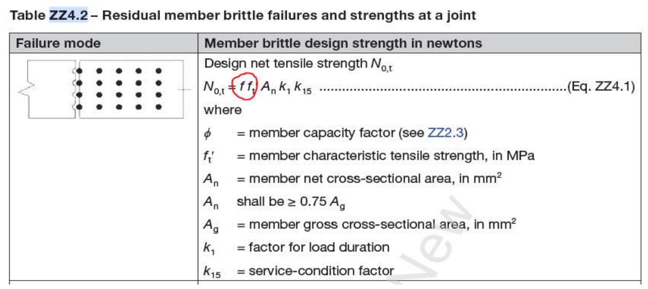
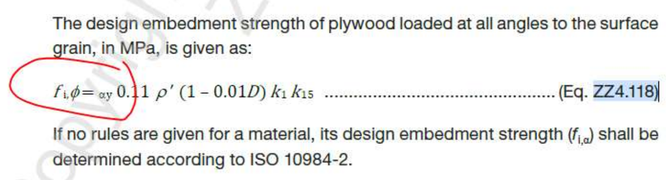
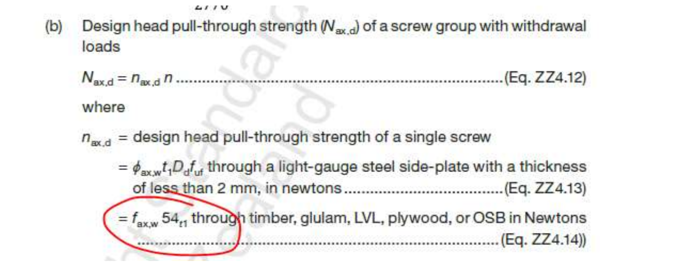
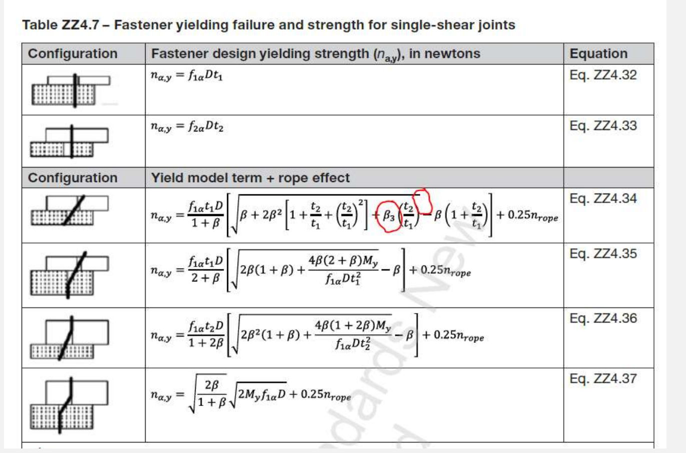
	Item	Where	What	Description	Upload
# 1	Incorrect reference	Cl ZZ 4A 7.2.2.4.2.3	The last paragraph in this paragraph tells you to use Table ZZ 4.12	The last paragraph in this paragraph should tell you to use Table ZZ 4.11	
# 2	Verified Timber/Seasoned Timber	Clause 1.7.2.21 and Table ZZ2.1	The moisture content specified for seasoned timber (15%) is different to NZS3602 (18%) NZS3622 (16%). Clause ZZ2.2.3 is not clear enough that the moisture content used in NZS3622 should also be reduced.	Include a definition of "seasoned timber" in ZZ1.7 which includes reference to NZS3622 e.g "timber, verified in accordance with NZS3622, shall be considered seasoned"	
# 3	Detailed Design - Small dowels - Undefined term	Clause ZZ4A.7.2.4.1 and table 4.9	"dz" is not defined. This means "H" (as defined in table ZZ 4.9) cannot be calculated. This means lambda1 to lambda 3 (equations ZZ4.81 to ZZ 4.83) cannot be calculated, and so on and so forth.	Define dz. Preferrably with a diagram, perhaps Figure ZZ 4.1a or Figure ZZ 4.1b	
# 4	ZZ4A.7.3.2.2.3 Rope Effect 0.25 Double Counted	Clause ZZ4A.7.3.2.2.3 Identical error in ZZ4A.7.2.2.2.3	In clause ZZ4A.7.3.2.2.3 the fastener axial capacities are multiplied by 0.25 to calculate the term n_rope. However when n_rope is implemented in the EYM in Table ZZ4.12 and Table ZZ4.13 the rope effect is again multiplied by a factor of 0.25. This lead to the fastener axial capacity being multiplied by 0.25 twice meaning that the rope effect term is now 0.25*0.25=6.25% of the fastener axial capacity.	It is assumed that the author's intent was not to limit rope effect to 6.25% of the fastener withdrawal capacity. Therefore the 0.25 factor needs to be removed from either the Tables ZZ3.12/13 or from Clause ZZ4A.7.3.2.2.3. Given the way the limits of rope effect to 25% of EYM term are set up, it makes the most sense to remove the 0.25 factor from the Tables ZZ3.12/13 This same fix also needs to be implemented for Clause ZZ4A.7.2.2.2.3 and Tables ZZ4.7/4.8	
# 5	Typo Eq ZZ4.1 Member Brittle Design Strength	Eq ZZ4.1	Equation reads f * ft', but it means: phi * ft'	Fix the typo and swap the f for phi	 Table ZZ4.2 – Residual member brittle failures and strengths at a joint Failure mode / Member brittle design strength in newtons Design net tensile strength $N_{0,t}$ $N_{0,t} = f f_t A_n k_1 k_{15}$ ....(Eq. ZZ4.1) where ϕ = member capacity factor (see ZZ2.3) f_t' = member characteristic tensile strength, in MPa A_n = member net cross-sectional area, in mm^2 A_n shall be ≥ 0.75 A_g A_g = member gross cross-sectional area, in mm^2 k_1 = factor for load duration k_{15} = service-condition factor
# 6	Typo Eq ZZ4.118 Embedment of Plywood	Eq ZZ4.118	The equation reads fi,phi = alpha y *0.11... which is clear typo with the alpha and phi terms being swapped	Swap the alpha and phi terms to correct the equation.	 The design embedment strength of plywood loaded at all angles to the surface grain, in MPa, is given as: $f_{i,\phi} = _{\alpha y} 0.11 \rho' (1 - 0.01D) k_1 k_{15}$ ....(Eq. ZZ4.118) If no rules are given for a material, its design embedment strength ($f_{i,\alpha}$) shall be determined according to ISO 10984-2.
# 7	Net Area Definition Eq ZZ4.123 for Group Tear Out	Eq ZZ4.123	The net area between the two outer rows is determined as A_GT-net = (a_2-D) * (n_r-1) in mm^2 However, this only gives the clear distance between the rows of fasteners. Should this not include a term for the the net thickness of the timber to give the area between fasteners being loaded in tension?	Needs review.	
# 8	Capacity factor formatting	Eq ZZ4.14	Formatting of capacity factor	f should be written in Greek letters	
# 9	Equation not correct/applicable	Eq ZZ4.14	Equation 54 t1 does not apply to timber members, except for thin plywood panels, see correspondence with Ying Hei Chui and paper "Derivation of code requirement to prevent head pull-through failure of wood screws". This equation should not be used for LVL, glulam etc.	Head pull through should refer to axial capacity of Type 2 joints for bolts, section 4.4.3.3, equation 4.4(6)	**See Appendix B below**

