

# Research & Development Summary



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Wood

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## Use of OSB and Other Wood-based Panels in Furniture Frames

Canadian wood panel producers are looking for new markets for their products. Based on marketing studies carried out at Forintek and elsewhere, the upholstered furniture sector has been identified as a market where there is good potential for expansion (Tabarsi 2002).

Furniture manufacturing is an \$11 billion industry in Canada, with 105,000 direct employees. Approximately 50% of furniture production in Canada is in Ontario, 30% in Quebec, and the remaining 20% is distributed among the other provinces. Canada is the fourth largest furniture exporter in the world after Italy, China and Germany.

Oriented strandboard (OSB) and other panel materials are not new to the furniture industry, but technical data has been lacking to support the optimum use of these products in furniture frames. With the increased competition from foreign countries in North American furniture markets, the need to reduce costs and optimize processes is now more urgent than ever before. Fastener holding capacity in OSB and other panel products has been identified as being one of the major issues that currently limits the increased use of wood-based panels in the upholstered furniture industry.

A series of studies to address those issues were launched at FPInnovations -- Forintek Division under Natural Resources Canada's *Value to Wood* program. This document summarizes findings from two *Value*



Figure 1: Typical furniture frame manufactured with OSB components.

*to Wood* research projects. The key objectives of those two studies were to:

- evaluate fastener holding capacity in commercial panel products and determine how such properties are affected by the localized in-plane density distribution in the panel; and
- compare the suitability, performance and cost effectiveness of low grade hardwood lumber, OSB and other panel products for the manufacture of furniture frames.

## Research Results

### Evaluation of Fastener Holding Capacity in Panels for the Upholstered Furniture Industry

Correlations between fastener holding capacities and localized horizontal density distributions of panels (i.e., oriented strandboard (OSB), particleboard (PB) and medium density Fibreboard (MDF)) were established following testing in order to investigate how density distribution within the plane of the panel could affect the fastener holding capacity. The panels were scanned using a commercial X-ray system at Alberta Research Council (ARC) to obtain in-plane (horizontal) density distribution of the full size panels. Sampling of test specimens from mapped panels was carried out in such a way to cover low and high horizontal density zones.

Findings from this study indicated that poor fastener holding capacity, especially on the edge of the panel, is one of the key panel attributes that is currently limiting the use of OSB and other wood panel products in upholstered furniture. Fasteners driven into low density points or zones may fail at much lower load levels than those driven into high density points, with failure initiating at those low density zones and progressing to other zones.

Increasing panel density will ultimately improve the fastener holding capacity. However, reducing the variability in the in-plane density by producing panels with more consistent and uniform density distribution could be a more effective and economical way of improving the fastener holding capacity in panels for use in the upholstered furniture industry. Previous research indicated that optimization of other panel manufacturing variables such as strand or particle quality, geometry, and amount and distribution of resin could also improve the fastener holding capacity, but density and uniformity in density distribution have the greatest impact on fastener holding capacity, especially for OSB panels.

Basic panel properties would have to be looked at carefully as consistency in basic strength properties is critical for the furniture industry. Certain panel components in a typical upholstered furniture frame are subjected to high loads and it is quite important for the panel producers to manufacture high quality panels designed for the furniture industry with better strength and stiffness properties.

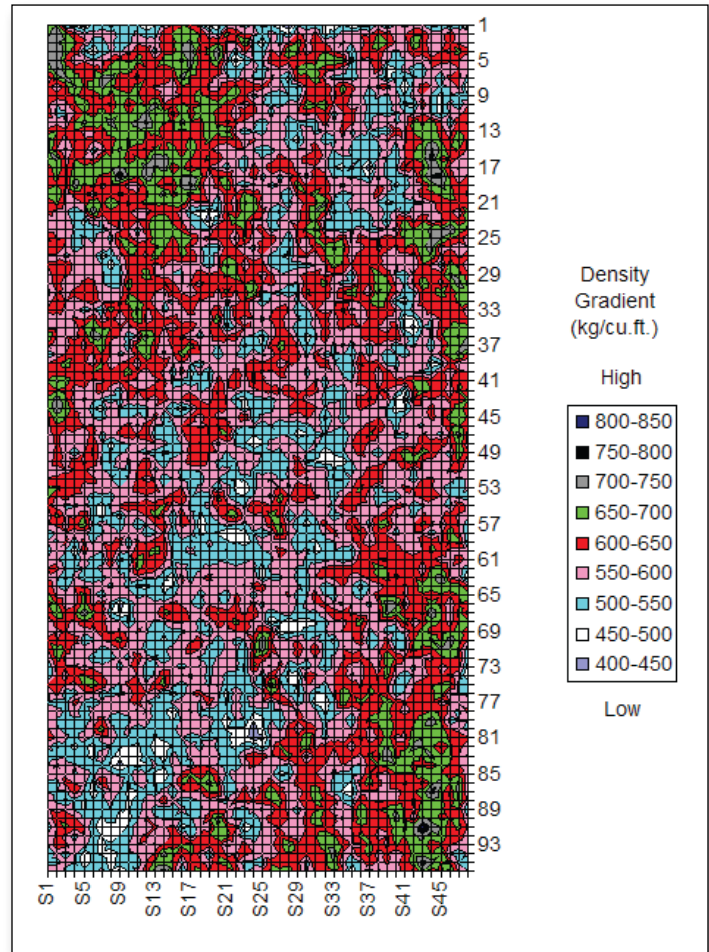


Figure 2: A scanned image of OSB pane showing in plane (horizontal) density distribution.

