

Systematic Approach Of Constructional works through using water fall model

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ABSTRACT

While we are well known that construction industry is an one of the complex mode of industry compared to other sector-al works. Because, from initial stage to final stage of finishing works it involves lot of men, machinery, materials, and methods at each and every stage. So for that efficient management of these men, machinery, material, method so many project management techniques , models, methodologies are introduced for smooth flow of work in an sequential manner. So, each and every technique , management method has their own gains and limitations. So, while we go for any work that we executed based on the work strategy we will select and choose the which type of management technique is suitable to carry out the work effectively can be determined prior to work that we executed. So, for that we discuss one of the project management model that is water fall model. Actually it is originated from manufacturing sectors and they used in production management and later for developing software's in it sectors used these technique to develop software's in their software development life cycle models so using these model they has developed good software's with limited difficulties. So, in these paper we will discussed about the how these water fall model will help in construction work for efficient management over the quality and quantity parameters can be known, for these we will consider an case that is production of RCC panels. So we know that concrete is an one of the major constituent material used in construction industry if it requires care full and strict control over the starting and ending stages of the the entire production process. Because , for major mass construction concrete work it should involved lot of physical, chemical, environmental factors if any negligence in any stage of concrete production it will impact the all over quality of the structure. So, for these concern we need an efficient management over these process. So. How these water fall model will helps efficient management of production of good quality of concrete and RCC panels can be discussed as follows.

Keyword : - waterfall model, decision tool, linear sequential approach.

1. INTRODUCTION

Water fall model the name itself explains its meaning that is generally we see that in water fall water flows from higher level to lower level in between it is effected by so many obstructions. The same strategy can be used to develop these model nothing but while we execute any work it has some methodology to complete the work from these same concern water fall model follows that is it approach the work linear sequential manner to complete work or any task it means ones you complete the work then only we go for the next stage of work in completion of any stage and revert to previous stage will leads to rising of so many problems and it will ultimately effect productivity and quality of work. So, water model can be used as an one of the decision making tool on any work it means prior to work that we execute and carried we can well define your objective and goal of work. Regarding construction it involves lot of works each and every stage can be effectively supervised for these respective water fall water fall

model is so much of help full. That is we can initially aware about the requirements and then we can properly analyse the process that we implemented then documented the work in detailed, once completion of document work we can go for design after these probably we go for implementation of the work from the reference of analysis and design phase , then out put of the product should be subjected to testing to known it shall meet all acceptable standards and limits and specifications, then finally we will go for final stage maintenance in that we will notify serviceable condition of structure with respect to any defects are found and noted down these defects and used it as future reference to avoid the repetition of these defective works..

So, each and every stage of work will explains us prior to execute work we can collect all information including maintenance so that flow of work will not effected by ambiguity involvement work that we carried in an sequential model and water fall can be help's the divide the work into manageable departments so, that we can allocated the working men based on their skill. So, water fall model follows an stage by stage work so that involvement of entire project members and their decisions are important because if any error occur in sequence of work it leads to effect whole project remember water fall model not flexible because we will not reverse back your work so it is an efficient management tool and used as care full control tool.

2. OBJECTIVE

- Efficient management of production of concrete panels from starting to finishing stages using these water fall model
- Control the quality and quantitative parameters in production of concrete panels using these water fall model
- How to integrate these water fall model in construction activities
- How these water fall model used as decision tool in construction

3. METHODOLOGY

Requirement gathering

The main objective of these phase is to collect the all details from the available resources then it should properly checked and corresponded with the all gathered details regarding the work that we planed as well as executed then list ou the requirements in an systamatic manner using tabular performa [decision tool].

3.1 Analysis

After, completing these requirement gathering phase we go for analysis in that we can conclude details that is is collected information enough for work execution or not can be known, then how to approach the work using requirement gathering In different ways can be access through various alternatives. Then, select most probable economical solution and schedule the work to complete the project with in the said stipulated time. The, know the how to divide the project into manageable working departments can be documented properly. So for that we can analyse and find out the best possible solution to complete work in effective way.

