

# The Design of Digital of information System For Shipbuilding Proccess : Current Condition of Medium Shipyard

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#### Abstract

In the era of the industrial revolution 4.0, information technology is developing rapidly so that it is now easier to design an information system that can facilitate aspects of work. The ship production process in a shipyard involves complex information. The Information should be manage to keep the shipbuilding project progress with the Plan. The smooth flow of information during the ship production process will delay project completion and reduce costs. Currently, it take time to transfer information between departements since the required information distributed in paper based.Hence, a digital integrated information system that functions to facilitate the flow of information between departements is required to overcome the problem. This study aims is to design a digital information system facilitate the flow of information among four departements in a medium shipyard. The departements consist of the design,purchasing, material warehouse, dan production departement ..

Keywords: Information system; Ship production process; Ship production division

#### 1. Introduction

A shipyard is a place designed to repair and build ships. There are approximately 250 registered shipbuilding companies operating in Indonesia with capacities between 50 - 50,000 gross tons.[2] From this range, most of these shipyards have capacities below 500 gross tons. The rest of the shipyards consist of shipyards with capacities range from 1000 to 5000 gross tons.

Most of the small shipyards in Indonesia have a core business of ship repair and new buildings. However, the applied production technology of building new ships in thesel shipyards is still relatively using the old version of ship production technology.

In today's industry 4.0 era, ship production technology must also be developed to the level of the the more advance technology which refer to the integration of Hull construction, outfitting and painting or better known as the Integrated Hull Construction, outfitting, and painting (IHOP) method at the stages of the development process of ship [3,4].

In The shipbuilding industry is in dire need of upgrading with new engines, software and new organizational restructuring implemented; however still faced difficulties with many changes during construction and a large number of ship series leading to loss of cost control and quality control [5].

To support the ship production process in the Indonesian medium shipyard, a digital information system for the ship production process is required. The Existence a digital information system will increase the ship production process [6].

# The Design of Digital of information System For Shipbuilding Proccess : Current Condition of Medium Shipyard

In the ship production process, a large amount of information is used and flows within and between the departments involved in the shipbuilding process. Each shipyard handles this information and its flow differently depending on the technology implemented at the respective shipyard. In general, it is difficult to standardize information and its flow that can be used for all shipbuilding projects in shipyards [7]. A ship production process is a very complex process, especially in the Design division (Engineering), material warehousing, production division and purchasing. division.

However, there are also several aspects that must be monitored or that need to be carried out in the 3 divisions in the shipyard's for good management process, including: man, material, money, machine and method [8] and [9].

#### 2. Methods

The research method used is a case study The object of research is the ship production process information system aIndonesian medium shipyard.

Data collecting consist of information flow from and the four division consist of a0Design, production, warehousing and purchasing sections. b) Data on suppliers of ship construction components including: Location of the supplier, what products are offered/supplied, price of the product offered, lead time of the product and transportation cost of the product from the supplier's location to the Shipyard.

The stages of the research can be divided into: a) detailing any information about the material requirements that flow in each division and from the suppliers.b) Create a coding system to identify construction components, machinery components, production data c) Design of digital shipbuilding production process information system model.

#### 2.1. Information System Application Design Framework

Systematic flow in the design of this information system model is presented in Fig.1.

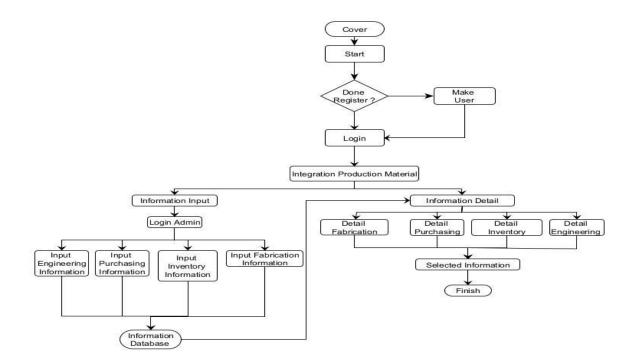


Figure 1. Framework for production information systems in each division.

