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Role of Kanban System in Construction

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Abstract- Kan-ban is an system that is under the category of tool it is mainly used in the reduce the time period in the manufacturing and production processes the main objective and idea to introduce these system it will deliver the products on time I,e lead time with out any further delay occurrence.In terms of Japanese terminology the word kan means visual and ban means card. So combine we called these word as visual card. The main function of these visual cards they signal the system with in the process system to continue the production with out any intermediate in differences in between the stages of production.So the Kan-ban cards shows how the work is going on I.e information is displayed on the cards they include tasks they completed , need of materials, need of resources if any etc.So they should be standard texture, size, and shape with varying colour based on the sequence of works we carried .In these Kan-ban system they consider pull system process, in these system based on the customer requirements and quantity demand they can be produced the concept is idealized with the following description.It consists of one line with series of activities are carried out from start to finish so many activities are involved so in these process what is the product we produced that only can be produced at end.The products may processed in series line manufacturing is as follows the raw material insertion , partly semi finished product and finally we derive an finished product.So, In these paper we use these kanban system in case of construction and evaluate how it should be use full and how to deliver materials with in the construction site and how the processing will happen can be described.For these respective we consider an 'n' number of PCC slab construction as an example and describe the how these kanban system help full and what are the advantages and how it should be shown impact on entire process flow can be explained.

Keywords:- kanban system, kanban card, Kanban container, visual metric, production process.

I. INTRODUCTION

Kanban the word that is related to Japanese it means it is an sign board or as well it will also be an bill board these type of scheduling system developed in Toyota automobile manufacturing system and these system will be introduced by an industrial engineer Taichi ohno the idea of his concern is to improve the manufacturing efficiency with in the internal and as well as all over the production system.

Sometimes these kanban will also be called as Toyoto name plate particularly in respect of auto mobile sector so, while production of large quantity or manufacturing of a materials there will be an some ambiguity in between the process and if any alteration in between the stages of these production we will enable to loss and waste our resources.

So, kanban is an one of the effective system to control the production work and what amount we need to required that only can be produced with in

an short and minimum acceptable lead time they reduce inventory (goods stock), and when the material is demanded for the particular activity then only we can pass the information at production source (upstream end) then they check and cross verify and send the definitive quantity to the consumer end (downstream end) with respect to these we can follow basic steps is passing order, passing information, and finally shipment of materials at distinct lead time.

Another aspect in kanban system is it is an visual interpreter and visual metric commutator. So we can easily ascertain at what stage what is the work we done and what are the needs of thee particular zonal area and tasks they completed can be properly enumerated on the basis of kanban cards.

Kanban card is an one of the essential element in the over all kanban syste3m it plays on major role, the kanban card has following that is name of the work tasks remaining tasks completed need of sources etc can be eventually displayed on the particular column of work.

Next, another important parameter in the kanban system is kanban containers the name containers perhaps tells us that it is an similar to an one storage box. So, kanban containers can reveals information is what is the standard volume of container and what it is storage capacity can be significantly we can known.

II. HISTORY

Kanban system initially originated during second world war in that period the UK factories will be produced spit fires for these production process they idealized about the simplest concept I.e visual stock replenishment signaling system an empty box. These system nothing but we present called as " two bin system".

Example
The material consumed in one container and it should be emptied, and when you go for second container we can place an information card one the container next, we can call for order what is the quantity of material of we need then we can simply get required quantity at and elapsed lead time.
After that in late 1940s, the Toyota company has started the observations on super markets, so they finally idealize that the customers has to need to retrieve their requirements for the necessary commodities in the supermarkets either less time or with in the time frame they sell the products with an assured frequency.

Then, Toyota will studied these preceding processes they, idealize that with respect to proper signaling system we can control our production based on their needs so, the signal will be simply indicates reveals the information how the work is done, is any need of resources for the particular area and continuous production will be achieved against avoidance of stock piling of good.

Based on the requirements only we can produce that quantity of materials, so in these respect we can effectively avoid wastage's and complete the with in the scheduled time. Another concern in these is bring better visibility through supplier consumer and as well as buyer.

So finally these kanban system can be effectively adopted in Toyoto production system in 1953 in their main production plant machine shop.

III. SYSTEMS AND TYPES OF KANBAN

1. Production Kanban:
Production kanban is one of the basic one while it should be simply shows that it will be facilitate the what are needs and requirements of the particular activity can be probably known.

So, production kanban has designates quantity of material we proceed and quality parameters we meet can essentially known.

