

Analysis of Machine Design Project Scheduling Ncb 8 Critical Path Method (Cpm) Load and Method of Manufacturing Oriented Control (Lomc) in Pt. XXX

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Abstract:- Accuracy in order fulfillment time of the company's promise and product quality are in line with expectations, as well as the fees charged are considered reasonable is unsur-satisfaction elements that must be met by the company to the consumer. PT. XXX is a manufacturing company engaged in the manufacture of products such as car parts car roof, hood and fenders. Based on data from the company, according to the company in 2018 many mismatches or delayed against the schedule or machines that have been made. The purpose of this study to determine the time of receipt to the method Expenses Oriented Manufacturing Control (LOMC) in which the time of receipt of the order is based on a calculation that takes into account the lead time delivery time manufacturing orders for customers, available capacity at each work station, the processing time at the work station and the flow of production on the production floor and also determine the critical path on the activities to be undertaken by the NCB 8 engine. By using the Load method Oriented Manufacturing Control by observing the available capacity, delivery times and priority sequence obtained in the acceptance of the project and also made a critical path analysis of the project to be undertaken by the NCB 8 engines like PL, BJN, BJ, BN, bY. and K2. This shows that the calculation time of order entry order using expense method Oriented Manufacturing Control (LOMC) is more accurate than the actual method. delivery times and priority sequence obtained in the acceptance of the project and also made a critical path analysis of the project to be undertaken by the NCB 8 engines like PL, BJN, BJ, BN, BY. and K2. This shows that the calculation time of order entry order using expense method Oriented Manufacturing Control (LOMC) is more accurate than the actual method. delivery times and priority sequence obtained in the acceptance of the project and also made a critical path analysis of the project to be undertaken by the NCB 8 engines like PL, BJN, BJ, BN, BY. and K2. This shows that the calculation time of order entry order using expense method Oriented Manufacturing Control (LOMC) is more accurate than the actual method.

Keywords:- Critical Path, Project, Date Reachive.

I. INTRODUCTION

➤ Background

In the manufacturing industry, manufacturing plays a vital role in transforming raw materials into finished products. It is a challenge for the manufacturing industry, ie. XXX involved in car manufacture. To support the passage of the production process in the company there are important activities in the important activities of its itu. The go into production planning production schedule for each project to meet the demand of consumers to achieve effective and efficient cycle. Then in carrying out production activities are those that would occur in the production process runs that shift production schedule. production plans project that can not be produced today because it does not comply with existing project schedules so that there is a delay in implementing the next project.

The aim of this project as an activity that takes place within a specific time with a specific end result. Projects generally have a job that never happened and never repeat exactly the same (Dimiyati & Nurjannah, 2014) is. So the project has a certain time limit that is intended as a guide or indicator of the level of accuracy or delay of the project itself. Strategy scheduling (Scheduling) is a key factor in implementing the project, the right strategy to make the project a success before or right at a predetermined time.

Loading control-oriented manufacturing manufacturing systems are important in reducing lead times and inventory levels of semi-finished. Therefore, it has developed a new concept in the control of manufacturing systems is the concept of workload. One concept developed workload is load control-oriented manufacturing. Loading control oriented manufacturing (LOMC) is toflow control time factory floor by controlling the input actual versus planned work output.

➤ Problem Formulation

Based on the description of the background underlying this report, the formulation of issues to be raised in this paper are as follows:

1. How is the implementation of the project on the critical path method (CPM) and the Load method of making oriented control (LOMC)?
2. how the design project scheduling will be done by the NCB 8 engine?

➤ *Limitations*

Limitation of problems that are used are:
 This research data collection is taken through section Production Die DEPT. Machining Parts. And analysis used only the NCB machine 8. With this method, we choose the critical path method (CPM) and load control-oriented manufacturing (LOMC) on the data obtained in the period from August to September 2018.

