NEW ZEALAND
TIMBER INDUSTRY FEDERATION INC.

Specifying Timber

We wish to acknowledge funding assistance from the Forest Industry Development Agenda initiative for this presentation

BUILDING TRADITION

Lightweight and strong with a plentiful supply, Timber is the first choice structural material today as it has been for hundred's of years.

Timber's popularity as a building material is undisputable. Timber framing comprises over 97% of wall and roof frames in New Zealand and over 90% in Australia, North America and Scandinavia.

The New Zealand Timber Industry Federation has created this guide as an accompaniment to the "Specifying Timber" seminar to help you get the most from this wonderful product.

No Better Choice Than Timber

Environmentally friendly

Timber could not be kinder to the environment. It has low production energy requirements and is a net carbon absorber. Timber is a renewable resource and world leading New Zealand forest management ensures continuous and sustainable production.

Best Value

Comparative studies have shown that, in terms of direct expense, timber is consistently the most cost effective building material.

In plentiful supply

Timber will always be available. New Zealand has significant forest resources with 1.8 million hectares of environmentally friendly plantation forests currently yielding 22 million m^3 of roundwood per annum.

Strong and lightweight

Timber is strong, light and reliable making construction simpler and safer than that of steel or concrete.

Safe

Because it is lightweight and strong, timber frame construction requires little in the way of heavy lifting equipment making building sites safer work places. Timber being non conductive has obvious benefits in terms of electrical safety.

Flexible

A particular feature of timber is the flexibility of design forms and finishes that can be used. This flexibility extends to the ease with which existing buildings can be added to or modified to suit changing circumstances. User friendly and versatile, timber gives designers and architects creative freedom to bring extraordinary beauty to buildings and structures.

TREATED TIMBER

1. Treated Timber
   - Required durability.
   - Treated at treatment plant.
2. Preservative treatment of timber was once relatively straightforward.
   - Out of the weather – Boron
   - Exposed to the weather – CCA

3. A number of issues have resulted in changes to this simple approach.
   - Health and safety concerns about treated timber.
   - Environmental concerns.
   - Leaky homes.
   - Business efficiency.
   - Competition for timber.

4. Health and safety concerns about CCA arose in New Zealand following voluntary restrictions imposed on the use of CCA treated timber in the US.

   Note the US restrictions were and are voluntary. They are not backed up by scientific evidence.

   Similarly in Australia, restrictions imposed in 2005 there are “precautionary”.

   The ERMA review conducted in New Zealand in 2003 concluded that there is no reason to amend the existing risk assessment for CCA.

   Nevertheless the US restrictions prompted the preservative suppliers to make available CCA alternatives. These largely copper based formulations have been approved for use in New Zealand and are Alkaline Copper Quaternary and Copper Azole.

5. Concerns raised by various consumer groups about exposure to chemicals in general reflected on the use of treated timber again prompting the preservative suppliers to make available preservatives that are seen to be more benign such as substituting organics for heavy metals.

6. Issues to do with end of life/waste disposal have come to the fore in recent years and have been another reason behind the development of new preservatives.

7. The leaky homes issue prompted the lawmakers to require the use of treated timber in almost all framing situations but in so doing, differentiated between treatment levels for internal frames and external wall framing as well as splitting H3 into two sub-classes.

8. Perceived advantages of more rapid stock turnaround has led to the development of quicker treatment processes.

9. Business efficiency is also tied up with the competitiveness of timber against alternative building materials and building systems. For timber this has meant a need to be cost competitive and also to be able to present an attractive product to the market.

10. To many in the building industry and those in the timber industry as well, the changes surrounding preservative treatment of timber have led to considerable confusion. The confusion has arisen in the areas of:
    - Hazard classes
    - Branding and identification
    - Different preservatives

11. The hazard class system is the means under which timber is determined to have been treated for a particular end-use or service condition. The hazard classes and the preservatives approved for them are set out in the timber treatment standard NZS 3640:2003. The correct use of treated timber in building is specified in NZS 3602:2003.

