Problem Statement:

Forklifts have proven to be a significant source of accidents in warehouse working environments due to a combination of factors including lack of visibility and tip-overs.

Picture source: "Fork Lift Collision Occurrences." Fork Lift Collision Occurrences. Web. 21 Mar. 2012. <http://crossinggu ardsa fety.co m/collisio n-awareness/fork-lift- collision- occu rrences.h t ml (http://crossingguardsafety.com/collision-awareness/fork-lift-collision-occur rences.html) >

- Forklift Accident Causes:
  - 42%; Tip-overs
  - 25%; People being crushed between the vehicle and a surface
  - 11%; People crushed between two vehicles
  - 10%; Struck or run over by a forklift

- 42% of forklift related fatalities occur in manufacturing facilities.

"Forklift Safety Training." Accident Statistics. Web. 01 June 2012. <http://forklift-safety-trainin g.blogsp ot.c om/2006/05/ acciden t- sta ti stics.html (http://forklift-safety-training.blogspot.com/2006/05/accident-statistics.html) >

- "There is a fatality from forklifts once every three days in the U.S. This is in addition to about 95,000 other injuries caused by forklifts every year."

- "Accidents are a drag on both businesses and individuals. There are strong incentives for employers to take measures to eliminate this risk....there's a big chance of a lawsuit if anyone gets injured."

"Forklift Accidents." Forklift Accidents Statistics. Web. 13 Sept. 2012. <http://www.forkliftsguide.com/forklift-accidents.htm (http://www.forkliftsguide.com/forklift-accidents.htm)>

- Employers lose money as a result of forklift accidents in the form of lost output, indirect cost of injuries, administrative cost of claims, and damage to facility, equipment and product.

- "The costs incurred because of forklift accidents are estimated to be above $100 million."

- "Studies have shown that money spent on improving safety can return an investment of over four dollars for every dollar spent!"

- "OSHA estimates there are about 85 forklift fatalities per year, 34,900 serious injuries and 61,800 non-serious injuries."

- "According to the Industrial Truck Association, there are about 855,900 forklifts in the U.S., so over 11 percent will be involved in some type of accident each year"

- "The ITA also reports that the useful life of a lift truck is eight years, which means that about 90 percent of all forklifts will be involved in some type of accident during their useful life."

"OSHA Forklift Standard : Forklift Training Systems." Forklift Training Systems. Forklift Training Systems. Web. 13 Sept. 2012. <http://www.forklifttrainingsystem.com/osha.htm (http://www.forklifttrainingsystem.com/osha.htm)>

"WORKER DIES AFTER BEING HIT BY FORKLIFT"

November, 2012,

Authorities say that a 52-year-old Michigan woman has died after being struck by a forklift while working at a recycling center in Isabella County.... The sheriff's department said that the employee was hit by a forklift driven by a co-worker, who was transporting a large recycling bin.

-This incident supports a forklifts lack of visibility while carrying a load. The driver was unable to see the woman and ran her over as a result.

"WORKER DIES IN CRAWFORSVILLE FACTORY ACCIDENT"

"A man working at a Crawfordsville factory died Tuesday after he was struck by a forklift, authorities said."

"WORKER DIES AFTER BEING HIT BY FORKLIFT"

“April, 2011,

A crane operator guide at --- Terminal died last week after she was hit by a forklift. -------- --------, of Portsmouth, was standing on a pier, guiding a crane via a radio. At the same time, a forklift operator was nearby, picking up containers with the forklift, according to the Portsmouth Police Department. The containers were on the front of the forklift and blocked the operator's views, and the forklift hit the employee.”

"Fork Lift Collision Occurrences." Fork Lift Collision Occurrences. Web. 21 Mar. 2012. <http://crossingguardsafety.com/collisio n-awaren ess/fork-lift- collision - occurrences.html (http://crossingguardsafety.com/collision-awareness/fork-lift-collision-occurrences.html)>

EMPLOYEE STRUCK BY FORKLIFT

"Employee #1, a clerk assigned to the marine terminal, was walking on the wharf alongside a container top lift machine. A forklift truck, with a squeeze attachment carrying two rolls of paper, was traveling in the same direction as employee #1. The forklift truck continued forward and apparently the load (which was approximately 11 inches higher than the steering wheel) obstructed the driver's forward view. He struck and crushed employee #1 beneath the load."

