Container stack collapses – causes and solutions

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Standard Club has released a timely report on the increased concern relating to the recent increase in the number of container stack collapses.

Its report, published on January 18th and ahead of knowledge of the latest incident in the Pacific, noted that in 2019 the international liner shipping industry transported 226m containers around the world with a cargo value of more than US$4tn.
However, despite various advances in standards and procedures, collapses were still happening.

These incidents could often result in significant financial losses to the container industry and their marine insurers, sometimes with hefty fines for clean-up costs.

Standard Club noted that an average of 1,382 containers were lost at sea each year between 2008 and 2019 (World Shipping Council figures). The Club said that the frequency and value of container stack collapse claims experienced by Standard Club members had grown during the past five years, rising to a record $1m in 2019, from 13 incidents.

The rash of incidents in the past six weeks would be of considerable concern to clubs. Analysts hypothesized that the huge demand for containership space, combined with increased logistical problems at ports as a result of the Covid-19 pandemic, could have been a factor.
Standard Club listed a number of possible contributory factors:

Bigger ships: The 2020 Algeciras class container ships have a capacity of just under 24,000 teu, with a length of 400m and a beam of 61m – over three times wider than the early vessels. With a deck capacity of 24 bays, 24 rows and up to 12 tiers, ultra-large container carriers can carry nearly 14,000 teu above the holds.

More powerful ship engines: Increasing commercial pressures meant that container ships were

kept to tight operating schedules. As a result, they had increasingly powerful engines, not only to provide the high speeds required but also to enable speed to be maintained during bad weather. Standard Club said that, when ships were driven hard in bad weather, the loads on the container lashing and securing gear could be severe.

Higher wind loading: Almost all container stack collapses at sea occurred in rough weather with strong winds, the Club said. When fully loaded, the deck stacks on modern container ships presented additional windage areas over 25 metres high. Combined with large freeboards, the stacks acted like giant sails, amplifying a ship’s motions as the weather deteriorated and further adding to lashing and securing loads.

Parametric and synchronous rolling of ships: Parametric rolling was rare, but when it did occur it tended to affect vessels which have large bow and stern flares, like modern containerships. Synchronous rolling occured if a vessel's natural roll synchronized with the experienced wave period. Larger, stiffer container vessels tended to have shorter natural roll periods that more closely matched the periods of the wave spectrum, said Standard Club, noting that this in turn increased the risk of synchronous rolling and over-loaded container lashing and securing gear.

Green water and wave impacts: In heavy weather, waves and ship motions could become so large that water flowed over the deck, known as 'green water loading'. On container ships this could cause high impulsive loading on container stacks and potentially trigger a collapse. Steep waves with high horizontal speeds breaking against the side of a container ship could also generate additional forces in container lashing and securing gear.

Improper stowage and overweight containers: A matter of concern during the current pandemic, which had seen logistical difficulties in ports amid a significant rise in demand for container space, was the danger of misbalanced stowage and/or containers being overweight. Standard Club noted that "deck stack collapses often occur in those bays where the stack weight was exceeded". Cargo securing manuals generally advised that deck containers should be stacked in weight order, with the heaviest in the bottom tier and the lightest at the top, to minimize loads on the lashing and securing gear. This relied on accurate knowledge of container weights and the organization to make sure that the right containers end up in the right place.

Although there was no evidence yet to suggest that this might be the case, the high demand for container space might make it more likely that some containers might have a greater verified gross mass (VGM) than declared on the shipping document. As Standard Club noted, the shipper was responsible for stating the VGM in the shipping document. That was submitted to the master or their representative and to the terminal representative in time for it to be used in preparing the ship stowage plan.

> "In practice, the role of the ship planner and terminal representative in ensuring compliance with the regulations is critical. While some container ports in developed countries have created resilient systems to comply with the regulations, there are ports in lesser-developed jurisdictions which fail to implement them. Port authorities are often unable to afford spot checking or enforcement, which does little to encourage offending shippers to comply". Standard Club noted.

Combined with this was the fear that the current high demand for container throughput might increase the chance that some containers were not packed correctly. Masters and officers did not have sight of or control over the contents of containers or the methods by which they were packed and secured. Carriers usually depended on third parties such as the shipper, freight forwarders or their sub-contractors for stuffing and securing cargo in containers.

A stack of containers was only as strong as its weakest member. A container damaged due to shifting cargo could collapse and lead to a domino effect, resulting in an entire bay collapsing, the Club warned.

Structurally weak containers: Recent events had led to a mismatch globally between where containers were and where they were needed. Another fear was that this led to structurally weak containers, damaged by use over time, might continue to be used because no other container was available. Standard Club said that "effective stacking of containers relies on the strength of the corner posts to support the weight of the containers above. Damage to a corner post, in particular buckling, can seriously degrade its compressive strength and lead to collapse of a container stack".

Inadequate securing: Containers were secured to each other with twistlocks fitted at their four corners. Lashing rods and turnbuckles were then used to secure the container stacks to the deck by connecting them to the hatch covers, deck posts or lashing bridges if fitted.

However, lashing rods were only able to reach to the bottom of the third tier of containers loaded on hatch covers or deck posts, or to the bottom of the fourth or fifth tier of containers where a lashing bridge was fitted. This meant that, on large modern container ships, several upper tiers were secured by twistlocks only. The Club warned that missing twistlocks, unlocked twistlocks, damaged lashing gear and lashings becoming loose in a seaway could lead to a container stack collapse. Lashing and securing gear was not usually inspected by a classification society. Replacement of sub-standard equipment was the responsibility of a ship’s crew.

> Standard Club's conclusion was that, as container ships had become larger, beamier and thus stiffer, the only significant enhancement in deck lashing and securing systems had been the provision of lashing bridges. "While larger container ships

provide commercial advantage to shipowners, these are often being staffed with fewer and fewer crewmembers. Given the highly commercial and systems-driven nature of the container trade, crewmembers might sometimes think their role is reduced to that of passive bystanders. This must not be allowed to happen: they must always be able to react quickly and make the correct decisions."