

Developing an improved pre-slaughter restraining box for cattle

Final Report

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1 Abstract

The upgrade of the Mark 1 restraint box and the production of a Mark 2 box were carried out as part of the live export industry's goal to improve animal welfare, processing efficiency and meat quality in countries that process Australian cattle. The Mark 1 box is an improved version of the existing boxes in use in South East Asia and will meet the needs of clients seeking a minimum investment.

The Mark 2 box is redesigned with a tilting side door rather than a swinging side door, which improves animal welfare, operator safety and the efficiency of blood collection. The additional features in the Mark 2 box will suit those clients seeking a box where the animal will not touch the abattoir floor. This is an important hygiene consideration and conforms to export abattoir guidelines.

Both boxes are simple in design and rely only on limited moving parts without the need for electricity or hydraulics. Both boxes can be manufactured in most in-country workshops. Given that the basic design is the same in both boxes, it is a simple step to upgrade from a Mark 1 box to a Mark 2 box. A separate manual has been produced as part of this project, which details the features of the boxes and contains comprehensive plans and drawings of the boxes.

The use of these boxes in markets importing Australian cattle will improve the welfare of the animals, the quality of the processed meat and improve abattoir throughput and working conditions. These improvements will all improve the demand for Australian cattle.

2 Executive Summary

This project resulted in improvements to the design of the existing restraint box that will improve operating efficiencies and improve animal welfare. A separate manual has been developed which describes the features of the new design to potential users of the restraint box.

The project was undertaken to improve animal welfare standards and processing efficiency in overseas abattoirs slaughtering Australian cattle. It is a priority for the live export industry to enhance the processing end of the Australian live export chain.

This project set about making minor improvements to the design of the existing Mark 1 box and developing a prototype Mark 2 box that incorporates a new design in the restraint mechanism. The Mark 2 box was successfully tested in an Indonesian abattoir.

The end result is a manual that includes both the Mark 1 and Mark 2 box containing construction and application details. The design and construction is simple avoiding the use of electrical or hydraulic power, which reduces construction and maintenance costs. As there is no reliance on electrical power, power interruptions are not an issue.

The use of either box will improve animal welfare, improve processing efficiencies and enhance operator safety in overseas abattoirs. This will result in an improved level of meat quality and improve the acceptance of Australian cattle in traditional overseas abattoirs.

3 Main Research Report

3.1 Background

In 2000, the live export industry identified improving the traditional pre-slaughter and slaughter handling of imported Australian cattle in Asia and the Middle East to be a priority. In the Asian market place Australian imported cattle have historically been discounted in the market. This has largely been due to suboptimal slaughter techniques resulting in dark cutting meat and a reduced shelf life. The additional stress encountered in slaughtering Australian cattle without adequate restraint often results in a lowering of muscle glycogen and an elevated muscle pH. By improving animal welfare during pre-slaughter and at slaughter, meat quality is improved, operator safety is enhanced and the efficiency of processing is superior.

Since 2000, the following developments have occurred:

- During October 2000, a cattle restraining box [Mark 1] was designed and built in Darwin,
- During 2001, four Mark 1 boxes were built and installed in Indonesia,
- During 2002, a further five Mark 1 boxes were installed in Malaysia, Indonesia, Middle East and Brunei
- During 2003, industry sought to improve the design of the Mark 1 box. Amal Services was contracted to incorporate minor improvements to the existing Mark 1 box and develop a prototype of a modified restraining box [Mark 2]

At the time of printing of this report, there are twenty-five confirmed Mark 1 boxes or replicas, two revised mark 1 boxes and one prototype Mark 2 box installed. An audit by the joint MLA/LiveCorp program is currently underway to determine the number of boxes working in Indonesian abattoirs. Of the approximate twenty-five licensed abattoirs in Greater Jakarta, the majority have restraining devices that were installed by the joint program or copied by the abattoir owner.

The project objectives are as follows:

- 1) Incorporate into the current restraining box model, features that will:
 - a) Improve the rate of throughput via improved hinge design, leg capture and reduced operating noise,
 - b) Allow more effective blood collection,
 - c) Improve animal welfare characteristics by reducing the chance of head bruising, providing for stunner operator, reducing gate noise and improving the rate of bleed, and
 - d) Increase the ease of operation while respecting cultural and industrial relation implications.
- 2) Prepare a manual that describes the principles and features of the improved restraining box for potential users. The manual will be in English and include drawings, photos and plans.
- 3) Communicate the benefits of the improved restraining box to stakeholders and potential users.
- 4) Supervise construction and installation, field test and report on an improved restraining box.

