	264	264	264
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1278	1357	1538	1355	1522	1573	1652
Yaw (deg)		.86	1.33	.79		.56	1.05
RESULTS							
P (mm)	58.2	78.4	104.8	72.7	94.3	106.0	118.2
d (mm)							
Vol (cm^3)							
SCALING							
P/αL	.315	.424	.567	.393	.510	.573	.639
P/L	.468	.630	.842	.584	.758	.852	.950
d/D							
P/d							
Figure No.	2.1.53	2.1.53	2.1.53	2.1.53	2.1.53	2.1.53	2.1.53

Woolsey (1991)

Test No.	T26-90-6	T26-90-7
PROJECTILE		
L (mm)	124.46	124.46
D (mm)	6.22	6.22
L/D	20.01	20.01
M (g)	65.10	65.10
Mat'l	X-27	X-27
Supplier	Teledy	Teledy
ρ (g/cm^3)	17.33	17.33
Nose	Hemi	Hemi
BHN	345	345
Elong (%)		
TARGET		
Mat'l	RHA	RHA
Thick (mm)	---	---
ρ (g/cm^3)	7.85	7.85
BHN	264	264
Elong (%)		
Obliq (deg)	0	0
IMPACT		
V (m/s)	1070	1602
Yaw (deg)	1.12	1.69
RESULTS		
P (mm)	38.0	100.4
d (mm)		
Vol (cm^3)		
SCALING		
$P/\alpha L$	.205	.543
P/L	.305	.807
d/D		
P/d		
Figure No.	2.1.53	2.1.53

APPENDIX B

FINITE-THICKNESS DATA

Appendix B Contents

Residual Velocity Data

Forrestal, Rosenberg, Luk, and Bless (1986)

Test No.						
PROJECTILE						
L (mm)	146.0	146.0	146.0	146.0	146.0	146.0
D (mm)	9.53	9.53	9.53	9.53	9.53	9.53
L/D	15.32	15.32	15.32	15.32	15.32	15.32
M (g)	78.00	78.00	78.00	78.00	78.00	78.00
Mat'l	T-200	T-200	T-200	T-200	T-200	T-200
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Conical	Conical	Cone/cut	Cone/cut	Conical	Conical
BHN	427	427	427	427	427	427
Elong (%)						
TARGET						
Mat'l	6061-T6	6061-T6	6061-T6	6061-T6	6061-T6	6061-T6
Thick (mm)	25.4	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71
BHN	99	99	99	99	99	99
Obliq (deg)	0	0	0	0	0	0
RESULTS						
Yaw (deg)	1.0	1.0	1.0	1.0	1.0	1.0
V_s (m/s)	254	344	537	691	272	315
V_r (m/s)	80	258	479	640	141	207
L_r (mm)						
M_r (g)	78.0	78.0	78.0	78.0	78.0	78.0
SCALING						
$\Delta L \cos \theta / t$	0.264	0.264	0.264	0.264	0.264	0.264
Figure No.	2.2.1	2.2.1	2.2.1	2.2.1	2.2.1	2.2.1

Fugelso (1980)

Test No.	1929	1893	1930	1871	1931	1872	1894
PROJECTILE							
L (mm)	76.7	76.7	76.7	76.7	76.7	76.7	76.7
D (mm)	7.67	7.67	7.67	7.67	7.67	7.67	7.67
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	18.45	18.45	18.45	18.45	18.45	18.45	18.45
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	6.3	6.3	6.3	6.3	6.3	6.3	6.3
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Obliq (deg)	57.0	58.9	54.9	54.5	53.6	53.6	53.4
RESULTS							
Yaw (deg)	3.60	14.10	.30	-4.50	-4.40	-3.80	-4.90
V_s (m/s)	1512	1343	1500	1349	1507	1354	1356
V_r (m/s)	1367	997	1472	1310	1506	1350	1315
L_r (mm)							
M_r (g)	29.0		55.4	58.0	63.1	57.1	55.4
SCALING							
$\Delta L \cos\theta/t$	3.690		1.069	.798	.252	.915	1.108
Figure No.	2.2.2	2.2.2	2.2.2	2.2.2	2.2.2	2.2.2	2.2.2

Fugelso (1980)

Test No.	1895	22	1905	1906	1858	23	24
PROJECTILE							
L (mm)	76.7	76.7	76.7	76.7	76.7	76.7	76.7
D (mm)	7.67	7.67	7.67	7.67	7.67	7.67	7.67
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	18.45	18.45	18.46	18.46	18.46	18.46	18.46
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	6.3	6.3	12.7	12.7	6.3	6.3	6.3
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Obliq (deg)	53.2	55.0	64.9	64.0	55.8	56.0	55.0
RESULTS							
Yaw (deg)	-11.7	3.9	5.4	6.7	3.2	2.7	6.2
V_s (m/s)	1332	1449	992	994	1468	1446	1456
V_r (m/s)	1254	1324	619	522	1467	1381	1077
L_r (mm)							
M_r (g)	55.4	54.6	21.3	17.1	14.9		26.0
SCALING							
$\Delta L \cos \theta / t$	1.114	1.152	1.727	1.955	5.284		4.206
Figure No.	2.2.2	2.2.2	2.2.2	2.2.2	2.2.2	2.2.2	2.2.2

Fugelso and Taylor (1978)

Test No.	1685	1687	1689	40	50	58	59
PROJECTILE							
L (mm)	76.7	76.7	76.7	76.7	76.7	76.7	76.7
D (mm)	7.67	7.67	7.67	7.67	7.67	7.67	7.67
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	18.46	18.46	18.46	18.46	18.46	18.46	18.46
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	50.8	50.8	50.8	6.4	6.4	6.4	6.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	280	280	280	370	370	370	370
Obliq (deg)	0	0	0	64.2	63.6	64.2	63.6
RESULTS							
Yaw (deg)	.78	.54	.51	-7.10	-7.70	-12.30	-10.90
V_s (m/s)	1160	1180	1140	1247	1167	1069	1257
V_r (m/s)	820	1100	1010	1186	1123	942	1207
L_r (mm)							
M_r (g)	15.4	47.8	45.2	49.9	46.9	47.3	50.7
SCALING							
$\Delta L \cos \theta / t$	1.154	0.407	0.467	1.237	1.508	1.445	1.199
Figure No.	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3

Fugelso and Taylor (1978)

Test No.	60	62	64	66	69	70	71
PROJECTILE							
L (mm)	76.7	76.7	76.7	76.7	76.7	76.7	76.7
D (mm)	7.67	7.67	7.67	7.67	7.67	7.67	7.67
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	18.46	18.46	18.46	18.46	18.46	18.46	18.46
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	6.4	6.4	6.4	6.4	6.4	6.4	6.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	370	370	370	370	370	370	370
Obliq (deg)	65.5	62.8	64.6	65.1	63.2	65.8	69.9
RESULTS							
Yaw (deg)	-9.0	-3.9	6.6	5.1	9.4	12.1	10.1
V_s (m/s)	1360	1489	1414	1627	1295	1298	1531
V_r (m/s)	1266	1470	1315	1601	1244	1132	1454
L_r (mm)							
M_r (g)		53.7	57.1	42.6	49.5	36.7	42.6
SCALING							
$\Delta L \cos \theta / t$		0.981	0.654	1.760	1.315	2.157	1.437
Figure No.	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3

Fugelso and Taylor (1978)

Test No.	72	73	74	75	76	78	80
PROJECTILE							
L (mm)	76.7	76.7	76.7	76.7	76.7	76.7	76.7
D (mm)	7.67	7.67	7.67	7.67	7.67	7.67	7.67
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	18.46	18.46	18.46	18.46	18.46	18.46	18.46
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	9.5	9.5	9.5	9.5	9.5	9.5	9.5
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	370	370	370	370	370	370	370
Obliq (deg)	64.6	64.9	65.6	65.1	65.1	64.6	64.8
RESULTS							
Yaw (deg)	2.4	4.5	4.2	7.8	6.1	-4.5	-3.3
V_s (m/s)	1307	1442	1635	1332	1527	947	1316
V_r (m/s)	1289	1390	1609	1215	1467	637	1200
L_r (mm)							
M_r (g)	42.6	46.0	46.9	35.0	43.9	46.5	
SCALING							
$\Delta L \cos \theta / t$	1.208	1.017	0.944	1.581	1.118	1.002	
Figure No.	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3

Fugelso and Taylor (1978)

Test No.	85	88			
PROJECTILE					
L (mm)	76.7	76.7	76.70	76.70	76.70
D (mm)	7.67	7.67	7.67	7.67	7.67
L/D	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	18.46	18.46	18.46	18.46	18.46
Nose	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	345	345	345	345	345
Elong (%)					
TARGET					
Mat'l	RHA	RHA	RHA	RHA	RHA
Thick (mm)	9.5	9.5	19.00	19.00	19.00
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86
BHN	370	370	300	300	300
Obliq (deg)	65.2	65.1	59.9	60.0	60.0
RESULTS					
Yaw (deg)	-6.2	-5.6	0.1	1.2	0.4
V_s (m/s)	1213	1498	1490.0	1515.0	1550.0
V_r (m/s)	1134	1449	1310.0	1190.0	820.0
L_r (mm)					
M_r (g)	38.0	51.6	29.8	35.8	31.6
SCALING					
$\Delta L \cos \theta / t$	1.419	0.718	1.102	0.914	1.043
Figure No.	2.2.3	2.2.3	2.2.3	2.2.3	2.2.3

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	25	25	25	25	25	43	43
D (mm)	2.5	2.5	2.5	2.5	2.5	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	0.96	0.96	0.96	0.96	0.96	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	5.1	10.2	15	19.2	12.5	15.2	19.7
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
V_s (m/s)	3610	3508	3632	3518	3400	1743	2137
V_r (m/s)	3573	3250	3330	2500	3181	1245	1717
L_r (mm)	13.3	8.8	4.2	0	6.2	18	15
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.294	1.588	1.387		1.504	1.645	1.421
Figure No.	--	--	2.2.4	2.2.4	--	2.2.4	2.2.4

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	43	43	43	43	43	43	43
D (mm)	4.3	4.3	4.3	4.3	4.3	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	19.6	19.9	19.5	10	25.5	19.5	10.1
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
V_s (m/s)	2349	2422	2464	2470	3322	3278	3359
V_r (m/s)	2050	2100	2110		2830	2850	2990
L_r (mm)	15	15.4	15.5	25	8.7	14.5	23.2
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.429	1.387	1.410	1.800	1.345	1.462	1.960
Figure No.	2.2.4	--	2.2.4	--	2.2.4	2.2.4	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	43	43	43	43	54	54	54
D (mm)	4.3	4.3	4.3	4.3	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	8.25	30.2	30.4	6.15	28.4	40.5	15.1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
V_s (m/s)	3155	2734	3170	3139	2615	2667	2673
V_r (m/s)	3008	2220	2740	2990	2153	1784	2350
L_r (mm)	27.3	5.9	5.4	30.6	14.6	3.8	27.5
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.903	1.228	1.237	2.016	1.387	1.240	1.755
Figure No.	2.2.4	--	--	--	--	2.2.4	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	54	54	54	54	54	54	54
D (mm)	5.4	5.4	5.4	5.4	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	10.1	19.2	5.1	19.2	5.75	7.8	10.2
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
V_s (m/s)	2696	2696	2676	2659	2985	2909	2884
V_r (m/s)	2384		2410		2880	2804	2743
L_r (mm)	32.8	24	40.6	24	41.4	38.7	
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.099	1.563	2.627	1.563	2.191	1.962	
Figure No.	2.2.4	--	--	--	--	--	2.2.4

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	54	54	54	54	54	54	54
D (mm)	5.4	5.4	5.4	5.4	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	10.2	14.9	19.05	26.05	30.4	35.5	40.1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	<1	<1	<1	<1	<1	<1	<1
V_s (m/s)	2973	3056	2920	3039	2973	2960	3076
V_r (m/s)	2810	2865	2725	2779	26[illegible]	2620	2456
L_r (mm)	34	29.5	25.1	17.7	13.7	8.7	4.1
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.961	1.644	1.517	1.393	1.326	1.276	1.244
Figure No.	2.2.4	--	2.2.4	--	--	--	2.2.4

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	199	199	199	199	199	199	199
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	460	460	460	460	460	460	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	4.3	1.9	2.2	4.1	6.5	0.0	0.0
V_s (m/s)	1770	2019	2281	2246	2178	1395	1415
V_r (m/s)	1435	1808	2147			0	0
L_r (mm)	13	18.2	21.8	22.3	21.3	0	0
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.184	1.932	1.757	1.733	1.782		
Figure No.	2.2.5	2.2.5	2.2.5	2.2.5	2.2.5	2.2.5	2.2.5

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	199	199	199	199	199	401	401
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	460	460
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	1.6	2.4	4.0	2.4	1.0	1.4	1.6
V_s (m/s)	1623	1649	1840	1808	2287	1381	1422
V_r (m/s)		1177		1488	2145		224
L_r (mm)	9.8	11.5	14.8	14	21.8	5.5	7.7
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.340	2.257	2.097	2.136	1.757	2.549	2.442
Figure No.	--	2.2.5	--	2.2.5	2.2.5	--	2.2.5

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	401	401	401	401	401	401	401
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	460	460	460	460	460	460	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	3.1	3.9	3.0	2.4	1.7	0.0	0.0
V_s (m/s)	1514	1833	2077	2252	2274	1410	1390
V_r (m/s)	544	1402	1839	2115		0	0
L_r (mm)	9.6	18.2	23	25.8	24.6	0	0
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.350	1.932	1.699	1.563	1.621	0.000	0.000
Figure No.	2.2.5	2.2.5	2.2.5	2.2.5	--	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	56	56	56	56	56	56	56
D (mm)	5.6	5.6	5.6	5.6	5.6	5.6	5.6
L/D	10	10	10	10	10	10	10
M (g)	12.17	12.17	12.17	12.17	12.17	12.17	12.17
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	8.83	8.83	8.83	8.83	8.83	8.83	8.83
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	271	271	271	271	214	214	214
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	11	20.6	20.6	11
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	0	60	0	0	60
RESULTS							
Yaw (deg)	0.0	1.6	2.1		0.0	2.5	
V_s (m/s)	1385	1772	2083	1802	1415	1773	1811
V_r (m/s)	0	1453	1868	1432	0	1435	1464
L_r (mm)	0	16.2	21.2	13.6	0	13.3	11.9
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$		1.932	1.689	1.927		2.073	2.005
Figure No.	--	--	--	2.2.6	--	--	2.2.6

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	60	60	60	60	60	60	60
D (mm)	6	6	6	6	6	6	6
L/D	10	10	10	10	10	10	10
M (g)	13.9	13.9	13.9	13.9	13.9	13.9	13.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	246	246	246	246	514	514	514
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.0	1.3	2.4	3.2	0.0	1.6	5.8
V_s (m/s)	1390	1620	1770	2058	1337	1590	2030
V_r (m/s)	0	966	1419	1818	0	1128	1796
L_r (mm)	0	11	17.5	23.9	0	20.6	29.5
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$		2.379	2.063	1.752		1.913	1.481
Figure No.	--	--	--	--	--	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	60	58	58	58	58	58	58
D (mm)	6	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	13.9	12.56	12.56	12.56	12.56	12.56	12.56
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	514	265	265	265	265	265	322
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	11.2	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	0	0	0	60	0
RESULTS							
Yaw (deg)	2.9	0.0	1.3	2.7	4.5		0.0
V_s (m/s)	1755	1390	1611	1800	1997	1815	1385
V_r (m/s)	1449	0	1025	1455	1716	1484	0
L_r (mm)	25	0	12.6	17.3	21.5	15.5	0
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.699		2.204	1.976	1.772	1.897	
Figure No.	--	--	--	--	--	2.2.6	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.56	12.56	12.56	12.56	12.56	12.56	12.56
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	322	322	322	415	415	415	415
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	11	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	60	0	0	0	0
RESULTS							
Yaw (deg)	0.2	2.7		0.0	2.4	1.9	3.4
V_s (m/s)	1619	1812	1812	1385	1613	1793	2027
V_r (m/s)	952	1468	1356	0	1029	1409	1768
L_r (mm)	13.8	19.6	22.7	0	15.6	20.8	25.8
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.146	1.864	1.605		2.058	1.806	1.563
Figure No.	--	--	2.2.6	--	--	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.56	12.56	12.56	12.56	12.56	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	8.2	8.2	8.2	8.2	8.2	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	415	492	492	492	492	558	558
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	11	20.6	20.6	20.6	11	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	60	0	0	0	60	0	0
RESULTS							
Yaw (deg)		0.0	2.3	4.3		0.0	1.3
V_s (m/s)	1803	1380	1615	1807	1812	1327	1635
V_r (m/s)	1452	0	1115	1460	1457	0	1195
L_r (mm)	20.9	0	18.2	24.7	23	9.1	21
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.686		1.932	1.617	1.591	2.374	1.796
Figure No.	2.2.6	--	2.2.5	2.2.5	2.2.6	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	558	558	558	592	592	592	592
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	11	20.6	20.6	20.6	20.6
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	60	0	0	0	0
RESULTS							
Yaw (deg)	2.0	3.2		0.0	2.8	0.9	2.7
V_s (m/s)	1797	2037	1798	1320	1640	1785	2009
V_r (m/s)	1480	1785	1440	0	1174	1461	1735
L_r (mm)	25.4	26.6	23.1	12.1	20.9	26.2	27.9
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.583	1.524	1.586	2.228	1.801	1.544	1.461
Figure No.	--	--	2.2.6	--	--	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	592	524	524	524	524	524	493
Elong (%)							
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	11	20.6	20.6	20.6	20.6	11	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	60	0	0	0	0	60	0
RESULTS							
Yaw (deg)		0.0	0.6	0.6	2.4		0.0
V_s (m/s)	1785	1338	1637	1790	2152	1805	1380
V_r (m/s)	1458	0	1222	1435	1935	1446	0
L_r (mm)	22.1	10.25	22.5	24.6	27.1	24.9	11.5
M_r (g)							
SCALING							
$\Delta L \cos\theta/t$	1.632	2.318	1.723	1.621	1.500	1.505	2.257
Figure No.	2.2.6	--	--	--	--	2.2.6	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	493	493	493	493	445	445	445
Elong (%)					10	10	10
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	11	20.6	20.6	20.6
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	460	460	460
Obliq (deg)	0	0	0	60	0	0	0
RESULTS							
Yaw (deg)	1.1	0.9	3.2		0.0	1.0	0.8
V_s (m/s)	1642	1778	2039	1807	1400	1500	1516
V_r (m/s)	1245	1451	1787	1463	0	675	
L_r (mm)	24.4	26	26.9	23.5	6.5	12	12.9
M_r (g)							
SCALING							
$\Delta L \cos\theta/t$	1.631	1.553	1.510	1.568	2.500	2.233	2.189
Figure No.	2.2.5	2.2.5	2.2.5	2.2.6	--	2.2.5	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	445	445	445	445	445	445	445
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	460	460	460	460	460	460	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	2.1	1.6	5.1	1.4	2.8	3.4	0.0
V_s (m/s)	1639	1779	1815	2029	2057	2243	1405
V_r (m/s)		1399	1459		1795	2036	0
L_r (mm)	16.9	19.1	20.4	23.2	24.8	26.2	8.6
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.995	1.888	1.825	1.689	1.612	1.544	2.398
Figure No.	--	2.2.5	2.2.5	--	2.2.5	2.2.5	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	445	445	445	445	445	445	445
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	1.4	0.8	1.9	0.5	1.5	4.0	1.2
V_s (m/s)	1465	1500	1501	1642	1831	2014	2319
V_r (m/s)	374	707		1173	1495	1756	2136
L_r (mm)	10.9	12	13.5	15.7	21.7	23	26.9
M_r (g)							
SCALING							
$\Delta L \cos\theta/t$	2.286	2.233	2.160	2.053	1.762	1.699	1.510
Figure No.	2.2.5	2.2.5	--	2.2.5	2.2.5	2.2.5	2.2.5

