

**Target Shooting New Zealand**

# **Target Shooting Range Manual**

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# TSNZ Target Shooting Range Manual

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## Introduction

Smallbore Target Shooting in New Zealand has a history extending back to the turn of the 20th century. The pursuit was generally followed by people who wanted to practise target shooting locally without the need to wait for fine weather. Local community halls and purpose built indoor ranges were put into use and the practice quickly turned into a recreational sport.

Later, with the sport becoming an Olympic and Commonwealth Games events, 10m air rifle and 50m smallbore rifle ranges were constructed.

There is a need to develop a document outlining the safe utilisation of Smallbore Rifle Ranges. This comes about with Government Departments and Local Bodies demanding that pursuits such as target shooting are carried out safely and without annoyance to the general public.

TSNZ's number one priority in this Manual is to ensure that Smallbore Rifle Shooting continues to be a safe Recreational Sport. It endeavours to provide Smallbore Target Shooting Clubs with information so they may upgrade existing ranges to acceptable safety standards and to provide a resource for planners of Smallbore Rifle Ranges in the future.

It does not propose to be a Gospel for Shooting Ranges - especially in the detail. There will always be the opportunity for the use of any other form of procedure, protection, device or material not specifically mentioned in the technical details of this manual to be used in the construction of ranges. The only criteria required is that any procedure, device, design or technical change must be documented and demonstrated that it fulfils its design function to the satisfaction of TSNZ .

- Standards

There is a general lack of information and standards on the construction of Shooting Ranges. Most of the information available has been written by the military.

The NSRA of Gt. Britain and their ranges have been influenced by the UK Ministry of Defence "**RANGE CONSTRUCTION AND REGULATIONS (ALL ARMS)**"[PAM22]. PAM 22 has now been superseded by JSP403. NZ Defence has agreed to allow access to JSP403 for a period to enable civilian shooting organisations to utilise the standards and procedures. This has enable NZ shooting organisations to rewrite their manuals to a more up to date standard.

The National Rifle Association of America has published "**THE RANGE MANUAL**". Both outline the planning, design criteria and acceptable practice for a variety of

ranges. TSNZ has copies of all documents. Further sources are continually being assessed and any relevant and potentially useful information that is backed up by reference to accepted international publications will be incorporated in this manual as supplements.

These references have been used in the past as defacto standards within New Zealand Shooting Organisations. The organisation involved has usually decided which document would be the more useful. The military have mainly utilised PAM22 and JSP403 and civilian groups the NRA document.

It is of the opinion that any of these documents alone are insufficient to use as a total reference when implementing changes to existing ranges or the design of new ones. Therefore this manual has extracted sections, drawings, construction and design criteria from both that are relevant to Rimfire and Air Rifle Shooting.

The landmark event of the closure by the military of the Trentham Shooting Ranges to all shooting has been a major reason why this document has not been published earlier. As of September 2002, some ranges at Trentham are still closed. The range relevant to TSNZ, Allen Range, is open to all forms of smallbore rifle shooting.

Some aspects of the application of JSP403 have been used to certify Allen Range for civilian target shooting that appear to contradict accepted practice as outlined in PAM22 or JSP403 in applying military shooting standards to civilian usage of ranges.

This is totally due to the military accepting the fact civilian target shooting is significantly more accurate than normal military shooting training activities.

The outcome is significant for 50m outdoor ranges where the calculated Cone of Fire (COF) for smallbore rifle has enabled a considerable reduction in the footprint for a 50m range.

In all other cases, eg Indoor 20 and 25yd ranges, more conservative recommendations will generally be the criteria adopted. These types of ranges are the learning venues for practically all smallbore shooters. The provision of enhanced safety is required because of the higher rate of "random shots".

This sign indicates a paragraph containing important criteria, instructions or recommendations TSNZ deem all Ranges shall comply with.

The reasoning behind any of the requirements is to ensure shooting is carried out safely. A proportion of the safe operation is related to the **physical range construction**, a proportion is related to **range use procedures** and the rest is related to **common sense**.

- **What this Manual is about**

This Manual is designed to provide technical guidance along with typical examples of physical layout and equipment used on Rimfire and Air Rifle Ranges.

It is specifically related to smallbore (0.22in or 5.60mm calibre), subsonic, soft lead projectiles fired from a single shot target rifle and 0.177in or 4.5mm pellets fired from a single shot air rifle. To ensure clarification throughout this manual, from here on in, **smallbore ammunition** as described above, shall be referred to as “**RIMFIRE**” unless otherwise stated. Air Rifle projectiles will be referred to as “**PELLETS**”

The general specifications of Indoor and Outdoor Rimfire Rifle Ranges will be dealt with separately. Content will overlap and all endeavours will be made to ensure any differences are obvious.



## **Seven Basic Rules for Firearm Safety**

- 1. Treat every firearm as loaded**
- 2. Always point firearms in a safe direction**
- 3. Load a firearm only when ready to fire**
- 4. Identify your target**
- 5. Check your firing zone**
- 6. Store firearms and ammunition safely**
- 7. Avoid alcohol or drugs when handling firearms**

**New Zealand Arms Code**

## • Safety is Paramount

All shooters in TSNZ affiliated ranges shall:

Be familiar with the Range Operation Manual  
Be familiar with the safe use of firearms  
Use all firearms under the controlling instructions of the Range Officer.

Obey the designated Range Officer who shall have absolute control of the rifle range while shooting is in progress. Shooters shall obey ALL their instructions.

Treat firearms AT ALL TIMES as loaded. This means when handling any firearm, check the action is open and the breech is clear of ammunition.

Ensure that visitors to TSNZ affiliated ranges shall be accompanied by a person competent in the safe handling of firearms and who is fully conversant with the Range Operation Manual. This person shall ensure that a valid firearms license holder is present whenever a visitor is handling a firearm and that before the visitor handles a firearm they are informed of all safety procedures pertaining to the Rifle Range and the safe operation of firearms.

Ensure that AT ALL TIMES the Rifle Range shall be operated in a manner that ensures the safety of all shooters and the general public.

### ***Firing Range Safety Implies:***

- the proper use of a range as it relates to its physical design;
- a continuous and ongoing training programme for users, instructors and supervisors;
- regulations on the safe use of the range coupled with enforcement of these regulations are followed.

## Range Construction

All Rimfire and Air Rifle Ranges shall be constructed to ensure projectiles fired from the firing point towards the range targets are confined within the immediate range area and their remains do not pose a hazard to safety and health.

**Indoor:** This means within the building

**Outdoor:** This means within the area defined by the appropriate range design.

The physical range construction is designed to prevent the remains of bullets, - whether they be whole or in part, from exiting the building or range environs, or returning to the shooter as dangerous projectiles.

The construction will be designed to capture the bullet or to deflect the bullet so that it may be captured and to enable ricochet - if and when it occurs - to occur safely.

### • No Danger Area Ranges

In general a “**No Danger Area**” range is created by the introduction of a stop butt or wall, either of natural or artificial composition, used in conjunction with a severely restricted arc of fire.

A range that does not conform to the “No Danger Area” criteria must therefore be tested as a “**Full Danger Area**” range using the “**Safety Template**” applicable to the firearm and ammunition that will be used on the particular range.

All 20 and 25yd Indoor, and 50m Outdoor Ranges on which TSNZ affiliated Clubs and/or Associations hold TSNZ sanctioned events shall conform to the “No Danger Area” range criteria.

## Danger Zone Definitions

There are three main Danger Areas within a range that require protection from direct and indirect bullet strikes.

### **Defence Zone**

Areas subject to occasional impact that will usually strike at shallow angles. Side walls, roofs, floor.

**Backplate area**

Areas subject to more than occasional direct strikes

**Bullet catcher**

Areas subject to intense and continual strikes. Immediately behind the targets - and including the warmer or fouling shot area!

**Indoor Ranges**

The criteria are based on the angles and distances as outlined in Table , Appendix 1 and the minimum construction details outlined in “Danger Area Protection”.

The range shall be constructed or modified such that it is able to meet or exceed the criteria.

**Table 1 - Indoor Range Defence Zones**

Defence Zone	Description	20yd	25yd
Vertical	Limit of <b>Defence Zone</b> over LOS to highest target centre	7°	7°
Horizontal	Limit of <b>Defence Zone</b> from flank LOS	4°	4°
<b>Backplate</b>			
Vertical	<b>Backplate</b> height over highest LOS	750mm over LOS	770mm over LOS
Horizontal	<b>Backplate</b> width beyond flank LOS	450mm per flank	470mm per flank
<b>Bullet Catcher</b>			
Vertical	<b>Bullet Catcher</b> height over highest LOS	180mm over/under LOS	200mm over/under LOS
Horizontal	<b>Bullet Catcher</b> width beyond flank LOS	180mm per flank	200mm per flank

(Measurements rounded up to nearest 5mm)

**Note:**

1. The LOS (Line of Sight) is defined as the line from the rifle barrel ( measured from 300mm directly above the firing line )to the target. These design heights and widths are at the **target line**. Backplates and bullet catchers can be at differing distances behind the target. To cater for this, the height and width of the bullet catcher and backplate shall increase at a rate of 30 mm per metre behind the



Statistically this implies that approximately 1 in 1 million shots is expected to hit outside a radius of 60mm centred on the middle of the target for a shot aimed at the target.

Of course it is known that shots occur outside this circle on more frequent occasions. Therefore there is a requirement to estimate where these shots are likely to appear. This can include the following: those shots that are deliberately aimed at the wrong target, these usually occur within 2 targets of the intended target; Accidentally discharged shots occurring when the bolt is closed and a shot goes off; A shot inadvertently let off in the process of aligning the rifle on the target.

#### Extended COF for Smallbore Rifle Target Shooting

Raw COF	=	0.06m
Azimuth COF (2 targets)	=	2.5m
Estimate of "loose shots"	=	0.5m

Therefore the total COF is = 0.5m vertically (elevation)  
2.5m sideways (azimuth)

The sideways COF is defined as a shot being fired from 2 firing points from the end and hitting the end targets. This will define the width of the bullet catcher required.

