



Dr. Shyama Prasad Mukherjee Swimming Pool Complex (SPM)

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Summary

Due to minimized dead load, cable systems have a key advantage for spanning large distances.

Keywords: Commonwealth games 2010, Stadium, Aquatic center, Cable, Roof, Seating bowl.

1. Roof Structure

Located on Mother Teresa Crescent in central Delhi, the venue for swimming and diving events for CWG 2010 was originally built for the ASIAD 1982 as an open air arena. To insulate the interior from the city's noise & air pollution, to meet the requirements of controlled temperature for athletes & spectators, and to provide controlled lighting for television transmission, it was decided to roof and enclose the aquatic center.



Figure 1 Exterior view after upgrading

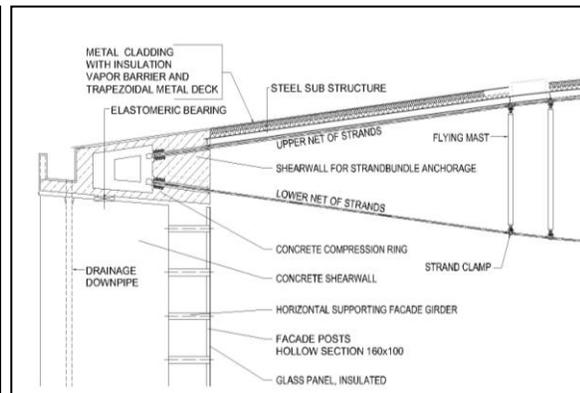


Figure 2 Components of the new roof

The new structure enclosing the aquatic venue is oval in plan with major axis length of 150 m and minor axis 130 m. This covers the existing stadium without the use of any interior columns. A cable supported roof system was selected as the least weight option for this long span roof.

The top consists of a corrugated aluminium sheeting backed by a perforated trapezoidal aluminium deck. Special hydrophilic insulation and a vapour barrier were used to prolong the service life of the components and to provide thermal insulation. The deck is supported by a steel sub-frame resting on the upper layer of a two layered cable net load carrying structure. The cables are anchored into the inner face of a hollow peripheral concrete compression ring, which is in turn supported by 32 cantilevered shear walls on pile foundations. To allow some movement due to thermal loads, and to allow for creep & shrinkage, guided elastomeric bearings were provided between the compression ring and the supporting shearwalls. Various components of the roofing system are shown in Figure 2.

Anticipating high chloride content in the swimming pool environment, hot dip galvanized seven wire strands sheathed with resin filled HDPE were specified. The cables consist of 13 strands in the upper net and 25 strands in the lower net. The cables were cut to calculated lengths and anchored into the compression ring. Both ends of the cables are dead ends and the stressing was



accomplished by installing vertical props (flying masts) between the two layers of cables. The ends of the flying masts are clamped to the cable nets after due adjustments so that the desired stress is introduced into the cables. The space between the flying masts was used to accommodate catwalks which house the new sports lighting and the sound systems. The structural steel elements, were painted with a C5-M (ISO 12944-2) rated system except for parts embedded in concrete.

2. Seating Bowl

The requirements of spectator sightlines, wheelchair access to each differently accredited areas (Athlete, Games family, Press, Spectators, etc), and the requirement for a six lane warm up pool

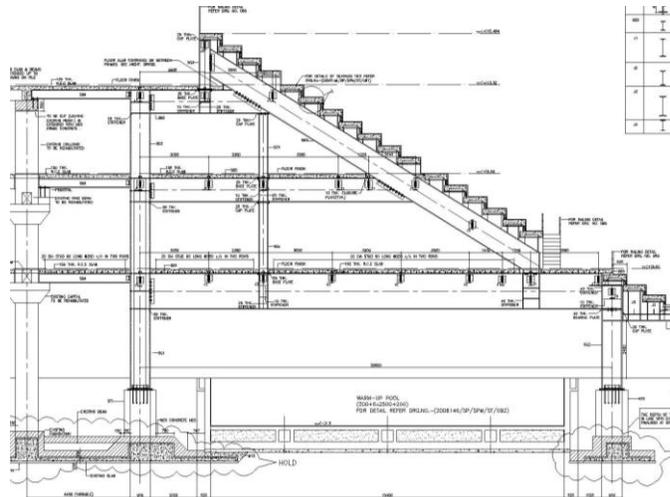


Figure 3 Retrofitted & upgraded stands

with sufficient deck space, required dismantling of the existing concrete arch supported stands. The new stands were built with a steel moment resisting frame with a clear span of approx 22m to accommodate the warm up pool in lieu of the existing 4 lane pool. Steel was proposed so that the existing foundations designed for a heavier concrete frame could be reused, and to keep structural depths low to afford some flexibility in providing the necessary sightlines for the spectators. Figure 3 shows the layout after the new construction.

The diving tower was replaced to include space for synchronized diving, and to be upgraded to the latest FINA dimensional and vibration frequency requirements. New water filtration & temperature control systems along with HVAC system were also installed for the games.

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New ramped entry structures were provided along with several lifts to allow wheelchair access to the concourse and the seating areas for all classes of accreditation. Public facilities were added to bring the stadium at par with the international requirements. Since the city's building laws did not allow for any significant increase in the footprint of the stadium, a few facilities specific to the conduct of games were provided in the form of temporary structures

The project's success is another example of the numerous possibilities and solutions cable supported roof system can provide. Due to minimized dead load, cable systems have a key advantage for spanning large distances.