Trus Joist
A Weyerhaeuser Business

11 February, 2000

Mr. Jim Gauntt
Executive Director
Railway Tie Association
115 Commerce Dr., Suite C
Fayetteville, GA 30214

Dear Jim:

Please find enclosed the items I was tasked with during our R&D planning session in Perdido Beach.

The first item I was asked to forward was the standard used by the Window and Door Manufacturers Association (WDMA, formerly NWWDA) to evaluate new materials. This document is specific to composites, and I was part of the team that got it moving in WDMA. I've included two enclosures relative to this subject; the first being the letter I wrote in 1997 to get the subcommittee moving on the subject. The second is the final draft the subcommittee published, dated January 1999. These should serve as a good template for the RTA to act on. It is likely that the RTA would have one for each category of product (e.g. crossties, hardware).

The second item is the Scheffer index, both from a text book published by Zabel & Morrell and the version adopted into the AWPA Book of Standards. A map of termite attack probability from the SBC Code is also included. These can be used to create a template which each railroad can use to overlay their track route and determine the decay and insect hazard by track location.

Please call if there any questions.

Sincerely,

Paul

Paul Merrick
Mgr. Preservation Technology

Cc: Dave Webb

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Ref. WOOD MI... HOLOGY, DECAY + PREVENTION R.A. ZABEL + J.J. MOR... 1992

CHAPTER 15

Decay Problems Associated with Some Major Uses of Wood Products

One of the major drawbacks associated with the use of wood products is their susceptibility to biological deterioration. This deterioration often occurs as we inadvertently duplicate natural conditions for decay in our structures. These conditions can sometimes be prevented by proper structural design, but wood often must be exposed to ground contact or periodic wetting. When this is unavoidable, economic realities dictate the use of preservative-treated or naturally durable woods. Despite these efforts, a substantial percentage of the wood in service falls to the agents of decay.

Quantifying decay losses has long stymied researchers. Wood failures occur in buildings, utility poles, railroad ties, bridge timbers, piling, and myriad other unrelated uses. With the exception of utilities and railroads, most wood users lack a systematic method for quantifying their decay losses, and even these groups have a relatively imprecise knowledge of their losses. Quantifying losses in residential structures is particularly difficult since there are no uniform procedures for reporting damage. As a result, many potentially important decay problems may be overlooked.

The replacement of decayed wood alone has been estimated to consume 10% of the timber cut annually in the United States (Boyce, 1961). In 1988, this figure for softwoods amounted to $613 million (Anderson, 1990). Whereas wood decay results in substantial losses, labor costs involved in replacing structures, productivity losses, or liability that stems from poorly maintained wood far exceed the raw value of the wood. The total cost of insect and decay repairs in buildings in California approaches $400 million per year (Brier *et al.*, 1988). Even simple kinds of decay can sometimes cause significant productivity losses. For example, decaying ties decrease the speed at which trains can safely travel, thereby decreasing track use and increasing transit times for trains. These slowdowns are estimated to cost $18.60 per tie per year in main-line track (Anonymous, 1985). When nearly 3000 ties are

present in a single mile of track, the cost of decay can rapidly mount. The cost to replace a single utility pole in California approaches $3000, including labor, and may also trigger costly service interruptions. Individual utilities often have 100,000 or more poles within their system and incur rejection rates of 0.3 to 0.4% per year, amounting to $900,000 to $1,200,000 annually in replacement costs. Furthermore, the liability associated with the failure of a wood pole can easily exceed several million dollars if a serious injury is involved. On a more personal note, decay or insect attack in residential homes can markedly reduce the home value.

It is readily apparent that we accept a certain level of decay loss within specific commodities; however, declining supplies of wood and increasing raw-material costs will necessitate a more careful evaluation of wood usage. In this chapter, we review the causes of decay losses in the major commodities where wood is employed and stress the principles and practices used to prevent or minimize these losses.

Decay Hazard

In most interior uses and many structural applications where wood is kept dry, there is no decay hazard and this material will last indefinitely. Decay hazards are related to exterior uses of wood subjected to atmospheric wetting or other moisture sources such as soil contact.

Before we address decay problems associated with specific wood uses, it is important to consider that the risk of decay varies widely with climate and geographic location. This premise is employed in the specifications of the American Wood-Preservers' Association through the incorporation of different levels of chemical protection that users can specify for their particular regions (AWPA, 1990). It is readily apparent that the risk of decay is considerably greater in southern Florida than northern Wyoming and that the degree of exposure has a marked influence on performance. Decay problems are minimal in the dry southwestern United States or at higher elevations, but become quite significant in the southeastern United States. It is, however, less apparent that decay risks can vary widely within closely situated sites. These hazards often necessitate the use of either species with naturally durable heartwood or wood that has been preservative treated.