	Item	Where	What	Description	Upload
# 10	Typo Eq ZZ4.14 Screw Head Pull Through	Eq ZZ4.14	In Eq ZZ4.14 the t1 term is subscripted, where it should not be. Please note that this error was only found in the version of 1720.1 that includes the AS text. When checking the excludes AS text version error, this error was not apparent.	<u>Remove</u> the <u>subscript formatting</u> from t1 on the appropriate standard version.	
# 11	Double Counting of k1,k15 in Coach Screw Withdrawal	Eq ZZ4.20 Eq ZZ4.21	Eq ZZ4.21 is used to calculate a the design withdrawal strength of a single coach screw n_axw. Eq ZZ4.20 references the value of n_axw from Eq ZZ4.21 and multiplies this by the number of fasteners in the joint to calculate the design withdrawal strength of a group of coach screws N_axw. However both these equations account for k1 and k15. When used as written in the code, the factors k1 and k15 would be counted twice. It is not thought that this is author's intention.	Remove reference of k1 and k15 from Eq ZZ4.20 Consider whether the k13 factor is more appropriate in Eq ZZ4.20 or ZZ4.21	
# 12	Typo Eq ZZ4.34 EYM for Nails, Screws, Rivets	Eq ZZ4.34 Table ZZ4.7	The beta^3 term is written as beta subscript 3. The last (t2/t1) within the square root term is missing its squared term.	The beta subscript 3 needs to be changed to beta superscript 3 The (t2/t1) term identified needs to be squared. See picture for clarification on which term.	
# 13	Whole standard is not fit for purpose	Everything	I cannot believe that we waited 29 years to get a standard that is an unclear and unusable butchering of a standard that Australia produced in 2010. It is a complete disgrace as it is so difficult to use. Did anyone at Standards NZ consider the absolute mind-boggling loss of productivity lost across the industry as everyone has to have two PDFs open at once to be able to use this (the Appendices open on one window and the body of the standard in another)? It is no exaggeration that this will cost the industry millions of dollars in wasted time through the life of this standard, let alone the very high potential for mistakes resulting from the incredible complexity and confusion of using it.	I cannot believe that we are in a position to have to give this feedback. The standard is so obviously not fit for purpose. 29 years for this? The entire standard needs to be rewritten as a standard and not as an Appendix. Get rid of the ZZ notation that makes it so difficult to understand what is going on, and have all clauses combined so that we don't have to click through everything twice.	

