Newsletter 05/2012

Arezzo: The Pope's first pastoral visit of 2012

For most of May CMW Engineering was engaged in the assembly of the structure used for the Pope's first pastoral visit of 2012. The event took place on Sunday, May 13 at 10:00 a.m. during the visit of Pope Benedict XVI to the city of Arezzo. The venue was the city park known as "Il Prato" where the Pope celebrated mass and a recital of the "Queen of Heaven" followed.

"Luce è Srl", a leader in theatrical lighting and sound was the head company engaged directly by the Diocese of Arezzo for the setup of the venue. Together architects Mario Maschi, Giorgio Tenti and Mario Fabbrini designed the architecture of the structure and directed work. "Luce è Srl" turned to us for the actual structural elements, which included:

- Stage of approximately 300 square meters
- Covering of approximately 400 square meters
- Sacristy with bathrooms and gazebos for "Eucharist"
- 2 cluster towers
- 2 sound towers
- 4 RAI towers
- 3 LED screens supports
- Press bleachers with 300 seats and covered chorus bleachers with 150 seats.

Stage dressing and design was handled directly by "Luce è Srl" and their collaborators at "Mutina Eventi Srl".

All work was completed according to the established timeline despite the very tight turnaround and unplanned additional work and numerous unforeseen events. Both the client and the involved authorities expressed great appreciation and satisfaction at the results.

The most challenging part of the project to complete was that requested by Architect Maschi and consisted of the creation of a compact and slim roof inspired by the 15th century portico by Benedetto da Maiano at the Sanctuary of Saint Mary of Mercy in Arezzo.

The portico was supported by 18 columns composed of multi-directional scaffolding with circular covering. These columns would bear the most strain in the case of frontal wind perpendicular to the frontal panel that extended along the entire length of the portico roof. Most commercial programs for the calculation of this strain could not accurately project that case within the required security margins (Not too low, neither too high!?). Thanks to our decade-long collaboration with Engineer Alessandro Incerpi our proposed model not only fit within these margins but was the closest to the desired physical structure and the most mathematically sound, allowing for the assembly of the structure with ample margin even in case of strong winds ("out of service"), as demonstrated in the feasibility study.

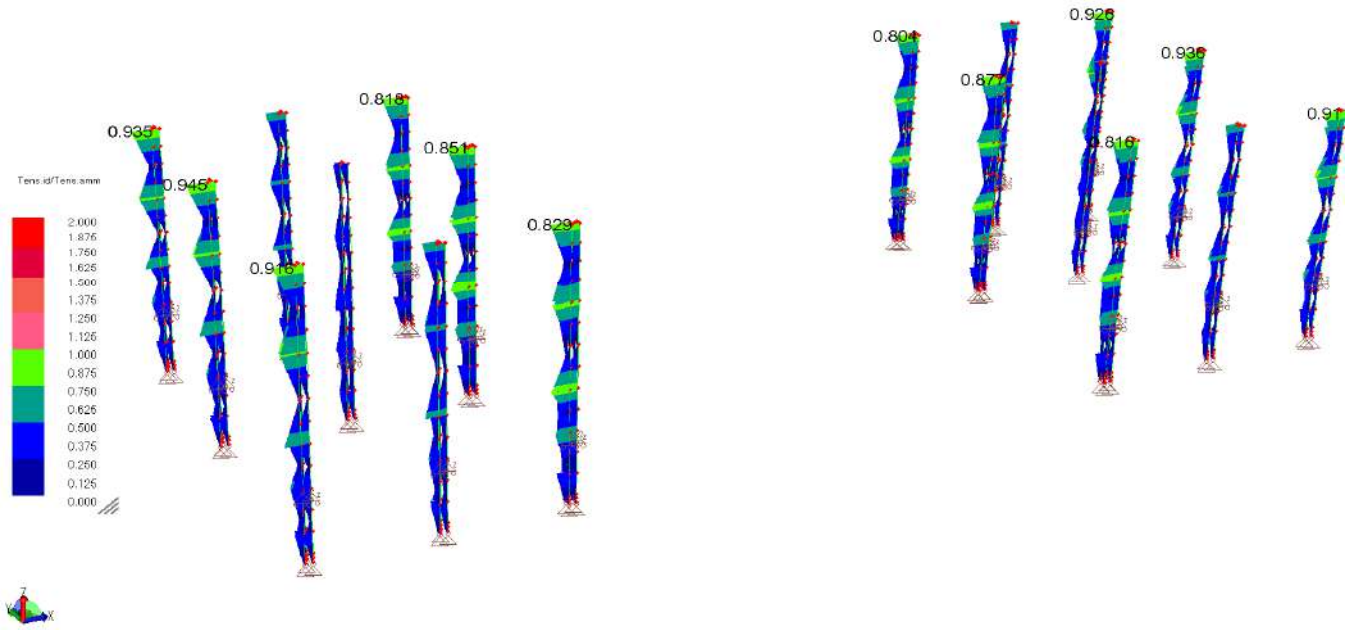
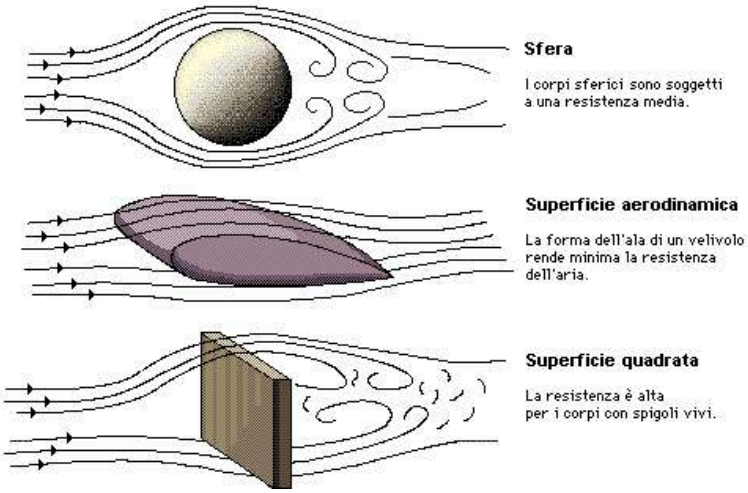


