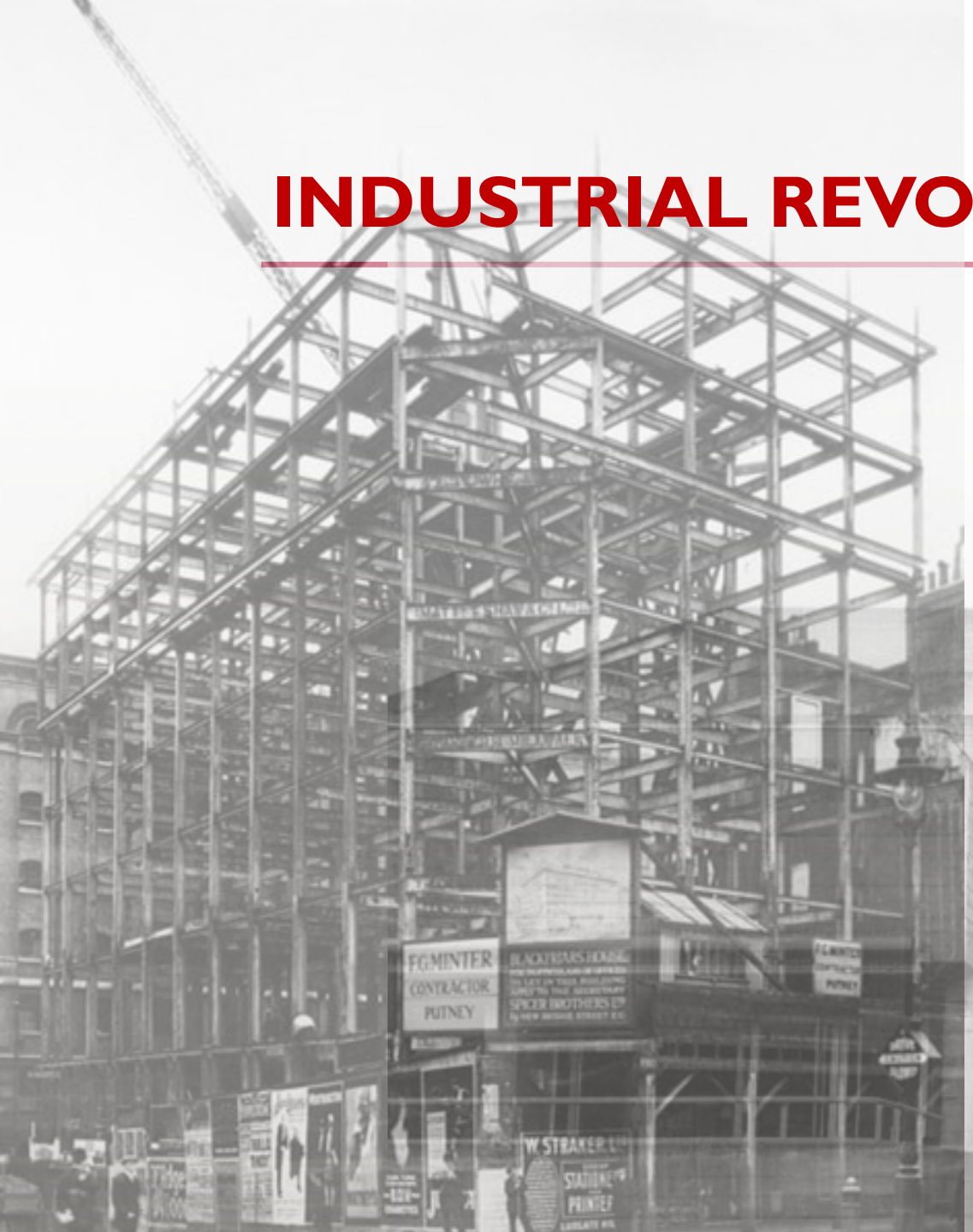
RED STAG
TRANSFORMING CONSTRUCTION

RED STAG.

WHY CANT WE BUILD BETTER?

- What drives our current development choices?
- Are we prioritising short-term gains over long-term sustainability?
- Can innovation in materials and methods reduce costs and emissions?
- Why is low-carbon construction not the default?
- Who benefits from the status quo—and who bears the cost?
- Why can’t we create the returns from sustainable options?

INDUSTRIAL REVOLUTION



- Early engineering and construction primarily utilised timber due to its availability.
- The industrial revolution introduced concrete and steel.
- Modern trends emphasize sustainable building – a resurgence in timber.
- Innovations in Engineered Wood Products are making timber more viable for large structures.

REVIVING THE ROOTS FOR TOMORROW

Horyu-ji Temple, Japan 607 AD

Tauranga City Council, NZ 2024

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WHAT DOES BETTER LOOK LIKE?

- Having a point of difference.
- Creating better returns.
- More sought after.
- Faster to market.
- Being sustainable for the land and generations to come.
- Buildings that embrace and draw on nature.
- Incorporate biophilic and physiological benefits.

HOW DO WE ACHIEVE IT?

- Stop doing what we have for the past +100 years.
- Focus above ground superstructure on sustainable materials.
- Reduce traditional carbon emitters.
- Early Contractor & Supplier Engagement.
- Speed up construction.
- Incorporate more OSM.
- Give the market what it wants - Sell the points of difference.

HOW TO INFLUENCE CARBON IN A BUILD

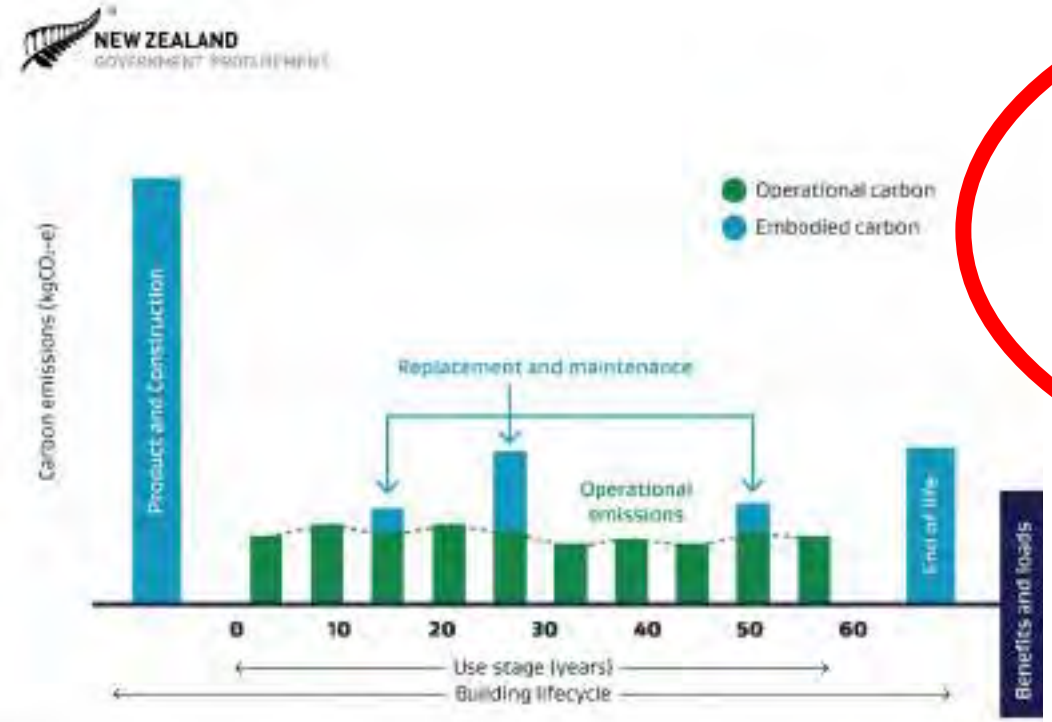
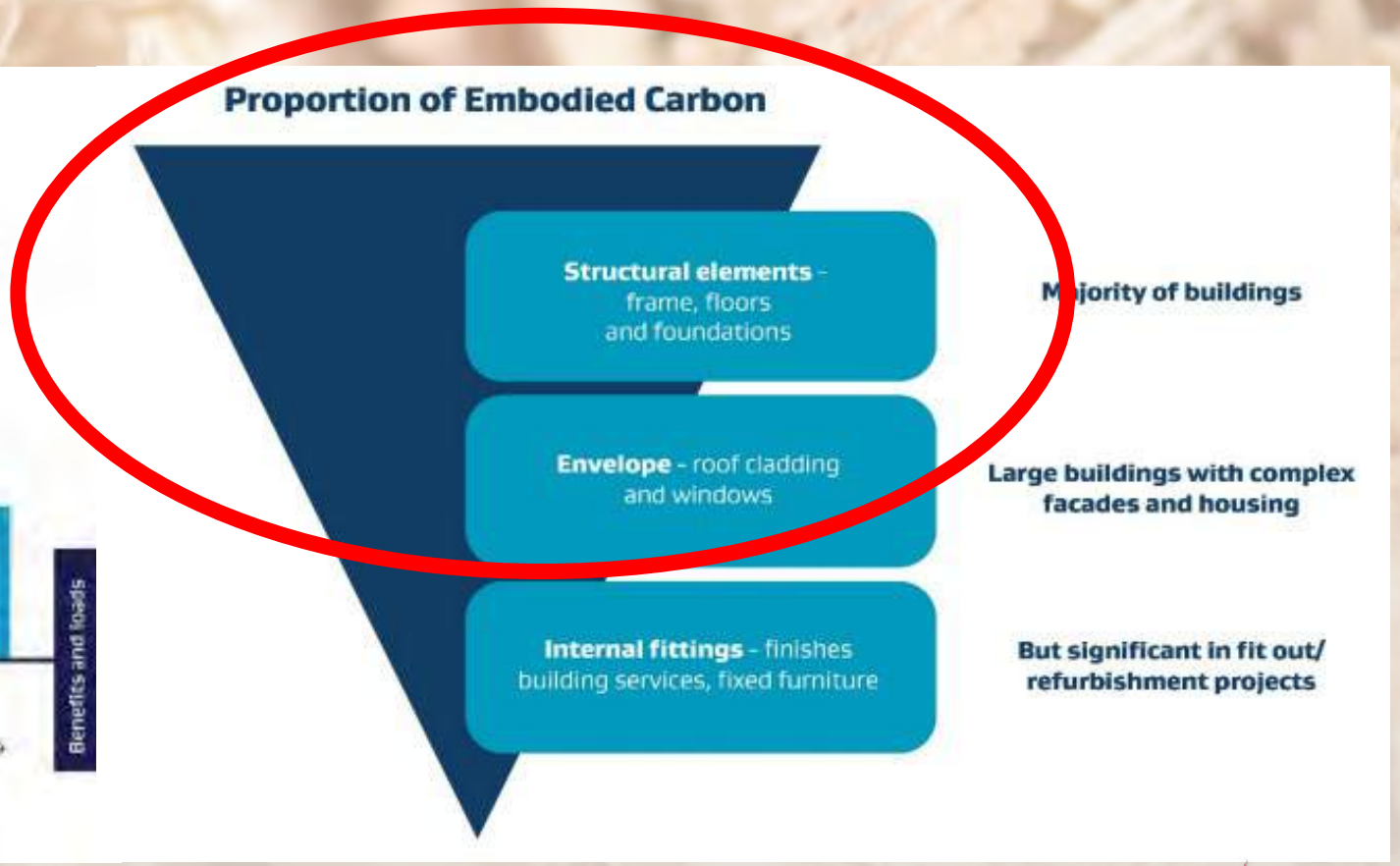


Figure 3. How embodied carbon and operational carbon relate over the building lifecycle



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EATING OUR CAKE

- Sustainable does not need to impact profitability.
- Create the right team – Different materials, different teams.
- Just like materials, not all consultants are equal.
- Prevent QS and Engineers compounding contingencies on timber.
- Create a structure where the developer reaps the reward.
- Use the right material in the right application.
- Utilise efficient EWP cross sections – Standardise wherever practical.
- Choose your partner carefully – not all are equal.

WHY TIMBER?

