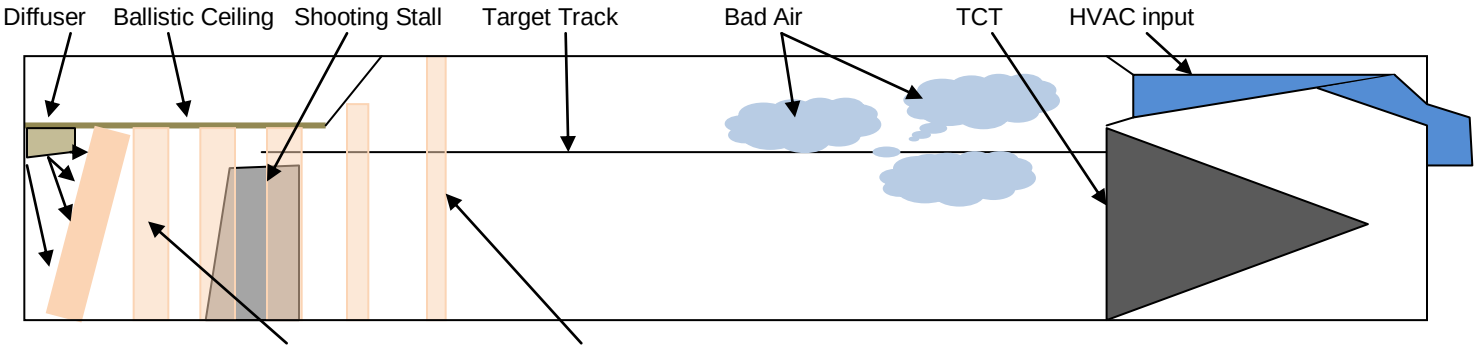
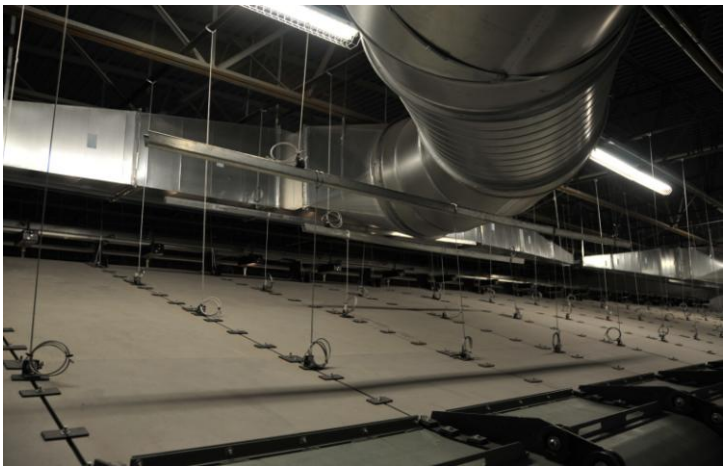
Air Handling on Indoor Range – Alternative.
Plus Information on Private Ranges

When considering building an indoor shooting range one factor is the air filtration.
This can be extremely expensive both to install and run.

Normally, you would install a filtration system, complete with HEPA filters, Carbon Filters and HVAC (heating and cooling) to condition the air within the range environment.



Diffusers create a “wall” of air that moves down the range without creating turbulence around the shooting stall.
Particulates and smoke are taken away from the shooter to the rear of the range.
The equipment to handle this can look overwhelming.



Depending upon where the range is to be built, there is the option of discharging the air without filtration, all within EPA regulations. Air is taken in at the shooter’s end, forced downrange and expelled behind the bullet trap. Certain measures have to be taken, but this provides a very cheap alternative to filtration.

Having said that, again it depends on the location of the range; in South Texas, there is minimal requirement to heat the range, but it would need cooling in summer, whereas in Minnesota there would be a requirement to heat the range during winter months.

Further, you have to look where the range is being built in relation to other buildings and residential developments. If the range is in between “Home Depot” and “Wal-Mart” in a shopping mall, it is very unlikely you can throw away the polluted air, but if the range is in an industrial park between light industries it can be possible. Likewise, having a “stand-alone” location at a freeway intersect, outside city limits, would qualify for discharging the unfiltered air..

Another consideration would be the volume of traffic. A range that is extensively used will generate more particulates….. the amount of “pollution” would be a factor EPA would evaluate to determine filtration requirements.

Let's look at a range in Texas – This is primarily a Law Enforcement Training facility without extensive use, unlike a commercial range.

The range is open to the air (sky). The general rule for such a range is "No Blue Sky", meaning that wherever a shot is taken, the shooter cannot see blue sky and as such, any misplaces projectile will stay within the confines of the range.

