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CHAPTER 4

ANCILLARY ROOMS

4.1 Rooms for Sport

4.1.1 AREA, ROOM SCHEDULE, FURNISHING AND EQUIPMENT

If possible, the ancillary rooms for sports participants should always be arranged at the same level as the sports areas. If differences in levels cannot be avoided, stairs should be installed or, where differences in level are small, ramps.

National and local building regulations must be observed. This applies, above all, where aspects of safety and the interests of disabled persons, are concerned.

Air-conditioning or mechanical ventilation systems are needed in all rooms without sufficient natural ventilation.

All energy-saving measures and, in particular, heat recovery from the outgoing air of ventilation systems and shower water, should be investigated with a view to efficient operation.

Water-saving measures including dual-flush toilets, low flow efficient shower heads and spring-loaded taps should be considered even if they are not mandated by local regulations. Roof water may be collected in water tanks for flushing toilets.

All floor coverings should be resistant to abrasion, easy to clean and anti-slip. Walls should generally be designed shockproof, smooth and easy to clean.

In wet areas, floors and walls must be waterproof up to a minimum height of 2m and furnished with a water-resistant surface. Windows in changing and shower rooms etc. should not permit any view into these rooms from the outside. Ceilings should be resistant, for example to balls and, if possible, sound absorbing.

Wall and ceiling lights must be protected against damage and in wet areas against water spray and humidity.

Entrance Area

Behind the entrance doors, special dirt removing mats should be installed. Signposts and information boards to guide sports participants and visitors are essential. A generously sized notice board will enable information provision on matters of current interest.

Corridors

Corridors must be at least 1.20m wide and for wheelchairs not less than 1.50m. A clear line of direction should be established. In addition information boards and signposts should facilitate the orientation of the visitor.

For ventilation systems, a fresh air capacity of 25m³ to 30m³ is needed per person per hour.

Further Advice

If sports halls, gymnastics rooms or suchlike are to be integrated into the facility, the IAKS Principles of Planning for Sports halls are generally applicable.

4.1.1.1 Rooms for Athletes and Coaches

Equipping sport grounds and stadia with ancillary rooms, such as showers, washrooms and toilets, must be based on the needs of the user and therefore may have to satisfy very different requirements. On the one hand there are the minimum requirements for school, leisure and mass participation sport which have to be realised with limited funds, and, on the other hand, there are the demands of top-level sport for rooms, area requirements per athlete and equipment which may require a high degree of comfort.

The following area and room schedule is primarily concerned with the minimum of space, but also gives an indication for higher standards. Consider using rooms at competitions which are normally used for other purposes. Temporary structures can be used to augment the permanent facilities for major competitions.

Space requirements of wheelchair athletes have to be taken into account in accordance with national regulations. Amount of space should be provided in accordance with appropriate demand.

The size of the foyer and reception area for this category of users depends on the number of persons using the rooms in this area. The foyer size is usually calculated on the basis of 15m² per 30 users. This is supplemented by a reception room with counter, 10m² to 15m² in size, a women's toilet (1 lavatory, 1 washbasin) and a men's toilet (1 lavatory, 1 urinal, 1 washbasin).

4.1.1.1.1 Changing Rooms

The type of use of a sports area (number of users, mode of operation, sequence of use) determines the necessary number, size and equipment of the changing and sanitary areas and rooms. This use can only be efficient if the structure of the changing area permits a continuous sequence of sports times (time available to the user on the sports area for his sports activity which is usually governed by a timetable). This inevitably means that sports time is dependent on changing time (time available to the user in the changing and sanitary area for changing and showering / dressing after his sports activity – usually three periods of 15 minutes each) and clothes position time (time in which the clothes of the user occupy a clothes position – preferably in a closed clothes locker) and, to be cost-effective, needs the following system of utilisation.

For an athletics facility with a large field enclosed by the track, this type of utilisation demands at least 4 changing rooms, each of which is equipped with a clothes locker (0.33m wide, 0.50m deep and 1.80m high) per changing position. If the sports time is equal to or longer than the changing time, (usually 45 minutes) the sports areas can be used continuously. This ensures the full utilisation of the sports areas.

A bench length of at least 0.66m and a width of 0.50m must be provided per sports participant. The minimum distance between benches on opposite sides of the

room and between bench and wall is 1.50m. A distance of 1.80m will allow greater freedom of movement for faster changing. Changing room benches should be easy to clean and designed with as few floor supports as possible. Clothes hooks should be recessed to avoid accidents. The furnishings comprise wall mirrors with shelves. Hairdryers and safe deposits for valuables may be considered.

Elements of the changing room:

Changing Positions

As a portion of a changing bench: 0.66m wide (reducible to 0.40m for school sports use) and 0.50m deep with a 0.75m deep changing zone in front of the bench.

Clothes position in the form of a clothes locker: 0.33m wide, 0.50m deep and 1.80m tall (in cold and temperate regions, preferably single-door; in general two-door, 0.90m each).

Clothes positions are also possible in the form of clothes pegs (0.66m wide with double pegs). Since the changing room cannot then be put to variable use and because of the lack of protection from theft, this provision frequently adopted for school sports is not recommended.

The number of changing positions depends on the number of simultaneous users of the athletics facility. At multifunctional sports facilities (athletics facilities combined with pitches), the largest user group in each case is decisive, and in team sports both teams must always be provided for. (See 4.1.2.3 with 4 planning examples, offering 12, 18, 24 or 36 changing positions per changing room.)

Traffic Area

Between changing zone and changing zone or changing zone and clothes locker or wall: at least 0.75m. (In the access area of the changing room, a screen is necessary.)

Massage Area

At sports facilities for high-performance and top-level sports, 1 massage area (2.40m x 1.80m) is recommended in each changing room or in an adjoining room. This room is furnished with massage bed(s), stools, cupboard for massage utensils and laundry, clothes cupboard and hooks.

A washbasin may also be needed.

Electrical fittings comprise 2 double sockets for each bed for massage and therapy equipment.

Massage beds must be accessible from 3 sides. The distance between beds is 1.20m.

4.1.1.1.2 Showers / Toilets

As part of changing time (4.1.1.1.1), the sanitary area is always used after sports time. If this area can be assigned alternately to each changing room, one sanitary area is sufficient for 2 changing rooms.

Elements of the sanitary area:

Shower Positions

Open rows of showers: 0.80m wide and 0.80m deep.

Open rows of showers with splash screens: 0.95m wide and 0.80m deep.

Open rows of showers with privacy partitions: 0.95m wide and 1.40m deep.

The distance between shower heads is at least 0.80m. Only slanted showers with non-adjustable shower heads 1.80m above the floor level should be used.

An automatic cut-off to limit the duration of the shower is recommended.

Number of Shower Positions, Washbasins and Toilets

At least 1 shower position per 2.5 changing positions.

At least 1 WC per 20 shower positions.

At least 1 washbasin per 2 shower positions.

(The 4 planning examples mentioned in Section 4.1.1.1.1 and published in Section 4.1.2.3 are based on these figures.)

Washing Positions

0.60m wide and 0.80m deep.

In the washbasin area, the distance between the taps is at least 0.60m; installation height above floor level 0.75m.

Further advice relevant to installation:

- Safety thermostat to limit temperature
- Tap with hose connection for cleaning the room
- Water treatment system for therapy pool as required
- Shelves and boards for soap and other washing utensils must be suitably placed

Basis of calculation for hot water supply:

- Withdrawal temperature of hot water maximum 40°C
- Water consumption per shower 10 litres per minute
- Duration of shower per person 4 minutes
- Heating up period for hot water preparation: for school operation 50 minutes, for team sports 100 minutes
- Hot water storage temperature maximum 50°C

The floor of the shower room has the same design as that of the drying area. For ventilation systems, a fresh air capacity of 25 to 30m³ is required per person per hour.

To avoid the moist air passing into the changing room and then outside, the ventilation system in the drying and shower area should be operated on low pressure.

Electrical switches and sockets must be placed outside the shower room.

Drying Area

In terms of its characteristics, the drying area is a wet area. Accordingly, it is usually open towards the shower room, opposite the changing room separated by a door.

The floor covering should be designed such that no water can flow into the adjoining rooms (tub-like floor design, 2% slope, floor drains). Plastic or rubber gratings are recommended in this area. Wooden gratings are not suitable for reasons of hygiene.

Walls must be fitted with robust hand towel hooks or rails and shelves or boards for depositing washing utensils.

Toilets

WC: 0.90m wide and 1.20m deep (doors opening outwards) or 1.40m deep (doors opening inwards)

Slab urinal: 0.50m x 0.60m

Bowl urinal: 0.75m x 0.80m

Washbasin: 0.60m x 0.80m

For reasons of hygiene, toilets should be accessible from the changing room and not from the drying area of the shower room.

To facilitate room cleaning, wall-mounted water closets are recommended.

In addition to the washbasin, roll-shaped holders, clothes hooks, hand towel holders, paper towels or electrical hand-dryers are desirable.

Traffic Area

Between shower positions or between washing positions: at least 1.10m.

All other traffic areas at least 1.00m wide.

Therapy Pool

If supplied, a space requirement of 2.00m x 0.60m per user should be provided. The beds (with head supports) should be 0.60m beneath the surface of the water. Resting areas with deck chairs should be 2.50m x 1.00m per user; passage areas at least 1.20m wide.

4.1.1.1.3 Rooms for Coaches

2 rooms, approximately 20 m² area, each including shower, toilet, washbasin and 1 to 3 lockers for 1 to 3 coaches. These rooms, which are located close to the changing rooms of the sports participants, should be furnished with a desk, 1 to 3 chairs, filing cabinet, lockers, notice board and clothes hooks. A socket for room cleaning and for a computer should be provided. Switchboard units may also be considered. For details of shower and toilet, see the respective data given in this Section.

4.1.1.1.4 Call Room

Sports facilities used for athletics competitions must be furnished with control areas in which athletes assemble to await their call. The area requirement is determined and specified on site based on the number of sports participants. Generally, one can expect athletes for up to 3 different events (for example Long Jump, Shot Put, 110m Hurdles) at the same time. The space required should be calculated on the basis of 1.2m² per athlete therefore the Call Room should be 80 m² area.

4.1.1.1.5 Room for Victory Ceremony Preparation

Seating, exercise space and make-up room for up to 12 athletes, 8 protocol persons and 2 officials. Changing area for protocol persons is advisable. Room size between 30m² and 45m².

4.1.1.1.6 Weight Training Room

Modern athletics training systems recommend the use of weight lifting and other body building devices. A weight training facility can range from a relatively small room (approximately 24m²) to a fairly large hall (approximately 240m²). Its equipment may range from a common weight lifting platform to specialised training machines and up to 12-station training machines. (See also 8.5.2)

The type of apparatus for heavy exercise must be decided upon at an early stage. The access (door or gate) must be sufficiently large to allow all equipment to be moved in and out.

For the floor, either a cross-grained wooden or polyurethane covering on cast asphalt or a very durable PVC surface is advised.

The equipment consists of freestanding and wall-mounted weight training machines, wall bars and hand apparatus.

If heavy dumbbells are available for free use, part of the floor area must be fitted with additional protective surface.

For ventilation systems, a fresh air capacity of at least 30m³ is needed per person per hour.

4.1.1.1.7 Sauna / Relaxation Area

The use of a sauna by an athlete after athletics training has a positive effect on his stressed muscles and on his general well-being. The functional sequence of the sauna bath (changing - cleansing - sauna dry steam - chilled water shower or dive - warm up - drying) should strictly be observed in layout of rooms and in actual use (Table 4.1.1.1.7).

Room	Size m ²	Equipment Installation
Changing Room	min. 8	Benches, lockers
Shower / Drying-up Room	min. 5	Shower, hooks shelf
Sauna Chamber	min. 6 max. 12	Heating unit ("Oven"), Benches
Cooling down Area	min. 10	Showers, cold water plunge bath
Rest Room	min. 10	Lounges
Outdoor Relaxation Area	min. 15	Lounges, benches

Table 4.1.1.1.7 - Size of, and installations in, saunas

4.1.1.2 Rooms for Officials

4.1.1.2.1 Changing Rooms for Judges and Referees

Judges

2.50m² each for 30 or less judges.

2m² for more than 30 judges each and 1m² each for over 50 judges.

Including adequate locker space; minimum 2 showers, 2 washbasins and 1 toilet cubicle for women and 1 for men.

The furniture of this room comprises 1 working desk and 2 chairs per 5 judges, 1 locker per official and clothes hooks. (Shower and toilet as above.)

Referees

1 room, approximately 20 m², including shower and toilet, as changing and lounge area for referees and linesmen during team sport competitions. For events at which at least two competitions are consecutive without a break or for competitions controlled by male and female referees, a further room of similar type is required in rotation for the subsequent team of referees and linesmen.

The furniture for this room comprises a working desk, 3 chairs, 3 lockers and clothes hooks. (Shower and toilet as above.)

4.1.1.2.2 Showers / Toilets

At least 5m² of sanitary zone for 5 judges (at least 1 shower position and 1 toilet with washbasin) up to maximum of 20m² for 20 officials (at least 2 shower positions and 2 toilets with washbasin).

4.1.1.2.3 Meeting Room

Stadia, at which important athletics competitions are staged, must have an adequate room for meetings of competition officials. This room can be used at other times for teaching purposes.

4.1.1.3 First Aid Room and Station for Medical Services

4.1.1.3.1 First Aid Room

1 room at least 15m² including washbasin and toilet, for first aid and for treating minor injuries.

4.1.1.3.2 Station for Medical Services

Minimum requirements waiting room (10m² to 15m²), consultation and examination room (15m²), treatment room (15m²) and toilets.

The first aid room should be equipped with:

- Examination table / bed
- Work desk
- 2 chairs
- 2 portable stretchers
- Washbasin (hot water)
- Low foot-basin (hot water)
- Glass cabinet for medicines
- Treatment table
- Oxygen bottle with mask
- Blood-pressure gauge
- Heating apparatus (hot plate) for instruments
- Heart defibrillator
- Equipment for injections and infusions
- Equipment for intubation
- Equipment for thoracic drainage

The above list is subject to change on the recommendation of the responsible medical authorities. The IAAF Medical and Anti-Doping Commission will also provide regularly updated guidelines and recommendations for each major IAAF competition.

A telephone connection is needed with direct outside access or with an emergency connection.

In training centres and large facilities, one room or one group of rooms for athletes' physiotherapy in accordance with their special needs

4.1.1.4 Doping Control Rooms

The rooms for doping control depend on the number of sports participants who have to be controlled.

4.1.1.4.1 Waiting Room

Room for up to 15 athletes with controlled access, allowing for approximately 2m² per person.

The waiting room should be furnished with 2 to 4 clusters of seating (each comprising 3 to 4 armchairs and side-tables), clothes hooks, refrigerator for drinks, television set and magazines board.

4.1.1.4.2 Working Room

Room with work place for the doping control officer, furnished for storing test samples; room size approximately 18m².

The working room contains 1 work desk with 3 chairs, a filing cabinet, a clothes cupboard, a cupboard for urine bottles and packaging material and a lockable refrigerator.

4.1.1.4.3 Toilets

Room with at least 2 toilet cubicles for giving samples. Cubicles must be minimum 4.50m².

Toilet cubicles are equipped with a water closet, clothes hooks and shelving, anteroom with washbasin.

4.1.1.5 Rooms and Space for Distinguished Guests, VIPs and Sponsors

4.1.1.5.1 Distinguished Guests

In considering the design of the main tribune it should be noted that the highest level of competition will attract distinguished guests of international and national standing. Space, dignity, comfort and security are of vital importance. It is not necessary for this area to be permanently prepared for a royal occasion, but space and requisite services should be available if the need arises. The tribune should be in the centre of the main stand with direct access from the rear for guests without the need to pass through public and media areas. Provision for 20 to 25 seated guests should be considered.

A VIP area with rooms for hospitality should be located in the central part of the main stand (see 4.1.1.5.4).

4.1.1.5.2 VIP Seating

Designation of VIP seating can be problematic and must be handled with diplomacy. However, in preparing a stadium it is advisable to cater for more guests rather than less. Position and quality of seating are important. If the stadium configuration allows, the VIP seating should be divided into three sections. These three blocks should be arranged to the left, right and below the royal box tribune. There should be 200 seats available in each block. For small events the VIP seating below the royal box should take precedence in priority seating. Directly behind the VIP seating should be provision for a hospitality area which provides relaxation, refreshments and TV monitors.

It is judicious to provide a room / rooms for presidential presence near to the VIP area. This permits a relevant president to be close to key guests but also have working facilities.

In many major stadia, VIP seating areas can consist of sky boxes and business seats. Sky boxes are private rooms inside the stand with direct view to the infield and with seats at the front of the box. Business seats are large and comfortable seats on the main stand which give the seat owners the right to participate in the stadium's hospitality programme. Selling sky boxes and business seats is often a key factor when the financial concept for constructing and operating a stadium is defined.

4.1.1.5.3 Sponsors' Seating

Marketing programmes have increased the importance of hospitality at major athletics meetings, and it is therefore necessary to provide high quality service.

The key personnel of major sponsors should be included in the VIP/honorary guests section of seating. Blocks of seating immediately to the left of the left-hand VIP seating block should be reserved for sponsors. Additional hospitality services directly behind this area should be provided with all requisite facilities and services.

Car parking and car-drop areas for VIPs, guests and sponsors must be provided.

4.1.1.5.4 Hospitality Facilities

Hospitality facilities within the stadium for the next level of VIPs, guests and sponsors are important. Space, lighting, air-conditioning and decor should be considered.

Protection from the elements and full services including TV monitors must be provided. A regular and rapid delivery of results is an appreciated service. Catering facilities to a reasonably high standard are expected. The size of facilities will be dictated by expected numbers and the level of competition, but the maximum peak flow should be catered for in forward planning.

4.1.1.6 Other Areas

4.1.1.6.1 Athletics Equipment Room

Doorways must be at least 2.20m wide and have a clear through height of 2.20m.

Large floor areas readily accessible to the arena are required for the storage of jumps landing areas and hurdles on purpose-built trolleys. Other apparatus required for the conduct of events is stored on the floor or shelves.

A suitable desk is required for the official responsible for the control of equipment and a long enough bench for the implement measuring apparatus.

Subject to the type of design selected for the floor and the wall, a hose connection is required for cleaning the room and apparatus as well as a tap with washbasin and cleaning water basin.

The electrical fittings comprise 2 to 4 sockets.

4.1.1.6.2 Display Areas

The host city, the venue management and sponsors are usually keen to have an opportunity to display their attributes and/or goods. Display areas should be provided in the main entrance to the stadium, the hospitality area(s) and public franchise areas. Display areas must not cause congestion in key areas of flow, particularly in case of an emergency, and should never be placed on or near stairways, escalators or moving walkways. Provision of display areas should be restricted to approved authorities and sponsors.

4.1.1.6.3 Franchises

The rights to sell (food, drink, merchandising) in a sports venue are of a commercial nature. The need for food and drink is essential, and the stadium layout must provide for easy public access to franchise areas, room to relax, adequate litter receptacles, etc. Dangerous congestion near stairways and dead-ends must be avoided. Many countries now impose very strict health and safety regulations at all sports venues, and these must be adhered to.

Delivery of goods to franchise areas must be considered when designating points of sale.

4.1.1.6.4 Advertising Boards

Size, numbers, wording and placement of advertising boards in and around stadia is clearly defined in the IAAF Advertising Regulations. Note that advertising boards can block the full view of some spectators at the lowest levels of the stand and may impede the movement of athletes, officials and equipment unless well planned beforehand.

4.1.2 FUNCTIONAL GROUPING

The individual sections listed in the area and room schedule must be grouped together in the overall design of the facility to enable a smooth operation of the facility. The more diverse and comprehensive the schedule for the individual areas is, the more difficult it is on the one hand to group the individual sections properly within their respective areas and, on the other, to integrate the different areas functionally into the facility as a whole.

4.1.2.1 Allocation of Areas and Rooms for Athletes

Figures 4.1.2.1a and 4.1.2.1b show diagrams of the layout of rooms and the traffic routes to and within the areas and rooms for athletes. Figure 4.1.2.1a refers to training and 4.1.2.1b to competition.

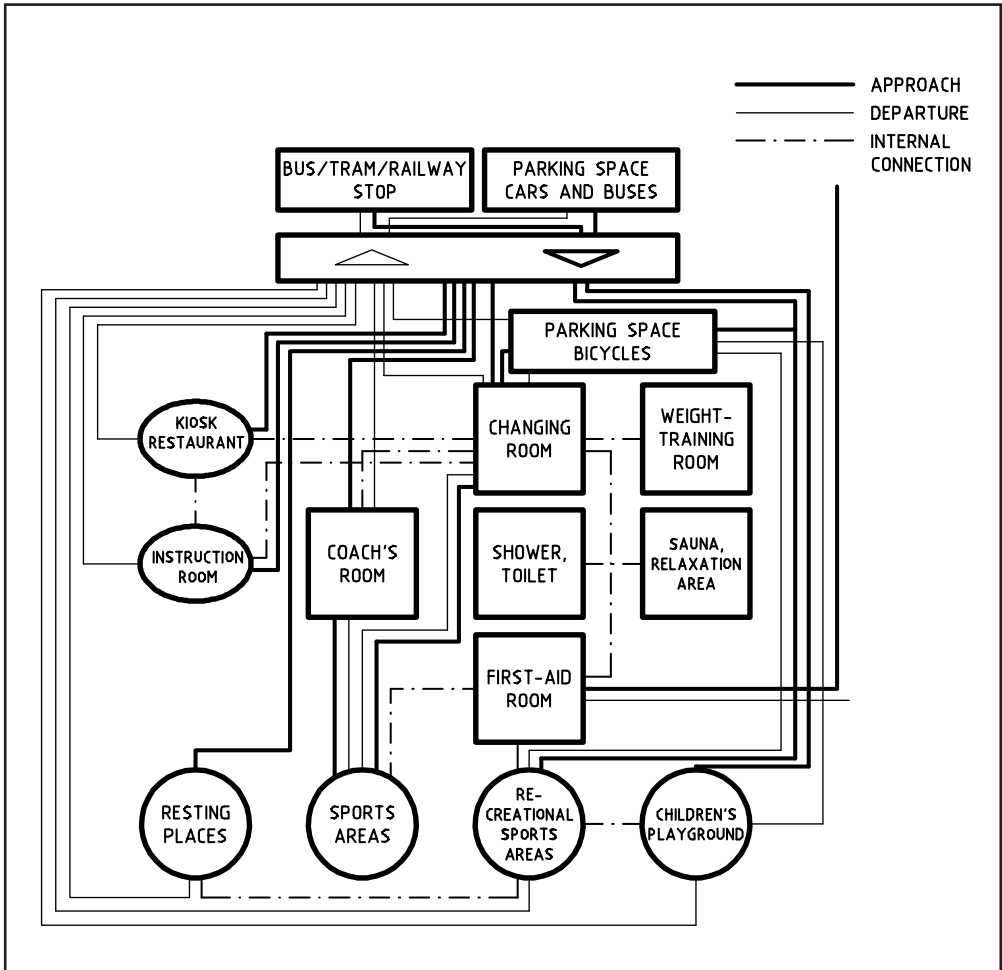


Figure 4.1.2.1a - Allocation of areas and rooms for athletes in the stage of training

Source: *Planning Principles for Sportsgrounds / Stadia, IAKS Series Sports and Leisure Facilities No. 33*

After reaching the facility by public or private transport, the athlete proceeds to the changing room and from there to the sports areas (thick access lines) or to the weight training room (dotted lines marking internal routes). On returning from the sports areas (thin return lines) he proceeds to the sanitary area with showers and toilets, in some cases via the sauna and relaxation area, again via the internal routes marked with dotted lines.

It should be stressed at this point that the diagram does not represent a site plan or ground plan of a facility. The sole purpose of this drawing is to show the organisational relationship between the various areas and rooms used by the athlete.

When designing such a sports facility, such diagrams (and the same applies to other illustrations of the same kind in this chapter) are used as a planning aid and as a means of checking the organisation of installations and rooms.

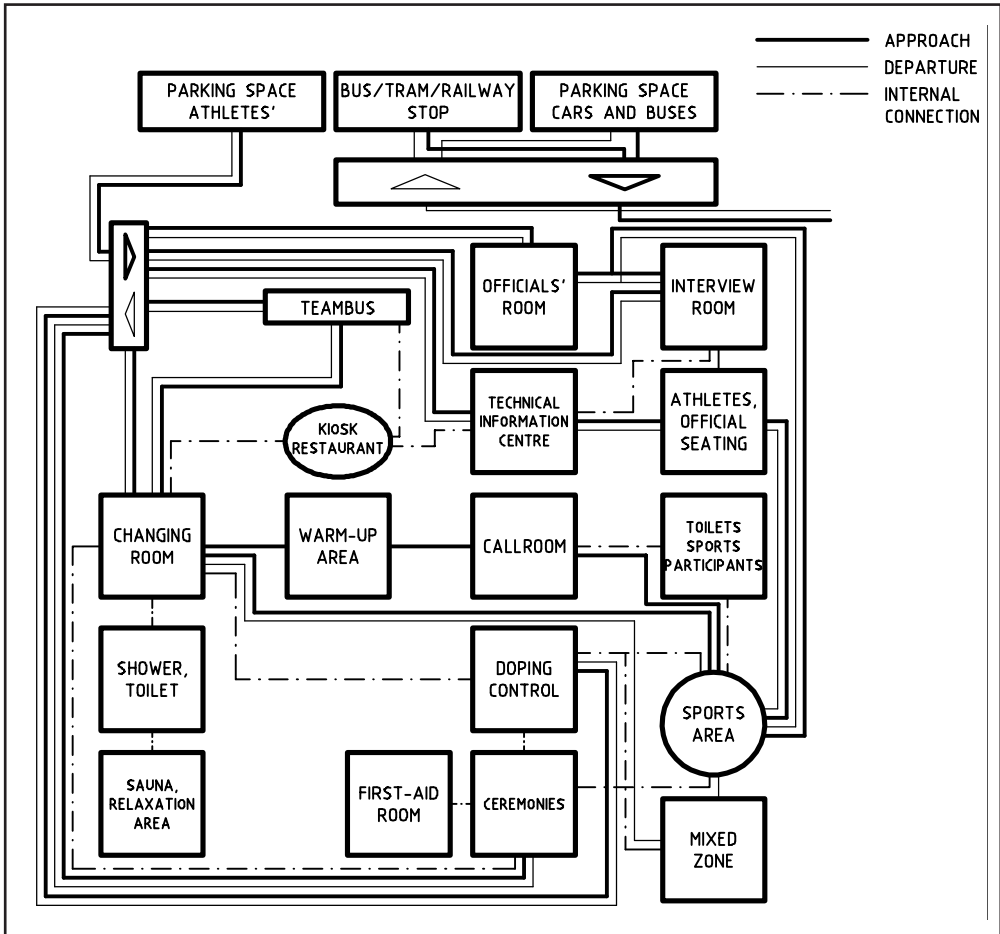


Figure 4.1.2.1b - Allocation of areas and rooms for athletes, officials, first-aid and doping control in the stage of competition

Source: *Planning Principles for Sportsgrounds / Stadia, IAKS Series Sports and Leisure Facilities No. 33*

Figure 4.1.2.1b illustrates the allocation of rooms and areas for athletes and officials at a competition.

In this case, access to the relevant areas and rooms is afforded along routes strictly separated from those used by spectators (including distinguished guests) and the media. By referring to the above introductory explanation of the diagram's purpose, the reader will understand the interrelationships indicated by the different lines representing the access route, return route and internal routes.

As an example, the athlete's route from the car park (or team bus) is : he proceeds to the changing room and, depending on how the event is organised, goes to the sports area directly or via the warm-up area and call room. After competing, the route takes him via the Mixed Zone back to the changing room or from the sports area to the doping control area and from there to the changing room. There he will find, as in the training set-up, the usual sanitary installations and possibly a sauna and

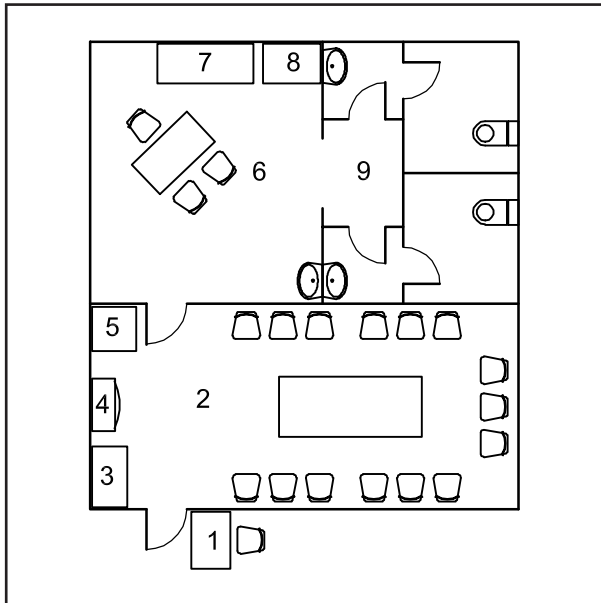


Figure 4.1.2.1c
Allocation, installation and
furnishing of doping control rooms

- 1 Access control
- 2 Waiting room
- 3 Magazines
- 4 Television
- 5 Refrigerator / drinks
- 6 Doping Control Officers' room
- 7 Equipment table and cupboard
- 8 Lockable refrigerator
- 9 Toilets

relaxation area. The route from the changing room then leads back to the team bus or straight to the exit from the athletes' area.

The doping control area shown simply as a square in Figure 4.1.2.1b (with the internal routes between the sports area and changing room) is broken down into its various functional rooms in Figure 4.1.2.1c. The athlete proceeds past the entrance control to the waiting room where he awaits his call to the working room, and from there to the toilets.

Where both males and females are to be tested, it would be preferable to have two separate toilet areas leading off the working room.

In selecting accommodation for doping control security, privacy, cleanliness and relative comfort should be the priorities.

Where, due to lack of an alternative, it is not possible to have a suite comprising all three areas (working, waiting and WC) it is permissible to use a nearby area for waiting but there must be a tight security screen on that area and athletes selected for doping control must be accompanied when passing from one area to the other.

4.1.2.2 Allocation of Areas and Rooms for Distinguished Guests, VIPs and Sponsors

The diagram in Figure 4.1.2.2a shows how the areas for distinguished guests, VIPs and the sponsors' lounges (boxes) fit into the overall concept of spectator facilities in a stadium. There are separate arrival and departure routes and car parks for each visitor category, and distinguished guests may have a helicopter pad at their disposal. They also have their own routes to the restaurant.

Figure 4.1.2.2b shows the arrangement of the various groups of distinguished guests in the main grandstand.

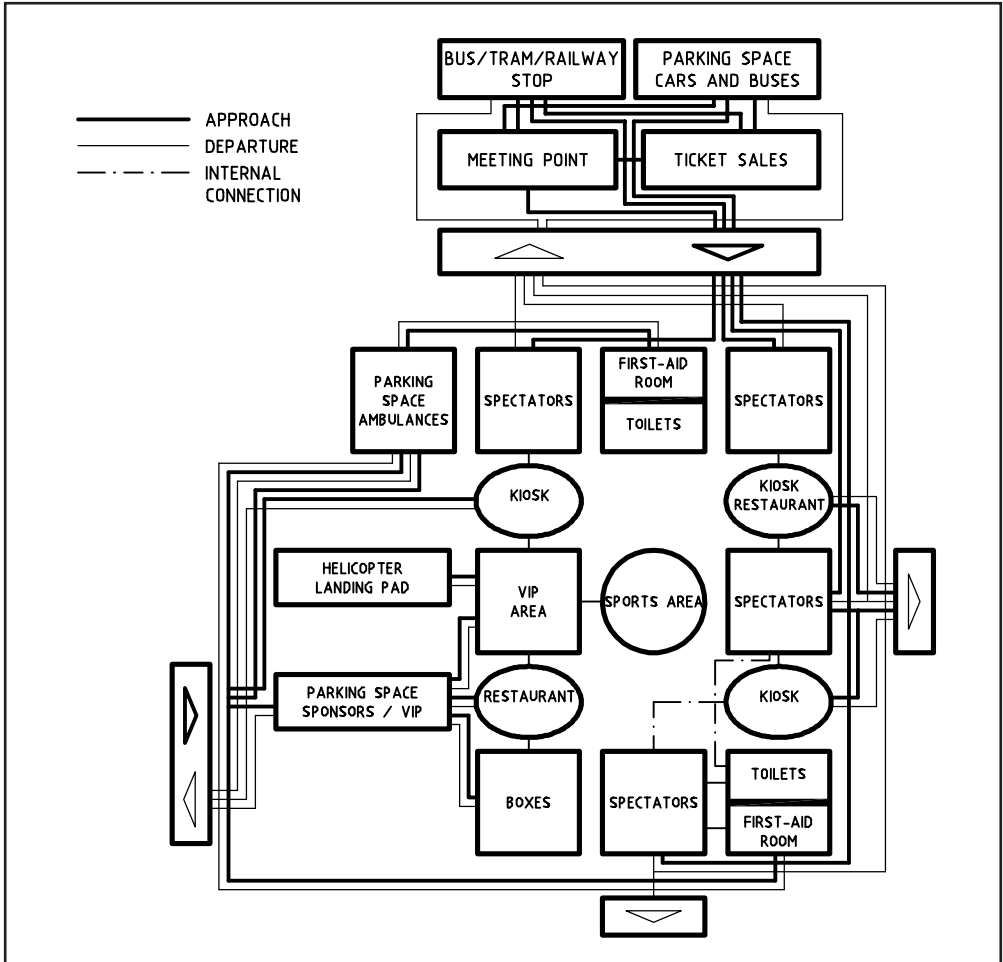


Figure 4.1.2.2a - Integration of areas and rooms for VIPs into the overall concept

Source: *Planning Principles for Sportsgrounds / Stadia, IAKS Series Sports and Leisure Facilities No. 33*

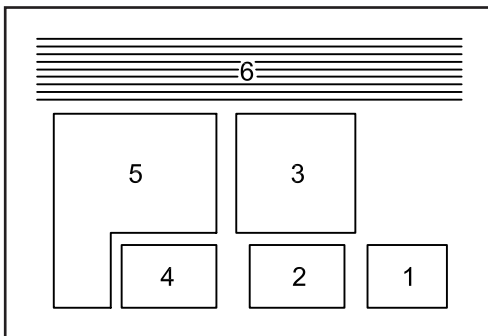


Figure 4.1.2.2b - Arrangement of seating areas on the grandstand

- 1 VIP seating - group B
- 2 Royal box
- 3 VIP seating - group A
- 4 VIP seating - group C
- 5 Sponsor seating
- 6 Finish straight

4.1.2.3 Diagram of Planning Examples of Changing and Sanitary Areas for Sports Users

The following planning examples outline in each case the alternate use of the sanitary area with 2 changing rooms and its capability to be partitioned into 2 separate rooms if the changing rooms can be subdivided for use by teams.

The planning examples differ in offering 12, 18, 24 or 36 changing positions per changing room, each equipped with 2 clothes lockers per changing position, and with 6, 8, 10 or 14 shower positions and each with 1 sanitary room for 2 changing rooms.

4.1.2.3.1 Planning Example 1

This example shows 2 changing rooms, each of them partitionable, each containing 12 changing positions (0.66m), 8m of changing bench (2 x 4m), 24 clothes lockers and each with 1 divisible sanitary area containing 6 shower positions, 2 toilets and 4 washbasins.

The required space of about 75m² is composed of 2 x 27.50m² + 1 x 22.50m².

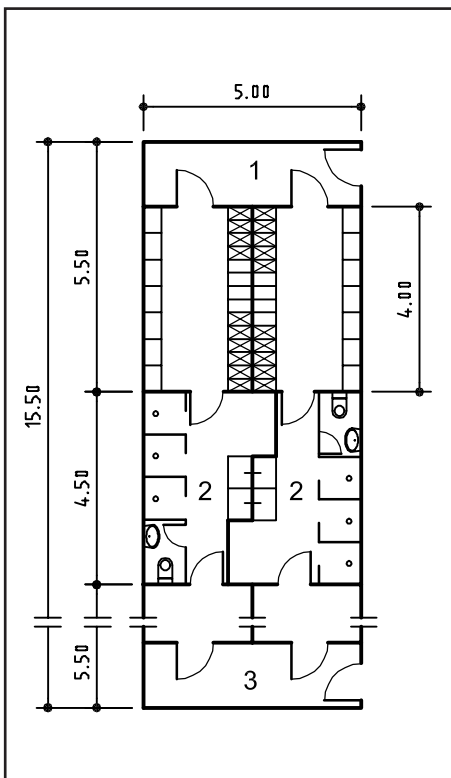


Figure 4.1.2.3.1
Planning example 1 for changing and sanitary areas with 2 x 12 changing positions

- 1 Changing room I with lockers, subdivisible
- 2 Shower room with wash basins and toilet
- 3 Changing room II, equipment as for I

Source: Basic Data for Sports Facilities, IAKS

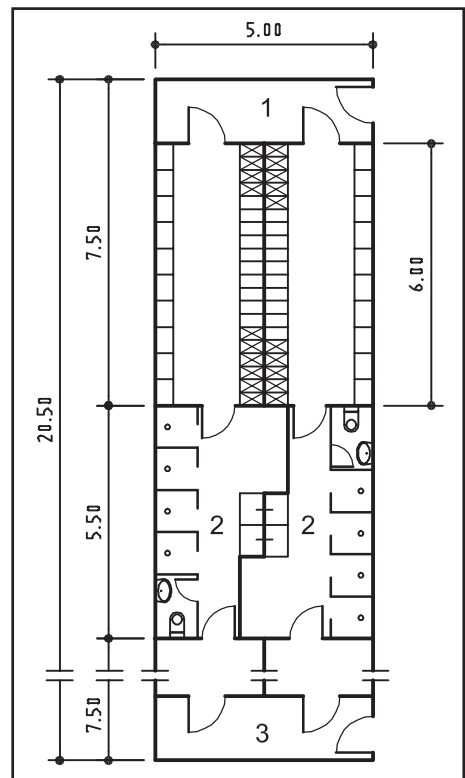


Figure 4.1.2.3.2
Planning example 2 for changing and sanitary areas with 2 x 18 changing positions

- 1 Changing room I with lockers, subdivisible
- 2 Shower room with wash basins and toilet
- 3 Changing room II, equipment as for I

Source: Basic Data for Sports Facilities, IAKS

4.1.2.3.2 Planning Example 2

This example shows 2 changing rooms each containing 18 changing positions (0.66m), 12m of changing bench, 36 clothes lockers and one sanitary area containing 8 shower positions, 2 toilets and 4 washbasins.

The required space of about 100m² is composed of 2 x 37.50m² + 1 x 27.50m².

The changing room provides 30 changing positions (0.40m) at a time for 1 class of school children.

4.1.2.3.3 Planning Example 3

This example shows 2 changing rooms, each containing 24 changing positions (0.66m), 16m of changing bench, 48 clothes lockers and one sanitary area containing 10 shower positions, 2 toilets and 6 wash-basins.

The required space of about 145m² is composed of 2 x 55m² + 1 x 35m².

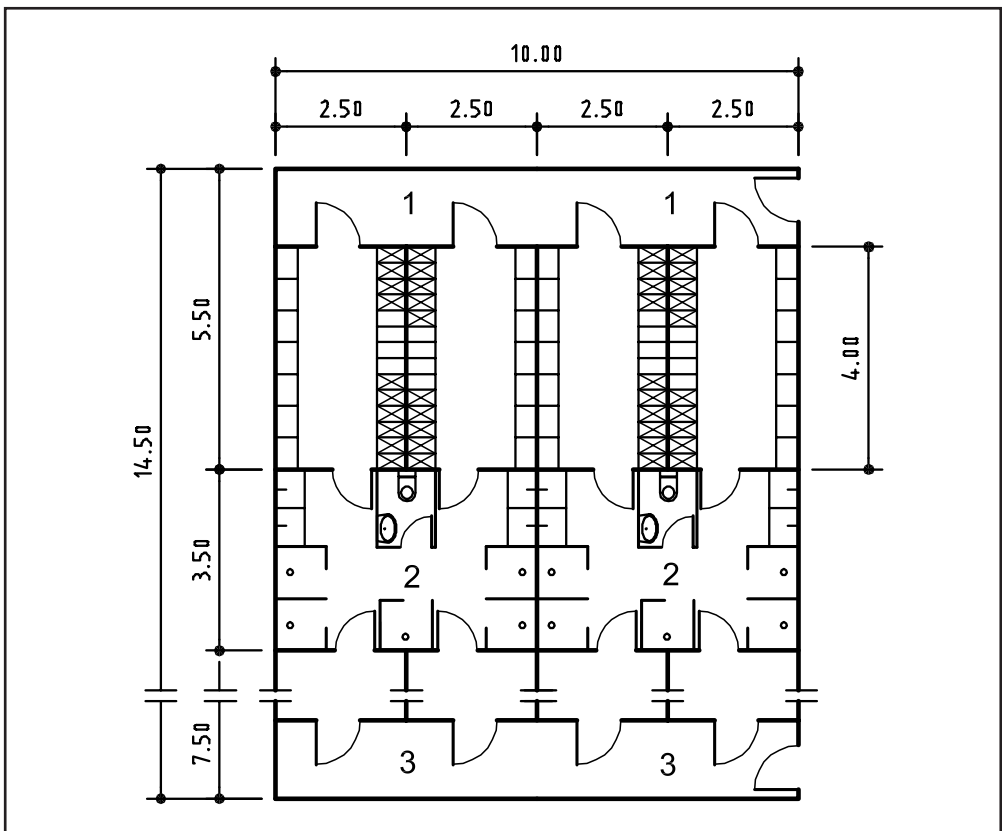


Figure 4.1.2.3.3 - Planning example 3 for changing and sanitary areas with 2 x 24 changing positions

- 1 Changing room I with lockers, subdivisible
- 2 Shower room with wash basins and toilet
- 3 Changing room II equipment as for I

Source: *Basic Data for Sports Facilities, IAKS*

4.1.2.3.4 Planning Example 4

This example shows 2 changing rooms, each containing 36 changing positions (0.66m), 24m of changing bench, 72 clothes lockers and one sanitary area containing 14 shower positions, 2 toilets and 8 wash-basins.

The required space of about 195m² is composed of 2 x 75m² + 1 x 45m².

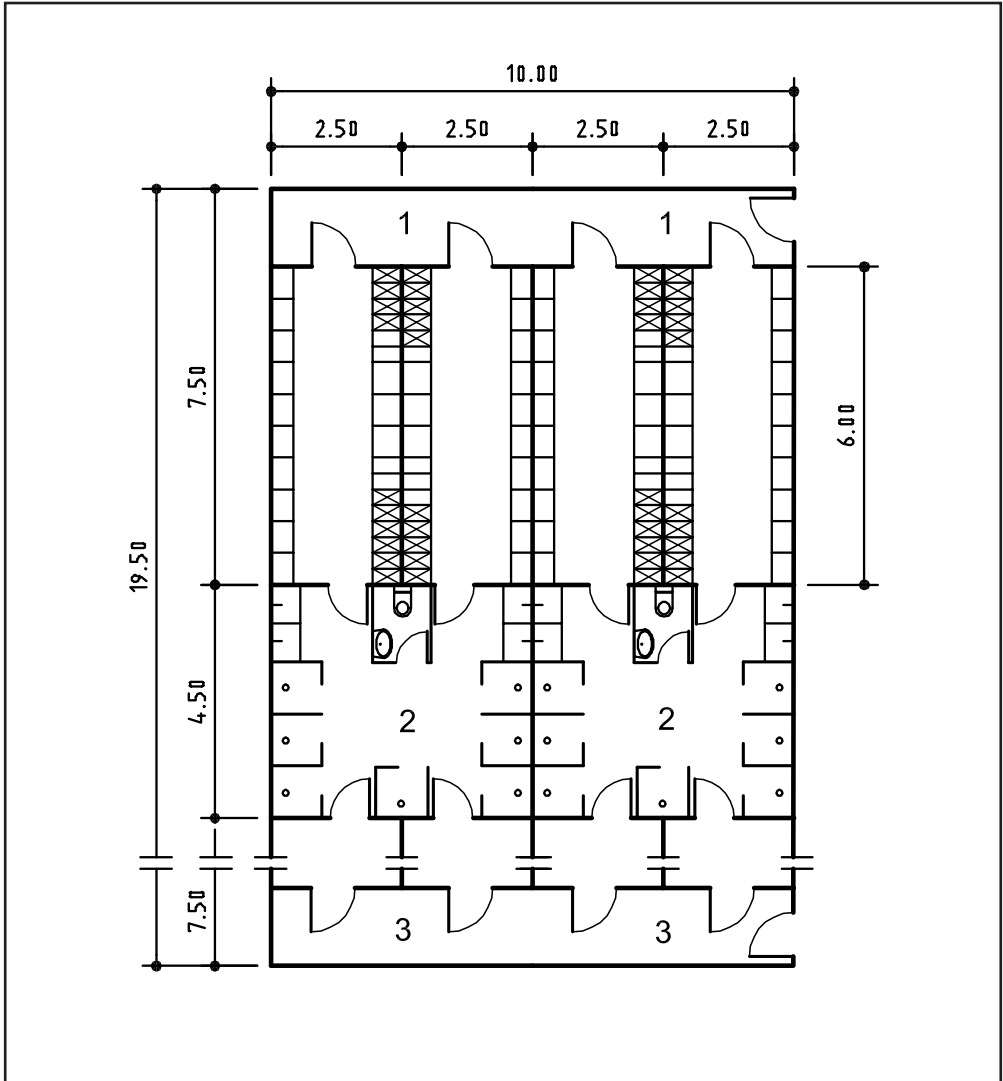


Figure 4.1.2.3.4 - Planning example 4 for changing and sanitary areas with 2 x 36 changing positions

- 1 Changing room I with lockers subdivisible
- 2 Shower room with wash basins and toilet
- 3 Changing room II equipment as for I

Source: *Basic Data for Sports Facilities*, IAKS

4.2 Rooms for the Media

4.2.1 AREA AND ROOM SCHEDULE / EQUIPMENT

4.2.1.1 Media Centre

4.2.1.1.1 Reception Area, Entrance Hall

Entrance Hall	as required
Reception/Information	as required
Telephone exchange	as required
Telephones	as required
Cloak-room	if required
Toilets	as required

4.2.1.1.2 Administration Secretariat, Press Office

Director	20m ²
Other members of staff	12m ² /person
Secretariat	12m ²
Temporary press office	20m ²

4.2.1.1.3 Room for Press Conferences

While for the Olympic Games the main media centre should have a large press conference room capable of dealing with up to 400 seated persons with full TV facilities, this room is not required for IAAF events, where the formal interview room is used if necessary.