Upload (# 10):

(b) Design head pull-through strength ($N_{ax,d}$) of a screw group with withdrawal loads

$N_{ax,d} = n_{ax,d}\, n$ ......(Eq. ZZ4.12)

where

$n_{ax,d}$ = design head pull-through strength of a single screw

= $\phi_{ax,w} t_1 D_d f_{uf}$ through a light-gauge steel side-plate with a thickness of less than 2 mm, in newtons ......(Eq. ZZ4.13)

= $f_{ax,w}\, 54_{t1}$ through timber, glulam, LVL, plywood, or OSB in Newtons ......(Eq. ZZ4.14))

Upload (# 12):

Table ZZ4.7 – Fastener yielding failure and strength for single-shear joints

Configuration	Fastener design yielding strength ($n_{a,y}$), in newtons	Equation
	$n_{\alpha,y} = f_{1\alpha} D t_1$	Eq. ZZ4.32
	$n_{\alpha,y} = f_{2\alpha} D t_2$	Eq. ZZ4.33
Configuration	Yield model term + rope effect	
	$n_{\alpha,y} = \frac{f_{1\alpha} t_1 D}{1+\beta}\left[\sqrt{\beta + 2\beta^2\left[1 + \frac{t_2}{t_1} + \left(\frac{t_2}{t_1}\right)^2\right] + \beta_3\left(\frac{t_2}{t_1}\right)} - \beta\left(1 + \frac{t_2}{t_1}\right)\right] + 0.25 n_{rope}$	Eq. ZZ4.34
	$n_{\alpha,y} = \frac{f_{1\alpha} t_1 D}{2+\beta}\left[\sqrt{2\beta(1+\beta) + \frac{4\beta(2+\beta)M_y}{f_{1\alpha} D t_1^2}} - \beta\right] + 0.25 n_{rope}$	Eq. ZZ4.35
	$n_{\alpha,y} = \frac{f_{1\alpha} t_2 D}{1+2\beta}\left[\sqrt{2\beta^2(1+\beta) + \frac{4\beta(1+2\beta)M_y}{f_{1\alpha} D t_2^2}} - \beta\right] + 0.25 n_{rope}$	Eq. ZZ4.36
	$n_{\alpha,y} = \sqrt{\frac{2\beta}{1+\beta}}\sqrt{2 M_y f_{1\alpha} D} + 0.25 n_{rope}$	Eq. ZZ4.37

