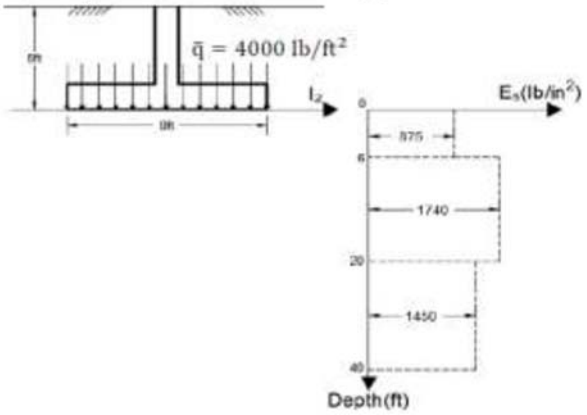
Modified Schmertmann's Method (1978) for calculating settlement in Sand soils: Verification manual

The paper presented by Mohammed A. Hassan (2017) has provided comparison between modified Schmertmann's method using the graphical approach with influence factor and mathematical expression of the influence factor using the integration.

In this manual, we provide verification of the modified Schmertmann's method with integration method they have provided and compare the results obtained from Settle3. This is an example from Hassan (2017) in **Example 3[7]:**

A continuous foundation resting on a deposit of sand layer is shown in the figure (6), along with the variation of the modulus of elasticity of soil (Es). Assuming γ=115 Ib/ft3.

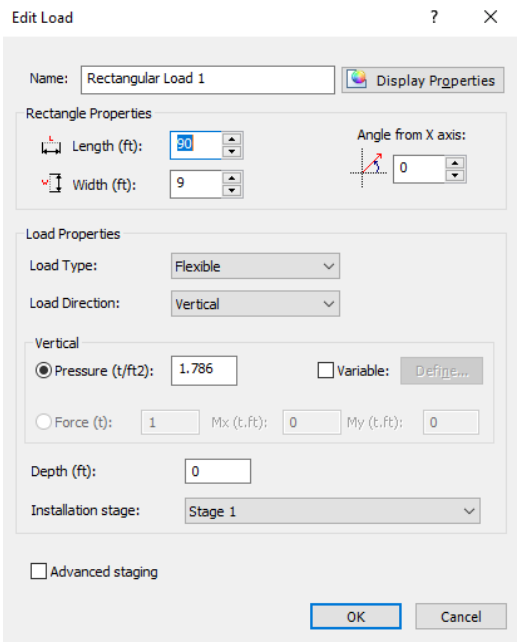


Based on the solution using Schmertmann's method (1978) using strain influence factor with integration, the settlement is calculated for each layer as the following:

Layer No.	dz(ft)	E_s (lb/ft²)	$\sum \int_a^b \frac{I_z}{E_z} dz$
1	6	126000	$\int_0^6 \frac{(\frac{451}{2000}z+0.2)}{126000} dz = 1.75774 \times 10^{-5}$
2	2	250560	$\int_6^8 \frac{(\frac{451}{2000}z+0.2)}{250560} dz = 4.74637 \times 10^{-6}$
3	12	250560	$\int_8^{20} \frac{217(32-z)}{8000x250560} dz = 2.33837 \times 10^{-5}$
4	12	208800	$\int_{20}^{32} \frac{217(32-z)}{8000x208800} dz = 9.35345 \times 10^{-6}$
			$\sum \int_a^b \frac{I_z}{E_z} dz = 5.506 \times 10^{-6}$

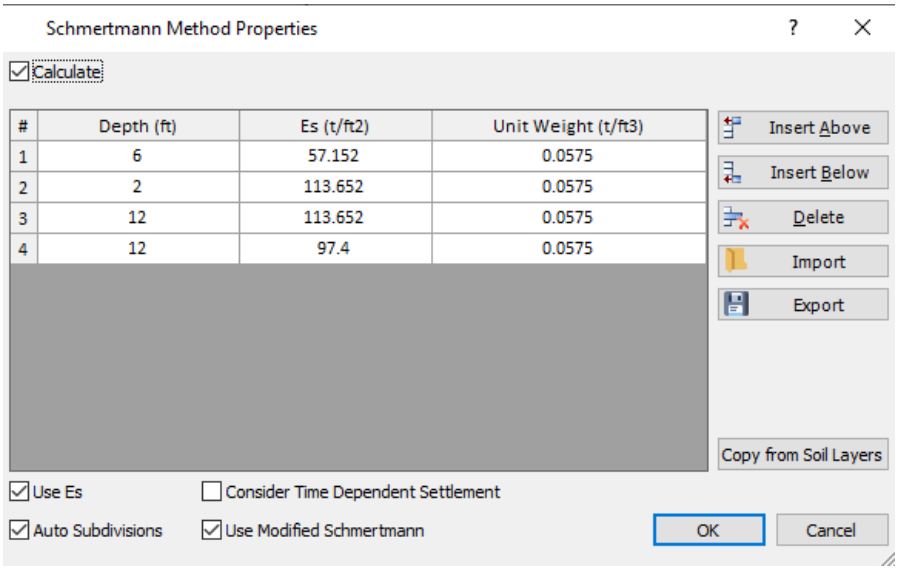
With total elastic settlement: S_i=0.916x1.4x3425x5.506x10-5=0.24183ft = 2.88 inches.

In Settle3, the loading condition for strip foundation is determined where length is greater than ten times the width of the foundation. Thus, the loading condition can be defined in the load section as shown below:



Where this load condition replicates the strip foundation with width of 9 ft and continues in length of 90 ft with magnitude of 4000 lb/ft^2.

The following input parameters for the soil from the case study is entered in Schmertmann Method properties with 'Use Modified Schmertmann' option on. Please refer to Online Help Settle3 theory manual for more details on equations used in this method.



With load condition defined and soil properties entered through modified Schmertmnn method, the results are shown on the modeler on top of the load as shown below.

The table below shows results are in good agreement as the paper has proposed for this case study.

	Modified Schmertmann (integration, Hassan 2017)	Settle3 modified Schmertmann	Difference
Settlement (in.)	2.88 in	2.96 in	3%

Settle3 yields 2.96 inches of settlement whereas with strain influence factor using integration the paper yields 2.88 inches of settlement. This 3% difference can be explained by the different method used in influence factor calculation.

Reference:

Hassan (2017). Modified Schmertmann's Method (1978) for calculating Settlement in Sand Soils by using integration. *International Journal of Engineering and Technical Research (IJETR)*. **ISSN: 2321-0869 (O) 2454-4698 (P) Volume-7, Issue-8, August 2017**