Revolutionary, world-first, Biligom® Eucalyptus structural timber introduced

Newly established Limpopo-based sawmilling company Biligom® International has launched a revolutionary new structural timber product into the international market.

Biligom® International has successfully introduced its Biligom® branded Eucalyptus structural timber product in September at a launch event in Johannesburg.

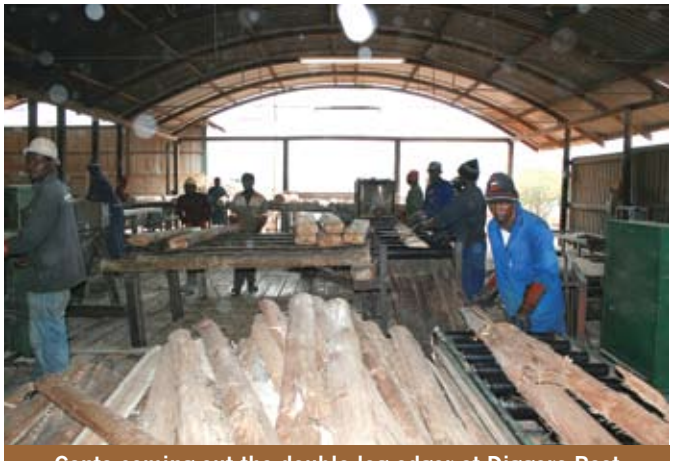
Young, moist Eucalyptus timber has never before been fingerjointed, treated and certified for use in structural applications, and Biligom® International is the first sawmilling company in the world to succeed in producing, branding and patenting a Eucalyptus structural timber product.

Wood Southern Africa and Timber Times visited Biligom® International in George's Valley near Tzaneen to learn more about this product.

Biligom® product overview

Biligom® timber is produced from young *Eucalyptus grandis* and *Eucalyptus grandis* x *cameldulensis*. The trees are harvested at a five to eight-year rotation and debarked in-field through the standing rip strip method. The trees are left in the field to dry for six weeks bringing the moisture content (MC) down to about 30%.

Trees are manually felled by chainsaw operators who make a basic front cut and final cut to control the fell direction. Tree lengths are extracted to a landing where a pole grader measures the various products from the tree to use the whole length.



Cants coming out the double log edger at Diggers Rest

Biligom S7 graded structural timber

The cut poles are sorted into diameter and length classes and are then transported to the 4 000 m² Digger's Rest sawmill where the log breakdown and ripping operations take place.

The logs enter a double log edger, which produces two flat sided cants. The double log edger ensures a flat surface is obtained for further processing. The cants enter multirip saws where the final cuts are made to produce the boards for Biligom®.

The boards are stacked and transported to the 1 600 m² Biligom® International factory, where they are sorted into grading divisions before defects are cross-cut from the boards to supply the best quality short lengths for fingerjointing.

First a fingerjoint shaper or profiler squares the end and makes the fingerjoint profile, directly after this a polyurethane glue is applied and the planks are assembled on a hydraulic press. Completed planks move from the press to curing stacks where they remain for 2,5 hours before machining takes place. The planks are planed all-round and end nail plates are inserted. Thereafter each plank passes through a stress grader to be graded to S7.

The automatic stress grader is calibrated to produce only S7 material. For example, a 38 mm X 114 mm is stress graded to 6 500 N along its entire length. This ensures the integrity of the timber. Lastly the stacks are treated to the H3 hazard class in a conventional pressure vessel and bundled for delivery. This whole production process takes place in a single production line.

Biligom® International is currently producing 120 m³ to 300 m³ of Biligom® a day and is considering implementing thin kerf sawing technologies in the near future to increase recovery. About 40 000 m³ of Biligom® has already been supplied into the low-cost housing market.

Biligom® is produced in all popular construction sizes and building timber sizes as seen below:

- 38 mm x 38 mm/50mm/76 mm/105 mm/114 mm/ 152 mm
- 50 mm x 76 mm/114 m/152 mm
- Lengths: 3,6 m, 4,2 m, 4,8 m, 5,4 m, 6,0 m and 6,6 m

Biligom® timber carries the complete quality mark of approval for S7 graded structural timber as endorsed by the South African Technical Auditing Services (SATAS).

Benefits of Biligom®

Biligom® is not intended to replace Pine structural timber, but rather to supplement the supply, relieving long-term pressure on the Pine plantations. Biligom® International reports that Pine trees are being harvested younger and younger as the demand grows. The ideal age for the use of Pine for structural applications is 28 to 30 years, but many mills are now receiving Pine timber as young as 17 years, indicating that Pine of the desired age is not readily available. The industry does not yet know what the long-term effect of using young Pine timber will be. However, it is a known fact that younger Pine has less dense timber and this is impacting on the ability of the mills to produce S5 and S7 material in sustainable volumes.

Each plank stress graded: A differentiating factor of Biligom® is that each piece of timber is automatically machine proof graded to S7. In general S5 Pine structural timber is only batch graded and many mills only implement visual grading. If each piece of S5 structural Pine were to be machine graded the results will be very interesting.

Strength despite cracking: Even though Eucalyptus is known to develop surface cracks as it dries, studies commissioned by Biligom® International have shown that the cracks do not affect the strength of the timber. Biligom's® strength properties match or exceed that of South African Pine.

Lower capital investment: Further, the initial cost input for the raw material is more affordable than Pine and the operation does not require the use of a drymill or the timber to be seasoned in drying kilns therefore significantly reducing the start-up costs.

The most important feature of Biligom®, however, is that it takes only one day from the time saw logs are loaded in the plantations to the finished product ready for dispatch on the evening of the same day. There is currently nobody in South Africa or the world for that matter that can produce structural timber in such a short time.

