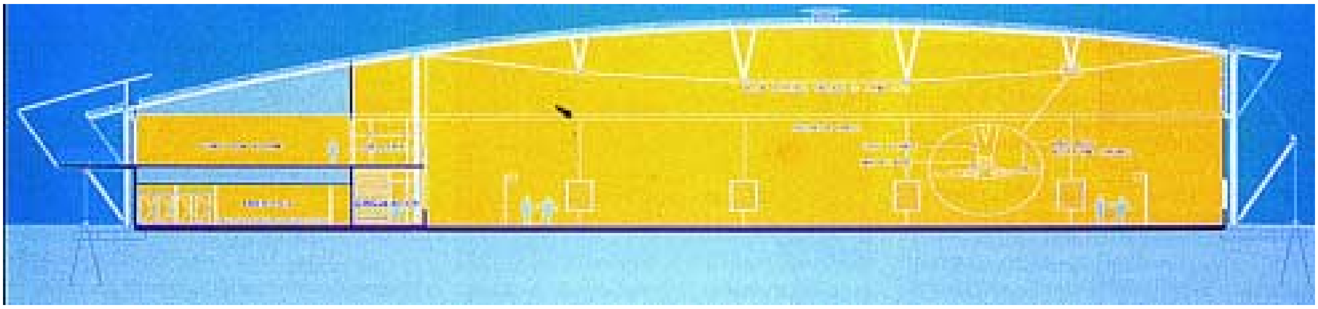


WANNEROO INTERNATIONAL NETBALL STADIUM

A dynamic stadium design matches the excitement of this fast-paced game

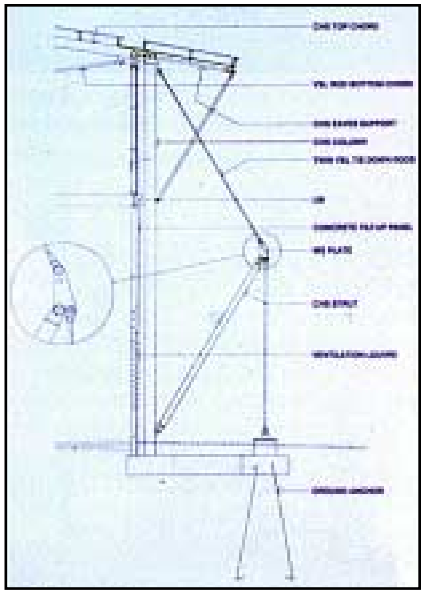
WHAT IS NETBALL?

Netball is a game similar to basketball. There are seven players on each team and the idea is to get the ball in the opposing goal hoop as many times as possible throughout a 60 minute match. The netball court is 100' long by 50' wide and is split by two lines that divide the court into thirds. At both ends of the court there is a shooting semicircle and a 10' goal post with no backboard. Each team member has a specific position that is restricted to an area on the court. These restricted areas have an attacking and defending player in them, each from an opposing team.

By Rupert Grayston

THE WANNEROO DISTRICTS NETBALL ASSOCIATION in Perth, Western Australia is proud of their new home. The architecture is stunning and the facilities are world class, with four state-of-the-art netball courts and extensive amenities. The price tag, however, is a modest $3.6 million (Australian). The architects Cox Howlett and Bailey and structural engineers Connell Wagner developed an exposed steel frame as a dominant architectural feature of the building. A tensile roof structure made up of ten bowstring trusses span 39 meters (128.7') over the court area. The structure imparts a lightweight and elegant appearance, while remaining cost effective.

"A large floor area with a clear span was required; this lent itself to a steel roof structure," Greg Howlett, Director of Cox Howlett and Bailey recalls. "Conventional portal framing would have provided an efficient solution, but would not have been aesthetically acceptable. Instead the approach was to get



as light a structure as possible and to use the materials economically to pay for the special components and the more detailed fabrication and erection."

The bowstring trusses are formed from a curved CHS top chord, a bottom chord of proprietary VSL high tensile bars and forged fittings, and V-shaped fabricated web members. In total the roof structure is a featherweight 12 kg/m^2 (2.5 psf), inclusive of columns, bracing, purlins and trusses. Downward loads are resisted by tied arch action, with each bowstring truss spanning between supporting columns. Upward loads are resisted by catenary tension in the top chords alone. A pair of VSL rods transfers this tension force from the top of each column to an external pile cap. Tensioned ground anchors then hold down the pile caps.

According to Don Phillips, Director of Connell Wagner, "It is important with such projects that the structure takes an efficient form and its capacity is fully utilized. The frame must have a dual function of structure and aesthetics to that the additional fenestration is not required. With a creative collaboration of architect and engineer, a good result can be achieved without a high cost premium."

Australian Institute of Steel Construction's fabricator member Metro Lintels, of Bibra Lake, in Western Australia, performed the shop detailing, fabrication, surface treatment and erection of the 100 tonnes (110 tons) of structural steel that went into the project. They were well prepared for the erection of the light steel frame, ensuring a smooth and safe operation on site. "We

wrote a detailed method statement and pre-assembled one complete truss in the workshop," says contracts administrator Karl Cicanese. "We made special jigs for site assembly of the trusses on the ground. Each jig had two cradles to support the truss ends and a long bar separating them to control the truss length."

The concrete tilt-up wall panels were first erected onsite, with temporary props providing support. The steel columns with tie-downs loosely attached were then erected. Finally, a steel ring beam was connected to the columns. The bowstring trusses were assembled stick by stick on the jogs, and the top chords site welded. The threaded VSL rods were then adjusted to attain the required truss curvature. Two 40 tonne (44 ton) mobile cranes then lifted the trusses in to place in pairs with purlins, bridgings and flybraces attached. Judicious placement of chains allowed the lift to be performed without strong-backs.

After erection of the trusses, the purlins to the intermediate bays were erected. Metro Lintels assembled the purlins and bridgings one bay at a time at ground level, hung off two strong-backs at measured heights to form the curved roof profile. They then craned the purlin assemblies into place. Riggers, able to walk the trusses with harness protection, bolted the purlins in place.

Tensioning of the tiebacks to the external ground anchored footings completed the steel structure. The tilt panel props were removed and VSL rods adjusted as necessary for plumb. By performing most of the assembly at ground level, Metro Lintels maintained a high quality of workmanship and a safe working environment with minimal delays.

Main contractors, BGC Constructions, completed the project in September 1997, after a construction program of only about 31 weeks. This was made tighter still by the need to complete and vacate the building 12 weeks earlier to accommodate the court flooring contractor.

According to Jerry Tugwell of BGC "We worked closely with the client and architect to ensure they got what they wanted. We were able to finish before time and within budget and we are very pleased with the finished result." The client's project coordinator and centre manager Barbara Connett was likewise pleased, "The building has been a huge success and looks $2 million more than its budget. The steel theme is brilliant. The architect and builder have matched our dreams with reality."

Grayston is the Australian Institute of Steel Construction's State Manager Western Australia. This article first appeared in "Construct In Steel" and is reprinted courtesy of the Australian Institute of Steel Construction.