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Reference
Indoor shooting range – Düsseldorf

Safety and Exclusivity

Figure 1: Indoor shooting range – Düsseldorf police force

Indoor shooting range – Düsseldorf police force

Shooting with small arms in indoor areas, such as official shooting ranges for police and security services, together with public shooting clubs, causes health threatening pollution of the range and the breathable air. In addition to the particulate wear of the guns and ammunition, discharge of the weapons creates gases, powder fumes and metal dusts which are harmful to the human body.

These hazardous substances must be removed from the areas occupied by the shooters, trainers and supervisors, particularly where they stand, but without causing turbulence or backflow. Critical for the room air contamination are the number of shots to be fired in a known time period, the type of ammunition to be used and the dimensions of the range.

With a displacement ventilation system (using plug flow), fresh air is supplied from behind the shooter. This causes the hazardous airborne substances to be transported away from the occupied zone, where people are breathing, towards the end of the shooting range. From the end of the shooting range the polluted air is removed using shot proof exhaust openings and is filtered before being returned to the environment.

The design aim is to generate an even air flow with a velocity ranging from 0.25 m/s to 0.33m/s. Care is also taken to consider the acoustic stresses caused by the sound reflection of the primarily metal elements in the construction.

Strulik displacement ventilation systems for indoor shooting ranges and/or partially covered installations are individually designed and optimised to meet all the requirements for a specific project.

Figure 2: Target practice in the indoor shooting range

Optimum environment

The Düsseldorf police enclosed shooting range provides an optimised training environment for more than 2000 police and security officers belonging to the criminal investigation department. This includes training in shooting with small arms, together with take down methods and tactics.

A total of three separate shooting ranges, each equipped with highly modern technology are used in a two shift operation covering the most diverse applications.

"Blue-box" rooms and computer simulations can be used to represent various scenarios. Fog machines and lighting effects offer further enhancement to reflect real-life situations.

Figure 3: 180 degree shooting range

The 35 metre shooting range is of particular interest. This very large and elongated room makes it possible to hold target practice against a 180 degree backdrop.

Optimised room ventilation

All of the shooting ranges are supplied with outside air controlled by a Strulik supply air system. The individual ceiling high diffuser elements of the system are specially designed for the project to ensure optimum displacement air ventilation in the form of piston flow through each range.

The supply air flows through the shooting range in the direction of fire at a constant preset speed towards the end of the gallery. It flows around the shooters without them feeling a draught.

During exercises beginning at the 3.6 m firing zone at the end of the range, the shooters move backwards in the direction of the air diffuser elements and therefore against the airflow. This ensures that, even for fast movements, all the personnel in the shooting range are always located in an unpolluted area. An additional consideration on these primarily unheated spaces is the temperature difference between the indoor and outdoor air. When fresh supply air is provided in any system, care must be taken in the design, to make sure that a space does not cool down or heat up to an undesirable level.

The issue of energy loss and the temperature difference of inside and outside air are not ignored as these are balanced and recovered using heat exchangers which are installed as part of the system supplying each of the ranges.

For the large shooting range (35 m) the considerable depth and width mean that an air volume of 1200 cubic metres must be moved and completely replaced at the specified air velocity.

Figure 4: Supply ventilation details

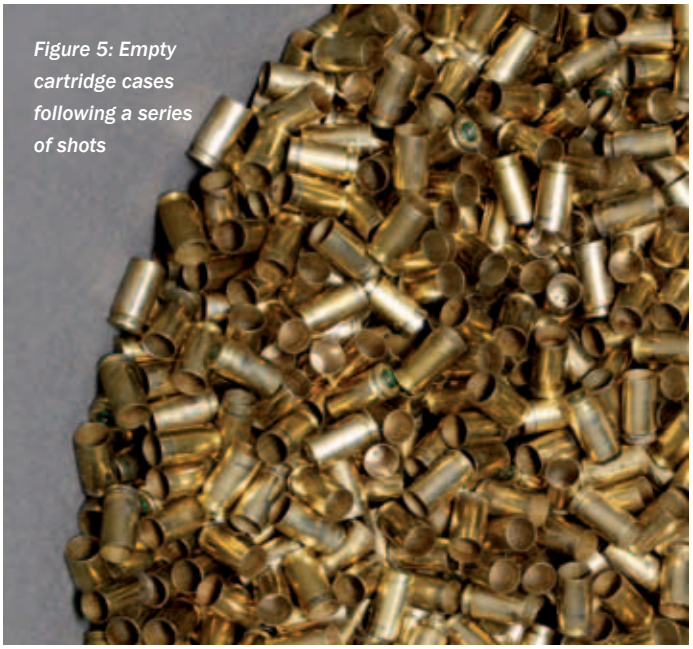

Figure 5: Empty cartridge cases following a series of shots

Indoor shooting ranges – "Something in the air"

If a maximum expected shot rate is used to give an empirical value for the room air contamination, it can soon be determined that several hundred litres of pollutant gases and particulate matter can form in a short time from a simple firing sequence.

The high utilisation rate of the shooting ranges and the fast consecutive target practice sessions generate heavy air pollution and therefore they must be expected and dealt with. This will include lead amongst other metal particulates, together with gases from the propellants. These are transported away from the shooters and other personnel in the occupied breathable air zone at a constant flow velocity of 5 m/s.

Important criteria for the design of a supply air system for enclosed shooting ranges

- **Weapons with cartridge ammunition**
  - Type of cartridge ammunition used
  - Front-loader weapons
- **Room size**
- **Firing sequence**
  - Firing frequency
  - Stationary shooting
  - Shooting while in motion
- **Commercial or non-commercial use**
  - Workplace guidelines
  - Shooting range guidelines
  - Requirements of the employers' liability insurance association
  - Environmental regulations: (BimSchG), TA Luft, TA Lärm, German Closed Substance Cycle and Waste Management Act (KrWG)
  - Building regulations
  - Energy saving ordinance (EnEV)
  - Room temperatures
  - Sound insulation and absorption

Assurance:

Fundamental knowledge and proven practical experience of the implementation and operation of supply and exhaust air systems for shooting ranges form the basis of all Strulik project designs.

Our vast number of reference design projects demonstrates the different applications, individual planning challenges and solutions that each indoor shooting range requires.

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