II. RESULTS AND DISCUSSION

A. methods Critical Path Method (CPM)

➤ *Network*

The results of the analyzed data to support the critical path data processing variables that were analyzed can be seen in Table 1 below:

No.	Type of work	Duration (Hours)	Previous Activities
1	PL	245	
2	BJN	150	A
3	BJ	695	B
4	BN	10090	C
5	BY	370	D
6	K2	7215	D, E
7	PL	440	F
8	BJN	1130	G
9	BJ	280	H
10	BN	2220	H, I
11	BY	1880	J
12	K2	12650	K

Table 1:- Activities and Events Sequence Accompanied Previous Estimated Time Period

➤ *Advanced Computation*

No.	Type of work	Event Codes	Duration (Hours)	Previous Activities	ICE	EF (ES + Duration)
1	PL	A	245		0	245
2	BJN	B	150	A	245	395
3	BJ	C	695	B	395	1090
4	BN	D	10090	C	1090	11180
5	BY	E	370	D	11180	11550
6	K2	F	7215	D, E	11550	21640
VTV						
7	PL	G	440	F	21640	22 080
8	BJN	H	1130	G	22 080	23 210
9	BJ	I	280	H	23 210	23 490
10	BN	J	2220	H, I	23 490	25 710
11	BY	K	1880	J	25 710	27 590
12	K2	L	12650	K	27 590	40 240
BZC						

Table 2:- Calculation of Forward CPM

On advanced computation, calculation of the initial event moves toward the terminal event is to calculate the fastest time of the event and the fastest time of start and finish of activity (TE, ES and EF).

➤ *Countdown*

No.	Type of work	Event Codes	Duration (Hours)	Previous Activities	ICE	EF (ES + Duration)	LS	LF
1	PL	A	245		0	245	11,660	11 905
2	BJN	B	150	A	245	395	11 905	12055
3	BJ	C	695	B	395	1090	12055	12750
4	BN	D	10090	C	1090	11180	12750	22840
5	BY	E	370	D	11180	11550	22840	23 210
6	K2	F	7215	D, E	11550	21640	23 210	23 580
VTV								
7	PL	G	440	F	21640	22 080	23 580	24020
8	BJN	H	1130	G	22 080	23 210	24020	25 150
9	BJ	I	280	H	23 210	23 490	25 150	25 430
10	BN	J	2220	H, I	23 490	25 710	25 430	25 710
11	BY	K	1880	J	25 710	27 590	25 710	27 590
12	K2	L	12650	K	27 590	40 240	27 590	40 240
BZC								

Table 3:- Calculation of CPM backwards

In the countdown, move the calculation of terminal events leading up to the initial event. The goal is to calculate the timing of the latest of the event and when the start of the slowest and activities completed (TL, LS, and LF) or is intended to determine the time and date of the end of the project in order to start and end each activity without delay period of completion of the project whole.

➤ *Calculation of the CPM Network Diagram*

Having obtained the results of CPM calculation forward and backward, next is calculate free float and total float can be found on the path is the critical path. Which is the critical path is the path that consists of a series of activities within the scope of the project, which if delayed will result in delays in the overall project. Calculation of free float and total float is as follows:

No.	Type of work	Event Codes	Duration (Hours)	Previous Activities	ICE	EF (ES + Duration)	LS	LF	FF	TF
1	PL	A	245		0	245	11,660	11 905	0	11,660
2	BJN	B	150	A	245	395	11 905	12055	0	11,660
3	BJ	C	695	B	395	1090	12055	12750	0	11,660
4	BN	D	10090	C	1090	11180	12750	22840	0	11,660
5	BY	E	370	D	11180	11550	22840	23 210	0	11,660
6	K2	F	7215	D, E	11550	21640	23 210	23 580	2875	4815
VTV										
7	PL	G	440	F	21640	22 080	23 580	24020	0	1940
8	BJN	H	1130	G	22 080	23 210	24020	25 150	0	1940
9	BJ	I	280	H	23 210	23 490	25 150	25 430	2000	1940
10	BN	J	2220	H, I	23 490	25 710	25 430	25 710	0	0
11	BY	K	1880	J	25 710	27 590	25 710	27 590	0	0
12	K2	L	12650	K	27 590	40 240	27 590	40 240	0	0
BZC										

Table 4:- Calculation of CPM network diagram

From the table, as a sign that the project is a critical path activity, then the activity red letters is the critical path

that will be described in the critical path network, is as follows:

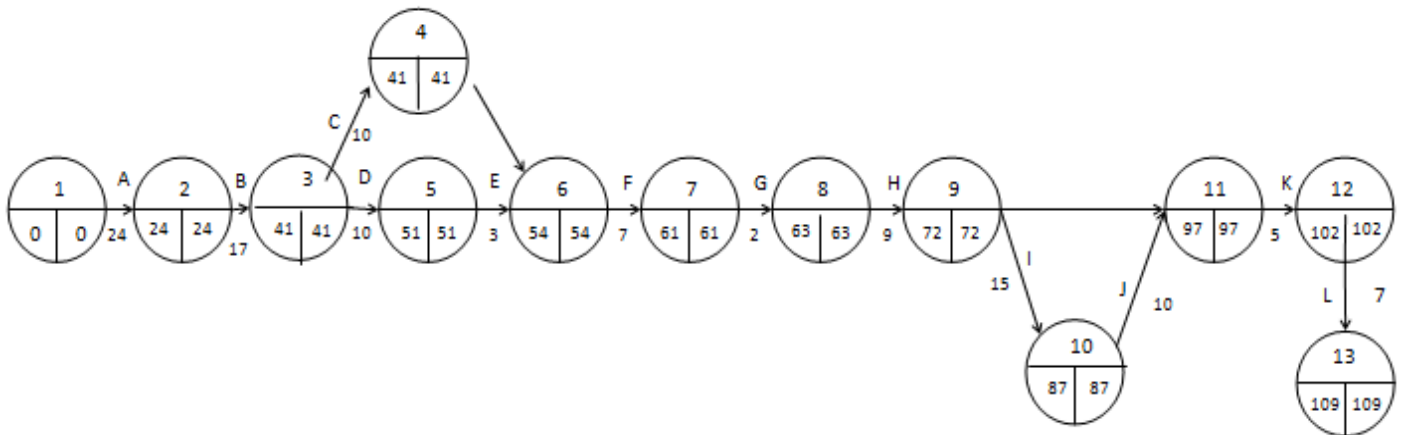


Fig 1:- Network CPM critical path diagram

B. LOMC method (Load-Oriented Manufacturing Control)

➤ *The Standard Time*

Product demand data collected in this study were drawn from the data product orders who died of August - September 2018.

Project type	Process	Cycle Time (min)	Loading Time (min)	rating Factor	Normal Time (min)	allowance	Standard Time (min)
VTV	PL	122.5	36.7	00:13	163 971	29%	211.52
	BJN	75	22.5	00:12	100.2	28%	128.25
	BJ	347.5	104.2	00:09	461 078	35%	622.45
	BN	5045	1513.5	00:12	6740.12	28%	8627.35
	BY	185	0	00:12	185	37%	253.45
	K2	3607.5	1082.2	00:09	4787.098	29%	6175.35
BZC	PL	220	66	00:13	294.58	29%	380.01
	BJN	565	169.5	00:12	754.84	28%	966.19
	BJ	140	42	00:09	185.78	35%	250.8
	BN	1110	333	00:12	1482.96	28%	1898.19
	BY	940	0	00:12	940	37%	1287.8
	K2	6325	1897.5	00:09	8393.275	29%	10827.32

Table 5:- Normal calculation Time and Standard Time

➤ *Calculation of Available Capacity*

The production capacity is available every type of process is calculated based on the number of operators, the number of machine hours per working day, the number of shift work, efficiency and utilization factor. The number of operators working days 1 week is 6 days and the number of working hours 1 day 8 hours, and the number of work shifts 1 day 2 shift working hours. The capacity available in the OT (the grinding process to the cast dies) is calculated as follows:

$$\begin{aligned}
 \text{Hour capacity supplied PL} &= \text{Jlh machine / operator} \times \text{hours / day} \times \text{Number of shifts} \times \text{Efficiency} \times \text{Utilization} \\
 &= 1 \times 8 \text{ hours / day} \times 2 \times 0.85 \times 0.90 \\
 &= 12:24 \text{ hours / day}
 \end{aligned}$$

The same calculation is done to calculate the available capacity on the BJN process until the process on K2. The total capacity available on each of the dies can be seen in Table 6.

