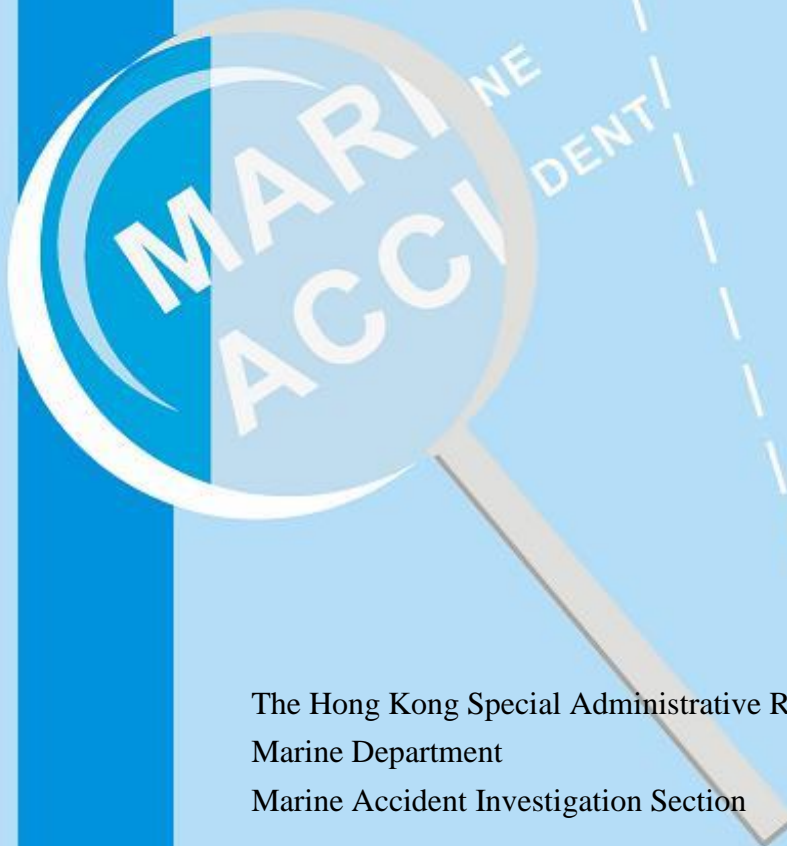




**Report of Investigation  
into the injury of a crew  
on board Hong Kong  
Registered Ship  
“BREVIK BRIDGE” in  
Singapore on 30 August  
2015.**



The Hong Kong Special Administrative Region  
Marine Department  
Marine Accident Investigation Section

29 August 2016

## **Purpose of Investigation**

This incident is investigated in accordance with the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (the Casualty Investigation Code) adopted by IMO Resolution MSC.255(84).

The purpose of this investigation conducted by the Marine Accident Investigation and Shipping Security Policy Branch (MAISSPB) of Marine Department, in pursuant to the Merchant Shipping Ordinance Cap. 281, the Merchant Shipping (Safety) Ordinance (Cap. 369), the Shipping and Port Control Ordinance (Cap. 313), or the Merchant Shipping (Local Vessels) Ordinance (Cap. 548), as appropriate, is to determine the circumstances and the causes of the incident with the aim of improving the safety of life at sea and avoiding similar incident in future.

The conclusions drawn in this report aim to identify the different factors contributing to the incident. They are not intended to apportion blame or liability towards any particular organization or individual except so far as necessary to achieve the said purpose.

The MAISSPB has no involvement in any prosecution or disciplinary action that may be taken by the Marine Department resulting from this incident.

