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Incident Investigation Reporting Form

(to be completed electronically and uploaded to HSES Database within 14 days of the incident)

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Incident Type (choose one):

☐ Health ☒ Safety ☐ Environment

Incident Category (choose one):

☐ Fatality ☐ Lost Time ☐ Modified Work ☐ Medical Aid ☐ First Aid ☒ Near Miss

Incident Potential (choose one):

☐ Low

Must be reported in he HSES Database by the 10th day of the following month

☒ High

Must be reported within 24 hours (Form 6853.1.2 Incident Notification Form), BU conference call within 72 hours, incident investigation (Form 6853.1.3 Incident Investigation Reporting Form) completed and uploaded in HSES Database within 14 days.

Incident Title	Evergreen Rapid Transit Project Super Beam		
Incident Number	2014061714-01		
Incident Date (yy-mm-dd)	2014-06-17		
Was a Business Unit conference call held?			Yes
Was this activity / task identified in the Risk Register?			Yes
Does a standard / procedure exist to control the risk?			Yes
If yes, was the standard / procedure adhered to?			Yes
Was this incident a system failure?			No
Was there any property damage?	Yes	If yes, what amount?	Less than $5k
Modified Work Injury	No	If yes, how many days modified work?	Click to enter number of days
Lost Time Injury	No	If yes, how many days lost time?	Click to enter number of days

Root Cause Analysis Session:			
Session start date(s) (yy-mm-dd)	2014-06-24	Session end date (yy-mm-dd)	2014-06-24
List session participants	Gianni Bonassi, Roberto Sani, Cem Akkaymak, Arda, Cicek, Will Gowen, Donovan Hides, Willard Marshall.		

Sequence of Events:

The launching crew prepared to launch the truss from pier 32 to pier 31 on North Road at Foster Ave. The supervisor instructed the foreman to lift the support beam & legs off the pier transverse beam with the winch in preparation for travel.

During the normal process the winch is connected to the support beam to carry rear loading until such time as the beam travels far enough past the 5th wheel so that the beam is balanced and supported solely by the 5th wheel – at which time the winch is disconnected. The winch is connected to the support beam via a saddle and a pin.

The supervisor then instructed the fifth wheel operator to engage the hydraulics and advance the support

beam.

During the normal process the 5th wheel operator advances the support beam as the winch operator matches the beam travel speed (5 centimeters per second) with the winch and trolley from a hand held control pad. The support beam travels via a hydraulic ram which pushes the beam. The stroke of the ram is 1.2m there for the max travel distance is 1.2m and then the ram must be reset.

The beam travel approximately 1.2 meters with no apparent issues and just before the support legs cleared the working platform witnesses reported a loud bang and the support beam started a slow down/fall. The beam did not drop suddenly because it was partially supported by the counter balance of the support beam past the fulcrum of the 5th wheel and the hydraulics in the 5th wheel.

The back end of the support beam dropped 4 meters at which time the fifth wheel supported the support beam and stopped it from falling any further. The support legs on the back of the support beam struck the working platform on Pier 32, knocking it from its position on the pier and causing some damage to the platform. The operator locked down the 5th wheel to prevent further movement.

The point of failure was the connection between the support beam and the winch. Inspections and photos confirm that the connecting pin and the support beam saddle were damaged.

The area around the Launching Truss was closed off to protect workers and the public. This included shutting down North Road for several hours.

In order to stabilize the Launching Truss a plan was devised in consultation between SLCW-EG and Deal (equipment supplier) to use the winch to lift and reset the back legs onto the transverse beam on Pier 32. Note that the transverse beam was not damaged. All damage was confined to the work platform.

The support beam was rigged and hoisted however due to the length of the rigging there was not enough height to allow the legs to clear the transverse beam and be set back onto the Pier.

After careful consideration and planning the decision was made to complete the launch. This entailed using the winch with the attached rigging to support the end of the support beam (this is the normal procedure however the beam is normally attached using the saddle and pin rather than the rigging) The launch was completed without further incident. North Road was returned to normal use at around 2200hrs.