Use less timber in trusses: Owing to the S7 rating the fabricator will also benefit from material savings as about 28% less timber is required than S5 graded Pine timber to cover the same roof area. Fabricators will also enjoy a

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Revolutionary, world-first, Biligom® Eucalyptus structural timber introduced

40% average reduction in the area of gang nail plates required for the truss structure.

Affordable raw material: Readily available young Eucalyptus timber, S7 graded quality, lower input costs and significant material savings are just some of the factors that make Biligom® a superior product. When considering the bigger picture, Biligom® also has the potential to make structural timber more accessible to low-cost housing developers and to offer an alternative to Pine timber, which is already under pressure.

A good alternative: Globally the commercial forestry, sawmilling and woodworking industries are under increasing pressure from alternative building and consumer material industries such as concrete, steel, plastics and composite materials.

Promoting a wider range of more accessible and affordable timber products can go a long way in increasing the use of timber in South Africa and this will, in turn, benefit many timber-related industries from manufacturers and suppliers to sawmillers and fabricators.

Company background

Biligom® International founders, father and son team Spencer and Fred Drake, say the development of this product took years of planning, continuous tweaking of the system and a significant capital investment, but even before all the hands-on hard work started Spencer knew with every fibre in his being that the Eucalyptus product would not let them down. The company's story starts in the picturesque George's Valley near Tzaneen.

The Drake family has been in George's Valley for decades and opened Diggers Rest sawmill in 1974. In 1960, Spencer's father established Eucalyptus plantations in the area and Spencer grew up in the forestry and sawmilling business. Later Fred would follow in the same footsteps.

Even though the company owned mainly Eucalyptus plantations, Spencer worked mostly with Pine when he took over Diggers Rest. However, the wonder of Eucalyptus always remained with him. At the company's product launch Spencer reflected on a structure that he built from Eucalyptus when he was a young adult. This structure still remains intact today.

The view of Diggers Rest

For the past 40 years Diggers Rest sawmill has been a busy fencing and building pole treater supplying hardware stores and game farms in South Africa, Botswana and Namibia with South African Bureau or Standards certified chromated copper arsenate and creosote treated products.

Nowadays this mill is more than just a veteran treater, it is also the birthplace of Biligom®.

"We have been working with Eucalyptus for decades and we have learnt many wonderful things about this species. Small hints from the drying of the timber in-field and our experiences with treating this timber to working with structural components, all made me realise that much more can be done with this species. The curiosity grew in me and when I was sure that Eucalyptus could without a doubt be used in structural applications, we embarked on this adventure," says Spencer.

Fred explains that his father is very modest about the accomplishment, but he actually masterminded the whole idea and literally went to work with his own hands to ensure the success of the product.

"My father did not only conceptualise Biligom®, he also designed and fabricated all the machinery used in the production of the product. Everything from the cross-cut to the profiler and the modified hydraulic press to the stress grader came from his exceptional intellect and artisan hands," notes Fred.

Spencer and Fred agree that it was very challenging introducing this product into the local market. "The industry is conservative and not an early adopter of new technologies and ideas. However, we believe that the data, tests, accreditation and stress grading done on the product will give the fabricator and user confidence in Biligom®."

Biligom® International business kit

Spencer explains that the Biligom® franchise business kit is ideal for entrepreneurs with access to the raw material and sawmilling experience.

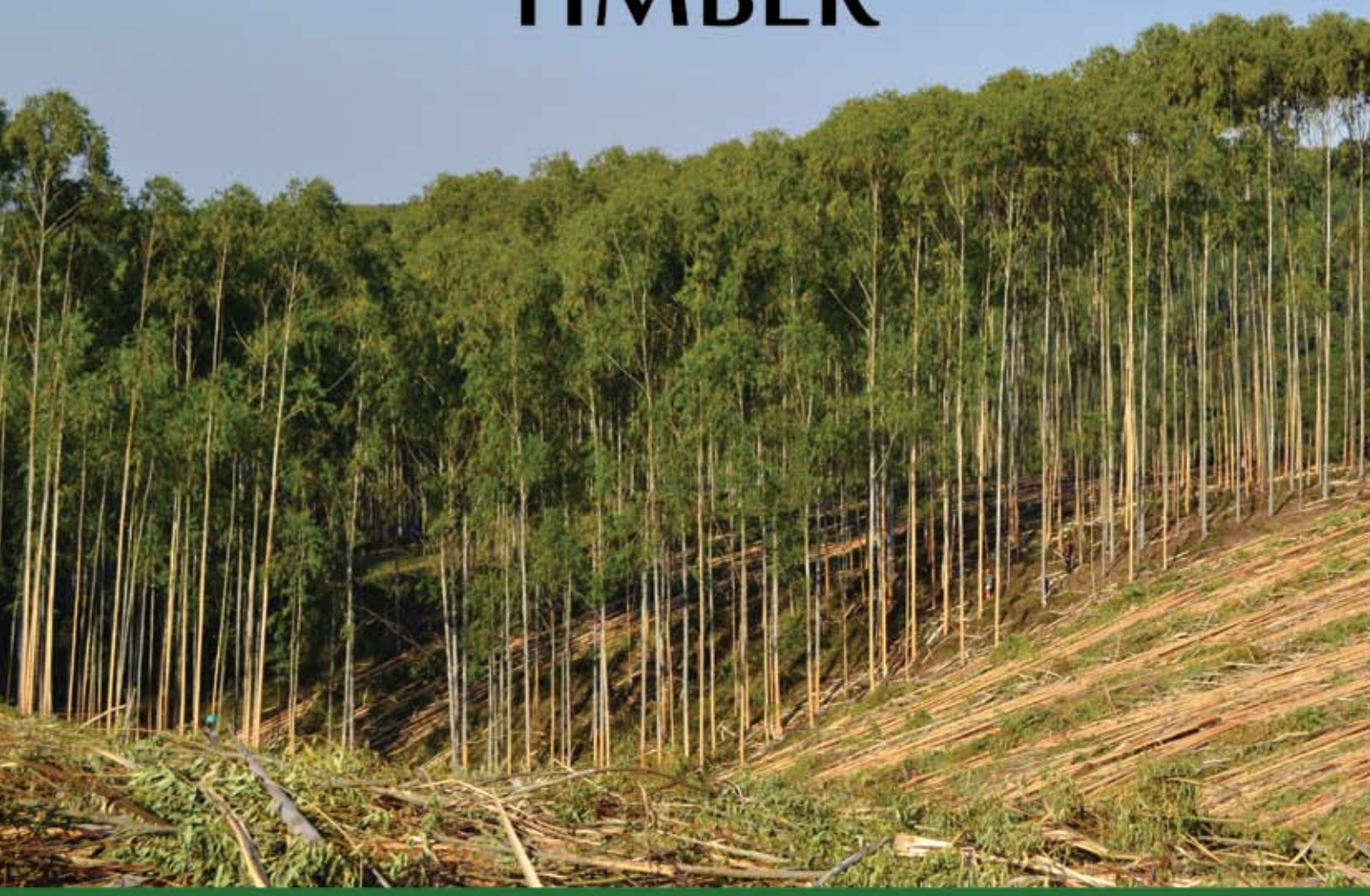
The business kit will also greatly benefit previously disadvantaged people working in forestry and sawmilling communities around the country that want to be part of the Biligom® innovation.