3.2 Methods

The first step was sourcing an appropriate subcontractor to assist with the design, modelling and drawings. A subcontract agreement was put in place with Food Science Australia (FSA) at the end of July 2003. FSA is a joint venture between CSIRO and the Australian Food Industry Science Centre (AFISC).

FSA prepared 3D models and drawings of the existing Mark 1 restraining box, guillotine gate, latch mechanisms, floor shape and operator access platform for mechanical stunning in accordance with the current drawings and supplied information. This design included basic steel section shapes such as sheet, pipe, flat and round. These models and drawings were reviewed and accepted via a meeting in Brisbane with FSA in August 2003.

The development of design improvements and additional features to the existing unit commenced using AutoCAD software. AutoCAD is a computer aided drafting application program, which is able to produce 2D and 3D images. Using the AutoCAD software, construction and assembly colour images in JPG format were completed. No images of cattle were included in the photo images as these are not available in the 3D CAD format. These images and drawings were approved in November 2004.

Two days was spent with the FSA team in late August, where time was spent targeting the design changes. This was achieved by firstly briefing the FSA team with the help of a Power Point presentation on work completed to date and outlining the environment in which the restraining boxes are operated. The FSA engineers needed to understand the building and construction materials available and the skill level within most Asian countries.

In communicating with FSA, the most important industry objective was to keep the construction and installation costs to a minimum. All the steel construction materials used in the prototype must be readily available in the countries that import Australian cattle. During this visit, the FSA team agreed that the new restraining box could be effective and remain mechanical in operation, without the need for power or hydraulics.

It was originally intended to install the prototype Mark 2 restraint box in West Malaysia, however as there were few Australian cattle being slaughtered in public abattoirs at the time, the decision was made to test the prototype in Indonesia. The prototype was shipped to Jakarta and installed in the new abattoir at Rumpin, south of Jakarta during June 2004.

funding to build the prototype in Darwin and its installation in country was funded by the joint MLA/LiveCorp Asia program. Previous experience meant that it was more economical and easier to supervise to build the prototype in Darwin. Asian tradesmen will observe the design standards in the constructed box.

A relevant issue in design is that in Asian abattoirs there is no real advantage in increasing the rate of throughput through the restraining box design unless the cattle bleed more rapidly. Well designed handling facilities and good animal husbandry and handling will help to maintain cattle in a relaxed state which is known to improve bleeding following slaughter.

During October 2003, after a number of meetings with a Darwin engineer, it became apparent that there was sufficient detail in the drawings and models to proceed with the manufacture and construction of a prototype box in Darwin. It was important to bench test the equipment in Darwin prior to shipping. During bench testing it was important to simulate the conditions of an Asian or Middle Eastern abattoir that has a requirement to ritually slaughter large cattle that are not accustomed to being lead.

Due to some unforeseen delays with the sub contractor, FSA, the first drawings for a model design were received in late November 2003. These drawings were due at the end of October 2003. More regular communications took place with FSA to confirm the urgency of the project.

The model design is based on experience and an understanding of how to move cattle into a restraining device whilst the cattle remain confident and unafraid. There have been valuable lessons learnt by observing the operation of boxes designed by engineers that are not familiar with Australian cattle.

The prototype Mark 2 model was completed in a Darwin workshop during the month of March 2004 and transported on a livestock ship to Jakarta. It is of note that during the past four years, Australian livestock exporters have shipped nine restraining boxes out of Darwin for nil cost. The prototype box was successfully tested during June 2004 albeit the new abattoir at Rumpin was not yet operational. Of note was the fact that the test animals were local cattle and following the testing were returned unharmed to their pen where they continued to feed and behave normally. This clearly demonstrated the animals were unharmed and unaffected as a result of being restrained.

3.3 Results and Discussion

The design and construction of this prototype, restraining box [Mark 2] has minimised the design faults that were identified in the original design. It is better suited to processors with slaughterhouses that are reasonably sophisticated.