FORKLIFT TIPOVER

"While an employee was operating a forklift, the forklift tipped over while the operator was apparently making a sharp turn at excessive speed. No seat belt was installed and when employee fell from the seat he was crushed by the rollover bar."

STRUCK BY FORKLIFT

"The employee was given instructions to take the forklift to unload a truck. The employee picked up the forklift located on the premises less than one half mile from where the accident occurred. Traveling down an incline, the employee attempted to make a left turn into a parking lot, struck a pothole in the road, and the forklift began to tip over to the right. The employee attempted to jump clear of the forklift, but was struck and killed as the forklift fell."

STRUCK BY FORKLIFT

"Operator was driving a forklift forward with a load on the forks which obstructed his view. The operator did not see the employee walking by and struck her."

FORKLIFT TIPOVER

"An employee was driving an unloaded forklift down a ramp with a 13% slope when the forklift started to tip over. The operator attempted to jump clear and the ROP of the forklift landed on him and killed him. The employee was not wearing the supplied seatbelt."

FORKLIFT TIPOVER

"The victim/operator drove a forklift down a ramp rapidly and appeared to be attempting to make a sharp left turn. The forklift overturned. Apparently, the employee was unaccustomed to the quickness and sharp turning radius of the new forklift. The victim was not wearing the provided seatbelt. The driver/victim was dislodged from the seat and his head was caught under the overhead protective cage."

"Summaries of Selected Forklift Fatalities Investigated by OSHA." OSHA. U.S. Department of Labor. Web. 20 Sept. 2012. <http://www.osha.gov/dte/library/pit/fatalities_sum.html (http://www.osha.gov/dte/library/pit/fatalities_sum.html) >

The best way to improve the safety of forklifts would be to improve the visibility.

- Eric Muellecker, of Abele Tractor & Equipment Co., Inc.

Alicia Lemke says in her eight years of experience in occupational health and safety, most forklift incidents cause injuries to the pedestrians working around forklifts but it is tip-overs that cause the most fatalities among operators. Feb. 2008

- Owner and senior consultant of Wisconsin, US-based Complete Safety Concepts (CSC); a materials handling safety specialist

"Forklift Safety in Warehouses." Forklift News. 28 Feb. 2008. Web. 23 Mar. 2012. <http://forkliftaction.com/news/newsdisplay.aspx?nwid=5291 (http://forkliftaction.com/news/newsdisplay.aspx?nwid=5291) >

"I do believe [forklift safety] is a problem, not only here but across warehouses nationwide. Being in charge of safety puts on a great deal of pressure and it would be great to have something a small to medium size warehouse could afford."

"The highest cause of forklift instability derives from excessive loads on the front."

- Frank R. Benedetto, OSHA certified Safety/Personnel Director of Yank Waste Co.,Inc.

"Yes, forklifts do cause safety concerns. Preventing them is the goal."

- Dan Lavinski, Maintenance Department Warehouse of local Price Chopper.

"Yes, I do agree with you that [forklift safety] can be seen as a problem, especially in large size warehouses where there can be up to one hundred of these vehicles running…"

- Tom Deveney, Manager of Cabinet and Delivery at local Lowe's.

Jury Awards Almost $20 Million Dollars After Forklift Backs over Worker (http://crossingguardsafety.com/collision-awareness/fork-lift-collisi on-occur rences/29-jur y-awards-almost-$20-million-dollar s-after-fork lift-backs-over-worker.html)

August 17, 2011

A forty-three year old construction worker in Nevada was working on a construction site when he was backed into by a fourteen thousand-pound rough terrain forklift. He was pinned beneath one of its wheels. The entire forklift then rolled back over his body. As a result, the worker experienced multiple severe injuries, which included a crush injury requiring amputation of his right leg at the knee, removal of his spleen, and a traumatic brain injury. He is required to wear a leg prosthesis, and will likely require additional surgeries to repair bony protrusions at the amputation site.