- Environmentally friendly
  - Natural resource.
  - Carbon sequestering.
  - Biophilic and physiological well-being.
- Structural Performance
  - Lighter.
  - Constructability.
  - Seismic benefits.
  - Speed of construction.
- Supply Chain
  - Strong domestic forestry and wood processing.
  - Lower price escalation compared to alternates.

RED STAG.

PGP MID RISE PROGRAMME

- Red Stag has partnered with MPI to establish the PGP mid-rise programme.
- Showcase real timber hybrid buildings: design, engineering, costs, methodology and timelines.
- Targeting a mixture of timber and hybrid building typologies with a focus on mid rise.
- Open source project data, including:
  - Case studies
  - Engineering solutions and details.
  - DfMa and OSM opportunities.
  - Project timelines and benefits.
  - Costs.
- www.midrisewood.co.nz

Ministry for Primary Industries
Manatū Ahu Matua

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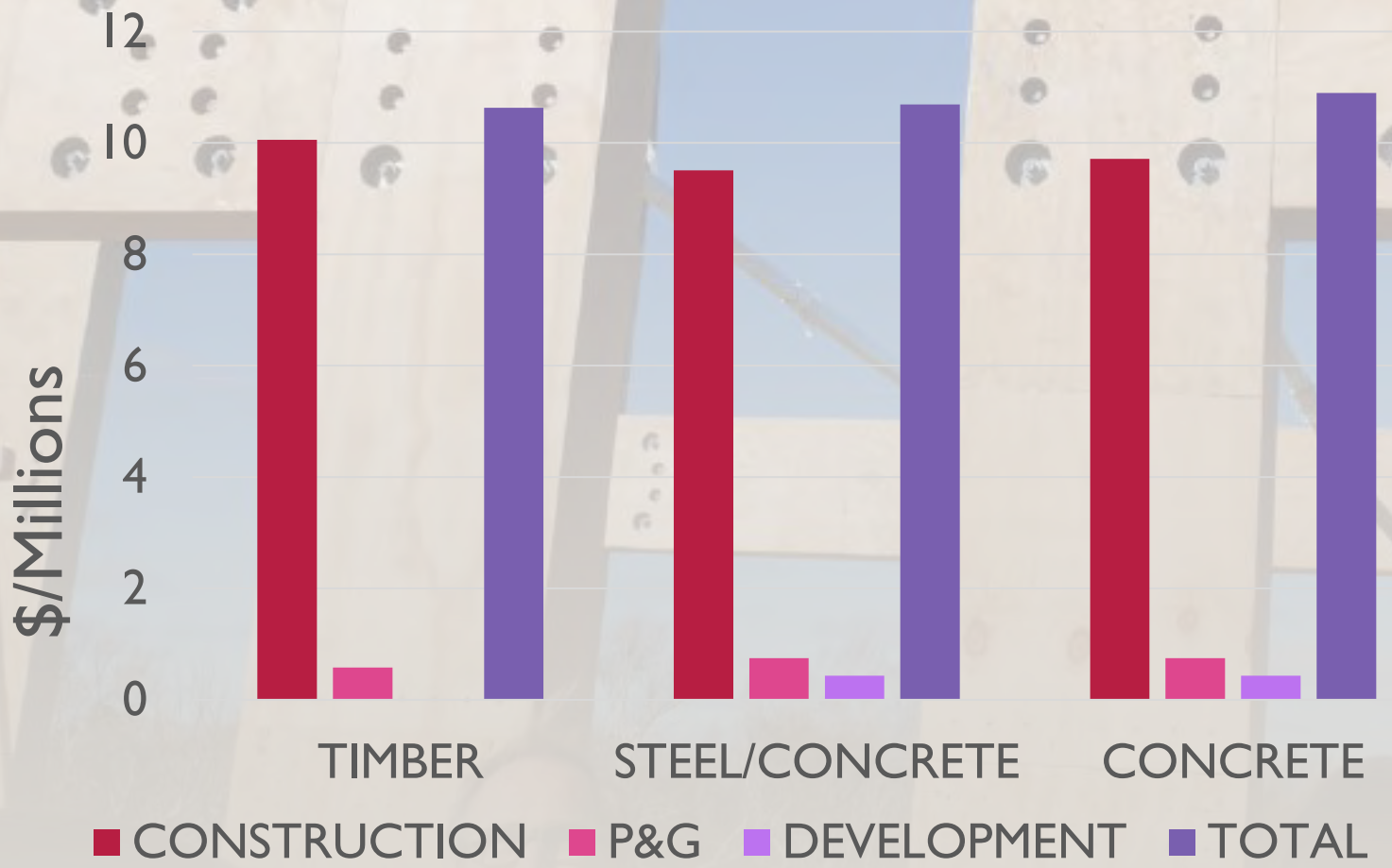
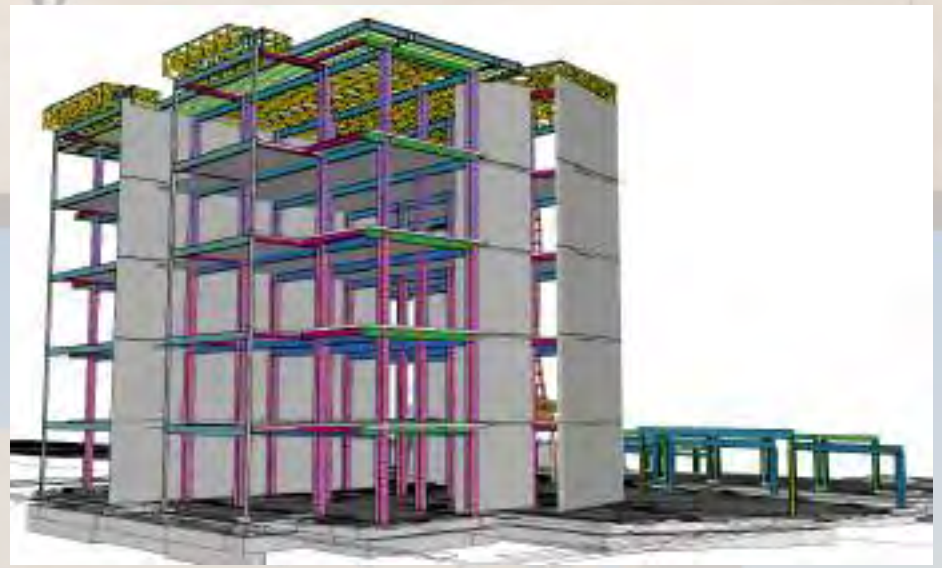
MASS TIMBER VERSUS STEEL & CONCRETE





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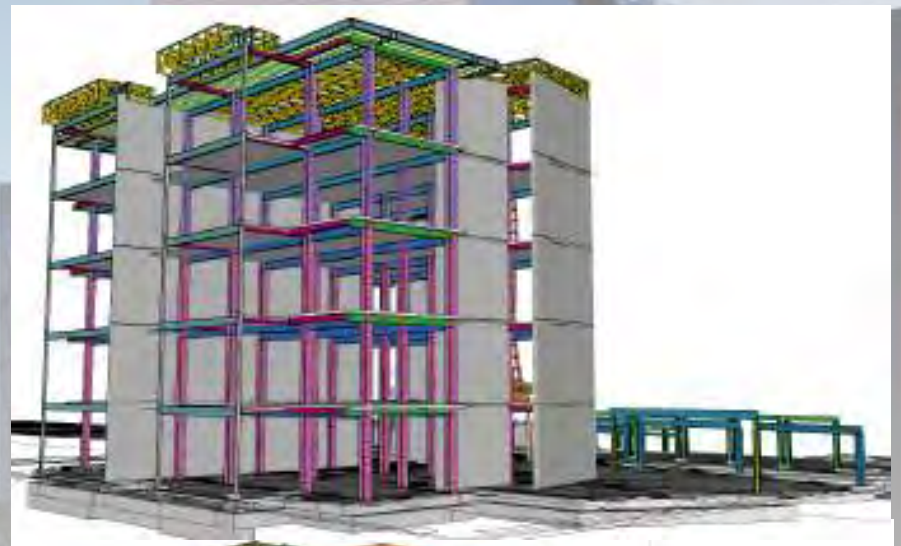
MASS TIMBER VERSUS CONCRETE & STEEL
CO_2 EMISSIONS FROM STRUCTURAL COMPONENTS

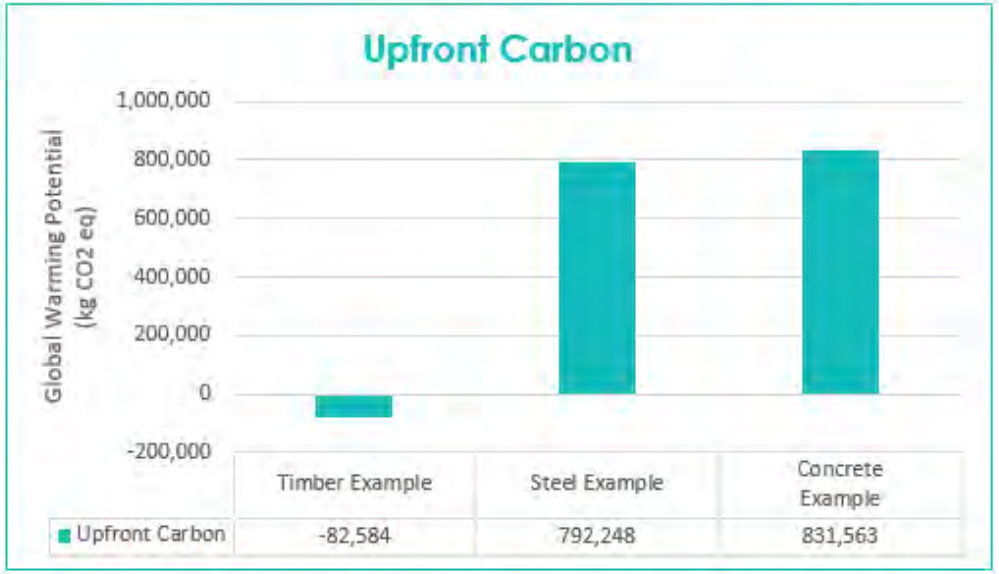


Naylor Love

Building Carbon Calculator

Results *(Automatically Populated)*

	Name	Upfront Carbon [$kgC0_2eq$]
Building 1	Timber Example	-82,584
Building 2	Steel Example	792,248
Building 3	Concrete Example	831,563