2. Withdrawl Kanban:
With drawl kanban has simply explained as if consumer on the down stream side has need the product he may send the request of consent to the up stream side supplier. So, he may know that what is the quantity and how much you produce ? and at what time we can supply? can be appropriately he known.

3. Supplier Kanban:
Supplier kanban is noting but the some of the company's are make provision for may direct contact with supplier and they permanently made as apart of system.

So that they straight a way contact with supplier with out any intermediate in differences and avoid awaiting and send the request to the source of item they want for the particular supplier and with out any further delays they get an efficient product.

4. Emergency Kanban:
Emergency kanban will deals with un expected and unexplicit situation it requires an immediate observation.

They signals the immediate replacement of faulty and defective products in the production flow process. These is an essential system, when ever there is an any in difference are arised in the production as a part of products are get effected with respect to its quality.

So, emergency kanban signals that situation and avoid those part of goods and ascertain where the problems is encountered.

So, we can substantially avoid wastage's and fourth coming production can be done in smoothly with out any issues.

5. Express Kanban:
Express kanban will also similar to the emergency kanban they might resolved the un usual circumstances with in the production flow immediately compared to emergency kanban they will not be signify the defects but they signals if any specific product is shortage or less.

While it should be simply explains as following sequence in the continuous production, in between the production if any disruptions are occurs then the system will be running slow, immediately these information passed by express kanban

Sometimes, we can stop the entire process until the some important products are delivered. So, express kanban plays an vital role for continuous production with out any slowing down and stooping the process.

6. Through Kanban:
Through kanban has combination system in between both production and with drawl kanban will takes place. These kind of system introduced where two different production teams are working together and contact with each other these mode of kanban is applicable by simply describing that in an organization two different working teams are worked together.

So, one team will be start the particular mode of work and alternatively the second team will be ready to receive and done the work more efficiently. So, in these both teams will involved with varying performance of their applications and works. While these kind of kanban will increase the efficiency of work and maximize the time flow of working.

IV. METHODOLOGY

In kanban system the methodology and sequence they followed is,

Design - Manage - Improve Flow - Production & Lead Time

1. Design:
In these phase it is completely an thinking approach we can observe the present working scenarios then we will set the tools nothing but placing of kanban cards establishment of kanban visual metrics to see the how work is going on. Then improve the production process.

2. Manage:
- Initially place an on board then kanban cards placed.
- Assign the kanban cards to each column or working area.
- Then knows the what are the needs and requirements
- Place the documentation if need
- Make discussions if need
- Need check the work through check list
- Implement work in progress limits
- Tag or labeled the kanban cards
- Enable with start and end date
- Then know the needs and requirements of the activity that we proceed.

3. Improve the Work Flow
- We must once recheck all policies and regulations.
- Verify the work in progress limits.
- Done overhaul of the board if completion of task

4. Production & Lead Time:
- Products should be produced when request of consent from customer's.

- Products should be delivered on lead time.
- Avoid defective products.
- The process should be continuous.
- Avoid the stocking inventory and also stock piling o goods.

V. WORKING PROCEDURE & HOW TO PROCEED

While what ever the process it may be we must follow the some standard specified step wise procedure then only we can simply achieve our required objective.

1. Visualize the Work Flow:

- To visualize the work to place a map for an present carried out or proceeding work that you can be place an visual control board to ascertain the how the work is going on.
- Divide the work into number of manageable departments.
- Ensures at each areas place buffers.

2. Work In Progress:

- Work in progress in these they induce the certain constraints
- Limiting the number of working units for the particular processing area
- By limiting the allowance of production units we can relieve some time constraints and then we smoothly finish up the work and production and conveyance can be done acceptable lead time.

3. Policies Explicit:

- We can divide quantity demanded of a products into classes
- Suppose some products has high cost and delivered longer lead
- So, based on the demand and quantity of production and also cost considerations we can balance and made work smoothly with out any delays
- For emergency work we must supply on lead time based on the concerned situation.

4. Measure & Manage:

- In these prominent step we measure the speed of production and manage the quantity of process.
- The speed is measured in terms of cycle time.
- It means how much quantity is p produced can be measured in terms of mathematical equivalent.
- The cycle time is measured how much time will to move product from one place to another place nothing but in between production system.

5. Optimize Using:

- So in these stage while we can see that is any actual performance of particular work improved or not can be accessed.
- We can reduce defective product production.

