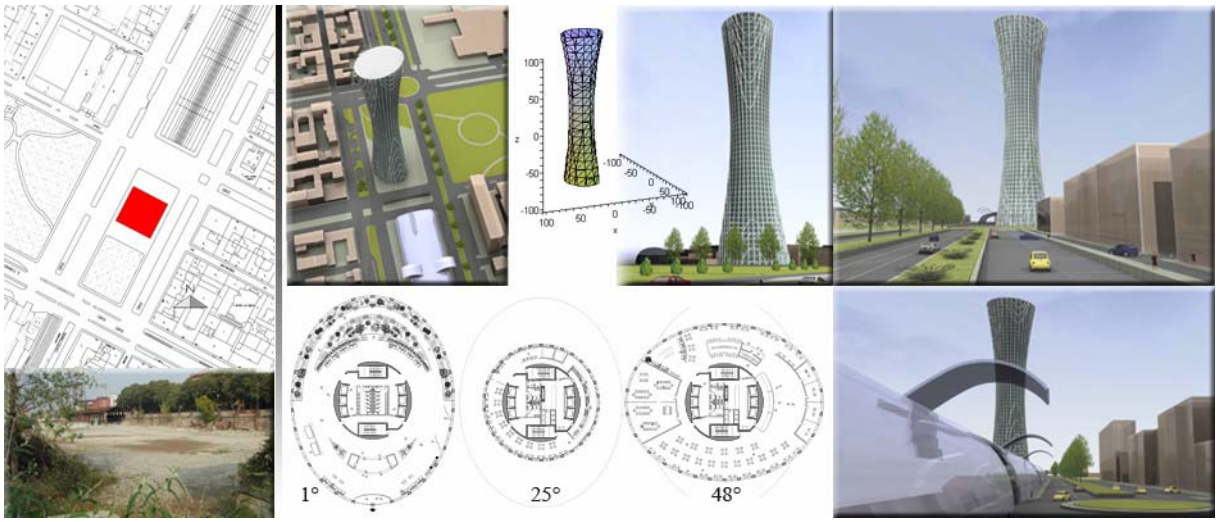
POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture
Honors theses

Project of a skyscraper for SanPaolo IMI on "Spina 2"
by Cristina Zannini Quirini
Tutor: Giuseppe Ferro

This dissertation has the aim to carry on the subject started along the three years' graduation course concerning high-rise buildings. Now, I want to give a more critical and developed look to the problems concerning skyscrapers.
The decision to insert this project in the city of Turin wants to point out how this city is going through a phase of social, cultural and architectural ferment but, moreover, it wants to be an aware provocation towards those who put themselves - still today - in a sceptical attitude towards these kinds of buildings, considered different from those built in a traditional Italian urban style.
The research of the useful architectural form has come to an end when I decided to adapt the quadratic equation to obtain a geometric shape that could match the project of a skyscraper. This happened after numerous mathematical processing carried out starting from the equation of a hyperbolic hyperboloid: $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$



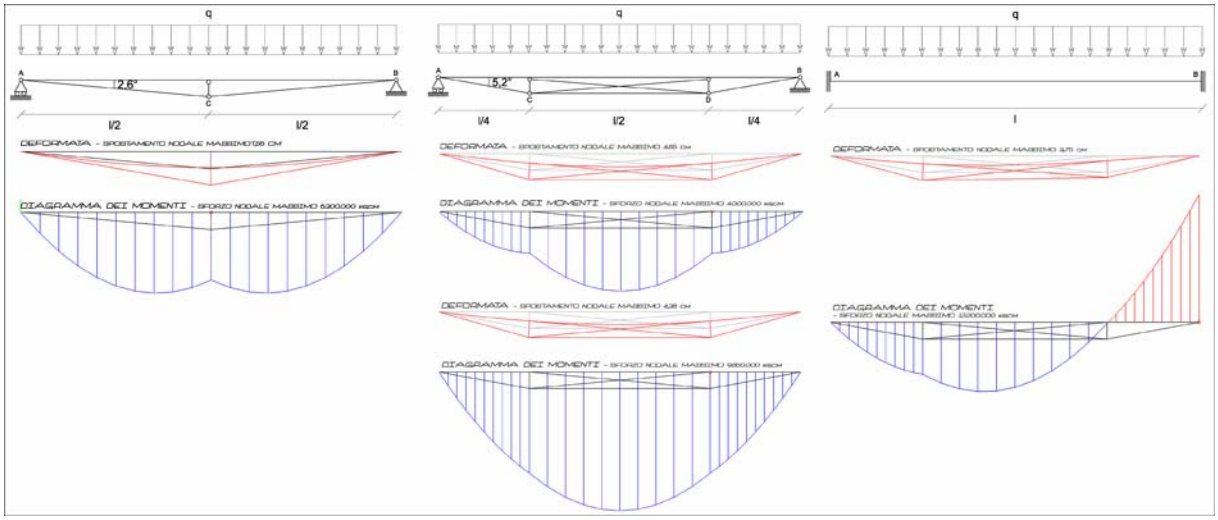
From the left: Planimetry of the lot and state of fact; signifying plans and rendering

An analysis of the loads was particularly important, especially for those typologies that strongly interact on a high-rise building. I studied problems caused by wind, gravity loading, seismic actions as well as problems related to the endurance and deformation of reinforced concrete and steel.
The choice of the structural models was developed following manual pre-sizing, to get the best shape of the structure itself. Columns, floors and stiffness systems was processed carefully.

