

# Long-Term Water Absorption Behavior of Various Composite Decking Products

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## Abstract

This work presents the long-term water absorption behaviors of several commercial composite decking products. Within the testing results, it was observed that there are very broad differences in water absorption performance between material formulation types, product categories and manufacturers. This work also shows how the commonly accepted testing duration of 30 days (720 hours) does not necessarily outline the actual long-term water absorption performance, and that there is a broad range of water absorption rates, even with similar formulations.

## Background

The use of composite decking has been increasing in the United States over the last decade, yet the product technology is in a relative infancy when compared to many other building materials. Currently, there are many commercial composite decking products available for purchase. However, the durability of these products when exposed to the environment is not always understood. In the case of water absorption, the longer term behavior may indicate the overall resistance of the material to internal degradation and mechanical property loss. For example, in order for mold and fungi to grow, they require food and moisture. Therefore, if a composite product absorbs less water than others, then that product will be much less likely to have internal mold and fungi growth. Product testing is not only limited, but is closely held by the manufacturers, and not available to the consumer. Many manufacturers make claims to the water resistivity of their products. However, there is rarely scientific data provided to back those claims. This study was conducted to bring clarity to the water absorption performance of many different brands of composite decking. In this project, the water absorption behavior of several commercially available composite decking products was observed over a 2,000 hour total time period. This was done to determine how the amounts of water absorbed vary between manufacturers, products, and material types. As these values were determined, the individual products were ranked from lowest absorbing to highest absorbing. Along with these observations, the lowest absorption composite decking product was used as a comparison point to all other products by product types.

## Methods & Materials

Table 1 lists all of the commercially available composite decking products tested. The products were purchased anonymously at various retail outlets to minimize any potential bias.

**Table 1: Commercially Available Composite Decking Products Tested**

- |  |   |
|--|---|
| - Azek Deck                                  | - CorrectDeck CX                          |
| - Elk/GAF CrossTimbers Professional          | - Fiberon Tropics                         |
| - GeoDeck Traditional                        | - Gossen Original                         |
| - Kodiak Composite Decking                   | - Master Mark RhinoDeck                   |
| - Midwest Manufacturing Ultradeck Fusion     | - Midwest Manufacturing Ultradeck Natural |
| - Midwest Manufacturing Ultradeck Rustic     | - TAMKO Evergrain                         |
| - Trex Origins                               | - Trex Transcend                          |
| - TimberTech Twin Finish                     | - TimberTech XLM                          |
| - Universal Forest Products (UFPI) Latitudes |   |

The testing condition used is based on ASTM standard D7032, which outlines testing standard for composite decking. Test samples from each group were cut to ~ 6 inch lengths, and placed in an oven at 215° F for 24 hours to remove any absorbed moisture. The samples were then allowed to cool to ambient

conditions (70°F), weighed, and placed in water which was also ambient. If the samples were lighter than water, they were weighed down to ensure they were completely underwater. The samples were then left submerged for 720 hours, 1,000 hours, and 2,000 hours. The reason that 720 hours was chosen, is that most water absorption testing for composite decking is only examined for 30 days, and the intent was to determine if this is a valid timeframe to determine “long-term” water absorption behavior. At each time interval, the samples were towel-dried and weighed.