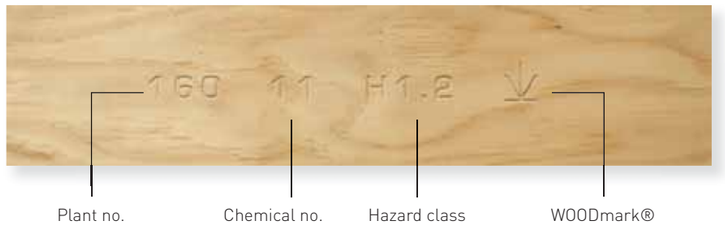
12. The efficacy requirements for each hazard class may be satisfied by several preservatives.

	CCA	Boron	TBTO/TBTN	IPBC	Azole	ACQ	CuAz	Pyrethroids	CuN
H1.1	●	●						●	
H1.2		●	●	●					
H3.1	●	●	●		●	●	●		●
H3.2	●					●	●		●
H4	●					●	●		
H5	●					●	●		
H6	●								

13. Branding and identification. Treated timber is required to be identifiable by:
    - Hazard class
    - Preservative
    - Treatment company

    Each has a unique number although in many cases companies choose to brand their own name on the timber as well.

    A typical brand layout:



This brand may be:

- Applied direct to the timber by burn brand, ink or incision.
- Printed on a plastic tag and fixed to the timber.

In the case of framing a running or face brand is required. However there are instances where it is not possible to apply such a brand. In such cases the timber is to be colour dyed as well as end branded. The purpose of the colour dye is to permit ready identification of the preservative used and the hazard class.

The requirements are:

H1.2:	TBTO/TBTN or IPBC permethrin	blue
	Boron	pink
H3.1:	TBTO/TBTN or Azole	green

In addition, boric treated H3.1 timber is required to be pre-primed with a grey primer.

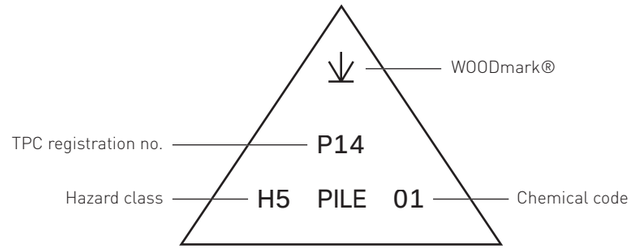
14. As mentioned, hazard classes may be treated using different preservatives. It is your personal choice to prescribe a particular preservative if you wish.

    If you express no preference, any hazard class you may specify may be met by any of the preservatives approved for that hazard class. Each will, based on field and laboratory trials, provide the timber with the protection required.

15. A special word about house piles.

    Not all timber treaters are licensed or permitted to produce house piles.

    House piles are required to meet certain grading criteria as well as treatment specifications. Because of this, house piles are branded with a distinctive triangle brand.



    The triangle brand is burnt into one face of the pile between the third and half way along its length.

    Note that only timber with the approved triangle brand may be used as house piles. It is not legal to use any other timber even though it may be treated to H5.

16. Treatment processes

    In the simple world there were two basic processes:

    - For boron, timber was dipped and then the solution diffused into the wood over a period of six to eight weeks.
    - For CCA, the timber was air dried then treated in a pressure cylinder.

    In order to shorten up treatment times, new accelerated processes have been introduced. For boric treatment and CCA treatment the timber is usually kiln dried or steamed instead of air dried before treatment.

    Preservatives carried in white spirits (LOSP) have short cycle times with low uptakes which makes them ideal for treating timber in its final shape and form.

    Similarly the new boron processes are ideal for treating timber in final shape and form due to low uptake.

17. Brush or spray on treatments

    Brush or spray on treatments out of a can are remedial treatments. They are designed for coating cut ends, notches, etc.

    These treatments will not achieve the standards of treatment required for compliance with the relevant standards.

    Only treatments conducted at a treatment plant using equipment and methods that are proven to achieve standards of penetration and retention will provide the required level of efficacy.

18. Standards

    The standard for treatment of timber is NZS 3640:2003. The treatment of plywood, glulam, LVL and reconstituted boards is covered by a suite of joint Australia//New Zealand standards, AS/NZ 1604 parts 2 to 5.