A similar procedure to the Indoor Range is used to ascertain whether a range meets the "No Danger Area" criteria for Outdoor Ranges.

A set of Safety Angles, Stop Butt and Bullet Catcher Wall widths and heights are set out in Table 2 and Appendix 2. The only difference is that the measurements are scaled up to the required ranges, which in Smallbore Rifle shooting is usually 50m.

The criteria for a "No Danger Area" range includes a "**severely restricted arc of fire**" and by insisting that the firearm is cocked at the shoulder, the design of this type of range fulfils the criteria adequately.

A Range to qualify as a No Danger Area Range shall be constructed or modified such that it is able to meet or exceed the criteria.

**Table 2 - Outdoor Range Defence Zones**

<b>Stop Butt</b>	<b>Description</b>	<b>50m</b>	<b>100m</b>
Vertical (C in Appendix 2)	<b>Stop Butt</b> crest over LOS	3500mm over LOS	4500mm over LOS
Horizontal (XY in Appendix 2)	<b>Stop Butt</b> flank width	2500mm per flank	4000mm per flank
<b>Bullet Catcher</b>			
Vertical	<b>Bullet Catcher</b> height over highest LOS	850mm over LOS	1000mm over LOS
Horizontal	<b>Bullet Catcher</b> width beyond flank LOS	600mm per flank	750mm per Flank
<b>Crest</b>	Thickness at top of stop butt	600mm	600mm

[ Extracted from JSP403 & PAM22 Annex P] (Measurements rounded up to nearest 5mm)

**Note:**

1. The LOS (Line of Sight) is defined as the line from the rifle barrel ( measured 300mm immediately above the firing line ) to the target.
2. These design heights and widths are at the **target line**. Stop Butts and Bullet Catchers can be at differing distances behind the target. To cater for this the height and width of the Stop Butt and Bullet Catcher shall increase at a rate of 20mm per metre behind the target. ie If a Bullet Catcher is 3m behind the target line, the dimensions of the Bullet Catcher will increase by 60mm in height and 120mm in width.
3. The top of the Bullet Catcher and Stop Butt may be further back than the bottom of the Bullet Catcher and Stop Butt. This must be taken into account. ie The top of the stop butt crest will be wider by the proportioned amount.
4. Given that the target is in the same position for all 3 positions in 3P shooting, The prone position is the 'worst case' for calculating the stop butt height. When kneeling and standing the LOS is depressed relative to the prone position.
5. The same rules for multiple targets as indoor apply for outdoor ranges. ie the top row counters and the furthestmost counters are taken into account for calculating LOS.

**Note**

Table 2 above is based on the premise that “normal military training” is being carried out on this type of range.

An important qualification that was introduced for the Allen Range, Trentham was the range operational procedure that smallbore shooters must be trained on a 25 yd Indoor range before shooting on the Allen Range. This was to show the shooter was demonstrably able to shoot within the COF applied to the Allen Range for smallbore rifle shooting.

This procedure enabled a substantially reduced bullet catcher / stop butt height. This was reduced to 1.5m above the target height (measured at the target line).

The possibility to use such a reduced COF is contingent on the above restriction on the use of the range by “experienced shooters”.

The existence of an extensive stop butt behind the range had a substantial effect on the acceptance of this procedure and construction. The case was made that the existing bullet catcher required for pistol shooting was more than sufficient to enhance the NDA range criteria for smallbore rifle shooting.

Criteria as outlined in Table 1 shall be used for initial planning and design of 50m smallbore rifle ranges for shooting by TSNZ affiliates.



- Danger Area Protection - Indoor

The protection requirements for the three zones are as follows:

### Defence Zone

Since this area will generally be subject to occasional impact, the requirement is to contain bullets that glance the walls, floor and ceiling at shallow angles. The provision of vertical baffles along the wall if there is sufficient space and their incorporation in the ceiling may be advantageous in allowing a minimum of material to be used. (See Baffles below)

#### Acceptable surfaces for the Defence Zone:

- Smooth concrete floor
- Soft earth floor
- Concrete block walls, smooth finish with smooth pointed joints.
- 3mm sheet steel supported on the walls and ceiling overlapped with the join towards the target.
- Adequate thickness of overlapping timbers.
  - 30mm Hardwood } extremely variable depending on
  - 40mm Softwood } type and quality of timber
- Any other method ***demonstrated and documented*** to be equally as effective

### Pillars

Concrete or steel pillar supports that project into the range along the walls or down the middle of the range, must have their facing sides ( sides nearest shooter) protected with soft timber. This prevents backslash and the 'reflection' of shots back to the shooter.

Suitable cover is 50mm soft wood attached firmly to the pillar.

See Appendix 3 and 7 for further detailed examples.

### Backplate

This area is subjected to more than random shots and will usually be hit with a direct shot at steep angles. Since there is not sustained damage in a concentrated area, the surface need only stop no more than 2 or 3 bullets in any one spot.

**Acceptable surfaces for the Backplate:**

- Smooth Concrete blocks covered with 25mm of softwood
- 4mm sheet steel covered with 25mm of softwood
- Any other method **demonstrated and documented** to be equally as effective

See Appendix for detail

**Bullet Catcher**

This area will be subjected to sustained impact in a concentrated area. It requires special construction to ensure the capture of the bullet.

A number of devices have been developed that are suitable for this requirement.

- Sand supported by timber boxing
- Sheet steel deflectors
- Wooden blocks
- Bullet traps that contain the bullet and fragments within itself
- Proprietary supplied bullet catchers

See Appendix 5 and 7 for details of a number of examples.

**Points to note:**

This area of the range is the greatest generator of lead dust. The smashing of the bullet into and through bullet catching material scrapes off significant quantities of lead particles. The best types of bullet catchers are those that are easily maintained and require the minimum of protective equipment to clean. ie, produce a minimum of lead dust.

The cleaning and maintaining of bullet catchers and the rifle range in general is outlined in Lead - Recommended Cleanup Procedures on Page 30.

**Ceiling Protection**

The case of ceiling protection can be approached in a variety of ways. The priority is to prevent direct shots and ricochets from exiting the range. The ceiling invariably is the 'weakest wall' of a range. Ranges that are built beneath buildings have a requirement to prevent shots going through the floor into the spaces above. Corrugated iron sheet by itself is **not** adequate.

The methods outlined in the Danger Zone requirements are effective but sometimes space requirements and cost may mean that other methods are more useful. So much depends on the layout of the range but the function of the installed protection shall remain.

Ranges with a reasonably high ceiling and width will almost certainly have rafters and / or trusses supporting the roof. These vertical sections can be utilised to support bullet catching material that will prevent the direct shot from exiting the range. Remember that in this case the vertical truss is no longer taking glancing hits, it will therefore require more protection than the Danger Zone criteria. These vertical trusses are effectively baffles. The layout, use and design of baffles is outlined later.

Ranges built beneath buildings can utilise the floor joists (if they are running at right angles to the LOS) as bullet stoppers, or joists can be used to support protected sheet steel as per the Danger Zone criteria above.

Remember that the addition of steel and other heavy material to the underside of floors, ceilings etc. may require engineering calculations due to the extra load on these structures. Check local Building Regulations before construction!

## **Baffles**

Baffles may be placed in the ceiling or along the walls enabling smaller and possibly cheaper alternatives to protecting the full Danger Zone of the range.

The placement of the baffles is a matter of geometry. The basic idea is to place vertical or horizontal panels such that no direct paths are created for a direct shot to exit the range. They must be constructed such that the direct shot is stopped and ricochet and backslash is eliminated.

If there is space to the side of the range and sufficient height then there may be a case for the installation of baffles instead of a full wall lining for the length of the safety zone. Remember that joists of a floor if they are running at right angles in effect are baffles. Generally if the walls are close to the LOS then a sheet type of protection on the wall is the most feasible. Baffles should also be used to protect light fittings along the range.

It is important to note that if there is a chance of ricochet from within the range such that a ricochet bullet is likely to hit the ceiling between the baffles, then it is necessary to ensure that the ceiling itself can stop the ricochet. The bullet loses significant energy after a ricochet and therefore the ceiling may only require a minimum of protection. A lining of 12mm particle board, 10mm ply, or equivalent would be appropriate.

See Appendix 3 and 7 for construction and placement detailed examples.

- Outdoor Ranges

## Application of Field Firing Area Templates

A Field Firing (FFA) template is used when the criteria for a 'No Danger Area' range is unable to be fulfilled on an outdoor range. It outlines the area that a bullet may be expected to pose a danger if shooting is carried out within the confines of a range and directed towards defined targets. In TSNZ's case this usually means a 50m range firing towards targets where bullet catchers may or may not be being used.

The COF for smallbore will almost certainly mean that the bullet impact area *behind* the target is the important area to concentrate on.

All new ranges must fulfil the requirements of either a 'No Danger Area' Range or satisfy the requirements of the application a FFA template.

All existing ranges that do not comply with the 'No Danger Area' criteria will have the FFA template applied.

Fig 1 page 17 indicates the shape and dimensions of a FFA.

Point FP is the firing point. The distance that the FFA extends will be 1200m from point FP. The width of the FFA is related to the type of area that is between the shooter and the targets. 150m is applicable with soft or ground targets. 300m is applicable for hard or rocky targets. That is, if there is soil and grass up to the targets then it is soft, If there is a considerable number of rocks or hard areas up to the targets then it is hard.

The FFA is transferred to a clear plastic overlay and manufactured to the same scale as the map that it is to be laid over. Small holes drilled accurately at the corner points make transferring the FFA to the map easier. A sharp compass needle works well.

It is necessary to take into account the width of the firing point. This means that the extreme firing points are used to find the total area that the FFA will apply to.

### How to apply the FFA template

1. Obtain a map of suitable scale. At least 1:50,000. Larger scales of 1:20,000 or 1:10,000 would be better. It is imperative that it be based on a surveyed base grid. DOSLI sourced maps comply with this requirement. It must have a geodetic scale over the map.
2. Identify the position of the range, firing line, target direction and target line. This should be done with a compass to get the proper directional alignment. Taking

into account the Magnetic Declination, convert the directions from Magnetic to True.