Diagram: rate of material flexibility for ULS and frontal wind against front panel



the least resistance to air.
Square surface
Objects with sharp edges of corners produce a great deal of resistance.

The presence of the frontal panel also created interesting and important aerodynamic effects on the structure by no means negligible.

Despite the panel structure's weight of about 1000 kg and the wind resistance described above, the panel, when hit by the airflow perpendicularly to its front, generated turbulence due to the contact of that airflow with the sharp corners around the panel's perimeter (non-laminar flow).

FROM DIAGRAMS IN ITALIAN:
Sphere
Spherical objects are subject to medium resistance.
Aerodynamic surface
A wing-shaped form such as that of an airplane produces

With the covering acting as a wing surface, the turbulence generated prevented the airflow, particularly that at the boundary layer, from being laminar at the top of the wing, and in our case at the extrados of the covering, therefore generating lift (P) that would tend to lift the structure and the all that is connected to it.

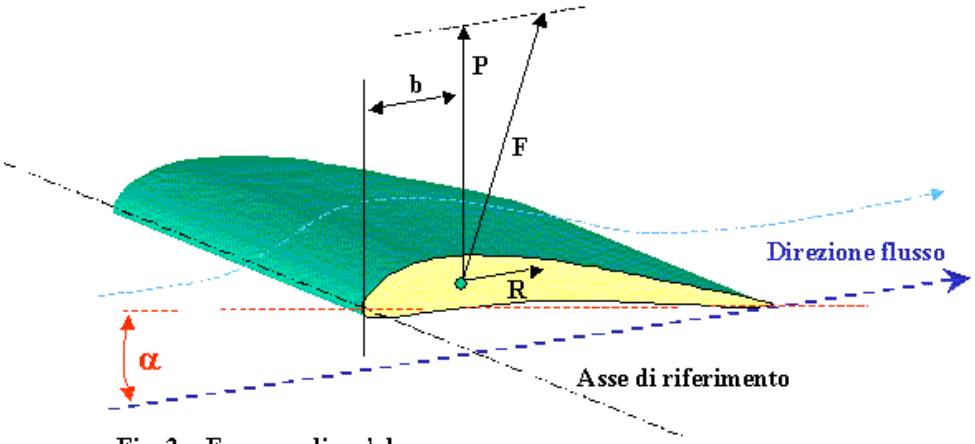
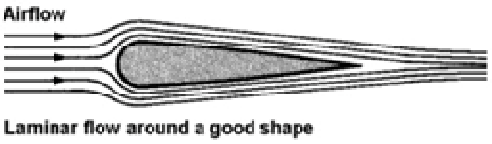
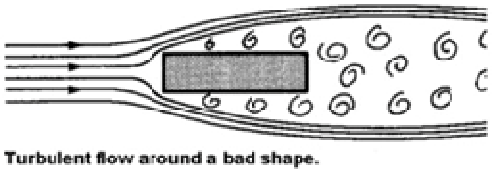


Fig. 3 – Forze su di un'ala



Laminar flow around a good shape



Turbulent flow around a bad shape.

With a shallow rear angle, only possible with a long thin object, it is easier for the air to follow the object's shape and keep the size of any wake down to a small value. A poor aerodynamic shape causes early separation and a large wake, and thus high drag.

Basically the panel increased the Reynolds number** of the structure overall and consequently reduced the vertical forces in favor of the horizontal ones.

The calculations for the ballast required for the structure to prevent lifting however has not taken in account the advantage of this effect, but rather was based entirely on safety regulation requirements so as to ensure the utmost security.

$$Re = \frac{UL}{\nu}$$

**= The Reynolds number *Re* is a dimensionless quantity that is used in fluid dynamics and is the ratio of inertial forces to viscous forces. This number allows to determine whether fluid flow is laminar or turbulent.

Given the unique nature of this project we feel it is necessary to thank all of the companies that collaborate with us on a regular basis and whose contribution was fundamental to its successful completion. The aggressive time frame complicated the timely completion of contracts and administrative documentation and often called for work to be completed at night and on holidays.

The mutual trust and esteem of the professionals involved made everything go smoothly ...

Suppliers who worked on-site:

- ALTER EGO Srl
- AQUILA ponteggi S.A.S. di Hamiti Kreshnik & c.
- AUTOGRU VALDARNO di Petricca Ubaldo
- BB-99 Srl di Brudaglio Davide
- COOP RIFREDI S.c.r.l.
- GIMAR Srl di Pizzichi Marino e figlio
- GLOBAL Ponteggi di Lamaj Fjodor
- JUNGHEINRICH ITALIANA Srl – Filiale di Firenze
- TECNIFOR Spa
- TELONERIA FIORENTINA di Zani Gabriele & c. Snc
- TUBETTIFICIO ROBBIESE Srl

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