4.2.1.1.4 Catering Facilities	as required
--------------------------------------	-------------

4.2.1.1.5 Lounge Area	1m ² of equipment space for every 2 persons
------------------------------	--

4.2.1.1.6 Cloak Room	if required
-----------------------------	-------------

4.2.1.1.7 Toilets	as required
--------------------------	-------------

4.2.1.1.8 Store for Cleaning Equipment	as required
---	-------------

4.2.1.2 Press

The four main working areas of the journalists in the stadium are the main stand seating, the main press centre for major games/championships, the working area within the stadium and the formal interview room. (For some details see Table 4.2.1.2)

4.2.1.2.1 Main Stand Seating

The amount of seating required will be dictated by the size of the competition.

The amount of technical service required will rise in proportion to expected numbers, whilst the principles of service remain the same regardless of numbers. Numbers to be expected at a national competition vary, but as a broad estimate 50 seats with desks and 30 seats only (observers) can be anticipated.

Numbers of journalists to be expected to attend a regional or World / Olympic competition are regional 500 (300 with desks), international 900-1200 (800-900 with desks).

Working Area	Equipment	National Competitions	Regional Competitions	World/Olympics Competitions
Main Stand Seating	Seat (with desk)	50	300	800-900
	Seat (only)	30	100	200-300
TV Monitors (Written Press)		-	75-100	260-300
Phones (Dedicated Lines)		10	50	100
Main Press Centre	Desks in working area	40-50	200-250	500-650
TV Monitors		2-5	10-15	20-35
Computers for Public Use		2-5	20-30	60-80
Phones (Card)		2-5	10-15	20-30
Broadband Internet Access / WI-FI		-	required	required
Pigeon Holes		75-100	300	400
Formal Interview Room	Seats	50-70	100-150	200-300

Table 4.2.1.2 - Press equipment for competitions at different levels

4.2.1.2.2 Main Press Centre (MPC)

This is the nerve centre of the entire media operations. It should be located as near as possible to the press stands and accommodate all the necessary facilities and services.

The MPC should ideally be located within the stadium.

If the MPC is not inside the stadium but within 200 to 250 metres of the press stands, a small working room with telecommunication facilities will also be needed in the stadium itself. If the MPC is further away, the size of the working area in the stadium will have to be considerably increased.

The working area in the MPC should cater for working places for 50-60% of the expected number of journalists.

At World Championships / Olympics, technical needs would be:

- Working places for 500-650 journalists
- TV monitors: 20-35 in common working area plus additional ones in private offices
- Telephones: 20-30 card phones (with pin code) in addition to private lines ordered by the journalists
- Mobile telephone services (rental and repair)
- Telefaxes: 2-4
- Computer with internet access and access to Media Information System: 60-80
- Provision of broadband internet access and/or WI-FI is nowadays essential

An area should be set aside for the photo centre, ideally adjacent to the MPC but separate. This area should be as near as possible to the track.

Facilities to be provided are as follows:

- Lockers: 250-300 for storage of photographic equipment
- Private offices for major photo agencies and newspapers
- A limited number of public telephones (with pin code) in addition to private lines ordered by the media organisation
- Computer with internet access and access to Media Information System: 15-20
- Provision of broadband internet access and/or WI-FI is nowadays essential

4.2.1.2.3 Working Area within the Stadium

Unless the MPC is located within the stadium, a working area directly behind the main press stand must be provided, allowing for complete working facilities for 10% to 30% of the expected number of journalists, depending on the distance between the MPC and the press stands.

Full telecommunication facilities should be available at the main press centre (if such exists), but limited facilities should be provided at this working area at regional and world competitions.

4.2.1.2.4 Formal Interview Room (see Television and Radio)

There are few technical services required in the formal interview room, other than simultaneous translation at major games/championships. The interviews should be fed by the Host Broadcaster to all TV monitors in the media working positions in the stadium and in the working room.

For World / Olympic competitions an additional conference room with 80 to 100 seats can be provided.

4.2.1.2.5 Results Preparation and Delivery

The urgent and accurate delivery of hard copy information to journalists is of paramount importance. It is therefore essential to consider the procedure for delivery of start lists and results information to the press area, and their immediate printing and distribution to the journalists. An on-line link to the official computer service is essential, with the requisite number of fast-speed photocopiers available in the working room directly behind the journalists stand. Results should not take more than 10 minutes to be delivered, with an absolute limit of 20 minutes in case of extreme difficulties. When such major difficulties arise it is imperative that journalists are informed as to the reason for the delay. Backup facilities in case of failure are essential.

A priority distribution must be prepared to ensure that those journalists with the tightest deadlines working for the most important agencies and publications get first service.

Because of the number and size of photocopiers required for this task, consider providing air conditioning to ensure that machine failure and human mistakes are kept to a minimum. Consider also collating needs when preparing and allocating space, as it is not always possible to depend on machine collation.

The link to the computer service is the most important link for this working area. Telecommunication requirements are linked to computer requirements and cabling needs should be considered accordingly.

As an example, 2.25 million sheets of A4 paper were processed at the 2005 World Championships in Athletics in media areas (1.1 million in the main media centre and 1.15 million in the media stands).

A pigeon hole system for the distribution of information sheets must be prepared and placed in a position which is within convenient reach of the journalists' working places and the print services representatives who will be required to feed the system. Congestion in an area of high traffic must be avoided.

4.2.1.2.6 Camera Repair Service

At major competitions at regional or World / Olympics level, where photographic equipment is subjected to considerable wear and tear, provision of a camera repair service is required. The service will be performed by the official camera sponsor of the event (if such exists), and only space is required. Safe storage units are essential for expensive photographic equipment.

4.2.1.2.7 Lockers

As technology improves, photographers' equipment becomes more sophisticated and diverse. The value and range of such equipment must be considered when providing storage facilities for photographers. Individual lockers of suitable size should be provided in the media working area / main press centre: national (30-40), regional (125-150) and World / Olympic (250-300). 24-hour access is required and constant security essential.

4.2.1.2.8 Press Agencies

International press agencies take priority over all other journalists in the allocation of stadium seating and working areas. It is a common practice for agencies to require independent working rooms within the press working area / press centre of the stadium. Size will be dictated by the competition and the agency itself. Access will be 24 hours a day and will be limited to agency representatives and those serving them within the media department plus main press centre service staff.

Key telecommunication requirements are direct international telephone lines and ADSL / ISDN lines for high speed data transmission.

4.2.1.3 Television and Radio

All television and radio activities are conducted in five main areas: commentary positions, camera positions, formal interview room, international broadcast centre (IBC) and outside broadcast (OB) van compound.

Each area has its own specific technical service requirements.

4.2.1.3.1 Commentary Positions

The number of positions required will be dictated by the size of the event, but the following figures can be expected: national (5 to 6), regional (20 to 30), international (80 to 100), World Championships and Olympic Games (150).

Minimum space required per position is 1.50m front and 1.60m depth for two persons.

4.2.1.3.2 Camera Positions

The number of camera positions will vary from event to event. The final decision of number and placement of cameras will be decided by the Host Broadcaster and the Organising Committee.

4.2.1.3.3 Formal Interview Room

This room is where the medallists of each event should be brought to meet the media in a controlled environment.

The size of the room will depend upon the size of the competition but should be planned for the largest possible attendance, i.e. for national events 50/70, regional events 100-150 and international events 200-300 persons. Figure 4.2.1.3.3a shows, as an example, a suitable room shape and the grouping of those persons involved.

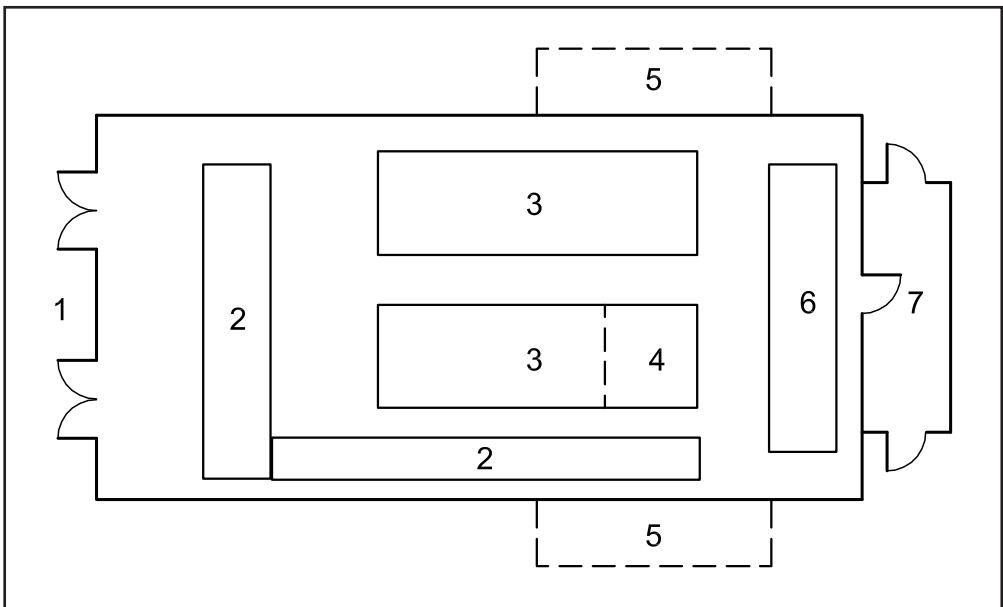


Figure 4.2.1.3.3a - Scheme of formal interview room

- 1 Media entrance / exit
- 2 TV and photographers' platform
- 3 Journalists
- 4 Radio
- 5 Simultaneous translation booths
- 6 Head table on raised platform for interviewees
- 7 Holding room for interviewees

At major games and championships consider providing simultaneous translation facilities in the formal interview room. Advanced thought to cabling needs is therefore required.

Consideration should be given to any backdrop prepared for the interview room to ensure its colour receptivity to the television camera.

Access must be in close proximity to the journalists' working areas with a minimum of two doors that allow entry and exit without congestion. A holding room allowing athletes' entry from behind the head table (to be set up on a raised platform) is ideal if the stadium configuration allows.

Because it is impossible to schedule formal interviews exactly, a constant flow of people in and out of the room is inevitable, and it is therefore recommended that doors are placed at the back of the room for minimum disturbance. Every effort should be made to keep the front of the room and the interviewees' area as clear as possible in order to ensure a clear view to all participants.

The formal interviews should be relayed to the journalists' stand monitors by use of a dedicated TV channel.

Details of the next formal interview can be conveyed simply to the media by use of an information board (60cm x 100cm) which is carried aloft by a representative of the media services division along the front of the media stand (Fig 4.2.1.3.3b).

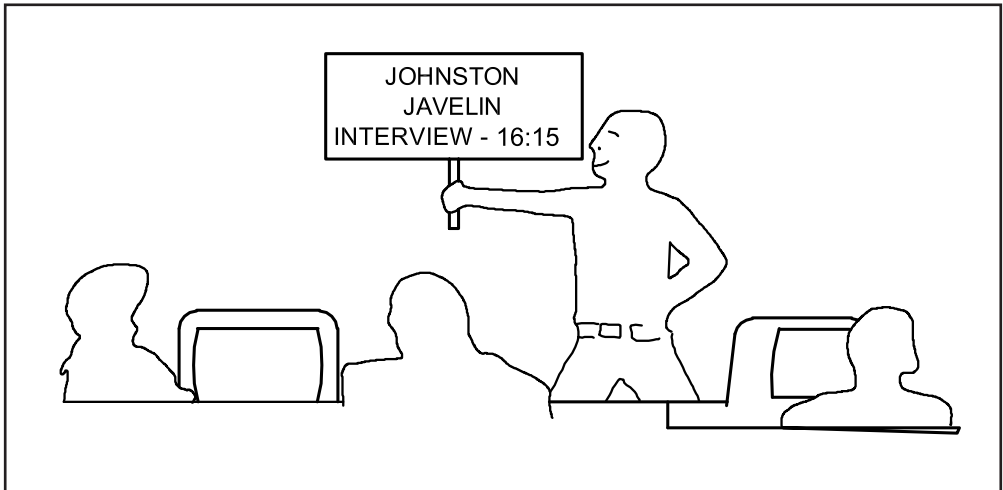


Figure 4.2.1.3.3b - Interview information board along the front of the media stand

4.2.1.3.4 International Broadcast Centre (IBC)

For major games / championships, the Host Broadcaster will be required to prepare an IBC. This is a separate entity from the press centre and functions solely for television and radio. Facilities provided are as follows:

- Host Broadcaster signal edit and distribution
- Unilateral edit rooms
- Television studios
- Administration offices
- Commentary switching centre
- Highlights programme production
- Archive
- Catering, bank information, etc.

Size is determined by the type of competition. Access is for television and radio personnel and those serving them only and is for 24 hours per day with maximum security. The telecommunication requirements of the IBC are extensive for major games / championships, and extend to sub-sites for a multi-sport competition.

Principal needs are telephone, internet access, telefax, portable cellular phones, pagers and walkie-talkies.

For the Olympic Games in Barcelona (1992), a vanda contribution network was established to transport all international television and radio signals and unilateral vandas from venues to the IBC. (A vanda circuit is a one-way circuit with one video channel and associated audio channel(s).) Television signals produced in the IBC by world broadcasters were routed to the world via optic fibre and radiolink earth network. Outward-bound signals were uplinked to communication satellites from earth stations in Spain.

4.2.1.3.5 Outside Broadcast (OB) Vans Compound

The Host Broadcaster and those TV companies who have undertaken unilateral coverage will require space adjacent to the stadium for positioning of their OB vans. All unilateral camera feeds will be collected within the OB vans, edited and transmitted via satellite to various domestic audiences.

The size of compound required will depend upon the scale of the event. A national competition will require space for 2 to 3 vans, i.e. 800m² (max.) including administration and services. A major regional/international competition must cater for 10 to 12 vans within an area of 1500m², whilst an event on the scale of the World Championships in Athletics must provide for 20 to 25 vans and will require 3000m². The average size of an OB van is 16.00m in length, 2.50m in width and 4.50m in height. The overall weight is approximately 30 metric tons.

The OB van compound should be positioned as close to the finish line area as possible to keep cable runs to the minimum. Access portals for cabling into the stadium must be considered. These should avoid all public / vehicular passages.

The OB van compound requires 24 hour security and only TV personnel should have access.

The power requirements of an OB van are enormous and separate power substations with backup generators must be installed for major competitions. An output of 600kW was provided for the world broadcast compound at the last World Championships.

4.2.2 FUNCTIONAL GROUPING

Like the athletes, officials and distinguished guests, the media reach their working areas within the stadium via a separate entrance and exit area.

The diagram in Figure 4.2.2 illustrates the allocation of rooms and areas including the areas for the outside broadcast vans and camera platforms.

Detailed information on the requirements of the press (and photographers), radio and television can be obtained from the following text sections and figures in this chapter.

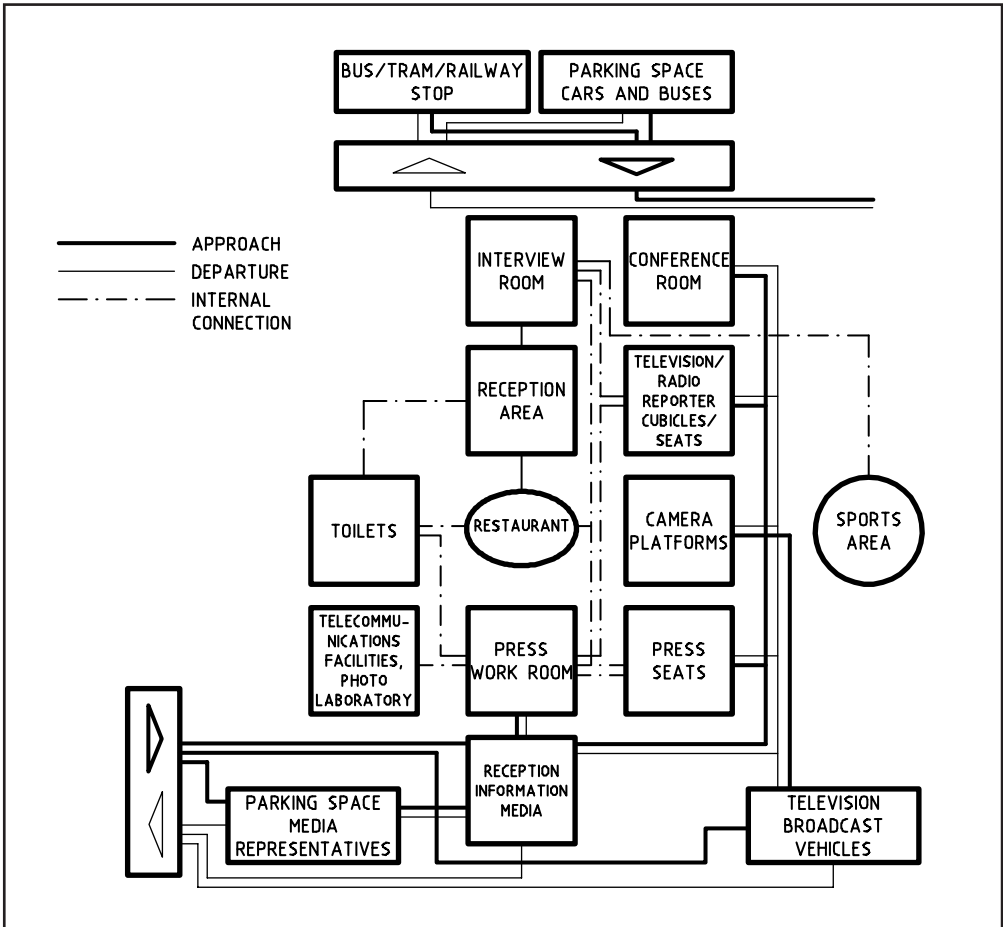


Figure 4.2.2 - Allocation of areas and rooms for the media

Source: *Planning Principles for Sportsgrounds / Stadia, IAKS Series Sports and Leisure Facilities No. 33*

4.2.2.1 Media Centre

It is the focal point for all the media services. The access from the stadium entrance and from the parking area must be clearly signposted and quickly reachable. The representatives of the different media will be led from the entrance hall with reception desk to the various functional areas described in Sections 4.2.2.2 and 4.2.2.3.

The offices of the press administration are situated in the vicinity of the reception desk. The press conference room must be within easy reach of the reception area. It is useful to group the necessary catering facilities in this area.

4.2.2.2 Press

4.2.2.2.1 Main Stand Seating

This is the primary working area for journalists where they will be seated for the majority of the competition period.

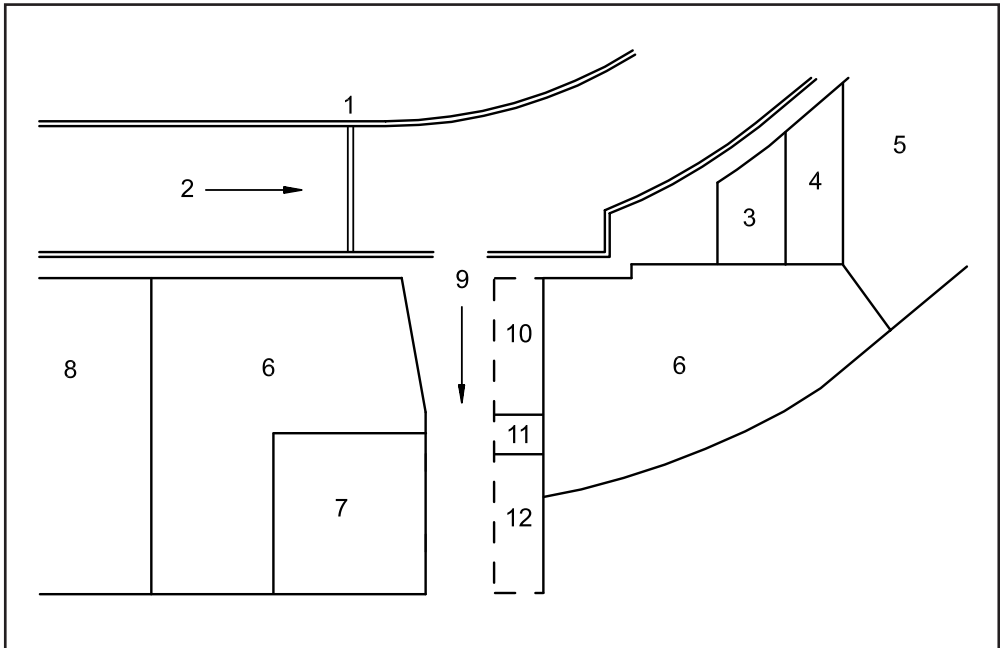


Figure 4.2.2.3a - Scheme of functional grouping of athletes' exit point and finish line grandstand area

- 1 Finish line
- 2 Direction of running
- 3 Head-on TV cameras
- 4 Photographers
- 5 Team seats or spectators
- 6 Media stands
- 7 Priority TV
- 8 VIP seats
- 9 Exit for athletes to Mixed Zone
- 10 TV Mixed Zone
- 11 Radio Mixed Zone
- 12 Press Mixed Zone

The seating area should be placed on the finish straight side of the stadium and should extend not further than 30m before and 50m after, the finish line. It should be no lower than the fifth row of the stadium seating and should not extend into second level seating in a major stadium (Figure 4.2.2.3a).

This area directly above the finish line is of high priority to the media and must be shared with television and radio. Because of the live nature of television and radio they shall have priority on direct finish line positions but every effort should be made to provide agencies and major newspapers with the equivalent. Journalists representing small publications, without deadlines, should be allocated seating on the outer limits of the working area.

The seating area should be within easy reach of the media centre, working areas within the stadium, interview rooms and Mixed Zone.

With the need to move regularly throughout the competition between seating area, Mixed Zone, interview room and the media centre, access is of prime importance. Consideration must be given to constant movement in and out of the

stadium by journalists and those serving them. In this respect, passageways, doors and steps should be wide and well lit. Directional signage is of particular importance, as is rigorous imposition of accreditation and access checks.

Strenuous efforts must be made to enforce this as a working area. Therefore, accreditation should be judiciously provided and every effort should be made to stop people loitering in doorways, passageways and stairs.

The other groups with whom journalists will require interface are media services, athletes, catering, computer services, printing and transport.

Telecommunication requirements (See 5.6) are telephones, ADSL/ISDN lines, TV monitors and results monitors.

Cabling of telecommunications lines, results monitors and TV monitors at the journalists' desks is an important aspect that requires planning and consideration.

4.2.2.2.2 Working Area

Prior to, and at the conclusion of, each competition session, journalists require a working area in which they can prepare their copy for filing to their respective publications.

The working area should be within the stadium, preferably behind the seating area of the journalists. It should be in close proximity to the Mixed Zone and the interview room in order to facilitate easy movement, in the immediate post event period. Seating within the working room is without priority and is on a "first come, first served" basis. Size is dependent on the numbers but should allow for comfortable working conditions, be well lit, well ventilated and, if necessary, heated or air conditioned. Access should be such that constant movement in and out by large numbers of people will not cause congestion in doorways.

Because of the considerable movement in and out of the working room throughout a competition session, but particularly immediately afterwards, multiple entry and exit points are recommended and must be well controlled to avoid entry by those without accreditation.

Access to this area for computer services, telecommunication staff and catering is essential.

Full telecommunication services are required in the working room or immediately adjacent to it. These should include telephone and limited telefax facilities, as well as provision of broadband internet access and or WI-FI. A number of computer terminals for access to the Media Information System and the Internet are required. Cabling of telecommunication equipment must be considered well in advance as well as ancillary power needs should the printing of start lists and results sheets be generated in this area or close by.

4.2.2.2.3 Mixed Zone

The Mixed Zone is a designated area immediately after departure from the track through which all athletes, including those taking part in Field Events, heats and qualifying rounds, must pass upon leaving the stadium (Figure 4.2.2.2.3a). The surface should be suitable for athletes in spiked shoes to walk upon. Journalists have access to this area and may make contact with the athletes.

The Mixed Zone should be placed at the point of exit from the track, and should be the point at which athletes retrieve their tracksuits and competition bags. Priority in the Mixed Zone is to live unilateral broadcast cameras, followed by ENG cameras and live radio and, finally, journalists and photographers. The size and layout should be sufficient to avoid congestion for both athletes and media. A waist-high barrier should delineate a passage through which athletes pass and to which the journalists do not have access. Provision must be made for photographers and ENG crews to get clear shooting access above the heads of journalists.

Access to the Mixed Zone should be restricted to athletes leaving the stadium and media representatives, as well as the indispensable organisational staff. A limited number of team representatives should have access to this area on the conditions laid down beforehand. The athletes should pass through this area unimpeded and reasonably swiftly. Provision should be made for athletes' welfare in this area, for example first aid and water. Media service must have access to this area, particularly those responsible for flash interviews. There are minimal telecommunication requirements but consideration of lighting is imperative. 1-6 TV monitors (depending on the type of event) should be provided to allow media representatives to follow the action in the stadium. 1-3 live results monitors should also be provided.

The various services required to interface with the media at ground level and level one of the main stand are illustrated in Figure 4.2.2.3b.

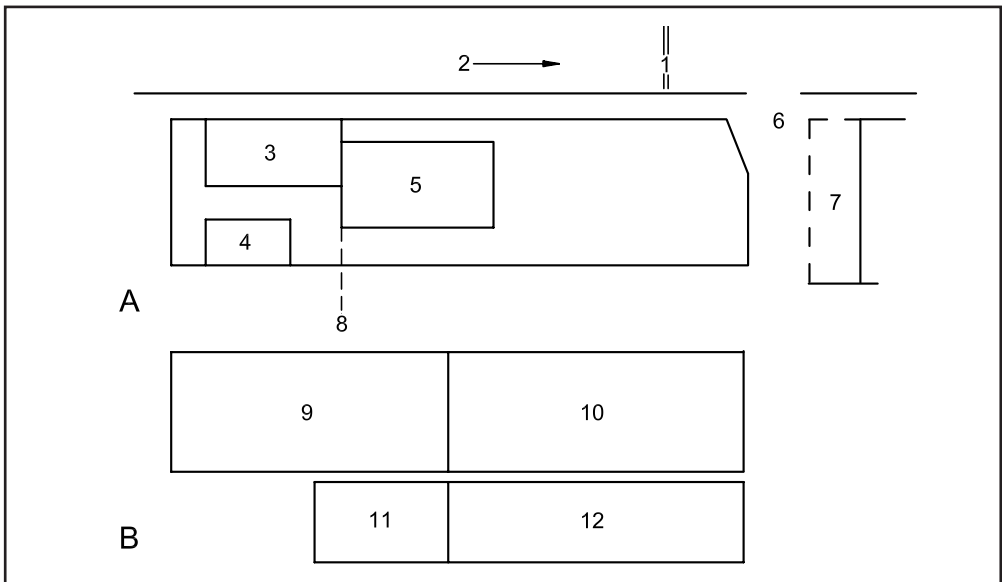


Figure 4.2.2.3b - Scheme of services at ground level and level 1 of the main stand

A Ground floor plan

B Level 1 plan

- | | |
|-----------------------------------|-------------------------|
| 1 Finish line | 7 Mixed Zone |
| 2 Direction of running | 8 Limit to media access |
| 3 Ceremonies | 9 Grandstand |
| 4 Doping control | 10 Media seats |
| 5 Interview | 11 Results and printing |
| 6 Exit for athletes to Mixed Zone | 12 Media working area |

4.2.2.2.4 Interview Room

The interview room should be in a convenient area of the stadium en route from the medal ceremony to either doping control (if required) or back to the athletes stand. A minimum detour should be required to reach this room. Similarly, it should not be a great distance from the journalists' working area within the stadium. Journalists and TV commentators should share the front seating, whilst cameramen and photographers should be arranged to the sides and rear of the room. Sufficient space must be provided to allow easy movement around the room for camera crews and photographers (Figure 4.2.1.3.3a).

Lighting, acoustics and air conditioning need full consideration.

4.2.2.2.5 Photographers

The key photographers' positions within the stadium are shown in Figure 4.2.3.2.5a.

The angle of these positions in relation to the track, and in particular the finish line, is critical. Of equal importance is the elevation which should be neither too high nor too low. Potential for a number of photographers to operate within a narrow sector must be considered.

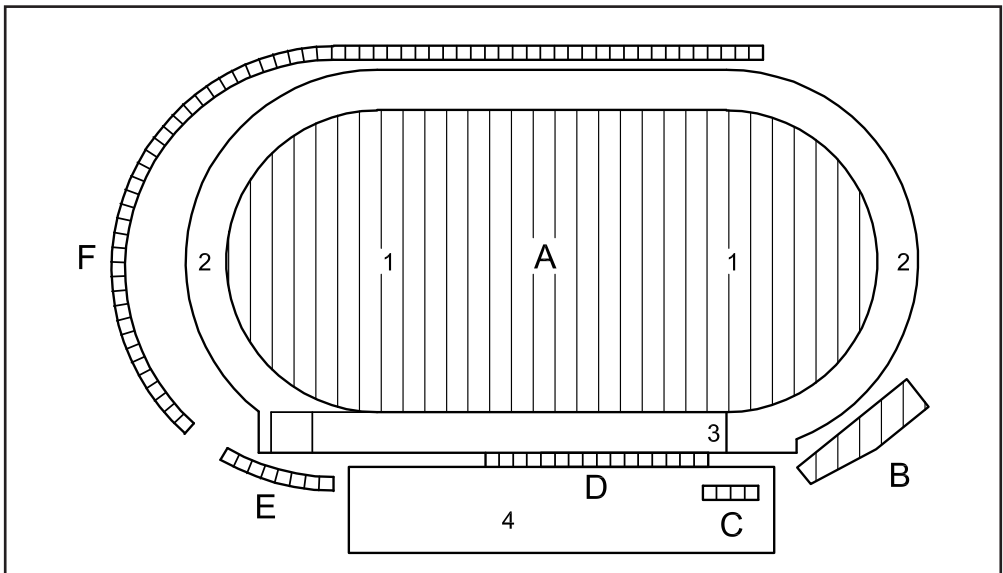


Figure 4.2.2.2.5a - Key positions for photographers

- A Infield
- B Head-on at finish line
- C Side-on at finish line
- D Finish straight moat
- E 100/110m start
- F Moat or behind advertising boards

- 1 Infield
- 2 Track
- 3 Finish line
- 4 Main stand

Moats are now not favoured for positioning photographers as advertising signage 1200mm high around the track for IAAF meets blocks their view. Moats are however useful for photographers' circulation around the stadium, and if wide enough can also accommodate platforms for shooting positions.

At the finish line, limited space must be shared with television to ensure all representatives get a good opportunity for the key shot (Figure 4.2.2.2.5b).

It is quite common for photographers to work independently and they therefore need access to a number of positions. Swift and easy movement between positions which allows for transportation of bulky equipment without disturbing other stadium users must be considered.

Figures 4.2.2.2.5c and 4.2.2.2.5d deal with the infield access. Accreditation should be very limited (a total of 16 photographers for outdoor competition and 12 for indoor is stipulated in the IAAF Media Guidelines). "no go" zones must be respected. The "no go" zone should be restricted to a limited number of designated officials only. No mobile TV cameras or pool photographers should be allowed. There should be minimal crossing of the track by photographers.

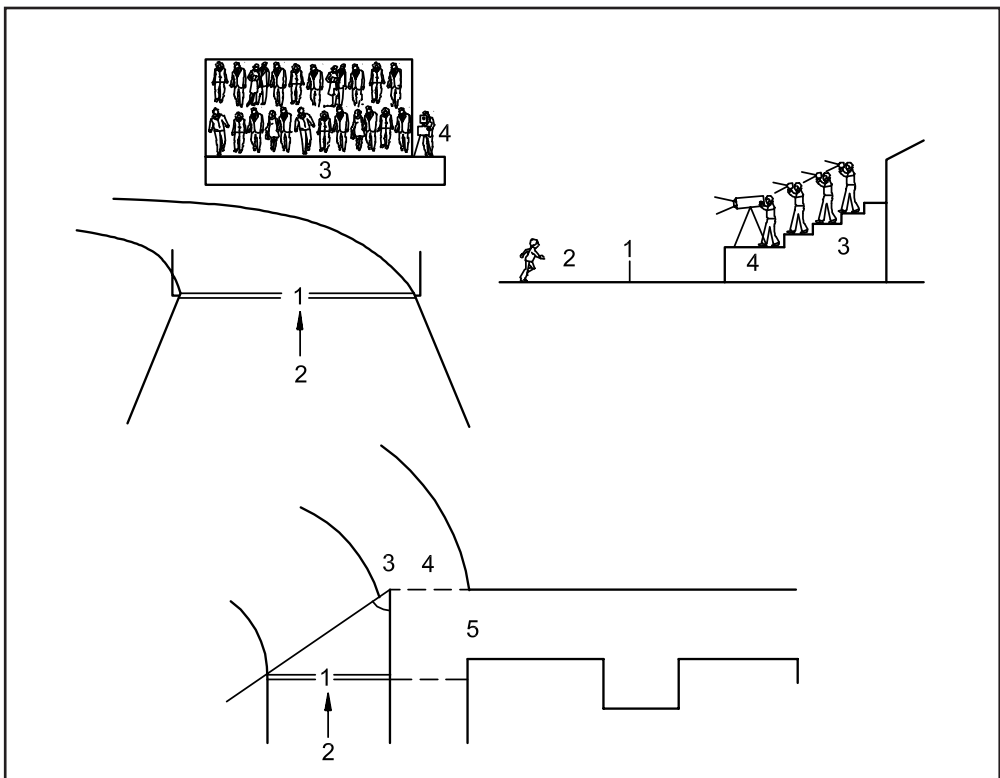


Figure 4.2.2.2.5b - Positioning at finish line

- 1 Finish line
- 2 Direction of running
- 3 Photographers' platform
- 4 TV
- 5 Exit for athletes to Mixed Zone

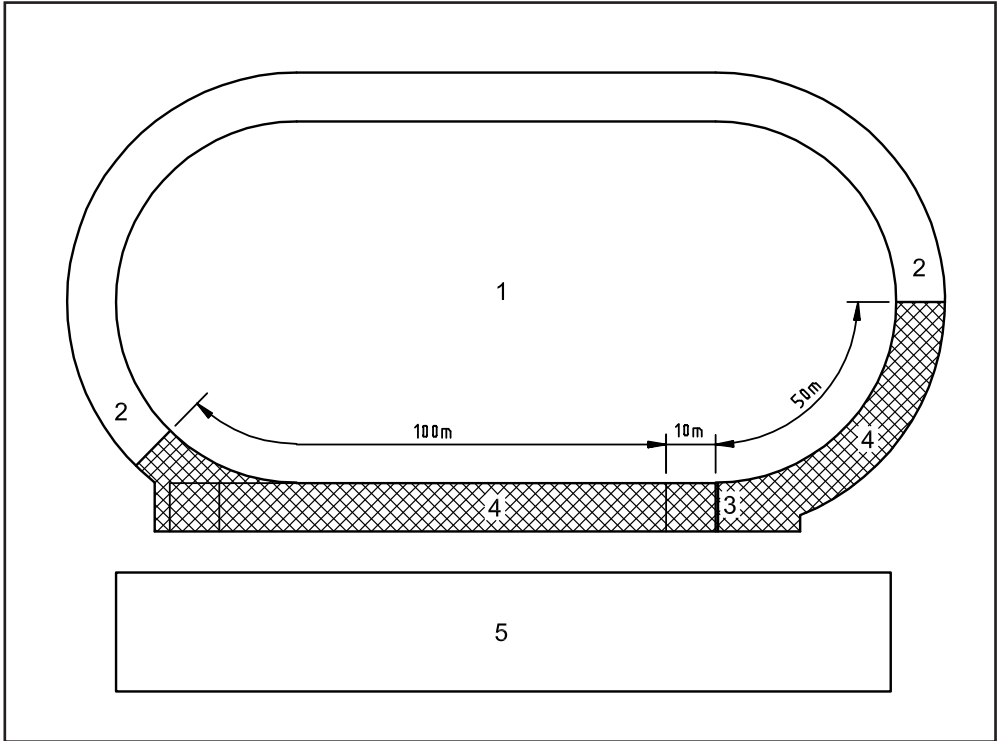


Figure 4.2.2.2.5c - "No go" zone on the track

- 1 Infield
- 2 Track
- 3 Finish line
- 4 "No go" zone
- 5 Main stand

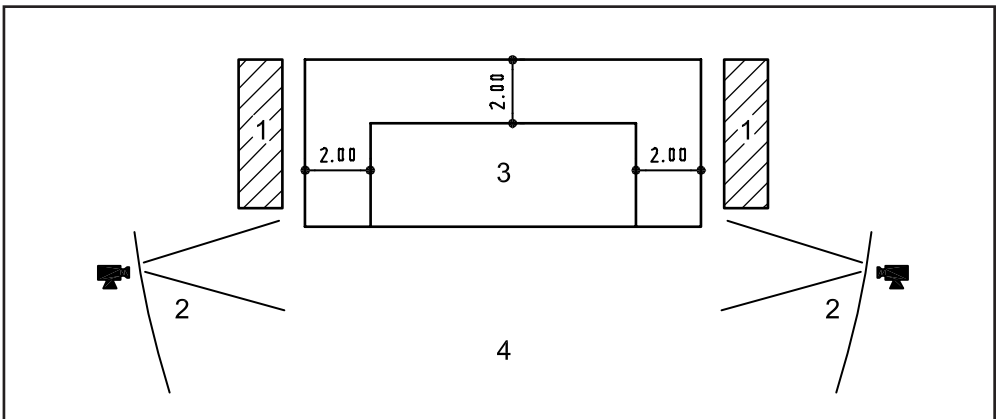


Figure 4.2.2.2.5d - Photographers' position on the infield (example High Jump)

- 1 Photographers' position
- 2 TV position
- 3 Landing mat
- 4 Runway

4.2.2.3 Television and Radio

4.2.2.3.1 Commentary Positions

The commentary positions provided to television and radio are the areas in which commentary is principally added to all television coverage of a competition. Unlike the written press, the electronic media representatives will remain seated in the commentary positions throughout the competition.

The seating must be directly above the finish line area and should extend no further than 30m either side of the finish line. It should begin no lower than the fifth row of the stadium seating and should never extend into upper tiers of the main stand.

Television and radio shall have priority on finish line seating. Those with live transmission schedules shall take priority over those broadcasting on a delayed basis.

4.2.2.3.2 Camera Platforms

The important principle of coverage for athletics is not the total number of cameras used as much as their positioning. However, the complexity of athletics coverage compared to other sports requires the employment of numerous cameras, the majority of which are cabled. It is often necessary to build a certain number of camera platforms and consideration must be given to seats lost by construction and viewing impaired once the structures are built. Certain key camera positions for athletics must be guaranteed no matter how small the competition or corresponding TV production (for example finish line camera). Platforms in the grandstands should be part of the permanent construction of the stadium.

Figure 4.2.2.3.2 is an example for a major athletics competition.

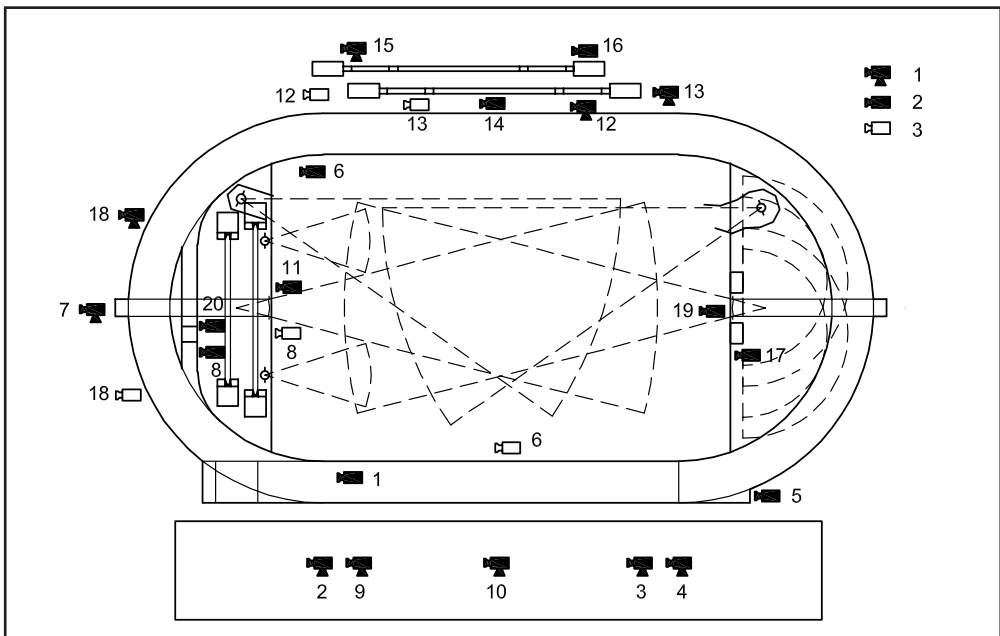


Figure 4.2.2.3.2 - Camera positions for major events

- 1 Fixed camera
- 2 Hand-held camera
- 3 Alternative position

Cabling ducts to known camera positions should be foreseen in the stadia construction. Access to camera positions and cables is required at all times. Cameras and cable connectors must be protected from the elements, in particular flowing water (rain/flood). Every effort should be made to ensure that human and vehicular traffic over cables is kept to a minimum.

Infield connection points for TV cameras are of critical importance.

Channelling inside the track kerb is required for circulation of television, computer, timing and general electrical cabling. Access to the channel at regular intervals is a necessity.

Individual camera positions which are cabled require constant power supply from the OB van through a suitable connector. Up to 15 cameras can be connected to one OB van.

4.2.2.3.3 Unilateral Facilities

Whilst the majority of participating television networks at major competitions will rely exclusively on the Host Broadcaster signal, some major networks will wish to supplement the Host Broadcaster coverage with their own feed. This will require additional cameras (and possibly platforms/platform space) particularly at the finish line, interview area and editing facilities. At major games/championships reservable studio facilities and equipment are required within the international broadcast centre.

To sustain a major unilateral operation requires huge staffing and will impact on accreditation considerations. Independent security measures are often arranged for a major unilateral operation and responsibility for this must be agreed in advance.

Major telecommunication requirements include the reservation of satellite channels and up-links from the IBC to the relevant satellite. Unilateral operations will have a major requirement for international telephone and telefax facilities within the TV compound and the IBC.

4.2.2.3.4 Finish Line Positions

Any television network undertaking unilateral coverage will seek a minimum of one camera position head-on to the finish line. From this platform the camera will concentrate on individual athletes, particularly where national interest arises.

The same camera will be employed for post-event interviews. Access is therefore required for cameramen, sound recorders, interviewers and technicians/engineers but not necessarily all at the same time.

The post-event interview area / Mixed Zone is the most pressurised zone in any athletics stadium. It therefore needs careful planning as to distribution of space, priority, security and control.

4.2.2.3.5 Interview Area

Television requires the earliest opportunity to interview participants in the moments after completing an event. To achieve this end in a controlled, dignified manner, a unilateral interview area must be created beyond the finish line en route to the exit point from the track into the stadium and the Mixed Zone. Radio interviews will take priority over those by journalists in the Mixed Zone area. Space must be

provided at the finish line camera point for the conduct of interviews with individual athletes.

4.2.2.3.6 Infield Positions

In providing television coverage for participating broadcasters, the Host Broadcaster requires presence on the infield. This is particularly relevant for Field Events. Maximum use can be made of hand-held RF cameras for flexibility but some use of cabled cameras will be necessary. It is essential therefore to plan for the necessary cabling and relevant channelling / ducts and power points beneath the track and infield.

4.2.2.3.7 Mixed Zone

After the unilateral television area, priority in the Mixed Zone must be given to ENG cameras and radio interviews. Space, lighting and accessibility are considerations of importance for all involved.

4.3 Operational Rooms and Rooms for Competition Organisation

4.3.1 AREA AND ROOM SCHEDULE

Area and room schedules for the operational rooms and for the competition organisation are variable due to the differences in the location, standard, type and size of sports facilities. A schedule can only be arranged once all details of the facility are known.

The schedule should be arranged into permanent rooms for temporary use. The latter may be provided either by assigning sections of the building temporarily for this purpose or by means of provisional arrangements. Buildings or tents erected temporarily must be suitably sized and well positioned allowing easy access to areas in permanent use.