3. Measure the length of the firing line with an accurate tape measure.
4. Identify one end of the firing line and transfer the length and direction of the firing line to the map.
5. Construct lines from the ends of the firing line towards the targets. This is assumed to be at right angle to the firing line.
6. Place point FP over one end of the firing line, align the centre line of the FFA over the target direction line and carefully mark all corners of the FFA onto the map.
7. Repeat this with the other end of the firing line.
8. There will now be two FFA's overlaid onto the map. The complete area that both FFA's cover is the area that needs to be taken into account when defining the safety zone.
9. Identify any features where people, animals and building may be within the safety zone.
10. If there are any features that relate to this within the Safety Zone then measures must be taken to eliminate and / or minimise the problem.

Fig 2 shows an example of a FFA overlaid onto a map.

TSNZ requires that any range where a FFA template is applied must have a Safety Zone that is completely free from inhabited areas. This includes houses, roads, walkways, that are legitimately accessible to the general public at any time.

If there is any human habitation at all within the Safety Zone then shooting is prohibited. The Range must be closed forthwith.

Permission must be obtained from land users when shooting is to be undertaken and measures put in place to ensure people and stock remain outside the Safety Zone for the duration. This may require flags and notices which indicate when shooting is taking place.

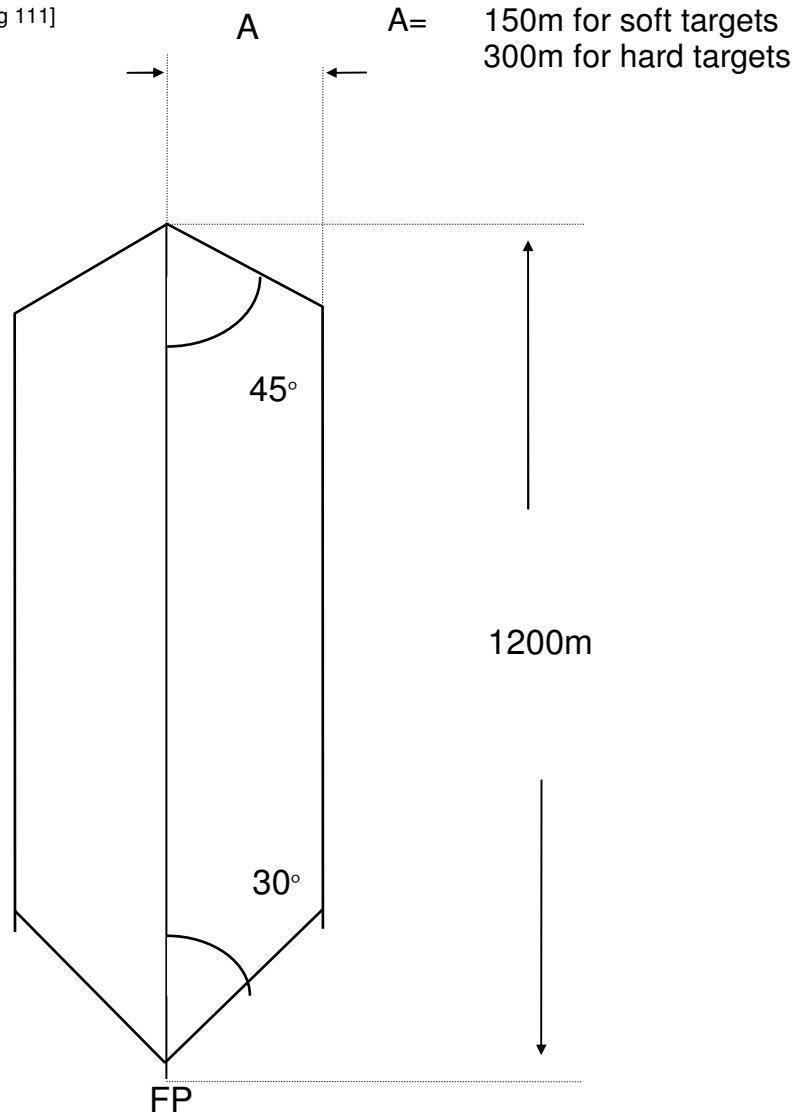
Farmland areas must have the permission of the Land User to be used as a Safety Zone. It is imperative that communication between the Range Users and the Land Users be initiated detailing when shooting is to take place.

**Figure 1**

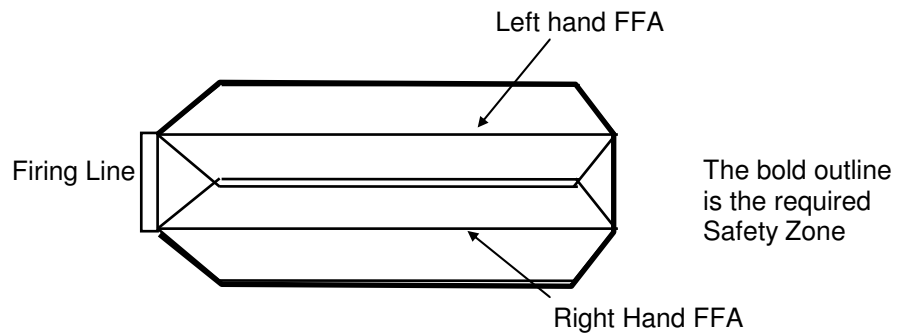
**Full Field Firing Template**

Rimfire subsonic e.g. "Eley Tenex 0.22 calibre

[Extracted from PAM 22 Fig 111]



**Figure 2  
Applying FFA to  
Range**



## Ricochet

It is useful to discuss ricochet and when it is likely to occur. The stop butt criteria imply that the surface of the stop butt is a “penetrable” target. A bullet will rarely ricochet when the impact angle is greater than  $30^\circ$  from the surface of a penetrable surface. It is obvious then that since the stop butt angle must be greater than  $56^\circ 20'$ , a direct hit will strike at an angle greater than  $30^\circ$  over the whole of the Stop Butt. That is, it will rarely induce a ricochet. A direct shot in practically all cases is absorbed by a conforming stop butt. If the angle of the stop butt is less than  $56^\circ 20'$  then it is possible that a direct hit will hit at an angle less than  $30^\circ$  thus increasing the danger of ricochet. A further case for a conforming Stop Butt is to ensure that ricochet occurring from the ground between the shooter and target will have a good chance of being caught by the Stop Butt.

## Stop Butt

The adequacy of a Stop Butt has been fraught with one big problem. The problem has always been the interpretation of the requirements. The two types, natural and artificial are subject to stringent criteria. To understand the reasons for adequate Stop Butts it is necessary to understand the ricochet danger. See this page for a short resume of ricochet.

### Natural Stop Butts

Usually consist of natural hills, quarries, sandpits, old mines etc. But rarely is a natural hill adequate for the purpose.

The natural stop butt must conform to the following:

1. Must be the highest available bank face
2. A downrange area, beyond the bank face, comparatively free from habitation, roads, and pathways.
3. A forward area (this means between shooter and target) and bank as free as possible from hard, ricochet inducing surfaces consistent with 1 and 2 above
4. A bank slope not less than ( $56^\circ 20'$ ) or a slope of 3 in 2 (3 units up for 2 units along) from the horizontal (over the total mean height).

No. 4 is the hardest to acquire and harder to accept as necessary. It is steep! It comes down to the function of the stop butt, which is to stop a direct shot and a ricochet from any part of the ground between shooter and target.

## Artificial Stop Butt

Usually consists of earthworks specifically designed to conform to the stop butt criteria. Points to note here are the height and width of the stop butt and the thickness of the top of the butt.

For rimfire ammunition this minimum thickness of the crest is 600mm.

The minimum slope of a Stop Butt is 3 in 2. That is, for every 2 units horizontally the height increases by 3 units. This is equal to 56° 20'.

This angle is measured from the base of the slope to the furthest crest from the target line. See Fig Appendix

The Stop Butt shall consist of material that is penetrable. (ie Clay or material such that a bullet impacting the bank will be retained). Small sections near the top of the a stop butt made of clay or soil that do not meet the total requirements of the criteria may have walls built of wood for instance to cover those parts that do not conform.

## Bullet Catchers

A form of bullet catcher must be provided over the full width and height as defined in Table 2. It may consist of timber, dense rubber screens, sand or fine soil, free from hard lumps and stones. Alternatively proprietary steel bullet traps with baffles may be used provided all risk of splash back to shooters, arising from such devices, is eliminated.

In naturally occurring stop butt / walls, the bank itself may consist of sand or other light grained material, which is itself suitable as a bullet catcher. The angle from the horizontal of this sand bank type of bullet catcher shall be kept greater than 33° (A slope of 2 units up and 3 units along). However, due to de-leading, constant firing and weathering, the lower portions will eventually collapse and seek a natural angle of repose of less than 30° to the horizontal, thereby rendering the bank unsuitable.

Regular maintenance needs to be carried out to ensure the correct slope is maintained.

Ricochet will rarely occur with bullets hitting **soft sand** at angles greater than 30° from the horizontal. Note here the mention of **soft sand**. The criteria for the rest of the stop butt being a penetrable target implies that it may be clay or similar penetrable material.

The slope of the bullet catcher must be kept at an angle of greater than 33° or a slope of 2 in 3 (ie 2 units up for 3 units along the ground.) at all times. This ensures that the bullet will not tend to ricochet from the catcher.



It is advisable to build up a bullet catcher separate from the stop butt. This will keep the stop butt wall in one piece and will allow easier maintenance of the bullet catcher, for instance deleading the catcher. Removing spent bullets helps to eliminate the occurrence of 'pop-overs'. Pop-overs are when a live round hits a spent round and ejects that out of the bullet catcher. These have the potential to be propelled with reasonably dangerous velocities anywhere over the stop butt. Regular sieving of the bullet catcher keeps this to a minimum. Building up the front edge of the catcher will enable the thickness of the sand trap to be retained easier. The thickness of the bullet catcher must not be less than 600mm, measured horizontally, at any place within the bullet catcher measurement criteria.

