SIRT

Strategic Integrated Research in Timber

Edinburgh Napier UNIVERSITY

main points and coming changes

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Standards

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New versions soon to be published

EN 14081 Part 1: General requirements
EN 338 Structural timber - Strength classes
EN 384 Structural timber - Determination of characteristic values of mechanical properties & density
EN 14358 Timber structures - Calculation and verification of characteristic values

To be dropped

EN 14081 Part 4: Machine grading; grading machine settings for machine controlled systems

New standard soon

EN16737 Structural timber. Visual strength grading of tropical hardwood

Minor revision starting

EN 14081 Part 3: Machine grading; additional requirements for factory production control

Major revision starting

BIG CHANGES COMING

EN 14081 Part 2: Machine grading, additional requirements for initial type testing

(these are just the ones relating to grading according to EN 14081)

The maintenance of standards

- The European Commission
- CEN TC124 “Timber Structures”
  - WG1 “Test Methods”
  - WG2 “Solid Timber” (not glulam etc)
    - TG1 “Grading”
      - Approves machine settings, and assignments in EN 1912
- BSI B/518 “Structural Timber”
- UKTGC “UK Timber Grading Committee”
- “Industry” and “Notified Bodies” (SG18)
- Users of standards

Process for ENs (simplified)

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CEN committees draft or amend standard

⇩

"Enquiry" Goes to National Standards Bodies for publication as draft for **public comment**

⇩

Comments within countries are collated by National Standards Bodies.
A UK position is formulated by BSI B/518 and UKTGC

⇩

Comments from all countries are reviewed by the CEN committee , debated and the standard changed (perhaps)

⇩

Standard is sent to National Standards Bodies for Formal Vote

⇩

Passed – Standard published
Failed – Standard goes back to CEN committee for more work / is dropped

Things that can go wrong

- Negative impact on yields (without reason)
- Expensive or impractical factory production control requirements (without reason)
- Complicated or ambiguous standards
  - Confusion in the market
  - Practices that are not “standard”
  - Loss of confidence in structural timber
- Over conservative standards
  - Loss of competitiveness against other materials
- Unsafe or unreliable standards
  - Loss of confidence in structural timber

Some quick points

- Not all strength classes are easily available
- There is no need to over specify
- You cannot regrade reject timber (without special consideration)
- Visual grading assignments are not fixed forever
- Strength classes are not fixed forever
- You can make your own strength classes
  - EN 338 is not the definitive list – it is just handy
  - Actually, it is Declaration of Performance (DoP) that matters

Some quick points

- You need to pay attention to
  - Treatments that may affect properties
  - The moisture content
  - Changing the cross-section
- Piece marking (grade stamps) (!!!!!)
  - Be aware of the UK's position (see later)
- Researchers: The strength class doesn't tell you that much about the properties of an individual piece

For those grading

- Manufacturer ensures products comply with the declared performance (DoP)
- Equipment
  - Regular calibration / inspection
- Raw materials
  - Inspection scheme ensuring compliance
  - (covers, for example, a change in quality)
- Traceability and marking
  - With regard to production origin

Responsibilities

- The manufacturer assumes the responsibility for the conformity of the construction product with the declared performance in the DoP
- A merchant is considered a manufacturer if they place a product on the market under a company name or trademark or modify it in a way that might affect the DoP

Regrading timber

- You cannot regrade timber (by machine or visually) if it has already been graded
  - This applies to timber that is rejected
  - And timber already assigned a grade
- Unless the action of the first grading is properly considered
- Because grading works on the population
  - if you remove the better quality timber beforehand you probably won't achieve the required characteristic properties with the same thresholds

Visual grading assignments

- EN 1912
  - Regularly updated
  - In the meantime, approved assignments sent to SG18
  - Note that assignments can change
    - Assignments have been removed
      - Test data was not provided to confirm ‘old’ assignments
      - Visual grading standard changed
    - Assignments have been lowered (new test data)
- Other assignments can be found elsewhere
  - Formally they require approval by a Notified Body
  - But might be presented in a National Standard
  - They should not conflict with EN 1912