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	445	445	445	445	445	445	445
Elong (%)	10	10	10	10	10	10	10
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	40	40	40	40	40	11	11
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	460	460	460	415	415
Obliq (deg)	0	0	0	0	0	60	60
RESULTS							
Yaw (deg)	0.0	0.3	0.0	3.9	3.4		
V_s (m/s)	2000	2298	1940	2041	2309	1797	1870
V_r (m/s)	0	1181	0		1092	1392	1512
L_r (mm)	0	6	0	5.3	6	18.8	20.2
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$		1.300		1.318	1.300	1.782	1.718
Figure No.	--	--	--	--	--	2.2.6	2.2.6

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	685	685	685	685	685	685	685
Elong (%)	7.2	7.2	7.2	7.2	7.2	7.2	7.2
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	460	460	460	460	460	460	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.0	6.5	4.6	2.8	2.0	3.5	0.0
V_s (m/s)	1280	1396	1504	1787	2044	2210	1280
V_r (m/s)	0	244		1493	1823	1976	0
L_r (mm)	8.5	13.8	20.9	27.2	30.4	29.8	8.7
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	2.403	2.146	1.801	1.495	1.340	1.369	2.393
Figure No.	--	2.2.5	--	2.2.5	2.2.5	2.2.5	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	685	685	685	685	685	685	685
Elong (%)	7.2	7.2	7.2	7.2	7.2	7.2	7.2
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.6	20.6	20.6	20.6	40	40	40
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	3.0	1.6	0.3	3.4	0.0	2.2	3.3
V_s (m/s)	1375	1516	1786	2270	1910	1983	2233
V_r (m/s)		1101	1518	2098	0		
L_r (mm)	18.5	21	26.7	30.9	5	7	6.6
M_r (g)							
SCALING							
$\Delta L \cos\theta/t$	1.917	1.796	1.519	1.316	1.325	1.275	1.285
Figure No.	--	2.2.5	2.2.5	2.2.5	--	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	685	685	685	685	685	685	685
Elong (%)	7.2	7.2	7.2	7.2	7.2	7.2	7.2
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	40	40	40	40	11	11	11
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	460	460	415	415	415
Obliq (deg)	0	0	0	0	60	60	60
RESULTS							
Yaw (deg)	5.6	2.7	0.0	4.8			
V_s (m/s)	2264	2267	1900	2182	1586	1818	1872
V_r (m/s)		1435	0	1144	1208	1495	1555
L_r (mm)	6.7	9	0	6.4	23	24.7	27.8
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.283	1.225		1.290	1.591	1.514	1.373
Figure No.	--	--	--	--	2.2.6	2.2.6	2.2.6

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	12.02	26.04	26.04	26.04	26.04	26.04	26.04
Mat'l	C110W1	D17	D17	D17	D17	D17	D17
ρ (g/cm^3)	7.85	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	685	294	294	294	294	294	294
Elong (%)	7.2	8	8	8	8	8	8
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	11	20.6	20.6	20.6	20.6	20.6	20.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	460	460	460	460	460	460
Obliq (deg)	60	0	0	0	0	0	0
RESULTS							
Yaw (deg)		0.0	1.3	2.7	0.2	3.7	1.9
V_s (m/s)	1884	945	1064	1188	1640	1824	2076
V_r (m/s)	1594	0	587	941	1510	1737	2009
L_r (mm)	26.6	7.1	15.2	22.7	34	37	35.2
M_r (g)							
SCALING							
$\Delta L \cos\theta/t$	1.427	2.471	2.078	1.714	1.165	1.019	1.107
Figure No.	2.2.6	--	2.2.5	2.2.5	2.2.5	2.2.5	2.2.5

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.04	26.04	26.04	26.04	26.04	26.04	26.04
Mat'l	D17	D17	D17	D17	D17	D17	D17
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20	20.9	20.9	20.9	20.9	20.9	20.9
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	460	415	415	415	415	415	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	2.4	0.0	2.0	1.3	3.2	6.4	2.7
V_s (m/s)	1523	950	1028	1077	1197	1408	1427
V_r (m/s)	1417	0	598	670	964	1245	1292
L_r (mm)	30.7	6.2	14.7	14.5	24.1	26.3	30.9
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.365	2.478	2.072	2.081	1.622	1.517	1.297
Figure No.	2.2.5	--	2.2.5	2.2.5	2.2.5	2.2.5	2.2.5

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.04	26.04	26.04	26.04	26.04	26.04	26.04
Mat'l	D17	D17	D17	D17	D17	D17	D17
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	20.9	20.9	20.9	20	20	40	40
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	415	415	415	415
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	3.3	1.7	2.6	4.4	3.1	0.0	1.6
V_s (m/s)	1613	1845	2086	1606	1524	1350	1609
V_r (m/s)	1513	1771	2017	1518	1421	0	1179
L_r (mm)	34.7	35.3	36.4	34.7	32.1	0	12
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.115	1.086	1.033	1.165	1.295		1.150
Figure No.	2.2.5	2.2.5	2.2.5	2.2.5	2.2.5	--	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.04	26.04	26.04	26.04	26.04	26.04	26.04
Mat'l	D17	D17	D17	D17	D17	D17	D17
ρ (g/cm^3)	17	17	17	17	17	17	17
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	294	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	Steel	Steel	Steel	Steel	Steel	Steel	Steel
Thick (mm)	40	40	40	40	40	40	40
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	415	415	415	460	460	460	460
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	2.3	0.4	1.3	0.0	3.1	2.3	4.5
V_s (m/s)	1828	1901	2110	1360	1598	1816	1893
V_r (m/s)	1576	1637	1952				
L_r (mm)	15.4	15.2	18.7				
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$	1.065	1.070	0.983				
Figure No.	--	--	--	--	--	--	--

Hohler and Stilp (1991a)

Test No.		
PROJECTILE		
L (mm)	58	58
D (mm)	5.8	5.8
L/D	10	10
M (g)	26.04	26.04
Mat'l	D17	D17
ρ (g/cm^3)	17	17
Nose	Flat	Flat
BHN	294	294
Elong (%)	8	8
TARGET		
Mat'l	Steel	Steel
Thick (mm)	40	40
ρ (g/cm^3)	7.85	7.85
BHN	460	460
Obliq (deg)	0	0
RESULTS		
Yaw (deg)	2.9	3.9
V_s (m/s)	1934	2084
V_r (m/s)		
L_r (mm)		
M_r (g)		
SCALING		
$\Delta L \cos \theta / t$		
Figure No.	--	--

Lambert (1978)

Test No.	82	80	79	84	83	85	19
PROJECTILE							
L (mm)	64.9	64.8	64.8	64.8	64.8	64.7	64.9
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.99	4.98	4.98	4.98	4.98	4.98	4.99
M (g)	64.76	64.59	65.01	64.87	65.03	64.77	64.98
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	19.1	19.1	19.1	19.1	19.1	19.1	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	364	364	364	364	364	364	340
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	1.3	0.8	1.2	1.3	2.6	2.7	2.8
V_s (m/s)	721	748	763	909	917	1053	879
V_r (m/s)	81	384	429	609	548	730	249
L_r (mm)							
M_r (g)		43.0	42.3	46.7	42.2	40.2	30.0
SCALING							
$\Delta L \cos \theta / t$		1.235	1.270	1.049	1.275	1.370	1.423
Figure No.	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7

Lambert (1978)

Test No.	18	17	16	15	14	13	12
PROJECTILE							
L (mm)	64.8	64.8	64.8	64.7	64.8	64.8	64.8
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.98	4.98	4.98	4.98	4.98	4.98	4.98
M (g)	64.68	64.81	65.07	64.81	65.08	64.98	65.02
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	340	340	340	340	340	340
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	1.9	0.8	1.0	0.4	1.3	1.2	1.2
V_s (m/s)	913	942	966	987	1022	1124	1272
V_r (m/s)	213	363	367	474	525	624	797
L_r (mm)							
M_r (g)	28.0	26.1	33.0	33.8	36.6		34.1
SCALING							
$\Delta L \cos\theta/t$	1.495	1.566	1.306	1.272	1.170		12.643
Figure No.	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7

Lambert (1978)

Test No.	47	46	45	44	43	42	41
PROJECTILE							
L (mm)	64.8	64.8	64.7	64.7	64.8	64.7	64.7
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.98	4.98	4.98	4.98	4.98	4.98	4.98
M (g)	64.71	65.05	64.52	64.78	65.00	64.73	64.38
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	31.8	31.8	31.8	31.8	31.8	31.8	31.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	321	321	321	321	321	321	321
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.8	2.0	2.1	2.6	1.3	0.6	0.7
V_s (m/s)	1130	1137	1164	1185	1241	1304	1352
V_r (m/s)	36	65	223	314	465	661	849
L_r (mm)							
M_r (g)	34.3	34.3	18.4	18.8	31.4	34.2	36.8
SCALING							
$\Delta L \cos \theta / t$	1.004	1.004	1.480	1.468	1.091	1.004	.925
Figure No.	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7

Lambert (1978)

Test No.	28	27	135	131	121	122	118
PROJECTILE							
L (mm)	64.8	64.8	64.8	64.7	64.7	64.8	63.8
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.98	4.98	4.98	4.98	4.98	4.98	4.91
M (g)	64.84	64.78	64.92	64.68	64.85	64.73	64.97
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.1	38.1	50.8	50.8	50.8	50.8	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	321	321	286	286	293	293	302
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.4	0.6	1.7	1.6	8.2	4.5	4.7
V_s (m/s)	1306	1330	1567	1595	1611	1630	1630
V_r (m/s)	199	514	162	143	298	44	474
L_r (mm)							
M_r (g)	25.3	25.3			16.9		9.8
SCALING							
$\Delta L \cos\theta/t$	1.064	1.064			.955		1.071
Figure No.	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7

Lambert (1978)

Test No.	129	132	117	115	171	127	116
PROJECTILE							
L (mm)	64.7	64.8	64.7	64.7	64.7	64.8	64.8
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.98	4.98	4.98	4.98	4.98	4.98	4.98
M (g)	64.68	64.70	64.76	64.81	64.59	64.80	64.84
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	50.8	50.8	50.8	50.8	50.8	50.8	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	302	302	302	286	293	302	302
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	4.9	3.4	2.0	8.0	2.7	2.6	.5
V_s (m/s)	1632	1639	1644	1646	1650	1652	1667
V_r (m/s)	478	262	308	128	373	517	391
L_r (mm)							
M_r (g)			9.8	10.5		10.7	15.7
SCALING							
$\Delta L \cos\theta/t$			1.089	1.076		1.074	0.979
Figure No.	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7	2.2.7

Lambert (1978)

Test No.	113	172	137	191	193	206	190
PROJECTILE							
L (mm)	64.8	64.8	64.8	63.8	64.8	64.6	64.8
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.98	4.98	4.98	4.91	4.98	4.97	4.98
M (g)	64.45	64.62	64.85	63.84	64.90	64.91	64.65
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	50.8	50.8	50.8	25.4	25.4	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	286	302	286	340	340	340	340
Obliq (deg)	0	0	0	60	60	60	60
RESULTS							
Yaw (deg)	0.8	0.3	0.7	3.5	1.5	0.9	0.2
V_s (m/s)	1679	1832	1941	1461	1462	1509	1520
V_r (m/s)	532	973	1283	277	197	348	398
L_r (mm)							
M_r (g)					16.2		20.9
SCALING							
$\Delta L \cos\theta / t$					0.970		0.881
Figure No.	2.2.7	2.2.7	2.2.7	2.2.11	2.2.11	2.2.11	2.2.11

Lambert (1978)

Test No.	199	198	200	197	203	201	204
PROJECTILE							
L (mm)	64.8	64.7	64.8	64.8	64.7	64.8	64.4
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	13.00
L/D	4.98	4.98	4.98	4.98	4.98	4.98	4.95
M (g)	64.54	64.71	64.86	64.85	64.75	64.39	64.60
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	340	340	340	340	340	340
Obliq (deg)	60	60	60	60	60	60	60
RESULTS							
Yaw (deg)	3.3	0.7	2.1	1.7	3.1	7.8	1.3
V_s (m/s)	1546	1558	1565	1576	1712	1573	1841
V_r (m/s)	568	391	453	470	704	901	948
L_r (mm)							
M_r (g)	16.9	17.5	15.1	17.4	12.1	15.0	15.1
SCALING							
$\Delta L \cos \theta / t$	0.957	0.943	0.991	0.947	1.045	0.993	0.983
Figure No.	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11

Lambert (1978)

Test No.	71	88	70	77	76	9	7
PROJECTILE							
L (mm)	101.5	101.6	101.9	101.6	101.6	101.6	101.6
D (mm)	10.20	10.20	10.20	10.20	10.20	10.20	10.20
L/D	9.95	9.96	9.99	9.96	9.96	9.96	9.96
M (g)	63.42	63.67	63.82	63.60	63.68	63.63	63.67
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	19.1	19.1	19.1	19.1	19.1	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	364	364	364	364	364	340	340
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.2	2.5	1.2	1.1	0.9	1.4	
V_s (m/s)	801	828	852	1002	1361	955	956
V_r (m/s)	379	493	467	712	1229	432	246
L_r (mm)							
M_r (g)	31.3	28.9	39.7	42.4	22.5	25.3	21.6
SCALING							
$\Delta L \cos \theta / t$	2.763	2.963	2.099	1.863	3.485	2.449	2.676
Figure No.	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8

Lambert (1978)

Test No.	6	5	4	3	2	34	33
PROJECTILE							
L (mm)	101.5	101.6	101.6	101.6	101.6	101.6	101.6
D (mm)	10.20	10.20	10.20	10.20	10.20	10.20	10.20
L/D	9.95	9.96	9.96	9.96	9.96	9.96	9.96
M (g)	63.52	64.48	63.57	63.55	63.63	63.56	63.68
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.4	25.4	25.4	25.4	38.1	38.1
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	340	340	340	340	321	321
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	4.5	2.0	1.6	4.2	1.8	2.6	1.4
V_s (m/s)	984	1053	1103	1137	1219	1211	1237
V_r (m/s)	317	594	690	783	910	128	313
L_r (mm)							
M_r (g)	26.7	30.8	36.1	35.6	39.1	21.0	15.0
SCALING							
$\Delta L \cos\theta / t$	2.359	2.112	1.787	1.818	1.603	1.808	2.054
Figure No.	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8

Lambert (1978)

Test No.	32	31	30	142	144	140	139
PROJECTILE							
L (mm)	101.6	101.7	101.5	101.7	101.5	101.5	101.6
D (mm)	10.20	10.20	10.20	10.20	10.10	10.20	10.20
L/D	9.96	9.97	9.95	9.97	10.05	9.95	9.96
M (g)	63.66	63.68	63.61	64.00	63.71	64.31	64.18
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.1	38.1	38.1	50.8	50.8	50.8	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	321	321	321	286	286	286	286
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.8	0.9	6.1	1.0	0.7	0.5	0.3
V_s (m/s)	1243	1366	1384	1414	1422	1422	1450
V_r (m/s)	501	907	868	290	255	375	251
L_r (mm)							
M_r (g)	23.0	21.8	27.2				
SCALING							
$\Delta L \cos \theta / t$	1.727	1.778	1.552				
Figure No.	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8

Lambert (1978)

Test No.	138	148	153	216	220	185	224
PROJECTILE							
L (mm)	101.7	101.5	101.6	100.6	101.1	101.5	101.8
D (mm)	10.20	10.20	10.20	10.30	10.30	10.20	10.30
L/D	9.97	9.95	9.96	9.77	9.82	9.95	9.88
M (g)	64.10	63.91	64.25	63.91	63.86	64.30	64.00
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	50.8	50.8	50.8	25.4	25.4	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	286	286	286	340	340	340	340
Obliq (deg)	0	0	0	60	60	60	60
RESULTS							
Yaw (deg)	0.8	0.3	0.5	0.7	0.8	1.5	1.1
V_s (m/s)	1454	1531	1765	1304	1323	1339	1352
V_r (m/s)	628	772	1286	367	581	427	586
L_r (mm)							
M_r (g)						18.8	
SCALING							
$\Delta L \cos \theta / t$						1.422	
Figure No.	2.2.8	2.2.8	2.2.8	2.2.11	2.2.11	2.2.11	2.2.11

Lambert (1978)

Test No.	182	180	181	179	226	25	23
PROJECTILE							
L (mm)	101.6	101.6	101.6	101.7	101.5	160.7	160.6
D (mm)	10.20	10.20	10.20	10.20	10.20	8.10	8.10
L/D	9.96	9.96	9.96	9.97	9.95	19.84	19.83
M (g)	63.82	63.68	64.16	63.72	63.99	64.63	64.84
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	340	340	340	340	340	340
Obliq (deg)	60	60	60	60	60	0	0
RESULTS							
Yaw (deg)	2.6	1.3	1.6	1.8	0.4	0.6	1.0
V_s (m/s)	1361	1361	1370	1396	1504	998	1011
V_r (m/s)	151	212	171	678	907	125	428
L_r (mm)							
M_r (g)	15.6	7.8	12.0	16.4	12.8	19.8	25.2
SCALING							
$\Delta L \cos \theta / t$	1.522	1.761	1.632	1.499	1.606	4.402	3.873
Figure No.	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11	2.2.9	2.2.9

Lambert (1978)

Test No.	22	21	39	37	36	161	158
PROJECTILE							
L (mm)	160.6	160.6	161.9	161.9	161.9	162.0	162.0
D (mm)	8.10	8.10	8.10	8.10	8.10	8.10	8.10
L/D	19.83	19.83	19.99	19.99	19.99	20.00	20.00
M (g)	64.67	64.70	64.67	64.73	64.82	64.74	64.75
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.4	38.1	38.1	38.1	50.8	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	340	321	321	321	293	286
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.9	2.0	1.2	0.9	1.3	0.5	0.3
V_s (m/s)	1090	1154	1160	1234	1327	1297	1315
V_r (m/s)	776	886	338	834	1025	499	215
L_r (mm)							
M_r (g)	37.2	40.4	16.5	29.7	34.6	13.4	11.1
SCALING							
$\Delta L \cos\theta / t$	2.707	2.396	3.180	2.325	2.007	2.538	2.649
Figure No.	2.2.9	2.2.9	2.2.9	2.2.9	2.2.9	2.2.9	2.2.9

Lambert (1978)

Test No.	163	176	156	175	167	157	155
PROJECTILE							
L (mm)	161.9	160.6	162.0	160.6	161.9	161.9	162.0
D (mm)	8.10	8.20	8.10	8.10	8.10	8.10	8.20
L/D	19.99	19.59	20.00	19.83	19.99	19.99	19.76
M (g)	64.70	64.56	64.67	64.63	64.69	64.80	64.88
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	50.8	50.8	50.8	50.8	50.8	50.8	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	286	302	293	293	286	293	286
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.5	0.5	1.1	1.0	0.8	0.3	0.5
V_s (m/s)	1318	1328	1327	1328	1347	1364	1400
V_r (m/s)	383	234	502	378	796	842	948
L_r (mm)							
M_r (g)	13.3	12.0	16.7	12.7	19.0		23.7
SCALING							
$\Delta L \cos \theta / t$	2.541	2.592	2.377	2.544	2.264		2.065
Figure No.	2.2.9	2.2.9	2.2.9	2.2.9	2.2.9	2.2.9	2.2.9

Lambert (1978)

Test No.	170	215	213	210	212	239	238
PROJECTILE							
L (mm)	162.0	160.5	160.4	160.6	160.5	102.5	102.5
D (mm)	8.10	8.10	8.10	8.10	8.10	10.20	10.20
L/D	20.00	19.81	19.80	19.83	19.81	10.05	10.05
M (g)	64.57	64.33	64.40	64.75	64.62	64.00	64.11
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	50.8	25.4	25.4	25.4	25.4	25.5	25.5
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	293	340	340	340	340	364	364
Obliq (deg)	0	60	60	60	60	45	45
RESULTS							
Yaw (deg)	1.8	0.6	0.8	0.4	1.4	1.0	0.4
V_s (m/s)	1566	1242	1260	1263	1271	1096	1138
V_r (m/s)	1183	707	735	564	725	199	536
L_r (mm)							
M_r (g)	23.5					10.7	14.2
SCALING							
$\Delta L \cos \theta / t$	2.047					2.380	2.229
Figure No.	2.2.9	2.2.11	2.2.11	2.2.11	2.2.11	2.2.10	2.2.10