3.2 Design

In the design phase what ever the approach of work that we selected based these analysis phase we will go for design that is using the logical design we can access the all possible ways of solution to complete the project then it will helps to involvement of whole project members from the lower level to the super intended of higher level, then, completing these logical design based on these we can ensure and go for physical design, after these it will detailed into an project specifications.

3.3 Implementation

In these phase what ever the design that we done in the previous phase can be implemented in the implementation stage we must care about working process check the work regular intervals it is done as per the design are not, then immediate action is required in the implementation stage if any anomalous defect rises in between the work.

3.4 Verification and testing

The phase is also known as testing, and the term is self explanatory nothing but after implementation product will be ready to use so, before usage of these product we must ensure that is the product must meet the specifications are not can be determined and it is satisfied as done in the requirement phase can be known in these stage. Briefly, written as product meet the standards are not in phase 1 considerations [requirement gathering] and it shall done as per the design are not can be decided in these stage.

3.5 Deployment

Once we can complete verification stage and product has meet its performance with respect to design , then it is released t the market nothing but deployed into customer and ready to use.

3.6 Maintenance

We are well known that on regular usage of the product that we design it has some defects occurred due to some external factors. So, the ageing of the product will adversely effect the serviceability condition of the structure. So, keep notice from the customer and make recommendations on the further developed product with increased life time.

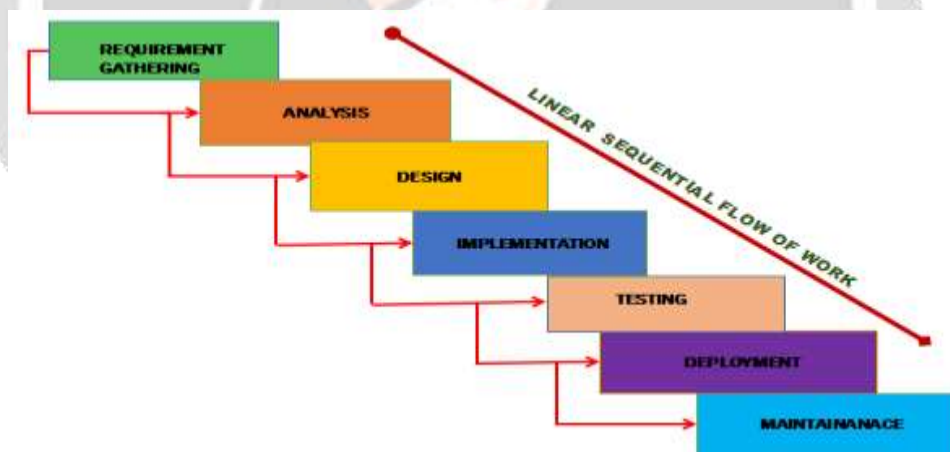


Fig -1 : water fall model methodology

4. HOW TO USE THESE WATER FALL IN CONSTRUCTION [PRODUCTION OF RCC PANELS]

4.1 Requirement gathering

For production of concrete we ascertain the needs to prepare concrete mix nothing but in these phase the selection of materials is the objective of of work.

4.2 Analysis

In these phase we mention production process of concrete and access the all alternative solution with respect following operation they are method of handling, method of placing, method of compacting, and method of finishing operations. From these working processes we must select best possible one example in method of compaction we will which is feasible that is hand compaction or mechanical vibration.

4.3 Design

After the analysis we go for trail mixes and select most suitable one from the laboratory results that is we can design the mix which feasible for that local condition.

4.4 Implementation

In these phase we can implement design concrete mix then include the analysis phase operations such as mixing, transporting, placing, compacting, finishing, curing so we must effective and strict management over these sequential processes.