Example of changes

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EN 1912:2004+A4:2010

Strength class	Grading rule publishing country	Grade (see Note 1)	Species commercial Name	Source
D70	UK	HS	Balau	South East Asia
		HS	Greenheart	Guyana
	The Netherlands	A/B	Azobé	West Africa
	UK	HS	Ekki	West Africa
D60	UK	HS	Kapur	South East Asia
		HS	Kempas	South East Asia
D50	UK	HS	Keruing	South East Asia
		HS	Karri	Western Australia
		HS	Opepe	West Africa,
		HS	Merbau	South East Asia
		TH1	American white oak	USA

EN 1912:2012

with corrigendum August 2013

Strength class	Grading rule publishing country	Grade (see Note 1)	Species commercial Name	Source
D70	The Netherlands	C3 STH	Azobé	West Africa
	UK	HS	Greenheart	Guyana
	UK	HS	Ekki	West Africa
D60	The Netherlands	C3 STH	Cumaru new	Brazil
	UK	HS	Kapur	South East Asia
		HS	Kempas	South East Asia
D50	AC1 *text deleted* AC1			
	UK The Netherlands	HS C3 STH	Balau/Bangkirai	South East Asia
	The Netherlands	C3 STH	Greenheart	Suriname, new

D70 to D50 (new test data)

French standard changed, assignments were removed in the corrigendum

Be aware of amendments and corrigenda

Strength classes

prEN338:2015 compared to 2009 version												
	Softwood											
	C14	**C16**	**C18**	C20	C22	**C24**	C27	**C30**	C35	C40	C45	C50
Strength												
Bending	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tension parallel	-10%	-15%	-9%	-4%	0%	4%	3%	6%	7%	8%	11%	12%
Tension perpendicular	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Compression parallel	0%	0%	0%	0%	0%	0%	0%	4%	0%	4%	7%	3%
Compression perpendicular	0%	0%	0%	0%	0%	0%	-4%	0%	-4%	-3%	-6%	-6%
Shear	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Stiffness												
Mean MoE parallel	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5% MoE parallel	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Mean MoE perpendicular	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mean G	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Density												
5% density	0%	0%	0%	0%	0%	0%	-3%	0%	-3%	-5%	-7%	-7%
Mean density	0%	0%	0%	3%	0%	0%	-4%	0%	-2%	-4%	-6%	-5%

Strength classes

prEN338:2015 compared to 2009 version														
	Hardwood													
	D18	**D24**	D27	**D30**	D35	**D40**	D45	**D50**	D55	**D60**	D65	**D70**	D75	D80
Strength														
Bending	0%	0%		0%	0%	0%		0%		0%		0%		
Tension parallel	0%	0%		0%	0%	0%		0%		0%		0%		
Tension perpendicular	0%	0%		0%	0%	0%		0%		0%		0%		
Compression parallel	0%	0%		4%	0%	4%		3%		3%		6%		
Compression perpendicular	-36%	-37%		-34%	-33%	-34%		-33%		0%		-11%		
Shear	3%	-8%		-3%	2%	5%		13%		7%		0%		
Stiffness														
Mean MoE parallel	0%	0%		0%	0%	0%		0%		0%		0%		
5% MoE parallel	0%	-1%		0%	0%	0%		0%		0%		0%		
Mean MoE perpendicular	0%	0%		0%	0%	1%		0%		0%		0%		
Mean G	0%	2%		0%	0%	0%		0%		0%		0%		
Density														
5% density	0%	0%		0%	0%	0%		0%		0%		-11%		
Mean density	0%	0%		0%	0%	0%		-1%		0%		-11%		

Changes over time

	1995	2003	2009	pr2015		1995	2003	2009	pr2015	
	C16	**C16**	**C16**	**C16**		**C24**	**C24**	**C24**	**C24**	
Strength										
Bending	16	16	16	16		24	24	24	24	
Tension parallel	10	10	10	8.5		14	14	14	14.5	
Tension perpendicular	0.3	0.5	0.4	0.4		0.4	0.5	0.4	0.4	
Compression parallel	17	17	17	17		21	21	21	21	
Compression perpendicular	4.6	2.2	2.2	2.2		5.3	2.5	2.5	2.5	
Shear	1.8	1.8	3.2	3.2		2.5	2.5	4	4	
Stiffness										
Mean MoE parallel	8	8	8	8		11	11	11	11	
5% MoE parallel	5.4	5.4	5.4	5.4		7.4	7.4	7.4	7.4	
Mean MoE perpendicular	0.27	0.27	0.27	0.27		0.37	0.37	0.37	0.37	
Mean G	0.5	0.5	0.5	0.5		0.69	0.69	0.69	0.69	
Density										
5% density	310	310	310	310		350	350	350	350	
Mean density	370	370	370	370		420	420	420	420	