Lambert (1978)

Test No.	232	233	231	235	234	237	236
PROJECTILE							
L (mm)	102.4	102.4	102.4	102.4	102.4	102.5	102.5
D (mm)	10.20	10.20	10.20	10.20	10.20	10.20	10.20
L/D	10.04	10.04	10.04	10.04	10.04	10.05	10.05
M (g)	64.31	64.42	64.33	64.31	64.29	64.40	63.88
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.6	25.6	25.4	25.6	25.6	25.5	25.6
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	364	364	364	364	364	364	364
Obliq (deg)	45	45	45	45	45	45	45
RESULTS							
Yaw (deg)	1.5	0.9	1.0	0.7	1.2	2.1	0.8
V_s (m/s)	1187	1205	1213	1431	1433	1542	1828
V_r (m/s)	744	815	857	1166	1161	1280	1575
L_r (mm)							
M_r (g)	19.1	21.1	19.1	30.2	31.0	32.4	32.7
SCALING							
$\Delta L \cos \theta / t$	2.007	1.921	2.023	1.530	1.495	1.443	1.425
Figure No.	2.2.10	2.2.10	2.2.10	2.2.10	2.2.10	2.2.10	2.2.10

Lambert (1978)

Test No.	245	241	242	243	244	253	251
PROJECTILE							
L (mm)	102.2	102.4	102.3	102.3	102.4	96.9	96.9
D (mm)	10.20	10.20	10.20	10.20	10.20	9.70	9.70
L/D	10.02	10.04	10.03	10.03	10.04	9.99	9.99
M (g)	64.02	64.22	64.15	64.30	64.09	64.37	64.58
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	S7/W	S/7W
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.3	38.5	38.3	38.1	38.3	38.2	38.2
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	321	340	321	340	340	321	321
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.2	0.6	0.8	0.2	1.0	0.2	0.4
V_s (m/s)	1217	1244	1246	1469	1809	1097	1125
V_r (m/s)	139	507	530	1200	1548	54	478
L_r (mm)							
M_r (g)	13.8	17.1	14.0	25.1	32.7	10.3	10.7
SCALING							
$\Delta L \cos \theta / t$	2.107	1.968	2.102	1.659	1.344	2.072	2.054
Figure No.	2.2.8	2.2.8	2.2.8	2.2.8	2.2.8	--	--

Lambert (1978)

Test No.	250	249	247	248	255	256	257
PROJECTILE							
L (mm)	96.7	96.9	96.8	96.7	96.9	96.8	96.8
D (mm)	9.70	9.70	9.70	9.70	9.70	9.70	9.70
L/D	9.97	9.99	9.98	9.97	9.99	9.98	9.98
M (g)	64.42	64.44	64.00	64.40	64.80	64.54	64.28
Mat'l	S/7W	S/7W	S/7W	S/7W	S/7W	S/7W	S/7W
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.2	38.3	38.4	38.3	38.2	38.2	38.3
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	321	332	321	321	340	340	340
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)	0.5	0.6	0.1	0.4	0.6	0.3	1.8
V_s (m/s)	1185	1257	1258	1269	1377	1627	1789
V_r (m/s)	868	1033	1045	1047	1194	1465	1586
L_r (mm)							
M_r (g)	16.5	26.4	22.5	30.5	29.0	31.9	34.0
SCALING							
$\Delta L \cos\theta/t$	1.788	1.343	1.512	1.154	1.230	1.096	.999
Figure No.	--	--	--	--	--	--	--

Lambert (1978)

Test No.	263	262	261	265	260	259	258
PROJECTILE							
L (mm)	102.6	102.6	102.5	102.2	102.5	102.6	102.5
D (mm)	10.20	10.20	10.20	10.20	10.20	10.20	10.20
L/D	10.06	10.06	10.05	10.02	10.05	10.06	10.05
M (g)	64.43	64.29	64.06	64.04	64.34	64.20	64.35
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.3	25.6	25.3	25.4	25.5	25.4	25.3
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	364	351	364	364	340	351	364
Obliq (deg)	60	60	60	60	60	60	60
RESULTS							
Yaw (deg)	0.1	0.6	0.8	0.2	0.7	0.8	1.5
V_s (m/s)	1227	1282	1360	1471	1489	1647	1800
V_r (m/s)	204	509	768	997	903	1145	1285
L_r (mm)							
M_r (g)	8.5	15.0	22.4	20.2	20.1	18.3	
SCALING							
$\Delta L \cos \theta / t$	1.766	1.548	1.336	1.393	1.396	1.459	
Figure No.	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11	2.2.11

Lambert (1978)

Test No.	266	267	91	93	55	53	65
PROJECTILE							
L (mm)	97.0	96.9	161.9	161.9	161.9	161.9	101.5
D (mm)	9.70	9.70	8.10	8.10	8.10	8.10	10.20
L/D	10.00	9.99	19.99	19.99	19.99	19.99	9.95
M (g)	64.46	64.42	64.68	64.65	64.75	64.77	63.77
Mat'l	S7/W	S7/W	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.3	25.3	19.1	19.1	31.8	31.8	31.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	364	364	364	364	321	321	321
Obliq (deg)	60	60	0	0	0	0	0
RESULTS							
Yaw (deg)	0.2	1.2	2.2	1.0	0.3	0.8	1.0
V_s (m/s)	1331	1758	882	886	1061	1087	1146
V_r (m/s)	898	1399	445	555	503	597	566
L_r (mm)							
M_r (g)	22.6	24.0	24.4	33.7		28.7	25.5
SCALING							
$\Delta L \cos \theta / t$	1.148	1.098	5.322	4.120		2.863	1.943
Figure No.	--	--	2.2.9	2.2.9	2.2.9	2.2.9	2.2.8

Lambert (1978)

Test No.	63	61	64	62	1662	1663	1666
PROJECTILE							
L (mm)	101.6	101.9	101.5	101.9	76.7	76.7	76.7
D (mm)	10.20	10.20	10.20	10.20	7.67	7.67	7.67
L/D	9.96	9.99	9.95	9.99	10.00	10.00	10.00
M (g)	63.90	63.60	63.57	63.69	65.00	65.00	65.00
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	U-3/4Ti	U-3/4Ti	U-3/4Ti
ρ (g/cm^3)	7.86	7.86	7.86	7.86	18.46	18.46	18.46
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN	560	560	560	560	345	345	345
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	31.8	31.8	31.8	31.8	19.0	19.0	19.0
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	321	321	321	321	300	300	300
Obliq (deg)	0	0	0	0	60	60	59
RESULTS							
Yaw (deg)	3.8	5.7	3.8	4.3	1.2	0.4	0.1
V_s (m/s)	1185	1198	1201	1214	1515	1550	1490
V_r (m/s)	684	623	638	662	1190	820	1310
L_r (mm)							
M_r (g)	32.6	21.0	29.1	22.4	35.8	31.6	29.8
SCALING							
$\Delta L \cos\theta/t$	1.599	2.176	1.767	2.108	0.914	1.043	1.102
Figure No.	2.2.8	2.2.8	2.2.8	2.2.8	--	--	--

Rosenberg and Forrestal (1988)

Test No.	849	945	963	989	985	987	983
PROJECTILE							
L (mm)	81.8	81.8	81.8	93.2	93.2	93.2	93.2
D (mm)	7.10	7.10	7.10	6.60	6.60	6.60	6.60
L/D	11.52	11.52	11.52	14.12	14.12	14.12	14.12
M (g)	24.00	24.00	25.30	23.40	23.60	23.50	23.70
Mat'l	T-200	T-200	C-300	T-200	T-200	T-200	T-200
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Conical	Conical	Conical	Cone/cut	Cone/cut	Cone/cut	Cone/cut
BHN	427	427	427	427	427	427	427
Elong (%)							
TARGET							
Mat'l	6061-T6	6061-T6	6061-T6	6061-T6	6061-T6	6061-T6	6061-T6
Thick (mm)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71	2.71	2.71
BHN	99	99	99	99	99	99	99
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
Yaw (deg)							
V_s (m/s)	1442	1516	1575	315	360	421	532
V_r (m/s)	1397	1445	1509	40	175	282	433
L_r (mm)							
M_r (g)							
SCALING							
$\Delta L \cos \theta / t$							
Figure No.	2.2.12	2.2.12	--	2.2.12	2.2.12	2.2.12	2.2.12

Rosenberg and Forrestal (1988)

Test No.	993	991	990	971	848
PROJECTILE					
L (mm)	81.8	81.8	81.8	81.8	81.8
D (mm)	7.10	7.10	7.10	7.10	7.10
L/D	11.52	11.52	11.52	11.52	11.52
M (g)	25.10	25.10	25.10	25.10	24.00
Mat'l	T-200	T-200	T-200	T-200	T-200
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85
Nose	Conical	Conical	Conical	Conical	Conical
BHN	427	427	427	427	427
Elong (%)					
TARGET					
Mat'l	6061-T6	6061-T6	6061-T6	6061-T6	6061-T6
Thick (mm)	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	2.71	2.71	2.71	2.71	2.71
BHN	99	99	99	99	99
Obliq (deg)	0	0	0	0	0
RESULTS					
Yaw (deg)					
V_s (m/s)	383	419	515	886	1394
V_r (m/s)	175	260	399	827	1334
L_r					
M_r (g)					
SCALING					
$\Delta L \cos \theta / t$					
Figure No.	2.2.12	2.2.12	2.2.12	2.2.12	2.2.12

Limit-Velocity Data

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	518.2	303.8	76.2	79.3	15.6	15.6	19.6
D (mm)	25.91	15.42	7.62	7.93	3.12	3.12	3.91
L/D	20.00	19.70	10.00	10.00	5.00	5.00	5.01
M (g)	3628.80	907.20	61.48	59.50	1.94	1.94	3.89
Mat'l	WC	M-3000	M-3950	F583-U	M-3000	M-3000	M-3000
ρ (g/cm^3)	14.60	17.00	18.00	17.40	17.00	17.00	17.00
BHN	800	286	264	432	253	253	253
Elong (%)		15.0	9.0	1.0	15.0	15.0	15.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	101.6	101.6	25.4	25.4	6.3	12.7	12.7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	258	258	371	371	381	381	381
Obliq (deg)	60	60	60	60	0	0	0
RESULTS							
V_L (m/s)	1094	1585	1167	1143	689	1181	1024
SCALING							
$t/\alpha L$	0.144	0.227	0.220	0.215	0.277	0.554	0.441
t/L	0.196	0.334	0.333	0.320	0.407	0.814	0.648
$t/(D \cos \theta)$	7.843	13.178	6.667	6.406	2.035	4.071	3.248
Figure No.	2.2.16	2.2.18	2.2.21	--	--	--	--

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	24.8	78.8	79.4	79.6	20.2	203.45	203.45
D (mm)	4.95	7.88	7.94	7.96	4.04	20.35	20.35
L/D	5.01	10.00	10.00	10.00	5.00	10.00	10.00
M (g)	7.78	71.00	67.00	66.50	1.94	453.60	453.60
Mat'l	M-3000	E592-U	581-U	F584-U	Bearcat	Bearcat	Bearcat
ρ (g/cm^3)	17.00	18.75	17.68	17.90	7.80	7.80	7.80
BHN	253	353	525	421	560	560	560
Elong (%)	15.0	7.5	1.5	7.0	10.0	10.0	10.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	12.7	25.4	25.4	25.4	12.7	25.4	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	381	381	381	381	381	327	258
Obliq (deg)	0	60	60	60	0	0	0
RESULTS							
V_L (m/s)	831	1020	1105	1112	1432	381	671
SCALING							
$t/\alpha L$	0.348	0.209	0.213	0.211	0.631	0.125	0.251
t/L	0.512	0.322	0.320	0.319	0.629	0.125	0.250
$t/(D \cos \theta)$	2.566	6.447	6.398	6.382	3.144	1.248	2.496
Figure No.	--	--	--	--	2.2.13	2.2.13	2.2.13

Grabarek (1971)

Test No.							
PROJECTILE							
L(mm)	203.45	311.4	406.15	391.67	259.1	259.1	259.1
D (mm)	20.35	15.80	13.69	19.89	12.95	12.95	12.95
L/D	10.00	19.71	29.67	19.69	20.01	20.01	20.01
M (g)	453.60	453.60	453.60	907.20	453.60	453.60	453.60
Mat'l	Bearcat	Bearcat	1095 Stl	1095 Stl	WC	WC	WC
ρ (g/cm^3)	7.80	7.80	7.80	7.80	14.20	14.20	14.20
BHN	560	560	654	654	800	800	800
Elong (%)	10.0	10.0					
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	76.2	152.4	101.6	101.6	101.6	127.0	152.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	301	271	258	258	258	258	247
Obliq (deg)	60	0	60	60	60	60	60
RESULTS							
V_L (m/s)	1742	1547	1884	1697	1609	2062	2085
SCALING							
$t/\alpha L$	0.376	0.491	0.251	0.260	0.292	0.365	0.438
t/L	0.375	0.489	0.250	0.259	0.392	0.490	0.588
$t/(D \cos \theta)$	7.489	9.646	14.843	10.216	15.691	19.614	23.537
Figure No.	2.2.13	2.2.13	--	2.2.14	2.2.16	2.2.16	2.2.16

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	338.3	325.1	325.1	325.1	325.1	423.7	423.7
D (mm)	11.28	16.26	16.26	16.26	16.26	14.12	14.12
L/D	29.99	19.99	19.99	19.99	19.99	30.01	30.01
M (g)	453.60	907.20	907.20	907.20	907.20	907.20	907.20
Mat'l	WC	WC	WC	WC	WC	WC	WC
ρ (g/cm^3)	14.20	14.20	14.20	14.20	14.20	14.20	14.20
BHN	800	800	800	800	800	800	800
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	101.6	25.4	101.6	127.0	152.4	50.8	101.6
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	258	371	258	258	247	258	258
Obliq (deg)	60	60	60	60	60	0	60
RESULTS							
V_L (m/s)	1701	524	1489	1803	1919	431	1399
SCALING							
$t/\alpha L$	0.223	0.058	0.233	0.291	0.349	0.089	0.178
t/L	0.300	0.078	0.313	0.391	0.469	0.120	0.240
$t/(D \cos \theta)$	18.014	3.124	12.497	15.621	18.745	3.598	14.391
Figure No.	2.2.16	2.2.16	2.2.16	2.2.16	2.2.16	--	2.2.16

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	79.3	76.2	78.8	78.8	78.7	101.6	76.96
D (mm)	7.93	7.62	7.88	7.88	7.87	10.16	7.70
L/D	10.00	10.00	10.00	10.00	10.00	10.00	9.99
M (g)	67.00	59.50	67.00	68.40	61.50	64.80	64.80
Mat'l	F583-U	F583-U	E593-U	E591-U	M-3950	Bearcat	W-2
ρ (g/cm^3)	17.40	17.40	18.57	18.89	18.00	7.80	18.60
BHN	512	432	481	371	264	560	286
Elong (%)	1.0	1.0	3.0	16.0	9.0	10.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	381	381	381	381	381	381	381
Obliq (deg)	60	60	60	60	60	60	60
RESULTS							
V_L (m/s)	1044	1143	966	1003	1167	1356	1112
SCALING							
$t/\alpha L$	0.215	0.224	0.210	0.208	0.213	0.251	0.215
t/L	0.320	0.333	0.322	0.322	0.323	0.250	0.330
$t/(D\cos\theta)$	6.406	6.667	6.447	6.447	6.455	5.000	6.597
Figure No.	--	--	--	--	--	2.2.13	2.2.21

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	83.92	25.4	25.4	25.4	49.4	49.4	49.4
D (mm)	8.38	6.35	6.35	6.35	4.06	4.06	4.06
L/D	10.01	4.00	4.00	4.00	12.17	12.17	12.17
M (g)	64.80	10.60	10.60	10.60	10.05	10.05	10.95
Mat'l	WC	U	U	U	U	U	U
ρ (g/cm^3)	14.20	19.15	19.15	19.15	19.15	19.15	19.15
BHN	800	226	226	226	226	226	226
Elong (%)		6.0	6.0	6.0	6.0	6.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	12.7	19.05	12.7	22.23	22.23	22.23
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	381	353	381	353	409	409	409
Obliq (deg)	60	0	0	60	0	45	0
RESULTS							
V_L (m/s)	1245	701	919	1097	975	1271	978
SCALING							
$t/\alpha L$	0.225	0.320	0.480	0.320	0.288	0.288	0.288
t/L	0.303	0.500	0.750	0.500	0.450	0.450	0.450
$t/(D \cos \theta)$	6.062	2.000	3.000	4.000	5.475	7.743	5.475
Figure No.	--	2.2.19	2.2.19	2.2.20	2.2.19	2.2.20	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	49.4	44.65	44.65	44.65	62.99	62.99	62.99
D (mm)	4.06	3.68	3.68	3.68	5.08	5.08	5.08
L/D	12.17	12.13	12.13	12.13	12.40	12.40	12.40
M (g)	10.95	8.85	8.85	9.05	23.00	23.00	23.00
Mat'l	U	U	U	U	U	U	U
ρ (g/cm^3)	19.15	19.15	19.15	19.15	19.15	19.15	19.15
BHN	226	226	226	226	226	226	226
Elong (%)	6.0	6.0	6.0	6.0	6.0	6.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	4130	RHA
Thick (mm)	22.23	22.23	22.23	22.23	12.70	13.21	29.21
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	409	409	409	409	344	344	353
Obliq (deg)	45	0	45	45	60	60	0
RESULTS							
V_L (m/s)	1228	1039	1219	1244	901	922	943
SCALING							
$t/\alpha L$	0.288	0.319	0.319	0.319	0.129	0.134	0.297
t/L	0.450	0.498	0.498	0.498	0.202	0.210	0.464
$t/(D \cos \theta)$	7.743	6.041	8.543	8.543	5.000	5.201	5.750
Figure No.	2.2.20	2.2.19	2.2.20	2.2.20	2.2.20	--	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	62.99	81.28	81.28	81.28	76.2	76.2	76.2
D (mm)	5.08	2.79	2.79	2.79	3.81	3.81	3.81
L/D	12.40	29.13	29.13	29.13	20.00	20.00	20.00
M (g)	23.00	9.10	9.10	9.10	15.70	15.70	15.70
Mat'l	U	U	U	U	U	U	U
ρ (g/cm^3)	19.15	19.15	19.15	19.15	19.15	19.15	19.15
BHN	226	226	226	226	226	226	226
Elong (%)	6.0	6.0	6.0	6.0	6.0	6.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	29.21	31.75	19.05	12.70	19.05	25.40	31.75
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	353	344	390	381	371	371	344
Obliq (deg)	30	0	60	45	60	60	0
RESULTS							
V_L (m/s)	1055	1067	1202	1165	1100	1324	989
SCALING							
$t/\alpha L$	0.297	0.250	0.150	0.100	0.160	0.214	0.267
t/L	0.464	0.391	0.234	0.156	0.250	0.333	0.417
$t/(D \cos \theta)$	6.640	11.380	13.656	6.437	10.000	13.333	8.333
Figure No.	2.2.19	--	--	--	2.2.20	2.2.20	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	76.2	76.2	76.2	76.2	25.4	25.4	25.4
D (mm)	3.81	3.81	3.81	3.81	6.35	6.35	6.35
L/D	20.00	20.00	20.00	20.00	4.00	4.00	4.00
M (g)	15.70	15.70	15.70	15.70	13.70	13.70	13.70
Mat'l	U	U	U	U	U	U	U
ρ (g/cm^3)	19.15	19.15	19.15	19.15	19.15	19.15	19.15
BHN	226	226	226	226	226	226	226
Elong (%)	6.0	6.0	6.0	6.0	6.0	6.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	22.23	46.99	22.23	31.75	22.23	22.23	22.23
ρ (g/cm$_3$)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	409	409	409	400	409	409	409
Obliq (deg)	60	0	45	0	0	45	30
RESULTS							
V_L (m/s)	1250	1298	1012	1036	1082	1321	1161
SCALING							
$t/\alpha L$	0.187	0.395	0.187	0.267	0.561	0.561	0.561
t/L	0.292	0.617	0.292	0.417	0.875	0.875	0.875
$t/(D \cos \theta)$	11.669	12.333	8.251	8.333	3.501	4.951	4.042
Figure No.	2.2.20	2.2.19	2.2.20	2.2.19	2.2.19	2.2.20	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	25.4	25.4	25.4	25.4	25.4	25.4	25.4
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	4.00	4.00	4.00	4.00	4.00	4.00	4.00
M (g)	13.65	13.65	13.65	13.65	13.65	13.65	13.65
Mat'l	U	U	U	U	U	U	U
ρ (g/cm^3)	19.15	19.15	19.15	19.15	19.15	19.15	19.15
BHN	226	226	226	226	226	226	226
Elong (%)	6.0	6.0	6.0	6.0	6.0	6.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	12.70	31.75	19.05	15.88	12.70	19.05	25.40
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	344	344	353	371	353	381	344
Obliq (deg)	60	0	60	0	0	0	0
RESULTS							
V_L (m/s)	1032	1213	1372	799	721	931	1152
SCALING							
$t/\alpha L$	0.320	0.801	0.480	0.401	0.320	0.480	0.641
t/L	0.500	1.250	0.750	0.625	0.500	0.750	1.000
$t/(D \cos \theta)$	4.000	5.000	6.000	2.501	2.000	3.000	4.000
Figure No.	2.2.20	2.2.19	2.2.20	2.2.19	2.2.19	2.2.19	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	25.4	28.19	28.19	28.19	28.19	28.19	28.19
D (mm)	6.35	6.99	6.99	6.99	6.99	6.99	6.99
L/D	4.00	4.03	4.03	4.03	4.03	4.03	4.03
M (g)	13.65	16.00	16.00	16.00	16.00	16.00	16.00
Mat'l	U	SD170	SD170	SD170	SD170	SD170	SD170
ρ (g/cm^3)	19.15	17.00	17.00	17.00	17.00	17.00	17.00
BHN	226	279	279	279	279	279	279
Elong (%)	6.0						
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	12.70	25.50	19.05	15.88	12.70	22.23	22.23
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	353	371	381	390	353	409	409
Obliq (deg)	60	0	0	60	60	0	45
RESULTS							
V_L (m/s)	1023	1045	913	1248	1035	1052	1335
SCALING							
$t/\alpha L$	0.320	0.613	0.460	0.383	0.306	0.536	0.536
t/L	0.500	0.901	0.676	0.563	0.451	0.789	0.789
$t/(D \cos \theta)$	4.000	3.634	2.725	4.544	3.634	3.180	4.498
Figure No.	2.2.20	2.2.18	2.2.18	2.2.18	2.2.18	2.2.18	2.2.18

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	28.19	13.61	13.61	21.08	21.08	21.08	21.08
D (mm)	6.99	1.78	1.78	1.78	1.78	1.78	1.78
L/D	4.03	7.65	7.65	11.84	11.84	11.84	11.84
M (g)	16.00	.54	.54	.83	.83	.83	.83
Mat'l	SD170	U	U	U	U	U	U
ρ (g/cm^3)	17.00	19.15	19.15	19.15	19.15	19.15	19.15
BHN	279	226	226	226	226	226	226
Elong (%)		6.0	6.0	6.0	6.0	6.0	6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	15.88	12.70	19.23	19.23	12.70	12.70	12.70
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	390	390	381	381	344	344	344
Obliq (deg)	0	0	0	0	0	45	30
RESULTS							
V_L (m/s)	859	1303	1827	1294	1023	1253	1125
SCALING							
$t/\alpha L$	0.383	0.598	0.905	0.584	0.386	0.386	0.386
t/L	0.563	0.933	1.413	0.912	0.602	0.602	0.602
$t/(D\cos\theta)$	2.272	7.135	10.803	10.803	7.135	10.090	8.239
Figure No.	2.2.18	--	--	2.2.19	2.2.19	2.2.20	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	76.96	76.96	76.96	76.96	76.96	79.5	79.5
D (mm)	3.56	3.56	3.56	3.56	3.56	3.98	3.98
L/D	21.62	21.62	21.62	21.62	21.62	19.97	19.97
M (g)	12.40	12.40	12.40	12.40	12.40	13.50	13.50
Mat'l	U	U	U	U	U	WC(K95)	WC(K95)
ρ (g/cm^3)	19.15	19.15	19.15	19.15	19.15	14.60	14.60
BHN	226	226	226	226	226	800	800
Elong (%)	6.0	6.0	6.0	6.0	6.0		
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.40	66.04	15.88	25.40	31.75	15.88	15.88
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	381	301	381	381	344	390	400
Obliq (deg)	0	0	60	60	60	60	60
RESULTS							
V_L (m/s)	893	1573	988	1311	1570	975	1097
SCALING							
$t/\alpha L$	0.211	0.550	0.132	0.211	0.264	0.147	0.147
t/L	0.330	0.858	0.206	0.330	0.413	0.200	0.200
$t/(D \cos \theta)$	7.135	18.551	8.921	14.270	17.837	7.980	7.980
Figure No.	2.2.19	2.2.19	2.2.20	2.2.20	2.2.20	2.2.16	2.2.16

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	79.5	79.5	25.4	25.4	25.4	42.16	42.16
D (mm)	3.98	3.98	6.35	6.35	6.35	5.33	5.33
L/D	19.97	19.97	4.00	4.00	4.00	7.91	7.91
M (g)	13.50	13.50	10.40	10.40	10.40	12.15	12.15
Mat'l	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)
ρ (g/cm^3)	14.60	14.60	14.60	14.60	14.60	14.60	14.60
BHN	800	800	800	800	800	800	800
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	15.88	22.23	22.23	22.23	12.7	13.2
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	253	253	409	409	409	362	362
Obliq (deg)	60	60	25	30	45	45	45
RESULTS							
V_L (m/s)	1234	1006	1073	1174	1417	905	975
SCALING							
$t/\alpha L$	0.234	0.147	0.642	0.642	0.642	0.221	0.230
t/L	0.319	0.200	0.875	0.875	0.875	0.301	0.313
$t/(D \cos \theta)$	12.764	7.980	3.863	4.042	4.951	3.370	3.502
Figure No.	2.2.16	2.2.16	--	2.2.15	2.2.15	2.2.15	2.2.15

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	42.16	42.16	25.40	25.40	55.88	55.88	40.64
D (mm)	5.33	5.33	6.35	6.35	6.35	6.35	10.16
L/D	7.91	7.91	4.00	4.00	8.80	8.80	4.00
M (g)	11.95	11.95	12.15	12.15	25.65	25.65	50.00
Mat'l	WC(K95)	WC(K95)	M3000	M3000	M3000	M3000	M3000
ρ (g/cm^3)	14.60	14.60	17.00	17.00	17.00	17.00	17.00
BHN	800	800	271	271	271	271	271
Elong (%)			15.0	15.0	15.0	15.0	15.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	13.20	13.20	15.88	15.88	12.70	19.05	19.05
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	362	362	362	362	353	371	381
Obliq (deg)	45	30	0	60	60	60	45
RESULTS							
V_L (m/s)	992	806	855	1306	945	1132	869
SCALING							
$t/\alpha L$	0.230	0.230	0.425	0.425	0.155	0.232	0.319
t/L	0.313	0.313	0.625	0.625	0.227	0.341	0.469
$t/(D \cos \theta)$	3.502	2.860	2.501	5.002	4.000	6.000	2.652
Figure No.	2.2.15	2.2.15	2.2.18	2.2.18	--	--	2.2.18

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	40.64	60.96	60.96	32.26	32.26	78.99	78.99
D (mm)	10.16	7.62	7.62	6.35	6.35	6.35	6.35
L/D	4.00	8.00	8.00	5.08	5.08	12.44	12.44
M (g)	50.00	47.70	47.70	13.40	13.40	34.60	34.60
Mat'l	M3000	M3950	M3950	WC(K95)	WC(K95)	WC(K95)	WC(K95)
ρ (g/cm^3)	17.00	18.00	18.00	14.60	14.60	14.60	14.60
BHN	271	271	271	800	800	800	800
Elong (%)	15.0	9.0	9.0				
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	Russian
Thick (mm)	12.70	22.23	22.23	31.75	12.70	25.40	46.99
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	353	409	409	344	344	381	432
Obliq (deg)	60	45	60	0	60	60	0
RESULTS							
V_L (m/s)	846	960	1143	1138	1015	1215	1143
SCALING							
$t/\alpha L$	0.212	0.241	0.241	0.722	0.289	0.236	0.436
t/L	0.313	0.365	0.365	0.984	0.394	0.322	0.595
$t/(D \cos \theta)$	2.500	4.126	5.835	5.000	4.000	8.000	7.400
Figure No.	2.2.18	--	--	2.2.15	--	2.2.16	--

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	50.80	50.80	50.80	50.80	50.80	50.80	25.40
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	8.00	8.00	8.00	8.00	8.00	8.00	4.00
M (g)	21.40	21.40	21.40	21.40	21.40	21.40	9.60
Mat'l	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)
ρ (g/cm^3)	14.60	14.60	14.60	14.60	14.60	14.60	14.60
BHN	800	800	800	800	800	800	800
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	22.23	12.70	12.70	15.88	15.88	22.23	12.70
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	409	390	390	390	400	409	400
Obliq (deg)	30	45	60	45	60	60	60
RESULTS							
V_L (m/s)	875	658	870	817	1085	1294	1180.0
SCALING							
$t/\alpha L$	0.321	0.183	0.183	0.229	0.229	0.321	0.367
t/L	0.438	0.250	0.250	0.313	0.313	0.438	0.500
$t/(D \cos \theta)$	4.042	2.828	4.000	3.537	5.002	7.002	4.000
Figure No.	2.2.15	2.2.15	2.2.16	2.2.15	2.2.16	2.2.16	2.2.16

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	25.40	25.40	81.28	81.28	81.28	81.28	36.83
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	7.11
L/D	4.00	4.00	12.80	12.80	12.80	12.80	5.18
M (g)	9.60	9.60	33.40	33.40	33.40	33.40	16.40
Mat'l	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)	WC(K95)
ρ (g/cm^3)	14.60	14.60	14.60	14.60	14.60	14.60	14.60
BHN	800	800	800	800	800	800	800
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	15.88	15.88	15.88	15.88	22.23	15.88	19.05
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	390	390	390	400	409	390	381
Obliq (deg)	60	45	30	60	30	45	64
RESULTS							
V_L (m/s)	1474	1091	475	977	768	735	1367
SCALING							
$t/\alpha L$	0.459	0.459	0.143	0.143	0.201	0.143	0.380
t/L	0.625	0.625	0.195	0.195	0.273	0.195	0.517
$t/(D \cos \theta)$	5.002	3.537	2.888	5.002	4.042	3.537	6.112
Figure No.	2.2.16	2.2.15	--	--	--	--	--

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	75.69	75.69	78.74	78.74	78.74	25.40	25.40
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	11.92	11.92	12.40	12.40	12.40	4.00	4.00
M (g)	42.40	42.40	44.35	44.35	44.35	13.35	13.35
Mat'l	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo
ρ (g/cm^3)	18.40	18.40	18.40	18.40	18.40	18.40	18.40
BHN	455	455	455	455	455	455	455
Elong (%)							
TARGET							
Mat'l	RHA	Russian	RHA	RHA	RHA	RHA	RHA
Thick (mm)	31.75	46.99	31.75	31.75	25.40	15.88	12.70
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	344	432	344	344	381	390	344
Obliq (deg)	0	0	30	45	60	0	60
RESULTS							
V_L (m/s)	853	1143	881	1006	1091	748	972
SCALING							
$t/\alpha L$	0.274	0.406	0.264	0.264	0.211	0.409	0.327
t/L	0.419	0.621	0.403	0.403	0.323	0.625	0.500
$t/(D\ cos\ \theta)$	5.000	7.400	5.774	7.071	8.000	2.501	4.000
Figure No.	2.2.19	--	2.2.19	2.2.20	2.2.20	2.2.19	2.2.20

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	25.40	25.40	25.40	25.40	25.40	25.40	25.40
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	4.00	4.00	4.00	4.00	4.00	4.00	4.00
M (g)	13.35	13.35	13.35	13.35	13.35	13.35	13.35
Mat'l	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo
ρ (g/cm^3)	18.40	18.40	18.40	18.40	18.40	18.40	18.40
BHN	455	455	455	455	455	455	455
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	19.05	22.23	22.23	31.75	22.23	22.23	22.23
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	381	409	409	390	409	409	409
Obliq (deg)	60	0	45	0	45	0	30
RESULTS							
V_L (m/s)	1432	1032	1343	1346	1315	1070	1134
SCALING							
$t/\alpha L$	0.490	0.572	0.572	0.817	0.572	0.572	0.572
t/L	0.750	0.875	0.875	1.250	0.875	0.875	0.875
$t/(D \cos \theta)$	6.000	3.501	4.951	5.000	4.951	3.501	4.042
Figure No.	2.2.20	2.2.19	2.2.20	2.2.19	2.2.20	2.2.19	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	25.40	34.93	34.93	34.93	50.80	50.80	50.80
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	4.00	5.50	5.50	5.50	8.00	8.00	8.00
M (g)	13.35	18.55	18.55	18.55	27.55	27.55	27.55
Mat'l	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo	U-2 Mo
ρ (g/cm^3)	18.40	18.40	18.40	18.40	18.40	18.40	18.40
BHN	455	455	455	455	455	455	455
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	Russian	RHA
Thick (mm)	12.70	19.05	22.23	19.05	22.23	46.99	22.23
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	344	381	409	390	409	432	409
Obliq (deg)	45	60	0	60	0	0	60
RESULTS							
V_L (m/s)	730	1240	939	1390	841	1358	1303
SCALING							
$t/\alpha L$	0.327	0.356	0.416	0.356	0.286	0.605	0.286
t/L	0.500	0.545	0.636	0.545	0.438	0.925	0.438
$t/(D \cos \theta)$	2.828	6.000	3.501	6.000	3.501	7.400	7.002
Figure No.	2.2.20	--	--	--	--	--	--

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	73.03	73.03	73.30	57.15	57.15	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	11.50	11.50	11.54	9.00	9.00	5.00	5.00
M (g)	40.90	40.90	40.90	13.40	13.40	6.45	6.45
Mat'l	U-2 Mo	U-2 Mo	U-2 Mo	Ketos	Ketos	Ketos	Ketos
ρ (g/cm^3)	18.40	18.40	18.40	7.80	7.80	7.80	7.80
BHN	455	455	455	722	722	722	722
Elong (%)							
TARGET							
Mat'l	Russian	Russian	RHA	RHA	RHA	RHA	RHA
Thick (mm)	46.99	46.99	22.23	25.40	12.70	17.53	12.45
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	432	432	409	381	353	344	390
Obliq (deg)	0	30	60	0	60	0	0
RESULTS							
V_L (m/s)	1157	1265	1107	1265	1282	1170	917
SCALING							
$t/\alpha L$	0.421	0.421	0.198	0.446	0.223	0.554	0.394
t/L	0.643	0.643	0.303	0.444	0.222	0.552	0.392
$t/(D \cos \theta)$	7.400	8.545	7.002	4.000	4.000	2.761	1.961
Figure No.	--	--	2.2.20	2.2.14	2.2.14	2.2.14	2.2.14

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	107.95	107.95	107.95	107.95	80.26	80.26	80.26
D (mm)	5.16	5.16	5.16	5.16	4.01	4.01	4.01
L/D	20.92	20.92	20.92	20.92	20.01	20.01	20.01
M (g)	36.87	36.87	36.87	36.87	19.44	19.44	19.44
Mat'l	DU-2 Mo	DU-2 Mo	DU-2 Mo	DU-2 Mo	U(Depl)	U(Depl)	U(Depl)
ρ (g/cm^3)	18.14	18.14	18.14	18.14	18.70	18.70	18.70
BHN	390	390	390	390	243	243	243
Elong (%)					9.0	9.0	9.0
TARGET							
Mat'l	Sim Sov	Sim Sov	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	50.80	38.10	50.80	25.40	25.40	38.10
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	443	390	319	319	327	327	327
Obliq (deg)	0	0	0	0	45	60	0
RESULTS							
V_L (m/s)	925	1052	932	1097	1041	1191	1064
SCALING							
$t/\alpha L$	0.232	0.310	0.232	0.310	0.205	0.205	0.308
t/L	0.353	0.471	0.353	0.471	0.316	0.316	0.475
$t/(D \cos \theta)$	7.384	9.845	7.384	9.845	8.958	12.668	9.501
Figure No.	--	--	2.2.19	2.2.19	2.2.20	2.2.20	2.2.19

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	80.26	80.26	80.26	80.26	80.26	82.80	82.80
D (mm)	4.01	4.01	4.01	4.01	4.01	4.14	4.14
L/D	20.01	20.01	20.01	20.01	20.01	20.00	20.00
M (g)	19.44	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	U(Depl)	U(Depl)	U(Depl)	U(Depl)	U(Depl)	U-8.5 Mo	U-8.5 Mo
ρ (g/cm^3)	18.70	18.70	18.70	18.70	18.70	17.30	17.30
BHN	243	243	243	243	243	253	253
Elong (%)	9.0	9.0	9.0	9.0	9.0	10.0	10.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	38.10	38.10	50.80	50.80	25.40	25.40
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327	327
Obliq (deg)	30	45	60	0	30	45	60
RESULTS							
V_L (m/s)	1113	1207	1440	1179	1281	1031	1177
SCALING							
$t/\alpha L$	0.308	0.308	0.308	0.410	0.410	0.207	0.207
t/L	0.475	0.475	0.475	0.633	0.633	0.307	0.307
$t/(D \cos \theta)$	10.971	13.437	19.002	12.668	14.628	8.677	12.271
Figure No.	2.2.19	2.2.20	2.2.20	2.2.19	2.2.19	2.2.17	2.2.17

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	82.8	82.8	82.8	82.8	82.8	82.3	82.3
D (mm)	4.14	4.14	4.14	4.14	4.14	4.12	4.12
L/D	20.00	20.00	20.00	20.00	20.00	19.98	19.98
M (g)	19.44	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	U-8.5 Mo	U-8.5 Mo	U-8.5 Mo	U-8.5 Mo	U-8.5 Mo	U-Quad	U-Quad
ρ (g/cm^3)	17.30	17.30	17.30	17.30	17.30	17.70	17.70
BHN	253	253	253	253	253	512	512
Elong (%)	10.0	10.0	10.0	10.0	10.0	4.0	4.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	38.10	38.10	50.80	50.80	25.40	25.40
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327	327
Obliq (deg)	0	30	45	0	30	45	60
RESULTS							
V_L (m/s)	1055	1106	1199	1190	1278	1002	1147
SCALING							
$t/\alpha L$	0.310	0.310	0.310	0.414	0.414	0.206	0.206
t/L	0.460	0.460	0.460	0.614	0.614	0.390	0.309
$t/(D \cos \theta)$	9.203	10.627	13.015	12.271	14.169	8.719	12.330
Figure No.	2.2.17	2.2.17	2.2.17	2.2.17	2.2.17	2.2.17	2.2.17