Biligom® International takes it very seriously that the proper chain of custody procedures must be followed for the whole process right from the start with harvesting to the end with the erector of the roof truss.

Visit www.biligom.com to learn more about licence agreements to produce this product.

BILIGOM®
INTERNATIONAL (Pty) Ltd

EUCALYPTUS CONSTRUCTION TIMBER



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Scientific testing of Biligom® by the University of Stellenbosch

Before Biligom® could be launched Biligom® International had to have clear and accurate data stating the mechanical and physical properties of moist and dry Eucalyptus boards.

The project was undertaken by Philip Crafford from the University of Stellenbosch as part of his thesis for a Master of Science degree in Forestry (Wood Product Science). Crafford's paper is entitled *An investigation of selected mechanical and physical properties of young, unseasoned and fingerjointed Eucalyptus grandis timber.* Stellenbosch University lecturer in wood mechanics and wood products manufacturing Brand Wessels supervised the work done by Crafford.

Speaking at the product launch Crafford explained that the objective of his study was to investigate the potential of Biligom® to be used as a component in roof structures while still in the wet state and the effect of the drying of the timber over time. The focus of the study was on the mechanical and physical properties besides others.

Crafford explains that the university received the timber specimens wrapped in plastic. He says this was done so that the timber could be tested as wet as possible. The timber was above fibre saturation point.

They divided the sample timber into a dry and wet group. The dry group was stacked in a greenhouse to air dry. This was quite a severe environment to simulate the real conditions inside a roof. The exception was that the greenhouse was covered in clear sheeting so direct ultraviolet radiation could occur. The boards were also unfixed and not in a roof structure.

"We immediately did destructive testing on the wet group when the timber arrived. For the dry group we waited until the equilibrium moisture content of 14% was reached. This took nine weeks in April weather conditions for Stellenbosch. When the desired MC was reached we started the destructive testing."

Crafford used the South African National Standards (SANS) 6122 and 1783-2 codes for the destructive testing and physical testing.

"It was quite interesting to investigate all the different properties present in a structural component. This includes bending, tension parallel to the grain, tension perpendicular to the grain, compression parallel to the grain, compression perpendicular to the grain, shear parallel to the grain, modulus of elasticity (MOE) and mean MOE."

Crafford says the most important of these properties is the bending strength because in most typical load bearing applications it determines if a component will fail or not. The tension parallel or along the grain is also important especially in a roof truss system as the bottom chord is mostly under tension. The stiffness is equally important because this prevents a roof from deflecting or sagging and will also counter buckling of a member under compression.

To test the mechanical properties a tensile testing machine was used to determine the tensile parallel and along the length of the board. An Instron bending machine was used for other destructive testing.

Crafford also recorded the less important properties such as the tension perpendicular to grain, shear as well as physical properties such as bow, cup, spring and twist.

	Wet specimens				Dry specimens				SANS characteristic grade stresses	
	n	Min	5th perc	Mean	n	Min	5th perc	Mean	5th perc	Mean
Bending strength (MPa)	100	14.9	20.8	37.1	100	19.5	25.9	43.7	S5 11.6 S7 16.6 S10 23.1	
Modulus of elasticity (MPa)	100	5355	7041	9800	100	5945	7334	9828	S5 4630* S7 6700* S10 7130*	7800 9650 12000
Tensile, strength (MPa)	100	3.3	14.8	21.1	100	11.3	14.1	20.7	S5 6.7 S7 10 S10 13.3	
Tensile, strength (MPa)	40	0.2	0.48	0.9	40	0.28	0.3	1.04	S5 0.36 S7 0.51 S10 0.73	
Compression, strength (MPa)	40	15.4	19.3	24	40	24.8	24.8	26.3	S5 18 S7 22.8 S10 26.7	
Compression, strength (MPa)	40	3.86	4.16	6.8	40	2.92	3.91	7.75	S5 4.7 S7 6.7 S10 9.1	
Shear strength (MPa)	40	1.55	2.21	3.6	40	2.15	2.7	4.23	S5 1.8 S7 2 S10 2.8	

The characteristic stress values for wet and dry Biligom® timber with the SANS 10163-1 (2003) characteristic grade stresses. *Values from draft version of SANS 10163-1

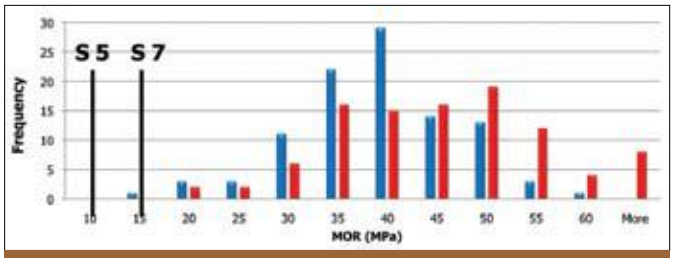
In the first three rows you can see the values for bending, stiffness and tensile along the grain. To test these properties Crafford used 100 boards from each group (wet and dry). For the less important properties he only used 40 specimens.

