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Development of Production Information and Control System for Bicol Block Precast Contractor

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Abstract.
The study aims to develop the production information and control system of Bicol Block Precast Contractors considering monitoring the flow need for material plan to meet both the requirements of the master schedule and the capabilities of the production facility, to have an effective "time phased" deliveries, consignments and constant review of methods and maintenance of record integrity. All of these needs require application of material requirements planning in order to provide a system that will facilitate their production system. This system provides computer-based information system through the use of Microsoft Excel for ordering, scheduling, and managing dependent demand inventory requirements for wall panels produced by BBC Precast Contractor that can help them in reducing inventory and shortages through timely acquisitions and production of material. They can also improve customer service levels with an increase in on-time deliveries and direct labor productivity and provide them with accurate and timely information. MRP can provide full visibility of latest material requirements linked directly to production plan and served as a single planning process with all the information required to make informed planning decisions and also clears warnings of potential problems and affected orders directly on the plan when material availability changes.
Keywords: *Development of Production, Control System, Bicol Block Precast Contractor*

INTRODUCTION

Construction is different from manufacturing in that manufacturing tasks are performed indoors with controllable environmental factors. However, construction projects rely on timely delivery of materials produced by manufacturers [1]. These products and the fabrication shops which produce them sit squarely at the intersection between manufacturing and construction [6]; Production control [2] is defined as the task of coordinating manufacturing activities in accordance with manufacturing plans so that preconceived schedules can be attained with optimum efficiency [3]. Fabricators strive for business success by delivering the required quantity and quality of products on time. This cannot be achieved without an appropriate production control system [4]. Production control systems have been proven effective in solving various kinds of managerial problems.

Manufacturing organizations, whatever their products are, face the same daily practical problem that customers want products to be available in a shorter time than it takes to make them. This means that some level of planning is required and this includes the application of Material Requirements Planning (MRP).

Companies need control the types and quantities of materials they purchase, plan which products are to be produced and in what quantities, and ensure that they are able to meet current and future customer demand, all at the lowest possible cost. Making a bad decision in any of these areas will make the company lose money.

Material requirements Planning (MRP) system intends to ensure materials and products are available for production and delivery to customers, maintain the lowest possible level of inventory and plan manufacturing activities, delivery schedules and purchasing activities.

BBPC, one of the precast manufacturers in Bicol that offer products that serve as the underpinning for many world's structures, but that doesn't preclude them from having to practice excellent management strategies. They have a need for material plan to meet both the requirements of the master schedule and the capabilities of the production facility, to have an effective "time-phased" deliveries, consignments, and constant review of purchase methods and maintenance of record integrity. All of these needs require the application of material requirements planning in order to provide system that will facilitate their production information and control system.

MATERIALS AND METHODS

Material Requirements Planning will be used in this study to develop the production schedule of BBPC. This system is expected to provide computer-based information system through the use of Microsoft Excel for ordering, scheduling, and managing dependent demand inventory requirements for wall panels produced by BBPC. Ahead to determine how large their future inventory capacity needs to be in order to meet demand.

Project Design

Material requirement Planning (MRP) is a computer-based inventory management system designed to assist production managers in scheduling and placing orders for dependent demand items. Dependent demand items are components of finished goods-such as raw materials, component parts, and subassemblies- for which the amount of inventory needed depends on the level of production of the final products while the Capacity Requirements Planning also known as CRP, in MRP parlance, is the technique that allows business to plan ahead to determine how large their future inventory capacity needs to be in order to meet demand. CRP also helps companies determine how much space they will need to hold these materials. It verifies if there's sufficient capacity available to meet the capacity requirement for the MRP plans. It thus helps the planners to make the right decisions on scheduling before the problem develops.

The study will also make use of descriptive and developmental method. Descriptive research intends to present facts concerning the nature and status of situation, as it exists at the time of the study. It also concerned with relationships and practices that exists, beliefs and process that are ongoing. In addition, such approach tries to describe present conditions and systems based on the facts stated by the people involved in the study.