Types of Decay Hazard

The variations in exposure were used by Scheffer (1971) to develop a climate index for decay hazard for various exterior wood uses above the ground (Fig. 15-1A). This index uses rainfall and temperature data to develop an index rating ranging from 0 (no risk) to 100 (high hazard). These values are then adjusted on the basis of known service records of wood in the various regions. The index establishes three broad hazard zones: *severe decay hazard* (southeastern United States and the Olympic Peninsula), *moderate decay*

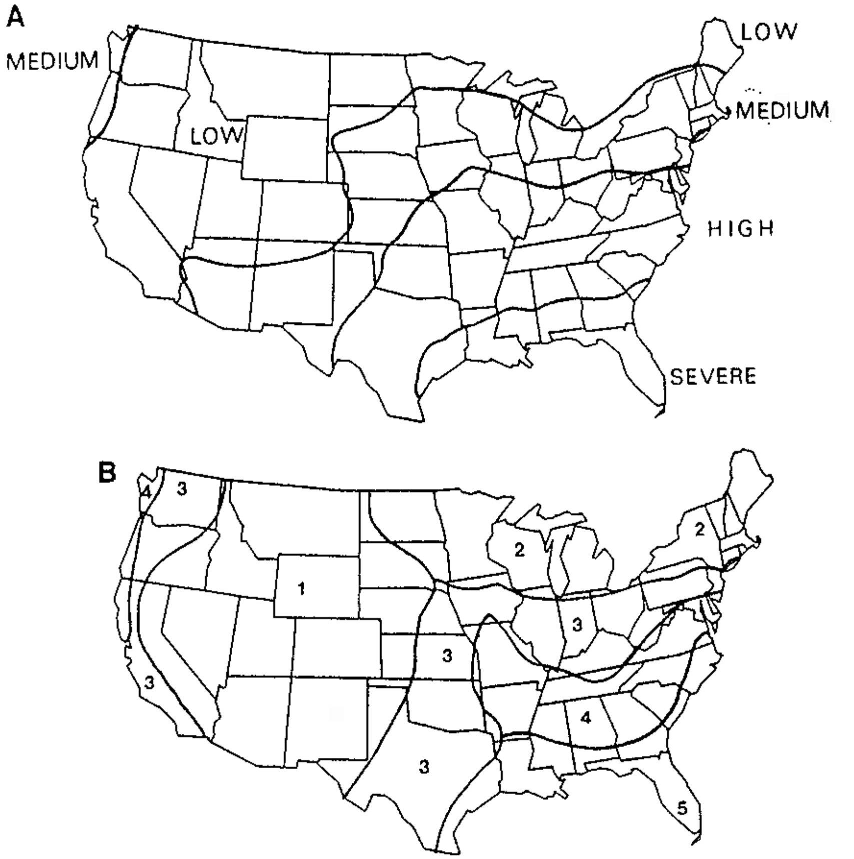

Figure 15-1 Decay hazards for (A) aboveground exposure (from Scheffer, 1971) and (B) utility poles in the United States (from REA, 1973), where 1 represents low decay hazard and 5 represents severe exposure.

hazard (northeastern United States, north and central states, and western Oregon to California), and *low decay hazard* (Southwest, Rocky Mountains, and the eastern Pacific Northwest). Whereas the climate index is useful for predicting performance of wood in non-ground-contact applications, it cannot predict ground-contact performance, since it cannot account for variations in soil type, water-holding capacity, and vegetation. The climate index has, however, been included in the AWPA Standards and is often employed by wood users to assess their relative decay risk.

As an alternative to the climate index, the Rural Electrification Administration (REA) developed a hazard index for utility poles based on inspection data from across the United States (Fig. 15-1B) (REA, 1973). Their system has

five decay-hazard categories, and utilities that receive REA loans must utilize these requirements. These zones, based on actual pole failures, probably represent the most comprehensive national data base of wood performance based on climate.

It is interesting that there are relatively few guidelines available to assist in the specifications of wood products; however, this void reflects the wide array of uses in which wood is employed and the absence of an effective mechanism for monitoring wood losses in these many commodities.

Types of Wood Products—Decay Fungi

Almost without exception, the principal wood products decayers are common saprobic fungi that decay fallen timber and slash in the forest.

A wide array of fungi colonize decaying wood in the forest, but the number of species isolated from wood products is relatively limited. This decreased variety may reflect the more restrictive conditions within the wood product as well as the scarcity of extensive, systematic data on fungal colonization of wood. In most instances, the fungi present in wood products probably reflect a close replication of an environmental niche present in decaying wood in the forest ecosystem.