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## 1. Summary

- 1.1 At 1545 on 30 August 2015, a fitter joined the Hong Kong registered container carrier “BREVIK BRIDGE” (the *vessel*) at Pasir Pajang Container Terminal, Singapore. Two hours later the fitter was seriously injured by a hook block of a monorail transverse hoist that suddenly dropped down from a height of 7 meters when he stood underneath the hoist.
- 1.2 When crew members including the fitter were working on receiving provision stores by the hoist, the hook block of the hoist suddenly failed to respond to the hoisting command from the remote controller. Two electricians (Electrician A and Electrician B) on board on that day were summoned to examine the hoist. However, safety precaution was not established in planned manner among the crew members throughout the repair work. When the accident happened, the fitter did not follow others to stay away from the hoist.
- 1.3 During the process of trouble shooting, Electrician A hoisted up the hook block by repeatedly pressing the “Up” button on the local controller. When the hook block was about to enter the parking socket within the frames on the monorail, the hoist wire parted suddenly.
- 1.4 As a result, the hook block dropped and knocked on the fitter. The fitter was seriously injured in unconscious state with serious bleeding. An ambulance was called by the master and the fitter was sent to a local hospital immediately. After surgery and intensive care, the fitter’s condition was stabilized and made recovery.
- 1.5 The investigation had identified the following contributory factors to this accident:
  - a) due to twisting residual within the hoist wire, the hook block was not aligned with the opening between the frames on the monorail resulting in the hook block snagged onto the frames before reaching the designed parking socket. The repeatedly winching up action generated enormous stress and parted the hoist wire;
  - b) lack of planning and supervision to the repair work; and
  - c) the fitter failed to stay away from the dangerous zone underneath the hoist.
- 1.6 The investigation also reveals the following safety factors:
  - a) lack of supervision to confirm the routine maintenance being done properly, as a safety device of the hoist was found seized up by bulky composite resin paint that was caused by negligence during routine maintenance; and
  - b) the crew did not receive sufficient training and familiarization in using the hoist.

## 2. Description of the vessel

### 2.1 Particulars of “BREVIK BRIDGE”

Port of Registry	:	Hong Kong
IMO Number	:	9492696
Official Number	:	HK-2976
Call Sign	:	VRHY7
Classification Society	:	Det Norske Veritas
Type of Ship	:	Container Carrier
Keel Laid	:	02 July 2010
Built At	:	Samsung Heavy Industries Co Ltd, Geoje, South Korea.
Ship Owner	:	Xiangcheng Shanghai Ship
Ship Manager	:	Seaspan Ship Management
Length	:	254.3 metres
Breadth	:	35 metres
Depth	:	19.5 metres
Gross Tonnage	:	46,444
Net Tonnage	:	20,191
Deadweight	:	58,200 tonnes
Main Engine	:	one set of Hyundai MAN B&W 7K 98ME-7 Engine
Engine Power	:	43,610 kW
No. of Crew	:	26



Fig 1: M.V. " BREVIK BRIDGE"

### **3. Sources of Evidence**

- a) The statements of the master, officers and the crew of the *vessel*
- b) Information provided by the Ship Management of the *vessel*

#### 4. Outline of Events

(All times were local time GMT + 8 hours)

- 4.1 At 1454 on 30 August 2015, the Hong Kong registered container carrier “BREVIK BRIDGE” (the *vessel*) arrived and berthed portside alongside pier no.7 at Pasir Pajang Container Terminal, Singapore for cargo operations.
- 4.2 At about 1545, new crew members including a fitter joined the *vessel*. The chief officer conducted safety familiarization training to the newly joined crew and briefed them to be aware of their duties and the safety equipment on board the *vessel*.
- 4.3 At about 1715, the newly joined fitter was called to help shifting the provision stores which were received on board by means of the ship’s monorail transverse hoist (the hoist) located just at the aft of the accommodation deckhouse (Fig.2). The hoist was provided with a lifting hook block on each side (i.e. portside and starboard side).
- 4.4 The portside hook block was used to lift the stores from the pier to the port side main deck. After the stores had accumulated to a certain amount on the port side main deck, it was decided to move the stores to starboard side in order that the remaining stores could be loaded on the deck. The bosun operated the starboard hook block. It was un-parked but not lowering down anymore.
- 4.5 When the bosun tried to operate the portside hook block again using the remote controller, it also failed to response. At about 1730, the bosun informed the duty officer and the chief engineer about the problem. Later on, Electrician A and Electrician B arrived on the scene to check the hoist.
- 4.6 When they found out that the remote controller of the hoist was in good working condition, they went up to the platform of the hoist to check the condition of the local controller and the control panel box of the hoist, which were located respectively at the forward and aft part of the platform.
- 4.7 Electrician A was testing the function of the local controller (Fig.6) while Electrician B was removing the canvas cover of the control panel box. Electrician A could lower down the portside hook block by about half a meter by operating the local controller. He then asked the bosun to rise up the portside hook block using the remote controller to see whether the hoist could be reset. However, the hook block still could not be operated by the remote controller. Electrician A then repeatedly and quickly pressed the “Up” button on the local controller and the hook block hoisted up quickly. At about 1820, when the hook block was about to reach its parking socket fitted within the frames on the monorail of the hoist, the steel wire of the hook block parted. The hook block dropped down from a height of about 7 meters and hit the fitter who was staying on the main deck underneath of the hook block (Fig.2, Fig.3 & Fig.4).

