

# Final report

## Open Innovation Pipeline rubber flooring trials - Australia

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## Abstract

This project evaluated whether anti-slip rubber matting could reduce the incidence of slips and falls during livestock handling within the livestock export supply chain. While rubber matting is widely used in sectors such as dairy, equine and beef, its suitability for sheep and cattle handling in pre-export facilities and livestock vessels had not previously been assessed. The project focused on whether this type of matting could be adapted for use in high-traffic areas such as ramps, laneways and drafting zones, and whether it could deliver benefits in terms of both animal welfare and handler safety.

The target audience for this work includes livestock exporters, registered establishment operators, livestock transporters and vessel managers. These stakeholders are responsible for animal management in areas where slips and falls can occur and are therefore well placed to apply any effective solutions. The results of the trial are intended to inform operational decisions about flooring treatments and contribute to the ongoing improvement of welfare standards under the Livestock Export Program (LEP).

Trials were carried out at four sites: three pre-export quarantine facilities and one livestock vessel. A variety of matting products were installed in areas identified as high traffic, following a baseline observation period. Animal movements were recorded before and after installation to allow direct comparison of slip and fall rates. Stakeholder feedback was also collected to assess installation practicality, cleaning requirements, and any changes in animal behaviour.

The trial found that all mat concepts tested eliminated falls entirely. Most also eliminated slipping incidents; the remainder reduced slips by at least 96 percent. In addition to these quantitative outcomes, handlers reported that livestock appeared calmer and more confident during movement, with fewer signs of stress such as baulking or hesitation. The mats contributed to smoother movement through handling areas, reduced noise levels, particularly on hard surfaces, and improved working conditions for staff. These positive results were consistent across both sheep and cattle locations, under a range of environmental and operational conditions.

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## 1. Background

The livestock export industry continues to pursue proactive improvements in animal welfare, particularly in the handling and movement of livestock through pre-export facilities and on vessels. A persistent area of focus is reducing the risk of slips, and falls in high-traffic zones such as ramps, laneways, and drafting races. These incidents can compromise animal welfare, increase stress levels, and pose potential risks to handler safety. While various surface treatments have been implemented, such as steel mesh, timber battens, and sawdust, results have been variable and context dependent.

This project was delivered as part of the LEP's Open Innovation Pipeline, which supports short-duration, small-scale technology trials aimed at solving critical industry problems through agile proof-of-concept approaches. The Pipeline is designed to rapidly assess the practical applicability of both new and existing technologies drawn from other sectors. This matting trial represents one such proof-of-concept, targeting the reduction of animal slips and falls through adaptive use of rubber matting solutions already proven in dairy, beef, and equine industries.

Numat Agri, a New Zealand-based manufacturer, supplied the matting used in this trial. With established applications in dairy sheds, feedlots, and equine facilities, Numat Agri's products are designed for traction, shock absorption, and durability. This trial marked the first application of Numat Agri matting within livestock export facilities and vessels. By evaluating its effectiveness under export-specific conditions, including temporary use, high through-put, and biosecurity constraints, the project addressed whether this established technology could be modified to meet the specific needs of the livestock export industry.

The intended users of these findings include exporters, yard and vessel operators. Insights from the trial will contribute to industry guidance, influence facility design, and promote best practices in animal welfare and handler safety across the livestock export supply chain.



**Image: Sheep moving across Ergo interlocking with custom cut holes mat**

## 2. Methodology

The project implemented a structured, site-specific trial methodology to assess the effectiveness of various anti-slip rubber matting products in reducing livestock slips and falls. Four trial sites were selected: three land-based pre-export facilities (handling either sheep or cattle) and one livestock vessel. Each site was chosen based on the presence of known high-traffic areas, such as ramps, laneways, curved raceways, and draft zones.

A site visit was conducted by Numat Agri for each of the four locations. Based on the assessment of each site they developed recommendations for installation location and concept of matting to be used at each location.




