

## Solutions for Working at Height on Cranes



## Canada Occupational Health and Safety Regulations (SOR/86-304)

<http://laws-lois.justice.gc.ca/eng/regulations/SOR-86-304/page-66.html#docCont>

### FALL-PROTECTION SYSTEMS

• **12.10** (1) Subject to subsection (1.1), every employer shall provide a fall-protection system to any person, other than an employee who is installing or removing a fall-protection system in accordance with the instructions referred to in subsection (5), who works

- (a) from an unguarded structure or on a vehicle, at a height of more than 2.4 m above the nearest permanent safe level or above any moving parts of machinery or any other surface or thing that could cause injury to a person on contact;
- (b) from a temporary structure at a height of more than 6 m above a permanent safe level; or
- (c) from a ladder at a height of more than 2.4 m above the nearest permanent safe level where, because of the nature of the work, that person is unable to use at least one hand to hold onto the ladder.

• (1.1) Where an employee is required to work on a vehicle on which it is not reasonably practicable to provide a fall-protection system, the employer shall

- (a) in consultation with the policy committee or, if there is no policy committee, the work place committee or the health and safety representative,
- (i) perform a job safety analysis to eliminate or minimize the need for the employee to climb onto the vehicle or its load, and
- (ii) provide every employee who is likely to climb onto the vehicle or its load with training and instruction on the safe method of climbing onto and working on the vehicle or its load,
- (b) make a report in writing to the regional health and safety officer setting

## Why is Fall Restraint Better ?

- The system is a Fall Restraint system, which does not allow the operator to fall to a lower level
  - Moveable handhold at heights keeping the operator safe and secure
  - To date we have yet to have a single incident or injury reported
- Potential to lower your liability insurance**

# You can't have a safety system that isn't safe

Overhead life lines are Fall Arrest Systems that allow the user to fall and at 14 feet are not effective.

Overhead life line systems typically allow a pendulum effect causing additional trauma to the fallen worker

In the event of a fall, the user will hit the ground if lifeline is not tight and work surface is 14 feet or less above ground.

The ergonomics of falling with a cable at your feet do not work.



# Lattice Crane Solution Fall Protection Systems

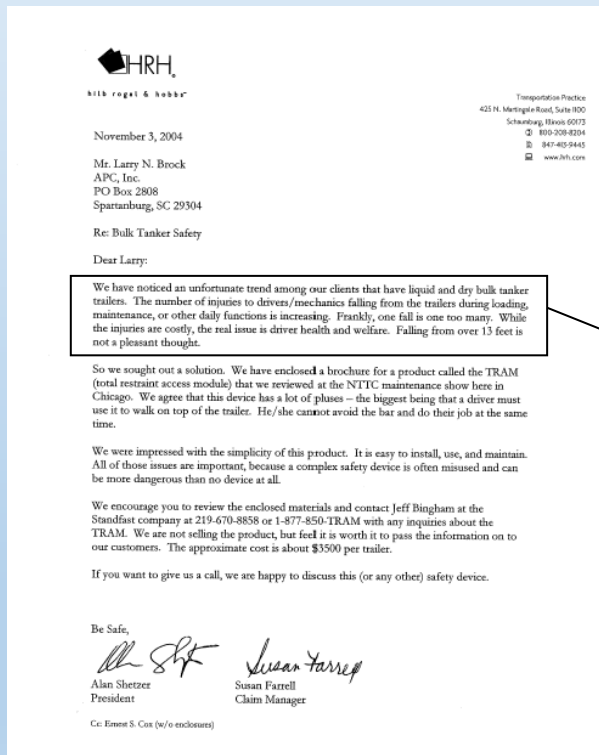


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## Injury Data and Associated Costs: Actual Example

Carrier X Fall Statistics and Associated Costs Period 1998-2006		
Fleet Size - Drivers	900	
Total Direct Injury Cost – 9 Years	\$3,330,000	31 Driver Falls
Average Cost Per Injury	\$107,420	
Annual Cost	\$370,000	3.44 Falls/Yr
Total Direct and Indirect Costs Associated With Injury Est. at 4x Injury Cost	\$429,680	
Total Annual Cost	\$1,480,000	

## The following is from a letter sent out to bulk fleets in the USA by Hilb, Rogal & Hobbs (HRH), now part of Willis, a large trucking insurer....



**“We have noticed an unfortunate trend among our clients that have liquid and dry bulk tanker trailers. The number of injuries to drivers/mechanics falling from the trailers during loading, maintenance or other daily functions is increasing”**

# Operational Challenges





# Double paradox – safety improvements will not occur unless we make them happen

High  
risk



**This one just parked on the wrong side of the fall protection tower – consequently he will not use it**

# You can not have safety systems that are not safe





## Safety of workers when accessing the top of tank containers

HSL/2005/04



*“The transfer between  
the ladder and the  
walkway, particularly  
in the descent, is  
considered to be the  
most hazardous  
element of the whole  
access operation”*

## Does the Solution Actually Work?

- The simple fact that a safety system has been put in place does not indemnify the manager or company from costs associated with safety risk.
- Attempting to solve the safety risk problem by allocating resources to complying with regulatory mandates is insufficient
  - Safety risk is a cost of conducting business
  - Failure to understand and incorporate the cost of risk into business decisions increase the likelihood of realizing a cost hazard in the future
  - Insurance companies understand risk and how to underwrite and price it
    - The out-of-pocket cost of any safety risk is priced at premium by underwriters (rule-of-thumb: insurance cost =  $1/0.7 = 1.43$  of potential out-of-pocket expense)
  - Safety risk management is just another technology challenge firms face

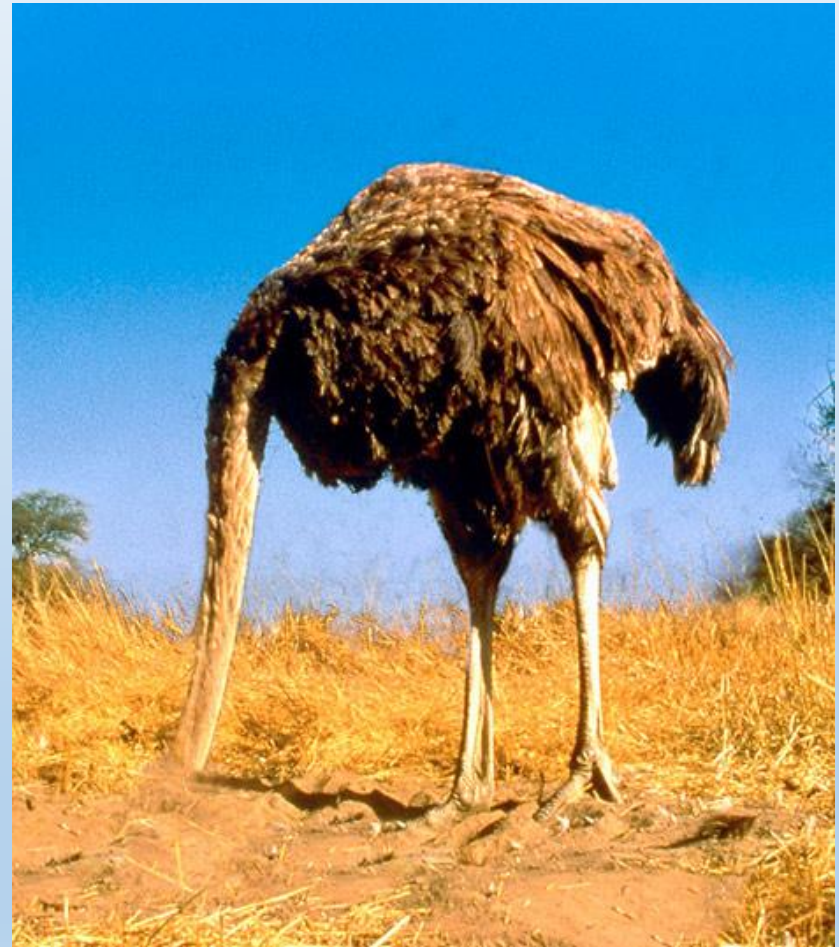
**Many managers are forced to adopt or promote unsafe practices: reactive, not proactive risk management.**

**Choosing to ignore cost of poorly developed safety risk management policies and technologies invite loss: The law of large numbers do not favor managers who ignore the real cost of safety risk (think of a roulette gambler hoping to walk away from the casino with large winnings after a long night of betting).**

**Considered “hedging with hope”  
in the financial markets”**

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## The Ostrich Effect?



## In the News: Outsourcing Does Not Mitigate Safety Risk

# Transocean Blamed in BP Suit for Billions in Spill Damages

Bloomberg News, April 21, 2011

**“The simple fact is that on April 20, 2010, every single safety system and device and well control procedure on the Deepwater Horizon failed, resulting in the casualty,” BP said in its complaint.**

**One Bad event can significantly impact a whole nation as well as many companies.**

**Regardless of the legal outcome, the negative impact on BP business has been significant despite the work being outsourced.**

# Solution Overview

## Ladder & Transition Protection



## Full Protection From Fall on Platform





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Terex Superlift 3800 crawler crane jobsite debut!





## Uninterrupted travel over all sections of Boom

**Sagging Lifeline  
not allowed by OSHA**

**Attachment not directly  
above head**

**Tear lanyard  
making fall  
distance  
over 10  
feet**



**Non continuous -  
Operator has to  
unhook and re-  
hook onto each  
section**

**Lanyard should be set length & as short as possible.  
The retractable type fall arrester lanyard may be longer than 2m & although it should automatically tension, in the event of a fall there is some initial downward acceleration of the user needed to activate the locking mechanism**

**Operator will need to disconnect to change direction or walk back along walkway - otherwise the lanyards will cross and may not operate as expected in the event of a fall**

**Retractable type fall arrester should be mounted overhead for fall arrest**

**Possible snagging or hook ups with scaffold hook to horizontal line  
– increasing fall distance  
Cannot pass intermediate anchorage points without disconnection  
Better to have purpose designed trolley and rail**

**Anchorage at foot level -increases fall distance  
Better to have anchor point at or above point of attachment**

**Tear out energy absorber  
- increases fall distance**

**The following slides contain excerpts from  
proper use OSHA sections including guidance  
for fall protection systems**