Second method that will be employed is the developmental. This study technique will enable the researcher to develop a system through the use of Microsoft Excel by applying the capacity and material requirements planning principles. The different areas of consideration like the components used; lead times and cost of producing wall panels can also be justified in developmental design. The research procedure is also capable of providing an easy way to determine when the order should be placed, how many components are needed and when it must be delivered considering its lead-time to meet customer satisfaction.

Project Development

The development of the production schedule of Bicol Block Pre-Cast Contractors specifically for the production of wall panels will be the focuses of this Study. Using Microsoft Excel, it will develop a system that can help to organize BBPC production information and master schedule.

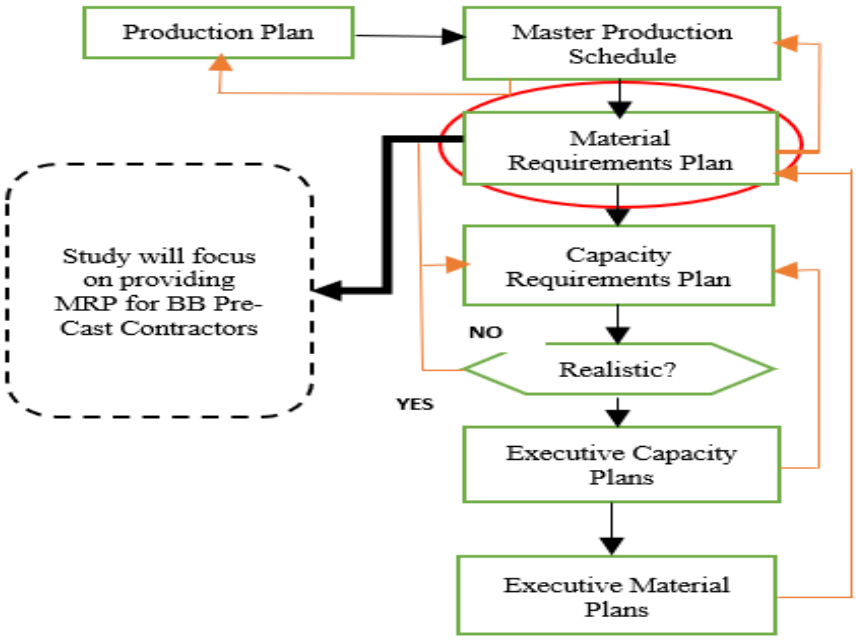

FIGURE 1. Production Plan Process

Material Requirements Planning will enable to develop the following:

- Product Structure tree of Wall Panels
- Gross Requirements
- Time Phase Plan

Operating and Testing

MRP works backward from a production plan for finished goods to develop requirements for components and raw materials. MRP begins with a schedule for finished goods that is converted into a schedule of requirements for the subassemblies, component parts, and raw materials needed to produce the finished items in the specified time frame.

The information input MRP systems comes from three main sources: a bill of materials, a master schedule, and an inventory records file. The bill of materials is listing of all the raw materials, component parts, subassemblies required to produce one unit of a specific finished product. The bill of materials is arranged in a hierarchy, so that it can easily see what materials are needed to complete each level of production.

MRP uses the bill of materials to determine the quantity of each component that is needed to produce a certain number of finished products. From this quantity, the system subtracts the quantity of that item already in inventory to determine requirements.

