



## TECHNICAL NOTE

---

TECH NOTE NO: 38

TITLE: Compaction of Unsuitable Materials in SW Quadrant of ORD

AUTHORS: Marshall Thompson and James H. Long

CONTACT: M. R. Thompson, University of Illinois, Dept of Civil &  
Environmental Engineering 1215 NCEL, MC-250, Urbana, IL  
61801, Ph: (217) 333-3930, e-mail: mrthomps@uillinois.edu

DATE/REV: 08/29/08

---

The existing profiles of the Southwest Quadrant of the airfield are quite variable. Variable depths of fill materials composed of soil plus many types of construction debris and wood are present. The 5-9-08 Wang Engineering letter summarizing the results of 93 test pits excavated in the area indicates:

“The existing fill material consists of a mixture of soil and construction debris such as concrete, asphalt, steel, wood and bricks ...”

The test pit data showed the fill material depths vary from 0 to greater than 20 feet.

Several remedial options were considered by O’Hare Airfield Engineers (OAE). They are shown in the MATRIX file (Improvement Matrix 0709083.xls) prepared by OAE. In an 8-21-08 telephone conference (Long, Thompson and Lange - UIUC, and OMP an OAE representatives), OAE briefly described the Southwest Quadrant conditions. Various remedial options presented in the MATRIX were discussed. OMP and OAE considerations (technical feasibility/desirability and an initial economic analysis of the various options presented in the MATRIX document) trended toward the selection and more in-depth evaluation of two options: **DYNAMIC COMPACTION (DC)** and **UNDERCUT/BACKFILL (UC/BF)**.

**NOTE:** Following the TELCON, David Lange brought a CD with various files concerning the problem for review by Long and Thompson. A copy of the MATRIX file was also provided to Long and Thompson.

Long and Thompson have reviewed the CD information/data that the CD and also the "MATRIX" of potential options. We offer the following comments/observations.

\* Based on the test pit photos and the soils lab data, it is apparent that the majority of the soils are "fine-grained/ cohesive." The test pits were standing "open" with somewhat vertical sides on the excavations. Most of the soils have > 20% clay content and high PIs and LLs. Typically, these soils are not particularly amenable to dynamic compaction. The predominance of fine-grained soil is also supported by the results of many cone penetration tests conducted throughout the area.

\* Dynamic compaction is less effective on fine-grained soils, and particularly ineffective if the fine grained soils are saturated or nearly saturated. The presence of a water table at some locations and not at others would result in non-uniform compaction/densification. The presence of large obstructions such as tree trunks could also introduces challenges to uniform compaction/densification.

\*Cut/fill areas should not have any abrupt changes in elevation (thickness of fill should taper gently).

\* OMP/OAE indicated the economic analysis suggests a 2.5% to 3% premium for the UC/BF option. Suitable fill material is available for executing the UC/BF option.

\* OAE has prepared an EXHIBIT (File Name: 080318 SW Quad Undercut Areas.pdf) showing the variation in undercut depths for the runway, taxiway, and shoulder areas. Most of the UC depths are in the 6 to 10 foot and 10 foot to 15 foot range.

\* Good quality control concerning BF material selection and placement conditions (density/moisture content) can be achieved with UC/BF. Thus, a more uniform compacted fill is achieved and the possibility of differential settlement reduced.

\* As the BF approaches subgrade level, BF soils most amenable to lime treatment should be utilized. Lab testing should be utilized to confirm the suitability of the BF soils for lime treatment.

\* Runway/taxiway structural response & overall performance can be achieved with the UC/BF option.

\* Overall, UC/BF will provide a higher level of confidence/reliability. Long & Thompson concur with the OMP and OAE choice of UC/BF.