Cooleco Pty Ltd was engaged on a consultancy basis to coordinate the delivery of the trials, including development of trial designs, facilitation of agreements with facility operators, on-site oversight during installations, and post-trial reporting. Cooleco served as the primary liaison between the LEP RD&E Program, Numat Agri, exporters, and site operators, and managed logistical arrangements to ensure consistent trial delivery across all locations.

At each location, matting was installed in targeted high-traffic areas following a baseline observational period. Pre-installation data was collected by observing and recording animal movements through trial zones. Slips, trips, and falls were recorded using direct observation and, where possible, video footage. Post-installation, the same observational method and sample size were applied to evaluate the comparative impact of the matting.

Seven different mat concepts were selected and/or modified by Numat Agri for the trial. These concepts were YoungStar, AirStud, VGrip, AirFlex, and Kura mats, each selected for their specific grip profile, resilience, and cleaning characteristics. These adapted concept products were temporarily installed using stainless steel anchors or placed freely where appropriate. This approach was necessary to maintain compliance with biosecurity protocols, which require thorough wash-down and disinfection between voyages or changes in livestock consignments. The trials also captured qualitative data on installation complexity, mat movement during use, cleaning efficiency, and any behavioural changes observed in the livestock.

Observational outcomes were recorded for fall and slip rates, and anecdotal feedback was captured regarding animal handling and noise levels.

**TABLE 1.** Numat Agri product concepts included in trial

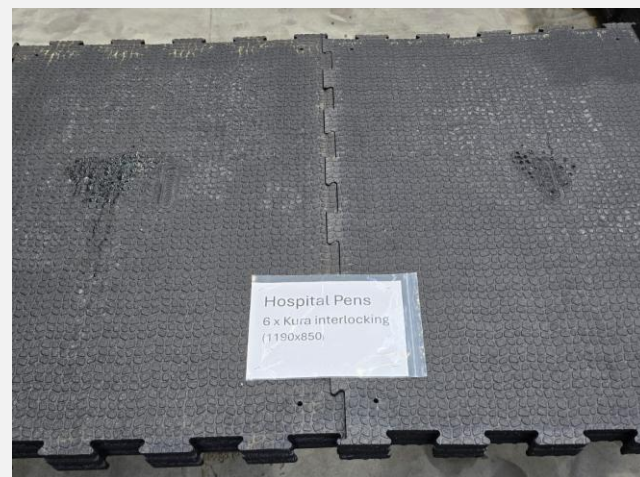
CONCEPT	IMAGE
<p><b>AirFlex</b></p>	
<p><b>Airstud - interlocking</b></p>	
<p><b>AirStud Straight Edge</b></p>	

**CONCEPT** **IMAGE**

**AirStud Straight  
Edge with custom  
cut holes**






**DoubleStud -  
interlocking**



**Ergo**



CONCEPT	IMAGE
<p><b>Ergo – interlocking with custom cut holes</b></p>	
<p><b>Kura - interlocking</b></p>	
<p><b>Kura – Interlocking with custom cut holes</b></p>	

CONCEPT

IMAGE

**VGrip**



**YoungStar**



### 3. Results

The results from the three observed land-based trial sites provided strong evidence that selected rubber matting concepts significantly reduced incidents of slipping and falling in both sheep and cattle across a range of livestock export environments. At these locations, falls were eliminated entirely following mat installation, and slipping incidents were either eliminated or reduced by no less than 96%, depending on the mat concept and location. While no formal observations were possible on the livestock vessel, anecdotal feedback suggested the mats had positive uses in specific scenarios, such as at turning points or over surfaces requiring temporary repair.

In addition to the quantitative improvements, qualitative observations across the observed locations indicated positive behavioural changes in livestock, including greater footing confidence, reduced stress indicators (e.g. baulking, hesitancy), and a noticeable reduction in handling-related noise.

