STEAMSHIP MUTUAL

MSC Napoli – A Case History

On the 17th January 2007 the 4419 TEU container ship 'MSC Napoli' departed Antwerp on passage to Sines in Portugal, by the 20th January 2007 the vessel was aground in Branscome Bay on the south west coast of England with a partially broken back.

The reasons behind the strutural failure of an apparently well found vessel, as is often the case, are many and varied, and when all taken together caused an incident which was very much in the media spotlight.

The vessel operated a regular port rotation between North West Europe and South Africa, and on this voyage had departed from Cape Town 4 days behind schedule, in order to make up time 2 port calls in Northern Europe were cancelled and the cargo from these ports was transhipped to Antwerp for loading. However, due to various problems with her main engine turbochargers and the main engine governor the vessel was 6 days behind schedule by the time she departed Antwerp and therefore trying to make up time on her schedule. Upon departure from Antwerp although all the 4 turbochargers had been repaired the main engine governor was still not operational and the main engine rpm was being controlled locally from the engine side. The vessel was therefore still under pressure to make up time and comply with her sailing schedule.

As the vessel sailed down the channel she encountered increasingly heavy weather such that by the time she has passed throught the Casquets Traffic Seperation Scheme she was encountering storm force winds with seas of between 5 and 9 metres. The main engine was set at a speed that would normally enable the vessel to make 17knots, however in the strong winds and high seas she was only making 11 knots over the ground, even with the tidal stream assisting the vessel, and although the vessel was pitching heaving she was not rolling to any great extent. The vessel charter speed was 21.5 Kts. At this time the Master was happy with the speed of the vessel and he considered that no damage would be caused to the containers loaded forward by seas washing over the bow and shoulders.

Shortly after 1100 on the morning of 18th January 2007 the vessel pitched heavily into several large waves and a loud cracking sound was heard, subsequently several engine room bilge alarms sounded and upon further investigation by the engineers a large quantity of oil water was noted in the bilges and what appeared to be a large fracture in the side shell plating was sighted; it transpired that the hull was starting to fail in way of the forward engine room bulkhead, the main engine was stopped and the engine room evacuated. After discussions between the Master and Chief Engineer and the inspection of the hull by the Master from both the port and starboard bridge wings it was concluded that the vessel was breaking her back and the descission taken to abandon ship. All crew subsequently mustered and due to the starboard side being exposed to the wind and waves, they abandoned ship in the port lifeboat, which was successfully lowered into the water and released from her falls, although some difficulty was had in releasing the painter the boat eventually manoevered away from the ship. Distress messages had been sent by MF DSC and by VHF to the local Traffic Seperation Scheme VTS prior to the crew departing the vessel, and the EPIRB and SART were both subsequently activated in the lifeboat. The crew were subsequently rescued by helicopter without any casualties and the vessel was taken under tow. However, during the tow concerns increased that the vessel may break her back completely and sink therefore she was intentionally beached in Branscombe bay, where a number of containers were lost overboard, some of which came ashore nearby.

The contribution of the various factors which combined to cause the breakup of the vessel were many and various, and are discussed below:

Ship Speed

The speed of the vessel had been reduced by 11 rpm during the night preceeding the incident, this however was purely due to difficulties being experienced in controlling the the main engine rpm without a functioning engine governor. Tests have shown, as would be expected, that a reduction in speed reduces the bending moments imposed on the hull form, and reduced the occurance and the magniture of slamming and whipping. At the time of the casualty the vessel was making good 11 kts over the ground, therefore there was scope for reducing the ship speed still further before steerage would be lost. It is hightly likely that a reduction in the speed of the vessel in this instance would have reduced the possibility of hull failure occuring.

Bending Moment Limitations

On departure Antwerp the vessel was limited to a maximum sailing draft of 13m in order to be able to sail at any state of the tide so as not to delay the vessel any further. However, in order to maintain a maximum 13m draft the vessels ballast and cargo configuration was such that she departed the berth in Antwerp with a bending moment of 116% of the permissable seagoing limit, the plan being to adjust the ballast configuration as the vessel sailed down the River Schelte to the sea. After the vessel had departed the locks at Antwerp the ballast was adjusted such that the seagoing bending moment was reducted to 99% of the maximum permissile limit and the aft draft increased to 13.5m. The pilot was never informed that the draft had increased and trim changed during the river passage.

