Response to Dr. Bryant, "The Theoretical Foundations of Geotechnical Engineering I: A Geotechnical Engineer Apologist's Perspective"[1]

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Introduction

First, the writer would like to thank Dr. Bryant for his thoughtful response to my earlier paper. Dr. Bryant addressed six points which addressed questions I raised in my Fall 2008 presentation[2] relative to the 3rd Edition of the PTI Design Manual. The following response is relative to the applicability of the "trumpet" shape suction profile for calculation of the potential movement of the ground surface, y_m. The balance of the questions will be addressed at a later date.

It should be mentioned that I have been reminded that the Volflo program is a reflection of equations and procedures contained within the PTI design manual. It should therefore be stated that any questions relative to Volflo in proceeding papers or within the following comments should be interpreted as questions relative to the PTI design theory.

Discussion, "Trumpet" Shape

> *From Wikipedia, the free encyclopedia -*
>
> *A phrase attributed to Benjamin Disraeli and popularized in the United States by Mark Twain goes something like, "There are three kinds of lies: lies, damned lies, and statistics."*
>
> *The statement refers to the persuasive power of numbers, the use of statistics to bolster weak arguments, and the tendency of people to disparage statistics that do not support their positions.*

Dr. Bryant states that all suction profiles controlling soil movement are "trumpet" shape as a fundamental result of a universal overlying diffusion theory. As proof, Dr. Bryant offers statistical analysis of approximately 26,000 suction determinations from Texas, Colorado, and Louisiana (Bryant's Figure 3). The statistical relationship provided by Dr. Bryant is reproduced as Figure 1.

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[1] Bryant, J.T., (2009). "The Theoretical Foundations of Geotechnical Engineering I: A Geotechnical Engineer Apologist's Perspective". Proceedings, ASCE Texas Section, Spring 2009. South Padre Island, Texas.

[2] Reed, R.F. (2008). "Observations on the PTI 3rd Edition design Procedure". Proceedings, ASCE Texas Section, Fall, 2008. Addison, Texas.

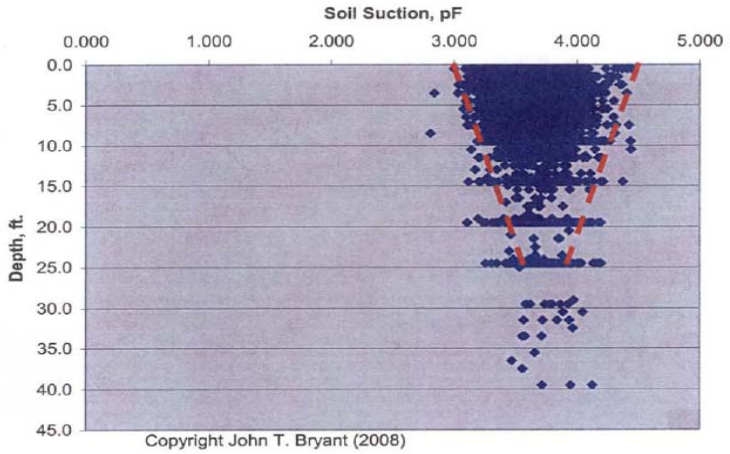

Figure 1. Triangle (bell-shaped) suction distribution consistent with theory. (From Bryant (2009).

The argument that Dr. Bryant makes is that the statistical data clearly illustrates a "trumpet" shape. However, it is important to note that the mouth of the "trumpet" was set at a depth of 45 feet in Dr. Bryant's presentation (and by extension of the boundary curves shown in Figure 1).

The writer does not have access to the statistical database in Figure 1; however, since Dr. Bryant's practice is based in the Dallas/Fort Worth area, it is concluded that the majority of data points are from the North Texas Region. For the North Texas Region, the zone of seasonal moisture fluctuation is approximately 10 to 15 feet (varying with climate and geologic conditions). If a seasonally active zone of approximately 15 feet is imposed on Figure 1, the resulting variation in suction is illustrated in Figure 2. Analysis of Figure 2 indicates that, based on the statistical data, the suction profile would vary relatively uniformly from approximately 4.5 pf to 3.0 pf within the seasonally active zone, and that the shape of the "standard" suction profile for the determination of movement is trapezoidal, rather then "trumpet". It is anticipated the shape of the composite profile is more of reflective of plotting all results, rather than any climatic change in the suction profile on any particular site.

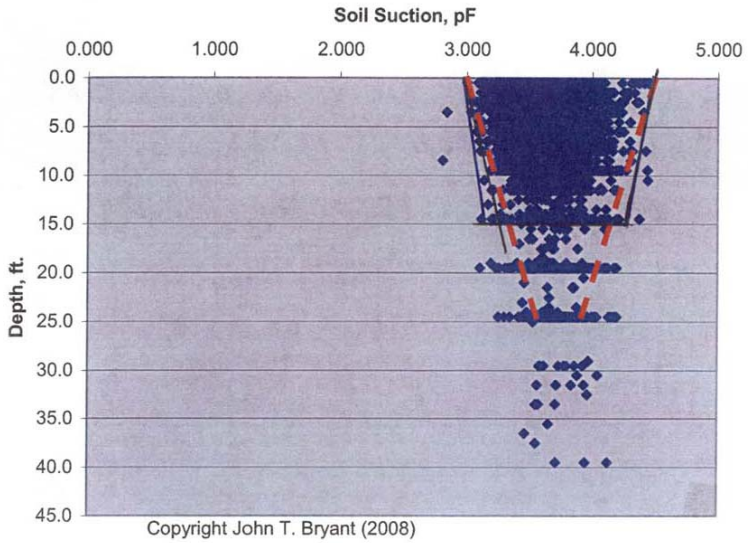

Figure 2. Modification of suction distribution with average seasonal depth of activity.

In any event, superposition of a "trumpet" shape on the data points within the upper 10 feet, as performed by Bryant in his Figure 2, would not seem to be reasonable or conclusive evidence of any "universal theory". It would also appear that use of a "trumpet" shape with the mouth of the trumpet at 10 feet, would not be conservative or justified by the statistical data.

It is anticipated that the "trumpet" shape for the suction profile may be applicable for relatively dry or relatively wet climatic conditions; for example, Phoenix, Arizona, (average Thronthwaite Index of approximately -20) or Houston, Texas (average Thronthwaite Index of +20), although it is anticipated that only one side of the trumpet would be observed.

Summary

The "trumpet" shape is not considered applicable for all climate or geologic conditions for calculation of the potential for differential movement of the ground surface. The use of the "trumpet" shape and proposed PTI design method may be acceptable to generate the PTI slab stiffness design values, y_m and e_m, provided it is understood that the stiffness values do not have any real meaning relative to actual observed or predicted differential soil movement associated with expansive soils.