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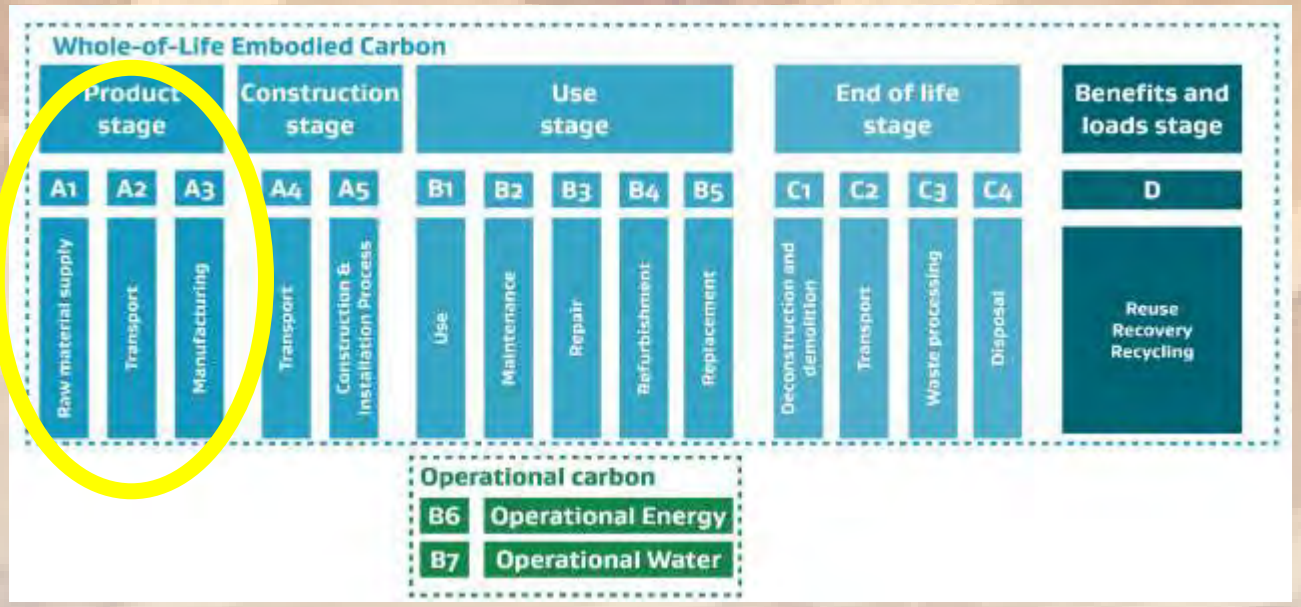
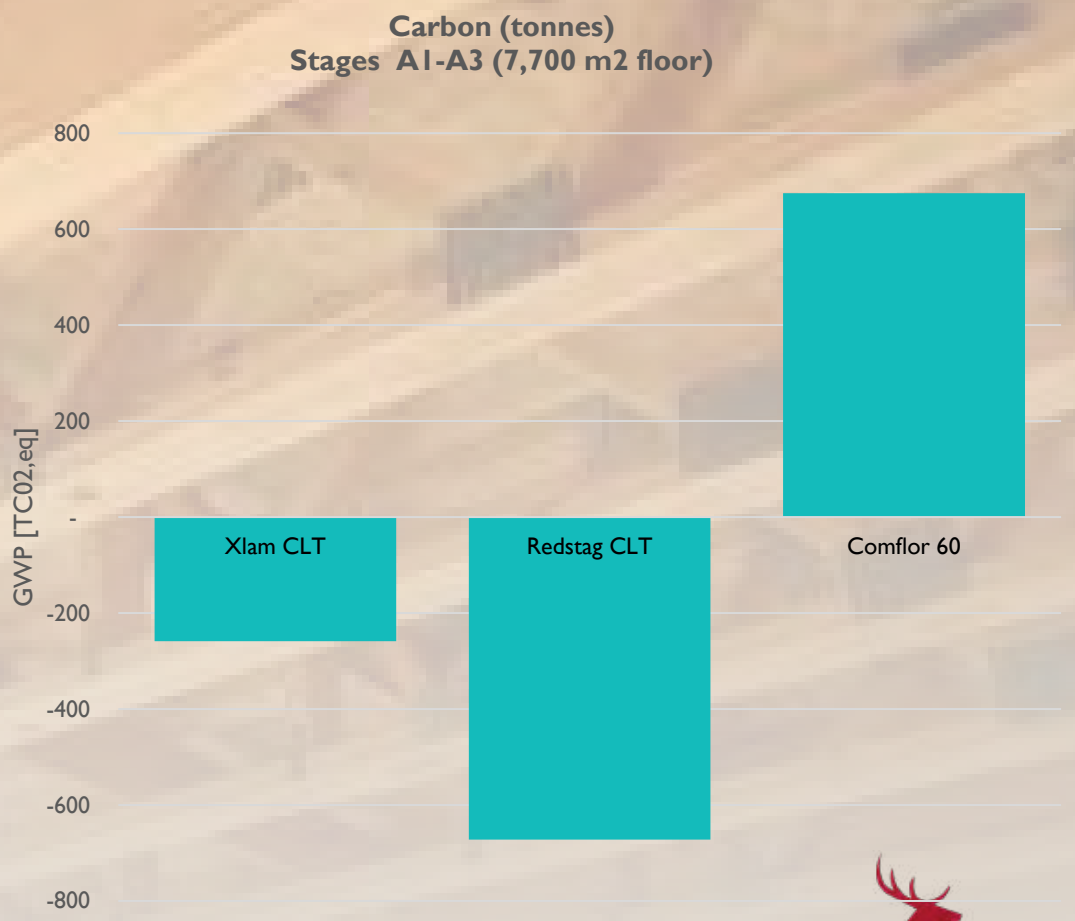
BUILDING FOR CLIMATE CHANGE – IMMINENT REGULATION





RED STAG.

IN NEW ZEALAND FOR NEW ZEALAND

- Locally growth forestry.
- Domestically milled and processed.
- Largest private employer in Rotorua.
- Locally owned and operated.
- Vertically integrated – Mitigated risk
- Produced to New Standards and Codes.
- Significantly better environmental position.
- Domestic focused supply.

STRUCTURAL TIMBER

RED STAG.

CREATING THE FEEDSTOCK - SAW MILLING

- Largest structural sawmill in the Southern Hemisphere.
- 120 Truck & Trailer loads of logs per day (5,000 MT/day).
- All logs graded for density, length and SED prior to milling.
- $70 million upgrade in 2018.
- 700,000 m^3 with plans for 1 million m^3.
- Most advanced scanning technology in New Zealand.

RED STAG.

BETTER DRYING

- Red Stag Timber has the most modern kiln drying system in New Zealand.
- Kilns are powered by on-site renewable energy center.
- The kilns are the biggest user of energy on site.
- Two types of kilns are used to dry timber on site.
  - High temperature kilns.
  - Counter flow kilns.
- Five high temperature kilns: 120^{o}C for 12 – 30 hours.
- Four reconditioning chambers: 6 hours + 72 hours equalizing.
- Three Counter Flow Kilns (CFK) - Red Stag were the first to implement in New Zealand.
  - Reduced energy demand.
  - 600 m^3 of timber with a drying time of 54 hours.

RED STAG.

QUALITY & SPEED - SECONDARY PROCESSING

- Final moisture and density testing prior to planing.
- High speed planing up to 1,200 LM/min with +/- 0.5 mm accuracy.
- Post planing Metriguard bend test (every 150 mm) to confirm structural properties.
- Final scan to confirm visual properties prior to packetising for treatment.

RED STAG.

YOUR INSURANCE POLICY - TREATMENT

- Most advanced timber treatment plants in the New Zealand.
- NZS3640 treatment standard requires a retention of 0.4. Red Stag treat to 1.0 (2.5 x Standard).
- New PTP plant under construction – commissioning mid 2023.
- Structural: Boron H1.2 and H3.2 CCA.
- Outdoor and non-structural: H3.2 – H4 CCA.
- EWP clear H1.2 boron treatment.

RED STAG.

ENGINEERED WOOD PRODUCTS (EWP)

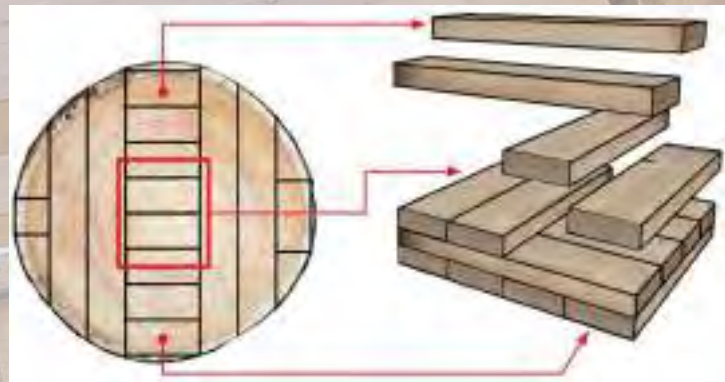
CHANGING BUILDING TYPOLOGY

- Timber in 3604 Builds
  - Consents dominated by 1 – 3 storey structures.
  - Timber dominant at ~94%.
  - Consent ratio changing.
- Timber in Mid Rise Builds
  - Inverse ratio to 3604.
  - Increasing ratio of builds above three levels.
  - Missing opportunity for low carbon alternatives.

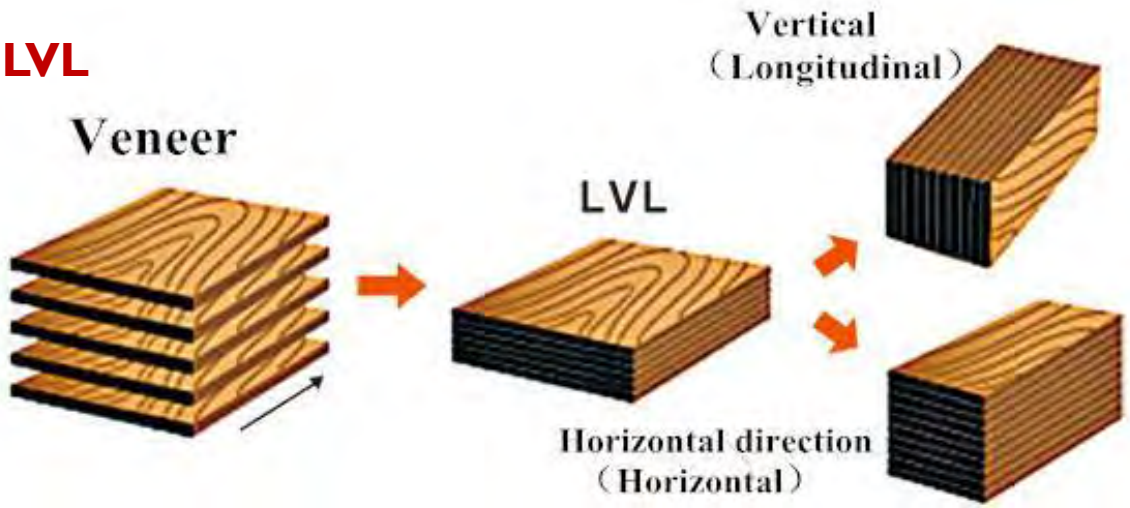
RED STAG.

ENGINEERED WOOD PRODUCTS

- Three primary types:
  - Glue Laminated Timber (GLT)
  - Laminated Veneer Lumber (LVL)
  - Cross Laminated Timber (CLT)



LVL



CLT

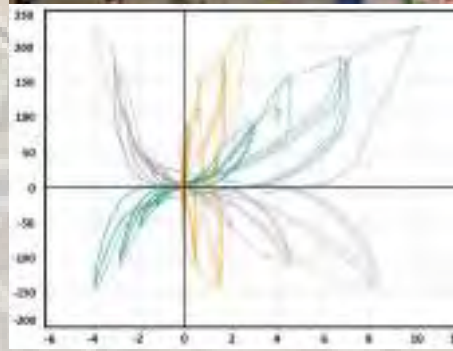
CLT DESIGN BENEFITS

- **Structural & Scale**
  - Large format panels (up to 75 m^2).
  - Double spans typically between 4 – 7 m.
  - Exceptional seismic and bracing performance.
  - Less LM of perimeter requires less screw fixing.
  - Faster and cheaper installation.
  - Typically reduce foundation size by ~30%.
- **Lighter**
  - Reduced foundations, de-risk uncertain civil works phase.
  - Reduce craned size.
  - Reduced transportation movements.
- **Thermal**
  - Intrinsic R-Values typically between 1.0 – 2.0.
- **Fire**
  - Extensive fire testing confirming 60-60-60 in the majority of application without encapsulation.
- **Acoustic**
  - Common acoustic configurations can achieve STC 66 dB and IIC 60 dB.

RED STAG.

SEISMIC MANAGEMENT

- Lighter structures allow for raft opportunities.
- Typically, more elastic in nature.
- Timber typically outperforms the theoretical calculations by 20% - 300% depending on the mode.
- Structural flex and resilience in connections typically allows timber structures to remain habitable after large events.
- Design integration of simplified replaceable connections saves time and money, especially after major events.



