MET PELAKS KAPAL BETON DAN KAYU

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SHIPBUILDING METHOD OF CONCRETE JOINT WOOD INNOVATIVE BOAT WILL REDUCE STRUCTURAL WOOD SOURCES

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Abstract

Small to medium size 50 DWT fishing vessels are dominated by wooden ships, while wood for the structure is the keel, stern and frames used a lot, and the keel, and stern must be large around 25/35 (width 25, height 35). Large size wood structure is very rare and cutting large-diameter trees damage the environment This paper, type boat of Purse Seine with keel structure, middle frames to stern, and stern used reinforced concrete,

Objective: using concrete materials to reduce wood with the right ship-building method will accelerate execution time

Exploration methodology based on standards of concrete, wood, and building structure Data on the dimensions material of the wooden hull, wooden beam, wooden and concrete frames, wood height with concrete height and keel concrete, lines plan, construction profile plan, structure drawing and equipment

The structure of the ship must be able to accept dynamic and static forces. Skilled personnel need training

The optimal shipyard area is at least 120% of the ship's size

Conclusion

The concrete blanket of more than 3 cm. The bolt requirements of a minimum bolt diameter of 13 mm, between bolt distance of 39 mm.

The time for the construction of an innovative boat is 50% faster than that of wood

Keywords: *Large diameter trees, a damaged environment, Concrete Joint Wood structure boat, Innovative boat*

1.Introduction

Indonesia consists of +/- 70% of the sea, with a variety of marine wealth, among others, various types of fish and shallow marine fish. The cliffs /walls are in the water until the coral walls are very sharp. So that wood is used on the hull and high keel frames Small to medium size 50 DWT fishing vessels are dominated by wooden ships, while wood for the structure is keel, stern and frames used a lot, and the keel, and stern must be large around 25/35(width 25, hight 35). The large-size wood structure is very rare On this paper ship Purse Seine with keel structure, stern and middle frames to stern used reinforced concrete

The shipbuilding method greatly determines the success of ship construction. A good method will produce ships that meet optimal cost requirements, effective time, good quality, and comfort or safety of the shipbuilder

Ship construction is, complex of activities concerned with the design and fabrication of all marine vehicles.

Ship construction today is a complicated compound of art and science. In the great days of sail, vessels were

designed and built based on practical experience; ship construction was predominantly a skill. With the rapid growth and development of the physical sciences, beginning in the early 19th century, it was inevitable that hydrokinetics (the study of fluids in motion), hydrostatics (the study of fluids at rest), and the science of materials and structures should augment the shipbuilder's skill. The consequence of this was a rapid increase in the size, speed, commercial value, and safety of ships.

Material knowledge and understanding of ship-building methods determine the success of the ship's structure and finishing

Shipbuilding the concrete joint wood purse seine vessels are prepared and analyzed to be carried out in the community shipyard so that it is easily carried out by the fishing community. Ordinary fishermen make fishing boats in community shipyards with cooperation.

Making connections is very important for the strength of the structure, each element must be connected according to needs, applicable standards, and styles that will be accepted. Standards used from the Indonesian Classification Bureau (BKI), SNI to Timber Regulation and Concrete Regulations 2002.
Bolt connection provisions by the Indonesian Wood Construction Regulation (PKKI) that bolt connectors must be made of ST 37 steel or of iron which has the least strength as St.37, Bolt holes must be made to be sufficient and the allowance should not exceed 1.3 mm. The center line of the smallest bolt must be 10 mm (3/8 ") while for the connection, both one-sided and two-sided, with thicker wood greater than 8 cm, must be worn with a bolt with the smallest diameter of 12.7 mm (1/2 "). Bolts must be accompanied by a following plate with a minimum thickness of 0.3 d and a maximum of 5 mm with a 3d diameter or if it has a rectangular shape, the width is 3d, where d = the center line of the bolt. If the bolt is only as a complement, the thickness of the joining plate can be taken at a minimum of 0.2 d and a maximum of 4 mm.

The fishing boat owned by the fisherman traditionally was built without the use of design drawings such as general arrangements, line plans, deck profiles, profile construction, engine seating, and others. The boat is not equipped with hydrostatic calculations, stability, trim, and so on (Pasaribu B.P, 1984).

