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Gap Analysis of Ship Design Approval Case Study: Key Plan Drawing Assessment for Dual Fuel Harbour Tugboat

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ABSTRACT

Starting to build the ship, the ship's designer or builder must prepare key plan drawings with an approval statement that comes from the Classification Society (CS) based on the conformity of key plan drawings to comply with the rules or sometimes do not comply with those rules in several cases, so this situation could be minimized by using a gap analysis technique prior to the approval of the ship design process. Gap analysis is the tool to evaluate whether the design has been conforming to comply with the rules of the classification society or not. This paper chooses some parts of the ship design of a Dual Fuel Harbour Tugboat (DF Tug) to show the level of conformity to the rules. The assessment process involves Biro Klasifikasi Indonesia (BKI) since the DF Tug will be classified by BKI as a competent national classification society. The findings gap is used to improve the design of DF Tug. Finally, the framework of corrections and improvements to the DF Tug design is proposed as part of the refinement of key plan drawings, and the final ship design complies with rules and gets full approval from the classification society.

Keywords: *Gap analysis, key plan design, dual fuel harbour tugboat.*

1. INTRODUCTION

The ship design proceeds in three phases: preliminary design, contract design, and construction detail design [1]. The preliminary drawings are conceptual and preliminary design drawings used in discussion with the client before the contract agreement and its need for further development of design drawing [2]. Once the preliminary design has been accepted and orders are given by the client, a set of contract design documents, drawings, and calculations is begun. During the Contract design stage, refinements are made to the Preliminary drawings and calculations, the details such as piping schematics and electrical calculations are done, and the weight, stability, and speed/power/range/fuel consumption estimates are updated as more details become available, and the drawings necessary for a shipyard to bid on the building contract are produced [2]. These design documents and drawings shall comply with classification society rules requirements since the ship will be classed by the classification society (CS). The ship as an object of this report is classed by Biro Klasifikasi Indonesia (BKI) as the chosen CS.

The plan used for the building proses of the ship is called a construction detail design drawing or shipbuilding drawing. The number of plans can be divided into various groups based on the user. The groups are (1) to convey information pertinent to the design engineers and (2) the various craft personnel that does the construction. The first group is key plan documents, drawings, and calculation papers, and the next group is working on detailed documents and drawings. Both groups are produced by the engineering working group [2] and correlate with each other. In the general procedure of shipbuilders, the working detail documents and drawings will be made after the key plan documents and drawings are approved by chosen CS. The chosen CS reviews and assesses the documents and drawings in conformity with the chosen CS rules, which the shipbuilder has submitted to the chosen CS. Once the process of review and assessment is done, the chosen CS will provide the decision that the submitted documents and drawing are (i) approved, (ii) approved with a comment, or (iii) not approved. If the results are (ii) or (iii), this means a difference gap between chosen CS plan approval engineer and the engineering working group. So, to solve these issues, it is necessary to conduct a gap analysis.

Gap analysis is either a tool or a process to identify where gaps are and what differences exist between a condition's current performance and "what ought to be" in the condition [3]. In this paper, we concern with the activities of the design of the Dual Fuel Harbour Tugboat (DF Tug), which was conducted based on the applicable requirements contained in the Regulation of the Minister of Transportation (PM) of the Republic of Indonesia No. 93 of

2014 concerning Ship Guiding Auxiliary Facilities and Infrastructure, also based on the Minister of Transportation of the Republic of Indonesia No. 57 of 2015 concerning Ship Guiding and Towing [4,5]. The increasingly stringent regulations regarding limiting the levels of exhaust gas particles such as CO, Sox, NOx, etc. and Circular of the Director General of Sea Transportation No. SE. 35 of 2019, dated 18 October 2019, concerning the Obligation to Use Low Sulfuric Fuel, which is the target of the International Maritime Organization (IMO) to reduce exhaust emissions from ship operations [MARPOL 73/78]. Regarding a ship, construction design is referred to under BKI rules. Moreover, the design of DF Tug shall comply with the applied rules, regulations, and standards.

