

Piles Supported Embankments For Accelerated Construction

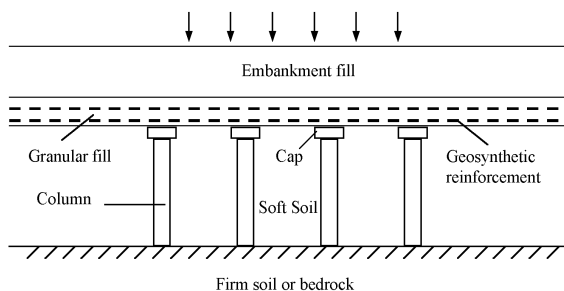
Problem:

Historically, the most frequent cause of the longest construction durations has been the presence of soft site soils which require “Ground Improvement” in order for the roadway to provide an acceptable level of short and long-term performance. The least direct cost ground improvement solutions can require between six-months to four-years. The most accelerated methods can be up to ten times the cost of the long duration solutions. Currently, soft soil projects have become much more frequent and problematic as described below.

- *New Alignment Projects.* The only land available is that which is not economically viable for most commercial purposes. Specifically, the soils are extremely poor, contaminated, and/or the site is a closed sanitary landfill.
- *Widening of Existing Roadways over Soft Soils.* The most economical solution of wick drain and surcharge will not only be of significant duration, but will also include issues of: (1) long term differential settlements between the new and old embankments (longitudinal depression along the length of the alignment); (2) lateral instability of new and old embankment; and (3) damage to existing utilities, adjacent bridges and buildings.
- *Special Deposits.* Landfills, Dumps, Wastes from Mining Operations, Brownfield sites, etc. Two major problems exist with these sites: (1) they may be difficult if not impossible to sample and test by ordinary means; (2) because of this, their engineering behavior is not well documented, well understood, and usually can not be designed with confidences; and (3) the least cost method of wick drain and surcharge would cause a “squeezing out” of significant quantities of contaminated water.

Putting it in Perspective:

The current economic approach and political realities of highway projects make traditional long duration ground improvement to costly and unacceptable in many instances. In addition, many new highway projects are widening of existing roads or they cross special soil deposits where traditional methods are not technically viable.



Solution: Modern Pile Supported Embankments – see diagram above

The use of pile supported embankments is not a new technology. Embankments on relief piles have been used for more than 60 years, and “modern” stone pile technology was first implemented in Europe in the 1960’s. However, the new approach of considering total direct and indirect project costs along with newer more economical designs has dramatically increased the usage of pile supported embankments worldwide. Specifications, for designing modern pile supported embankments have been implemented in the United Kingdom, Sweden, and Germany.

Modern pile and soil reinforcement technology, pile supported embankments will frequently provide the best combination of economy, construction speed, settlement performance, reliability, installation/QC simplicity, and environmental compliance than that of any other ground improvement method or bridge construction technique.

Benefits:

- The Pile Supported Embankment method is a very rapid technique for constructing embankment over soft soils. The mechanics of the technique allow for immediate embankment construction in a single placement stage.
- Pile Supported Embankments are a highly effective technique for widening of existing Roadway and Railway embankments. No differential settlement between the new and old embankment, no instability issues (the embankment load is transferred to the stiff piles and not the soft soils).
- Pile Supported Embankments are extremely well suited for Special Deposits Sites. The embankments loads are transferred to the pile and not the soil, so detailed knowledge of the existing soils strength and settlement characteristics are not needed. Also, this load transfer method eliminates the squeezing of contaminated soils from the site.
- The advanced speed of construction is extremely well suited to toll/concession projects where each additional day of construction adds too both borrowing costs, and lost revenue.
- Unlike most of the other non-wick drain accelerated ground improvement techniques, pile supported embankment technology uses conventional practice for all aspects of design, specification and construction.

Applications

Modern Pile Supported Embankments have been designed and built extensively in Europe and Asia. In particular, the Construction of the Rapid Rail Network interconnecting the European Union.

Selected US Highway Projects.

Pile Supported Embankments (PSE):

- Route 9, Section 15D, New Jersey.
- Victory Bridge, Route 35, New Jersey.
- Woodrow Wilson Bridge Project, US 1 Interchange (VA), Phase II Ground Improvement will be CSE, Virginia DOT.
- State Road 13, Jacksonville FL, Florida DOT.
- Pile Supported Embankment, Iowa DOT.
- I-45 Galveston Bay Causeway, Texas DOT I-45.

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