Fork Lift Collision Occurrences." Fork Lift Collision Occurrences. Web. 06 June 2012.

http:/ /crossin ggua rd safety.co m/collision -awareness/ fork-lift-co llisi on- occur rences.ht ml (http://crossingguardsafety.com/collision-awareness/fork-lift-collision-occur rences.html) .

Worker Struck by Forklift Files Lawsuit Against Employer (http://crossingguardsafety.com/collision-awareness/fork- lift-collisi on-occur rences/28-worker-str uck-by-forklift-files-lawsuit-a gainst-employe r.html)

November 2010

A man who worked for - - - Packing Incorporated, a frozen food packaging warehouse, is filing a workplace injury lawsuit against the company, reports the Southeast Texas Record.

The claims state that while he was performing his normal duties, a co-worker struck him with a forklift carrying ice, injuring him. --- packing allegedly failed to give him a safe work environment and proper supervision.

"Indiana Law Blog." Indiana Law Blog. Web. 06 June 2012.

http:/ /blog.billh urst.com/ 2011/03/fo rklift- accidents-p revention / (http://blog.billhur st.com/2011/03/forklift-accidents-prevention/) .

Worker Dies in Friday Mill Accident (http://crossingguardsafety.com/collision-awareness/fork-lift-collision-occurrences/27-wor ker-dies-in-friday-mill-accident.html)

The 55-year-old Kennesaw man involved in a Friday on-the-job incident at ------ Cartersville steel mill, died from multiple blunt force traumas.

Bartow County Deputy Coroner said --------, an engineer with the company since at least 2006, was overrun by a forklift. In a Friday phone interview, -------- director of external communications and public affairs indicated the man was "struck by a piece of heavy, mobile equipment. The forklift driver was not injured.

"Number of Major Fork Lift Accidents Reaches New Low." Statistics Show Fall in FLT Accident Rate. Web. 22 March 2012.

http:/ /ww w.men to rtrain ing.co .u k/ news/mentor/lift- tru ck- acciden t- sta tistics (http://www.mentor training.co.uk/news/mentor/lift-tr uck-accident-statistics) .

Incidents from OSHA (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary9.html)

Summary No. 9 (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary9.html)

Hazard:

Employees were exposed to the hazard of being struck by a forklift operating with an obstructed forward view.

Process:

A forklift with a clamp attachment is used to carry rolls of newsprint from a warehouse to a container for shipment by truck.

Activity at time of incident:
A forklift operator was proceeding towards an intermodal shipping container as an employee on foot was crossing in front of the container.

Incident Description:

Setting:
A forklift operator is transferring rolls of newsprint from a storage area in a warehouse to a container at a loading dock for truck shipment. The operator carries a single roll at a time, with the load attached in a clamp in front of the forklift. Each roll weighs approximately 5,000 pounds. The forklift operator travels through several passageways in the warehouse to reach the container. The operator loads the roll of newsprint into the container from an elevated platform adjacent to the container.

Incident:
At the time of the incident, an employee was crossing the loading dock as the forklift was entering the container. The employee was killed after being caught between the container and the forklift's load, a 5,000-pound roll of newsprint.

Relevant Factors:
Forklift operators failed to use their horns when approaching locations where visibility was obstructed.

Supervisors had not received formal training in accident prevention.

"Longshoring and Marine Terminals: Fatal Facts -- Section I - Vehicular Accidents: Summary No. 9." United States Department Of Labor. United States Department Of Labor, 04 Dec. 2010. Web. 20 Sept. 2012. <http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary9.html (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary9.html) >.

Summary No. 10 (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary10.html)

Hazard:

Employees were exposed to the hazard of being struck by a forklift truck with an obstructed forward view.

Process:

A forklift truck transfers paper rolls from a cargo vessel to a pier shed (warehouse).

Activity at time of incident:
The forklift operator was driving through the doorway of the pier shed while another employee was standing in the doorway.