Crafford explains the fifth percentile (grade strength) value as seen in the graph. "If you have a group of 100 boards the fifth weakest board will determine your grade potential or characteristic strength."

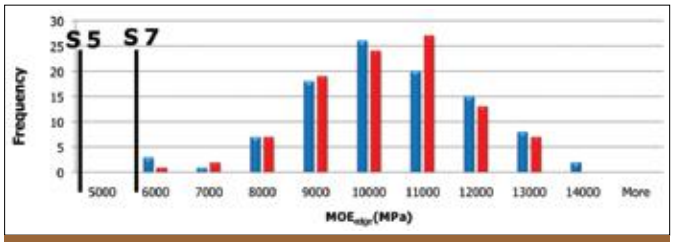
In the graph S5 is indicated in yellow, S7 in green and S10 in blue.

"What as very interesting is that Biligom® , even in the wet state, conformed to at least S7 with the important properties which are bending strength, stiffness and tensile along the grain.

"As it dried some of the properties became stronger and then conformed to S10, which is a great discovery especially considering the parallel stress along the grain where the fingerjoints exceed the minimum required strength."



The MOR distribution of the wet (blue) and dry (red) bending specimens



The MOE distribution of the wet (blue) and dry (red) bending specimens

From the second and third graph it can be seen that wet and dry Biligom® conformed to S7 without grading. As can be seen in the graph between S5 and S7, there is a variation. This is allowed because out of 100 boards, five are allowed to fail (weakest or fifth percentile).

Further, the physical results were also very surprising to Crafford.

"It is a common perception that solid Eucalyptus boards are supposed to warp (which in most cases they do), but according to the structural grade softwood code SANS 1783 used, less boards were rejected owing to warping than expected."

- 0% were rejected owing to bow and spring

Warp	Bow	Spring	Twist			Cup		
Width (mm)	73&111	73&111	73&111	73	111	73&111	73	111
Reject (%)	0	0	30	45	14	0.5	1	0

Defect	Checks			End-splits		
Width (mm)	73&111	73	111	73&111	73	111
Reject (%)	35.5	54	17	1.5	1	2

The percentage of (200) boards from the dry sample that did not conform to warp requirements for structural grade softwood timber according to SANS 1783-2 (2004)

- 30% were rejected owing to twist
- 0,5% were rejected owing to cupping
- 35,5% were rejected owing to checking
- 15% were rejected owing to splitting

Crafford explains that 35,5% would have been rejected owing to checking but the mechanical results show that the dry timber actually conforms to S10 based on the important mechanical properties. "One cannot make a judgement just based on what is seen."

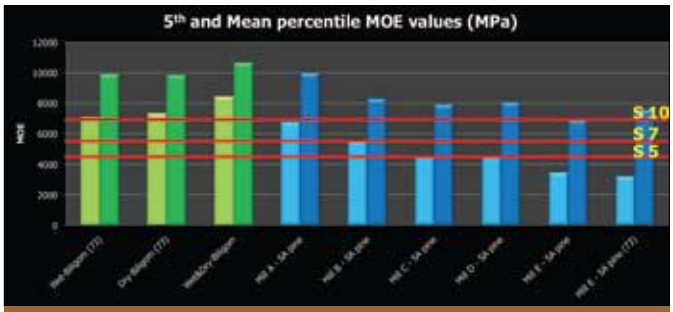
Comparing Biligom® to South African Pine

In the below graph consider the highlighted sections indicating the coefficient variation of stiffness and the strength.

	Dimension	48 x 73 and 36 x 111 mm		36 x 111 mm boards						36 x 73 mm
	Source	Wet-Biligom	Dry-Biligom	Wet&Dry-Biligom	Mill A SA pine	Mill B SA pine	Mill C SA pine	Mill D SA pine	Mill E SA pine	Mill E SA pine
MOE (MPa)	Mean	9900.3	9825.8	10627.1	9961.4	8273.6	7868.8	8060.0	6875.6	7557.2
	Std Dev	1601.4[a]	1493.7[a]	1248.8[a]	1853.7[a]	2065.6[b]	2160.3[b]	2490.9[b]	2181.7[b]	2632.3[a]
	Coeff Var (%)	16.2	15.2	11.8	18.6	25.0	27.5	30.9	31.7	34.8
	5th per	7040.8	7334.2	8419.4	6732.3	5488.1	4533.8	4511.8	3437.7	3184.7
MOR (MPa)	Mean	37.07	43.72	41.26	39.56	35.61	35.56	37.48	26.34	28.48
	Std Dev	8.27[a]	12.54[b]	7.12[a]	14.13[b]	15.67[b]	15.90[b]	16.06[b]	11.54[a]	14.24[b]
	Coeff Var (%)	22.3	28.7	17.3	35.7	44.0	44.7	42.8	43.8	50.0
	5th per	20.82	25.91	29.79	21.02	17.16	14.99	19.23	11.06	7.87
	n	100	100	100	100	100	100	100	100	100

The mean, standard deviation, coefficient of variation and characteristic stress values for MOE and MOR of wet and dry Biligom® timber and different SA pine sources and dimensions. Values in same row containing different superscripts (a,b) are significantly different (p<0,05)

Biligom is indicated in yellow and ungraded structural South African Pine is red. All samples were destructively tested by Crafford.



