PORT SKILLS & SAFETY

IMPROVING STANDARDS THROUGH COLLABORATION

How can AI improve port safety

Port Skills and Safety Ltd (PSS), the UK's professional safety and skills membership organisation for ports, has been collecting statistics on incidents and near misses in UK ports for more than ten years. Whilst the trend for injuries, and specifically fatal ones, has been declining, there has been a plateau in incident reduction over recent years. Slips, trips and falls and manual handling incident statistics remain frustratingly high, highlighting that it is often the everyday safety that is the problem, rather than the less frequent, high risk lifts.

Basic investigations may identify underlying causes of incidents, but it is vital to get to the root causes in order to redress the balance and make a genuine difference to safety performance in the port industry. Analysing the root causes of incidents (be it injuries, damage, or near misses) provides a much clearer picture of the issues that prevail and can provide a path forward for tackling and reducing everyday hazards.

Background

PSS, along with most organisations in high-risk major accident hazard (MAH) sectors, has been echoing the mantra of data, data, data for many years. There has been a movement towards recording of leading indicators such as near misses, unsafe conditions, and observations alongside the traditional lagging indicators; injury and damage reports.

The problem comes with being able to meaningfully analyse the huge amount of data that is captured in incident reports, investigations, and observation notes.

At the end of the day, recording and analysing information on near misses and observations can be a huge task for a small port with only one or two employees in its health and safety department. If there is no clear, fast and tangible benefit then time may be better spent elsewhere; being visible around the port and not behind a desk filing reports. Organisations are now being asked to collate and record more data than a human or team of humans can analyse manually. And that's without looking at all the data which can inform risk but isn't kept by the health and safety team, such as HR information, contractor management and procurement.

It is already clear that technology can allow us to analyse large amounts of data and by using artificial intelligence (AI), such as using natural language processing (NLP), it is now possible to analyse the qualitative free text in reports which cannot be 'counted' in a spreadsheet unlocking previously unseen insights. These include:

- Analysing and identifying hazards
- Establishing root causation
- Understanding severity and the potential for more significant outcomes
- Locating incident hot spots
- Assisting with preventive action planning
- Tracking hazards

The ports sector is onboard with the principle of encouraging reports of near misses and unsafe conditions to identify issues that are yet to cause injury or damage. However, many do not have the resource in their H&S teams to pursue the root causes of each and every near miss, in order to identify the latent dangers and really ensure they are eliminated.

This is where AI really comes into it's own. AI can analyse vast numbers of detailed records and provide insights which are not visible to a single human data processor. PSS has recently undertaken a pilot project with one of its service provider members – STC Insiso, to understand if AI, and specifically NLP, can be used to analysis large amounts of incident data to reveal new insights that include root causation, to direct interventions in the future.

Findings

The principle finding from this pilot project was that, in far too many cases, reports of incidents are very brief and therefore only provide a limited amount of useful data. This speaks to the fact that PSS has been promoting the recording of data for many years but without the context of how that data can be used, it is difficult to fully understand what data should be recorded. This pilot will enable PSS to better define for members, what to record about incidents and observations, in order for root causes to be identified and patterns to emerge. The ability of AI to identify root causes for near misses and observations without the sole need for investigation by personnel, will allow ports to learn lessons much more effectively and address the root causes most likely to be the cause of incidents in the future.

This initial sample gave results which will not come as a great surprise to anyone working in health and safety in ports. Container handling, vehicle operations (not mobile plant) and mechanical systems featured most regularly in the data, although on the positive side, all three had shown improvements in safety between September 2022 and September 2023.

Other commonly occurring topics include mooring equipment, load securing equipment and emergency response and preparedness. The trends for these topics showed occurrences are on the increase. This perhaps shows that the current focus on improving safety in container handling and vehicle operations are showing results, but that focus should be placed on the latter area to arrest the decline.

The data showed that for almost 80 per cent of reports, individual and organisational human factors (the operating environment) were strong root cause contributors. Training – something often blamed when trying to find a quick solution, was a root cause in less than one percent of incidents. In fact, in incidents where individual human factors is identified as a root cause, inattention/lack of awareness is present as an underlying cause in a significant proportion, just under 60%, of incidents and near misses.

The pilot deliberately included large and small ports to understand whether a system that requires such a large amount of data in order to find patterns, would cope with smaller data levels. Unsurprisingly, it highlighted the inconsistency in reporting that between large ports with a lot of resources and the smaller ports. This issue is one that PSS has been grappling with in its data collection process for some time. Because there is no requirement for the port industry to centrally collect safety data, as there is in the rail industry, there is a lack of consistency in what information is recorded, how is it recorded and how specific terms (such as near miss) are defined. One of the outcomes of this pilot is that the technology will be

able to group together different ways of reporting an incident and find some common terminology which ports can adopt to provide more consistency.

The individual ports participating in the pilot all received a data dashboard analysis their data. One of the participants used the dashboard to test an underlying concern the team had around the number of incidents associated with a particular piece infrastructure on the quayside. The Comet Signals dashboard was able to immediately prove that this was an issue by bringing to light the context and number of times it had been a contributing factor in reports. This enabled the team to present their board, a proven need for remedial action to reduce the risk of a serious incident.

About the pilot project

Working with five port members, The Bristol Port Company, Forth Ports, Peel Ports, Hutchinson and the Port of Blyth; PSS gathered the records ports' H&S teams already had stored around incidents, near misses and observations.

The project wanted to understand if AI could provide useful insights at both a sector level and within each port company (large and small). It also had to work for a sector where each organisation reports incidents in a different way, and on different systems (unlike the rail sector for instance which has a more strongly regulated process for reporting).

The project worked on three basic principles for understanding root causes:

- They never occur in isolation.
- They don't have a hierarchy of seriousness.
- They don't change based on failure type.

Using STC's *Comet Signals* software, data was collected from all five ports, provided as downloads directly from whichever EHS system they use to collect and manage HSE records. The data included reports by first responders, investigation reports and general safety observations.

The pilot project examined the data from the ports to understand where common root causes occurred across the sector and also to allow individual ports to interrogate their own incident data to:

- To prove a theory or a hunch about potential issues
- To proactively develop H&S strategy and budget planning.
- To highlight patterns or trends in the data not initially obvious.
- To identify incident hot spots
- To better understand how the business is operating.
- Track the effectiveness of H&S interventions.

Just over 33,000 records were uploaded as part of the pilot project; nearly 10,000 incident reports, 1,000 near miss reports and the remaining records were classified as observations. A large part of this pilot project was teaching the AI port-specific knowledge and terminology so that the natural language processes could classify data and map it to port operations. In the future this means that as more ports come on board and submit data, the modelling will be able to accurately understand the context and provide better analysis and outcomes.

The AI analysis looks for topics or words that are commonly occurring together in the data. Through topic modelling these are grouped to understand the constituent parts of a serious injury or fatality. The system is trained to understand the severity of an incident which can help to undercover where there have been a larger number of low severity incidents with the same root causes which may be overlooked. It can then track improvements in these root cause areas over time to demonstrate whether a resulting improvement action has been successful.

Future development

Although the pilot project is reaching an end, additional functionality is still being developed. Location data is being utilised to produce heat maps, showing where in a port there is a high propensity for a future incident.

The next step for this project is to roll it out to more ports so that they can individually benefit from the insights that Comet Signals can give, and PSS can lead sector-wide improvements in data collecting and reporting, leading to better analysis and more informed actions to drive continuous improvement in safety performance across the port industry.