

RULES FOR CERTIFICATION OF NO DANGER AREA RIFLE RANGES
FOR
NRANZ FULLBORE RIFLE SHOOTING

12 September 2006

Amended 6 September 2010

THE NATIONAL RIFLE ASSOCIATION OF NZ**RULES FOR THE CERTIFICATION OF NO DANGER AREA RIFLE RANGES**

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1 GENERAL

This document sets out the range construction details and the certification process approved by the National Rifle Association of New Zealand (NRA of NZ) for no danger area rifle ranges to be used for shooting controlled by itself and its affiliated Clubs and Associations.

2 NRANZ NO DANGER AREA RIFLE RANGES - RANGE DANGER AREA

In spite of their name no danger area ranges (NDA) do have a range danger area on each side of the range floor. Their name comes from the fact that they do not have a danger area continuing beyond the butt stop wall.

The NRANZ RDA for NDA is based on the definitions and methodology of "Handbook of Defence Land Ranges Safety, Volume II, Design, Construction and Maintenance of Small Arms and Infantry Weapon Systems Ranges" being JSP403 Issue 2 (JSP403) produced by the Ministry of Defence (UK). The NRANZ RDA for NDA is designed to completely contain the calculated Cone of Fire (COF) for NRA of NZ shooting. (See references for details)

This approach ensures that the NRA of NZ RDA for NDA provides at least the same level of safety to range users and those outside the RDA as ranges certified as complying with JSP403 provide for relevant military shooting practices. For these military ranges the inherent level of risk of a fired projectile leaving the RDA is stated as less than 1 in one million for all shots fired with an acceptable firing error plus as much of an allowance for unacceptable firing error as is practicable. This level of risk has been accepted by the NZ Army for its ranges and is therefore adopted by the NRA of NZ also.

The following definitions are copied from JSP403.

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"0231. **Range (Zone).** A range is a space reserved, authorised and normally equipped for hazardous firing (weapons or lasers). The following are types of range:

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- c. **No Danger Area Range.** A no danger area (NDA) range is a range where, for all practical purposes, the design precludes the risk of injury or damage to persons or property beyond the range floor caused by shot, direct or ricochet, fired in accordance with authorised procedures and aimed within the bounds of accepted aimer deviation. The minimum design requirement is to contain all correctly aimed shot fired within the bounds of accepted weapon deviation."

"0236. **Range Floor.** The range floor comprises the ground from the furthest firing point to the target including any range construction intended for or capable of capturing correctly aimed shots or inducing ricochet."

When the range definition is applied to NRANZ documents replace "weapon" or "weapons and lasers" with "rifle" or "rifles".

Section 0291 to 0297 of JSP403 sets out the general requirements, design criteria and specific details for military NDA ranges. The general clause refers to the definition in 0231 (above) and notes that no additional danger area is required for

such ranges beyond the constructed part of the range. It also notes that ricochet from ground strike is often the greatest deviation in the COF.

The design criteria are prefaced with the statement "the advice and data used is based on legitimate and authorised practices, and cannot prevent a shot fired with unacceptable aimer deviation from leaving the range boundary." This comment also applies to gallery ranges and the corresponding NRANZ RDA.

In essence the JSP403 design criteria and prescriptive details for NDA are designed to ensure all acceptably aimed shots and all range floor ricochets are captured by the mantlet and/or butt stop. Alternatively NDA ranges can be designed to preclude any range floor ricochet.

The NRANZ RDA for NDA is based on eliminating all ricochets and capturing all the COF by the mantlet (if any), bullet catcher and/or other structures.

This is to be achieved by some or all of the following:

- Constructing the mantlet and butt stop with vertical or near-vertical faces so that ricochets cannot be induced from these. *Conventional mantlets and stop butts (and the NRANZ RDA) rely on the slope of the front face of these structures being maintained at a large enough angle to have a zero probability of ricochet. There is always a risk with these earth structures that continual projectile impacts will cause local reduction in the angle below this confidence limit if maintenance is not carried out often enough.*
- Requiring the height of the stop butt and mantlet to be sufficient to catch all the COF from all ranges.
- As the above could require prohibitively high butt stop walls for ranges of more than 600m length, sight elevation settings must be independently checked before firing at any distance greater than 600m. *This will have the effect of removing the component of the NRANZ COF included to allow for gross errors in setting sights (such as shooting at 1000yards with a 300yard setting on the sight).*
- Constructing baffle walls to the sides of the range to limit the width of the RDA where desired
- Constructing cross range baffle walls to eliminate all range floor ricochets
- Using steel deflector plates
- Constructing overhead baffles to contain any possible shots above the COF

3 NRANZ RDA FOR NDA

The NRANZ RDA for NDA diagram, Figure 3, is appended.

As the RDA is based on the premise that no ricochet can occur, there is no requirement for air danger height (ADH) as defined by JSP403.

Unlike the NRANZ RDA there is no danger area beyond the stop butt, however it would be prudent to add an extra area extending 100m past the line of the targets into the RDA where possible to cater for possible "pop-over" ricochets.

4 CONDITIONS

The NRA of NZ RDA for NDA only applies when all the following conditions are met:

- NRA of NZ shooting rules are complied with. The RDA is particularly dependent on two rules. These are the requirement to remove bolts from rifles at all times except when the rifle is permitted to be on the firing point and the prohibition on the bolt being closed except when the rifle is in the shoulder and pointing at the target.
- All shooting is carried out in single shot deliberate practices.
- Target rifles (TR) are limited to a maximum of 4300joules muzzle energy and 1000m/sec muzzle velocity.
- F Class shooting either complies with the limits for TR or is limited to a maximum of 5160joules muzzle energy and 1000m/sec muzzle velocity provided no shooting is carried out forward of 300yards (274m) from the targets.
- TR shooting must be sling supported from the prone position. F Class rifles must be supported by a rest, bipod, pedestal or other acceptable method at the fore-end of the rifle and controlled in position at the butt.
- Calibres do not exceed 8mm. Only ball or match ammunition is used. Tracer is explicitly prohibited.
- Elevation settings are independently checked prior to the shooter being permitted to commence firing for all firing distances greater than 600m.
- The range construction is as set out in the next section.