Through gap analysis, the engineering working group seeks to improve its current key plan drawing to reach the desired situation in the ship design of DF Tug. The results of the gap analysis indicate the critical areas where we should take action to narrow the gaps and offer an objective and detailed glimpse at the direction and size of gaps among involved constituents. Gap analysis contributes to devising the engineering working group’s implementation plan and improving its function and organizational effectiveness in many different areas of teamwork. These can include a management system such as human resources or resource planning, engineering tools such as hardware and software, implementations of the ship standard and regulations, information technology, and so on [3]. All of them can refer to factors of the design need, coherence, accuracy, communication intensity, quality of teamwork, and value [6]. This paper will explain the gaps which occurred in the ship design activities of the DF Tug and the effort to minimize the gaps in terms of compliance with the applied rules, regulations, and standard.

2. METHODOLOGY

This study is qualitative research and an interview-based survey to find the gap between the qualities of the key plan drawing of DF Tug.

Gap analysis is conducted in four steps: (i) identifying the working group’s key activities of the present situation in the preparations of the key plan drawing in the design of the Dual Fuel Harbour Tugboat, (ii) determining the ideal future or desired situation of engineering result, (iii) highlighting the gaps that exist and need to be filled, and (iv) modifying and implementing organizational plans to fill the gaps [3].

3. KEY PLAN DRAWING ENGINEERING PROCESS: AS THE PRESENT SITUATION

3.1 Ship Design

The ship design is the result of the ship's architect defining an object for what is requested by the ship's customer (owner) and meeting the requirements and limitations that become a reference in the design process both theoretically and by regulations. The ship design process will involve technical communication or interaction between the ship architect/shipyard and the ship's customer/owner. A design that enables compact communication is a spiral design concept from Evans. This model emphasizes that many design problems interact with each other and must be considered in order and detail, which respectively forms a spiral until a single design reaches all constraints and considerations. This approach is essentially a point-based design. It is called so because it will eventually lead to a point in the design of space [7] and is described in Figure 1.

The spiral design concept consists of four phases, namely concept design, preliminary design, contract design, and detail design, where each phase consists of several sequential and continuous design work sections, which include mission requirements, proportion, preliminary powering lines, body planes, hydrostatic and Bonjean curves, floodable length and freeboard, hull and machinery arrangements, structure, powering, lightship estimate, capacities, trim, intact stability, damaged stability, and cost estimate.

In the process, the design of a dual fuel harbour tugboat begins with the issue of the need for environmentally friendly ships to support the reduction of Sulfuric Oxide (SOx) and Nitric Oxide (NOx) gas emissions in the maritime sector, where regulations on preventing air pollution from ships are contained in MARPOL 73/78 Annex VI, on the way MARPOL Annex VI First adopted in 1997. MARPOL Annex VI states the limitation of air pollution, especially in ship exhaust gases, including NOx and SOx and prohibits ozone-depleting emissions and regulates ship combustion and the emission of volatile compounds. Following the entry into force of MARPOL Annex VI on 19 May 2005, the Marine Environment Protection Committee (MEPC) agreed to revise MARPOL Annex VI to significantly strengthen the emission limits under MARPOL Annex VI and the technical code related to NOx 2008 came into force in July 2010. Currently, Emission Control Area (ECA) in its territorial waters, but in the future, there will be policies related to this, so preparation for the introduction and application of environmentally friendly ship designs and supports for the reduction of harmful gas emissions is quite important to do.

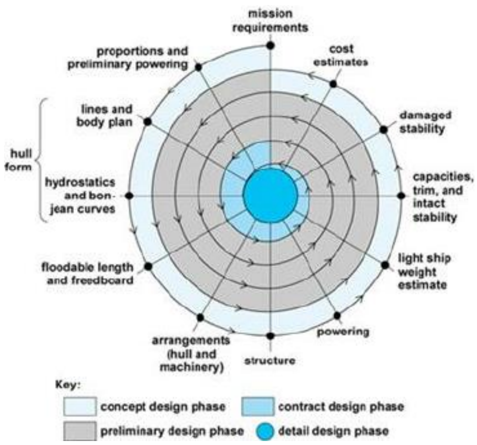


Figure 1. Ship Design Spiral [7]

The design requirements and objectives at the initial stage have been prepared and become a reference in the basic design that produces design documents, namely, lines plan and offset table drawings, general arrangement drawings, hydrostatic curves and tables, intact stability report (preliminary), speed power prediction, capacity plan, freeboard calculation, tonnage measurement, lightweight calculation, deadweight calculation, and scantling calculation.

