

Development of a Movable Wall Shoot House for Small Arms and Grenade Training

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Mr. Brad L. Huntsman, Terran Corporation, Beavercreek, OH

Mr. Joe G. Tom and Dr. Philip G. Malone

**US Army Engineers Research and Development Center
Vicksburg, MS**



Uses of SACON in Training Facilities

- **Background**

- Corps of Engineers has developed different types of shock-absorbing concrete (SACON) for weapons testing and live-fire training
- SACON is a foamed, fiber-reinforced concrete that will not produce ricochets when fired on

- **New Developments**

- New Lower Cost SACON Mixture Produced
- SACON Tunnel Bullet Traps Installed
- New Shoot Houses/Grenade House Design with Fixed Self-supporting Panels Produced
- Moveable Panel Block Demonstrated



Background Information on Shock-Absorbing Concrete



- Corps of Engineers developed different types of shock-absorbing concrete (SACON) for weapons testing
- SACON has become popular in bullet barriers



How SACON Absorbs Impacts

- Density is one-half that of conventional concrete
- No coarse aggregate
- Fiber produces toughness
- Concrete crushes on impact



Effects of Multiple Impacts on the Same Point in SACON



- Multiple impacts on the same point do not produce ricochets
- A pocket of debris forms
- The pocket moves deeper into the foamed concrete
- Even in multiple impact most (>85%) of the debris remains in the block



Proportioning of Materials for 90 pcf Polypropylene Fiber-Reinforced SACON

Cement (ASTM Types I-II) 972 lbs./cu.yd.

Water 466 lbs./cu.yd.

Sand 972 lbs./cu.yd.

Stabilizer 0.27 lbs./cu.yd.

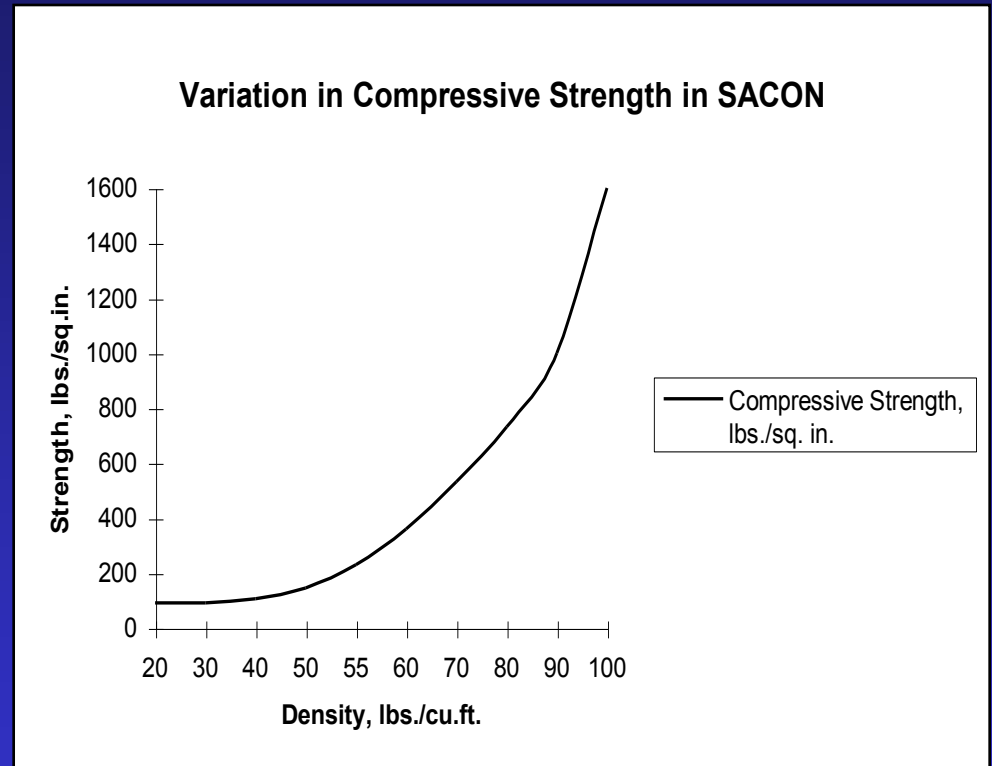
Fiber 14.8 lbs./cu.yd.

Foam 8.9 cu.ft./cu.yd.



Compressive Strength vs Density

- Increasing density increases strength
- Changing the amount of foam added to the sand-cement paste changes the density and strength
- Most useful materials are in the 70 to 90 pcf range



Where SACON Can Be Useful

- Live-fire shoot houses and grenade houses
- Bullet traps for lead and/or tungsten (green bullet) recovery on conventional ranges
- Land-based and ship-borne live fire facilities of all kinds
- Barriers for reduction of safety fans in live-fire exercises
- Back-up walls in exercises that use shoot-through materials such as plywood, plastic, glass or sheet metal



Where SACON Can Be Useful (cont.)