**<https://www.osha.gov/doc/outreachtraining/htmlfiles/subpartm.html>**

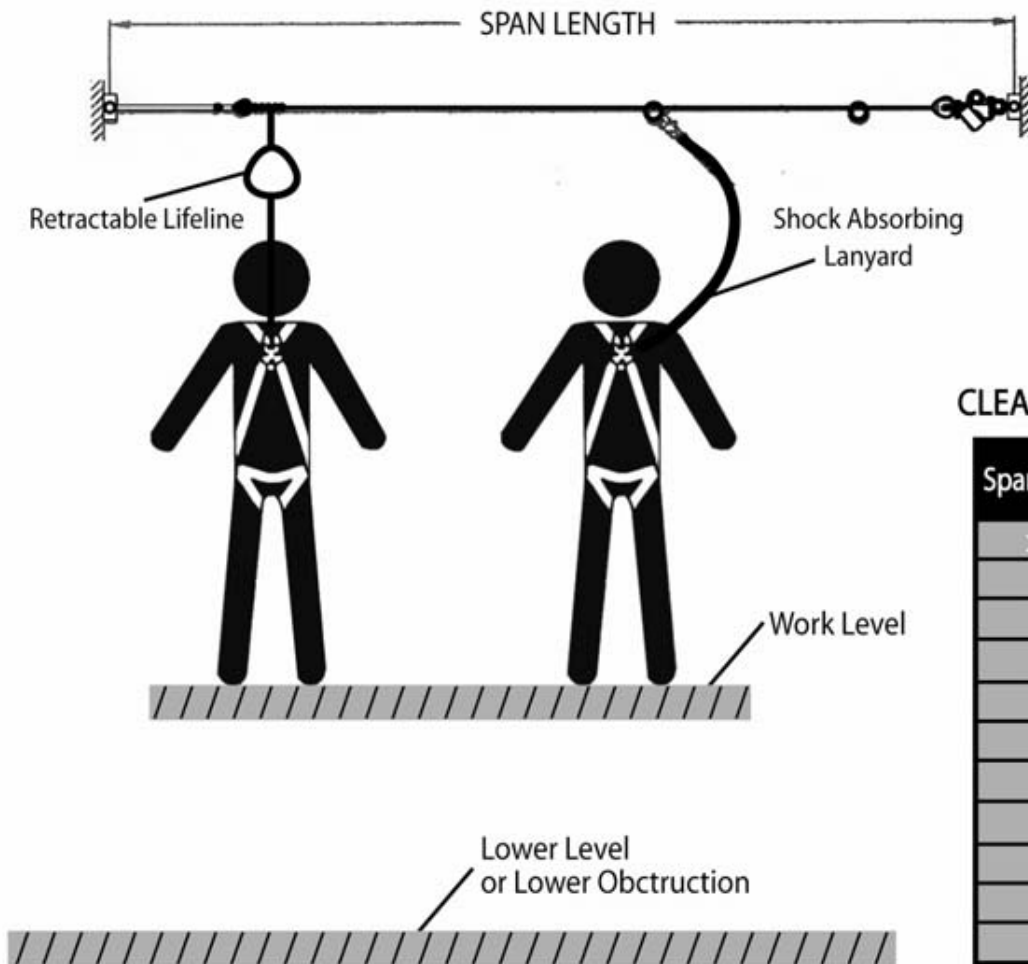
## **SWING FALLS: The force of striking an object in a swing fall may cause**

serious injury or death. Swing falls occur when the anchor point is not directly over the head of the worker. Minimize swing falls by working below the anchor point, or by sliding the anchor point along the line, positioning it directly over head. A swing fall will significantly increase all clearances required when using a self retracting lifeline or other variable length connecting subsystem.

**FALL CLEARANCE:** Proper clearance must be present below the worker to arrest a fall and avoid striking a lower level, obstruction, or the ground.



## FIGURE 3 CLEARANCE EVALUATIONS - FCP Shock Absorbing Lanyards



CLEARANCE TABLE - FCP Self Retracting Lifelines

Span Length in feet	Required Distance
>0' and ≤10'	12' - 6"
10' - 20'	15' - 6"
20' - 30'	17' - 6"
30' - 40'	19' - 6"
40' - 50'	20' - 6"
50' - 60'	21' - 6"

> Greater than      ≤ Less than or equal to

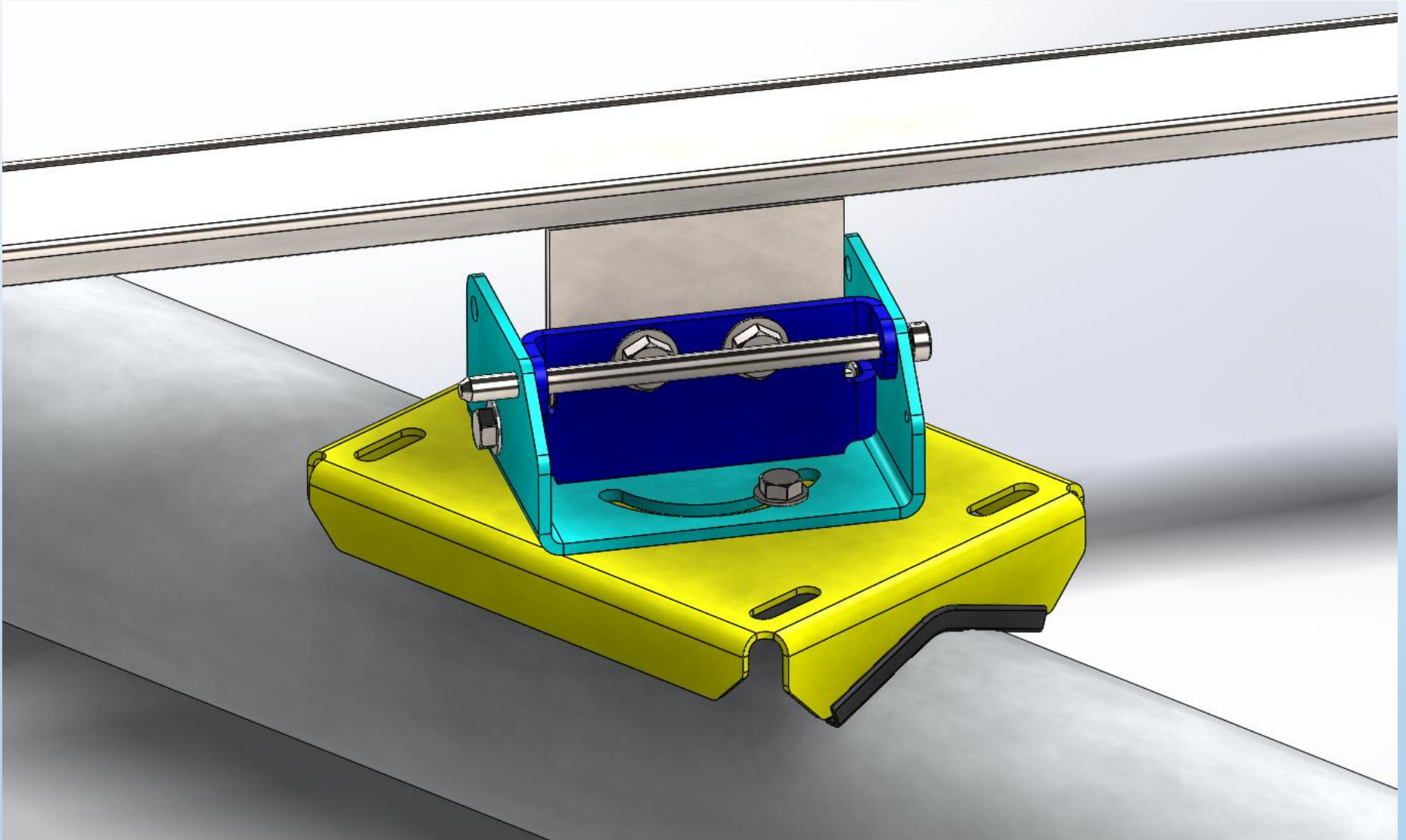
CLEARANCE TABLE - FCP Shock Absorbing Lanyards

Span Length in feet	Length of Shock Absorbing Lanyard in feet & Inches			
	3	4	5	6
>0' and ≤10'	14' - 6"	15' - 6"	16' - 6"	17' - 6"
10' - 15'	16' - 6"	17' - 6"	18' - 6"	19' - 6"
15' - 20'	17' - 6"	18' - 6"	19' - 6"	20' - 6"
20' - 25'	18' - 6"	19' - 6"	20' - 6"	21' - 6"
25' - 30'	19' - 4"	20' - 4"	21' - 4"	22' - 4"
30' - 35'	20' - 2"	21' - 2"	22' - 2"	23' - 2"
35' - 40'	21' - 0"	22' - 0"	23' - 0"	24' - 0"
40' - 45'	21' - 8"	22' - 8"	23' - 8"	24' - 8"
45' - 50'	22' - 5"	23' - 5"	24' - 5"	25' - 5"
50' - 55'	23' - 2"	24' - 2"	25' - 2"	26' - 2"
55' - 60'	23' - 9"	24' - 9"	25' - 9"	26' - 9"

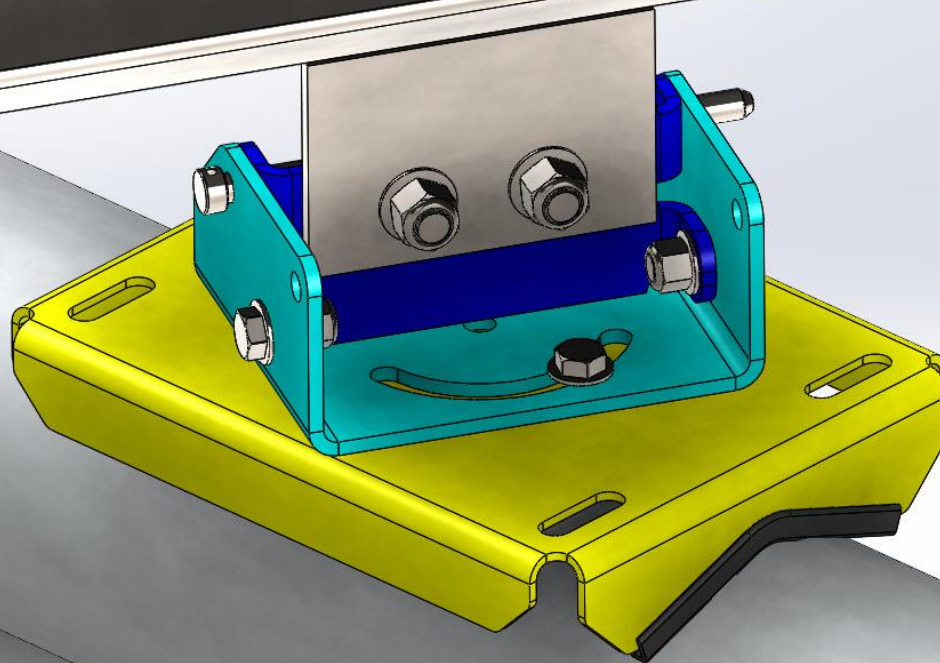
> Greater than      ≤ Less than or equal to

**This information only applies when the HLL and SRL are located overhead and above the level of the harness attachment point and the user is standing.**

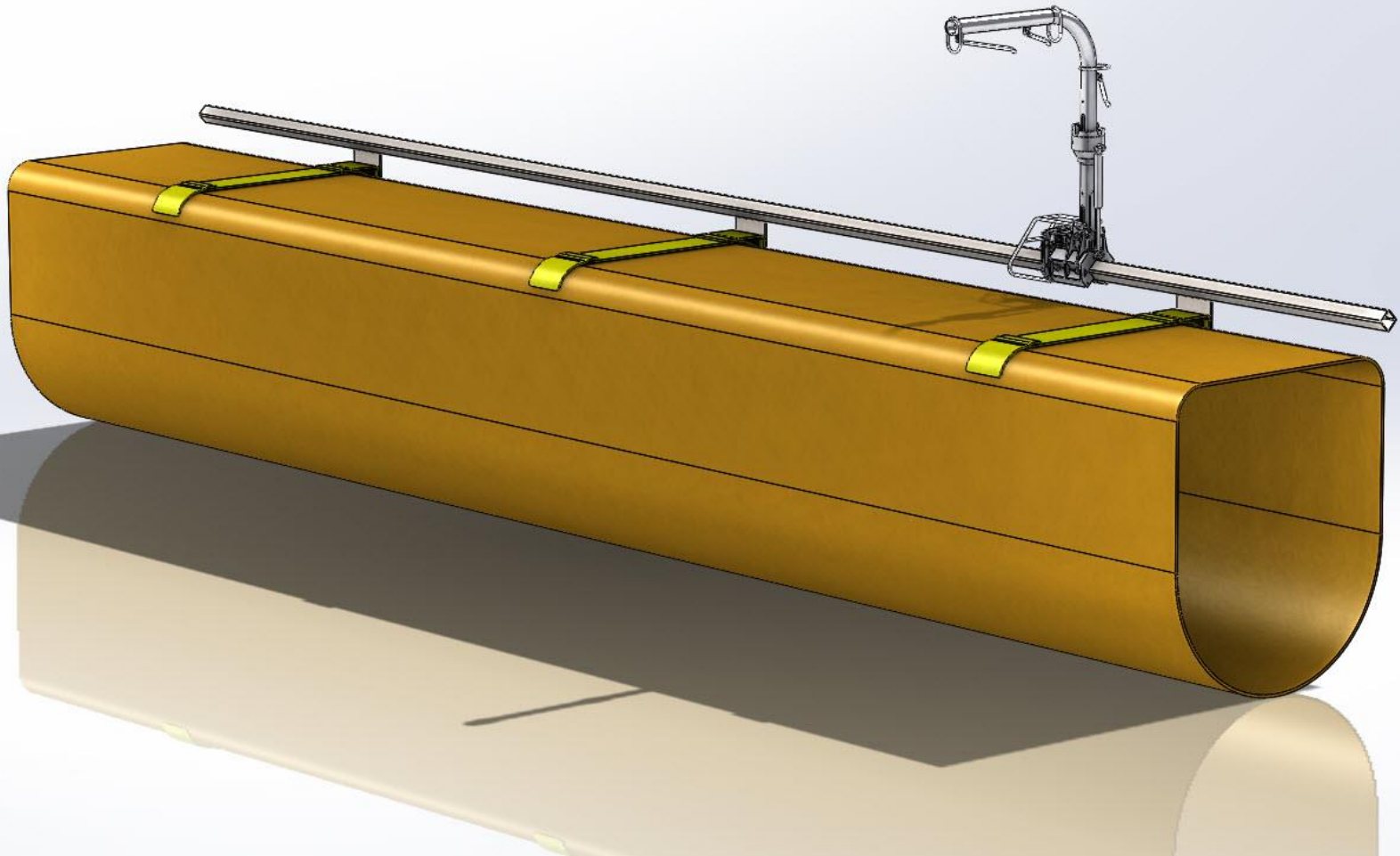
**TWO PERSONS - ONE HORIZONTAL LIFELINE:** If a person falls while connected to the horizontal lifeline, the system will deflect. If two workers are connected to the same horizontal lifeline and one person falls, the second worker may be pulled into a fall due to the deflection. The potential for greater deflection, and the second person falling, increases as the span length increases. The use of multiple horizontal lifeline systems, or a shorter span length, is recommended to minimize the potential of the second person falling.