Process	Total Engineering / Operator	Hours / shift	Number of Shifts	Utilities (%)	Efficient (%)	Total Capacity Available (Hours / Day)
PL	1	8	2	85%	90%	00:24
BJN	2	8	2	85%	90%	24.48
BJ	1	8	2	85%	90%	00:24
BN	2	8	2	85%	90%	24.48
BY	2	8	2	85%	90%	24.48
K2	2	8	2	85%	90%	24.48

Table 6:- hour capacity available every process

➤ *Loading Sequence*

The order of loading order determined by the rules of priority FCFS (First Come First Serve). Released Project is the first project to arrive. This rule is used as the arrival time the project did not come together. By using the

priority rules FCFS (First Come First Serve) and time of arrival of the project to see the data in Table 6 the loading sequence of the first sequence is VTV 03, followed by VTV Project 04, BZC BZC 02 and 04. In Table 7. can see the order of the first charged.

Project type	PL	BJN	BJ	BN	BY	K2
	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)
VTV 03	0	0	0	428.3	61.7	612.5
VTV 04	40.8	25	115.8	1253.3	0	590
BZC 02	0	0	0	370	45	2015.8
BZC 04	73.3	188.3	46.7	0	268.3	92.5

Table 7:- loading data sequence

➤ *Load Conversion*

Load conversion is done to see the magnitude of the load to be received by each process on the dies. Before converting the load, the first known percentage loading (LPG).

$$BK_{ijk} = TO_{ij} \cdot j^{-1} \left(\frac{100}{LPG} \right)$$

$$BK_{ijk} = 0 \times 1^{-1} \left(\frac{100}{131} \right)$$

$$= 0$$

$$LPG = X \cdot 100\% \frac{\text{Load Limit (hours)}}{\text{Planned Output (hours)}}$$

From the data capacity and load limit the company can be obtained that LPG by 131%. For example in PL capacity available at 12:24 hours, while the load limit (hour / day x number of machines) is 16 hours / day x 1 = 16 hours, then the LPG by 16 / 12:24 x 100% = 131%. The percentage value of loading (LPG) will be used to convert the load.

If the known value of LPG was 131%, then the workload VTV 03 projects for the period 1 operations 1 is as follows.

Then, in the same way each project workload types VTV 03 in the period 1 with operating-2 = 0 h, 3 = 0 hour operation because the process is not pengeraan. Then, the operation of all 4 = 191 hours, operating all 5 = 21 hours and operation of all 6 = 159 hours ,. In the same way do the calculation of load conversion for the type of project VTV 04, BZC BZC 03 and 04 in period 1. load conversion results in the period 1 can be seen in Table 4:18. Before the conversion load in period 2, first seen in the results of the sequencing period 1. From the sequencing results for the period of operation of 03 3 Project VTV 1 to 6 operations have been completed (*), whereas 04 projects 1-6 VTV operation has not been completed, so the change workload for the operation of 1-6.

Project type	Operation No. 1 OT	Operation No. 2 BJN	Operation No. 3 BJ	Operation No. 4 BN	Operation No. 5 BY	Operation No. 6 K2	Project Status (Release / No release)
	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	
VTV 03	0	0	0	85	5	24	R
VTV 04	40.8	25	115.8	1,253.3	0	590	X
BZC 02	0	0	0	370	45	2,015.8	X
BZC 04	73.3	188.3	46.7	0	268.3	92.5	X

Table 8:- Load conversion period 3

Project type	Operation No. 1 OT	Operation No. 2 BJN	Operation No. 3 BJ	Operation No. 4 BN	Operation No. 5 BY	Operation No. 6 K2	Project Status (Release / No release)
	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	TO (Hours)	
VTV 03	*	*	*	*	*	*	R
VTV 04	18	15	88	957	-	344	X
BZC 02	0	0	0	370	45	2,015.8	X
BZC 04	73.3	188.3	46.7	0	268.3	92.5	X

Table 9:- The conversion period of the load 4

➤ Loading

The loading process is based on the conversion of the load. The loading process is done to determine the project that will be released during the period based on the load limit any kind of proceedings against the dies.