4.5 Verification & Testing

Then completion of the implementation phase we can go for our another stage that is testing we can check finished RCC panel with respect to its performance then check the is the product meet all specifications can be determined in the testing phase

4.6 Deployment


After testing if product meet all standards as per decision table it is ready to handed over to the customer

4.7 Maintenance

After deployment we can adopt periodical maintenance because, if any defects and errors found in the product with respect to regular usage and some external factors.


The serviceability of the structure is effected so for that we notify these defects and used it as reference in future works to avoid these erroneous works and maintain and increased life time of product.


Table -1: Decision Tool Of Water Fall Model


S.N O	PHASES OF WATER FALL MODEL	DESCRIPTION OF WORK	DECISION ON SELECTION FROM FOLLOWING ALTERNATIVES		FINALLY SELECTED FROM THE ALTERNATIVES	REMARKS	
1.	Requirement Gathering	 <p>Production Of Concrete Panels</p>	SELECTION OF MATERIALS		53 grade cement used is 12269-1987		
			cement	33 grade			53 grade
				43 grade			
				53 grade			
			sand	Grading zone 1	Grading zone 2		Use grading zone 2 of 1.18 mm is 383-1970
				Grading zone 2			
				Grading zone 3			
				Grading zone 4			
			Aggregate	80 mm	20 mm		Use 20 mm aggregate is 383-1970
				63 mm			
				40 mm			
				20 mm			
				16 mm			
				12.5 mm			
				10 mm			
				4.75 mm			
				2.36 mm			
Steel	Mild steel	HYSD	Use HYSD [high yield strength deformed bars]				
	HYSD						
Steel reinforcement	Mild steel [Fe 250]						
	Mild steel grade						


		Production Of Concrete Panels		1[20-50mm]	Use Fe 415	
				Mild steel grade 2 [20mm - 50mm]		
				Medium tensile steel [16 - 32mm]		
				Fe 415 & Fe 500		
				Diameter of bar	6 mm	Use 10 mm bars
					8 mm	
					10 mm	
					12 mm	
					20 mm	
2.	Analysis		Production Of Concrete Panels	selection of process to produce RCC Panels		
		Batching		Volume batching	Adopt Volume batching	
				Weigh batching		
		Mixing		Hand mixing	Adopt machine mixing	
				Machine mixing		
		Transporting		by mortar pan	Adopt transit mixer for transporting of concrete	
				Wheel barrow		
				Crane or rope way		
				Dumpers & truck mixers		
				Belt conveyors		
			chute			
			Skip & hoist			
			Transit mixer			
		Through pumping				

<p>Production Of Concrete Panels</p>	<p>placing</p>	Placing of concrete with in the mould	<p>Adopt the steel form on which only concrete is placed</p>
		Placing of concrete timber plank form work	
		Placing concrete on with in steel shutters	
	<p>Compacting</p>	Hand compaction	<p>Adopt And use internal vibrator for vibration or compaction</p>
		Rodding	
		Tamping	
		Compaction by using mechanical means	
		Internal vibrator	
		Form work vibrator	
		Table vibrator	
		Platform vibrator	
		Surface vibrator	
		Vibratory roller	
	Compaction by jolting and spinning		
	<p>Finishing</p>	Surface treatment as smooth finish	
		Exposed aggregate finish	
		Bush hammering	
		Applied finish	

		<p style="text-align: center;">Production Of Concrete Panels</p> 		Combed finish Rough cast finish Pebble dash Colour finish through coloured concrete Wear resistance finish Grinding and polishing Whisper finish	Adopt wear resistance surface finish to prevent slipperiness				
			<p style="text-align: center;">Curing</p>	Water curing immersion ponding spraying Wet covering Other methods Membrane curing Applying of heat through steam Application of chemicals such as calcium chloride Electrical curing By applying infra red radiation		Adopt curing method as immersion Effective for hydration prevent loss of water from panel			
3.	Design						Trail mixes		Same should be followed as mention in the trail mix
				Grade of concrete			M20		

