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Strength Calculation of Local Structure Deck Load for Ship Carter Requirement Information

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Abstract: *Several ship expeditions or shipping line in effort of core business condition in carrying goods to sea transportation by ship, for information strength local requirement of ship owners in the process of carter a ship. Strength calculation should provide information and technical specifications for the local structure deck load of the ship. Owner need for information quickly about the strength local structure deck of a ship in the strength structure loading before carter. It is necessary to provided because effort payload capacity can be transported to allow mobile, motor, dump truck or other vehicle that go to access through deck ship. In the general calculation of the strength local structure is calculated by several formulas the classification of the Indonesia Biro Classification Rules for Hull (Part 1, Vol. II). Scantling Calculation methods derived in numeric formulae of the strength local structure are taken by some basic equation or the standard response about plate distribution loading evenly occurring laterally. Basic of equation formulae can show in the form of empirical either by changing the variable, or by adjusting the units in accordance with the general pattern in Rules for Hull. Result calculation example of cargo deck for existing LCT ship is strength with value 6.0 t/m^2 where it assumption condition noted 100 percent condition of deck thickness without corrosion.*

Keywords: *Local structure, deck load, thickness, rules, ship carter.*

1. Introduction

LCT which means Landing Craft Transportation is a type of flat-hulled vessel with a hull form. Not only it can enter shallow waters but also lean on the shoulder of the beach. Landing Craft Transportation or initially LCT ship usually as a type of landing craft carrying define military equipment such as tanks, army, amphibious at the time for the Second World War. At this time the ship LCT is the transportation equipment that is used in almost all the world, for the benefit of sending goods and heavy equipment. Indonesian waters used for the benefit of heavy equipment or send goods to all regions island in Indonesia. For the purposes of sea transport ship type is very beneficial, especially when used for transportation in the shallow waters such as rivers. For river or sallow draft that has a depth of only two meters can still be traversed by LCT ship with tonnage small. A lot of these ships operating in the waters and river channels Indonesia as commercial ships carrying various payloads or types of goods that are large and weighty large (example, dump trucks, dozers, excavator, construction tools, steel structure, boiler, turbine engines, rig equipment, transformers, project materials, etc.) to various parts of Indonesia, especially to the mining areas or locations that are on the island or coastal and river channels.

LCT ship types are also commonly used as a means of ferry boats for crossing lines between islands in Indonesia. Other functions of the LCT are as a means of transport the liquid material to supply the needs of clean water and fuel oil at the site of mining projects or for distribution to remote areas in Indonesia.

In most ramp door access designs with deck load value will be considered strength adequate. Ramp doors be form swing-arm type, clam-type, directly-hinged type, side-hinged or wing-type such as constrain condition. The ramp door is strength design from the ramp due to safety reasons. When the ramp door is in its open position for access operation, it is must check strength about ramp door structure to give distribution load and concentration load. It is divided in strength calculation to permitted load access allow according way of ramp door as information strength ramp door. The shipping company or expedition in its efforts to conduct core business in shipping goods by sea transportation by LCT ship, to requirement the ship owners in the process for rent or carter a ship, should provide information and technical specifications for ramp door deck load of the ship. Owner need for information about the strength ramp door deck of a ship in the strength structure load. It is necessary to provide certainty in payload capacity can be transported or carry such as dump truck, container trucks, heavy transportation etc that go to access through allow the ramp door ship.

2. Result Strength Calculation Local Structure

For example LCT ships to information about the strength ramp door deck of a ship in the strength structure load for carter requirement as Vessel Adinda Celinna. It is (IMO: 9631785, MMSI: 525007269) is a Landing Craft Transportation type built in 2013 and

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currently sailing under the flag of Indonesia. MV. Adinda Celinna has 79 m length overall and beam of 17 m. Her gross tonnage is 1719 tons. The structure consists of a ramp door mounted some strengthening, such as, plate, bracket and girder profiles. The structure formed in such a way become form construction to the strength structure of the ramp door. As shown example structure ramp door deck load for calculation:

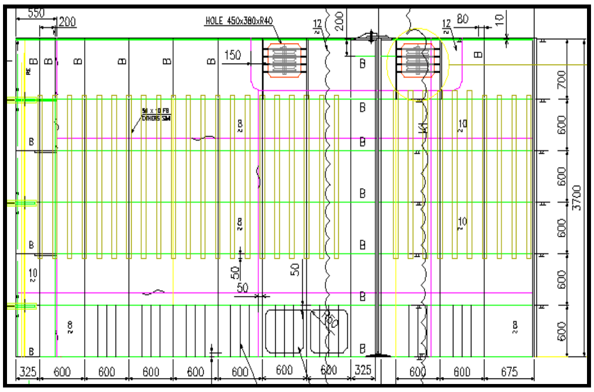

***Figure1:** Ramp door Drawing*

Assumption;
w = Uniform load per unit length along s
w = P x 1 (mm)
P = Deck Load

Relations simple curved beam reference shown in the following formula:

$$\frac{M}{I} = \frac{E}{R} = \frac{\sigma}{Y} \quad \text{........} \qquad (1)$$