It is important to understand that panels should be manufactured to suit the appropriate end-use application. Panels produced for the furniture industry should have high density and less density variation, thus improved fastener holding capacity, compared to typical panels made for other applications (e.g., construction panels). This is more critical for OSB panels as the greatest variations in horizontal density distribution were observed for OSB panels (as opposed to MDF and particleboard). Full-size testing of upholstered furniture frames made of panel products must be done, and various forces especially at the connection between front, back and side frame systems must be analyzed in order to better understand the distribution of forces in a typical sofa frame. By knowing the magnitude of stresses that the various frame components are subjected to, it is possible to produce panels and designs that can meet such performance requirements.

## OSB Use in Furniture Manufacturing

In this study, sofa frame arm assemblies made from furniture grade OSB, plywood and low grade hardwood lumber were tested for their ability to withstand vertical and horizontal forces. Although edge staple holding was initially a problem for the OSB when compared to the hardwood, minor design changes resulted in increased strength and stiffness for the OSB arm assembly. The study further demonstrated that furniture frame performance is very specific to frame design, material choice and design details. For example, replicating the design of a side assembly with OSB instead of hardwood lumber would not meet the required performance.

Partial frame assembly testing as used in this study is a technique that furniture manufacturers can use to reduce frame design development time and costs.

The work clearly demonstrates that OSB and plywood can comfortably be specified by the furniture industry as viable, and in many cases, less costly alternatives for furniture frames provided that proper designs are developed that take into account the panels' unique set of properties. It is anticipated that the end result will be better utilization of raw materials by furniture manufacturers (the right material in the right application), as well as a better understanding on the part of the raw material supplier of the types of products required by the value-added sector.

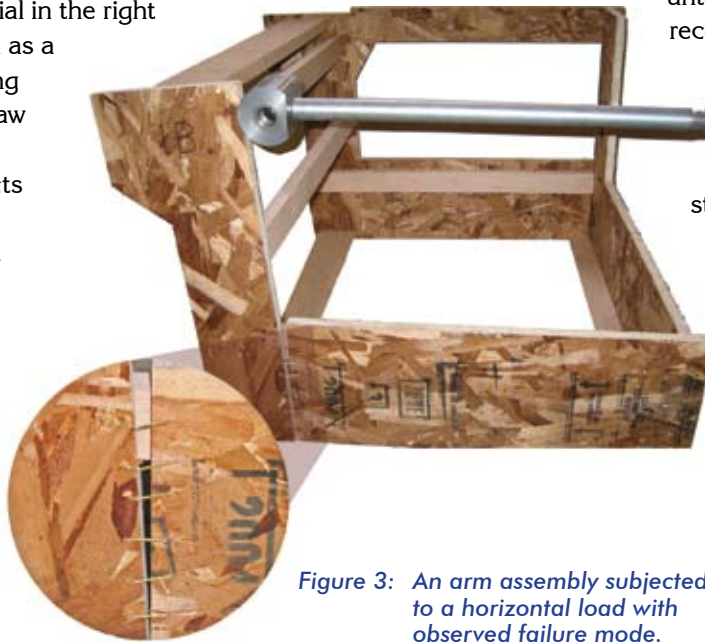


Figure 3: An arm assembly subjected to a horizontal load with observed failure mode.

## Application of Results and Benefits

Structural panels (OSB and plywood) offer potential cost savings to furniture manufacturers in terms of material costs and manufacturing efficiency. Panel material recovery factors for manufacturing operations using a CNC router with an optimized cutting pattern can range from 85% to 90%, compared with recovery factors of 70% and lower for hardwood lumber. Additional cost savings from using panels can come from increased automation, reduced handling, fewer processing operations and standardization of parts or components.

Furniture manufacturers using OSB in their frame designs report cost reductions of 10% to 20% per part. With individual parts typically costing between CAN\$0.50 and CAN\$1.00, and a typical upholstered frame being constructed from 40 or more individual parts, potential cost savings to Canadian furniture manufacturers from using OSB are substantial. For example, if a manufacturer were able to save CAN\$0.05 per part for a frame composed of 40 parts, the material cost savings per frame would be CAN\$2.00.

Furniture represents a large and mostly untapped market for OSB. It should be recognized that these two studies were exploratory in nature and there are numerous other factors that affect furniture frame performance. More detailed and application-specific studies will come in the future. Nevertheless, the intended end result of these specific projects is to move toward better utilization of raw materials by furniture manufacturers (the right material in the right application), as well as a better understanding on the part of the raw material supplier of the types of products required by the value-added sector.



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## Reference

Tabarsi, E. 2002. *Suitability of Oriented Strandboard for Upholstered Furniture: Market Analysis*. Forintek Canada Corp. Report No. 3251.

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