

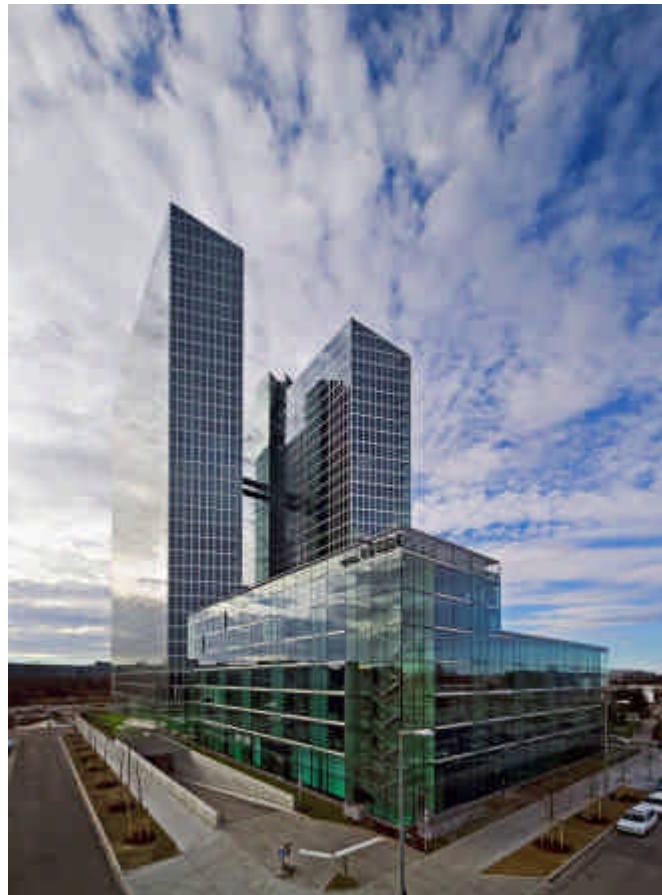
# **ANNEX 3-B**

## **Case study**

### **HIGHLIGHT MUNICH BUSINESS TOWERS**

In the north of Munich a new ensemble of high-quality office buildings has been developed, which provides a maximum of transparency and flexibility by using an innovative framework bracing structure in steel.

## HIGHLIGHT MUNICH BUSINESS TOWERS



HighLight Munich Business Towers is a high-rise ensemble in the north of Munich, in Parkstadt Schwabing, a new residential and commercial district. The location is significant, both within the immediate area, and for the city as a whole, as the towers overlook the junction of the main autobahn route from the north with the principal ring road around the inner city.

The objective of the concept design was to offer the investor maximum transparency and flexibility with a minimised use of materials; tenants of the offices find coherent, flexible areas being good to use, the staff enjoys personal comfort, natural ventilation and pleasant working atmosphere. The exceptional slenderness of appearance and the stringent transparency are the result of an innovative design and engineering concept, which could only be realised in steel and composite construction. The high-rise towers have no bracing massive concrete cores and no massive load-bearing inner

walls; all partitions are plasterboards or glass walls; so are the walls of the staircases.

The ensemble consists of four buildings: HighLight Tower 1 and HighLight Tower 2 (33 and 28 storeys), flanked by a low-rise hotel block (7 storeys), and a HighLight Forum (5 floors), the latter two achieving a smooth transition to the surrounding commercial development.

The slender high-rise buildings have the form of rhomboids with a length of approx. 80 m and a depth of 13.5 m each. The overall floor space is about 68,000 m<sup>2</sup>: 61 lettable storeys with more than 1,000 m<sup>2</sup> each. The storey height of the ground level is 7.50 m, of all upper storeys 3.50 m.

The connecting bridges and glazed elevator shafts have no statical function but play a key role in the visual image of this ensemble.

### Application Benefits

- Maximum internal flexibility due to absence of massive walls and cores
- Innovative bracing system using steel space trusses
- Maximum transparency of facades
- Pre-fabricated façade panels assembled without rack
- High-quality working environments
- Minimised bolted or welded joints

### Project Team

<b>Client:</b>	KanAm-Gruppe, München Aaeral Bank AG, Wiesbaden
<b>Architects:</b>	Murphy/Jahn, Inc. Architects
<b>Structural Engineer:</b>	Werner Sobek Ing. GmbH & Co. KG
<b>Steel Construction:</b>	stahl + verbundbau GmbH
<b>General contractor:</b>	Strabag AG
<b>Facades:</b>	Schmidlin AG



*Impressions from the construction process of the steel framework bracings, [2]*

### Construction details

#### Support structure

The main structure of the two towers is an innovative composite construction of steel and concrete. Its principal elements are concrete filled tubular steel columns with a core of solid steel and flat slabs of reinforced concrete with upstand beams around the perimeter. The towers are stabilised by two trussed steel frames at both ends of the buildings. These trussed frames consist of three interconnected trussed sections: a truss 12 m wide across the width of the building, plus sections 8.10 m and 6.75 m wide parallel to the long facades. In the plan the three sections form a U-shape. All members are designed rigid in tension and compression.

Each bracing module spans two floors vertically, which means the columns and the diagonals pierce the intermediate floors lying between two main nodes in the frame.

The columns outside the trussed bracing are designed as composite columns, generally tubular sections with a steel core and filled with concrete. In both high-rise buildings more than 1,100 single-storey composite columns exist, which are simply connected to each other as in a construction kit; bolted or welded connections are not provided.

Generally steel grade S355 is used; in joints also high-strength steel grades of S460 and

S690 are used with regard to weldability and low residual stress.

The intermediate floors are reinforced concrete flat slabs, 28 cm thick, with an integrated heating and cooling system. Each of the towers is covered with a shed-roof-shaped space frame that is fully glazed. This steel and glass structure extends over two storeys, enclosing the top-most gallery level.

All four buildings of this ensemble stand upon the shared three-storey underground car park.

All load-bearing and bracing elements with their supports are designed to R120 fire resistance, others to R90.

#### Facades

Each tower is clad with a single-skin curtain wall made up of fully prefabricated storey-high façade panels made of thermally insulated metal profiles. The individual panels are divided into glazed sections with solar shading, 400 and 950 mm wide, in which the smaller one can be opened for natural ventilation.

Pictures: [1] R. Viertlböck, Architekturfotographie, München  
[2] stahl+ verbundbau GmbH, Dreieich