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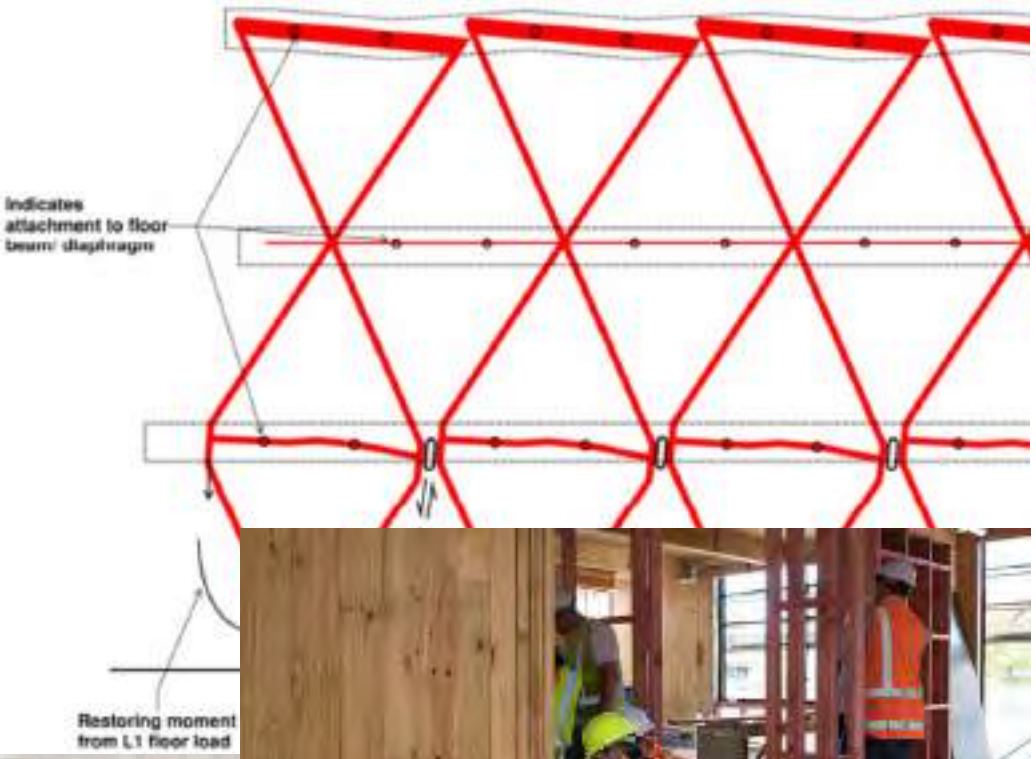
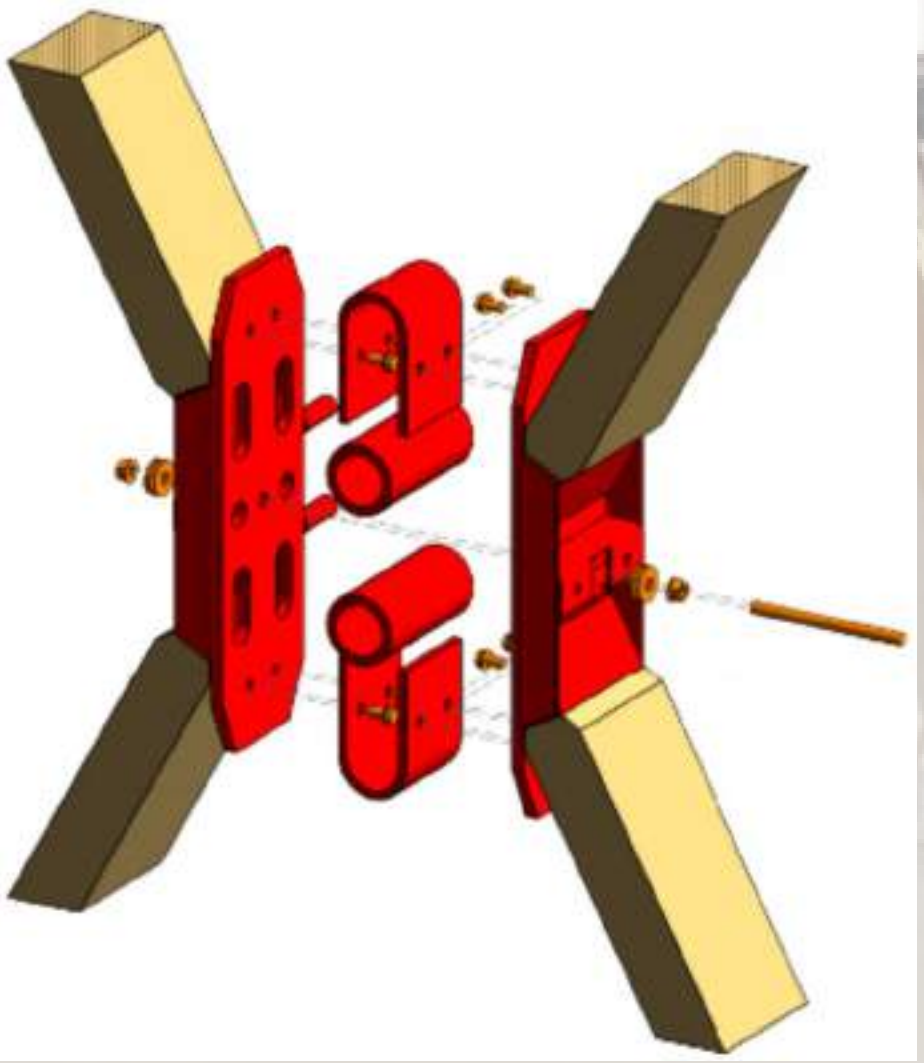
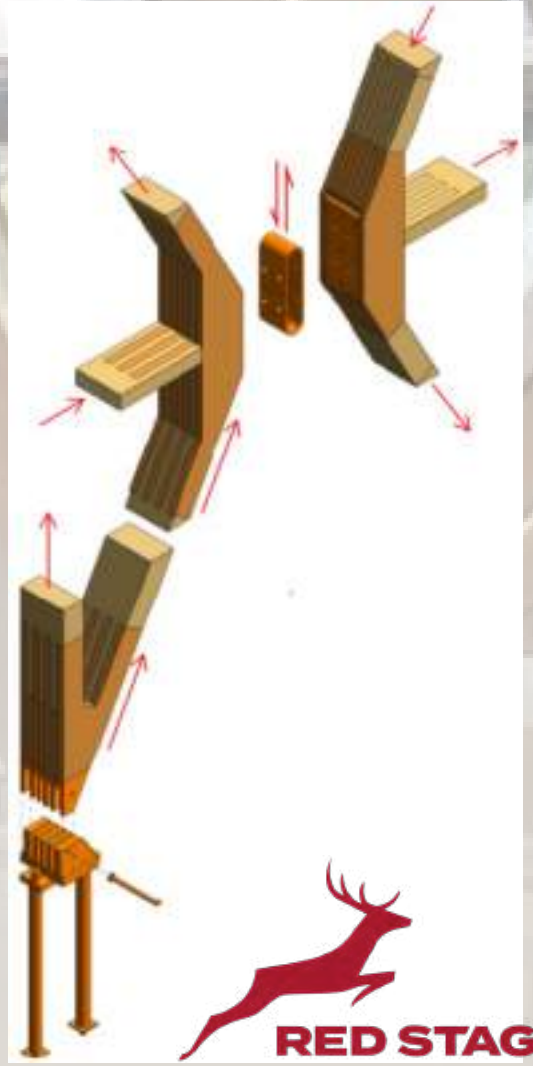
SEISMIC RESILIENCE







FIRE RESILIENCE

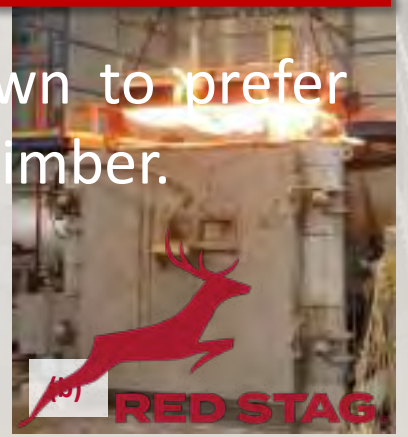
pfits laboratory
passive fire inspection & test services

IANZ
ACCREDITED LABORATORY

Summary of Test Results

Specimen	Actual structural adequacy (min)	Actual Integrity (min)	Actual insulation (min)	FRL
Cross Laminated Timber (CLT) floor - One single piece 3.95 m x 3.4 m x 0.105 m panel	62	62	62	60/60/60

Insurances have shown to prefer the fire resilience of timber.



RED STAG ENGINEERED WOOD PRODUCTS

- **Cross Laminated Timber (CLT) - Rotorua**
  - New Zealand's largest manufacturer of CLT.
  - Applications: Floors, Walls, Stairs and Roof and Beams.
  - Panels as large as 75 m^2 (16.5 m long x 4.5 m wide x 0.43 m deep).
  - Treated to New Zealand standards (H1.2 and H3.2).
  - Direct substitute for concrete and light timber mid floors, walls, lift shafts, stairs, etc.
  - Lighter and faster to install than alternates.
  - Higher seismic and bracing properties.
  - Exception fire performance.
  - Improved R-Value.
- **Glue Laminated Timber (GLT) – Auckland & Rotorua**
  - New format for GLT, focusing on vertical board configuration.
  - Applications: Lintels, Beams, and Columns with a focus on frame and truss.
  - Expansion scheduled through 2022.

RED STAG.

EWP FEEDSTOCK & RECIPES

- EWP Feedstock & Testing:
  - Downfall from gauged SG timber (45 mm thick).
  - Average MoE: 8 GPa (Majority); 10 GPa and 6 GPa.
  - Two primary gauges: 140x45; 100x25.
  - Finished thicknesses: 42 mm & 20 mm.
  - Recipes focusing on 42 mm lamella are the most cost effective per cubic meter (i.e. CL3/126; Cl5/210).
  - Treated to NZS3640 standards – H1.2 & H3.2.
  - Treated feedstock redried to 6 - 8 ± 2%.

RED STAG.

COMPLIANCE & QUALITY ASSURANCE

- CLT has no New Zealand Standard.
- Red Stag manufacturers to the ISO16696-1 International Standard.
- Red Stag is in the final stages of being fully accredited to the EN16351-2021 European CLT Standard.
- Red Stag are the only CLT manufacturer to treat lamella to the NZS3640 standard (Minimum of H1.2 – clear boron).
- Red Stag have internal quality control measures in place to test and confirm the performance of:
  - MoE (Stiffness of Feedstock – Red Stag Timber).
  - Treatment performance (Red Stag Timber).
  - Moisture content of feedstock (6 - 8 +/- 2%).
  - Finger Jointing performance (shear testing).
  - Delamination testing (glue line delamination testing).
  - Dimensional accuracy of CNC'd components.
- Red Stag has passed all CodeMark audits for both its CLT and GLT (manufactured via a different process outside of NZS1328) and is in the final stages to obtain a CodeMark in July 2025.

RED STAG.

POINTS OF DIFFERENCE

- Red Stag treat to a minimum of H1.2 (Clear boron) or H3.2 (CCA) - Not a T3 alternate solution.
- Red Stag has the most advanced and automated timber treatment plants in the Southern hemisphere.
- Red Stag's investment in saw milling, scanning and automated quality control processes make it the most advanced saw mill and associated EWP operation in the Southern hemisphere.
- Red Stag has completed comprehensive structural testing of its products with Scion.
- Red Stag have completed the most comprehensive fire testing of its products in the market.
- Red Stag has the most advanced EWP testing laboratory in New Zealand for FJ, delamination and four point bed testing.

