DEFLECTION CHARACTERISTICS OF CSM-LHT-T DETERMINED THROUGH STANDARD AND TRIDENT FOOTPAD STATIC PLATE TESTING

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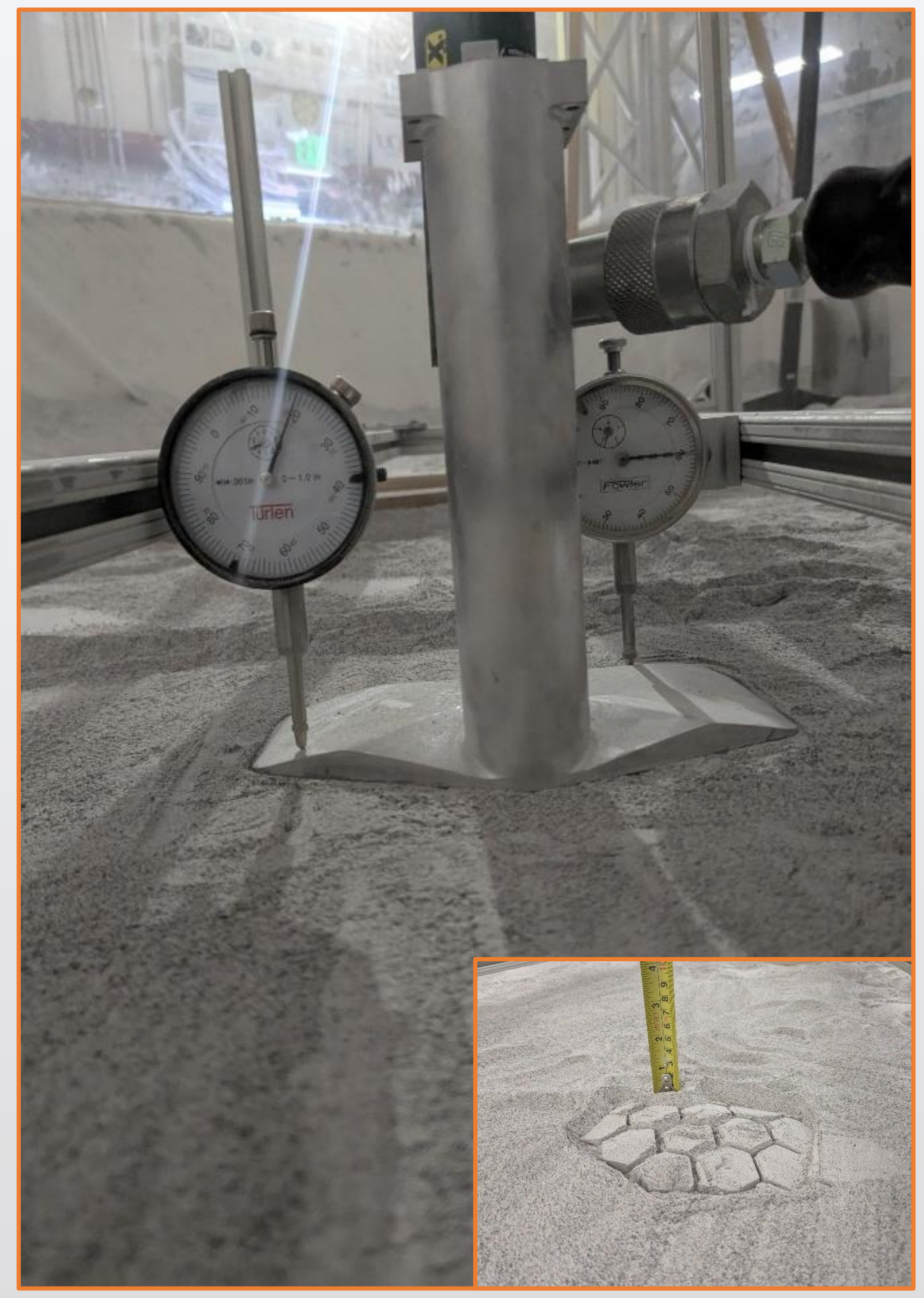
As lunar exploration initiatives progress toward sustained surface operations, a reliable understanding of lunar regolith behavior under loading is essential. Surface infrastructure, including landers, rovers, and construction systems, requires predictive models of soil deformation and bearing response. This study presents the results of static plate load tests performed on Colorado School of Mines-Lunar Highland Type-Testbed (CSM-LHT-T) lunar highland regolith simulant contained in the new Mines Lunar Surface Simulator (MLSS). The data collected during this testing used a standard plate geometry and the footpad from the Honeybee Robotics TRIDENT drill, focusing on the relationship between plate deflection and relative density. The findings support the development of in-situ geotechnical instrumentation and offer pathways to derive fundamental soil parameters from lunar surface loading tests.