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	82.3	82.3	82.3	108.2	108.2	108.2	108.2
D (mm)	4.12	4.12	4.12	5.41	5.41	5.41	5.41
L/D	19.98	19.98	19.98	20.00	20.00	20.00	20.00
M (g)	19.44	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	U-Quad	U-Quad	U-Quad	52100	52100	52100	52100
ρ (g/cm^3)	17.70	17.70	17.70	7.80	7.80	7.80	7.80
BHN	512	512	512	739	739	739	739
Elong (%)	4.0	4.0	4.0				
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	38.10	50.80	25.40	25.40	38.10	38.10
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327	327
Obliq (deg)	0	30	0	45	60	0	30
RESULTS							
V_L (m/s)	1036	1083	1149	1312	1463	1352	1423
SCALING							
$t/\alpha L$	0.308	0.308	0.411	0.236	0.236	0.353	0.353
t/L	0.463	0.463	0.617	0.235	0.235	0.352	0.352
$t/(D \cos \theta)$	9.248	10.678	12.330	6.640	9.390	7.043	8.132
Figure No.	2.2.17	2.2.17	2.2.17	2.2.14	2.2.14	2.2.14	2.2.14

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	108.2	108.2	108.2	108.2	88.9	88.9	88.9
D (mm)	5.41	5.41	5.41	5.41	4.44	4.44	4.44
L/D	20.00	20.00	20.00	20.00	20.02	20.02	20.02
M (g)	19.44	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	52100	52100	52100	52100	WC	WC	WC
ρ (g/cm^3)	7.80	7.80	7.80	7.80	14.20	14.20	14.20
BHN	739	739	739	739	800	800	800
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	38.10	50.80	50.80	25.40	25.40	38.10
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327	327
Obliq (deg)	45	60	0	30	45	60	0
RESULTS							
V_L (m/s)	1547	1817	1495	1617	1106	1175	1065
SCALING							
$t/\alpha L$	0.353	0.353	0.471	0.471	0.213	0.213	0.319
t/L	0.352	0.352	0.470	0.470	0.286	0.286	0.429
$t/(D \cos \theta)$	9.960	14.085	9.390	10.843	8.090	11.441	8.581
Figure No.	2.2.14	2.2.14	2.2.14	2.2.14	2.2.15	2.2.16	2.2.15

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	88.9	88.9	88.9	88.9	88.9	83.31	83.31
D (mm)	4.44	4.44	4.44	4.44	4.44	4.17	4.17
L/D	20.02	20.02	20.02	20.02	20.02	19.98	19.98
M (g)	19.44	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	WC	WC	WC	WC	WC	W-10	W-10
ρ (g/cm^3)	14.20	14.20	14.20	14.20	14.20	17.00	17.00
BHN	800	800	800	800	800	294	294
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	38.10	38.10	50.80	50.80	25.40	25.40
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327	327
Obliq (deg)	30	45	60	0	30	45	60
RESULTS							
V_L (m/s)	1166	1379	1558	1275	1431	1096	1259
SCALING							
$t/\alpha L$	0.319	0.319	0.319	0.425	0.425	0.207	0.207
t/L	0.429	0.429	0.429	0.571	0.571	0.305	0.305
$t/(D \cos \theta)$	9.909	12.135	17.162	11.441	13.211	8.614	12.182
Figure No.	2.2.15	2.2.15	2.2.16	2.2.15	2.2.15	2.2.18	2.2.18

Grabarek (1971)

Test No.							
PROJECTILE							
L (mm)	83.31	83.31	83.31	83.31	83.31	83.31	80.77
D (mm)	4.17	4.17	4.17	4.17	4.17	4.17	4.04
L/D	19.98	19.98	19.98	19.98	19.98	19.98	19.99
M (g)	19.44	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	W-10	W-10	W-10	W-10	W-10	W-10	W-2
ρ (g/cm^3)	17.00	17.00	17.00	17.00	17.00	17.00	18.60
BHN	294	294	294	294	294	294	286
Elong (%)							6.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	38.10	38.10	38.10	50.80	50.80	25.40
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327	327
Obliq (deg)	0	30	45	60	0	30	45
RESULTS							
V_L (m/s)	1176	1204	1381	1514	1281	1372	1059
SCALING							
$t/\alpha L$	0.311	0.311	0.311	0.311	0.415	0.415	0.204
t/L	0.457	0.457	0.457	0.457	0.610	0.610	0.314
$t/(D \cos \theta)$	9.137	10.550	12.921	18.273	12.182	14.067	8.891
Figure No.	2.2.18	--	2.2.18	2.2.18	2.2.18	--	2.2.21

Grabarek (1971)

Test No.						
PROJECTILE						
L (mm)	80.77	80.77	80.77	80.77	80.77	80.77
D (mm)	4.04	4.04	4.04	4.04	4.04	4.04
L/D	19.99	19.99	19.99	19.99	19.99	19.99
M (g)	19.44	19.44	19.44	19.44	19.44	19.44
Mat'l	W-2	W-2	W-2	W-2	W-2	W-2
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60
BHN	286	286	286	286	286	286
Elong (%)	6.0	6.0	6.0	6.0	6.0	6.0
TARGET						
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.40	38.10	38.10	38.10	50.80	50.80
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86
BHN	327	327	327	327	327	327
Obliq (deg)	60	0	30	45	0	30
RESULTS						
V_L (m/s)	1206	1158	1166	1308	1260	1419
SCALING						
$t/\alpha L$	0.204	0.307	0.307	0.307	0.409	0.409
t/L	0.314	0.472	0.472	0.472	0.629	0.629
$t/(D \cos \theta)$	12.574	9.431	10.890	13.337	12.574	14.520
Figure No.	2.2.21	2.2.21	--	2.2.21	2.2.21	--

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	5.5	5.5	5.5	9.2	9.2	9.2	12
D (mm)	5.5	5.5	5.5	9.2	9.2	9.2	12
L/D	1	1	1	1	1	1	1
M (g)	1.03	1.03	1.03	4.8	4.8	4.8	10.65
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	9.6	12.5	11.5	18.7	18.7	10.58	10.4
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	180	135	180	135	135
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1905	3004	2950	2396	2715	1180	890
SCALING							
$t/\alpha L$	1.745	2.273	2.091	2.033	2.033	1.150	0.867
t/L	1.745	2.273	2.091	2.033	2.033	1.150	0.867
$t/(D \cos \theta)$	1.745	2.273	2.091	2.033	2.033	1.150	0.867
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	12	12	12	12	12	15	15
D (mm)	12	12	12	12	12	15	15
L/D	1	1	1	1	1	1	1
M (g)	10.65	10.65	10.65	10.65	10.65	20.8	20.8
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	19.4	20.8	9.6	19.8	15.12	24.3	25.65
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	180	180	135	135	180
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1745	1815	920	1950	1250	1370	1890
SCALING							
$t/\alpha L$	1.617	1.733	0.800	1.650	1.260	1.620	1.710
t/L	1.617	1.733	0.800	1.650	1.260	1.620	1.710
$t/(D \cos \theta)$	1.617	1.733	0.800	1.650	1.260	1.620	1.710
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	20	20	20	20	20	20	20
D (mm)	20	20	20	20	20	20	20
L/D	1	1	1	1	1	1	1
M (g)	49.32	49.32	49.32	49.32	49.32	49.32	49.32
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	10.2	5.4	9.6	8.6	19.2	24.2	30.2
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	135	135	135
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	616	315	550	490	920	1150	1520
SCALING							
$t/\alpha L$	0.510	0.270	0.480	0.430	0.960	1.210	1.510
t/L	0.510	0.270	0.480	0.430	0.960	1.210	1.510
$t/(D \cos \theta)$	0.510	0.270	0.480	0.430	0.960	1.210	1.510
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	20	40	25	25	25	25	25
D (mm)	20	40	2.5	2.5	2.5	2.5	2.5
L/D	1	1	10	10	10	10	10
M (g)	49.32	394.58	1	1	1	1	1
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	24.2	39.6	2	10	29.5	30.2	7.3
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	135	135	135	135	180
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1320	880	255	1270	3390	3693	1154
SCALING							
$t/\alpha L$	1.210	0.990	0.080	0.400	1.180	1.208	0.292
t/L	1.210	0.990	0.080	0.400	1.180	1.208	0.292
$t/(D \cos \theta)$	1.210	0.990	0.800	4.000	11.800	12.080	2.920
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	25	25	25	25	25	25	25
D (mm)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
L/D	10	10	10	10	10	10	10
M (g)	1	1	1	1	1	1	1
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	28.2	29.5	10.1	5.2	15.1	10.2	5.1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	60	60	45	45	60
IMPACT							
V_L (m/s)	3302	3946	1945	1180	2040	1550	2227
SCALING							
$t/\alpha L$	1.128	1.180	0.404	0.208	0.604	0.408	0.204
t/L	1.128	1.180	0.404	0.208	0.604	0.408	0.204
$t/(D\cos\theta)$	11.280	11.800	8.080	4.160	8.542	5.770	4.080
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	43	43	43	43	43	43	43
D (mm)	4.3	4.3	4.3	4.3	4.3	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	4	6.7	15.1	24.7	26	24	25.4
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	135	135	135	135	135
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	350	774	1208	1440	1440	1440	1513
SCALING							
$t/\alpha L$	0.093	0.156	0.351	0.574	0.605	0.558	0.591
t/L	0.093	0.156	0.351	0.574	0.605	0.558	0.591
$t/(D \cos \theta)$	0.930	1.558	3.512	5.744	6.047	5.581	5.907
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	43	43	43	43	43	43	43
D (mm)	4.3	4.3	4.3	4.3	4.3	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	25.4	40.5	48.5	47.5	3.2	6.5	25
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	135	135	135	180	180	180
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1605	2030	2622	2830	314	820	1540
SCALING							
$t/\alpha L$	0.591	0.942	1.128	1.105	0.074	0.151	0.581
t/L	0.591	0.942	1.128	1.105	0.074	0.151	0.581
$t/(D \cos \theta)$	5.907	9.419	11.279	11.047	0.744	1.512	5.814
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	43	43	43	43	43	43	43
D (mm)	4.3	4.3	4.3	4.3	4.3	4.3	4.3
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	38.5	48	19.2	10.2	15.4	19.2	10.1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	0	60	60	60	45	45
IMPACT							
V_L (m/s)	2060	2715	2070	1330	3100	1583	1080
SCALING							
$t/\alpha L$	0.895	1.116	0.447	0.237	0.358	0.447	0.235
t/L	0.895	1.116	0.447	0.237	0.358	0.447	0.235
$t/(D \cos \theta)$	8.953	11.163	8.930	4.744	7.163	6.315	3.322
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	43	43	54	54	54	54	54
D (mm)	4.3	4.3	5.4	5.4	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	4.9	4.9	9.7	9.7	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	10.1	5.1	4	41.5	60.3	58.8	59
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	135	135	135	135	135
Obliq (deg)	60	60	0	0	0	0	0
IMPACT							
V_L (m/s)	2840	1170	210	1760	2350	2400	2547
SCALING							
$t/\alpha L$	0.235	0.119	0.074	0.769	1.117	1.089	1.093
t/L	0.235	0.119	0.074	0.769	1.117	1.089	1.093
$t/(D\cos\theta)$	4.698	2.372	0.741	7.685	11.167	10.889	10.926
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	54	54	54	54	54	54	54
D (mm)	5.4	5.4	5.4	5.4	5.4	5.4	5.4
L/D	10	10	10	10	10	10	10
M (g)	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52
Thick (mm)	60.3	22.8	25.2	39.3	46.5	56	30.4
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	135	180	180	180	180	180	180
Obliq (deg)	0	0	0	0	0	0	45
IMPACT							
V_L (m/s)	2550	1330	1385	1783	1960	2536	1850
SCALING							
$t/\alpha L$	1.117	0.422	0.467	0.728	0.861	1.037	0.563
t/L	1.117	0.422	0.467	0.728	0.861	1.037	0.563
$t/(D\cos\theta)$	11.167	4.222	4.667	7.278	8.611	10.370	7.961
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	54	54	54	54	54	54	25
D (mm)	5.4	5.4	5.4	5.4	5.4	5.4	2.5
L/D	10	10	10	10	10	10	10
M (g)	9.7	9.7	9.7	9.7	9.7	9.7	0.96
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	St37/52	St37/52	St37/52	St37/52	St37/52	St37/52	Ger Arm St
Thick (mm)	19.3	10.2	10.2	10.1	14.9	10.1	6.4
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	295
Obliq (deg)	60	60	45	60	45	45	0
IMPACT							
V_L (m/s)	1650	1002	900	2000	2080	1360	1210
SCALING							
$t/\alpha L$	0.357	0.189	0.189	0.187	0.276	0.187	0.256
t/L	0.357	0.189	0.189	0.187	0.276	0.187	0.256
$t/(D\cos\theta)$	7.148	3.778	2.671	3.741	3.902	2.645	2.560
Figure No.	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.22	2.2.23

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	25	25	43	43	43	43	54
D (mm)	2.5	2.5	4.3	4.3	4.3	4.3	5.4
L/D	10	10	10	10	10	10	10
M (g)	0.96	0.96	4.9	4.9	4.9	4.9	9.7
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	21.5	26.3	6.2	15.7	31.4	41.5	6.2
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	2480	3520	900	1480	2110	2836	780
SCALING							
$t/\alpha L$	0.860	1.052	0.144	0.365	0.730	0.965	0.115
t/L	0.860	1.052	0.144	0.365	0.730	0.965	0.115
$t/(D \cos \theta)$	8.600	10.520	1.442	3.651	7.302	9.651	1.148
Figure No.	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	54	54	54	5.5	5.5	5.5	9.2
D (mm)	5.4	5.4	5.4	5.5	5.5	5.5	9.2
L/D	10	10	10	1	1	1	1
M (g)	9.7	9.7	9.7	1.03	1.03	1.03	4.8
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	11.4	26.3	31.3	6.5	11.5	15.6	6.5
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1100	1670	1810	1400	2950	3950	820
SCALING							
$t/\alpha L$	0.211	0.487	0.580	1.182	2.091	2.836	0.707
t/L	0.211	0.487	0.580	1.182	2.091	2.836	0.707
$t/(D \cos \theta)$	2.111	4.870	5.796	1.182	2.091	2.836	0.707
Figure No.	2.2.2[illegible]	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	9.2	9.2	9.2	12	12	12	12
D (mm)	9.2	9.2	9.2	12	12	12	12
L/D	1	1	1	1	1	1	1
M (g)	4.8	4.8	4.8	10.65	10.65	10.65	10.65
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	11.6	15.6	21.6	6.5	11.6	15.7	21
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1500	2090	3300	600	1100	1580	2189
SCALING							
$t/\alpha L$	1.261	1.696	2.348	0.542	0.967	1.308	1.750
t/L	1.261	1.696	2.348	0.542	0.967	1.308	1.750
$t/(D \cos \theta)$	1.261	1.696	2.348	0.542	0.967	1.308	1.750
Figure No.	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	12	15	15	15	20	20	20
D (mm)	12	15	15	15	20	20	20
L/D	1	1	1	1	1	1	1
M (g)	10.65	20.8	20.8	20.8	49.32	49.32	49.32
Mat'l	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1	C110W1
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	230	230	230	230	230	230	230
Elong (%)							
TARGET							
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	26.4	11.6	15.7	26.4	15.7	21.6	26.4
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	295	295	295	295	295	295	295
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	3130	950	1194	2000	854	1211	1487
SCALING							
$t/\alpha L$	2.200	0.773	1.047	1.760	0.785	1.080	1.320
t/L	2.200	0.773	1.047	1.760	0.785	1.080	1.320
$t/(D \cos \theta)$	2.200	0.773	1.047	1.760	0.785	1.080	1.320
Figure No.	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23	2.2.23

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	58	58	58	58	58	58
D (mm)	5.8	5.8	5.8	5.8	5.8	5.8	5.8
L/D	10	10	10	10	10	10	10
M (g)	26.04	26.04	26.04	26.04	26.04	26.04	26.04
Mat'l	D17	D17	D17	D17	D17	D17	D17
ρ (g/cm^3)	17	17	17	17	17	17	17
BHN	320	320	320	320	320	320	320
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	St52	St52	St52	St52	St52	St52	St52
Thick (mm)	83.3	43	66.5	35.5	32.7	57	21.6
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	180	180	180	180	180	180
Obliq (deg)	0	60	0	60	60	0	60
IMPACT							
V_L (m/s)	1860	1874	1515	1503	1396	1400	1010
SCALING							
$t/\alpha L$	0.976	0.504	0.779	0.416	0.383	0.668	0.253
t/L	1.436	0.741	1.147	0.612	0.564	0.983	0.372
$t/(D \cos \theta)$	14.362	14.828	11.466	12.241	11.276	9.828	7.448
Figure No.	2.2.24	2.2.24	2.2.24	2.2.24	2.2.24	2.2.24	2.2.24

Hohler and Stilp (1991a)

Test No.							
PROJECTILE							
L (mm)	58	28	28	28	28	28	28
D (mm)	5.8	2.8	2.8	2.8	2.8	2.8	2.8
L/D	10	10	10	10	10	10	10
M (g)	26.04	2.93	2.93	2.93	2.93	2.93	2.93
Mat'l	D17	D17	D17	D17	D17	D17	D17
ρ (g/cm^3)	17	17	17	17	17	17	17
BHN	320	294	294	294	294	294	294
Elong (%)	8	8	8	8	8	8	8
TARGET							
Mat'l	St52	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	34.75	6.4	11.4	15.8	21	26.2	31.4
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	180	426	404	404	345	363	345
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V_L (m/s)	1030	765	1000	1187	1360	1520	1710
SCALING							
$t/\alpha L$	0.407	0.155	0.277	0.383	0.510	0.636	0.762
t/L	0.599	0.229	0.407	0.564	0.750	0.936	1.121
$t/(D \cos \theta)$	5.991	2.286	4.071	5.643	7.500	9.357	11.214
Figure No.	2.2.24	2.2.24	2.2.24	2.2.24	2.2.24	2.2.24	2.2.24

Hohler and Stilp (1991a)

Test No.				
PROJECTILE				
L (mm)	28	60	60	60
D (mm)	2.8	6	6	6
L/D	10	10	10	10
M (g)	2.93	28.83	28.83	28.83
Mat'l	D17	D17	D17	D17
ρ (g/cm³)	17	17	17	17
BHN	294	294	294	294
Elong (%)	8	8	8	8
TARGET				
Mat'l	Ger Arm St	Ger Arm St	Ger Arm St	Ger Arm St
Thick (mm)	41.5	6.4	21.2	41.5
ρ (g/cm³)	7.85	7.85	7.85	7.85
BHN	298	426	363	300
Obliq (deg)	0	0	0	0
IMPACT				
V_L (m/s)	2325	495	915	1265
SCALING				
t/αL	1.007	0.072	0.240	0.470
t/L	1.482	0.107	0.353	0.692
t/(D cos θ)	14.821	1.067	3.533	6.917
Figure No.	2.2.24	2.2.24	2.2.24	2.2.24

Lambert (1978)

Test No.							
PROJECTILE							
L (mm)	64.8	64.8	64.8	64.8	64.8	64.8	101.6
D (mm)	13.00	13.00	13.00	13.00	13.00	13.00	10.20
L/D	4.98	4.98	4.98	4.98	4.98	4.98	9.96
M (g)	64.80	64.90	64.80	64.80	64.80	64.80	63.70
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	19.1	25.4	31.8	38.1	50.8	25.4	19.1
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	364	340	321	321	286	340	364
Obliq (deg)	0	0	0	0	0	60	0
RESULTS							
V_L (m/s)	720	906	1130	1304	1568	1451	798
SCALING							
$t/\alpha L$	0.295	0.392	0.491	0.588	0.784	0.392	0.188
t/L	0.295	0.392	0.491	0.588	0.784	0.392	0.188
$t/(D \cos \theta)$	1.469	1.954	2.446	2.931	3.908	3.908	1.873
Figure No.	2.2.25	2.2.25	2.2.25	2.2.25	2.2.25	2.2.25	2.2.26

Lambert (1978)

