Pulse Velocity and Strength Properties of Acrylamide Grouted Sand

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Abstract
In order to better characterize the behavior of acrylamide grouted sand, triaxial test, and Pulse velocity method were used. The results showed that the strength properties and pulse velocity remained nearly constant after 3 days of curing. The average pulse velocity, friction angle and cohesion were $4.25 \times 10^3$ ft/sec (1300 m/s), 10°, and 53 psi (366 kPa), respectively for the acrylamide grouted sand.

1. Introduction
Non Destructive Tests (NDT), such as the ultrasonic pulse velocity and impact resonance have been successfully used to quantify the properties of different construction materials. Ata and Vipulanandan (2000) used the impact resonance method to determine the cyclic and dynamic properties of sodium silicate grouted sand. They reported P-wave velocities ranging from $10 \times 10^3$ in/sec (260 m/s) to $16 \times 10^3$ in/sec (420 m/s). Dano, Hicher and Tailliez (2004) studied the engineering properties of three different grouted sands by means of triaxial and grindosonic (impact resonance) tests, and cohesion varied from 30 psi (200 kPa) to 68 psi (450 kPa) and friction angle varied from 39° and 42°. Ribay, Maigre, Cabrillac and Gouvernot (2004) used the resonant column to determine the shear modulus ranged from $30 \times 10^3$ psi (200 MPa) to $75 \times 10^3$ psi (500 MPa) and damping ratios varied from 1% to 5% for sodium silicate, microfine cement and mineral grout grouted sands.

2. Objectives
The overall objective was to determine the changes in the mechanical properties of acrylamide grouted sand with curing time, using the Ultrasonic Pulse Velocity method, and the triaxial tests.

3. Materials and Testing Method
Commercially available “AV-118 Duriflex” N-methylolacrylamide (NMA) grout (Avanti Grout International, Webster Texas) was used for this study. Commercially available sand with the USCS classification of SP and $d_{10} = 0.10$ mm, and $d_{50} = 0.19$ mm with specific gravity of 2.62 was also used in this study.

4. Results and Discussion
The average unit weight of the grouted sand specimens was 118.6 pcf with a std. dev. of 5.25% and a COV of 0.02%. Triaxial UU tests were performed at confining pressures of 5, 10 and 20 psi. A stress-strain relationship of grouted sand is shown in Figure 1 and the failure strains were in the range of 2.5% to 3.5%. The angles of internal friction obtained after 3, 14, and 28 days were 11, 7 and 11 degrees respectively, and the
cohesion were 51 psi (325 kPa), 58 psi (400 kPa) and 49 psi (338.1 kPa), respectively (Figure 2).

The P-wave pulse velocity tests performed on the samples just before the triaxial tests and the values measured after 3, 14 and 28 days were $51 \times 10^3$ in/sec (1300 m/s), $55 \times 10^3$ in/sec (1400 m/s), and $51 \times 10^3$ in/sec (1300 m/s) (Figure 3).

5. Conclusion

The pulse velocity, cohesion, and friction angle of grouted sand remained almost unchanged after 3 days of curing.

5. Acknowledgements:

This work was supported by the Center for Innovative Grouting Materials and Technology (CIGMAT) with funds from NSF-International and private companies.

6. References:

