



**Subject** Analysis of Proposed 7 Module Load Restraint Configuration for Round Cotton Modules – 3 Cross Straps  
**Client** Cotton Australia Pty Ltd  
**Client Address** Unit 3/6 Rutledge St, Toowoomba, QLD 4350  
**Revision** 5  
**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 Exclusions

This analysis is an assessment of the load restraint capacity, and does not include any assessment of trailer or load dimensions or vehicle stability for the purposes of highway regulation compliance.

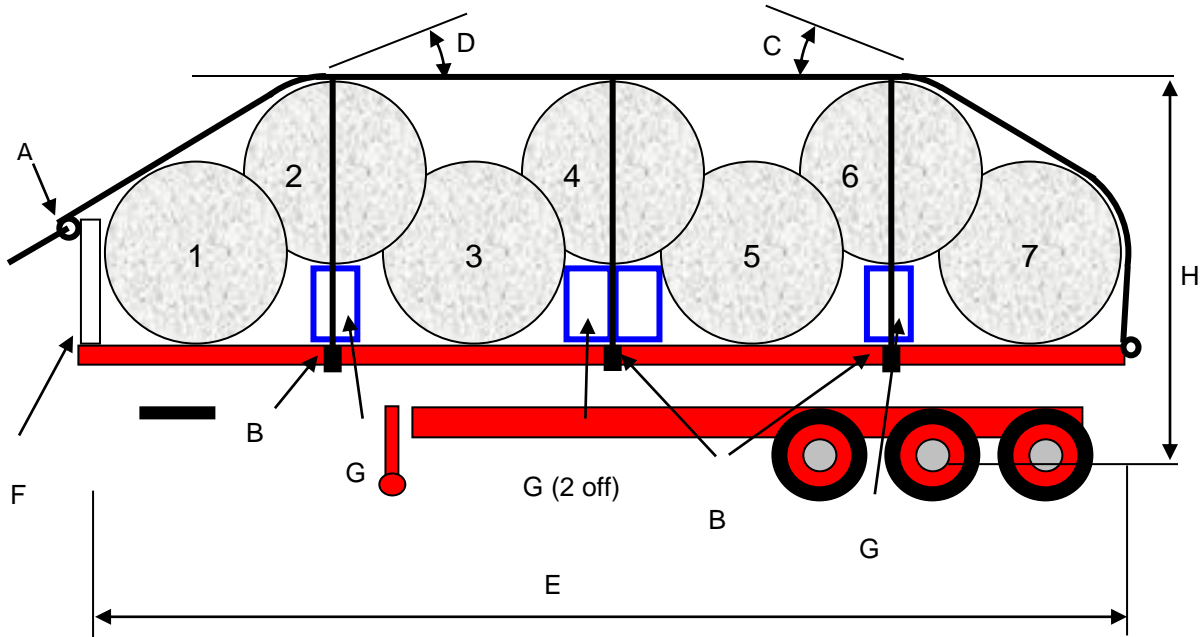
## 3 Reference Material

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



### 4 Proposed Restraint Configurations

#### 4.1 Flat Bed Trailer



A	75mm or 100mm webbing strap winch (may be located at front or rear) minimum lashing capacity: 4000kg 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	15° 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# JB13262-100 or JB14065-200, bolted to trailer deck with 4 off M16 gr 8.8 boltsets including 50mm square structural washers. (please note, <b>additional</b> restraint such as tie-down straps can be used in conjunction with the specified bolted fastening if desired)
H	4600 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	<ol style="list-style-type: none"> <li>1. Tension longitudinal strap using winch "A" to 1150 kgf (minimum)</li> <li>2. Tension lateral straps using winches "B" to 600 kgf (minimum).</li> </ol>



## 5 Design Data

### 5.1 Design Data

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

## 6 Calculations

### 6.1 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 Restrain Guide 2 <sup>nd</sup> 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	<b>total forward restraint</b>	<b>8612kgf</b>	<b>= E + F (exceeds D therefore acceptable)</b>

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 Restrain Guide 2 <sup>nd</sup> 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 JB13262-100
G	<b>total forward restraint</b>	<b>6630kgf</b>	<b>= E + F (exceeds D therefore acceptable)</b>

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



### 6.2 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 2 <sup>nd</sup> 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 JB13262-100
H	<b>total rearward restraint</b>	<b>6630kgf</b>	<b>= E + F (exceeds D therefore acceptable)</b>

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 2 <sup>nd</sup> edition 2004)
E	friction due to self-weight (modules 5,7 only)	2000kgf	= friction co-efficient x A x 2
F	webbing strap capacity	4000kgf	Lashing capacity for webbing strap
G	<b>total rearward restraint</b>	<b>6000kgf</b>	<b>= E + F (exceeds D therefore acceptable)</b>

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



### 6.3 Lateral direction restraint

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

	<b>Lateral Restraint</b>		
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 Restraint Guide 2 <sup>nd</sup> edition 2004)
E	friction due to self-weight	7000kgf	= friction co-efficient x A x B
F	50mm strap pretension	600kgf	(Load Restraint Guide 2 <sup>nd</sup> edition 2004)
G	Angle effect	1	
H	total effective 50mm strap downforce	3600kgf	=FxGx2x3
I	100mm strap pretension	1150kgf	
J	Module 2 angle effect	0.25	
K	Module 2 effective downforce	288kgf	=IxJx1
L	Module 6 angle effect	1	
M	Module 6 effective downforce	1150kgf	=IxLx1
N	Total lashing downforce	5038kgf	=H+K+M
O	Total lashing restraint	2015kgf	=N x friction co-efficient
P	<b>total lateral restraint</b>	<b>9015kgf</b>	<b>= E + O (exceeds D therefore acceptable)</b>

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:*
  - *mechanical interaction present between the strap and end modules where the strap buries into the module, and*
  - *Friction at headboard*
- 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.*



### 6.4 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 strap 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 Restraint Guide 2 <sup>nd</sup> edition 2004)
E	100mm strap minimum pretension	1150kgf	
F	angle effect – module 2 100mm strap	0.25	
G	downforce – module 2 100mm strap	288kgf	= ExF
H	angle effect – module 6 100mm strap	0.25	
I	downforce – module 6 100mm strap	288kgf	= ExH
J	angle effect – module 7 100mm strap	1	
K	downforce – module 7 100mm strap	1150kgf	=ExJ
L	50mm strap minimum pretension	600kgf	
M	angle effect 50mm straps	1	
N	Total effective downforce for 3 off 50mm straps	3600kgf	=JxKx2x3
O	<b>total vertical restraint</b>	<b>5326kg</b>	<b>= G + I + K + N (Exceeds D therefore acceptable)</b>

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

## 7 Conclusion

The load restraint configuration detailed in section 4 has been calculated to comply with the performance standards set out in the Load Restraint Guide 2025.

### Approved by

Noel Straker

Principal Engineer

25/05/2026

Name

Position

Signature

Date