Histogram for MOE (36 x 111 mm) wet and dry Biligom® timber and SA pine from different sources and of different dimensions. Also different fifth percentile grade requirement levels, indicated by thick lines from the SANS 10163-1 draft document

The fifth percentile value of the tested Biligom® is a very positive indicator. This means the minimum strength of Biligom® is very high, which can give the fabricator and user great confidence in the product especially if proof-grading is considered.

Crafford's conclusions from the study

The Biligom® timber product tested in this study had very good flexural properties in both the wet and the dry condition. The mean MOE and MOR fifth percentile strength values complied with the current SANS 10163-1 (2003) requirements for grade S7 without grading.

The fifth percentile tensile parallel to the grain of both the wet (14,9 MPa) and dry (14,1 MPa) groups conformed to SANS grade S10 requirements.

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MiTek Industries getting the system and nail plates right for Biligom®

International truss software and nail plate system developer MiTek Industries is also involved with Biligom®. At the product launch in September, MiTek Industries technical executive Mike Newham gave a breakdown of the company's role in testing complete roof truss prototypes produced with Biligom® timber.

Spencer approached Newham about two and a half years ago to discuss ways of adding value to Eucalyptus by using it in structural applications.

MiTek Industries was the logical choice for these tests as the company has an engineering office, which specialises in timber and light gauge steel products.

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Scientific testing of Biligom® by the University of Stellenbosch

The fifth percentile shear conformed to SANS requirements for grade S7 for both the wet and dry groups.

The fifth percentile compression parallel to the grain conformed to SANS requirements for grade S5 for the wet group and grade S7 for the dry group.

The fifth percentile tensile perpendicular to grain and compression perpendicular to grain strength did not conform to SANS requirements for grade S5. In total, 30% of the 200 dried boards were rejected according to SANS 1783-2 (2004) due to twist and 35,5% checking.

The five-year-old 48 mm x 73 mm boards showed significantly higher levels of twist and checking compared to 11-year-old boards of the same dimensions.

Variation in both MOE and MOR values of the Biligom® product proved to be significantly lower in comparison with SA pine solid timber resources.

The study shows the concept of producing roof trusses from wet, unseasoned and finger-jointed young *Eucalyptus grandis* timber has potential.

MiTek Industries were approached to undertake prototype tests with this timber to ascertain whether the timber could be used in a wet off-saw state, the effect of the timber drying out on the plates and the differences between the wet off-saw and the dry timber trusses.

"The expected problem was that the green Eucalyptus timber will dry, shrink, twist and warp. Despite these challenges, we pushed ahead and designed two different sized trusses. We manufactured six trusses spanning 9 000 mm with a fink configuration and tested three of these trusses immediately at a moisture content (MC) of between 24% and 28% as measured on the surface and between 35% and 38% as measured in the middle of the section," explains Newham.

MiTek Industries then allowed the timber to dry out for a period of six months and then tested another three trusses.

MiTek used its full-scale truss testing rig, which it purchased from the Council for Scientific and Industrial Research about 25 years ago, to complete the tests. The test entailed putting chains over the trusses and then pulling them down with hydraulic cylinders. The resultant forces and deflections were measured to determine the strength of trusses.

Newham explains that in accordance with the prototype testing requirements as laid out in SANS 10163, a tested truss must reach a safety factor of 2,15 for a sample of three trusses. The Biligom® trusses exceeded the requirements with ease as the trusses tolerated 3,5 to four times more force than they were designed for. This showed that they were possibly much stronger than the Grade 7 strength allocated to them.

"It was very interesting that the third truss failed as a result of a bending failure of the timber in the first panel. This does not normally occur in South African Pine species."

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Tanalith™ E treated Biligom® in a roof structure

Henkel SA behind the Biligom® bond

Global adhesive specialist Henkel SA's innovative Purbond adhesive is used for the fingerjointing of Biligom® timber.

Henkel's Purbond is a one-component, moisture-curing liquid polyurethane adhesive system for engineered wood in structural and non-structural applications. Henkel SA technical sales consultant for construction adhesives Marnus Ferreira-Netto explains that the requirement from Biligom® International was that the glue system needed to adhere to very wet timber.

He notes that there are adhesive systems like melamine-urea-formaldehyde available that can adhere to timber with a 16% MC. However, with Purbond the moisture actually acts as a catalyst to strengthen the bond.

Henkel SA started trials for the fingerjointing of wet timber at Diggers Rest in 2011 and consulted with their overseas partners about the potential of Purbond for use on Eucalyptus fingerjoints with a MC of 30%.

In their experimentation with the product Henkel SA found that its Purbond product worked perfectly fine on soaking wet timber of 60% MC.

The fingerjoint made on the profiler

The start of the Biligom® production line where defects are cross-cut from the planks

All the machines in the production line were designed and built by Biligom® International

The company did continuous tweaking to get the adhesive system right and have now fine-tuned a direct in-line adhesive system that applies the glue to the fingerjoint profiles at Biligom® International. The adhesive cures before entering the treatment plant.

Biligom International is using Purbond HBS 159 in a closed system. Purbond HBS 159 has an open time of 15 min and curing time of 40 min whereafter it can be ripped, planed and treated.

Advantages and benefits of Purbond

- **Optimised spreading rate:** reduced use of resources and less material to handle
- **Fast curing system:** flowing or in-line process and improved productivity
- **No mixing:** increased reliability of the production process
- **No cleaning cabinet:** reduced cost and less space required
- **No waste water:** reduced cost and no pollution
- **Minimum quantity of adhesive residue at the application unit:** efficient use of resources, clean production line and simple disposal of residue
- **No odour:** pleasant working environment
- **Wide application range:** one single adhesive technology in the production process, no time consuming daily adhesive switch and can join wet timber reducing cost of drying
- **Bond hardness similar to wood hardness:** longer tool life and improved machine ability
- **Clear, transparent bond:** aesthetically appealing and very similar to natural wood
- **Toxicologically harmless and chemically stable:** no emissions during use, equivalent to natural wood: Frauenhofer Institute for Wood Research, Germany
- **No harmful emissions:** reduced risk in case of fire when burning and no environmental issues for thermal disposal at the end of the life cycle

Purbond is certified by the South African Technical Auditing Services.

