

# ANALYTICAL PENETRATION MODELING

The Walker-Anderson penetration model developed by Southwest Research Institute (SwRI) personnel is based on momentum conservation along the projectile-target centerline. Originally developed for semi-infinite metallic armors, the model can be used to solve a wide range of problems including bulging and perforation, incorporating seven different exit failure modes. The model provides a fast-running, accurate capability to estimate penetration performance in metallic, ceramic, and fabric armors.

## KEYWORDS

Penetration Mechanics

Armor Mechanics

Ballistic Impact

Ceramic Armor

Body Armor

Terminal Ballistics

Penetration Performance

Ballistic Performance

Long-Rod Projectiles

Fragment-Simulating Projectiles

FSP

Small Arms

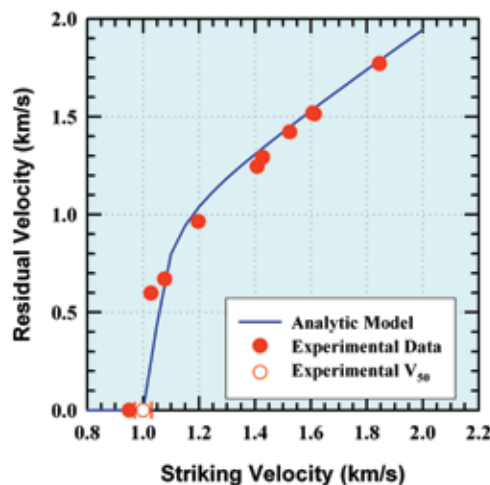
Ballistic Fabrics

Composite Armor

Homeland Security

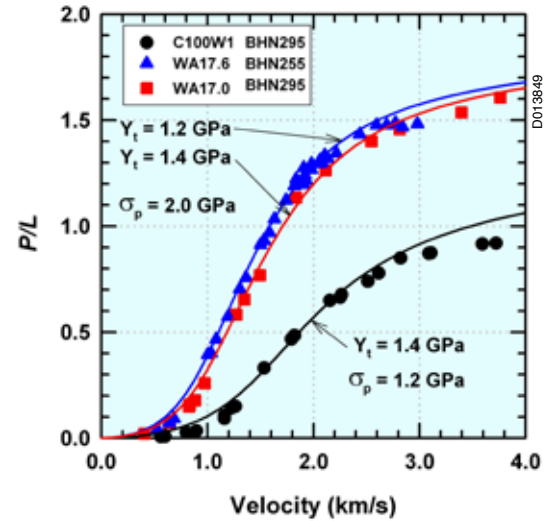
## Applications

- Long-rod projectiles
- Small arms (armor-piercing and ball rounds)
- Fragment-simulating projectiles
- Brittle materials (e.g., glass and ceramics)
- Ballistic fabrics and composites
- Estimates for ballistic protection such as  $V_{50}$ , mass efficiency, and limit thickness
- Hypervelocity impact

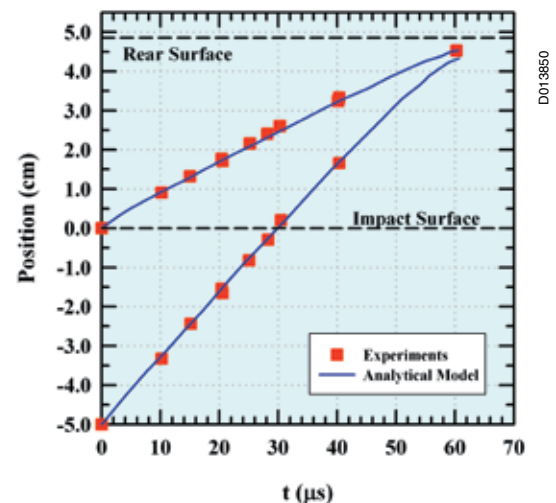


Comparison of  $V_S - V_R$  and  $V_{50}$  by Walker-Anderson model to experimental data