A number of workers have reported on the incidence of fungi in various products (Richards, 1933; Silverborg, 1953; Davidson *et al.*, 1947; Toole, 1973; Cowling, 1957; Eslyn, 1970; Eslyn and Lombard, 1983; Graham and Corden, 1980; Zabel *et al.*, 1980, 1985). The most comprehensive listing was prepared by Duncan and Lombard (1965), which summarized fungi associated with wood-products decays collected by the U.S. Forest Products Laboratory, Madison, Wisconsin, and the Forest Disease Laboratory, Beltsville, Maryland, over a 30-yr period. These identifications tend to favor those organisms that produce large, durable fruiting structures or that are readily cultured and identified from wood, but they do provide a relative guide to the major decayers of wood products in the United States. The Duncan and Lombard results indicate the following.

1. Brown rots constituted 76% of the nearly two thousand samples examined. These results probably reflect the extensive use of coniferous woods in many structures.
2. The 10 most prevalent fungi on conifers were *Neolentinus lepideus, Gloeophyllum trabeum, G. sepiarium, Postia (Poria monticola) placenta, Meruliporia (Poria) incrassata, Coniophora arida, Antrodia (Poria) vaillantii, Antrodia (Poria) xantha, Coniophora puteana*, and *Antrodia (Poria) radiculosa.*
3. The six most prevalent species on hardwoods were *Gloeophyllum trabeum, Trametes (Coriolus, Polyporus) versicolor, Antrodia (Poria) oleracea, Meruliporia incrassata, Xylobolus frustulatus*, and *Schizophyllum commune.*