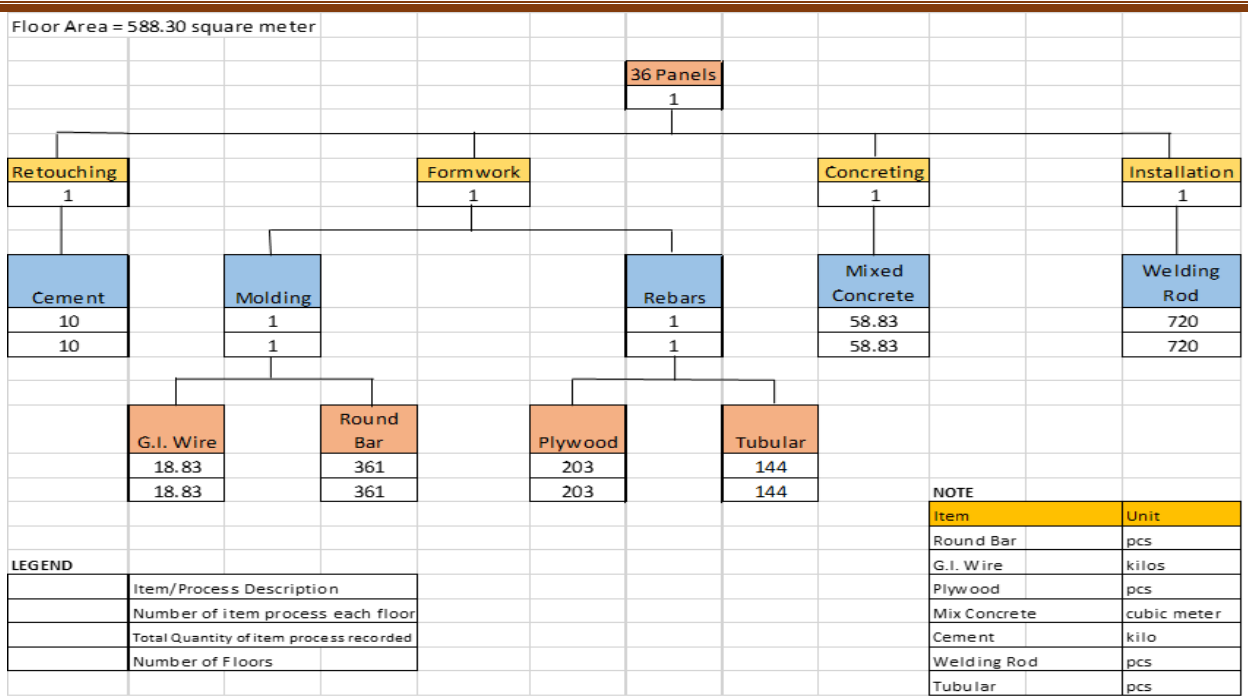

FIGURE 2. Product Structure Tree for 588.30 m² floor area

The figure shows the product structure tree for 588.30 m² floor area given the item/process descriptions and its quantity. For every molding process in each 588.30 m² floor area, it requires 18.83 kilos of G.I. wire and 361 pieces of round bar. In rebar processing, it requires 203 pieces of 6x3 cm of plywood and 144 pieces of tubular. 10 kilos of cement are needed for retouching, 588.30 m³ for the mixed concrete and 720 pieces of welding rods.

The illustration demonstrates the application of MS Excel for easy determination of the materials needed considering its parent item/ process and level coding. One floor having 36 panels is the parent item which is also in the top level '0' of the structure tree while the items below the given level are the children items/processes. These children items/ processes are the following: level 2 code for retouching, formwork, concreting and installation, level 3 for cement, molding rebar and welding rod, lastly, level 4 for G.I. wire, round bar, tubular and plywood.