Other bullet catchers consisting of timber walling of sufficient thickness to absorb all shot and eliminating backslash, or thinner timber that allows the shot to pass through into a protected clear space behind can be utilised. Both of these require regular turning and moving of the timbers to ensure that they are not "shot out" and lose their effectiveness.

It is recommended to install strakes indicating the required angles along the stop butt and bullet catches to enable easy indication of slope disintegration. This enables easier maintaining of the slopes as well. See Fig Appendix

## **The Firing Point to Target Area**

The area of ground between the firing point and the target should be clear of all ricochet inducing material. This includes rocks and stones to less than 10mm diameter. Sticks and hard clods of clay should also be removed. It should be of a "soft" target nature that will cause a minimum of ricochet of any shot accidentally fired into it. Top soil covered in mown grass is the ideal. But any soft shot absorbing material will suffice. Literature suggests that any ricochet from a shot hitting the ground (of soft soil) between shooter and target will tend to be deflected into the area of the stop butt.

For smallbore rifle shooting the ground will be outside of the COF. It is advised that the ground should still be cleared of material likely to induce ricochet.

## **Range Accessories and Equipment**

Any accessory and equipment that is used on the range must be of a material or protected material so that ricochet is prevented.

These must be constructed of material that will allow bullets to pass through relatively unimpeded and remain within the immediate range area. Or to catch a bullet and prevent ricochet.

### **Targets / Frames**

Targets, their frames and target numbers should be made from wood or wood product or some other material that is easily penetrable by rimfire bullets. The centre of the target should ideally be 750mm above the mean ground level provided the datum point, 750mm below the target, is on the same horizontal plane as the firing point. UIT specifications suggest that an allowance of  $\pm 500$ mm is allowed for the centre of the target from this 750mm height. That is, the target may be from 250mm to 1250mm above the horizontal plane from the firing point. (Maidstone Changers have been shown to catch direct shot or reduce their energy to a safe level).

## Flags

Flag sticks should be made from light wooden doweling or other material that will tend not to promote ricochet. The method of holding the flag to the stick needs to be of a light chain or thin gauge wire to ensure a small target is presented to a bullet. UIT specifications suggest the flag be made of cotton of a weight of 80gms/m<sup>2</sup> and be at least 300mm long and 50mm wide. There are no specifications as to how to hang it from the flag stick.

## Targets at Intermediate Distances

It may be necessary to position targets carefully when the minimum stop butt is being employed. The stop butt must be designed for the greatest range used. This is especially true if a 100m range is used. When targets are positioned at intermediate distances e.g. 50m, they must be aligned so that they are echeloned, or on the same LOS as the 100m targets. In other words a shooter in the firing position will see targets in the same relative position when the targets are positioned at the intermediate and far positions. This ensures that the maximum use is being made of the stop butt and that the range still conforms to a "No Danger Area" Range. See Fig for an example of echeloned targets.

Check the bullet flight line for standing shooting when the targets are positioned at intermediate distances. The bullet needs to impact a bullet catcher. The range floor is NOT a bullet catcher!.

## Firing Points

In the past, firing point space provided for each shooter has been a matter of squeezing in the greatest number of shooters as possible. This has meant that it has usually not provided a fair opportunity for all shooters to be offered the firing point of their choice or if drawn by lot, there has been a need to push left hand shooters to the end of the firing line.

ISSF specifications for target shooting stipulate a minimum distance between shooters and targets of 1.25m to a maximum of 1.6m. This allows for left and right hand shooters to fire on any firing point.

TSNZ recommends that 1.25m be the minimum spacing between targets and firing points for any new ranges - Indoor or Outdoor.

The firing point shall be flat for at least 2.5m from the firing line towards the rear of the firing point. It shall be constructed of hard material that will not shift or move from the influence of adjacent shooters or range personnel moving around behind the firing line. The provision of shooting tables from which to shoot may be an alternative to the floor of the firing point.

- **Range Access During Shooting**

It is necessary to ensure that access to the range in front of the firing points and within the range safety area is eliminated while shooting is in progress.

Target changing doors need to have some form of lock and emergency exit doors need to be only accessible from inside the range. Electric interlocks on target changing doors that operate with any 'red light' system may be utilised but must be regularly checked for correct operation.

It is important that any locking mechanism must be able to be overridden to ensure easy exit from the range in an emergency. Do not forget to ensure that the overriding instructions are well known – paradoxically even to those you are trying to keep out!

### **Temporary Ranges**

There will be occasions when shooting is carried out on temporary premises, e.g. Town halls, gymnasiums. In these cases it is imperative to ensure that all external doors and windows behind the target area, e.g. supper rooms, toilets, are locked and / or entry restricted while shooting is in progress.

Entry points on the outside walls of the building accessible to the general public that may enable them to enter the area in front of the firing line and within the safety areas must not be readily accessible from the outside.

- **Regular Checking of Range**

A range should be regularly checked against the "No Danger Area" range criteria. Any aspect that does not conform to the criteria shall be rectified immediately before shooting can recommence.

A list of critical aspects of the Range should be made and inserted in the Range Operation Manual. A check against this list should be undertaken at the end of the season and about midway through the season. This will ensure maintenance is done prior to the next season and the midway check ensures the range is maintaining it's integrity.

## Air Rifle Ranges

Air Rifle Ranges are a case where the usual protection required as for rimfire ammunition is not as stringent. Pellets have a relatively low energy and the range surrounds require significantly less protection.

Pellets propelled from an Air Rifle nevertheless can still be dangerous if a person is hit. The loss of an eye is extremely serious.

The same rules apply to Air Rifle shooting as rimfire shooting as regards the general operation of a range. Where Air Rifle Shooting differs is that sufficient protection is offered by general building materials and thus little special safety factors need to be built into any normal hall or room.

The major piece of protection required is a good pellet catcher. These usually come fitted to commercial target changing apparatus. Target changing equipment that is otherwise manufactured must have a pellet catcher. This needs to be 4mm steel set at an angle of at least 45° to the horizontal and 250mm square centred on the target position. A tray that catches and contains the pellet is advantageous.

Lead dust is generated and care needs to be exercised when cleaning the range.

Read **Lead** on Page 35.

## First Aid

For Health and Safety, organisations that partake in **potentially** dangerous activities should ensure that there are persons present **while the activity is in progress** who have possession of current First Aid qualifications.

### Minimum Requirements for Range Shooting

The minimum First Aid requirements for acceptable Range Operation are:

A complete and current First Aid Kit within the range building or the immediate environs.

A readily accessible list within the range or the immediate environs, of emergency medical services.

An Action List that explains what to do in the event of a firearm accident that has caused injury.

TSNZ recommends its members attend an accredited First Aid course.

**Note** For the purposes of this Manual:

1. **While the activity is in progress** means at any time **shooting** is taking place on the range.
2. **Immediate environs** means within 50 metres of the firing point.
3. **Complete** means the First Aid Kit contains the minimum quantities and all components of the below list **at all times**, and **current** means that the “used-by” date of individual components of the Kit have not lapsed.
4. St Johns and other First Aid trainers will willingly include the first Aid treatment of bullet wounds in their courses. Just notify them of the requirement to cover this in the course beforehand.

### First Aid Officer's Role

- Check the contents of the First Aid Kits(s) against the contents list and replace used items. If any components have a “use - by” date then ensure that they are replaced before the expire date.
- Insist and ensure that the Notebook is filled in.
- Ensure that the incident sheet is filled in and sent to the Executive Officer, TSNZ.

### Accident / Incident Reporting Notebook

ALL items that are taken from the kit to use for ANY accident or incident MUST be written in the notebook. Note the name of the victim, the name of the person who

removed the items, date and time, accident / incident description, what action was taken, what items were used, date any items replaced.

- **Important**

The purpose of the notebook is to log accidents / incidents and any use of the kit. It is necessary to document this information so that a reliable log of events can be shown to have occurred. This will also assist the shooting fraternity in demonstrating that shooting *is* a safe sport. **Please**, do not sweep incidents and accidents under the carpet. The practice of safe shooting will never be improved if events are not recorded, analysed and acted upon. The “fact” that TSNZ has difficulty recalling any firearm injury accident within any of its Club’s ranges attests to a safety record second to none. Whether this “fact” is true is unknown. The fact is, TSNZ has received no reports. Nevertheless complacency must never creep into the sport and care and attention must be exercised at all times. A First Aid kit and trained personnel will ensure that safety is at the forefront of Club operations. **Please play your part.**

### **Shooting Accident Reporting Procedure**

If an incident occurs over and above what could be classed as a “non shooting” accident [cut finger or grazes etc.] but is **DIRECTLY** related to firearms or shooting **AND** causes an injury to **any** person then the following **SHALL** occur:

Carry out recommended First Aid procedures on the victim  
Notify Accident and Emergency services as necessary  
Ensure the victim is adequately cared for. [ Over care is preferable to undercare ]  
As soon as practicable and no later than 24hrs after the incident notify the Police.  
Notify and send completed Incident Sheet to the Executive Officer, TSNZ, within 7 days of the incident.

## Recommended First Aid Kit

A First Aid Kit specifically designed to provide for firearm accidents is listed below. These are available from the TSNZ at cost plus a small handling and postage fee.

A kit that meets this minimum shall be installed in every TSNZ affiliated range.

- Wound dressings [size ] [ 2 ]
- Wound dressings [size ] [ 2 ]
- Crepe bandage 50mm wide [ 2 ]
- Roll of adhesive tape [ 1 ]
- Triangular bandages [ 2 ]
- Medical gloves [ 3 pair - 1x small 1x medium 1x large ]
- Resuscitation mask [ 1 ]
- Box of sticky plasters [Assorted sizes][ 1 packet ]
- Forceps [ 1 ]
- Hepatitis / HIV warning sign [ 1 ]
- First Aid Book [St John or Red Cross][ 1 ]
- Notebook and pen to note accident and action taken
- Quick Reference Chart

The First Aid Kit is to be kept in a handy place in full view of range users, either in the range or in the social area.