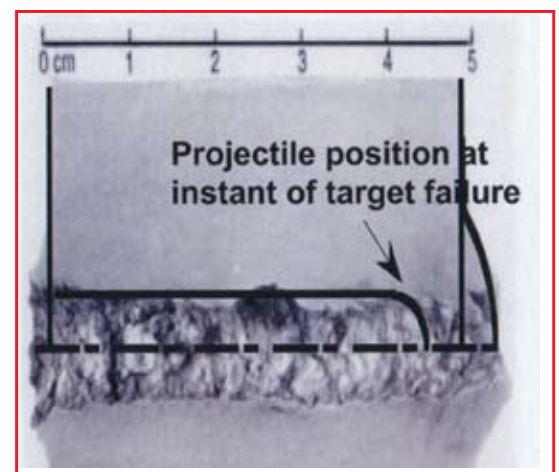
Graph



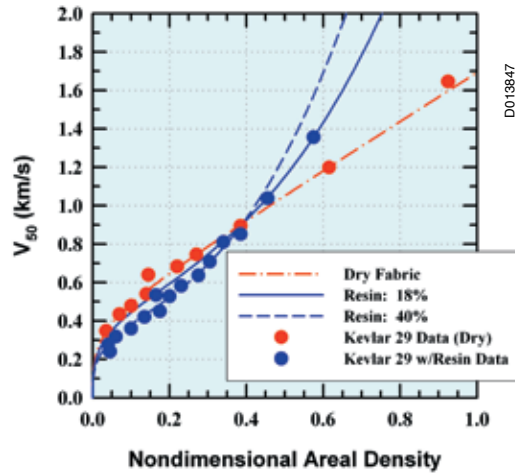
Comparison of Walker-Anderson model (solid lines) to experimental data for tungsten alloy and steel L/D 10 long rods into armor steel targets



Comparison of Walker-Anderson model (solid lines) to nose and tail positions of a long rod penetrating an armor steel target

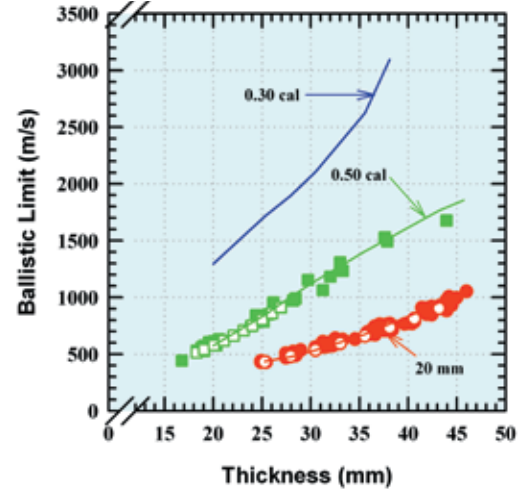


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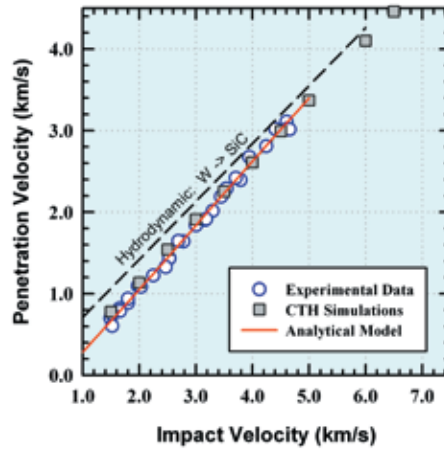
DOI13847

Comparison of fabric response model (solid lines) to experimental data (symbols)



DOI13846

Ballistic limit vs. thickness predictions for FSPs, and comparison to experimental data (solid lines are the model; experimental data are denoted by the symbols)



DOI13852

The analytical model reproduces the experimental data for tungsten long-rod penetration into a semi-infinite silicon carbide target



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We welcome your inquiries. For additional information, please contact:

James D. Walker, Ph.D.  
Staff Scientist, Computational Mechanics Section  
(210) 522-2051  
james.walker@swri.org

Engineering Dynamics Department  
Mechanical and Materials Engineering Division  
Southwest Research Institute  
6220 Culebra Road • P.O. Drawer 28510  
San Antonio, Texas 78228-0510

Charles E. Anderson, Jr., Ph.D.  
Director, Engineering Dynamics Department  
(210) 522-2313  
charles.anderson@swri.org

Southwest Research Institute Website:  
[www.swri.org](http://www.swri.org)  
Engineering Dynamics Department Website:  
[www.engdyn.swri.org](http://www.engdyn.swri.org)