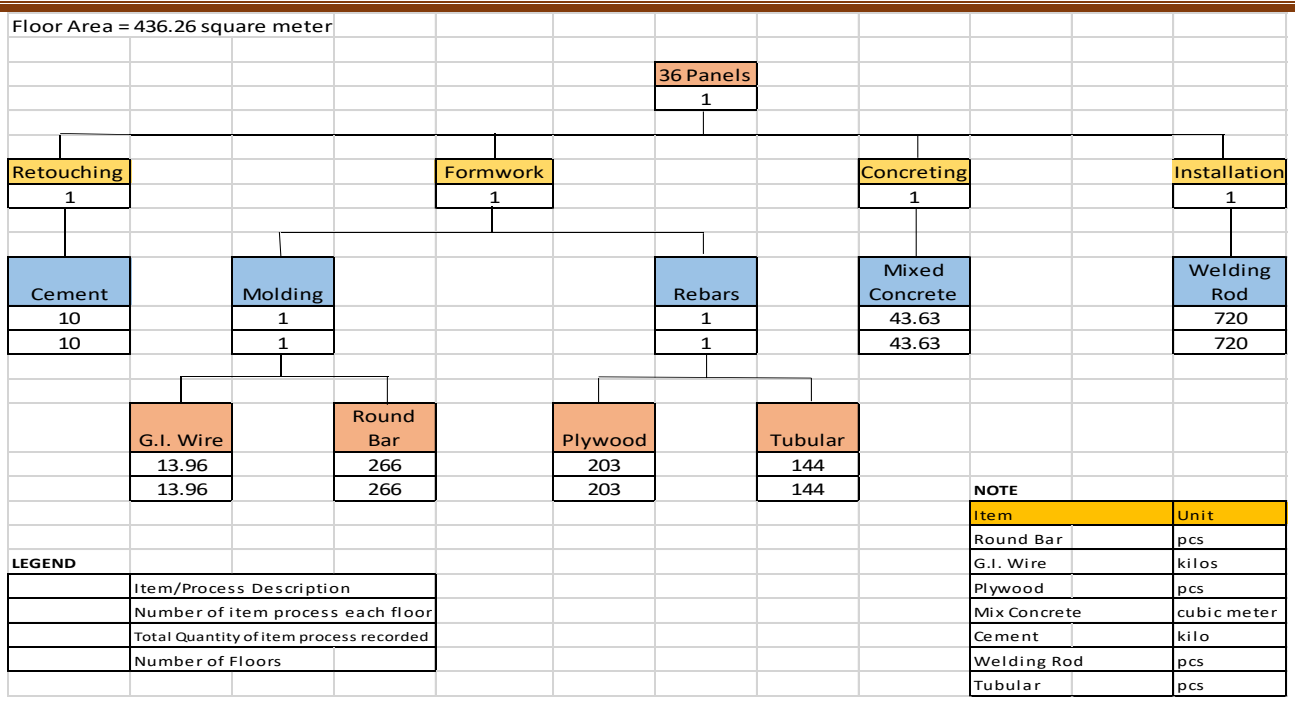

FIGURE 3. Product Structure Tree for 436.26 m² floor area

The analysis of data shows the product structure tree for 436.26 m² floor areas given the item/process descriptions and its quantity. For every molding process in for 436.26 m² floor area, it requires 13.96 kilos of G.I. wire and 268 pieces of round bar. In rebar processing, it requires 203 pieces of 6x3m of plywood and 144 pieces of tubular. 10 kilos of cement are needed for retouching, 43.63 m³ for the mixed concrete and 720 pieces of welding rod.

The illustration demonstrates the application of MS Excel for easy determination of the materials needed considering its parent item/process and level coding. One floor having 36 panels is the parent item which is also in the top level or level '0' of the structure tree while the items below the given level are the children items/processes. These children items/processes are the following: level 2 code for retouching, formwork, concreting, and installation, level 3 for cement, molding, rebar and welding rod, lastly, level 4 for G.I. wire, round bar, tubular and plywood.

TABLE 1. Gross Requirement for 588.30 m²-floor area

588.30 m²-FLOOR AREA										
Item/Process Description		**DAY**								**Lead Times**
		1	2	3	4	5	6	7	8	
One Floor (36 Panels)	Required Date								1	
	Order Placement							1		1 day
Formwork	Required Date							1		
	Order Placement					1				2 days
Concreting	Required Date							1		
	Order Placement				1					5 days
Installation	Required							1		

	Date Order Placement Required					1		3 days
Retouching	Date Order Placement Required				1			2 days
Molding	Date Order Placement Required					1		1 day
Rebars	Date Order Placement Required				1			1 day
Round Bar	Date Order Placement Required			361				1 day
G.I. Wire	Date Order Placement Required			18.83				1 day
Plywood	Date Order Placement Required			203	203			1 day
Mixed Concrete	Date Order Placement Required	58.83	58.83					1 day
Cement	Date Order Placement Required				10			1 day
Welding Rod	Date Order Placement Required			720	720			1 day
Tubular	Date Order Placement			144	144			1 day

Table 1, shows the desired time when the materials are needed and when the process should be finished. This includes the order placement, which is the time where items/materials are being placed and the required date wherein the materials should be available for the next process. For example, the 58.83 m^3 of mixed concrete are needed by day 1 in order to release it by day two, which is the start of concreting (curing) process. This concreting process must start by day two in preparation for 5 days lead-time. By day 7, the processed concrete is then ready for wall panel assembly in one floor.