5 RANGE CONSTRUCTION

5.1 FIRING POINTS

Firing points may be constructed of earth, concrete, timber, etc. No firing point may be within the cone of fire from a further firing point. This provision will be satisfied if they are not within an angle of 4 mils (1mil is the angle subtended by 1unit at 1000units distance and equals approximately 3.44minutes of angle) below the line of sight from the further firing point. The line of sight is a direct line from 300mm above the firing point to the centre of the target in its fully raised position. No fences or steel posts or other metal, concrete or other ricochet inducing materials may intrude into the cone of fire from a further firing point.

5.2 OBJECTS IN THE RANGE AREA

During shooting there may not be any objects made of metal, concrete or other materials that could induce ricochets within the cone of fire from any firing point. The cone of fire may be taken as 3mils above to 4mils below the line of sight and 30mils on each side. This requirement will normally affect poles for wind flags, (timber preferred and care with fixing bolts etc. out of the way from any stray shot) structures such as fences around firing points, (which may need to be dropped while shooting is in progress) bridge handrails, etc. Where ricochet inducing surfaces are within the cone of fire they can be protected by 375mm thickness of softwood or 250mm thickness of hardwood or by vertical timber walls containing at least 1500mm horizontal thickness of earth.

Steel deflector plates can be used where purpose designed. Any upwardly inclined forward facing surfaces (such as the top edge of an inclined plate) that could cause ricochets are to be covered or bevelled to avoid potential ricochets. Any steel used to trap or deflect bullets must be at least 12mm thick armour plate with a Brinell hardness of 500. (A typical specification is AR500 steel).

5.3 TARGETS

Targets faces must be constructed from timber, cardboard, paper, rubber, or similar materials through which a bullet can easily pass and their frames from timber or other non-metallic material. There must not be any metal or other components that could cause a bullet to be deflected out of the RDA.

5.4 TARGET CARRIERS

The design of target carriers must be such that no metal part can be struck by a bullet just clearing the mantlet. This provision will be achieved if the highest metal is at least 75mm below a line of sight that just clears the top of the mantlet, taken from any firing point. When the carrier is lowered to allow marking of the target the top of the target must be at least 75mm below the line of sight that just clears the mantlet from any firing point. When the targets are fully raised the lower edge must be at least 75mm above the line of sight to the top of the mantlet from the firing point.

Targets must be supported by the carriers on timber legs or by other methods that preclude the use of any metal above the top of the carrier. Fixings must be such that they will not cause ricochets if they are hit by a bullet. The same restriction applies to any scoring device, spotter, etc that is ever raised above the mantlet.

5.5 MANTLET AND MARKERS' GALLERY (WHERE REQUIRED)

The height of the mantlet above the range floor must be at least 1800mm. At least 1800mm height of the mantlet must be visible from every firing point. The mantlet must extend at least 6m past the centre of the flank target at each end.

The mantlet is required as protection for the markers' gallery. The front face of the mantlet must be a wall with its forward face within 5 degrees of a right angle to the line of sight from all firing points. If it is constructed with timber retaining walls enclosing soil there must be at least 1.5m horizontal thickness of soil at any point. The top of the mantlet and the cover over the markers' gallery must fall back towards the targets at a minimum slope of 1 in 12.

Other constructions that will stop a bullet without causing ricochets may also be used but must be sufficiently thick to protect the markers at all times even after repeated impacts at the same point.

The roof over the markers' gallery must protect the markers from sun and rain. A minimum of 1m cover from the back wall of the gallery is recommended. The distance from the back wall of the gallery to the face of the target when lowered for marking should be no less than 2m. The roof should be designed for any loads it may credibly have to support such as livestock, snow etc.

5.6 STOP BUTT

All shots fired within the cone of fire must be stopped by a cross wall, mantlet or the stop butt (after passing through the target). The stop butt must be constructed with a near-vertical face or series of near-vertical faces as shown on the appended diagrams. The angle of the forward faces must be within 5 degrees of a right angle to the line of sight from all firing points.

The stop butt should be at least 25m but no more than 30m behind the targets. The top of the stop butt must be at least 8m above the level of the range floor at the toe of the mantlet or in front of the targets where there is no mantlet. It must also be at least 6.2m above the level of the top of the mantlet. The line of sight to the top of the stop butt from 300mm above each firing point must also be above the centre of a fully raised target by at least the amount shown in the table for that distance:

Distance	300yds	500yds	600yds	800yds	900yds	1000yds
Height above centre of target	2.0m	2.3m	2.5m	2.6m	2.8m	3.0m

The toe of the stop butt wall should be low enough to ensure that a bullet that has passed over the mantlet cannot impact the range floor in front of the stop butt. This needs to be calculated depending on the distance from the target line to the stop butt. The calculation is carried out by taking the vertical drop of the bullet from the target line to the stop butt below the line of sight from 300mm above the firing point that just clears the mantlet. Typical maximum drops for 7.62mm beyond the targets are:

Distance fired	300yds	500yds	600yds	800yds	900yds	1000yds
Drop after targets over 30m	0.2m	0.3m	0.4m	0.6m	0.7m	0.8m

The stop butt must be wide enough to capture the extremes of the cone of fire and all acceptable aimer deviation plus a factor of safety. This distance depends on the longest distance from which firing can take place. The full height of the stop butt must be continued the following distances past the line from the extreme ends of the furthest firing point to the centre of the flank targets.

