



THE CITY HALL OF PORVOO – THE REINFORCING OF THE FOUNDATION AND LEVELING OF THE BUILDING

DESIGN AND IMPLEMENTATION

The renovation of the city hall of Porvoo was a unique and demanding design and construction project and a concrete example of the importance of the interaction between design and implementation, particularly in renovation projects. The project attracted a great deal of attention during the design and leveling phases. The engineering was done by IP-Engineering Finland Ltd. and the work was performed by YIT Ltd.

The city hall is located in the center of Porvoo at the edge of an area of clay on the eastern side of the Porvoo River. In 1893, the original contractor of the building managed to convince the city leaders, that piles would not be necessary if the building was built on a rough-cut stone foundation over a gravel bed on the clay subsoil. The result of omitting the piles was, that the building settled unevenly in such a way that it sloped along one of the diagonal directions approximately 830mm. The total settlement at the Southwest corner was approximately 1200mm and at the Northeast corner approximately 400mm.

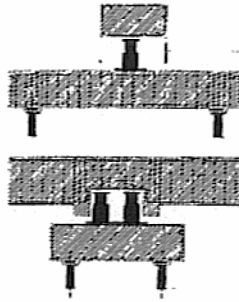
SETTLEMENT GRAPH

While the staff of the city administration complained of the possible harms caused by the sloping floors, the decision was made to correct the alignment of the structure based on the proposal by the Building Department of the City of Porvoo.

COLORED SECTION OF THE FAÇADE

The load bearing walls are made of brick supported on a rough-cut stone foundation. The intermediate floors are constructed out of wood or are supported by brick vaults. The uneven settlement had caused cracks and stresses in the building.

Since the reinforcing was designed to be mainly under the original stone foundation, the excavation at the exterior walls had to extend down to a depth of 3,5 m from the grade. The piers were poured against the clay subsoil; thus they transferred the load of the building to the passive side to prevent collapse of the soil while the excavation progressed.



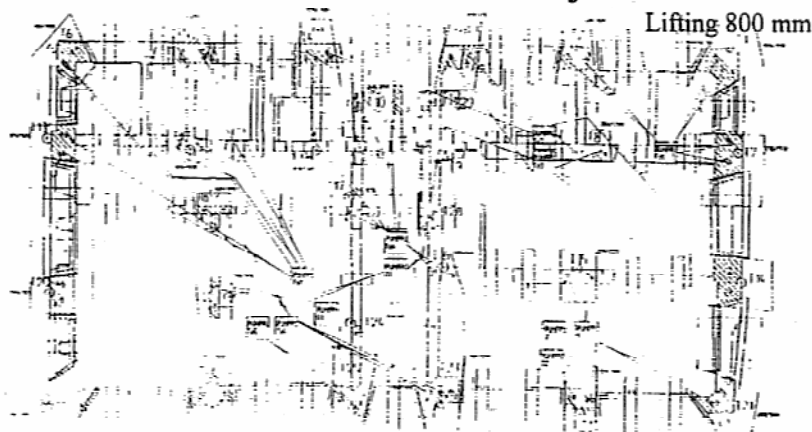
TEMPORARY FOUNDATION

The pier foundation was designed in such a way, that the addition of piers needed just for the lifting of the building was minimized by allowing the foundation piers to have double the load compared to the final load, during the lifting phase. The ultimate load was verified at the start of the project by PDA measurements.

The lifting of the fragile building was performed using 27 jacking locations and without causing unnecessary damage to the building. The lifting process was adjusted to the behavior of the structure. The building was jacked up in a wave like manner starting from the lowest corner. The structure, which weights 6000 tons, was bent during the process in such a way, that sufficiently long stretch of the foundation was always supported by piers, which provided the lateral support, while the other foundation sections were being lifted upwards. Approximately 8000 tons of lifting capacity was placed under the building to ensure that it would rise up. The wave like lifting process could also take advantage of the lifting effect of the elastically compressed piers, while the foundation section near the jack was being lifted up.

There was, in addition to the fifty hydraulic jacks, hundreds of "pier jacks" under the building to balance the line of bending.

Lifting system, connection of the jacks



Lifting 0 mm

The project control was handled from a "central command post", which was located in a temporary office trailer on site. The orders for jack strengths and loading points were given by the designer via VHF phones. The lifting of the building was performed during sixteen working days. The building is now level and in good condition.