TABLE 2. Gross Requirement for 436.26 m^2- floor area

Item/Process Description	436.26 m^2 FLOOR AREA DAY 1	2	3	4	5	6	7	8	Lead Times

	Required Date						1	
One Floor (36 Panels)	Order Placement					1		1 day
	Required Date					1		
Formwork	Order Placement				1			2 days
	Required Date					1		
Concreting	Order Placement			1				5 days
	Required Date					1		
Installation	Order Placement				1			3 days
	Required Date				1			
Retouching	Order Placement			1				2 days
	Required Date				1			
Molding	Order Placement			1				1 day
	Required Date			1				
Rebars	Order Placement				1			1 day
	Required Date			268				
Round Bar	Order Placement		268					1 day
	Required Date			13.96				
G.I. Wire	Order Placement		13.96					1 day
	Required Date			203				
Plywood	Order Placement		203					1 day
	Required Date	43.63						
Mixed Concrete	Order Placement	43.63						1 day
	Required Date				10			
Cement	Order Placement			10				1 day
	Required Date			720				
Welding Rod	Order Placement		720					1 day
	Required Date			144				
Tubular	Order Placement		144					1 day

The table, shows the gross requirement of materials and process for 436.26 m² floor areas. In this illustration, the amount of mixed concrete volume, number of round bars and G.I. wire were changed because the area of the floor is different from the previous illustration (figure 2), while the rest remains the same because these materials from 5th floor (project covered by Bicol Block Precast Contractor) were reused.