Longest firing distance	300yds	500yds	600yds	800yds	900yds	1000yds
Minimum distance between flank target centre and end of stop butt (m)	12m	20m	25m	36m	42m	48m

As the number of impacts on the extension of the butt stop wall past the flank targets will be extremely low and very widely spaced, an earth stop bank may be used for these extensions provided its forward face is constructed and maintained at no less than 30° to the horizontal. In this case the near-vertical stop butt construction must continue for at least 6m past the centre of the flank targets before a transition is made to the earth bank construction.

As an alternative to providing butt stop walls of the widths set out above a system of side baffle walls can be used in conjunction with the butt stop wall to achieve at least the same degree of safety. Such an approach needs to be purpose designed in accordance with the NRANZ COF and the physical dimensions of the range.

5.7 SIDE BAFFLE WALLS

Figure 4 attached shows a typical approach to limiting the side areas of the RDA by installing side baffle walls. The essential requirement is that there must be a baffle wall stopping all shots from all firing point positions fired up to and including the angle of the RDA that is required outside the flank target for the longest distance. This angle is shown on Figure 4 as α .

The length of the butt stop wall must be extended sufficiently past the flank target to work with the side baffle walls to ensure this is achieved.

Figure 5 shows how the minimum height of the baffle walls is determined.

For a conventional range the top of the COF is determined from each firing point to the butt stop wall and the tops of the side baffle walls (and the butt stop wall) are set to give a minimum of 1m clearance above the highest trajectory. In the example for a 1000 yard range with the target centre line at 3.1m above the range floor this relates to wall heights rising from 3m at 1000 yards to 8.5m at 500 yards. For this case the slowest credible projectile speed of 2,500 feet per second is used as this is the most conservative.

For a single firing point range the same approach requires the butt stop wall, and the walls between 500 yards and the targets, to be 11m high. This could be reduced if the target centreline at 300 yards was lowered but such a change will increase the length over which shots from 300 yards will need to be stopped by cross walls to avoid range floor ricochets so it needs to be carefully considered. For this case the maximum credible muzzle velocity of 3,000 feet per second is used as it is the most conservative.

Another way in which the height of the walls can be reduced for a single firing point range is to institute independent sight elevation settings at all ranges. This will have the effect of eliminating the allowance for a sight set on 1000 yards being shot at 300 yards and could reduce the requirement for baffle walls heights to be reduced from 11m high to 8m. This must be calculated for each case specifically.

5.8 CROSS RANGE BAFFLE WALLS

Figure 6 shows the trajectories of bullets with an MV of 3,000 feet per second on a conventional range. These presume effective independent checking of elevation settings before shooting at all firing distances greater than 600 yards. This is an essential requirement for the certification of all NRANZ no danger area ranges and must be included in the Range Standing Orders.

Provided sight checking is carried out the COF will not impact the range floor at any point. However it would be prudent to construct the firing points and install some extra cross walls to ensure low shots fired with unacceptable firer error are also trapped and cannot ricochet off the range floor.

Figure 6 also shows the bottom of the COF for all ranges fired from a single 1000 yards firing point. The slowest muzzle speed is used for conservatism. Cross walls are required from 600 yards on to catch virtually all such shots from all distances. The height and spacing of these walls must be such that the slowest bullet that just clears one wall will not impact the range floor beyond it but will impact the next cross wall. Again, for prudence, extra walls can be installed in the first half of the range to preclude ricochets from shots fired with unacceptable firer error out of the COF.

Figure 7 shows some typical details for cross range walls and for firing points on conventional ranges combined with cross range walls. Walls are also shown that can be used on single firing point ranges where they are out of the COF from all distances and therefore will rarely, if ever, be hit.

Figure 8 shows some typical details for walls that will be hit by properly fired shots on single firing point ranges. Details such as these must be used for such cross walls at least for 600mm each side of the centre line of each lane. Outside that area very few hits should occur and damage to walls can be accepted or patched.

The use of sacrificial timber, sandbags or other protection to cross walls must be combined with regular maintenance. This is not only to maintain the wall protection but also to avoid scoops occurring and inducing ricochets.

5.9 STEEL DEFLECTOR PLATES

Where steel plate is used for bullet stopping it must have a Brinell hardness of 500 and should be 12mm thick where it is regularly hit and 6mm thick where it is at least 600 yards for the firing point and in less often hit areas where it can eventually be replaced if necessary. A typical specification for this plate is AR500 Armour Plate.

5.10 COMMUNICATIONS

An effective means of communication between the firing point and the butts must be available at all times that shooting is taking place.

Appropriate warning signs must be placed strategically so that they are effective in warning the general public to keep clear of the range when it is being fired on.

6 RANGE CERTIFICATION

The NRA will keep a register of rifle ranges that have been inspected and certified as complying with these rules. It will also keep a register of rifle ranges for which it has granted dispensations from these rules.

6.1 CERTIFICATION

To be included in the register a rifle range must be inspected and certified by an NRA Range Inspector approved by the Council of the NRA of NZ.

6.2 APPROVAL OF RANGE INSPECTORS

Before approving NRA Range Inspectors the Council must satisfy itself that each candidate has relevant knowledge and experience. A pass in a recognised Range Inspecting Officers' Course will be taken as proof of that level of knowledge. A Chartered Professional Engineer with professional qualifications in civil engineering will also be considered to have the necessary knowledge. Candidates with the appropriate knowledge can be approved by the Council as NRA Range Inspectors provided it is satisfied that they also have sufficient understanding of NRA shooting procedures and rules.