## Results

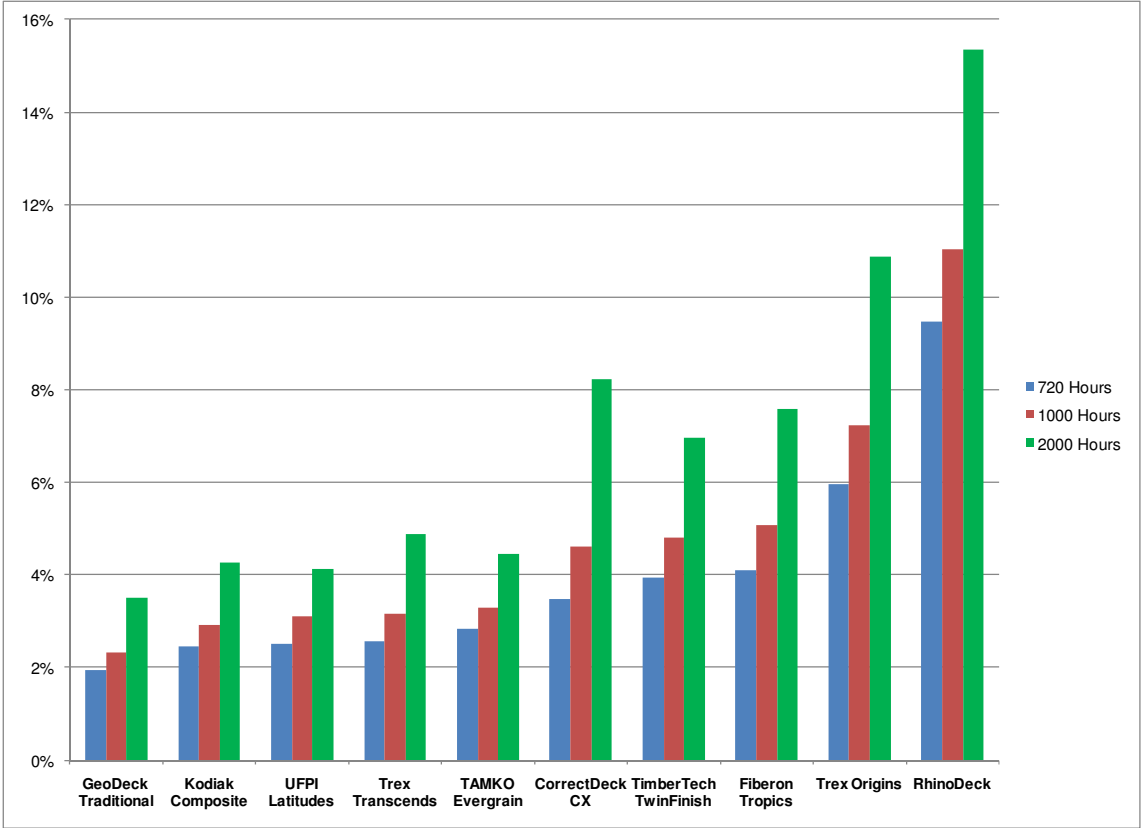
Table 2 shows the water absorption results of the tested composite products. The different products are ordered in the table based on their water absorption amounts at the 720 hour (30 day) interval, from lowest absorption to highest absorption. It is important to show here that the best performing product, GeoDeck Traditional, had a 25% lower water absorption rate compared to the next closest product, Kodiak Composite. In addition, this superiority level was maintained though the duration of the experiment. The data also shows a broad range of water absorption amongst the samples. The best performing product absorbed only 2-3% by weight of water; others absorbed as high as 20% by weight for the same exposure duration.