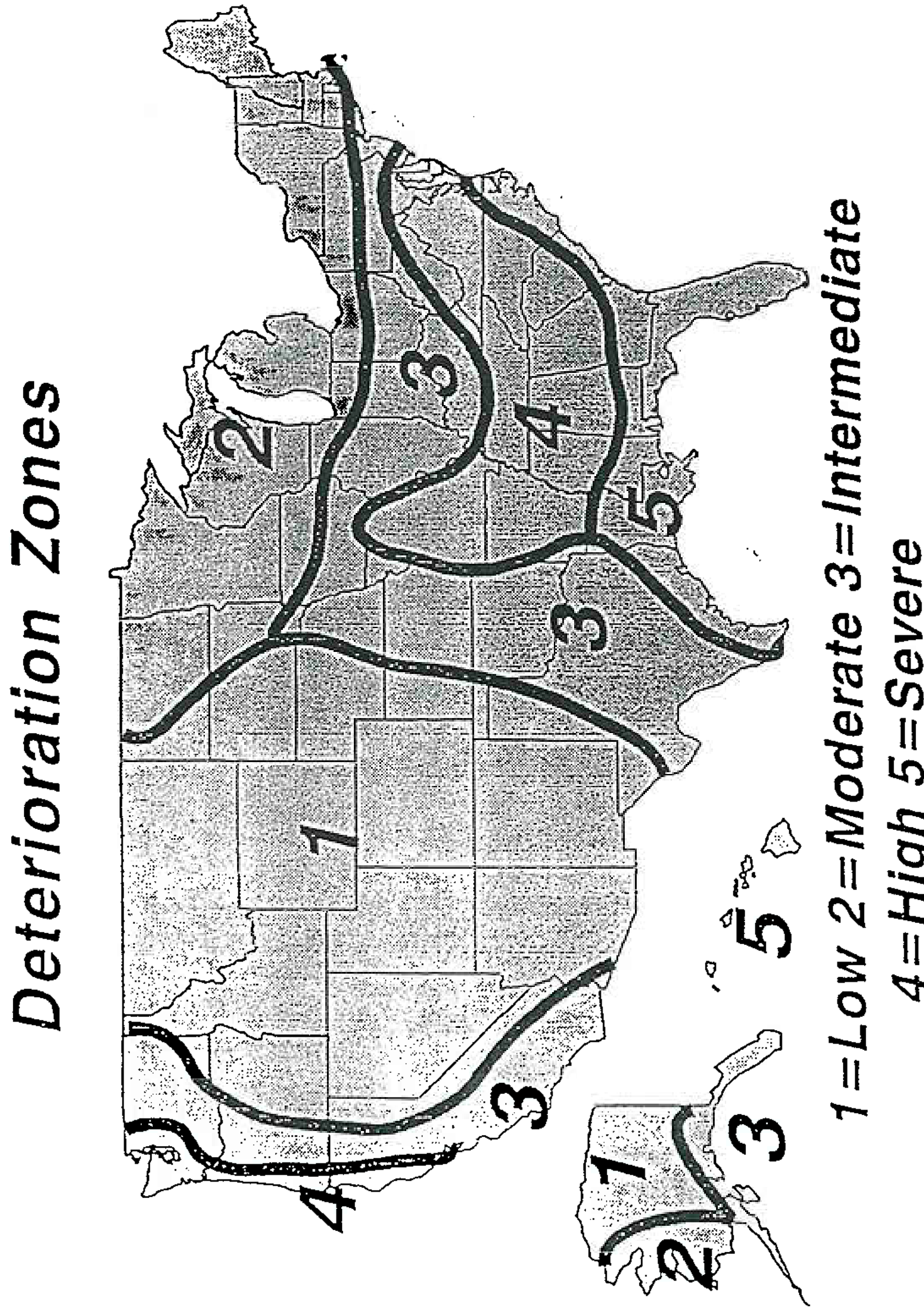

Figure 1.

Figure 1. Major regional differences in potential for deterioration of wood used in contact with the ground are shown in Figure 1. In certain modified environments such as banks along irrigation canals or irrigated residential or agricultural lands, a higher degree of protection might be needed than would be required in the local natural environment. It must also be recognized that within individual regions, certain natural environments such as river valleys or coastlines may present greater potential for wood deterioration than the region as a whole.