Approval by the NRA of NZ as a NRA Range Inspector only entitles the individual to inspect and certify ranges used by the NRA of NZ and its affiliated clubs and associations for shooting carried out in accordance with NRA rules. Certification of other types of ranges and use of ranges for other shooting practices will require approvals from other organisations.

6.3 REGISTER OF NRA RANGE INSPECTORS

The NRA of NZ will maintain a register of all individuals approved as NRA Range Inspectors.

6.4 RENEWAL OF CERTIFICATION

Certificates of compliance with these rules are for 5 years after which a further inspection is to be made and certificate issued. After the first inspection has confirmed compliance with these rules, it is expected that subsequent inspections will be purely to ensure there have been no changes which would void the certification and that maintenance has been carried out sufficiently to ensure the range is still compliant.

6.5 DISPENSATIONS

The Council may issue dispensations to all or part of these rules as it sees fit. Such dispensations must be based on evidence that the risk of a bullet leaving the NDA is no greater than would be the case if the range complied fully with these rules, or that such risks can be safely managed, or that the consequences of such an event are such that no hazard occurs to humans and any other effects are acceptable. In considering dispensations the Council will take into account the safety record of the range and the recommendations of an NRA Range Inspector.

7 REFERENCES

Handbook of Defence Land Ranges Safety, Volume II Design, Construction and Maintenance of Small Arms and Infantry Weapon Systems Ranges; Ministry of Defence (UK) JSP403 Issue 2

Assessment of Cone of Fire for NRANZ Shooting and Range Danger Area for Seddon Range, Trentham; Tony Loughnan, August 2001 amended November 2001

Summary of Calculations supporting the paper above; Tony Loughnan, June 2002

Development of Rules for Certification of rifle Ranges for the National Rifle Association of NZ; Tony Loughnan 12 September 2006 amended September 2010.

Hatchers Notebook; Maj. Gen. (US) Julian S Hatcher

Development of Rule for Certification of Rifle Ranges for NRANZ: Tony Loughnan, September 2006, amended September 2010

8 ATTACHMENTS

Figure 3 – NRANZ No Danger Area Range RDA

Figure 4 – NRANZ No Danger Area Range RDA with Side Baffle Walls

Figure 5 – NRANZ No Danger Area Ranges – Minimum heights for side baffle walls and butt stop walls

Figure 6 - NRANZ No Danger Area Ranges – cross range baffle walls positions

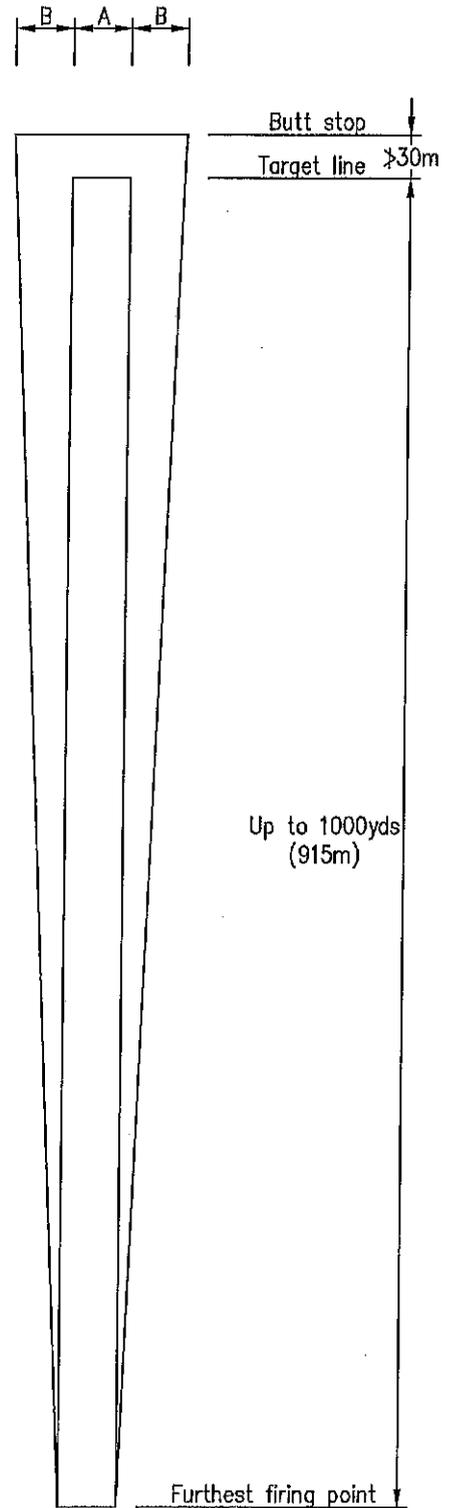
Figure 7 - NRANZ No Danger Area Ranges – possible details for cross range baffles walls that are unlikely to be hit

Figure 8 - NRANZ No Danger Area Ranges – possible details for cross range baffles walls that are likely to be hit. Bullet catcher detail

FIGURE 3.