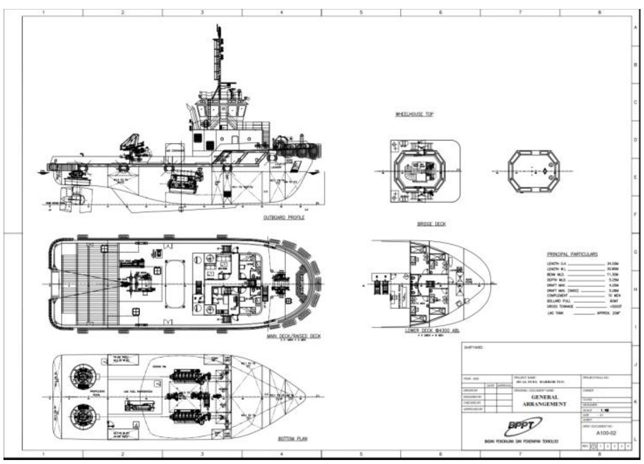


Figure 2. The general arrangement of the dual fuel harbour tugboat [8]

The basic design document is the basis for the following calculation and design: the preparation of a detailed design or key plan for double-fueled port tugboats and key plan design outputs among others. In the preliminary design result, we obtain the main dimension of the dual fuel harbour tugboat and the general arrangement as shown in Figure 2, and the following are the principal dimensions of the ship [8].

- Length overall : Approx. 32.00 m
- Length between p.p. : Approx. 31.37 m
- Breadth molded : Approx. 11.30 m
- Depth molded : Approx. 5.25 m
- Draft max. molded : Approx. 4.20 m
- Gross tonnage : Less than 500

3.2 Teamwork

With the calculation and design load, the personnel who carry out the design activities are adjusted to the number of personnel involved in this activity, where the number of personnel is limited and must be adjusted to the position of the activity organization according to engineering standards that must be met in every research and innovation activity. The engineering for the design innovation of a dual fuel harbour tugboat and its output responsibilities are presented in the following matrix.

The key plan-making activities in the engineering organization structure involve 16 engineers with the competence of shipping engineering and system engineers who occupy the appropriate duties and responsibilities [9], as shown in Table 1.

Table 1. Engineering organization structure of Working Group

Group Leader (Key plan Design)		
Leader 1 (Construction Design)	Leader 2 (Design System)	Leader 3 (Hydrodynamic Test)
Engineering Staffs (5 persons)	*Engineering Staffs (4 persons)*	*Engineering Staffs (3 persons)*
Hull Construction • Midship section • Construction Profile and Deck Plans • Shell expansion • Transversal section and bulkhead • Engine room including engine foundation • Welding detail and procedure (Welding table) • Accommodation construction (including Bulwark Construction) • Wheelhouse construction • Mast Construction • NDT plan	**Machinery Outfitting, Shafting & Propeller, Piping Diagram** • Propeller Drawing • Shafting arrangement and detail • Engine room arrangement • Air Conditioning and ventilation system • Fire, General System, and deck wash system • Bilge, OWS and Sludge System • Sea water cooling system • Exhaust Gas System • Compressed air system	**Hydrodynamic Test Dual Fuel Harbour Tug** • Test model preparations • Resistance test, Seakeeping test, Manoeuvring test. • Test analysis • QA/QC

- Skeg Construction (if available)

Hull Outfitting & Deck Machinery

- Safety Plan (fire plan, structural fire plan, escape plan, safety equipment)
- Z-Peller Arrangement
- Arrangement of Manhole, Hatch, and Bollard
- Rudder Stock and Detail
- Mooring Arrangement
- Towing Arrangement
- Arrangement and detail of door
- Calculation of anode
- Calculation of Equipment Number
- Calculation of CO2 Room
- Lubricating oil system
- Fuel Oil System
- Ballast System
- Scupper System
- Sea and Fresh Water Sanitary System
- Sewage System
- Sounding, Filling, and air Pipe System

Electric & Electronic Outfitting

- Electric Power Balance
- One Line Diagram of Electric system
- Arrangement of electric equipment
- Arrangement of nav-com equipment
- Arrangement of electronic equipment in wheelhouse

The completion of the key plan is an intensive interaction and communication between engineers and is facilitated by appropriate leaders and group leaders. In this case, for the completion of the detailed drawing of the middle section of the ship, such as the schematic flow in the following Figure 3.