Based on Figure 1 above, this information system model algorithm begins with the login stage. On the login menu each user must have a username and password that has been registered in the user database, otherwise must be register first.

The home menu is a menu that displays the types of information contained in the ship production information system. On the home menu there are 2 main menu options, namely the production information integration and the production process

On the information input menu, there are 4 divisions to choose from namely the Design Division, Purchasing Division, Material Warehouse Division and Production (Fabrication) Division. This menu is specifically only for the administration of each division that has been registered in the database. Information from each division can be seen by everyone who has registered in the user database. In this menu the user can select and print the desired information.

In the Production Process Menu, there is a choice of information on the Fabrication treatment of the Hull Block Section which has detailed information starting from Block, Sub Block, Panel and components.

#### 3. Results and Discussion

#### **3.1. Material Procurement Process**

Presentation of Information on the Material Procurement Process in as shipyard is presented in the following 3 parts of the Flowchart :

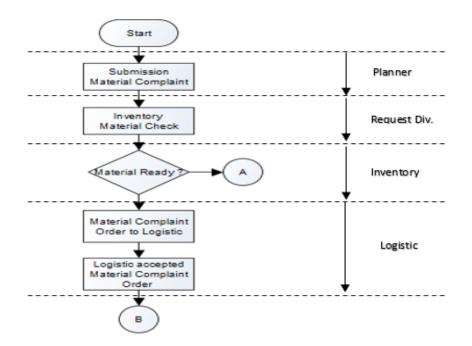


Figure 2. Material Procurement Process

The Design of Digital of information System For Shipbuilding Proccess : Current Condition of Medium Shipyard

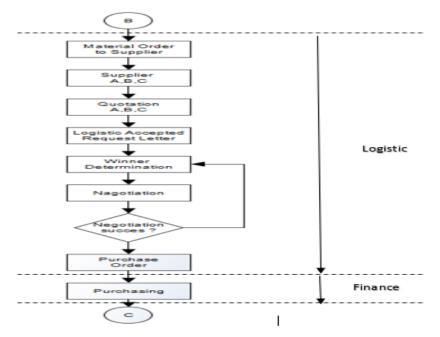


Figure 3. Material Procurement Process

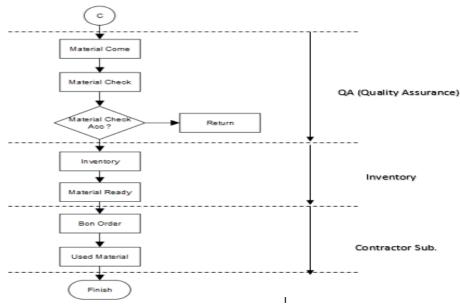


Figure 4. Material Procurement Process

The description of the material procurement procedure at are as follows:

- a. The design that has been accepted by a shipyad is then processed in the Planner Section so as to produce material requirements that will be used in the construction of new ships. Furthermore, the Planner Section submits a Material Procurement Request to the Request Section.
- b. Material Procurement Requests that have been received by the Request Section are then checked for Material Availability in the Warehouse.

- c. Materials that are available in the warehouse can be used immediately after getting a Request Certificate by the Sub Contractor and materials that are not available will be made a Material Procurement Request to the Logistics Section of a shipyad.
- d. After the Logistics Section receives a Material Procurement Request, the logistics section will write to suppliers regarding requests for material offers.
- e. Supplier provides a Letter of Offer (Quotation) to the Logistics Section of a shipyad.
- f. After receiving the Quotation, the Logistics Department determines the winners from the suppliers who participate in providing the Quotation.
- g. After the winner is selected, negotiations will be held regarding the readiness of suppliers to supply materials at a shipyad.
- h. If the negotiation fails, the winner will be re-elected (return to point 6). Meanwhile, if the negotiation is successful, the Logistics Section will make a Purchase Order to the Finance Department for further processing.
- i. Furthermore, the Finance Department will make purchases in accordance with the Purchase Order from a shipyad. Logistics to the selected Supplier.
- j. After the material arrives at a shipyad, the QA (Quality Assurance) Section will check material specifications based on the Purchase Order agreed by the Shipyard and Supplier.
- k. If it does not match, a product return procedure will be carried out. And if appropriate, then the material will be stored in the warehouse and ready to be used.
- 1. The Sub Contractor will make a Request for Receipt to the Warehouse and can use the material as needed.

