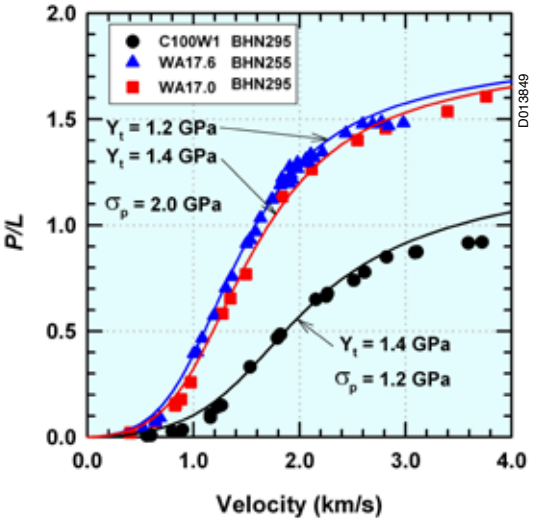
Southwest Research Institute®

ANALYTICAL PENETRATION MODELING

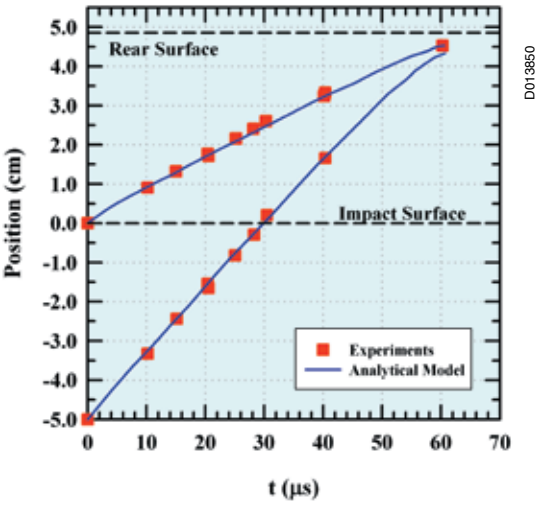
The Walker-Anderson penetration model developed by Southwest Research Institute® (SwRI®) personnel is based on momentum conservation along the projectile-target centerline. Originally developed for semi-infinite metallic armors,the model can be used to solve a wide range of problems including bulging 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.

Applications

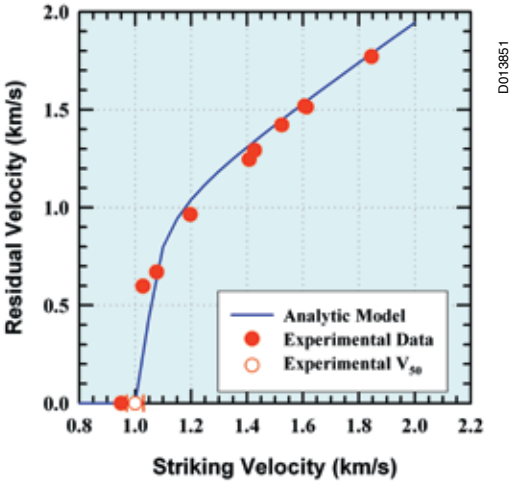
- Long-rod projectiles
- Small arms (armor-piercing and ball rounds)
- Fragment-simulating projectiles
- Brittle materials (e.g., glass and ceramics)
- Ballistic fabrics and composites
- Estimates for ballistic protection such as V_{50}, mass efficiency, and limit thickness
- Hypervelocity impact



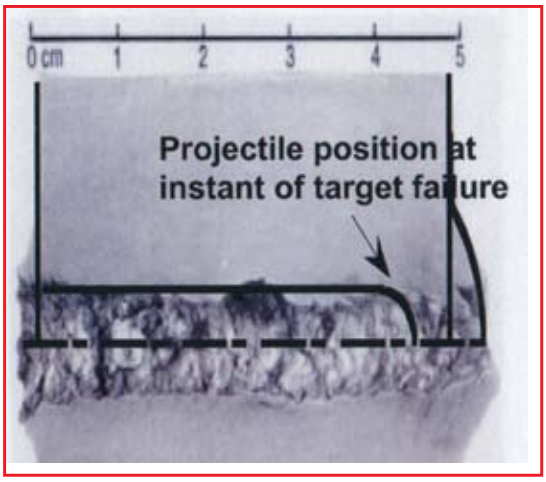
Comparison of Walker-Anderson model (solid lines) to experimental data for tungsten alloy and steel L/D 10 long rods into armor steel targets



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



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



Graph

KEYWORDS

Penetration Mechanics

Armor Mechanics

Ballistic Impact

Ceramic Armor

Body Armor

Terminal Ballistics

Penetration Performance

Ballistic Performance

Long-Rod Projectiles

Fragment-Simulating Projectiles

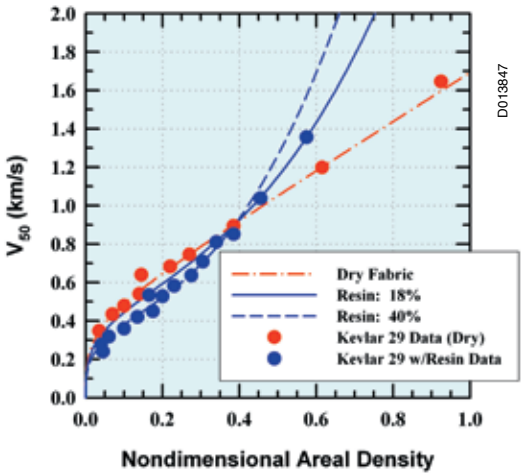
FSP

Small Arms

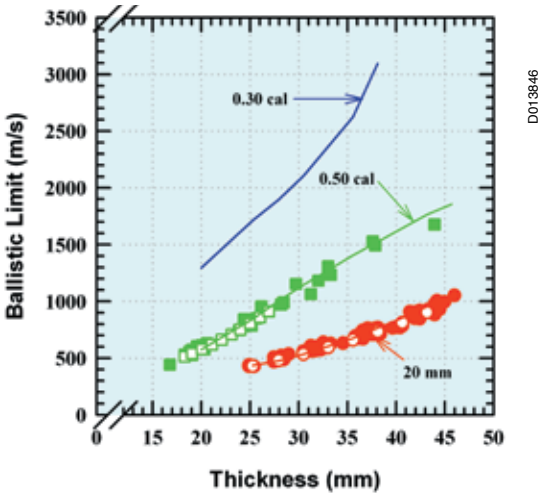
Ballistic Fabrics

Composite Armor

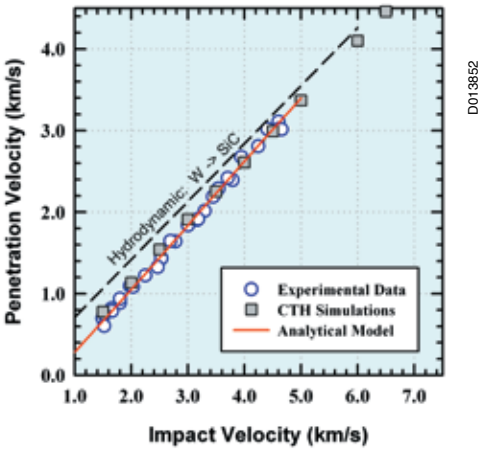
Homeland Security



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



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



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

Southwest Research Institute® is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides more than 2 million square feet of laboratories, test facilities, workshops and offices for more than 3,300 employees who perform contract work for industry and government clients.

We welcome your inquiries.

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