- Barriers to collect fragments produced in blasting
- Three-dimensional stationary or movable targets
- Protective structures for video cameras or weapon simulators
- Safe realistic rubble for combat scenarios



Shock-Absorbing Concrete (SACON) Shoot House

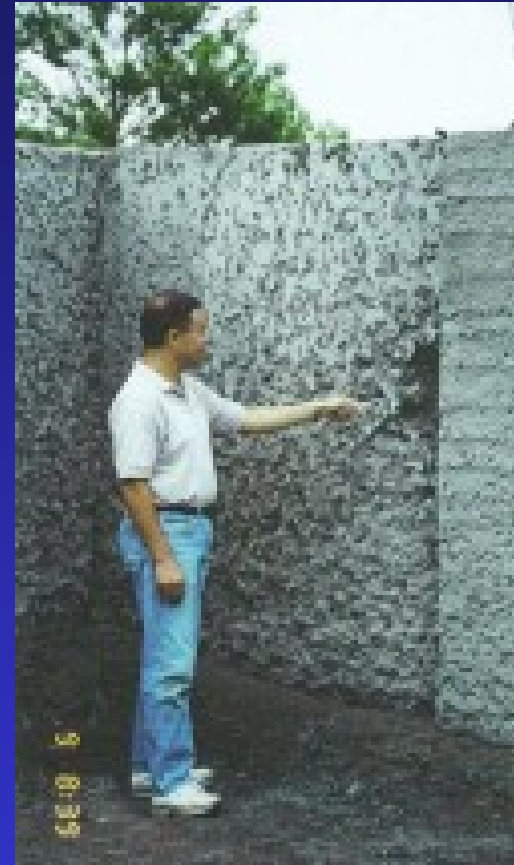


- Made with foamed, fiber-reinforced concrete panels
- All metal supports covered
- Metal attachment plates in top and bottom
- No rebar



Interior of SACON Shoot-House

- Safe, no ricochets
- Fire resistant
- Resists vermin
- Can be used with grenades



SACON Huts

- Live-fire training structures
- Realistic exercises with tracers permitted
- Rapidly assembled by bonding cast-on-site SACON panels
- Tip-up construction techniques can be used with SACON



Single-Story SACON Building



- Cast-in-place with continuous formwork
- SACON pumped into formwork
- Door and windows built into the formwork
- Work done with troop labor



Tank Made from SACON



SACON Target Backstops/Bullet Traps



- Can absorb bullet impacts from thousands of rounds of ammunition
- Tracer rounds and deflagrating rounds can be used
- Alkalinity of concrete reduces lead leaching
- Only practical method of recycling the new “green bullet”



Natural Features Can Be Reproduced in SACON



- Mock-ups of tree stumps, rock crops, and other natural features can be produced
- SACON can be--
 - molded into almost any shape
 - pigmented to have color throughout the object
 - painted to disguise the surface



SACON Tunnel Bullet Traps Ft. Jackson, SC



Conventional berms on a 25-meter range wash out quickly at the bullet impact points

Maintenance requirements are high

Lead-contaminated soil washes from range.

Simple, inexpensive, low - maintenance traps reduce the requirement to regrade the berms

Spent bullets are retained in tunnel--no wash-outs



SACON Traps and the Green Bullet

- The cost of tungsten requires that the “green bullets” be collected and recycled (common impact areas cannot be used)
- SACON traps offer the best performance in collecting intact bullets
- SACON traps can be made secure to prevent pilfering of tungsten (tungsten is worth \$30/lb as scrap, lead is worth \$0.30/lb as scrap)



New Movable Wall Shoot House Panel Design



Fixed Wall Shoot House/ Grenade House



One training scenario
Crane required for servicing
structure.
Roof is not practical
Floor is packed sand

Movable Wall Shoot House/ Grenade House

Panels can be moved with a forklift
Training scenarios can be changed quickly
Can be assembled under cover (warehouse or hangar)
Floor is SACON blocks for better footing



New Movable Wall Shoot House Design

Panel Block



Each panel has pedestal base

Walls are arranged on a conventional concrete pad that is protected by a 2-ft thickness of SACON

Can be assembled into any configuration of rooms

Crane or forklift can be used for positioning

Floor Block



Not to Scale



Summary

- SACON is prepared using conventional mixers and ordinary Portland cement
- Water-based foam, fiber and thickeners are the only additional components
- Extremely versatile--material has a range of densities and can be cast in any shape or color
- Construction techniques are similar to conventional concrete (block, pre-cast panels, or cast-in-place)
- Used SACON generally considered construction waste -- non-hazardous and non-flammable



Summary (cont.)



- Less expensive concrete formulation allows us to do more construction on same budget
- SACON bullet traps reduce range maintenance
- Self-supporting and moveable panels provide safe, realistic training structures
- Approaching the goal of building facilities that allow us to training anywhere, any time using the same weapons we fight with



Points of Contact for SACON

Mr. Brad L. Huntsman

Terran Corporation

4080 Executive Drive

Beavercreek, OH 45430-1061

e-mail blhuntsman@terrancorp.com

Mr. Joe G. Tom

Geotechnical Structures Laboratory

U.S. Army Engineer Research and Development Center

Vicksburg, MS 39180-6199

Phone: 601-634-3278

e-mail tomj@mail.wes.army.mil

Dr. Philip G. Malone

Phone: 601-634-3960

e-mail malonep@mail.wes.army.mil