	Item	Where	What	Description	Upload
# 14	Layout	EVERYWHERE	The problem with the current layout is that all the NZ-specific changes are lumped together at the start of the document, but the clauses that they change are spread throughout the original Australian section. What this means in practice is that, for example, if you wanted to read the clauses in order you'd need to read: • Start on page 125 of the pdf for the first half of clause 1.1 • Back to page 19 of the pdf for the second half of clause 1.1 • Forwards to page 125 for clause 1.2 • Back to page 20 for clause 1.3 and the first quarter of clause 1.4 • Forwards to page 127 for the rest of clause 1.4 • … and so on. • The original, Australian standard is 166 pages long (not including the introduction, bibliography, etc). The NZ changes are 105 pages long. That's a lot of backwards and forwards. I don't feel like this layout is fit for purpose. There's a good chance it will lead to NZ buildings being improperly designed because an engineer mis-reads a clause or loses their place.	Insert the NZ clauses in between the original Australian clauses, instead of lumping them all at the beginning and putting the onus of figuring it out on the reader	**See Appendix A below**
# 15	wc (Table ZZ 4.9)	Table ZZ 4.9	wc has multiple different formulae, but they are all labelled as wc	wc have additional subscript corresponding to the failure mode. And/or Table ZZ 4.9 subdivided into more sub-tables. wc,w1 = a2 (nr - 1) wc,w2 = a2 (nr - 1) + 2 a4c wc,w3 = a2 (nr - 1)	
# 16	Detailed Design - Small dowels - Zero capacity answer	Table ZZ 4.9	If you have only a single row of fasteners (for instance along the edge of a braced wall system) then the code tells you it has zero capacity. wc = a2 (nr - 1) = zero because nr = 1 Ath = t0,eff,e.wc = zero because wc = 0 N'0,wh,e = 0 because Ath = 0 This then propagates through equations ZZ 4.70 ; ZZ 4.69 ; ZZ 4.67; ZZ 4.24 ; ZZ 4.23 and sets them all to zero.	Either make having 2 rows of fastener a minimum code requirement, or fix the definition of N'0,w,e to have an exception for a 1 row system.	

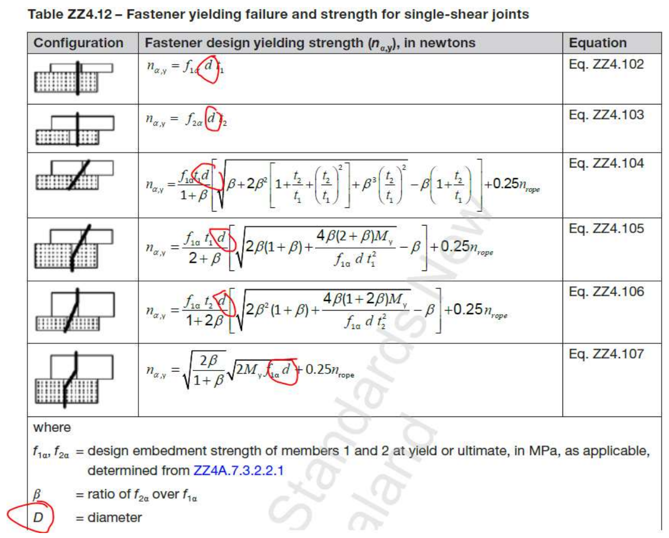
	Item	Where	What	Description	Upload
# 17	Typo Table ZZ4.12 EYM Bolts, Dowels, Coach Screws	Table ZZ4.12	The parameters descriptions below refer to diameter as uppercase D, whereas it is written as lower case d in the equations above.	Change all references to either d or D to be consistent. Correct rope effect (see above items)	
# 18	Equation incorrect	Table ZZ4.14 Eq. ZZ4.123	Equation for AGT-net is incorrect. D (fastener of diameter) replaced by fastener hole diameter To be multiplied by timber thickness, t	AGT-net = (a2 – Dhole)(nr – 1)t	
# 19	Double up of brittle failure mode checks	Table ZZ4.2	Equations ZZ4.2 and ZZ4.3 require to check for brittle failure modes for all connections. These failure modes perpendicular to grain are however also checked as per table ZZ4.10 for small dowel-type fasteners and in table ZZ4.15 for large dowel-type fasteners. It is unclear, why the same or similar failure modes are to be checked several times.	Clarification needs to be provided on which of the perpendicular to grain failure modes are effectively required. We cannot provide a suggestion for amendment, as the reasoning and theory of the failure modes is not unknown	
# 20	Appropriate capacity factor not defined	Table ZZ4.2, equation ZZ4.3	It is unclear which capacity factor is to be taken. The one from the timber member to ZZ2.3 (as per the other equations in this table), or the capacity factors for brittle failure modes to ZZ4A.4.1, table ZZ4.3.	Provide annotation and reference for capacity factor in equation ZZ4.3	
# 21	Rope effect term incorrect	Table ZZ4.7 Table ZZ4.8 Table ZZ4.12 Table ZZ4.13	correction required	Remove the **0.25** and leave nrope in the EYM equations.	see item #28 for the correction of the rope effect.