NRANZ RDA FOR NDA RANGES

(Only to be used in strict compliance with the relevant NRANZ rules for the certification of NDA ranges)

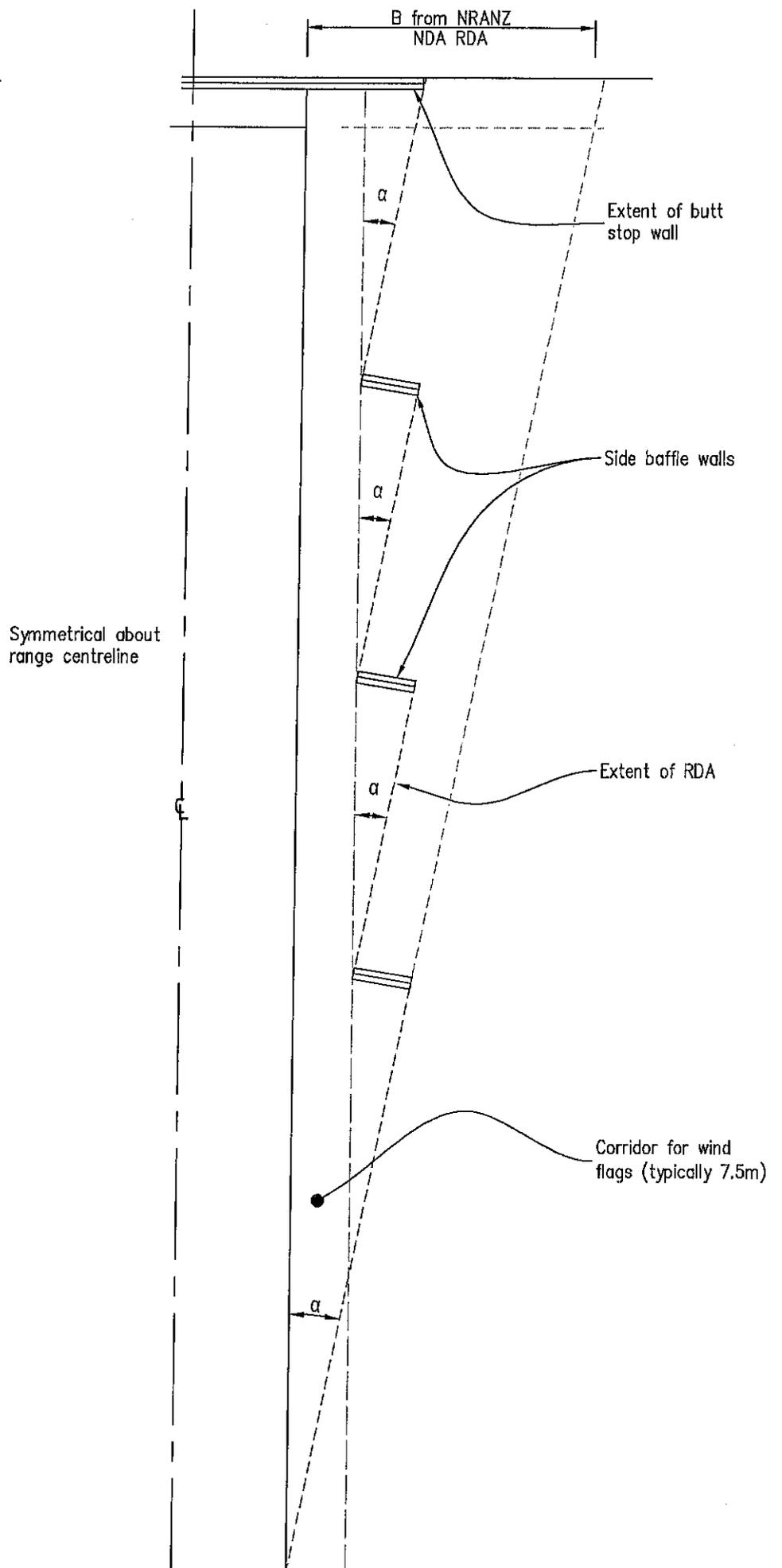


A = Width of firing points and targets

Longest firing distance	B
300m	12m
500yds(457m)	20m
600yds(549m)	25m
800yds(732m)	36m
900yds(823m)	42m
1000yds(915m)	48m

Scale 1:5000

FIGURE 4.
NRANZ RDA FOR NDA RANGES



Not to scale

FIGURE 5.

