

S.S. "GRETASTON".

Failure of Strength Deck Plating under Compressive Stress.

The question of the failure of unsheathed deck plating under compressive stress has engaged the attention of the Committee on various occasions.

So long ago as 1906 this matter was brought before the Committee in a memorandum which set forth detailed particulars of cases in which failure of the plating of bridge or shelter decks had occurred.

At that time it was considered that the trouble was due to the then prevalent practice of fitting beams to alternate frames, and the Rules of the Society were altered to require that in the case of unsheathed steel decks beams should be fitted in every frame, and, in addition, intercostal girders should be fitted below the deck joining the hatchway coamings and deckhouses. These requirements were incorporated in the Society's Revised Rules in 1909.

Since that time, other cases of failure of shelter deck plating have occurred, but in only a few cases has the information regarding the loading of the vessel necessary to enable a full investigation to be made been supplied.

As one instance may be cited the case of the "GLENWORTH", built in 1920, dimensions: 450' x 55' x 26.4', which showed such signs of weakness on her first voyage that she was returned to the builders in order that additional strengthening to the deck in the form of doubling plates and deck girders should be fitted to the weather deck.

Last November a special memorandum was placed before the Committee dealing with the cases of the "PORT BOWEN", built in 1919, dimensions: 480.7' x 62.4' x 32.9', and the "PORT AUCKLAND", built in 1922, dimensions: 480.8' x 62.4' x 32.9'. Each of these vessels was loaded with a sufficient supply of coal for the round voyage, amounting to 3,100 and

4,600 tons respectively, and in both vessels the shelter deck plating buckled. From information supplied by the Owners it appeared that in accordance with their usual practice the whole of the coal was stowed abreast the machinery and in a spare cross bunker forward of the boiler room.

In the "PORT AUCKLAND" the compressive stress on the deck plating was 8.9 tons per square inch and in the "PORT BOWEN" 8.7 tons per square inch. It may be mentioned that the condition of loading of the "PORT BOWEN" approximates closely to the case of the "GRETASTON", in which, as mentioned in the endorsement of 6.6.24, 47 per cent. of the displacement was concentrated over 135 feet amidships.

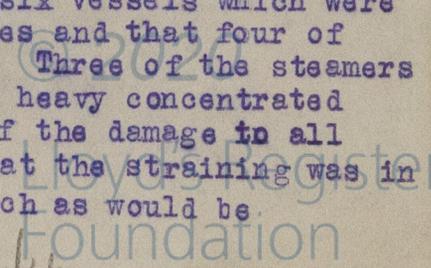
The case of the "GRETASTON" has been very fully investigated, and it has been found that the compressive stresses on the bridge deck plating under different conditions are as follows:-

	1921-22 Rules	Revised Rules
Normal Fully-Loaded Condition.....	3.8	4.0
With no cargo, but with double bottom and peak tanks full, and:-		
(a) With 1,000 tons of coal stowed amidships.....	5.8	6.1
(b) With 1,000 tons of coal stowed amidships and with deep tank filled in addition, or with 2,000 tons of coal stowed amidships....	7.8	8.2
(c) With 2,000 tons of coal stowed amidships and with deep tank filled in addition.....	8.5	9.0

While it is not possible to lay down a definite limiting safe stress, it may be said that where the compressive stress on deck plating exceeds about 7 or 7½ tons per square inch the possibility of trouble exists.

It may be of interest to quote the concluding remarks of the 1906 memorandum already referred to, which read as follows:-

"It will be observed that the six vessels which were "damaged were of five different types and that four of "them had deep water ballast tanks. Three of the steamers "are known to have been loaded with heavy concentrated "weights amidships and the nature of the damage in all "six vessels shows without doubt that the straining was in "each instance caused by sagging such as would be.



"experienced in the trough of a sea. This tendency to
"sag is much accentuated when a vessel is ballasted
"with heavy weights concentrated amidships through
"filling deep midship tanks with water and carrying
"large quantities of bunker coal in the vicinity of the
"same while the forward and after holds are empty.

"The scantlings provided for in the Society's Rules
"are adapted for vessels properly loaded or ballasted.
"With such a distribution of weights no buckling of deck
"plating has been experienced; but owing to changes in
"trade exigencies a practice has arisen of late of
"sending vessels across the Atlantic ballasted, with
"their principal weight concentrated amidships. It has
"been under these conditions that cases of buckling have
"occurred."

The foregoing observations, made in 1906, are directly applicable to the case of the "GRETASTON", and also point to the fact that at times when economic conditions similar to those prevailing in 1906 exist, i.e. when little outward cargo is offering from the United Kingdom, vessels will be cleared outwards in ballast with bunker coal for a long round voyage.

The buckling of deck plating in cargo vessels is not a new experience, but intermittent cases have arisen over a long period of years. Whenever detailed investigation of the cause of the buckling has been possible, it has been found that the vessel has been loaded with heavy concentrated weights amidships.

It may be stated that it is the present practice of the Committee to suggest to the builders that where two ordinary deep tanks are fitted amidships, additional strengthening should be provided in the form of intercostal girders under the deck.

The cases of vessels in the ballast condition might be classed under the following headings:-

1. Vessels which have no deep tank amidships and which carry a normal supply of coal, sufficient say for 30 days steaming.
2. Vessels which have no deep tank amidships and which carry a sufficient quantity of coal for a long round voyage, say for 60 days steaming.
3. Vessels which have one deep tank amidships and carry a normal supply of coal (30 days).
4. Vessels which have two deep tanks amidships and carry a normal supply of coal (30 days).
5. Vessels which have one deep tank amidships and carry coal for a round voyage of 60 days.
6. Vessels which have two deep tanks amidships and carry a supply of coal for 60 days.

Case 1 is the normal condition for a ship, as contemplated by the Rules, and no apprehension need be felt regarding the strength of the deck plating.

Cases 4 and 6, vessels having two deep tanks amidships and carrying coal either for an ordinary voyage or for a long round trip, are liable to develop stresses beyond the safe limit in the deck plating, and in such cases, as already mentioned, it is the practice of the Committee to recommend additional strengthening to be fitted to the deck.

Case 5, vessels having one deep tank and carrying coal for a round trip, i.e. the case of the "GRETASTON", may be classed with cases 4 and 6 as being likely to develop weakness.

Cases 2 and 3, vessels which have no deep tank amidships and carry coal for a long round trip, or vessels which have one deep tank amidships and carry a normal supply of coal, represent similar conditions as regards stress on the deck plating and may be said to be on the border line between a safe condition and one in which trouble is likely to be experienced.

It should be observed that the original draft for the new Rules contained a Section dealing with the treatment of vessels, which detailed the Society's limitations in regard to improper loading, both as regards stability and distribution of cargo both longitudinally and vertically. A copy of this Section is attached, and Clause 3(c) reads as follows:-

"(c) Special attention should be given to the amount and distribution of ballast used when the vessel is in light condition."

It was however decided that such a section should not be included in the Rules; but had this been done, the question of any liability on the part of the Society in this case would have been covered.

It is considered that the Revised Rules provide sufficiently for normal trading conditions.

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7.7.24

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