In the Material Requirement Planning (MRP) of a shipyad, there are several parts that play a role in the process of planning, procurement, storage and use of materials in order to create an integrated flow of material information. The information flow can be integrated with each other more efficiently if there is a model that is able to flow related information from one part to another precisely and quickly.

#### **3.2.** Information System Design

#### 3.2.1 Detailed Features of Information System

The detail information feature serves to view information on material for the production of the hull block of the 750 GT Ferry Ro-Ro. Detailed Information Features are divided into 4, namely: Detailed Design Information Features, Purchase Information Details Features, Material Warehouse Division Information Features and Material Workshop Information Details Features.

#### 3.2.2 Detailed Engineering Information Features

The detailed design information feature contains work level, ship type, ship name, GT, input detail sizes and quantities of materials, ship data input, image input, component data input based on digits, print and exit orders as shown in Fig. 5 - 7.

The Design of Digital of information System For Shipbuilding Process : Current Condition of Medium Shipyard

Name Of Ship	KM LAKAA	N	Informasi Umum				abrication, Fabri	cation, S					
Work Level	Pra-Fabrika	asi		50.50		3. Kind of	material	-	5. Using	Metode		PRII	
Type of Ship	FERRY		LOA	00.00	m	Plate			1			-	-
T	2500		LWL	-	m	3.a Item	-	-		ficatin Material		EXI	<b>7</b>
			LBP	•	m	WELDI				secondary steel B/AH			
Work Group	Hull Constr	uction	в	14.00	m	_	ion Time Working	-		Personel needed			
No. Blok	4		T	2.70		3 Hari		-	1				
				2.70	m	4. Tools		-	8. Cost				
			Н	3.80	m	None			1				
			СВ	0.61			cation, Sub-Asse	mDiy, As		erming Information			
			Volume	•			th Marking			and a second second			
			Displacement		_	12		m	15	. Material Forming Item			
			Displacement	-	-	Cutting	Information	_		None			
						10. Len	gth Of cutting		15	a Material place Forming			
					-	12		m		1	-		
					and the owner water w		g Information						
Ukuran Material			Berat Komponen				d of welding	_	_	11 · 6 · F			
	6				Filled Weld Non-Cont			Assembly information 16. kind of assembly					
Length		m	Weigth	15984	То	12. We	ding Length	— m			-		
Breadth	1,8	m											
Thick	12	m				13. We	ding Layer Total		M	oved Material Information			
Diameter	•	Inchi	and the second se					Layer	17	. Metode Pemindahan			
total	3				_	100	rk Position	_			_		
						Down	Hand				-		
No Type Kapal Na 1 FERRY KM	ma Kapal LAKAAN	GT 2500	1st 1.a Hull Cons 4		2nd Pra-Fabrikas	3rd Plate	3.a 3.b WELDINC 3 Hari	4th None	5th	6th 7th Class I secon 1	8th	9th 12	10th 12
2 GENERAL C/ KM	LAKAAN	2500	Hull Cons 4		Pra-Fabrikas	Plate	WELDING 3 Hari	None	1	Class I secon 1	1	12	12
3 GENERAL Ci KM 4 GENERAL Ci KM		2500 2500	Hull Cons 4 Hull Cons 4		Pra-Fabrikas Pra-Fabrikas		WELDING 3 Hari WELDING 3 Hari	None None	1	Class I secon 1 Class I secon 1	1	12	12 12
5 GENERAL C/ KM	LAKAAN	2500	Hull Cons 4		Pra-Fabrikas	Plate	WELDING 3 Hari	None	1	Class I secon 1	1	12	12
6 FERRY KM 7	LAKAAN	750	Hull Cons IV		Fabrikasi	Plate	CUTTING 3 Hari	Manual Ci	Manual	Class I secon 3	Rp 4.2	00.000 613	-