Strength classes

- It will be allowed that hardwoods can be graded to C classes (poplar was already allowed)
  - Some hardwoods fit better to C classes than D classes as they have lower density
  - Cannot grade softwoods to D classes
    - We don't know if the secondary properties would be ok
- Tension classes added to EN 338
  - They are not new (but are new to EN 338)
  - Based on tension testing
    - Bending properties are secondary (conservative)
  - Intended for glulam and similar

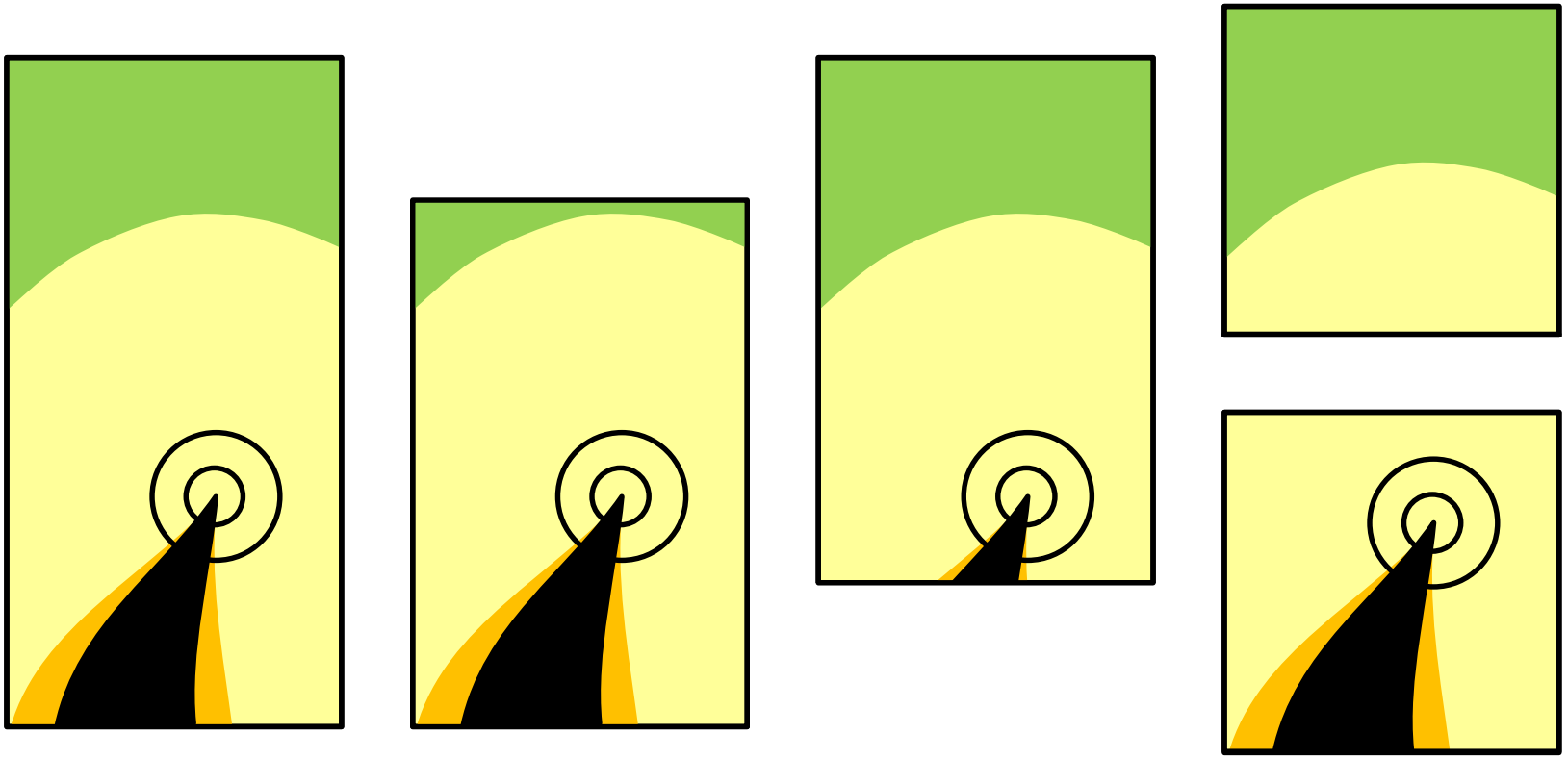
Treatments

- Preservative treated timber is within the scope of EN 14081
- But it does not cover timber treated by fire retardant products
  - Not enough information on impact on mechanical properties (thought to be OK, but we just don't know)
- Does not cover timber that is thermally or chemically modified
  - Not enough information on impact on secondary mechanical properties, and process control

Changing the cross-section

- EN14081 sets acceptable limits for cross-section change after grading
  - ≤ 5 mm for dimensions between 22 mm and 100 mm
  - ≤ 10 mm for dimensions > 100 mm
- Any reprocessing that is outside these limits requires the timber to be graded again
  - This kind of regrading is OK because it is assumed the cross-section change is enough to negate the effect of the first grading (we don't know how valid this assumption is)

Changing the cross-section



Marking

- The upcoming EN 14081-1 allows two methods for visually graded timber
  - Method A “individual piece marking” (grade stamps)
    - Although there are no rules about where the mark can be
  - Method B “package marking” (no mark on the timber)
    - To satisfy small producers
    - UK tried to prevent this (and failed)
- Machine graded timber still needs to be piece marked (method A)

UK position

- The UK mirror committee, BSI B/518, of CEN/TC124/WG2, disagrees with package marking
- Owing to the risk of misidentification and/or loss of identification of strength-graded structural timber which is not individually grade stamped
  - The Construction Products Regulations require the package mark to accompany the timber, but the UK is concerned that this will really happen

UK position

- Method A is expected
  - Furthermore, the grade stamp must be stamped clearly and indelibly at least once on a face or edge and at least 600mm from the end of the piece
- If there is no stamp (method B) the UK National Annex to EN 1995-1-1 applies an increased partial safety factor (γ_m = 2.0 rather than 1.3)
- The only exception is when the grade stamp is omitted for aesthetic reasons
