FULL BORE CLASSIFICATION RANGES

SECTION 1. DESCRIPTION

Classification ranges allow for a reduced danger area due to the nature of their construction. The template has been reduced in size based on the premise that all firing will take place on a limited arc of fire, from prepared firing points and at penetrable targets. The safety of such a reduced template also depends on a high degree of range discipline, as a bullet in free flight which passes over the crest of the stop butt could exit the RDA by up to 1000m. A reduced danger area is applied, but is dependent on:

a. all firing taking place on a single line of fire at a target presented within determined limits.

b. all projectiles striking the stop butt,

c. the range area forward of the firing points and up to the stop butt being free of ricochet inducing materials.

d. a high degree of range discipline being enforced, and

e. a high degree of integrity being shown on the part of the firers.

Classification ranges comprise the following:

a. Firing Mounds. Firing mounds are located at intervals of 100 m/yds.

The mounds are elevated and provide the number of firer positions required for the specific range. A distance of 1.5 m is normally provided between firers on the firing mound, and firing lanes are to be numbered with a marker positioned on the right edge of each lane.

b. Stop Butts. Stop butts may be artificial or natural and are located behind the targets to stop bullets fired down the range. The butts also enable firers to see the strike of the bullet.

c. Target Numbers. Target numbers are located on the crest of the stop butt, immediately above each target and are numbered from left to right (when looking from the firing point).

d. Markers Gallery (Butts). The markers gallery is located immediately behind the mantlet and houses the target mechanisms. The gallery is protected from small arms fire by an earthen mound known collectively as the mantlet. The gallery provides a protected area for the butt party.

e. Mantlet. The mantlet provides protection to the gallery and reduces the number of ricochets from low shots. The mantlet must be maintained to prevent the formation of scoops caused by low bullets cutting the earth away.

The standard layout for a Classification Range is depicted in Figure 3.1 on the following page.

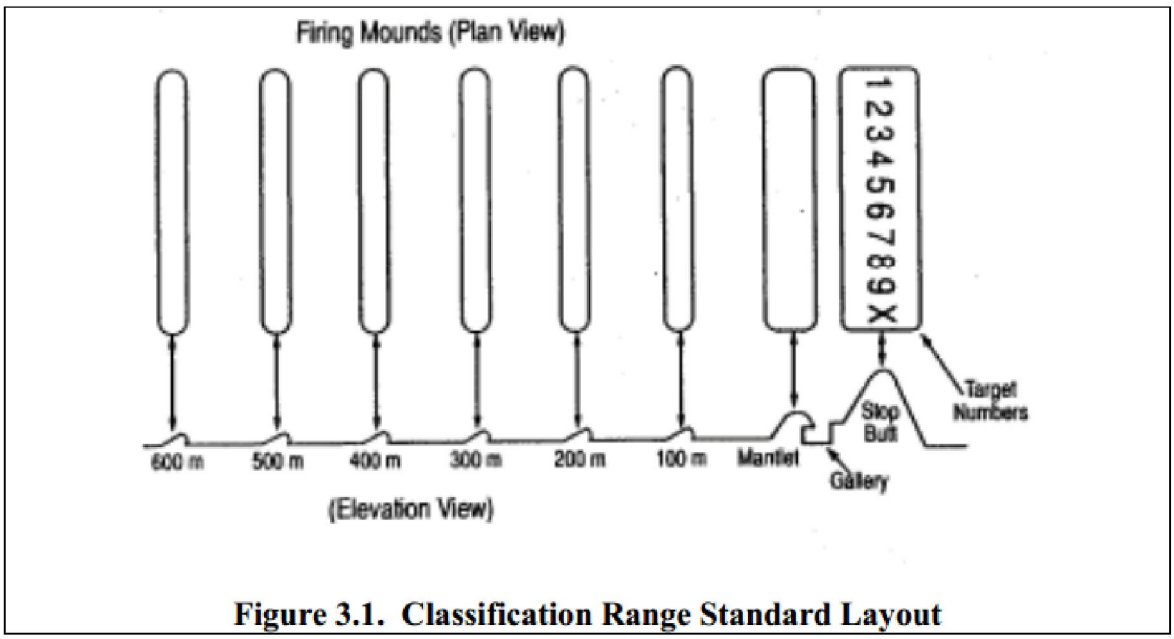

Figure 3.1. Classification Range Standard Layout

Dimensions

A depiction of a 10-lane classification range is shown in Figure 3.2. The overall length of the range is divided into three sections by the target line, and the rear area full width line. The distance occurring before the target line is variable and depends on the number of firing points catered for. This could be as little as 100 m or as many as 1200 m in rare cases. The length of the danger area behind the target is a constant 1830m in length. The first 915m behind the target line expands in width from 150 m to 350 m as measured outward from each flank line of sight. The end portion of 915m length continues at a constant width of 350 m measured from each flank line of sight throughout its length. From this it will be seen that the terminal width is twice 350 m plus the width between the flank firers.