- 4.8 The fitter was seriously injured. He became unconscious and bled seriously. He was sent to a local hospital immediately for treatment. After surgery and under intensive care, his condition turned to stable and later was discharged from the hospital and repatriated home.

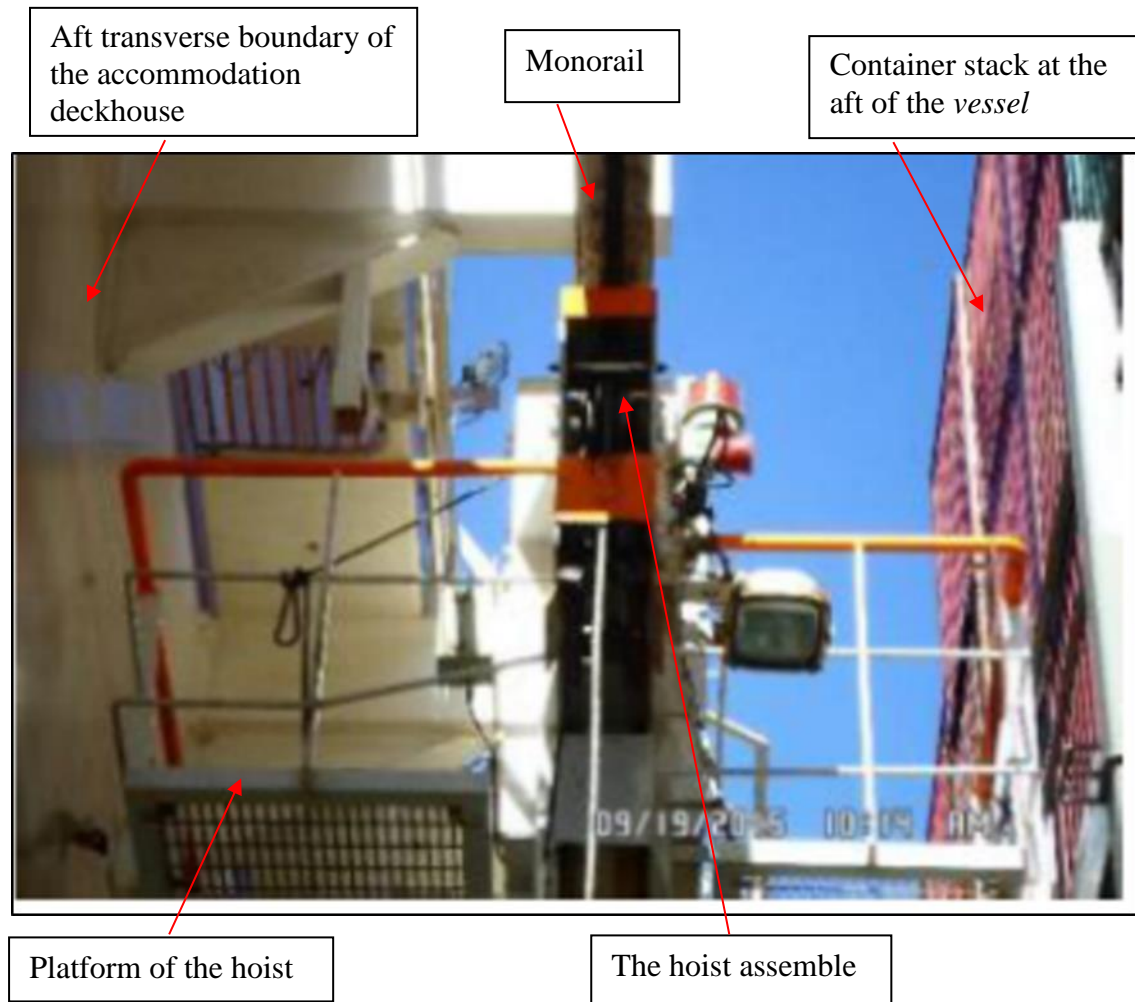


Fig.2- View beneath the monorail hoist (portside hook assemble but without hook)



