

Road Sub Base

Central Road, Schaumburg, IL
Cook County Highway Department
2003

Density: 30 pcf

Volume: 10,400 cy

Due to underlying peat and compressible soils, Central Road experienced a costly cycle of continued settlement and “quick-fix” asphalt overlays. During the reconstruction of this four-lane highway, a long-term solution was achieved via the use of PROVOTON foam concrete. An average depth of 4.25’ of foam concrete was placed 70’ wide over 950’ of the roadway for construction of the lightweight road (raft) foundation. Also, eight - 10’x10’x3’ deep, foam concrete pads were constructed in lieu of rip rap foundation to support the manhole structures from settling along the roadway’s shoulder. This is a typical “Two-stage” road fill project where steel sheeting is installed down the centerline of the roadway to support live traffic while excavation, placement of foam concrete, and pavement construction can be preformed in the first stage. Once complete the traffic is switched and construction on the other side begins.

The project scope was 3 km in length of full depth reconstruction of a four-lane road with drainage improvements and installation of curb and gutters. At the east end of the project, the road is constructed over a marsh area with soft organic underlying soils (peat) located at a depth of 3m to 5m under the road. The original roadway over the marsh area had continually settled, and for temporary improvements, the owner had placed a number of asphalt overlays on the settled section. The asphalt overlays although temporarily improved the roadway surface, it increased the loading on the soft soils, which in turn increased the settlement.

Removal and replacement of the poor soils would have been costly due to their depth and to provide adequate stability for the active two lanes of traffic during the two stages of construction would have been difficult. The owner chose a cost efficient lightweight fill design to bridge over the soft soils. The design of the lightweight fill is to excavate a minimal amount of soil and to replace it with a lightweight material that will provide load reduction and bridge over the soft underlying soils for a lightweight foundation.

Expanded polystyrene (EPS) was originally designed in as the lightweight fill material. Typical cross section of the lightweight fill below the road structure was a 150mm sand leveling pad placed on the excavated soil, with 1250mm on EPS on top of the sand pad, and topped off with 125mm thick reinforced concrete cap.

The general contractor proposed a combination of a 900mm thick layer of 400 kg/m³ and 600mm layer of 500 kg/m³ PROVOTON foam concrete in lieu of the EPS to construct the lightweight fill. The major benefits the general contractor sited to the owner for the change in material was lower unit cost, less installation time, and higher quality of material.



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Permanent steel sheeting was installed down the center lane of the roadway to support the two westbound lanes with two-way traffic during the first stage of construction so the eastbound pavement could be removed and soil excavated to be replaced with foam concrete. The excavation was 1.5m deep x 300m long x 21m wide (total for all four lanes, 10.5m wide per stage).

Prior to placement of the lightweight fill, 600mm Ø concrete drainage pipe was installed parallel to the south side of the roadway connecting to four manhole structures. The structures were set on 600mm of crushed concrete riprap. The weight of the manhole structures was too much for the soft soils and settlement of the sub base of stone and the structures was almost immediate.

Proposed to the owner was to remove the structures and sub base stone and to construct 3.3m x 3.3m x 750mm thick PROVOTON foam concrete mat foundations to support the manhole structures in place of the stone sub base. The foam concrete mat foundations provided enough load reduction that there was no additional loading on the sub soils. Once the manhole structures were in place again, placement of the foam concrete road foundation began.

The foam concrete fill was placed in 300mm to 375mm thick lifts with a typical placement volume of 600-650cm³/day. The following day, a subsequent lift of foam concrete was placed on the previous days' pour until the final elevation of the lighter density material was made. The last 600mm was the 500 kg/m³ material to finished elevation for the foam concrete fill with the road structure consisting of 300mm of sub base granular material and 275mm thick asphalt concrete pavement.

Traffic was switched over to the newly constructed eastbound lanes in stage two and pavement removal and excavation began on the westbound lanes. Construction was similar to the eastbound lanes including construction of four mat foundations of foam concrete to support the manhole structures in the roadway.

This project is typical for the construction of lightweight foam concrete road fills. Soft organic underlying soils with low bearing capacity, which will consolidate and compress with additional loading. Some common methods for soil improvement in these areas had been to remove and replace the poor soils with suitable soils or structural fill, surcharging the area, and installation of wick or sand drains with surcharging.

Costs associated with removal and replacement of soil have risen greatly due to labor, equipment, trucking, and material increases. And most projects do not allow time for surcharging in the schedules, so removal of minimal amount of soils and bridging over the compressible soils with additional load reduction provides for cost efficient method to construct settlement free construction. Total volume of foam concrete placed - 9,600cu. m.