On arrival at Antwerp the vessel had arrived at the port with a bending moment of 120% of the maximum permissible seagoing limit, and it seems from the ships loading computer that the vessel had arrived or departed from berths on numerous occasions with bending moments above the permissible seagoing limits.

Bow Slamming and Hull Whipping

Slamming, being the impact of either the bottom of the hull with the water in a seaway, or the flare of the bow with the water, and whipping which is the residual affect of slamming on the hull form, could also have possibly increased the bending moment effect on the hull taking the bending moments experienced way past the permissible seagoing limits imposed on the vessel, seeing as she was already at 99% of the permissible seagoing limit.
Various tests on ships and models has shown that the whipping affect may increase the wave loading/bending moment on the vessel by 30%, possible even 50%. The effect of whipping in this instance may have had a profound affect as the vessel slammed into several large waves immediately prior to the hull failure, and she was built with a moderately large flare at both the bow and the stern which could have exacerbated the slamming and the resultant whipping of the hull. However, the effect of whipping is notoriously difficult to model accurately and more work is to be done to assess the affects of whipping on a hull form in a seaway.

Hull Design and Construction

The MSC Napoli was a post panamax containership, being at the time of her construction one of the largest of her type, her design being based on that of a smaller vessel. She was a one off construction having no sister vessels.

Her hull was arranged with a ¾ aft accomodation superstructure, with 6 holds forward and 1 aft of the accomodation. The framing system for the vessel was longitudinal forward of the engine room forward bulkhead, and aft of this the lower structure changed to being transversely framed with plate floors, with a transition area where longitudinals from the cargo hold forward of the bulkhead continued aft into the engine room. The upper structure aft of the engine room bulkhead continued to be longitudinally framed. In addition to the change in the principal framing method; at the forward engine room bulkhead the deck plate thickness was reduced by 19%, the size of the hatch coaming was also reducted and the wing tanks were discontinued.

At the time of her design the Classifications societies rules for construction required a finite element analysis to be conducted on an area of the hull covering from midships to 0.2 of hull length either side, to ensure the hull complied with applicable buckling criteria, therefore the area in way of the engine room bulkhead where the framing system changed substantially was never subject to three dimensional stress analysis, even though due to the substantial change in the faming system at this point it should have been subject to closer scrutiny.
When the vessel changed Classification Soceity many years, later, due to be both soceities being members of the International Association of Classification Soceities (IACS), no further checks were conducted due to the vessel having been built under the rules common between IACS members at the time.

A survey of the hull structure after the casualty revealed that the hull had failed just aft of the forward engine room bulkhead. It was also found that the longitudinal girders in way of the failure on the port side were continuous, and had generally failed mid frame. Those on the starboard side were not continous and had failed at the fillet welds. In this area some of the fillet welds were found to be mariginally smaller than the build specification, however the strength of the welds was found to have negated the slightly smaller size of weld. Some samples of steel taken from the hull in way of the failure were also found to have been repaired and it was not know when these repairs took place, as they had never been reported to the vessel classificaiton society at the time, as they should have been. In addition it was noted that the grades of steel used were generally in line with build specificiaton, however the centreline girder was found to be mild steel instead of the specified high tensile steel.

Container Weights and Locations

The loading and ballasting condition of the containers onboard the vessel was analysied post incident and it was found that the 7% of the containers on the deck were found to not be the in the same position or the same container as shown in the loading plan, in addition, of the deck containers, 20% of these were found to be more than 3t different from their declared weight. Both these factors leading to inaccuracy in the load condition used to determine the stability and bending moment affecting the vessel, and would possibly have increased the bending moment of the vessel still further towards her seagoing limits.

Summary

As can be seen, a combination of possible excessive speed in the prevailing environmental conditions, lack of strutural analysis of the entire hull, or at least the area of change of framing prior to building, the operation of the vessel close to or above the permissible seagoing bending moment combined with innacurate information about container distribution and weight onboard possibly exacerabating the problem, and the effect of slamming and whipping on the hull form in heavy weather may well have all been instrumental when coming together to cause the failure of the hull on the ‘MSC Napoli’.

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