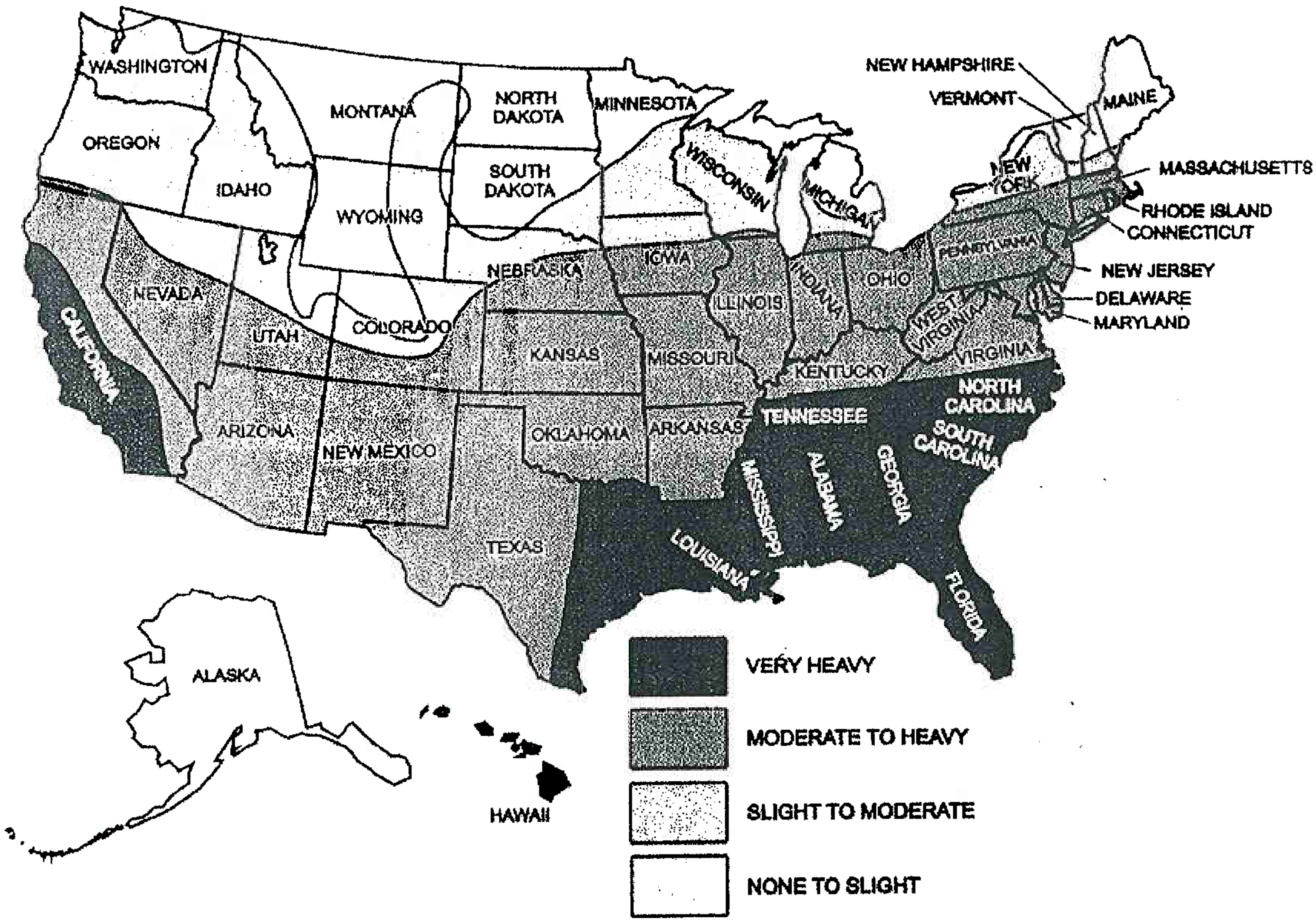

FIGURE 2304.1.4
TERMITE INFESTATION PROBABILITY MAP

WDMA INDUSTRY SPECIFICATION I.S.10 FOR

Testing Cellulosic Composite Materials For Use in Fenestration Products

TABLE OF CONTENTS

Page

Published By
Window and Door Manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

Introduction

The wood working industry uses many familiar materials which are made by combining processed wood with polymers. Plywood, particleboard, plastic laminate and laminated veneer lumber are all produced in this manner. These materials are considered to be composites because the fibers and polymers are not chemically combined into a new substance but remain distinctly present as separate phases of a matrix structure.

Innovative research is developing new ways to combine fibers and polymers. Wood can be broken down in different ways into fibers, flakes, and strands. While thermosetting polymers have a long history of use in composites, combinations of fibers and thermoplastic polymers are a more recent development. New polymers are making it possible to use cellulosic fibers from agricultural sources as an alternative to wood.

The many possible combinations of fibers and polymers give rise to materials with a wide variety of physical properties and process capabilities, and there would be many ways to classify and regulate these materials. This specification for testing is intended for the fenestration manufacturer with a general interest in materials of this type who is confronted with an expanding class of new materials and must compare them to established materials and to each other. The following principles were considered in establishing this specification.

1) *Composite materials are by intent a broadly defined class of materials. This broad definition is intended to accommodate future material innovations and to encourage their responsible use rather than to stifle it with regulations which would be, to some extent, arbitrary because this is a broad class of materials.*

2) *This comprehensive package of tests has been chosen to evaluate materials in this class reliably and without bias for properties important in fenestration applications. This will enable a manufacturer to compare competing materials on a level playing field and to monitor the quality of material over time.*

3) *Not all materials in this class are intended to be suitable for all end uses. Composite manufacturers are required to perform all tests for performance characteristics unless they openly acknowledge the tests are not applicable to the end use.*

4) *Required minimum and maximum values are attached only to material properties where design of fenestration products cannot accommodate performance levels above or below a specific point.*

WDMA INDUSTRY SPECIFICATION FOR TESTING CELLULOSIC COMPOSITE MATERIALS

For Use in Fenestration Products

1.0 Scope

1.1 This specification applies to composite materials that will be used in the manufacture of fenestration products. It will provide a common test basis for composite materials used in the manufacture of fenestration products.

1.2 The test methods listed in this specification will aid in the evaluation of certain properties of these composite materials as well as listing minimum/maximum performance requirements for some of these properties.

2.0 Minimum Requirements

2.1 To qualify as meeting this specification, products shall be tested in accordance with this specification, and shall meet the Gateway values given in Table 1.

2.2 Composite materials shall comply with the most recent version of WDMA I.S.4 *Industry Standard for Water-Repellent Preservative Non-Pressure Treatment for Millwork.*

2.3. Surface coatings shall comply with the most recent version of WDMA TM-12 *Test Procedure and Acceptance Criteria for Factory Applied Pigmented Coatings on Wood and Wood Composites for Millwork.*

2.4 Prime only coatings shall comply with the most recent version of WDMA TM-11 *Test Procedure and Acceptance Criteria for Pigmented Primer on Wood and Wood Composites for Millwork.*

3.0 Tests Procedures

3.1 Test Specimens - A minimum of 10 specimens shall be tested for each of the properties given in this section.

Exceptions:

1) A minimum of 5 specimens shall be required for each of the tests specified in Section 3.8 for Long Term Durability.

2) Only one specimen is required to be tested for Flame Spread in accordance with Section 3.14.

3.2 MOE – Measure in accordance with ASTM D790.

3.3 MOR / Maximum Fiber Stress – Measure in accordance with ASTM D790.

3.4 Internal Bond / Tensile Strength Perpendicular to Surface – Test two sample sets consisting of 10 specimens each. One sample set shall be conditioned to equilibrium at 50% RH and 20°C (68°F). The second set shall be conditioned to equilibrium at 95% RH and 20°C (68°F).. Measure in accordance with ASTM D1037, Sections 28-33.