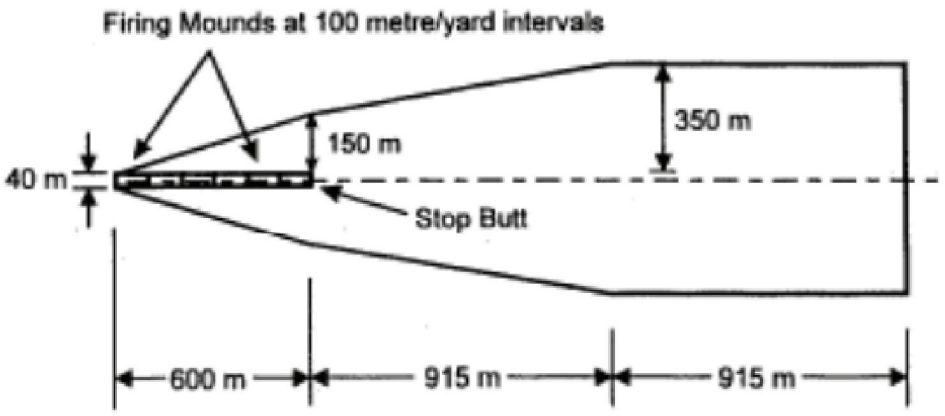

Figure 3-2. An Example of a Classification Range Danger Area Safety Trace,10 Target Range

The Classification Range should always have a stop butt behind the targets, to both stop bullets in free flight and low ricochets, and to enable the markers to accurately locate the strike of the bullets on the face of the stop butt. If a full danger area template is applied, a stop butt is not strictly necessary but is to assist both the firer and the observer to see the fall of shot, a reduced stop butt or bullet catcher should be constructed. If the complete classification range specifications cannot be met e.g. height of stop butt or the full depth of the mantlet is not visible from a firing point, the full danger area template is to be applied.

Firers are required to fire in line with the axis of the range. Should firers be required to fire at an angle to the axis, the danger area required for the range is to increase. It will be necessary to construct a new RDA safety trace to cover the changed danger area.

In exceptional circumstances and at the discretion of FAR, old existing ranges may be permitted to maintain the template that was first applied at the time of construction.

SECTION 2. DESIGN REQUIREMENTS FIRING POINTS AND RANGE SURFACE

Prepared firing points on most existing classification ranges are keyed to multiples of 100 yards, but in all new construction measurements should be keyed to metres.

The centre line of each firing lane is to be parallel to the main axis of the range. If any firing point has to be built off centre, the danger area for the range is to be adjusted accordingly.

Firing points should be as close to ground level as possible so that they are self-draining and provide an uninterrupted view of the full mantlet. Elevated or raised firing points may be necessary in the case of hollow or swampy sites. The dimensions of firing points, whether elevated or ground level are to be the same.

The firing points or mounds as shown at Figure 3-1, are to be built to the following dimensions:

a. Length. The length is to provide for 4m lanes, times number of targets plus end ramps where necessary.

b. Width. The useable width is to 3 m with run up and run off slopes added to the width.

c. There should be a minimal fall from the front edge (which should be 0.6m above the surrounding ground) to the rear edge of approximately 1:12 (180 milsor 10 deg).

d. Access Slopes. The slope down from either end of the firing mound should be at the natural angle of repose. It is suggested, but not mandatory that the slopes leading up to the mound should be at a gradient of not more than 1:6 (90 mils or 5 deg) to cater for easy movement to and from the mound.

Each firing point is to be accurately measured from the target line and indicated by a timber marker with the firing distance painted on it. Lane numbers are to be painted on bricks recessed into the firing point, on the right side of each firing lane. These markers are to be spaced at the same distance apart as the centre to centre spacing of the targets.

To assist ongoing range safety inspections, a range centre line marker is to be placed on all firing points and the mantlet.