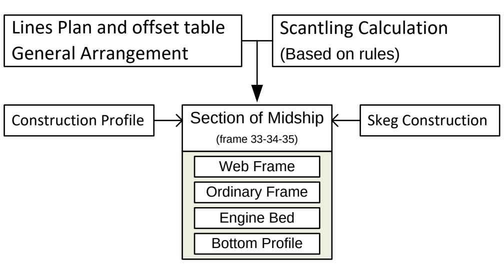


Figure 3. Schematic of the midship section drawing process

3.3 Key Plan Drawing on The Midship Section

The basic design documents that are directly related to the construction of midship section construction drawings are lines plan and general arrangement drawings, where the line plan provides an overview of the outer contours of the ship's hull while the general plan drawing provides input regarding the position of the midship section and the type of tusk (ordinary and web frames). Scantling calculation is carried out based on the requirements of BKI rules as stipulated in [10]. The steps in the calculation include:

1) Design principles, determination of the equality of the main ship sizes (length, width, height, draught, frames, block coefficient).
2) Design load, namely the load on the weather deck, the external load on the side of the ship in the cargo hold, the load on the ship’s bottom, the load on the inner bottom, the load on the tank structures, the maximum static pressure planning, design pressure for partially filled tanks, the load on the superstructure and deck, and allowable stress loads.
3) Shell plating, minimum plate thickness, bottom plate thickness, keel plate, side plate, bilge strake plate, deck plate, top lane side plate, transverse bulkhead thickness, special plate thickness planning in the engine room, a side plate of superstructure & house decks, and deck plates, strengthening for harbour and tug maneuvers.
4) Design of bottom structure, determination of double bottom height, side girders, inner bottom plate, sectional modulus to determine the profile, sectional modulus of the bottom transverse, watertight floor, floor plate.
5) Hull construction planning, the modulus of the cross-section of the underside of the draft, the modulus of the main frames, the modulus of the frame in the tank structure, the web frame and stringers.
6) Deck construction planning on midship, calculated the minimum thickness of deck plating, main frame on deck, main deck support, main deck transverse support, forecastle deck support, forecastle deck transverse support, bridge deck support, bridge deck transverse support, the fortresses and their stiffeners, the thickness of the impermeable bulkhead plates and their reinforcement (modulus), the collision bulkheads and their stiffeners.
7) Construction in the engine room (bottom construction, hull, engine bed, etc).

In the case of calculating and designing detailed construction drawings of the midsection of the ship, the calculation of plate thickness and modulus for profile selection becomes important. Accuracy in the selection of construction profiles and plate thickness, of course, in the process of describing ship construction in general and the middle section of the ship will help in the perfection of the derivative construction drawings and the subsequent calculation of the weight of the empty ship.

3.3 Checking the Key Plan Drawing

The scheme of checking the key plan drawing also determines the perfection of the key plan drawing from misrepresentation and construction size assumptions, where the role of leader and group leader is quite important in this regard. However, the process of checking and re-checking the image will involve all parties involved in the key plan design process.

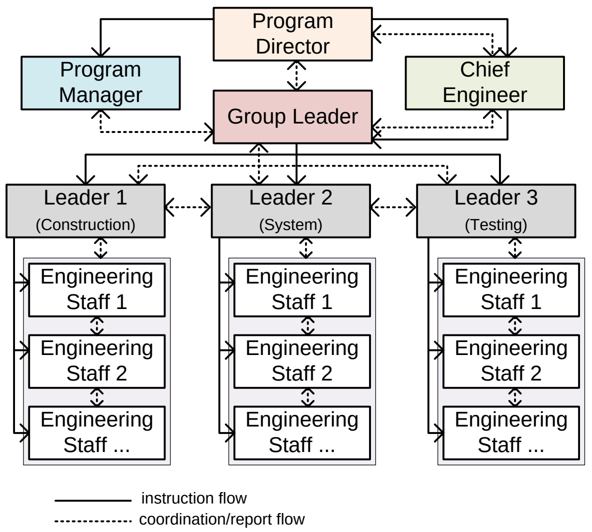


Figure 4. Instruction flow and coordination in engineering systems [9]

In the process of instruction and coordination of the detailed construction drawings' completion of the ship's midsection, which is coordinated by leader 1-construction with the related engineering staff team, according to the scheme in Figure 4, completing the middle section of the ship will require basic design documents such as lines plan, general arrangement and scantling where basic design activities have been carried out in the previous fiscal year (different work teams and engineering work procedures). The nature of the coordination between engineering staff in a work package is only limited to exchanging technical information in accordance with the activities being carried out, while the necessary directions and limitations also the references refer to the instruction sheet received from the group leader (Leader), where if there are major obstacles will be coordinated with the group leader (Group Leader). The following picture shown in Figure 5 is the result of the detailed design of the midship section of the ordinary ivory construction of a dual fuel harbour tugboat.

