

CitySpace

Structural Olympics

By Christopher Choa



We can't help it; we're training hard for 2008, and every potential athletic opportunity is being explored. Why should we stop at humans? We propose some new competitors. With all the fantastic construction around us, we should include a category for Athletics in Structural Engineering.

Long jump

The Lupu Bridge has the longest arched span in the world - 553 meters; no other bridge of its kind comes close. And at 36 kilometers, the proposed Shanghai-Ningbo bridge, scheduled to be constructed in Hangzhou Bay, will be the longest bridge in the world of any kind.

Forget Bob Beamon and Mike Powell; we'll be zooming over the entire landing pit.

High jump

We've all seen it: the giant floating roof on the Grand Theater in People's Square. This sort of upward-curving shape may be considered a modernist cliché, but it is still a spectacularly athletic high-bar.

The 6000-ton roof was prefabricated in sections by Shanghai's very own Jiangnan Shipyard, assembled on the ground and then hoisted up as a whole unit over the course of a single day.

A gold medal, for sure.

Synchronized swimming

The Grand Theater also has all sorts of mechanical equipment to assist performances, one of the most elaborate systems in the world. Eighteen hydraulic lifts on the main stage alone can appear or disappear at the flick of a switch. An enormous turntable can spin performers on stage. Eight sets of scenery can change simultaneously. The entire orchestra pit can levitate more than five meters to receive applause. The Grand Theater should sell tickets just for us to see all the machinery operating at once.

A mechanized architectural ballet worthy of the opening ceremony.

Dead lift

In its heyday, the *New York Daily News* dubbed the old Nanjing Theater the "Asian Roxy". Completed in 1930, it was one of the very first theaters in the world with synchronized sound equipment. In 1959, it was renovated and became a symphony hall; the impressive acoustics were perfect for the Shanghai Orchestra. But by the mid-1990's, everything was a bit tawdry, and bad vibrations from the nearby subway line and elevated highway intruded into performances. The building was also in the wrong place - it stood where a new public park was planned.

No problem. In 2003, over the course of two months and with the help of 60 massive hydraulic jacks, one hundred and thirty workers

heaved the 6,000-ton heritage building onto a massive concrete tray and hauled it 70 meters to its current location. The building, known today as the Shanghai Concert Hall, is perched on its new, vibration dampening foundations.

And no steroids!

Pistol shoot

The soon-to-be-completed World Financial Center in Pudong will become the tallest building in Shanghai a supremely elegant and elongated chisel point, with a giant hole shot through its top.

There is a lot of fuss about the hole, and ongoing efforts to try and 'plug' it up. Some critics think it looks too much like a Japanese flag (the project is being developed by the Mori group, one of the pre-eminent developers in the word, who happen to be Japanese). This is all nonsense; the hole is graceful and elegant, and no culture owns the form of a circle.

Besides working hard at being beautiful, the circular opening at the top of the building serves an exquisite structural purpose. Because the floor plates in the narrowing top of the tower are quite small, and because wind loads increase

with height, it is important to find ways to decrease the structural stresses at the top of the building. Punching a hole at the top of the building relieves a lot of wind pressure and gives the tower a signature silhouette at the same time.

Perfect technique.

Archery

The next time you find yourself in the starting blocks to check-in at Pudong Airport, look up at the ceiling. Trusses support most giant spans, and this ceiling is no different. Normally, trusses are messy things with all sorts of diagonals and ungainly structural connections wasting valuable energy and cluttering up the clean lines of the architectural space.

If you examine the Pudong trusses, however, you will notice that there are no hefty diagonals. Think of the roof as a series of huge arched bows. The bowstring is the black cable that is stretched under terrific tension. Those giant white tubes are the arrows; they are even notched at the ends to fit over the bowstrings. To keep the arrows from skidding out of place, instead of giant fingertips (or ugly diagonals), elegant spherical nodules are clamped to the bowstrings to keep the notched arrow ends in position.

Take a deep breath. Think of the famous archers from the Iliad... TWANG.

A bull's-eye.