Test No.							
PROJECTILE							
L (mm)	101.6	101.6	101.6	101.6	161.9	161.9	161.9
D (mm)	10.20	10.20	10.20	10.20	8.10	8.10	8.10
L/D	9.96	9.96	9.96	9.96	19.99	19.99	19.99
M (g)	63.80	63.70	63.70	64.00	64.70	64.70	64.60
Mat'l	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	38.1	51.0	25.4	25.4	38.1	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	321	288	340	340	321	291
Obliq (deg)	0	0	0	60	0	0	0
RESULTS							
V_L (m/s)	916	1234	1411	1296	997	1157	1296
SCALING							
$t/\alpha L$	0.250	0.375	0.502	0.250	0.157	0.235	0.314
t/L	0.250	0.375	0.502	0.250	0.157	0.235	0.314
$t/(D \cos \theta)$	2.490	3.735	5.000	4.980	3.136	4.704	6.272
Figure No.	2.2.26	2.2.26	2.2.26	2.2.26	2.2.25	2.2.25	2.2.25

Lambert (1978)

Test No.							
PROJECTILE							
L (mm)	161.9	101.6	101.6	96.8	101.6	96.8	161.9
D (mm)	8.10	10.20	10.20	9.70	10.20	9.70	8.10
L/D	19.99	9.96	9.96	9.98	9.96	9.98	19.99
M (g)	64.50	64.20	64.10	64.40	64.30	64.40	64.70
Mat'l	AISI-S7	AISI-S7	AISI-S7	S7/W	AISI-S7	S7/W	AISI-S7
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	560	560	560	560	560	560	560
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	25.4	25.5	38.3	38.2	25.4	25.3	19.1
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN	340	364	331	331	358	372	364
Obliq (deg)	60	45	0	0	60	60	0
RESULTS							
V_L (m/s)	1234	1095	1216	1097	1225	1229	879
SCALING							
$t/\alpha L$	0.157	0.251	0.377	0.395	0.250	0.261	0.118
t/L	0.157	0.251	0.377	0.395	0.250	0.261	0.118
$t/(D \cos \theta)$	6.272	3.536	3.755	3.938	4.980	5.216	2.358
Figure No.	2.2.25	2.2.26	2.2.26	2.2.26	2.2.26	2.2.26	2.2.25

Lambert (1978)

Test No.	
PROJECTILE	
L (mm)	161.9
D (mm)	8.10
L/D	19.99
M (g)	64.70
Mat'l	AISI-S7
ρ (g/cm^3)	7.86
BHN	560
Elong (%)	
TARGET	
Mat'l	RHA
Thick (mm)	31.8
ρ (g/cm^3)	7.86
BHN	321
Obliq (deg)	0
RESULTS	
V_L (m/s)	1045
SCALING	
$t/\alpha L$	0.196
t/L	0.196
$t/(D\cos\theta)$	3.926
Figure No.	2.2.25

Magness (1990)

Test No.							
PROJECTILE							
L (mm)	76.80	102.40	76.80	51.20	76.80	102.40	106.00
D (mm)	7.68	10.24	7.68	5.12	7.68	10.24	3.53
L/D	10.00	10.00	10.00	10.00	10.00	10.00	30.03
M (g)	65.00	154.00	65.00	19.00	65.00	154.00	19.00
Mat'l	X9C	X9C	X9C	X9C	X9C	X9C	X9C
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60	18.60
BHN							
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	38.10	50.80	50.80	50.80	76.20	101.60	25.40
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Obliq (deg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RESULTS							
V_L (m/s)	965.0	936.0	1131.0	1448.0	1406.0	1360.0	926.0
SCALING							
$t/\alpha L$	0.322	0.322	0.430	0.645	0.645	0.645	0.156
t/L	0.496	0.496	0.661	0.992	0.992	0.992	0.240
$t/(D \cos \theta)$	4.961	4.961	6.615	9.922	9.922	9.922	7.195
Figure No.	2.2.27	2.2.27	2.2.27	2.2.27	2.2.27	2.2.27	2.2.27

Magness (1990)

Test No.			
PROJECTILE			
L (mm)	106.00	106.00	159.10
D (mm)	3.53	3.53	5.30
L/D	30.03	30.03	30.02
M (g)	19.00	19.00	65.00
Mat'l	X9C	X9C	X9C
ρ (g/cm^3)	18.60	18.60	18.60
BHN			
Elong (%)			
TARGET			
Mat'l	RHA	RHA	RHA
Thick (mm)	50.80	76.20	114.30
ρ (g/cm^3)	7.86	7.86	7.86
BHN			
Obliq (deg)	0.0	0.0	0.0
RESULTS			
V_L (m/s)	1218.0	1428.0	1385.0
SCALING			
$t/\alpha L$	0.312	0.467	0.467
t/L	0.479	0.719	0.718
$t/(D \cos \theta)$	14.391	21.586	21.566
Figure No.	2.2.27	2.2.27	2.2.27

Magness and Farrand (1990)

Test No.							
PROJECTILE							
L (mm)	100.4	101.0	102.1	102.3	103.0	100.4	100.4
D (mm)	6.69	6.73	6.81	6.82	6.86	6.69	6.69
L/D	15.01	15.01	14.99	15.00	15.01	15.01	15.01
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	97W	96W	93W	93W	90W	U-Be-Ti	U-3/4Ti
ρ (g/cm^3)	18.60	18.30	17.70	17.60	17.20	18.60	18.60
BHN	409	371	443	381	381	381	371
Elong (%)	4.0	7.0	6.0	13.0		11.0	24.0
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	76.2	76.2	76.2	76.2	76.2	76.2	76.2
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
V_L (m/s)	1318	1313	1326	1338	1350	1228	1221
SCALING							
$t/\alpha L$	0.493	0.494	0.497	0.498	0.500	0.493	0.493
t/L	0.759	0.754	0.746	0.745	0.740	0.759	0.759
$t/(D \cos \theta)$	11.390	11.322	11.189	11.173	11.108	11.390	11.390
Figure No.	2.2.28	2.2.28	2.2.28	2.2.28	2.2.28	2.2.29	2.2.29

Mag ·nd Farrand (1990)

Test No.							
PROJECTILE							
L (mm)	100.4	100.4	100.8	100.8	103.0	103.0	76.8
D (mm)	6.69	6.69	6.72	6.72	6.86	6.86	7.68
L/D	15.01	15.01	15.00	15.00	15.01	15.01	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	U-3/4Ti	U-3/4Ti	U-Hf-Ti	U-Mo-Ti	U-Zr-Ti	U-Be-Ti	U-3/4Ti
ρ (g/cm^3)	18.60	18.60	18.40	18.40	17.30	17.20	18.60
BHN	443	469		469	543	371	424
Elong (%)	12.0	6.0	20.0	6.0	1.0	20.0	
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	76.2	76.2	76.2	76.2	76.2	76.2	76.2
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
V_L (m/s)	1203	1193	1221	1177	1216	1228	1322
SCALING							
$t/\alpha L$	0.493	0.493	0.494	0.494	0.499	0.500	0.645
t/L	0.759	0.759	0.756	0.756	0.740	0.740	0.992
$t/(D \cos \theta)$	11.390	11.390	11.339	11.339	11.108	11.108	9.922
Figure No.	2.2.29	2.2.29	2.2.29	2.2.29	2.2.29	2.2.29	2.2.29

Magness and Farrand (1990)

Test No.							
PROJECTILE							
L (mm)	76.8	76.8	77.2	78.2	78.6	78.6	78.8
D (mm)	7.68	7.68	7.72	7.82	7.86	7.86	7.88
L/D	10.00	10.00	10.00	10.00	10.00	10.00	10.00
M (g)	65.00	65.00	65.00	65.00	65.00	65.00	65.00
Mat'l	97W	80W-20T	96W	93W	91W(CW)	U-6Nb	90.7W
ρ (g/cm^3)	18.60	a	18.30	17.60	17.30	17.30	17.20
BHN	321	18.60	328	353	363	269	372
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	76.2	76.2	76.2	76.2	76.2	76.2	50.8
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
BHN							
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
V_L (m/s)	1430	1455	1453	1461	1470	1475	1448
SCALING							
$t/\alpha L$	0.645	0.645	0.647	0.651	0.653	0.653	0.645
t/L	0.992	0.992	0.987	0.974	0.969	0.969	0.992
$t/(D \cos \theta)$	9.922	9.922	9.870	9.744	9.695	9.695	9.922
Figure No.	2.2.28	--	2.2.28	2.2.28	2.2.28	2.2.29	--

Magness and Farrand (1990)

Test No.

PROJECTILE

L (mm)	79.0
D (mm)	7.90
L/D	10.00
M (g)	65.00
Mat'l	90W
ρ (g/cm^3)	17.10
BHN	274
Elong (%)	

TARGET

Mat'l	RHA
Thick (mm)	114.3
ρ (g/cm^3)	7.86
BHN	
Obliq (deg)	0

RESULTS

V_L (m/s)	1385

SCALING

$t/\alpha L$	0.467
t/L	0.718
$t/(D \cos \theta)$	21.566

Figure No. 2.2.28

Tate, Green, Chamberlain, and Baker (1978)

Test No.							
PROJECTILE							
L (mm)	28.3	28.3	35.7	35.7	35.7	35.7	35.7
D (mm)	9.45	9.45	11.91	11.91	5.94	5.94	5.94
L/D	2.99	2.99	3.00	3.00	6.01	6.01	6.01
M (g)	33.70	33.70	67.70	67.70	16.80	16.80	16.80
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
ρ (g/cm^3)	17.00	17.00	17.00	17.00	17.00	17.00	17.00
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	20.0	30.0	20.0	30.0	20.0	30.0	40.0
ρ (g/cm^3)	7.80	7.80	7.80	7.80	7.80	7.80	7.80
BHN							
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
V_L (m/s)	875	1220	590	880	1010	1255	1590
SCALING							
$t/\alpha L$	0.479	0.718	0.379	0.569	0.379	0.569	0.759
t/L	0.707	1.060	0.560	0.840	0.560	0.840	1.120
$t/(D\cos\theta)$	2.116	3.175	1.679	2.519	3.367	5.051	6.734
Figure No.	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30

Tate, Green, Chamberlain, and Baker (1978)

Test No.							
PROJECTILE							
L (mm)	45.0	45.0	45.0	56.7	56.7	56.7	56.7
D (mm)	7.49	7.49	7.49	9.45	9.45	9.45	4.72
L/D	6.01	6.01	6.01	6.00	6.00	6.00	12.01
M (g)	33.70	33.70	33.70	67.70	67.70	67.70	16.80
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
ρ (g/cm^3)	17.00	17.00	17.00	17.00	17.00	17.00	17.00
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	20.0	30.0	40.0	20.0	30.0	40.0	20.0
ρ (g/cm^3)	7.80	7.80	7.80	7.80	7.80	7.80	7.80
BHN							
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
V_L (m/s)	825	1080	1300	725	925	1160	1020
SCALING							
$t/\alpha L$	0.301	0.452	0.602	0.239	0.358	0.478	0.239
t/L	0.444	0.667	0.889	0.353	0.529	0.705	0.353
$t/(D \cos \theta)$	2.670	4.005	5.340	2.116	3.175	4.233	4.237
Figure No.	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30

Tate, Green, Chamberlain, and Baker (1978)

Test No.							
PROJECTILE							
L (mm)	56.7	56.7	71.4	71.4	71.4	89.9	89.9
D (mm)	4.72	4.72	5.94	5.94	5.94	7.49	7.49
L/D	12.01	12.01	12.02	12.02	12.02	12.00	12.00
M (g)	16.80	16.80	33.70	33.70	33.70	67.70	67.70
Mat'l	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy	W alloy
ρ (g/cm^3)	17.00	17.00	17.00	17.00	17.00	17.00	17.00
BHN							
Elong (%)							
TARGET							
Mat'l	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61	STA 61
Thick (mm)	30.0	40.0	20.0	30.0	40.0	20.0	30.0
ρ (g/cm$_3$)	7.80	7.80	7.80	7.80	7.80	7.80	7.80
BHN							
Obliq (deg)	0	0	0	0	0	0	0
RESULTS							
V_L (m/s)	1140	1350	820	1020	1180	770	910
SCALING							
$t/\alpha L$	0.358	0.478	0.190	0.285	0.379	0.151	0.226
t/L	0.529	0.705	0.280	0.420	0.560	0.222	0.334
$t/(D \cos \theta)$	6.356	8.475	3.367	5.051	6.734	2.670	4.005
Figure No.	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30	2.2.30

Tate, Green, Chamberlain, and Baker (1978)

Test No.			
PROJECTILE			
L (mm)	89.9	22.60	22.60
D (mm)	7.49	7.49	7.49
L/D	12.00	3.02	3.02
M (g)	67.70	16.80	16.80
Mat'l	W alloy	W alloy	W alloy
ρ (g/cm^3)	17.00	17.00	17.00
BHN			
Elong (%)			
TARGET			
Mat'l	STA 61	STA 61	STA 61
Thick (mm)	40.0	30.00	20.00
ρ (g/cm^3)	7.80	7.80	7.80
BHN			
Obliq (deg)	0	0.0	0.0
RESULTS			
V_L (m/s)	1090	1450.0	1030.0
SCALING			
$t/\alpha L$	0.301	0.899	0.599
t/L	0.445	1.327	0.885
$t/(D \cos \theta)$	5.340	4.005	2.670
Figure No.	2.2.30	--	--

APPENDIX C

MULTIPLE (SEGMENTED) IMPACT DATA

Appendix C Contents

Charters, Menna, and Piekutowski (1990)

Test No.	0691	0698	0708	0709	0696	0746
PROJECTILE						
L (mm) each	5.54	5.54	5.54	5.54	5.54	5.54
D (mm)	5.54	5.54	5.54	5.54	5.54	5.54
L/D	1.00	1.00	1.00	1.00	1.00	1.00
Spacing (mm)	5.54	5.54	5.54	5.54	5.54	5.54
S/D	1.00	1.00	1.00	1.00	1.00	1.00
No. of Segs	5	5	5	5	5	5
M (g) each	2.28	2.28	2.28	2.28	2.28	2.28
Pen M (g)	11.40	11.40	11.40	11.40	11.40	11.40
Pen Mat'l	W10	W10	W10	W10	W10	W10
Supplier	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam
ρ (g/cm^3)	17.1	17.1	17.1	17.1	17.1	17.1
BHN	275	275	275	275	275	275
Elong (%)	20.0	20.0	20.0	20.0	20.0	20.0
Filler	None	None	None	None	None	None
Connector	Ti	Ti	Ti	Ti	Ti	Ti
Container	None	None	None	None	None	None
Tot M (g)	12.10	12.28	12.56	12.56	12.24	10.04
TARGET						
Mat'l	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85
BHN	344	344	344	344	344	344
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	2480	1980	2000	1980	2520	2000
Yaw (deg)	8.00	6.40	10.05	9.16	1.41	5.00
RESULTS						
P (mm)	44.6	47.3	40.5	42.1	57.0	47.2
d (mm)						
Vol (cm^3)					5.02	
SCALING						
$P/\alpha L_c$	1.091	1.157	0.991	1.030	1.394	1.155
P/L_c	1.610	1.708	1.462	1.520	2.058	1.704
P/D	8.051	8.538	7.310	7.599	10.289	8.520
P/nD	1.610	1.708	1.462	1.520	2.058	1.704
Figure No.	2.3.1	2.3.1	2.3.1	2.3.1	2.3.1	2.3.1

Charters, Menna, and Piek' owski (1990)

Test No.	0747	0799	0869	0870	0874	0875
PROJECTILE						
L (mm) each	5.54	5.54	5.54	5.54	5.54	5.54
D (mm)	5.54	5.54	5.54	5.54	5.54	5.54
L/D	1.00	1.00	1.00	1.00	1.00	1.00
Spacing (mm)	5.54	11.08	11.08	11.08	11.08	Varied
S/D	1.00	2.00	2.00	2.00	2.00	0.80
No. of Segs	4	5	5	5	5	5
M (g) each	2.28	2.28	2.28	2.28	2.28	2.28
Pen *M* (g)	9.12	11.40	11.40	11.40	11.40	11.40
Pen Mat'l	W10	W10	W10	W10	W10	W10
Supplier	Kennam	Kennam	Kennam	Kennam	Kennam	Kennam
ρ (g/cm^3)	17.1	17.1	17.1	17.1	17.1	17.1
BHN	275	275	275	275	275	275
Elong (%)	20.0	20.0	20.0	20.0	20.0	20.0
Filler	None	None	None	None	None	None
Connector	Ti	Ti	Ti	Al	Ti	None
Container	None	None	None	None	None	None
Tot *M* (g)	10.04	13.75	12.70	12.44	12.72	11.31
TARGET						
Mat'l	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85
BHN	344	344	344	344	344	344
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	2000	2110	1900	2540	2060	2690
Yaw (deg)	3.16	0.99	4.27	2.00	3.64	3.64
RESULTS						
P (mm)	39.0	75.0	38.7	69.3	52.0	51.0
d (mm)						
Vol (cm^3)		5.17				
SCALING						
$P/\alpha L_c$	1.192	1.835	0.947	1.695	1.272	1.247
P/L_c	1.760	2.708	1.397	2.502	1.877	1.841
P/D	7.040	13.538	6.986	12.509	9.386	9.206
P/nD	1.760	2.708	1.397	2.502	1.877	1.841
Figure No.	2.3.1	2.3.1	2.3.1	2.3.1	2.3.1	2.3.1

Hohler and Stilp (1991b)

Test No.	7119	7120	7128	7121	7124	7125	7126
PROJECTILE							
L (mm) each	1.5	1.5	1.5	1.5	1.5	1.5	1.5
D (mm)	1.5	1.5	1.5	1.5	1.5	1.5	1.5
L/D	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Spacing (mm)	0	1.50	3.00	4.50	4.50	7.50	7.5
S/D	0	1.00	2.00	3.00	3.00	5.00	5
No. of Segs	10	10	10	10	10	10	10
M (g) each	0.0466	0.0466	0.0466	0.0466	0.0466	0.0466	0.0466
Pen M (g)	0.4660	0.4660	0.4660	0.4660	0.4660	0.4660	0.466
Pen Mat'l	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6	D17.6
Supplier							
ρ (g/cm^3)	17.6	17.6	17.6	17.6	17.6	17.6	17.6
BHN	397	397	397	397	397	397	397
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10
Filler	None	None	None	None	None	None	None
Connector	None	None	None	None	None	None	None
Container	None	None	None	None	None	None	None
Tot M (g)	0.4660	0.4660	0.4660	0.4660	0.4660	0.4660	0.466
TARGET							
Mat'l	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl	Ger Stl
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	290	290	290	290	290	290	290
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2447	2472	2611	2493	2637	2601	2601
Yaw (deg)							
RESULTS							
P (mm)	22.2	26.3	29.9	26.3	26.7	21.3	21.3
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L_c$	0.988	1.171	1.331	1.171	1.189	0.948	0.948
P/L_c	1.480	1.753	1.993	1.753	1.780	1.420	1.420
P/D	14.800	17.533	19.933	17.533	17.800	14.200	14.200
P/nD	1.480	1.753	1.993	1.753	1.780	1.420	1.420
Figure No.	2.3.2	2.3.2	2.3.2	2.3.2	2.3.2	2.3.2	2.3.2

Hohler and Stilp (1991b)

Test No.	7089	7127
PROJECTILE		
L (mm) each	1.5	1.5
D (mm)	1.5	1.5
L/D	1.00	1.00
Spacing (mm)	7.5	10.5
S/D	5	7
No. of Segs	10	10
M (g) each	0.0466	0.0466
Pen *M* (g)	0.466	0.466
Pen Mat'l	D17.6	D17.6
Supplier		
ρ (g/cm^3)	17.6	17.6
BHN	397	397
Elong (%)	10	10
Filler	None	None
Connector	None	None
Container	None	None
Tot *M* (g)	0.466	0.466
TARGET		
Mat'l	Ger Stl	Ger Stl
Thick (mm)	---	---
ρ (g/cm^3)	7.85	7.85
BHN	290	290
Elong (%)		
Obliq (deg)	0	0
IMPACT		
V (m/s)	2500	2599
Yaw (deg)		
RESULTS		
P (mm)	21.9	21.7
d (mm)		
Vol (cm^3)		
SCALING		
$P/\alpha L_c$	0.975	0.966
P/L_c	1.460	1.447
P/D	14.600	14.467
P/nD	1.460	1.447
Figure No.	2.3.2	2.3.2