    Each of these standards specifies:

    - The penetration of preservative into the timber for each hazard class.
    - The retention of preservative in the timber for each hazard class.

    These specifications are to be met regardless of method of treatment.

    The durability of the timber is determined by penetration and retention of preservative not so much by how it has been treated.

19. Nevertheless, treatment processes must be proven to be able to achieve the treatment standard on a consistent and reliable basis.

    For that reason the WOODmark® programme – a quality assurance scheme for treated timber, requires that all accelerated boric treatment processes be approved at individual sites prior to acceptance into the programme. Similarly new processes for treating products such as plywood, LVL and glulam must have specific approval.

20. Quality Assurance

    In today's climate you, as specifier, merchant or builder want to be assured that the treated timber you use will do the job you or your clients require.

    There is no mandatory quality programme for treated timber in New Zealand. However the majority of treaters do adhere to a quality assurance scheme. The longest established and most widely used scheme is the WOODmark®.

    All quality assurance programmes involve some form of independent audit and testing of product to ensure that standards of treatment are being achieved.

    As specifiers and users of treated timber it is in your interest to ensure that the treated timber you use is covered by a quality assurance programme.

21. Conclusion

    The timber preservation industry is conscious of a need to keep its products as simple to use as possible.

    However, for various reasons the simple approach has had some complications added to it.

    We hope this presentation has helped you to understand that things are not as complicated as it may seem. We expect that developments such as product rationalisation will sort out some of the confusion and we hope you will continue to be confident in your use of treated timber.

As specifiers and users of treated timber it is in your interest to ensure that the treated timber you use is covered by a quality assurance programme.

STRUCTURAL TIMBER

Summary

- Amended structural timber grading standards effective on 1 April 2007.
- The amended standards introduce a new suite of grades – the new grades are outlined and explained.
- All but one new grade requires verification of structural properties – an explanation of the verification process is given.
- Grade availability – Not all grades and sizes may be available – an explanation on why some sizes and grades may not be available is provided.
- Timber designers, builders and end users must specify and use grades correctly – key aspects are explained.

Amended Standards Cited In The B1 Compliance Document To The Building Code

Changes have been made to the way structural timber is graded with the introduction of amendments to New Zealand Standards governing structural timber grades.

The Department of Building and Housing has amended Compliance Document B1 Structure to the Building Code by referencing the following amended Standards:

Amendment 4 NZS 3603:1993 Timber Structures Standard.

Amendment 2 NZS 3604:1999 Timber Framed Buildings.

Amendment 1 NZS 3622: 2004 Verification of Timber Properties.

The amended Compliance Document will become effective on 1 April 2007. The amended standards will apply to building work consented on or after 1 April 2007.

Amendment 4 NZS 3603:1993 Timber Structures Standard

Amendment 4 NZS 3603 introduces the following new grades:

- Visually Stress Graded (VSG) 8 & 10.
- Machine Stress Graded (MSG) 6,8,10,12,15.
- G8 grade (this is a green version of a dry VSG/MSG8 grade where the timber is verified in its green or non dried condition).
- Unverified No1 Framing: This grade is visually graded to the No 1 Frame specifications in NZS 3631:1988 but its structural properties are not verified. Because this grade is not verified, its structural properties have been reduced from its previously established values.

Structural Timber Grades and their Characteristic Stresses (Obtained from Amendment 4 NZS3603:1993)

Grade	Colour Marks (MSG Only)	Average Modulus of Elasticity (Stiffness) (GPa)	Minimum Modulus of Elasticity (Stiffness) (GPa)	Bending Strength (MPa)	Compression Strength (MPa)	Tension Strength (MPa)
No 1 Framing (unverified) (Green)		4.8	3.2	7.5	11.0	3.0
No 1 Framing (unverified)		6.0	4.0	10.0	15.0	4.0
MSG6		6.0	4.0	10.0	15.0	4.0
G8 (Green)		6.5	4.4	11.7	12.0	4.0
VSG8		8.0	5.4	14.0	18.0	6.0
MSG8	Black	8.0	5.4	14.0	18.0	6.0
VSG10		10.0	6.7	20.0	20.0	8.0
MSG10	Green	10.0	7.5	20.0	20.0	8.0
MSG12	Purple	12.0	9.0	28.0	25.0	14.0
MSG15	Orange	15.2	11.5	41.0	35.0	23.0