From Table 8. it can be seen that in a period of 3 type VTV 03 projects charged to the OT (operation 1) to process BJ(Machinery Work at a certain angle tilt in the dies) at 0 hours because it has no progress in the process, while the operation of the four charged 85 hours, the operation of all five charged 5 hours, the operation of all six charged 24 hours. Because all types of work VTV 03 Project is under the load limit on the period of 3, then the type of Project VTV 03 can be released and marked R. Likewise with project-type work VTV 04, 02 da BZC BZC 04 has crossed the line of the load, so it can not released and marked X, and will wait for their turn to be released in the next period. To load the fourth period, the first visible result of the sequence of the third period.

➤ Sorting

Sequencing operating purposes to determine the order of projects in process at any period in accordance with the capacity of each process and evaluate projects that have been done on any type of process for the planning period. Booking must be based on the operation schedule data, which will produce the best performance from the due date to avoid delays in project completion.

The process of sequencing is based on the loading process in each period. Based on the calculation of the production capacity available, K2 (the construction side of the surface) is an important process, because it has the smallest capacity of 0.1 units / day, so that the allocation of the workload in the process of sequencing for all customized processes, this activity is done to balance the load on each process, thus avoiding congestion.

C. Calculation of Received Date

The time of receipt of the order (date received) obtained after the date of maturity. From sequencing diagram in the period 1 to period 12. The sequencing can be seen from the due date of each project died. The maturity date of death any kind of project can be seen in Table 10

No. project	Type column	Number (Trunk)	Arrival reserve (SPK)	Starting on mature	Due Date LOMC	Limit the last date
1	VTV 03	8	08/01/2018	08/02/2018	3 days	14 days
2	VTV 04	9	16/08/2018	18/08/2018	6 days	12 days
3	BZC 02	8	01/09/2018	09/03/2018	4 days	17 days
4	BZC 04	8	09/20/2018	09/21/2018	2 days	9 days

Table 10:- Due Date Calculation Results Every Order

III. CONCLUSION

1. Based on the CPM method known length of the project as much as 40 to 240 minutes with a critical path activity BN, BY and K2
2. Calculations in LOMC method indicates that the calculation is more accurate determination of the date it was received, given the available capacity at each different process, a process in a different process and production flow on the production floor. So, to know when the due date 4 project work, and all the different jobs that the project can be completed in accordance with the terms of the agreement, which had previously been delayed.

REFERENCES

- [1]. ADate, A., Goel, A., & Sundaramali., G. 2017. Analysis Project Planning Using CPM and PERT. International Journal of Computer and Mobile Computing, 6 (10), 24-25.
- [2]. Agyei, W. 2015. Project Planning and Scheduling Using PERT and CPM with Linear Programming Techniques: A Case Study. International Journal of Scientific & Technology Research, 4 (8), 222-227
- [3]. Angelin A. 2018. Analysis of Project Scheduling Method X with CPM (Critical Path Method) and PERT (Program Evaluation Review Technique). Thesis University of Mercur Buana.
- [4]. Arianie GP & Puspitasari, B. 2017. Management Planning Project to Improve Efficiency and Effectiveness of Company Resources (Case Study: Qiscus Pte Ltd). Journal of Industrial Engineering, 12.189-196.
- [5]. Wake up, V., H. 2016. Comparative Analysis Project Scheduling method Time With CPM (Critical Path Method) and PERT (Project Evaluation Review Technique) (Case Study: Marigold Botanical Ciputra Perumahan Pangkal Pinang). Authorship. Mercubuana University.
- [6]. Clara A. 2009. Analysis of Critical Path Scheduling Time With offices Maetode And Pert On Development Project (Jl. Pasar Lama Glodok N.20). Journal of Industrial Engineering & management system, 8, 59-82.
- [7]. Chatwal and Siddharth. 2014. Applications Project Scheduling Technique Using PERT and CPM. Yogyakarta: Graha Science.
- [8]. Dannyanti, E. 2010. Project Implementation Optimization Method PERT and CPM. Semarang: Diponegoro University.
- [9]. Desemberiano, N., C. 2014. Analysis of Time Project Efficiency With CPM Method & PERT (Project Case Studies Silo Modified Powder Plant in PT. Sayap Mas Utama of Jakarta). Authorship. Univeristy Mercubuana.
- [10]. Dimiyati, DH, & Nurjaman, K. (2014). Project management. Yogyakarta: Pustaka Setia. Gaspersz & Vincent. 2004. Production Planning & Inventory Control. PT. Gramedia Pustaka Utama: Jakarta.
- [11]. Haming, M., and Nurnajamuddin, M. 2011. Modern Production Manufacturing and Service Operations Management. Jakarta: Earth Literacy 2
- [12]. Hartini, et al. 2008. Determination Date Received Manufacturing Oriented Load Control. Mechanical Industry Program Diponegoro University, Semarang. J @ TI UNIDIP Journal, Vol 2 # 1.
- [13]. Hayun. A., A. 2005. Planning and project control with case study method CPM Pert- fly over Ahmad Yani Karawang ., The winners Journal, vol. 6, no. 2, pp. 155-174.
- [14]. Heizer, J. and Barry R. 2009. Operations Management. Jakarta: Four Salemba.
- [15]. Ilham, S. 2015. Analysis Method Scheduling CPM (Critical Path Method) and PERT (Program Evaluation Review Technique) For Left Mengefesiensi Project Type 36. On Housing Development Thesis. Mercubuana University.
- [16]. Juhri, S. 2017. Optimization of Development Sewage Treatment Works Scheduling Palant (STP) project JIExpo Sky City With CPM & NAUGHTY. Authorship. Mercubuana University.
- [17]. And Hendra Kusuma. 2004. Production Management, Planning & Production control. Yogyakarta: Andi.
- [18]. Lermen, F., H., Morais, M., D., F., Matos, C., Roder, R., & Roder, C.
- [19]. Time and Cost Optimization of Production Using Horizontal Project Pert / Cpm Technical. Independent Management Journal and Production.3. 833-853