Figure 5. Stages of Detailed Engineering Information

	<u>DE TAIL E NG</u>	NEE RING											
	Ship data												
Type of ship	: FERRY	LOA	: 50.50	m									
Name Of Ship	: KM LAKAAN		14.00	m									
GT	: 2500	т	: 2.70	m									
Work Group	: Hull Constructio		: 3.80 : 0.61	m									
No. Blok	: 4	Volume Displacement	1 A.	- 1									
	Ma terial	data		- 1									
Kind of Material	: Plate			- 1									
Material Spesification	: Class I secondar	y steel B/AH		- 1									
length	:6 m			- 1									
breadth	:1,8 m			- 1									
thick	: 12 mm			- 1									
Diameter	: · Inch	1		- 1									
Total	: 3			I									
Weigth	: 15984 Ton			- 1									
	Wort D												
Work level	: Pra Fabrikasi			- 1									
Item Working	: WELDING			- 1									
Duration Time Working	: 3 Hari			- 1									
Alat yang Dibutuhkan	: None												

Figure 6. Print Display of Engineering Division Information (Part 1)

Using Metode	: 1	
Personality needed	: 1	
*Pekerjaan Marking		
Length of Marking	: 1	
*Pekerjaan Cutting		
Length of cutting	: 12	
*Pekerjaan Welding		
Welding Item	: Filled Weld Non Cont	
Length of welding	: Filled Weld Non Cont	
Layer of welding	:	
work position	:	
*Pekerjaan Bending	Down Hand	
Forming	: None	
Place of forming	: None	
*Pekerjaan Ufting	1	
Item Assembly	: 1	
*Pekerjaan Fitting	1	
Moved metode	: 1	
	1	

Figure 7. Print Display of Engineering Division Information (Part 2)

Based on Fig. 6 and Fig. 7 above, the information that can be known from the Design division is ship data details, material information details and work information details.

3.2.3 Detailed Features of Purchasing Information (Purchasing)

The detailed purchase information feature consists of date, ship name, material detail data, order status, delivery time and material arrival time, print and exit orders as shown in Figure 8, Figure 9

Date	CII	Data Material Length 12	PRINT
Name Of Ship	LKBBB	Breadth 23	Meter
Necessary Item	Pembangunan Baru	Thick	Meter EXIT
Material Code	Lembar	Diseaster	Milmeter
Material Item	Pelat		Milmeter
Material Spec	Class I secondary steel B/AH	Iotal 4	
Unit	Lembar	Delivery Time 1.8	days
Ordering Status	Akan Dipesan	Arrived Time 10	
Energy Name Kapa   1 Cili UK888   2 12/27/202 UK888   3 12/28/202 UK888   4 12/29/202 UK888   5 12/30/202 UK888   6 12/31/202 UK888   7 1/1/2022 UK888	Anis Acoluti. Koos Platera Jenis matera Penbanguni Lembar Pelat Penbanguni Casa Isecon Pelat Penbanguni S421 Profile Pembanguni S421 Profile Pembanguni S43332221 Profile	s Spesm Unit Serus Waktu Waktu Teo Class I Lemba Akan I 1.8 10 Class I Lemba Akan I 1.9 1.8 Class I Lemba Akan I Class I Pos Akan I Class I Pos Akan I Class I Pos Akan I Class I Meter Akan I	Panjang Leoar leoai Diamee Juman 12 23 - 4 10 12 23 - 4

Figure 8. Detailed Purchasing Information

The Design of Digital of information System For Shipbuilding Proccess : Current Condition of Medium Shipyard