A PVC pipe is to be permanently sunken at one end of the firing points to support the firing point flags. A firing point flagpole may be erected as an alternative.

On the surface of the range, flagpoles are to be of non-ricochet inducing material and any structure or flagpole base is to be protected from projectile strike with an earth bank.

Consideration should be given to the installation of a loudspeaker system on large ranges.

Mantlet

The mantlet offers protection to the markers in the gallery and reduces the number of ricochets from low shots. It is important to understand that shot errors are just as likely to occur equally above, below or to the flanks of the target. For this reason, it is essential to provide a mantlet of a minimum height of 1.8 m, such that the whole forward face of the mantlet is visible to any firing position on the range. This provision is a key factor in justifying the use of the Classification Range RDA trace.

Where little or no mantlet is provided, the target will necessarily be lower, thereby lowering the general line of sight, resulting in low shots which would normally be caught by the full mantlet, ricocheting off the ground where a mantlet would normally be. To retain the use of a classification range RDA trace in these circumstances, very stringent conditions must be imposed with regard to the ground between the target line and the 100 m firing point (see para 3.22).

Mantlets are normally composed of earth with concrete, brick, timber or concrete slab walls. They must be a minimum of 1.5 m thick throughout the whole length and depth (Figure 3 - 3 gives typical cross sections).

The forward face should be constructed to a slope not less than 2:3 (580 mils or 33 deg) from the horizontal and should not be less than1.8 m to the crest line. The top surface should be provided with a fall of 1:12 (180 mils or10 deg) from the crest toward the target line. This is an additional feature that reduces the incidence of ricochet.

To ensure the correct height and width are maintained, the crest of the mantlet must be defined by the insertion of a profile board consisting of a wooden plank on edge. The crest formed by the profile board is critical, as it will contribute to the safety of those in the gallery. It is essential that the profile of the mantlet is maintained.

Not only do these scoops tend to cause widely divergent ricochets but also make it possible for bullets to penetrate the gallery. The mantlet must be regularly maintained and the profile board replaced when it deteriorates. The use of materials such as "Tenax Tenweb" should reduce the speed at which scoops form, and thus reduce maintenance.

Marker's Gallery

Figure 3 - 3 shows cross sections of marker's galleries. The following design conditions apply:

a. The gallery should be at right angles to the axis of the range, but where this is unattainable a deviation of up to 90 mils / 5 deg is permissible. It is desirable that the gallery and stop butts are parallel.

b. Protection is to be afforded to ensure the safety of the markers.

c. The height of the gallery roof is to be at least 1.8 m and should generally be not more than 1.95 m.

d. The markers must be able to see the strike of the bullets on the stop butt.

e. The bottom of the target, when raised, must be clearly seen from all firing points.

f. The roof of the gallery should slope approximately 1:12 (180 mils or 10 deg).

g. The preferred construction is a "half pit/half bank" as shown in Figure 3 -3.

Where the range is hollow (concave) or uphill, it may be necessary to construct a "full pit" gallery below ground level. In such cases, drainage may be a problem.

"No Mantlet" Galleries

A disadvantage of building a "full pit" gallery below ground level is that a greater number of low shots ricochet off the ground, whereas with a built up gallery they are absorbed by the mantlet. A method of reducing the number of ricochets is to cut out the ground between the gallery and the 100m firing point, using the earth to:

a. provide a small bank forward of the gallery as a mini mantlet;

b. improve the ground line and line of sight from the 100m firing point; or

c. provide topsoil to forma stop butt or build up the more distant firing points.

Where a full stop butt has been constructed, together with a small mantlet, the use of the classification range RDA trace may be permitted provided the range area is free from hard ricochet inducing surfaces and the area between the targets and firing point is not of hard, compacted material. Light topsoil, silts and sands free from stones should be placed in this area.

Where the full stop butt is not provided, or when the ground condition is unsuitable to permit the use of the classification range RDA, the field-firing template is to be applied.

The length of the gallery is governed primarily by the spacing between the target frames and the number of frames to be used. This spacing should be not less than 4 m between target frame centres. Even if firing only takes place over short distances of 300 m or less, this spacing should be maintained since any reduction of this dimension will cause congestion in the gallery and prejudice the efficient conduct of range practices. Some older ranges may be established with target centres 3.05 m (10 feet) for distances back to 700 yds and 3.7 m (12 feet) for ranges with longer distances.

A target store or workshop or both may be constructed at one end of the gallery and toilets at the other. The total length of gallery will therefore depend on these factors.