- [20]. Murahartawati. 2011. Planning and project control with Pert-CPM method flyover case studies Ahmad Yani Karawang ., The winners Journal, vol. 6, no. 2, pp. 155-174.
- [21]. Nasution and Judge. 1999. Production Planning and Control. Surabaya.
- [22]. Sinulingga, Sukaria. 2011. Methods. Issue 1. Terrain: USU Press.
- [23]. Nurhayati. 2010. Project Management. Yogyakarta: Graha Science.
- [24]. Rama S., et al. 2017. Study on Project Planning using deterministic and probabilistic models by Network Engineering Scheduling. International
- [25]. Journal of Engineering Research and Applications. 7 (3). 32-38.
- [26]. Shofa, W., N., Soejanti, I., & Ristyowati., T. 2017. Project Scheduling Den gan
- [27]. Applying Monte Carlo Simulation In the Method and Program Evaluation Review Technique. Journal OPTION (Industrial System Optimization), 10, 150-157.
- [28]. Sinulingga and Sukaria. 2009. Production Planning and Control. The first edition. Yogyakarta: Graha Science Sतालaksana, Ifktikar. 1979. Technical Working Procedures. Bandung: ITB.
- [29]. Suherman & Amp .; Ilma, A. 2016. Analysis of Project Scheduling Using PDM and PERT And Accidents Project (Case Study .: Main Building Power House PT Adhi Karya). Journal of Research and Scientific Work in the Field of Industrial Engineering, 2. 31-43.
- [30]. Soeharto. 1999. Project Management: Concepts and Implementation. Yogyakarta: Graha Science.
- [31]. Stelh, P. 2009. Analysis of Projects Using CPM (Critical Path Method). School of Doctoral Studies (EU), the Journal-July 2009 No 1
- [32]. Syahrizal & Amp .; Rizki., R., M. 2016. Evaluation of Project Scheduling Time And Cost Method PERT and CPM. University of Northern Sumatra
- [33]. Prasetya, Hary & Lukiastuti, Fitri. 2009. Operations Management. Medpress, Jakarta.
- [34]. Sharif, D. 2012. Implementation Method and PERT Critical Path Analysis in Project Global Technology For Local Communities. Journal of Information Technology and Telematics, Vol. December 5th, 2012, 14 -22.
- [35]. Wiendahl & Peter. 1995. Load-Oriented Manufacturing Control, Berlin: Springer Verlag, Hannover.
- [36]. Wignjosoebroto and Sritomo. 2000. Ergonomics, Motion and Time Study. Work Productivity analysis techniques to Surabaya: Widya Guna.