This restraint box is suitable for Halal slaughter performing the functions of:

- painlessly restraining cattle using a steel panel construction that blocks an animal's view of the slaughter process outside the box,
- offering added protection for the cattle and personnel,
- improved facilities to collect blood, without the need for electrical power.

A prototype of the Mark 2 box was constructed in Darwin and shipped to Jakarta, Indonesia where it was successfully tested in a new abattoir under construction. Local cattle were used in the tests. The restraint box worked well and the test cattle were returned safely and painlessly to their feeding pens. No major adjustments to the prototype box were required during testing.

The Mark 2 box could fill a market niche in a number of countries slaughtering Australian cattle both in South East Asia and the Middle East.

The major difference in the Mark 2 box from the Mark 1 box is that the restrained cattle are lowered not dropped to the slaughter position on an 'L' shaped door. The lowered door acts as a tabletop for safe and ergonomic access by the slaughter man.

The design of this model has kept the operation and maintenance of the restraint box relatively simple:

- The Mark 1 and 2 boxes can be built from a plan in an engineering workshop in all countries importing Australian cattle.
- Construction materials are readily available in importing countries.
- The restraining box can be galvanised to maximise its working life.
- Only counterweights and torsion springs are used in the restraining and tipping operations.
- There are no hydraulic or pneumatic power requirements for its operation.
- Operators can maximise blood collection.
- Construction costs for each unit are kept to a minimum.
- Allowance has been made in the design to upgrade an existing Mark 1 box to a Mark 2 by the addition of an extra post and the hinged door.
- The Mark 2 box will be able to restrain cattle from 380 – 800kg live weight without adjustments.

- The Mark 2 restraining box remains rectangular, straight-sided, at floor level, non-slip, well lit with an open top [300 lux]. The box dimensions will be a height of 1.8 metres, a width of 0.7 metres and a length of 2.2 metres.
- A florescent light is sited above the restraining box to eliminate any shadows that would baulk the entry of cattle.

More specifically the design improvements to the Mark 1 and Mark 2 boxes have accommodated several important requirements including:

- Blood collection

The plan allows for the collection of blood during Halal slaughter for two reasons. Firstly, the blood in the animal belongs to the owner of the animal and the owner has the right to collect the blood and sell it as a protein source. Secondly, it is important to discourage the discharging of blood into the other abattoir effluent.¹

- Guillotine gate

After a rope is placed on the hind leg of cattle they will often kick the guillotine gate at the rear of the restraining box to try and remove the rope. This has led to a number of abattoir personnel removing the guillotine gate to remove the source of noise. With the location of many of the abattoirs in highly populated areas, this noise is undesirable. The solution was to run the guillotine gate in a channel using a hardwood or industrial plastic strip to act as a buffer.

- Side gate and front gate hinges

These hinges have been redesigned to increase their strength and make provision for when the gates are in the locked position the standing animal is unable to lift the gate off its hinges. When the doors are in the open position they can be removed for maintenance purposes. It is essential that the material to make the hinges can be sourced in the importing country.

- Front and rear gate latches

Improvements were made to these gate latches to allow the operator to trip the two latches with one hand, and allow the operator to stand in a safer position. The latches are designed to quick release the gates in the event that an animal falls in the box and jams the gates from opening normally.

- Welding requirements

The specified welding requirements on the large panels were upgraded, which will reduce the cost of construction and also minimise the problem of the steel panels warping during the hot galvanising process (400 ° Celsius).

- Fall of the animal (Mark 1 box)

On some occasions when an animal is released from the restraint box, and on tripping, it will crash its head to the concrete plinth. The most practical solution was to place a used tyre (light truck 850x360) under the falling head of the beast. The tyre acts as a buffer between the head and the floor and the tyre is unlikely to be stolen. The design of the Mark 2 box eliminates this problem, as the tilting side panel supports the falling animal.

- Stunning platform

All the new box designs retained a platform for a stunner operator

¹ It has been reported that blood has a biochemical oxygen demand (BOD) of around 200,000 mg/L compared with abattoir effluent BOD of around 2,500 mg/L. Blood that goes down the drain is equivalent to about 5.7% of the dressed carcase weight.

