TechLine

Forest Products Laboratory

Outdoor Durability of Wood–Plastic Composite Lumber

Researchers at the Forest Products Laboratory evaluated how well structures made from wood–plastic composites, such as this deck, hold up to UV exposure and fungal attack.

Wood–plastic composite lumber is finding a place in the market for outdoor structures such as decking. The material is known for its environmental advantages: it diverts both wood and plastic from waste streams, and scraps produced during processing and installation can be recycled. Wood–plastic composites are promoted as durable materials that resist cracking and warping and require less maintenance than traditional pressure-treated wood decking.

Background

Concern about the durability of wood–plastic composite lumber came to the attention of the Forest Products Laboratory (FPL) through public inquiries and conference feedback. Many studies have examined the mechanical properties of wood–plastic composites, but few have investigated durability and service life.

Objectives

The goal of this study was to investigate the durability of wood–plastic composite lumber exposed to fungi and ultraviolet (UV) radiation. Researchers also studied how additives such as stabilizers, pigments, and fungicides improve the product's resistance to UV radiation and fungi.

Approach

The study was conducted in two phases. In the laboratory (phase one), composites were tested for resistance to fungi and stability when exposed to UV radiation. Test methods had to be developed or modified to evaluate wood–plastic composites.

Researchers determined fungal resistance of the composites by tracking weight loss, mechanical performance, and visual appearance of the material. The effect of moisture sorption and manufacturing methods on fungal attack were also examined, and several fungicides were added to test their effects on fungal resistance.

Researchers used color change and mechanical performance to evaluate UV stability of the composites. Different combinations of pigments and other additives were used to improve UV stability.

In phase two, composites with combinations of the best performing additives for fungal resistance and UV stability were used to produce full-size deck boards on commercial-scale equipment. These deck boards were installed at outdoor test sites in Mississippi and Wisconsin and will be periodically evaluated.

Outcomes

This research program resulted in

- appropriate methods for evaluating UV stability and fungal resistance of wood–plastic composites,
- baseline information on durability of wood–plastic composites,
- a better understanding of how additives improve the durability of composites, and
- full-size deck boards of known composition for outdoor evaluation.

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