The lists of rooms shown below serve only as a check list and may be achieved by multiple use of areas and larger rooms.

4.3.1.1 Rooms for Operation and Technical Installations

Box for competition director	4 x 3m
Box for event presentation manager	4 x 5m
Box for stadium announcers	4 x 3m
Box for scoreboard operator	2 x 3m
Box for security / police	4 x 3m
Box for monitor surveillance	as required
Box for public address system	2 x 2m
Box for lighting control	2 x 2m
Box for timing / photo finish evaluation	3 x 5m
Toilets	as required
Store for cleaning equipment	as required

4.3.1.2 Stewards and Public Order Services

Assembly and lounge for police, fire brigade and stewards	1m ² per person
Toilets	as required
Security cells	as required

4.3.1.3 Rooms for Organisers / Sports Federations

International president's office	24m ²
International secretary general's office	18m ²
National president's office	24m ²
National secretary general's office	18m ²
Competition secretariat	as required
Computer room	30 to 35m ²
Technical information centre	as required
Rooms for statisticians	as required
Conference room (among others for the Jury of Appeal and for video monitoring)	20 to 30m ²
Small kitchen	min. 8m ²
Toilets	as required

4.3.2 FURNISHING AND EQUIPMENT

Generally, the same requirements apply for the furnishings and equipment of the operational rooms and rooms for competition organisation as for the rooms for administration (See 4.4.2).

An adequate number of connections for telephone, fax and EDP systems should be supplied.

4.3.3 FUNCTIONAL GROUPING

Figure 4.3.3a shows the layout of the operational rooms and rooms for competition organisation in the overall stadium set-up. At large facilities, a separate access and departure area is necessary for these user groups, with parking space for police organisers and for stadium administration staff.

Whilst the rooms for competition organisation and administration are situated beneath the stand (or in the immediate vicinity of the stand in a separate building), the operational rooms for competition director, event presentation manager, announcers and scoreboard operator are situated in a high, central location of the main stand with a clear view over the whole competition area. It must be ensured that a clear, unbroken line to scoreboards will not be disturbed by cantilever roofing or support pillars.

Whilst acoustically separated from each other, visual contact between these parties is of great assistance (Figures 4.3.3a and 4.3.3b)

Section 4.3.1 also applies to these areas and rooms.

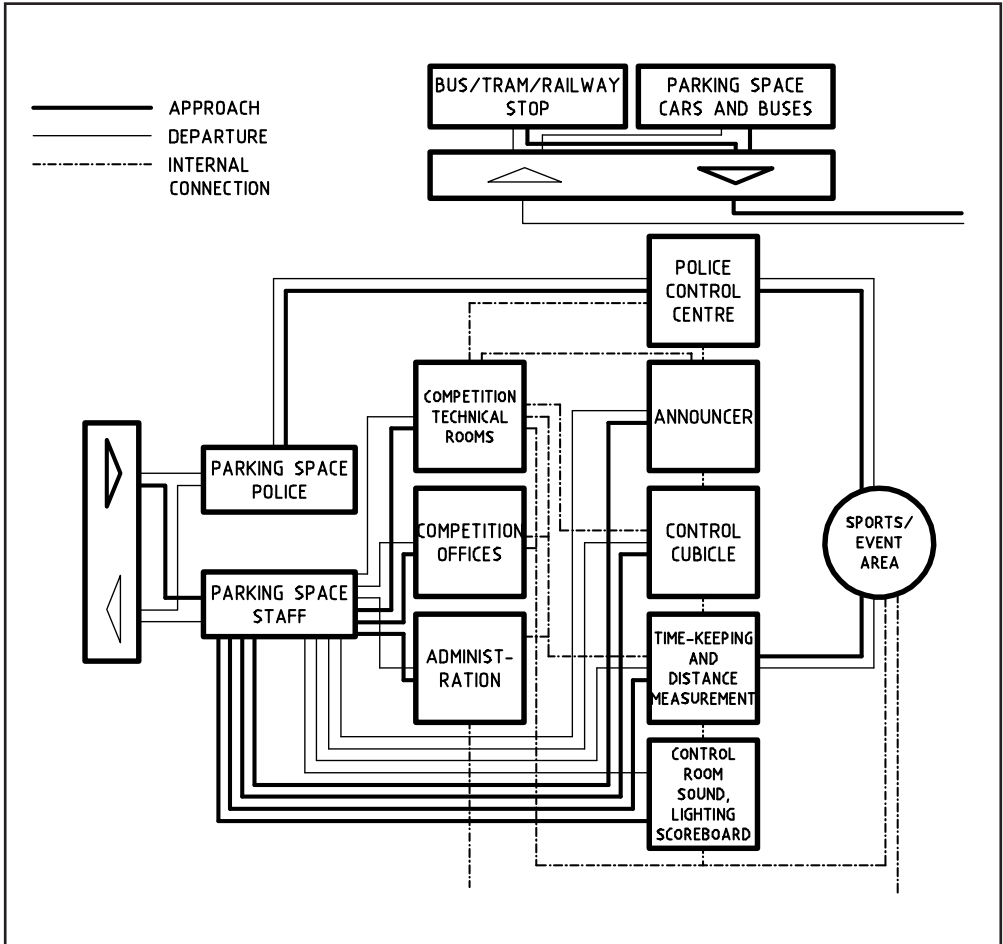


Figure 4.3.3a - Integration of operational rooms and rooms for competition organisation into overall concept

Source: *Planning Principles for Sportsgrounds / Stadia, IAKS Series Sports and Leisure Facilities No. 33*

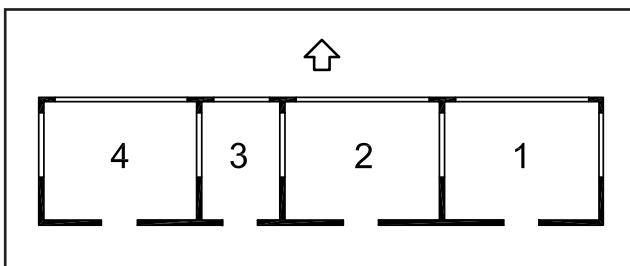


Figure 4.3.3b - Arrangement of the strategically important positions

- 1 Announcers
- 2 Videoboard / scoreboard operators
- 3 Competition director
- 4 Security

4.4 Rooms for Administration and Maintenance

4.4.1 AREA AND ROOM SCHEDULE

4.4.1.1. Administration

4.4.1.1.1 Reception Area

Entrance hall	as required
Reception / Information	as required
Telephone exchange	as required
Telephones	as required
Cloakroom	as required
Toilets	as required

4.4.1.1.2 Offices

Director	20m ²
Secretariat	12m ²
Other members of staff	12m ² /person
Accounts dept. / entrance tickets administration	12m ²
PR and marketing	12m ²
Competition organisation	12m ²

4.4.1.1.3 Conference Area

Conference room	20 to 30m ²
Small kitchen	
possibly also provisions room for administration staff	as required
Toilets	as required
Store for cleaning equipment	as required

4.4.1.2 Maintenance

4.4.1.2.1 Office for Maintenance Manager

possibly with briefing room	15 to 20m ²
-----------------------------	------------------------

4.4.1.2.2 Offices for the Technicians

Room for building maintenance	10m ²
Room for heating, ventilation, sanitary engineers	10m ²
Room for electrical engineers	10m ²
Room for ground staff	10m ²

4.4.1.2.3 Personnel Rooms

Changing and sanitary room	as required
Lounge with small kitchen	min. 8m ²
or	1.20m ² /person

4.4.1.2.4 Store Rooms and Workshops

Ideally, these facilities should be located on the eastern side of the arena with separate drive in and drive out entrances. There should be differentiation between those areas controlled by the stadium operator and those rooms under the control of the technical officials e.g. technical implement measurement and storage.

Sports Equipment Room

General requirement: 1m² of equipment space for every 500m² to 700m² of usable sports area. Additional space may be required for storing landing mats in winter.

Maintenance and Cleaning Room *as required*

Lawn mowers, sweepers, high-pressure cleaners, attachments for the sports areas, vegetation and pedestrian areas.

General requirement for facilities in which maintenance machines are housed:

- 1m² of equipment space for every 400m² to 500m² of usable sports area
- Maintenance is centralised, and machines are transported to and from:
- 1m² of equipment space for every 700m² and 900m² of usable sports area

<i>Room for Fertilisers, Cleaning Agents and Spare Parts</i>	<i>as required</i>
<i>Storeroom for Electrical Equipment</i>	<i>as required</i>
<i>Workshop</i>	<i>min. 15m²</i>
<i>Garage for Tractor</i>	<i>15m²</i>
<i>Garage for Small Pick-up Vans, Lorries</i>	<i>15 to 20m²</i>
<i>Fuel Store</i>	<i>as required</i>

4.4.1.2.5. Plant Rooms

The plant required for the adequate functioning of an athletics hall can be situated in different plant rooms. All plant can be controlled from a centrally located control room.

Heat Plant

For a heat plant with gas-fired boilers, a gas-pressure check-room and a gas metering station are needed. For oil-fired boilers tanks are needed.

Refrigeration Plant

The chilled water needed for air conditioning is produced by a refrigeration plant installed indoors and by cooling towers situated outdoors.

Ventilation Plant System

For the individual functional units of a stadium, self-contained ventilation plants are needed, positioned near to each functional unit.

Transformers and Power Distributors

The incoming high voltage electrical power will be transformed and then distributed through appropriate installations, control panels and switchboards to its destination.

Fire Fighting Water Network and Water Reservoir

The requirements of the local Fire Brigade are to be taken into consideration.

Mains Room

as required

4.4.1.2.6 Waste Disposal Area

as required

4.4.2 FURNISHING AND EQUIPMENT

These rooms must be designed, constructed and equipped to the required standard.

A good orientation system (overview plan, signposting, pictograms, emergency information) should be provided in the entrance area. It should contain glass cases and notice-boards and should impart an impression of clarity and safety to visitors. User-friendly design and furnishing (for example with seating clusters) are recommended.

Corridors, passages etc. should be adequately dimensioned and clearly arranged; doors to administration areas should be uniformly signposted.

Staff rooms are subject to the same requirements as changing rooms, shower rooms and washrooms for sports participants. Lockers should be supplied.

The small kitchen should be equipped with refrigerator/freezer facilities and microwave oven for ready-prepared food, tables and chairs.

The office rooms should normally be equipped with the following furniture: 1 or 2 work desks and accompanying chairs, 2 chairs for visitors, shelving and cupboards.

The dimensions of doors or gates to storage areas, sports equipment areas and garages should be appropriate for the vehicles used. Easily cleaned, oil and impact-resistant, hard-wearing materials should be selected for the floors, for example concrete covering or slab-stone paving. Walls should be impact-resistant and smooth.

Shelving, mountings for equipment, and mobile containers should be provided.

Garages must be provided with sinks, hydrants with hose connections and floor drains with, if necessary, separators.

National regulations concerned with storage of fuel and lubricants must be observed.

The access openings in the workshop must measure at least 1.50m x 2.00m but if vehicle access is possible the above recommendations apply.

Workshops must be equipped to meet all technical demands.

4.4.3 FUNCTIONAL GROUPING

The allocation of areas and rooms for administration and maintenance is shown in Figure 4.4.3. The staff has its own entrance and parking space for cars and bicycles. Access is gained to the administrative area, social rooms and workshops, which are interlinked to the sports areas.

It is preferable that equipment and implements should be transported into and out of the infield through a dedicated entrance / exit not used by athletes.

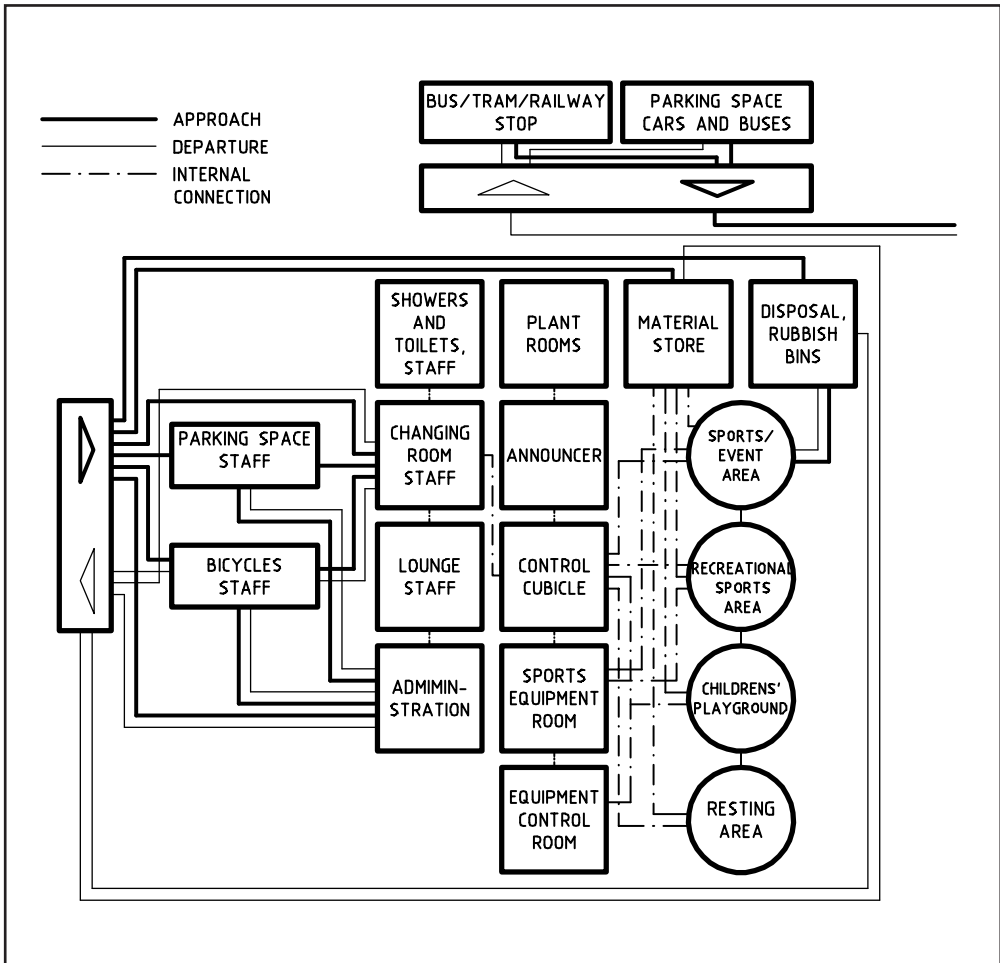


Figure 4.4.3 - Allocation of areas and rooms for administration and maintenance

Source: *Planning Principles for Sportsgrounds / Stadia*, IAKS Series Sports and Leisure Facilities No. 33

4.5 Other Design Issues

4.5.1 MARATHON TUNNEL

The Marathon tunnel is usually located at the 100m start end of the stadium. It should be at least 5 metres wide so as to be able to handle the bunched field at the start of the Marathon. The tunnel road with a grade not exceeding 8% should lead straight to the perimeter road system. The grade is important as is the tunnel access which must also be used by race walkers and wheel chair athletes.

4.5.2 SIGHTLINES

For athletics, the sightline focus should be the centre of the outer lane of the track or the centre of the outer Long Jump pit where this is located outside the track.

The minimum "C" value should be 60mm where "C" is the vertical difference between the sightlines from standard spectator figures seated in adjoining tiered rows.

It is accepted that advertising signage 1200mm high placed around the arena at IAAF meets will affect these sightlines.

Designers should also ensure that all spectators are also able to see at least one result scoreboard.

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CHAPTER 5

TECHNICAL SERVICES

5.1. Lighting and Power

5.1.1. USER REQUIREMENTS

The users of Track and Field facilities can be categorised according to their activities:

Athletes, Competition Judges and Team Officials

They must be able to see clearly all that is going on in the competition area so that they can produce their best possible performances, and/or make accurate decisions.

Spectators

They should be able to follow the performances of the athletes and other action in an agreeable environment. It follows that they must be able to see not only the competition area but also its immediate surroundings. The lighting should also enable spectators to safely enter and leave the sports facility.

Television Crews and Photographers

For television and/or film coverage, the lighting must be sufficient to ensure that high quality colour images can be obtained, not only of the overall action but also close-ups of both athletes and spectators. Close-up images are important to convey the excitement and atmosphere in a stadium to viewers watching at home.

As the competence level of athletes increases, so too does the speed of the action and consequently visual task becomes more difficult, requiring more light of a higher quality. Therefore, the artificial lighting for athletics is grouped into five classes reflecting the levels of activity:

Non-televised Competitions

- Recreation and training
- Clubs
- National and international

Televised Competitions

- National
- International

5.1.2. LIGHTING CRITERIA

5.1.2.1. Horizontal Illuminance (E_h)

It is the illuminance (measured in lux) on this horizontal plane, at ground level, that chiefly serves to establish the adapted state of the eye, by creating a stable visual background against which people and objects will be seen.

5.1.2.2. Vertical Illuminance towards Cameras (Ev)

Vertical planes are used to simulate the light falling on the body of athletes and objects. Generally, vertical illuminance towards cameras is calculated on a vertical plane 1.5 m above the competition area (orientated towards each relevant camera). However, the height chosen could also differ to ensure that athletes taking part in e.g. High Jump (around 2.5m) and Pole Vault (around 6m) are well lit at all times.

5.1.2.2.1. Ev towards Fixed Cameras

For the coverage of athletics events, it is usual for there to be a main fixed camera position located close to the finish line of the athletics track. This camera is used to maintain an overall view and continuity of the action over the entire area and for the coverage of specific Track Events. In addition, additional fixed cameras are commonly used around the competition area. (see sections 4.2.2.3.2 and 8.8.3.2 for camera positions) For cameras used in this way the calculations should be made specifically for them as described in figure below.

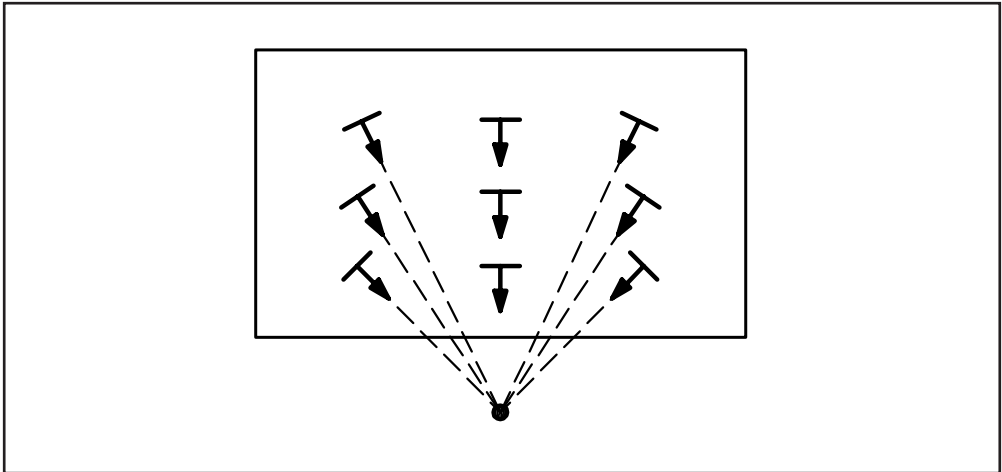


Figure 5.1.2.2.1 – Vertical planes perpendicular to camera axis at each grid point

5.1.2.2.2. Ev towards Mobile and ENG Cameras

It is now common for many cameras to be distributed around the arena to obtain close-up action shots from alongside each event area. However, each camera is only required to cover a small area of the total competition area. It is therefore not necessary to make calculations for each camera over the whole competition area.

In these situations where unrestricted camera positions are used, it is recommended to calculate the vertical illuminance toward all four sides of the competition area and assess the situation for each camera for the appropriate viewing area.

When this type of calculation is used, the uniformity (Ev min./Ev max.) between the four vertical calculations at a single grid point should not be lower than 0.3. This ensures that the modelling for the television camera will be sufficiently high.

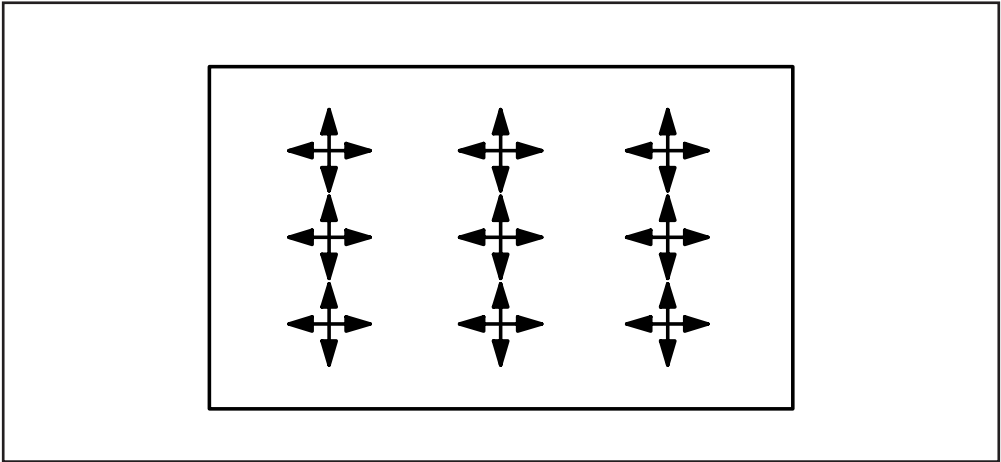


Figure 5.1.2.2.2 – Vertical planes in four orthogonal directions at each grid point

5.1.2.2.3. Ratios

To ensure the television picture has a well balanced brightness, the ratio between the average vertical and horizontal illuminance should be as closely matched as possible, but should not exceed the ratio of 0.5 to 2 times.

To ensure that the reactions of spectators can be captured, it is necessary that the spectator areas immediately adjacent to the competition area (around 15 first rows) be adequately lit. The vertical illuminance level on these spectators should be around but not be less than 25% of that provided for the competition area.

5.1.2.2.4 Planning, Measurement

The given densities of light (Tables 5.1.3.1 and 5.1.3.2) are nominal values (values in use). The planning value or replacement value of the lighting is to be calculated around at least 25% higher because of ageing and soiling of the lights.

5.1.2.3. Illuminance Uniformity

Good Illuminance Uniformity is important in order to avoid adaptation problems for both athletes and spectators. If the uniformity is not adequate, there is a risk that an implement and/or an athlete will not be clearly seen at certain positions on the competition area.

Uniformity is expressed as the ratios of the minimum to maximum illuminance (also called U1) and of the minimum to average illuminance (also called U2):

- $U1 = E_{min.}/E_{max.}$
- $U2 = E_{min.}/E_{ave.}$

In order to guarantee a visually acceptable illuminated field, a Uniformity Gradient (also called UG) is calculated for all grid points (spaced 5m apart). UG is the ratio in percentage of the Illuminance at the grid point to the Illuminance at every adjacent grid point.

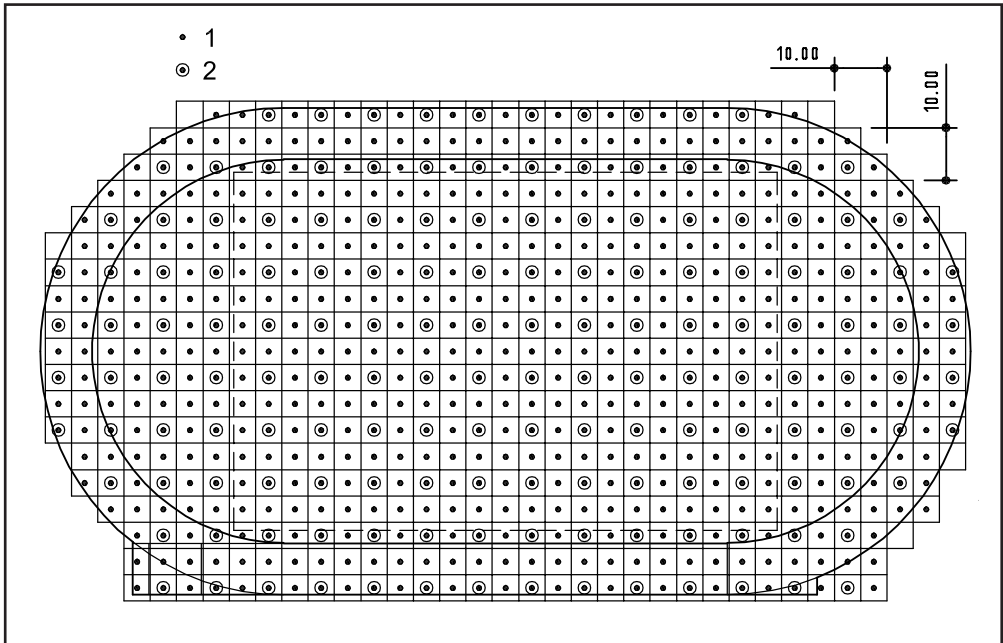


Figure 5.1.2.3 – Calculation and measurement grid for the 400 m Standard Track

5.1.2.4. Glare

Glare is caused by the difference (contrast) between the direct brightness of the lighting installation and the brightness of the competition surface. When the ratio of these two brightness is too high, this will cause visual discomfort or disability.

A method of calculating glare has been defined, resulting in a "Glare Rating" also called GR. GR is assessed on a practical scale of 10 (un-noticeable glare) to 90 (unbearable glare) and should not exceed 50 for any position on the competition area. GR should in principle be calculated for the athlete (observer) positions indicated in Figure 5.1.2.4. However, lighting designers may add positions where they believe particular attention is needed (e.g. Pole Vault or High Jump).

It should be noted that while the "GR" method can give an indication of potential problems, there remains a significant subjective element and the experience from one person to another is likely to be different.

Thought should be given to where reflections are likely to appear in the direction of the cameras in the event of rain. Luminaires should as far as possible be situated such that if the synthetic surface becomes wet that reflections will not be in the direction of the cameras or judges.

5.1.2.5. Colour Properties of Lamps

Good colour perception is appreciated even at recreational and club levels, though becomes more critical for televised events, where natural colour reproduction is expected by today's broadcasters. There are many types of light sources available and

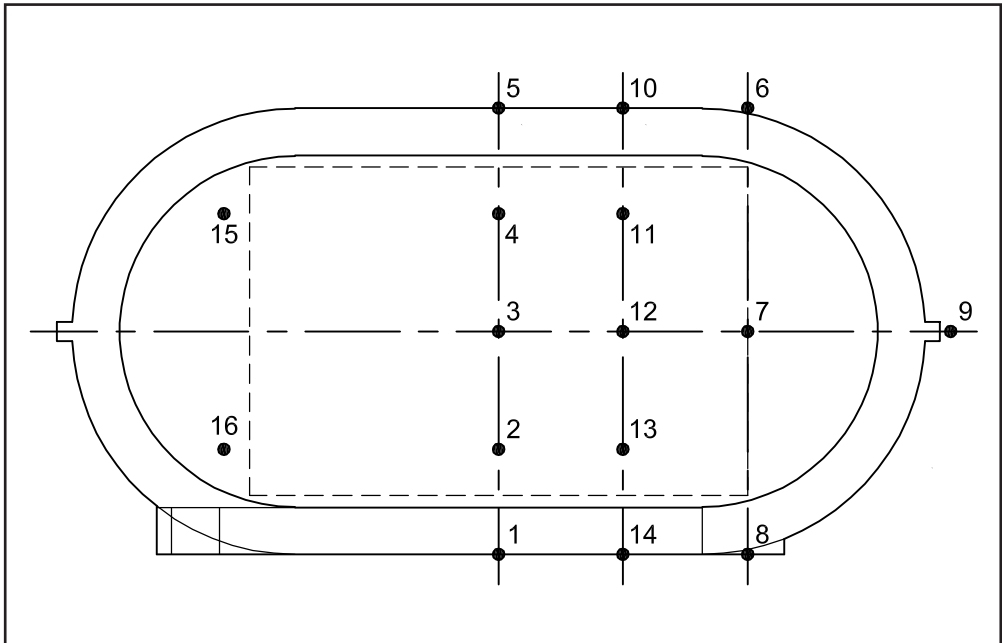


Figure 5.1.2.4 – Observer positions for calculation of glare rating GR

many names used to describe them, however light sources can be characterised by two key parameters.

5.1.2.5.1. Colour Temperature

Colour temperature (also called T_k) describes the feeling or appearance of how warm (red) or cool (blue), a certain type of lighting appears to be; it is measured in "Kelvin" (K).

A suitable range of colour temperature lies between 2000 K and 6500 K for outdoor facilities and 3000 K to 6500 K for indoor facilities.

Lighting systems used in combination with daylight should have a colour temperature close to that of daylight. A camera system can only adapt to one colour temperature at a time. In addition the preferred photographic films for sports usage are daylight balanced to around 5500 K. For televised events, a colour temperature range between 4000 K and 6500 K shall be used and the same colour temperature should be used throughout the facility.

5.1.2.5.2. Colour Rendering Index

Colour rendering (also called R_a or CRI) describes the ability of a light source to faithfully reveal and reproduce the natural colours. Colour rendering is ranked on a practical scale from R_a 20 to 100 where the higher the index the better the colour accuracy.

The degree of colour accuracy of a sports lighting system depends upon the purpose of the installation. For instance, recreational activity is less demanding than

that of televised events where promotional materials must be reproduced accurately. High colour rendering contributes to the quality of televised and photographic images.

5.1.3. LIGHTING RECOMMENDATIONS

5.1.3.1. Non-Televised Events

Where athletics facilities are to be used for non-televised activities, it is only necessary to provide a horizontal illuminance suitable for the required level of activity.

Activity Level	Horizontal Illuminance	Uniformity		Colour Properties of Lamps	
	Eh ave. (lux)*	U1 Emin./Emax.	U2 Emin./Eave.	Colour Temperature Tk (K)	Colour Rendering Ra
Recreational & training	75	0.3	0.5**	> 2000	> 20
Club Competitions	200	0.4	0.6	> 4000	≥ 65
National & International Competitions	500	0.5	0.7	> 4000	≥ 80

* Illuminance values are minimum maintained average values ; initial values are 1.25 times higher
 ** When only the track is to be used and the in-field lights are switched off, U2 should be ≥ 0.25

Glare Rating (GR)	≤ 50
Uniformity Gradient (UG) per 5 m (Only for National and International Competitions)	≤ 20%

Table 5.1.3.1 - Minimum requirements for non-televised events

5.1.3.2. Televised Events

Where colour television broadcasting is a requirement, it is necessary to provide an adequate vertical illuminance towards cameras across the scene viewed by the camera. If the vertical illuminance toward cameras is not sufficient, good quality broadcast pictures will not be possible.

5.1.3.3. Anti-Panic Lighting

For the purpose of safety and orientation for the spectators, in the event of a main power failure or emergencies, it is recommended to maintain an illumination of at least 25 lux in the stands.

5.1.3.4. Modelling and Shadows

To limit the length and hardness of the shadows caused by the athlete, the distribution of the total flux installed should be no greater than 60% for the main camera side and no less than 40% for the opposite side. The design of the lighting system should be based on light coming from at least two directions (side lighting) or, ideally, from as many directions as possible to create good visibility and modelling in all directions.

Activity Level	Camera Position for Calculation	Vertical Illuminance toward Cameras Ev ave. (lux)*	Minimum Uniformity		Colour Properties of Lamps	
			U1 Emin./Emax.	U2 Emin./Eave.	Colour Temperature Tk (K)	Colour Rendering Ra
National and International Competitions +Emergency TV lighting	Fixed camera	1000	0.4	0.6	> 4000	≥ 80
Competitions of Major International Importance such as World Championships and Olympic Games	Slow motion camera	1800	0.5	0.7	> 5500	≥ 90
	Fixed camera	1400	0.5**	0.7**	> 5500	≥ 90
	Mobile camera	1000	0.3	0.5	> 5500	≥ 90
	Photo Finish camera	2000				
* Illuminance values are minimum maintained average values; initial values are 1.25 times higher ** For Finish Line cameras U1 and U2 should be ≥ 0.9						

Ev point over 4 Planes (see 5.1.2.2.2.)	≥ 0.3
Eh ave. / Ev ave. (see 5.1.2.2.3.)	≥0.5 and ≤ 2
Ev ave. First Rows of Spectators (see 5.1.2.2.3.) / Ev ave	≥ 0.25
Glare Rating (GR)	≤ 50
Uniformity Gradient (UG) per 5 m	≤ 20%

Table 5.1.3.2 - Minimum requirements for televised events

5.1.4. INSTALLATION RECOMMENDATIONS

The lighting design for an athletics facility can be based on a number of basic floodlight arrangements. The mounting system employed may be either masts, columns or the structure of the stadium itself such as the roof.

5.1.4.1. Permitted Longitudinal Positioning of the Floodlights

In the majority of cases, athletics facilities will have limited, or no, spectator capacity and can be illuminated using floodlights mounted on columns arranged around the perimeter of the competition area. Where columns are used to support the floodlights, these columns should be positioned at least 4m from the edge of the track to prevent obstruction for athletes using the competition area.

Where the infield is also used for other sports such as soccer at a competitive level, it will be necessary to position columns so that to maintain good visual conditions for the goalkeepers and attacking players from the corners, lighting equipment shall not be placed within a zone of 15° either side of the goal line for televised competitions and 10° for non-televised competitions. (Figure 5.1.4.2.)

5.1.4.2. Pre-Determination of Tower Height

Tower height must be selected so that all parts of the field can be illuminated to the required standard for the number of cameras to be used. Column heights can

initially be estimated by ensuring that the angle subtended at the centre of the competition area to the head-frame centre shall be not less than 25° ($h = d \times \tan \alpha$), while ensuring that no luminaire is aimed above 70° from the downward vertical. (Figure 5.1.4.2.)

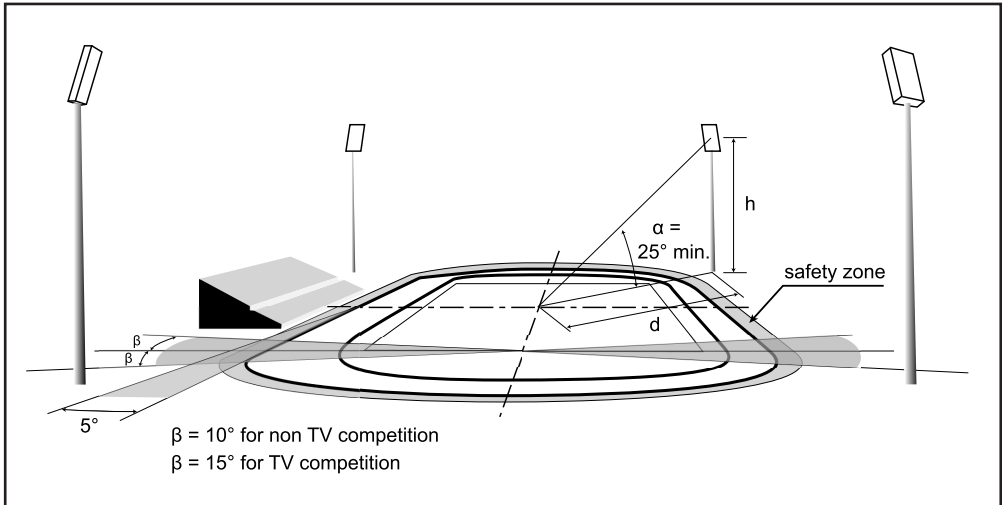


Figure 5.1.4.2 – Floodlights positioning

5.1.4.3. Stroboscopic Effect

All high intensity discharge (HID) lamps, operating on an alternating voltage will exhibit a fluctuating lighting output. This effect is referred to as "flicker" or stroboscopic effect. It is particularly disturbing to television cameras and photo-finish equipment and can cause loss of pictures at a critical moment. It can be minimised by ensuring that the illumination is provided by groups of three luminaires with overlapping beams. Each group of luminaires should be balanced across the three phases whether the individual luminaires are designed for connection between a phase and neutral or between two phases.

5.1.5 POWER REQUIREMENTS

If the high voltage power supply to the stadium comes from one sub station then for major events there should be standby generators either permanent or temporary available to ensure that the meeting can continue in the event of a blackout. In stadia with HID lamps, standby generators should have a "ride through" capability to avoid shut off and new starts of HID lamps which may need several minutes.

5.2 Measurements

The measurement of time, distance and wind speed today demand maximum objectivity and accuracy. The instruments employed must be geared to the needs of the events. So that the spectator's need for information is satisfied, scoreboard

systems have to be available in stadia as field boards and time elapsed clocks for the Field Events and as boards for the running times in Track Events and as large scoreboards for displaying the results.

5.2.1 TIMING

Because of the intensity of top-level competition in today's sprint events, timing has to be more accurate than in the past. In the early years of Track Events the hand-operated stop-watch was sufficient. When new methods of timing were developed (including devices controlled by the starter's gun) it was also essential to be able to determine precisely the order of finishing. With time differences measured to the nearest 1/1000 of a second, it is often impossible for the human eye to determine the respective positions. As a consequence, other methods of recording were sought. The slit camera seemed a suitable alternative. Here the slit is aimed at the finish line and records it in relation to time. It thus facilitates the identification of a definite finishing order with the allocation of the respective times.

The use of IAAF approved Transponder Timing Systems in events for races not held completely in the stadium is permitted under certain conditions.

The in-stadium use of active transponders attached to the front number bib offers the possibility of lap scoring and providing intermediate and lap times for all athletes in the race as well as immediate unofficial finish time and better identification of the finishers. The reception antenna is to be located under the synthetic surface according to the specification of the timing provider.

5.2.2. DISTANCE AND HEIGHT

5.2.2.1 Distance for Throws

The beginning of the 1970s saw the introduction of the measurement of throwing distance by tacheometer, a method long in use in land measurement. This system is faster than by measuring by tape. The accuracy of the measured distance is $\pm 0.005\text{m}$ and of the measured angle ± 10 angular seconds, which is equivalent to an average error for thrown distances of $\pm 0.005\text{m}$.

A direct measurement of a performance with an electro-optical angle and distance measuring instrument is not possible as the instrument cannot be set up beyond the centre of the throwing circle or arc during competition. The throwing distance is, therefore, measured from an eccentric point by means of combined distance and angle measurement.

Figure 5.2.2.1 gives an example for measurement of a throw distance.

Before the start of competition, the base line B (tacheometer position to centre of the throwing circle) and the direction are measured and, including the radius of the circle, stored. With the aid of an inbuilt microprocessor, the horizontal distance A and the direction to the reflector inserted by the judge at the impact mark left by the implement are measured after each throw. The throwing distance C then is calculated from the stored data in fractions of a second using the following formula:

$$C = \sqrt{A^2 + B^2 - 2AB \cos \alpha} - R$$

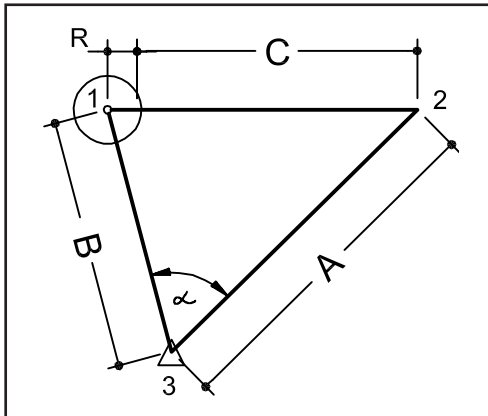


Figure 5.2.2.1 - Principle of measuring distance
(Example: Shot Put)

- 1 Shot Put circle
- 2 Point of landing
- 3 Electronic tacheometer

It takes only about 10s from the insertion of the reflector to the automatic indication of the distance on the field boards.

5.2.2.2 Distance for Long and Triple Jump

The technical equipment and trigonometry for calculation of length of jump are the same as for the throws with the base line B (Figure 5.2.2.2) being measured from the tacheometer to the take-off line.

5.2.2.3 Height

For the control measurement of the height of the crossbar for High Jump and Pole Vault, the tacheometer mentioned in 5.2.2.1 can be employed with sufficient measurement accuracy provided that

- the instrument is set up at least 35m from the perpendicular beneath the crossbar;
- the instrument's position deviates no more than 2m from the vertical axis of the runway, and
- when installing the measuring system for the Pole Vault, it has been checked that the position of the uprights and crossbar coincide with the zero line.

For the Pole Vault facility, it is also essential to ensure that to change the crossbar distance from the zero line (0.80m) the slides of the uprights on the ground or the supporting structure of the crossbar displacement of uprights in ground sockets are completely horizontal.

For the Pole Vault, for example, the height (H) of the crossbar above the runway level is calculated with the following formula:

$$H = A + B + C$$

where

$$C = BL \tan \beta$$

The use of other IAAF approved scientific measuring devices for the measuring of Field Event attempts is also acceptable. Video distance measurement for instance provides a permanent record of each attempt and can be a valuable assistance to officials, athletes and coaches.

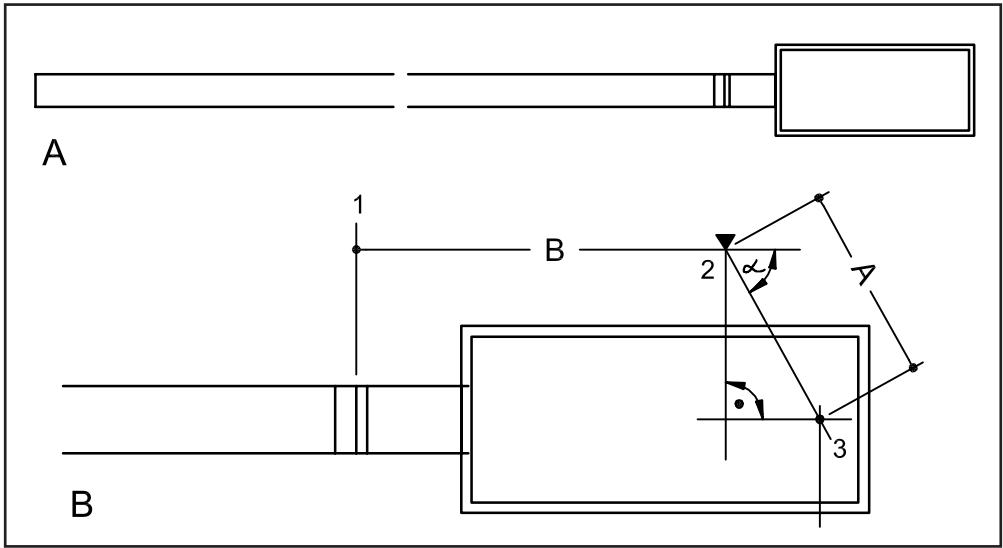


Figure 5.2.2.2 - Principle of measuring distance (Example: Long Jump)

A Top view of a Long Jump facility

B Detail

1 Take-off line

2 Electronic tacheometer

3 Point of landing (reflector at the impact mark)

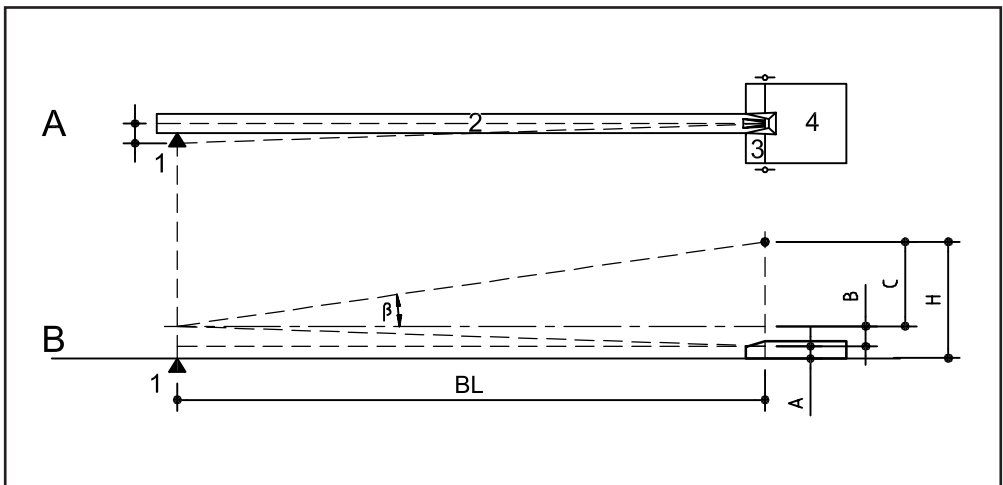


Figure 5.2.2.3 - Principle of checking height (Example: Pole Vault)

A Top view of a Pole Vault facility

B Detail

1 Electronic tacheometer

2 Runway

3 0-line

4 Landing mat

5.2.3 WIND SPEED

Any type of wind gauge may be used to measure wind velocity, provided it is certified as accurate by an appropriate authority. Gauges currently available measure wind velocity either by mechanical means (moving propellers) or by the use of ultrasonic or mass flow technology.

Because there are no moving parts as in propeller wind gauges and as the effect of air properties is eliminated, ultrasonic wind gauges are inherently more accurate and reliable. Hence ultrasonic wind gauges are used at most international competitions.

Wind gauges shall be used in the following events:

100m, 100m Hurdles, 110m Hurdles, 200m, Long Jump, Triple Jump.

They shall be positioned 1.22m high and not more than 2.00m away from the track or runway.

For Track Events, they shall be placed besides the straight, 50m from the finish line, adjacent to lane 1.

For Long and Triple Jump, they shall be placed 20m from the take-off board.

The wind gauge may be linked to the start / timing system and electronically activated or manually operated.