Naz and Lehr (1990)

Test No.					
PROJECTILE					
L (mm) each	8.00	8.00	8.00	8.00	32.00
D (mm)	8.00	8.00	8.00	8.00	8.00
L/D	1.00	1.00	1.00	1.00	4.00
Spacing (mm)	4.00	4.00	4.00	4.00	4.00
S/D	32.00	24.00	16.00	8.00	0.00
No. of Segs	4	3	2	1	0
M (g) each	4.00	4.00	4.00	4.00	1.00
Pen *M* (g)	7.28	7.28	7.28	7.28	29.11
Pen Mat'l	29.11	29.11	29.11	29.11	29.11
Supplier	29.11	29.11	29.11	29.11	29.11
ρ (g/cm^3)	W Alloy	W Alloy	W Alloy	W Alloy	W Alloy
BHN					
Elong (%)	18.1	18.1	18.1	18.1	18.1
Filler	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene
Connector	None	None	None	None	None
Container	Al Tube	Al Tube	Al Tube	Al Tube	Al Tube
Tot *M* (g)					
TARGET					
Mat'l	Steel	Steel	Steel	Steel	Steel
Thick (mm)	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85
BHN					
Elong (%)					
Obliq (deg)	0	0	0	0	0
IMPACT					
V (m/s)	2000	2000	2000	2000	2000
Yaw (deg)					
RESULTS					
P (mm)	52.8	46.4	52.8	54.4	52.8
d (mm)					
Vol (cm^3)	7.69	7.69	7.69	7.69	7.57
SCALING					
$P/\alpha L_c$	0.889	0.988	1.087	1.120	1.087
P/L_c	1.350	1.500	1.650	1.700	1.650
P/D	6.600	5.800	6.600	6.800	6.600
P/nD	1.650	1.450	1.650	1.700	6.600
Figure No.	2.3.3	2.3.3	2.3.3	2.3.3	2.3.3

Orphal and Franzen (1990)

Test No.	3	4	5	6	7	Cal	Cal
PROJECTILE							
L (mm) each	12.19	1.524	1.524	1.524	3.048	1.588	9.144
D (mm)	0.762	0.762	0.762	0.762	0.762	1.588	0.762
L/D	16.00	2.00	2.00	2.00	4.00	Sphere	12.00
Spacing (mm)	0	7.62	1.524	3.81	3.81	3.81	0
S/D	0	10.00	2.00	5.00	5.00	2.40	0
No. of Segs	1	8	8	8	4	8	1
M (g) each	0.1068	0.0133	0.0133	0.0133	0.0266	0.0187	0.0801
Pen M (g)	0.1068	0.1064	0.1064	0.1064	0.1064	0.1496	0.0801
Pen Mat'l	W	W	W	W	W	Copper	W
Supplier							
ρ (g/cm³)	19.2	19.2	19.2	19.2	19.2	8.93	19.2
BHN							
Elong (%)							
Filler	N/A	None	None	None	None	None	N/A
Connector	N/A	None	None	None	None	None	N/A
Container	N/A	None	None	None	None	None	N/A
Tot M (g)	0.1068	0.1064	0.1064	0.1064	0.1064	0.1496	0.0801
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	7075-T6
Thick (mm)	38.1	38.1	38.1	38.1	38.1	38.1	43.2
ρ (g/cm³)	7.85	7.85	7.85	7.85	7.85	7.85	2.80
BHN	300	300	300	300	300	300	
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3010	3030	2970	2990	3040	3060	4060
Yaw (deg)							
RESULTS							
P (mm)	18.9	12.7	20.9	15.3	18.2	12.0	34.0
d (mm)							
Vol (cm³)							
SCALING							
$P/\alpha L_c$	0.991	0.666	1.096	0.802	.955	0.886	1.420
P/L_c	1.550	1.042	1.714	1.255	1.493	0.945	3.718
P/D	24.803	16.667	27.428	20.079	23.885	7.557	44.619
P/nD	24.803	2.083	3.428	2.510	5.971	0.945	44.619
Figure No.	2.3.7	2.3.7	2.3.7	2.3.7	2.3.7	2.3.6	--

Orphal and Franzen (1990)

Test No.	8	9	10	12	13	14	15
PROJECTILE							
L (mm) each	1.588	1.588	12.704	1.588	1.588	1.588	1.588
D (mm)	1.588	1.588	1.588	1.588	1.588	1.588	1.588
L/D	Sphere	Sphere	8.00	Sphere	Sphere	Sphere	Sphere
Spacing (mm)	3.81	3.81	0	1.91	5.72	3.81	5.72
S/D	2.40	2.40	0	1.20	3.60	2.40	3.60
No. of Segs	8	8	1	8	8	5	5.5
M (g) each	0.0187	0.0187	0.225	0.0187	0.0187	0.0187	0.0187
Pen *M* (g)	0.1496	0.1496	0.2250	0.1496	0.1496	0.0935	0.1029
Pen Mat'l	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Supplier							
ρ (g/cm^3)	8.93	8.93	8.93	8.93	8.93	8.93	8.93
BHN							
Elong (%)							
Filler	None	None	N/A	None	None	None	None
Conector	None	None	N/A	None	None	None	None
Container	None	None	N/A	None	None	None	None
Tot *M* (g)	0.1496	0.1496	0.225	0.1496	0.1496	0.0935	0.1029
TARGET							
Mat'l	4340	7075-T6	7075-T6	7075-T6	7075-T6	4340	4340
Thick (mm)	38.1	43.2	43.2	43.2	43.2	10.2	10.2
ρ (g/cm^3)	7.85	2.80	2.80	2.80	2.80	7.85	7.85
BHN	300					300	300
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3230	3890	4230	4020	4170	4520	4740
Yaw (deg)							
RESULTS							
P (mm)	12.2	35.1	24.4	32.5	36.1	10.2	10.2
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L_c$	0.900	1.547	1.075	1.433	1.591	1.204	1.095
P/L_c	0.960	2.763	1.921	2.558	2.842	1.285	1.168
P/D	7.683	22.103	15.365	20.466	22.733	6.423	6.423
P/nD	0.960	2.763	15.365	2.558	2.842	1.285	1.168
Figure No.	2.3.6	2.3.5	2.3.5	2.3.5	2.3.5	2.3.6	2.3.6

NOTE: Partial number of segments indicate number of segments expended in perforating finite thickness target.

Orphal and Franzen (1990)

Test No.	16	17	18	19	20	21	22
PROJECTILE							
L (mm) each	1.588	1.588	1.588	1.588	1.588	1.588	1.588
D (mm)	1.588	1.588	1.588	1.588	1.588	1.588	1.588
L/D	Sphere	Sphere	Sphere	Sphere	Sphere	Sphere	Sphere
Spacing (mm)	3.81	3.81	3.81	1.91	3.81	3.81	3.81
S/D	2.40	2.40	2.40	1.20	2.40	2.40	2.40
No. of Segs	6.5	7	8	5.5	8	3.5	8
M (g) each	0.0187	0.0289	0.0187	0.0187	0.0187	0.0289	0.0187
Pen M (g)	0.1216	0.2023	0.1496	0.1029	0.1496	0.1012	0.1496
Pen Mat'l	Copper	WC	Copper	Copper	Copper	WC	Copper
Supplier							
ρ (g/cm^3)	8.93	13.80	8.93	8.93	8.93	13.80	8.93
BHN							
Elong (%)							
Filler	None	None	None	None	None	None	None
Connector	None	None	None	None	None	None	None
Container	None	None	Stl Tube	None	Stl Tube	None	Al Tube
Tot M (g)	0.1216	0.2023	0.4703	0.1029	0.3055	0.1012	0.2052
TARGET							
Mat'l	4340	7075-T6	7075-T6	4340	7075-T6	4340	7075-T6
Thick (mm)	10.2	43.20	43.20	10.20	43.50	10.20	43.20
ρ (g/cm^3)	7.85	2.80	2.80	7.85	2.80	7.85	2.80
BHN	300			300		300	
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	2990	4320	4010	4730	3950	4440	4050
Yaw (deg)							
RESULTS							
P (mm)	10.2	43.2	43.2	10.2	34.0	10.2	32.3
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L_c$	0.926	1.751	1.904	1.095	1.499	1.384	1.424
P/L_c	0.988	3.886	3.401	1.168	2.676	1.835	2.543
P/D	6.423	27.204	27.204	6.423	21.411	6.423	20.340
P/nD	0.988	3.886	3.401	1.168	2.676	1.835	2.543
Figure No.	2.3.6	--	2.3.5	2.3.6	2.3.5	--	2.3.5

Orphal and Franzen (1990)

Test No.	37	38	42	43	44	45	47
PROJECTILE							
L (mm) each	1.588	1.588	4.900	1.588	5.080	5.080	0.254
D (mm)	1.588	1.588	4.900	1.588	5.080	5.080	0.508
L/D	Sphere	Sphere	1.00	Sphere	1.00	1.00	0.50
Spacing (mm)	0	0	11.76	0	0	0	1.22
S/D	0	0	2.40	0	0	0	2.40
No. of Segs	1	1	6	1	1	1	9.5
M (g) each	0.0187	0.0187	9.3695	0.0289	0.9190	0.9190	0.0009
Pen M (g)	0.0187	0.0187	56.2170	0.0289	0.9190	0.9190	0.0081
Pen Mat'l	Copper	Copper	Ta/10%W	WC	Copper	Copper	Tantalum
Supplier							
ρ (g/cm^3)	8.93	8.93	16.9	13.8	8.93	8.93	16.6
BHN							
Elong (%)							
Filler	N/A	N/A	None	N/A	N/A	N/A	None
Connector	N/A	N/A	None	N/A	N/A	N/A	None
Container	N/A	N/A	None	N/A	N/A	N/A	None
Tot M (g)	0.0187	0.0187	56.2170	0.0289	0.9190	0.9190	0.0081
TARGET							
Mat'l	7075-T6	7075-T6	RHA	RHA	7075-T6	7075-T6	4340
Thick (mm)	43.20	63.5	152.0	102.0	76.2	76.2	7.6
ρ (g/cm^3)	2.80	2.80	7.85	7.85	2.80	2.80	7.85
BHN							311
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4060	4650	4060	3220	3768	3720	5388
Yaw (deg)							
RESULTS							
P (mm)	12.4	4.7	63.5	3.5	15.3	13.4	7.6
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L_c$	4.368	1.674	1.472	1.659	1.691	1.473	2.172
P/L_c	7.800	2.990	2.160	2.200	3.020	2.630	3.158
P/D	7.800	2.990	12.959	2.200	3.020	2.630	15.000
P/nD	7.800	2.990	2.160	2.200	3.020	2.630	1.579
Figure No.	--	--	--	--	2.3.5	2.3.5	2.3.4

Orphal and Franzen (1990)

Test No.	48	49	51	52	54	55	56
PROJECTILE							
L (mm) each	0.254	0.254	0.254	0.254	0.254	0.254	.254
D (mm)	0.508	0.508	0.508	0.508	0.508	1.016	1.016
L/D	0.50	0.50	0.50	0.50	0.50	0.25	0.25
Spacing (mm)	1.22	1.22	1.22	0.61	2.44	2.44	2.44
S/D	2.40	2.40	2.40	1.20	4.80	2.40	2.40
No. of Segs	11	13	13	13	13	7	11
M (g) each	0.0009	0.0009	0.0009	0.0009	0.0009	0.0034	0.0034
Pen *M* (g)	0.0094	0.0111	0.0111	0.0111	0.0111	0.0239	0.0376
Pen Mat'l	Tantalum	Tantalum	Tantalum	Tantalum	Tantalum	Tantalum	Tantalum
Supplier							
ρ (g/cm^3)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
BHN							
Elong (%)							
Filler	None	None	None	None	None	None	None
Connector	None	None	None	None	None	None	None
Container	None	None	None	None	None	None	None
Tot *M* (g)	0.0094	0.0111	0.0111	0.0111	0.0111	0.0239	0.0376
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	7.6	7.62	16.43	7.75	7.57	7.62	7.62
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	311	311	311	311	311	286	286
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	4682	3098	2663	4885	5047	4791	3194
Yaw (deg)							
RESULTS							
P (mm)	7.6	7.6	5.5	7.7	7.6	7.6	7.6
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L_c$	1.877	1.587	1.155	1.613	1.576	2.947	1.875
P/L_c	2.730	2.308	1.680	2.346	2.292	4.286	2.727
P/D	15.016	15.000	10.919	15.250	14.900	7.500	7.500
P/nD	1.365	1.154	0.840	1.173	1.146	1.071	0.682
Figure No.	2.3.4	2.3.4	--	2.3.4	2.3.4	2.3.4	2.3.4

Orphal and Franzen (1990)

Test No.	58	59
PROJECTILE		
L (mm) each	0.254	0.254
D (mm)	1.016	1.016
L/D	0.25	0.25
Spacing (mm)	2.44	2.44
S/D	2.40	2.40
No. of Segs	8.50	18
M (g) each	0.0034	0.0034
Pen M (g)	0.0291	0.0616
Pen Mat'l	Tantalum	Tantalum
Supplier		
ρ (g/cm^3)	16.6	16.6
BHN		
Elong (%)		
Filler	None	None
Connector	None	None
Container	None	None
Tot M (g)	0.0291	0.0616
TARGET		
Mat'l	4340	4340
Thick (mm)	7.62	19.00
ρ (g/cm^3)	7.85	7.85
BHN	286	286
Elong (%)		
Obliq (deg)	0	0
IMPACT		
V (m/s)	3972	2626
Yaw (deg)		
RESULTS		
P (mm)	7.6	7.8
d (mm)		
Vol (cm^3)		
SCALING		
$P/\alpha L_e$	2.427	1.169
P/L_e	3.529	1.700
P/D	7.500	7.650
P/nD	.882	.425
Figure No.	2.3.4	2.3.4

Sorensen, Kimsey, Silsby, Schleffler, Sherrick, and de Rossett (1991)

Test No.	6433	6434	6333	6335	6332	6334	6337
PROJECTILE							
L (mm) each	8.33	8.33	8.33	8.33	8.33	8.33	8.33
D (mm)	8.33	8.33	8.33	8.33	8.33	8.33	8.33
L/D	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Spacing (mm)	33.32	33.32	0	0	8.33	8.33	8.33
S/D	4.00	4.00	0	0	1.00	1.00	1.00
No. of Segs	6	6	15	15	15	15	15
M (g) each	8.62	8.62	8.62	8.62	8.62	8.62	8.62
Pen *M* (g)	51.72	51.72	129.30	129.30	129.30	129.30	129.30
Pen Mat'l	X27	X27	X27	X27	X27	X27	X27
Supplier	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy	Teledy
ρ (g/cm^3)	17.30	17.30	17.30	17.30	17.30	17.30	17.30
BHN	385	385	385	385	385	385	385
Elong (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Filler	FG-E	FG-E	None	None	None	None	FG-E
Connector	None	None	None	None	None	None	None
Container	Al Tube	Al Tube	Al Tube	Al Tube	Al Tube	Al Tube	Al Tube
Tot *M* (g)	123.00	123.00	185.00	185.00	185.00	185.00	196.00
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	269	269	269	269	269	269	269
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	3000	3050	2950	3000	2940	3020	3010
Yaw (deg)	1.22	0.94	0.41	2.62	3.04	0.58	1.89
RESULTS							
P (mm)	158.0	157.0	211.0	213.0	237.0	238.0	272.0
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L_c$	2.129	2.116	1.138	1.148	1.278	1.283	1.466
P/L_c	3.161	3.141	1.689	1.705	1.897	1.905	2.177
P/D	18.968	18.848	25.330	25.570	28.451	28.571	32.653
P/nD	3.161	3.141	1.689	1.705	1.897	1.905	2.177
Figure No.	2.3.8	2.3.8	2.3.8	2.3.8	2.3.8	2.3.8	2.3.8

Sorensen, Kimsey, Silsby, Schleffler, Sherrick, and de Rossett (1991)

Test No.	**6339**

PROJECTILE

L (mm) each	8.33
D (mm)	8.33
L/D	1.00
Spacing (mm)	8.33
S/D	1.00
No. of Segs	15
M (g) each	8.62
Pen *M* (g)	129.30
Pen Mat'l	X27
Supplier	Teledy
ρ (g/cm^3)	17.3
BHN	385
Elong (%)	10.0
Filler	FG-E
Connector	None
Container	Al Tube
Tot *M* (g)	196.00

TARGET

Mat'l	RHA
Thick (mm)	---
ρ (g/cm^3)	7.85
BHN	269
Elong (%)	
Obliq (deg)	0

IMPACT

V (m/s)	3030
Yaw (deg)	3.16

RESULTS

P (mm)	264.0
d (mm)	
Vol (cm^3)	

SCALING

$P/\alpha L_c$	1.423
P/L_c	2.113
P/D	31.693
P/nD	2.113

Figure No.	2.3.8

SUPPLEMENTARY

INFORMATION

SOUTHWEST RESEARCH INSTITUTE

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Materials and Mechanics Department
April 13, 1992

ERRATA - AD A 246351

AD: A246351

SUBJECT: **A Penetration Mechanics Database**
by C. E. Anderson, Jr, B. L. Morris, and D. L. Littlefield
DARPA Report: SwRI 3593/001
Errata: Pages 7/8; 23/24; and A-135/A-138

Dear Fellow Researcher:

An error was brought to our attention in the recently released database report. We had a copy of a briefing paper, and a vu-graph was essentially used again; we got a little confused by the labeling of the second graph. Anyway, a couple of datapoints were entered twice, once as a tungsten alloy, and then again as DU. In addition, when we checked the data tables, we found that some of the information had not been copied from the working table to the "report-ready" table. Although we certainly tried to check and recheck the data, mistakes can still slip through.

We have printed replacement sheets for both the figures and the tables. Please insert these sheets into the appropriate place in the notebooks, and discard the other sheets. We apologize for these errors, and hope that there has not been any inconvenience.

This letter also provides me with the opportunity to request your help in bringing to our attention data we have missed, newly-acquired data, or data for multiple-plate impacts. We hope to reissue an updated and expanded version of the database in approximately one year. We also hope that an electronic version of the database will be distributed at the same time.

Sincerely,

Charles E. Anderson, Jr.