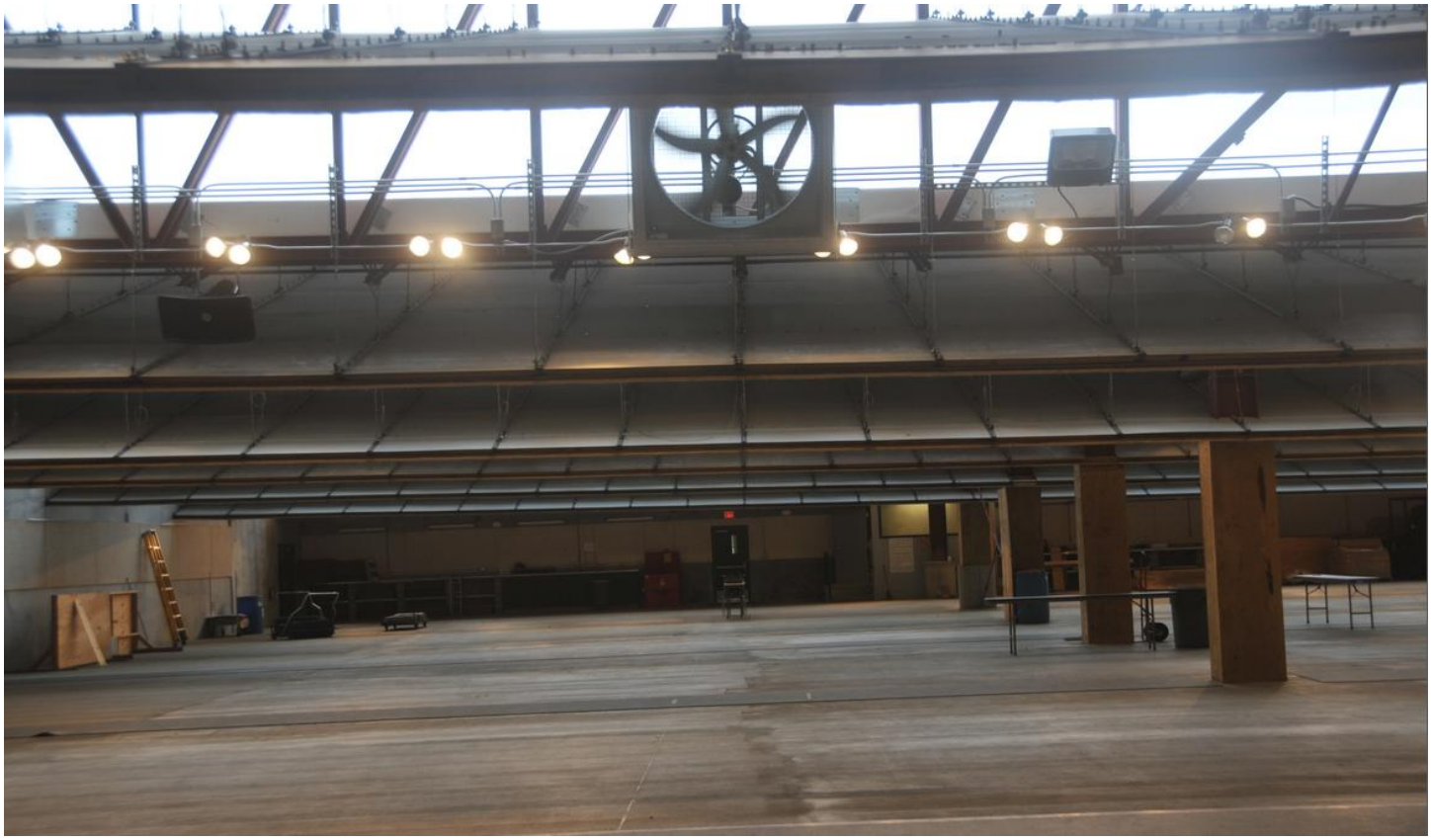
This photo is looking downrange from the shooter's position.

This photo shows looking back from "downrange" towards the rear of the range. Note the "swamp" coolers blowing air from the open area towards the rear of the range.

Another view looking towards the control room from the shooter's position.

This view shows the rear of the bullet trap with the open air section above.

Another view looking “up-range” from the bullet trap end – Note the baffle system overlap.



See below, the distance markers on the wall, 5, 10, 15, 25, 35 where shooters will stand in relation to the targets at the bullet trap end. Each position (distance) has sufficient overhead baffles to ensure a “No Blue Sky” scenario.