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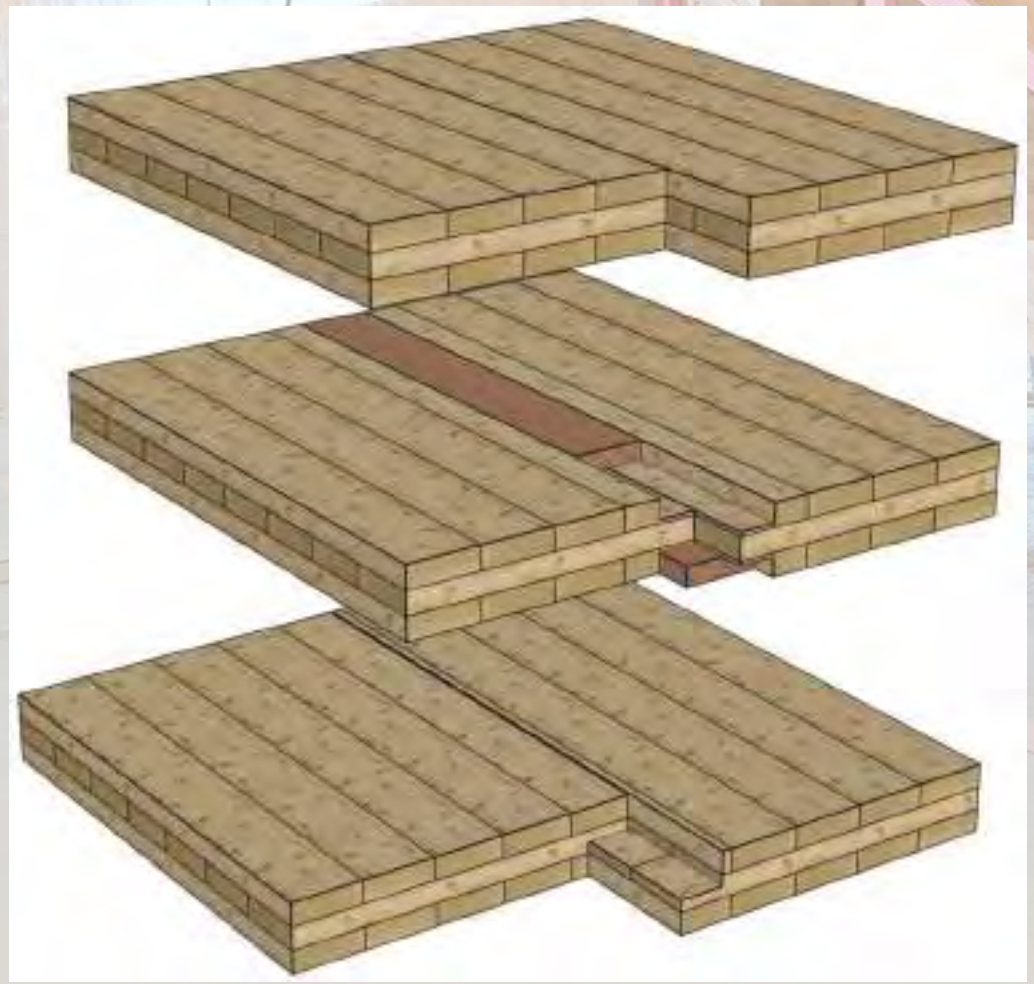
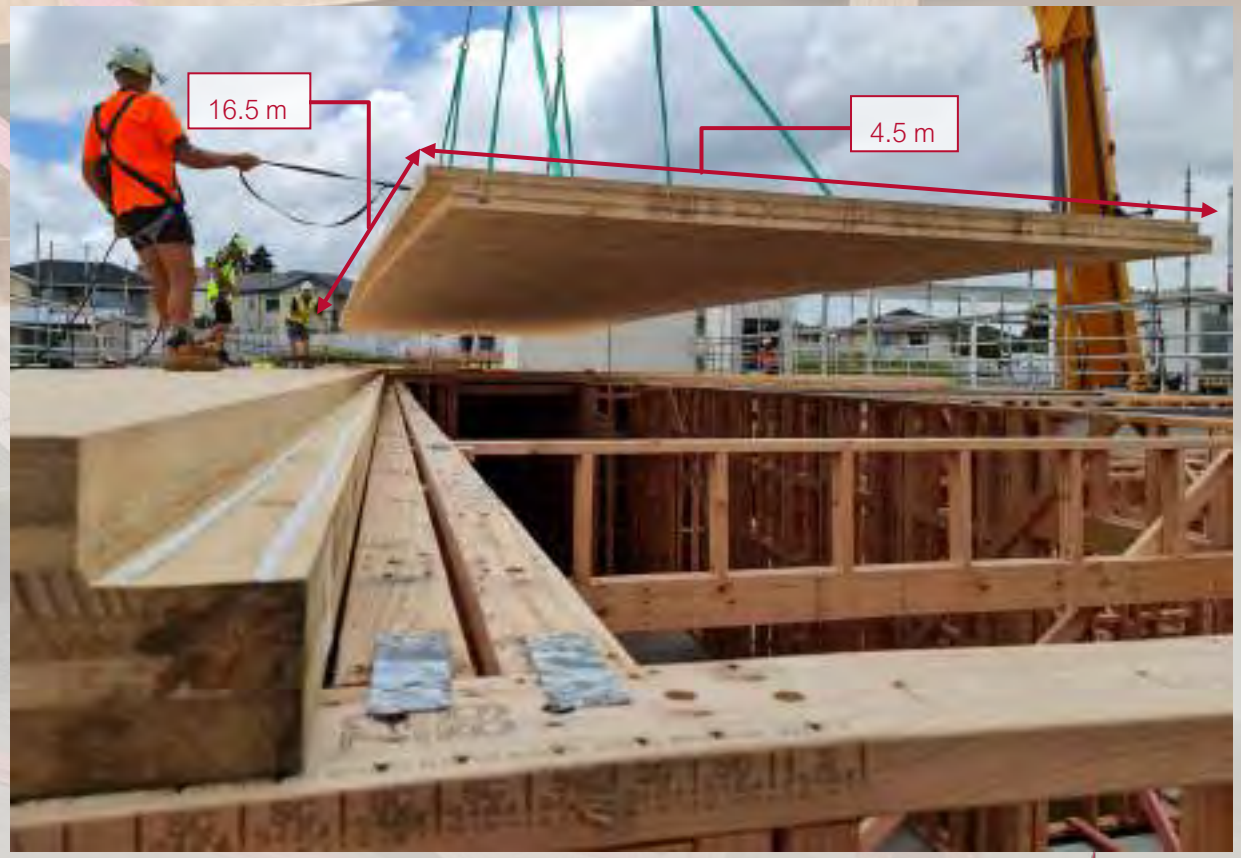
CLT FLOORS





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CLT WALLS

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CLT STAIRS

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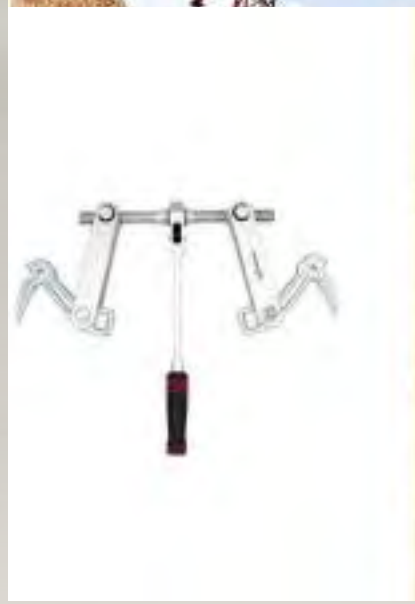
CLT INSTALLATION



RED STAG.

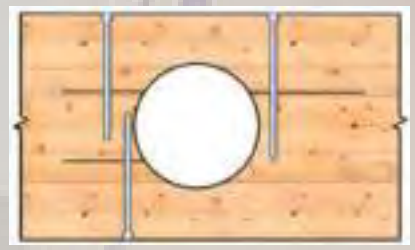
VERTIX BEAMS & COLUMNS

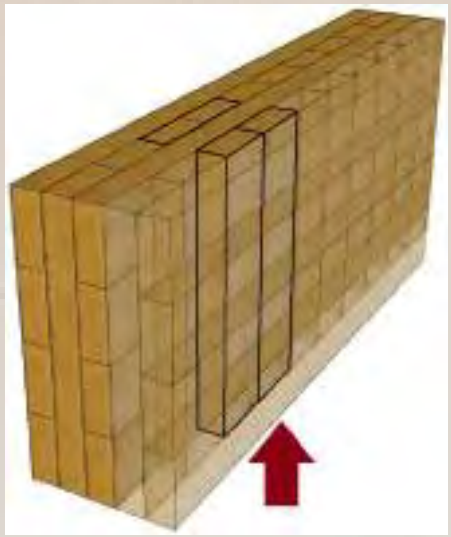
- Beams up to 17 m long x 89 - 420 mm thick and up to ~2.2 m wide.
- Treatment: H1.2 Boron or H3.2 CCA.
- Standard and visual grade options.
- Vertical board laminations to reduce deflection.
- Vertical solution designed for lintels and simple beams and columns.
- Option for horizontal bricked GLT for more complex jointing.
- CLT beams and columns being utilised for very high performing column to beam/rafter jointing.
- CLT beams are typically thicker, but are a very cost effective alternative.

RED STAG.

CLT BEAMS – PERFORMANCE BENEFITS

- Exceptional strength to weight compared to concrete and steel.
- Improved tensile strength due to transverse layers – less susceptible to rupture.
- Limited to no mechanical reinforcing around penetrations.
- Improved loading – end grain to end grain connections.





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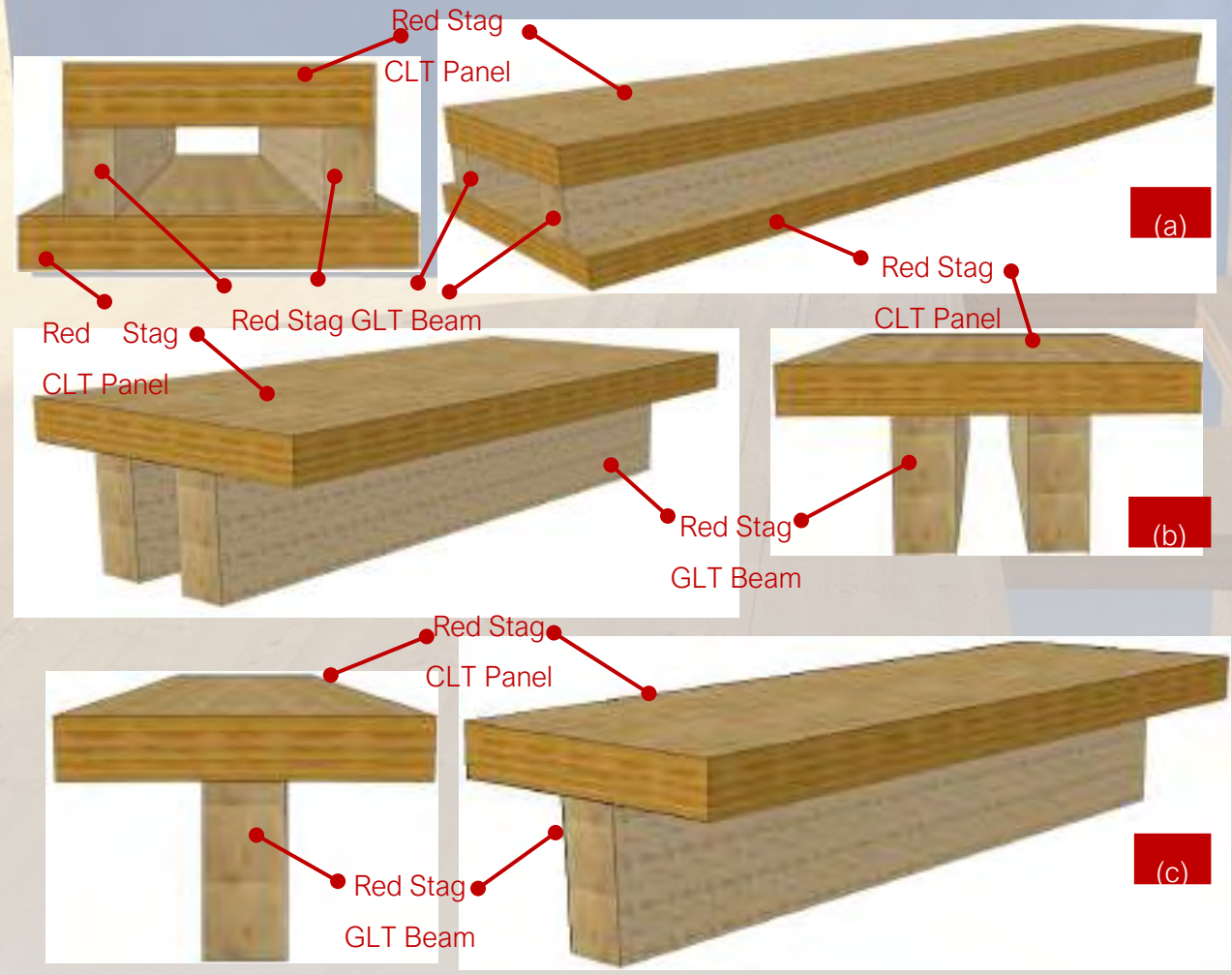
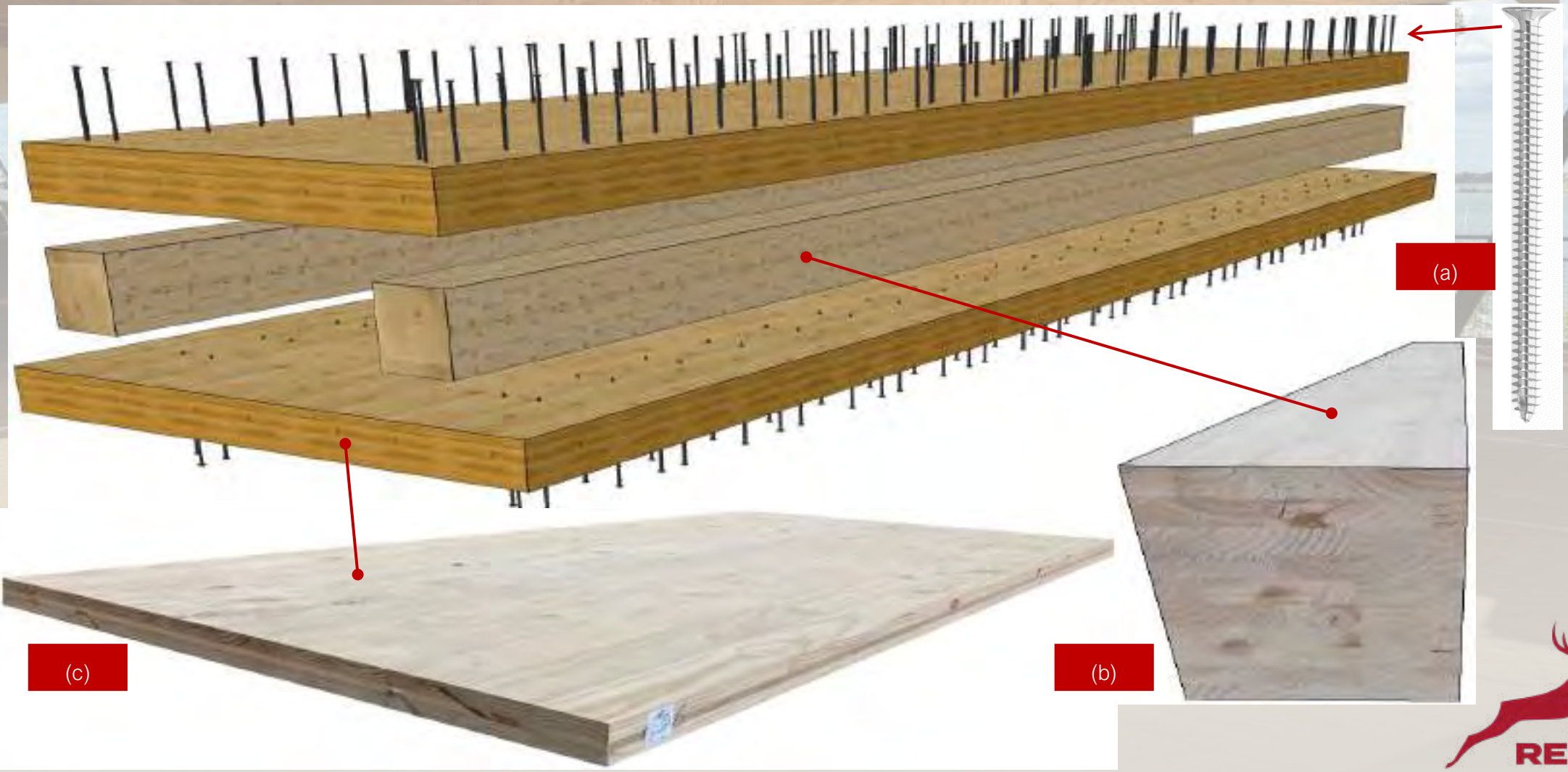
MODULAR COMPONENTS - LIVING PA