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MiTek Industries getting the system and nail plates right for Biligom®

The failure occurred as a result of compression failure in the member (resulting from the combination of the moment and compression forces acting together). On analysing this particular section under the loads and moments, MiTek found an excellent correlation to the compression strengths found by the University of Stellenbosch, being a failure stress of 24,7 MPa compared to a fifth percentile of 19,4 with mean of 24 MPa.

Newham says the stiffness of the members was comparable to that of grade S7 and the strength of the timber exceeded S7.

Further, MiTek has also developed proprietary nail plates that are normally used in dry timber. In this case, these plates were used on the wet timber.

"We had made up matched samples of individual pieces of timber to test the characteristic plate strengths of MiTek nail plates in Biligom®.

"The strength exceeded our expectations and calculations, and we had the plate failing across the joint at its characteristic strength. This served to show us that the plate strengths into the Biligom® exceeded that which we use in South African Pine. An example of this also could be seen in the failure mode of the first two trusses, where the heel plates failed at a safety factor of 5, compared to the required safety factor in practice of 2,5," notes Newham.

It must be noted that in the drying process, the Biligom® material has a tendency to develop surface and end cracks. In addition to this slight cupping and shrinkage could be seen. The surface cracks have no influence on the structural strength of the timber. The end cracks may be more severe on larger timber sections and an anti-split plate may be required.

The shrinkage of the timber had no effect on the plates, whereas on South African Pine, in a continual wet and dry process, the fibres tend to push the plates out.

The Biligom® material will be provided in the following sizes:

Cut size	38 x 38	finished size	35 x 35 (Battens)
Cut size	50 x 76	finished size	45 x 70 (Purlins)
Cut size	38 x 76	finished size	35 x 73
Cut size	38 x 114	finished size	35 x 100
Cut size	38 x 152	finished size	35 x 148

Biligom® has been added as a new species to the MiTek software design programme MiTek 20/20, where the user will have the ability to select timber as he or she requires. A mix and match of timber (Biligom® and South African Pine) will also be possible.

MiTek Industries can safely say that the Biligom® material can be used to manufacture MiTek trusses using the proprietary plates, in both a wet or dry situation, and the strength of the final product would equal or exceed that of a South African Pine truss.

"We believe the Biligom® product is structurally sound and we will back it," concludes Newham. SG

MiTek Industries' nail plate can be seem in the Biligom® in a roof structure

The Lonza Tanalith™ E treatment plant at Biligom® International

Lonza Wood Protection battling the borers for Biligom®

Lonza Wood Protection (Lonza) and Spencer have a business relationship that dates back to 1987, and today Lonza still supplies the Drake's pole treating business, Diggers Rest, with Tanalith™C for the treatment of fencing and building poles.

Speaking at the Biligom® launch, Lonza's GM, Doug Sayce, said that Spencer had always had an entrepreneurial spirit, and that he was enthusiastic for Lonza to find a solution for the preservative treatment of this product when the concept of the Biligom® product was shared with him.

"When Spencer asked me what the treatment solution for Biligom® was, I could not give him an answer right away. We at Lonza had to put our thinking caps on to come up with the right solution for treating wet young Eucalyptus, as this was something that, to our knowledge, had never been done before," added Sayce.

He explained that South African law requires that Eucalyptus timber used in structural applications, both inland and at the coastal regions, must be treated. This law, instituted by the SANS 10005 specification applicable to the preservative treatment of timber, was introduced as Eucalyptus is at risk of being attacked by the lyctus borer, which attacks the sapwood of the timber.

Lonza then considered the options to provide the best solution for the treatment of Biligom® within the confines of SANS 10005 and other applicable regulations.

Borates was considered as an option, but would require long periods for diffusion, and being a highly mobile product could diffuse out of the treated timber under wet conditions during storage.

An obvious option was chromated copper arsenate (CCA) Tanalith™C. This is the longest used preservative after creosote and is slowly being regarded as an old generation product in the modern environmentally-conscious world.

"For Lonza it did not make sense to take an old generation product and use it on a new innovation such as Biligom®," noted Sayce.

With Tanalith™C there are some technical issues to be overcome when treating wet timber. Sayce explained that it is very difficult to obtain the retention of 6kg/m3 as required by the specifications in the Biligom® timber because of the low ratio of available sapwood of the product.

The obvious option to consider was the new generation Tanalith™E, a copper azole product manufactured and supplied by Lonza and considered to be one of the global replacements for CCA.

When Tanalith™ E was included by Lonza in the SANS 10005 specification in 2004, the company also introduced the mass/mass retention method, as used in the Australian timber preservation Specification AS1604, as an alternative to its traditional mass/total volume method.