The organisation that administers the range shall designate a First Aid Officer who shall ensure the First Aid Kit is kept complete and current. This person's name shall be written legibly on the First Aid Kit.

Each Club that uses the facility for shooting purposes will be made familiar, by the administering organisation's First Aid Officer, of the First Aid Kit's whereabouts and the correct procedure for notification of use.

## Range Operation Manual

The Range Operation Manual is the handbook of the day to day operation of the range. It outlines the appropriate uses the range is certified for, the safety procedures, the allowed ammunition and firearms.

It is good practise to include details such as titles, leases, rent agreements, plumbing and electrical certificates, plans of the range including plumbing and drainage and electrical wiring diagrams and fire escape plans. By including this type of information in the ROM, continuity will be maintained and important information will be easily accessible to future Club Members.

Every range in which TSNZ affiliated Clubs shoot shall have a Range Operation Manual within easy access at all times the range is operational.

The following items are recommended to be included in a Range Operation Manual:

### **Where is the range?**

Identify the range. Show with the aid of maps and survey description the actual position of the range, its orientation, town and street.

### **Who's range?**

Describe who owns, rents, leases the range. Which organisation is responsible for the operation of the range. Contacts, which must be kept up to date - this may include the current range committee. It should outline procedures for other organisations using it - especially if the facility is not used for shooting. Another section of the manual could be kept aside for this in which it could be described what parts of the range are accessible to people - especially children as it is necessary to consider the effect of children having access to possibly lead contaminated atmosphere and soils inside the range area.

### **What sort of firearms / ammunition are allowed?**

Rifle, pistol, air rifle, combination? What ammunitions and firearms are permitted to be used on the range.

### **First Aid / Fire Plan / Approved Evacuation Plan**

Describe where the exits are. May need to outline the requirement to keep fire exit doors clear. Where are the Alarm switches, Smoke Detectors, what type are they, who services them and when do they need to be checked? First Aid kit, where is it, who looks after it, checks and replaces out of date or used items?

## **Shooting Procedures**



Outline the conduct of shooting at this range. Who is allowed to shoot. Where are firearms allowed to be handled, cleaned, disassembled. Who may issue ammunition to visitors. This procedure may differ from Club to Club but in all cases the issuing of ammunitions to people without Firearms Licences must be strictly controlled. It is imperative that good auditing of ammunition usage is carried out and policed.

The Range Officer's function needs to be outlined. Describe who has control of the shooters on the firing point. What procedures must be adhered to when preparing to shoot, eg: changing targets, loading firearms, red light operation, verbal instructions expected during shooting.

### **Maintenance Procedures**

What needs cleaning; rubbish bins, ammo case rubbish, used targets. Range cleaning procedures. The pertinent measures as outlined in the section on **Lead** of this Manual may be included here with specific reference to the techniques to be used on the particular range. This may include emptying bullet catchers, cleanup and disposal of brass and lead, clothing and protective equipment to be worn, recycling of old targets. Where is the vacuum cleaner, brooms, cleaning chemicals kept. Who is responsible?

An example of a Range Operation Manual is included in Appendix 4.

---

## Lead

### Lead and the human body

Lead is dangerous and can cause severe health problems. It can affect your blood, kidneys and nervous system including your brain.

Children are very susceptible to lead. A child is able to absorb upwards of 90% of ingested lead compared to about 10% for an adult. The effect of lead on children can be profound.

No child under the age of 12 shall be permitted into the area forward of the firing line to the target area at any time.

Lead gets into the body by:

- Breathing in dust and fumes
- Eating or smoking with unwashed hands
- Biting dirty fingernails

Further references and information are included in Appendix

### Avoidance of Lead

Avoidance is the best policy in preventing personal lead contamination. This can be achieved by following some simple and basic procedures.

- Avoid eating and drinking within the confines of the shooting range.
- Avoid raising dust.
- Do not allow dust to collect around areas where people congregate.
- Do not sweep any part of the shooting range without wearing a mask. Avoid dry sweeping the range area.
- Wear overalls when cleaning and keep them separate from normal day to day clothing. It is necessary to wash these regularly. **DO NOT INCLUDE THEM IN THE REGULAR WASHING OF DAY TO DAY CLOTHES. WASH SEPARATELY.**
- Keep hands and fingernails clean. Hands should be washed in warm soapy water. Use a nailbrush. Wash the face before food is eaten or before smoking. Don't forget to wash before supper.
- Vacuum with efficiently filtered cleaners.
- Breathing through the nose decreases lead uptake.
- Avoid wiping hands across your face and mouth area.

Clubs should seriously consider installing a hand washing basin in the social area of their ranges. This should have an instant hot/warm water supply. Club members

should be actively encouraged to wash their hands before eating or drinking and leaving for home.

## **Recommended Range Cleanup Procedure**

The recommended clothing to be worn includes: overalls, gloves, footwear, breathing mask as a minimum. The clothes should be carefully removed and washed separately from normal household washing.

Avoid moving rapidly. The cleanup should proceed slowly to avoid excessive dust movement.

Containers for the collection should be set aside. They should be easily handled. Lead is heavy. Many small containers are better than a few large ones.

Bullet catchers must be emptied slowly, a small shovelful at a time. Again to keep the airborne dust to a minimum.

Once the bigger pieces of lead, ie bullet pieces, are contained, it is then necessary to dampen down the area that contains the dust. A mist spray is best as it allows the smaller water droplets to be absorbed with the lead without dislodging it. Let the moisture soak and then wet sweep and / or wipe the accessible areas.

Care should be exercised in checking all places that lead can settle. Horizontal surfaces are the biggest collectors. Trusses, beams, wall top plates, floors are some places. To assist future cleaning it may be useful to line trusses with thin plywood so that the horizontal surfaces are no longer accessible to dust, thus leaving only vertical surfaces. Unpainted walls attract dust into the cracks. It is recommended that walls, especially timber, be painted.

## **Ventilation of Indoor Ranges**

The firing of lead bullets as used in Rimfire Rifles and Air Rifles contributes to airborne lead dust. To assist in preventing shooters from inhaling the gases produced by the firing process it is necessary to ensure there is adequate ventilation on the range.

It is necessary to ensure that an airflow towards the targets is present at all times. Ventilation exits at the target end of a range are necessary.

The provision of adequate ventilation is dependant on a number of factors:

- The range must be fairly airtight to begin with and must be maintained airtight.
- Existing bullet holes in roofs contribute to leakage. They must be sealed.
- This ensures that the maximum airflow will occur using air from within the range.

- If there are leaks, for instance along the top plate, ceiling and walls then air ingress will occur at those points.
- This means that air is coming into the range and contributes to inefficient ventilation of the shooter's space.

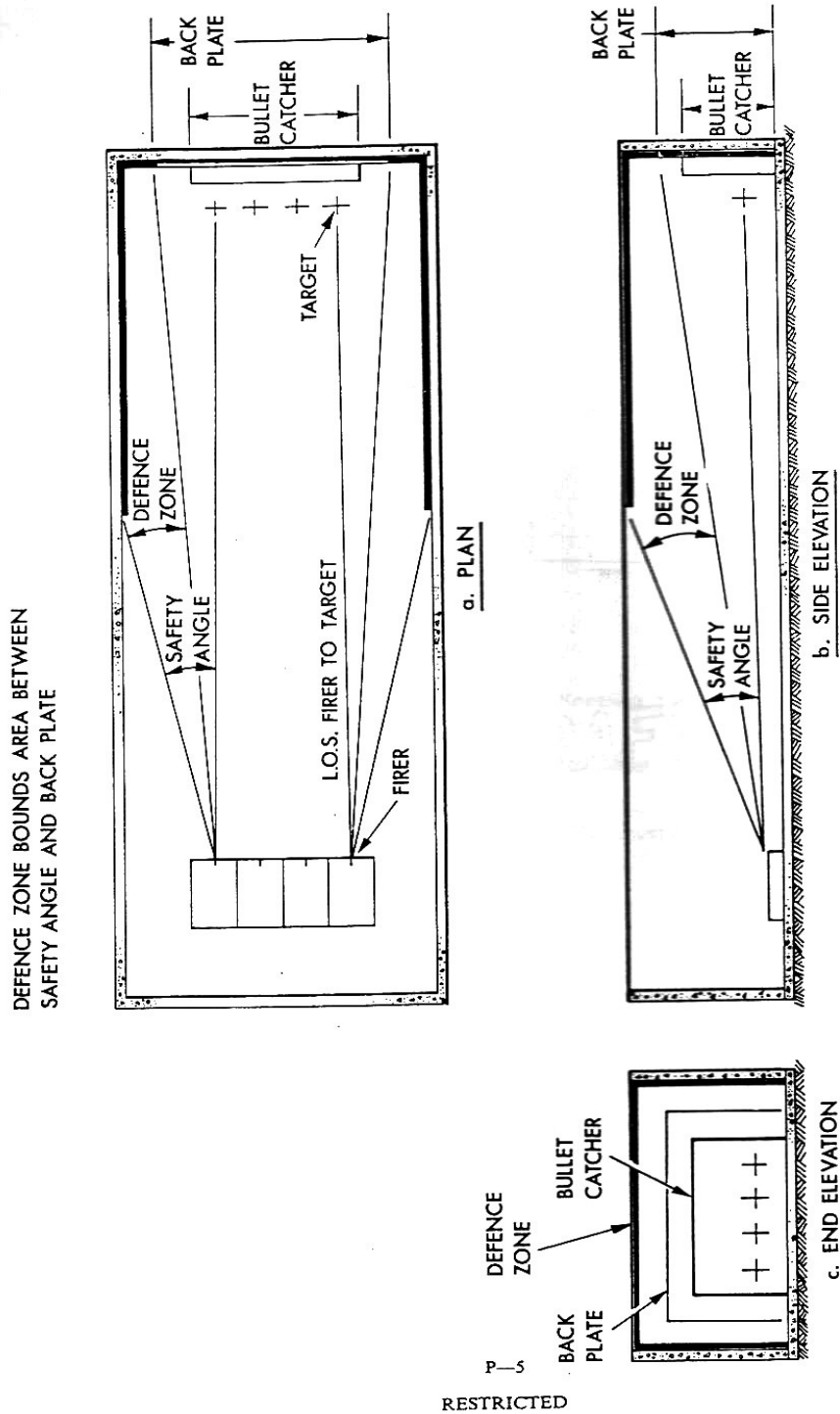
If procedures are in place that prevent people from travelling over lead dusted areas when shooting or target changing, then large air flow velocities may not be necessary. What this means is that care must be taken when moving around the range while shooting is in progress. It is suspected that the high velocity air movements in some recommendations is in some part an attempt to eliminate the dust from settling within the range. Given New Zealand's shooting preference for Indoor Shooting to be a winter activity, this would probably entail large air conditioning systems to ensure that shooters shot in some degree of 'pleasant' and warm surroundings.