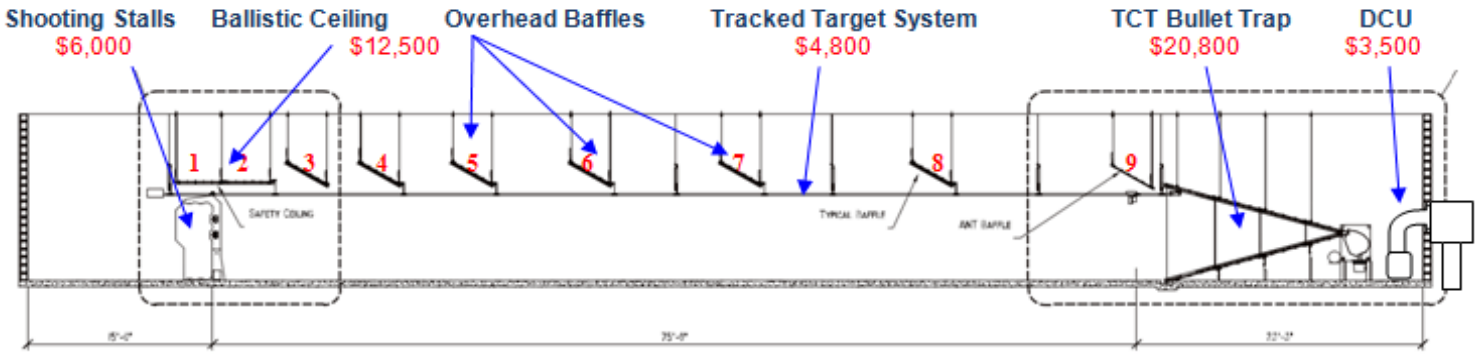
The above scenario shows an indoor / outdoor range that is open to the elements in a temperate climate. It is also possible to build an enclosed / underground range that has the same benefits.

Take a private range at a residence…. The user has two indoor shooting lanes (4' x 75') and purely uses it for personal use. He uses a rubber berm trap (least expensive) and his shooting volume is around 10,000 rounds per lane per year. This would qualify for "no filtration" and the rubber trap would need cleaning / reclaiming lead every eight to ten years. (80 – 100 thousand rounds per lane)

The same with a commercial range…. The bullet trap options may vary – Rubber Berm or Total Containment Trap (TCT). With a TCT, the range is operational 24/365 with no downtime or cleaning time, but with a rubber berm trap under heavy use, the range may have to close for 3 - 4 days every six months for lead removal and cleaning.

Let's assume we can get away without HEPA filtration. Look at the range options…. First a commercial range.

Let's take an example below….This is a Pistol Only - 25 yard 12' ceiling requiring overhead baffles and a TCT with DCU
Prices are per 5' lane



Per lane price would be: $6,000 + $12,500 + $4,800 + $20,800 + $3,500 = $47,600 per lane 10 lanes = $470,000

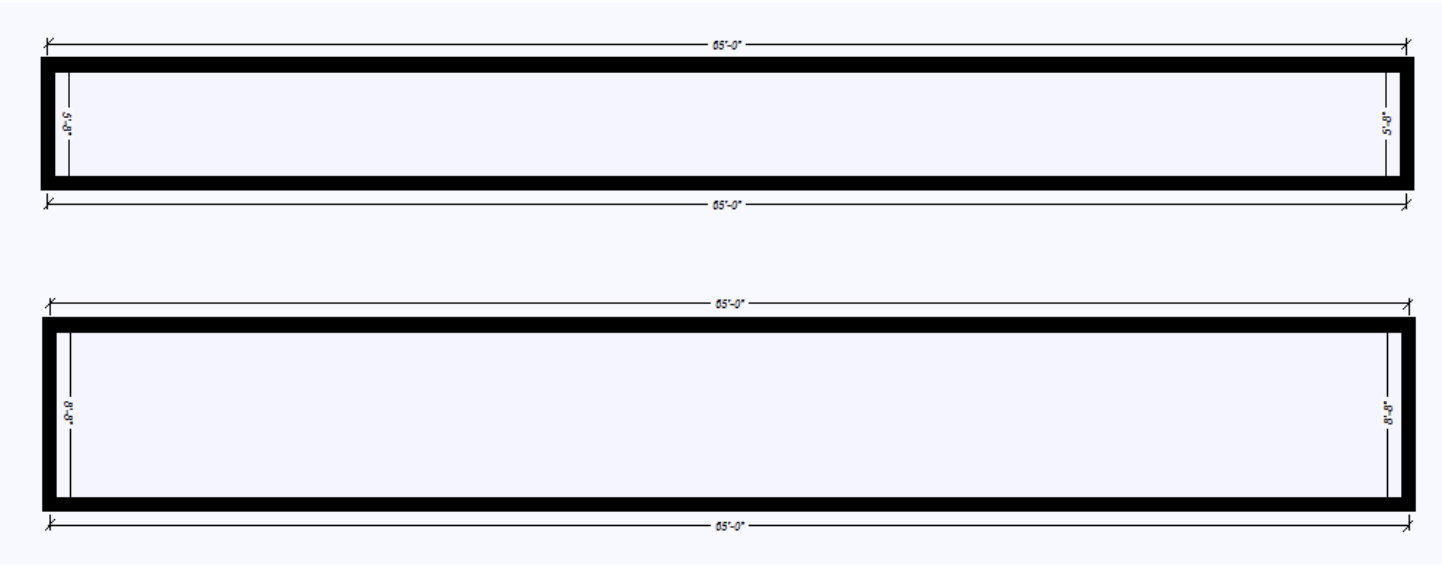
NOW…Take a minimum lane size of 4 feet wide..