Approximate D_r	Compaction Method
73%	Natural conditions of testbed
75%	Foot stamping
78%	Moderate hammer tamping
85%	Heavy hammer tamping



ASTM D1195 specifies that the curve generated by the recorded deflection data can be used to create a best-fit second-degree polynomial, which can provide geotechnical property approximation using these relationships:

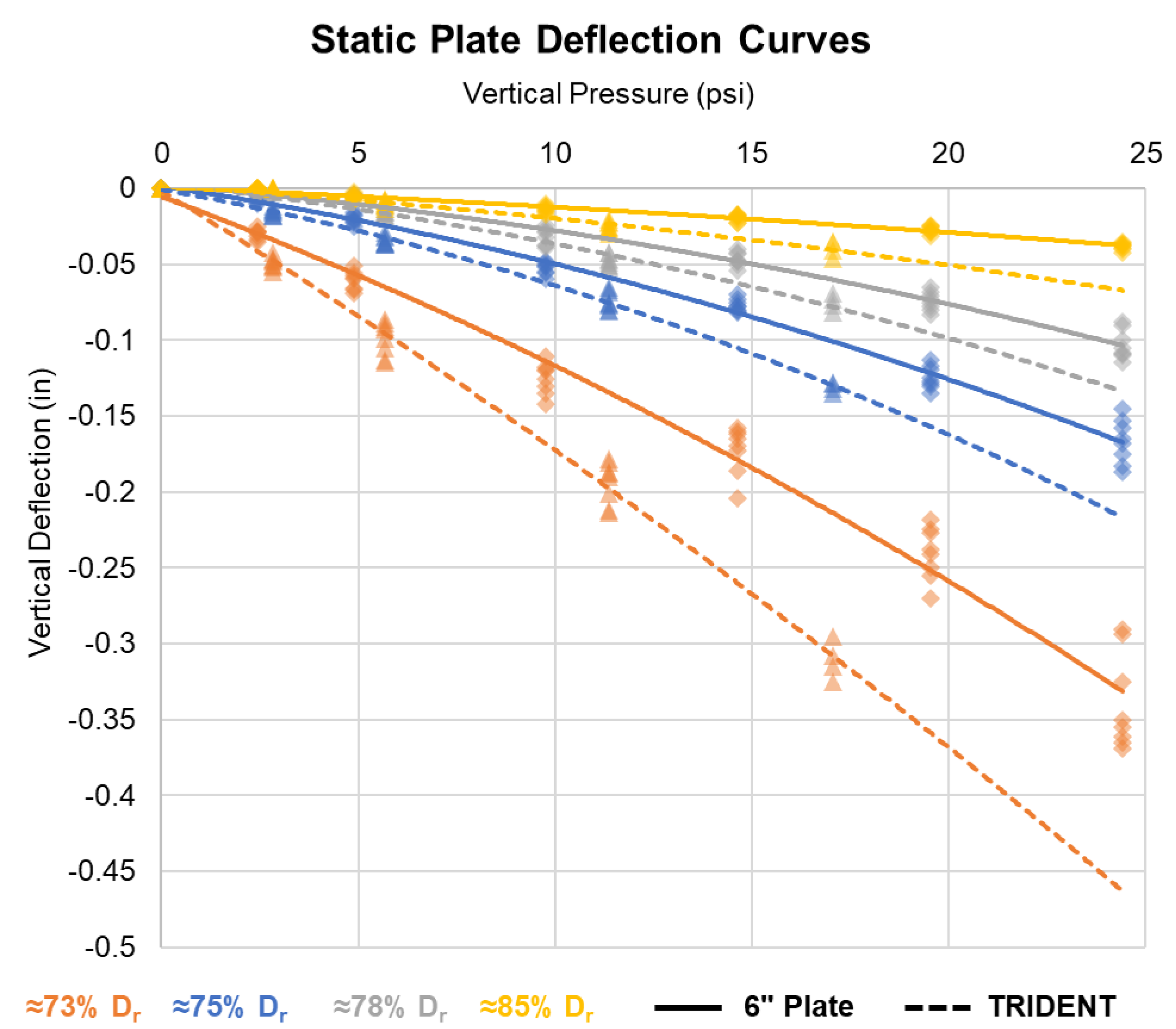
$$s = a_0 + a_1 \cdot \sigma + a_2 \cdot \sigma^2$$