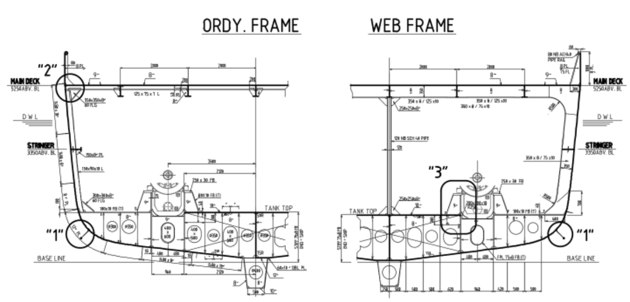


Figure 5. Details of the Midship Section [9]

4. APPROVAL DRAWING PROCESS FOR THE DESIRED SITUATION

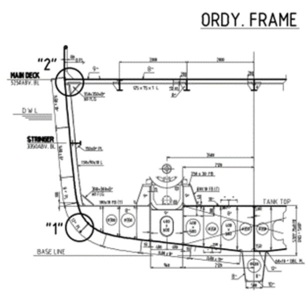
The structural design of a marine structure or ship includes the structural layout and determination of geometrical properties, commonly known as scantlings, of each structural element, each element being interconnected with other elements. The basis of this design is the mechanical properties of the material used, such as yield strength, ultimate strength, compressive strength, elongation characteristics and plastic deformation, fracture and fatigue characteristics, and other properties. The mechanical properties of various materials are discussed in the next section. The loads that come on the ship or marine structure are varied by nature [7].

The layout design is expressed diagrammatically as the structural elevation, structural decks, and structural sections, which show the major (and minor) structural components, their extent and their connectivity with other structural components, and the particulars of plates and rolled/fabricated sections based on which steel material listing can be prepared, steel mass, and its center of gravity can be estimated. The structural layout must cater to the following needs.

1) The layout must integrate with other functional and operational requirements of the structure.
2) The layout should support equipment installation, piping, ducting, and electrical cable for various systems in the ship. This is necessary for ease of installation of all these items as per the production schedule. Normally, ships are outfitted after steel work is complete. If the structural layout is done in such a manner that outfitting could be advanced and done during steel erection itself which is known as advanced outfitting, the time of ship construction can be reduced.
3) An effective structural layout is also necessary to ease personnel movement during ship operation to monitor the equipment's function.
4) The structural layout should support proper monitoring of the ship's structural condition for surveying, inspection, and preventive maintenance.
5) The structural layout should ensure adequate strength in all possible loading conditions.
6) The structural layout should ensure continuity and avoid stress concentration.

Furthermore, the key plan document and drawing of DF Tug are reviewed based on BKI rules for hull [10]. The review process is conducted by the plan approval engineer by comparing compliance with the key plan and BKI rules. As a result, if the drawing has been to comply with BKI rules, then the drawing will be approved, whereas not complied yet or not fully complied must be refined based on the comments of the plan approval engineer.

The following figure shows an example of the comments from the plan approval engineer, located especially in the midship section, as shown in Figure 6 and Figure 7 as follows.



Dual Fuel Harbour Tugboat 5000 HP	Principal Dimensions	
	L = 32,6 m	H = 5,25 m
	B = 11,3 m	T = 4,2 m
	Cb = 0,70	
Bagian/Profil Konstruksi	**Hasil**	
Plate		
Minimum plate thickness	t = 8 mm	
Keel plate thickness	t_{FK} = 10 mm	
Keel lane width	b_{min} = 958 mm, b_{max} = 1500 mm	
E/R side plate	t_1 = 10 mm, t_2 = 8 mm, t_3 = 8 mm	
Top lane side plate	b = 1500 mm, t = 9 mm	
Deck plate	t_{min} = 6 mm	
Bottom Structure		
Height of double bottom	h_{db} = 1.24 mm	
Side girder	t = 8 mm	
Inner bottom plate	t = 8 mm	
Watertight floors	t = 9 mm	
Floors plate	t_{pf} = 9 mm	
Longitudinal girder	t = 18 mm	
Wrang plate	t = 9 mm, h = 600 mm, W = 141 cm^3	
Top plate	b = 400 mm	
Hull Structure		
Webframes	Profil=300x8 100x10, W=469 cm^3	