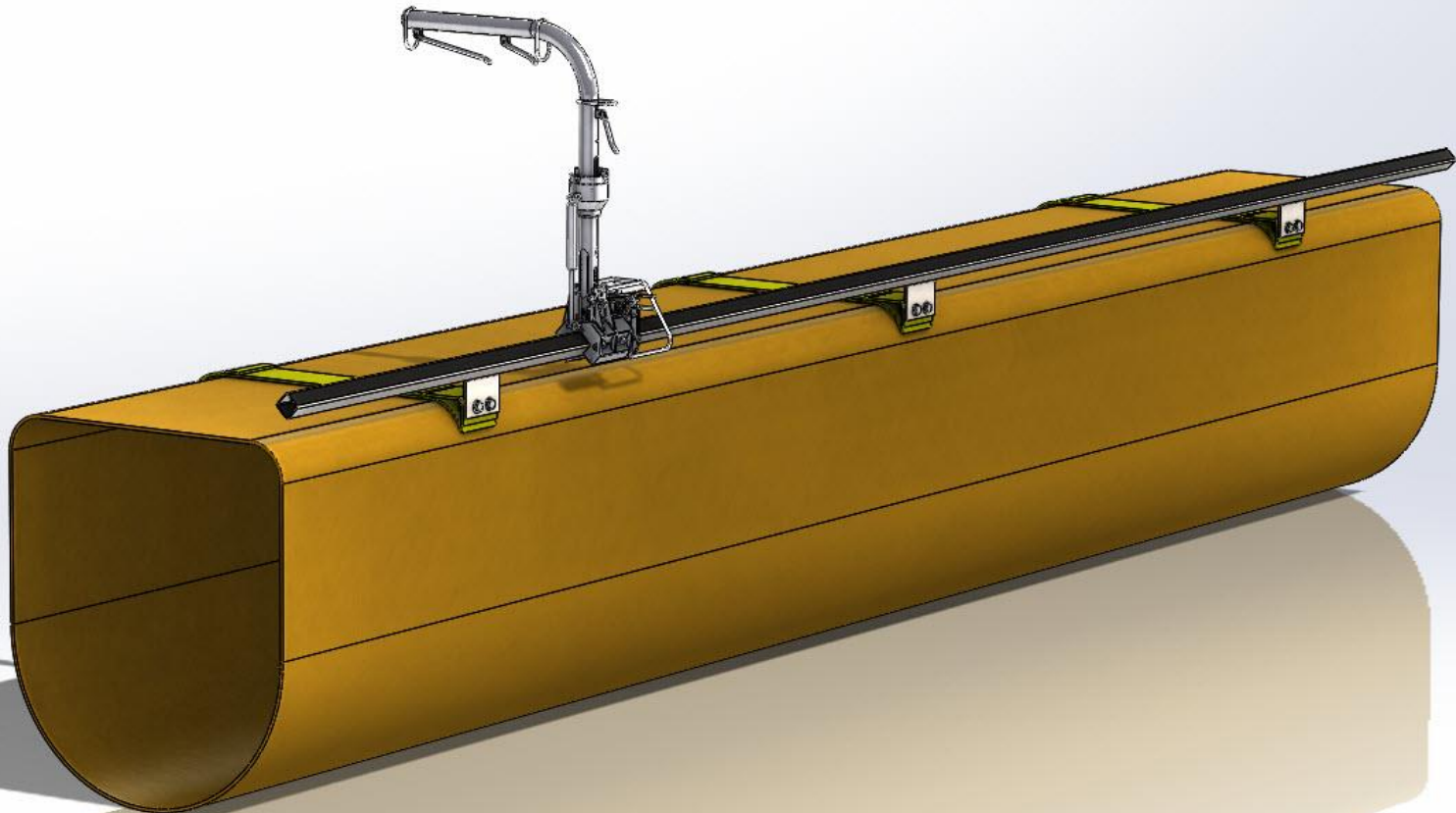
## Lattice Crane Lacing Mount – Folding Unit / View 1



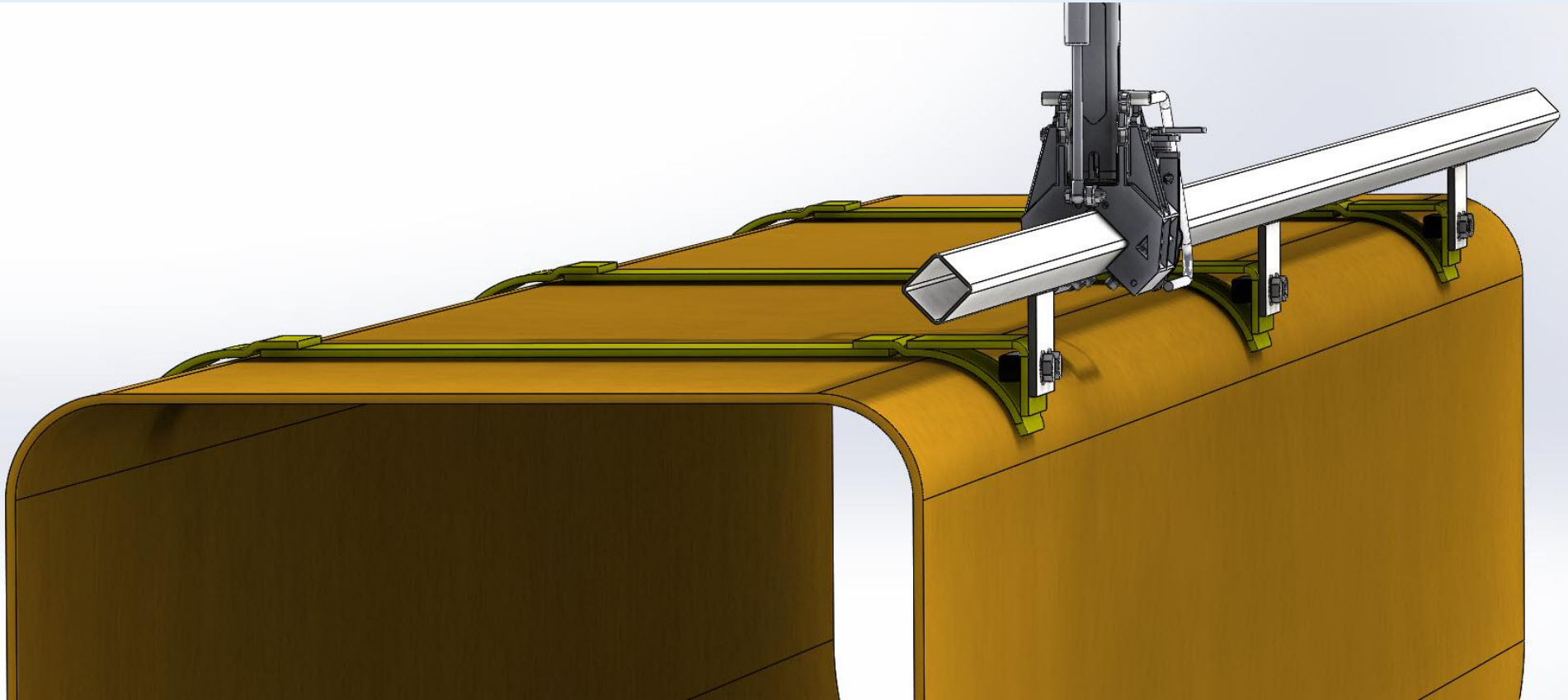
## Lattice Crane Lacing Mount – Folding Unit / View 2