3.4 Success in Achieving Objectives

Abattoir workers in Indonesia, Malaysia, Philippines and the Middle East, which are almost all subcontractors will at times attempt to incapacitate Australian cattle prior to slaughter as an act of desperation to restrain the beast so as to avoid personal injury. Apart from being an unnecessary painful action, this results in a high level of pre-slaughter stress, which in turn leads to dark cutting beef with a shortened shelf life. This meat can be discounted by as much as 30%. The restraining box effectively eliminates the need for this practice.

In some regions of Asia, Australian cattle are so difficult to handle relative to locally bred cattle, which have experienced close human contact since birth, that slaughtering Australian cattle is not considered a viable proposition.

The restraining boxes are designed to minimise bruising, block the vision of the cattle, minimise adrenalin secretion and accelerate bleeding so as to rapidly induce unconsciousness. The boxes are totally mechanical in operation without any hydraulic or pneumatic assistance making them relatively easy to maintain. There is nothing of value that can be illegally removed from the box and the box will operate in the most primitive of abattoir environments. As discussed earlier, the Mark 2 box prototype was successfully tested in an Indonesian abattoir, i.e. the box equipment worked well and the cattle tested experienced no obvious pain or discomfort.

3.5 Impact on Meat and Livestock industry

The use of the cattle restraint box is an important part of the pre-slaughter management of Australian cattle in overseas abattoirs. There are a number of countries, which prefer to slaughter only their local cattle, as they have been unable to safely restrain Australian cattle. The availability of a restraint box will improve the acceptance of Australian cattle in these markets and improve animal welfare in abattoirs. It is therefore expected that the availability of a cattle restraint box will help to open new market opportunities for Australian cattle in South East Asia and the Middle East.

In addition to the major upgrading of the existing design of the restraint box into a Mark 2 box, the design of the original Mark 1 box has also undergone improvements.

The overall impact of the restraint box will be a more sustainable live cattle trade for Australia.

3.6 Conclusions and Recommendations

There is a requirement for two separate boxes in the South East Asian market. It will be the budget and the level of sophistication at the slaughterhouse that will influence the choice of a Mark 1 box or a Mark 2 box. Both boxes have the capacity to slaughter 15-20 cattle per hour. The main influence on rate of throughput is the cattle bleed time to unconsciousness. The Mark 2 box will improve conditions for cattle as the tilting table will lower them slowly to the horizontal position.

It will be very important to minimise the equipment and installation cost in target countries. Importing countries cannot justify high equipment costs on the basis of animal welfare alone. A Mark 1 box is likely to be installed in a slaughter house that slaughters 20-30 beasts per night and a Mark 2 box is likely to be installed where the production is greater than 30 beasts per night. The Mark 2 box should be promoted over the Mark 1 box wherever possible.

It is extremely important that the recipient of a restraining box is assisted in the siting of the box on the slaughter floor so as to comply with the countries religious requirements. The race leading into the box should be plated on the inside so that cattle waiting are unable to observe the slaughter floor. The race leading into the box should only be two panels long (two cattle lengths long) if the rate of slaughter is up to 100 beasts per shift. Cattle should be held in a

two metre wide lane prior to entering the race. Cattle that are made to stand head-to-tail in a race will quickly lose their confidence².

As earlier stated the Mark 2 restraining box is a significant advance on the Mark 1 box without diminishing the simplicity of operation and maintenance. Improvements to the box will become obvious as the Mark 2 boxes are installed and used. It is recommended that continuing support be provided to the operators of slaughter houses to ensure the boxes are correctly built, installed, maintained and operated in the best possible way.

The drawings for the improved design of the Mark 1 and Mark 2 boxes are saved as Adobe Acrobat documents, however the drawings were created using the AutoCAD software. These AutoCAD files are available from an engineering firm CADNorth in Darwin and the files will be saved to CD and forwarded to MLA. Any further design improvements will have to be performed using AutoCAD.

The following Appendix contains Figures 1 to 4 depicting both Mark 1 and Mark 2 boxes as 3D models. Figure 5 is a photo of abattoir workers dragging a beast from a race as a means of restraint. This was the normal practice prior to the advent of the restraint boxes. More 3D models, photos and drawings of the boxes are contained in a separate manual produced as part of this project.