Charles E. Anderson, Jr., Ph.D.
Manager
Ballistic Sciences Section

F:\MATMECH\CEA\ERRATA.DOC April 13, 1992

Table 2.1.2. Projectile and Target Materials in Semi-infinite Target Database, with Corresponding Figure Numbers

	Target Material									
Projectile Material	Mg	Mild Al	Al	Hard Al	Mild Steel	Steel	Armor Steel	Pb	Pyrex	W Alloy
Mg				1						
Mild Al		12, 13	13		16	16				
Al	35	13, 17	13, 17, 35	1, 3	16	16, 35, 37		42		
Hard Al		13	50	50	16		50			
Ti			36							
Sn				1						
Mild Steel		14, 18	14, 18		15, 19, 38	15				
Steel		5, 7	14, 36, 43, 49	31, 49		15, 23, 41, 48	8, 23, 26, 45, 48			
Hard Steel			49	21, 22, 49	38	48	26, 51			
WC					6		6, 8, 28		20	
TiC									20	
Ta				3-4						
W Alloy			24	3	38	24	2, 8, 11, 20, 24-25, 27, 29, 31-34, 38-40, 44, 46-47, 52-53		20	24
DU Alloy							9-10, 30, 33			
Au				1						

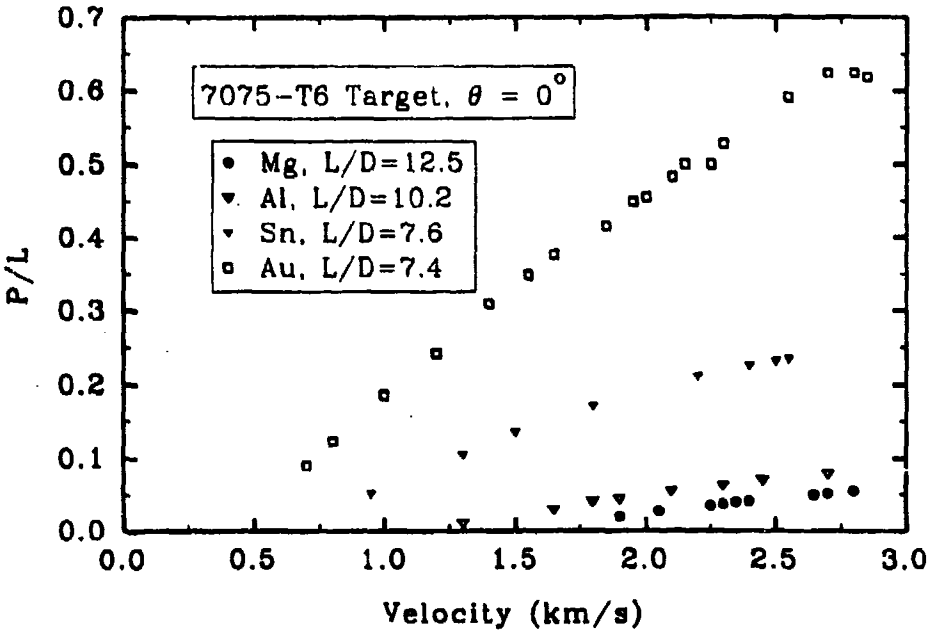

Fig. 2.1.1. Penetration Efficiency versus Impact Velocity, Allen and Rogers (1961)

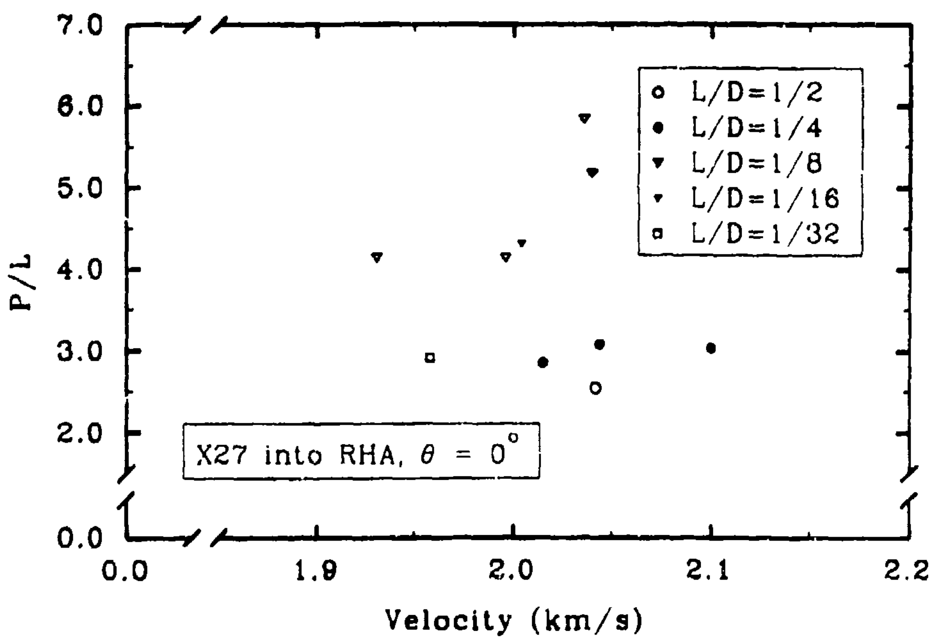

Fig. 2.1.2. Penetration Efficiency versus Impact Velocity, Bjerke *et al.* (1991)

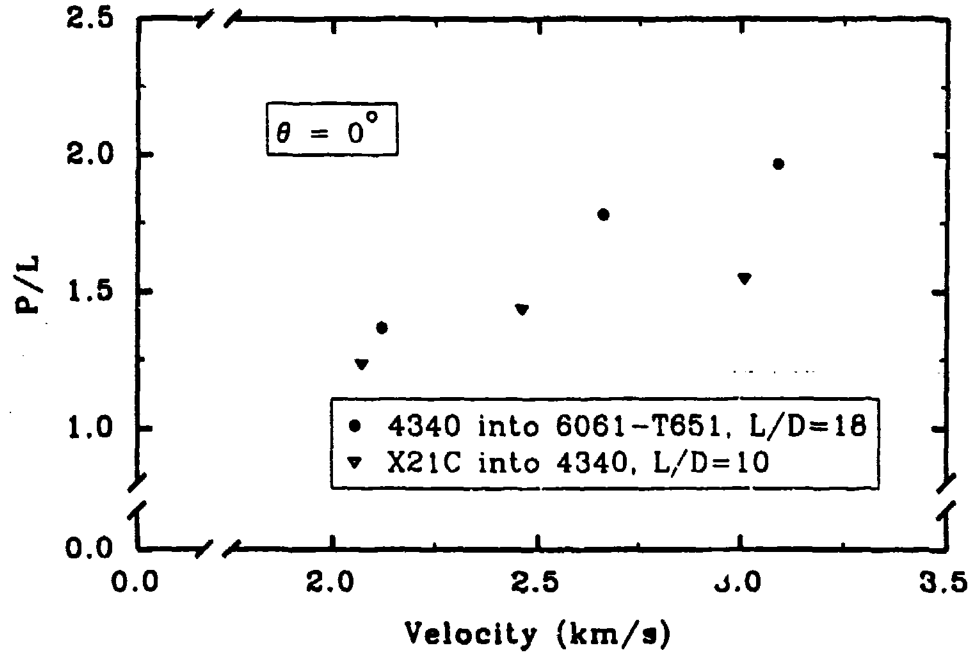

Fig. 2.1.31. Penetration Efficiency versus Impact Velocity, Luk and Piekutowski (1991)

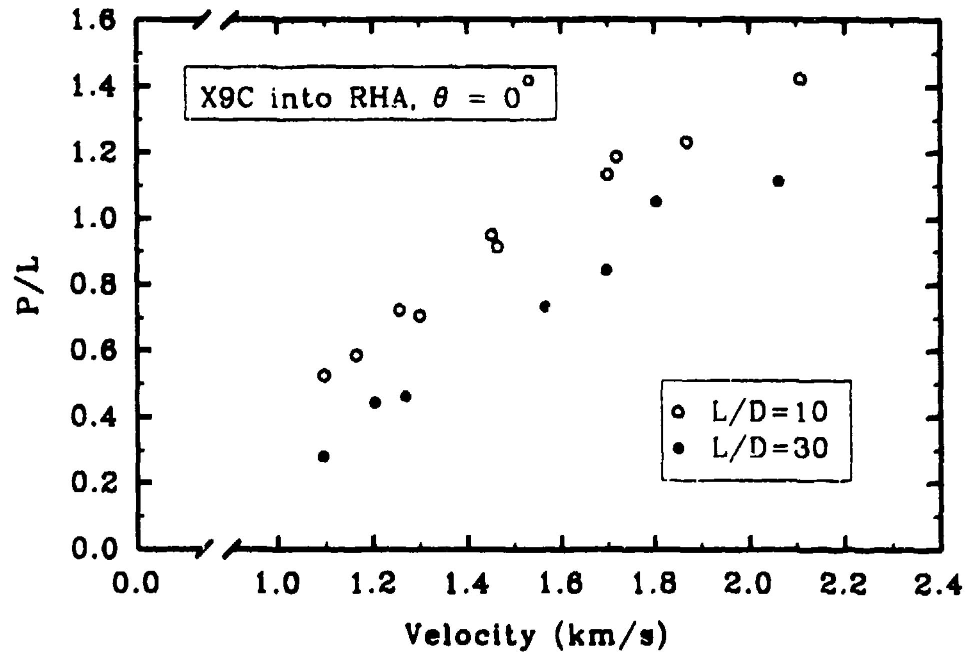

Fig. 2.1.32. Penetration Efficiency versus Impact Velocity, Magness (1990)

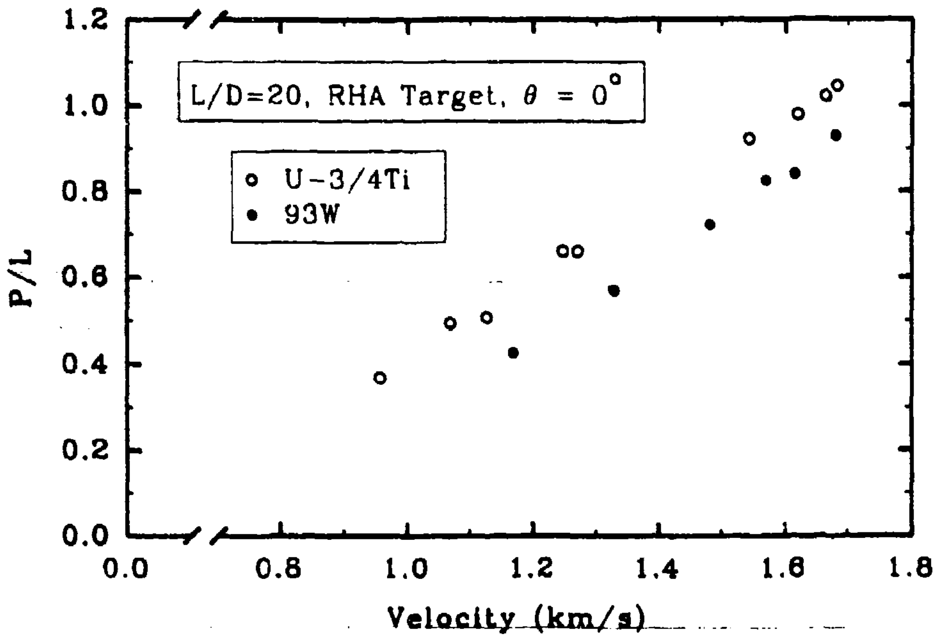

Fig. 2.1.33. Penetration Efficiency versus Impact Velocity, Magness and Farrand (1990)

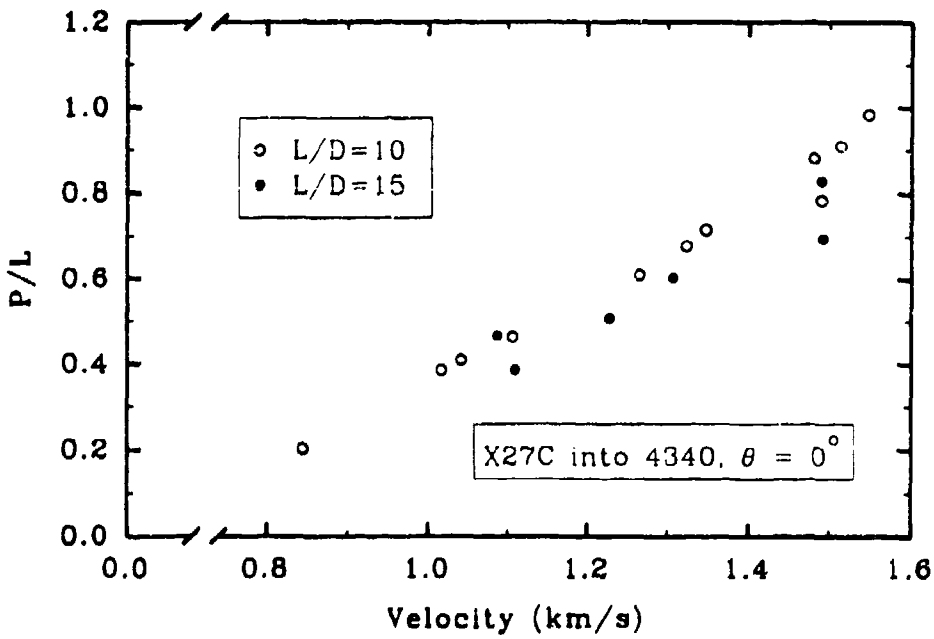

Fig. 2.1.34. Penetration Efficiency versus Impact Velocity, Morris and Anderson (1991)

Luk and Piekutowski (1991)

Test No.	4-0995	4-0992	4-0997	4-1046	4-1044	4-1048
PROJECTILE						
L (mm)	68.58	68.58	68.58	45.7	45.7	45.7
D (mm)	3.81	3.81	3.81	4.57	4.57	4.57
L/D	18	18	18	10	10	10
M (g)	6.2	6.2	6.2	13.69	13.69	13.69
Mat'l	4340	4340	4340	X21C	X21C	X21C
Supplier						
ρ (g/cm³)	7.81	7.81	7.81	17.65	17.65	17.65
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN						
Elong (%)						
TARGET						
Mat'l	6061-T651	6061-T651	6061-T651	4340	4340	4340
Thick (mm)	229	229	229	152	152	152
ρ (g/cm³)	2.71	2.71	2.71	7.81	7.81	7.81
BHN						
Elong (%)						
Obliq (deg)	0	0	0	0	0	0
IMPACT						
V (m/s)	2120	2660	3090	2070	2460	3101
Yaw (deg)	1.0	3.5	0.5	3.9	10.3	3.8
RESULTS						
P (mm)	93.7	122.1	134.9	56.2	65.5	70.5
d (mm)	7.60	10.75	11.48	9.71		13.89
Vol (cm³)	4.25	11.08	13.96	4.16		10.68
SCALING						
P/αL	0.805	1.049	1.159	0.818	0.953	1.026
P/L	1.366	1.780	1.967	1.230	1.433	1.543
d/D	1.995	2.822	3.013	2.125		3.039
P/d	12.329	11.358	11.751	5.788		5.076
Figure No.	2.1.31	2.1.31	2.1.31	2.1.31	2.1.31	2.1.31

Magness (1990)

Test No.							
PROJECTILE							
L (mm)	76.80	76.80	76.80	106.00	106.00	106.00	106.00
D (mm)	7.68	7.68	7.68	3.53	3.53	3.53	3.53
L/D	10.00	10.00	10.00	30.03	30.03	30.03	30.03
M (g)	65.00	65.00	65.00	19.00	19.00	19.00	19.00
Mat'l	X9C	X9C	X9C	X9C	X9C	X9C	X9C
Supplier							
ρ (g/cm^3)	18.60	18.60	18.60	18.60	18.60	18.60	18.60
Nose	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi	Hemi
BHN							
Elong (%)							
TARGET							
Mat'l	RHA	RHA	RHA	RHA	RHA	RHA	RHA
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86	7.86	7.86	7.86	7.[illegible]
BHN							
Elong (%)							
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1256	1453	1719	1094	1204	1269	1566
Yaw (deg)							
RESULTS							
P (mm)	55.6	73.0	91.1	29.8	47.0	49.0	77.8
d (mm)							
Vol (cm^3)							
SCALING							
$P/\alpha L$	0.471	0.618	0.771	0.183	0.288	0.301	0.477
P/L	0.724	0.951	1.186	0.281	0.443	0.462	0.734
d/D							
P/d							
Figure No.	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32	2.1.32

Magness (1990)

Test No.			
PROJECTILE			
L (mm)	106.00	106.00	106.00
D (mm)	3.53	3.53	3.53
L/D	30.03	30.03	30.03
M (g)	19.00	19.00	19.00
Mat'l	X9C	X9C	X9C
Supplier			
ρ (g/cm^3)	18.60	18.60	18.60
Nose	Hemi	Hemi	Hemi
BHN			
Elong (%)			
TARGET			
Mat'l	RHA	RHA	RHA
Thick (mm)	---	---	---
ρ (g/cm^3)	7.86	7.86	7.86
BHN			
Elong (%)			
Obliq (deg)	0	0	0
IMPACT			
V (m/s)	1697	1805	2062
Yaw (deg)			
RESULTS			
P (mm)	89.3	111.4	118.1
d (mm)			
Vol (cm^3)			
SCALING			
P/αL	0.548	0.683	0.724
P/L	0.842	1.051	1.114
d/D			
P/d			
Figure No.	2.1.32	2.1.32	2.1.32

SUPPLEMENTARY

INFORMATION

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Errata AD-A246835

Materials and Mechanics Department
July 29, 1992

SUBJECT: **A Penetration Mechanics Database**
by C. E. Anderson, Jr, B. L. Morris, and D. L. Littlefield
DARPA Report: SwRI 3593/001
Errata: Pages A-199/A-200

Dear Fellow Researcher:

John Zook, at the U. S. Army Ballistic Research Laboratory, found some typographical errors in the subject database. We have corrected the entries. The errors were solely in the Appendix; the corresponding figures, in the main part of the text, are correct. We thank John for bringing this to our attention. Although we certainly tried to check and recheck the data, mistakes still slip through. But with your help, these errors are being corrected.

We have printed replacement sheets for the two pages. Please insert these sheets into the appropriate place in the notebooks, and discard the other sheets. We apologize for these errors, and hope that there has not been any inconvenience.

This letter also provides me with the opportunity to request your help in bringing to our attention data we have missed, newly-acquired data, or data for multiple-plate impacts. We hope to reissue an updated and expanded version of the database in approximately one year. We also hope that an electronic version of the database will be distributed at the same time.

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Charles E. Anderson, Jr., Ph.D.
Manager
Ballistic Sciences Section

C:\MS\MSDATA\ERRATA1.DOC July 29, 1992

Wilson, Foster, Jones, and Gillis (1989)

Test No.	50	51	52	53	54	55	56
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	9.53	9.53	9.53	9.53	9.53	12.70	12.70
L/D	3.33	3.33	3.33	3.33	3.33	2.50	2.50
M (g)	17.78	17.78	17.78	17.78	17.78	31.57	31.57
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Obliq (deg)	0	0	0	0	0	0	0
IMPACT							
V (m/s)	1051	1064	2360	2520	2495	1655	1599
Yaw (deg)	2.0	0.0	4.1		3.6	1.0	2.0
RESULTS							
P (mm)	7.11	7.11	44.45	31.75	36.58	21.34	25.40
d (mm)	17.53	17.53	22.23	23.83	22.35	24.61	24.61
Vol (cm^3)							
SCALING							
P/αL	.224	.224	1.400	1.000	1.152	.672	.800
P/L	.224	.224	1.400	1.000	1.152	.672	.800
d/D	1.839	1.839	2.333	2.501	2.345	1.938	1.938
P/d	.406	.406	2.000	1.332	1.637	.867	1.032
Figure No.	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51	2.1.51

Wilson, Foster, Jones, and Gillis (1989)

Test No.	14	15	16	18	19	22	23
PROJECTILE							
L (mm)	31.75	31.75	31.75	31.75	31.75	31.75	31.75
D (mm)	6.35	6.35	6.35	6.35	6.35	6.35	6.35
L/D	5.00	5.00	5.00	5.00	5.00	5.00	5.00
M (g)	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Mat'l	4340	4340	4340	4340	4340	4340	4340
Supplier							
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
Nose	Flat	Flat	Flat	Flat	Flat	Flat	Flat
BHN	249	249	249	249	249	249	249
Elong (%)	23.50	23.50	23.50	23.50	23.50	23.50	23.50
TARGET							
Mat'l	4340	4340	4340	4340	4340	4340	4340
Thick (mm)	---	---	---	---	---	---	---
ρ (g/cm^3)	7.85	7.85	7.85	7.85	7.85	7.85	7.85
BHN	411	411	411	411	411	411	411
Elong (%)	16.60	16.60	16.60	16.60	16.60	16.60	16.60
Obliq (deg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IMPACT							
V (m/s)	1270	1270	1010	1500	1490	2480	2480
Yaw (deg)	4.0	0.0	7.6	2.0	5.0	8.6	1.4
RESULTS							
P (mm)	10.29	7.90	2.36	10.29	12.67	10.29	18.24
d (mm)	15.88	14.27	12.70	12.70	12.70	12.70	12.70
Vol (cm^3)							
SCALING							
P/αL	0.324	0.249	0.074	0.324	0.399	0.324	0.574
P/L	0.324	0.249	0.074	0.324	0.399	0.324	0.574
d/D	2.501	2.247	2.000	2.000	2.000	2.000	2.000
P/d	0.648	0.554	0.186	0.810	0.998	0.810	1.436
Figure No.	2.1.48.	2.1.48.	2.1.48.	2.1.48.	2.1.48.	2.1.48.	2.1.48.