## LOW PROFILE ADHESIVE MOUNT – Plug Weld on-site

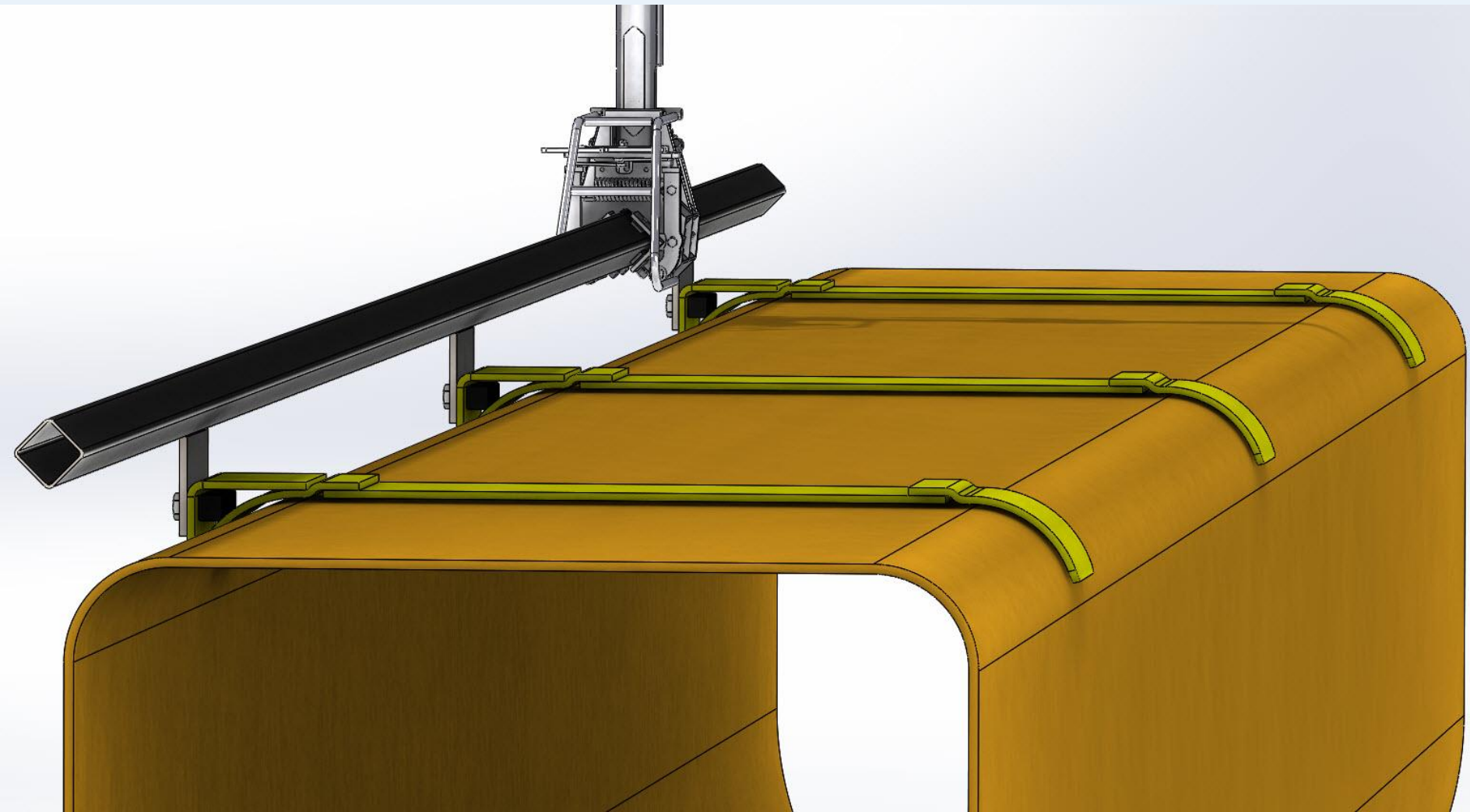


## LOW PROFILE ADHESIVE MOUNT – Plug Weld

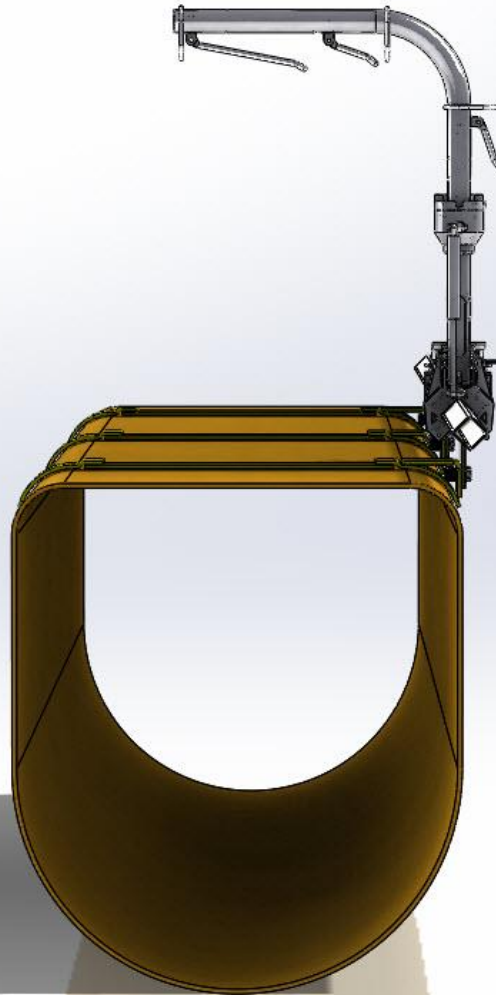


## LOW PROFILE ADHESIVE MOUNT – Plug Weld

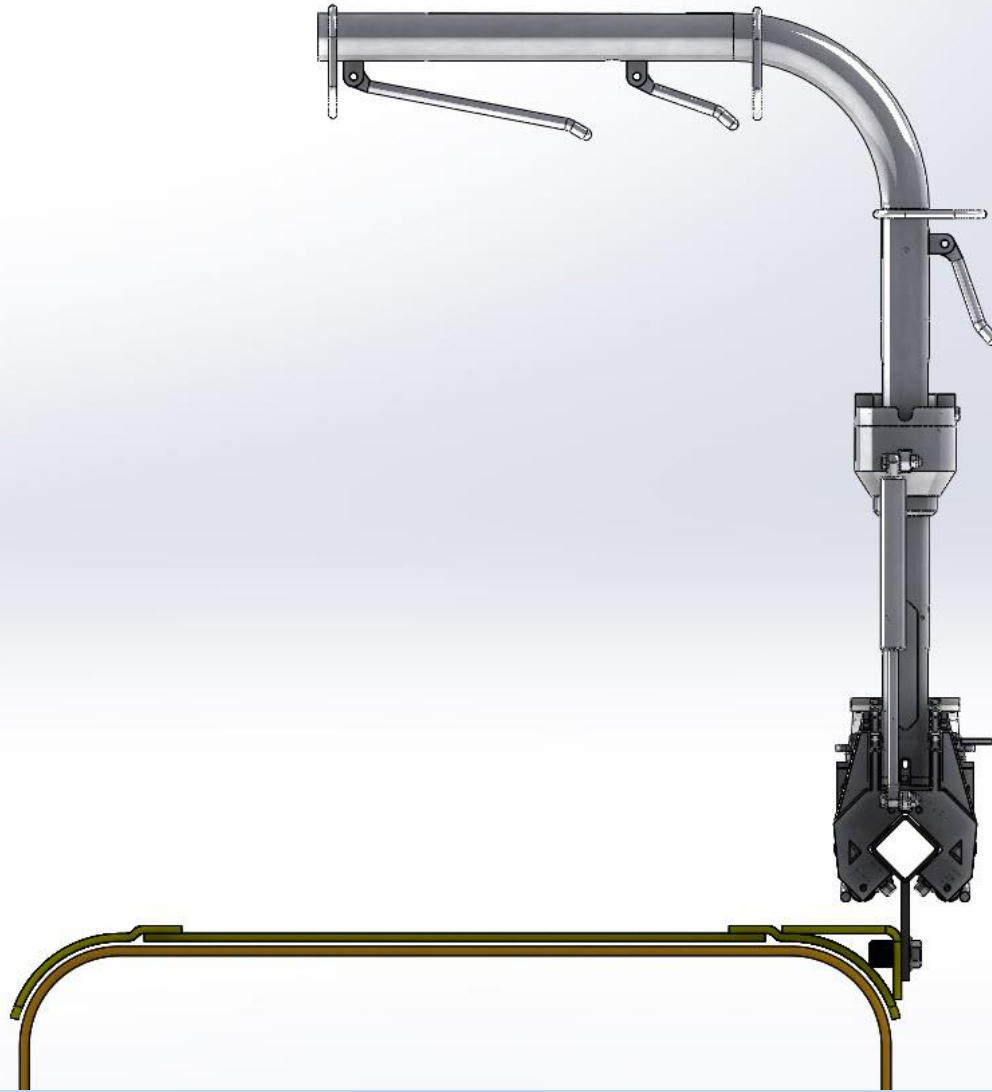




## LOW PROFILE ADHESIVE MOUNT – Plug Weld

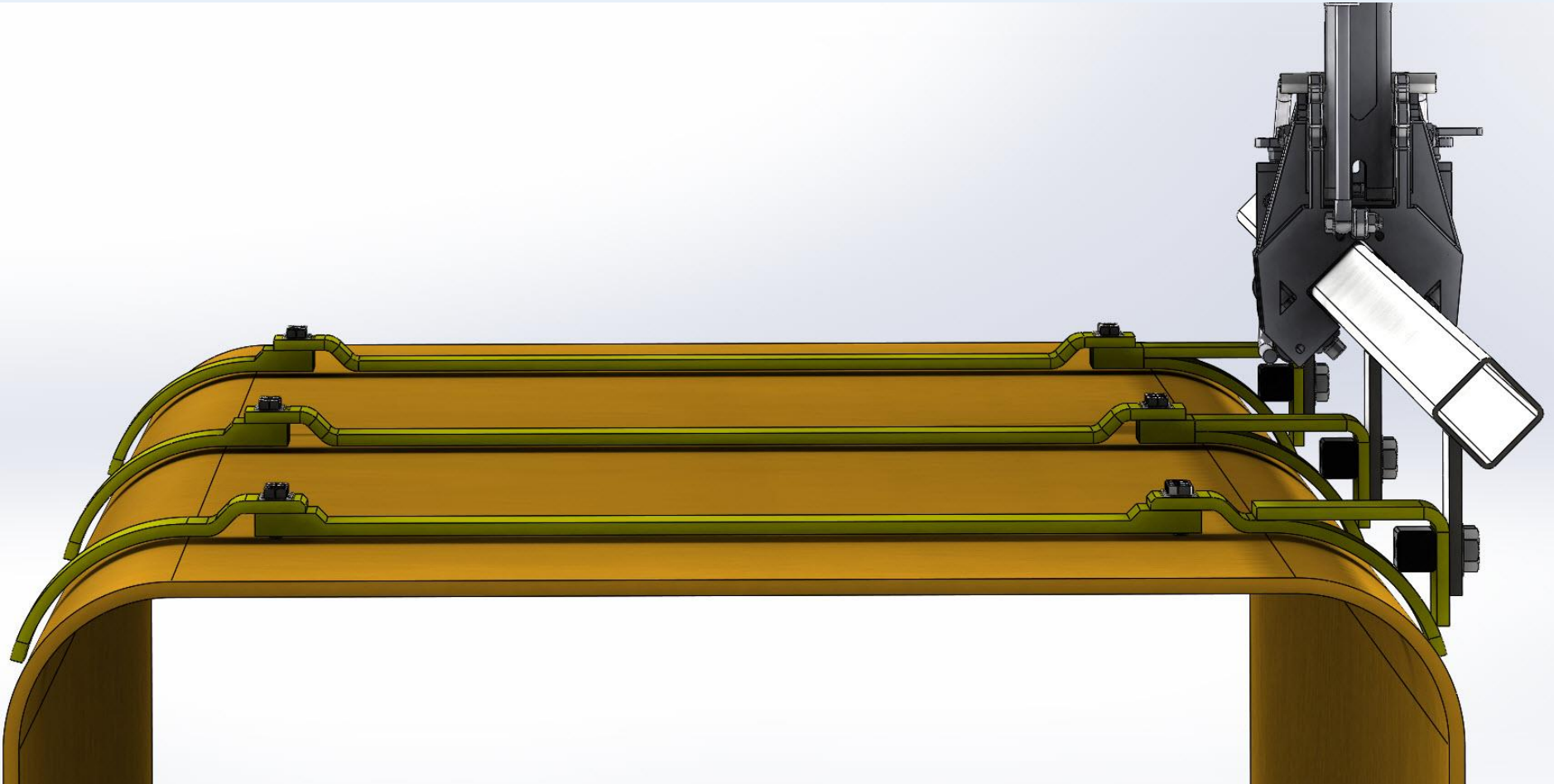


## LOW PROFILE ADHESIVE MOUNT – Plug Weld



## LOW PROFILE ADHESIVE MOUNT –Plug Weld In Field

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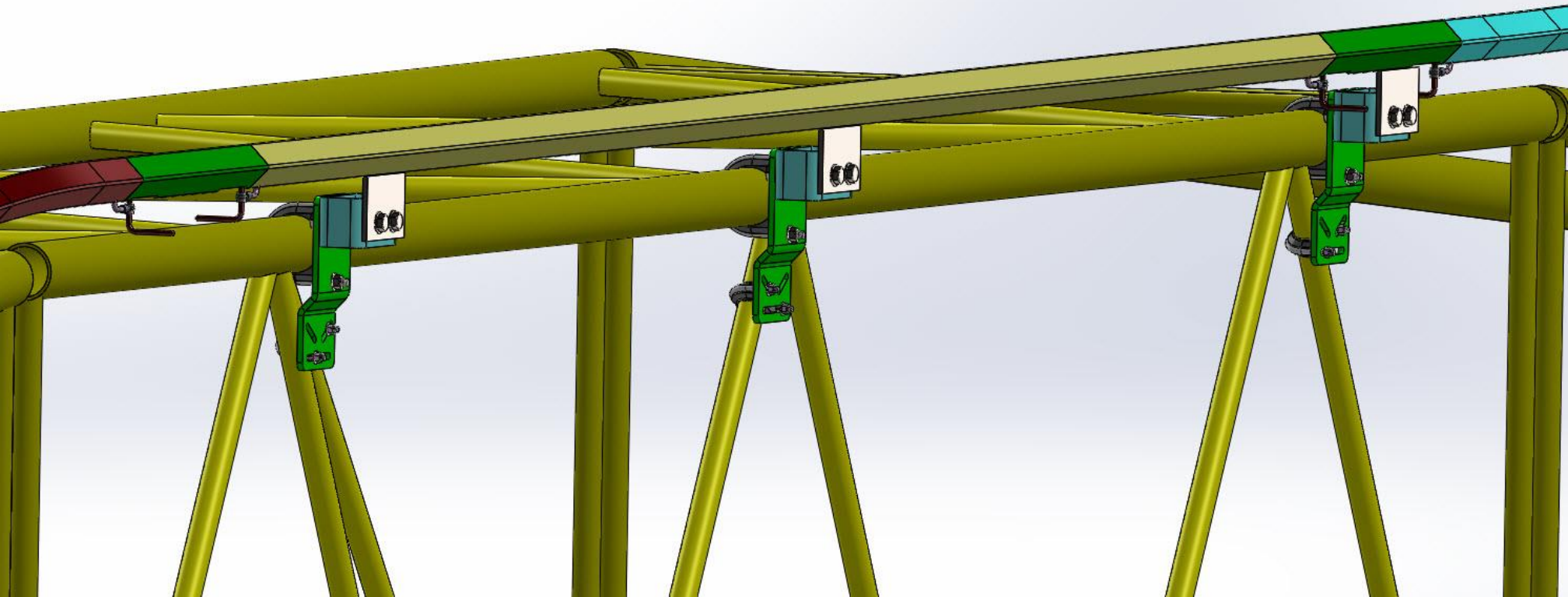