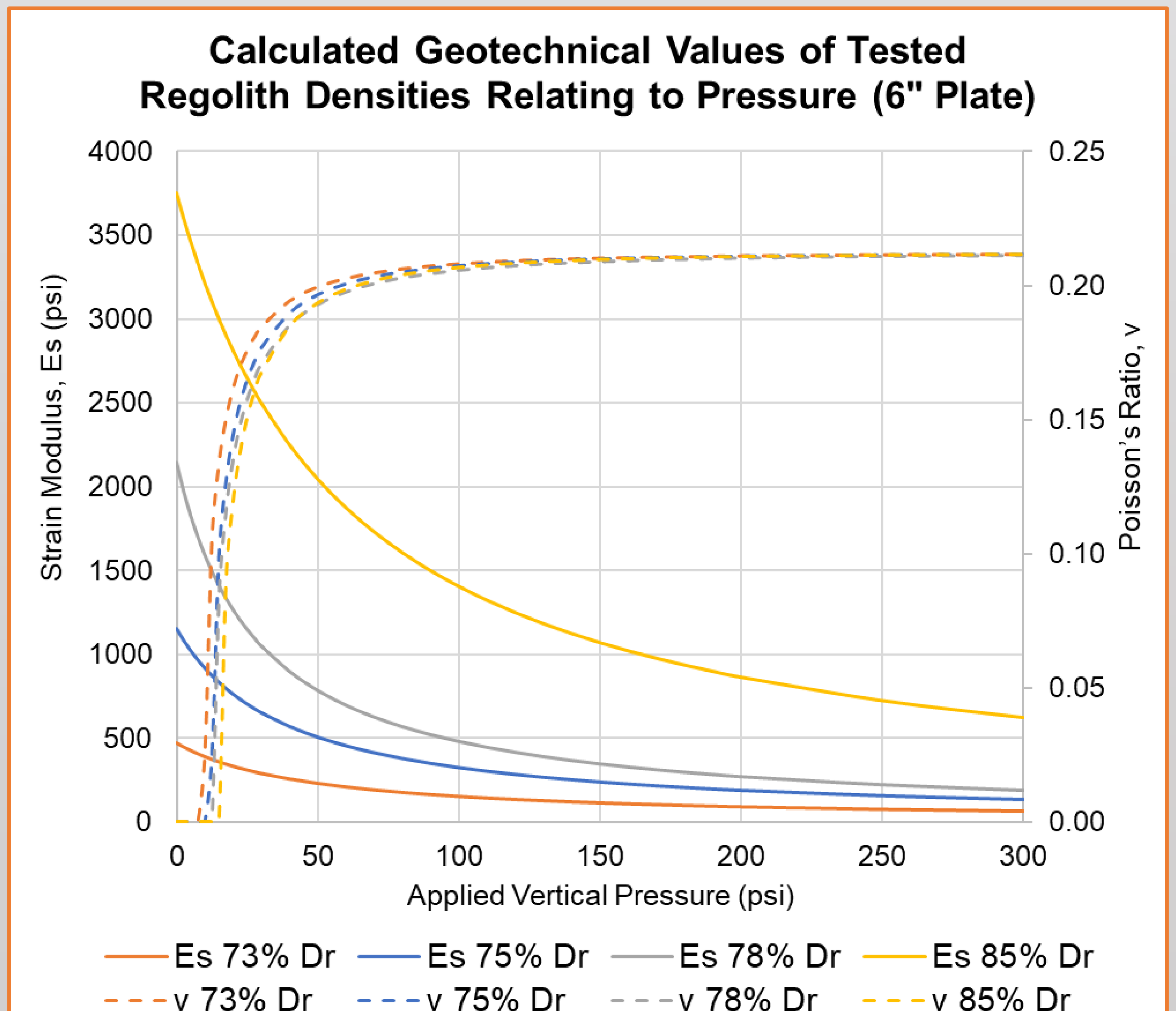
$$E_s = 1.5 \cdot r \cdot \frac{1}{a_1 + a_2 \cdot \sigma}$$