Deal Engineering conducted a thorough inspection of the launching truss and all ancillary equipment on June 23rd, 2014. It was confirmed that the winch pin and saddle were the only point of failure on the Launching Truss. It was further determined that the winch was lagging behind the support beam anchor assembly by approximately 550 mm. This misalignment would have caused the rigging to be at an angle of approximately 42 degrees and would account for the lateral loads on the lifting pin and saddle which caused the failure. The only plausible explanation for the misalignment of the winch is operator error.

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Root Cause Analysis (RCA) Investigation Results:

Absent or Failed Defenses Safety Device Operation	Description: The saddle and pin which secured the winch to the support beam failed. This was due to lateral load imposed on the pin. The saddle and pin do not appear to be designed to withstand significant lateral loads.
Absent or Failed Defenses Control Systems	Description: There is no inter-link between the controls on the 5th wheel and the winch control pad. The winch operator is tasked with matching the winch trolley speed to the support beam speed which is driven by the fifth wheel. If the operator makes an error it could cause the winch trolley to travel slower or faster than the fifth wheel which then applies a horizontal force against the lifting assembly and anchor point.
Absent or Failed Defenses Hazard Identification	Description: The horizontal loads imposed on the pin and saddle does not appear to have been considered in the design of the pin and saddle. No incident of this nature has been reported in the world wide fleet of launching trusses, however; in light of this incident it is apparent that the loads can be significant enough to cause failure.
Individuals / Team Actions Work Method	Description: Workers were situated on top of the support beam during transit. This exposed the workers to a fall hazard. There are fall protection tie off points available and all workers were tied off at the time of the incident. While this is consistent with the work method of a drop of the support beam would likely result in workers suspended in their fall protection gear.
Individuals / Team Actions Work Method	Description: Workers were situated on top of the column and below the support beam during transit. This exposed the workers to a suspended load hazard. While this is consistent with the work method the location of the workers put them at risk.
Individuals / Team Actions Equipment Use	Description: The operator on the winch reports that he was in line with support beam and that he was operating in accordance with the procedure. This is in conflict with the physical evidence found on site. This is a strong indicator of operator error on the part of the winch operator.
Task / Environmental Conditions (Workplace) Hazard Analysis / JSA / StepBack / Take 5	Description: The hazard review of the equipment operation did not recognize the lateral loading that was a potential for the saddle and pin.
Task / Environmental Conditions (Workplace) Hazard Analysis / JSA / StepBack / Take 5	Description: A review of the JSA revealed that a winch operator error was not considered nor was this a consideration of the step back hazard analysis. While this was not a direct contributing factor as the workers reported that they knew and understood their tasks this should be addressed.

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Task / Environmental Conditions (Human) Competency / Experience / Skill for Task	Description: It is unclear what lead to the operator error however this was a key contributing factor in this incident. The worker strongly believes that he was within the normal operating parameters for this operation. The evidence clearly shows this was not the case.
Organizational Factors Design, Construction and Commissioning	Description: It is clear that the Truss manufacturer did not consider the potential for this type of incident. Furthermore this was not considered during the commissioning and acceptance by the employer for this piece of equipment.

Underlying (Root) Causes and Key Contributing Factors:

The design of the lifting pin and saddle did not appear to be sufficient for the horizontal loads imposed by the 5th wheel.

The controls between the 5th wheel and the winch are not interlocked and as a result of human error resulted in a horizontal loading to the connecting pin and saddle.

The direction of travel of the winch trolley – a critical operation – has no process to capture and/or prevent error. The operator may have observed the winch to be traveling at a slower speed than the fifth wheel and could have inadvertently pushed the winch control arm into reverse which would compound the problem.

The JSA did not adequately assess the risk to workers in potentially dangerous areas and did not impose appropriate controls.

The winch operator either engaged the winch very late or engaged the winch in the opposite direction of travel of the support beam. It was noted that the winch speed is faster in a reverse direction.