## LOW PROFILE ADHESIVE MOUNT-Bolted Version

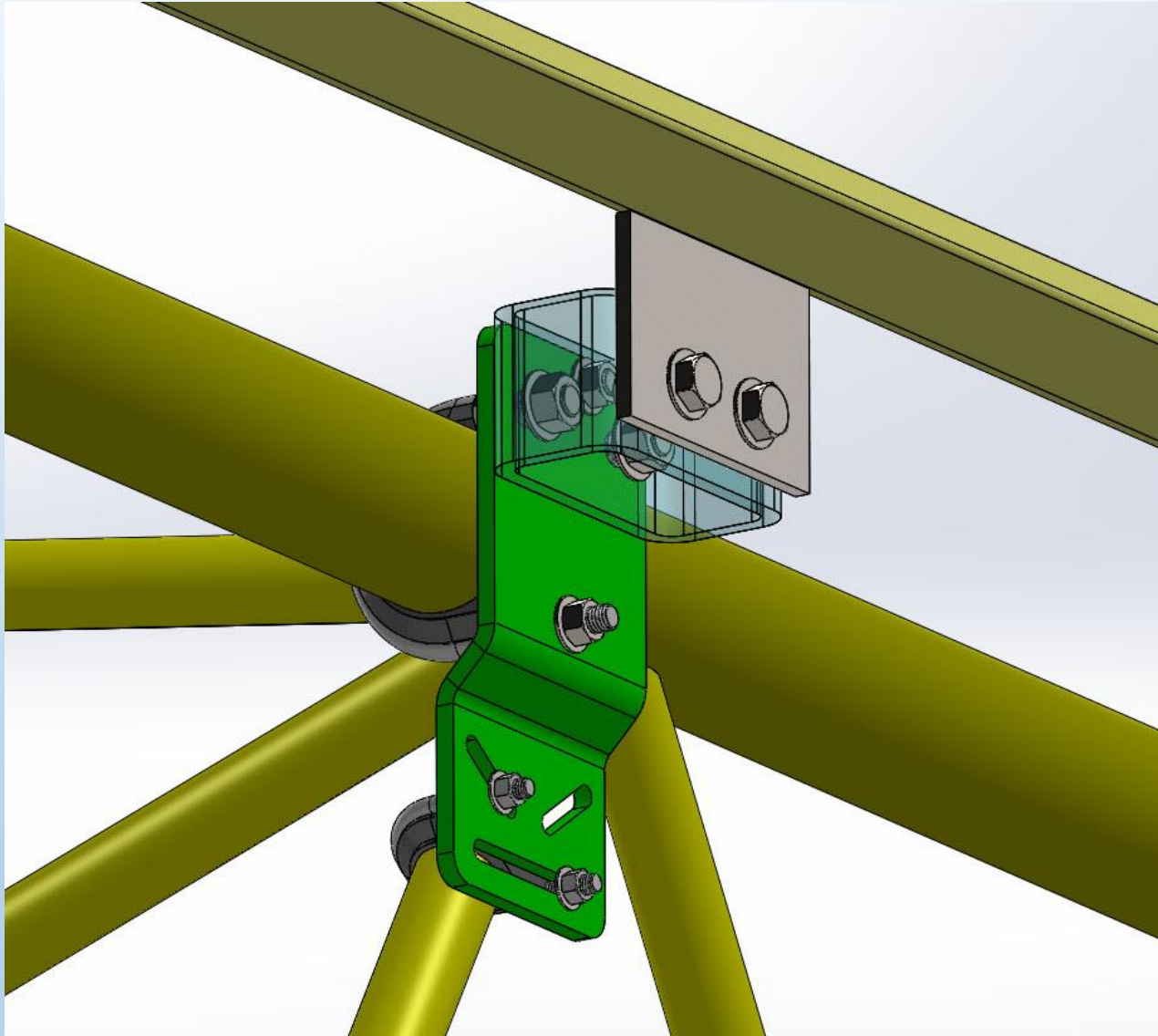


## Finished Adhesive Mount Rail

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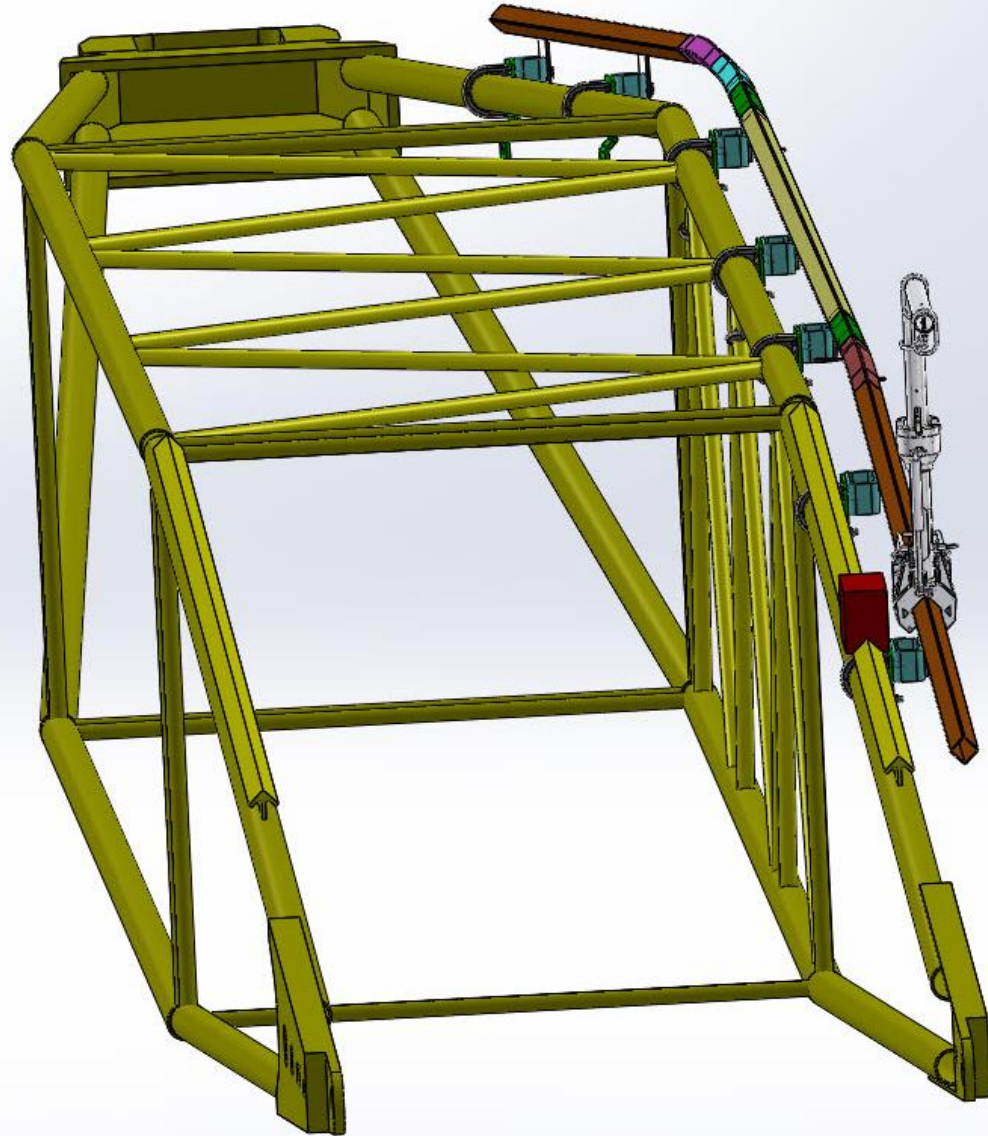


## FRPD ISO VIEW CLOSE UP 2014-3-25



## FRPD LWR ISO VIEW CLOSE UP 2014-3-25

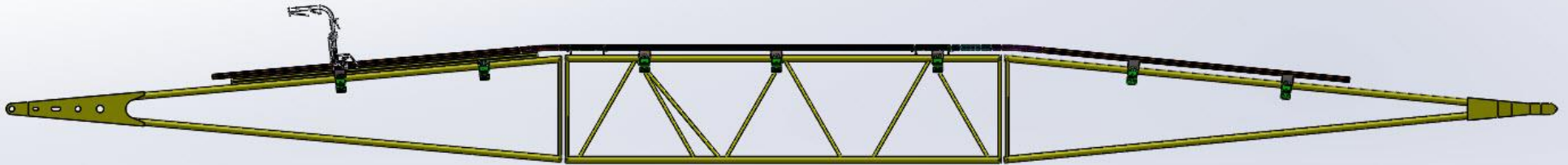
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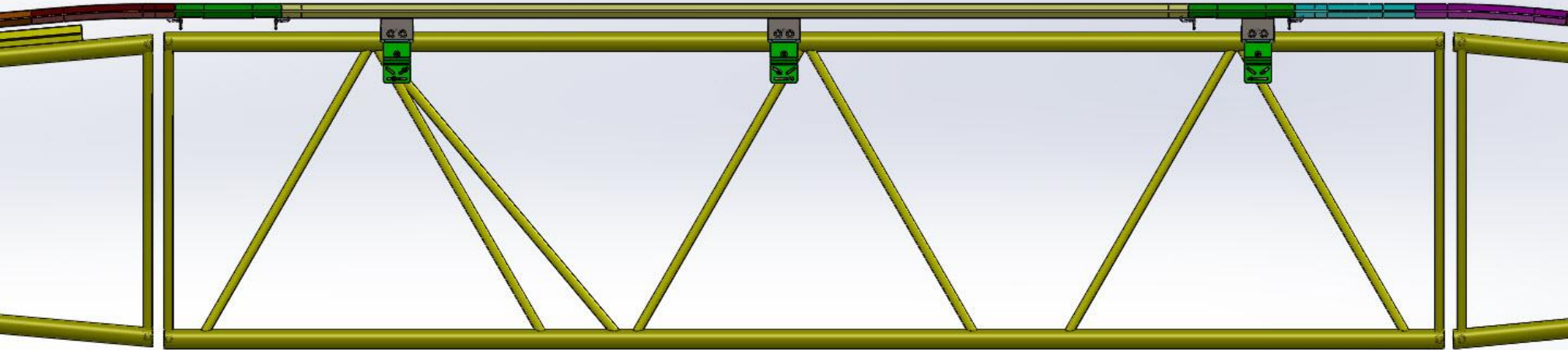
## FRPD REAR ISO VIEW 2014-3-25