		<p style="text-align: center;">Production Of Concrete Panels</p> 	Maximum size of aggregate	20mm	Same should be followed as mention in the trail mix	
			Maximum water cement ration	0.30		
			Work ability in terms of slump	100mm		
			Exposure condition	moderate	Same should be followed as mention in the trail mix	
			Grading zone of aggregate	Grade zone 2 1.18 mm (Fine aggregate) (20 mm size of aggregate)		
			Type of aggregate	Coarse aggregate of cubical shape		
			Maximum cement content	300 kg/m ³		
			Mineral and chemical admixtures	Plasticizer used [lignosulphate]		
			Materials specific gravity	Coarse aggregate 2.80		
		Fine aggregate 2.70				
4.	implementation		Form phase 2- phase 3 implement the working process			
			Mixing	Machine mixing	Implement machine mixing	

		Production Of Concrete Panels 	Transporting	By transit mixer	Implement transportation by transit mixer	
			Placing	Placing should be on steel slip forms and mould	Implement placing of concrete steel forms	
			Compacting	Using internal vibrator	Implement internal vibrator for compacting	
			Finishing	Wear resistance finish	Implement floor finish as wear resistance	
			Curing	By immersion	Implement curing method as immersion	
5.	Verification & Testing	Production Of Concrete Panels	Testing		Test the finished sample as by cubes To determine compressive strength	
			Compressive strengt	Using cubes determine compressive strength Using cylinder from mix test compressive strength		
			Flexural strength	To measure tensile splitting tensile test	Test the sample as by cylinders To determine tensile strength	
				Ring tension test		
6.	Deployment	Production Of Concrete Panels	Customer		Meet all specifications then handed to customer	
			the product meet all standards and specifications then it is ready for use			
7.	Maintenance		Regular	Day by day supervision	Adopt by monthly maintenance and	

		Production Of Concrete Panels 	periodical	Definitive interval of time that is 7 -10 days	check serviceability condition of the concrete panel	
			Monthly	By monthly to check serviceability of product	Noted down the defects if any found	
			yearly	Yearly once check the structure with destructive and non- destructive testing methods	Rectify it next and further work that we carried	

5. OBSERVATIONS FROM TABULAR FORM:

From the above tabular form it shows that an perfect implementation of water fall model each and every stage of production of RCC concrete panels.

5.1 phase 1 [requirement gathering]

That is in the first phase of requirement gathering is selection of materials for production of concrete can be approximately gathered it means we will follow an sequential order with respect to collection of materials.

5.2 phase 2 [analysis]

Then second phase that is analysis we will access various alternatives for production of concrete it is also an sequential order that is mixing, handling, placing, compacting, and finishing operations.

5.3 phase 3 [design]

Then in the third phase (design) based on the above selected operations we will design the mix as per codes so actually it is an standard mode of concrete it will not require design mix bu, follow the standard.

5.4 phase 4 [implementation]

then, in the fourth phase based on the third phase and second phase will implement the work and start the production start of mixing, handling, compaction, finishing , curing and ready to next stage.

5.5 phase 5 [verification and testing]

Then, in the fifth phase cured concrete panel is ready for use prior that we will conduct tests on it regarding strength of it is meet then we go for another stage.

5.6 phase 6 [deployment]

After, fifth stage we go for for deployment handling of product to customer and product must meet all specific standards then only we can go for deployment.

5.7 phase 7 [maintenance]

Final we will observed the structure stability, service ability of the structure though the final phase that is maintenance in that we will noted down all defects and documented then used it an reference guide to avoid the repetition of these errors.

Finally the table performa we see that selection the word vary with material, process, design, implementation, testing, maintenance that is selection of material, selection of process, selection of design, selection of implementation process from analysis phase , selection of testing method, selection of maintenance process. While in these column it will simply figure out the site supervisor which material is used , process and design that we follow, methodologies regarding implementation, testing, maintenance can be easily understated and it is help full for as decision taking tool in construction prior to work to be carried out.