3.5 Compression Strength – Test two sample sets consisting of 10 specimens each. One sample set shall be conditioned to equilibrium at 50% RH and 20°C (68°F). The second set shall be conditioned to equilibrium at 95% RH and 20°C (68°F). Measure in accordance with ASTM D1037, Sections 34-40.

3.6 Stress Relaxation / Sustained Uniform Load (Sag) – Measure in accordance with ASTM D2164, Sections 17-20.

3.7 Permanent Weight and Size Change – Measure in accordance with ASTM D756, Procedure E with –40°C (-40°F) as the lowest test temperature required, for 6 cycles.

3.8 Long Term Durability – Measure in accordance with the following method:

3.8.1 Record all dimensions and weight of samples.

3.8.2 Expose samples outdoors in South Florida at 45 degrees south for 5 years or to Xenon Arc utilizing a 6500 watt lamp per ASTM G26 (Test Method 1, Test Method A) for a period of 4500 hours.

Note: *Permitting the choice of 4500 hours of Xenon arc or 5 years of exposure in South Florida is not intended to imply that one exposure is equivalent to the other.*

3.8.3 Following exposure record dimensional changes and weight changes.

3.8.4 Test specimens per Sections 3.2, 3.3, 3.4, 3.5, 3.11 and 3.15.

3.9 Moisture Content and Specific Gravity – Measure in accordance with ASTM D1037, Sections 119-120.

3.10 Coefficient of Thermal Expansion – Measure in accordance with ASTM E228, with the modification that the temperature range to be used for the test is –30°C (-22°F) to 70°C (158°F). The test results shall be graphed with temperature on the "X" axis and length change on the "Y" axis.

3.11 Dimensional Stability with Regard to Moisture Content – Measure in accordance with ASTM D1037, Sections 107-110.

3.12 Thermal conductivity – Measure in accordance with ASTM C518.

3.13 Heat Distortion Temperature – Measure in accordance with ASTM D648 at 1.82 MPa (264 psi).

3.14 Flame Spread – Measure in accordance with ASTM E84.

3.15 Impact Strength – Measure in accordance with ASTM D256, Method B .

3.16 (*Ballot Item, Not yet Final)*
Screw Withdrawal – Measure in accordance with ASTM D1761, Sections 1-20.

3.17 Split Resistance – Measure in accordance with NWWDA TM-5.

3.18 Surface Hardness – Measure in accordance with ASTM D1037, Section 68-73.

3.19 Chemical Resistance – Measure in accordance with ASTM D1308.

4.0 Approval

4.1 The formal approval process is between the composite material manufacturer and the fenestration manufacturer. Complying with this specification does not guarantee acceptance by a particular fenestration manufacturer. Composite materials qualified for use by this specification shall be evaluated inn accordance with each company's own material specifications and quality requirements. The conditions of Sections 4.2 shall be met.

4.2 A report shall be drafted for each candidate composite, stating that all tests completed were done in accordance with this specification. The report shall include the following:

4.2.1 A summary of the test values of Section 3.0.

4.2.1.1 Any deviation or modification from the tests required in Section 3.0 shall be clearly stated in the report.

4.2.1.2 Results from the evaluation of the gateway material requirements are mandatory. If a non-gateway performance characteristic is not reported by the composite manufacturer, the report shall include a statement that the material is not applicable for end uses requiring that material property.

4.2.2 Name(s) and address(es) of the organization(s) that conducted the tests and issued the reports.

4.2.3 The sample size and specimen size, unless specified in the standard referenced in Section 3.0.

4.2.4 A record of any treatment, coating or conditioning of the test specimens before testing.

4.2.5 Complete identification of the composite material, including cellulosic species, origin, shape and form, chemical components of polymers or adhesives, fabrication procedure, type and pertinent physical or chemical characteristics relating to the quality of the material.

4.2.6 Information as required for test reports in each of the test methods used.

4.2.7 Notes regarding any specific details that may have a bearing on the test results.

5.0 Precision and Bias

5.1 Precision and bias shall be as specified in the test standards used.

6.0 Definition

6.1 Cellulosic Composite – A composite whose ingredients include cellulosic elements. These cellulosic elements can appear in the form of, but are not limited to: distinct fibers, fiber bundles, particles, wafers, flakes, strands and veneers. These elements may be bonded together with naturally occurring or synthetic polymers. Also, additives such as wax or preservatives may be added to enhance performance.

7.0 Referenced Documents.

7.1 All test standards referenced in this specification are most recent edition, unless otherwise noted. Copies of the standards referenced are available from the following agencies.