² The inside measurement of a cattle race is 70 centimetres or 28 inches. Cattle will quieten quickly if they are able to stand along side each other in a lane greater than 2 metres wide.

4 Appendix

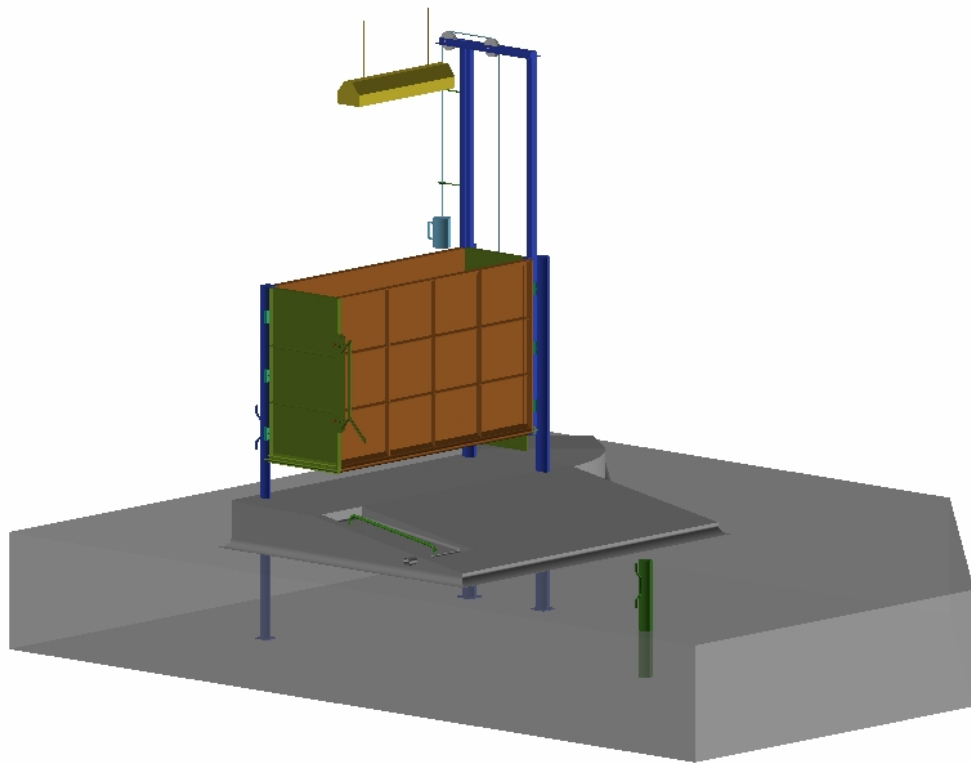


Figure 1

Mark 1 box model – closed

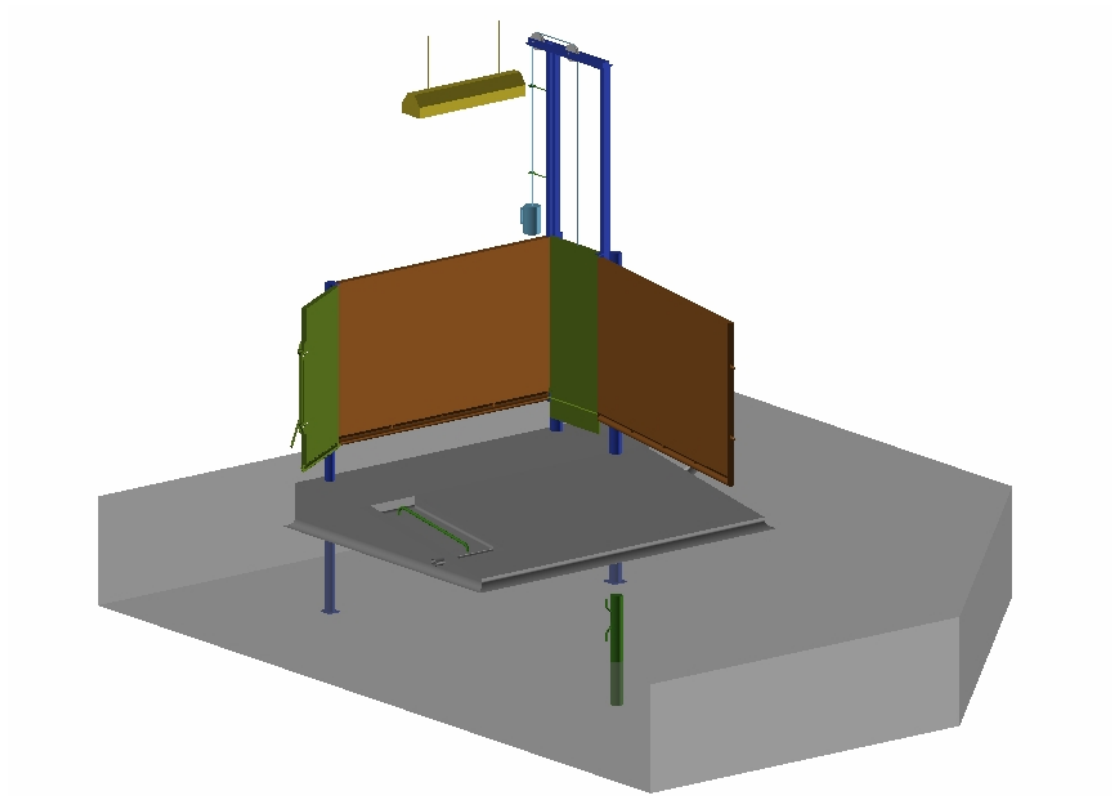


Figure 2 **Mark 1 box model – open**

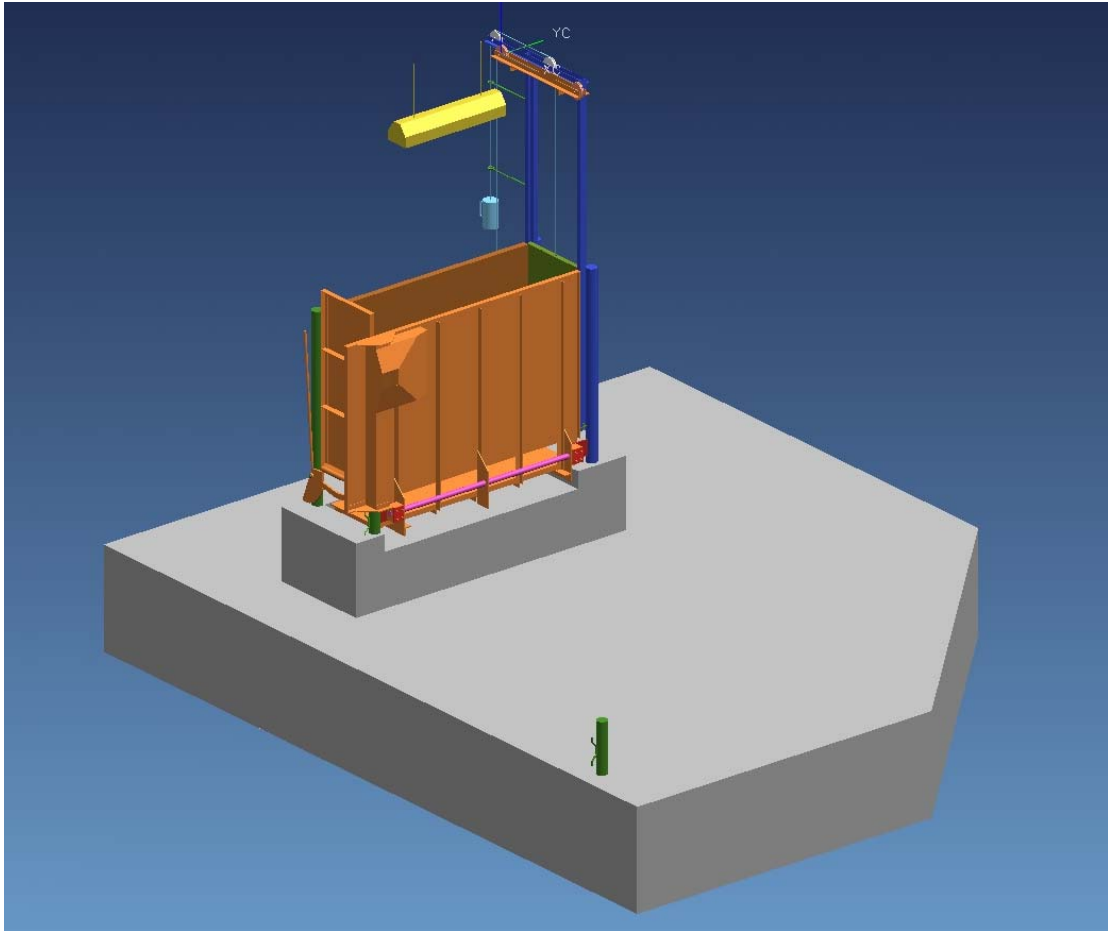