Table ZZ4.12 – Fastener yielding failure and strength for single-shear joints

Configuration	Fastener design yielding strength ($n_{\alpha,y}$), in newtons	Equation
	$n_{\alpha,y} = f_{1\alpha} d\, t_1$	Eq. ZZ4.102
	$n_{\alpha,y} = f_{2\alpha} d\, t_2$	Eq. ZZ4.103
	$n_{\alpha,y} = \frac{f_{1\alpha} t_1 d}{1+\beta}\left[\sqrt{\beta + 2\beta^2\left[1+\frac{t_2}{t_1}+\left(\frac{t_2}{t_1}\right)^2\right]+\beta^3\left(\frac{t_2}{t_1}\right)^2} - \beta\left(1+\frac{t_2}{t_1}\right)\right] + 0.25 n_{rope}$	Eq. ZZ4.104
	$n_{\alpha,y} = \frac{f_{1\alpha} t_1 d}{2+\beta}\left[\sqrt{2\beta(1+\beta)+\frac{4\beta(2+\beta)M_y}{f_{1\alpha} d\, t_1^2}} - \beta\right] + 0.25 n_{rope}$	Eq. ZZ4.105
	$n_{\alpha,y} = \frac{f_{1\alpha} t_2 d}{1+2\beta}\left[\sqrt{2\beta^2(1+\beta)+\frac{4\beta(1+2\beta)M_y}{f_{1\alpha} d\, t_2^2}} - \beta\right] + 0.25 n_{rope}$	Eq. ZZ4.106
	$n_{\alpha,y} = \sqrt{\frac{2\beta}{1+\beta}}\sqrt{2M_y f_{1\alpha} d} + 0.25 n_{rope}$	Eq. ZZ4.107

where

$f_{1\alpha}, f_{2\alpha}$ = design embedment strength of members 1 and 2 at yield or ultimate, in MPa, as applicable, determined from ZZ4A.7.3.2.2.1

β = ratio of $f_{2\alpha}$ over $f_{1\alpha}$

D = diameter

	Item	Where	What	Description	Upload
# 22	Typos and formatting in equation	Table ZZ4.7, Eq. ZZ4.34	⍰3 should be 3 The last (t2/t1) under the square root should be squared	see item # 1 and see corrected equation and -->	$n_{\alpha,y} = \frac{f_{1\alpha} t_1 D}{1+\beta}\left[\sqrt{\beta + 2\beta^2\left[1+\frac{t_2}{t_1}+\left(\frac{t_2}{t_1}\right)^2\right]+\beta_3^{3}\left(\frac{t_2}{t_1}\right)^{2}} - \beta\left(1+\frac{t_2}{t_1}\right)\right] + n_{rope}$
# 23	Nr of subheadings	Throughout the standard	The new NZS AS 1720.1 uses up to 6 subheadings. This is non-user firendly and makes the standard even harder to read,. For instance refer to ZZ4A.7.2.2.4.2.2. New standards like the next generations of Eurocode are now being edited specifically to ensure they are userfriendly and easy to follow. Our new standard fails to address this and it seems to be written for academic purposes, rather than a DESIGN standard.	The number of headings is to be reduced to max 3 subheadings. The standards is to be formatted and structured to be easy to follow. As a minimum the following shoul be considered: - reduce cross-references - ensure cross-references to not end in circles or do not lead to a dead end - ensure wording is consistent	
# 24	Clean compiled copy	Whole document	It is not helpful to have the New Zealand version of the standard as a set of revision overrites over the Australian version of the Standard, it means you constantly have to cross reference between the two and can easily miss something.	Simply publish a clean copy of the NZ version of the standard.	
# 25	Scope of simplified method – shear walls and diaphragms	ZZ4.1.1	It was proposed that the exception of requiring the detailed method for nails as PDE is extended to plywood shearwalls and diaphragms. This is because brittle failure modes are unlikely governing (and difficult to check).	Add plywood shear walls and diaphragms under the exception. Alternatively, exclude the requirement of checking brittle failure modes, but leave the requirement of using the EYM.	
# 26	k17 factor	ZZ4A.7.2.2.1	k17 does not specify that the number of nails is to be taken along one edge in shear walls and diaphragms.	Change first line of definition of k17 to 1.3 for connections in shear walls and diaphragms with wood-based sheathing materials and with 50 or more nails along one edge of the diaphragm or wall.	
# 27	k17 factor	ZZ4A.7.2.2.1 General	"k17= 1.3 for connections containing 50 or more nails. For fewer nails, the factor shall be obtained by linear interpolation to the value of 1 for 4 nails." k17 does not specify that the number of nails is to be taken along "one edge" in shear walls and diaphragms.	ZZ4.2 reduction of this factor should be limited to the connector on one edge at the time and not for the whole wall. This requires a more specific description to avoid misinterpretation.	
# 28	Annotation definition of kD	ZZ9.2.12.3	Factor kDt is still referred in the annotation definition table, although it does not appear in the standard anymore (as the proposed value has been removed)	Remove kDt and definition	