The elements which proved to be the most problematic were floors specially as they get the largest size (~18 meters span). So, a series of static schemes were created and analyzed by a specific software that showed the most suitable structural solutions. Only those ones which respected the following conditions were considered:

- building easiness of the structural nodes;
- thin floor sections;
- buildable with “off the shelf” elements.

This led me to the final solution based on: main beam HeA800, secondary beams IPE400 and sloped trusses ∅30.
Regarding vertical systems, I obtained through a manual reckoning 30 perimetric columns following the hyperbolic shape of the front composed of 2HeB600 included in a box-shaped profile and a central stiffening core in reinforced concrete with a steel core.
Horizontal and vertical stiffening systems were included to convey forces to the ground and to give stability to the whole structure, above all if it’s stressed by winds or earthquakes. Horizontal systems were placed along the perimeter of each ceiling and the other ones are composed of two net-shaped ribbons with steel sections and six vertical stripes.

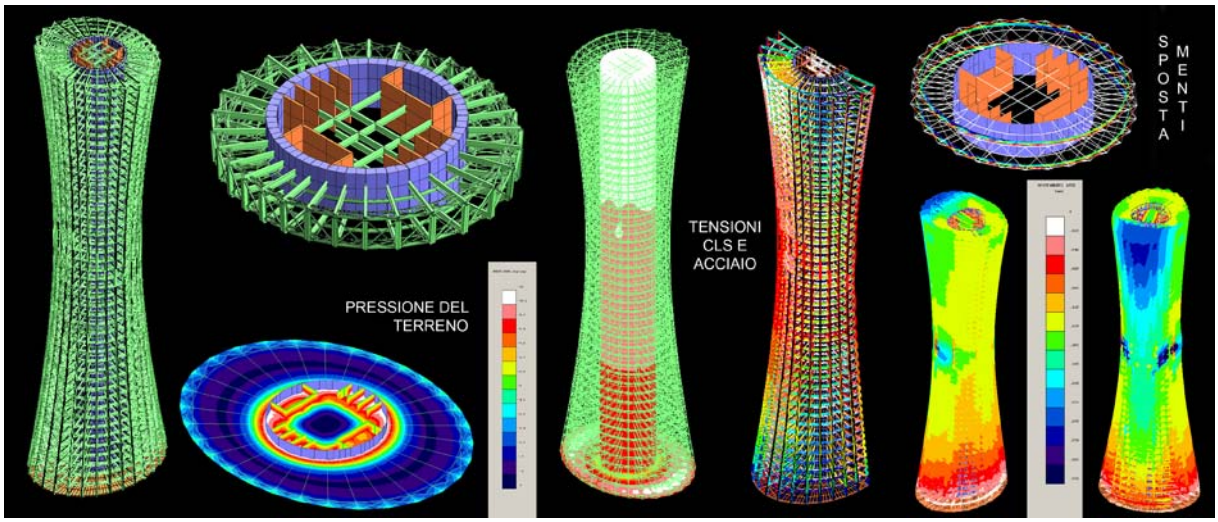


Possible static schemes for floors (definitive solution in the middle).
For details see test of the degree

The drawn structure was included in a reckoning finite elements software (CDS Win) and materials and loads were chosen. The software, using the admissible tensions algorithm in static nodal condition, verified all structural elements to resistance and deformation.
However, some remarks have to be considered. The main are the following ones:

- the graphics show the decreasing trend of the tension values to the increasing of the height;
- the continuous structure of the foundations can be assimilable to a Gerber beam on elastic bearings;
- the values trend of the bending moment shows how the whole structure is moving like a cantilever submitted to a distributed charge;

- the shifting of the main floor-girders is between 0,2 and 4cm, so it is smaller than the maximum deformation allowed.



Output of the software

The course illustrated till now can't be considered exhaustive with regard to all the problems. I believe I've developed a method that can be used for a more specifying analysis of each subject.
About my academic education, I think I've given a quite good outline of the base problems and I hope I've at least inspired in someone the doubt that these buildings aren't to be considered like giants not related to our times. But, if they are projected with care, they can become a worthy architectonic symbol of XXI century.

For further information, e-mail:
Cristina Zannini Quirini: cristina.zanniniquirini@fastwebnet.it