The periods for which wind velocity shall be measured in Track Events shall be:

for 100m from the flash of the starter's gun	10 seconds
for 100m Hurdles	13 seconds
for 110m Hurdles	13 seconds
for 200m from when the first athlete enters the straight	10 seconds

In the Long Jump and Triple Jump, it shall be measured for a period of 5 seconds from the time the athlete reaches a mark on the runway placed 40m from the take-off board for the Long Jump and 35m for the Triple Jump.

If an athlete runs less than these distances the wind shall be measured from the time he commences his run up.

All wind velocities shall be read, and recorded, in metres per second, rounded to the next higher tenth of a metre per second in the positive direction. Digital gauges shall be constructed so as to comply with this.

5.2.4 CABLES

To connect up the timing, distance measurement and data processing equipment, permanently laid cables should be provided. They enable the equipment to be swiftly installed and significantly reduce the risk of accidents caused by loose cables (Figures 5.2.4a to 5.2.4c). Cable ducts for permanent cables should have a minimum diameter of 0.30m. Depending on the design of the stadium, there should be 4 to 7 manholes with connection points for the field boards. In each manhole there should be four 10 amp single phase waterproof power outlets.

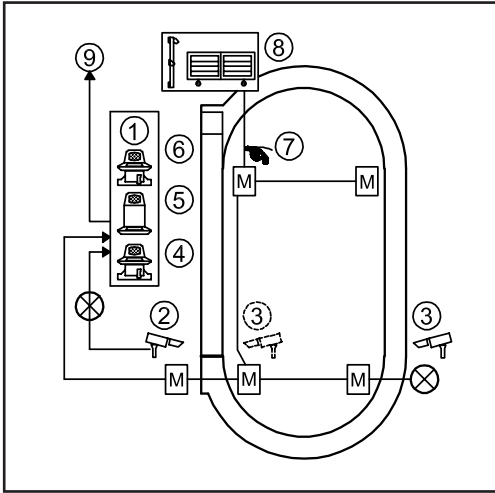


Figure 5.2.4a - Timing installation

M Manhole with connection points for permanent cables for Track and Field Events

- 1 Control room with feed to television scoreboard and data processing
- 2 Video finish camera I
- 3 Video finish camera II
- 4 Camera I evaluation point
- 5 Computer for processing the information
- 6 Camera II evaluation point
- 7 Starter's gun
- 8 False start system
- 9 Exit to TV, connection to data processing and exit to scoreboard

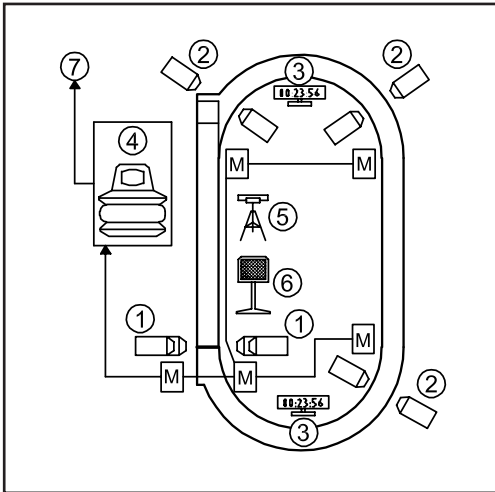


Figure 5.2.4b - Cables and auxiliary equipment for timing

M Manhole with connection points for permanent cables for Track and Field Events

- 1 Double photoelectric cell at the finish line
- 2 Photoelectric cells for the intermediate times
- 3 Numeric board for the running time
- 4 Timing instrument for intermediate times
- 5 Wind gauge, measurement for track events
- 6 Lap counter
- 7 Exit to TV, connection to data processing and exit to scoreboard

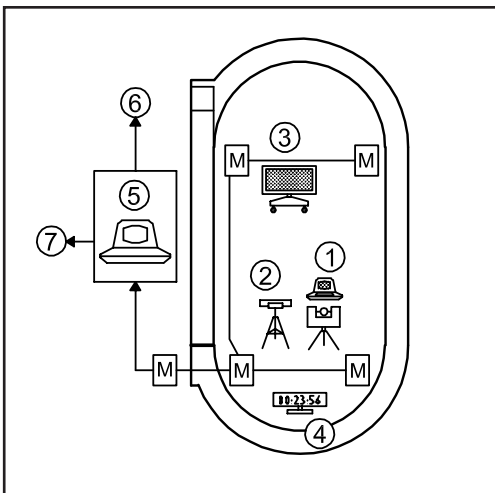


Figure 5.2.4c - Cables and auxiliary equipment for Field Events

M Manhole with connection points for permanent cables for Track and Field Events

- 1 Tacheometer for measuring distance and checking height for High Jump and Pole Vault
- 2 Wind gauge
- 3 Field board with computer
- 4 Time elapsed clock (concentration clock)
- 5 Control room for data processing
- 6 Exit to scoreboard and television
- 7 Exit to main data processing station (only for major events)

Not only the control cables should be permanently laid but also the feed cables. Depending on the applicable national standards or guidelines, two cable ducts, tubes or racks have to be provided. As TV cables are rarely permanently laid owing to their infrequent use, the ducts should be dimensioned to enable the cables and plugs to be pulled with ease.

5.2.5 FIELD BOARDS

Each board should provide as much information as possible including athlete's name, number, nationality, details of the performance and the current position of the athlete. To be able to display such information, the boards should have at least 3 lines of 10 characters or 2 lines of 10 characters if the information is displayed sequentially.

5.3 Scoreboards

Modern sports facilities require information systems which will keep spectators, sports participants, officials and media representatives fully informed of what is happening in the arena. If required, these installations can also promote the safety of spectators and athletes.

At major sports grounds, the spectator should not only be kept informed about what is happening in the sports arena, but also be given the opportunity to familiarise himself with the athletes (features on individuals or entire teams), or to watch live recordings of the actual event or action replays (including slow motion recordings) of special phases of the competition. These information systems can also be used in the intervals for blending in up-to-date news or advertisements.

The following scoreboard technologies are available:

- Scoreboards with incandescent lamps (for colour and black and white)
- Electromechanical scoreboards (split dots, rotating cylinders or others)
- LCD scoreboards
- LED scoreboards
- Cathode ray tubes (one tube per pixel or several pixels)
- Fluorescent tubes (special version of the conventional tube)

The advantages and disadvantages of these technologies are shown in Table 5.3.

Since 2000, LED devices have become the dominant technology for large screen display. LCD, Cathode Ray Tube and Fluorescent Discharge displays are still in use and can offer good performance if well maintained however no manufacturers are currently offering this technology for new applications.

5.3.1 BOARD TYPES

The technology allows the realisation of large colour video matrix boards (huge monitors) of up to 200m². The size to be chosen depends on the size of the stadium and the position of the board inside the facility.

5.3.1.1 Numeric Boards

They only permit the indication of numeric results without names or other alphanumeric information.

Type of system	Advantages	Disadvantages
Incandescent Lamps	<ul style="list-style-type: none"> - Proven technology - Lamps obtainable everywhere - Visible day and night - Ease of maintenance - Relatively inexpensive 	<ul style="list-style-type: none"> - High power consumption - Medium colour quality - High reaction time (after-glow) - Expensive to operate - Lamp reliability at bottom limit in continuous use
Electromechanical (Flip-dot)	<ul style="list-style-type: none"> - Low power consumption - Proven technology - Comprehensible even to non-technically minded - Data remain displayed during power failures - Reflections on protective screen 	<ul style="list-style-type: none"> - Slow (high reaction time) - Limited number of colours (6 maximum, 2 normal) - Not video-compatible - Reliability at bottom limit - Requires mechanical protection
LCD	<ul style="list-style-type: none"> - Basic technology familiar - Low control effort 	<ul style="list-style-type: none"> - Bleeding through is not under control - Continuous power consumption even for black backgrounds (relatively high) - Limited viewing angle - Grid structure not always acceptable (gap between elements) - Contrast at bottom limit of acceptability - High switching time at low temperatures (requires heating) - High reflection
LED	<ul style="list-style-type: none"> - Inexpensive - Viewing angle of at least 160 degrees horizontally - Short reaction time - Long service life - High reliability - Lower power consumption and heat output - Good luminance of red 	
Cathode Ray Tubes (CRT)	<ul style="list-style-type: none"> - Good reliability - Good colour quality - Familiar technology - No limit to size 	<ul style="list-style-type: none"> - Expensive - High power consumption - Strong electrostatic field, attracts dust - Visibility impaired in direct sunlight - High voltage - Frequent adjustment - Cleaning of front - 50% decline in luminance after 8000 hours of service
Fluorescent Tubes	<ul style="list-style-type: none"> - Good visibility in direct sunlight - Good legibility - Good colour quality - No limit to size - Very short reaction time - High luminance - Visible day and night - Familiar technology - High contrast - No sunlight reflection - No scanning - 25% decline in luminance after 7,000 hours of service - Pixel simple to replace 	<ul style="list-style-type: none"> - High power consumption - Heating necessary at low temperatures - Small pixels are difficult and expensive to replace

Table 5.3 - Advantages and disadvantages of the various scoreboard technologies

5.3.1.2 Alphanumeric Boards

They permit a full display of results in capital and small letters, like matrix boards, but only in one character size. The display of graphics is very limited.

5.3.1.3 Matrix Boards (2-tone)

They permit a full display of results and the presentation of graphics and line drawings. A rapid succession of graphics also permits the display of animations and cartoons in black and white.

5.3.1.4 Colour Video Matrix Boards

These are similar to large TV screens although the resolution is less fine. For an acceptable picture quality, the boards must have at least 100 and if possible 200 lines. The boards are also used for displaying results. Each pixel must be driven either directly by the computer or for video images by the control unit including the digitiser.

5.3.2 CHOICE OF BOARD

5.3.2.1 Legibility of Alphanumeric Information

The legibility distance of a text is generally accepted as 500 times the character height. With normal computer text, this entails a matrix of 7 x 5 dots. In an athletics stadium, the maximum viewing distance is 150m to 250m, depending on the size of the stadium and the position of the boards. Therefore, a character height between 0.35m and 0.52m must be used.

5.3.2.2 Pixel Size on Video Matrix Boards

On colour video matrix boards, only the approximate pixel size taking into consideration the size of the board and the required resolution can be defined. There are no generally applicable standards for video images as it exists for texts. Today the minimum required resolution is 120 to 200 lines. Current technology outdoor displays are likely to have a pixel pitch of between 10mm and 30mm. Therefore in a giant athletics stadium with an average viewing distance of 120m and a maximum distance of 250m, 30mm pixels can be used with a minimum of 192 lines and the height of the board should be about 6m.

5.3.2.3 Board Size

The height of the board should be 3% to 5% of the maximum viewing distance. For an athletics stadium with a maximum viewing distance of 250m, this yields a height of 7.5m to 12.5m. A height of 7.5m permits 11 lines of a 0.52m high text. The minimum length of the board is dictated by the widescreen television screen for aspect ratio of 16:9. However as a compromise programmes are often made/broadcast in 14:9 so that the images are viewable on both types of TV set. Accepting that the display height is the critical factor boards have to increase in overall size and cost by 20% to accommodate the new format without compromising on effectiveness for both text and Video images. If the alphanumeric information requires a longer board than that demanded by the television format, either the height should be increased, a non-TV-standard format should be accepted, or a combined board consisting of colour, and black and white sections should be employed.

5.3.2.4 Luminance and Contrast

Good legibility depends not only on the luminance, but also, and above all, on a strong contrast. On matrix boards (2-tone), the contrasts in extreme conditions (direct sunlight) must be at least 4 but preferably 6. On colour video matrix boards, on the other hand, the contrast must be higher (8 or 10). This contrast is defined by the ratio of the sum of reflected and emitted light to the reflected light. The reflected light of a scoreboard with a black background varies from 3% to 15% of the solar reflection of a white sheet of paper. Good boards have low reflection values. The reflection of a white paper exposed to the sun varies from 10,000 NIT to 15,000 NIT (candles per m²) and on snow it may be as high as 25,000 NIT. The calculations of most manufacturers are based on 5000 NIT as this value is rarely exceeded. Reflection may increase by 4% to 5% due to the accumulation of dirt on the front over a period of time.

With a reflection of 5%, the boards must have the following minimum luminance:

- 2000 NIT for 2-tone matrix boards
- 4000 NIT for colour video matrix boards

Assuming the above conditions, the luminance of 4,000 NIT for colour video matrix boards when new and clean yields a contrast of 11. At the end of the lifetime of the element luminosity decreases at least 25 and often 50% therefore the contrast decreases to 8.5 or even 5 as long as the front face is clean. With a dirty front face the contrast is reduced to 7 from 8.5 and to 4 from 5. This shows clearly that the original luminosity has to be chosen in accordance with the reflection and the loss of luminosity due to aging. A board's nominal luminosity is the value which it has after at least 100 hours of service.

5.3.2.5 Choice of Board Size

A matrix board allows not only text with 7 x 5 dots, but many other matrices as well. However, as soon as a matrix with more than 7 x 5 dots is selected, the quantity of information is reduced. If, for example, 10 lines of 32 characters can be displayed on a given board size (with a matrix of 7 x 5 dots), only 5 lines of 16 characters are possible with a matrix of 14 x 10 dots.

At major athletics meetings, at least 10 lines of 32 characters are required to display the position, name, nationality (3 characters) and performance. In a stadium with a viewing distance of 200m to 250m, the character height must thus be at least 0.52m. This yields a distance between the dot centres of 0.075m, given a matrix of 7 x 5 pixels. The distance between the lines should, preferably, be 3, but a minimum of 2 dots. The distance between the characters should be 2, but 1 dot minimum. A matrix board must therefore have 90 to 100 vertical dots and 192 to 210 dots horizontally. In most cases, boards with 192 horizontal and 100 vertical dots are used. The matrix field thus has a height of 7.5m and a length of 14.4m. This height thus corresponds to the given minimum height of 3% of the maximum viewing distance.

A portable colour video board of 32m² area with an aspect ratio of 4:3 would have an image height of 4.8m. With the height as 3% of the maximum viewing distance would give a maximum viewing distance of 160m. The size of the board would increase to 40m² for an aspect ratio of 14:9 for widescreen format. The basic writing matrix is 11 x 7 pixels.

5.3.3 FUNCTIONS

All functions are controlled by the video or computer system. The information must be displayed at the speed or in the sequence demanded by the control system. For video signals, the board must be capable of indicating 25 or 30 or, alternatively, 50 or 60 frames per second. If fast-reacting display elements are employed, the display frequency must be increased so that no flicker is perceived by the human eye. The number of frames in this case must be 75 per second or more. This is achieved by repeating each frame 3 times.

Traditionally, video boards have been used to show TV picture and matrix boards for results and timing information. There are now products available capable of displaying television and also accepting information direct from the sports timing /results system. Thus these boards can function as both scoreboard and video display. Specialist interfaces are required to ensure that the alphanumeric information has sufficient clarity.

5.4 Public Address (PA) Systems

Stadium facilities built to Construction Category I-III standards should be equipped with public address systems used to transmit speech (messages related to anything from event programmes and competition results to safety control announcements) as well as music. Effective safety control announcements require a maximum loudness and good speech intelligibility.

5.4.1. REQUIREMENTS AND CRITERIA FOR THE TRANSMISSION OF SPEECH AND MUSIC

Speech intelligibility is a subjective criterion difficult to quantify. While general-purpose announcements require only a low level of intelligibility, advertising must be fairly easy to understand. The highest degree of intelligibility is required for safety control announcements made by the stadium announcer or the police, as such announcements may be vital to the spectators. The parameter determining the intelligibility of spoken messages is the percentage of consonants correctly received by the listener. These sounds are primarily transmitted in the upper frequency range.

90% of all speech intelligibility is achieved in the range between the 500Hz and 4kHz octaves. This corresponds to a frequency range of approximately 350 to 6000Hz, which can be delivered by fairly basic public address systems.

For transmission of music, however, the situation is different. In order to achieve an appropriate reproduction quality, it is necessary to add both the lower frequency band from 50 to 100Hz upwards and, even more importantly, the higher range up to 10kHz and beyond (Figure 5.4.1). The transmission of music will therefore require a more sophisticated loudspeaker system than a facility designed only to transmit spoken messages (See 5.4.5).

5.4.2. REQUIRED TRANSMISSION VOLUMES

In the absence of interfering background noise, speech is easily intelligible even when whispered. However, as we are permanently surrounded by background noise

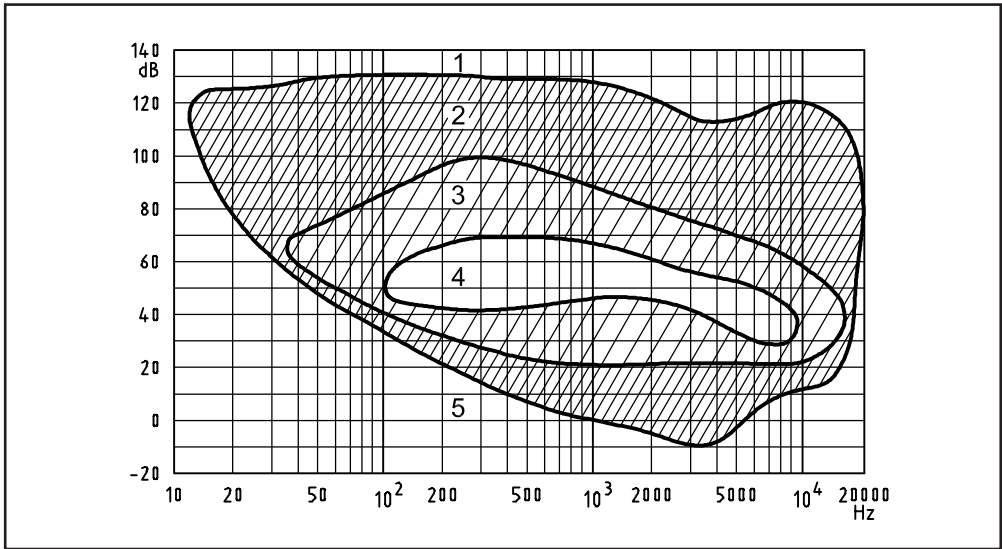


Figure 5.4.1 - Frequency and dynamic ranges of speech and music within the overall audible range

- 1 Pain threshold
- 2 Audible range
- 3 Orchestra range
- 4 Language range
- 5 Audible threshold

Source: *Handbuch der Elektroakustik, Boye / Herrmann, Hüthig Buchverlag, Heidelberg*

from the environment (wind, traffic, spectator noise in sports facilities, etc.), the useful information signal must at all times remain above this noise level. An illustration of the loudness levels and dynamic ranges of various noise sources is given in Figure 5.4.2.

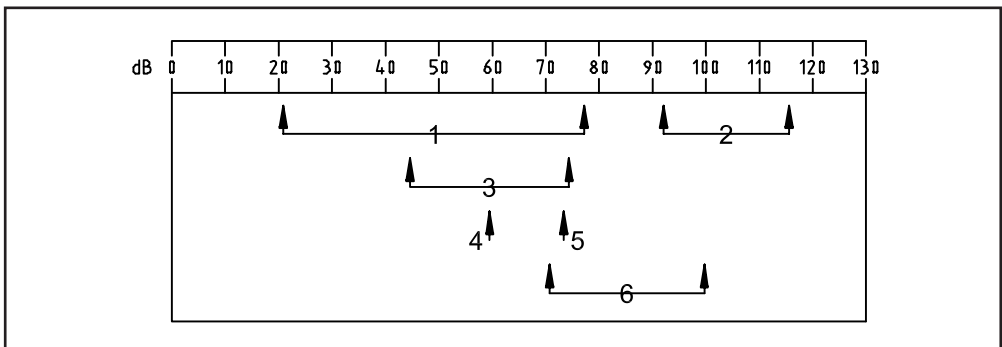


Figure 5.4.2 - Loudness levels and dynamic ranges of various interference noise sources

- 1 Street noise
- 2 Thunderstorm
- 3 Traffic
- 4 Passenger car
- 5 Truck
- 6 Motor bicycle

Loudness is measured in phons or decibels (dB). Whereas phon is the unit of the frequency-related loudness perceived by the human ear, dB is a technical unit of loudness related to the intensity-level scale (at 1000Hz, phon and dB measurements coincide). Both units are logarithmically defined. Zero phons is the lower human audibility threshold. At approximately 120 phons, noise begins to be associated with pain (the noise level of a normal conversation is approximately 65 to 70 phons). Loudness levels are predominantly indicated in terms of the dB(A) scale, which is essentially identical to the phon scale. The index "A" denotes a frequency-related evaluation curve.

The intelligibility of speech deteriorates as background noise increases. According to an accepted general rule, the useful signal level at the listener's ear should exceed the background noise by at least 10dB.

The necessary useful signal levels to be produced in the spectator's plane of hearing by a loudspeaker system are shown in Table 5.4.2. The design of public address facilities should always be based on a "least favourable case" hypothesis, i.e., assuming the highest expected level of interference.

Interference Noise Source	Loudness
Spectators Watching Silently	60 - 70 db(A)
Spectators in Conversation	70 - 80 db(A)
Wind / Traffic	40 - 70 db(A)
Cheers or Applause	95 - 100 db(A)
Unrest or Panic	up to and over 105 db(A)

Table 5.4.2 - Typical spectator and background noise levels in sports stadia (empirical values)

In a panic situation involving a maximum spectator noise level of 105dB(A), the public address system would have to produce a useful signal of 115dB(A) to ensure the required 10dB(A) signal-to-noise gap. This would certainly place a severe strain on the economic efficiency of any system. In a large stadium, the fulfilment of the above requirement would necessitate an amplified and loud-speaker output substantially in excess of 100kW. The need to install such high power levels is avoided by transmitting an attention signal (i.e. a bell or similar tone) some 2 to 3 seconds after an emergency is detected and making the appropriate announcement immediately afterwards. In this case, a loudness level of approximately 100 to 105dB(A) will be sufficient, especially if an electronic volume compressor / limiter unit is employed to compress the natural speech volume range near the upper modulation / power threshold of the system, which results in a perceived loudness increase of approximately 6dB.

In athletics competitions, the required loudness level in the inner stadium area (e.g. for calling up or introducing athletes) is less dependent on spectator noise. Here it will generally suffice to design for a useful signal loudness between 75 and 90dB(A).

The loudness level needed for music transmissions is much lower. For an adequate perception of music it is sufficient to provide a volume approximately equal

to the noise level. Depending on the type of music and the purpose of the transmission, the music volume may even be below the noise threshold (background music).

5.4.3. ENVIRONMENTAL IMPACT OF PUBLIC ADDRESS SYSTEMS

Stadium PA systems operating in the immediate vicinity of residential areas may be considered a nuisance by nearby residents. The standard objective, therefore, is to achieve maximum loudness levels inside the stadium while minimizing the emission of sound towards the outside. The conflict of goals imposed by this is difficult to resolve. Loudness is known to decrease in proportion to distance squared, but technically speaking, doubling the distance from the source will attenuate the sound level by a mere 6dB. In other words, a source generating a sound level of 80 dB(A) at a distance of 20m is still perceived as producing 74dB(A) at 40m, 68dB(A) at 80m, etc.

Some countries have set statutory maximum thresholds for facilities situated near residential areas. These specifications must be taken into account in the planning and calibration of public address systems.

A valuable technical aid is the automatic electronic volume limiter. This device can reliably prevent sound level overruns exceeding the statutory thresholds (noise emission in residential areas), even if the announcer speaks very loudly.

5.4.4. LOUDSPEAKER ARRANGEMENT

Sound approaching the ear from the front is perceived more easily than that at the listener's side or behind his back. A good loudspeaker system must therefore be designed to ensure that most of its signal output reaches the spectator from the front, or at least from an overhead location.

With covered spectator stands it is generally a good solution to mount the loudspeaker units near the front edge of the roof structure. This will ensure the desired frontal exposure for the majority of spectators, while only those seated in the lower stands will be reached vertically from above.

In sport facilities without roof structures, the frontal sound reception requirement can be met by erecting masts near the outer perimeter of the track and aiming the loudspeakers at the spectators' plane of hearing. However, this may cause problems if residential areas are located along the extended loudspeaker axis (See 5.4.3). In most cases these difficulties can be satisfactorily overcome by using high-directivity loudspeakers focused on the spectator area.

The optimum loudspeaker arrangement will always depend highly on the overall design of the facility and the distance to nearby residential areas. As a result, requirements will vary for each project.

5.4.5. SUITABLE LOUDSPEAKER SYSTEMS

All loudspeakers installed must be fully weatherproof. In addition, the prevailing background noise conditions will usually call for the use of high-directivity loudspeakers with sharply focused beam characteristics which ideally should address only the spectator areas while radiating a minimum of noise to the surrounding environment.

A straightforward and inexpensive type is the horn loudspeaker with pneumatic pressure chamber (Figure 5.4.5a). Such systems have a radiation angle of as little as 30° to 60° (related to 4000Hz) and can therefore be easily focused on the areas to be covered. Another benefit of this loudspeaker type is its high efficiency, i.e. the ability to produce a high useful sound volume at a comparatively low amplifier output. However, the reproduction frequency response of these units is very limited, comprising only the range between 300 and 6000Hz. For this reason, horn loudspeakers are only suitable for speech announcements (e.g., lane allocation, competition results, crowd control information).

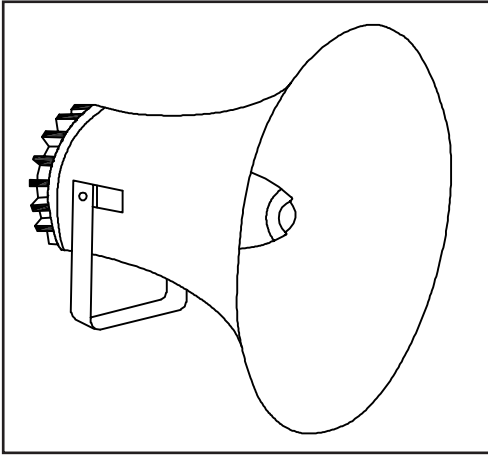


Figure 5.4.5a
Reflecting horn loudspeaker characterised by high efficiency and good speech transmission properties

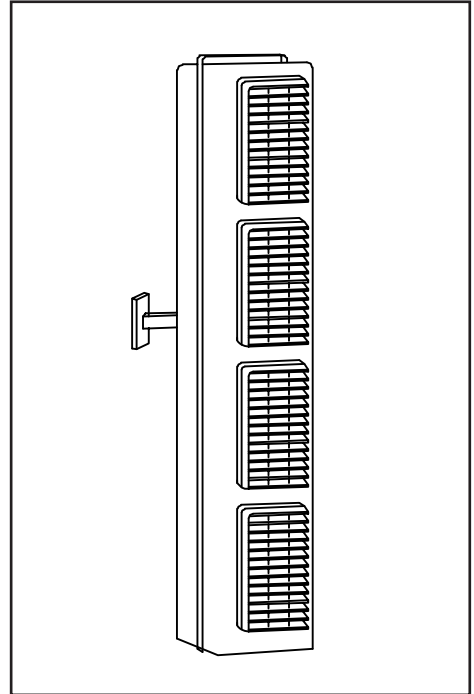


Figure 5.4.5b
Line source speaker systems give ideal directionality and allow high quality music transmission

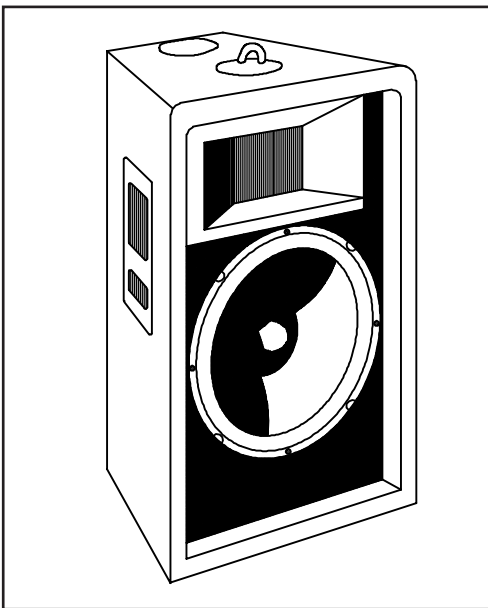


Figure 5.4.5c
High performance multipath speaker systems give optimum sound quality through separate woofers and tweeters

If the system is expected to transmit music as well as speech, it is necessary to use higher grade loudspeaker systems. These include line source units (Figure 5.4.5b) which, due to their linear sound emission characteristics, allow the designer to define the useful vertical sound aperture angle. The specific aperture angle depends on the individual model. At a length of approximately 1m, this angle will be approximately 15° (at 4000Hz). By using shorter or longer dimensions, it is possible to provide an optimum sound aperture for the intended auditory reception area.

The horizontal sound aperture angle lies between approximately 60° and 90°.

The specific value will ultimately determine the distance between loud-speakers. The frequency response of line source loudspeakers lies in the region of approximately 100Hz to 12,000Hz. This makes them ideally suited for the transmission of speech and good quality entertainment music.

By arranging several loudspeakers into groups, it is possible to create almost any desired radiation characteristics, so that the system will probably be able to achieve a good compromise between a high useful signal volume inside the sports facility and a low external noise impact.

Where very high requirements are placed on the music transmission quality, it is necessary to use high-performance multipath speaker systems (Figure 5.4.5c).

These combine several dedicated loudspeakers for separate frequency ranges in a common housing. Units designed for outdoor use will usually comprise woofer and tweeter systems. Such systems provide frequency response curves from approximately 50Hz to 15,000Hz and deliver an optimum crisp and pure sound quality.

One disadvantage of these systems is that the bass frequencies are difficult to focus. "Stray bass" phenomena can contribute greatly to the emission of unpleasant noise. The use of such systems will therefore often be limited to covered spectator stand areas where the sound radiation is restricted by walls and roof structures, or to outdoor facilities located far away from residential areas.

5.4.6. AMPLIFIER OUTPUT REQUIREMENTS

The necessary amplifier output is essentially dependent on the size of the facility and the useful signal volume to be achieved. As the human ear perceives sound on a basically logarithmic scale, a similar law applies to the selection of the desired amplifier power.

Doubling the amplifier output (and hence, the loudspeaker power handling capacity), for example from 100 watts to 200 watts, will increase the loudness by only 3dB. The difference is barely perceivable, regardless of whether a speech or music signal is emitted. In order to double the loudness, for example from 80dB(A) to 90dB(A), it is necessary to increase the amplifier and loudspeaker output by a factor of 10. In the above example this would mean an increase from 100 watts to 1000 watts.

In a sports facility with covered spectator stands along both sides and a capacity of approximately 50,000 to 60,000 seats, a broadband multipath speaker system for speech and high quality music transmission would have to provide a loudness of approximately 100dB(A). This requires an amplifier output of at least 10,000 watts.

5.4.7. CONTROL FACILITY, OPERATION AND SYSTEM AVAILABILITY

The control facility must be installed in an appropriate location providing sufficient room. The announcer's position behind the microphone must afford good visibility of everything in the stadium.

Equipment required for a large stadium should include the following:

- a) Announcers' room, with soundproofing against external noise (approximately 50dB insulation value) to avoid acoustic feedback to the microphone.
- b) Police announcer's position meeting similar requirements as the facility described in a), but with an additional absolute priority function to overrule the stadium announcer as well as a circuit design allowing individual spectator stand sections to be separately addressed (e.g., fan blocks, access and escape routes).
- c) Sound control room meeting similar requirements as described in a), designed to accommodate a sound control desk, sound playback equipment, and an announcer's microphone.
- d) Amplifier room for the central amplifier and system control unit (cabinet with chassis rack), including an appropriate ventilation system ensuring proper heat dissipation.
- e) Microphone connections will likewise be found to be practical in the VIP box (for speeches) and near the track perimeter (for the victory ceremony, event management, etc). A wireless microphone installation (microport system) for interviews and similar uses may be provided.

The entire system is controlled from a sound control desk allowing the operator to select optimum tone and volume settings for each sound source. A pushbutton panel allowing a separate activation of individual sound system sections and/or spectator stand areas will also be found to be practical, as sound should only be directed to those parts of the stadium which are actually occupied by spectators.

The larger the sports facility, the more important is the proper availability and reliability of the public address system. Operating reliability can be achieved by selective automatic monitoring features, for example the continuous supervision of the power amplifiers by means of a pilot tone that is emitted at a frequency above the audibility threshold (approximately 20kHz). If the pilot signal changes across an amplifier output due to a malfunction, this condition is immediately indicated and the system activates a standby unit. The spectators will not even become aware of the defect.

It is also possible to have the entire installation (including the wiring and loudspeakers) supervised by a digital system monitoring unit, which will offer a maximum degree of system reliability and availability.

A major item to be considered is the ability of the sound control technician. The availability of competent personnel is an issue to be clarified as early as at the system design stage. An anticipated lack of qualified control personnel can largely be

compensated by increasing the use of automatic equipment, but the system flexibility will suffer as a result.

The main reason why uninterrupted system availability is so important is the need for safety control announcements by the police. Such announcements must be possible by the touch of a single push button at the microphone announcing station and must overrule all other sound sources and controls fully automatically.

For specific emergency situations it is also helpful to provide a digital speech storage device in which all relevant announcements are recorded in advance. In a hazard situation, the suitable announcement is released at the touch of a button and will be transmitted, objectively, in optimum quality and at the right volume.

5.4.8. SUMMARY

There are no all-purpose standard PA system designs. The builder, owner and architect must jointly discuss all relevant facts for each individual situation in order to create a system concept that will satisfy both engineering and financial requirements in the best possible manner.

5.5 Television Monitoring Systems (Crowd Control)

To monitor car parks, spectator access ways, ticketing facilities, control points and spectator seating/standing areas, installations are necessary for safety and security reasons.

Such television monitoring systems have until recently only been available in black and white because of the prohibitive cost. Another disadvantage was the required level of lighting for sufficient picture clarity. Today colour cameras are only slightly more expensive than black and white. Due to the change in the recording technology (from the camera tube to the semiconductor image converter), colour cameras require no more light than conventional black and white ones. Since different colours can now be identified, objects can be distinguished with greater ease.

In areas monitored by colour cameras, it is easy to identify people and vehicles. In this way, control can be affected quickly. Through continuous surveillance it is possible, even over relatively long distances, to identify individual persons when safety-related incidents occur. CCD recording technology now allows the cameras to operate relatively maintenance-free. For this reason, cameras can even be installed in poorly accessible places.

5.5.1 LIGHTING REQUIREMENTS

CCD colour cameras supply distortion-free images in natural colours in almost all light conditions. In the case of artificial lighting, it is essential that the lamp contains all the colours of natural light. Halogen lamps, for example, meet this requirement. Colour cameras observe a scene just as the human eye would see it. The spectral sensitivity of the camera has been adapted to that of the eye. In this way, the quality of the colour fidelity is maintained, even in fading light.

5.5.2 LAMP TYPES / COLOUR FIDELITY

Table 5.5.2 indicates colour fidelity in relation to the type of lamp chosen.

Modern cameras can operate with as little as 5 lux. The latest colour cameras require a minimum of 0.9 lux of light reflected by the object, measured at the lens (f 1.0). With this illumination, the video signal has only about 50% of the normal amplitude but it is still capable of producing acceptable images.

Lamp Type	Colour Fidelity
LP Sodium Vapour Discharge (SOX)	Poor, monochrome yellow
HP Sodium Vapour Discharge (SON)	Moderate
HP Mercury Vapour Discharge (HPL)	Moderate
Metal Halide (HPI)	Good to excellent
Tubular Fluorescent (TL)	Moderate to excellent
Halogen Lamps	Excellent
Incandescent Lamps	Excellent

Table 5.5.2 - Effects of lighting technology on colour fidelity

5.5.3 IMAGE PROCESSING

A high image resolution is also necessary at the monitor. Central units, such as video-matrix, quad units, multiplexers and video switches, enable the pictures to be available in the right place at the right time. Because monitoring staff find it difficult to study several pictures at the same time, surveillance is simplified by multiplexers. Four, eight or sixteen pictures are shown reduced in size on a grid on a single monitor. If the observer notices an incident, he can switch to a full screen picture on the same monitor. With a 2-fold zoom, he can study details of pictures. The installation of a multiplexer can often replace a bank of monitors or at least the manual switching gear.

The multiplexers operate with a video digitalisation process and the camera signals are coded in such a way that it is always possible, when the pictures are played back, to ascertain which camera took the picture. For ease of identification, each camera picture is capable of displaying camera number, location, time and date. The standard functions of a multiplexer include such facilities as the automatically controlled sequential display of full-size pictures with individually specified hold times along with by-pass switches for periodically unimportant camera shots. The picture freeze function enables stills to be created for closer analysis.

5.5.4 TECHNICAL INSTALLATION CONCEPT

To document and later reconstruct crowd violence or other incidents, it is desirable to have a complete record of all incidents from the beginning to the end of the sports event. Multi-camera systems would require a large number of video recorders with high investment and operating costs (tapes, recorder servicing). The use of a long-playing video recorder minimises this outlay. Used in conjunction with a

multiplexer, four, eight or sixteen pictures can be digitally recorded simultaneously. The picture can then be played back, similar to monitor surveillance, as a full screen picture.

More recent recorder models also offer important auxiliary functions: still picture, automatic search and slow-motion replay. During playback, the operator can then choose any of the pictures for full screen replay.

The choice of camera positions requires special consideration. It is usually possible to erect outside cameras on roofs, columns or walls. Suitable brackets, including those for remote controlled pivot/tilt heads, should be used. When choosing the locations, it is essential that they are not directed straight at the rising or setting sun (Figure 5.5.4). If the camera has an unobstructed view of the horizon, the low height of the midday sun from autumn through to spring should also be borne in mind.

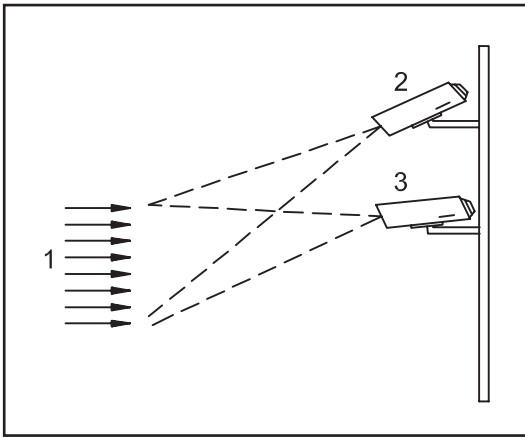


Figure 5.5.4

Elimination of glare caused by low-lying sun by choosing higher camera positions

- 1 Light from rising or setting sun
- 2 Right position
- 3 Wrong position

5.6 Technical Services for the Media

5.6.1 COMMUNICATIONS

Electronic interface between key elements within the stadium has become a vital aspect of modern athletics. Technological advances have greatly enhanced the management of the sport. However, the proliferation and sophistication of available equipment requires a high level of cooperation and interface.

The parties required to submit to a working interface are:

- Television
- Announcers
- Scoreboard
- Videoboard
- Timing Service
- Computer Service
- Telecommunications Agency
- Event Management
- Ceremonies Division
- Printing / Photocopying

The smooth conduct of an athletics competition requires well prepared, professional conduct by the officials. However, the complexity of athletics requires that for a major competition the event must be conducted so that the public can follow the significance of all that is happening at any one time. To this end, the coordination

between competition director, event presentation manager, announcers and scoreboard operator is of vital importance. Communication between these four parties must be constant.

Direct sight, telephone link or ideally open radio link are essential. Whilst the use of portable telephones has escalated in recent years, caution is advised in the stadium where prestressed concrete breaks the signal and limits the range.

The PA system used by the announcers should be given comprehensive testing and rehearsal, particularly in regard to its effect on planned television microphone positions (Figure 5.6.1) and the working areas of television, radio and journalists.

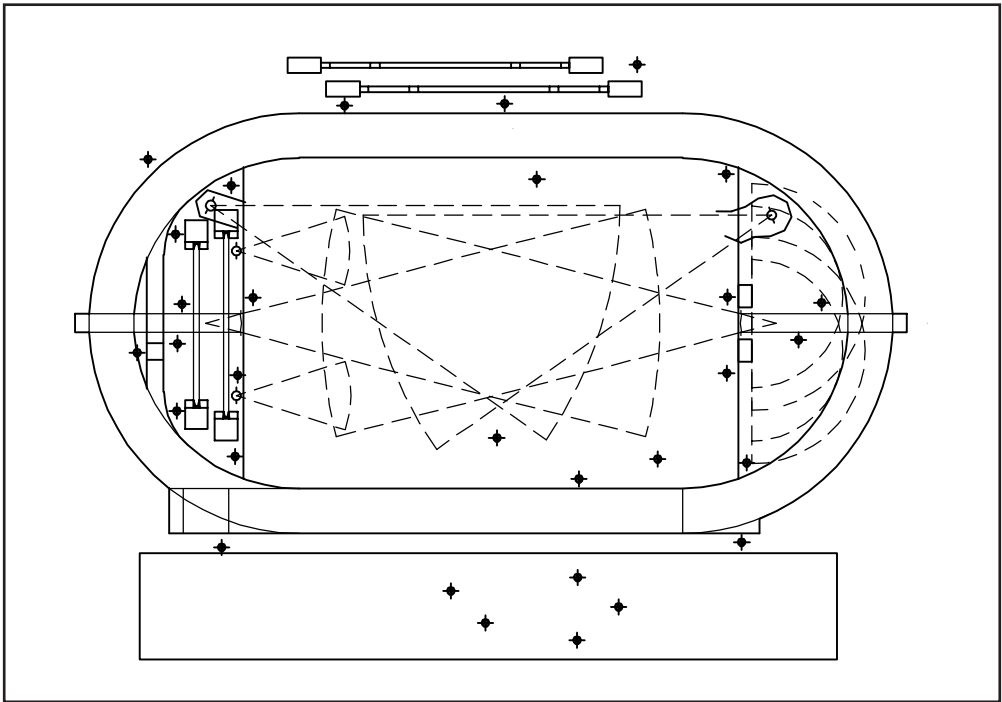


Figure 5.6.1 - Television microphone positions for major Track and Field Events

The interface between the Official Data Processing Company and the Scoreboard is essential to avoid the need for data re-entry, thus keeping delivery time of key information to a minimum.

A protocol for the commencement of sessions, events, and ceremonies must be established prior to the competition. The sequence, visual images and words must be clearly defined by all three parties. Care with languages, abbreviations and names is of great importance. Additional attention is necessary when North American / European equipment / software is to be employed in a venue where Asian / Arabic / Cyrillic lettering will predominate. The lines and space available on the scoreboard are critical when preparing the protocol.

Advance notice of required video formats for the videoboard must be provided to television, sponsors, etc.

A separate television edit for use on the video scoreboard can be created, but advance preparations are necessary to provide the equipment, staff and interface required.

Fast provision of hard copy is essential. Therefore full consideration must be given to printing capability and delivery to the desks. One high speed copier with sorter (80 copies per minute) for every 100 media representatives (excluding technicians) is recommended. 2/3 of these copiers to serve the media stands, 1/3 for the main press centre / international broadcast centre / working area within the stadium.

One "runner" can effectively serve 35 working positions. Backup services and replacements are essential.

At the World Championships in Athletics held in Osaka in 2007, the following numbers of copiers were used: 8 high speed copiers in the main photocopy unit behind the tribune; 5 high speed copiers in the main media centre as well as additional machines in the international broadcast centre and the sub-press centre in the main media hotel.

5.6.2 PRESS

5.6.2.1 Work Area of Journalists

The working area allocated to each journalist should have dimensions of 0.75m in width and 1.60 in depth (compared to normal grandstand dimensions of 0.50m in width and 0.80m in depth for each seat). These measures provide sufficient space behind the seat for the comfortable movement of other journalists, and delivery of results by "runners".

5.6.2.2 TV Monitors

At a national / local event it is unlikely that TV monitors will be available for the media stand. At larger events, seats with desks require TV monitors (no larger than 35cm/14"), and a 110/250V power supply. One monitor per three journalists flat screen or recessed into the table, should be provided. Recommended are 150 for major regional, and 300-400 for major international, events.

Multi-channel facility is required. A full Electronic Results Service (ERS) either via the TV monitors or separate computer terminals must be provided.

5.6.2.3 Telecommunications

Journalists may require provision of a dedicated direct telephone line, ISDN line or high speed internet access at their working desk. Installations costs and call charges are paid by the end user. These should be reserved in advance.

The use of mobile phones and ISDN/ADSL lines had greatly reduced the number of private analogue telephone lines requested. At the World Championships in Athletics held in Paris in 2003, private lines requested by the press (not including broadcasters) did not exceed 80 in the press centre and 100 in the press stands.

5.6.3 TELEVISION AND RADIO

5.6.3.1 Work Area of Commentators

An equipped commentary position caters for three persons and is usually furnished with the following:

- Commentary unit connected to the commentary control room at the venue, and 3 headsets for TV commentators.
- Colour TV monitor connected for reception of the international signal produced at the venue, as well as signals broadcast over the air.
- Data channels.
- An information terminal carrying the ERS must be provided to each commentary position. A 110/220V tension socket supply is required for the equipment.

Size: As the sport expands, so does the traditional commentary team. There must be room for 3 persons, and the total width must be at least 1.60m (Figure 5.6.3.1). Broadcasters with larger teams can order further modules.