Amendment 2 NZS 3604:1999 Timber Framed Buildings

Amendment 2 NZS 3604 provides design information in the form of tables for three sets of grades. Tables are provided for:

- MoE (Stiffness) 6 grades (MSG6 and Unverified No 1 Framing)
- MoE (Stiffness) 8 grades (MSG8,VSG8 and G8 (when dry))
- MoE (Stiffness) 6.5 grades (this is the value assigned for wetted in service 8 grades) (G8, MSG8, VSG8)
- MoE (Stiffness) 10 grades (MSG10 and VSG10)

NZS 3622:2004 Verification of Timber Properties

All of the new grades (except unverified No 1 Framing grade) require verification in accordance with the verification Standard NZS 3622:2004. The verification method and pass criteria are the same for both grading systems (VSG & MSG). The requirement to use a third party quality assurance audit organisation is mandatory.

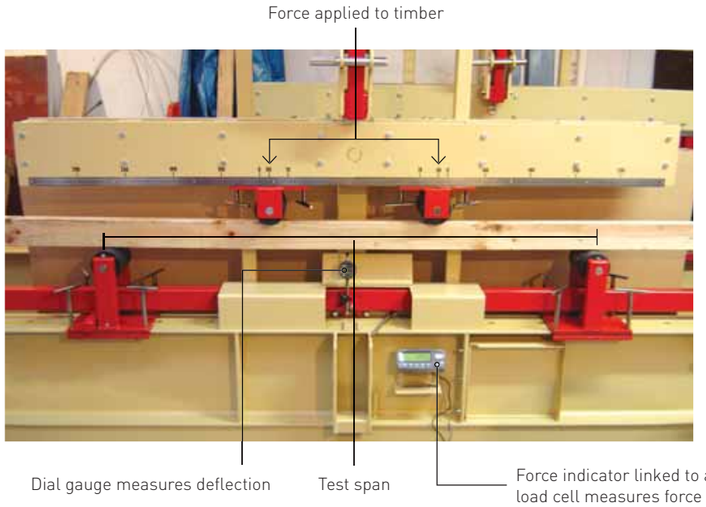
VSG And MSG Grades

Both grading systems assign timber into grades according to their stiffness and strength.

A machine stress grader is only capable of testing the stiffness of timber but not strength. There is correlation between stiffness and strength but visual characteristics such as knots are the main determinant of strength. Machine Stress Graded (MSG) timber is subject to visual grading ('visual override') in accordance with AS/NZS 1748 after it has been graded for stiffness although larger defects are allowed compared to VSG grades which must be graded to the No 1 Frame grade specifications of NZS 3631:1988.

In order to determine whether the strength properties for machine stress graded product are being achieved, samples of the production must be taken and tested on a separate static testing machine in accordance with the verification Standard NZS 3622:2004. The verification process is also important to check that the machine stress grader is assigning the correct stiffness values for the grade.

Quality Assurance Static Testing Machine used for Verifying Timber



VSG (Visual Stress Grades) are sorted on the basis of visual characteristics. Visual characteristics are good for determining strength but not so good for predicting stiffness. Whereas the quality assurance checking for machine stress grades is probably more important for ensuring the strength characteristics are achieved, in the case of visual stress grades, the verification process is more pertinent for checking the stiffness characteristics.

The key aspect to ensure both grading systems are compliant is the verification process and both grading systems are subject to the same rules and grade acceptance criteria set out in the verification Standard NZS 3622:2004.

There was no provision made for a VSG6 grade when the standards were designed as the rationale was that unverified No 1 Framing grade had the properties of MSG6 and therefore a VSG6 grade was not required. Some producers who have recognised the importance of verification and are choosing to verify the properties of No 1 Framing and marking it as Verified No 1 Framing. This grade is essentially a VSG6 grade but by marking it as Verified No 1 Framing it technically complies with the standards as there is no mention of a grade called VSG6.