Measurements and numerical analysis (with bearings' foundation stiffness characteristics taken into consideration) have got a good correlation in cold main engine conditions. Also, the influence of engine thermal conditions on the bearing reaction level was confirmed. The influence of ship ballast condition in the shafting alignment, not taken into account so far, seems not to be negligible.

In the author's opinion, stiffness and damping characteristics of the boundary conditions should be taken into account during static and dynamic analysis of the shaft line alignment and whirling vibrations. Shaft line alignment must be performed in the dock or on the slipway. Stern tube bearings should be modeled as continuous support, and intermediate bearings and main engine bearings support can be modeled as points. Hull's local stiffness, intermediate bearing's frame, and oil film stiffness are in the same order of magnitude, therefore all these components should be taken into account. Foundation stiffness might be determined by modeling only the stern part of the ship hull even without the deckhouse and chimney (to the upper deck). Natural frequencies of the intermediate bearing's frame are high, therefore only static analysis can be done.
Objective: using concrete materials to reduce wood with the right ship-building method will accelerate execution time

2. Method and Data

Exploration methodology based on standards of the concrete, wood, building structure, and the author's experiences in the construction field since 1983.

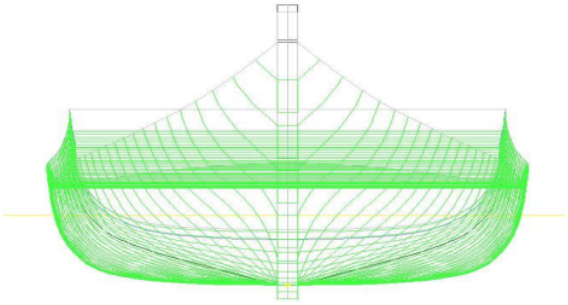
2.1 Data needed

The data of the purseine vessel needed (Fyson, 1985) include:

(1) Data on the dimensions of the ship's structure, namely the dimensions of the wooden hull, wooden beam, wooden and concrete frames, wood height with concrete height, and keel concrete

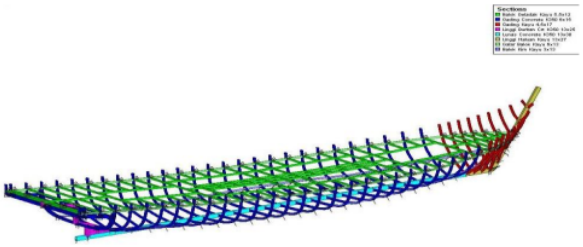
C_W	C_b	C_Φ	C_{vp}	C_p	L_{OA} (m)	L_{PP} (m)	L_{WL} (m)	B (m)	D (m)	d (m)	B_{WL}
0,777	0,504	0,741	0,649	0,680	25,00	20,50	20,70	6,50	1,33	1,00	6,10

(1) Lines plan

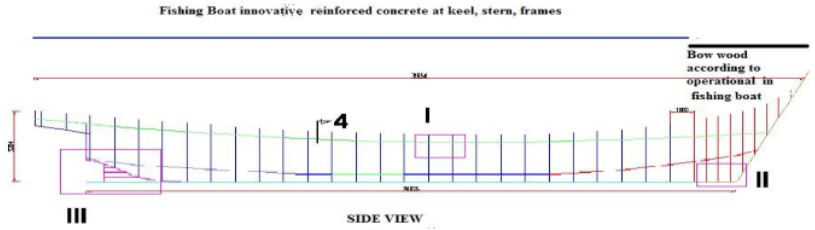


(2) Table *offset*

(3) Construction profile plan



(4) In addition, it is necessary to calculate and structure drawings, and mechanical and electrical images.



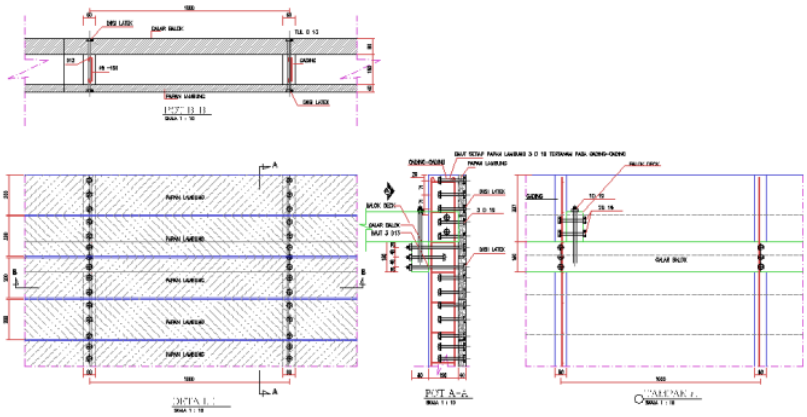
A connection drawing is needed to make the connection run according to technical requirements. These details are:

a. Detail I is a wooden hull with concrete frames and woodwork

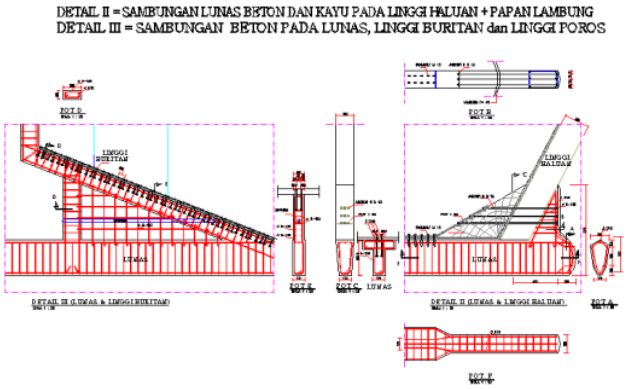
b. Detail II is a concrete keel, wooden bow, and wooden hull.

c. Detail III is a concrete keel, concrete stern, and center stern concrete.

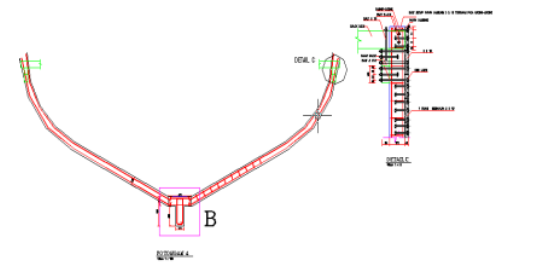
The detail I was a wooden hull with concrete frames and woodwork. Bolt Connection on the Hull Filled with Latek

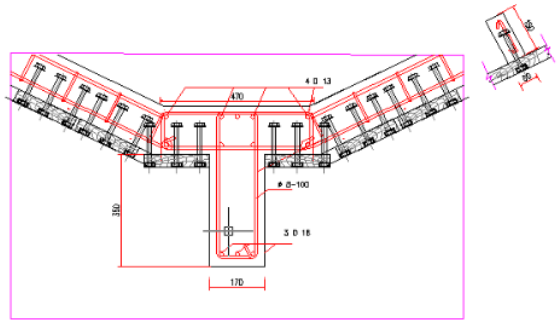


Detail II is a concrete keel, wooden bow, and wooden hull
Detail III is a concrete keel, concrete stern, and concrete center bow



1) Galar and wood frames





DETAIL B
ESCALA 1 : 10

2) Galar and wooden frames (detail C). Completed Connection with frames Wood (detail B).

All documents must be made communicative, clear, detailed, and complete

Photo 1: Concrete mixer for mixing concrete

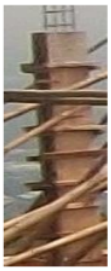
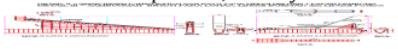


Photo 2: Examples of formwork

Foto 3: Gutter for casting concrete

The shipping builds the concrete and wood purse seine vessels and is prepared and analyzed to be carried out in the community shipyard so that it is easily carried out by the fishing community. Ordinary fishermen make fishing boats in community shipyards with cooperation.

The construction of the ship structure is carried out in parallel, namely the work



3. Making concrete (if without the ready mix of manufacturing), the quality of split, sand, and cement is observed. good quality split is 2-3 cm in size and has many side shapes and is rough. Concrete sand with coarse, clean, non-chemical granules. The cement is resistant to seawater and alkali resistant.
4. Concrete mixer is used as much as the casting volume in one element. As much as casting continues (as much as cubic elements to be cast, for example, keel, stern, at least one frame.
5. Formwork should be of 9 mm MDF (multiplex coated with film glass
, membrane) so that it is neat and smooth. In making formwork, pay attention to stiffeners, support, and steel skewers with a distance of 40 cm so that no deformation occurs.
6. Casting foundry must be strong, and shaped following the shape of the keel, stern, and desired frames. In addition, the casting must be solid, assisted by compacting with a vibrator.