8.5 M BOX BEAMS - THE LIVING



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CERTIFICATIONS & CODEMARK – BUREAU VERITAS

BUREAU VERITAS Certification

'S' Mark Licence

RED STAG TIMBERLAB LTD

EWP Plant, Waipa State Mill Road, Rotorua, 3073, NEW ZEALAND

Bureau Veritas grants the above organization the right to use the Product Certification (S) Mark as shown below, only in respect of the products described and detailed in the schedule to this Licence and manufactured in accordance with the requirements of the Standard indicated above under an approved Quality Management System. The Licence is granted subject to the Bureau Veritas Conditions of Service and the Rules governing the use of Product Certification Licences.

STANDARD

ISO 16696-1:2019

Timber structures – Cross laminated timber Part 1: Component performance, production requirements, & certification scheme

Licence No: 2506

Date Granted: 06 December 2024

Expiry Date: 06 December 2025

Signed on behalf of Bureau Veritas

Sam Gahid
Product Certification Manager

BUREAU VERITAS

Bureau Veritas Certification
CodeMark
Certification Scheme

Certification
Site Assessment Report

Of

Red Stag Wood Solutions Limited

REPORT ISSUED FROM:

BUREAU VERITAS AUSTRALIA PTY LTD
31-41 Williamstown Road
Port Melbourne, Victoria, 3207
AUSTRALIA

pass

RED STAG

RED STAG® CROSS LAMINATED TIMBER

PURPOSE

EXPLANATION

For further assistance please contact:

SCOPE AND LIMITATIONS OF USE

Scope	Limitations
Location	
Building	

USEFUL INFORMATION

OTHER CERTIFICATIONS AND APPROVALS HELD BY RED STAG® TIMBER LTD

VERSION:

RED STAG

INDUSTRIAL SOLUTIONS

RED STAG.

LOW CARBON INDUSTRIAL BUILDINGS

- Warehousing is traditionally steel and concrete.
- Focus on large clear spans with narrow columns.
- Is timber a viable substitute?
- The ‘Modern Industrial Building Optimisation’ (MIBO) initiative.
  - Review design EWP options for market requirements.
  - Create standardised EWP & Hybrid designs.
  - Optimise designs – must be cost competitive.

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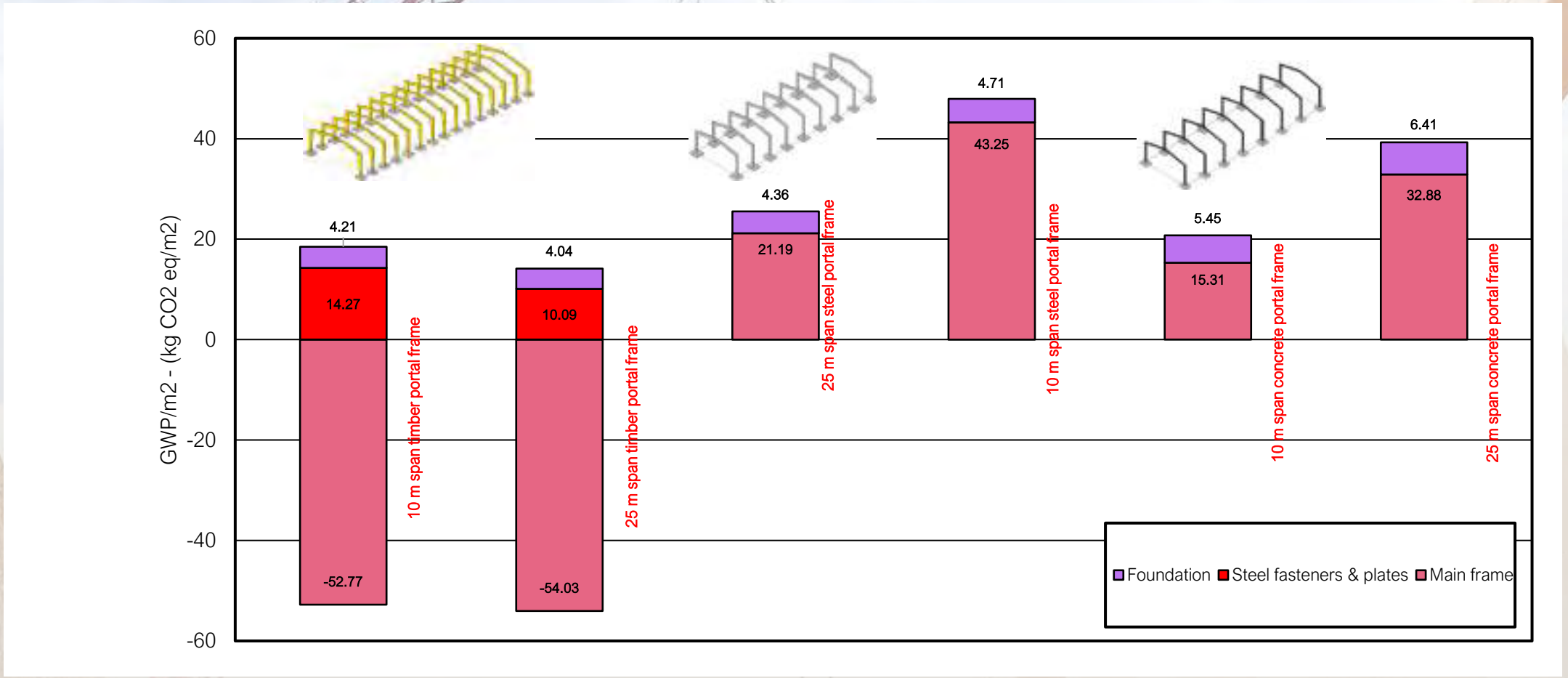
ENVIRONMENTAL BENEFITS



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MIBO 1.0: 60 M CLEARSPAN

- **R&D project in conjunction with Structure Design to share design lessons comparing:**
  - **All-Wood Clear Span vs Hybrid Steel-Wood Clear Span.**
  - **Reviewed the impact of adding a row of columns (15m from one wall).**

	CLT Storage - all wood or...	CLT Storage - steel-wood hybrid	CLT Storage - all wood with intermediate column at 14.6 m	CLT Storage - steel-wood hybrid with intermediate column at 14.6 m
Portal columns	CLT 9/356 Tapered 3500-2000	CLT 9/356 Tapered 3500-2000	CLT 9/356 Tapered 3000-1500	CLT 9/356 Tapered 3000-1500
Portal beams/truss	Single chord GL8 truss, Top 600x230, Bottom 600x230, Struts 360x180	Single chord Gr300, Top 250UC 72.9, Bottom 250UC72.9, Struts 125x9 SHS	Single chord GL8 truss, Top 450x230, Bottom 450x230, Struts 300x200	Single chord Gr300, Top 200UC60, Bottom 200UC60, Struts 125x9 SHS
Girts	190x45 SG8	190x45 SG8	190x45 SG8	190x45 SG8
Purlins	600x90 GL8 main purlins, 400x90 GL8 secondary beams, 190x45 purlins	600x90 GL8 main purlins, 400x90 GL8 secondary beams, 190x45 purlins	600x90 GL8 main purlins, 400x90 GL8 secondary beams, 190x45 purlins	600x90 GL8 main purlins, 400x90 GL8 secondary beams, 190x45 purlins
End wall columns	1000xCLT7/250	1000xCLT7/250	1000xCLT7/250	1000xCLT7/250
Internal Columns			1000x600x200 GL8 I Column	1000x600x200 GL8 I Column
Shear Wall CLT Panels	CLT3/104	CLT3/104	CLT3/104	CLT3/104

