

TABLE 12.7 Dimensional change coefficients, %

Board	Water absorption (%)	Length increase (%) (C_T)	Width increase (%) (C_W)	Depth increase (%) (C_D)
GeoDeck old	11.9(30 days)	0.64(0.054%)	2.25(0.19%)	4.8(0.40%)
Same	21.8(110 days)	1.1(0.050%)	2.0(0.09%)	4.0(0.18%)
Same	17.1(100 days)	0.86(0.050%)	1.8(0.11%)	4.4(0.26%)
GeoDeck newmedium density($d =$ 1.16 g/cm ³)	13.6(100 days)	0.5(0.037%)	1.8(0.13%)	2.5(0.18%)
Same	7.65(117 h)	0.15(0.020%)	0.52(0.068%)	2.7(0.35%)
Same	9.4(45 days)	0.50(0.053%)	0.96(0.10%)	3.5(0.37%)
GeoDeck, density 1.12 g/cm ³	8.7(45 days)	0.29(0.033%)	0.84(0.097%)	3.0(0.34%)
GeoDeck, density 1.16 g/cm ³	8.7(45 days)	0.43(0.049%)	0.90(0.10%)	3.1(0.36%)
Trex	14.3(110 days)	0.17(0.012%)	2.3(0.16%)	5.3(0.37%)
TimberTech	13.0(100 days)	0.50(0.038%)	2.3(0.18%)	4.3(0.33%)
UltraDeck	16.8(100 days)	0.20(0.012%)	3.6(0.21%)	6.3(0.38%)

C_T : tangential (lengthwise), C_W : widthwise, and C_D : depthwise coefficients.

are much lower (0.016–0.018 and 0.03–0.04%, respectively) compared to those at a long-term water absorption (average $C_T = 0.037%$ and $C_W = 0.13%$, see above). Therefore, they are not included in Table 12.7.

When a material swells, it produces pressure toward any object resisting the moisture-driven expansion. That is why deck boards on a deck are normally installed with a certain gapping, such as 1/4–3/8-in. between boards (Fig. 12.1–12.3).



Figure 12.1 A typical gapping of deck boards on a deck.



Figure 12.2 A typical gapping of deck boards on a deck.

If gapping is too narrow and cannot accommodate the swelling, this situation leads to buckling, distortions, cracking, and other types of failure (Fig. 12.4–12.9)

Clearly, for such distortions and mechanical failure of composite deck boards, a significant pressure/load should have been developed. It was determined that the

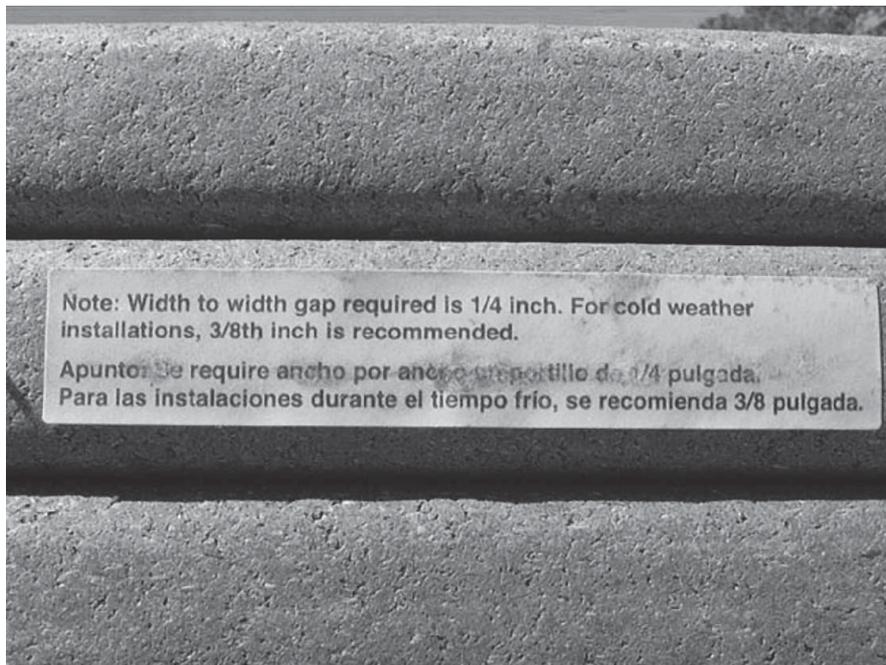


Figure 12.3 An instruction for board gapping (Trex boards).



Figure 12.4 Distortions of WPC deck boards due to water absorption.



Figure 12.5 Moisture-induced distortion and mechanical failure of WPC deck boards.



Figure 12.6 A crack in a composite deck board as a result of buckling due to water absorption and insufficient gapping.

pressure can reach thousands of pounds. The experiment was conducted with a GeoDeck hollow deck board, 13.5 in. long, 896 g (close to 2 lb) weight, immersed in water at room temperature. A pressure being developed as a result of swelling in the widthwise direction was measured using a load cell.

At the same time, the length of the boards was measured. After 24 h the board length was increased by 0.05" (0.37%), after a week by 0.10" (0.74%), and after a



Figure 12.7 Moisture-induced dimensional instability of a WPC material.