



## Office Building “Belvedere”, Prestressed in three Directions

**Jochen EHMANN**

Civil Engineer  
Ingenieurteam Bergmeister  
Vahrn, Italy  
*EhJ@bergmeister.it*

**Oliver ENGLHARDT**

Professor  
& Structures  
Munich, Germany  
*office@andstructures.com*

**Matthias GANDER**

Civil Engineer  
Ingenieurteam Bergmeister  
Vahrn, Italy  
*GaM@bergmeister.it*

**Elmar KINDLE**

Civil Engineer  
Hoch & Gassner AG  
Triesen, Liechtenstein  
*ekindle@hoch-gassner.li*

**Josef TAFERNER**

Civil Engineer  
Ingenieurteam Bergmeister  
Vahrn, Italy  
*TaJ@bergmeister.it*

### Summary

In 2013 the structural part of the office building “Belvedere” in Vaduz (Liechtenstein) was finished. The building consists of 6 floors (one underground) and is above ground 25m x 65m in plan. Supporting walls are offset 5,6 m from the edges of the slabs thus every slab bears a cantilever of 5,6 m. Only four cores of vertical circulation carry the load of the upper four floor slabs to basement and foundation. The building’s walls are arranged in two planes in chess board shape and are designed to support a 15-m-cantilever. Tendons have been used to reduce the deformation of the slabs and to reinforce the shear walls; hence the building is prestressed in three dimensions. A strut and tie model has been used to calculate the forces in the walls. Particular attention has been paid to the nodes of the trusses. These points were critical for the bearing capacity of the structure.

**Keywords:** post-tensioning; tendons; slabs; shear walls; cantilever; strut-and-tie model; node design

### 1. Introduction

In 2011 the first advisory group, an international financial service provider, decided to organize a competition for their new head office in Liechtenstein. In this location the company had rented different offices and wanted to unite all groups in one single building. The architects Hildmann Loenhardt Mayr together with the authors won the competition with the building described in this paper.



*Fig. 1: Side view of model during competition*