Minimum heights for side baffle walls for NRANZ NO DANGER AREA ranges

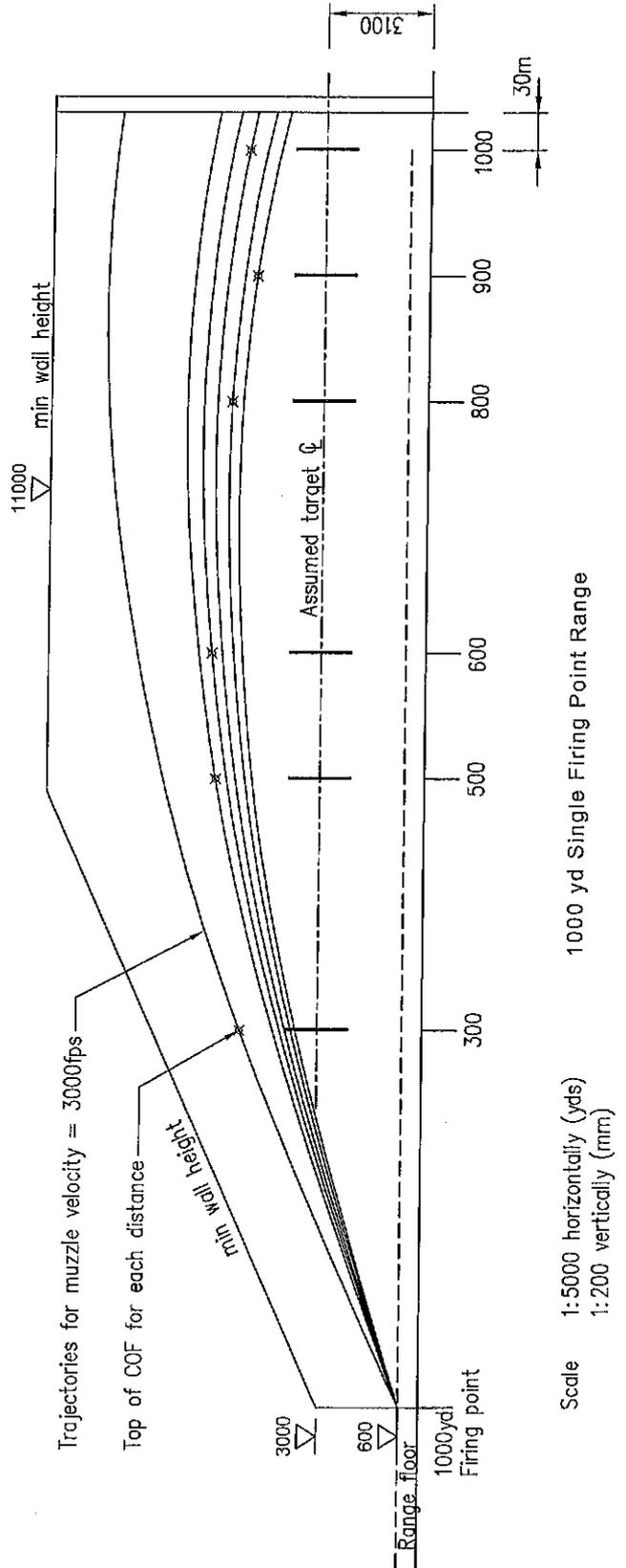
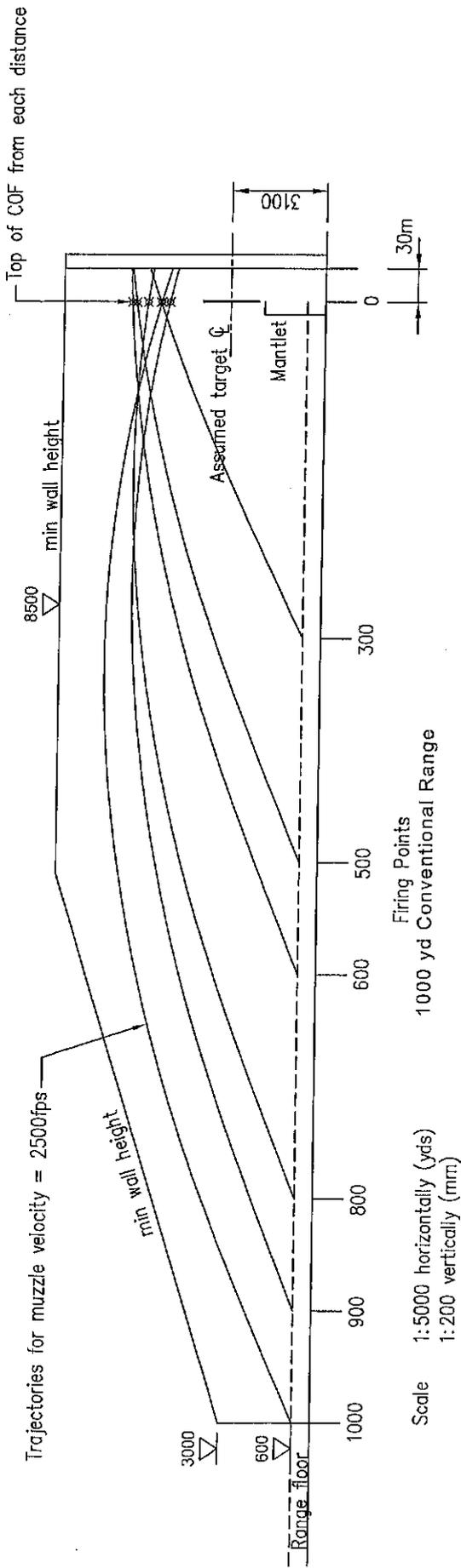


FIGURE 6.