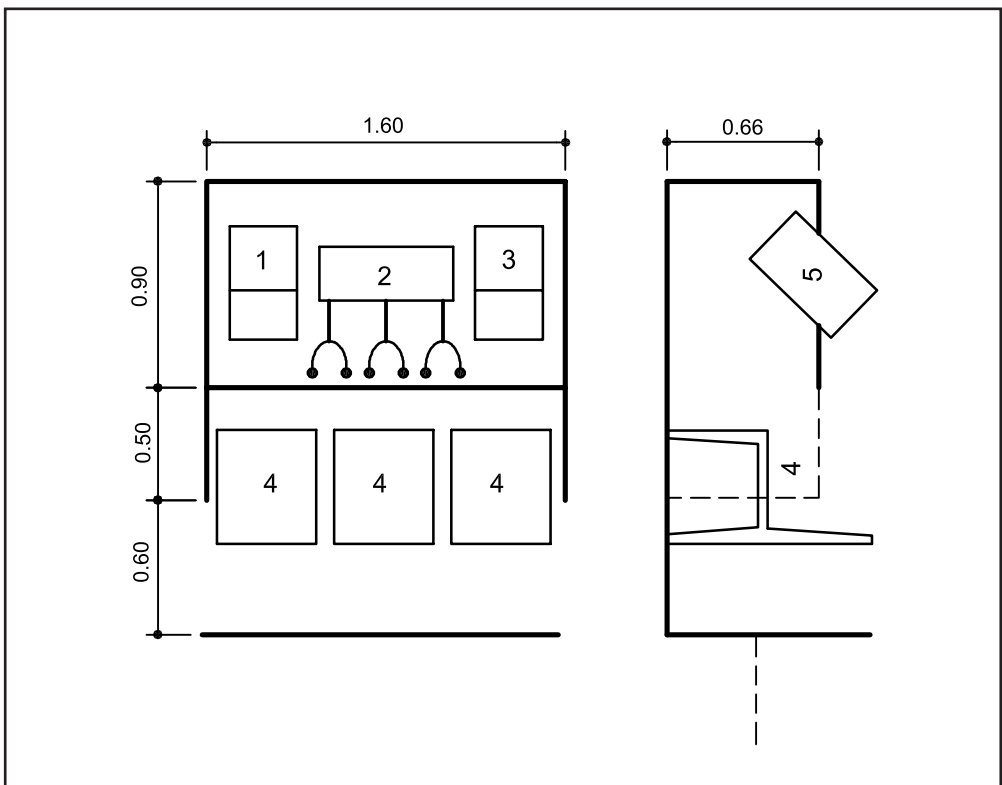


Figure 5.6.3.1 - TV commentary position top and side views

- 1 Television monitor
- 2 Commentary unit
- 3 Information terminal
- 4 Chair
- 5 Recessed monitor

There must be 0.66m of leg height under the working table. There must be at least 1.00m between the edge of the working table and the start of the row behind, to allow clear passage for other workers and results distributors. The depth of the working surface should be 0.90m.

It should be noted that unlike journalists, commentators cannot move freely around the stadium. Consideration must be given to service access for information, catering (especially drinks), technicians, etc. The quality of seating is important, as is storage and security of papers. Protection of the commentators and equipment from the elements must be fully considered.

Telecommunication requirements (which are detailed in the following part of this Chapter) are TV monitors, commentary unit, telephones (telefax).

The cabling of telephones, TV monitors and commentary units at the commentators' seating needs considerable forward planning, in particular the path and size of ducts for cabling, and security of all cabling.

5.6.3.2 International Broadcast Centre (IBC)

Creation of an IBC is only necessary for a major games or championships, and can be extensive, as at the Olympic Games (Barcelona - 45,000m²). The IBC is the nucleus of television and radio operations. The IBC also houses numerous facilities for broadcasters' unilateral programme production. Facilities are made available on a bookable basis and include edit rooms and television studios equipped with cameras, vision mixers, etc.

Approximately 600 persons can be expected to be employed by the Host Broadcaster alone in the IBC at a major games. All participating broadcasters will require administrative office space of varying sizes.

The telecommunications (telco) room, commentary switching and distribution centres will be linked by a complex telecommunications network.

5.6.3.2.1 Telecommunication Room (Telco)

At the IBC, the telco room is the point of entry for contribution network lines on their way to the distribution centre. Optic fibre and radiolink terminals will be located there. The telco room will also house the equipment for signal equalising, measuring and control for maintaining video and audio quality.

5.6.3.2.2 Commentary Switching Centre

The commentary switching centre is the control facility for the entire commentary system. All commentary circuits terminate there. The circuits are then distributed to broadcaster production facilities within the IBC. Numerous 4-wire circuits (up to 400 at the '92 Olympic Games) will carry the outgoing international programmes to destinations around the world.

5.6.3.2.3 Distribution Centre

The monitoring and equalising of incoming Vanda signals from the venue(s) takes place in the distribution centre before delivery to the world broadcasters' areas, transmission control and bookable facilities. The distribution centre will generate the

master synchronisation signals, test signals and the master clock reference signal for the IBC and venues.

5.6.3.2.4 Central Facilities

Central Facilities will house a Video Tape Recording (VTR) room to record signals from venues at major competitions, editing rooms for summaries and a post-production suite.

5.6.3.2.5 Transmission Control

The main functions of transmission control are the switching, processing and insertion of Video International Transmission Signal ((VITS) and International Distribution (ID) signals and the equalisation, monitoring and transmission of outgoing signals (via both satellite and earth networks).

5.6.3.2.6 Broadcasters' Coordination

A terminal from the IBC general intercom matrix can be installed which permits coordination with the distribution and transmission centres for broadcasters who are receiving the Host Broadcaster international signal(s) and who dispose of unilateral distribution channels. It should not be possible however to have direct communication with other technical areas of the Host Broadcaster operation.

5.6.3.3.7 Booking Office

The booking office at the IBC will take bookings of occasional services and facilities made available by broadcasters. The following services and facilities should be available on a booking basis in the IBC:

- TV Studio
- Radio Studio
- Editing Rooms
- Off-Tube Booths
- Post-Production Suite
- Briefing Room

5.6.3.2.8 Information Office

The information office at the IBC is responsible for immediately compiling and distributing results and general information for broadcasters before and during the event. Hard copies of results are distributed through a pigeon hole system, a regular structure of open ended shelving that permits the distribution into neat orderly files. The media representatives then take the information they require. Each individual shelf should be capable of comfortably containing up to 150/200 copies of an A4 document at any one time.

Other information of interest to broadcasters should be edited and distributed via a daily bulletin and bulletin boards.

5.6.3.2.9 Audiovisual Archive

There should be a documentation service in the IBC available for broadcasters' use. The service should process all audiovisual information produced by the Host Broadcaster. The service should give access to tapes of professional quality.

5.6.3.2.10 Common Service Centre

A common service area for all media representatives between the IBC and MPC should be provided for rest, recreation and additional services, e.g. restaurants, travel

agency, car rental, bank, medical centre, pharmacy, news-stand, post office and courier service, customs agent, safe deposit, office materials shop, souvenirs, florist, cash-point, computer maintenance, etc.

5.6.3.2.11 Telecommunications Network

Vanda Contribution Network

The contribution network is designed to transport all international television and radio signals and unilateral Vandas from venue(s) to the IBC.

Optic fibre with backup links in a ring configuration can be used for the transportation of signals within a confined city area. Signals emanating beyond such a city ring will require transportation to a telecommunications tower via radiolinks and on to the city ring and from there to the IBC.

Audio Contribution Network

The telecommunications agency will need to provide a system for the transportation of audio signals from the venue(s) to the IBC. A convergent network of 4-wire circuits is required. This may be achieved in three stages:

- transport of the audio signal in low frequency from the venue(s) to the nearest telephone exchange
- transport of the radio signal in high frequency (multiplexer channels transmitted by optic fibre) between the telephone exchange nearest the venue to the telephone exchange nearest to the IBC
- transport of the audio signal in low frequency from the nearest telephone exchange to the IBC.

The following types of 4-wire circuits are used: Type I (3.4kHz), Type II (7kHz) and Type III (15kHz).

Outgoing Communications Network

The numerous television signals produced in the IBC by broadcasters and other international and unilateral signals are transmitted via optic fibre and radiolink earth network. Outbound signals are uplinked to communication satellites from earth station(s) within the host country.

The international distribution of television signals is carried out by means of a ground network of national and international links provided by the telecommunications agency.

The network will be made up of analogue and digital systems over radiolinks and fibre optic systems, with sufficient capacity for routing all expected traffic and with the possibility of restoring and diversifying routes to ensure the efficiency of the system.

5.6.3.2.12 Outside Broadcast (OB) Vans Compound

The camera feeds of all unilateral cameras are channelled into the OB van compound. Interface with the organising committee data network is necessary if data and timing graphics are to be injected on to unilateral pictures, unless the broadcaster has its own character generator facility.

At major competitions adequate power sources must be provided for the large number of OB vans. For 20-25 OB vans, an outlay of approximately 600kW is necessary.

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CHAPTER 6

COMPETITION EQUIPMENT SPECIFICATIONS

6.1 Equipment for Track Events

In competitions directly under IAAF control, all equipment and implements used must conform to IAAF requirements and must hold current IAAF certificates of approval.

These certificates do not, of course, preclude the need for regular and proper maintenance.

While other equipment may conform to IAAF Rules it is preferable that equipment fully approved by IAAF is used at all levels of competition. The list of certified equipment is available for download from the IAAF website.

If any equipment and/or implements supplied as having an IAAF Product certificate do not comply with the IAAF Rules then the supplier should be asked to replace it at no extra cost with a complying item. If satisfaction is not obtained from the manufacturer then the matter should be referred to the IAAF for resolution.

6.1.1 STARTING BLOCKS (RULE 161)

Starting blocks shall be used for all races up to and including 400m (including the first leg of the 4x200m and 4x400m) and shall not be used for any other race. When in position on the track, no part of the starting block shall overlap the starting line or extend into another lane.

Starting blocks shall comply with the following general specifications:

- Starting blocks shall be rigid in construction and shall be totally inert.
- They shall be fixed to the track by a number of pins or spikes, arranged to cause the minimum possible damage to the track. The arrangement shall permit the starting blocks to be quickly and easily removed. The number, thickness and length of pins or spikes depend on the track construction. The anchorage shall permit no movement during the actual start.
- They shall consist of two foot plates and be mounted on a rigid frame, which shall in no way obstruct the athlete's feet as they leave the blocks.
- The foot plates shall be sloped to suit the starting position of the athlete, and may be flat or slightly concave. The surface of the foot plates shall be prepared to accommodate the spikes in the athlete's shoes, either by using slots or recesses in the face of the foot plate, or by covering the surface of the foot plate with suitable material permitting the use of spiked shoes.
- The mounting of the foot plates on a rigid frame may be adjustable, but it shall allow no movement during the actual start. In all cases, the foot plates shall be adjustable forward or backward in relation to each other.

- The adjustments shall be secured by firm clamps or locking mechanism, which can be easily and quickly operated by the athlete.
- In competitions held under Rule 1 (a), (b) and (c), the starting blocks shall be linked to an approved false start detection apparatus.

6.1.2 HURDLE (RULE 168)

Each lane in a hurdles race shall have ten flights of hurdles. The hurdles shall be positioned so that the side of the top bar nearest the athlete coincides with the edge of the line or mark indicating the position of the hurdle nearest the athlete (Table 2.2.3.1, Chapter 2).

The hurdle shall consist of two feet and two uprights made of metal or other suitable material with a top bar of wood, PVC or other suitable material. The uprights shall be at the extreme end of each base which may be rounded to ensure, as far as possible, that, when toppled in competition, the hurdle remains in its own lane.

The hurdle shall be of such a design that a force exerted horizontally by a weight at least equal to 3.6kg and not greater than 4kg applied to the centre of the top edge of the top bar is required to tilt it. Where a hurdle is adjustable in height the counter weights shall be similarly adjustable so that the tilting force is maintained within the same limits.

Hurdle Specifications:

Weight:	Minimum 10kg
Width:	1.18m-1.20m
Base Length:	Maximum 0.70m

Top Bar:

Height:	0.07m ± 0.005m
Length:	1.18-1.20m
Thickness:	Between 0.01m and 0.025m

Competition Heights:

Women / Junior:	400m	0.762m ± 0.003m
	100m	0.838m ± 0.003m
Men / Junior:	400m	0.914m ± 0.003m
	Men:	110m 1.067m ± 0.003m
Junior Men	110m	0.991m ± 0.003m
	Youth Girls:	400m 0.762m ± 0.003m
Youth Boys:	100m	0.762m ± 0.003m
	400m	0.838m ± 0.003m
	110m	0.914m ± 0.003m

The top edge of the top bar shall be rounded and the bar should be painted with white and black stripes or with other strong distinctive contrasting colours, (and also in contrast with the surrounding environment) such that the lighter stripes are on the outside. The stripes shall be at least 0.225m wide.

Tolerances for hurdle position distances:	100m and 110m ± 0.01m
	Over 110m ± 0.03m

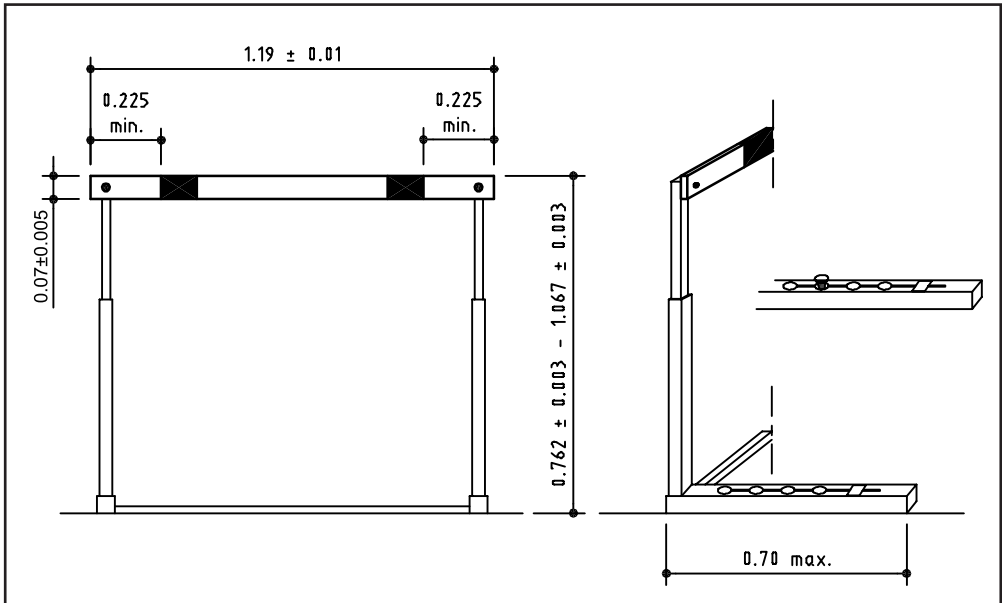


Figure 6.1.2 - Hurdle, view from the direction of running and side view (Dimensions in m)

6.1.3 STEEPLECHASE WATER JUMP (RULE 169)

The water jump, including the hurdle, shall be $3.66\text{m} (\pm 0.02\text{m})$ in length and $3.66\text{m} (\pm 0.02\text{m})$ in width (See 2.2.4).

At the hurdle end, the depth of the trough below the level of the surface shall be 0.70m and this depth shall be maintained for 0.30m . The level will then slope regularly upwards to the level of the track surface at the farther end of the jump. In many parts of the world there are severe water restrictions. Consequently the 2007 Congress approved the reduction of the depth of the water jump to 0.50m but keeping the same angle of slope to the bottom of water jump trough as provided for the former 0.70m deep trough. This equates to a level bottom of approximately 1.20m at the 0.50m depth. Existing water jump troughs may have concrete added to the bottom of the trough to reduce the depth to 0.50m . Suitable provision will have to be made for drainage. All new water jumps should be constructed to the new depth. Existing water jumps that comply with the old rule will continue to be accepted.

The bottom of the water jump should be surfaced with the same synthetic material as the track of thickness 0.025m . This material shall extend for at least 2.50m from the end of the jump in the direction of the hurdle.

For a non-synthetic track a heavy coir matting may be fixed to a concrete base. The sides of the trough shall have no rough or sharp edges which might be a hazard to athletes. The hurdle may be fixed or removable but, when in position, must be firm and immovable.

The hurdle shall be 3.66m wide and for men's events $0.914\text{m} (\pm 0.003\text{m})$ high and for women's events $0.762\text{m} \pm 0.003\text{m}$ high. The top bar shall be 0.127m square.

If adjustable steeplechase hurdles are used, they must be constructed so as to be perfectly stable at any height to which they may be set.

The top bar should be painted with white and black stripes or with other strong distinctive contrasting colours, (and also in contrast with the surrounding environment) so that the lighter stripes are on the outside, which should be at least 0.225m wide.

When not in use, the water jump trough should be covered by blanking boards.

6.1.4 STEEPLECHASE HURDLE (RULE 169)

Each hurdle will be constructed of wood or other suitable material.

The top bar shall be of wood or other material which will allow an athlete wearing spiked shoes to step safely on the hurdle. The section of the top bar shall be 0.127m square. It shall be painted with black and white stripes, or with other distinctive contrasting colours, so that the lighter stripes are on the outside. The stripes shall be at least 0.225m wide.

Each hurdle for men's event shall be $0.914\text{m} \pm 0.003\text{m}$ high and for women's events $0.762\text{m} \pm 0.003\text{m}$ high with a minimum width of 3.94m and shall weigh between 80kg and 100kg. It shall have a base between 1.20m and 1.40m at each end.

Each hurdle shall be positioned so that the top bar extends 0.30m inside the inner edge of the track.

It is recommended that the first hurdle should be at least 5.00m wide.

Where adjustable hurdles are used, they shall be constructed so as to be perfectly stable at any height to which they may be set.

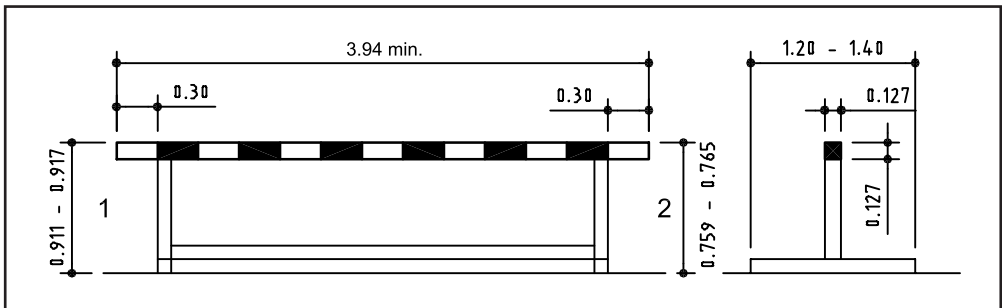


Figure 6.1.4 - Steeplechase hurdle, front and side view (Dimensions in m)

1 Height for men's races: 0.911m to 0.917m

2 Height for women's races: 0.759m to 0.765m

6.2 Equipment for Jumping Events

6.2.1 TAKE-OFF BOARD FOR LONG AND TRIPLE JUMP (RULES 185 AND 186)

6.2.1.1 Take-Off Board with Indicator Board

In the Long Jump, a take-off board shall be installed so that the take-off line is between 1.00m and 3.00m from the nearer edge of the landing area.

In the Triple Jump, the take-off boards shall be installed so that the take-off lines are at least 13.00m (for Men) and 11.00m (for Women) from the nearer edge of the landing area. Additional positions appropriate to different levels of competition may also be provided.

The take-off board shall be installed so that its surface is level with the surface of the runway. It shall be rectangular, made of wood or other suitable rigid material in which the spikes of an athlete's shoe will grip and not skid, 1.22m \pm 0.01m long, 0.20m \pm 0.002m wide, not more than 0.10m deep and coloured white. The take-off board may be enlarged to incorporate the indicator board as shown in Figure 6.2.1.1 or the design illustrated in the IAAF Competition Rules. When in position, the take-off board shall be firm and unyielding.

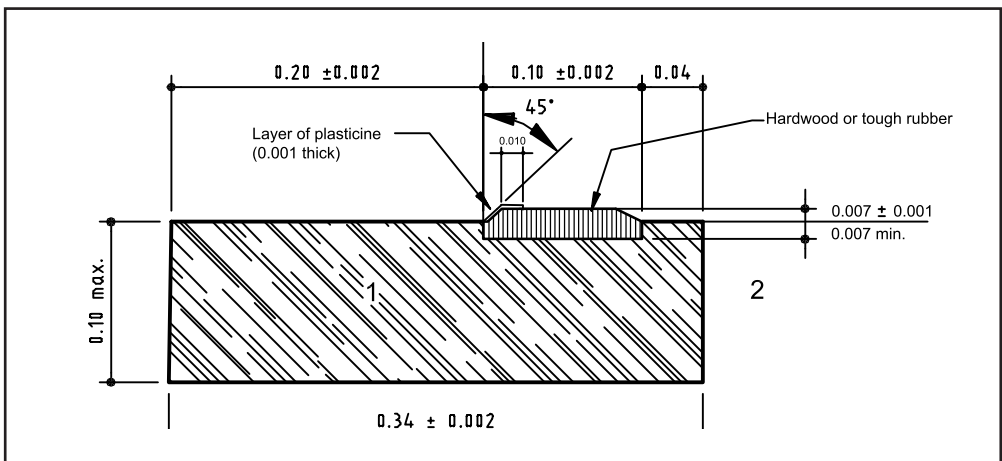


Figure 6.2.1.1 - Example of a take-off board incorporating indicator board (Dimensions in m)

The indicator board is 0.10m \pm 0.002m wide and 1.22m \pm 0.01m long made of wood, tough rubber or other suitable rigid material and shall be painted in a contrasting colour to the take-off board. Where possible, the plasticine should be a third contrasting colour. The surface of the board beneath the plasticine shall be of a material in which the spikes of an athlete's shoe will grip and not skid.

The indicator board shall rise from the level of the take-off board to a height of 7mm \pm 1mm. The edges shall either slant at an angle of 45° with the edge nearer to the runway covered with a plasticine along the length 1mm thick or shall be cut away so that the recess, when filled with plasticine, shall slant at an angle of 45°. The upper part of the indicator board shall also be covered for the first 10mm approximately and along its entire length, by a plasticine layer. When mounted in this recess, the whole assembly shall be sufficiently rigid to accept the full force of the athlete's foot.

Constructions in which the take-off board incorporates an indicator board recess are recommended.

6.2.1.2 Blanking Board

All take-off-positions not in use shall be filled by a solid, firmly fitting blanking board of metal or any other suitable material covered with synthetic material identical to the runway.

It should fit firmly in the foundation tray and may be fitted with adjustable legs to ensure that, when in position, the surface is level with the surrounding runway.

If constructed of metal, the support legs or base of the tray should be coated with rubber, PVC or other sound absorbing material.

6.2.2 HIGH JUMP UPRIGHTS (RULE 182)

Any style of uprights or posts may be used, provided they are rigid. They shall have supports firmly fixed to them and be constructed so as to exceed the maximum height to which the cross-bar can be raised by 0.10m minimum.

They shall be positioned at least 4.00m and not more than 4.04m apart minimum.

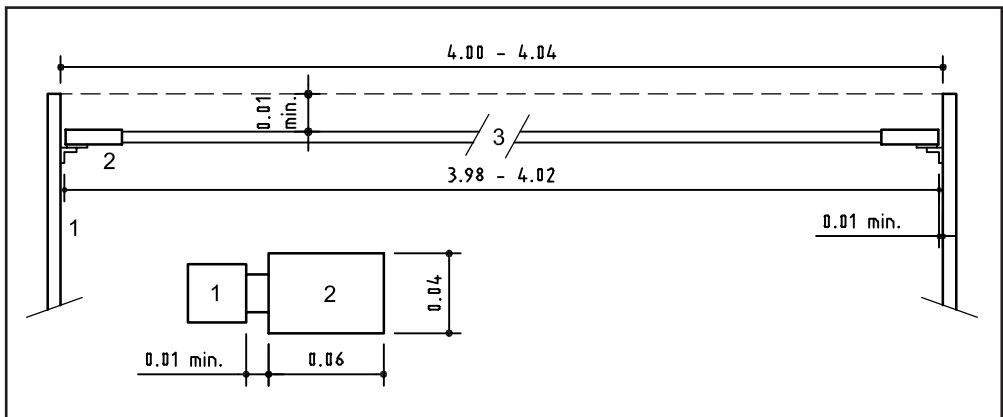


Figure 6.2.2 - High Jump crossbar support (Dimensions in m)

- 1 Upright
- 2 Support
- 3 Crossbar

6.2.3 LANDING MATS FOR HIGH JUMP (RULE 182)

The landing mats shall be at least 6.00m x 4.00m x 0.70m and shall be positioned so that no part of either upright is nearer than 0.10m to the landing area, to avoid any risk of the cross-bar being dislodged by the landing area coming in contact with the uprights during the competition.

The landing area shall be constructed of one or more pads of a honeycomb or similar construction designed to protect a jumper falling from a height of 2.50m. The pad(s) shall be covered and bound together in such manner as to prevent the athlete's limbs or any part of the athlete's body from catching between pads.

The entire landing area shall be covered by a single spike-proof top mat approximately 0.05m thick and should have a weatherproof covering.

The landing area may have "cut outs" to allow the front of the landing area to be placed immediately under the crossbar. It should be not less than 0.70m high and may be placed on a base or pallets to increase ventilation. The base should not be more than 0.10m high.

It should be stressed that the type of foam and the construction used is the major factor in the cushioning ability of the landing area.

6.2.4 BOX AND BLANKING BOARD FOR POLE VAULT (RULE 183)

The take-off shall be from a box constructed from metal, wood or other suitable material preferably with rounded upper edges.

It shall be sunk level with the ground and shall be 1.00m in length measured along the bottom of the box, 0.60m in width at the front end and tapering to 0.15m wide at the bottom of the stop board. The angle between the bottom of the box and the stop board shall be 105° and the stop board shall be 0.224m long. The side walls of the box shall slope outwards to form an angle of approximately 120° to the base.

If the box is constructed of wood the bottom shall be lined with sheet metal for a distance of at least 0.80m from the front of the box. The box may have one or more drainage holes in the corners of the base linked to the drainage system or a permeable layer under.

A blanking board, surfaced with the same material as the runway or a solid plug of the synthetic material may be placed over the box when not in use.

Tolerances: All box dimensions given may be $\pm 0.01\text{m}$. Angles $-0^\circ / +1^\circ$

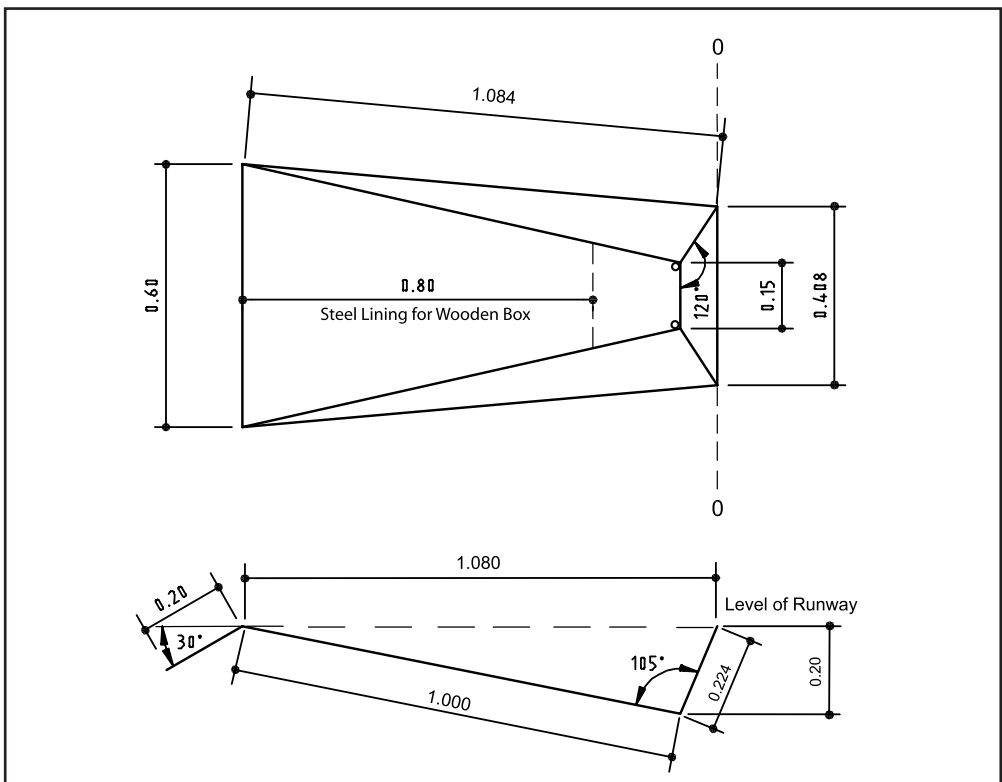


Figure 6.2.4 - Pole Vault box (Dimensions in m)

0 — 0: Zero line

6.2.5 POLE VAULT UPRIGHTS (RULE 183)

Any style of uprights or posts may be used provided they are rigid.

Pegs mounted on the uprights or on extension arms shall be used to support the crossbar. The distance between these pegs shall be not less than 4.30m nor more than 4.37m.

The construction shall ensure that the crossbar may be moved 0.80m in the direction of the landing area from the vertical plane of the inside edge of the top of the Pole Vault box (the zero line). This may be done by moving the uprights on rails or by using fixed uprights with horizontally adjustable pegs on a vertically adjustable rail.

The base tracking should be covered with padding as shall the lower part of the uprights to protect the athletes.

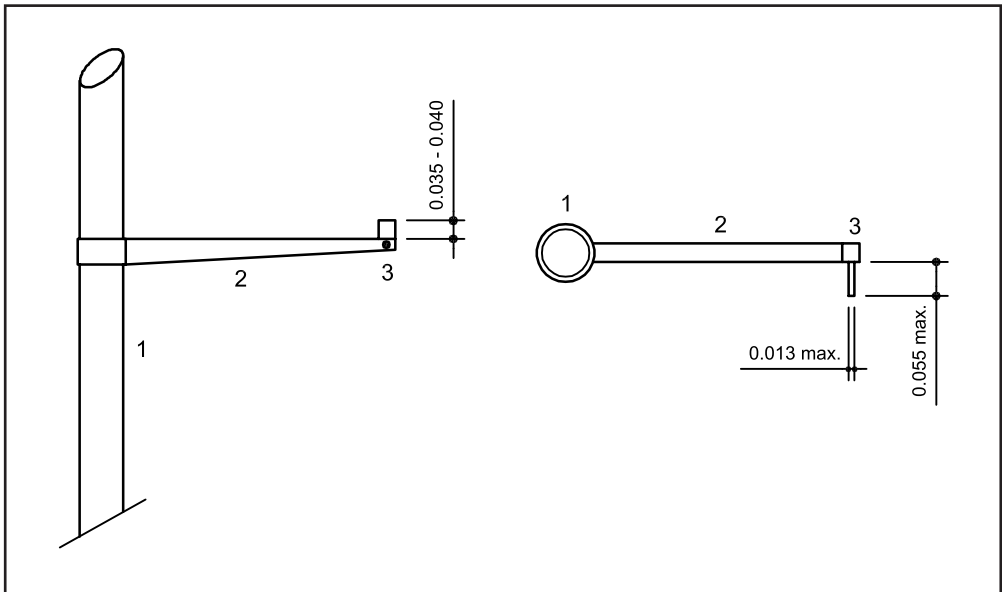


Figure 6.2.5 - Pole Vault crossbar support, view from the landing mat and top view (Dimensions in m)

- 1 Upright
- 2 Support
- 3 Peg

6.2.6 LANDING MATS FOR POLE VAULT (RULE 183)

For major international competitions, the landing area shall be at least 6.00m x 6.00m positioned behind the zero line with sloped sections at either side of the Pole Vault box extending a minimum of 2.00m in the direction of the runway. The sides of the landing area nearest the box shall be placed 0.10m to 0.15m from the box and shall slope away from the box at an angle of 45° from the vertical plane. For other competitions, the landing area should measure not less than 5.00m long (excluding the front pieces) x 5.00m wide.

The landing area should be approximately 0.10m from the uprights to avoid any risk of the crossbar being dislodged by the landing area coming in contact with the uprights during competition.

The landing area shall be constructed of one or more pads of good quality PVC foam of a honeycomb or similar construction designed to protect a vaulter falling from a height of 6.50m. The pad(s) shall be covered and bound together in such manner as to prevent the athlete's limbs or any part of the athlete's body from catching between pads.

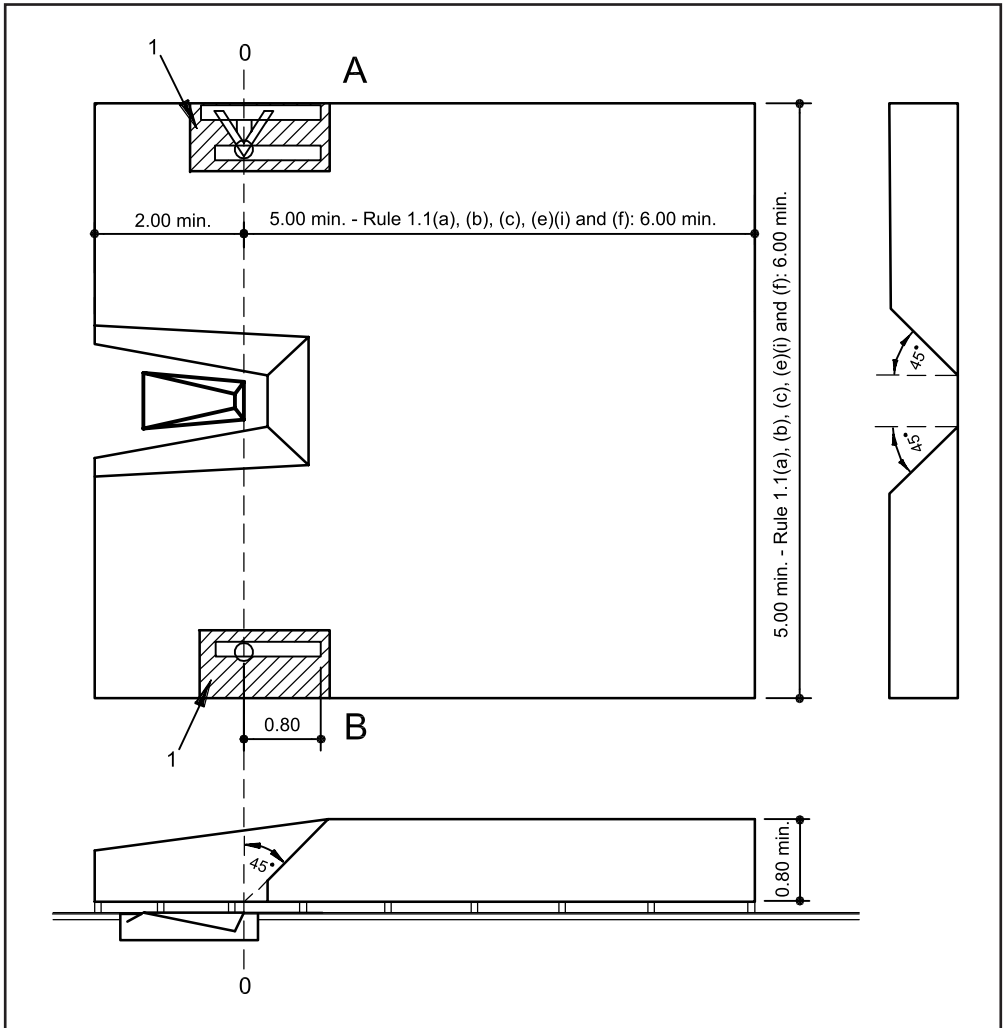


Figure 6.2.6 - Landing area for Pole Vault, top view, cross section and longitudinal section
(Dimensions in m)

0 — 0: Zero line
A Upright on rails
B Fixed upright

1 Protective pad

The entire landing area shall be covered by a single spike-proof top mat approximately 0.05m thick and should have a weatherproof covering.

The landing area should be not less than 0.80m high but may be placed on a base or pallets to increase ventilation. This base should not be more than 0.10m high. The section immediately behind the box should be closed.

It should be stressed that the type of foam and the construction used is the major factor in the cushioning ability of the landing area.

6.2.7 CROSSBAR (RULE 181)

The crossbar shall be made of fibre-glass, or other suitable material but not metal, circular in cross-section except for the end pieces. The overall length of the crossbar shall be 4.00m \pm 0.02m in the High Jump and 4.50m \pm 0.02m in Pole Vault. The maximum weight of the crossbar shall be 2kg in the High Jump and 2.25kg in Pole Vault. The diameter of the circular part of the crossbar shall be 30mm \pm 1mm.

The crossbar shall consist of three parts - the circular bar and two end pieces, each 29-35mm wide and 150-200mm long for the purpose of resting on the supports of the uprights. These end pieces shall be circular or semicircular with one clearly defined flat surface on which the bar rests on the crossbar supports. They shall be hard and smooth. They may not be covered with rubber or any other material, which has the effect of increasing the friction between them and the supports. The crossbar shall have no bias and, when in place, shall sag a maximum of 20mm in the High Jump and 30mm in Pole Vault.

Control of elasticity: Hang a 3kg weight in the middle of the crossbar when in position. It may sag a maximum of 70mm in the High Jump and 110mm in Pole Vault.

6.3 Equipment for Throwing Events

6.3.1 SHOT PUT STOP BOARD (RULE 188)

The stop board shall be white and made of wood or similar suitable material in the shape of an arc so that its inner edge coincides with the inner edge of the Shot Put circle. It shall be placed so that its centre coincides with the centre line of the landing sectors and shall be firmly fixed to the ground or the circle concrete surround.

The board at the narrowest point shall be 0.112m \pm 0.002m wide and, when firmly in position 0.10m \pm 0.002m high in relation to the level inside the circle (Figure 2.4.4.2).

A portable Shot Put circle of similar construction to that illustrated in Figure 8.9 but with a band iron or steel ring may be used provided that all the IAAF Competition Rules are met.

6.3.2 SAFETY CAGES

Hammer and discus shall only be thrown from an enclosure or cage to ensure the safety of spectators, officials and athletes. (Figures 2.4.1.2 and 2.4.2.2)

Cages specified here are intended for use in major stadia in high class competition when the event takes place outside the arena with spectators present or when the event takes place in the arena and other events are taking place at the same time. Simpler and smaller cages may be adequate for competition of lower standard and for well regulated training facilities.

Advice is available from national federations or from the IAAF Office.

Hammer cages may also be used for Discus Throw competition either by installing 2.135m/2.50m concentric circles (Figure 6.3.2) or by using an enlarged Hammer cage design but with a Discus circle installed in front of the Hammer circle. This latter construction is not recommended because of the cost involved, the space requirements and the effect on viewing.

The design of cages and in particular the gates in the case of a Hammer cage can be innovative provided that they give the same degree of protection as a conventional design and the relevant danger zone is not increased.

The gates should be constructed so that they can be quickly moved during competition.

The nets and supporting structure shall be designed to a design wind speed commensurate with the proposed use. If a cage is to have the netting remain in place

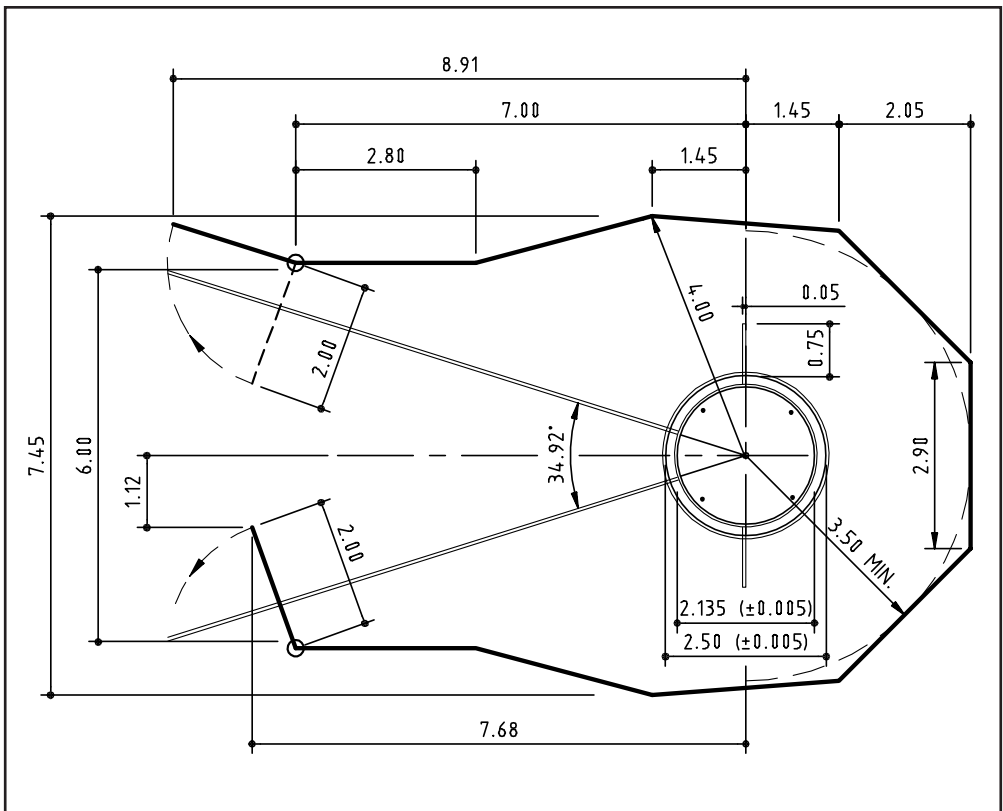


Figure 6.3.2 - Combined Discus and Hammer throwing cage (Dimensions in m)

then it should be designed for the 1 in 50 year maximum wind gust for the locality. Manufacturers shall disclose the design wind speed to purchasers and in their documentation.

The whole construction, including handling equipment, shall be designed so as to minimise the possibility of an implement striking a hard surface by suspending the netting well clear of supports and padding hard surfaces where necessary.

The desirable properties of a cage are the following:

- The cage meets the dimension requirements of the IAAF Rules.
- The netting cord must be strong enough so that it does not break under the impact of the hammer, abrade where it is attached or deteriorate unduly under the effects of ultra violet ray exposure.
- The net can be quickly raised and lowered.
- There is positive attachment of the netting at ground level which maintains the net in correct relationship to the throwing circle(s).
- The netting when blown by wind does not impede the athlete making a throw.
- The gate pivot posts should not be exposed so that it can be hit by an implement causing damage to both.
- The netting shall be hung clear of the support posts so that the posts are not struck by a thrown implement.
- The gates shall be easy to open and close manually quickly with a positive positioning arrangement in the fully open and closed positions.
- The gates shall maintain their integrity under long term usage.
- The supporting frame shall be stiff enough so that it does not deflect out of position unduly under the weight of the net and the force of wind.

6.3.2.1 Necessary Safety Precautions

National safety regulations may require tests in addition to those listed. However, the following are considered to be the minimum safety tests and requirements:

- Careful and regular check of all materials, joints, bolts, lifting mechanisms and supports before each competition season.
- Inspect netting and repair if necessary before each competition.
- Test netting materials at least once per year.

If fibre netting is used, several sample lengths, minimum 2 metres long, or several sample mesh pieces should be worked into the net by the manufacturer. One of these samples should be removed and tested at least annually to confirm the continued strength of the netting.

The netting cord must be strong enough so that it does not break under the impact of the hammer, abrade where it is attached or deteriorate unduly under the effects of ultra violet ray exposure.

The cage must be properly operated during training and competition.

6.3.2.2 Hammer Cage (Rule 192 and Figure 2.4.2.2)

The Hammer cage shall be designed, manufactured and maintained so as to be capable of stopping a 7.26kg hammer moving at up to speeds of 32m per second. This equates to a kinetic energy of 3.72kJ. It may be assumed that Type B1 netting

with a minimum breaking energy at end of life of 4.4kJ as defined in EN 1263-1:1996 will meet this requirement.

The netting which may be of suitable natural or synthetic fibre cord or of mild or high tensile steel wire should be arranged so that there is no danger of the hammer ricocheting, rebounding or forcing its way through joints in the netting or panelling, or under the netting.

The minimum height of the netting shall be 7.00m. There must be adequate attachments of the netting at ground level and at the top, which maintains the net in correct relationship to the throwing circle.

The maximum mesh size for wire netting shall be 0.05m and, for cord netting, 0.044m and the minimum breaking strength of cord or wire shall be 300kg. Alternatively, the energy absorption of the mesh shall meet the dynamic test principles laid down in EN 1263-1:1996 such that the netting will withstand an object 100kg mass being dropped into the netting from a height of 7m.

The netting may be in sections or in continuous form hung from a well-supported and braced framework. It is desirable that the netting can be raised and lowered quickly. In any construction the minimum distance from the centre of the circle to any point on the cage netting shall be 3.50m. The netting shall be hung clear of the support posts or frame so that a thrown implement cannot strike the posts when the netting moves under the impact.

The supporting structure shall be rigid enough so that it does not deflect out of position unduly under the weight of the netting or the force of the wind.

The width of the cage at the mouth should be 6.00m when measured to the insides of the netting positioned 7.0m in front of the centre of the Hammer circle. Two movable netting panels 2.00m wide and at least 10.00m high shall be provided at the front of the cage. These panels shall be constructed and erected so as to allow the panels to be opened and closed to suit "right-handed" and "left-handed" throwers. The structures supporting the front panels (gates) shall be easy to open and close manually and constructed so that they can be secured firmly in the fully open and closed positions.

This cage is suitable for Discus Throw.