Overhead cover for the markers is to project at least 1.05 m, measured from the inside of the gallery wall, and must extend the whole length of the gallery. This cover, of 75 mm thick reinforced concrete, must slope at 1:12 (180 mils/10 deg) downwards towards the target frames, and should, where possible, be covered by at least 150 mm of earth and suitably supported along its length.

The material of which the retaining wall and gallery are constructed depends on the degree of permanency of the range. Preferably they should be built of concrete or brick or both. Some older ranges are constructed using timber or concrete slab retaining walls. Timber walls could be used to construct expedient ranges in times of expansion.

Any timber material used must be treated against white ants etc. Weep holes for drainage of water should be provide through the structure at low level.

The target trench may be drained by inserting clinker drainage beds between the concrete target foundations.

A small seat for each marker should be fixed to the gallery wall opposite the centre of each target. A chalkboard should be affixed to the gallery wall at each target position.

A shelf or recess in the gallery wall should be provided for a telephone or radio. In large galleries it will often be necessary to provide additional telephone connections; these should be spaced proportionately along the gallery. Consideration should be given to the installation of a public address system on large ranges.

A permanent pole, of non-ricochet inducing material e.g. wood or plastic, and guide is to be installed at one end of the gallery to mount the markers flag while firing is in progress without exposing the person raising the flag.

Target Mechanisms

The target mechanisms installed on recently constructed Classification Ranges in a cantilever style, sometimes referred to as the 'Neilsen Mechanism'. The most common target mechanism installed on older ranges is the 'Hythe' pattern.

The following should be noted when erecting target mechanisms:

a. They should be set in a straight line, and should be mounted at no less than 4 m centre to centre of frame.

b. The exact level at which the targets are to be set to ensure that no part of the target mechanism projects above the mantlet and that they are not struck by a projectile travelling on its downward trajectory from the maximum range.

c. The distance from the edge of the gallery roof to the centre of each target frame is to be 1.05 m.

d. The frame should then be placed perfectly plumb and square in relation to the gallery and mantlet.

For 'Hythe' pattern mechanisms:

a. The concrete bases on which the turned ends of the main uprights are to be placed should be 0.3 m wide.

b. To prevent the target carriages from being damaged on the concrete floor, a 100mm by 75mm softwood timber buffer should be provided 13 mm above the floor.

Target Store and Workshop

The best position for the target store and workshop is at one end of the marker's gallery.

On ranges with up to 10 targets it will be found that a combined target store and workshop will be adequate. In the case of larger ranges it is advisable to have a larger building divided into two parts, with the target store sited nearer the gallery.

It is important that the target store and workshop be provided with adequate forward and overhead protection.

The workshop should be equipped with a large flat-topped target table, a carpenter's bench, cupboards, and adequate heating and lighting facilities. A water supply is desirable.

Where it is necessary to locate the work shop away from the gallery and in a place where it cannot be adequately protected, it must be sited outside the danger area.

Stop Butts

A stop butt is an artificial bank constructed with soil or other small grained material, free from stones and other hard elements, sited within prescribed distances behind the target line. The primary purpose for the construction of a stop butt is to reduce pollution to a minimum by containing the lead of spent projectiles in specific areas for ease of collection and removal, and environmental control.

Various types of stop butts include:

a. earth mound,

b. earth mound with wall,

c. tandem, and

c. terraced hill.

The most common stop butt, and the most likely to be constructed on modern ranges is the earth mound. The specifications are discussed in the following paragraphs.

Height of Stop Butts. The minimum acceptable height is defined as a visible projection above the mantlet crest of 3.05 m as viewed from the prone position on the 100 m / yard firing point. This view produces constant angles of 32 mils / 2 degrees at 100 m. These angles do not relate to the

horizontal, but to a line drawn between the mantlet crest and the viewer on the firing point, each usually at different levels. The total height of the stop butt cannot be deduced from this angle alone, but will depend upon the ground level differences between the 100m firing point and the selected site for the stop butt.

The greater the distance between the target line and the centre line of the stop butt, the greater the overall height of stop butt is required. A simple method of assessment to determine whether the stop butt is an adequate height is to provide a post, fitted with a cross bar at right angles, in the form of a 'T' with an overall height of 3.05 m. The pole is placed upright at any point on the leading edge of the mantlet. When viewed from a prone position from 100 m / yards forward of the targets, the crest of the stop butt should never appear lower than the top level of the 'T' post. The whole length of the stop butt must conform to this minimum crest height.