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
West Conshohocken PA 19428-2959
Phone: (610)-832-9500
Fax: (610)-832-9555
E-mail: service@astm.org

ASTM C518 *Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter.*

ASTM D256 *Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.*

ASTM D648 *Test Method for Deflection Temperature of Plastics under Flexural Load.*

ASTM D756 *Practice for Determination of Weight and Shape Changes of Plastics under Accelerated Service Conditions.*

ASTM D790 *Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.*

ASTM D1037 *Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.*

ASTM D1308 *Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.*

(Ballot Item – Not Yet Final) **ASTM D1761**
Standard Test Method for Mechanical Fasteners in Wood

ASTM D2164 *Methods of Testing Structural Insulating Roof Deck.*

ASTM E84 *Test Method for Surface Burning Characteristics of Building Materials.*

ASTM E228 *Test for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer.*

American Society of Testing and Materials – continued

ASTM G26 *Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.*

Window and Door Manufacturers Association[1]

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E-mail: admin@wdma.com
Website: www.wdma.com

NWWDA TM-5 *Test Method to Determine the Split Resistance of Stile Edges of Wood Doors.*

WDMA I.S.4 *Industry Standard for Water-Repellent Preservative Non-Pressure Treatment of Millwork.*

WDMA TM-11 *Test Procedure and Acceptance Criteria for Factory Applied Pigmented Primer on Wood and Wood Composites for Millwork.*

WDMA TM-12 *Test Procedure and Acceptance Criteria for Factory Applied Pigmented Coatings on Wood and Wood Composites for Millwork.*

[1] Documents published prior to 1998 are designated National Wood Window and Door Association, which was the former name of the Window and Door Manufacturers Association.

Table 1
Material Properties

Section	Test Method	Property	Gateway Value
3.2	ASTM D790	Tensile Strength – Modulus of Elasticity (MOE).	NO
3.3	ASTM D790	Flexural Strength – Modulus of Rupture (MOR).	NO
3.4	ASTM D1037	Internal Bond	NO
3.5	ASTM D1037	Compression Strength.	NO
3.6	ASTM D2164	Stress Relaxation	NO
3.7	ASTM D756	Permanent Size and Weight Change	YES 3% maximum change in dimension.
3.8	Long Term Durability - Properties of Conditioned Specimens		
	ASTM D790	MOE	NO
	ASTM D790	MOR	NO
	ASTM D1037	Internal Bond	NO
	ASTM D1037	Compression Strength	NO
	ASTM D1037	Dimensional Stability with Regard to Moisture	NO
	ASTM D256	Impact Strength	NO
3.9	ASTM D1037	Moisture Content.	YES 12% maximum
3.9	ASTM D1037	Specific Gravity	NO
3.10	ASTM E228	Coefficient of Thermal Expansion.	NO
3.11	ASTM D1037	Dimensional Stability	YES 5% maximum
3.12	ASTM C518	Thermal Conductivity.	NO
3.13	ASTM D648	Heat Distortion Temperature	YES 158°F (70°C) minimum
3.14	ASTM E84	Flame Spread.	NO
3.15	ASTM D256	Impact Strength	NO
3.16	ASTM D1761	Screw Withdrawal	NO
3.17	NWWDA TM-5	Split Resistance	NO
3.18	ASTM D1037	Surface Hardness	NO
3.19	ASTM D1308	Chemical Resistance.	NO

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August 28, 1997

TO: Jim Krahn 218-386-1913
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Steve Hubert 417-862-3780

cc: Kevin Doll - Pella
John McFee - NWWDA
Kurt Koch - TJM

FR: Paul Merrick

RE: NWWDA Composites Committee - "Re-Processed Wood" Task Force Assignment

At the July 10 Composites Committee meeting in Chicago, the four of us were tasked with defining the scope and test methods for evaluating reprocessed wood for use in millwork.

Below I have sketched out a rough introduction and scope statement and included a table of tests and candidate methods. The format should allow it to grow into a standard or, more likely, a set of guidelines for the evaluation of such substrates. I attempted to model it after the pending ASTM Specification for Evaluation of Wood-Thermoplastic Composite Lumber and the AWPA composites treating guidelines. The rationalization was that vendors pursuing NWWDA recognition would be familiar with the other documents also. Where possible, I have tried to reference the root standard for evaluating the property. As most of you are aware, ASTM test standard tend to incorporate existing methods into new standards.

I welcome your comments.... remember this is just a draft and we'll be able to improve it later.