keel, frames, and concrete height cast at the same time as well as the installation of wood in frames and bow high. The order of construction is as follows:

1. Making formwork and keel reinforced

2. Making formwork and frames reinforced, stern, center stern

7. Curing (maintenance after casting) keel concrete, stern, and frames must be covered with wet sacks so that evaporation of cement water is not fast. When fast evaporation will easily crack

3. Analysis

Analysis of the construction method of Ship Structure in terms of:

1. Design:

The fc' 40 mpa concrete includes high quality and waterproof but is easily carried out with a concrete mixer that can be carried out in various places. But it is necessary to pay attention to the concrete material that must be qualified by being tested in the laboratory. In the area to be installed, the bolt is installed with additional reinforcement, given a fastener and reinforcement. To reduce the weight of the concrete, in a location with a relatively small style, the center concrete is hollow.

The relationship between concrete and wood must be strong and good. To produce a strong connection and monolith, bolts for concrete and wood joints are installed before the concrete is cast so that the wood is first perforated and threaded or a bolt head is installed. The casting principle must not be interrupted in the following work:
1) Keel and stern the reinforced concrete.
2) reinforced concrete frames.
Concrete and wood connections that are considered are:
1) Keel and wooden bow
2) Frames and hulls.
3) Keel and hull.
4) Bow and hull
5) Keel and frames

The distance between bolts following the standard is 3 times the diameter of the bolt. In this case, the author has paid attention to the place (adequacy of the connection location) of each connection. The length of the bolt that enters the concrete is made five centimeters or at least 1/3 of the height of the concrete and this is also included in the calculation of the force of the pulling permit that can be received by the bolt. To maintain the connection between concrete and wood, the bolt head is installed before casting, connection image: is

2) Wooden hull joints with concrete frames, wooden bars, and wooden deck beams according to detail I The bolt connection on the hull is filled with latex
3) Concrete keel joints with bow and hull wood height. According to detail II
4) Concrete keel joints with concrete stern height and concrete shaft height according to detail III
5) Galar and wooden frames (detail C). Completed Connection with Frames-frames Wood (detail B).

The concrete structure must be given a purchase, even though the purchase is minimal. This is to overcome cracks. Following SNI 5-2002 "Procedure for Calculation of Concrete Structures for Buildings" minimal clearance of each structural element is determined as follows:
1) Plates = 0.18% of the area of plates / m2.
2) Beam = 0.035%.
3) 1% column.
Concerned concrete and concrete connections [6] are
1) Length of distribution of cuttings (cuttings).
2) Long overlapping reinforced
3) Continuity of casting.
4) Not hollow (solid).
Concrete substitution wood in frames, keel, stern and center stern are produced as follows:
(1) Frames 2.44 m3.
(2) Ahead of Keel 0.21 m3.
(3) Back of Keel 2.14 m3.
(4) stern 0.19 m3.
2) The volume of wood from the calculation as follows
(1) Frames 4.06 m3.
(2) Keel 2.35 m3.
(3) Stern 0.47 m3.

2. Resources:
a. Expert and skilled
b. Equipment
c. Material

a. Experts and skilled personnel:
The role of all personalities involved in the "Quality First" commitment to producing a quality product is crucial. All personalities must have a cultural quality and the coordinator/design team leader must have a leadership spirit, it does not mean that others do not need to have a leadership spirit but must have one even though the demands are minimal for the smallest environment. [7] Experts who understand the structure and management of construction, while skilled workers understand carpentry and shipping

b. Material
Concrete is sand, split, cement, and working. Wood and wood preservatives BJ quality 39/40 used Ø≥ 13 mm thread and 30 plain BJ ≤ 10 mm

c. Equipment
Equipment for concrete and wood. The concrete mixer capacity

which is usually used and easily obtained is 0.6m3, although a large concrete mixer standard of 0.8m3 is available on the market.