Per lane price would be: **$6,000 + $10,000 + $4,800 + $16,600 + $2,800 = $40,200** per lane 10 lanes = **$402,000**

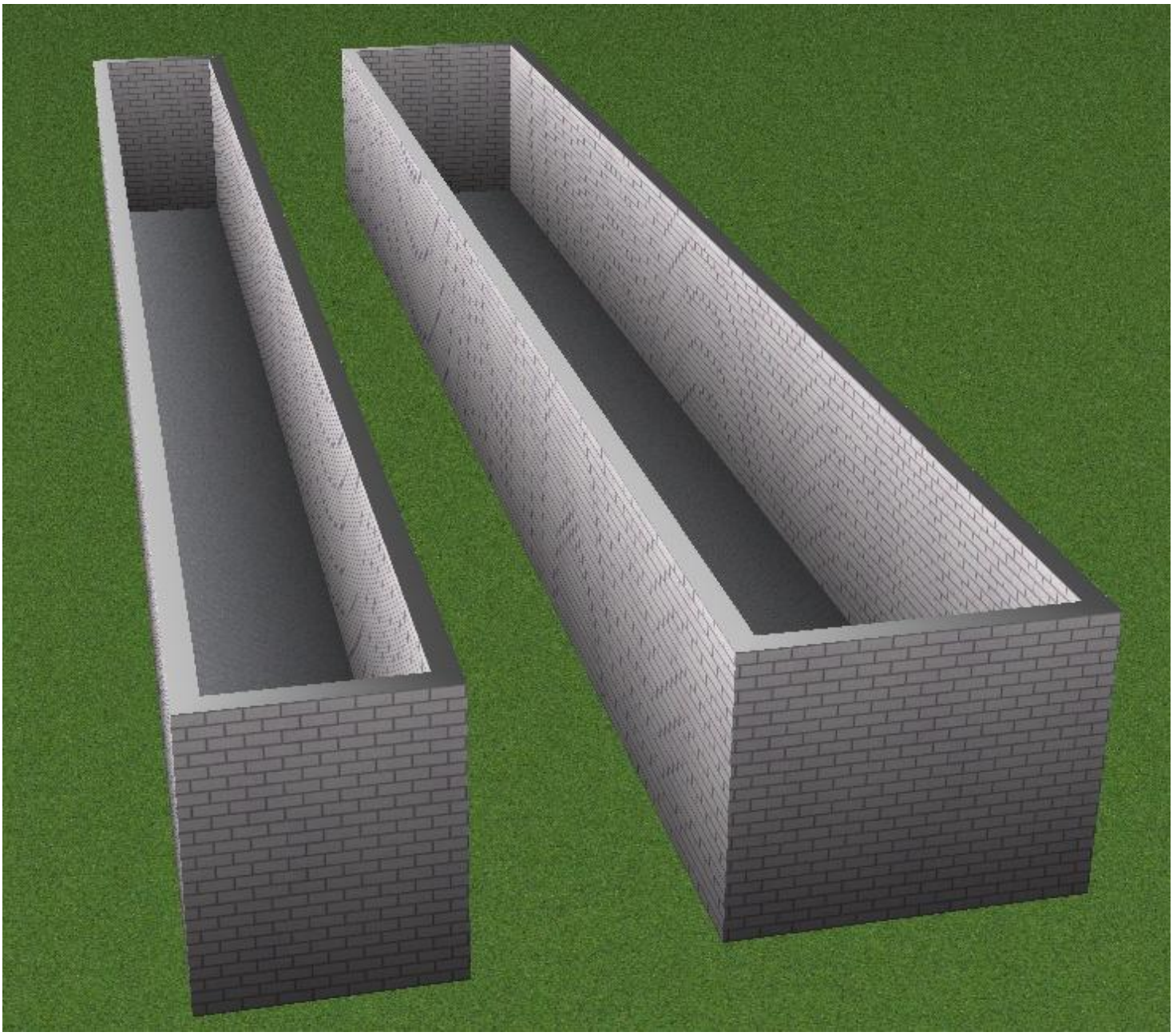
If we swap the TCT Bullet Trap and DCU for a Rubber Berm Trap, we deduct $16,600 + $2,800 and add $4,800 per lane. This would come out at $40,200 - $19,400 + $4,800 = $25,600 per lane …… 10 lanes = **$256,000**
Further…. If we have a concrete roof, we can further reduce the price by possibly removing baffles 4 – 7. This would reduce the per lane price by $4,400 … 10 lanes would be $44,000 lowering our cost to **$216,000**
Further… With a concrete roof it's possible to remove the ballistic ceiling and baffle 3 – This would reduce the per lane price by $3,300 …. 10 lanes would be $33,000 lowering our cost to **$183,000**

These prices are guidelines only and a lot would depend on the quality of the building, the roof composition, roof height and anticipated throughput, etc. **(See section at end Appendix 1)**

Now look at a private, residential range…. Two options – One lane 5' wide or two lanes 4' wide both 65' long.



