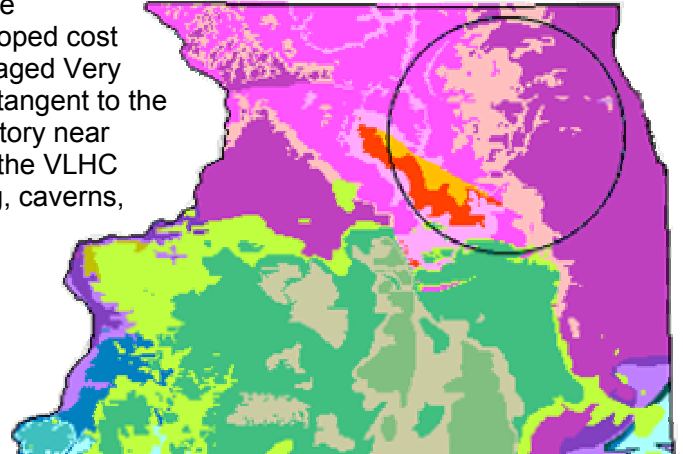


# Heavy Civil Construction Costs - Very Large Hadron Collider Northern Illinois

The team of CNA Consulting Engineers and the Toronto office of Hatch-Mott-MacDonald developed cost estimates for underground construction of a staged Very Large Hadron Collider (VLHC) project located tangent to the Tevatron at Fermi National Accelerator Laboratory near Chicago, Illinois. Conventional construction of the VLHC consists of a 233-km circumference tunnel ring, caverns, shafts, risers, and other tunnels and facilities. CNA's work addressed the anticipated construction costs for excavation, ground support, water control and lining of the underground, heavy civil portion of the conventional facilities. Costs are estimated for three tunnel alignments—the North Inclined Ring, North Flat Ring, and South Inclined Ring—and tunnel diameters of 12 ft and 16 ft.



Underground construction components of the VLHC project include the main beamline tunnel, many caverns of varying size and shape, straight and bypass tunnels, portals for the equipment tunnels, injection ramp connections to the existing Tevatron, a magnet installation ramp of the far side away from FermiLab, major experiment installation shafts, access shafts, emergency egress and ventilation shafts, site risers, and utility penetrations. Tunnel depths for the alignments varied from 180 ft to 700 ft below the ground surface. The tunnels and caverns for all alignments would be constructed in the limestone, dolomite, shale and sandstone bedrock of northeastern Illinois. Shafts would be constructed in the bedrock and overlying glacial soils.



Fourteen rock condition types encountered in the three alignment alternatives were assigned to one of three tunneling conditions types:

- TBM Type A is used in the best rock conditions where minimal ground support and water control is required
- TBM Type B, an open TBM with finger shield, is used where more ground support and water control is required
- TBM Type C, a sealed TBM, is used where water inflow is great enough to require immediate sealing of the tunnel.

In all cases, the ground support, grouting and final lining methods were selected to produce stable excavations with less than 50 gpm average water inflow per mile of tunnel, including the inflow from caverns and shafts.

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**Owner — Fermi National Accelerator Laboratory**

**Completion Date — NA**

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