Validating Design Model and Performance Benefits of Multi-Axial Geogrids Used in FAARField® Runway Design Analysis

Brown Field Airport, San Diego, California

by Garrett Fountain, P.E., G.E.

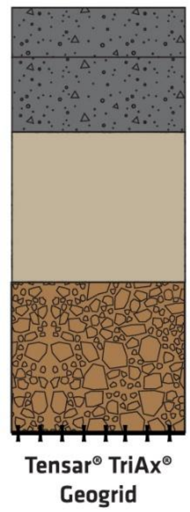
BACKGROUND

Brownfield Airport is located 1½ miles north of the US/Mexico border in the Otay Mesa Community of the City of San Diego. Established in 1918 by the U.S. Army as an aerial gunnery and aerobatics school, Brown Field served four branches of the US Military until 1962, when it was decommissioned and transferred to the ownership of the City of San Diego. Brown Field has since functioned as a public airport servicing commuter aircraft. The FAA has classified Brown Field as a reliever airport for San Diego International Airport.

APPLICATION

The subject project consisted of the rehabilitation of Runway 8L-26R. This included rubbilization of the existing concrete runway and construction of a flexible section. *(See cross section to the right).*

The plans prescribed using Tensar Multi-Axial TriAx geogrid for support of the crushed miscellaneous base due to poor subgrade support characteristics. For the design the Engineer modeled the benefit of the geogrid by simply doubling the CBR/Elastic Modulus of the subgrade within the readily available software FAARField®. Although this is a standard of practice for geogrids, data points documenting this are not common. During construction, the contractor encountered the anticipated soft subgrade soils. Field testing of subgrade using dynamic cone penetrometer confirmed CBR values between 1% - 2%.



PURPOSE / OBJECTIVE

Verifying the adequacy of the modeling of geogrids within FAARField® by subgrade enhancement methods.

TEST PROCEDURE

A series of third-party piloted Automated Plate Load Test's (APLT) were performed at the subject site. APLT is a system developed to perform fully automated static and repetitive/cyclic plate load tests, per AASHTO and ASTM test methods. For this project the elastic modulus and modulus of subgrade reaction were tested after achieving compaction just prior to geogrid placement at the planned subgrade elevation. Remarkably, the exposed subgrade surface achieved the required relative compaction but was NOT firm and un-yielding. The surface of the subgrade was pumping. This is an example of where relative compaction is not necessarily an indicator or performance. The APLT tests measured the support characteristics of the subgrade in accordance with AASHTO T222 identifying the existing elastic modulus and modulus of subgrade reaction. After the geogrid and crushed miscellaneous base placement the APLT tests measured the stress dependent resilient modulus of the:

- Composite crushed miscellaneous base, geogrid, subgrade
- Crushed miscellaneous base; and
- Subgrade.

The resilient modulus testing is performed in accordance with AASHTO T221.

RESULTS / KEY FINDINGS

Tensar representatives oversaw the testing of 2 sections with similar subgrade conditions. The first section consisted of 12 inches of crushed miscellaneous base underlain by TX5. The second section consisted of 14 inches of crushed miscellaneous base underlain by TX7. Table 1 presents a summary of findings.

TABLE 1

Section	TX5 Section	TX7 Section
Crushed Miscellaneous Base Depth (inches)	12	14
Modulus of Subgrade Reaction(K)[1]	51 pounds per cubic inch	42 pounds per cubic inch
Subgrade Elastic Modulus(E)[1]	1059 pounds per square inch	867 pounds per square inch
Subgrade Resilient Modulus(Mr)[2]	5493	9601
Suggested Subgrade Improvement Factor for FAARField Modeling	2.5	4
Measured Subgrade Improvement Factor[3]	**5**	**11**

1. *Based on APLT results*
2. *Subgrade Mr determined in accordance with AASHTO T221 and Odemark's method of equivalent thickness (MET) concept*
3. *It is assumed that the resilient modulus is equivalent to the elastic modulus*

The purpose of the testing was to verify that applying a subgrade improvement factor(SIF) within the FAARField® software is an acceptable method for modeling geogrids. **Based on the APLT test results, the modeling of multi-axial geogrids in FAARField® using a Subgrade Improvement Factor is acceptable, provided the proper product specific field performance and calibration factors have been validated using accepted field verification methods.**

The results also verified the addition of a multi-axial geogrid below the aggregate base course layer, stiffens the aggregate layer, improves load distribution and provides a better performing, more sustainable perpetual pavement structure.

REFERENCES

1. *"In Situ Performance Verification of Geogrid-Stabilized Aggregate Layer: Brown Field Municipal Airport, Otay Mesa, San Diego, California", prepared by David J. White, Ph.D., P. E. dated May 2016*

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