	Item	Where	What	Description	Upload
# 29	General Layout			Include the ZZ sections within the actual code itself. Having two separate parts we're supposed to read in tandem is not a great approach. It not only increases the likelihood of missing critical sections, but the amount of time spent thumbing back and forward adds up. It would seem obvious that the amount of time and money spent by the publisher on integrating the two documents properly will pale in comparison the collective cost across the industry, of each of us effectively having to do it ourselves.	

NZS AS 1720.1:2022 - TDC errata - Appendix A

Current Standard

For LVL containing cross-band veneers, the thickness of an individual ply shall be assumed to be in proportion to its nominal thickness, as the finished minimum LVL thickness is to the total of the nominal veneer thicknesses. Section properties for cross-banded LVL shall be determined as follows:

(a) Any veneers with nominal grain direction at right angles to the direction of stress shall be ignored for the calculation of area, first moment of area and second moment of area when assessing the edgewise bending, tension and compressive capacity and edgewise flexural rigidity.

(b) For on-flat bending and shear applications, section properties shall be determined in accordance with Paragraph I3 of Appendix I.

It is appropriate to assume the full sectional area is effective in resisting in-plane shear.

8.3.4 Capacity factors

The capacity factors to be used for the computation of design capacities for structural LVL elements shall be as given in Table 2.1.

8.4 MODIFICATION FACTORS

8.4.1 General

The modification factors for strength and stiffness given in Section 2 shall generally apply for design with LVL except for those factors specified in Clause 8.4.

8.4.2 Duration of load

The modification factors for duration of load for strength (k_1) and stiffness (j_2 and j_3) given in Clause 2.4.1 shall be used as appropriate.

8.4.3 Moisture condition

Where LVL is subjected to conditions, such that the average moisture content for a 12 month period will exceed 15%, the modification factors for strength (k_4) and for stiffness (j_6) given in Table 8.1 shall be used, except where different values have been determined by testing.

Proposed improvement (typical example)

97 NZS AS 1720.1:2022

For LVL containing cross-band veneers, the thickness of an individual ply shall be assumed to be in proportion to its nominal thickness, as the finished minimum LVL thickness is to the total of the nominal veneer thicknesses. Section properties for cross-banded LVL shall be determined as follows:

(a) Any veneers with nominal grain direction at right angles to the direction of stress shall be ignored for the calculation of area, first moment of area and second moment of area when assessing the edgewise bending, tension and compressive capacity and edgewise flexural rigidity.

(b) For on-flat bending and shear applications, section properties shall be determined in accordance with Paragraph I3 of Appendix I.

It is appropriate to assume the full sectional area is effective in resisting in-plane shear.

8.3.4 Capacity factors

The capacity factors to be used for the computation of design capacities for structural LVL elements shall be as given in Table 2.1.

Add ZZ8.3.5 to clause 8.3.

ZZ8.3.5 Other LVL characteristic properties

The use of other characteristic design values for LVL, including those for cross-banded LVL and LVL 'on flat', are acceptable, provided such characteristic design values are determined by testing in accordance with AS/NZS 4357.0 and evaluated using procedures consistent with those given in AS/NZS 4063.2.