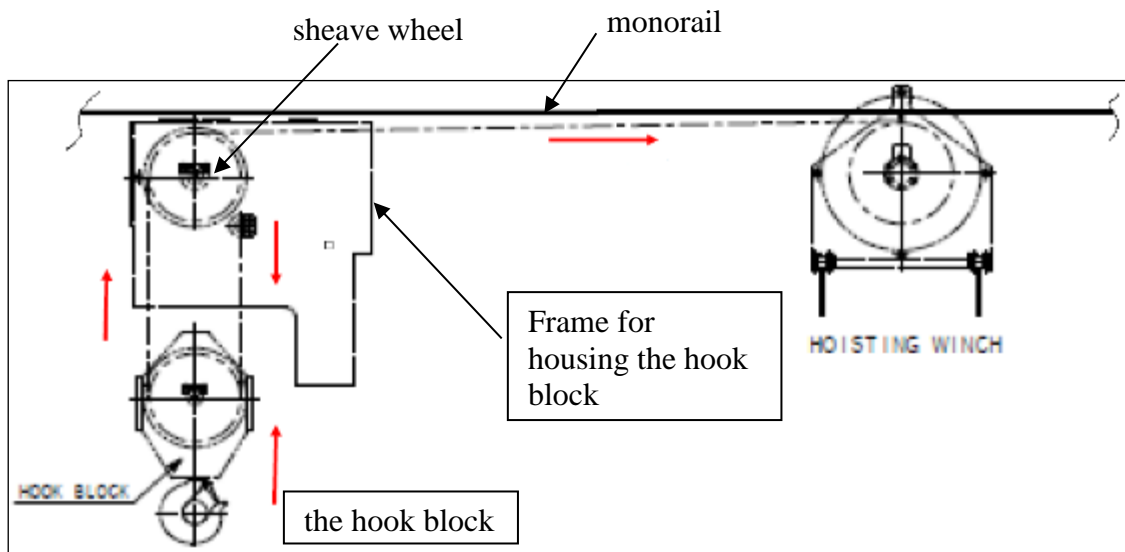


Fig.3- Arrangement of the monorail transverse hoist (portside hook)



Fig.4- The hook block fell down on the deck

## **5. Analysis**

### **Ship's manning and crew**

- 5.1 The *vessel* was manned by a total of 26 crew members of different nationality. The master, the chief officer and the chief engineer officer had served on board cargo ships for many years. All of them had valid and appropriate certificate of competency and Hong Kong license.
- 5.2 Electrician A joined the *vessel* at last port in Shekou, Mainland China on 25 August 2015. He had about four years of shipboard experience as an electrician. He did not hold any certificate in relation to his rank as electrician on board as it is not a mandatory requirement. During the voyage from Skekou, Mainland China to Singapore, Electrician A was carrying out shipboard familiarization training under the supervision of Electrician B, who would hand-over the duty to Electrician A in Singapore.
- 5.3 Electrician B had about seven years of shipboard experience as an electrician. He joined the *vessel* on 8 March 2015. He possessed a certificate of proficiency as able seafarer engine issued by the Republic of the Philippines.
- 5.4 The bosun had more than 20 years of shipboard experience. He joined the *vessel* on 08 May 2015.
- 5.5 The injured fitter had about 10 years of experience working on ships as a fitter. He did not hold any certificate.

### **Fatigue and alcohol and drugs abuse**

- 5.6 There was no evidence to show that any of crew members involved in the incident, suffered from fatigue at work. And alcohol and drugs abuse.

### **Weather and sea conditions**

- 5.7 At the time of the accident, the weather was fine with light breeze, ambient temperature about 29°C and slight swell at sea. The ship was berthed alongside pier without rolling.

### **The monorail transverse hoist**

5.8 The particulars of the hoist were as follows :

Maker	:	Dongnam Marine Crane Co., Ltd.
Type	:	Electric driven hoist
Model	:	ECS-1635-4S
Safe working load (SWL)	:	12.5 tons
Year of installation	:	Jan 2011
Certified by	:	DNV

5.9 The hoist had passed the annual inspection conducted by the Classification Society on 16 November 2014. The hoist had proper maintenance records and was maintained in accordance with the shipboard planned maintenance programme. The latest maintenance of the hoist before the accident was carried out on 29 July 2015 by the chief officer and Electrician B. All safety devices, steel wires and other components of the hoist were inspected and found satisfactory.

5.10 The hoist was provided with a lifting hook block on each side (i.e. portside and starboard side). Each hook block assembly weighed about 180kg. The hook block would only serve their respectively side of the *vessel*. Besides, an interlocking device was fitted in the system to prevent both hook blocks from working simultaneously. One of the hook blocks must be hoisted up near the parking socket to release the interlocking device before the other one could be operated by the remote controller. However, such interlocking device could be by-passed at the local control panel (i.e. one hook block could be operated at the local control panel even though the other hook block was not hoisted up) to return the hook block to its parking socket.

### **Analysis of the parted steel wire**

5.11 The parted hoisting wire, which was put into service since delivery of the *vessel* on 25 January 2011, had been found in good condition. It was inspected by the chief officer and Electrician B about one month before the accident.