Paul

DRAFT - 08/26/97

NWWDA IS-00
Composites Committee

Guidelines for the Evaluation of Composite Lignocellulosic Products

1.0 Introduction

Composite Lignocellulosic Products (CLP's) are defined as substrates whose primary (dominant) ingredient is lignocellulosic fibers. Forms these lignocellulosic fiber elements can appear in are, but are not limited to: distinct fibers, fiber bundles, particles, wafers, flakes, strands and veneer. These elements may be bonded together with naturally occurring or synthetic resins. Also, additives such as wax or preservatives may be added to enhance performance. Examples of CLP's which may be suitable for millwork applications include, but are not limited to; laminated veneer lumber (lvl), laminated strand lumber (lsl), oriented strandboard (osb), particleboard, medium density fiberboard (mdf), hardboard, strawboard and wheatboard. Composite products whose ingredients include thermoplastic (ie. polyethylene) substrates are directed to follow the evaluation guidelines established for those products.

2.0 Scope

This document is intended to provide manufacturers of Composite Lignocellulosic Products a starting point for determining if their substrate is suitable for millwork applications. Testing performed at this stage is intended to characterize the basic physical and mechanical properties of the candidate CLP. Future testing and evaluations will be required to determine if the substrate performs adequately as part of a millwork component or finished product. This secondary testing is beyond the scope of this document and Committee.

3.0 Reference Documents

Selected ASTM, NWWDA and AWPA test methods will be referenced in this document.

4.0 Testing

4.1 Material submitted for evaluation shall be selected randomly from normal production.
4.2 Ponderosa pine (supplied by the NWWDA) shall also be tested as a benchmark.
4.3 Each test set shall consist of a minimum of 30 specimens.
4.4 Testing shall be conducted at a third party lab, or witnessed by an independent inspection agency (ie. TECO, PFS).
4.5 Evaluation of selected physical and mechanical properties shall be conducted according to the test method(s) outlined in the table. Substitution of a different test method must be approved by the Committee.
4.6 Petition can be to the Committee to exclude specific test(s) deemed to be not applicable.

4.7 Table of Recommended Testing & Methods.

Physical Property Evaluation	Test Method
Moisture Content	ASTM D4442, method A or B
Specific Gravity / Density (Whole)	ASTM D2395
Specific Gravity / Density (Profile)	ASTM D2395 by sections or QMS Equipment (or similar)
Dimensional Change - Thermal	? ?
Dimensional Change - Humidity	ASTM D1037 (section 107)
Dimensional Change - Liquid Moisture	ASTM D1037 (section 100)
Flame Spread Rating	ASTM E84
Smoke Toxicity	ASTM E1678
Thermal Conductivity	ASTM C518 (C177?)
Natural Fungal Decay Resistance	ASTM D2017
Secondary Bonding	ASTM D1037 (sec. 87)
Adhesive Offgassing (Formaldehyde)	ASTM D5582 (Desiccator)
Machining Characteristics (comparative)	ASTM D1666
Chemical Resistance	? ?
UV Degradation Resistance	? ?

Mechanical Property Evaluation	Test Method
Internal Bond	ASTM D1037
Bending Strength (MOR) - edge/flat √	ASTM D4761
Bending Stiffness (MOE) - edge/flat √	ASTM D4761
Tensile Strength (parallel to grain) √	ASTM D4761
Compression Strength - edge/flat √	ASTM D1037 (section 34)
Hardness - Janka Ball	ASTM D1037 (section 68 or 74)
Impact Strength (toughness ?)	ASTM D1037 or ASTM D143 ?
Creep (Sag) Characterization √	ASTM D2164 ? ?
Split Resistance	NWWDA TM-5
Fastener (screw) Holding	ASTM D1761 (sections 1-11) NWWDA TM-10

4.8 Notes to accompany Table 4.7.

4.8.1

4.8.2 Adhesive off-gassing test is only applicable to substrates using formaldehyde based adhesives.

4.8.3 For Dimensional Change - liquid moisture, also measure width & length.

4.8.4 For Compression strength edge/flat, it is not required to do test on wet specimens. But, do test on both edgegrain & flatgrain of mtrl.

4.8.5 For all bending tests (MOE, MOR), use third point loading and a l/d ratio of 21.

5.0 Report

5.1 The test data package should include tables illustrating the mean, minimum, maximum, standard deviation and coefficient of variation for each property evaluated.

5.2 Graphs and pictures for the report are encouraged if they help explain results.

5.3 A description of the CLP substrate (ie. how made, fiber and adhesive used) should accompany the report. This description should be as complete as possible, without compromising proprietary information.

5.3 Results shall be presented in person to the Committee at a mutually agreed upon time.

5.4 The Committee reserves the right to request additional testing / analysis of CLP properties.

6.0 The Next Step(s)

6.1 Successful completion of the requirements of the Composites Committee shall result in the forwarding of the CLP data package (with Committee comments) to the appropriate NWWDA Application Committee(s).

6.2 The manufacturer of the candidate CLP shall also be directed to contact these Committees.