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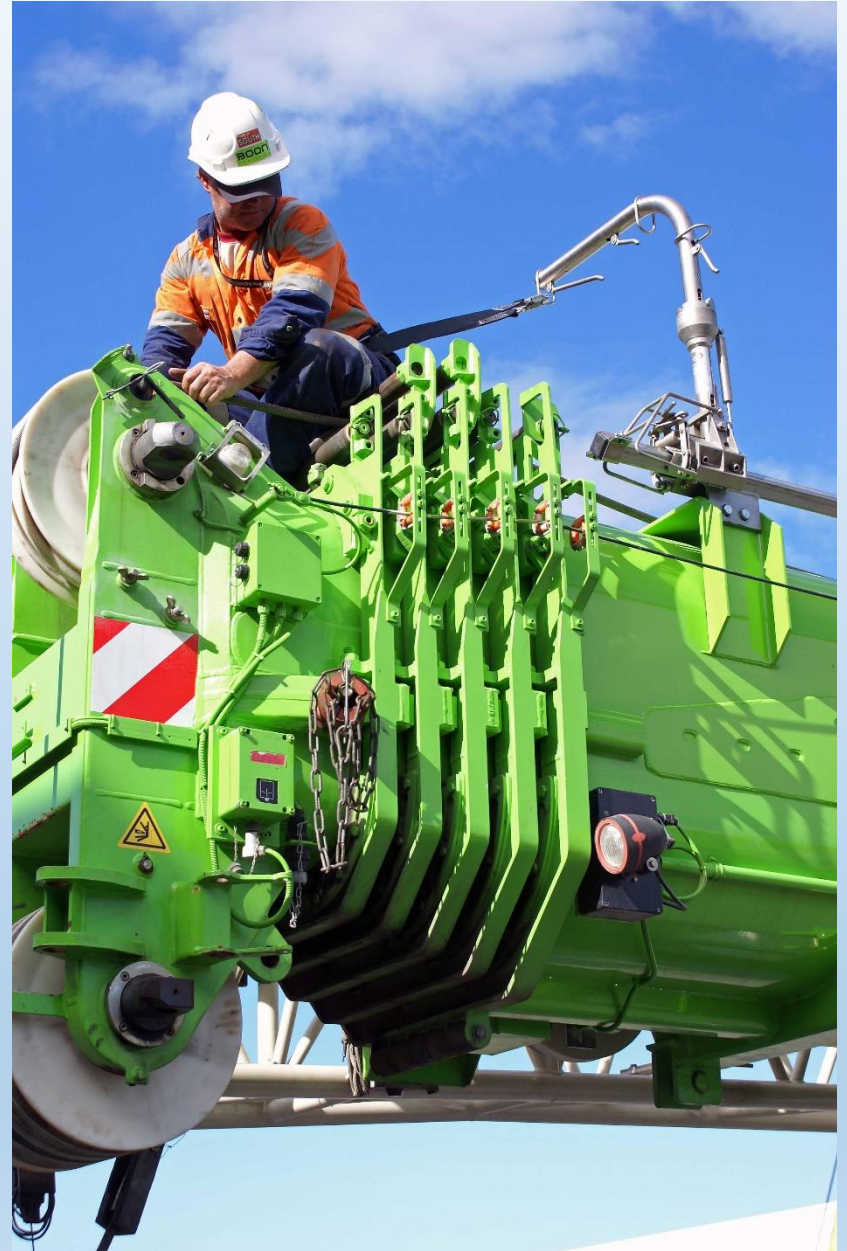
## FRPD SIDE VIEW 2014-3-25



## FRPD SIDE VIEW CLOSE UP 2014-3-25



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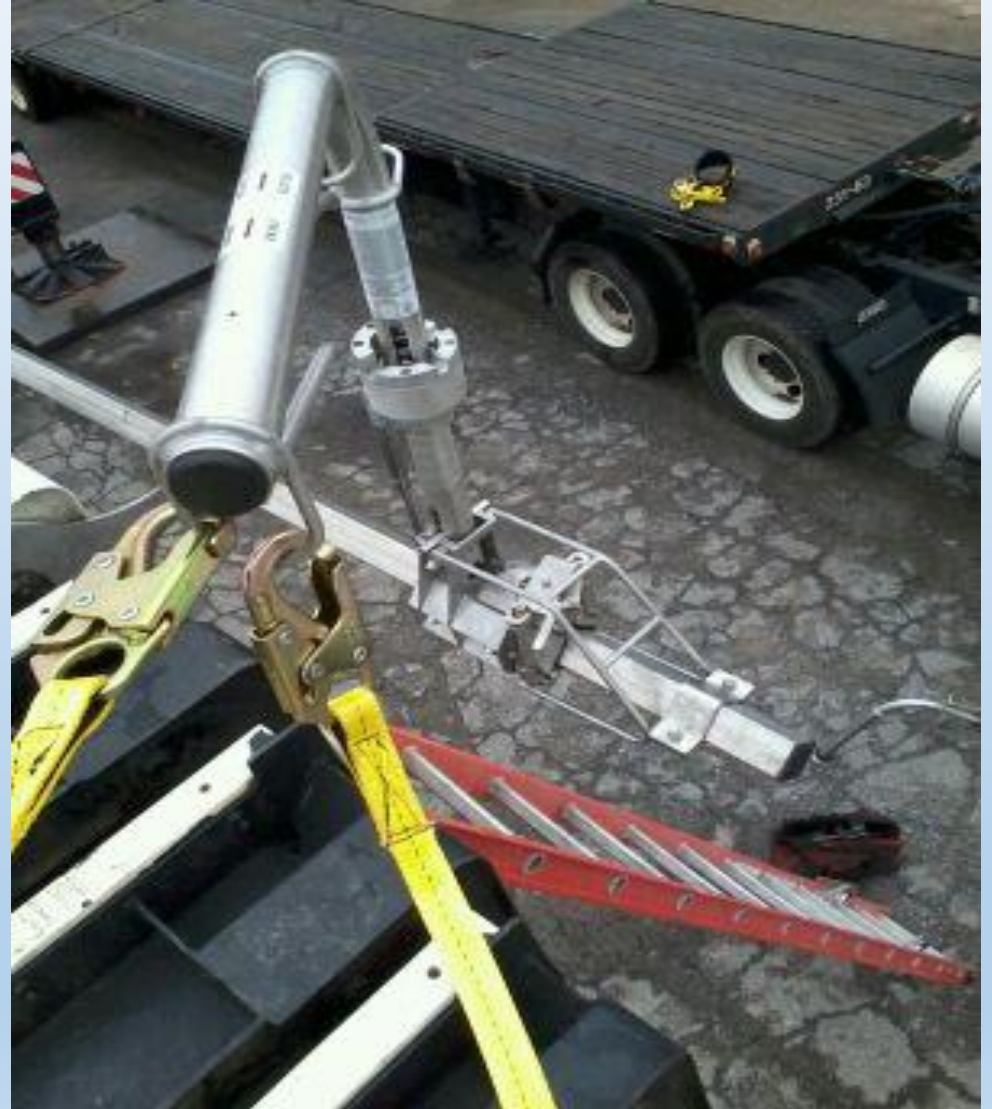


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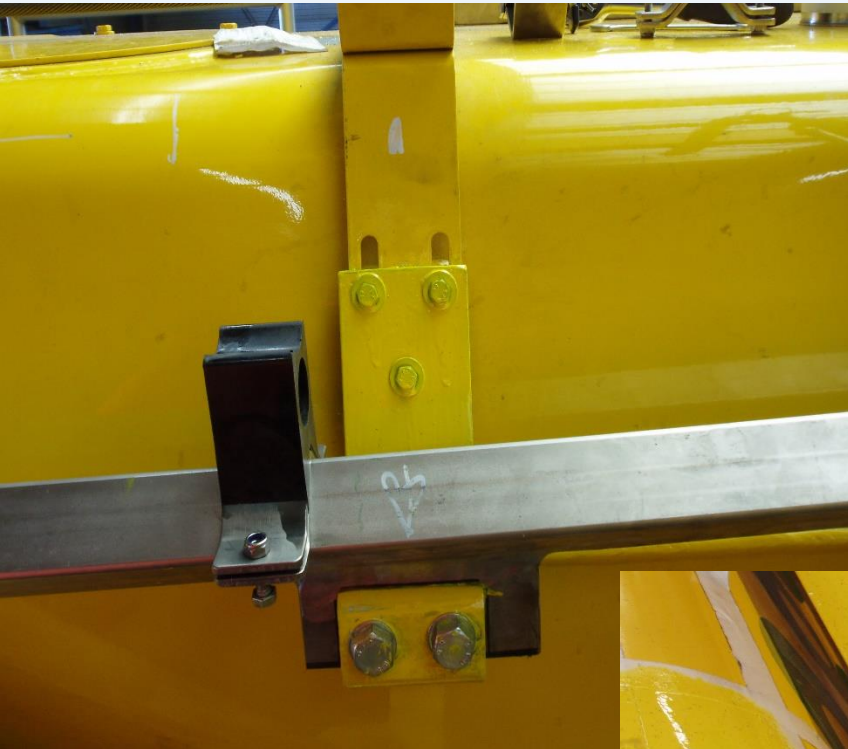


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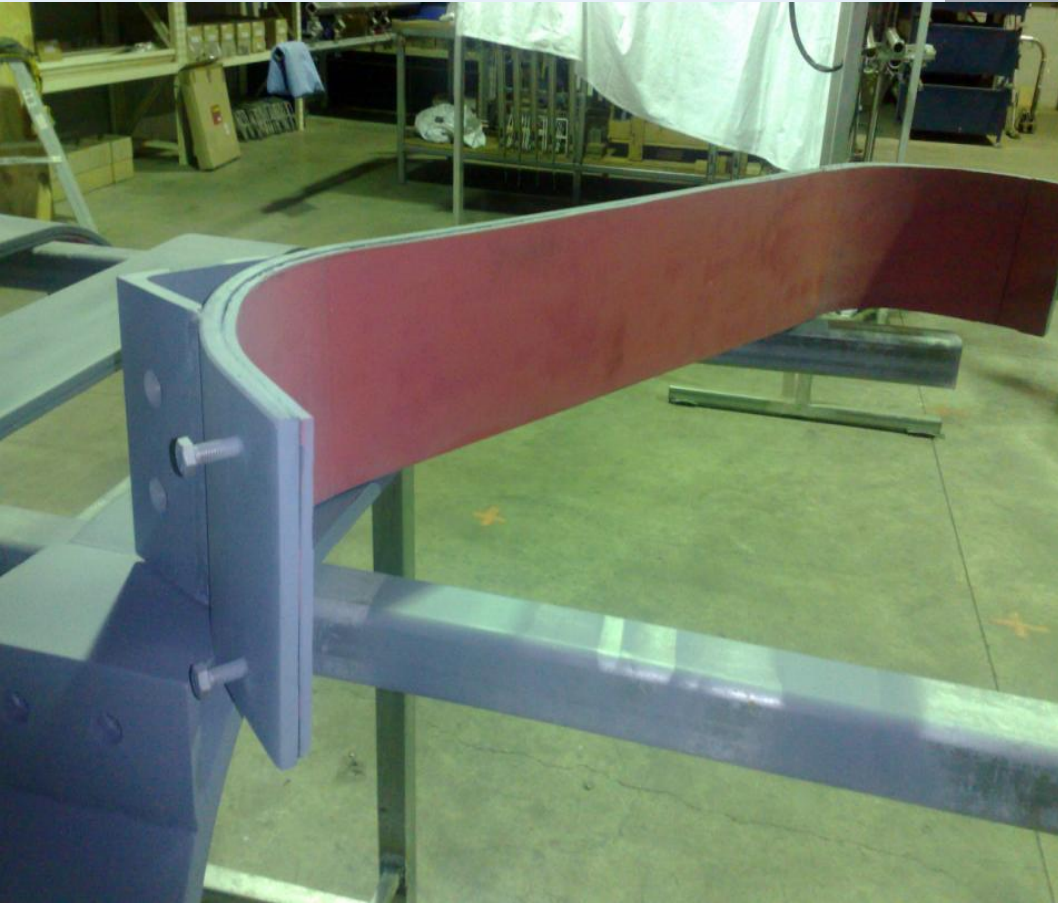