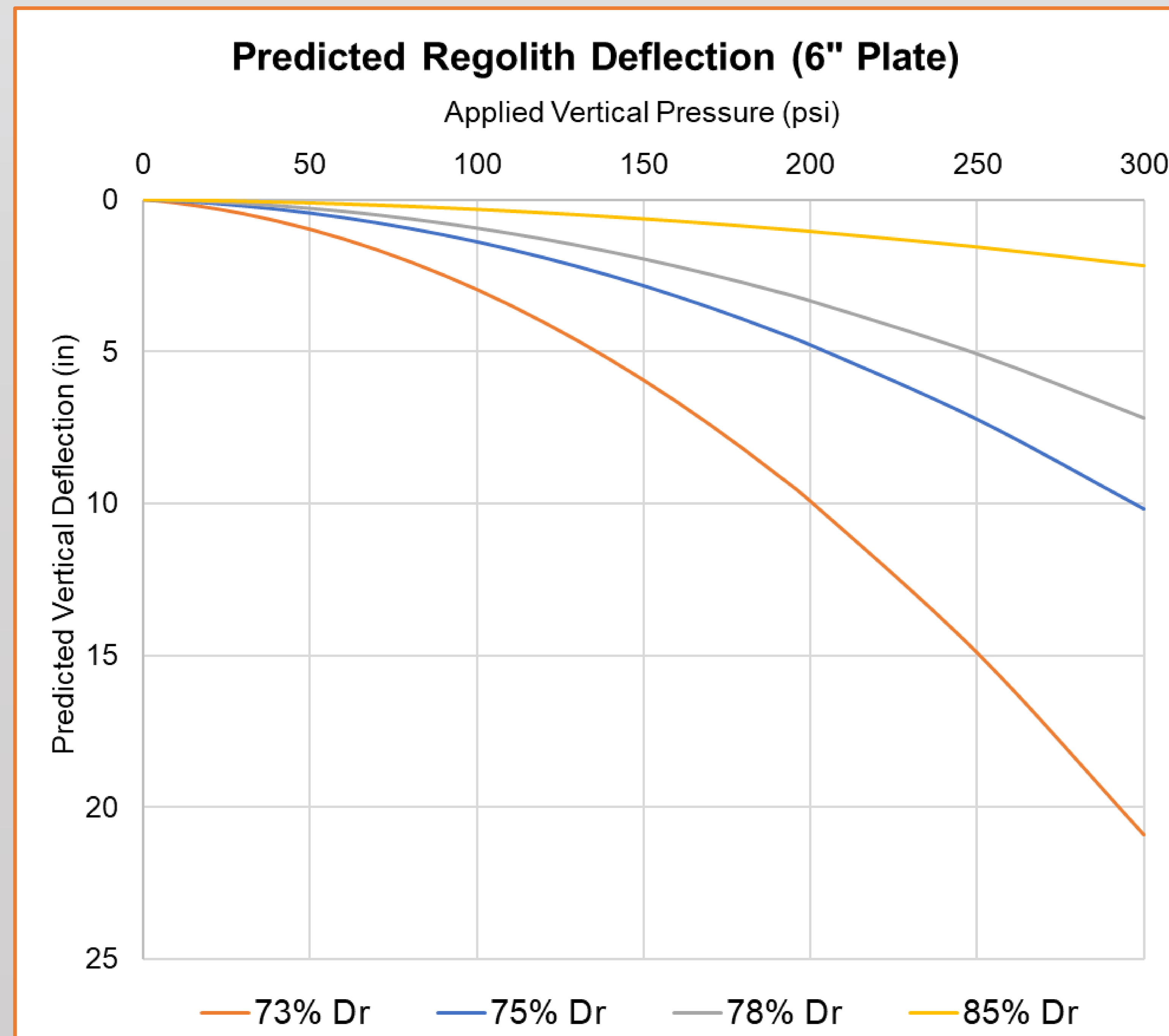
$$s = \frac{\pi \cdot \sigma \cdot r \cdot (1 - v^2)}{2 \cdot E_s}$$

$$v = \sqrt{1 - \frac{s \cdot E_s}{\pi \cdot \sigma \cdot r}}$$

s = measured vertical deflection, a_x = constants of the second-degree polynomial, σ = normal stress below the loading plate, r = radius of plate, E_s = strain modulus (Young's modulus for granular material), v = Poisson's ratio.







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