Length of Stop Butts. The overall length along the crest should be ascertained by describing lines at 60 mils (4 deg) outwards from flank lines of sight using the flank positions at 100m / yards as centre points. The points where these lines bisect the stop butt line, indicate the required length of stop butt. The overall length may also be assessed by taking the whole distance between centre points of both flank targets and adding 14 m. The system is valid where the distance between the target line and the base of the stop butt does not exceed 30 m. As an example, in the case of a 10 target Classification Range, ideally situated with a stop butt 30m behind the target line, and where lane widths are 4 metres, the crest length is assessed as follows:

10 lanes with 9 separations of 4 m = 36 m plus flank widths of 7 m per side = 14 m

Crest length = 50 m.

Where the distance between the target line and the base of the stop butt exceeds 30 m, the overall crest length must be increased by 0.6 m for every additional 5 m. The length at the base of the stop butt depends on the overall height and the degree of end slope.

The stop butt is to be sited so that it is bisected by, and lies square to, the range axis.

Thickness of Stop Butts. The crest of the stop butt should be level and not less than 1.5 m thick. The thickness of the base will vary, depending on the slope and height of the stop butt. It is advantageous if the crest of the stop butt is wide enough to allow vehicles used for maintenance (e.g. backhoe) to drive onto the crest with safety. This will enable maintenance to be conducted with relative ease.

While the face of the stop butt need not be steeper than the natural angle of repose of the material of which it is composed, an attempt should be made to preserve as steep a slope as possible, thus reducing the like lihood of ricochets. Where possible, slopes of 1:1 (800 mils / 45deg) or better should be provided. Slopes of less than2:3 (600 mils / 35 deg) are not acceptable. Layers of fascines placed at right angles to the slope, will assist in its preservation. Plastic geo textiles used for erosion control, especially those that form a series of pockets when laid, may be placed on the stop butt to retain the sand face. The slope at which the ends and rear of the stop butt may be at the normal angle of repose of the material of which the stop butt is composed.

Position of Stop Butt in Relation to Targets. The distance between the foot of the stop butt and the targets is tobe no less than 5 m, and this minimum distance is only permissible when the stop butt is constructed of sand or soft earth which can be guaranteed to be completely free from stones and any other material that may permit backsplash and potential injuries to markers. Generally, the distance from the foot of the stop butt to the target line is to be no less than 25 m.

Where possible, the stop butt should be constructed 25 to 30 m from the target line.

This will enable the intervening space to be adapted for use as a 25m range. When the area is so adapted, it is advantageous to construct a target trench along the foot of the butt.

Sand Boxes or Bullet Catchers. When the stop butt is unavoidably constructed of shingle or any other hard material or where it is not possible to guarantee that the fill material is free form stones, sand boxes or bullet catchers must be provided to prevent backsplash and to aid marking. The effective height and width of the sand boxes is to be such that where a 1.8 m (6 ft) large square target is installed, at least a clear 0.3 m of sand would be visible to the firer all round it. The material in the bullet catcher is best composed of an equal mixture of washed coarse river or pit sand and sawdust, and should be not less than 900 mm thick at any point. Beach sand is not to be used as the fine sand grains compact and are likely to cause ricochets. The use of plastic geo textile that is designed for soil retention may be added to the bullet catcher to assist in retaining the sand.

A natural stop butt may be provided by a steep hill immediately behind the targets.

However as the hill should rise very steeply immediately behind the targets, it will usually be necessary to cut into the face of the hill and place bullet catching sand or other material in the bullet strike area, until it conforms to the conditions required for an artificial stop butt.

Use of Tyres. On some classification ranges, in particular those used by rifle clubs, it has become common practice to use tyres in the bullet strike area of the stop butt. Tyres can cause backsplash ricochets into the marker's gallery, either by projectiles bouncing back from the tyre directly or from pieces of steel belt being broken off when a projectile hits the tyre and deflects into the gallery as a secondary missile. Tyres do not allow sand to fall into tunnels created by concentrated bullet strike and the presence often hides the true condition of the stop butt. For these reasons, tyres are not to be used in the bullet strike area, or the face of the stop butt.

Use of Hay or Straw Bales. On some ranges, hay or straw bales have been placed on stop butts and terraced. These bales hide the condition of the stop butt, and do not prevent backsplash. For these reasons, hay or straw bales are not to be used on stop butts.

Flagpole

A flagpole 6 to 9 m high, of non-ricochet inducing material, is to be provided on the stop butt for the red flag or warning lamp (for night firing).

Target Numbers

Targets are to be numbered by either erecting target numbers along the crest of the stop butt or mounting them on the forward face of the mantlet. It may sometimes be found that those placed on

the crest of the stop butt provide temptation to firers to use them as targets. In such cases long range shots will occur for which the RDA does not cater.

Such shots can range as far as 4000 m. Where no stop butt is constructed, the target numbers should be installed on the forward slope of the mantlet.

Target numbers are to be constructed of penetrable material, usually wood, plastic or aluminium. The numbers should be well coated with paint or preservative to minimise deterioration due to weathering. The overall height of these numbers should be one metre for use on ranges with firing points up to 600m from the target line. For longer ranges 1:4 metres is recommended. The width should be proportioned to the required height.

Stepped Mantlets and Stop Butts

Where cross fall occurs on a selected site, stepped mantlets and stop butts may be constructed, provided that all other design criteria are met.

Communications

Classification ranges may be equipped with a telephone system but it is now common practice to use hand held radios. If telephones are installed, underground cable or overhead line may be used. It is advantageous to have the telephone or radio connected to a loudspeaker system.

On ranges up to ten targets, one circuit from the centre of the firing point to the centre of the gallery will normally suffice. However on larger ranges additional circuits should be provided, on a scale of one circuit to every 10targets, the cable being laid centrally between each group of 10 targets and their corresponding positions on the firing point. For example, on a 20-target range, two cables should be laid down the range, opposite number 5 and 15 firing positions and targets. When the overhead line system is used, the poles should run down one side of the range, well clear of the firing point (for larger ranges) to each group of 10 firing positions. It is essential that, whichever system is used, that each circuit can be used independently.

The telephone circuits should in all cases consist of approved and suitable cable, which should be buried to a depth of not less than 0.5 m. Where surface cable markers are used, they must be mounted flush or defended from fire to their rear and must not constitute a ricochet hazard.

The connections at the gallery and at each firing point are to be approved external weatherproof fittings. The cable should run directly between sockets, without joints.

The firing point terminals are to be housed in strong weatherproof boxes of wood, metal or concrete, with the opening facing towards the targets. The boxes should be sunk into the ground so that their lids are flush with or slightly below ground level.

Maintenance

The design and construction of this type of range creates prepared ground conditions up to the target line that reduces the ricochet hazard to a minimum. For this reason the total danger area is smaller than that required for free firing over open ground. It is therefore essential that classification ranges are regularly and thoroughly maintained.

Deterioration of the firing points, mantlet and stop butt including a build up of lead, will increase the chance of ricochet and in extreme cases may result in the closure of the range or restrictions in its use.

Due to the high maintenance effort and costs for this type of range, it is strongly recommended that regular maintenance days be set aside to permit remedial work to minor damage before it deteriorates further.

Design Modifications

The Firearms Registry has the discretion to consider the application of alternative templates in exceptional circumstances. Such consideration will only be applied to existing ranges that were builtusing design criteria that were acceptable at the time of construction.

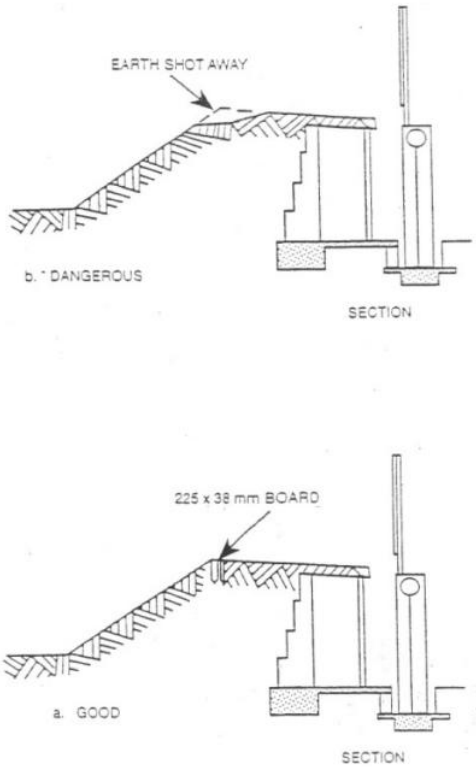

Figure 3.3 Mantlet / Gallery Configuration