**TABLE 2. Summary of trial performance by site**

Site	Species	Areas	Mat concepts trialled	Sample size	Fall reduction	Slip reduction
<b>Site 1</b> <b>Pre-export facility</b>	Cattle	<ul style="list-style-type: none"> <li>• Loadout lane corner</li> </ul>	<ul style="list-style-type: none"> <li>• YoungStar</li> </ul>	~1,100	100%	99%
<b>Site 2</b> <b>Pre-export facility</b>	Cattle	<ul style="list-style-type: none"> <li>• Force area leading into main raceway to draft</li> <li>• Exit/entry point of back-pens, in wide laneway</li> </ul>	<ul style="list-style-type: none"> <li>• YoungStar</li> </ul>	~820	100%	99%
<b>Site 3</b> <b>Pre-export facility</b>	Sheep	<ul style="list-style-type: none"> <li>• Base of unloading ramps</li> <li>• Drafting race</li> <li>• Corners of yards where sheep are turning</li> </ul>	<ul style="list-style-type: none"> <li>• AirStud Straight Edge</li> <li>• AirStud Straight Edge with custom cut holes</li> <li>• DoubleStud interlocking</li> <li>• YoungStar</li> <li>• VGrip</li> <li>• Interlocking Ergo with custom cut holes</li> <li>• Interlocking Kura with custom cut holes</li> </ul>	~4,500	100%	96% on Youngstar and VGrip 100% on all others
<b>Site 4</b> <b>Live export vessel</b>	Sheep and cattle	<ul style="list-style-type: none"> <li>• Raised crossovers (middle lane)</li> <li>• Hospital pens</li> <li>• From loading ramp to centre laneway on vessel (through pens)</li> <li>• Base of vessel ramp</li> </ul>	<ul style="list-style-type: none"> <li>• Kura</li> <li>• Airstud</li> <li>• AirFlex</li> <li>• YoungStar</li> <li>• VGrip</li> </ul>	Anecdotal feedback only	Significant	Significant

### 3.1. Summary of trial site results

#### 3.1.1. Site 1 – cattle pre-export facility

The YoungStar rubber matting was installed at a 90-degree turn in the loadout laneway; an area identified as a potential high slip and fall risk due to the polished condition of the existing patterned concrete surface. The YoungStar matting was installed by facility staff. Falls were eliminated entirely, and slip incidents were reduced by 99%.

Some minor baulking was observed in lead cattle when the matting was newly cleaned and the contrast between the black rubber and the surrounding concrete was high. This hesitation lasted only a few seconds and may have helped moderate animal pace. The mats were not permanently fixed due to site restrictions on water use but remained in place without shifting during trial period.



Image: YoungStar mat installed at site 1



**Image: Cattle moving through installation area making right angle turn**

### **3.1.2. Site 2 – cattle pre-export facility**

YoungStar rubber matting was installed in two locations at site 2: the force area leading to the draft race (under cover) and a wide laneway connecting the back pens (no cover). The facility had previously trialed various anti-slip surfaces, such as rio-bar, patterned concrete, and recycled tyres, but found them either ineffective over time or difficult to maintain.

Only the YoungStar matting was used. It was installed by site staff and performed well, eliminating all falls and reducing slips by 99%. Some minor slipping was observed during post-installation observations during wet conditions in the unroofed laneway. Overall, the matting was considered more durable and easier to manage than previous treatments.



**Images: Installation area in force leading into main raceway before and after installation**

### **3.1.3. Site 3 – sheep pre-export facility**

Multiple mat concepts were installed across several potential high-risk areas at the sheep facility, including the base of unloading ramps, drafting races, and turning points within the yards. The site does not use water for cleaning, so all mats had to be removable and compatible with manual cleaning processes.

Several products were trialled: Kura, Ergo, VGrip, YoungStar, and AirStud, with and without custom cut holes with both interlocking and straight edges. The inclusion of mat concepts with holes was specifically to address the cleaning constraints at this location. Under normal conditions, rubber mats are cleaned by washing faeces and debris off the surface. However, at this site, the holes were intended to allow faeces to fall through and accumulate beneath the mats. The build-up could then be removed by lifting the mats and manually or mechanically cleaning the area before reinstalling them. This approach was designed to maintain surface traction for livestock while enabling effective cleaning without water.

Staff preferred the interlocking Kura mats with custom holes due to their lighter weight and ease of handling; one person could move them without assistance. These mats also locked together effectively and remained stable during use. Installation of the concepts took 5-10 minutes each and required no tools or fixings.