Maximum bending moment

$$M = \frac{w \times s^2}{12} \quad \text{.........} \qquad (2)$$

$$M = \frac{p \times s^2}{12}$$

Maximum Bending stress (σx)

$$\sigma x = M/ze$$

$$= \frac{Ps^2/12}{t^2/6}$$

$$\sigma x = \frac{Ps^2}{2t^2}$$

Principal stress

$$\sigma 1 = 1.13\ \sigma y \quad \text{.........} \qquad (3)$$

Equivalent with principal stresses (σ1)

$$\Sigma x = \sigma 1$$

$$\frac{Ps^2}{2t^2} = 1.13\ \sigma y$$

$$\frac{Ps^2}{t^2} = 2.26\ \sigma y$$

$$P = \frac{2.26\ \sigma y\ t^2}{s^2} \quad \text{........} \qquad (4)$$

Where
σ = 235 N/mm^2
for yields stress material deck mild steel grade A
t = 8 mm ramp door deck thickness
s = 600 mm span

100 percent condition of ramp deck thickness without corrosion
Deck load (P) = 0.08 N/mm^2
= 9.44 t/m^2

Diminution 20 percent condition of deck thickness or reduce of additional factor corrosion
tk = Corrosion addition for ramp
tk = 1.50 mm
t = 6.50 mm

Deck load (P) = 0.06 N/mm^2
= 6.23 t/m^2

Judgment of structure:
Actual existing ramp deck load strength 6.0 t/m^2, with 100 percent condition of deck thickness with corrosion

Several result of calculation Class has showed in bellow figure. Class calculation has calculated high value than deck load formulae. It is cause variable safety factor rules have high too. So deck load formulae can be used to judgment local structure has better and fast.

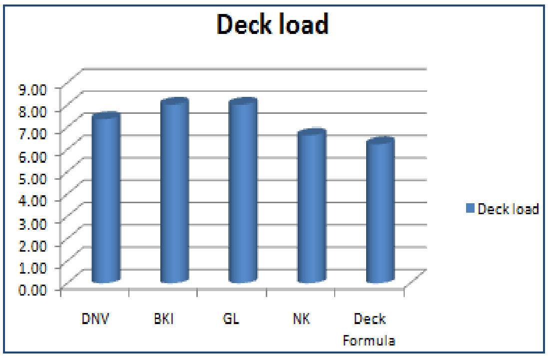

***Figure2:** Other Rule and deck load formulae*

Figure above show result of calculation deck load. deck load formulae more safe better than other rule regulation. So it's forward to development for fast operation calculation with software open source.

3. Acknowledgements

Thank to lecture in PPNS support sharing knowledge in Campus.

4. References

Strain can occur due to the force exerted on the object or the wire is removed, so that the wire back to the initial shape. If the force applied to exceed the limits of elasticity, the object cannot be returned to its original form (it get into the area range and can range plastic deformation state). If force has given by the growing number of objects can be damaged even dropped. In other words, Hooke's law applies only to the limit of elasticity

Here is shown a graph strain and stress in a tensile test material (sample taken public on the steel material tensile test). In the graph of strain and stress are two parts of the area which is the area of elastic and plastic regions (inelastic). Where the views of the nature of the behavior of the structure during the reaction loading, explained that the area elastic until range elastic (up to the legal limit of Hook) because it has no strain value, then there is no deformation, while the value of area yield (up to the elastic limit) will occur deformation though not until the structure becomes damaged. For the plastic area, when the loading resulting in deformation, even if the value of the loading increases will result in excessive deformation of the structure breaks even. Value style or loading that occurs is proportional to the voltage that occurs. The span of structure is proportional to the strain that occurs.

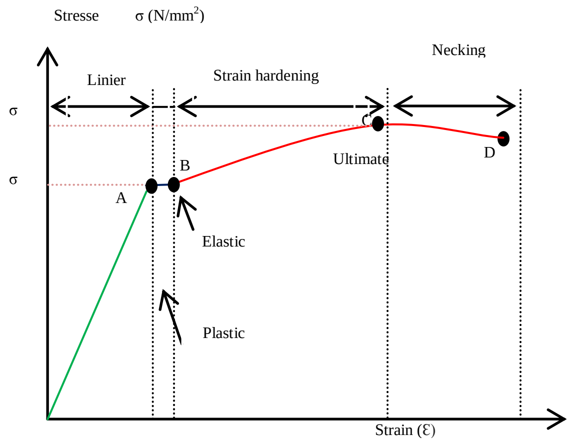

***Figure3:** Stress strain relation*

Euler-Bernoulli beam theory (commonly known as the theory of beam techniques or classical beam theory) is a simplification of the linear theory of elasticity to which it explained the meaning of the translation of the calculations that led to the imposition and deflection. Stress, strain, dimensions, curvature and elasticity are interconnected with one another under the conditions set forth into the theory of beams in simple curved shape. Where do the loading that causes the results from the curved beam by having the amount of deflection occurs, without considering the sheer force factors occur. [1]

In the calculation of the power ramp door is calculated by calculating the classification of the ICC Rules For Hull (Part 1, Vol. II) [2]. Working methods in the calculation of the power ramp door is by lowering some basic equation or the standard response for plate loading evenly occurring laterally. Then change the basic equation in the form of empirical either by changing the variable, or by adjusting the units in accordance with the general pattern in Rules for Hull. Rules For Hull in Section 3, A. 3 mentioned, “The formulae for plate panels subjected to lateral pressure as given in the following Sections are based on the assumption of an un-curved plate panel having an aspect ratio b/a >= 2,24”.

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