In South Africa, the amount of chemical loading in the timber is measured relative to the total timber volume,

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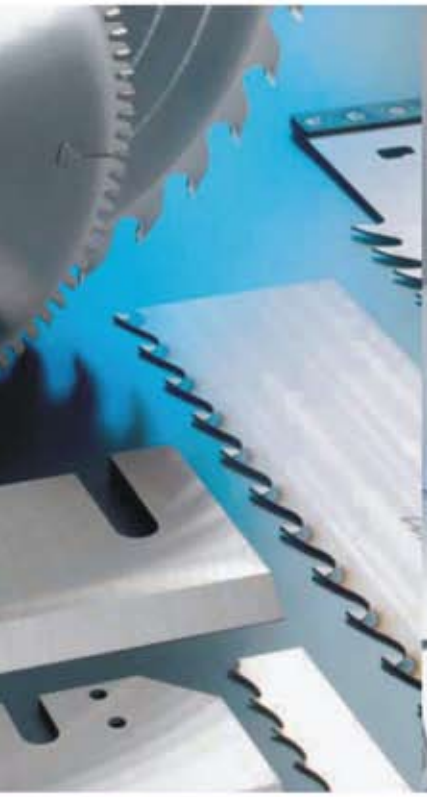

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Lonza Wood Protection battling the borers for Biligom®

whereas in most other countries, the chemical loading is measured as kilograms per cubic meter of the sapwood portion of the timber only, or what is known as the treated zone.

The mass/mass method ensures that the minimum amount of chemical required to preserve the timber is applied. "We are all aware of the trend nowadays of bacteria, fungi and pests to build resistance to chemicals. Hence it is the responsible approach to use the minimum amount of chemical to preserve the timber. The mass/mass retention method allows us to do this without compromising efficacy" noted Sayce.

With Biligom® the treatment plant operator uses the prescribed sampling plan to determine the mass and sapwood ratio of the timber to be treated and adjusts the treatment solution accordingly. Tanalith™E readily enables Biligom® International to apply this method.

The treatment criteria of Biligom® International includes the following:

- Low treatment cost, as the treated Biligom® would be competing against untreated Pine in inland regions.
- Full sapwood penetration and retention.
- Treatability of timber with a high moisture content.
- Short treatment process cycle.
- Compact in-line treating plant.
- Globally accepted preservative.
- Preferably a second generation or 'green' product.
- Both insect and fungal protection required.
- No post-treatment drippage.

To meet these requirements Lonza had to overcome many challenges with one of the biggest issues being the treatment of high moisture content timber.

Sayce explained that in the preservation world there is the common knowledge that wet timber should not be treated. Lonza's own guidelines indicate that timber with a MC of above 28% should not be treated.

"The norm worldwide is not to treat timber which has a moisture content over 30% and the Biligom® timber typically reaches the treatment plant when it is in excess of 30% MC," added Sayce.

Nonetheless, Lonza Wood Protection took on this task and was very successful in their experimentation with treating wet Eucalyptus with Tanalith™E.

Technical challenges for Lonza

Sayce explained that one of the challenges was treating timber with a low sapwood content (15% to 25% compared to 60% to 100% for other Eucalyptus and Pine products). The sapwood takes up the chemical and the mass/mass retention method enabled them to establish the correct amount of chemical to be used.

The high MC of 35% to 40% compared to the traditional 28% used in industry, was another challenge to be overcome and Lonza also had to take into consideration other variables such as the variability in timber species and timber density. Various clones, hybrids or species and the region in which they are grown can all affect the sapwood content and timber density, noted Sayce.

To test the suitability of Tanalith™E in meeting all Biligom® International's requirements, Lonza conducted a trial in May 2013 using a commercial scale Tanalith™E treatment plant at Mintroad Sawmills in Gauteng.

The company tested 100 pieces of three of the standard Biligom® timber sizes that are going to be produced.

Sayce reported that a very acceptable consistency was achieved in the results with a surprisingly high sapwood solution uptake of over 600 litres per cubic meter being achieved. In the smallest sizes, the sapwood solution uptake was in excess of 700 litres per cubic meter.

It has not been ascertained why such high solution uptakes are being achieved with Tanalith™E, but Sayce is of the opinion that it is a combination of the various ingredients which improves the mobility of the product in the timber during the treatment process. The specific Tanalith™E formulation used by Lonza in South Africa is one of the earlier formulations, which was produced specifically for timber species that were resistant to impregnation, such as Fir and Spruce in the Scandinavian countries.

Setup at Biligom® International

For Biligom International, Lonza modified a standard Tanalith™C plant to apply Tanalith™E.

Because of the mass/mass retention method, Lonza had to install a sampling plan which determines the average density and sapwood ratio of the timber coming into the plant.

The cycle time of the Tanalith™ E plant is 1.5 hours and the capacity of the plant correlates with the mill's production throughput to prevent bottlenecks.

The plant at Biligom® International has been running for four months and is meeting production and quality requirements.

Biligom International requested in-line treatment, which meant that the timber had to be treated shortly after being finger-jointed and planed. Sayce explained that usually timber is kept in stock for a while and is only treated as orders for treated timber are received.

"This is a very unique concept and as far as I know there is only one other mill in Australia doing in-line treatment," concluded Sayce.

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  H3: Exterior above-ground - thatching poles and lathes, timber decking joists, bearers and boards, external cladding and walkways.

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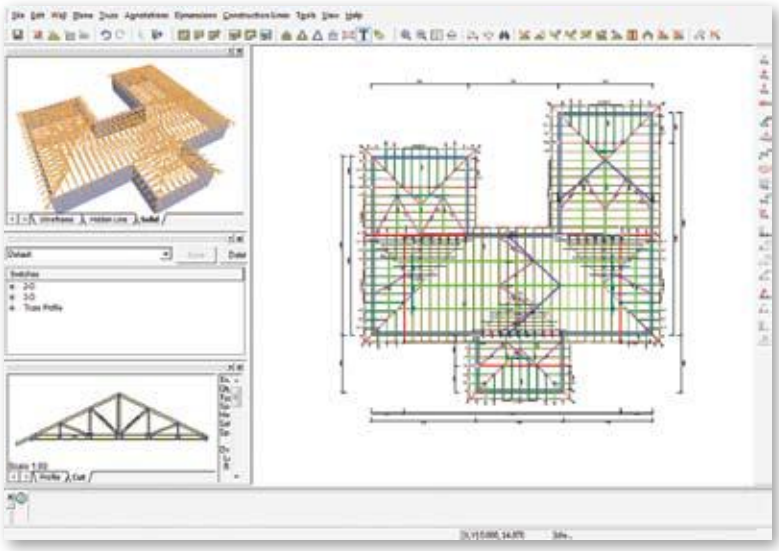