Cross range baffle walls for NРАНZ NO DANGER AREA ranges

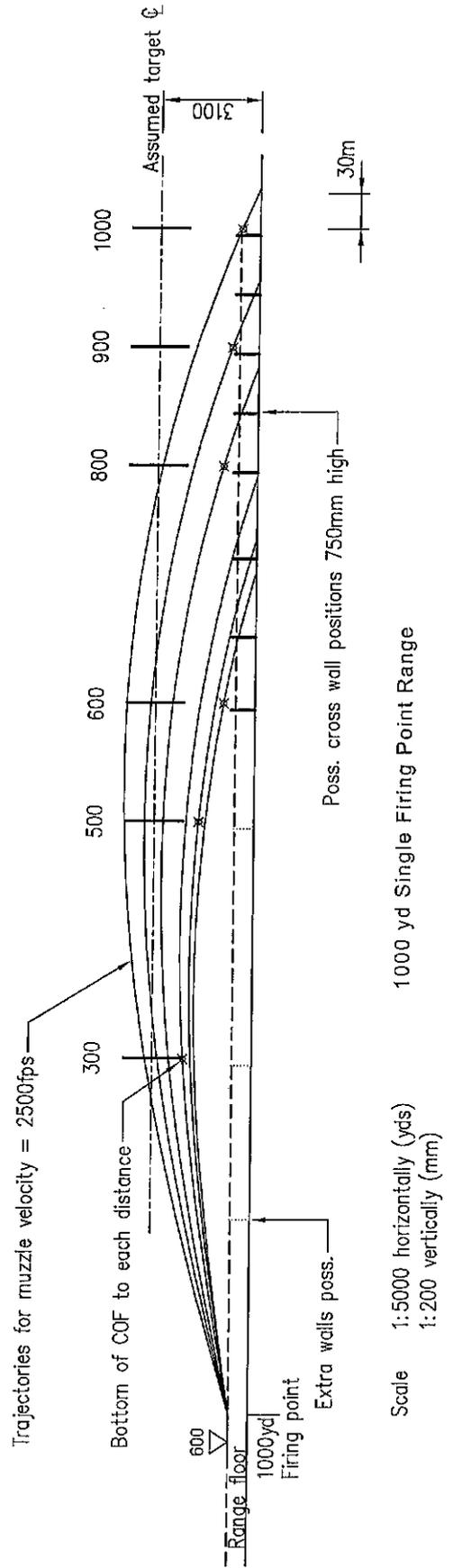
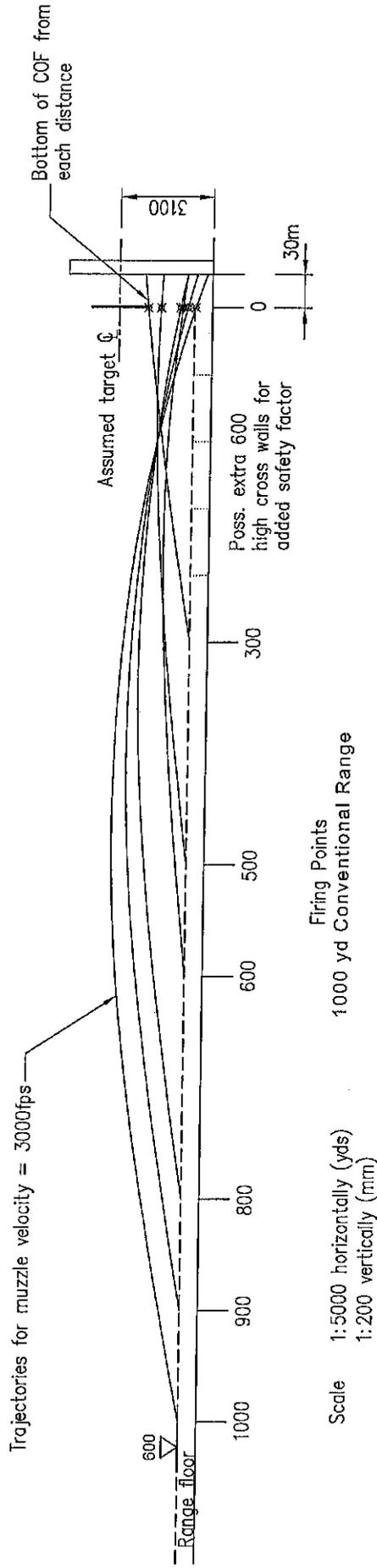
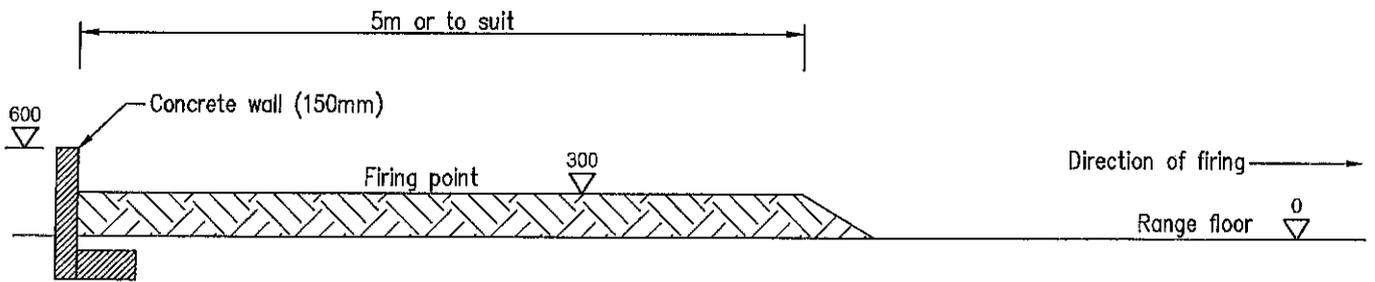
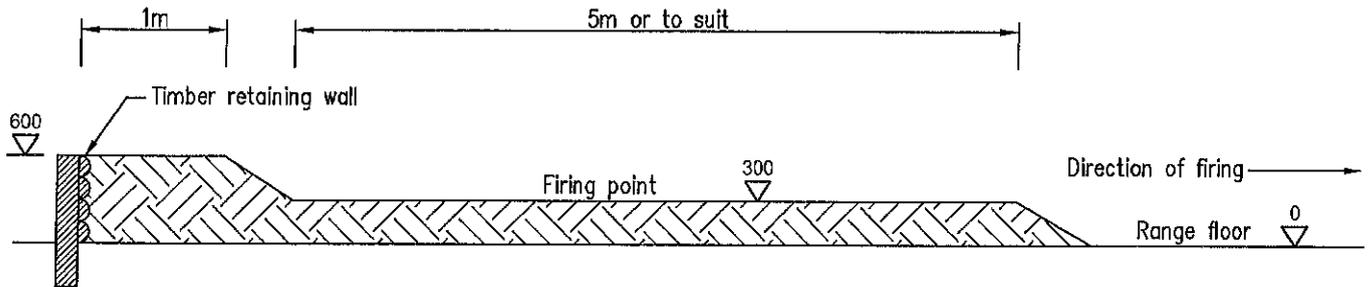


