RSIO

Summer 1989

Volume 3 No. 2

Case History Report

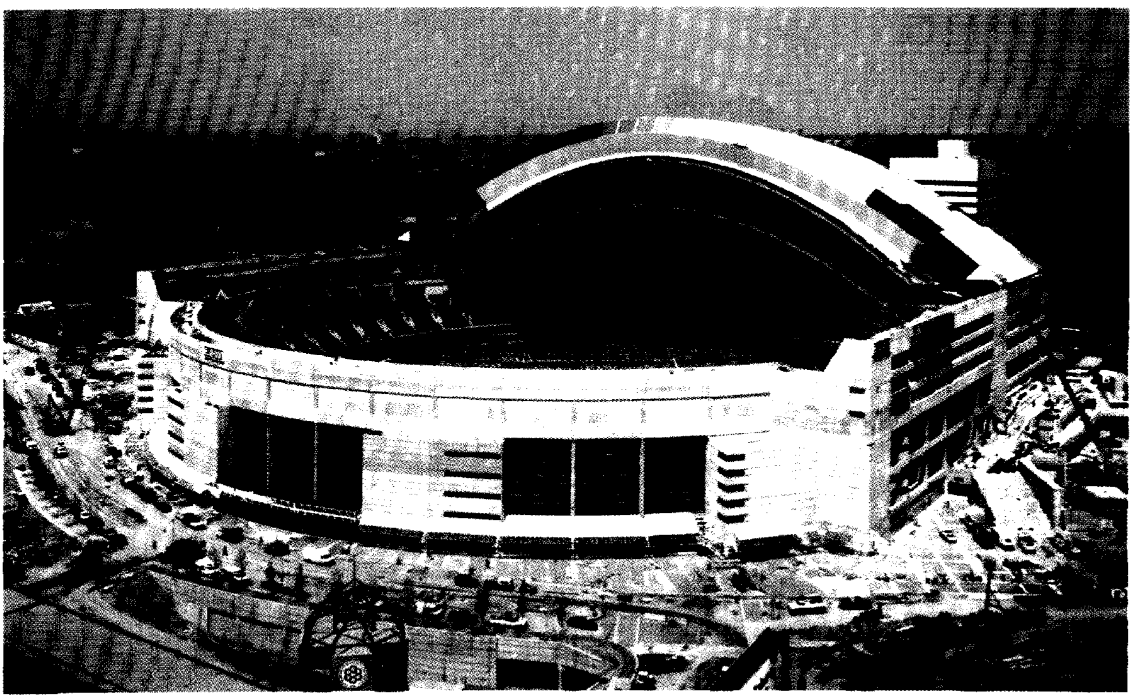
SkyDome

Without the use of reinforced concrete in the SkyDome, the marvel of the only completely retractable stadium roof on the planet could never have happened. Even before groundbreaking, the glamour and wonder of this never-before-seen roof grabbed all of the attention and newspaper headlines.

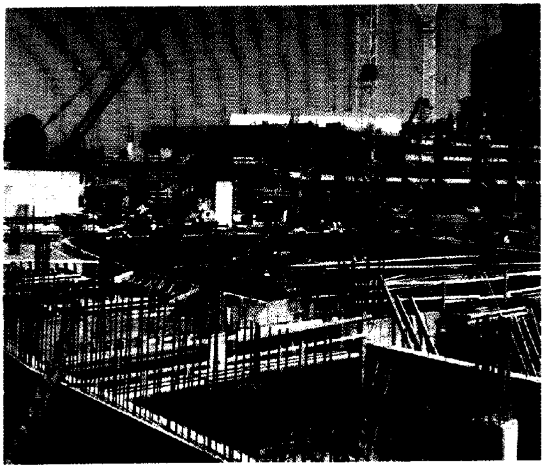
The track beams, on which the trucks ride to effect the motion of the three moveable roof panels, is of cast-in-place reinforced concrete construction. Reinforced concrete is ideal, as it conforms to any and all shapes.

Building the all-important track beams was a challenging undertaking, due to the complex geometry of their design. There are two straight, parallel sections on the west and east, positioned on either side of the circular beam, which allows the 270 degree circular movement of the south panel. It was obvious that diverse shapes such as these demanded the special qualities of reinforced concrete.

With rail tolerances required to plus or minus 3 mm, the pouring of the concrete around the 2 200 tonnes of rebar in the track beams had to be completely accurate to minimize grouting. The ability to meet the tight tolerances had an unexpected benefit. The roof moved much more quietly than had earlier been anticipated.



SkyDome's exposed concrete exterior – an effective, economical finish. ▲



Effective scheduling of work areas was a must. ▲

The ability of cast-in-place concrete to adapt to design changes was tested early. Soon after work on the foundations had begun, a proposal was introduced to endow SkyDome with a 370-room, 12-storey hotel, to be situated at the north end of the stadium. Ideally suited to the design/build method, concrete met the challenge.