8.4 MODIFICATION FACTORS

8.4.1 General

The modification factors for strength and stiffness given in Section 2 shall generally apply for design with LVL except for those factors specified in Clause 8.4.

8.4.2 Duration of load

The modification factors for duration of load for strength (k_1) and stiffness (j_2 and j_3) given in Clause 2.4.1 shall be used as appropriate.

8.4.3 Moisture condition

Where LVL is subjected to conditions, such that the average moisture content for a 12 month period will exceed 15%, the modification factors for strength (k_4) and for stiffness (j_6) given in Table 8.1 shall be used, except where different values have been determined by testing.

Derivation of code requirement to prevent head pull-through failure of wood screws

by

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And

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Background

When a panel-to-wood wood screw joint is subjected to a withdrawal load, it could fail in two ways: fastener withdrawal from wood or screw head pull-through. In the proposed code provision for wood screws, a design equation is provided to predict withdrawal resistance from wood. Corresponding provision is required to prevent head pull-through failure.

A limited test program was undertaken by Forintek to provide head pull-through resistance of panel material. This paper provides details on the test program, which was performed by the eastern laboratory of Forintek Canada Corp, analysis of the test data and the derivation of the prescriptive details. The derivation of design resistance also took into account the results from another study by Chui and Craft (2002).

Test Program

Table 1 summarizes the tests performed by Forintek and by Chui and Craft (2002), and summary statistics for each group. In the Forintek test program, four panel thicknesses (7.9mm, 11.1mm, 15.1mm and 18.3mm) were tested. For each thickness, three groups of specimens were tested: a control without washer, ½ inch washer and 5/8 inch washer. One fastener size was tested: 5mm long gauge 10 wood screw. At least 10 specimens were tested for each group. In the study by Chui and Craft (2002), two screw sizes (gauge 8 and 14) and one OSB panel thickness (11.7mm) was tested. The tests were conducted in accordance with ASTM D1761.

Table 1 – Head-pull through test program.

Panel type	Screw gauge	Panel thickness		Washer*	Head pull-through strength	Study
		(inch)	(mm)	(inch)	(kN)	
DFP	10	5/16	7.9	None	1.342 (0.12)	Forintek
DFP	10	5/16	7.9	1/2"	1.964 (0.34)	Forintek
DFP	10	5/16	7.9	5/8"	2.468 (0.28)	Forintek
OSB (O2)	10	7/16	11.1	None	1.648 (0.44)	Forintek
OSB (O2)	10	7/16	11.1	1/2"	3.016 (1.0)	Forintek
OSB (O2)	10	7/16	11.1	5/8"	3.382 (0.71)	Forintek
OSB (O2)	10	19/32	15.1	None	3.214 (0.41)	Forintek
OSB (O2)	10	19/32	15.1	1/2"	4.378 (0.78)	Forintek
OSB (O2)	10	19/32	15.1	5/8"	4.804 (0.91)	Forintek
OSB (O2)	10	23/32	18.3	None	2.968 (0.62)	Forintek
OSB (O2)	10	23/32	18.3	1/2"	4.569 (0.95)	Forintek
OSB (O2)	10	23/32	18.3	5/8"	5.65 (0.96)	Forintek
CSP	8	7/16	11.1	None	1.406 (0.22)	Chui and Craft
CSP	14	7/16	11.1	None	2.215 (0.28)	Chui and Craft
OSB	8	7/16	11.1	None	1.628 (0.32)	Chui and Craft
OSB	14	7/16	11.1	None	2.241 (0.44)	Chui and Craft

*Washer thickness is 1.6mm.

Discussion of Test Results and Derivation of Design Specification

The results from Chui and Craft (2002) showed that there is no significant difference between OSB and plywood, therefore results from the two materials can be combined. Assuming that the strength data is normally distributed, the 5^{th} percentile strength for each group can be estimated using the equation

5^{th} percentile strength = mean – 1.645 x standard deviation

Figure 1 presents a plot of calculated 5^{th} percentile strength versus panel thickness. An equation, proposed to be the characteristic equation relating the fifth percentile screw head pull-through resistance without washer and panel thickness. This relationship is considered conservative as it is below all data points shown, and that often there is more than one fastener in a joint. Although the smallest fastener used in the two test programs was gauge 8 screw (4.11mm diameter), the proposed characteristic equation is considered to be applicable to gauge 6 screw (3.5mm diameter). To support this point, additional nail (2.64mm diameter) head pull-through data from the Chui and Craft study (2002) is added to Figure 1. It can be seen that, despite the head diameter of 2.64mm nail being smaller than that of gauge 6 screw, the nail data points are either on the characteristic equation line or above it.