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*By utilizing the immense flexibility and power of the **20/20 Layout component** of the software, the designer enters the building parameters and then uses the comprehensive plane and frame solving tools to detail the trusses, using 2D input accompanied by real-time 3D visualization.*

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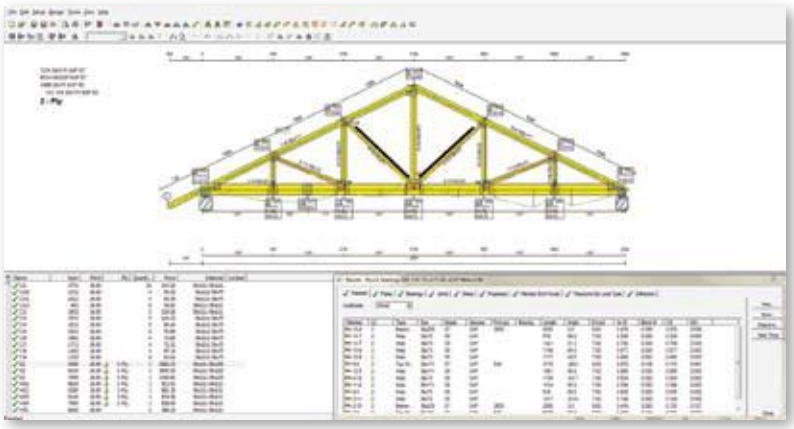

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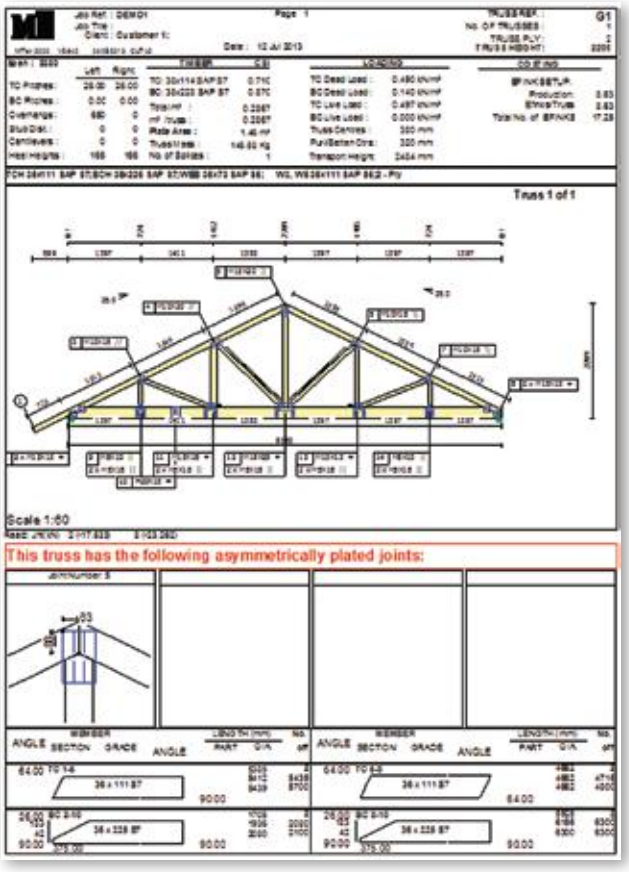
Attic roof structure

Form-work truss for bridge construction



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Indoor stand for arena

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MiTek® and Biligom®

MiTek® has recently been involved with Biligom® in the successful prototype testing of their specially treated Eucalyptus structural timber for suitability in truss manufacturing.

Full size trusses were tested on the MiTek testing rig in a wet off-saw state as well as dried out state in order to establish the strength of the timber as well as the behaviour of the nail plates.

Conclusion: MiTek can confirm that the Biligom structural timber material can be safely utilized for the manufacture of trusses utilizing the MiTek proprietary nail plates, in both wet or dry situation, and the strength of the final product would equal or exceed that of Pine timber trusses.

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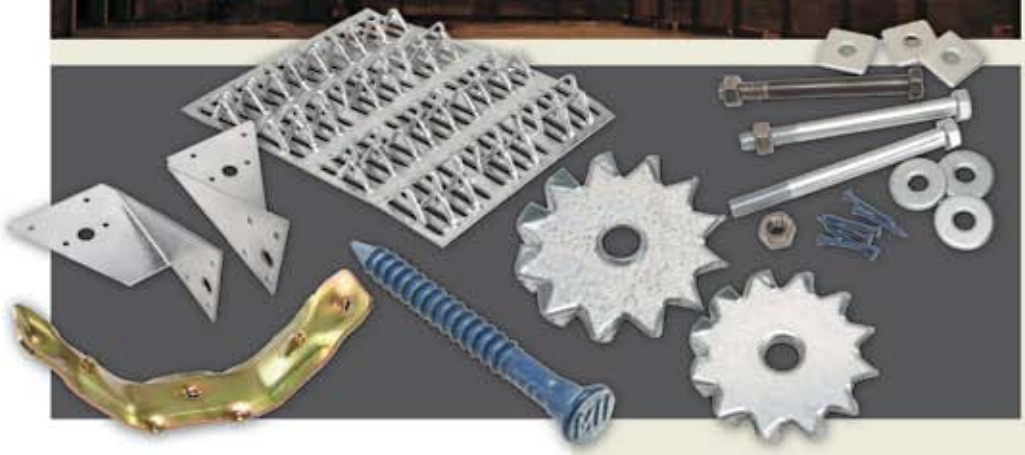

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