So, each and every stage of work it follows linear sequential order that is stage by stage completion of work we completing requirement gathering stage then only we go for analysis. So, care full supervision is needed each and every phase once the production process over, if any defect regarding concrete quality find out later stage may effect the all over productivity and economy of work.

The main idea regarding selection of these water fall model as an management technique is it allows sequential, care full mode of working method. So, entire project all supervisors and working men can be effectively involved because in production process entire working men mental ability vary each and every stage of wok. While using these water fall model there is an effective involvement of lower level of working men to higher level of supervisors it is it's own advantage and dis advantage. So, based on the importance of the work we will decide the alternatives because, once water fall model is used we will follow the profile of work and frame of work in sequential manner does not return to previous stage so, the decision should be perfect, and accurate if not it can leads to loss of quality of work and economy of work, productivity of whole work.

6. THE WATER FALL MODEL SHALL MEET OUR OBJECTIVES THAT IS

6.1 efficient management

Efficient management of production of concrete panels from starting to ending stages of work that is each and every stage of work we must satisfy the all requirements , regarding selection materials, selection production process, selection of design, selection of method to implement, selection of testing method, selection of maintenance approach etc

6.2 quality and quantitative approach satisfied

Then, at each and every stage of work both quality and quantity must satisfied that is In the selection of alternatives we mention the limits and process based on these selection list only we forward and execute the work

6.3 success full integration

So, we will see that each and every phase of the water fall model will successfully integrated in the production of concrete panels.

7.0 ADVANTAGES & DISADVANTAGES

7.1 Advantages of water fall model

- The understanding and implementation of water fall model is easy
- These model can be used in it sectors in software development life cycle models but its methodology is easily integrate with any production industries
- Each stage of work is well defined then only we go for another stage it helps the avoiding of rising defects and bottle necks
- Profile of water model is framed in to linear sequential manner so that each and every person in their stage involved effectively
- Accessing alternatives solutions through brainstorming will helps to determine most probable economical solution
- Effective management in complex works that is divide the project into manageable departments
- Planning, scheduling will be done carefully so that work can be completed smoothly with in the stipulated time

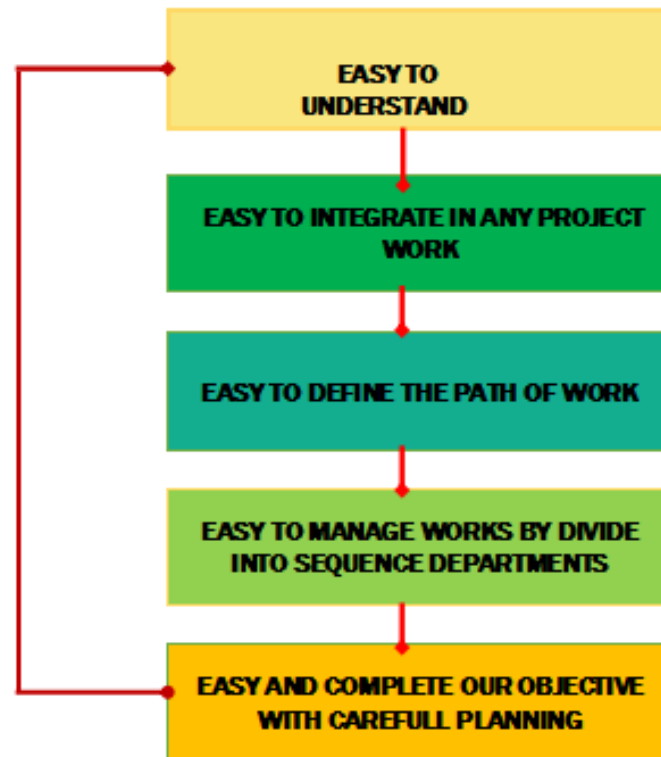
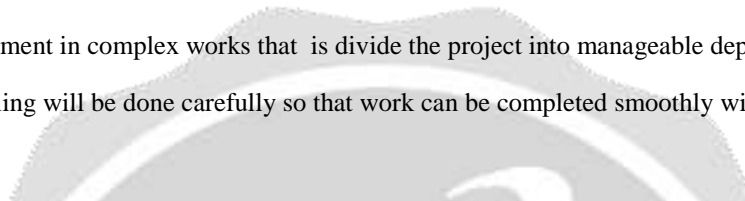