The IAAF Competition Rules indicates that for concentric circles in discus throwing configuration the Hammer cage gates should be fixed parallel to the closer landing sector line. This will reduce the danger zone to approximately 62° without impeding a throw.

6.3.2.3 Discus Cage (Rule 190 and Figure 2.4.1.2)

The cage should be designed, manufactured and maintained so as to be capable of stopping a 2kg discus moving at speeds of up to 25.00m per second. This equates to a kinetic energy of 0.63kJ.

The netting which may be of suitable natural or synthetic fibre cord or of mild or high tensile steel wire should be arranged so that there is no danger of the discus ricocheting or rebounding or forcing its way through joints in the netting. It shall be at least 4.00m high. The end of the cage side particularly adjoining the track may be of

greater height and/or length to the minimum dimensions specified so as to prevent a wayward discus landing on the track or beyond during a Discus Throw competition by going over the netting or past the end of the netting.

The maximum mesh size for wire netting shall be 0.050m, and, for cord netting, 0.044m. The minimum breaking strength of the cord or wire at anytime shall be 40kg. Alternatively the energy absorption of the mesh shall meet the dynamic test principles laid down in EN 1263-1:1996 such that the netting will withstand an object 15kg mass being dropped into the netting from a height of 7.00m.

The netting may be in sections or in continuous form hung from a well-supported and braced framework. It is desirable that the netting can be raised and lowered quickly. In any construction the minimum distance from the centre of the circle to any point on the cage shall be 3.00m. The netting shall be hung clear of the support posts or structure so that a thrown implement cannot strike these.

The supporting structure shall be rigid enough so that it does not deflect out of position unduly under the weight of the netting or the force of the wind.

The width of the cage at the mouth, measured to the inner edges of the cage netting, should be 6.00m positioned 7.00m in front of the centre of the Discus circle.

This cage is not suitable for Hammer Throw.

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- 7.3.2.3 Timing and Measuring Equipment
- 7.3.2.4 Fencing

CHAPTER 7

MAINTENANCE

7.1 General Aspects

The proper maintenance of the stadium is of paramount importance for the sport. The enjoyment of athletes and spectators is conditional upon such maintenance.

The benefit to the community of an attractive stadium cannot be over emphasised.

The lifetime of Track and Field facilities depends on regular maintenance.

Lack of maintenance leads to deterioration and is costly to rectify. It projects a bad image and can result in overspending of annual budgets.

Maximum use of Track and Field stadia requires the best conditions for athletes and spectators and for all maintenance personnel.

Authorities responsible for annual budgets must make adequate provision for the cost of necessary maintenance which should include cleaning, renovation and rebuilding works. Annual budgets must take into consideration all expenses including:

- Capital charges
- Running costs
- Arena equipment
- Maintenance equipment
- Maintenance materials
- Renovation of the sports surface

Failure to maintain and renovate regularly will result in expensive reconstruction costs often as much as 100% more.

Maintenance works must be carefully planned in good time and reviewed annually. All maintenance personnel must be kept well informed of these plans.

The education of staff at all levels must be conducted regularly. Lectures on proper maintenance, new methods and materials should be part of their employment.

7.2 Maintenance of Competition and Training Surfaces

Important factors for a high standard of maintenance are:

- Well designed and constructed Track and Field facilities
- Competent management
- Well qualified and trained groundstaff and other personnel
- Adequate annual budget and continuous financial control of all types of maintenance

- Readily available and suitable equipment for maintenance
- Sufficient quantity of necessary materials
- Detailed planning (daily, weekly, seasonally and annually) of all maintenance including a "log-book" recording all maintenance operations
- All persons involved should be informed in good time
- Technical supervision of the condition of the stadium and action on any resulting recommendations

7.2.1 SYNTHETIC SURFACED TRACKS

7.2.1.1 General Aspects

Synthetic surfaces for athletics facilities are not maintenance free. To obtain the required high standard, certain daily and seasonal procedures must be carried out. Consideration must be given to the right time for renovation by replacing a worn-out surface or re-topping and adequate budgetary provision must be made for this.

7.2.1.2 Suitable Equipment

For normal maintenance of a synthetic surface the following equipment is necessary:

- Hand tools for manual cleaning (hose, brush)
- Ride-on sweeper with rotary nylon (not metal) brushes
- High pressure (water) ride-on cleaner (tractor with equipment for high pressure and water tank)
- Ice spray boxes
- Repair kit for synthetic materials
- Marking and spraying kits
- Portable sprayer

7.2.1.3 Necessary Materials

It is recommended that colours for marking, synthetic material and glue for smaller repairs be available in the stadium.

7.2.1.4 Required Properties of the Surface

The most important factors are cleanliness of the running track, overall colour of the surface and white, accurate lines and standardised marks (correct form and colour).

Adequate maintenance will ensure these objectives.

7.2.1.5 Regular Procedure

Regular maintenance - after daily general inspection for damage, loose spots, need for cleaning - consists of cleaning, manual or with ride-on sweeper, hosing down partly or totally, removal of debris and loose deposits such as litter, grasscuts, leaves and sand from the landing area.

7.2.1.6 Basic Procedure

The basic maintenance programme for a synthetic surface should consist of:

- Manual cleaning with hose / brush
- Mechanical cleaning with a ride-on sweeper (large or small, as required)

- Treatment of weeds, algae and moss with approved chemicals then removal using pressure washing
- Freezing away chewing gum by means of ice spray
- Checking the top of surface is securely fixed to the base - loose spots are to be fixed immediately
- Special controls of areas with heavy traffic of spiked shoes
- Checking of all lines and marks, renewing when needed
- Allocation of lanes available for training

7.2.1.7 Seasonal Works

Seasonal maintenance, including major cleaning, is to be carried out twice a year. It is not recommended to hose down the total surface with water but to use high pressure water-cleaning, namely full rinsing using tractor with unit for high pressure treatment. No chemicals should be used on the synthetic surface.

Renewal of lines and marks should follow when needed.

When snow is to be removed, it must be swept off.

7.2.1.8 Restrictions on Use

To ensure a high standard of maintenance, restrictions should be imposed on the use of the synthetic track. In general, no vehicles should be permitted to drive on the synthetic surface. Before heavy-duty vehicles are allowed onto the surface, it must be protected by boards.

The use by athletes of chemicals (e.g. for muscle treatment) within the arena should not be allowed.

Fireworks and cigarettes on the synthetic surface are always forbidden.

The inside lane should be closed for training using barriers.

Soiling of the track surface from football boots should be avoided by placing covers on transition areas.

7.2.1.9 Renovation

The lifetime of a synthetic surface will depend upon its quality, its usage and its level of maintenance. In general, a normal synthetic surface used intensively will last 8 to 10 years before renovation is required.

Renovation should be periodically carried out to prevent the total damage of the surface which would necessitate complete renewal.

There are different procedures for the renovation of a surface:

- Total renewal by replacing the worn-out synthetic surface with a new material
- Section renewal by replacing the localised worn areas
- Renewal by re-topping or sealing with adequate synthetic materials
- Part re-topping in particular worn-out areas

Some of the many possible permutations and combinations to be addressed are:

Resurfacing a Poured Synthetic Surface with a Prefabricated System

If the existing surface is sound then the existing surface can be resurfaced with the Product Certificate thickness of the prefabricated material. The increased thickness

may require reconstruction of kerbing, and horizontal jump landing area kerbing and take-off boards etc.

Alternatively, the existing surface can be removed, the asphalt surface under repaired as necessary and a new prefabricated system installed.

Resurfacing a Poured Synthetic Surface with the Same Make and Type of Poured Synthetic Surface

If the existing surface is generally sound then it can be ground down and resurfaced with the appropriate thickness of new material to ensure that the specifications in the IAAF Track Facilities Testing Protocols are met. It is not generally possible to resurface spray coat systems that have been significantly damaged. However, it may be possible to re-top sandwich systems after grinding if the top layer of full PU rubber has not been destroyed.

Resurfacing a Poured Synthetic Surface with a Different Make of Poured Synthetic Surface

If the existing surface has a Product certificate and the surface is generally sound then it can be ground down and resurfaced with the appropriate thickness of new different Product certificate material to ensure that the specifications in the IAAF Track Facilities Testing Protocols are met.

Resurfacing a Poured Synthetic Surface that Does Not Have an IAAF Product Certificate with a Different Make of Poured Surface

If the existing surface is sound it can be ground down and resurfaced with the full thickness of the Product certificate material to ensure that the specifications in the IAAF Track Facilities Testing Protocols are met.

Resurfacing a Prefabricated Synthetic Surface

If the existing surface is sound it can be resurfaced with the same surface material of the requisite thickness. It is not recommended that a lesser thickness than the Product certificate thickness be used as it can quickly be worn through to the older surface particularly at points of take-off at track starts and jumps. The increased thickness may require reconstruction of kerbing, and horizontal jump landing area kerbing and take-off boards etc.

Facility owners would be well advised to seek the independent advice of an IAAF testing laboratory when it is intended to resurface an existing synthetic surface. If the laboratory determines that the existing surface is sound with good adhesion to the underlying asphalt, the laboratory can test representative areas of the existing surface over-coated with different thicknesses of new material to identify just how much new surface overlay is necessary to ensure compliance with specifications in the IAAF Track Facilities Testing Protocols.

When in doubt about how best to proceed, the IAAF should be consulted by the facility owner before committing to a particular course of action.

To obtain an IAAF Class 1 certificate for the renovated facility it will be necessary to have full in-situ testing of the facility synthetic surface.

Tracks must be re-marked and resurveyed after complete renovation. If the track has an IAAF certificate an IAAF Measurement Report must be forwarded to the IAAF

and the National Federation. Where improvements have been made to only certain sections of the surface, it must be decided whether or not a complete re-marking is necessary.

It should be noted that, for synthetic surfaces which are permeable to water, renovation by means of sealing or spray coating may diminish the water permeability of the surface.

7.2.2 NATURAL GRASS SURFACES

7.2.2.1 General Aspects

Natural grass surfaces are mainly used for infield throwing events. Turf requires specialist care. Since it is a living material, particular attention must be paid to the frequency of use.

7.2.2.2 Suitable Equipment

For normal maintenance, the following equipment is required:

- Tractor
- Ride-on grass-cutter
- Nutrient spreader
- Sand spreader
- Seed spreader
- Hand tools
- Renovation equipment

For renovation, the following equipment is recommended:

- Top dresser
- Airifyer / aerator with slices / pipes
- Slotter
- Verticutter
- Vertidrain
- Seeder

7.2.2.3 Necessary Materials

The following materials must be available:

- Substitute grass area
- Seeds
- Nutrients
- Sand in specific gradients
- Growth medium of standardised quality

7.2.2.4 Required Properties of the Surface

The most important factors are: evenness, compactness, growth and height of grass.

7.2.2.5 Regular Procedure

A natural grass surface should be inspected daily. The normal procedure consists of cutting and watering (frequency varies) and repair of the surface, when necessary.

7.2.2.6 Basic Procedure

The following main tasks should be undertaken in a basic maintenance plan:

- When mowing, the cutting height must take into consideration the sports activities for which the surface will be used. Prior to a Track and Field competition, the grass should be cut to 1.5cm to 2cm in height.
- All grass cuttings should be removed, ensuring they are not spilt onto a synthetic or unbound mineral surface.
- A quantity, quality and time programme of nutrition must be established.
- For watering, flush sprinklers are recommended.
- Local damage must be repaired immediately. All thatches are to be removed.
- When necessary, the surface must be loosened with special tools and sanded with 0.2mm to 0.4mm particles. Leaves, litter and other deposits are to be removed.
- Plant protection must be observed in accordance with national law.

7.2.2.7 Seasonal Works

The seasonal preparation of the grass surface is of great importance. Plans should be established for spring works (general preparation), autumn works and maintenance after each training session.

7.2.2.8 Restrictions on Use

Natural grass must be protected. The frequency of use must be regulated and sufficient time allowed for growth and maintenance (repair of bad spots, general treatment, renovation). The surface should be protected from heavy vehicles.

For Hammer Throw, the surface should only be used for competition.

7.2.2.9 Regeneration / Renewing

Even with well-planned and practiced maintenance, a natural grass surface will require a carefully planned regeneration after 6 to 10 years. Based on analysis of the growth medium, compactness, porosity and the condition of the grass, there are different principles for regeneration or renewing:

Simple Surface Renovation

This method is recommended as a natural renovation for uneven surfaces of large areas of worn grass.

The procedure consists of cutting the grass 1cm, verticutting for cleaning the surface and removal of dead grass and thereafter levelling with growth material. It is important that all compact areas are loosened. This is followed by a top dressing of sand and, finally, over seeding.

Combined Surface and Depth Renovation

To be used in cases of greater compactions, bad drainage and poor grass cover.

The surface should be cut, cleaned and levelled. In addition, it should be vertidraind to a depth of 15cm to 30cm before sanding and over seeding.

Renewing

This procedure is to be recommended in acute circumstances. The grass surface may be water-filled due to compaction. The procedure for renewing is the removal of

the top layer of approximately 5cm. The drainage must be inspected and, if necessary, renewed. The ground should be loosened and levelled with granular materials to the required standard consistency.

New soil of a standardised sand-based composition should be laid to a depth of 8cm to 12cm. This soil should be levelled and seeded.

7.3 Maintenance of Technical Installations

All technical installations in an athletics stadium need proper and regular care and maintenance to prevent deterioration.

7.3.1 TECHNICAL SYSTEMS

7.3.1.1 Drainage

General inspection of drainage channel (hosing down).

All drainage kerbs should be cleared by rodding or jetting.

All gully pots and catch pits should be cleared.

7.3.1.2 Water Hydrants

Control of water pressure.

All joints to be checked.

Water supply joint in the water jump to be checked.

7.3.1.3 Irrigation Installation

Movable systems (control of tubes, hose, sprinkler and joints).

Automatic systems (control of tubes, joints, water pressure, pop-ups).

7.3.1.4 Cable Channels

Control of all channels.

7.3.1.5 Ducts for TV and Electronic Equipment

All plug-in points to be controlled.

7.3.2 COMPETITION EQUIPMENT

7.3.2.1 Ground Equipment

7.3.2.1.1 Kerb

To be inspected and to be cleaned with liquid detergent.

7.3.2.1.2 Landing Area for Long and Triple Jump

Sand should have a gradient 0.2mm to 2.0mm, with no sharp edges. Salt may be added.

The landing area should be well turned over, levelled and moist.

7.3.2.1.3 Take-off Board for Long and Triple Jump

No irregular edges.

Solid foundation.

Painted white.

Supply of extra boards.

Plasticine indicator boards and supply of plasticine.

Trays for removable boards including drainage holes to be regularly cleaned.

7.3.2.1.4 Throwing Circles

Flat, with gentle stippled surface and no loose areas.

Check of dimensions.

Cleaning (hose, brush, cloth).

Drainage holes to be kept clear.

Shoe cleaning apparatus.

Shot put stop board must be firmly secured and checked for correct positioning.

It should be painted white.

7.3.2.1.5 Safety Cages

Frequent examination of all uprights, panels, nets and nettings.

Any repairs must be carried out without delay.

Grounds sockets should be free from mud, etc.

All nets to be pegged down firmly.

7.3.2.1.6 Uprights for Jumping / Vaulting

To be adjusted and repaired, when needed.

Rigidity to be checked.

7.3.2.1.7 Box for Pole Vault

Drainage holes to be cleared.

Rigidity to be checked.

7.3.2.1.8 Landing Mats for Jumping / Vaulting

Must receive frequent attention.

Misuse must be prevented.

Must be mounted on open duckboards.

Stored in a dry place.

Protected by a removable cover.

Repaired when necessary.

Correct handling when moved.

7.3.2.1.9 Arc for Javelin

Must be painted white.

7.3.2.1.10 Water Jump

Outlet drain to be controlled.

Hydrant for water filling to be checked.

Water to be drained after the event.

Landing area to be regularly checked to ensure that the synthetic surface is in good condition and safe.

Firmness of hurdle to be checked.

Hurdle well painted.

Concrete retaining walls to be checked for damage.

Removable kerb to be checked.

7.3.2.2 Track Equipment

7.3.2.2.1 Hurdles

To be checked at regular intervals.

To be kept clean with moving parts well lubricated.

Repainted when necessary.

Inspection of weights.

7.3.2.2.2 Starting Blocks

To be kept clean with moving parts lubricated.

To be stored in a dry place.

7.3.2.2.3 Hurdles for Steeplechase

To be carefully stored and painted.

Firmness and stability to be checked.

7.3.2.3 Timing and Measuring Equipment

All equipment must be stored carefully, checked before use and be calibrated annually.

7.3.2.4 Fencing

Fences and gates have to be checked in respect of rigidity and wear.

Damage has to be repaired.

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CHAPTER 8

FACILITIES FOR INDOOR ATHLETICS

8.1 Special Features of Indoor Athletics

The indoor stadium should include facilities adequate for the full range of events normally held indoors and should conform to IAAF Rules and Regulations.

Competition Categories, number of athletes, competition officials and auxiliary personnel at indoor meetings of different categories are shown in Table 8.1a.

Competition Category	Event ¹	Approximate Maximum Number of Participants at Any One Time			Duration of Competition Number of Days	Recommended Construction Category	Authorising Body ¹
		Athletes	Competition Officials	Personnel			
1	World Championships	40-60	50	20	3	I	IAAF IAAF Rule 1.1(a)
2	Continental, Regional Area Championships	50-60	50	20	3	II	Continental, Regional or Area Association IAAF Rule 1.1(c),(f),(g)
3	Continental, Regional and Area Cups	30-40	40	12	1-2	III	Group Association IAAF Rule 1.1(b),(g)
4	Group Games	30-40	40	12	1-2	III	
5	Matches	20-30	30	12	1-2	III	IAAF, Area or National Federation IAAF Rule 1.1(d),(h) and Rule 2.7
6	International Invitation Meetings specially authorised by IAAF	30-40	40	12	1	III	IAAF IAAF Rule 1.1(e)(i)
7	International Invitation Meetings specifically authorised by an Area Association	30-40	40	12	1	III	Area Association IAAF Rule 1.1(j)
8	Other Meetings specifically authorised by an Area or a Member and National Championships	30-40	40	12	1-2	IV	Area Association or National Federation IAAF Rule 1.1(i) and Rule 2.7
9	Combined Events	20-30	30	10	2	III	As appropriate
10	Other National Competitions	40-60	40	16	1-2	V	National Federation IAAF Rule 2.7

¹In accordance with IAAF Rule 1.1 and Rule 2.7

Table 8.1a - Competition Categories, number of athletes, officials and auxiliary personnel at indoor competitions

The requirements for planning the facility depending on the highest level of competition that is envisaged are listed in Table 8.1b.

		Construction Category				
		I	II	III	IV	V
1	200m Standard Track as described under Chapter 8 with 6 oval and min. 8 straight lanes for 60m and 60m Hurdles	1	1	-	-	-
2	200m Standard Track as line 1, but with 4 oval and 6 straight lanes	-	-	1	-	-
3	Track less than 200m circuit with 4 oval and 6 straight lanes for 50m and 50m Hurdles	-	-	-	1	-
4	200m or less circuit with bend radius outside range 15m to 19m, 4 or 6 oval and 6 or 8 straight lanes	-	-	-	-	1
5	Facility for Long and Triple Jump	1	1	1	1	1
6	Facility for High Jump	1	1	1	1	1
7	Facility for Pole Vault	1	1	1	1	1
8	Facility for Shot Put (permanent or temporary)	1	1	1	1	1
9	Ancillary rooms as described under Section 8.7	*	*	*	*	*
10	Full facilities for spectators	*	*	*	*	*
11	Warm-up area, comprising a 4 lane 150m circuit, 6 lane 50m straight, jumping facilities (similar surface to the competition track); throwing practice area for Shot Put	*	-	-	-	-
12	Warm-up area comprising a 6 lane 80m straight (synthetic surface); throwing practice area for Shot Put	-	*	-	-	-
13	Warm-up area comprising a 6 lane 80m straight	-	-	*	-	-
14	Warm-up area comprising a 4 lane 80m straight	-	-	-	*	*
15	Ancillary rooms e.g. for conditioning and physiotherapy, adequate space for athletes resting between events, with area of min. m ²	150	125	100	100	100
* Required						

Table 8.1b - Requirements of the Construction Categories for Indoor Tracks

8.1.1 IAAF RULES FOR INDOOR MEETINGS

The indoor stadium shall be completely enclosed and covered. Lighting, heating and ventilation shall be provided to give satisfactory ambient conditions for competition. In hot climates full air-conditioning may be necessary.

8.1.1.1 The Arena

The arena should include a 200m long oval track (Standard Distance Indoor Track) consisting of two straights and two bends which shall be banked; an infield straight track for sprints and hurdles; runways and landing areas for High Jump, Pole Vault, Long Jump and Triple Jump, and a circle and landing sector for Shot Put (Figure 8.1.1.1).

The IAAF recommends the "200m Standard Indoor Track" as the optimum solution but having regards to the need to accommodate demountable tracks in multipurpose facilities, also accepts the "200m Standard Distance Indoor Track" for all competitions.

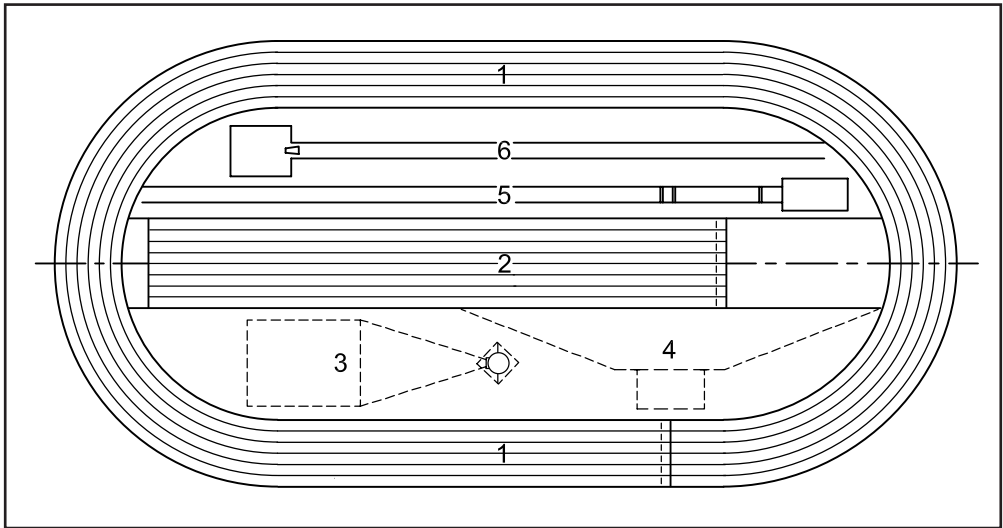


Figure 8.1.1.1 - Layout plan of the 200m Standard Indoor Track

- 1 Oval track
- 2 Infield track
- 3 Shot Put
- 4 High Jump
- 5 Long and Triple Jump
- 6 Pole Vault

The IAAF recognises that because of existing building size constraints it may be necessary to have an indoor track length less than 200m and such a facility will be satisfactory for training and local competition. The design principles given here should be followed for such facilities to the maximum extent possible.

8.1.1.2 Tracks and Lanes

The infield straight track should have a minimum of 6 but preferably 8 or more lanes separated and bounded on both sides by white lines 0.05m wide. The lanes shall all be $1.22\text{m} \pm 0.01\text{m}$ wide including the lane line on the right.

The oval track should have a minimum of 4 and a maximum of 6 lanes. The nominal width of the lanes shall be between 0.90m and 1.10m including the lane line on the right. All lanes shall be of the same width with a tolerance of $\pm 0.01\text{m}$ to the selected nominal width.

The tracks, runways or take-off surfaces shall be covered with the same synthetic material to specifications as outlined in Chapter 3 or have a wooden surface. Preferably the former surfaces should be able to accept 6mm running shoe spikes but the stadium management may specify other length spikes.

The thickness of the synthetic material on the oval track shall not be less than 9mm.

The foundation on which the synthetic surface of the tracks, runways and take-off areas is laid shall be either solid e.g. concrete or, if suspended construction (such as wooden boards or plywood sheets mounted on joists), without any special sprung

sections and, as far as is technically possible, shall have a uniform resilience throughout. This shall be checked, for the take-off areas for the jumps before each competition. However, it is accepted that where there is suspended construction, there will be some variation in the “feel” of the runway between supporting joists even when the flooring and the synthetic surfacing is of a reasonable thickness. A “sprung section” is any deliberately engineered or constructed section designed to give extra assistance to an athlete.

8.1.1.3 The Oval Track

The length of the Standard Distance Oval Track should not be less than 200.000m (+ 0.040m).

The oval track consists of two parallel straights and two bends, which may be banked, whose radii should be equal.

The inside of the track shall be bordered either with a kerb of suitable material, approximately 0.05m in height and width, or a white line 0.05m wide. The length of the inside lane shall be measured (measurement line) along the surface of the track 0.30m outward from the kerb. If there is no kerb, the measurement shall be taken 0.20m outward along the surface slope from the outer edge of the white line marking the inside of the track. However, during competitions, the white line shall be marked with cones or flags in accordance with Rule 213.4. A kerbed track is preferred.

The inside edge of the line or kerb shall be generally horizontal throughout the length of the track with a maximum overall longitudinal slope of 0.1%. It is recognised that normal construction tolerances mean that for short sections of the track the longitudinal slope may exceed 0.1%.

Experience has shown that the most suitable 200m oval tracks are constructed with bend radii of between 15.00m and 19.00m with an optimum of 17.200m. The IAAF recommends that where possible all future tracks are constructed to the latter specification and will be referred to as the “200m Standard Indoor Track”. It is accepted that building and other limitations may dictate that an indoor track be of a different radius and/or geometry. The designer shall ensure that the sprint track facilities can be fitted on the infield with satisfactory safety clearances.

The angle of banking of the bends should not exceed 15° or be less than 10°. The suggested maximum angles of banking for competition for a range of radii are given in Table 8.1.1.3. Tracks that are used primarily for sprint training may have slightly steeper banking than indicated.

	Radius of Running Line					
	15.00m	15.50m	16.50m	17.50m	18.50m	19.00m
Banking	15°	13°	11.5°	10°	10°	10°

Table 8.1.1.3 - Suggested maximum angles of banking

Source: Swedish Athletic Federation

The angle of banking in all lanes should be the same at any radial cross-section of the track.

The vertical transition between flat straights and banked bends must be continuous and uniform. The maximum gradient of the vertical transitions, measured in the running direction along the outside edge of the outer lane, should not exceed 5%. The vertical transition between straights and bends may extend up to 5m into the straight. The connection between the horizontal area and ascending and descending areas should be smooth, with a minimum vertical radius of 5m but much larger radii are preferred.

To ease the athletes' smooth passage from the straights to the bends, multi-radius or clothoid-type radial transitions may be constructed between the straights and the bends. However, the length of the straight should not, where possible, be less than 35m. The initial small offset of the transitions from the straight line may be disregarded in determining the straight length provided.

The radial transition between straights and bends may be made with two or three sections of radii gradually decreasing from a very large radius to the bend radius. This is a very practical solution to the radial transition problem that has been successfully adopted by several manufacturers, and the athletes have no problem handling this geometry.

Clothoid-type radial transitions are also possible. This solution widely used in road, railway and roller coaster curve design since the curvature of a clothoid varies continuously along the curve. As a consequence, the centrifugal force on a vehicle moving continuously along the curve also varies continuously and can be counter-balanced through a continuous increment of banking. The forward movement of an athlete is, however, less constrained than a vehicle as it is a series of chords and the athlete can continuously change the angle of his body relative to the perpendicular of the slope of the track surface so as to counteract rapidly varying centrifugal forces.

A clothoid is a curve where the radius at any point reduces as the arc length increases according to the clothoid parameter that determines the tightness of the curve.

The equations for a clothoid are somewhat complicated, but can be expressed in terms of the Fresnel integrals, which are used in physical optics and are well tabulated. Tables of standard offsets for a given curve radius and transition length are published.

Whilst the kerb or lane 1 marking can be set out with a multi-radius or true clothoid-type transitions, all other lanes markings will not be uniform radius or true clothoids because of the varying effect of the banking angle change. Each lane has to be set out from the kerb or lane 1 marking so that the lane width is maintained on the banked track.

It is not against the IAAF Rules if the descending transitions are made different to the rising transitions. However, the radii of the two fully banked bends should be equal.

8.1.1.4 Facility for High Jump

The same facility should be provided as for outdoors. (See 2.3.3) The minimum length of runway shall be 15.00m except in competitions held under Rule 1.1(a), (b) and (c) where the minimum shall be 20m. However, IAAF Rules allow an athlete to

start his approach on the banking of the oval track provided that the last 15m of his run-up is on a runway complying with Rules 182.3, 182.4 and 182.5. This should be borne in mind when designing the infield layout.

8.1.1.5 Facility for Pole Vault

The same facility should be provided as for outdoors. (See 2.3.4) However, IAAF Rules allow an athlete to start his approach on the banking of the oval track provided that the last 40m of his run-up is on a runway complying with Rules 183.6 and 183.7.

8.1.1.6 Facility for Long Jump and Triple Jump

The same facility should be provided as for outdoors. (See 2.3.1 and 2.3.2) However, IAAF Rules allow an athlete to start his approach on the banking of the oval track provided that the last 40m of his run-up is on a runway complying with Rules 184.2 and 184.3.

8.1.1.7 Facility for Shot Put

The landing sector shall be enclosed at the far end and on the two sides, as close to the circle as may be necessary for the safety of other athletes and officials by a stop barrier and protective netting approximately 4m high which should stop a shot whether in flight or bouncing from the landing surface.

The landing sector lines may either run radially from the centre of the Shot Put circle including a full 34.92° sector, or may be parallel to each other, the minimum distance between them being 9m (Figure 8.3.5). The stop barrier at the far end shall be at least 0.50m beyond the current world record for men or women.

The surface of the Shot Put landing area should be covered some suitable material on which the shot will make an imprint, but which will minimise any bounce.

A temporary or portable Shot Put circle may be constructed from plywood with the diameter and depth as indicated in Section 2.4.4.

8.1.2 MEETING VENUES, TYPE AND SIZE

The facility should be adequate to cater for the various Track and Field Events mentioned in Section 8.1.1.1. The use of the competition area inside the oval track for other sports is possible. Dimensions including safety zones are listed in Table 8.1.2.

8.2 Requirements, Design Principles and Guidelines

The building housing the indoor track will normally be fully integrated into urban development and will conform to local and national requirements for design, construction and safety.

The building will frequently be a multi-event venue designed to adapt to the needs of a variety of sports, cultural events, displays and exhibitions.

Indoor track designs are complex and should only be undertaken by design professionals with considerable experience otherwise costly mistakes can be made and the constructed facility may not meet IAAF and athlete expectations.

Sport	Activity Area Standard Size		Safety Zone		Total		Height
	Width	Length	Long Side	Short Side	Width	Length	
Acrobatics	12.00	12.00	1.00	1.00	14.00	14.00	5.50
Badminton	6.10	13.40	1.50	2.50	9.10	18.40	9.00
Basketball	15.00	28.00	1.00	1.00	17.00	30.00	7.00
Boxing	6.10	6.10	0.50	0.50	7.10	7.10	4.00
Dance	14.00	16.00	-	-	14.00	16.00	4.00
Handball	20.00	40.00	1.00	2.00	22.00	44.00	7.00
Hockey	20.00	40.00	0.50	2.00	21.00	44.00	5.50
Ice Hockey	30.00	60.00	-	-	30.00	60.00	5.50
Indoor Soccer	22.00	42.00	1.00	2.00	24.00	46.00	7.50
Judo / Karate	10.00	10.00	2.00	2.00	14.00	14.00	4.00
Olympic Gymnastics	27.00	52.00	-	-	27.00	52.00	8.00
Roller Hockey	20.00	40.00	-	-	20.00	40.00	4.00
Rhythmic Gymnastics	13.00	13.00	1.00	1.00	15.00	15.00	8.00
Tennis	10.97	23.77	3.65	6.40	18.27	36.57	9.00
Volleyball	9.00	18.00	5.00	8.00	19.00	34.00	12.50
Wrestling	12.00	12.00	2.00	2.00	16.00	16.00	4.00

Table 8.1.2 - Additional possibilities for use of the competition area inside the oval track (in m)

Permissible deviations are given as tolerances (+ or ± or –) after each figure. All linear measurements and levels shall be made to the nearest whole mm.

8.2.1 THE OVAL TRACK DESIGN

The requirements of Sections 1.1.3 and 1.2.2 should, as far as possible, be met so as to ensure equality of opportunity for all athletes as well as a basis for comparability of performances.

To this end, a Standard Distance Indoor Track can be designed incorporating the requirements of the IAAF Rules for indoor competition and providing for:

- Track geometry based on an optimum radius of 17.200m but not less than 15.00m nor greater than 19.00m. A larger radius track, because of building constraints, might be used for training and local competition.
- A construction type related to the projected uses of the building housing the track.
- Use of the arena for other sports (ball games, ice hockey, cycling, etc. - Table 8.1.2).
- The possible installation of mechanically or hydraulically activated retraction equipment or use of a demountable removable track to allow additional space for exhibitions, concerts, etc.

Basically, there are two design alternatives for oval tracks:

- An oval track may be constructed within an existing sports hall the dimensions of which limit track design to an acceptable, but not ideal, standard.
- An oval track may be designed as a component of a new indoor stadium where the dimensions of the building allow for a Standard Distance Indoor Track to be constructed.

8.2.1.1 200m Standard Indoor Track

For the reasons outlined in Section 8.2.1, it is recommended that, whenever possible, 200m Standard Indoor Tracks are constructed.

The 200m Standard Indoor Track (Figure 8.2.1.1a) comprises two bends, each with kerb radius of 17.200m, joined by two 9.474m long transitions to two straights 35.688m long. (Table 8.2.1.1a). This will form an oval shape such that the competition area inside the track is large enough to accommodate an infield track for sprints, facilities for the jumping events and the Shot Put.

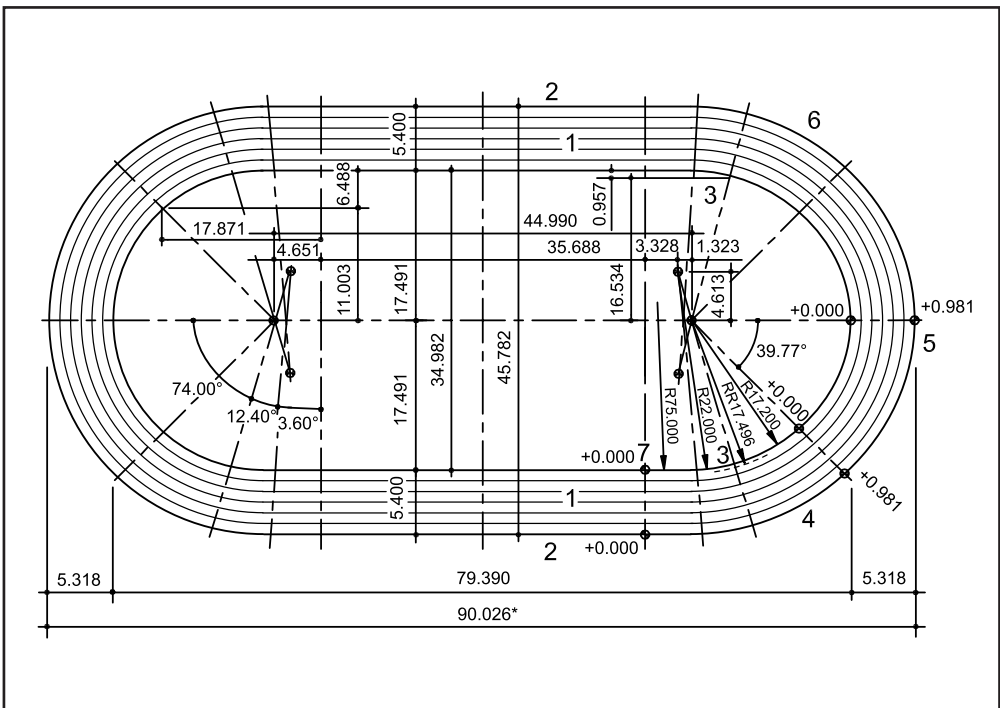


Figure 8.2.1.1a - Setting out plan of the 200m Standard Indoor Track (Dimensions in m)

- 1 Straight
- 2 Flat section
- 3 Transition curve
- 3 and 4 Ascending track
- 5 Bend with constant inclination
- 6 and 3 Descending track
- 7 Finish line

*Dimension including safety zones: 90.426

Track Components	200m Standard Indoor Track
Length of Track at Kerb	198.132m
Length of Track at Line of Running Lane 1	200.000m
R = Radius of Kerb	17.200m
RR = Radius of Line of Running Lane 1	17.496m
Length of Transition Curve at Kerb	9.474m
Length of Transition Curve at Line of Running Lane 1	9.557m
Length of Straight	35.688m
Inclination Angle of Banking	10.000°

Table 8.2.1.1- Dimensions of the 200m Standard Indoor Track

The inside of the 200m Standard Indoor Track is bordered with a kerb of suitable material, approximately 0.05m in height and width. Therefore the length of the inside lane shall be measured along the surface of the track 0.30m outward from the kerb.

The 6 oval lanes of the 200m Standard Indoor Track are 0.90m ± 0.01m wide. Whilst the 200m Standard Indoor Track is shown with 0.90m wide lanes, wherever possible the lanes should be made wider. At some venues for national competitions, it may better to have only 4 lanes with a larger bend radius and wider lanes.

The bends of the 200m Standard Indoor Track must be banked. The recommended angle of banking for this radius track is 10.00° and this is the minimum angle of banking appropriate for sprinters on a 17.200m radius.

The vertical transition between flat straights and banked curves may extend into the straights. The gradient of the vertical transition, measured in the running direction along the outside edge of the outer lane of the track, should not exceed 5%. The connections between horizontal areas and ascending and descending areas are smooth, with a suitable vertical curve not less than 5m (recommended 100m) radius equivalent (Figure 8.2.1.1b).

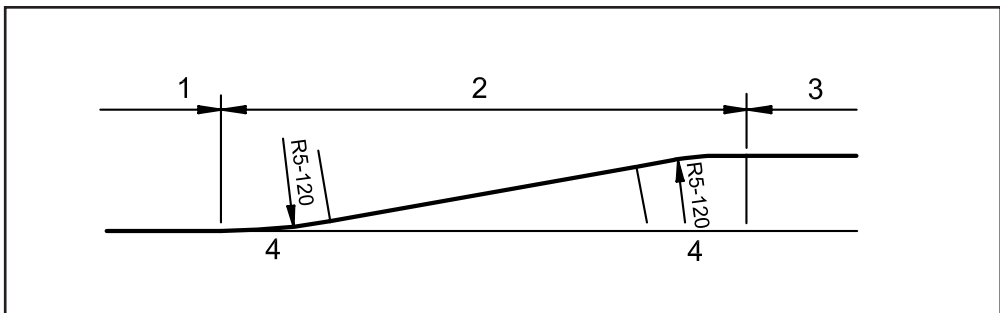


Figure 8.2.1.1b - Ascending line of the outside edge of the track from the flat section to the highest level of the banked track (Dimensions in m)

- 1 Flat section
- 2 Ascending / descending track including vertical curves
- 3 Bend with constant inclination
- 4 Gradual transition with radius 5m-120m

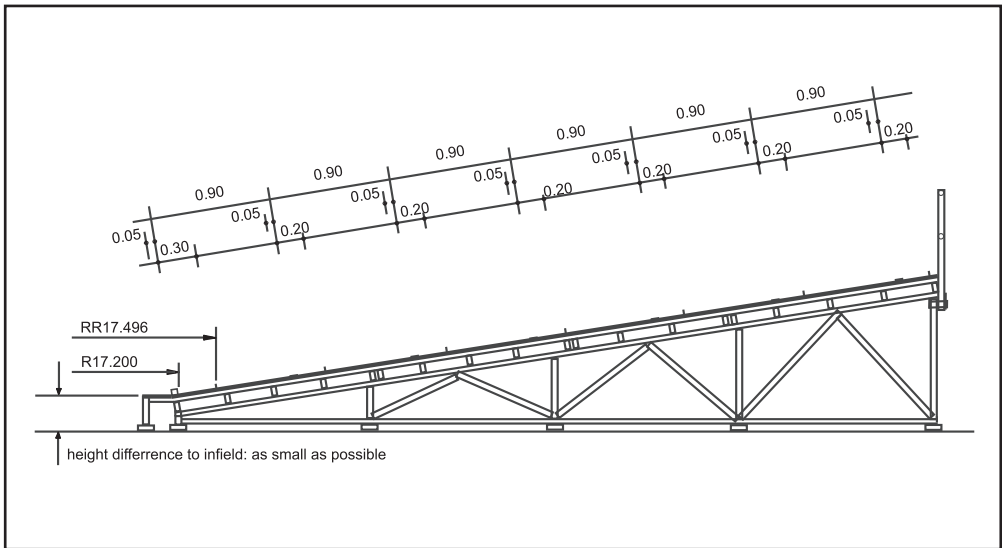


Figure 8.2.1.1c - Cross section of standard banked bends (Dimensions in m)

8.2.1.2 Dimensional Accuracy of 200m Standard Indoor Track

The dimensional accuracy required for all classes of competition is deemed fulfilled if the following set values are attained in the "25 Point control measurement" (Figures 8.2.1.2a and b) on the running line of the inside lane:

- 44.990m \pm 0.005m between the centres of the circular arches (1 reading)
- 34.982m \pm 0.005m between the two straights, at each end of the straights (2 readings)
- 35.688m \pm 0.005m for the length of the two straights each (2 readings)
- Alignment of the kerb in the area of two straights: no deviation greater than 0.01m (2 readings)
- 9.474m \pm 0.005m for the four transition lengths each (4 readings)
- 17.496m \pm 0.005m for 7 points on each of the two circle arches (14 readings). Each arch length must be 24.288m.
- The overall length of the 200m Standard Indoor Track along the running line: $(2 \times 35.688) + (2 \times 24.288) + (4 \times 20.012) = 200.000\text{m}$.

The 25 point control measurement should be carried out and the readings recorded. The total of the deviations must not exceed + 0.040m nor be less than 0.000m (Figure 8.2.1.2a, Table 8.2.1.2).

For portable tracks the control measurement must be undertaken before the start of any competition.

For the dimensional accuracy of the 200m Standard Distance Indoor Track location of the main control points should be marked by permanent non-corrodable drilled-in pegs or imbedded tubes flush with the hall flooring enabling the stadium staff to produce always the track of required dimensional accuracy.

As a matter of course the control reading can be applied for all other indoor tracks having individual dimensions using the basic dimensions of the given track in a logical way.

Measurement in Accordance with Fig 8.2.1.2a Number	Measuring Result m	Deviation from the Desired Value ¹ ± mm	Calculation of the Running Length Deviations using Curve Average Deviations m	
1	17.498	+2		
2	17.496	±0		
3	17.499	+3		
4	17.498	+2		
5	17.494	-2		
6	17.495	-1		
7	17.497	+1		
Average of Measurements 1 to 7 =		_____	1. Curve +0.0007 x 3.1416 x (79.54:180)= +0.0010	
8	17.497	+1		
9	17.494	-2		
10	17.495	-1		
11	17.492	-4		
12	17.494	-2		
13	17.497	+1		
14	17.498	+2		
Average of Measurements 8 to 14 =		_____	2. Curve +0.0007 x 3.1416 x (79.54:180)= -0.0010	
15	35.691	+3		
16	33.690	+2		
Total of Measurements 15 and 16 =			2 Straights +0.005	
17	20.010	-2		
18	20.014	+2		
19	20.010	-2		
20	20.011	-1		
Total of Measurements 17 to 20 =		_____	4 Transitions -0.003	Deviation from the running length (in m) 1. Curve +0.0010 2. Curve -0.0010 2 Straights +0.0050 4 Transitions -0.0030
21	0.005			Total +0.0020
22	0.006			Permitted max. +0.040
23	44.990	± 0		
24	34.982	± 0		
25	34.983	+1		

¹ Desired value for 1 to 7 and 8 to 14: 17.496 resp.
 Desired value for 15 and 16: 35.688 resp.
 Desired value for 17 and 20: 20.012 resp.
 Desired value for 21 and 22: Alignment
 Desired value for 23: 44.990
 Desired value for 24 and 25: 34.982 resp.
 Permitted deviation from desired value for 1 to 20 and 23-25: ±0.005
 Permitted deviation from alignment for 21 and 22: 0.01
 Permitted tolerance of the running length: + 0.040 max. (in m)

Table 8.2.1.2 - Record of 25 point indoor control measurement (Example with readings)

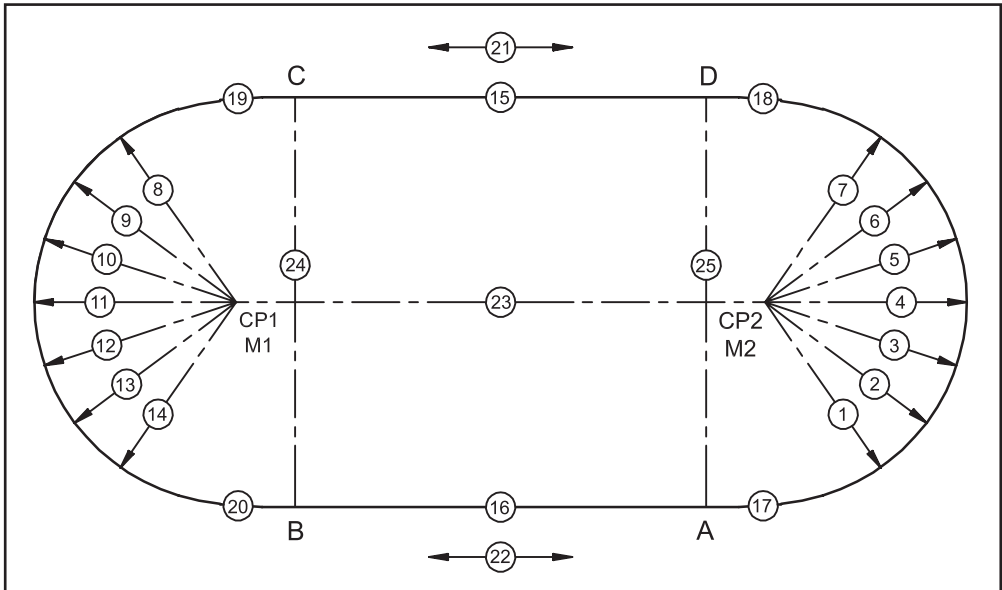


Fig 8.2.1.2a - 25 point control measurement of the 200m Standard Indoor Track running line

Measurement 1-7 and 8-14: 17.496 resp. ± 0.005

Measurement 15 and 16: 35.688 resp. ± 0.005

Measurement 17 to 20: Length of rising and falling track including horizontal transitions = 20.012 resp. ± 0.005

Measurement 21 and 22: Alignment of the straights (permitted deviation of 0.010)

Measurement 23: Distance from centres of circular arches (CP/M) = 44.990 ± 0.005

Measurement 24 and 25: Distance between the two straights = 34.982 resp. ± 0.005

(Dimensions in m)

Example of readings see in Table 8.2.1.2.