Figure 3 **Mark 2 box model – closed**

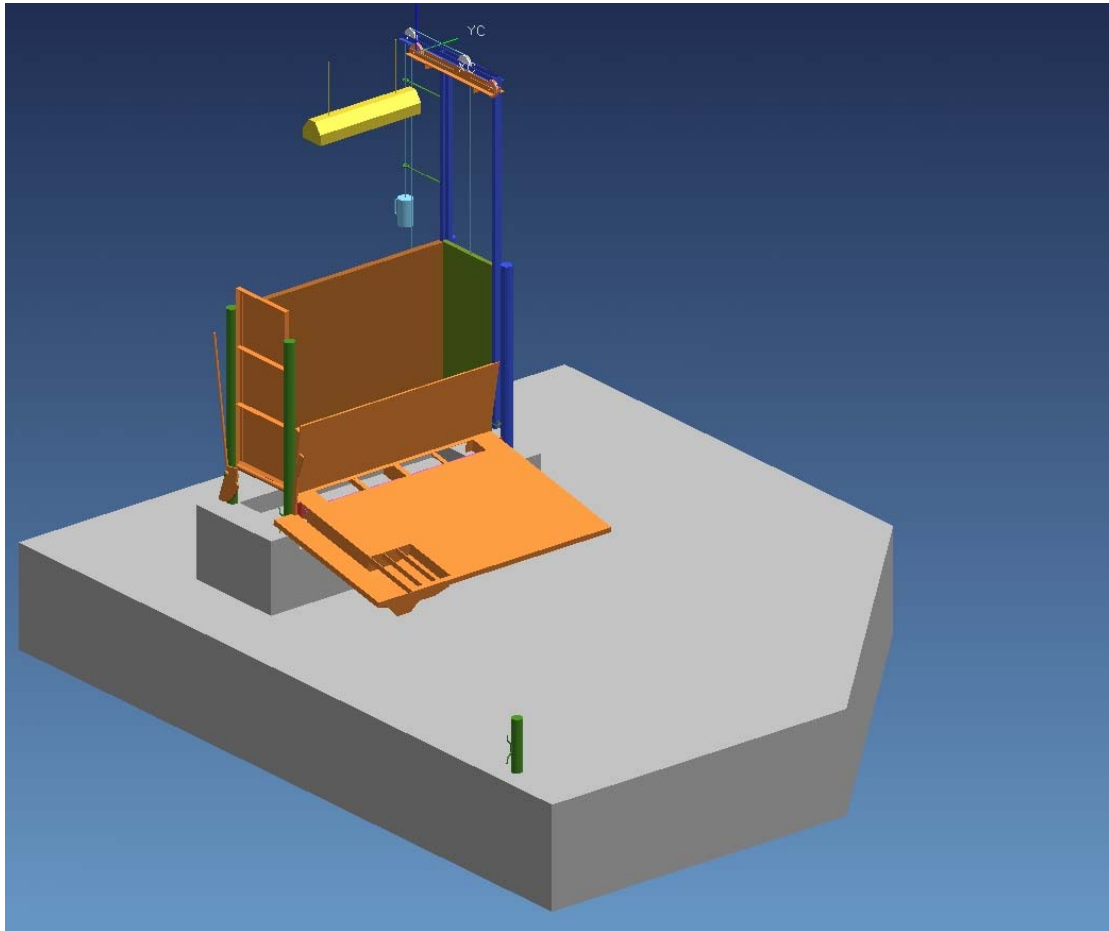


Figure 4

Mark 2 box model - open



Figure 5 Use of a restraint box will eliminate this method of restraint