**Table 2: Water Absorption Amounts at Various Time Intervals**

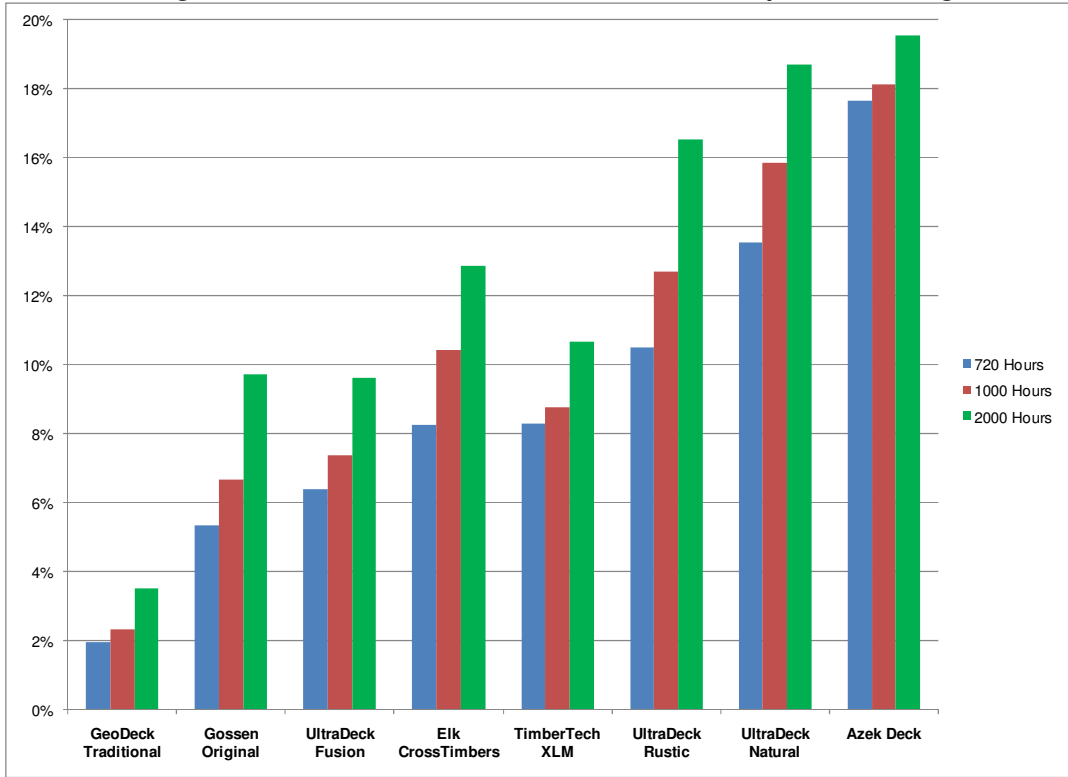
Product Identification	720 Hours		1,000 Hours		2,000 Hours	
	Change (%)	Rank	Change (%)	Rank	Change (%)	Rank
GeoDeck Traditional	1.95%	1	2.32%	1	3.50%	1
Kodiak Composite	2.47%	2	2.93%	2	4.26%	3
UFPI Latitudes	2.52%	3	3.10%	3	4.12%	2
Trex Transcends	2.57%	4	3.15%	4	4.88%	5
TAMKO Evergrain	2.85%	5	3.29%	5	4.45%	4
CorrectDeck CX	3.48%	6	4.61%	6	8.22%	8
TimberTech TwinFinish	3.95%	7	4.80%	7	6.97%	6
Fiberon Tropics	4.09%	8	5.07%	8	7.59%	7
Gossen Original	5.35%	9	6.68%	9	9.73%	10
Trex Origins	5.97%	10	7.23%	10	10.87%	12
UltraDeck Fusion	6.41%	11	7.38%	11	9.63%	9
Elk CrossTimbers	8.25%	12	10.42%	13	12.89%	13
TimberTech XLM	8.31%	13	8.77%	12	10.68%	11
RhinoDeck	9.47%	14	11.03%	14	15.35%	14
UltraDeck Rustic	10.49%	15	12.70%	15	16.54%	15
UltraDeck Natural	13.56%	16	15.87%	16	18.72%	16
Azek Deck	17.67%	17	18.14%	17	19.57%	17

Figure 1 shows the water absorption performance of GeoDeck compared to traditional solid composite decking products. These “traditional” composites are best known for having wood fillers mixed with either polyethylene or polypropylene, and formed into a plank which looks like a piece of lumber. In this group of products, there is a broad difference in water absorption by product and manufacturer. While some products were close to the low levels of GeoDeck, more than half of the products were substantially higher.

Figure 2 shows the water absorption performance of GeoDeck compared to both cellular PVC and other engineered profile composites (non-solid). When compared to the other tested engineered profiles (UltraDeck and CrossTimbers), GeoDeck had substantially lower water absorption levels throughout the testing. When compared to the cellular PVC products (Gossen Original, TimberTech XLM, and Azek Decking), GeoDeck outperformed them all.



**Figure 1: GeoDeck Versus Traditional Solid Composite Decking**



**Figure 2: GeoDeck Versus Cellular PVC & Other Engineered Profile Composites**

## **Conclusions**

In this project, the long-term water absorption behaviors of several commercial composite deck products were examined. From this work, the following conclusions were drawn:

- There is a wide range of water absorption between product categories and manufacturers.
- The expectations of how a product will perform over time, while currently based on a 30 day exposure, may not adequately account for the continued absorption seen by products in-use.
- The 30 day standard testing time does not reflect the long-term effects of water absorption.
- Composition and geometry appear to have no bearing on the water absorption of specific products.
- In all measure of testing, GeoDeck (a natural fiber-filled engineered profile) was the most resistant to the absorption of moisture.

## **References**

ASTM D-7032: Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails). ASTM International.

Acceptance Criteria AC-174: Acceptance Criteria for Deck Board Span Ratings, And Guardrail Systems (Guards and Handrails). ICC Evaluation Service, Inc.