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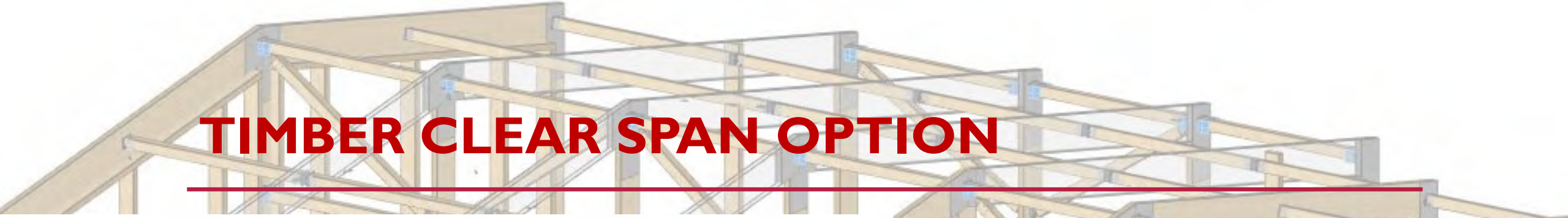
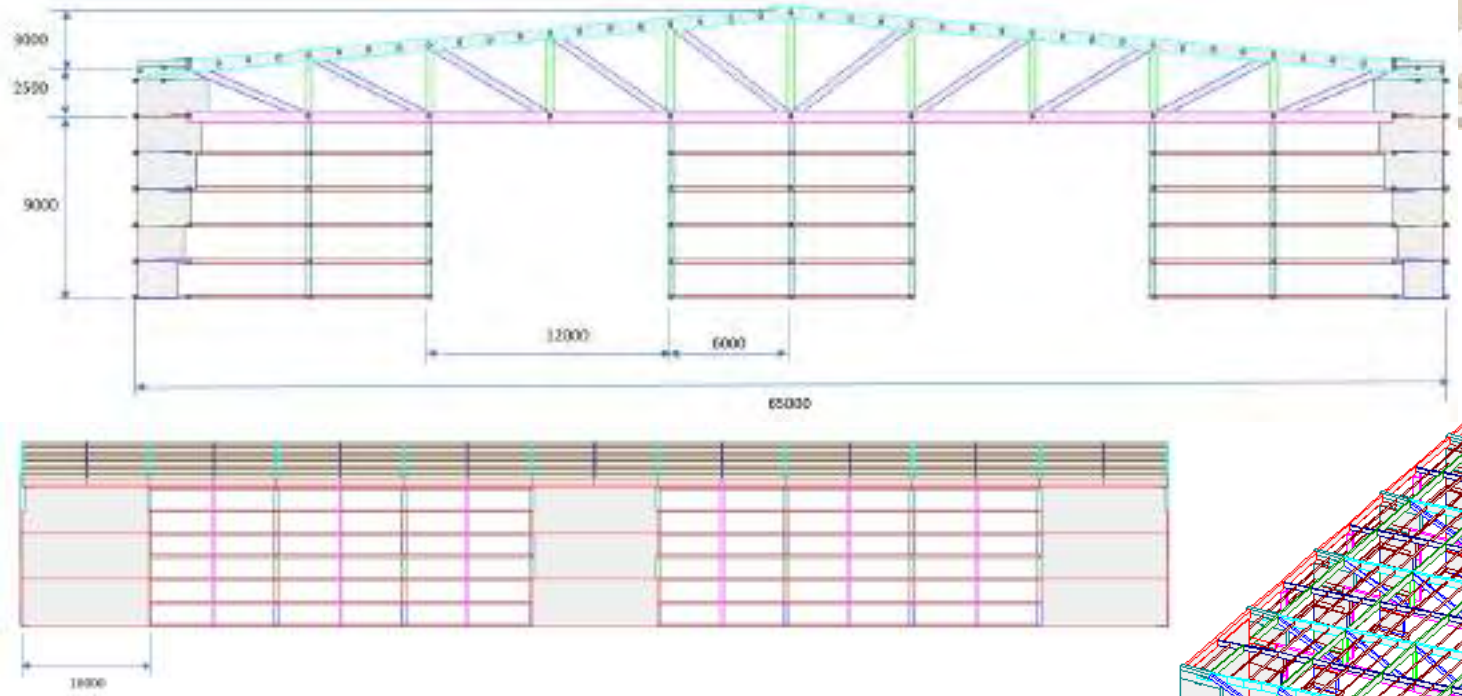
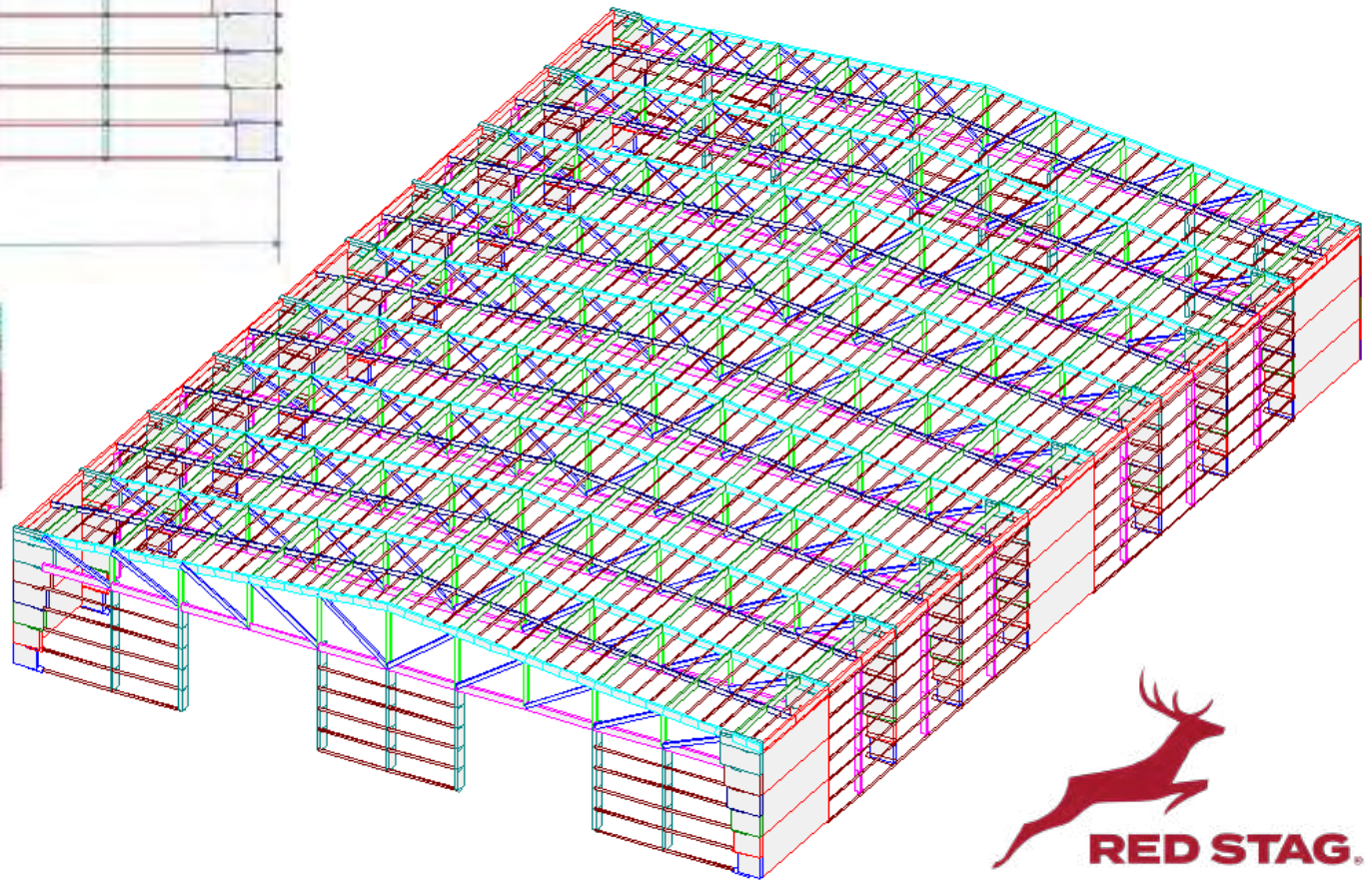
TIMBER CLEAR SPAN OPTION







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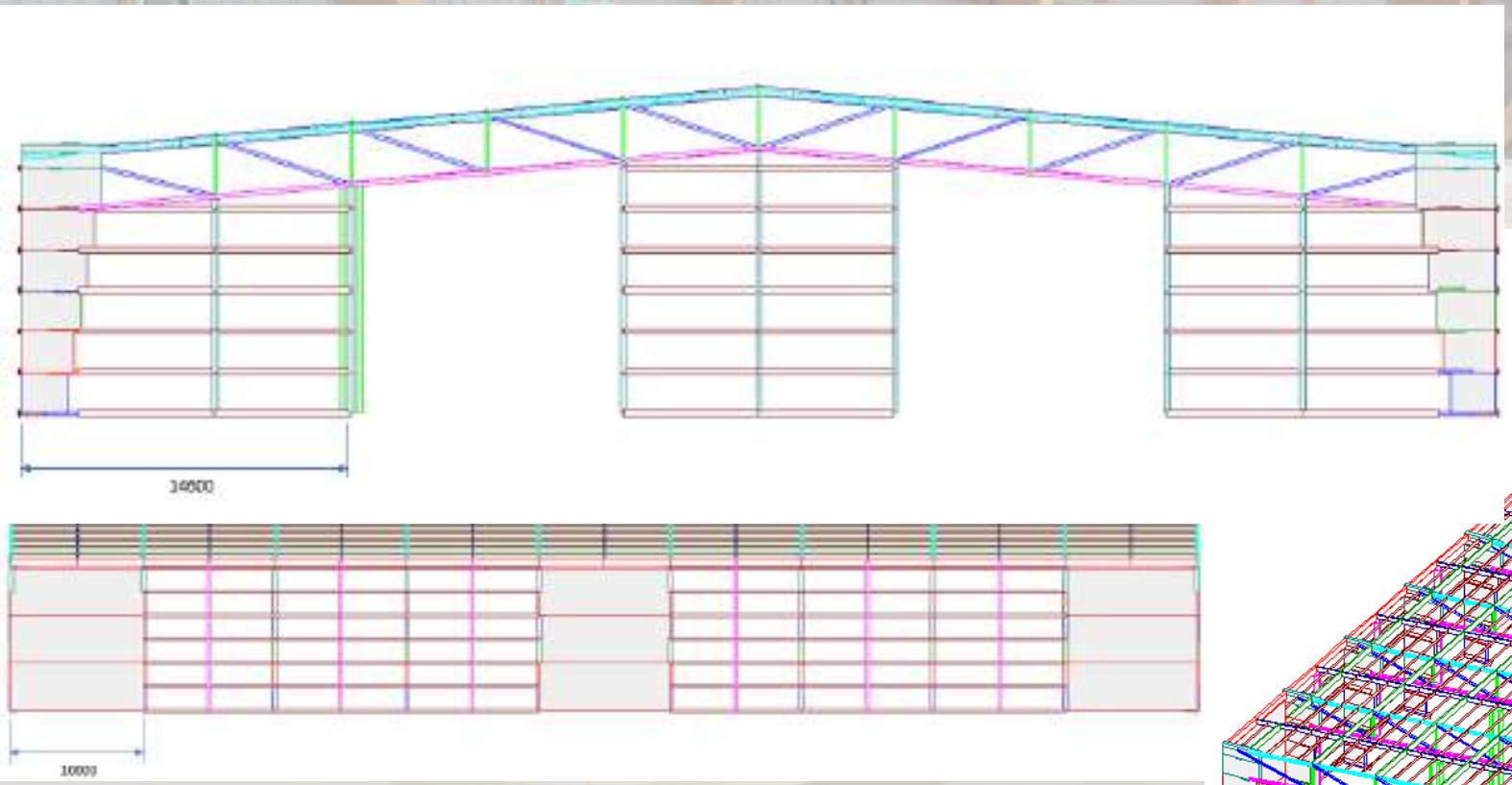
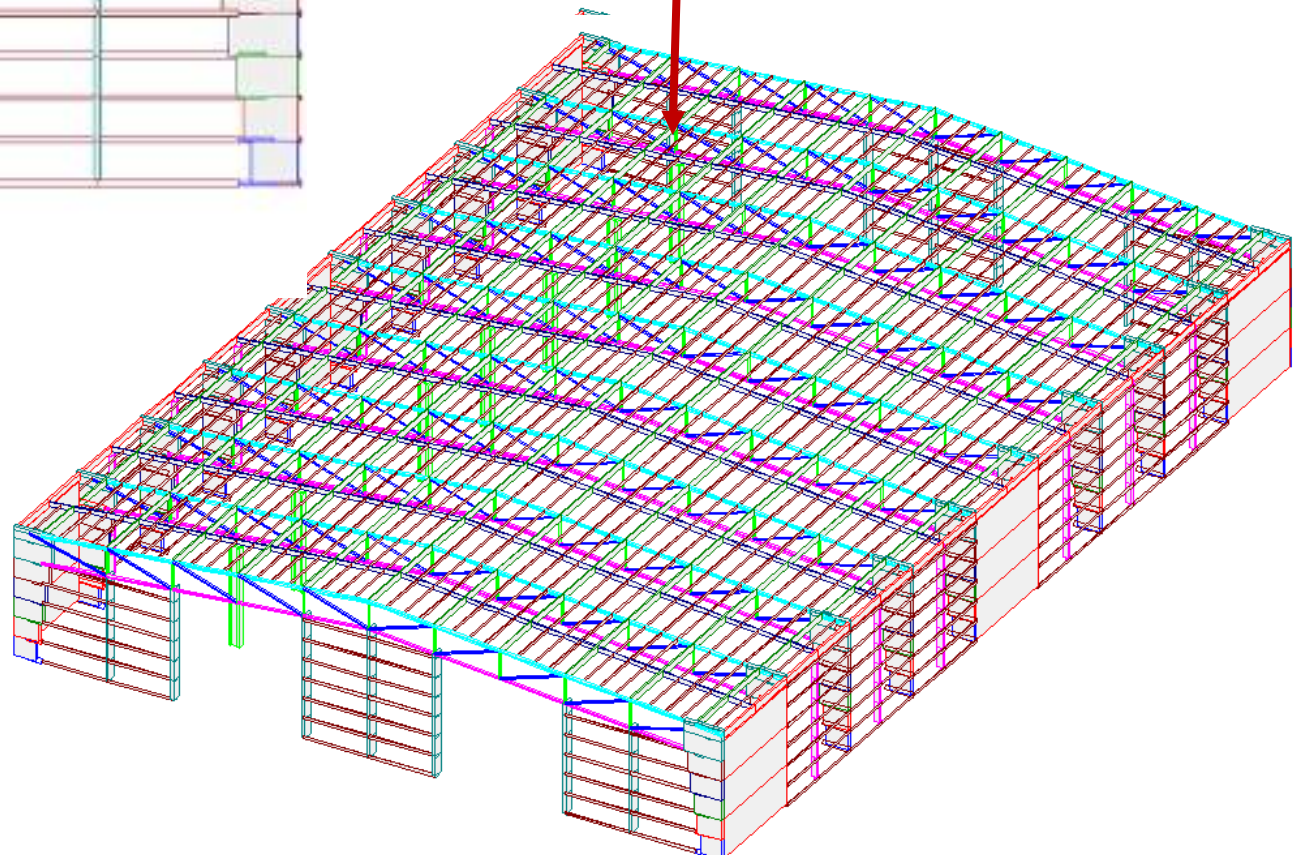
HYBRID STEEL OPTION WITH ROW OF COLUMNS