Because of the cost involved of any such system, TSNZ recommends that the careful approach with regular cleaning of the range, a ventilation system that ensures air movement towards the targets and careful personal hygiene be the adopted procedure in minimising lead contamination of range users.

The provision of a 'Lead Isolating Station' at the point where people enter the area forward of the firing points when changing targets would eliminate to a large degree the transfer of lead into the marking rooms and social areas of the range. Galoshes, gumboots, or any type of easily fitted shoe or overshoe would be appropriate to place at the Station.

Appendices

- Appendix 1: Indoor Range Defended areas



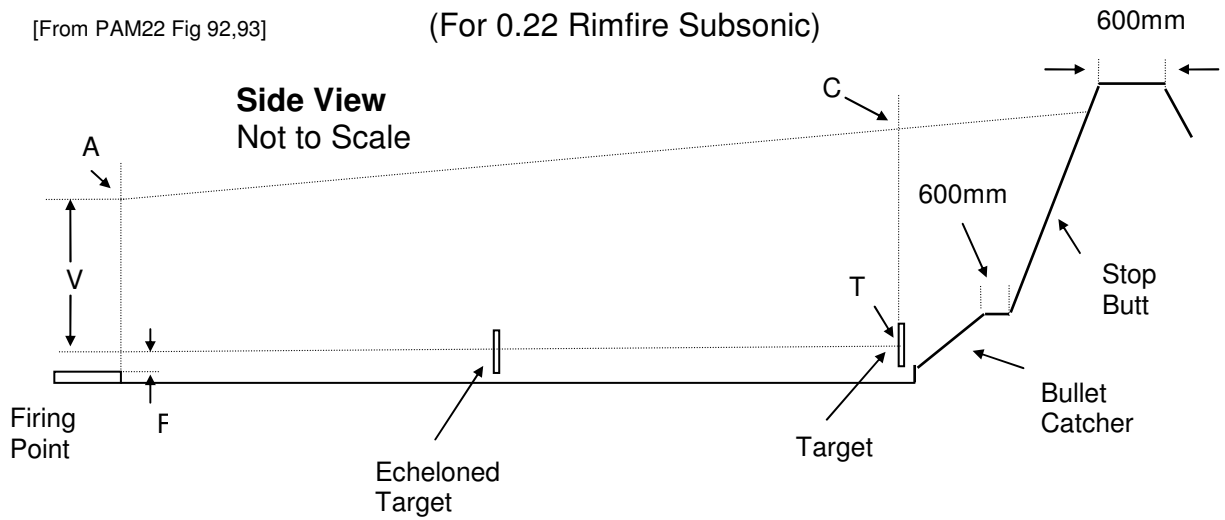
Figure—Indoor Range Defended Areas

• Appendix 2: Outdoor Range “No Danger Area” Range

Stop Butt Height / Width

[From PAM22 Fig 92,93]

(For 0.22 Rimfire Subsonic)

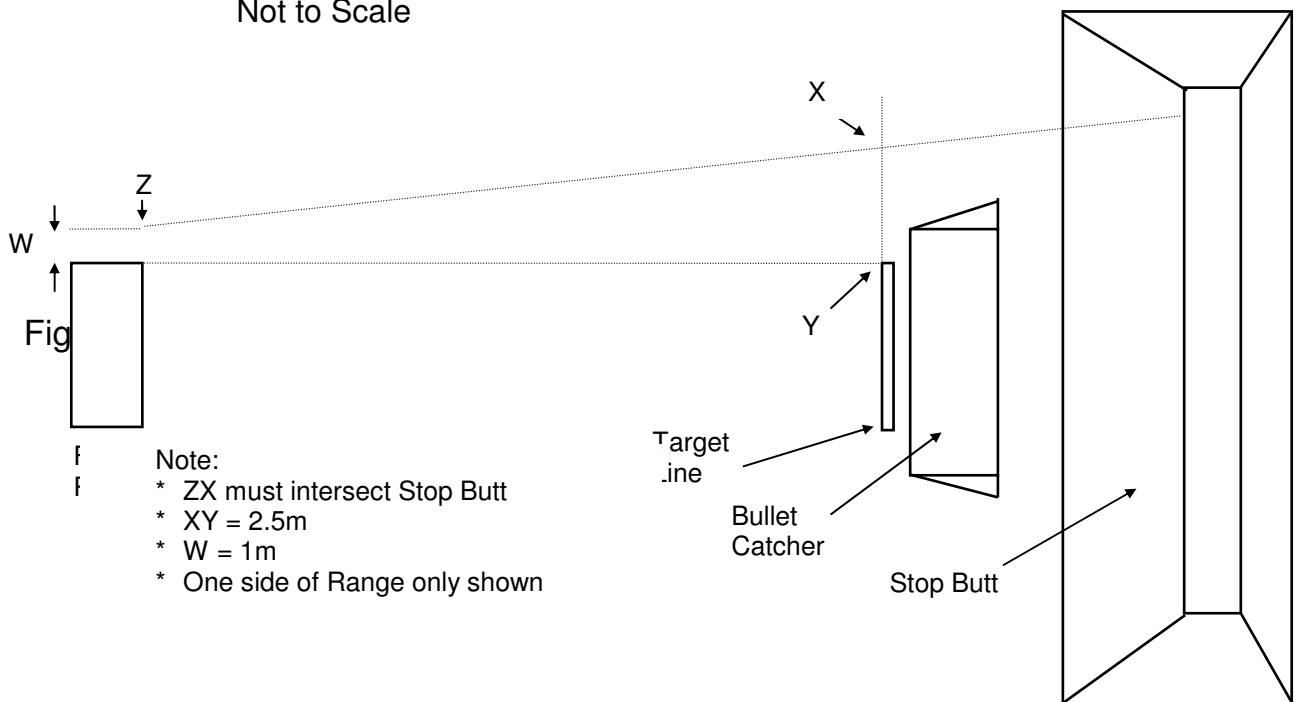


For 50m Range: F= 300mm for Prone, 800mm Kneeling, 1500mm Standing  
 V= 2.5m above F  
 C= 3.5m above T  
 T must be at centre of top target

Note:

- Extension of line AC must intersect Stop Butt.
- Minimum thickness of Bullet Catcher and Stop Butt must be 600mm

**Top View**  
Not to Scale

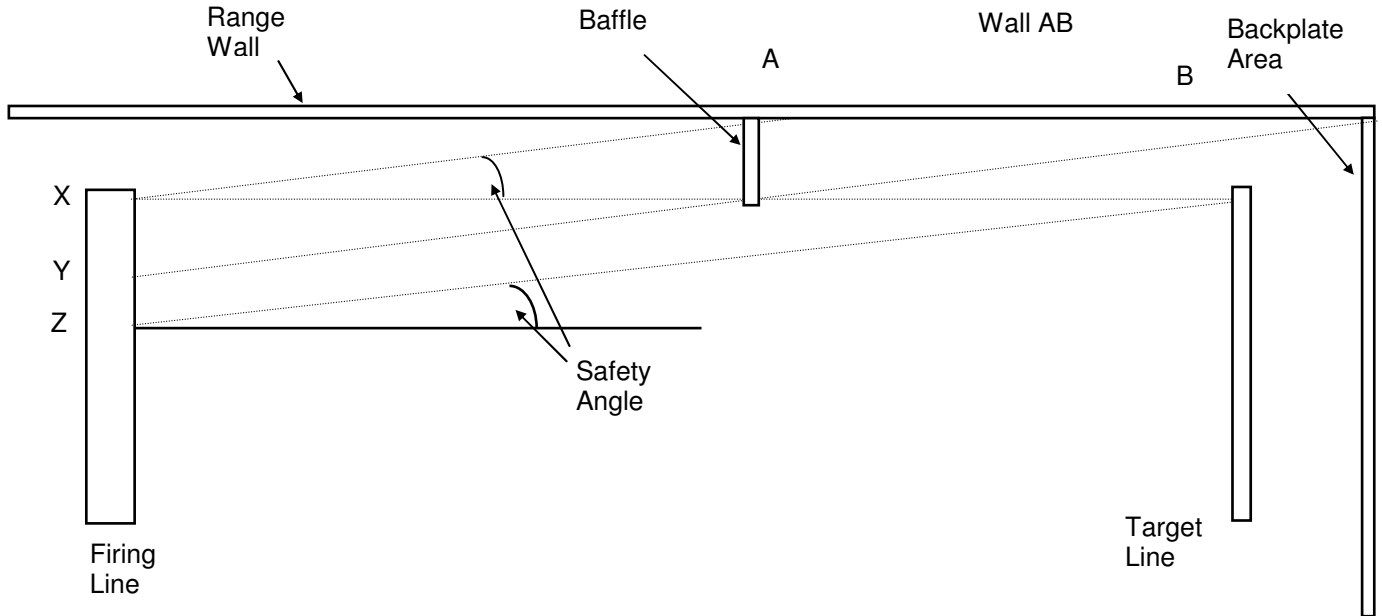


• Appendix 3: Baffles

**Baffles - Example of Installation**

**Top View**  
Not to Scale

[From PAM 22 Fig 106,107]