Incident Description:

Setting:
Longshoremen are transferring paper rolls from a cargo vessel to a pier shed, using a crane and forklift trucks. The paper rolls, which are each approximately 50 inches in diameter and weigh about 1,500 pounds, are lifted out of the vessel and placed on the pier by an on-board crane. The rolls are then picked up and carried by the forklift with a front clamp attachment. Each load consists of six rolls, stacked in two side-by-side columns of three rolls. There are two gangs performing the unloading operation, each consisting of 11 employees (4 piermen, 4 holdmen, 1 deckman, 1 crane operator, and a gang carrier). After the forklift drivers pick up the paper rolls, they back down the pier, pass the shed door, then drive forward a few feet and turn right through the door into the shed, and place the rolls on the floor for the longshoremen to pick up and distribute in the shed. The shed door is 20 feet wide and the pier apron is 36 feet wide.

Incident:
At the time of the incident, the gang carrier (the victim) was standing near the center of the doorway of the shed, as the driver turned right into the shed doorway. The left front side of the forklift struck the gang carrier and killed him.

Relevant Factors:
Despite training, the forklift driver failed to slow down and sound the horn as he turned the vehicle through the doorway of the shed. Several employees observed the incident and shouted at the forklift driver to stop. However, the forklift driver could not hear them over the noise at the site.

A video camera mounted on the right side frame of the forklift truck, intended to provide a clear line of sight for the operator to engage/disengage the load, was inoperative.

"Longshoring and Marine Terminals: Fatal Facts -- Section I - Vehicular Accidents: Summary No. 10." United States Department Of Labor. United States Department Of Labor, 04 Dec. 2010. Web. 20 Sept. 2012. <http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary10.html (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary10.html) >.

Summary No. 11 (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary11.html)

Hazard:

Employees were exposed to the hazard of being struck by a lift truck with damaged safety devices and impaired operator visibility.

Process:

A lift truck with a front-end attachment is used to load rolls of coiled steel onto a flatbed trailer.

Activity at time of incident:

Two employees were standing near a lift truck when the operator of the lift truck placed a load of coiled steel rolls on the flatbed trailer and began backing up.

Incident Description:

Setting:
A longshoreman is operating a lift truck equipped with a front-end attachment to transport rolls of coiled steel from a storage area to a flatbed trailer at a longshoring terminal. The operator is assisted by a checker. As the loading operation is almost finished, the facility's assistant operations manager arrives at the site and walks to a location within 50 feet of the rear corner of the lift truck (on the driver's side). He motions to the checker, who walks towards him, passing behind the rear of the lift truck. Both employees then stand with their backs to the lift truck, in an area bordered by stored rolls of coiled steel. Meanwhile, the lift truck operator, who has just finished placing a roll of coiled steel on the flatbed trailer, backs up from the flatbed trailer at an angle towards the lift truck operator's left.

Incident:
While backing up away from the flatbed trailer, the lift truck operator failed to see the two employees standing at the rear of the truck. The vehicle first struck the assistant manager in the back (pushing him to the side), and then struck the checker, apparently with the driver's side rear tire. After being knocked to the ground, the checker was caught under the lift truck, dragged, and killed. The assistant operations manager had unsuccessfully attempted to grab the checker, then ran to the front of the lift truck and yelled for the operator to stop the vehicle. However, by that time the lift truck had driven over checker's body.

Relevant Factors:
The driver's side cab window and both rearview mirrors on the lift truck were damaged. Instead of replacing the broken window, the employer installed a piece of cardboard over the broken section. The right rearview mirror was missing altogether, and the left rearview mirror mount was bent, causing the mirror's view to be blocked by a post on the cab. There was evidence of rust in the bent portions of the right side mirror as well indicating the damage was not recent. For the operator to see the area he was backing into, he would need to look out the cab door, which would have required him to get out of his seat.

The assistant operations manager claimed that he and the victim were standing at a distance of about 50 feet from the lift truck, stating that he could see the operator through the left side door of the lift truck cab and presumed that the operator could see them. The lift truck operator disputed the location of these employees, stating that they were standing just off to the left rear of the lift truck in his blind spot.