Optional Column Location



MIBO 1.0: PROJECTED RESULTS

	All Wood Clear Span	Hybrid Clear Span	All Wood – columns	Hybrid – columns
Cost	$ 6,227,544	$ 6,303,389	$ 5,937,418	$ 6,128,748
Cost ranking	# 3	# 4	# 1	# 2
Weight	3,425 tonnes	3,400 tonnes	3,476 tonnes	3,467 tonnes
CO2-e	25 tonnes	602 tonnes	51 tonnes	534 tonnes
Co2-e ranking	# 1	# 4	# 2	#3

Summary:

- Timber truss option was projected to be cheaper than steel parallel cord truss
- Steel hybrid options emit 10 x and 24 x more CO2-e than the timber equivalents.
- Columns reduce cost only slightly.
- With columns, timber was the cheapest option overall.
- Timber clear span projected to be only marginally more cost effective than steel, but significantly lower carbon.

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CONSTRUCTION

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MIBO 2.0

- MIBO 1.0 design backed costed for steel alternates in current market.
- Refinements required to compete with low steel prices.
- New hybrid solution being show cased in Spring 2025 at Red Stag MIBO Tour.
- Optimised solution less than steel installed.

WHAT'S THE COST?

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WHAT'S THE COST?

- CLT is the only building material that has come down in cost.
- Time is money. Install 300 – 450 m^2 per hour with two builders [i].
- Compare the installed costs with alternatives, not just the material cost.
- Focus design around 126 mm thick panels (CL3/126) to reduce material costs and balance performance.
- CLT typically incorporates an additional +R1 to the insulative properties.
- Installed costs for CL3 CLT is generally under $220/$m^2$ [ii].
- Reduces secondary trade time and costs on site (e.g. Electrical, plumbing, HVAC).
- CLT Stairs are more cost effective than precast, in situ poured concrete and are comparable to a high quality stringer/ply staircase.
- CLT stairs installed in 30 minutes, and delivered with the midfloor – No temporary ladders or stairs.
- Red Stag vertical GLT is scheduled to be 10% cheaper than alternatives on the market.

[i] Two builders, plus crane driver and rigger.

[ii] Based on $3,000/day for crane, driver and rigger, two builders, four panels installed per hour and an average panel size of 75 m^2.

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VOLUMETRIC SOLUTIONS

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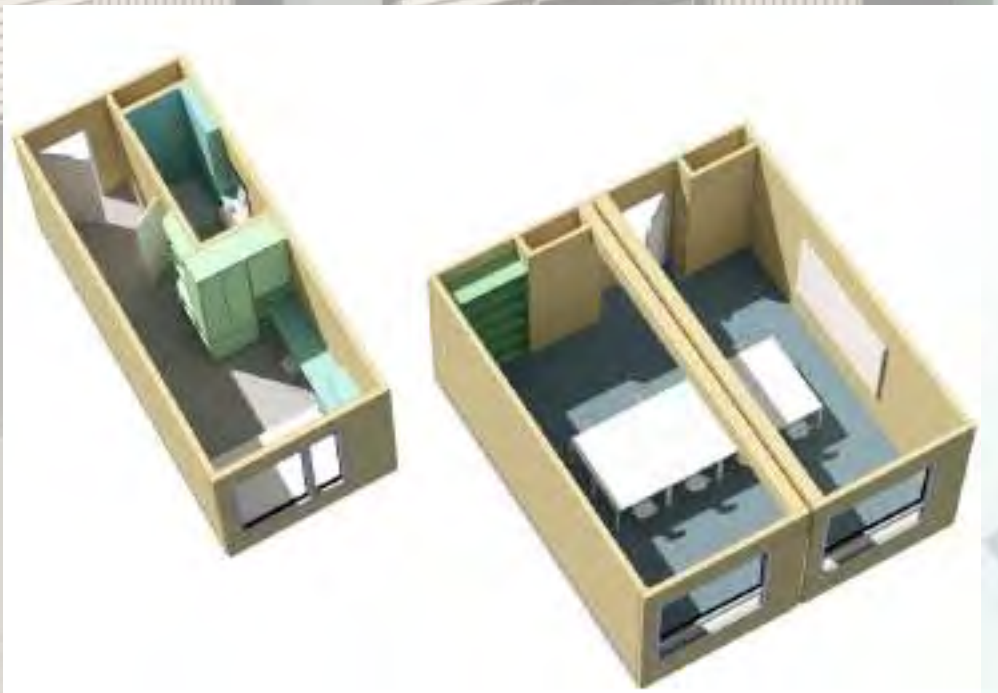
VOMO – VOLUMETRIC MODULAR

- New Zealand has often tried to recreate the wheel.
- Learn from European experience – Kaufmann.
- Focus on speed, efficiency, resilience and quality.
- CLT is the new material of choice for European modules.
- Critical points of difference: Volume, efficiency and vertical integration.
- Sustain low carbon advantage.

OPPORTUNITIES

- Versatile configuration, including large open spaces.
- Faster more cost effective construction.
- Transform MoE, Hotels and Student Accommodation.
- Higher performing thermal and acoustic structures.
- Partnering with MoE on single and multilevel expansions.
- +500 room student accommodation in Auckland.



PROJECTS

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THE LIVING PA - WELLINGTON

THE LIVING PA - WELLINGTON

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THE LIVING PA - WELLINGTON

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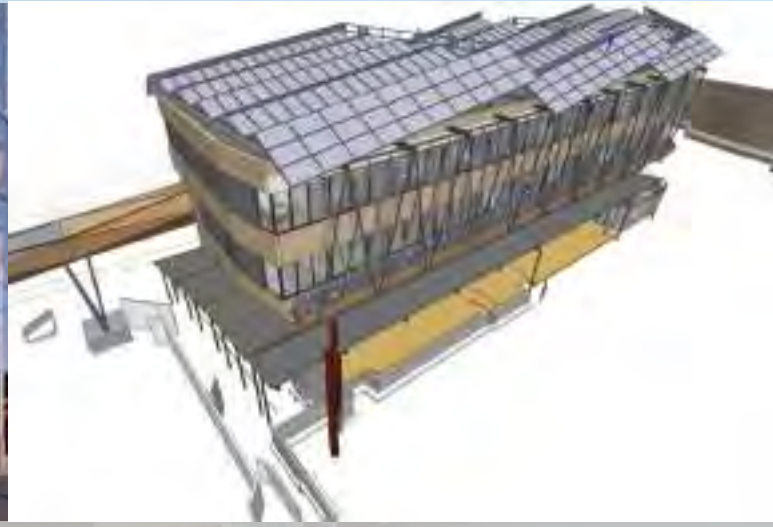
TAURANGA CITY COUNCIL - 90 DEVONPORT



- **Tauranga City Council/Willis Bond**
  - **90 Devonport Road (Tauranga)**
  - **8 Storey CLT & LVL Office Building.**

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TAURANGA CITY COUNCIL - 90 DEVONPORT

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TAURANGA CITY COUNCIL – 90 DEVONPORT ROAD

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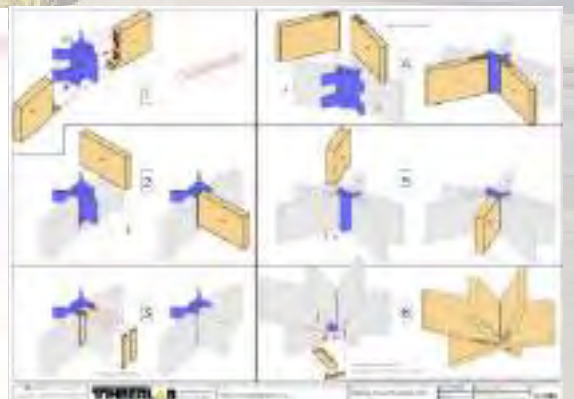
THE PA – UNIVERSITY OF WAIKATO

- Inspired by the form of a traditional Wharenui.
- 36.4 m long timber rafters
- 395 customer timber CNC mass timber components



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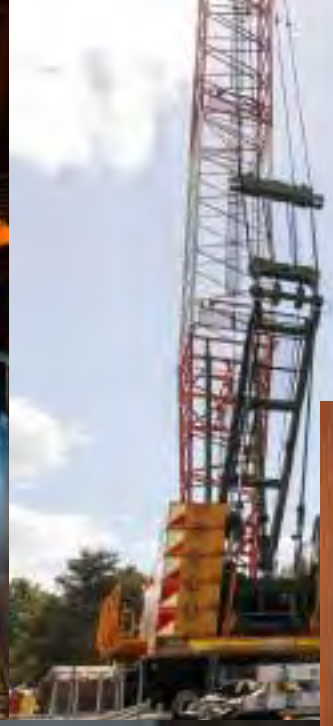

EEL NET - MELBOURNE

38m
WIDTH

38m
HEIGHT

16
ARCHES

6
LANES OF TRAFFIC

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PARLIAMENT

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FISHER & PAYKEL

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FINAL WORD

- Think to the future – you have the opportunity to transform how we develop for tomorrow.
- You can be innovative and challenge the status-quo cost effectively.
- Consider both the tangibles and perceived intangibles.
- Construction equates to approximately 17% of global emissions - help take to zero.

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SUSTAINABLE & EFFICIENT USE OF FIBRE

Logs

Residues for Heat

Steam & Electricity

Energy for Production

Processed Timber

Chip for Pulp

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REFERENCES

https://redstag.co.nz/wp-content/uploads/2022/08/

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