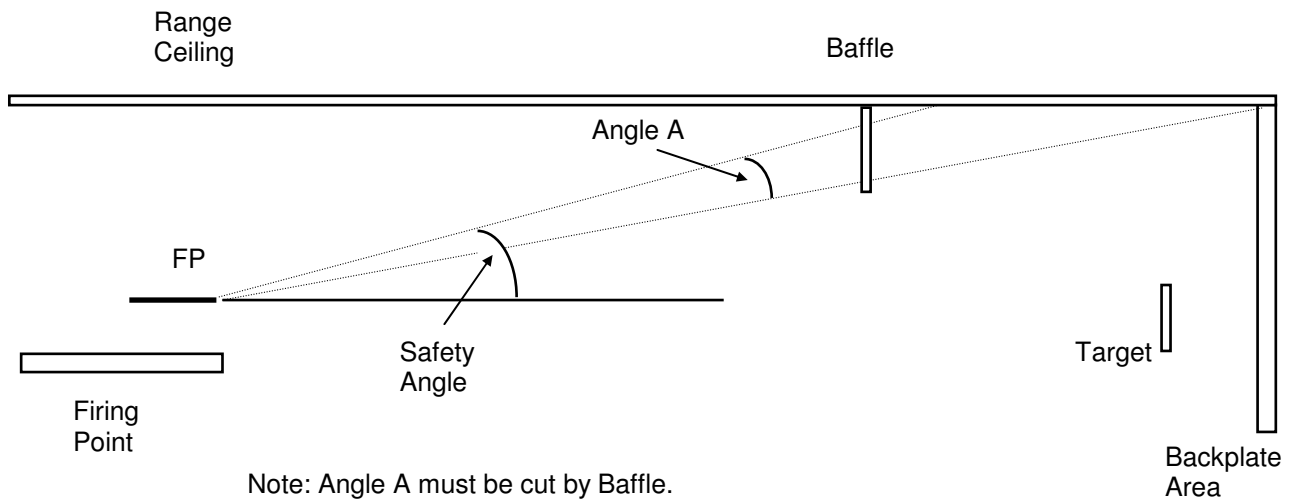


Note:

- Baffle intercepts any shot from firing points between X & Y that are within the sideways safety angle, protecting wall AB.
- Shots fired between Y & Z are intercepted by Backplate area.
- If Backplate was only as wide as Target Line, then a Baffle would need to be placed between Target and Side wall intercepting line from Y to corner of wall.

**Side View**

Not to Scale

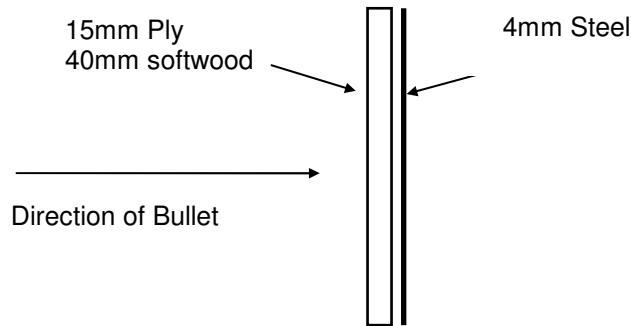


**Baffles - Continued**

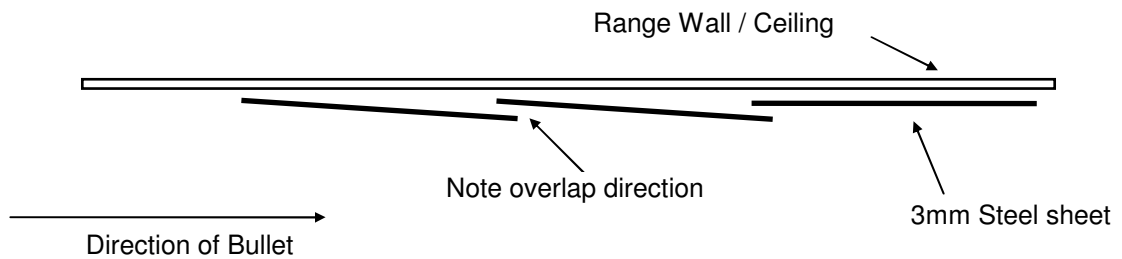
Points to note with Baffles are:

- There may be a need to place more than one baffle to cover the required angles that may be within the required safety angle
- See Table 1 page 9 and Table 2 page 11 for safety angles for different ranges.
- Being vertical plates that are placed at right angles to the line of fire means that the Baffle need to be able to stop a bullet and catch it. See examples of construction.

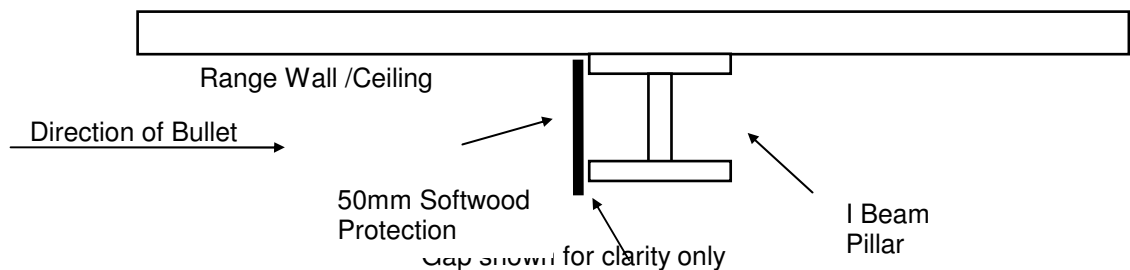
**Baffle Example**



**Flush Wall / Ceiling Lining**



**I Beam / Pillar Protection -Ceiling or walls**





- Appendix 4: Range Operation Manual -Example

## Range Operation Manual

### Use of an existing Range used for a descriptive example

#### Fill in appropriate info applicable to your Range

**Range Operator:** -----

**Location of Range:** -----,

**Range Owners:** The range building is owned by the ----- The property is owned by the ----- The property is zoned Recreational Reserve.

**Type of Range:** There are two shooting ranges within the building situated side by side. The right hand range is used for 25yd 0.22 rimfire shooting. There are 12 x 0.22 rimfire firing points situated in the RH range in a 6 up 6 down layout. The left hand side range is used for Air Rifle and 0.22 rimfire. There are 6 Air Rifle firing points or 5 0.22 rimfire firing points. The only permitted ammunitions are 0.22 Rimfire and Air Rifle Pellets.

**Description of Amenities:** The walls are made of concrete block with galvanised iron roof. A social area with kitchen, toilets, marking room and Club cupboards are included within the building. Entry is via a side double door and fire egress is via a side door in the LH range. Power is turned on at the switch board inside the first door on the right after entry. The board is then immediately on the left wall. The marked main switch turns on the Hot Water and lights. Heater switches are arranged as marked. User Clubs have access to in individual locked cupboard inside the LH range.

**First Aid / Fire Plan:** A first Aid kit is held in the kitchen area, on the wall to the right of the servery. It includes the basic equipment as outlined in the TSNZ Range Manual. This shall be kept current by the ----- designated First Aid Officer.

**Shooting Procedures:** Shooting may be carried out concurrently on both ranges. Air Rifle or rimfire shooting may be held in the LH range at the same time as the LH range is being used. The door between the two ranges that is situated approx 20m down the range shall be locked if Air Rifle is in the LH and rimfire is in the RH range. It may remain unlocked to facilitate target changing but only if both ranges are under the control of one designated Range Officer and the viewing hole between the two ranges is open.

Shooting may only be carried out under the control of a designated Range Officer. There shall be at least two persons present within the Range while shooting is in progress.

- Rifles shall be cocked at the shoulder. That is, the rifle may be loaded with a live round with the rifle off the shoulder, but the bolt cocked or action block must be closed **after** the rifle is placed on the shoulder.

Each Shooting Club that uses this range may vary their shooting programme to suit their circumstances but at all times acceptable and safe procedures shall be followed.

**Red warning lights:** Shall operate in the following manner when shooting is active on the ranges:

- Each range shall have a Red Light visible to all shooters. It shall remain on until the Range Officer gives the order to load and fire. A complementary Red Light situated close to the entry doors to the range that shall come on when the Range Officer switches the Shooter's Red Light off. This implies that the lights are electrically interconnected. These lights shall be positioned at the entry door from the social area of the range and also at the door that opens into the range from the firing point end.

The Range Officer shall follow and issue instructions for the different matches as outlined in the attached Range Instruction Sheet. The Range Officer shall have absolute control of shooting at all times.

**Target Changing:** Persons changing targets shall don overshoes at the Lead Isolation Station situated at the door just in front of the left hand range firing point. The ----- Executive shall provide sufficient overshoes suitable for persons to where while changing targets.

No persons under the age of 12 yrs shall change targets.

**Range Maintenance Procedures:** The following regular maintenance programme shall be followed by all users of the Range:

1. All rubbish shall be removed weekly. The ----- shall organise a roster each year of duty Clubs for the who shall be responsible for the regular cleaning of the ----- Range.
2. All 'empty' ammunition boxes shall be checked for the possibility of live rounds being inadvertently left in them before placing in the rubbish.
3. Individual Clubs are responsible for ensuring that the Range is tidy at the end of their designated shooting night.
4. The kitchen shall be kept hygienic, tidy and all dishes washed and put away in the appropriate place.
5. The ----- Executive shall be responsible for ensuring that cleaning material including dishwashing fluid, toilet cleaners and utensils are adequate.