Figure 6. Details of the ordinary frame and the scantling [9]

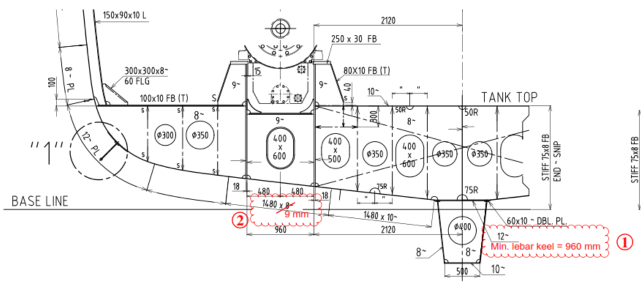


Figure 7. Notes on class inspection results on midship construction drawings [9]

5. GAP ANALYSIS MODIFYING AND IMPLEMENTING ORGANIZATIONAL TEAM FOR WORK PLANS TO FILL THE GAPS

The gap model of the ship design approval with a case study of the key plan drawing assessment for dual fuel harbour tugboat, especially in the midship section, which occurred, has pointed to six possible deficiencies that must be considered to achieve a class design approval. The model analysis the deficiencies of both the teamwork and its reviewer. In this ship design, to comply with the regulation, references must always be well-defined to make decisions aimed at improving design results. The following is a description of the six deficiencies to be assessed by teamwork and the symmetrical deficiencies to be analyzed by the reviewer.

5.1 Design Needs

The dynamics of stakeholders regarding the need for dual-fuel harbour tugboats are closely related to port activities and the demands for environmental friendliness by the maritime world. This forces the work team to continuously capture and analyze this information that needs to be implemented in its ship design work. Deficiencies can occur because they can change the size, shape, equipment, and fixtures that must be installed. This information determines the design implementation arrangements regarding time, effort, experience, and software utilization. Therefore, the emergence of this deficiency creates the need for time, additional/replacement of personnel, and additional software. Addressing this shortcoming is the first step in the design work so that DR&O is ensured from the outset that it is good, precise, and does not invite changes going forward, although this is often difficult to predict.

5.2 Coherence

Coherence determines the convergence or divergence level in the dual fuel harbour tugboat design, especially when making key plan drawings. This can be based on a quantitative or qualitative evaluation of the design results and engineering calculations. There may be differences due to errors in interpreting standards and regulations throughout the process. This fallacy can be low, and vice versa can be significant and fatal. This occurs where the consistency is based on referred regulations or standard in determining whether the assessment of the results of different designs is correct or not. This is a fundamental problem that must be solved in the communication between teamwork and reviewers to get conformity to the referred regulations and standards.

5.3 Accuracy

The work team should continuously measure the perceived level of execution of the design work by stakeholders to determine whether their technical needs are being met. It consists of scientific studies recognized by the academic literature, class regulations, and referenced standards regarding the quality of a design or its compliance with these regulations to obtain approval or acknowledgment of recognized quality. The customer's perceived service rating should match the actual reputation determined by the same scientific procedure. Any differences between them must be corrected to achieve a greater impact on the achievement of stakeholder expectations that are as close to reality as possible. In the event of a shortage for this matter, experts can consult the relevant experts.

5.4 Intensity

This deficiency is related to the position and visibility of the implementation of work team communication to users and the BKI class assessor in the ship design work process. This means that the intensity of communication is a factor that relates to the existence and implementation of the smooth implementation of ship design work, especially in making key plan drawings. However, this situation is often not normal because of the determination of mutually beneficial time agreements, so it is always necessary to build the work team's communication intensity to achieve the best ship design achievement. Visibility, visibility impact, and response are aspects that can be evaluated using special communication media that are flexible and agreed upon by all parties to reduce and cover each other's shortcomings and weaknesses and strengthen the successful implementation of the ship's design.