The key aspect to ensure both grading systems are compliant is the verification process and both grading systems are subject to the same rules and grade acceptance criteria set out in the verification Standard NZS 3622:2004.

Outdoor Structural Grades

Where timber is used in a situation where it may be wetted in service (i.e. it will not remain dry throughout its design life) the green condition stresses and moduli values for the grade shall be used. NZS3603:1993 defines timber as being green at 25% moisture content and dry at 16% moisture content with a tolerance up to a maximum of 18%. NZS3604:1999 section 2.3.4 outlines a number of situations where timber can be wetted in service and also provides design tables based around the green condition stresses and moduli values. Bearers and joists for decks are an example of members that may be wetted in service.

NZS3603 only provides green condition stress values for VSG grades and not MSG grades. However, the wetted in service tables within NZS3604 include MSG grades alongside their VSG equivalents. It appears that when NZS3603 was amended the Standards committee did not anticipate MSG grades would be used in wet service situations. It should be noted that the durability requirements of NZS3602:3003 must be met when timber is used in a wet service situation.

G8 Grade

G8 graded timber is a verified visual grade which has been verified green to the green condition stresses and moduli values determined for equivalent dry MoE 8 grades VSG8 and MSG8. The G8 grade was provided to cater for producers of outdoor treated (H3.2) timber as often these timbers are not dried below 25% moisture content prior to treatment and will remain wet post treatment. Typically this grade of timber will be used in a wet service situation because it has been treated to hazard class H3.2. However, if dry, it may also be used as an equivalent to VSG8 and MSG8. Similarly, VSG8 and MSG8 are equivalent to G8 when in the green condition and can be used in the same wet service situations as long as they are treated to the appropriate hazard class.

How the Verification Process Works

The verification process described in NZS 3622:2004 is an output control system, which means that timber is continuously taken from production and tested for stiffness and strength. The verification Standard is based on random sampling and statistical analysis to ensure the population of timber within a stress grade is meeting the requirements of the grade.

Timber that has been randomly selected from production is tested on a static bending test machine (the same type of machine is used for both MSG and VSG systems). A test for stiffness and bending strength is performed on each sample and the results are analysed and plotted against the acceptance criteria for the grade.

The new verified grades in NZS 3603:1993 have an assigned modulus of elasticity (MoE) (stiffness) and a lower bound MoE.

For example VSG8 and MSG8 have an MoE of 8.0 GPa and a lower bound MoE of 5.4 GPa. For timber to be assigned into these grades it must maintain a characteristic average MoE of 8.0 GPa and a lower 5th percentile MoE of 5.4 GPa. In the case of the lower 5th percentile, the statistical power estimates that 95% of the product will exceed the minimum value with 75% confidence.

Essentially, each grade has an average and minimum MoE.

For strength properties, the values assigned are based on the same principle as the lower 5th percentile MoE, in that they are an estimate of the property value determined with 75% confidence that would be exceeded by 95% of the product. VSG8 and MSG8 must achieve a strength value of 14.0 MPa.

Third Party Audit

It is mandatory for companies who wish to produce verified timber in accordance with NZS 3622:2004 to appoint a third party organisation to carry out audits of their in-mill monitoring. Currently there are three main providers of these services, Verified Timber Ltd, Grade Right Ltd and Bureau Veritas. Verified Timber Ltd and Grade Right Ltd have web sites with registers of their respective member companies, including details of the grades and sizes they are approved to produce.

Identification Of Verified Timber

Timber that has been verified in accordance with NZS3622:2004 must be marked in specific ways to identify its grade and to provide certain information to end users and building officials.

Company ID no. or name

Stress grade (may be indicated by colour for MSG grades)

Grading standard AS/NZS 1748 for MSG and NZS3631 for VSG

Quality Assurance providers mark (optional)

Note: The date of production may also be marked

Grade Specification and Availability

There are now multiple options of grades provided and there is a choice as to which grade to use for a particular design situation. In many cases a number of different grades may be suitable for the job as long as the design caters for the stress properties of the grade.