All falls were eliminated following installation. Slips were reduced by 96% on the YoungStar and VGrip mats and completely eliminated on all other mat concepts. The YoungStar and VGrip mats are designed specifically for cattle, and the spacing between the rubber lugs on their surface can sometimes allow the smaller hooves of sheep to slip through. While there was some concern that the custom holes might fill with material over time, this was not observed during the trial period.



**Image: Pre- installation surface at the bottom of the loading ramp.**



**Image: Post installation of interlocking Airstud with custom holes (left) and Airstud with straight edge (right)**



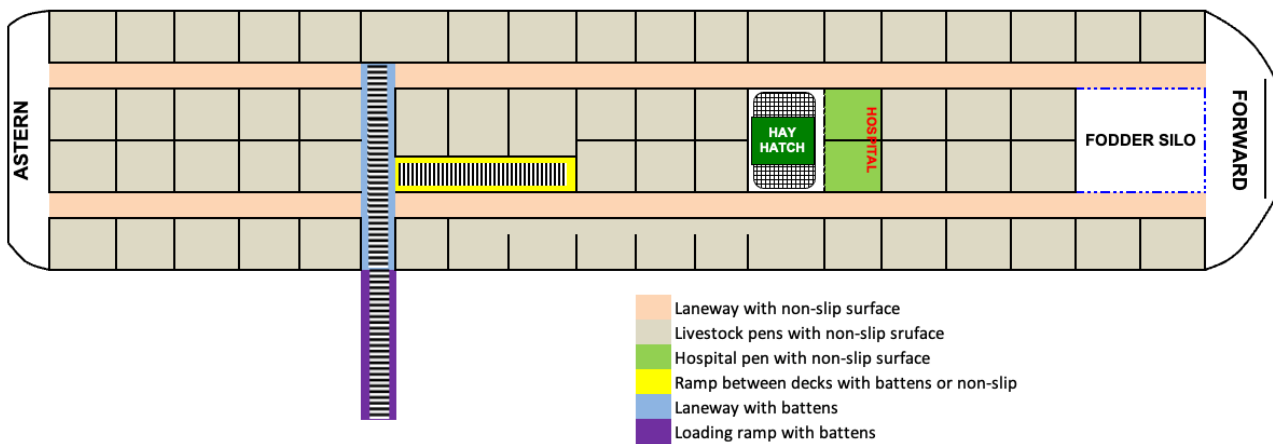
**Images: Installation of the Kura mat, the top preference by facility staff.**



**Image: Mats without interlocking edges moved over time due to inability to permanently secure.**

### **3.1.4. Site 4 – Livestock export vessel**

Five rubber matting concepts were trialled on a livestock export vessel operating on routes between Fremantle, the Middle East, and South America. The matting types were AirStud, AirFlex, Kura, YoungStar, and VGrip. The vessel carries both sheep and cattle and includes a range of areas where slips and falls can potentially occur when moving animals on and off the vessel. These include dedicated animal movement areas, such as loading and unloading ramps, deck entry and exit points, and ramps between decks, as well as dual-use areas including alleyways and pens. Figure 1 shows the different surfaces typical to the deck of a livestock vessel. Worth noting is that, although the total deck area is very large, the area designated solely for livestock movement may account for as little as 1% of the total space. Due to the vessel's operating schedule during the trial period, which was limited to South American routes, formal observation was not possible and all feedback was therefore anecdotal.



**Figure 1.** Example of typical deck layout and various surfaces

The rubber mat concepts were temporarily installed in various locations such as the base of ramps and turning points during loading and unloading of livestock, and in hospital pens. Permanent fixing was not possible due to biosecurity cleaning requirements, which stipulate that all surfaces must be accessible for full clean-down between voyages to eliminate faecal and organic matter. This ruled out any permanent installation, as it would prevent effective sanitation beneath the mats.