DETAIL PURCHASING									
Date	:	12/27/2021							
Name Of Ship	:	LKB BB							
material Name	:	Pembangunan Baru							
Material Code	:	Class I secondary steel A/AH							
Materialitem	:	Pelat							
Material Spesification	:	Class I secondary steel B/AH							
Unt	:	Lembar							
Order Status	:	Akan Dipesan							
Delivery Time	:	19							
Arrive Time	:	18							
Length	:	10							
Breadth	:	12							
Thick	:	23							
Diameter	:								
Total	:	4							

Figure 9. Print Display of Purchasing Information (Purchasing)

Based on Fig. 9 above, the information that can be known from the purchasing division is material specifications, material order status, material arrival time and quantity of material ordered.

#### 3.2.3 Detailed Features of Material Warehouse Information

The detailed material warehouse information feature consists of 2 parts, namely inventory and outgoing material information.

#### • Inventory Information Details

In the detailed inventory information contains the data input date , detailed material data available in the warehouse based on information from the Design division and the purchasing division, maintenance costs for materials, reorder quantity which contains information on the minimum inventory of materials to be reordered by the purchasing division, reorder status filled based on the minimum quantity available in the warehouse, print orders and add them as shown in Fig. 9 and Fig. 10

	Invento	Inventory							
Date	Name Of Ship	Location Material							
1/15/2022	KM MAJU MUNDUR	InnerWarehouse	PRINT						
ecessary Item	Unit	Quantity							
	Lembar		ВАСК						
laterial Item	Biaya/Cost	Reorder QTY							
Plate									
atorial Code Material S	pesification Inventory Value	Status Reorder							
aterial Coue material 3									
PL123456	EBUTUI JENIS MATERI/ KODE MATERI/ S	PESIFIKASI M SATUA LOKAS QUAN	W BIAYA/COS' INVENT						
PL123456		PESIFIKASI N SATU/ LOKAS QUAN Lemba InnerV	W BIAYA/COS INVENT						
PL123456	BUTUI JENIS MATERI/ KODE MATERI/ S	-	N BIAYA/COS INVENT						
PL123456	BUTUI JENIS MATERI/ KODE MATERI/ S	-	Y BIAYA/COS INVENT						
PL123456	BUTUI JENIS MATERI/ KODE MATERI/ S	-	N BIAYA/COS INVENT						
PL123456	BUTUI JENIS MATERI/ KODE MATERI/ S	-	V BIAVA/COS INVENT						
PL123456	BUTUI JENIS MATERI/ KODE MATERI/ S	-	N BIAYA/COS INVENT						
PL123456	BUTUI JENIS MATERI/ KODE MATERI/ S	-	Y BIAYA/COS INVENT						

Figure 10. Detailed Inventory Information

HASIL PEMII	JHAN	<u>DETAIL INVENTOR</u> Y
		Data Material
Date	:	1/15/2022
Name Of Ship	:	KM MAJU MUNDUR
Material name	:	
Material Item	:	Plate
Material Code	:	PL123456
Material Spesification	:	
Unit	:	Lembar
Quantity	:	
Cast	:	
Reorder Quantity	:	
Inventory Value	:	
Status Reorder	:	

Figure 11. Print Display of Inventory Information

Based on Fig. 11 above, information that can be known from the inventory section is material specifications, amount of material available, material maintenance costs, minimum amount of material for reordering and status for material orders.

• Outgoing Material Information Details

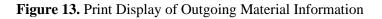
In the input section of the material information out, it contains the date the materials came out, the details of the material that came out according to the request of the production division, the amount of material available and the amount of material that came out, the print and exit orders as shown in Figure 12 and Figure 13.

