

KölnArena, Germany

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1 GENERAL INFORMATION

Client:

Property fund Köln-Deutz Arena und Mantelbebauung GbR

Architect:

Architekturbüro Böhm

Planning of structural framework:

Schömig + Höfling

Executive company:

Philipp Holzmann AG, Direktion West

Fire protection expertise:

Hosser, Hass + Partner, Braunschweig

Processing time:

1996 – 1998

Kind of building:

Multi-purpose hall

Total height:

76 m

Surface Area:

83,700 m²

Seats:

18,000

Costs:

150 Million Euro



Figure 1. KölnArena (Copyright by Philipp Holzmann AG)

2 INTRODUCTION

The greatest multi-purpose hall in Germany was built in 1998 in Cologne. Different events take part in the KölnArena:

- sport events
- concerts
- shows
- general meetings
- congresses

Characteristic for the multi-purpose hall is the arc with a height of 76 m.

3 STRUCTURE

The arc is carrying the roof of the hall. It has a span of 184 m. The cross-section of the arc is a triangle standing on the head. The height and the width of the triangle is 3 m. 28 truss beams in a distance of 5 m are connected to the arc by hangers made of round pipes. These pipes have a diameter of 177 mm.

36 columns are carrying a supporting ring in a height of 45 m. This ring is carrying the structure.

4 FIRE SAFETY CONCEPT

Details to temperature distribution – especially gas temperatures and heat fluxes – are needed to dimension the smoke exhausts and the fire protection of the structure. These are depending of the possible fire scenarios which are defined by the following parameters:

- location of the fire
- type, quantity and alignment of the flammable material
- period of time the fire is not disturbed by extinguishing actions

Due to the distribution of the fire load in the event area, fires with rate of heat releases up to 50 MW are possible if the fire extinguishing actions does not start within 10 – 12 minutes.

4.1 Roof structure

The result of the fire simulations was that the average gas temperatures in the middle of the roof structure are so low, so the truss beams and purlins could stay unprotected.

However, for evaluation of the structural behavior during fire exposure the higher temperatures near the seat of fire are decisive. These temperatures were determined by the use of the plume model. Following fire scenarios were analysed:

- fire in the event area
- fire in the loge
- fire on the top level of the tribunes

A fire on the top of the tribune can become critical because the flame can reach the roof structure. A collapse of steel members in a radius of 3 m could not be excluded after 10 – 12 minutes of fire impact. To ensure the stability of the whole roof structure during fire exposure, it was verified that a collapse of two beams lying side by side does not lead to a collapse of the whole roof structure.

The lower part of the arc (up to 3 m above the roof) and its horizontal bracing are protected by fire protection boards for a fire resistance of R 90. The truss beams and the round pipes stay unprotected.



Figure 2. Roof of the KölnArena during erection (Copyright by Philipp Holzmann AG)



Figure 3. Foyer of the KölnArena

4.2 Foyer

The opening of the KölnArena occurs via the foyer which surrounds the arena. It includes movement areas, rest areas in the different levels (+7.5 m, +14.25 m, +17.45 m) and staircases beginning in the upper level (+24.11 m) connecting the entrances to the tribunes with the outside. The staircases are the escape routes.

The staircases are not disconnected from the foyer, so the whole foyer has to remain a smoke free zone during the fire and has to be separated from the rest of the building. A fire in the movement and rest areas or a fire in an adjacent site such as loges, shops, wardrobes, restaurants and offices can be reasons for smoke in the escape routes. A fire in the foyer can lead to unmanageable situations because of the complex geometry. So the foyer has to stay clear of fire loads. A fire in an adjacent site leads to an automatic closing of a fire resistant door via smoke detectors. These units are additionally equipped with sprinklers and smoke exhausts. However, a limited amount of smoke can reach the foyer during the development of a fire. For this amount is low and temporary respectively, the air discharge openings in the facade are adequate.

REFERENCES

- Bauen mit Stahl 2000. Brandsicher bauen mit Stahl. *Bauen mit Stahl* documentation 608
Hosser, D. 1999. Brandschutzkonzept der Kölnarena. *Bundesbaublatt* vol. 7/99: pages 55- 59