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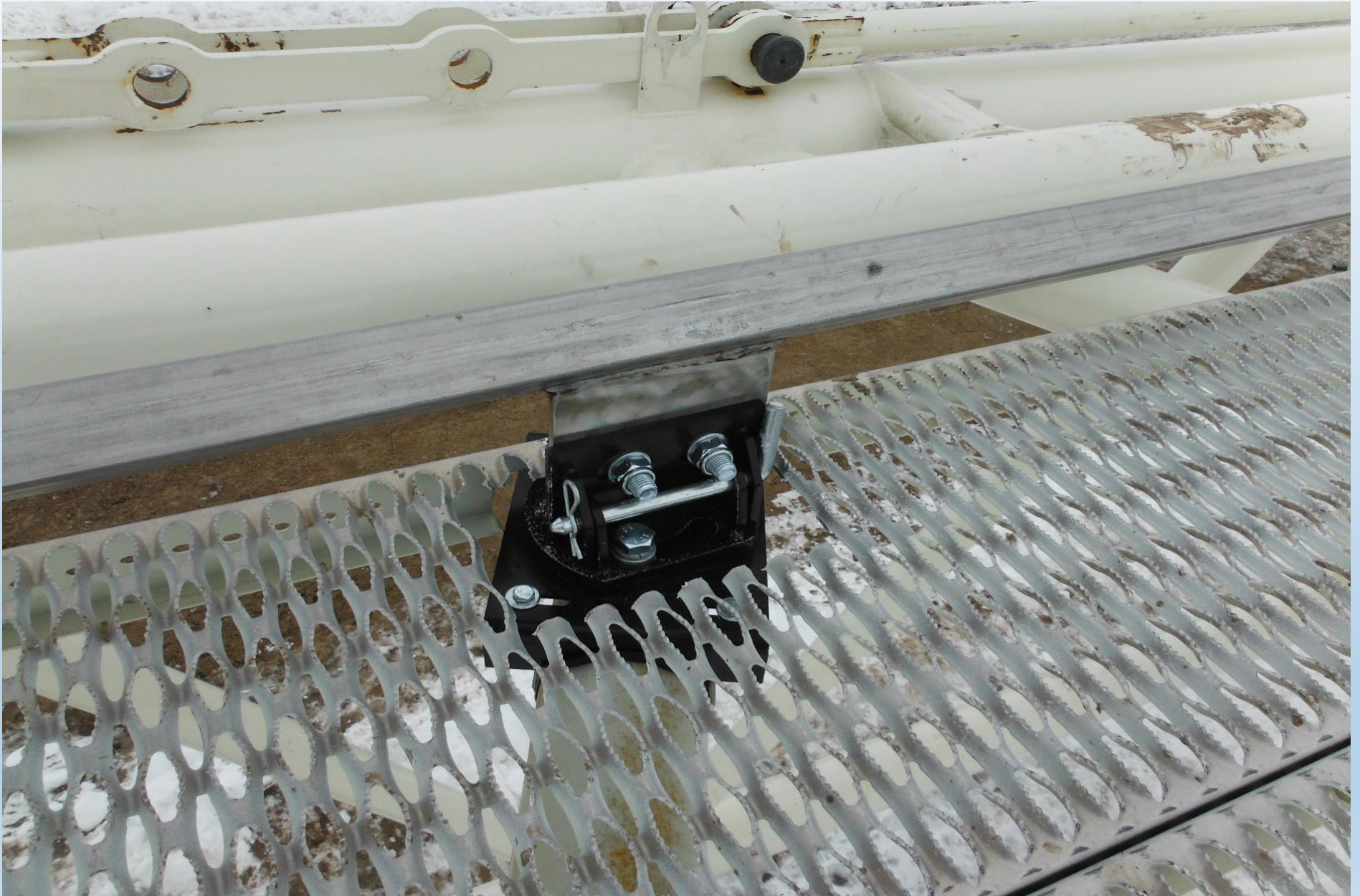
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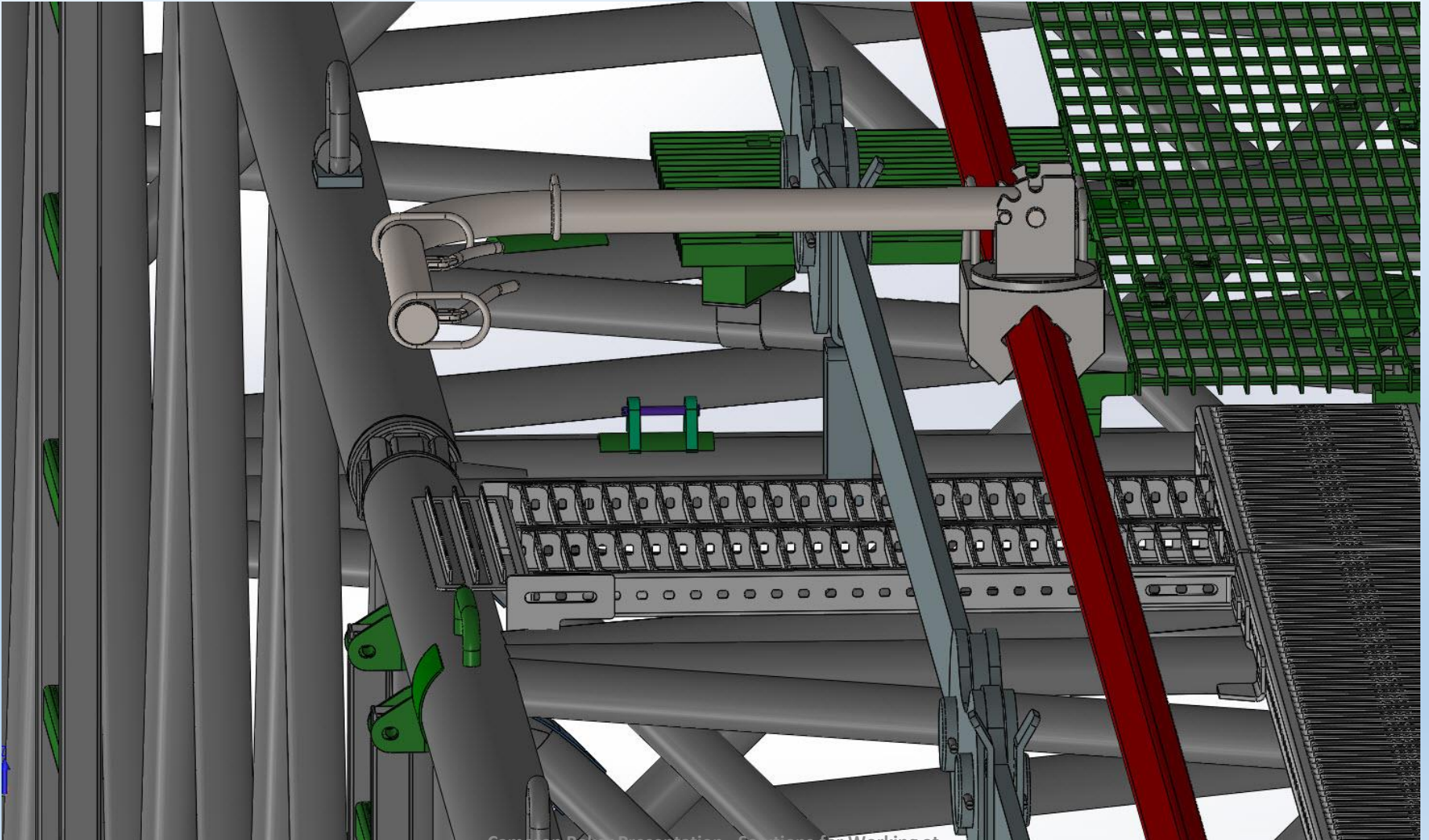
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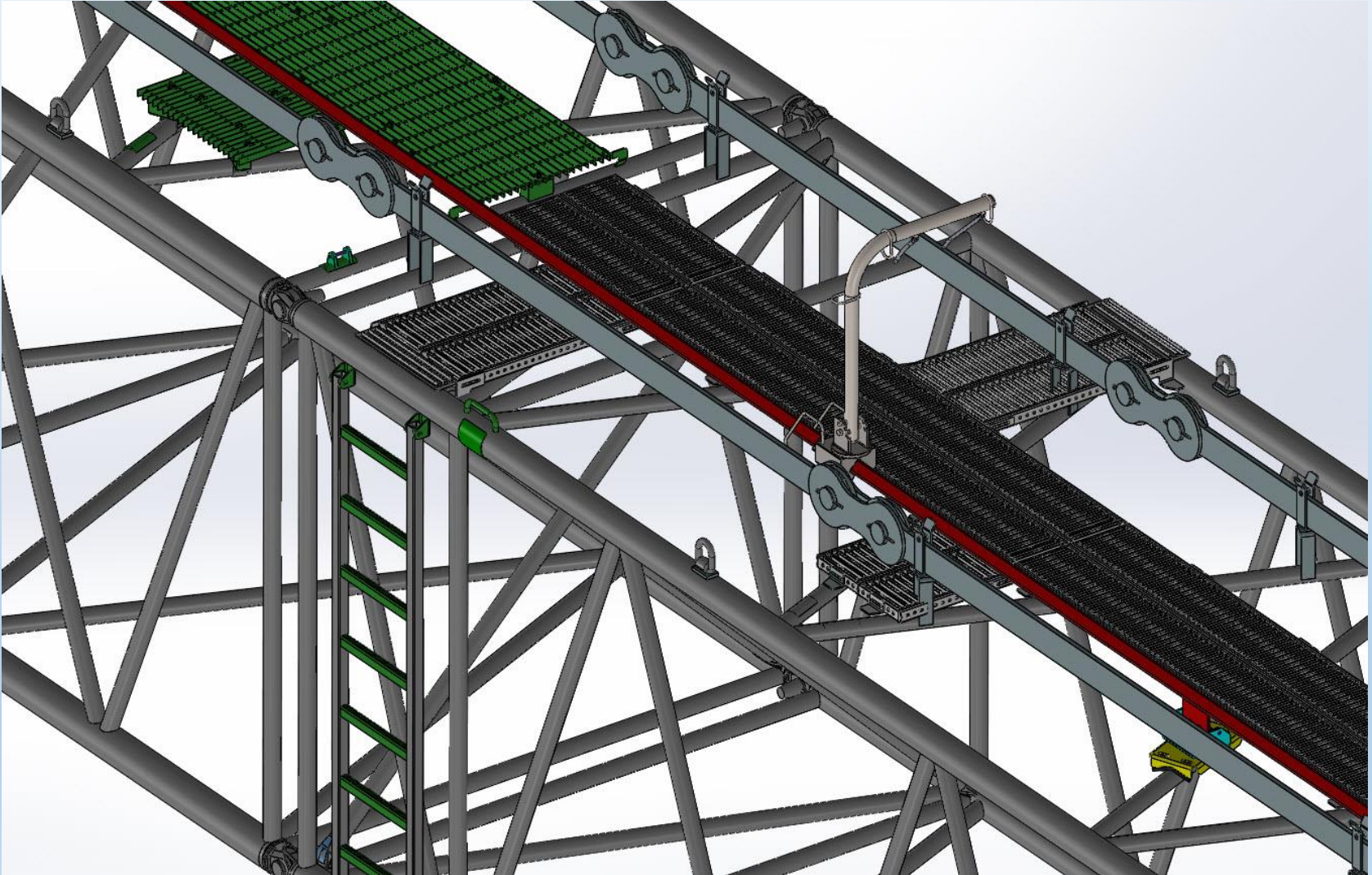
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# LADDER ISO VIEW 1