The characteristic equation is further modified by a duration of load factor. It is proposed that, in the absence of any data, the same factor (0.92) applied to withdrawal strength of nail is used. Therefore design equation for screw head pull-through resistance is proposed as follows:

$$P_{pt} = 0.92 \times 0.082\ \varphi\ l_1\ n_F$$
$$= 0.075\ \varphi\ l_1\ n_F$$

where $\varphi = 0.4$ (same as for steel side plate)
l_1 = side plate thickness, mm
n_F = no. of fasteners

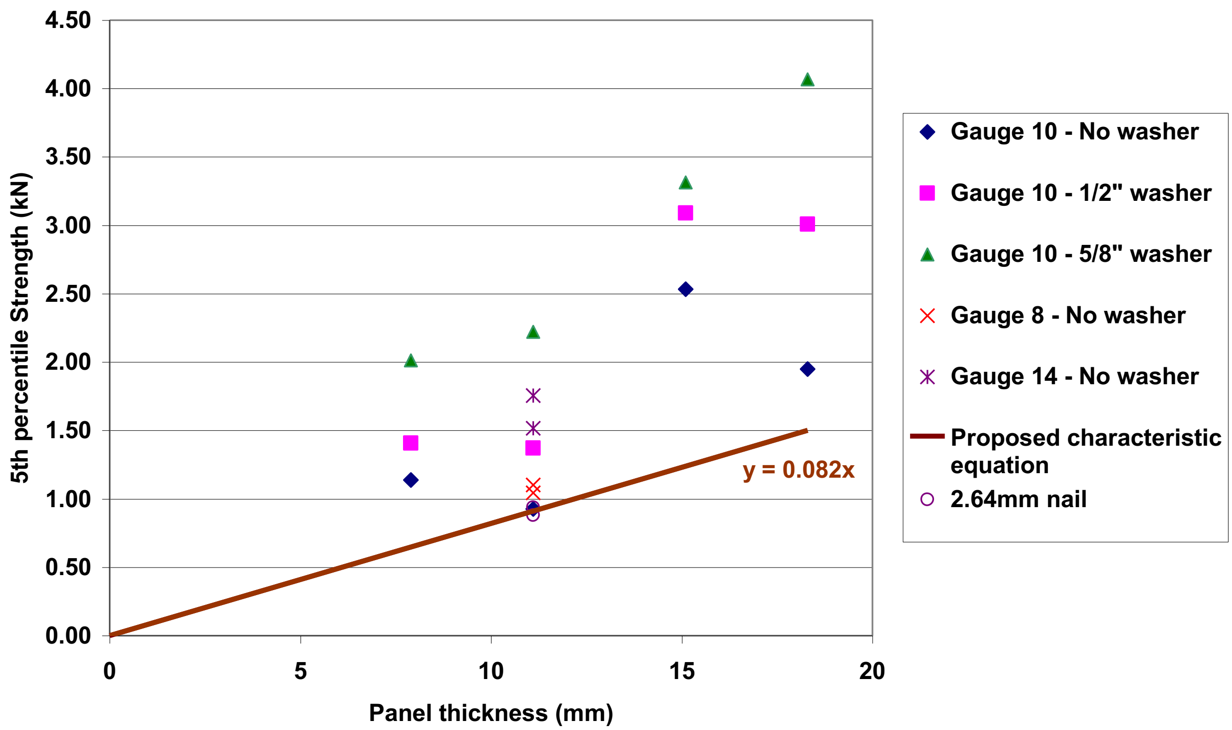

Figure 1 - Head pull-through resistance vs panel thickness.

Reference

Chui, Y. H. and Craft, S. 2002. Fastener head pull-through resistance of plywood and oriented strand board. Canadian Journal of Civil Engineering, 29(3):384-388