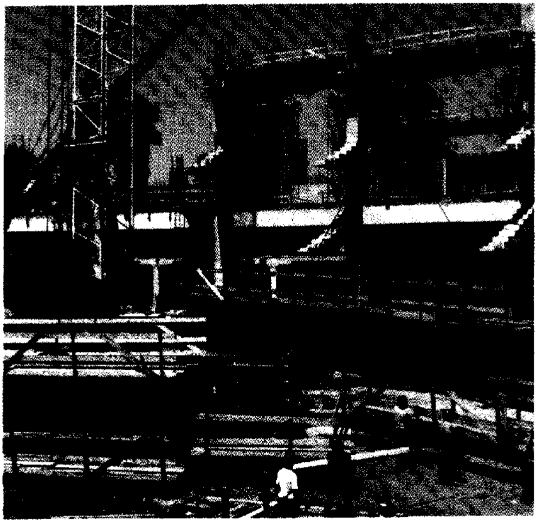
Footings and columns in the hotel area were strengthened, while the schedule on the remainder of the footings was maintained simultaneously. Similarly, the concept of a 3-level health club (below grade) on the west side was translated into a reality.

The confined space in which the work was taking place added to the problems that needed answers. Storage yards for rebar were set up outside the site's perimeter and a farm wagon hauled the steel to the site as required - a somewhat unsophisticated solution that nevertheless did the job.

Much of the work in preparation for the pouring of the 48 main frames was completed at ground level. By assembling rebar cages on site and hoisting them by crane, this part of the job took less than half the usual time. In all, about 2,000 self-supporting rebar cages were made, eliminating the cost of scaffolding and the time it would have taken to build it. Since the components of the main frames had been made at ground level, gaining access for placement without the benefit of floors to work from, was another part of the puzzle to solve. The answer was to build 600 mm wide platforms on two opposing sides of the pre-assembled forms, to serve as walkways. It was then relatively simple to drop the rebar cages into place.

Columns and main frames were constructed first, with tie beams coming later. A further factor which helped to speed things up was the use of full tension mechanical connectors employed at the intersection of the tie beams and mainframes.

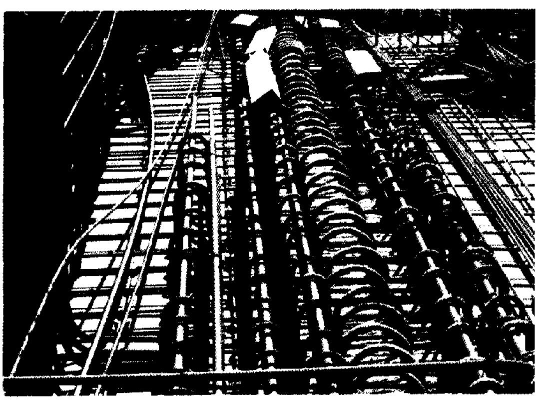
◄ 48 cast-in-place main frames form the basic structure.



Concrete forms were preassembled with 600 mm walkways.

For many vertical connections, mechanical splices were once again employed instead of bulky laps. Where compression only devices were required, adjoining ends of rebar, saw-cut to tight tolerances, were held in position by the connectors as the concrete was poured.

The ultra fast-tracking approach would dictate ingenuity and cooperation by all trades. Interaction between the RAN Consortium and the reinforcing steel fabricator was crucial to review complicated reinforcement placing sequences, since the design/build schedules did not allow the luxury of time for the submission and approval process common to other construction methods.

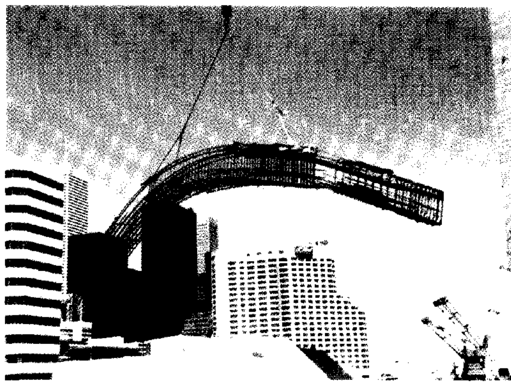


Reinforcing steel in the SkyDome is almost twice the weight of steel in the roof.

Using cast-in-place reinforced concrete not only saved time - it was also cost-efficient. Since its natural properties render it virtually fireproof, the need for extra fireproofing is unnecessary. Nor does it have to be painted. SkyDome's exterior finish is exposed concrete.

Reinforced concrete's inherent adaptability makes it possible to conform to any shape or form. No matter how eccentric, the combination of rebar and concrete greatly increases the stability of a structure; vibrations and sounds are more easily absorbed.

The reinforced concrete cantilever design of the seating levels not only formed the stepped aisleways, but, allowed for an unobstructed view of the complete playing field.



2000 rebar cages were prefabricated at ground level.

The 15 000 tonnes of reinforcing steel used in SkyDome varied in size from 10M to 55M and represents almost twice the amount of steel in the roof. Predominantly grade 400 MPa, some of the rebar was a weldable grade and some epoxy-coated. The epoxy was used mainly in high-traffic areas such as vehicular ramps, as well as in places where wintertime use of salt called for a durable component.

There is more than a passing resemblance between SkyDome and Rome's Coliseum. Viewing these edifices, comparisons are inevitably made. Rome's Stadium has endured for a couple of thousand years - SkyDome undoubtedly will be a landmark centuries from now.

'Coliseum like' SkyDome takes shape. ➤

◄ Cantilevered beams provided unobstructed views.

Credits:

DESIGN:

Architect: Roderick Robbie

Engineer: Mike Allen

Prime Consultants:

RAN Consortium, Architects and Engineers
Robbie, Sane Architects Inc.
Adjeleian, Allen, Rubeli Limited
NORR Partnership Limited

General Contractor: Ellis-Don Limited

Photos: Lenscape Inc.

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