The lift truck's audible backup alarm was in proper working order. The assistant operations manager heard the lift truck's alarm but failed to move in response to it. He stated that after hearing the backup alarm all day long, he became unconcerned about its warnings.

The lift truck operator was the only employee who operated the lift truck involved in the incident. He had worked for the employer for nine years and operated the lift truck daily. The operator had not been instructed to perform pre-operation inspections of the lift truck nor did he report the defects to anyone. After the incident, the employer returned the lift truck to service without repairing the damaged rearview mirrors or window.

"Longshoring and Marine Terminals: Fatal Facts -- Section I - Vehicular Accidents: Summary No. 11." United States Department Of Labor. United States Department Of Labor, 04 Dec. 2010. Web. 20 Sept. 2012. <**http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary11.html (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary11.html)**>.

Summary No. 12 **(http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summary12.html)**

Hazard:

Employees were exposed to the hazard of being struck by a forklift truck operating in a location not restricted to vehicular traffic.

Process:

A forklift truck transfers steel coils from a dock to a marine terminal warehouse.

Activity at time of incident:
A warehouse employee walked among stacks of steel coils when he stepped into the path of a forklift truck as it backed up.

Incident Description:

Setting:
Longshoremen are transferring steel coils from a dock to a marine terminal warehouse, using a forklift truck and a bridge crane to stack the coils in rows in the warehouse. The forklift operator would carry as many as two of the coils (weighing about 19,000 pounds each and measuring about 42.5 inches in diameter) at one time from the barge to the warehouse. The warehouse is 60 feet wide and 500 feet long. In the warehouse there is one well-defined main aisle of fixed length and width (about 18.5 feet wide), but the other aisles vary in width and length, depending on the number of coils in storage at any given time. The forklift truck, which is about 30 feet long and 9 feet wide, enters the warehouse through a roll-up door (about 18.5 feet wide), places the coils in a clear area of the warehouse, backs up across the main aisle into another clear area, and exits through the same door. The forklift operator usually carries two coils at a time on the lift truck. The warehouse employee operates an overhead (bridge) crane inside the warehouse to stack the coils after they are delivered by the forklift truck. No aisles within the warehouse are marked or designated.

Incident:
Just before the incident, a steel coil apparently slipped off the crane hook used to transport the coils throughout the warehouse, and the warehouse employee had left the bridge crane pendant control station to investigate the situation. It appears that the coil on the hook struck another stacked coil and fell from its hook. The employee walked among the stacks into an area used by the forklift truck operator to turn around, stepping into the path of the forklift truck as it backed up. The operator lost sight of the warehouse employee as he was turning around. The vehicle struck and killed the employee.

Relevant Factors:
The warehouse lacked designated safe aisle ways and operating areas for the forklift truck.

There was no designated drop off point for the coils in the warehouse. Moreover, a forklift truck safety manual kept at the work site specified the marking of forklift truck paths.

The forklift truck operator typically did not sound the horn in the warehouse unless he saw unauthorized personnel in the vicinity. However, the reverse signal alarm was operable (and assumed to be in operation at the time of the incident).

Other safety hazards were identified during the investigation. For example, the bridge crane and material handling gear in the warehouse

were not properly inspected prior to being placed in service. The brake pedal on the forklift truck did not have a non-slip surface and the forklift truck was not marked with its rated capacity visible to the operator. Hard hats were not required for employees working in the warehouse, although coils were moved at various heights throughout the building. Additionally, emergency exits were not clearly marked, and in some cases the view was obstructed by the stacked steel coils.

"Longshoring and Marine Terminals: Fatal Facts -- Section I - Vehicular Accidents: S ummary No. 12." United States Department Of Labor. United States Department Of Labor, 04 Dec. 2010. Web. 20 Sept. 2012. **http://www.osha.gov/dts/maritime/sltc /longshoring/section1 /su mmar y12.h tml (http://www.osha.gov/dts/maritime/sltc/longshoring/section1/summar y12.html)**