Description of Incident FOLLOWING the Root Cause Analysis Investigation:
(Complete if changed from Incident Notification Form)

Click to enter description of incident following RCA investigation

Root Cause Analysis (RCA) Diagram (if applicable):

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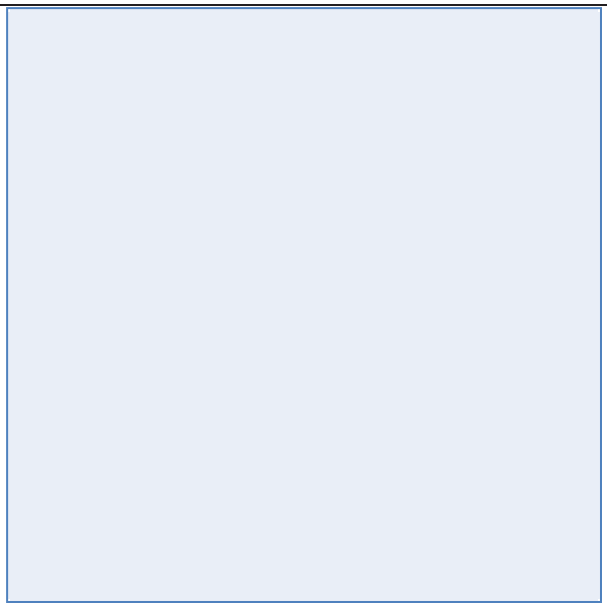

Permanent Corrective Actions to be Taken *(Actions should relate back to RCA Investigation findings)*:
Where the corrective and preventive action identifies new or changed hazards or the need for new or changed controls, the proposed corrective action(s) shall be taken through a documented risk assessment prior to implementation. Effectiveness of corrective action(s) shall be reviewed in a timely manner.

Action	Responsible Person	Due Date
The Truss engineer provided a new design for the installation of a new lifting pin and connecting saddle. The new system will withstand the maximum horizontal loading applied by the fifth wheel motor. This design, placed under a maximum load from the fifth wheel motor will tow the winch trolley with it regardless of winch operator failures. Additionally, an emergency stop button will be installed at the winch connection area so that the operator or crew members can shut the fifth wheel down should they observe that the winch is traveling behind the speed of the fifth wheel.	Gianni Bonassi & Cem Akkaymak	2014-06-25
The Job Safety Analysis was revised. The two ironworkers who stand beside the winch operator tasked with moving dywidag bars away from the support legs are also tasked with observing the winch position between the bar movements. They are equipped with radio communication to the 5th wheel operator. In the alternative these workers are able to activate the emergency shut off switch to stop all movement of the beam and/or truss.	Cem Akkaymak	2014-06-25
The Job Safety Analysis was revised. The two workers tasked with removing the guard rail system off the traverse beam deck will no longer be allowed to stand on the platform while the beam is in motion. These workers will move back on top of the pier or into the segment area. This will ensure they are not at risk should the support beam drop.	Cem Akkaymak	2014-06-25
A visual aid is placed on the support deck for the winch operator. This aid will be an outline of human feet in the direction of the launching travel. This aid will help the operator to orientate his body and the controls for the winch in the direction of the launch. This will reduce the confusion regarding direction and winch controls.	Willard Marshal	2014-06-26
Complete and submit report to WSBC	Mark Woods	2014-06-25
All SLCW (EG) launcher workers have attended the project orientation for the second time. All SLCW (EG) launcher supervisors have attended EGRT supervisor training for the second	Donovan Hides & Mark Woods	2014-06-23

time.		

Key Lessons Learned *(Summary of lessons from incident):*
Where the potential for significant outcomes are identified appropriate controls, including processes for error trapping, need to be developed and implemented. enter lessons learned

Project / Office Risk Register updated following investigation:	No

Does this incident require Government Authority notification?	Yes

Responsible Line Manager:	Cem Akkaymak	Telephone:	Click to enter phone number
Title:	Project Manager	Email:	Cem.akkaymak@snclavalin.com

Responsible HSE Contact:	Mark Woods	Telephone:	Click to enter phone number
Title:	Project Safety Manager	Email:	Mark.woods @snclavalin.com

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Insert Pictures / Sketches / Diagrams of Incident:

Click here to enter description of graphic

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