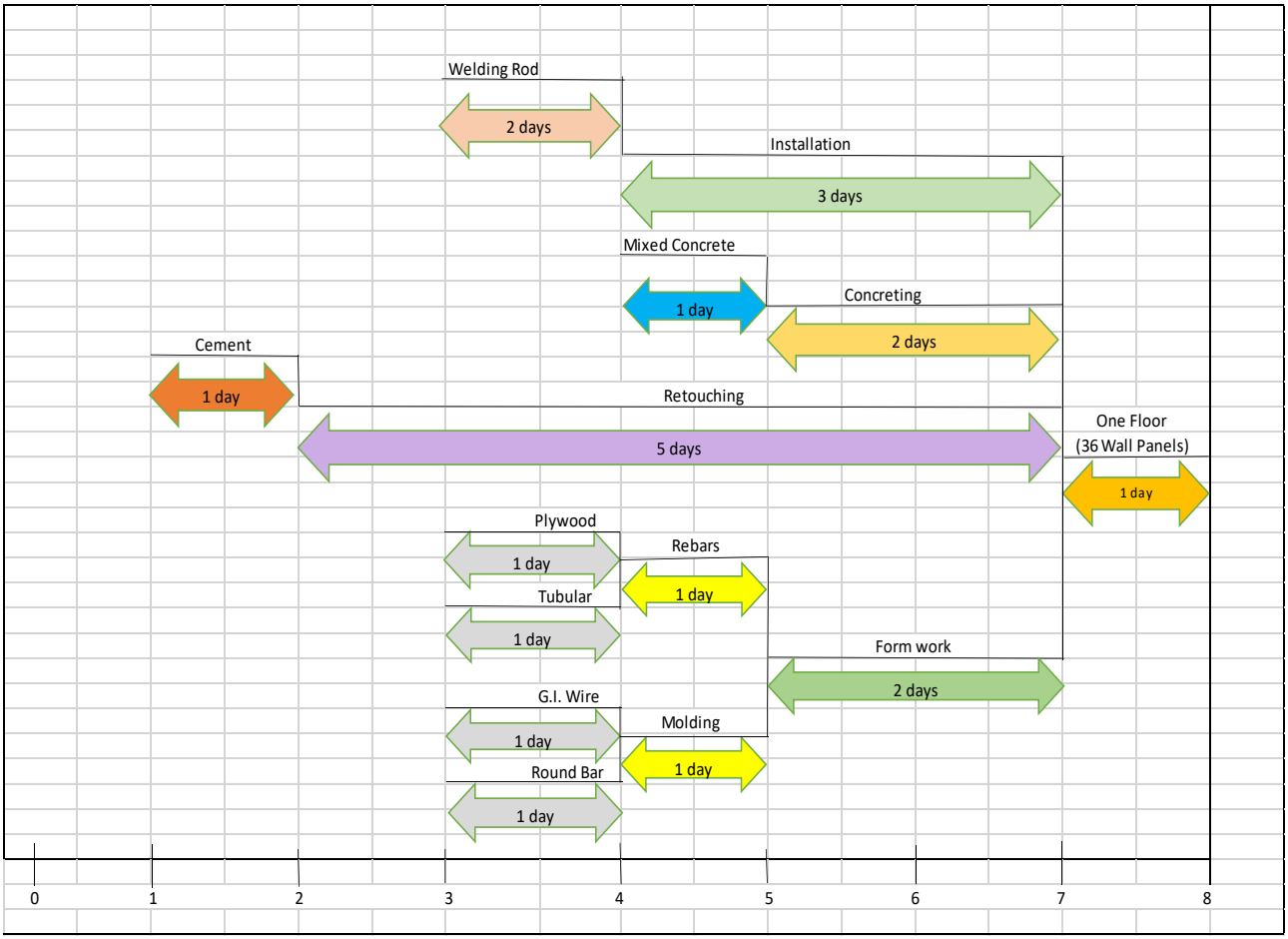

FIGURE 4. Time Phase Plan

The figure shows the time phase plan which indicates clear identification of lead time and which among the materials/process must be prioritized first specifying when the firm plans to build of each end items/process.

RESULTS

The study able to provide product structure tree indicating all the parent and children item, its level coding and quantity needed depending on the number of floors. Using Materials Requirements Planning (MRP), the study able to use dependent demand effectively such as master production schedule, specifications or bills – of-materials and lead times given by BBPC.

436.26 m² FLOOR AREA										
Item/Process Description		**DAY**								**Lead Times**
		1	2	3	4	5	6	7	8	
One Floor (36 Panels)	Required Date								1	
	Order Placement							1		1 day
Formwork	Required Date							1		
	Order Placement					1				2 days
Concreting	Required Date							1		
	Order Placement				1					5 days
Installation	Required Date							1		
	Order Placement					1				3 days
Retouching	Required Date					1				
	Order Placement				1					2 days
Molding	Required Date					1				
	Order Placement				1					1 day
Rebars	Required Date				1					
	Order Placement					1				1 day
Round Bar	Required Date				268					
	Order Placement			268						1 day
G.I. Wire	Required Date				13.96					
	Order Placement			13.96						1 day
Plywood	Required Date				203					
	Order Placement			203						1 day
Mixed Concrete	Required Date		43.63							
	Order Placement	43.63								1 day
Cement	Required Date					10				
	Order Placement				10					1 day
Welding Rod	Required Date				720					
	Order Placement			720						1 day
Tubular	Required Date				144					
	Order Placement			144						1 day

TABLE 3. Master Production Schedule

Likewise, the result is be able to provide time scheduling information specifying when each of the materials, parts and components should be ordered or produced through the use of gross requirement and time phase plan.

Based on a master production schedule, MRP system able to create schedules identifying the specific items required to produce end items, determines exact unit numbers needed and the dates when orders for those items should be released and when process should be accomplished, based on lead time.

RECOMMENDATION

The study aims to develop the production information and control system of Bicol Block Precast Contractors considering monitoring the flow need for material plan to meet both the requirements of the master schedule

and the capabilities of the production facility, to have an effective "time phased" deliveries, consignments and constant review of methods and maintenance of record integrity.