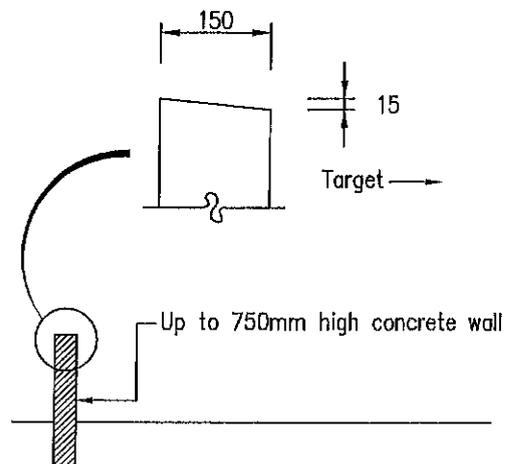
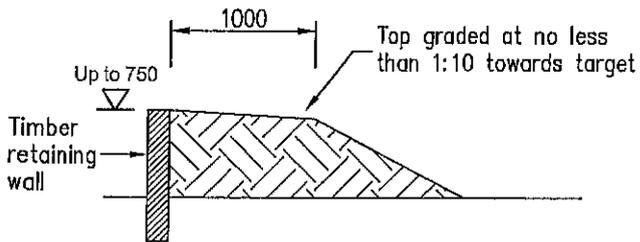
FIGURE 7.

POSSIBLE DETAILS FOR CROSS RANGE WALLS ON NРАНZ NO DANGER AREA RANGES -

Walls unlikely to be hit (out of COF).



Typical cross walls/firing points on conventional range

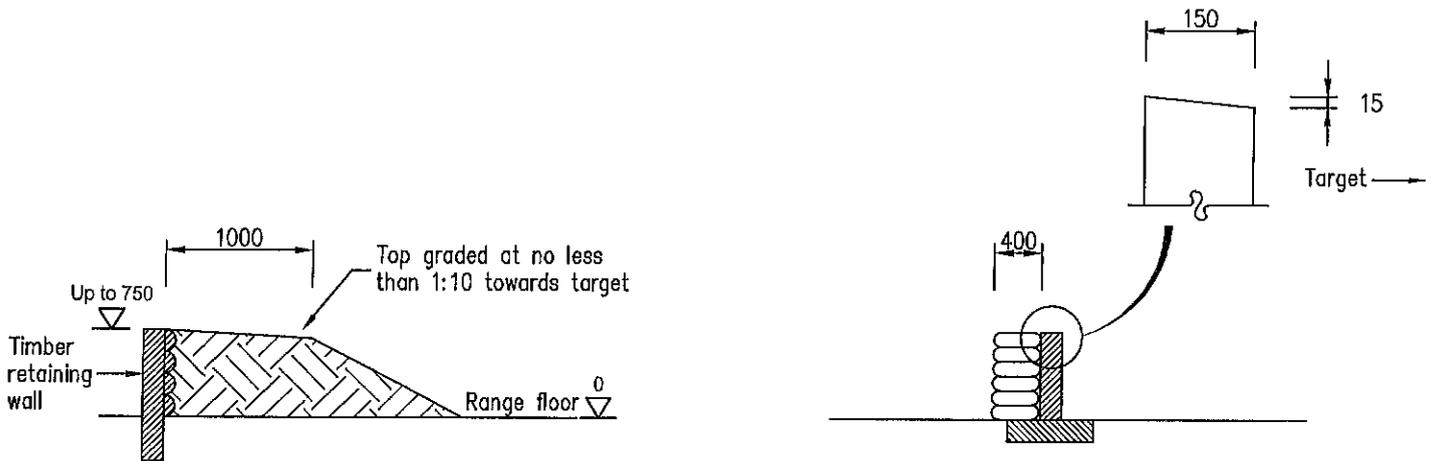


Typical cross wall details (out of COF)

FIGURE 8.

POSSIBLE DETAILS FOR CROSS RANGE WALLS ON NRANZ NO DANGER AREA RANGES -

Walls likely to be hit (within COF from a firing distance but at least 500yds from firing point).



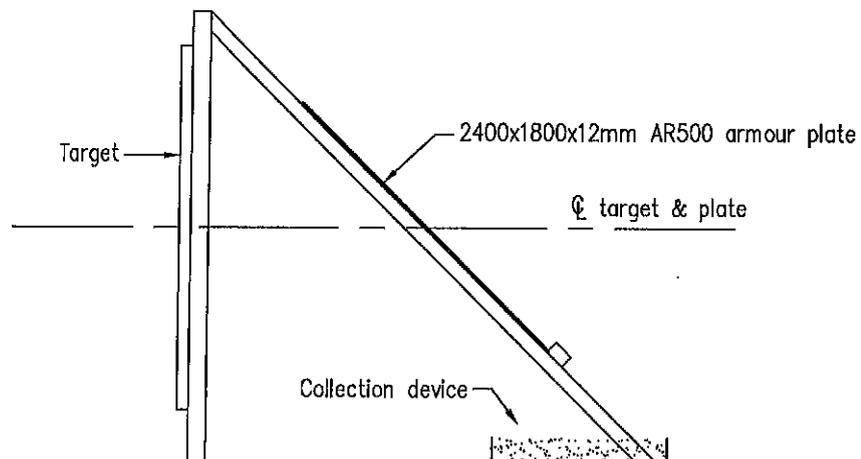
Protection may be placed in front of front of wall 1200mm wide x height of wall (600mm each side of direct line to target from firing point)

Protection options:

- At least 400mm thickness of sand bags (must be continuously maintained)
- 200mm sacrificial timber
- 6mm AR500 steel plate

BUTT STOP WALLS

- Single firing point at least 600yds away. Protect as for cross walls.



Conventional range bullet catcher