8.2.2 DESIGN OF INFIELD INSTALLATIONS

Infields in indoor tracks are more congested than for outdoors. Therefore, careful attention must be paid to the layout since it will affect the safety of athletes and officials, and the timetabling of events.

The infield track should be located along the longitudinal axis of the oval track. There should be 3.00m clearance before the start line and 10.00m to 15.00m after the finish line.

It is recommended that the Pole Vault, Long Jump and Triple Jump facilities be placed on one side of the infield track and the High Jump and Shot Put facilities on the other.

8.2.2.1 Facilities for Hurdle Races

The layout of hurdles for 50m and 60m races is shown in Table 8.2.2.1.

8.2.2.2 Facilities for Jumping Events

The best location for the Long and Triple Jump runways is on one side of the infield straight track with the Pole Vault runway adjacent and parallel to it. The runways

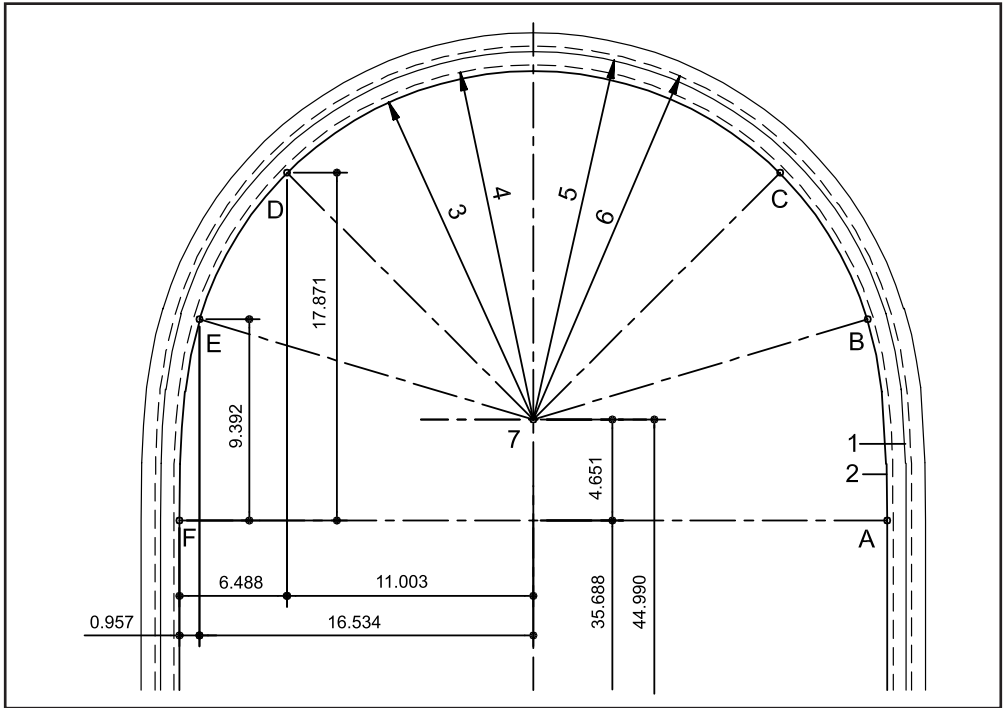


Fig 8.2.1.2b - 200m Standard Indoor Track bend layout (Dimensions in m)

- A-B Transition curve
- A-C Ascending track
- C-D Bend with constant inclination
- D-F Descending track
- E-F Transition curve
- 1 Lane marking
- 2 Kerb
- 3 Outside edge of kerb (R17.200m)
- 4 Measurement line (line of running) lane 1 (RR17.496m)
- 5 Outside edge of lane marking in lane 2
- 6 Measurement line (line of running) lane 2
- 7 Centre point of semicircle

Event	Height of Hurdles ¹	Distance from Start Line to First Hurdles ²	Distance between Hurdles ²	Distance from Last Hurdles to Finish Line ²	Number of Hurdles
50m Men	1.067	13.72	9.14	8.86	4
50m Junior Men	0.991	13.72	9.14	8.86	4
50m Youth Boys	0.914	13.72	9.14	8.86	4
50m Women / Junior	0.838	13.00	8.50	11.50	4
50m Youth Girls	0.762	13.00	8.50	11.50	4
60m Men	1.067	13.72	9.14	9.72	5
60m Junior Men	0.991	13.72	9.14	9.72	5
60m Youth Boys	0.914	13.72	9.14	9.72	5
60m Women / Junior	0.838	13.00	8.50	13.00	5
60m Youth Girls	0.762	13.00	8.50	13.00	5

¹ ± 0.003
² ± 0.01

Table 8.2.2.1 - Hurdle number, height and position indoors (in m)

should be constructed in opposite directions to each other to allow both runways to be used simultaneously, if required.

The runways may be extended up the banked bends. The High Jump facility should be placed with an equal run-up from both sides.

8.2.2.3 Facility for Shot Put

The Shot Put facility should preferably be situated with putting direction outward from the infield centre and parallel to the straight track in order to best separate Shot Put from other events.

8.2.3 OTHER EQUIPMENT WITHIN THE OVAL TRACK

In addition to the normal equipment necessary for competitions, provision must be made for infield scoreboards and victory ceremony podiums. Consideration should be given to locate podiums outside the competition area.

8.2.3.1 Scoreboards and Podium for Victory Ceremonies

At least one movable scoreboard which displays the athlete's name, trials and results should be provided for each Field Event. These scoreboards should be linked to the information system.

A podium for victory ceremonies should be placed such that it is clearly visible to the spectators and the announcer.

8.2.3.2 Electrical Connections

The electrical cables supplying the measuring instruments and communication network should be run underfloor or in recessed ducting around the oval track with sockets for connection at appropriate points.

The connection points should be safely placed under a flat lid, flush with the track or floor.

8.3. Track Construction

8.3.1 CONSTRUCTION ALTERNATIVES FOR OVAL TRACKS

The design of the track is dependent upon the uses to which the hall will be put. In a single-purpose athletics hall, the oval track may be permanently installed. For a multi-purpose hall which is used for other sports and non-sporting events, see 8.3.1.2 and 8.3.1.3.

8.3.1.1 Permanent Track

In a single-purpose athletics hall, a permanent track should preferably be installed.

A permanent track has the advantage that it can be laid on a solid base such that there is uniform resilience throughout. The foundation is normally of concrete. Also the measurement of all the starts is permanently fixed.

Whilst a permanent installation offers the best facilities for athletics competition and training, it can have economical disadvantage because of its lack of flexibility in

usage. If flexibility of usage is required, a permanent track with height-adjustable bends or a portable track should be installed.

8.3.1.2 Permanent Track with Height-Adjustable Bends

The disadvantages of a permanent track can partly be overcome by a track which is a combination of fixed and movable track portions. This is a track the straights and bends of which are installed flush with the floor level or marked on the floor. However, when required for competition or training, the bends can be raised to the required height. If a system of mechanical or hydraulic jacks is installed this procedure will only take a few minutes. Another benefit of a hydraulic or mechanical system is that the whole bend can be raised as a single unit thus ensuring that the synthetic surface of the track is even. During installation, the units laying flat have joints between the panels changing from 0 to a few millimetres outwards.

The rate of banking along the transition curve should be defined for each section and programmed for synchronised elevation by pushbuttons. The jacking into position of the banked bend is effected by using electronically controlled brakes.

The main advantages of a permanent track with height-adjustable bends are the flexibility of use for other events and the speed of assembly and disassembly.

8.3.1.3 Portable Track

A portable track can be assembled from prefabricated units which, after disassembly, will be stored when not in use.

There are two different unit types: the floor units with synthetic top layer and the support elements of the banked bends.

The floor units are panels made of wooden joists with frames faced with plywood sheets or boarding as a supporting layer for the synthetic surface. The panel edges should be tongued and grooved to facilitate joining.

The support structure framing can be made either of wood or metal, preferably of stackable design.

The assembly of the portable track is performed in the following stages:

- Pushing back the retractable stands (if any)
- Identification of the layout markings of the track
- Laying of a protective mat over the track area
- Installation of support frames for the banked bends
- Assembly of the 200m oval track
- Assembly of the 60m infield track
- Installation of runways and landing areas for jumping events
- Installation of the Shot Put facility
- Installation of a safety railing on the outside of the bends and a padded brake wall for sprinters

The track must be carefully designed to produce uniform resilience throughout. Heavy duty and rigid panels must be used although some difficulty may be encountered with assembly and disassembly, which are time consuming and labour-intensive, transportation and storage.

With careful design, a high quality portable track which meets all of the requirements of top athletes can be produced.

8.3.2 STRUCTURAL DETAILS OF THE OVAL TRACK

The specifications in Chapter 3 apply generally to the synthetic surface of the track. However, the force reduction and vertical deformation properties will be different if the absolute thickness is less than the absolute thickness on the Product Certificate. The thickness of the synthetic material on portable oval tracks shall be not less than 9mm and on permanent oval tracks 13mm.

For safety reasons, the banked bends should have a safety zone minimum 0.20m wide measured from the outer edge of the outer lane outer marking. In addition the outer edges should be provided with a protective railing from the beginning of the transition curve throughout the bend up to the beginning of the next straight.

If the inside edge of the track has a vertical drop in excess of 0.10m a safety zone minimum 0.30m wide, flush with the inner edge of the track, should be supplied.

8.3.3 STRUCTURAL DETAILS OF THE INFIELD TRACK

The synthetic surface of the infield track and the oval track should be the same product but may have a different thickness.

Where possible, the synthetic surface on the infield track and the runways should meet the specifications in the IAAF Track Facilities Testing Protocols and be the absolute thickness as indicated on the IAAF Product Certificate.

The overall dimensions of the infield track, with 3.00m clearance behind the start line and 10.00m to 15.00m clearance beyond the finish line will be 73.00m to 78.00m long and 7.32m (6 lanes at 1.22m) to 9.76m (8 lanes at 1.22m) wide.

The padded brake wall, where the athletes may come to a halt safely, should have a rigid frame and bracing enabling it to withstand horizontal impact stresses caused by 6 to 8 athletes arriving at the wall at speeds of up to 8m/sec.

The maximum overall lateral inclination of the infield track shall not exceed 1% and the overall inclination in the running direction shall not exceed 0.1% overall but at any point the inclination shall not exceed 0.4%.

8.3.4 STRUCTURAL DETAILS OF THE JUMPING FACILITIES

The Rules for jumping events require that the foundation on which the surface of the runway is laid must either be solid (for example concrete) or of suspended construction (such as wooden boards or plywood sheets, of adequate thickness so as not to spring unduly, mounted on joists) without any sprung sections.

The landing area for the Long and Triple Jump should preferably be a permanent construction in the hall floor.

The depth of the Pole Vault box must be taken into consideration when deciding the panel thickness of a portable Pole Vault runway.

In all other respects, structural requirements are as for outdoors.

8.3.5 STRUCTURAL DETAILS OF THE SHOT PUT FACILITY

The landing sector for Shot Put usually has a combined shape of a triangle (a portion of a 34.92° sector running radially from the centre of the Shot Put circle) and of a rectangle with sides minimum 9.00m apart and a base line at the far end at least 0.50m beyond the current world record for men or women (Fig 8.3.5). The surface of the Shot Put landing area should be covered with a suitable material on which the shot will make an imprint, but which will minimise any bounce. The landing sector shall be surrounded at the far end and as close to the circle as may be necessary for safety of athletes and officials, with a stop barrier and netting which will arrest a shot whether in flight or bouncing from the landing surface.

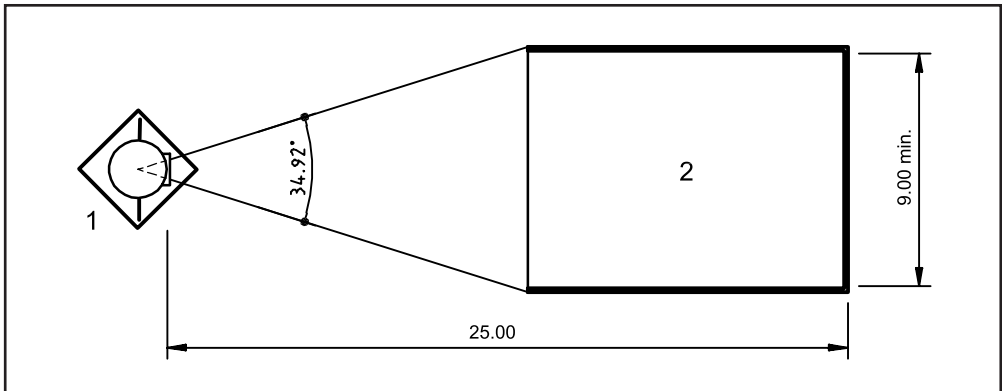


Figure 8.3.5 - Shot Put facility (Dimensions in m)

1 Shot Put circle

2 Landing area with safety barriers

8.3.6 MEASUREMENT AND MARKING OF THE 200M INDOOR TRACK (FIGURE 8.3.6C)

Detailed rules cannot be laid down for the marking of the start and finish for every track since the position will vary with the length of the track in lane 1. Instead, the basic principles to be adopted for any track are outlined together with details for marking a track of nominal length 200m.

The measurement of the track shall be made 0.30m outwards from the inside of the kerb or, where is no kerb, 0.20m from the white line marking the inside of the track. The other lanes shall be measured 0.20m outwards from the outer edge of each respective inside lane.

All track markings shall be in accordance with "IAAF 200m Standard Indoor Track Marking Plan" (Figure 8.3.6c attached to this Manual). Additional markings may be provided for national events provided they do not conflict with international markings.

The start and finish of a race shall be denoted by white lines 0.05m wide, at right angles to the lane lines for straight parts of the track and along a radius line for curved parts of the track. All distances are measured in a clockwise direction from the edge of the finish line nearer to the start to the edge of the start line farther from the finish.

The requirements for the finish line are that, if at all possible, there should be only one for all lengths of race, that it shall be on a straight part of the track and that as much of that straight as possible should be before the finish.

In order to confirm that the camera is correctly aligned and to facilitate the reading of the photo finish, the intersection of the lane lines and the finish line shall be coloured black in a suitable design. Any such design must be solely confined to the intersection, for no more than 20mm beyond, and not be extended before, the leading edge of the finish line.

The essential requirement for all start lines, straight, staggered or curved, is that the distance for every athlete, when taking the shortest permitted route, shall be the same.

As far as possible, start lines (and take-over lines for relay races) should not be on the steepest part of the banking.

Races of up to, and including, 300m shall be run entirely in lanes. Races over 300m, and less than 800m shall start and continue in lanes until the end of the second bend. Races of 800m shall either start and continue in lanes until the end of the first bend or use a group start. The method of marking shall be similar to that outlined in 2.2.1.6.

There shall be 0.05m wide lines (breaklines) distinctively marked across all the lanes to indicate when the athletes can break from their lanes. Races over 800m shall be run without lanes using a curved start line.

The start line in lane 1 should be on the principal straight. Its position shall be determined so that the most advanced staggered start line in the outside lane should be in a position where the angle of banking does not exceed 12 degrees.

The finish line for all races on the oval track shall be an extension of the start line in lane 1, right across the track and at right angles to the lane lines.

The staggered start lines for 200m and races up to and including 800m should be measured and marked in the following manner:

Staggered Start Line for 200m Race

The position of the start line in lane 1 and the position of the finish line having been established, the position of the start lines in the remaining lanes should be determined by measurement in each lane along the running line back from the finish line.

Measurement in each lane shall be carried out in exactly the same way as for lane 1 when measuring the length of the track.

Having established the position of the start line where it intersects the measurement line 0.20m outward from the inside of the lane, the line shall be extended right across the lane, at right angles to the lane lines if on a straight section of the track. If on a curved section of the track, the line of the position along a radius line through the centre of the bend and if on one of the transition sections along a radius line through the theoretical centre of curvature at that point. The start line can then be marked 0.05m wide on the side of the measured position nearer the finish.

Staggered Start Lines for Races over 200m, up to and including 800m

As the athletes are permitted to leave their respective lanes on entering the straight after running one or two bends in lanes, the starting positions must take two factors into consideration. Firstly, the normal echelon allowance similar to that for a 200m race. Secondly, an adjustment to the starting point in each lane to compensate for the athletes in outside lanes having farther to run than those in the inside lanes to reach the inside position at the end of the straight, after the break line.

These adjustments can be determined when marking out the break line, where the athletes are allowed to leave their lanes (see below). Since start lines are 0.05m wide, it is impossible to mark two different start lines unless the difference in position is in excess of approximately 0.07m to allow a clear gap of 0.02m between the start lines. Where this problem arises, the solution is to use the rearmost start line. The problem does not arise in lane 1 since, by definition, there is no adjustment for the break line. It arises in the inner lanes (for example lanes 2 and 3) but not in the outer lanes (for example lanes 5 and 6) where the adjustment due to the break line is greater than 0.07m.

In those outer lanes where the separation is sufficient, a second start line can be measured in front of the first one by the required adjustment determined from the break line layout. The second start line can then be marked out in the same way as that for the 200m race.

It is the position of the start line in the outside lane which determines the position of all the start lines and the finish line on the track. In order to avoid exposing the athlete starting in the outside lane to the very severe disadvantage of starting on a steeply banked track, all the start lines and hence the finish line are moved sufficiently far back from the first bend so as to restrict the steepness of the banking at the outer startline to an acceptable level. It is, therefore, necessary first to fix the position of the 400m and 800m start lines in the outside lane and then work back through all the other start lines, finally arriving at the finish line.

Figure 8.3.6a shows the staggered starts for the 200m Standard Indoor Track (lane width of 0.90m) in accordance with Table 8.3.6b.

Breaklines for 400m and 800m Races

The breakline where the athletes may leave their lanes at the end of a bend (or transition section of that bend) may be laid out as follows:

- Mark out a temporary line right across the track, at right angles to the lane lines at the end of a bend.
- Mark point X, on this line 0.30m (0.20m for a track without a kerb) outward from the inside of lane 1.
- Similarly, mark point X2, X3 etc for lanes 2, 3 etc. Lastly, mark point Y where the temporary line cuts the line marking the outside of the track.
- Stretch a cord tightly from this point Y to form a tangent to the measurement line 0.30m (0.20m for a track without a kerb) outward from the inside of lane 1 beyond the far end of the straight. Mark the point of contact of the tangent Z.
- With point Z as centre and with radius ZX1, draw an arc right across the track from the inside of lane 1 to the outside lane. Mark the points where this arc crosses the measurement line in each lane Y2, Y3 etc. Measure the offset X2 - Y2, X3 - Y3 etc. in each of the lanes.

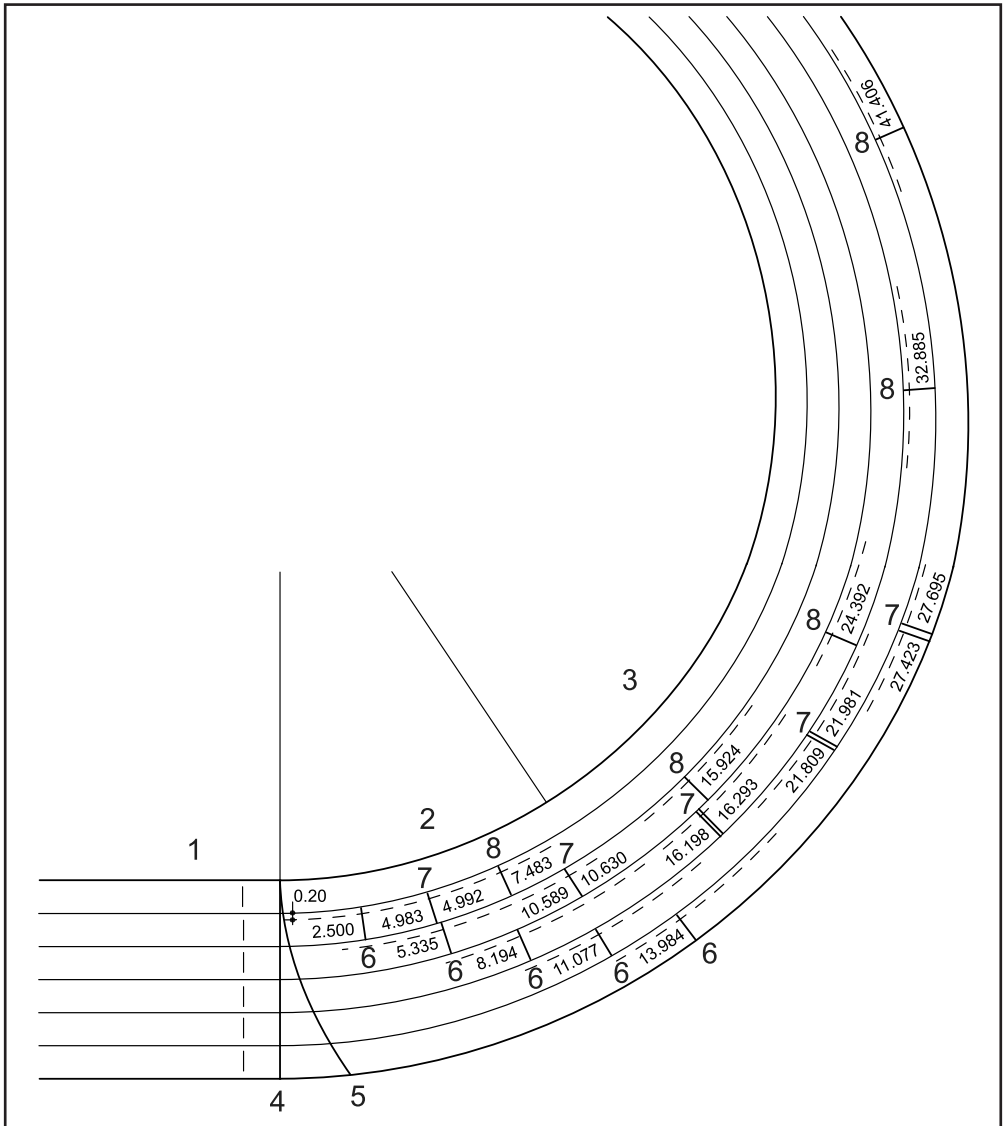


Figure 8.3.6a - Marking of staggered start lines and 3000m start line for the 200m Standard Indoor
(Dimensions in m)

- 1 Straight
- 2 Transition curve
- 3 Curve
- 4 Finish line
- 5 Start line 3000m
- 6 Start lines 800m, lanes 2 to 6
- 7 Start lines 200m/400m, lanes 2 and 3 single line 4.983m and 10.589 respectively, lanes 4 to 6 double line
- 8 Start lines 4x200m Relay, lanes 2 to 6

- With this arc as the edge nearest to the start, mark a line 0.05m wide. This is the break line. The end of the line outside the running track should be marked with flags or cones.

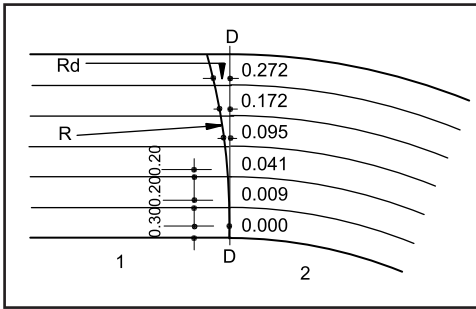


Figure 8.3.6b - Breakline marking for a Standard Indoor Track (Dimensions in m)

Rd Deviation from D-D (or the B-B) line
R Radius 35.688

1 Straight
2 Transition curve

For group starts in 800m, the break mark is at the intersection of the break line and the inner line of the lane in which the outer group starts.

To assist athletes identify the breakline, small cones or prisms (0.05m x 0.05m) and no more than 0.15m high of different colour to that of the breakline and the lane markings shall be placed on the lane lines immediately before the intersection of the lane lines and the breakline.

Figure 8.3.6b shows the break line for a Standard Indoor Track in accordance with Table 8.3.6.

	Kerb	Lane 1 Running Line	Lane 2 Running Line	Lane 3 Running Line	Lane 4 Running Line	Lane 5 Running Line	Lane 6 Running Line
Projected Radius	17.200	17.496	18.284	19.170	20.056	20.943	21.829
Projected Length of a Quarter of Bend	31.689	32.156	33.401	34.800	36.199	37.598	38.996
Rising Length	19.750	20.012	20.709	21.494	22.278	23.061	23.844
Length of Unchanged Banked Bend	11.939	12.144	12.691	13.306	13.921	14.537	15.152
Length of Track Measurement Line (Line of Running)	198.132	200.000	204.983	210.589	216.198	221.809	227.423
Position of Breaklines	0.000	0.000	0.009	0.041	0.095	0.172	0.272

Table 8.3.6a - Data of measurement lines for kerb and lanes and position of breaklines for a 200m Standard Indoor Track (dimensions in m)

Distance on Line of Running	Marking Plan Area	Bends Run in Lanes	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6
200	A	2	4.983	10.589	16.198	21.809	27.423
400, 4x400	A	2	4.992	10.630	16.293	21.981	27.695
800	A	1	2.500	5.335	8.194	11.077	13.984
4x200	A	3	7.483	15.924	24.392	32.885	41.406

Table 8.3.6b - Staggered start data for the 200m Standard Indoor Track (Dimensions in m)

Curved Start Lines for Races over 800m

Races over 800m shall be started from a curved line.

The principles for the layout and marking of curved starting lines are very similar to those of the break line in races run partly in lanes:

- The length of the race is first measured back from the finish line along the measurement line (0.30m or 0.20m outward from the inside of the track depending on whether it has kerb or not). Mark this point A on the measurement line.

This is the point where the rear edge of the start line will begin.

- Securely fix pins along a 0.30m measurement line (0.20m for track without kerb) beyond the starting point in lane 1. The pins should be not more than 0.30m apart.
- Secure the end of a length of cord to the surface of the track just beyond the last pin. This pin must be beyond the point where the cord forms a tangent to the measurement line when marking the outside of the start line.
- Laying the cord along the surface of the track against the pins B, C, D, etc., pull tight and mark the position on the cord of point A. Using this position on the cord and keeping the cord tight, mark the rear of the start line.
- The section from point A in lane 1 at either 0.30m to the kerb or 0.20m to the inside edge of the track, as appropriate, should be marked at right angles to the lane line, if the start coincides with the straight, and radially, if on a curve.

Relay Races

In the 4x200m relay race all the first stage and the first bend of the second stage shall be run in lanes. There shall be a 0.05m wide line (break line) distinctively marked across all the lanes at those points to indicate where each athlete can break from his lane.

In the 4x400m relay race, the first two bends shall be run in lanes. Thus the same break line, scratch lines etc. will be used as for the individual 400m race.

In the 4x800m relay race, the first bend shall be run in lanes. Thus the same break line, scratch lines etc. will be used as for the individual 800m race.

8.4 Hall Finish and Installations

8.4.1 DESIGN OF THE FLOOR, WALLS AND CEILING

Floor

The primary object in the design and construction of a suitable surface for indoor athletics is to provide a uniform competition surface conforming as far as possible to the specifications in the IAAF Track Facilities Testing Protocols (Chapter 3).

The floor finish of the arena outside the oval track can be made of different, less expensive material. In multipurpose halls where the track is assembled in prefabricated units, the original hall floor should be suitably protected.

Walls and Ceiling

In athletics halls, as in any other sports facility, the walls receive strong mechanical impacts. Consequently the wall linings should have appropriate material, construction and surface finish to withstand these stresses. Walls to a minimum height of 2.00m from the floor surface should have no projections nor indentations and be closed, non-splintering and smooth. Permissible construction joints of a wall lining is maximum 8mm and, for telescopic stands, 20mm. In both cases, however, edges must either be chamfered or rounded.

Doors, sports equipment, fixtures and installations of all kinds (hinges, door handles, switches, pipes, etc.) must be mounted flush with the wall in order to avoid injuries caused by protruding parts.

The impact resistance requirements for ceilings are the same as those for walls.

The colour scheme of the walls and ceiling should preferably be light.

Viewed from the hall, doors should open outwards.

In multipurpose halls, curtains or nets can be installed for the subdivision of the hall. These partitions should not constitute risk of injury. The same applies to practice facilities for Discus Throw and Javelin Throw.

Beyond the finish line of a straight track, after a clearance of 10m to 15m, a padded brake wall must be installed where the athletes can come to a halt without injury.

The same precaution should be taken in standard halls with the Long Jump and Triple Jump facility, where clearance is often needed when an athlete runs through.

8.4.2 MEASUREMENT AND DISPLAY INSTALLATIONS

8.4.2.1 Timing

Indoor facilities used for high level competitions will need fully automatic timing.

8.4.2.2 Photo Finish

Times and finish placings in a race are determined by the photo finish camera or similar approved equipment.

The optical axis of the camera shall be adjusted in the same plane as the finish line, and this axis shall be inclined at a 30° angle in relation to the farthest edge of the track.

The distance of the camera from the closest edge of the track is minimum 5.00m (Figure 8.4.2.2).

For high level competitions, a second camera - the backup camera - shall be installed, opposite to the former one and in the same plane, the optical axis of which should be inclined at an angle of 20°, in relation to the farthest edge of the track. The minimum distance of the camera from the closest edge of the track is 4.00m.

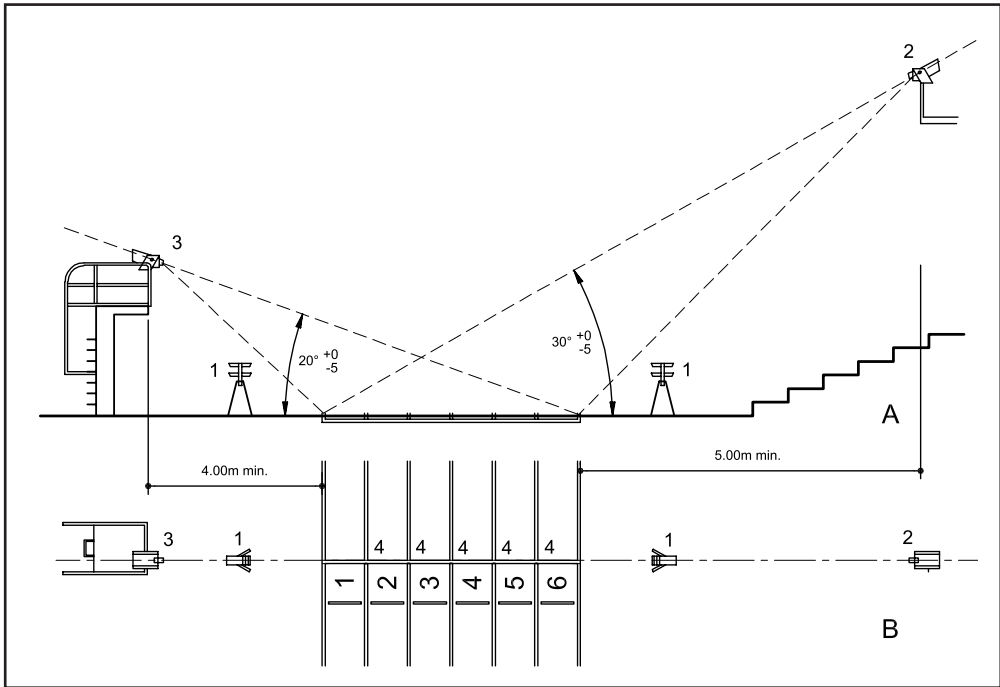


Figure 8.4.2.2 - Timing installations in a track and field hall

A Section

B Floor plan

4

- 1 Photo electric cells for electronic timing
- 2 Finish camera, adjusted at an angle of 30° with the finish line
- 3 Back up camera, adjusted at an angle of 20°
- 4 Reference points coloured black (see detail in figure 2.2.2.1)

Services	Area m ²
60m Photo Finish Camera	4
60m Backup Camera	4
200m Photo Finish Camera	10
200m Backup Camera	4
Photocells at Four Arena Locations	1 each
Timing and Photo Finish Evaluation	12
Scoreboard Operator	6
Competition Director	12
Event Presentation Manager	20
Announcers	12
Computer Centre / Data Handling	60
Results Printing	20
Closed Circuit TV	12

Table 8.4.2 - Space requirements for technical services

Space requirements are included in Table 8.4.2.

8.4.2.3 Video Network

In World and Continental Championships a continuous video recording should be made of all events for official use.

8.4.2.4 Infield Scoreboards

For the information of both spectators and the athletes, a continuous display of results in all the events is necessary. This can be done manually in local and lower level meetings. In international meetings and championships the information should be displayed by electronic board units. Mechanical data transfer should be minimised as much as possible.

8.4.2.5 Main Scoreboards

For an athletics hall designed for meetings of all levels and attended by spectators, a central score board system able to indicate events, athletes and results is essential.

Comprehensive details are shown in Section 5.3.

8.4.2.6 Information Network System

The most important components of the information system are: the press centre, radio and TV commentators' places, workplaces of media in the stands, bureau of press chief, offices of competition director and event presentation manager, technical manager, announcers' room, jury room, VIP and press areas. The data centre of the system can either be permanent or temporary. Connections for information monitors should be provided in all the listed locations.

8.4.2.7 Telephone Network

All rooms of the building, all the event locations and all workplaces in the arena should be connected to the telephone network in an athletics hall.

8.4.2.8 UHF Communication System

Referees, technical liaison personnel and key security staff should be given hand-held radios operated on pre-selected frequencies, enabling them to communicate. The operational range of the radios and the problem of interference should be taken into consideration.

8.4.2.9 Optical Distance and Height Measuring System

To ensure the required accuracy in measuring Field Events, instruments for an optical measuring system should be provided. Care should be taken that readings from the system are transferred directly to the data bank of the central computer.

8.4.2.10 Cables

To connect up the timing, distance measurement and data processing equipment, permanently laid cables should be provided (Figures 8.4.2.10a to 8.4.2.10c).

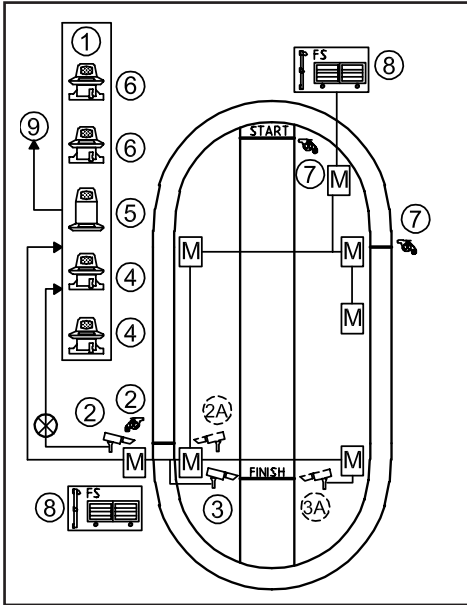


Figure 8.4.2.10a - Timing installation

M Manhole with connection points for permanent cables for Track and Field Events

- 1 Control room with feed to television scoreboard and data processing
- 2 and 2A Video finish cameras I and II
- 3 and 3A Video finish cameras III and IV
- 4 Camera I and II evaluation point
- 5 Computer for processing the information
- 6 Camera III and IV evaluation point
- 7 Starter's gun
- 8 False start system
- 9 Exit to TV, connection to data processing and exit to scoreboard

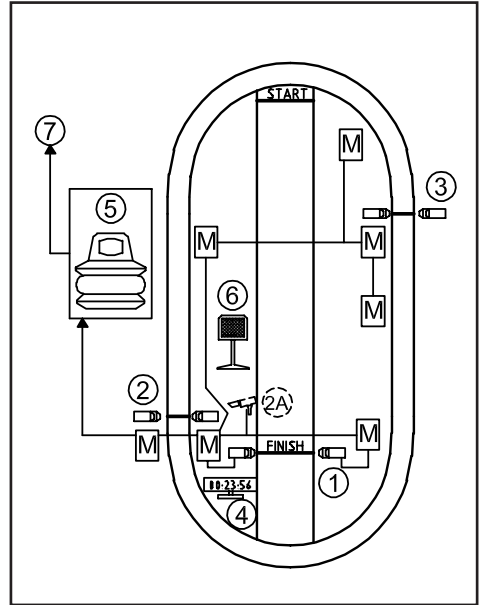


Figure 8.4.2.10b - Cables and auxiliary equipment for timing

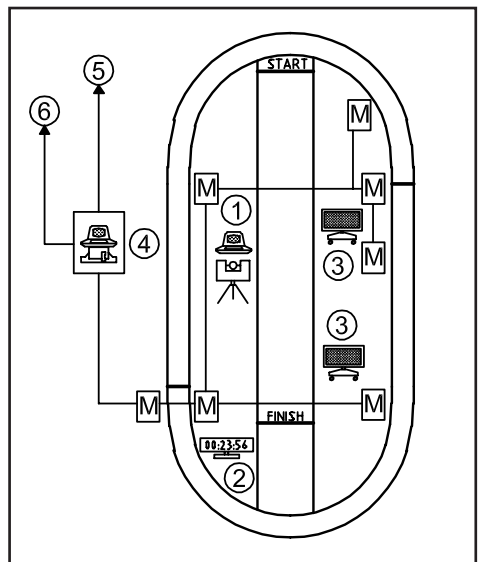
M Manhole with connection points for permanent cables for Track and Field Events

- 1 Double photo electric cell at the 60m finish line
- 2 Double photo electric cell at the 200m finish line
- 3 Photo electric cells for intermediate times
- 4 Numeric board for the running time
- 5 Timing instrument for intermediate times
- 6 Lap counter
- 7 Exit to data processing station

Figure 8.4.2.10c - Cables and auxiliary equipment for field events

M Manhole with connection points for permanent cables for Track and Field Events

- 1 Tachometer, for measuring distances and checking height for High Jump and Pole Vault
- 2 Time elapsed clock (concentration clock)
- 3 Field board with computer
- 4 Control room for data processing station
- 5 Exit to scoreboard and television
- 6 Exit to main data processing station (only for major events)



8.4.3 HALL TECHNICAL INSTALLATIONS

8.4.3.1 Heating, Ventilation, Air Conditioning, Cooling (HVAC) Systems

Athletics halls should be heated in moderate and cold climatic zones. Panel heating, infrared radiation and fan-coil systems (mechanical ventilation with heating or cooling operation) or a combination of these systems can be used.

The heating system should be adequate to ensure the room temperatures shown in Table 8.4.3.1.

Room	Temperature °C
Athletics Hall	16 to 18
Changing Room	22
Shower Room, Toilets	24
Massage Room	24
Medical and Doping Control Room	22
Prevention of Overcooling	8
Practice and Training Hall	12 to 16

Table 8.4.3.1 - Room temperatures, caloric calculation values

Natural ventilation is needed in all types of hall during long periods of non-use and in case of possible break downs, especially in a fire emergency.

Halls which are larger than 1000m² and also have a spectator facility (with a minimum seating capacity of 500 persons) should be considered for mechanical ventilation.

In smaller sports and games halls, air inlets not less than 2.5m above the hall floor surface with air outlets installed beneath and directly above the hall floor surface are adequate.

The minimum fresh air requirements are 30m³ fresh air/hour/athlete, assuming that minimum 35 athletes are present in the arena simultaneously and 20m³ fresh air/hour/spectator.

Noise level of the ventilation system in the hall must be below 45dBA.

Care must be taken to ensure the supply of clean air to minimise the amount of dust in the hall. The air stream velocity of mechanical ventilation should be controlled to avoid draughts. In warm and hot climatic zones, air conditioning of the hall and possibly the service rooms may be considered. In moderate climatic zones on hot summer days mechanical ventilation with cooling operation might be satisfactory, (fan-coil system).

8.4.3.2 Lighting

The lighting must be adequate for TV and photo finish, for athletes and spectators. It should be free from glare.

Daylight Lighting

Natural lighting of a hall can take the form of windows in the walls and/or skylights in the ceiling. The installation of these should be done according to safety requirements of Section 8.4.1 for walls and ceiling. For athletics, uniform, non-dazzling daylight lighting can only be attained by skylights in the ceiling. Exclusion of direct sunlight can be made by sun-breaks and blinds, or by appropriate orientation of the windows.

The windows situated in the boundary walls of the hall should also be protected from direct sunlight by movable blinds, and the shadow-casting effect of masonry walls or pillars should be taken into account to ensure an even and uniform illumination.

Artificial Lighting

Fixtures and switches for the artificial lighting should be arranged and their type selected taking into consideration the need for uniformity and density of lighting without causing dazzling. Lamps with a high luminosity factor and low radiant intensity (for example fluorescent lamps) in warm-white and neutral-white colours are particularly suitable.

The balanced visibility conditions depend to a great extent on the degrees of reflection of the space-enclosing surfaces. The values specified below are required:

- Ceiling 70 %
- Walls 30 to 60 %
- Floor 25 %

The degrees of reflection of various colours and materials are given in Tables 8.4.3.2a and 8.4.3.2b.

Colour	Reflection
Yellow	0.40 to 0.60
Green	0.15 to 0.55
Blue	0.10 to 0.50
Red	0.10 to 0.50
Brown	0.10 to 0.40
Grey	0.15 to 0.60
Black	0.05 to 0.10
White	0.70 to 0.75
White Broken	0.60 to 0.65

Table 8.4.3.2a - Degree of reflection of various colours

In athletics halls, in multipurpose sports halls and in games halls used for Track and Field athletics practice and training, the average horizontal illumination, should not be less than:

- 75 lux for recreation and training
- 200 lux for club competition
- 500 lux for national and international competition

Material	Reflection
Fair Faced Concrete (Depending on Design)	0.25 to 0.45
Brick Wall of Red Brick	0.15 to 0.45
Brick Wall of Yellow Brick	0.30 to 0.45
Lime Sand Brick	0.20 to 0.50
Wood Surface: Dark	0.10 to 0.40
Wood Surface: Medium	0.15 to 0.40
Wood Surface: Light	0.20 to 0.50
Floor Surface: Dark	0.10 to 0.15
Floor Surface: Medium	0.15 to 0.25
Floor Surface: Light	0.25 to 0.40

Table 8.4.3.2b - Degree of reflection of various materials

For uniformity of horizontal illuminance, colour temperature and colour rendering see 5.1.3 (Tables 5.1.3.1 and 5.1.3.2).

Photo finish equipment requires careful lighting of the actual finish lines to avoid problems caused by strobing.

Lighting requirements for colour film and television are quantitatively and qualitatively higher. Since cameras mainly record vertical surfaces, the vertical illumination value, measured 1.5m above the sports surface is significant. For international competition, this value should be 1400 lux and, for national competition, 1000 lux.

For average vertical illuminance, uniformity, colour temperature and colour rendering index see 5.1.3.

8.4.3.3 Public Address and Additional Information Systems

The functions of the PA system include:

- Informing the spectators
- Informing the athletes in the arena
- Transmitting music

The supplementary communication systems (walkie-talkie and other similar devices) are used to:

- Transmit information and instructions to the changing rooms, warm-up rooms and other ancillary rooms.
- Establish contact between referees, umpires and judges.
- Establish contact between the competition control centre and the judges.

For an effective sound system, installation of a sound centre is necessary. It usually consists of two rooms: one is the operators' room containing control panels, record and CD players, tape recorders and the loudspeaker system and having an overall view of the arena and spectator stands. It should have a connection also to the competition control centre. This room has both high voltage and low voltage power

supplies and telephone lines. The amplifiers are located in the other room, together with stand-by power generation equipment.

8.4.3.4 Room Acoustics

The reverberation time for an athletics hall which is empty should not exceed 2.3 seconds. Generally this requires a sound absorbing ceiling and wall lining on a portion of the wall.

Due to the large span of an athletics hall possessing both an oval track and spectators, care should be taken to avoid echo phenomenon and measures should be applied to produce an appropriate reverberation time. Instead of sound absorbing lining, resonators or sound boxes operating like resonators may be more practical. In this latter case, dimensions, facing materials of the sound boxes and the thickness of the enclosed air cushion should be calculated by an acoustics specialist. A decision should be made also to define the frequency zone which must be damped. If the hall will be used only for athletics (or another sport) as a single-purpose facility the frequency zone forming the basis for reverberation calculations will be between 1000Hz and 10,000Hz.