Some of the recommendations are using of the MRP system, BBPC can gain insight into real-time production information. Sales and marketing will enable to create sales goals, which fit the material and capacity constraints. Inventory shortages can be foreseen before they happen. Accounting and finance get accurate costs, which allow them to predict cash flow. All this will enable them to realize substantial savings and improved efficiencies, including quicker inventory turns and more efficient use of production equipment and floor personnel.

Further study on the applications of Materials Requirements Planning (MRP) in different fields (manufacturing, constructions) who are trying to maximize the amount of money they bring in so there needs to be a good balance between the inventory of materials are being able to meet the demand of the customers.

Moreover, extend of knowledge using the data gathered from MRP and work together with the application of capacity requirements planning (CRP) and aggregate planning to provide complete information needed in monitoring labor force and all the resources used in producing materials/finished items.

CONCLUSIONS

The findings of this study made evident the fact that MRP of Material Requirements Planning can help BBPC in reducing inventory and shortages through timely acquisitions and production of material. They can also improve customer service levels with an increase in on-time deliveries and direct labor productivity and provide them with accurate and timely information.

MRP can provide full visibility of latest material requirements like directly to the production plan and served as single planning process with all the information required to make informed planning decisions. it also clears "warnings" of potential problems and affected orders directly on the plan when material availability changes.

Other important factors of material requirements planning involve ordering all the materials at the right time. If production can't begin at the time, a company may fail to meet the deadline, which may cause customer dissatisfaction.

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REFERENCES

i. Ballard, G. and Arbulu, R. (2004). "Taking Prefabrication Lean." Proceedings of the 12th Annual Conference of the International Group for Lean Construction, Elsinore, Denmark.
ii. Barriga, E.M., Jeong, J.G., and Hastak, M. (2005). "Material Control System for the Manufactured Housing Industry." ASCE, Journal of Management in Engineering, 21 (2) 91-98.
iii. Bertrand, J.W.M., Wortmann, J.C., and Wijngaard J. (1990). Production Control: A Structural and Design Oriented Approach. Elsevier, New York.

iv. Hamez, F.R., Ballard, G., and Tommelein, I.D. (2008). "Improving construction work flow – The connective role of look ahead planning." Proceedings of the 16th Annual Conference of the International Group for Lean Construction, Manchester, UK.
v. Wijanto, S. (2006-a). Equivalent Monolithic System on Precast/Prestressed Element Joints For Seismic Prone Area in Indonesia, International Conference – Trisakti University – Jakarta, 26 January 2006.
vi. Walsh P, et al. (2004) The J-protein family: modulating protein assembly, disassembly and translocation. EMBO Rep 5(6):567-71
vii. Wijanto, S. (2006-b). Precast/Prestressed Concrete Systems at Seismic Prone Area in Indonesia , NZSEE Conference, Napier – New Zealand.
viii. Ergen, E., and Akinci, B. 2008. "Formalization of the flow of component-related information in precast concrete supply chains." Journal of Construction Engineering and Management, 134(2), 112-121.
ix. Sacks, R., Akinci, B., and Ergen, E. 2003. "3D modeling and real-time monitoring in support of lean production of engineered-to-order precast concrete buildings." Proc. 11th Annual Conference of the International Group for Lean Construction,Virginia, USA.
x. Benjaoran, V., and Dawoon, N., "Intelligence approach to production planning system for bespoke precast concrete products", Automation in Construction, Vol. 15(6), pp. 737–745, 2005.
xi. Liulin Kong, Heng Li, Hanbin Luo, Lieyun Ding, Xiaoling Zhang, "Sustainable Performance of Just-In-Time (JIT) management in time-dependent batch delivery scheduling of precast construction", Journal of cleaner Production, 2018.
xii. Polat G. Factors affecting the use of precast concrete systems in the United States. J. Constr. Eng. Manag. 2008;134:169–178. doi: 10.1061/(ASCE)0733-9364(2008)134:3(169)