The Design of Digital of information System For Shipbuilding Process : Current Condition of Medium Shipyard

	Outging Material	
Date		
12/12/2020	Name Of Ship	PRINT
Name Of Material	LAKAAN	
Plate Side	Unit	EXIT
Material Code	10	
1232yddd	Available Stock	
Material Item	20	
Plate	Outgoing Total	
Material Spesification	10	
grade a marine plate		
ТАЕ Ng таnggai nama kapa nama ma 1/15/2022	TERI KODE MATERI/ JENIS MATERI/ SPESIF	IKASI M JUMLA JUMLAH TERSEDIA

Figure 12. Details of Outgoing Material Information

OUT GOING	OUT GOING MATE RIAL INFORMATION										
	M	aterial Information									
Date	:	12/12/2020									
Name Of Ship	:	LAKAAN									
Material Name	:	Plate Side									
Material Code	:	1232yddd									
Material Item	:	Plate									
Material Spesification	:	grade a marine plate									
Unit	:	10									
Total Available	:	20									
Total Outgoing	:	10									



Based on Fig. 13 above, the information that can be seen from the outgoing materials form is material specifications, the amount of material that comes out of the material warehouse.

#### 3.2.4 Production Information Detailed Features

The process for checking the coding of ship construction components is through VBA (*Visual Basic for Application*).

COMPONENT NAME	BOTTOM PLATE		FRAME						DCL	, .	Ba	ck		
BLOK						COMPONENT CODE BP			SEARCH				Reset	
SUB BLOK					Data F	Result:	8		Proses	i ltern Te	erpilih (	(0 item	terpilii	1)
Bottom Plate 1	(Portside)	Frame 20-31		HS03	SB01	P03	20-31	BP1	(PS)			3	9	
Bottom Plate 1		Frame 20-31		HS03	SB01	P03	20-31	BP1						
Bottom Plate 2	(Portside)	Frame 20-31		HS03	SB01	P03	20-31	BP2						
Bottom Plate 2		Frame 20-31		HS03	SB01	P03	20-31	BP2	(SB)					
Bottom Plate 3		Frame 20-31		HS03	SB01	P03	20-31	BP3	(PS)					
Bottom Plate 3		Frame 20-31		HS03	SB01	P03	20-31	BP3						
Bottom Plate 4		Frame 20-31		HS03	SB01	P03	20-31	BP4						
Bottom Plate 4	(StarBoard)	Frame 20-31		HS03	SB01	P03	20-31	BP4	(SB)				9	

Figure 14. Component Information Search Menu

One example of the automatic identification of the code on the Ferry Ro – Ro 750 GT ship. Precisely on the *center girder construction component* located in *frames 20-31* or in block 3. Then the results of identifying component codes can be seen in the following figure:

	na Komponen tom Plate 1 (Portside		Kode Komponen Jumlah K   1H5035B01P0320-318P1 (P5)1139717003300217							Komponen Kembali		
1.054	Dimensi Komp Panjang (m	onen	6,000			Ketebalan (mm)			B	Berat ( Kg )		
1.1.10	Lebar (mm)	Lebar (mm) 1,120			Dia	meter (mn	n)			422		
	Item Digit				1. N9484 TIO A ND948487.			1 Malatina	1 1 0 1			
million	1 ST 1	1a ST	HS03	1b ST	SB01	1c ST	P03	1d ST	20-31	1e ST	BP1 (PS)	
126 13 34	2nd 1	3rd	1	4th	3	5th	9	6th	7	7th	1	
Cetak	8th 7	9th	0	10th	0	11th	3	12th	3	13th	0	
CCLAR	14th 0	15th	2	16th	1	17th	7					
Kode 1 ST	Kode 1a ST	Kod	e 1b ST	נ גענע נ	Kode 1c	ST	ľ	Kode 1d ST	Kode	1e ST		
Work Group	Block		Sub-Block	k (	Panel			Frame	Komponen			
Hull Construction	Hull Structure		Bottom	7	Shell Bottom		4	20-31	Bottom Plate 1 (Portside)			
Kode 7th	Kode 8th	in the second	Kode 9th		Kode 10th			21213-5	Kode 11	Kode 11th		
Thickness (Meter)	Shape	Lihat	Hole &	Slots	Lihat	Hole	£ Slots	Lihat	Prepro	cessing Tr	eatment	
5 < t < 10	7		0				0			1 + 2		
Kode 2nd	Kode 3rd		Koo	de 4th		10170	~ p	Kode 5th		Kode 6	th	
Level Produk	Tip	e			Material			Length (A	Meter)	Wio	dth (Meter)	
Plate	Stan	lart	1	Class II	-Primary S	TEEL B/AF	ł	> 6			1.5 < 1.7	
Kode 13th	Kode 14th	к	ode 15th			Kode 16th			Kode 17	th	10	
Forming	Connection Ty	pe	Work	Position		W	ork Stat	ion		Equipment Used		
None	None		Ove	erhead		Open	Plate Wo	rkshop		0 + 4 +	Lift	