VI. RULES OF KANBAN

For effective production system we must follow these six rules;

- For each process it should be necessary that the request from the consumer to the supplier then only we can produce the products.
- For each process we can produce the quantity of goods according to the request of consumer.
- With out an prior request consent no goods are produced and don't be transported.
- The consent of request can be always be attached it with an order good.
- The products and finished goods should be free from defects and we must consider that defected products can't send out as possible.
- While we take care about that pending requests can be limited as possible and make process more efficient and avoid the in efficiencies as must as possible.

VII. HOW TO IMPLEMENT KANBAN SYSTEM IN CONSTRUCTION

In construction so many works and tasks, procures are involved at every stage of construction in that respective the procurement of material and transportation of material and dumping and storing, conveying of materials with in the construction site is an eminent task.

So, in any of the above process in between the stages of material procurement rising of difficulties may lead to delay of construction project and we should not complete the project with in the scheduled time.So, we need of material procurement in the constructional activities is more important.
In that concern we use kanban system, so as we already discussed it is an efficient and continuation production system in the manufacturing industry with out any stocking of inventory.

So how should be implement in the construction can be enumerated with following flow chart and sequence of followed tabular performa.

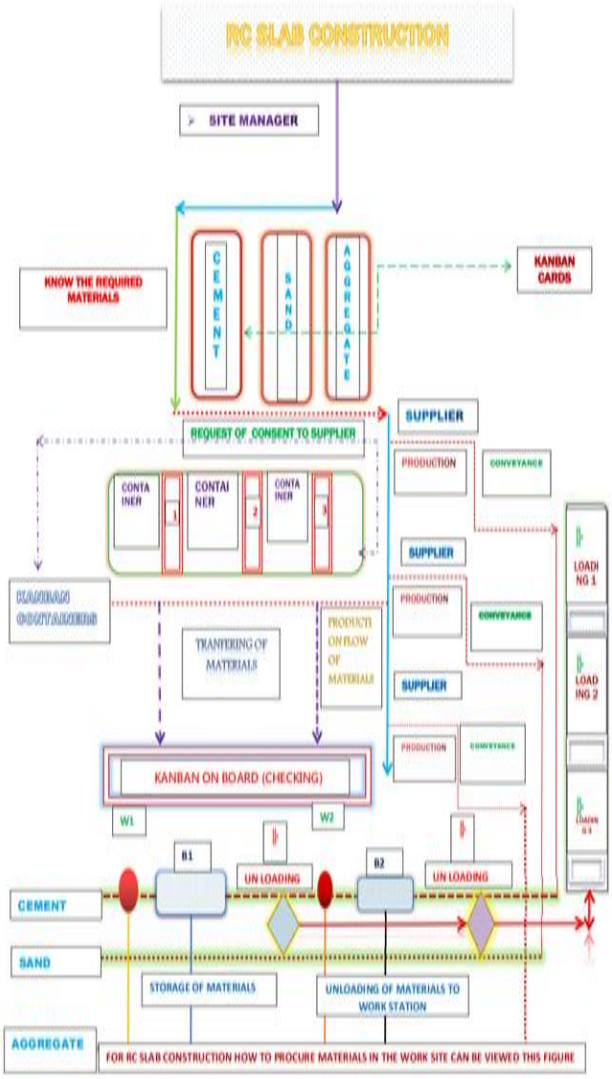


Fig 1. Flow chart of procurement of materials for construction of pcc slab.

VIII. FLOW CHART EXPLANATION

From these or above flow chart we seen that how the process is going to procure materials for construction of reinforced concrete slab construction.

We can discuss each stage in brief manner with respect to the following paragraphs.

For construction of plain concrete slab on the work site the site manager has initially known the what are the materials he required so these information can be posted on kanban cards for their reference they are cement, sand, and aggregate.

1. Kanban on Board Introduction:

In these kanban on board he must place the information what is the material type ? how much quantity he may need ? and mention the lead time in case of some emergency situations so these kanban cards are placed for ordering, they can be displayed with proper colour coding nothing but the visual metric.

2. Need of Kanban System:

So that we can fully aware about at what quantity we need with respect to time of arrival of material nothing but acceptable lead time after that these information passed to the supplier in the form of request of consent to supplier coming to our case we need three types of ingredients they are coarse aggregate, fine aggregate (sand), cement so that we cannot procure these materials from single supplier.

3. Requuest of Consent to Supplier:

So, for that based on the mode of classification of materials we can individually send the request of consent to 3 suppliers individually.