3. The innovative ship working time

The installation of formwork and reinforced concrete keel with reinforced concrete frame cuttings and anchor for wood frames was done in 1 day with 1 person carpenter and 1 person carpenter assistant and 1 person iron worker assistant. The volume of concrete that was worked on was relatively small and the entire keel had to be made directly with reinforced cuttings concrete frames installed and anchors for embedded wood frames. The total volume of the keel, 2.35 m3 is required 4 times concrete mixer is done at once in the position of the shipyard so that it becomes keel precast concrete. It takes 1 day to casting

. After a minimum age of 7 days, stern and frame concrete was carried out. Volume 2.63 m3 means 5 concrete mixers. When waiting for 7 days of keel age, frame formwork is made and frame formation is formed. It takes 1 person to the carpenter, 1 person to install reinforced concrete, and 1 person assistant the installment of reinforced concrete in 7 days which is enough to install reinforced concrete and formwork for the stern and frames. Stern and Frames formwork was done 3 days after the carpenter worked on the bow and frame wood in front of the boat. Frames were installed and anchored with reinforced concrete to connect the wood hull. To make a mix it takes 2-person masonry and 2-person assistants, Material split, sand, and cement must be measured in volume before being mixed. The concrete mixer was cleansed by an assistant masonry, cleaning concrete mixer. After measuring the volume, it is put into a concrete mixer and then mixed and then mixed with water. After 7 days 1 person carpenter, 1 person ironworker, and an assistant helped cast concrete. Stern casting and 28 frames 3 days, with 1 day casting from 2 concrete mixers, after 21 days finished making the last frame installed hull. Hull and wood frames are made while waiting 21 days after the last casting of frames. Total time needed 60 days. From the above time it takes 37 days, the remaining 23 days to complete the finishing of the ship

3. Workspace

The flexibility of movement will facilitate the making of the ship's structure/structure and finishing. So that it can produce economical, fast, and good-quality vessels.

4. Financial Support

Financial support will greatly affect the ship produced. Without financial support will slow down the work and the results are not optimal because the material is not sustainable.

4. Results and Discussion

1 Design

Design that is good engineering will result in ship structures that are in line with engineering requirements. The structure of the ship must be able to accept dynamic and static forces due to its weight, weight, load, stability, pitching, strength, and stability associated with the expected lifetime

2 Design results

Design results have been made namely connection details, lines plane, specifications, offset tables, and structural calculations. Need to make a work drawing/shop drawing. Working drawings are adapted to the available material.

3 Resources

Skilled personnel and experts need training so that technically, safety, and neatness are achieved Training to make shop drawings, methods of construction, operation, and maintenance of ships. Wood and concrete equipment must be fully available and the use of concrete mixers must always be clean. Coarse and graded broken stone material, clean concrete, and cement resistant to seawater. The time to implement alternative concrete ships combined with wood with the method

mentioned above with a vessel of 30 GWT is estimated to be around two months of construction considering that casting can be done at once, especially at one concrete mixer cast at a time. For frames approximately five times the concrete mixer of concrete while the keel and height are also five times the concrete mixer of concrete. The construction of the wooden ship which was observed in the community shipyard was around four months.

4 Workspace

The optimal shipyard area is at least 140% of the ship size, space means 40% of the shipyard area if the shipyard area is limited then at least 120% of the ship size.

5 Finance

The minimum available funds are 110% of the estimated construction costs. This is an element of work that is rejected because it does not meet the requirements

5. Conclusion

From the analysis and provisions above, The time for the construction of alternative ships is 50% faster than that of wood, it needs to be done:

1) Work drawings (shop drawings), made from design drawings and lines plane
2) Class II wood material and K 350 concrete are eligible and easily obtained. K350 concrete is used because it can still be made with a concrete mixer/mixer. By paying attention to the material quality and cleanliness of the material, such as crushed stone, sand, and cement which conform to SNI standards of concrete material. quality BJ 39/40 used thread Ø≥ 13 mm and BJ 30 plain ≤ 10 mm
3) Purchasing requirements on concrete meet the SNI requirements, namely the distance between the minimum clearance of 2.5 cm and the concrete blanket of more than 3 cm. Thus the bolt requirements still meet the requirements of a minimum bolt diameter.
4) Concrete mixer equipment must be clean before making concrete and the amount according to volume requirements makes one element that is paid in full, high, and frames
5) Skilled personnel and experts are prepared by providing training first
6) Work space must be free of at least 20% of the largest ship size.
7) The financial support is sufficient so that the construction continues until one vessel is complete and ready for operation

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