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Part 1: 10 Year Service Performance of Composite Oak Flooring
(Performance of first field test kit made by Havco Wood Products)

Date of Inspection:	November 1, 2004
Location:	Schneider National , 34500 LBJ Freeway, Dallas, TX 75241
Reported by:	Gopal Padmanabhan (Engineer, Havco Wood Products)

Trailer



Ten year old trailer with composite flooring.

Flooring of trailer # A442130 (Schneider National) was inspected at the Dallas maintenance facility. This trailer had a manufacturing date of February 24, 1995. The trailer flooring was identified as Havco composite (Version-Field test kit). Floor was composed of 20 foot long or shorter sections of composite boards. These boards were butted together at the ends of boards to

span the length of the floor. Based on the date and construction of flooring, this floor kit was identified as the first composite oak flooring ever made for field testing by Havco Wood Products (Cape Girardeau, MO). Age of floor at the time of this inspection was nearly 10 years.

History

The floorboards were made by hot pressing woven glass fabrics saturated with an epoxy resin on laminated oak boards. The size of the hotpress limited the length of boards to a maximum of 20 feet. The resulting composite boards were planed and machined to form shiplaps and beads at the edges of boards. The thickness of the flooring was 1 3/16", with a nominal thickness of fiberglass of 1/16". Twenty foot sections were shipped to Wabash National for installation in trailer for field testing. Each butt joint was located on top of a cross-member and joints were randomly located in the floor layout. Wabash National installed a 2 foot long sheet of steel between the cross-member and each of the butt joints of the floorboards. All of the cross-members were at 12 inch spacing, including those on the slider rails. The flooring did not have a threshold plate at the rear end.



Flatness of composite flooring at a rear section.

Observations-Top Side of Flooring

Flatness

Floorboards were found to be flat with no visible warping or cupping. A level was used to check flatness of boards at the rear and forward locations of floor, across mating shiplaps and across butt joints of boards. No abnormalities were found.



Flatness of composite flooring across a butt joint of boards.

Scuffing and Gouging

For the first 4 feet of the flooring at the rear location, the top surface of inner boards showed moderate amount of scuffing and wear marks caused during loading/unloading with lift trucks. From the 4 foot to the 12 foot mark at the rear location of flooring, several large and deep gouges were found. A few of these gouges were also present towards the forward location of flooring. The edge boards showed minimal wear compared to inner boards.

Color

Flooring had a more or less uniform discoloration or darkening compared to virgin oak.



Flatness of composite flooring at a forward section.

Hook Joints

No distinct water spots were seen at the hook joints (between the ends of wood components) or at any section of the floor, including the shiplaps and butt joints of boards. There was no evidence of swelling of wood (except for weathering at the rear end location of flooring).

Shiplaps

The shiplaps were not coated with undercoating. There was no evidence of any damage or abnormality at the shiplaps.

Rear End Weathering

From the rear frame to about 12 inches of flooring, surface cracking of flooring at glue lines was noted. For some boards, the cracks were within about 24 inches of the rear frame. These cracks were most likely the result of weathering and exposure to water at the top side of the floorboards. Typically, wetting and drying cycles of wood at the top side of flooring leads to this phenomenon. However, surface cracking did not lead to breakage of boards/wood or the fiberglass reinforcement at the bottom side of boards. Clearly, the glue line cracks did not extend

through the thickness of the boards. The rest of the flooring away from the 24 inch rear location showed no visible cracking.



Top side of rear section of composite flooring.

Floor Screws

Floor screws did not show any appearance of loosening or backing out and did not seem to need re-tightening.

Butt Joints of Boards

Flooring at and around the butt joints of boards were sound with no sign of any problem.

Observations-Bottom Side of Flooring

Fiberglass Underlayer

Bottom side of flooring was in excellent condition and showed no breakage or fracture of fiberglass reinforcement. The rear 12 to 24 inch section of flooring, which had surface cracking of gluelines on the top side (from weathering), showed no visible effect at the bottom side. The fiberglass layer of this section appeared as good as the other sections of the flooring.

Very few nails (less than a dozen) were seen protruding through the floor. The fiberglass layer was punctured at the tips of the nails and split along the length of board for about half an inch. There was no growth of damage originally caused by the nails.



Underside of composite flooring at the rear section.



Underside of composite flooring in the bay section.

Cross-Members

All cross-members were at 12” spacing. Three cross-members were checked in the bay area for permanent set by measuring the distance between each cross-member to a spare board placed on the shop floor. The spare board was checked to ensure its even level. Distance was measured with a tape and the process of measurement was subject to human errors. Readings of two persons showed permanent set of cross-members in the range of 0 to 1/8” at the most. Cross-members appeared straight to the naked eye when seen from the ends.

Field Test Floor versus Production Model of Havco Composite Floor

The current production version of Havco Composite floor available to customers is similar in many respects to the field test floor of this investigation. However, there are some significant differences.

Fiberglass Alignment

The fiberglass panel of the production version is produced by a continuous process wherein the longitudinal glass fibers are well aligned. This makes the fiberglass panel stronger and more rigid compared to the hot pressed fiberglass of the field test flooring.

Fiberglass Color

The fiberglass panel of the field test kit was colored black. The production version uses the natural lighter color of epoxy resin. The lighter color provides a better background to examine other underside parts of the trailer.

Fiberglass Layup

The fiberglass panel of the field test kit used a combination of continuous strand mat and woven rovings. The production version of composite flooring does not use the continuous strand mat, thereby increasing the longitudinal strength of the panel. However, the total amount of glass fiber is approximately equal. Further, the production composite floorboards are made by a continuous process using a large roll of fiberglass panel. Therefore, the length of floorboards can be made to suit the length of trailer.

Adhesive

The epoxy resin of the fiberglass layer in the field test model was also the adhesive that bonded the epoxy saturated fiberglass to wood. This resin was modified by lowering viscosity for ease of saturating the fiberglass. A polyurethane hotmelt adhesive is used to bond the fiberglass laminate in the production version. Peel tests with polyurethane adhesive shows improved bonding and increased wood tear.

Summary

Clearly, the fiberglass laminate helped to strengthen the laminated oak boards and further protect them from the roadside environment. In this process, it also mitigated any weakness of floor sections caused by the large gouges even though it could not prevent the gouges from occurring in the first place. Further, it reinforced the rear section of flooring that endured the effects of weathering at its top side. Composite flooring will not need re-undercoating since the fiberglass layer will not wash away. Expansion and shrinkage of wood from absorption and drying of wood is believed to be reduced at the bottom half thickness of flooring due to the fiberglass layer and the transverse glass fibers in it.

Damage to composite flooring is more likely to happen at the top side of flooring in the form of gouges and surface cracking at rear location due to weathering. A sealant applied to the top side for about 3 feet of flooring should reduce the effects of weathering and prolong life. Prevention of gouging needs careful operating procedures during loading/unloading, which can be difficult to implement on a consistent basis.

This field test experience shows that Havco Composite flooring can be expected to last for more than 10 years of service. It is unlikely that composite flooring will need much maintenance during its lifetime. Further, it is likely that composite flooring for most part can maintain its initial load rating due to absence of damage to the underside of flooring. Conducting the TTMA rolling load fatigue test in this Schneider trailer (or the few other Schneider trailers with similar field test floor kits) can conclusively establish the long term durability of composite flooring.