In these respect supplier 1 has to produce cement so, the difference in the start of request of consent to start of the conveyance is known as production time. From the end of production to the before loading is known as conveyance time.

Then these materials are loaded in to kanban containers so loading of material is indicated by green flag so that we clear about that the material is loaded and it should be ready to unload materials to working station. So, these unloading operation is indicated by red flag.

So, in the similar way we follow the same procedure for coarse aggregate, and fine aggregate (sand) in concern operations involved that are request of consent to supplier, production, conveyance, loading, and finally unloading the materials.

So, up to now we see how the production and conveyance and loading and unloading process are clearly understand then we go for how these materials are transported to work stations can be explained with following sequence of paragraphs.

4. Need of Buffer Stations:
So, we see in the flow chart before the buffer station B2 we unloading the materials and one more important concern or aspect is purpose of buffer station is once we can cross verify the materials hauling, quantity and include some of the quality parameters also.

5. Work Stations:
The materials are the meet the all above standards they can be transported to work station W2 so in that we can see that the materials are stored at location that is nothing but work station W2. These same process will follow in sequence in case of unloading of materials prior to B1 and storage of materials for W1.

6. Conveyance / Transfering:
So, we can complete how we conveyed the materials from buffer station to the within the work station while, now we reach our final step is on the work station it self we can place an kanban on board the function and purpose of these kanban board is after receiving the materials from all suppliers and cross verification of buffer station with respect to quality parameters now we start the work with these materials to construct on slab.

So that we involve so many operations with in the constructions site they are storing, handling, mixing, conveying, and placing & finishing so these are followed in a systamatic and sequence manner so in between these working states if any disruption will leads to may ultimately effect the scheduled and production time of slab construction.

So in these kanban on board we can access the progress of work at regular intervals with out prior disruption then role kanban containers is explained simply by these are standard dimension ed containers which are expressed in terms of kanban or no. of kanban they can give reliable information on how much quantity is stored? and how much quantity of materials required for further working activities can be known initially.

So, we can see that how we procure materials for plain concrete slab construction from top to bottom level of entire managerial process. So, we can simply compare these whole system in to standard kanban system.

While kanban is a anew of the production system used in manufacturing production system for continuous production with out inventory stock we can produce exact quantity of materials or products. So, these same system we can applied in the construction aspect6 as to procure materials and how much quantity we need ? how the process of working is also clear using these system.

Example;
For automobile production we can manufacture various spare parts to produce an car in an sequence and series of stages. So, same concept used for the construction also that is for plain cement concrete slab construction we can procure materials from supplier in an sequence and series of stages.

IX. TABLE EXPLANATION

1. Description of Work:
In these sample table performa we see that in the description of work we include the what the work we done coming to our case it is plain cement concrete slab construction in the same column we see that two works are involved they are classified under two modes they are external works and internal works involved.

So, under the external works involvement we classify works into procurement of materials and internal works involvement we classify the method of working while in case of procurement of materials we can procure the following sequence of materials they are aggregate, sand and cement and from the method of working we see that the following sequence of operations are involved they are storing, mixing, placing & finishing.

2. Check List Assesment:
So, these entire working process is done / or not according to standards can be cross verify using check list it showed on the sequence of net column of description of work. So, that we can initially complete all the cross verification's is you will get all materials and as well as how the method of working is carried can be substantially justify with respect to using these check list.
Table 1. Kanban check list for PCC Slab Construction.

S.No	Description of Work	Check List	S.No	Taks	To Do	Work In Progress	Done	Remarks
	Rc Slab Construction	Is work is done or/not				Reamaing Work		
1	External Works Involved							
	Procurement of Materials Cement, Sand Aggregate		1.	Slab 1	Slab 1	Slab 1	Slab 1	
			2.	Slab 2	Slab 2	Slab 2		
			3.	Slab 3	Slab 3			
2.	Internal Works Involved							
	Method of Working Storing, Mixing, Placing,		4.	Slab 4	Slab 4			
	Procurement of materials Is associated with external production process		5.	Slab 5				
	Method of working Is associated with internal working process of with in the		6.	Slab 6				

3. Tasks (Objective of Work):

So, next see that tasks, tasks are nothing but the what is your aim and object of your work so in these table we see that tasks we consider is construction of 6 no's of slabs so it is our task

4. To do (Start of Work):

Then, we go for to do column so, in these respective column we see that 4 no's of slabs are under the to do column will reveals the information is we start the construction of slab of 4 in no's.

