

FIRING POSITIONS - TANKS



Access Trail to Defilade



Blast Mat and Stone Rip-Rap

Design: Defilade positions are designed to include hull-down and turret-down positions for the M60 tank, M1 tank, and Bradley Fighting Vehicle (BFV). Each defilade position needs to be adjusted in accordance to site-specific conditions in order to provide line-of-sight to the target. The slope into the defilade position should be 2-3 percent. Refer to the Civil Details in the Appendix of this document, which shows the dimensions used in the design of defilade positions. There are two basic designs: one design with a level hull-down and turret-down position and one design with a gradual slope between these two positions. The area of the defilade subjected to the muzzle blast should be protected with stone rip-rap and a rubber tire blast mat. *This is necessary because blast overpressure typically displaces surface soil on the berm, forming a dust cloud immediately after firing that can obscure the target and slow training. Long term soil displacement during intensive firing exercises eventually causes loss of vegetation on the berm faces, which results in erosion of the defilade berm, and increased dust during firing exercises. While an extensive rip-rap cover on the defilade is effective in mitigating the effects of muzzle blast, it can make periodic maintenance of any sensors (such as vehicle position sensors) installed at the defilade position more difficult and expensive, since the stones must first be removed. The rip rap is also a “slip, trip and fall” safety hazard for personnel. The designer should also consider using a recycled rubber tire blast mat with a reduced stone rip-rap cover to stabilize the embankment face in the region of the highest blast wave impact, and a geosynthetic cellular confinement system (geoweb/geocell) on the remaining parts of the firing position embankment structure to stabilize the soil.*

Geocells are high density polyethylene strips that are welded together at specific intervals to form a panel of “honeycombed cells”. Commercially, geoweb panels are widely used to enhance embankment slope stability, and to control erosion and help maintain vegetation on slopes. The cell type and cell spacing used need to be specified by the design engineer. Typically, smaller cell sizes (SV20 and SV30 series) and closer spacing are used on steeper slopes and the larger more economical size cell (SV40 series) is used on slopes that are less steep. Geocell panels are typically installed from the top of the embankment down, and are anchored to each other and to the embankment face. Tendons can be used to provide extra support for the panels. The geocell panels are then backfilled from the top down. The underlying soil should be well compacted, and a vegetative cover established.

The vegetative cover should be planted and maintained on the firing position in areas not covered by rip-rap. It is very important to maintain the vegetative cover on the berms in order to minimize erosion. Refer

to the Appendix of this document for design details. In addition to constructed positions, natural defilade positions should be obtained by taking advantage of the terrain's characteristics, such as a drop in the trail or a stream crossing. Dummy defilade positions should be provided to facilitate training.

Concrete Access Ramps: Intensive training and maneuvering can cause major maintenance problems on access ramps, particularly at hull-down firing positions, turret-down defilade positions, and tank trail intersections. To prevent access ramp surfaces from being displaced during quick stops and to minimize maintenance on heavily used ranges, ramps are to be constructed with reinforced concrete surfaces. The designer should also consider the use of articulated "cable concrete mats" on ramps. A cable concrete mat is composed of individual trapezoid shaped concrete blocks that are strung together with steel cables into 8 ft by 16 ft "mattresses" that are placed side-by-side, clamped, and staked to the ground to provide one homogeneous system. Gaps between individual blocks are filled with aggregate base that is worked into crevasses using a shovel and broom. The type of traffic that the system must support determines the block size. While there are several sizes of block commercially available, either CC70 or CC90 size blocks should be used on ramps for firing positions, with the CC90 block being used on turn pads and at intersections. Refer to the Civil Details in the Appendix of this document.