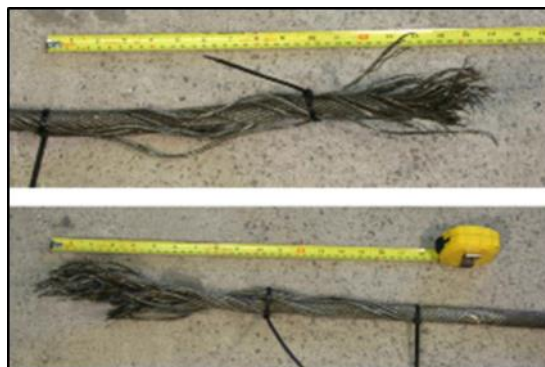


Fig.5- the parted hoist wire

5.12 Samples of the parted wire (Fig.5) were collected for micro analysis in laboratory and the results were as follows:

- a) the parted steel wire whose nominal diameter of 20mm with a breaking strength of 33.83 tons did satisfy the maker's specification requirement. As the maximum pulling force provided by the winch motor and transmitted to the wire was about 9.9 tons, the steel wire matched the requirement of the manufacturer of the hoist. Under normal operating condition, the steel wire should not part;
- b) there was no sign of damage to the steel wire due to, for example, corrosion, pre-existing crack; and
- c) inspection of the fracture ends of the parted steel wire revealed that the majority of the wire strands was yielded under excessive shearing force applied to the materials while the remaining wire stands yielded under excessive tensile force. This was supported by the bend in small radius on the steel wire in adjacent to the parted section. Steel wire failed prematurely due to excessive shearing force (typically at about 50-60% of the maximum tensile force).

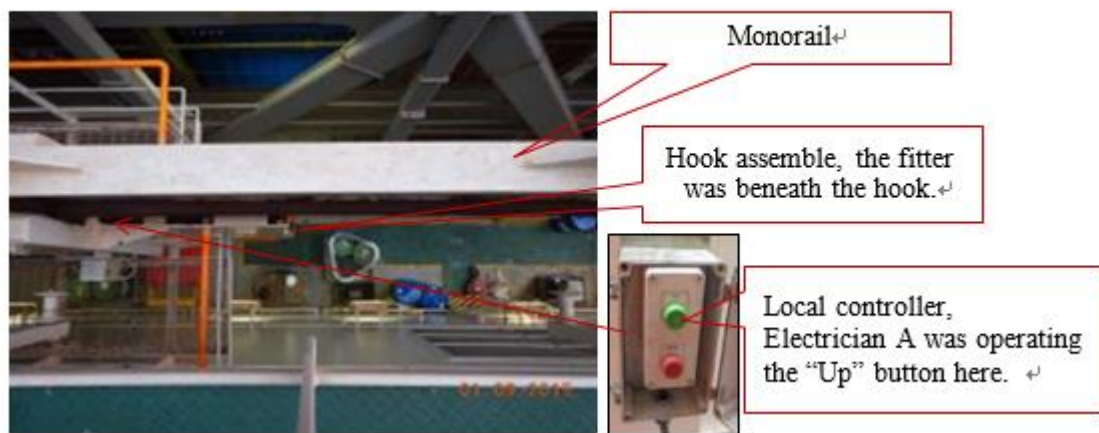


Fig.6- A view from top of the hoist

### **Probable cause of the accident**

- 5.13 Before the accident, the bosun reported that the portside hook block failed to function. It was probably due to the starboard hook block had been lowered down resulting its interlocking device being deactivated.
- 5.14 In turn, the interlocking device as a safety interlock prevented the portside hook block from operating by the remote controller, although the portside hook block still could be operated at the local controller on the platform of the hoist. Thus Electrician A could lower the portside hook block down for about half-a-metre at the local controller. When the bosun could not raise the portside hook block at the request of Electrician A, the latter quickly and repeatedly pressed the “UP” bottom on the local controller to bring up the portside hook block.
- 5.15 It was found out that the wire parted at a position close to the sheave wheel (the yellow spot in Fig.7) when the hook block was about to reach its parking socket. The hook block could probably snagged on the frames on the monorail at either of the two points marked “A” or “B” (Fig.9), especially when it was swinging during parking. The crew reported that they kept on encountering difficulties in parking the hook block before the accident happened.
- 5.16 According to the micro analysis report, the parted steel wire was jammed during the upward movement of the hook block that in turn induced excessive shear force to part the wire. Therefore, it was probable that when Electrician A kept pressing the “UP” bottom on the local controller to bring up the portside hook block, the hook block snagged on the frame without the awareness of Electrician A. It caused the majority of the steel wire strands yielded under excessive shear force and finally it parted.