  - Only where it is requested by a specific customer in respect of a specific project
- (Intention to put this in National Annex to EN 14081-1)

Some other changes

- Dry-graded timber – change of meaning
  - Means, specifically, checked for fissures and distortion at a moisture content of no more than 20%
  - Grading might have been done green
  - Not the same thing as moisture content specification
- Visual override
  - Relaxed twist limits for higher grades
  - (because some European timber struggled to comply)
- Control planks
  - Now supposed to be necessary for all machines

Some other changes

- Proof testing
  - Already required: machine grading softwood bending classes > C30
  - Clarified corresponding requirement for tension classes
  - TC124 WG2 recommends also applies for visual grading
  - A legacy of when there was less experience of higher softwood strength classes
  - Not clear what to do if check fails

A bit more about grading

- The mean (bending or tension) stiffness only needs only to exceed 95% of the mean stiffness value of the strength class

  (Because testing is currently done centred on the worst location in a specimen to get the lowest strength. In practice, the stiffness of the sample in general is more important)

- For machine grading, the characteristic bending strength of strength classes up to C30 (and equivalent) only needs to exceed 89% of the characteristic bending strength of the strength class

  (The k_v factor of 1.12 accounts for the reduced human involvement in machine grading and the additional confidence that this is supposed to afford)

A bit more about grading

- There is a size factor (k_h) that modifies the requirement for strength to do the opposite of the (k_h) in EN1995-1

  (It is not really known if there is a size factor for wood anyway)

- There are statistical adjustment factors that are applied to compensate from the added uncertainty of having fewer test results

  (But these cannot account for non-representative sampling – the sampling needs to be carefully done)

- There are adjustment factors for testing arrangement and moisture content

  (But we don't really know how to adapt historical test results and test results from other standards)

Summary

- Development requires industry and user input
- And the underpinning of research
  - To see the problems
  - To convince the committees
- Small changes can have massive impact
  - Changes in factory production control
  - Changes in testing standards and calculation procedures
  - Maybe for no good reason at all
- UK has a pretty unique situation
  - British spruce, stiffness limited
- There are a lot of changes to come