We can use a rubber berm bullet trap at $1500 per linear foot and the overhead target retriever at $5000 each. If we have two lanes (2nd option) then we would possibly need a shooting stall divider between the two shooters (8' x 5' armor) at $1500. (Note: this is purely a sheet of armor steel – no frills). If we wanted an aesthetically nice shooting area we would install a textured armor divider, with two blanks – one on each wall, together with shooting benches / tables, and ceilings with lights - this would be around $9,800)



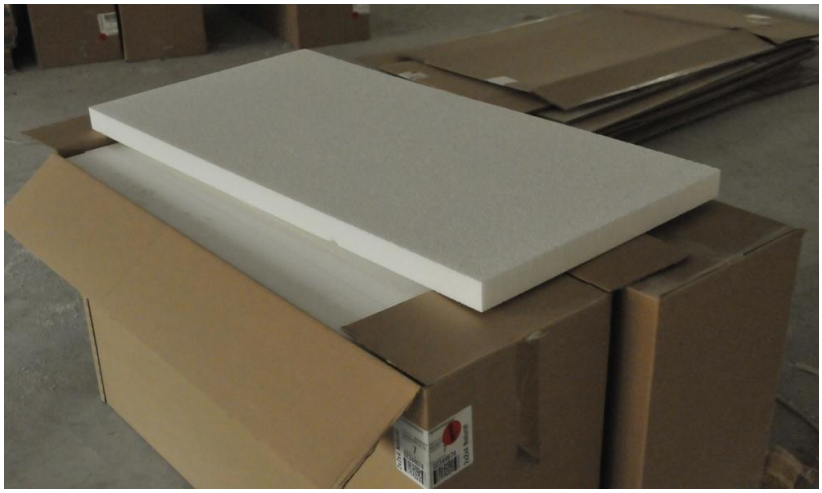
The "problem" with a one lane range is the ratio of width to the length. It can be claustrophobic. The ranges above have a target distance of 45' (15 yards). A normal range has a target distance of 25 yards. If we had a single lane range with that target length it would be uncomfortable to shoot in.
BUT. For home use a short range is fine. Usually installed so the family can practice and become familiar and proficient with their firearms a home range target distance can be 12 – 15 yards. Most handgun practice at commercial ranges have targets set at 15 and 25 feet, the maximum distance you would encounter an intruder in your home. So, for home defense practice, 12 yards (36') is adequate.

So, from the above figures, pricing would be :
Single lane = **$12,500** and a Two lane = **$23,500** with standard divider or **$31,800** with classic divider.

Add to this some very important sound insulation – the noise in a small range would be deafening.

SOUND INSULLATION

2" White PEPP (VRC .70) – Approximately $8.00 per square foot.



This material is far cheaper than the specialized sound absorption material designed specifically for shooting ranges.
It works just as well.

For the ranges in Abu Dhabi we installed over 16,000 square feet for internal and external surfaces.

Here we can see all the surfaces at the shooting booths of the high power rifle range completely covered with PEPP, the noise cancelling is tremendous.

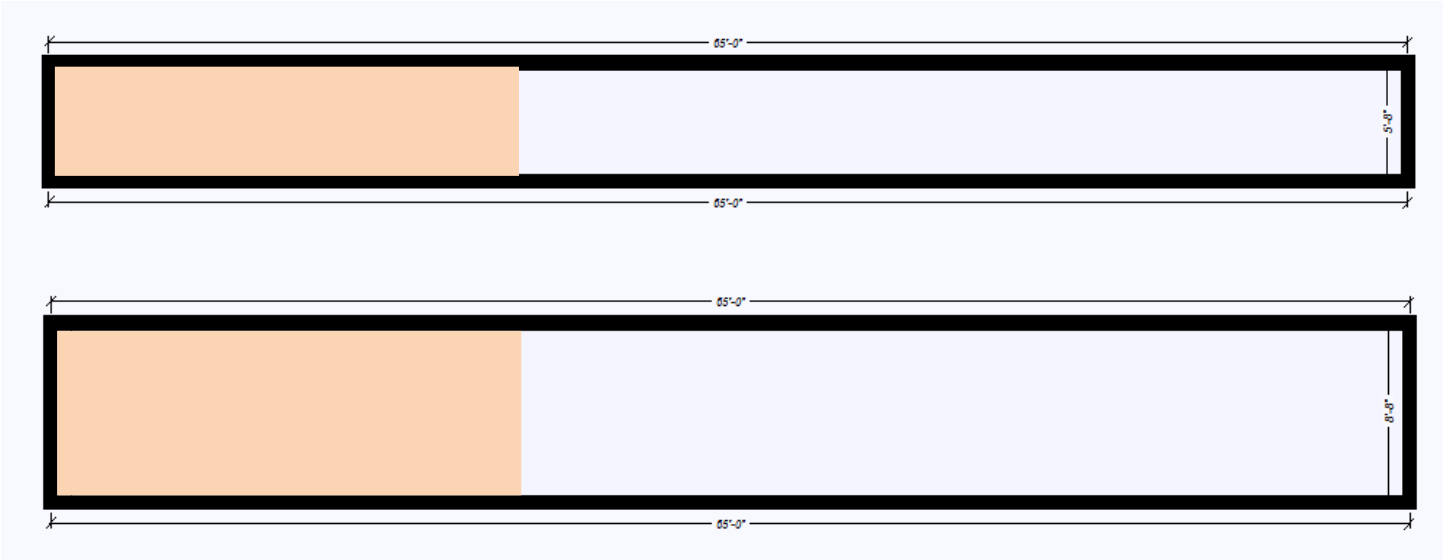
Side and rear walls are covered with PEPP then painted.