# WALKWAY ISO VIEW TRAM SQUARE







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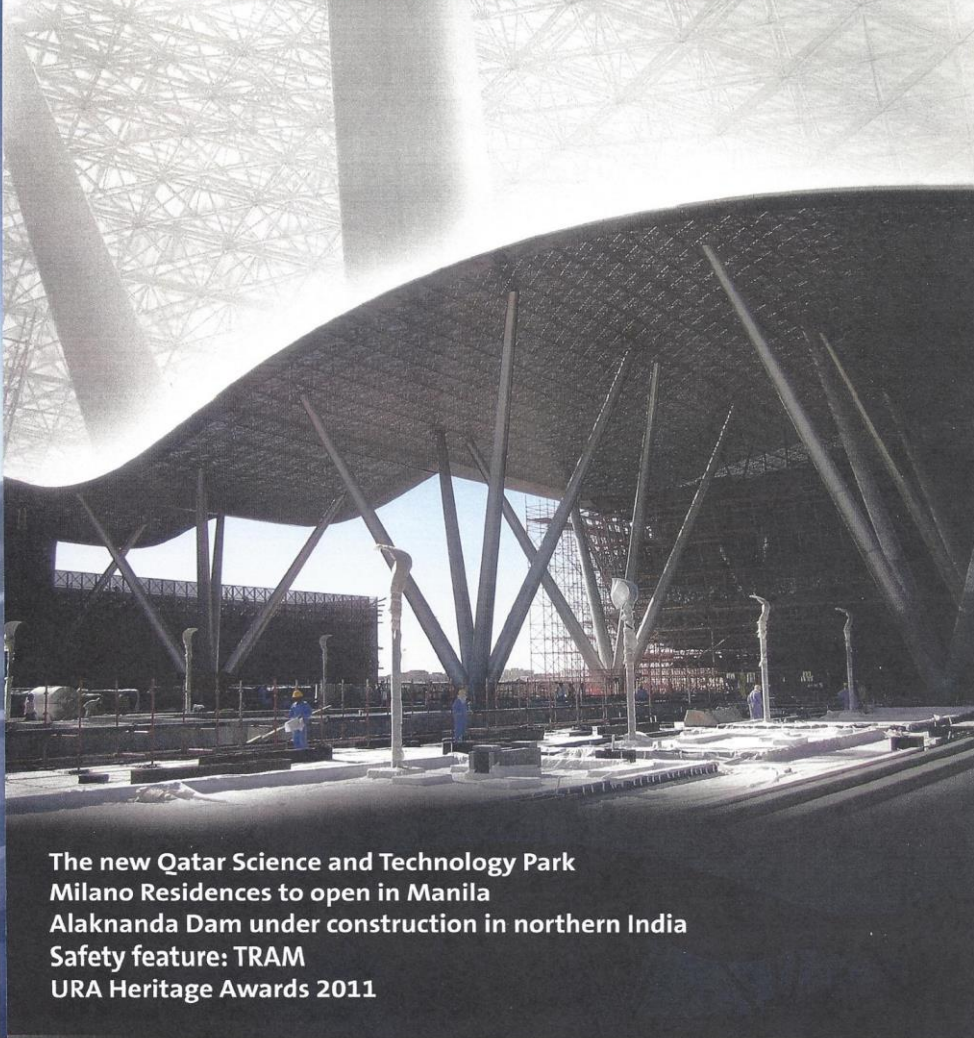


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• S O U T H E A S T • A S I A •  
**CONSTRUCTION**



The new Qatar Science and Technology Park  
Milano Residences to open in Manila  
Alaknanda Dam under construction in northern India  
Safety feature: TRAM  
URA Heritage Awards 2011

## TRAM-MING AROUND THE WORLD



New Zealand Crane Group is installing TRAM to every all terrain crane in its fleet above 80 t capacity.

**T**RAM (Travel Restraint Access Module), produced by Chicago-based Standfast Corporation, enables users to walk on top of the crane boom with absolutely no risk of falling. The user has a double lanyard that clips onto a moveable handlebar at waist height. The handle is fixed at foot level to a rail along the length of the boom. By tying off at waist level rather than foot level, TRAM users have no distance to fall in the event of a slip or trip, and still have total freedom to do their work.

The handle, or arm, rotates 180 deg to aid manoeuvrability and to allow the arm to fold down for storage when not in use. As the user climbs up the side of the crane, he or she clips the lanyard onto the arm. Squeezing the hand brake releases an air-powered spring that pushes the arm gently but firmly to vertical, helping the user climb up and over onto the top of the boom. Similar assistance is given in descent. A deadman's brake prevents the arm moving along the rail unless the hand brake is squeezed.

TRAM was originally developed for worker safety on bulk liquid tankers but has now been refined for cranes after several pilot installations in Europe and Australia have proved the concept. The product is becoming an increasingly popular way to improve safety on cranes around the world.

### New Zealand takes the lead

The New Zealand Crane Group is installing TRAM to every all terrain crane in its fleet above 80 t capacity - the first company in the world to commit to such a full-scale programme across its entire fleet. According to NZ Crane managing director Deane Manley, crane workers had been taking too many risks for too long when pinning jibs onto booms. "It has been standard industry practice for years to climb on top of booms without adequate fall protection, but this has just got to stop. It is clearly hazardous but no one seemed to know of a better way before. At 4-m above the ground, a fall from that height is enough to kill someone. When we found out about TRAM it was clear that ignorance was no longer an excuse."

Most of the company's cranes are Grove brands. The first two machines that were recently fitted with TRAM were a GMK 5170 and a GMK 4100. The company has ordered a further 10 TRAM units to be fitted to its other cranes before December this year.

For the first installations, TRAM Australia Pacific, Standfast's agent in the region, worked closely with long-standing Grove distributor Tidd Ross Todd (TRT) and NZ Crane to produce a methodology for fixing the rail to the booms. The precise method for





fixing the rail to the boom can be different for each crane type, depending on such diverse features as the location of rope retainers and angle of tilt of the cab.

Previous TRAM installations have seen the rail welded or handed on the boom. TRT engineering director Robert Carden proposed a chemical bonding solution instead, where the brackets that hold the rail are bonded to the boom by pressure injecting an epoxy resin into the joint. "We have used this method for the past six years to bond the fiberglass insert into our steel booms for live-line aerial platforms. We have also used it to bond the trailing boom trailer mast mounts under the boom of a GMK 4100 and GMK 5130-1."

TRAM Australia Pacific director Martin Jones designed a bracket that forms to the contour of the boom and laps over each side of the boom at the top, to resist shear forces. "Grove have been very helpful in supplying me with drawings of their boom profiles. This allowed me to manufacture brackets more easily knowing that they fit perfectly."

The bonding process has been designed and tested to AS/NZS 1891.4: 2009 Industrial Fall Arrest Systems and Devices – Selection Use and Maintenance, and certified to equivalent international standards. The TRAM unit itself is also independently certified as meeting all relevant international standards.

While welding and strapping have both worked perfectly well on other installations, Mr Jones believed that bonding has the benefit of looking very neat. The requirement for overnight curing adds to the installation time and there was an additional cost to the first two units simply because they were the first, but costs are expected to reduce rapidly.

With the methodology in place, tested and proven, Mr Manley said that NZ Crane and TRT will do the remainder of the installations themselves.

The two Groves with TRAMs already fitted are now back at work on the North Island grid update project, a NZ\$230 million project to build a new 400 kV power transmission line from Whakamaru to Auckland. NZ Crane's customer here is BBUG, a joint venture of Balfour Beatty and United Group.

For Mr Manley, the benefits of TRAM go beyond being able to sleep at night knowing that his workers are more likely to get home alive. There are also commercial rewards. It helps to position the company as likely supplier of choice for any customer like BBUG that takes safety seriously. And it has been a key component of a safety programme that has secured a 20 percent discount on insurance premiums for the



Above: The precise method for fixing the rail to the boom can be different for each crane type, depending on such diverse features as the location of rope retainers and angle of tilt of the cab.

Below: AmQuip has become the first crane rental company in North America to fit TRAM to its cranes.



country's mandatory Accident Compensation Corporation (ACC) scheme. "It's a no brainer. The only reason why you wouldn't fit TRAM is because you are too miserable."

#### Entering North American rental market

AmQuip has become the first crane rental company in North America to fit TRAM to its cranes. The company is initially targeting its largest telescopic boom cranes, where workers need access to the top of the crane to assemble attachments.

"We have identified 20 of our largest all-terrains as a priority for TRAM," said

AmQuip VP for Risk Management, Jeff Hammons. "We take safety seriously and most of our business is with customers who are equally safety sensitive. Neither AmQuip nor its customers can accept employees being unprotected on top of cranes any longer. TRAM provides a safe and convenient solution while still meeting compliance with OSHA's new Crane and Derrick standard, 1926.1400."

The first AmQuip units to be fitted with TRAM are four of its Grove GMK 7550 cranes, including two that have Grove's Mega Wing attachments. The first installation was completed mid-August. The next three

## SAFETY FEATURE



AmQuip has identified 20 of its largest all-terrains as a priority for TRAM.

installations will be completed by the end of September. The GMK 7550 is a 550 US (450 t) capacity telescopic crane with a five-section, 60 m main boom and jib extensions up to 73 m.

Ascent and descent is often the riskiest part of working at height. TRAM makes this not just safer but easier too. As the user climbs up the side of the crane, he or she clips the lanyard onto the handle. Squeezing the hand brake releases an air-powered spring that pushes the arm gently but firmly to vertical, helping the user climb up and over onto the top of the boom. Similar assistance is given in descent. A deadman's brake prevents the arm from moving along the rail unless the hand brake is squeezed.

"We spent a long time researching ways to assemble large cranes in a safer way," said Mr Hammons. "When we discovered TRAM, it was a clear choice not just because it is so effective, but because it is also convenient and very easy to use."

"I have found, in my 20-plus years providing safety and risk management services, that if something is not convenient and comfortable, people won't use it. TRAM meets all our criteria. It allows the employees to go about their work at their normal pace with no impediment – it prevents them from falling, and it stows away when it is not in use."

AmQuip Crane Rental LLC is a leading US crane rental company, serving the Northeast, Mid-Atlantic region, and most Midwest and Southern states.

#### Global move

Standfast has now retrofitted TRAM in Europe and Australia to several sizes and makes of both telescopic and lattice boom mobile cranes from 60 up to 600 t capacity upwards, as well as on gantry

installations, depending on the design of the crane. However, with growing demand from crane owners worldwide, Standfast has now developed, refined and standardised its methodology for either welding, banding or bonding TRAM rails to most crane types.

Crane owners that have already installed TRAM systems include Australian hire companies Boom Logistics and Hanchard Cranes; wind power company Suzlon Energy Australia; New Zealand Crane Group; Ainscough Crane Hire of the UK; and Royal Saan of the Netherlands.

As well as providing crane owners with a retrofit safety solution, Standfast supplies TRAM systems to Terex Cranes for fitment on original equipment. Terex offers TRAM as a recommended option on its larger all terrain cranes and has been recently specified by several Terex customers including King Lifting in the UK.

Standfast is also in discussions with other OEM manufacturers that are under pressure from customers to develop improved height safety measures that are both practical and affordable.

"The TRAM fall restraint system has attracted a lot of interest from crane owners and manufacturer alike. Safety authorities all over the world are really tightening up on working at height since falls are the biggest cause of industrial accidents. They are pressuring major contractors to raise their game in eliminating fall risk," said Standfast CEO Cameron Baker. "Producing a system that offers riggers safety while still giving them the freedom to do their work seems to have been quite a challenge for the crane industry. Fall arrest systems that leave guys dangling in the air and risking shock trauma are clearly inadequate. Fall restraint systems like TRAM that prevent falls in the first place are a far better approach." ■