It is important to note that all livestock movement areas on board are already required to have anti-slip surfaces under AMSA Marine Orders 43, and this vessel complied with that requirement. The use of rubber mats in this trial was not intended to replace existing non-slip infrastructure, but to assess the mats' performance when laid temporarily over the top of existing anti-slip surfaces. For example, mats were trialled at turning points at the top or bottom of ramps where the existing surface consisted of an abrasive finish. Mats could not be used on the ramps themselves where steel battens were in place. In one case, mats were used over a worn surface requiring minor repair to allow loading to proceed without delay and repairs to be carried out at a more convenient time. Additionally, it had been planned to place mats over metal ventilation grates in the laneway between pens, where livestock are moved during loading and unloading. However, this was not completed due to concerns that the mats could impair airflow and ventilation performance.

Anecdotal feedback from the vessel's Chief Officer indicated that the mats were useful in reducing slips and falls, particularly at turning points. The Chief Officer also noted that matting in hospital pens appeared to improve comfort for animals lying or standing in place. One practical example was provided where a section of flooring required minor surface repairs. Rather than delay or halt loading operations, the crew placed a rubber mat over the affected area to allow livestock movements to continue safely. Repairs were then carried out at a more suitable time, avoiding operational disruption and potential cost.

Feedback also noted operational challenges due to the weight and bulk of some mats. While the vessel's crane was used to move mats to the correct deck, crew had to carry them manually into position. Lighter mats such as Kura, AirStud, and AirFlex were preferred for their ease of handling and ability to be rolled. In contrast, heavier mats like YoungStar (approximately 50 kg) were more awkward and labour-intensive to handle. At the end of the voyage all of the rubber mats were manually removed, washed down with water and stored. This involved a substantial amount of manual labour and increased the time taken for wash-down.

The trial did not produce conclusive evidence regarding the benefits of rubber matting in hospital pens. While some crew felt it offered comparable comfort to traditional bedding materials, such as sawdust, no formal assessments were conducted to evaluate welfare outcomes. At this stage, rubber matting may be considered a supplementary option but cannot be recommended as a preferred alternative without further evidence.

Use of rubber mats in livestock pens more broadly is not considered feasible due to the need to remove and individually clean each mat after every voyage to meet biosecurity requirements. The labour required to install and remove mats at this scale would not be feasible with the number of personnel available.

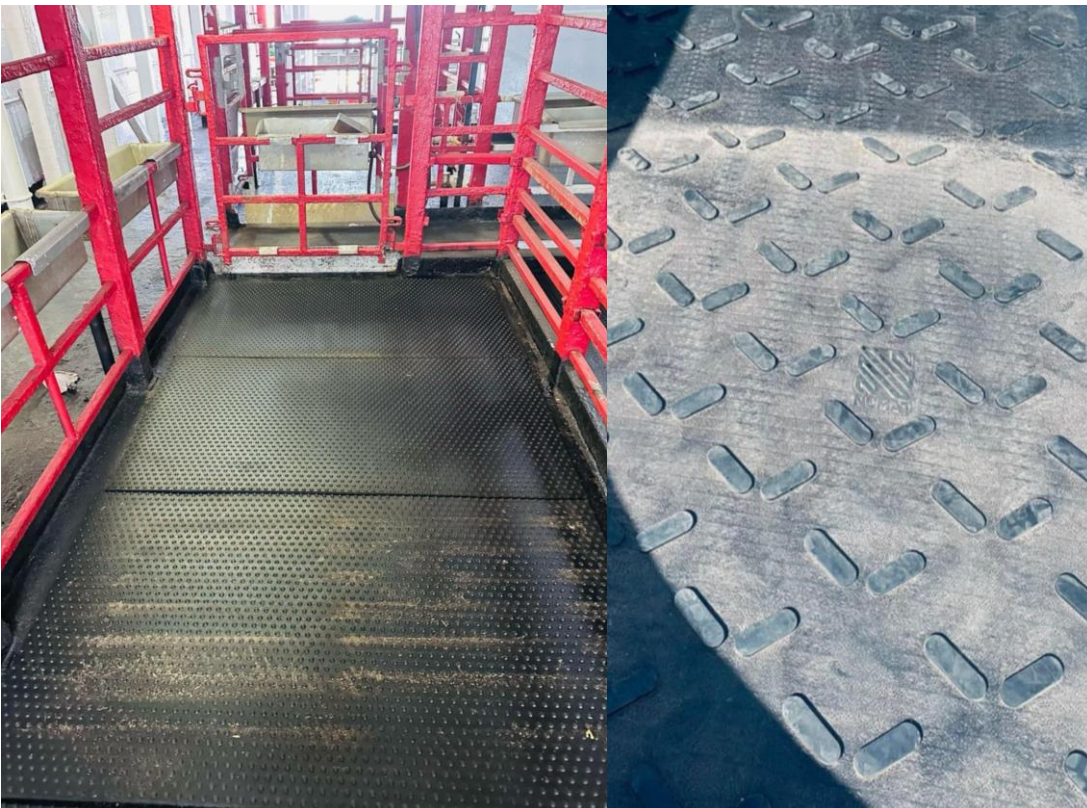
The clearest application from this trial is the use of rubber mats as an emergency or short-term measure in situations where existing anti-slip surfaces are damaged or require minor repair. In these cases, temporary matting can enable livestock movements to continue without interruption, avoiding the need to delay loading or unloading while repairs are completed. It may also be practical to keep a small number of mats on board for ad hoc use in specific high-traffic zones.