Below is the 300 meter range. These are the fronts of the shooting booths shown on the previous page. Note the side walls and overhead baffles are also covered with PEPP.

The sound insulation does not have to cover all walls. The immediate sides, rear and ceiling should be covered, but we only need to go a third of the way down the range.

So for our two ranges we would require

Single Range 5’:			Double Range 8’:		
Rear wall	40 sq.ft.	)	64 sq.ft	)	
Sides	320 sq.ft.	) 460 sq.ft.	320 sq.ft.	)	544 sq.ft.
Ceiling	100 sq.ft	)	160 sq.ft.	)	



Cost for insulation would be around $3700 or $4400

Conclusion for private home range:

5’ x 65’	**$12,500 (Equipment)**	**$3,700 (Sound)**	**<u>$16,200</u>**	**plus building and airflow.**
8’ x 65’	**$23,500 (Equipment)**	**$4,400 (Sound)**	**<u>$27,900</u>**	**plus building and airflow.**
or	**$31,800 (Equipment)**	**$4,400 (Sound)**	**$36,200**	**plus building and airflow.**

Note: The above prices are basically the same regardless of range length be it 45’, 55’ 65’ or 75’

See Appendix 2 for some further explanation……

Appendix 1:

An indoor range can be configured without protective baffles. Under normal circumstances a range would have air conditioning / air filtration ducting running back along the range ceiling as shown below.
Here we see the twin return ducts taking air back towards the shooter's end.

A better picture is shown here with the twin ducts running back from the bullet trap end.

These ducts need to be protected against projectile penetration. Also note, the concrete cross beams as part of the roof design. Even if the ducting were outside, the beams would pose a ricochet problem. (This roof was designed knowing ducting would be inside, and cross beams were incorporated to support the upper floors over the 50 foot span.)

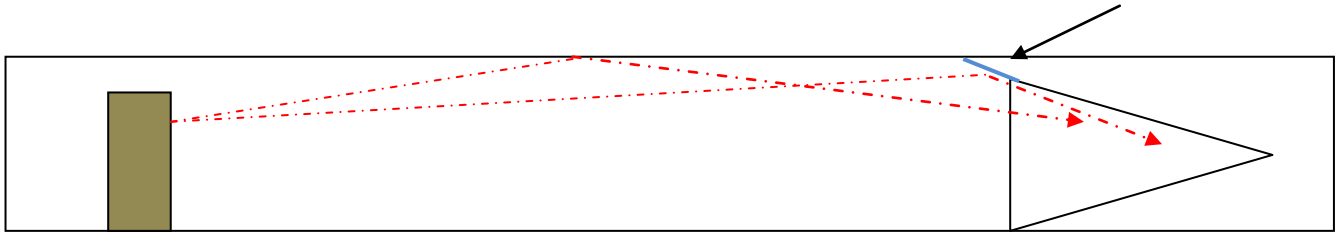
Another view of the air handling behind the bullet trap (not yet installed) showing the ducting coming back inside the roof.

Here we can see the protective baffles being installed below the ducting.

Another view of the baffles strung below the ducting. These baffles are required because the ducting is inside the building. If the ducting could be routed outside, or in an alley way adjoining the range, then we would not need the baffles.

OK…. If we can remove the ducting and get all cabling etc outside the range, then we can do away with the baffle system…. BUT…. We must have a ballistic ceiling.