6. All equipment, fittings and chattels shall remain the property of the -----.  
The ----- Executive shall be responsible for the upkeep of all equipment, fittings and chattels.
7. Specific equipment that Clubs use shall be the responsibility of the individual Clubs. This includes Club owned marking boards, rifles, scopes etc. These items shall be kept under lock and key in the appropriate Club cupboards.
8. The cleaning of the range of lead dust, the emptying of the bullet catchers, the upkeep of the lighting shall be the responsibility of the ----- Executive.  
The ----- shall organise (at least) yearly working bees to ensure this is carried out regularly.

**Non Shooting Club Use:** It may be appropriate at times to rent, lease or lend the facilities of the ----- Range to other organisations not involved with shooting. The following Code of Use shall be outlined to these organisations as they arrange the use of the ----- Range:

No persons may enter the shooting range area while the organisation has tenure. This is to ensure that the possibility of people being exposed to lead is reduced or eliminated.

They shall clean the ----- Range at the completion of each days use.

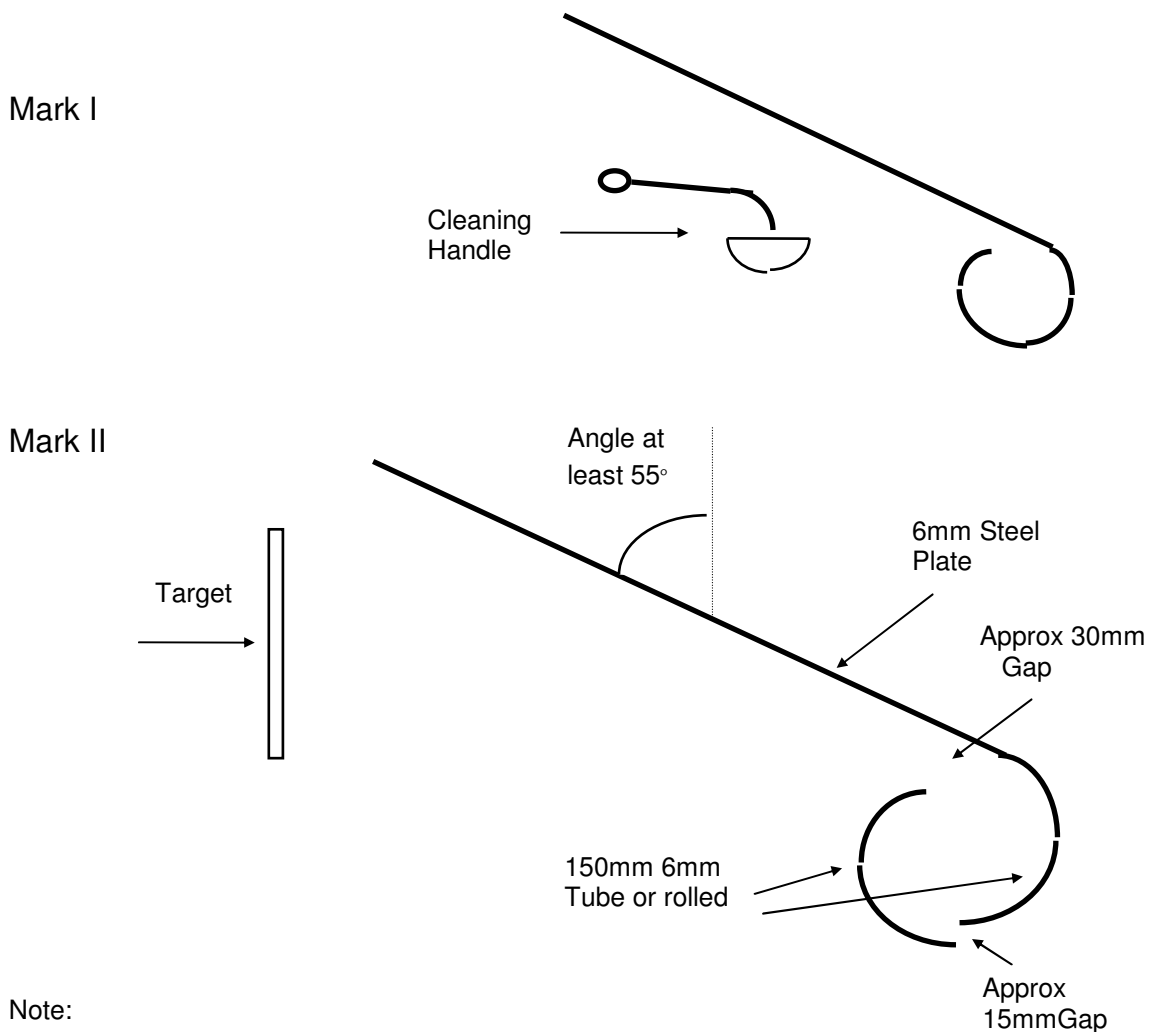
They shall keep the kitchen tidy and cleaned. All rubbish generated by them shall be removed.

They shall leave all paraphernalia associated with shooting alone.

All electricity shall be turned off when they leave.

- Appendix 5: Bullet Catchers

## Bullet Catchers - Examples

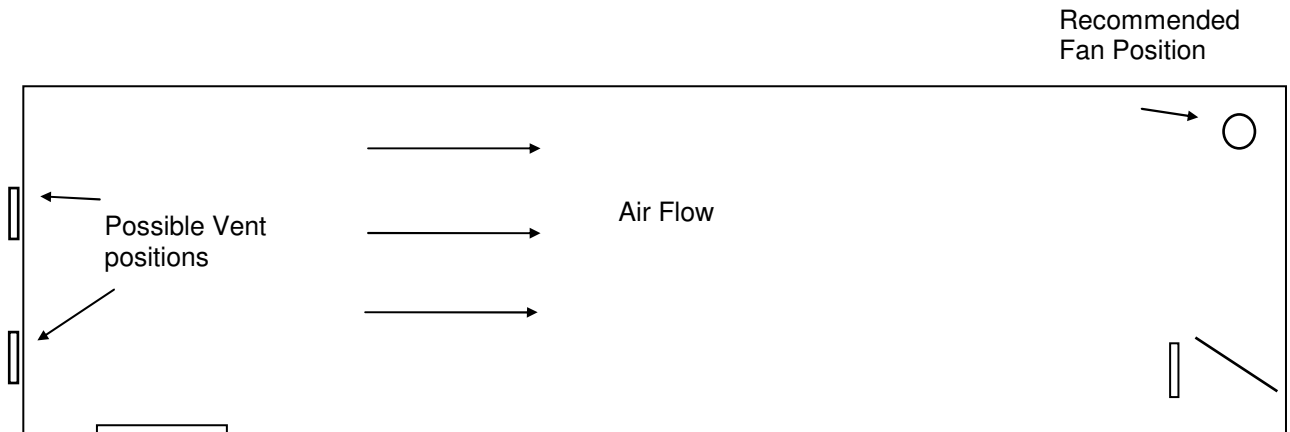


Note:

- The result of testing with an adjustable Test Rig, it was found that an angle less than 53° caused a bullet hitting the plate to break up. At angles greater than 53° the bullet did not. Thus the requirement to make sure the angle is > 55°.
- Mark I design did not incorporate the gap at the bottom of the tube. The bullet remains were left in the tube to be hit by later bullets. This meant extra lead dust being generated and regular cleaning was required. A semicircle of steel attached to a handle is used to scrape the remains out the end of the tube. The idea behind the gap is to allow the bullet to drop out of the tube and decrease the amount of lead dust generated. The bottom of the left hand tube needs to have a downward slope to assist the lead to fall out.
- One noticeable effect is the lack of pitting at high impact zones, ie sighter areas, as compared to more vertical plates.

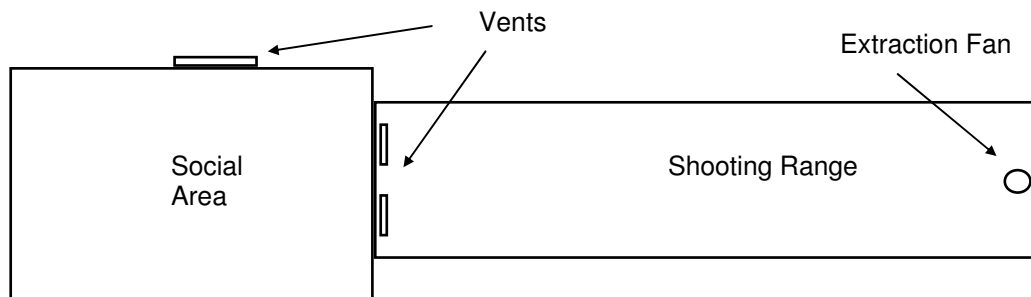
• Appendix 6: Ventilation of Ranges

**Examples of Vents / Extraction Fan siting**



Notes:

- Firing Point
- Ensure gaps throughout shooting range are eliminated. This will ensure that most of the air extracted by the fan is inside the range.
- A number of vents at the shooting end (more than 2) should be installed. This will ensure a more even flow and less turbulence around the shooter.
- Ensure that air is freely available from the area where the air is coming through the vents into the shooting range. If this is the social area, install a vent to the outside in the social area.
- The fan(s) should be operating at all times any part of the range is in use.



- Appendix 7

**This Appendix contains examples of constructional details that are extracted from PAM22 and the NRA Manual.**

Examples that are directly relevant to Rimfire Indoor, 50m Outdoor and Air Rifle Ranges have been included.

They are presented as examples of “ideas with experience”.

Range builders and or renovators are actively encouraged to design innovations into any range they are involved with.

The only criteria TSNZ will insist on is that:

The design works and

It fulfils the opening paragraph of Range Construction. Page 10

## References

### **Range Construction and Regulations (All Arms)**

#### **Pamphlet 22**

Published by UK Ministry of Defence

#### **JSP403**

Copies available from TSNZ

### **The Range Manual**

Published by: National Rifle Association of America

Copy available from TSNZ

Lead

**OSH** - Booklets and information on Clean-up procedures for Lead contamination

### **Merck Manual**

A comprehensive Manual on Chemical Injuries, Poisonings, Treatments

Available on the Internet [www.merck.com](http://www.merck.com)

Range Operation and Competition Procedures

### **TSNZ Rule Book**