In a concert of a symphonic orchestra lower and higher frequencies (up to 25,000Hz) can occur.

Aspects of room acoustics should be taken into consideration at an early stage in architectural design of the hall's shape. There are shapes developed by rotation which either have an axis or a centre where sound can be accumulated causing different sound volumes. Mistakes in selecting the architectural form can later be corrected only by additional, often expensive, measures.

8.4.3.5 TV Network

In athletics halls, installation of cables and antennae is necessary for the purpose of transmitting live or edited TV programmes.

Outside broadcasting equipment and vehicles should have adequate reserved parking space close to the hall and with connecting points to the hall's coaxial cable network.

8.4.3.6 Alarm System and Security

Adequate alarm systems for fire and security conforming to national standards must be installed.

Installation of a closed circuit TV network is sometimes advisable for security purposes.

8.4.4 STORAGE AND TRANSPORT OF TRACK AND HALL EQUIPMENT

The size of the storage area depends on the type of track construction. A portable track consists of more than 1000 components and, with all the other items of equipment needed for a competition, represents a large stock to be stored.

The area required should be determined in the design development stage by preparing a storage scheme, based on an assembly sequence of both the track and other equipment used in the arena. Handling and transport of the stored and stacked

material and track units should be managed with mechanical devices, elevators or lifting platforms depending on horizontal or vertical type of transport.

8.5 Additional Sports Rooms

Apart from those facilities immediately required for training and competition, additional sports rooms are desirable and often necessary.

8.5.1 WARM-UP AREAS

It is very important that warm-up areas appropriate to the standard of competition are provided. The minimum warm-up facilities required for each Construction Category are given in Table 8.7c. The warm-up facilities must be appropriately equipped with starting blocks, hurdles, jumping landing mats and uprights.

8.5.2 WEIGHT TRAINING ROOM

As stated in Chapter 4, modern athletics training systems recommend the use of weight lifting and other body building devices.

A weight training facility can range from a relatively small (approximately 24m²) to a fairly large room (approximately 240m²).

Its equipment may range from a common weight lifting platform to specialised training machines and up to 12-station training machines. The machines can be placed on the floor or mounted onto the wall or ceiling. Their weight and forces applied to the building components should be taken into account together with ways and means of connection and fixing.

At drop points for dumbbells the tread and skid-proof floor must be protected appropriately with an additional load distribution plate or mat. Ceiling, walls and lighting fixtures should be shockproof. A mechanically operated ventilation system should supply fresh air of minimum 100m³/hour per apparatus station.

8.5.3 SAUNA / RELAXATION AREA

See Chapter 4.1.1.1.7.

8.6 Alternatives for Competition and Training Facilities

Modern athletics has developed from a seasonal summer sport into a year-round programme of outdoor and indoor competitions.

Table 8.6 lists possible ways in which use of sports halls may be maximised.

8.6.1 MULTIPURPOSE SPORTS HALLS, WITH OVAL TRACK FOR COMPETITION, WITH SPECTATOR STANDS

In some multipurpose sports halls, national, international and world championships are held, as part of a year-round schedule.

Since the majority of events in a multi-purpose hall require flat flooring, it is preferable that the Track and the Field Event facilities be assembled from prefabricated

Basic Equipment and Additional Facilities Hall Types and Size m	Multipurpose Sports Hall, Oval Track for Competition, Spectator Stands (8.6.1)	Special Athletic Hall, Oval Track for Competition and Training, Spectator Stands (8.6.2)	Special Athletic Hall, Oval Track for Training, No Spectator Stands (8.6.3)	Special Athletic Hall, No Oval Track, for Training Only 44mx66mx8m 44mx88mx9m (8.6.4)	“Standard” Sports Hall, Additional Equipment for Training Only 27mx45mx7m 22mx44mx7m (8.6.5)
Basic Equipment:					
200m Standard Track, 4 Lanes	*	*	*	-	-
60m Straight, 8 Lanes	*	-	-	-	-
60m Straight, 6 Lanes	-	*	-	-	-
60m Straight, 4 Lanes	-	-	*	*	-
50m, 40m, 30m Straight, 3 to 6 Lanes	-	-	-	-	*
Facility for High Jump	*	*	*	*	*
Facility for Long Jump	*	*	*	*	*
Facility for Triple Jump	*	*	*	-	-
Facility for Shot Put	*	*	*	*	(*)
Additional facilities:					
Sprint Straight, 100m and 110m Hurdles	-	*	*	(*)	-
Practice Facility for Shot Put, Discus, Hammer, Javelin Throw	-	*	*	*	(*)
Spectator Stands	*	*	-	-	-
* Yes (*) Possible - No					

Table 8.6 - Alternative training and competition facilities

units or at least that the bends of the 200m oval track be laid flush with the rest of the flooring and jacked up to the required position, hydraulically or mechanically when necessary.

Training and practice in these halls can only be conducted before and after competition days while the track is installed.

8.6.2 SPECIAL ATHLETICS HALL, WITH OVAL TRACK FOR COMPETITION AND TRAINING, WITH SPECTATOR STANDS

A single purpose athletics hall should be equipped in conformity with IAAF Rules and specifications.

The 200m oval track can be a permanent installation. The requirements of the athletes, the spectators and the media should be met while observing IAAF Rules for indoor competitions.

Additional training and practice opportunities in such a hall are useful, especially when a longer straight track for 100m and 110m Hurdles (also used as run-up for Long

and Triple Jump) is added, together with training facilities for Shot Put, Discus, Hammer and Javelin Throw.

Figures 8.6.2a to 8.6.2c are examples of different types of use of such a facility. While Figure 8.6.2a shows the floor plan for a high level event with 4000 seated and 1,400 standing spectators, the example in Figure 8.6.2b shows the same facility with 2800 seated and 1400 standing spectators. The space of 1200 seats on retractable stands is used for an additional training area for sprints, Long Jump, Triple Jump and Pole Vault. Figure 8.6.2c shows the division of the complete inner space of the hall into training areas for ball games, standard Track Events and sprint / jump events.

8.6.3 SPECIAL ATHLETICS HALL, WITH OVAL TRACK FOR TRAINING AND COMPETITION, WITHOUT SPECTATOR STANDS

The nature of this hall enables construction of a permanently installed oval track. The landing facility for Long Jump and Triple Jump can be a permanent construction.

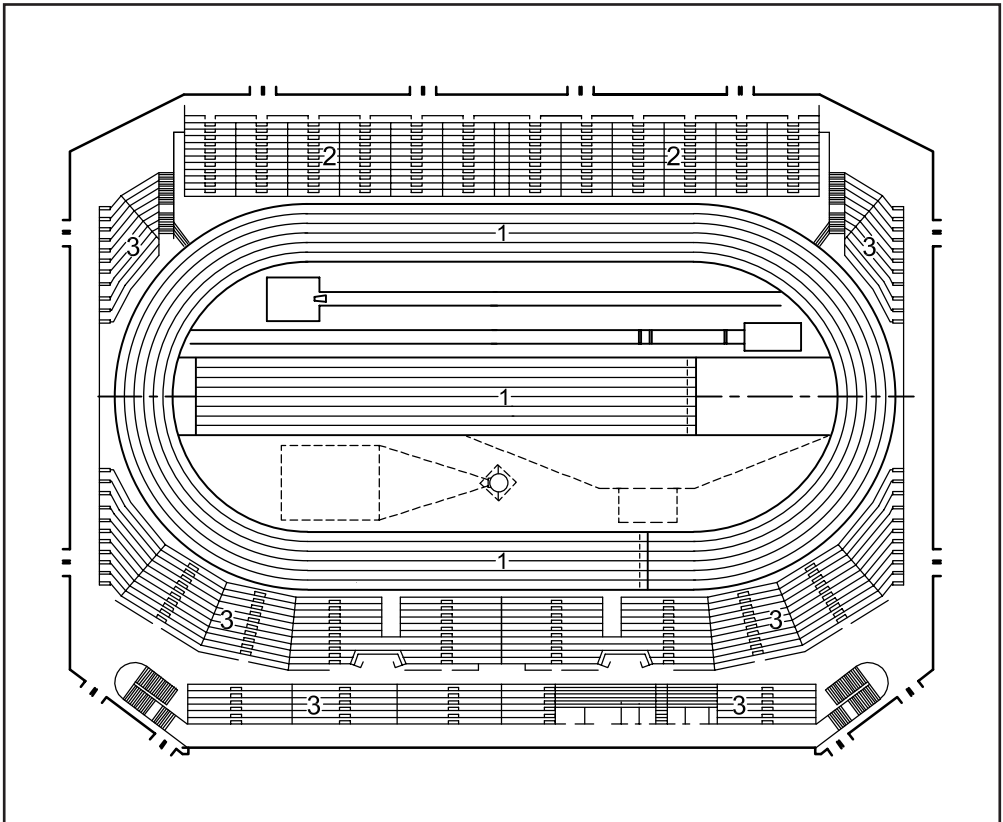


Figure 8.6.2a - Floor plan of an indoor facility for a high level event

- 1 Competition area with 200m Standard Track
- 2 Retractable grandstand with 1200 seats
- 3 Grandstand with 2800 seats

Source: *Hallen für Leichtathletik, P1/92, Federal Institute for Sports Science, Cologne*

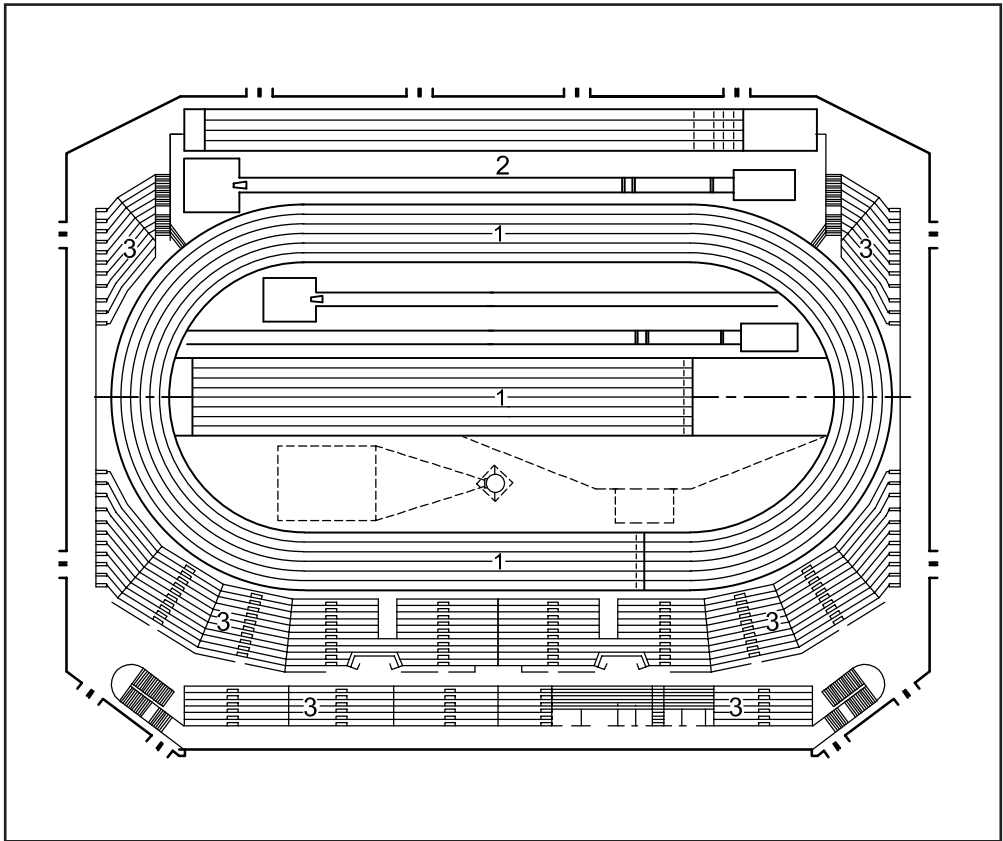


Figure 8.6.2b - Floor plan of a facility for a less important event

- 1 Competition area with 200m Standard Track
- 2 Additional training area
- 3 Grandstand with 2800 seats

Source: *Hallen für Leichtathletik, P1/92, Federal Institute for Sports Science, Cologne*

A removable cover for the Long and Triple Jump landing area is necessary. A suitable construction is shown in Figure 8.6.3.

The minimum clear height should be 9.00m.

Additional training and practice opportunities in these halls are useful, especially if both longer straights and training and practice facilities as explained in Section 8.6.2 are provided.

8.6.4 SPECIAL ATHLETICS HALL, WITHOUT OVAL TRACK, FOR ATHLETICS TRAINING ONLY

The basic function of this hall type is to provide specialised training opportunities for top athletes and coaches. Although these special athletics halls are mainly used for training, most of the equipment is also suitable for competition.

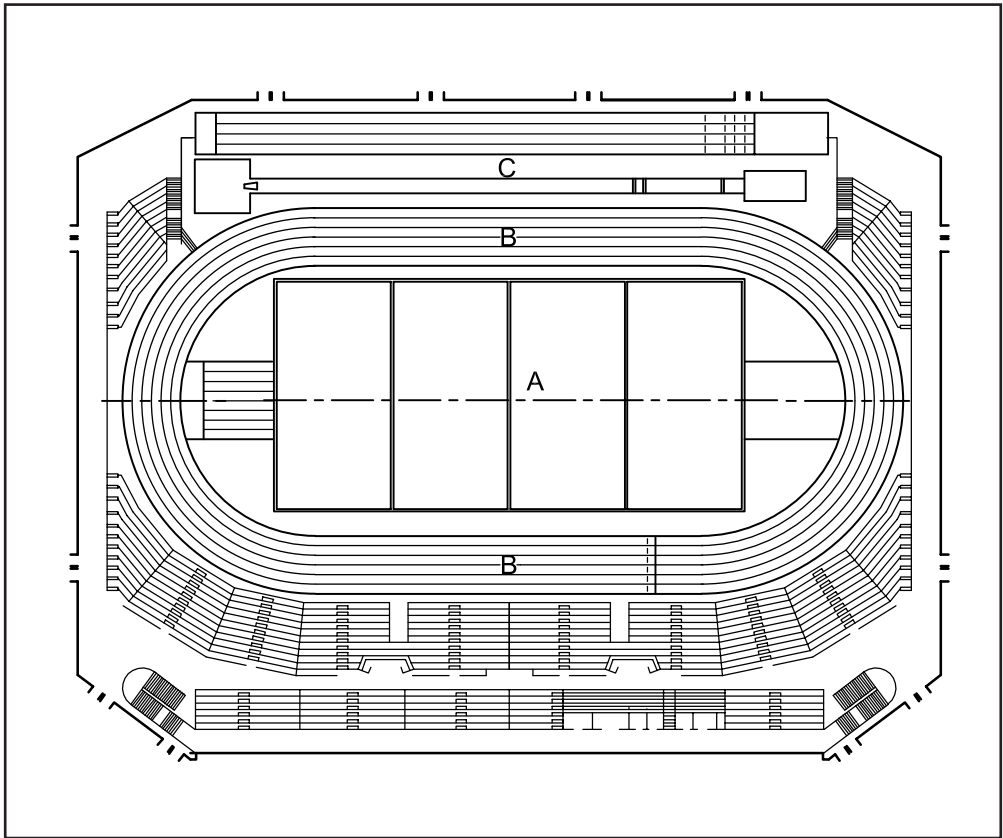


Figure 8.6.2c - Division of the inner hall space of the facility under Figures 8.6.2a and 8.6.2b for training purposes

- A Ball games area
- B Standard Track Events
- C Sprint / Jump Events

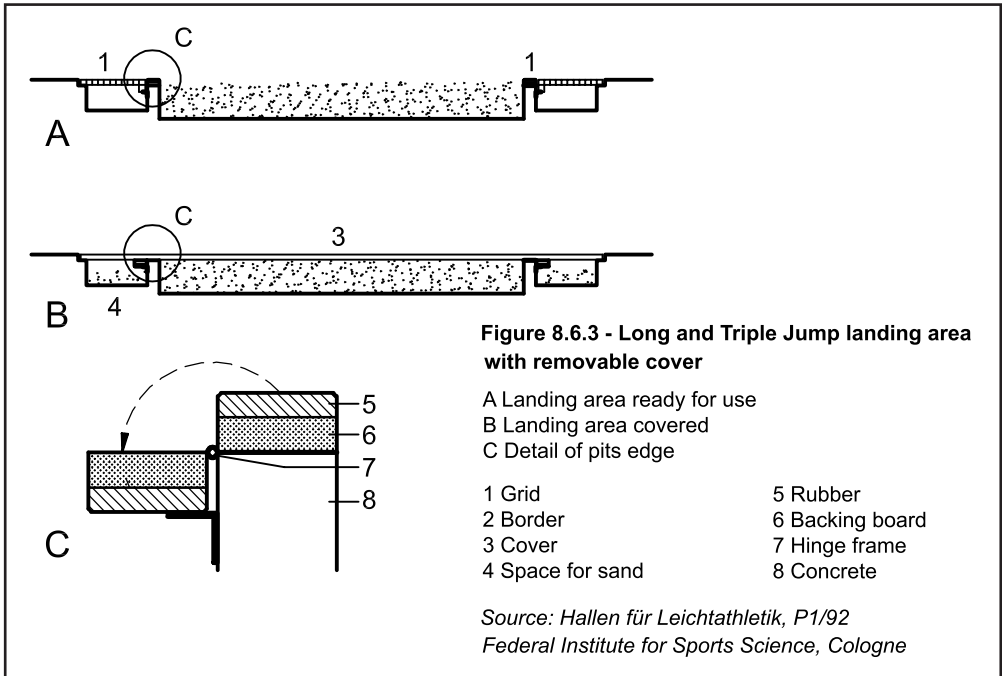
Source: Hallen für Leichtathletik, P1/92, Federal Institute for Sports Science, Cologne

The minimum length of the straight shall be 60m, but a length of 110m is preferable. With no oval track, these halls are usually equipped with training facilities for Shot Put, Discus, Hammer and Javelin Throw and with runways and landing areas for all jumping events.

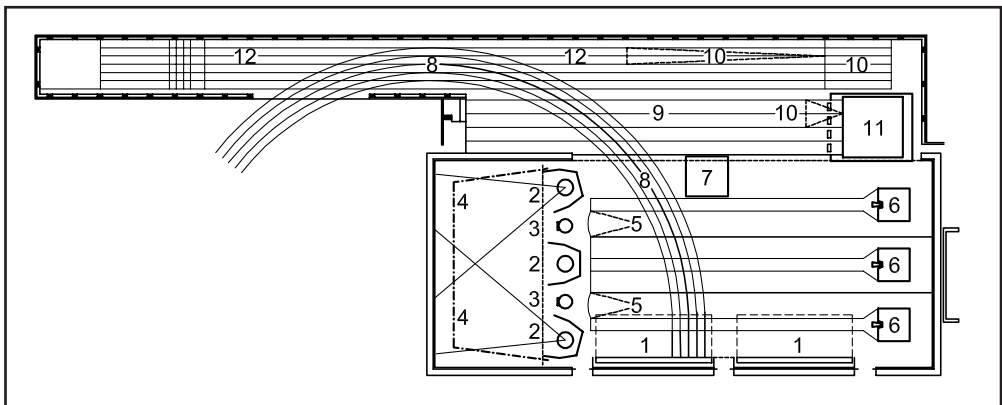
Figure 8.6.4 shows, as an example, the Track and Field hall of the German Sports University, Cologne.

8.6.5 "STANDARD" SPORTS HALL, WITH ADDITIONAL EQUIPMENT FOR ATHLETICS TRAINING

The basic function of these halls is to meet the requirements of physical education in schools and "sport for all" in a community. Athletics training and competition can be performed in them only to a limited extent, even when they are equipped with additional installations.



When considering hall sizes it should be borne in mind that for straight tracks a clearance of at least 3.00m behind the start line should be provided and at least 10.00m, but preferably 13.00m to 15.00m is needed beyond the finishing line, free of any obstruction with adequate provision of a padded brake wall beyond, for the athletes to come to a halt without injury.



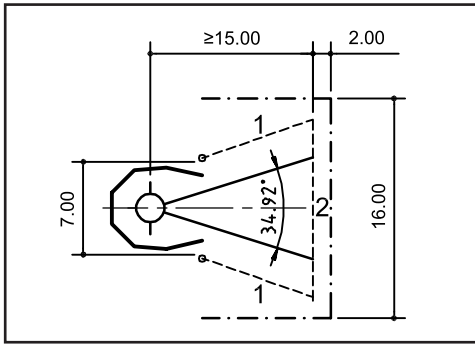


Figure 8.6.6a - Training facility for Discus
(Dimensions in m)

- 1 Stop net or curtain
- 2 Space for obstacle free moving of net or curtain

Source: *Hallen für Leichtathletik, P1/92, Federal Institute for Sports Science, Cologne*

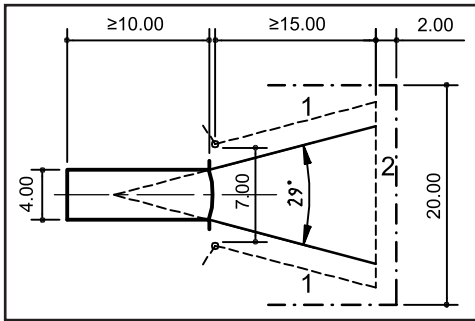


Figure 8.6.6b - Training facility for Javelin
(Dimensions in m)

- 1 Stop net or curtain
- 2 Space for obstacle free moving of net or curtain

Source: *Hallen für Leichtathletik, P1/92, Federal Institute for Sports Science, Cologne*

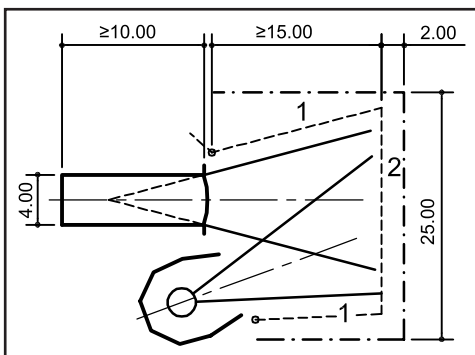


Figure 8.6.6c - Combined training facility for Javelin and Discus
(Dimensions in m)

- 1 Stop net or curtain
- 2 Space for obstacle free moving of net or curtain

Source: *Hallen für Leichtathletik, P1/92, Federal Institute for Sports Science, Cologne*

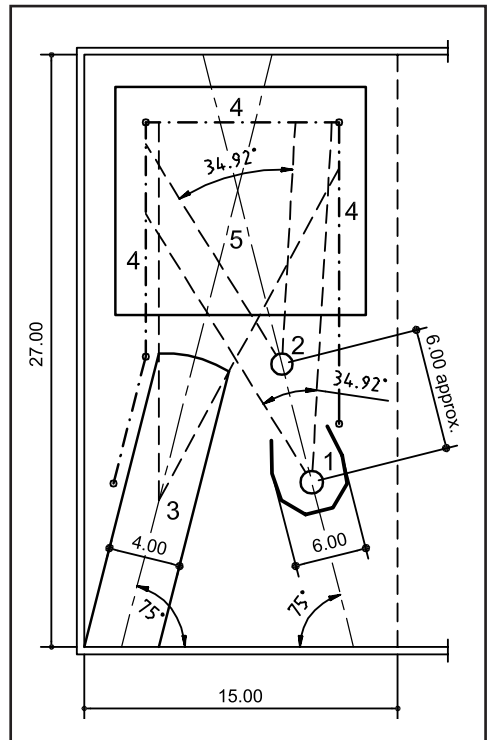


Figure 8.6.6d
Combined training facility for Discus, Hammer, Javelin and Shot Put
(Dimensions in m, not to scale)

- 1 Combined Hammer and Discus cage
- 2 Shot Put circle
- 3 Javelin runway
- 4 Stop net or curtain
- 5 Floor protection

8.6.6 TRAINING FACILITIES FOR DISCUS, HAMMER, JAVELIN THROW AND SHOT PUT

Due to the limited space available in most athletics halls, competition cannot be held in Discus, Hammer and Javelin Throw. For these events, only training facilities can be provided. The primary considerations for these facilities are the safety of all people in the hall and the protection from damage to the floor, walls and ceiling.

The minimum clear height in the training facility at a distance of 20m from the point of throwing should be 12m.

The best way to absorb the kinetic energy of flying objects is to throw them into curtains made of loose fabric or net with a weight at the bottom. The curtain will move with the impact of the flying object but at the same time it will stop the projectile. Measurable distances cannot be obtained, but training and practice can be performed indoors in winter months. Technical details of Discus, Hammer and Javelin Throw facilities for athletics halls shall be specific to each hall. For Shot Put facilities, the same consideration should be borne in mind as explained in Section 8.3.5 but a stop barrier is not required if the Shot Put area is a portion of the separate practice area for other throwing events.

8.7 Ancillary Rooms

Due to the limited space available, it is not always possible to provide the same number and size of rooms and areas as for outdoor stadia. Also, the number of participants is, generally, less than for outdoors. Table 8.7 illustrates the number of participants in athletics meetings of different levels, including staff and media personnel. See also Table 8.1a.

However, many of the requirements for outdoors, as described in Chapter 4, should be met. Therefore, in this Chapter, appropriate reference is made to Chapter 4.

8.7.1 CHANGING ROOMS, SHOWERS AND TOILETS

8.7.1.1 Changing Rooms for Athletes with Showers and Toilets

See 4.1.1.1.1 and 4.1.1.1.2

8.7.1.2 Rooms for Coaches and Officials

See 4.1.1.1.3 and 4.1.1.2

8.7.1.3 Changing Rooms for Ancillary Staff

Spare hall rooms with an area large enough for about 60 persons should be temporarily converted into changing rooms for the ancillary staff, separated by sex and equipped with washing and toilet facilities.

8.7.2 FIRST AID ROOM, MEDICAL ROOM AND DOPING CONTROL ROOMS

See 4.1.1.3 and 4.1.1.4.

8.7.3 COMPETITION OFFICE

See 4.3.

	Club, National and Association Meetings	International Meetings	Meetings between Countries	World and Continental Championships
Number of Events	6-25	15-25	25-30	26
Athletes - Male	30-150	100-150	30-85	350
Athletes - Female	20-140	80-120	30-80	300
Judges in the Arena	20-40	40	40	50
Competition Management including Ancillary Staff	10-20	30	30	40
Victory Ceremony Staff	4	6	6	10
Stadium Staff	6	10	10	12
Call Room Staff	3	6	3	15
Jury of Appeal	-	3	3	5
Technical Staff (Lighting, Sound, Scoreboard, Photo Finish)	3	3	6	6
Additional Technical Personnel	8	8	16	16
Authorities on Duty (Police, Fire, Ambulance)	3	8	8	12
Journalists	2-5	30-40	30-40	300-500
Radio and TV	-	8-10	8-10	40-50
Security Staff	-	5	5	30

Table 8.7 - Number of participants in various athletics meetings

8.7.4 OFFICIALS' ROOM

See 4.1.1.2.

8.7.5 ROOM FOR VICTORY CEREMONY PREPARATION

See 4.1.1.1.5

8.7.6 COMPETITION CONTROL CENTRE

See 4.3.1.1.

8.7.7 RESULTS DISPLAY

See 4.3.1.3.

8.7.8 ADMINISTRATION ROOMS

As the size of a facility varies from a gymnasium to a multipurpose indoor stadium number and size of offices needed for management vary, depending on the daily tasks of administration and the particular needs of each indoor meeting, according to the design brief.

8.7.9 DUTY STATIONS

The requirements for duty stations for fire brigade, police, ambulance / first aid and security staff must conform to national and local regulations and bylaws.

8.7.10 ROOMS FOR CLEANING EQUIPMENT AND WASTE DISPOSAL

Spectators in an athletics hall produce substantial waste, thus requiring a well-planned, well-organised cleaning operation.

Cleaning of circulation routes, toilets, consumption areas of kiosks, refreshment rooms and cafeterias needs particular attention. The cleaning of the stands and arena is an entirely different operation. Both need a stock of cleaning machines with abundant supply of detergents and chemical agents.

Waste should be collected in disposal bags and deposited in sealed containers, preferably in compressed state in a closed, ventilated room until final disposal.

For storage of cleaning machines, equipment and detergents, a well-ventilated storage room is needed.

An access route for heavy vehicles should be provided.

8.7.11 WORKSHOP ROOMS AND PLANT ROOMS

See 4.4.1.2.4 and 4.4.1.2.5.

8.8 Facilities and Technical Services for the Media

The facilities and services provided to the media (journalists, photographers, television and radio) at indoor competitions should be in conformity with the principles detailed in Chapter 4, Chapter 5 and in Table 8.8.

Function	Equipment	National Competitions	Regional Competitions	World Competitions
Press Seating	Seats (with desk)	40	200	250-280
	Seats (only)	20	50	50-80
	TV monitors (written press)	-	50-75	85-95
	Phones (dedicated lines)	5-10	30-40	40-50
Press Centre	Desks in working area	30-40	100-125	180-200
	TV monitors	-	4-6	6-8
	Computers for public use	2-5	10-15	20-25
	Phones (card)	2-5	5-10	10-15
	Broadband Internet access / WI-FI	-	required	required
	Pigeon holes	50-80	100-150	300
Formal Interview Room	Seating capacity	20-30	30-40	60-80
Commentary Positions	Units with three seats each	3	30	50
Camera Positions	Fixed cameras	4	6	8
	Hand-held cameras	1	2	4
OB Vans Compound	16.00mx2.50mx4.50m	1-2 600m ²	6-8 1200m ²	12-15 2000m ²

Table 8.8 - Seating and equipment in journalists' working area

8.8.1 PRESS

8.8.1.1 Seating / Tables and Seats

The limited amount of seating available allows for far fewer media personnel to be seated on the extension of the finish line(s). As for the outdoor stadium, priority should be given to television and radio personnel conducting live transmission.

The working area allocated to each journalist should conform as closely as possible to that defined for the outdoor stadium. Access to, and from, the seating area should be carefully considered, particularly when steep steps have to be encountered. Wherever possible the widest access points should be used, and well marshalled to avoid congestion from loitering.

8.8.1.2 Working Area within the Arena

The work room will mainly be used prior to, and at the conclusion of the meeting or session. The working room should be as close to the journalists' seats as possible. The Mixed Zone and formal interview room should also be in close proximity. It must be well lit, well ventilated and easily accessible. It should have sufficient space to accommodate 50% of the accredited media representatives at any one time, for example in national events 30-40 persons, in regional events 100-125 persons and in world events 200 persons.

Full telecommunication services are required in the work room, or immediately adjacent to it. If the event is of major importance - world/regional championships - these facilities would be contained within the main press centre.

8.8.1.3 Formal Interview Room

See 4.2.1.2.3 and 4.2.1.3.3.

8.8.1.4 Results Preparation and Delivery

See 4.2.1.2.5.

8.8.1.5 Mixed Zone

See 4.2.2.2.3.

8.8.1.6 Press Agencies

See 4.2.1.2.8.

8.8.2 PHOTOGRAPHERS

Due to the complexity of the problems with which photographers are faced - limited infield space, difficulty in gaining access to the infield (because of the bends), limited space outside the track, and usually difficulties regarding circulation - it is important to take the following aspects into consideration.

8.8.2.1 Photographers' Positions / Access and Movement

For indoor athletics, the key photographers' positions within the stadium are as follows:

- Infield including finish line / pool - maximum 10 persons (A)
- Head-on finish line - lap (B)

- Head-on finish line - sprint (C)
- Finish infield / ceremonies (D)
- Back infield / Field Events (E)
- Sprint start, raised (F)

The angles of these positions in relation to the track are similar to those outdoors but particular attention must be paid to the height of the banked bends and the advertising boards.

“No go” zones must be established, and respected, in keeping with those adopted for outdoor. (Figure 8.8.2.1a and b)

8.8.2.2 Camera Repair

See 4.2.1.2.6.

8.8.2.3 Equipment Storage

See 4.2.1.2.7.

8.8.3 TELEVISION AND RADIO

8.8.3.1 Commentary Positions

Greater attention must be paid indoors to acoustics since all sound will be contained more easily than outdoors (See 8.8.5).

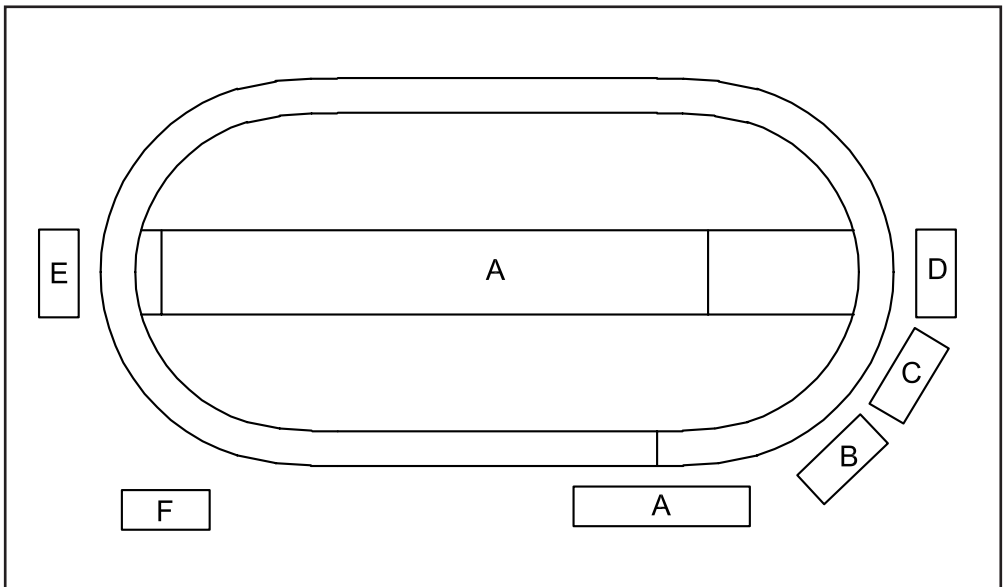


Figure 8.8.2.1a - Key photographers' positions

- A Infield / finish line
- B Finish line, lap
- C Finish line, sprint
- D Finish line, straight/ceremonies
- E Back-straight/field events
- F Start, straight

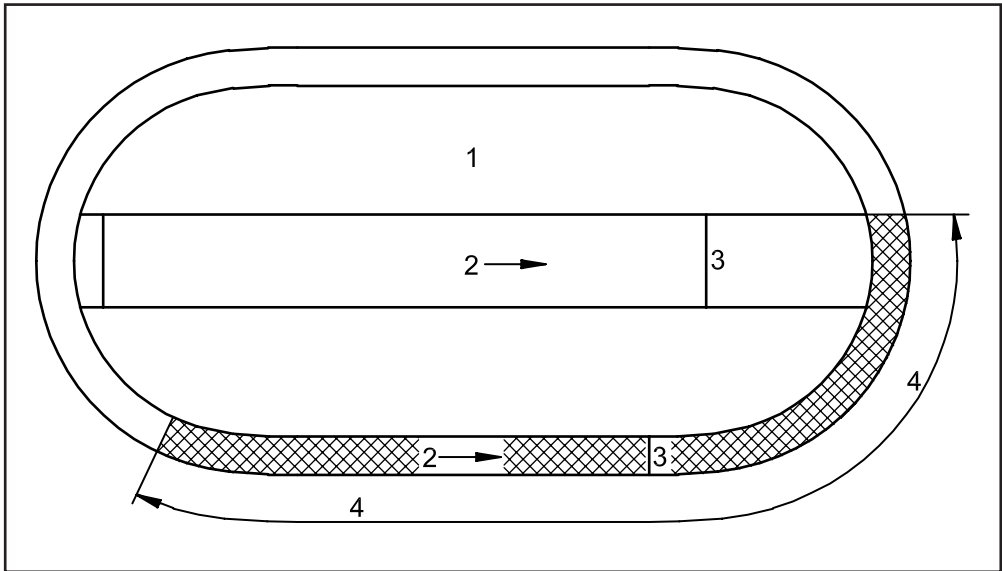


Figure 8.8.2.1b - “No go” zone

- 1 Infield
- 2 Direction of running
- 3 Finish line
- 4 “No-go” zone

Within an indoor stadium, commentators have even less room than for outdoors. Therefore, consideration must be given to service access for information, catering technical services etc. One advantage of an indoor stadium is the absence of wind which might scatter papers. However, it is still necessary to provide filing facilities.

8.8.3.2 Camera Positions

The reduced space and competition programme enables coverage of indoor athletics to be carried out with fewer cameras than for outdoors. Certain key camera positions however must be guaranteed no matter how small the event or corresponding TV production. Platforms for such cameras should be part of the permanent construction of the stadium.

Cabling ducts to these positions should be provided for in the stadium construction. There must be at least four cameras, one for running events located at the finish, one for the High Jump and Pole Vault, one for the Long and Triple Jump and one for the Shot Put.

The possible camera positions for a major indoor competition are shown in Figure 8.8.3.2.

Camera 1 is situated on the finish line of the oval races. This camera provides the master shot of the longer races.

Camera 2 is situated on the finish line of the sprint races. If the two lines are contiguous but the sprint lanes are in the middle of the arena, this camera should be higher than camera 1, to maintain the desired angle.

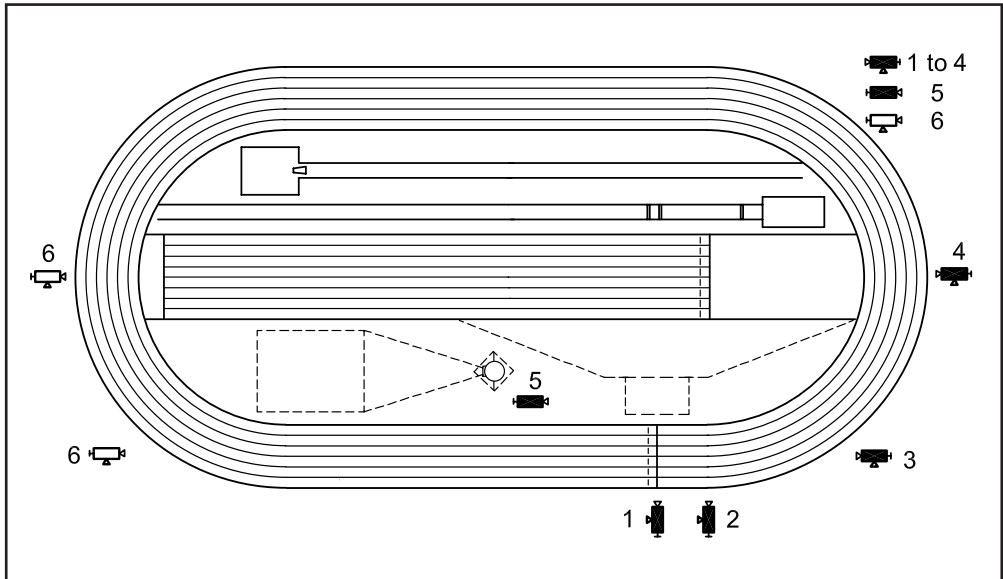


Figure 8.8.3.2 - Camera positions for major indoor competitions

- 1 Camera on finish line of the oval races
- 2 Camera on finish line of the sprint races
- 3 Camera head on to the finishing straight
- 4 Camera head on to the sprint straight
- 5 Hand-held camera
- 6 Camera on the back of the oval straight or the sprint straight

Note: Cameras 1 and 2 complement each other. On the longer races camera 1 is the master shot, while camera 2 provides the tighter coverage. This is reversed during the sprints.

Camera 3 is situated head on to the finishing straight. This camera provides coverage of the athletes as they enter the first turn and the run-out, and can serve as a good position for unilateral interviews. It should not be obstructed by photographers or barriers.

Camera 4 is head on to the sprint straight, and should be able to be aligned with the middle lanes.

Camera 5 is a hand-held camera, ideally on radio-frequency to allow it to be used in the congested environment unhampered by cables. It is used for the lane introductions of the athletes and different shots such as the lap bell and the low perspective of the athletes as they pass by on the back straight.

8.8.3.3 Unilateral Facilities

See 4.2.2.3.3.

8.8.3.4 Finish Line Positions

Despite the cramped facilities the unilateral TV network will seek space on the finish line for a camera which will concentrate on individual athletes of national interest. The same camera will be used for post-event interviews. Access (See 4.2.2.3.4) is

therefore required for cameramen, sound recorders, interviewers, technicians/engineers. This space - the post-event interview area / Mixed Zone - is the most pressured zone in the stadium.

8.8.3.5 Infield Positions

In providing television coverage for participating broadcasters, the Host Broadcaster must have presence on the infield. This is particularly relevant for Field Events. Maximum use of hand-held cameras can be made to great effect.

8.8.3.6 Formal Interview Room

See 4.2.1.3.3.

8.8.3.7 Outside Broadcast (OB) Vans Compound

The Host Broadcaster and those TV companies who have undertaken unilateral coverage will require space adjacent to the stadium for parking their outside broadcast (OB) vans. Where the location of the stadium limits available space adjacent to the venue, thought should be given to the use of an adjacent street which can be closed off for the duration of preparations and the competition itself. Maximum cooperation will be required from city authorities such as police and fire department to secure such a solution.

The size of the compound will depend on the scale of the event. A national event will require space for 1 to 2 vans, which require 600m² (maximum) including administration and services. A major regional/continental event must cater for 6 to 8 vans within an area of 1200m², whilst an event on the scale of the world championships must provide for 12 to 15 vans and will require 2000m².

The average size of a single OB van is 16m in length, 2.50m in width, 4.50m in height. The overall weight is approximately 30 metric tons.

Independent power units should be provided, with backup generator(s). 24 hours security and very limited, strict access is absolutely essential.

8.8.3.8 International Broadcast Centre

An international broadcast centre will only be required for a major world/regional event. It is a separate entity from the press centre and functions solely for television and radio.

Size is in proportion to the magnitude of the event. See 5.6.3.2.

The telecommunication requirements of the IBC can be extensive for major games and championships. In general see 4.2.1.3.4 and 5.6.3.2.

8.8.4 ACOUSTICS AND LIGHTING

The acoustics of an indoor stadium must be carefully considered for the media. For journalists working at desks in the stadium, it is very difficult to communicate by telephone if the volume of sound from the spectators is increased by a constant stream of sound from the PA system. Whenever possible, the latter should be directed away from the media working areas. Since the Host Broadcaster will wish to place directional microphones in, and around, the arena, detailed pre-planning is necessary to avoid problems with competition officials and/or equipment.

Strength, direction and quality of lighting must be considered for both television and photographers. The required lux levels across the arena must be maintained throughout a competition.

Coordination is required with the official timing company which will require increased lighting over finish line to guarantee accuracy of results and to prevent strobing.

8.9 Competition Equipment Specifications

The requirements for Pole Vault, High Jump, Triple Jump and Long Jump, indoors and outdoors are identical.

The Shot Put indoors is normally from a portable circle made of marine plywood or waterproof reconstituted wood with a rim of similar material (Figure 8.9). Alternatively, the portable circle can be placed on the facility floor on top of protective fabric.

For judging and safety reasons, the ground outside the circle shall be flush and level with the rim of the circle, and shall extend for at least 0.20m surrounding the circle. If there is no steel rim then a 6mm width of the rim shall be painted white.

The landing sector for Shot Put shall be of a suitable material on which the shot will make an imprint and which will minimise any bounce or damage to the flooring. The sector will be surrounded at the far end and on both sides as close to the circle as may be necessary for safety by a stop barrier which should be adequate to stop a shot whether in flight or bouncing.

The height of the stop barrier and protective netting should be approximately 4m.

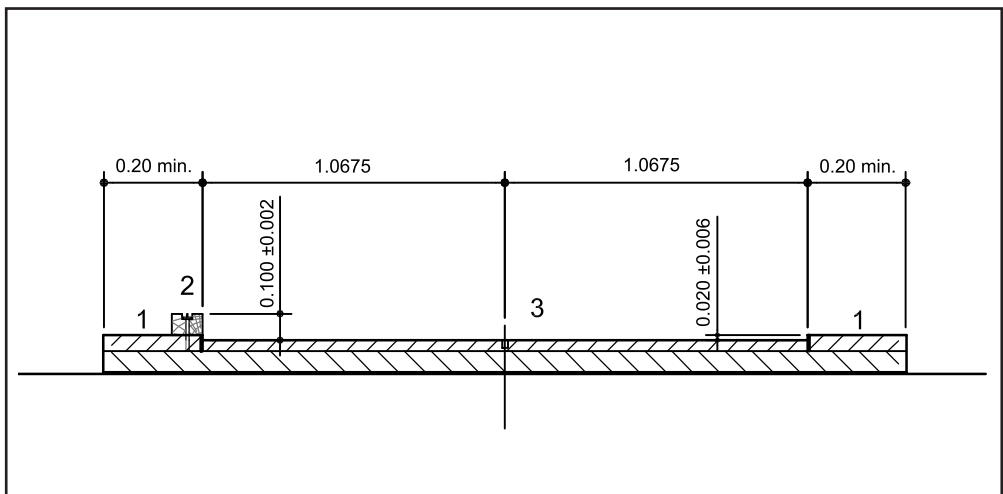


Figure 8.9 - Shot Put indoors (Dimensions in m)

- 1 Portable Shot Put circle
- 2 Stop board
- 3 Centre point