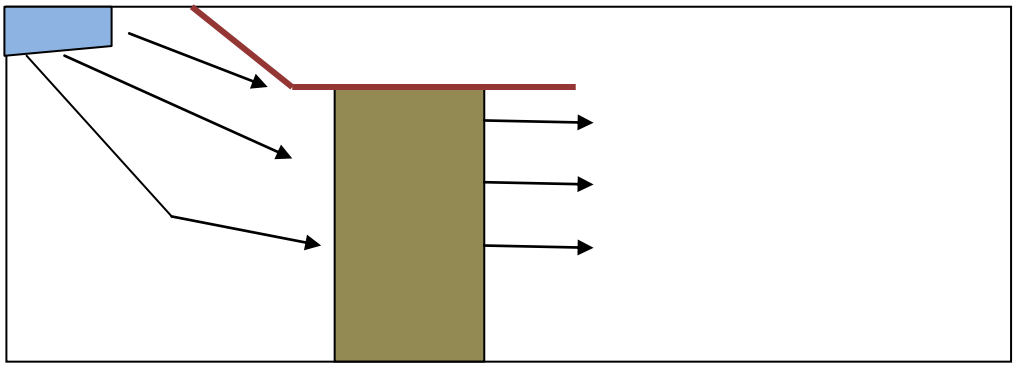
1) First: Six inches thick, reinforced concrete, or concrete beams.
2) Smooth ceiling – no overlaps or steps with potential for backwards ricochet.
3) Light fittings… Protected by 25 – 45 degree plates.
4) No electrical cables
5) Correct height for feed into bullet trap (i.e. no clearance above trap for projectiles to escape.)



Ballistic ceiling:

Main purpose is to prevent missfires going through roof. .

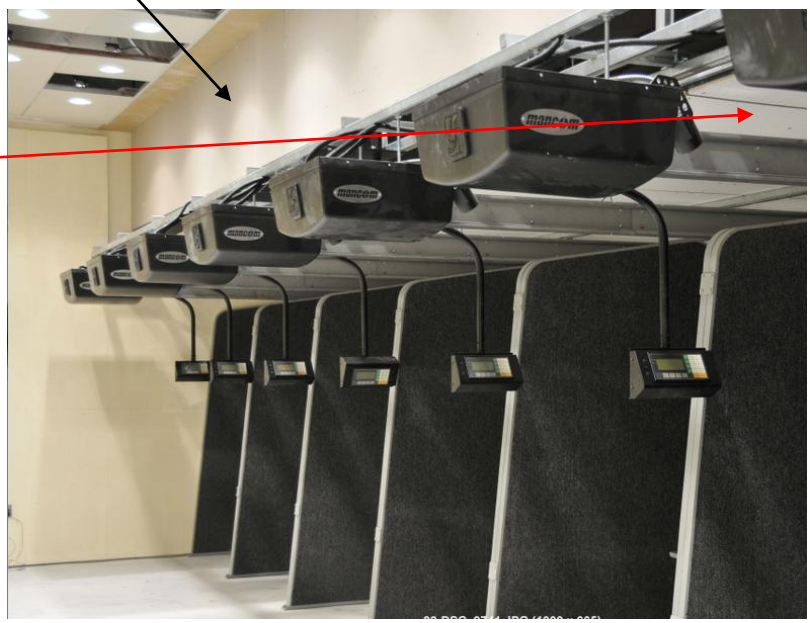
The ballistic ceiling also acts as part of the air handling system; forming a plenum to direct the air downrange.

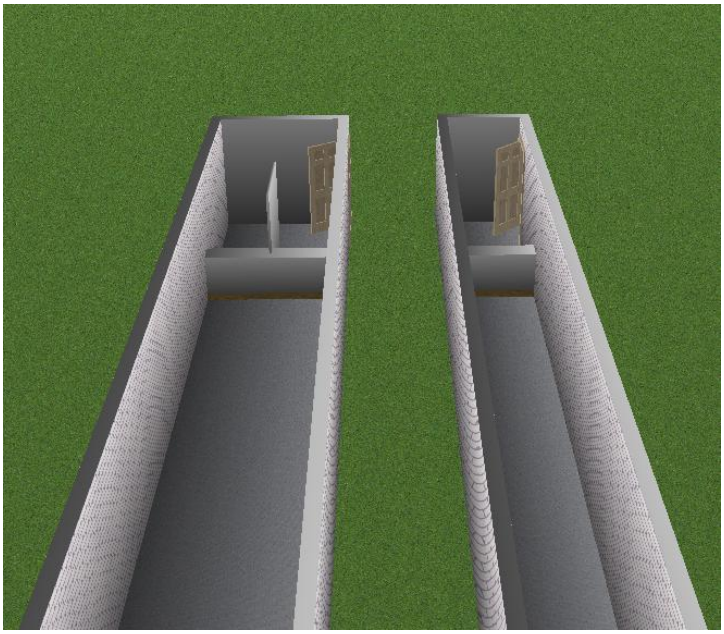


If the roof was smooth ballistic concrete then the “ballistic” ceiling could be easily made from ¾” plywood and splatter from errant shots could be contained within the plenum created by the plywood.

Shown below is a typical shooting booth showing the rear vertical wall (above the target retriever).

The ballistic ceiling is installed above the shooting stalls.