5. Work in Progress:

Then we go for further column work in progress in that column they describes us two 2 no's slabs are already in work in progress nothing but it should be remains in working condition.

6. Done(Completion of Work):

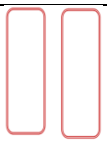
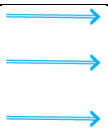
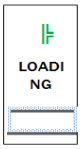
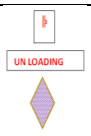
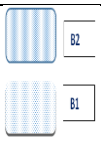
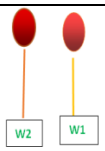
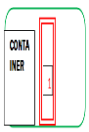
Then finally under the done column they shows the 1 no of slab is completed for entire construction process it will reveals so the process is continuous and will not lead to any delay time and avoid over stocking of materials with in the construction site.

So, in these way we can evaluate how was he work is going on in sequential manner while if any remarks are mentioned with respect to these series of slab construction process we can mention it despondently in these respective column.

So, these table performa of kanban system can give information how was the work is going on.

In step wise procedure can be approximately accessed in terms of kanban system these can be described as visual metric of kanban system (in case of graphical are plotted with the with the above tabular data).

Table 2. Conventional signs used in flow chart and their explanation.

S.no	Symbol	Description	Remarks
Signs related to conveyance and storing of materials in construction in plain cement concrete slab construction			
1		Site manager has to know the required materials for construction	
2		Kanban cards of aggregate, sand, cement	Display information of materials
3		Suppliers order	Request of consent to supplier
4		Supplier 1 Supplier 2 Supplier 3	Cement Sand Aggregate
5		Production Conveyance	The time consumed by production of products is known as production time. The time consumed by conveyance of products to work site is known as conveyance time
6		Loading 1 Loading 2 Loading 3	For loading of materials we indicate with green flag.
7		Unloading of materials	For unloading of materials we indicate with red flag.
8		Buffer stations	To cross verify the material quality and quantity
9		Work stations	These actual working areas that is construction site
10		Kanban on board	To indicate of flow of work in working site That is Procurement of materials Transferring of materials Storage Conveyance & placing & placing finally finishing can be systematically indicated kanban on board
11		Transferring of materials	These two arrows indicates transferring of materials from storage.
12		Kanban containers	These are standard dimenstion containers to give information regarding how much is the quantity of material is stored.
13		Indicate the material stocked at work station	Material is Cement

14		Indicate the material stocked at work station	Material is Sand
15		Indicate the material stocked at work station	Material is Aggregate

X. ADVANTAGES OF KANABAN

- Flexibility in the production of goods with out any ambiguity.
- Continuous delivery of products with out stocking of inventory or stock piling of goods.
- Improved productivity of output of goods.
- Increased efficiency of the total process flow.
- Ability of team member may boost up the products delivery on lead time.
- Maximum the work and minimize time period.
- Scheduling the work as per the standards.
- Deliver the products with in the lead time.
- Obtain and enable satisfy quality.
- Accuracy in the quantity of materials to be produced.
- Avoidance of wastage and awaiting.
- Avoidance of transportation bottle necks with in the internal production system.

XI. DISADVANTAGES OF KANBAN

- Use of out dated kanban on boards can be rise issues in the production system.
- Some times use of kanban boards may be over complicated.
- Some times don't concern time frame associated with it.
- Use of latest electronic systems and visual metrics system will enable how the process will be going on.
- Must aware about the all details of the kanban.
- Use of correct kanban conventional sign and signaling system.
- Keep regular monitoring of production of process.

XII. CONCLUSION

Kanban system is an one of the originated manufacturing production system developed By Toyoto production system. The objective of the implementation of the system is to avoid the overstocking of inventory and produce products continuously with definitive quantity so that we can use two essential elements one is kanban card and kanban visual metric or kanban containers the importance can be discussed in the flow chart description.

So, we can use these same system in case of construction and how it should be implement and what is the role and importance can be discussed with an forwarded example of plain cement slab construction

So in these respect we can simply compare with standard kanban system customer may sent request of consent to supplier then only supplier has start production and conveyed the materials at work station at an definitive time these time is nothing but lead time, the advantage we observe that to procure materials.

We can contact supplier ans send request proposal with respect to kanban cards s that supplier has to know how much quantity he may need ? and one more aspect is these entire process flow can be done in an distinct manner without any ambiguity involvement in between the stages of procurement of materials to the work station.

So, construction industry procurement of materials is not an easy task and construction will involve so many tasks so, they systematically access with respect these kanban system.

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