For example, in the situation of a 2.4 stud spaced at 600mm in a medium wind zone you could use 90x35 VSG8 or MSG8 grade for the job. A dimension of 90x45 No1 Frame or MSG6 grade spaced at 600mm would provide an equivalent solution. Which grade do you choose? A number of factors may influence your decision such as the type of design, the availability and maybe price of the various grades.

It should not be taken for granted that all grades and sizes listed in the standards will be available. There are a number of reasons why this may not be the case.

Due to the uncertainty surrounding the implementation of the new standards and the fact a final decision to cite them into the B1 Compliance Document to the Building Code was only made in mid September 2006 (implementation date is 1 April 2007), not all structural timber producers are ready to produce verified timber. Many companies are in the process of implementing systems and are at various stages of readiness. Some companies are approved to produce certain grades and sizes and will possibly broaden their scope of approval in time if they are able to do so.

It has yet to be determined what yield of grades and sizes the New Zealand forest resource is capable of producing. There are a wide range of factors that will determine what volume of grades and sizes will be available.

The structural properties of timber are determined from the logs the timber has been processed from and there are many aspects that can affect the structural properties within logs including: the trees genetics, the geographical location they are grown, how they are grown and the age they are felled. There is also variation between different logs within the same tree and also within the same log.

In respect of the variation, some very broad generalizations can be made about what aspects have positive effects on structural properties. In general, trees grown in the North of both islands tend to be better than those grown further South. Trees grown closer to the coast tend to be better than those grown further inland. Trees grown closer together and slower tend to be better than those grown faster at wider spacing. Older trees tend to be better than younger ones. Timber processed from the second and third logs tend to be better than that from the butt log and timber taken from the outside of the log tends to be better than that from the core.

Under the new regime, this variation must be controlled to ensure consistency of the structural properties of timber is achieved. Control can be achieved through using certain technologies and modifying various processes. The verification mechanism is designed to ensure this is achieved.

However, what can't be controlled is the current New Zealand forest resource and we are stuck with what structural properties it is capable of yielding. Silvicultural regimes can possibly modify crops of the future but the structural properties of today's trees have already been determined.

All this adds up to uncertainty about what grades and sizes will ultimately be available. There may well be differences in regional availability due to differences in regional forest resources. Due to the way different section sizes are processed from the log, it is more likely that smaller sizes (which are typically cut from the outside of the log) will be more readily available than wider sizes that must include more core wood.

Timber Designers

Designers should be aware there are now three sets of design tables within NZS3604 and they need to ensure plans and specifications are clear and include grade, size of timber, spacing etc. as this information is critical at consent and build stages. It is important that you check the availability of grades and sizes before specifying them. This will save you time and money in having to amend your design because the grade and size you have specified is not available.

In the case of VSG and MSG grades both are verified the same way against the same criteria. If you do not have a preference for one grade over the other then it is important to detail both VSG and MSG on your designs/plans as this will allow either grade to be used. The final choice of grade can be made at a later date based on availability and maybe price. You would also have the option to use a combination of VSG and MSG grades (of the same stiffness).

The choice is up to you as a designer but under the new standards it is important to make your choice of grade(s) accurately.

Note: NZS3604 has included some sizes of timber that are not currently produced (90x90, 90x70, 70x70) however options for building up these sizes by double studding are set out in sections 2.4.4.7 and 8.5.1.2. You should also be aware that the NZS3604 design tables have switched from call sizes to actual minimum dried sizes.

Timber Merchants

As a timber supplier, you may choose to stock grades and sizes according to your preference, limitations on space, grade/size availability and price. As a supplier it will be important to ensure you supply the exact grade ordered.

Builders

It will be the responsibility of the builder to purchase the correct grades from the supplier and install them according to the consented design/plan. In the case of pre-fabricated buildings, the responsibility rests with the frame and truss manufacturer.

Where grades which are not available have been specified, builders should ask the designer to redesign in available grades and amend the consent.

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