Figure 15 Identifying component code information

In addition to displaying the result of identifying the component code). In the VBA (*Visual Basic for Application*) *design that has been created, you can also perform print* commands. Where if the identification of the component code is printed, the *print out results* can be seen in the following figure.

The Design of Digital of information System For Shipbuilding Process : Current Condition of Medium Shipyard

					_ ,						
Name	Of Ship T	уре с	of ship	GT						nt name	
KM.L/	AKAAN	Fe	пy	750			Bo	ttom	Plate	1(Portsid	e)
				Mai	in Diı		ion				
LBP	B		H	Т	L	OA	Volu		СВ	CM	CWL
50.50	) 14		3.8	2.7	56	6.70	1164.4	3 (	D.61	0.95	0.85
W	eight and	Dim	ension	Comp	onen	t		<sup>2</sup> icti	ure		Fotal
Lengt			Thick								
6,000	and the second	)	8	-		122					1
					_			******	*****		
COMPONENT CODE 1HS03SB01P0320-31BP1 (PS)1139717003300217											
					Digit	Code	•				
1ST = 7	1 14:	ST =	20-31	4th = 🍢	3	8th =	7	12th	) = <sup>1</sup> 3	3   16th =	1
1aST =	HS03 let	ST = 3	3P1(PS	5th = 🖊	9	9th =	<b>0</b>	13th	) = <sup>1</sup> (	) 17th =	7
16ST =	SB01 2	nd = '	1	6th = 🚺	7	10th =	<b>0</b>	4th	n = <sup>1</sup> C	)	
1cST =	P03 3	3rd = '	1	7th = 🖊	1	11th =	<b>3</b>	15th	n= <b>1</b> 2	2	
				Inform	natio	n of I	Code				
1st =	Hull Const	ructio	n		5th =	>6		-14t	h= N	lone	
1ast =	Hull Struct	ture 3			6th =	1.5 <	1.7	15t	h= C	)verhead	
1bst =	Bottom				7th =		< 10	16t	h= C	)pen Plate	e Workshop
1cst =	Shell Botto	om			8th =	7		-17t	h= 0	+ 4 + Lift	
1dst =	20-31				9th = 1	-					
1est =	Bottom Pla	ate 1(l	Portside	e)	10th	0					
2nd =	Plate				11th	1+2					
3rd =	Standart				12th	Man	iual Bui	'n			
4th =	Class II-Pri	imary	STEEL	B/AH	13th	Non	e				

### HULL STRUCTURE COMPONENT

Figure 16 Print Display of Production Component Information

#### 4. Conclusions

Based on the discussion, the following conclusions can be drawn:

- 1. The results of identifying information in each division are:
  - In the Design division: information on the main size of the ship, the materials used and the details of the work to be done. In the purchasing division: information on the status of the material order and the time of arrival of the material ordered. In the material warehouse division: material information is available, material information is out, when material needs to be reordered. In the production division: fabrication component identification information
- 2. The design of an information system model that involves four divisions/sections in the shipbuilding process with some detailed information presented above, namely the design division (engineering), the purchasing division (purchasing), the material warehouse division (inventory) and the production division.

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