

Appendix J Shrink/Swell Adjustments

[Appendix J draws on the Day 1 Seminar Handbook's Shrink/Swell Adjustments and Volume Report interpretation discussions (a PDF copy of Day 1's shrink/swell discussion is available at <https://bit.ly/3A4Mljr> but is reproduced below; see pages 212-214 in Day 1's handbook for a detailed volume report breakdown).]

Fill Factors can be entered with Report Regions (pages 93 and 145) and Balance Regions (examples include pages 81, 162 and 237) to adjust for cut-to-fill shrink/swell but some AGTEK users don't enter them because they prefer to make their own shrink/swell adjustments in a spreadsheet or on paper, which is perfectly fine, especially when re-compaction volumes (see Section D on page 253) and subsidence (see Section E on page 253) are involved in the earthwork analysis. Other users may want to make shrink/swell adjustments in AGTEK but hesitate doing so because they don't want to make an incorrect entry. The following discussion is intended to clarify the "why", "what" and "how" of applying shrink/swell adjustments to the AGTEK volumes (some useful references with comments are provided at the end of this appendix).

A. Three Volume/Density States of Soil

Estimating earthwork involves quantity measures in three different volume/density states: **(1)** a soil at its native undisturbed density is measured in bank cubic yards (BCY); **(2)** the same soil that has been excavated typically has a lower relative density (its volume increases) and is measured in loose ("haul" or "truck") cubic yards (LCY); and, finally, **(3)** the same soil placed as compacted fill may increase in relative density (its volume decreases) and is measured in compacted cubic yards (CCY). On projects where both cut and fill are required to establish plan subgrade, **the difference in the relative densities of cut (BCY) and fill (CCY) must be considered to properly estimate any net volume of import or export.** Does AGTEK's volume report represent and reconcile BCY, LCY, and CCY all on one report? No, but AGTEK does allow adjustments to compensate for compaction shrink/swell between cut (BCY) and fill (CCY). [Although the native soil's intermediate loose (LCY) volume may be used for haul production estimates (see Section F on page 255), the LCY volume is not required for a proper BCY-to-CCY compaction shrink/swell analysis of onsite excavated materials.]

B. Estimated Shrink/Swell

Looking at the volume report below, the cut (*Column F*) is interpreted as BCY and the fill (*Column G*) as CCY. The 848 CCY of total fill is multiplied by the *Comp/Ratio* of 1.15 (*Column I*—this is the *Fill Factor* that was entered with the Report Regions for this report; the product (*Column G * Column I*) of 975 (*Column K*) is the BCY of cut that is required to make the 848 CCY fill with an estimated cut-to-fill shrinkage of 15% applied. But how do we determine the appropriate AGTEK Fill Factor for a project's compaction shrink/swell adjustment?

	Volume Report Subgrade vs. Stripped												
			Area		OnGrade	Volume		Comp/Ratio		Compact		Export -Import	Change Per .1 Ft
	Total	Cut	Fill	Cut		Fill	Cut	Fill	Cut	Fill			
Bldg 1	7,248	2,616	4,632	0	118	235	1.00	1.15	118	270	-152	31	
Bldg 2	8,590	7,540	1,050	0	232	14	1.00	1.15	232	16	216	37	
Bldg 3	10,904	9,315	1,589	0	369	17	1.00	1.15	369	20	349	46	
Bldg Sub:	26,742	19,471	7,271	0	719	266			719	306	413	114	
Landscape	31,236	19,169	12,068	0	598	370	1.00	1.15	598	425	173	133	
Pond Area	7,753	4,212	3,540	1	381	212	1.00	1.15	381	244	137	33	
Street Area	16,748	16,748	0	0	1,582	0	1.00	1.15	1,582	0	1,582	71	
Regions Total	82,479	59,600	22,879	1	3,280	848			3,280	975	2,305	351	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	