Straker Engineering Services

ENGINEERING REPORT

RE14010 rev 3

Subject	Analysis of Proposed 7 Module Load Restraint Configuration for Round Cotton Modules – 2 Cross Straps
Client	Cotton Australia Pty Ltd
Client Address	Unit 3/6 Rutledge St, Toowoomba, QLD 4350
Revision	3
Date	25/05/2026
Report By	Noel Straker

1 Scope and Introduction

Cotton Australia requested that Straker Engineering Services reassess work previously conducted regarding the suitability of a proposed load restraint system for the transport of round cotton modules, and its ability to comply with the requirements of the Load Restraint Guide 2025.

2 Reference Material

- NHVR Load Restraint Guide 2025
- Engineering Report RE11049 - Analysis of Proposed Load Restraint Configurations for Round Cotton Modules, *Straker Engineering Service Pty Ltd*

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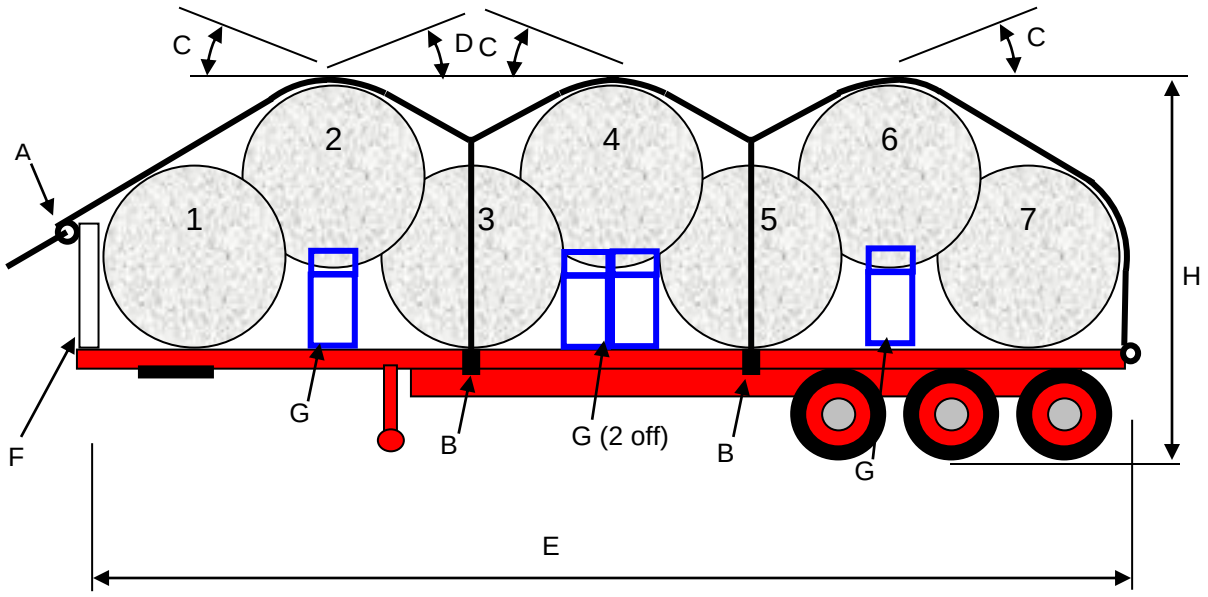
3 Proposed Restraint Configurations

3.1 Flat Bed Trailer



A	75mm or 100mm webbing strap winch (may be located at front or rear) minimum lashing capacity: 5000kg minimum pretension capacity: 1150kgf
B	50mm webbing strap winch, run across top of 100mm strap to opposite tie rail. minimum lashing capacity: 2000kg minimum pretension capacity: 600kgf
C	30° minimum
D	15° minimum
E	13700mm maximum (maximum 12300mm from kingpin to rear of trailer)
F	Reinforced headboard with minimum forward restraining capacity of 6000kgf
G	Module Support Frame in accordance with dwg# JB13262-000, bolted to trailer deck with 4 off M16 gr 8.8 boltsets including 50mm square structural washers.
H	4300mm maximum
Load	7 off Plastic wrapped cotton modules
Maximum module weight	2500kg
Module nominal dimensions	2438 mm wide x 2286 mm diameter
Trailer Surface	Smooth Steel or Floor plate (2.5mm minimum thickness)
Tensioning Sequence	1. Tension 100mm longitudinal strap using winch “A” to 1150 kgf (minimum) 2. Tension 50mm lateral straps using winches “B” until angles “C” are obtained in 100mm webbing strap.

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4 Design Data

4.1 Design Data

	Data	Value	Source
A	**Friction Co-efficient – Module on Smooth Steel**	0.4	Engineering Report RE11049 – Straker Engineering Services

5 Calculations

5.1 Forward Direction Restraint

Forward direction restraint is provided by frictional contact with the trailer floor and load blocking contact with the headboard and module support frames. A summary of the calculation is provided below:

	Modules 1 to 4		
A	maximum module mass	2500kg	
B	number of modules	4	
C	total mass	10000kg	= A x B
D	forward restraint required	8000kgf	= 0.8 x C (Load Restraint Guide 2nd edition 2004)
E	friction due to self weight (modules 1,3 only)	2000kgf	= friction co-efficient x A x 2
F	headboard capacity	6612kgf	calculated for 2 off 75x75x3.0 SHS Gr350 reinforcing uprights
H	**total forward restraint**	**8612kgf**	**= E + F *(exceeds D therefore acceptable)***

	Modules 5 to 7		
A	maximum module mass	2500kg	
B	number of modules	3	
C	total mass	7500kg	= A x B
D	forward restraint required	6000kgf	= 0.8 x C (Load Restraint Guide 2nd edition 2004)
E	friction due to self weight (modules 5,7 only)	2000kgf	= friction co-efficient x A x 2
F	restraint from blocking at module 4 support frame	4630 kgf	Horizontal force require to roll module over frame as per dwg JB13262-000
G	**total forward restraint**	**6630kgf**	**= E + F *(exceeds D therefore acceptable)***

The proposed restraint system has been calculated to provide a forward direction restraint force exceeding the performance standard set out in the Load Restraint Guide 2025.