**Image: Initial site inspection by the Numat Agri team**



**Image: Airstud installed in hospital pens**



**Image: Airstud installed in hospital pen (left) and VGrip installed in handling area (right)**

### 3.2. Observed impacts beyond slip and fall metrics

In addition to numerical outcomes, several practical and welfare-related benefits were noted across trial sites:

- Reduced vocalisation and animal agitation during movement
- Improved safety for stock handlers operating in high-traffic areas
- Reduction in ambient noise, particularly on hard-surfaced raceways.

## 4. Conclusions

The trials confirmed that rubber matting offers a practical, adaptable solution to reducing slips and falls in high-traffic areas within the livestock export supply chain. Across all three land-based locations where observations were completed, the installation of anti-slip matting resulted in the complete elimination of falls and a significant reduction in slipping incidents, with most mat concepts delivering 100% effectiveness. These outcomes were consistent across both sheep and cattle, under varying site conditions and handling configurations.

From an industry perspective, the findings provide clear evidence that targeted use of purpose fit rubber matting can support improved animal welfare outcomes, enhance handler safety, and help meet compliance requirements related to flooring conditions during loading, unloading, and internal movement. The project also demonstrated that temporary matting solutions are compatible with operational demands of the livestock export industry.

### 4.1. Key findings

- Rubber matting eliminated 100% of falls under observations.
- Slips were either eliminated or reduced by at least 96%, depending on mat concept and species.
- Cattle and sheep demonstrated improved confidence during movement, with fewer baulking events and stress indicators.
- Site operators and animal handlers noted reduced ambient noise and safer working conditions for staff.
- YoungStar matting was found to be most effective for cattle.
- The interlocking Kura matting with custom designed hoof-halting drainage cutouts was found to be most effective for sheep.

## 4.2. Benefits to industry

The trial outcomes support the adoption of purpose designed rubber matting as a targeted intervention to improve welfare and handling efficiency in the livestock export sector. For the red meat industry, key benefits include:

- Enhanced animal welfare outcomes aligned with regulatory and community expectations.
- Reduced incidence of injury and stress caused from slips and falls during pre-export handling and on-board movements.
- Improved working conditions for livestock handlers, lowering operational risk.

## 5. Future research and recommendations

The success of this trial highlights the potential for further investment in flooring innovations to improve livestock welfare outcomes in the livestock export supply chain. While the project demonstrated clear operational and welfare benefits, several areas were identified where additional research and development would enhance adoption and long-term value.

Future R&D priorities:

- Assess long-term durability and performance of rubber matting under extended operational conditions, including repeated voyages and exposure to cleaning agents.
- Investigate the biosecurity implications of temporary mat use on vessels, particularly regarding waste accumulation and pathogen retention beneath mats.
- Evaluate matting impacts on other welfare indicators, including lameness rates over time, animal performance, and behaviour during extended housing.