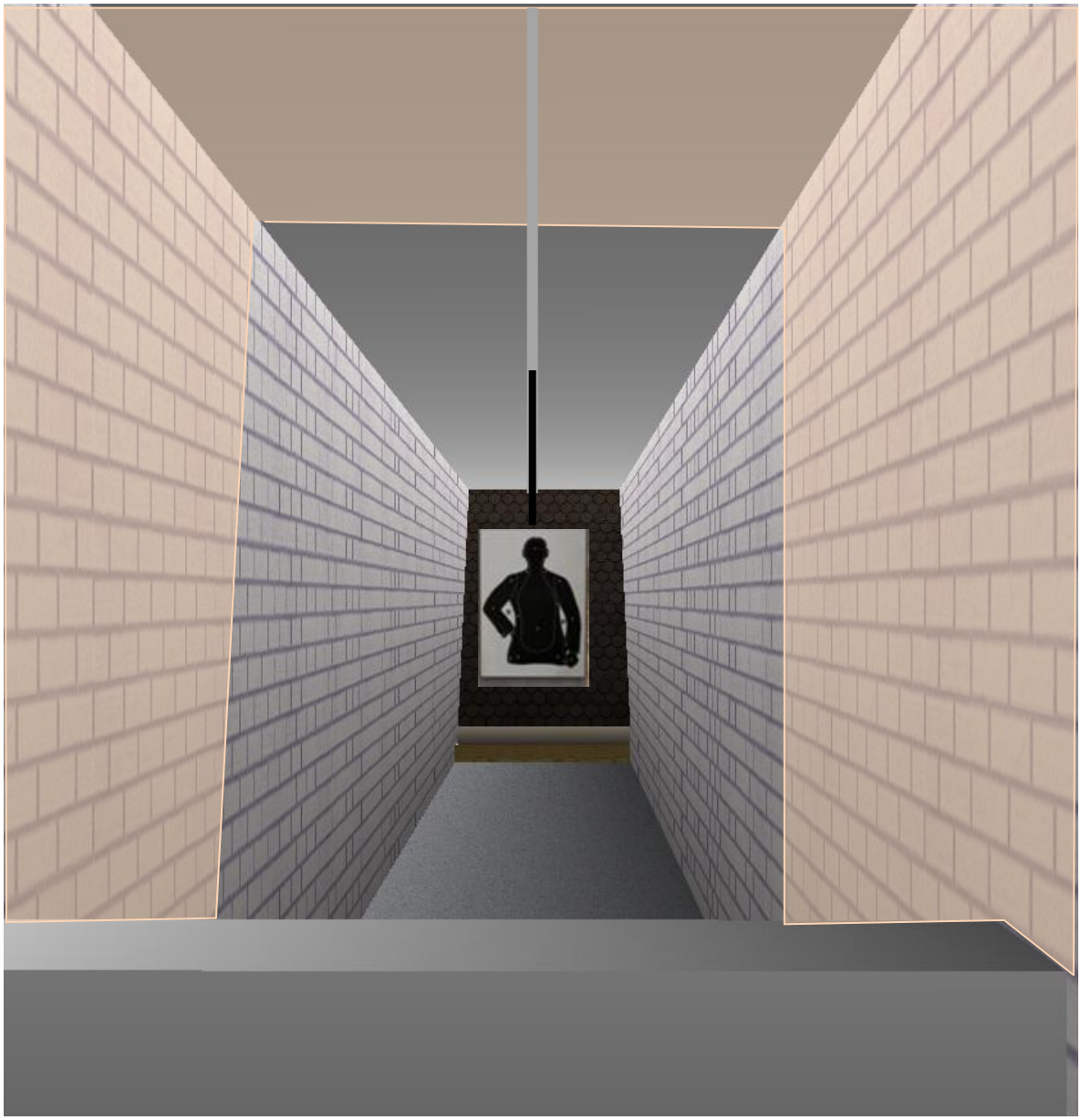


APPENDIX 2:
The photo to the left shows the two private ranges. Far left is the two lanes with divider.

Both ranges have a shooting table 10' from the rear wall.

Shooters should be standing in this position to allow air to "mass" behind them and sweep pass them and downrange. This carries the particulates and smoke away from breathing and settling on clothes.

Single lane, 5' wide with single overhead target retriever with Rubber Berm bullet trap at rear.
This setup needs to be relatively short so as not to be too claustrophobic. Soundproofing shown in pink – 1/3rd of the range, plus the rear wall.



Two lanes at 4' wide with divider. Twin overhead target retriever systems with Rubber Berm bullet trap at rear. This range can be longer as the cramped feeling from a single lane is not so pronounced.

The pink shaded area shows the extent of the soundproofing

This wider range has a "nicer" feel to it.

Note: A rubber berm trap takes 11' from the rear wall. So, to give a 36' shooting range, you'll need 36' plus 11' (trap) plus 10' (shooting position) = 57'

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