NOTE: The following sources of additional restraint were conservatively omitted from the calculation above:

- *Friction due to lashing downforce.*
- *Friction due to self-weight of modules 2, 4 and 6*

5.2 Rearward direction restraint

Rearward direction restraint is provided by frictional contact with the trailer floor, load blocking contact with the module support frames, and the 100mm webbing strap. A summary of the calculation is provided below

	Modules 1 to 3		
A	maximum module mass	2500kg	
B	number of modules	3	
C	total mass	7500kg	= A x B
D	rearward restraint required	3750kgf	= 0.5 x C (Load Restraint Guide 2nd edition 2004)
E	friction due to self-weight (modules 1,3 only)	2000kgf	= friction co-efficient x A x 2
F	restraint from blocking at module 4 support frame	4630 kgf	Horizontal force require to roll module over frame as per dwg JB13262-000
H	**total rearward restraint**	**6630kgf**	**= E + F *(exceeds D therefore acceptable)***

	Modules 4 to 7		
A	maximum module mass	2500kg	
B	number of modules	4	
C	total mass	10000kg	= A x B
D	rearward restraint required	5000kgf	= 0.5 x C (Load Restraint Guide 2nd edition 2004)
E	friction due to self-weight (modules 5,7 only)	2000kgf	= friction co-efficient x A x 2
F	100mm webbing strap capacity	5000kgf	Lashing capacity for 100mm webbing strap
G	**total rearward restraint**	**7000kgf**	**= E + F *(exceeds D therefore acceptable)***

The proposed restraint system has been calculated to provide a rearward direction restraint force exceeding the performance standard set out in the Load Restraint Guide 2025.

NOTE: The following sources of additional restraint were conservatively omitted from the calculation above:

- *Friction due to lashing downforce*
- *Friction due to self-weight of modules 2,4 and 6*

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5.3 Lateral direction restraint

Lateral direction restraint is provided by frictional contact with the trailer floor and load blocking contact with the module support frames. A summary of the calculation is provided below:

	Lateral Restraint		
A	maximum module mass	2500kg	
B	number of modules	7	
C	total mass	17500kg	= A x B
D	lateral restraint required	8750kgf	= 0.5 x C (Load Restrain Guide 2nd edition 2004)
E	friction due to self-weight (modules 1,3,5,7 only)	4000kgf	= friction co-efficient x A x 4
F	restraint from blocking at module support frames	5980kgf	Calculated restraint capacity for frame as per dwg JB13262-000
H	**total lateral restraint**	**9980kgf**	**= E + F *(exceeds D therefore acceptable)***

The proposed restraint system has been calculated to provide a lateral restraint force exceeding the performance standard set out in the Load Restraint Guide 2025.

NOTE:

1) *The following factors were conservatively omitted for the purposes of this calculation:*
   - *increases in the tension of the longitudinal strap caused by the tensioning of the mid-straps, and*
   - *mechanical interaction present between the strap and end modules where the strap buries into the module.*
   - *Friction at headboard*
   - *Friction due to lashing forces*
   - *Friction due to self-weight of modules 2,4 and 6*
2) *Work performed previously by Straker Engineering Services Pty Ltd (ref Engineering Report RE11049) demonstrates the ability of inter-module friction to prevent relative movement of the load to loads exceeding the 0.5g requirement.*

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5.4 Vertical direction restraint

Vertical restraint is provided to the cotton modules by the combination of the actions of the longitudinal 100mm webbing strap, the lateral 50mm webbing straps and bearing forces between the upper and lower modules.

A	maximum module mass	2500kg	
B	number of modules	7	
C	total mass	17500kg	= A x B
D	vertical restraint required	3500kgf	= 0.2 x C (Load Restrain Guide 2nd edition 2004)
E	100mm strap minimum pretension	1150kgf	
F	angle effect – module 2 leading edge	0.25	
G	angle effect – module 2 trailing edge	0.5	
H	downforce – module 2	863kgf	= ExF + ExG
I	angle effect – module 4	0.5	
J	downforce – module 4	1150kg	=ExIx2
K	angle effect – module 6 leading edge	0.5	
L	angle effect – module 6 trailing edge	0.25	
M	downforce – module 6	863kgf	= ExK + ExL
N	angle effect – module 7	1	
O	downforce – module 7	1150kgf	=ExN
N	**total vertical restraint**	**4026kgf**	**= H + J + M + O *(Exceeds D therefore acceptable)***

The proposed restraint system has been calculated to provide a vertical restraint force exceeding the performance standard set out in the Load Restraint Guide 2nd Edition 2004.

6 Conclusion

The load restraint configurations detailed in section 3 have been calculated to comply with the performance standards set out in the Load Restraint Guide 2025.

Approved by

Noel Straker	Principal Engineer		02/05/2026
Name	**Position**	**Signature**	**Date**

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