Creating the world’s best long-track speed-skating rink required engineers to construct a super-flat slab inside a structure resting on more than 700 feet of soft, compressible soil. To achieve this goal, designers used a reinforced concrete structural system and foundation to create an Olympic-grade athletic complex that is LEED Silver certified.

The challenges were daunting. Nearby project sites were known to settle as much as 7 inches, yet the Richmond Speed Skating Oval in Richmond, British Columbia, could not vary from level any more than 7/10 of an inch over its full length—a distance of over four times the length of a football field. The solution not only achieved the flatness required but provided space for 450 cars, athletic services, retailers and a rowing-training facility at no significant additional cost.

A two-level structure was designed on a combination raft and piled foundation in densified soil. The raft foundation is located in the infill areas between buttresses and has the dual purpose of supporting the suspended ice slab above in addition to serving as the parking-slab surface at grade. More than 84,000 square feet of 6-1/2-inch-thick conventionally reinforced concrete also was used to encase the in-slab refrigeration and cooling lines for the ice slab.

Pile caps located on the building’s north and south sides support the buttresses and in turn are supported on 460 reinforced concrete expanded base (Franki) piles. The buttress loading required heavy compression foundation resistance, yet due to soil layering, the piles only needed to be end-bearing at a relative shallow soil depth. Conventionally reinforced concrete was used for the buttresses due to its high compressive strength and stiffness.

The structural system consists of 13 post-tensioned reinforced concrete beams, each 2-1/2 feet wide by 12 feet deep and more than 344 feet long. They serve as both buttress-tension ties and support for the hollow-core and ice-slab structure. Fourteen bays of 14-inch-deep reinforced precast concrete hollow-core panels span 35 feet between post-tensioned beams. A mezzanine also was created, consisting of an 8-inch-deep slab and conventionally reinforced 20-inch-deep slab band structure.

The concrete allowed the visually exposed buttresses to form a significant aspect of the facility’s architecture, which includes cast-in native artwork at the water run-off runnels in the northern buttresses. Two elegant, wraparound architectural stairs were created of conventionally reinforced concrete. They connect to the buttress with a single steel clip creating a “floating” appearance.

The attention to detail and careful coordination of engineering needs created a distinctive and cost-effective building that will help train Olympic athletes for many years to come.

**Building an elevated ice rink above parking killed two birds with one stone. The design solution uses site-cast concrete to achieve a powerful aesthetic. The concrete also was instrumental in solving a geotechnical problem, resolving forces internal to the structure and letting the concrete solve multiple design challenges. It was a very innovative solution.**