### **Routine maintenance of the electrical control system of the hoist**

- 5.17 Under normal operation, the hook block would be seated in the parking socket and stopped when it pressed against a tilt pad, which in turn triggered a limit switch in the control circuit and stopped the movement of the hoist.
- 5.18 After the accident, it was found that the tilt pad was not free to move due to excessive painting work. It may render the safety control system of the hoist not reliable.

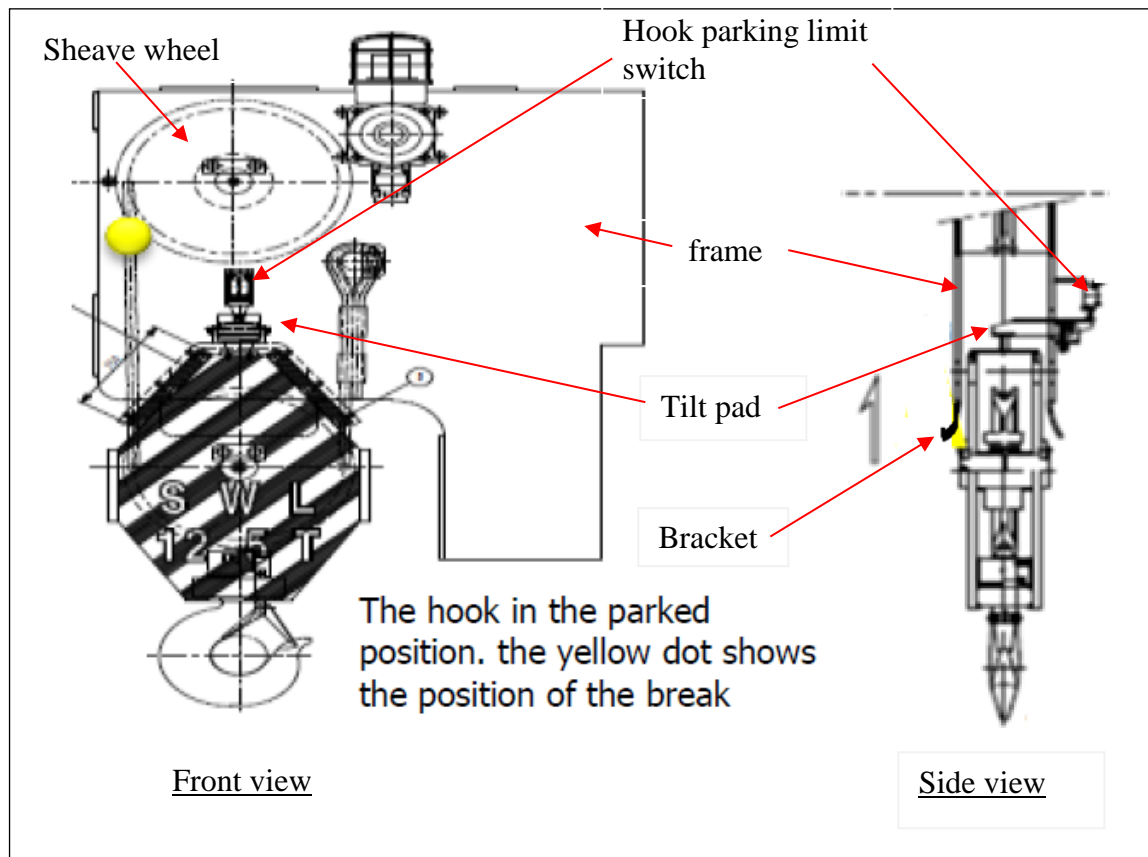


Fig.7- The hook in parking socket

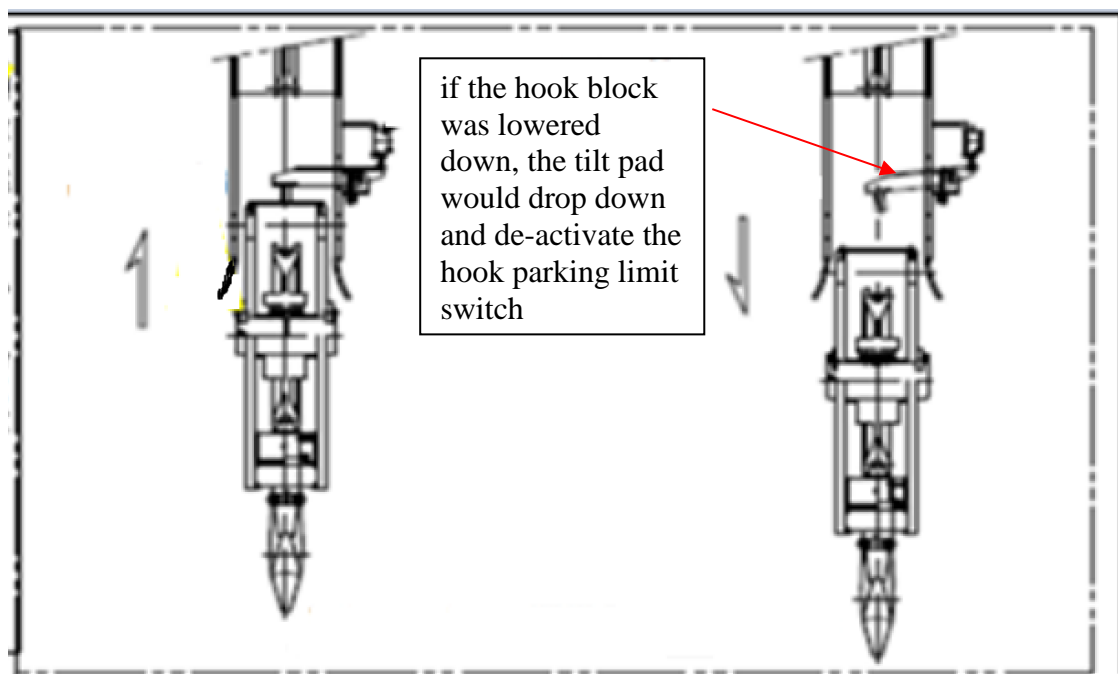


Fig.8- Side view of the hook block in the frame, showing the mechanism of the tilt pad and the hook parking limit switch.