Fig- 2: Advantages Of Water Fall Model

7.2 Disadvantages of water fall model

- While water fall model not flexible that is any error occur in previous stage we will not reverse back to its prior stage if we returned the previous stage it will modify entire work and increased cost of work
- Care full supervision, skilled trained personnel needed in each stage

- Involvement of all project members effectively with all stages of work if any working men made any small and negligible mistake leads to ambiguity in forwarded work
- Regular, periodic supervision is necessary at implementation stage. Because, number of negligible mistakes will leads to one major defect because, water fall model follows linear sequential model.

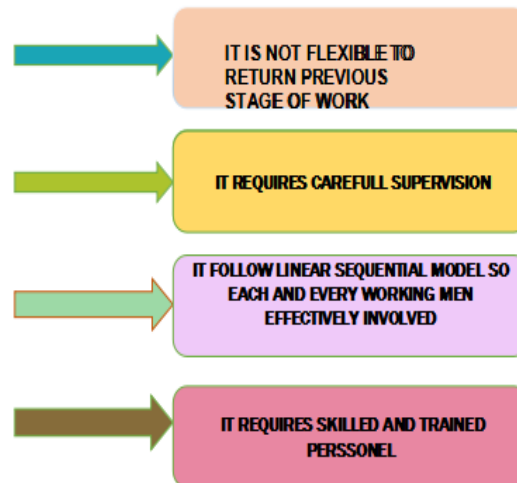


Fig -3 : Disadvantages Of Water Fall Model

8.CONCLUSION

While we see that using these water fall model as an project management tool it will effectively complete the work in efficient manner and strict control over quality parameters and each and every stage of work can be clearly pinpointed regarding execution of work each stage of work that will effectively meets each phase of water fall from starting to ending of all over the work we can clearly define our project objectives and profile and frame work of these model follows an linear sequential manner so that we can take care about respective stages of work and prior to work we can access the various solutions and avoid the defective mode of works then in the entire works we will see that decision tool [tabular performa] will helps the guiding map for site engineer so that if any disruptions are rises in the work those can be immediately rectified and divide the work into simple and manageable departments so that possibility of production output is in good quality and meet the acceptable limits and effective involvement of all workers ensures the smooth flow of work so each and every work can be perfectly planned before execution so that we can achieve our objective. Finally water fall model has an good and efficient management model but lack of flexibility of working that is complete one phase then only go for second phase other wise we will lost our planned work and objective, productivity of the work so, care must be taken while we deal with waterfall model

9. FUTURE SCOPE OF WORK

In the decision tool we see that, we will mention only how to use, how to approach the work with respective to its production of reinforced concrete panels and also in alternative selection column we will mention only selection of

materials, selection of production process, selection of design method, selection implementation process, selection of testing process, selection of maintenance process in that we will not mention reason why we select. For that reason in future trend of my research work we will practically implement these water fall model in onsite construction works and express the work in terms of efficiency. It enables us to measure the efficiency and productivity of the work using project management tools.

10. ACKNOWLEDGEMENT

I express my great full thanks to who ever the pioneers to developed these project management techniques and models methodologies for effective execution of the work. Based on their work we will use these technique and methods we can effectively control and manage the works and avoid defective mode of work.

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