5.5 Quality of Teamwork

The reputation of the work team affects the ship design work as expected by the user. Determine that the gap between the expected and perceived quality is to measure the quality of the team's work to reduce the emergence of gaps. This gap is the basis for assessing the quality of the resulting ship design [Parasuraman et al]. Therefore, as far as the user's expectations are concerned, it is possible to provide high-quality utilization of the ship's design results. Higher status is awarded if the perceived quality exceeds customer expectations. In this case, superior satisfaction will be achieved, and the customer's assessment of the quality of the utilization of the ship's design results by the work team will increase.

5.6 Value

Value is one of the variables measured by a particular expert, such as discussing the quality of design results. This is a construct that must be considered in evaluating the results of teamwork because it is related to the quality of ship construction design work. In this context, price is another determining variable in making decisions regarding the type and form of construction. Therefore, this is included in evaluating the results of the team's work against the opinion of the utilization of the results, as well as in evaluating the quality of the work as expected. This shortcoming consists in determining the difference between expected and perceived values. The expected value can be determined along with the quality of the implementation of the ship design as expected because it is related to what the user expects. This measure of expected user value can also be used to determine the lack of quality of teamwork.

The gap analysis of the proposed online reputation can be used to determine the effective, dynamic, and competitive management of corporate communications. The concepts introduced in the model make it possible to organize and structure different types of information and actions to maintain a competitive and honest image on the Internet. It is a model that considers market competition dynamics, where all companies focus on satisfying customer needs and earning their loyalty. However, it is a model that can be extended in terms of indicators and definitions of practical methods to measure the key variables that companies must control. Thus, it is possible to develop sector-specific tools that feature many online communication activities, depending on their characteristics and how the customer evaluates them.

6. DISCUSSION

One of the calculations that become a limitation in planning the construction drawings on the middle cross-section of the ship, as presented in Figure 6 and Figure 7, is the minimum calculation of the keel plate thickness and the width of the keel (table), where from the calculation results, it is found that the keel plate thickness is not less than 10 mm, and the width of the keel is not less than 958 mm. In the image of the middle cross-section of the ship that has been finalized, it has a keel width difference of about 158 mm. In the image shown, the size of the ship's keel plate is determined to be 12 mm with a keel width of 800 mm. The image is corrected by the examiner of the Class image so that a description is given as in the following image.

Based on the submitted key plan for a midship section of DF Tug, BKI, as chosen CS, informed the client of the result of the approval of the midship section of DF Tug by a statement letter or by accessing the Armada (the web-based system of information result of BKI plan approval activity of submitted documents and drawings). As a result, the approval status of the midship section of DF Tug is ‘not approved’ with the ‘open’ comments. Those comments [11] are:

1) The minimum requirement for flat keel width is 960 mm.
2) The bottom plate thickness requirement is 9 mm.
3) Pillars under the main deck must be replaced with a minimum of 125 NB SCH 60.

By paying attention to the comments from the chosen CS, it is necessary to re-check the detailed construction drawings of the midship section of the ship compared to the scantling calculations at the basic design stage carried out in the previous year. As shown in Figure 4 (table section), it was found that the scantling calculation was following the comments from the Class. Hence, an error existed in the drawing process, where the minimum flat keel width was 960 mm (in the scantling calculation, it was 958 mm) while the image measured 800 mm. There is a significant difference of around 160 mm. It is indicated that several factors cause gaps in the scantling calculation process with a detailed description of the construction, including:

1) Changes in personnel involved in making the basic design and detailed design/key plan so that it can bypass the information path in the latest calculation result file, where the calculation file is often changed or updated.
2) The soft file storage system is not well structured.
3) Weak coordination between engineering staff in one work package, wherein in one work package there are engineering staff in different work locations (Jakarta and Surabaya).
4) High working load engineering staff, where one engineering staff is usually involved in more than 2 parallel design activities in one fiscal year.
5) The working load leader and group leader are too high, where the leader and group leader can be involved in more than 1 parallel activity in one fiscal year.
6) Scheduling and completion targets at the drawing finalization stage are quite tight and limited and involve more than 1 parallel activity in one fiscal year.
7) Pandemic conditions require activities to be limited to coordination with online schemes.

7. CONCLUSION

In making key plan drawings for the midship section, there was a gap between the results that were carried out properly and expected. This is the result of the mismatch of scantling in the keel of the midship construction due to the multi-tasking work intensity and the sustainability intensity factor, which still needs to be improved. On the other hand, it is also affected by the COVID-19 pandemic. To minimize the gap, further attention needs to be given to the quality of teamwork and its sustainability.

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