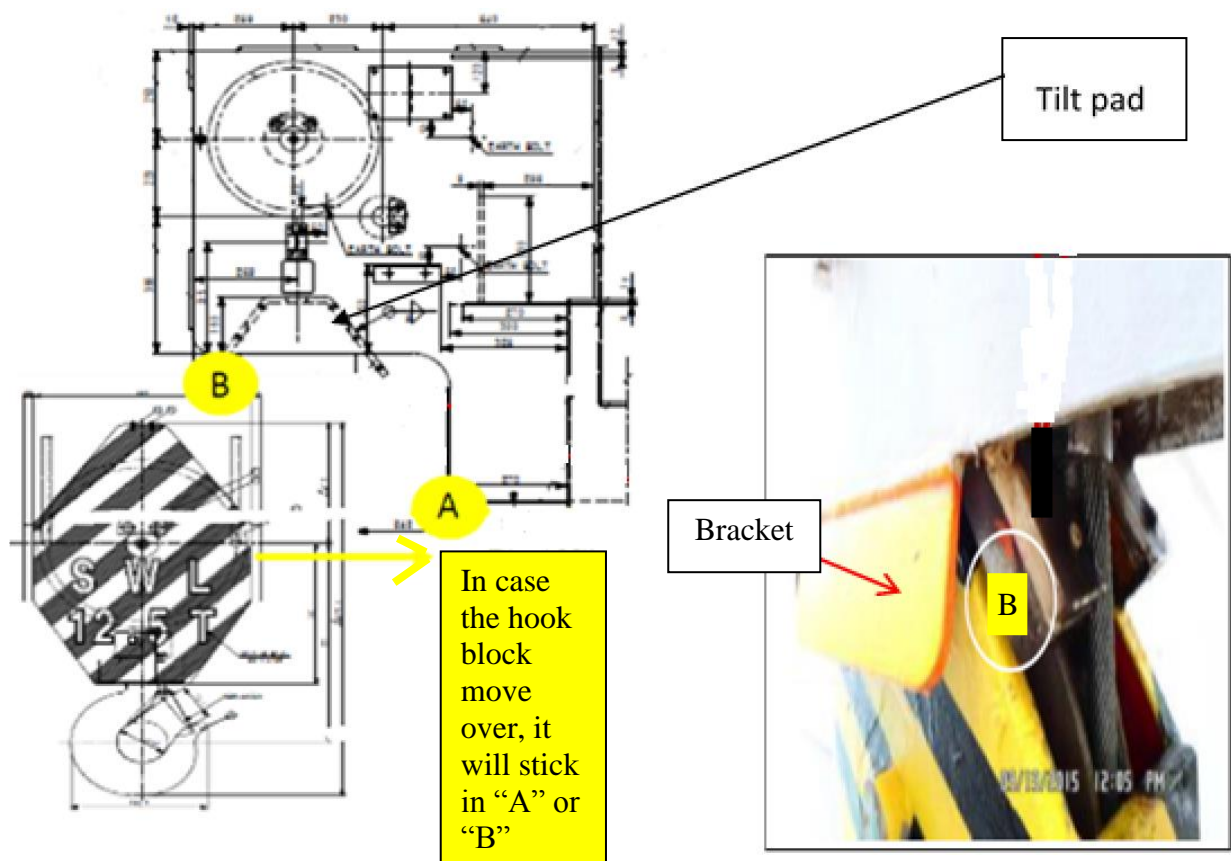


Fig.9- The frame of the hoist. (A: the edge of the assembly; B: the edge of bracket)

## 6. Conclusions

- 6.1 At 1545 on 30 August 2015, a fitter joined the Hong Kong registered container carrier “BREVIK BRIDGE” (the *vessel*) at Pasir Pajang Container Terminal, Singapore. Two hours later the fitter was seriously injured by a hook block of a monorail transverse hoist that suddenly dropped down from a height of 7 meters when he stood underneath the hoist.
- 6.2 When crew members including the fitter were working on receiving provision stores by the hoist, the hook block of the hoist suddenly failed to respond to the hoisting command from the remote controller. Two electricians (Electrician A and Electrician B) on board on that day were summoned to examine the hoist. However, safety precaution was not established in planned manner among the crew members throughout the repair work. When the accident happened, the fitter did not follow others to stay away from the hoist.
- 6.3 During the process of trouble shooting, Electrician A hoisted up the hook block by repeatedly pressing the “Up” button on the local controller. When the hook block was about to enter the parking socket within the frames on the monorail, the hoist wire parted suddenly.
- 6.4 As a result, the hook block dropped and knocked on the fitter. The fitter was seriously injured in unconscious state with serious bleeding. An ambulance was called by the master and the fitter was sent to a local hospital immediately. After surgery and intensive care, the fitter’s condition was stabilized and made recovery.
- 6.5 The investigation had identified the following contributory factors to this accident :
  - a) due to twisting residual within the hoist wire, the hook block was not aligned with the opening between the frames on the monorail resulting in the hook block snagged onto the frames before reaching the designed parking socket. The repeatedly winching up action generated enormous stress and parted the hoist wire;
  - b) lack of planning and supervision to the repair work; and
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- 6.6 The investigation also reveals the following safety factors:
  - a) lack of supervision to confirm the routine maintenance being done properly, as a safety device of the hoist was found seized up by bulky composite resin paint that was caused by negligence during routine maintenance; and
  - b) the crew did not receive sufficient training and familiarization in using the hoist.



## **7. Recommendations**

- 7.1 Actions of the company: The owners / management company of the *vessel* should issue circular to inform all masters, officers and crew of the findings of this accident investigation, and instruct them : -
- (a) to verify all vessels fitted with similar monorail hoist that the hoist wires, hook blocks, limiting switches and other parts are in good working condition;
  - (b) to strictly follow the shipboard safety procedures and code of safety working practice relevant to the works on electrical equipment and lifting appliances. Particularly during the crane operation, no person should be standing or passing under the crane even without load;
  - (c) to ensure that crew members are fully aware of the potential risks and safety precautions, and persons in charge of lifting operation must closely monitor the safe operation of the work carried out by crew members; and
  - (d) to ensure electrical officer who is in charge of electrical work should be familiar with the maker's instruction manuals of the shipboard equipment.
- 7.2 Action of the Marine Department: A Hong Kong Merchant Shipping Information Note is to be issued to promulgate the lessons learnt from the accident, particularly the familiarization in using the hoist or the provision crane on board in according to maker's instruction.

## **8. Submissions**

- 8.1 In the event that the conduct of any person or organization is commented in an accident investigation report, it is the policy of the Marine Department to send a copy of the draft report, either in part or in its entirety, to that person or organization for comments.
- 8.2 The draft report was sent to the following parties for their comments:
  - a) the shipowner, ship management company and master of the *vessel*; and
  - b) the Ship Safety Branch of the Marine Department.
- 8.3 By the end of the consultation, there was no comment received from the company. The feedback from the Ship Safety Branch of the Marine Department has been considered and incorporated in the final report as appropriate.