

KUMKANG ALUMINIUM FORMWORK TECHNOLOGY

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Abstract : Kumkang is a new and modified aluminium formwork technology which helps in faster completion of the construction works. Kumkang aluminium formwork technology is nearing solution to rising demands of housing in India. With changing times, new processes and materials are being used. The most important aspects that decide the success rate in construction are Time, Speed, Quality, Cost and Safety of works. FORMWORK SYSTEMS are key factors that decide the time, speed, quality and safety in construction. Formwork system basically moved from wooden to steel, and now from steel to Aluminium. Significant use of advanced formwork is suitable for complex construction processes and also provides best results in cost effectiveness. In this paper we shall deal with comparison of KUMKANG FORMWORK which a type of aluminium formwork (AF) with conventional formwork.

IndexTerms - Aluminium form-works (AF), Kumkang Formwork, cost, Speed, Quality, Safety of works.

I. INTRODUCTION

Aluminium formwork is concurring the world of construction in today's date. To meet the ever increasing demands of the population contractors, investors and engineers are striving hard to reduce cost of construction and making housing economical. Pre-fabricated technology, formwork technology, Precast technology are various technologies which cater speed in construction. Due to ever increasing population and extreme migration cities are getting over crowded. Migration leads to increase in number of slums. In this paper I am introducing a 7 days floor technique. This technique is extremely time saving, and gives a superior quality of construction. The most effective means available for the construction of high, medium and low rise mass housing RCC structures. It is a precision-engineered formwork fabricated in Aluminum. Monolithic pouring. Walls, columns, slabs & beam are poured together..

II. KUMKANG ALUMINIUM FORMWORK TECHNIQUE

General

Kumkang technique is a revolutionary aluminum formwork technique which is forming its base in construction field. It was invented in Korea in 1979. This formwork system is suitable for both residential & commercial construction. Kumkang formwork system is in today's date is most trustful, safe, and up-to-date formwork technology available in market. This is a unique formwork system in which walls, columns, beams, staircase, balconies along with door and window opening are cast in place.

The aluminum used in making the formwork is Aluminum A6061-T6 having specific gravity. Composition composed by aluminum are Inner wall panel- slab corner and beam, Slab panel and support- In corner and hunch and accessory- wall tie/ round pin/ wedge pin.

Components used in Kumkang Aluminium formwork technique

1. **SLAB PANELS-** The slab panel will be used to support the concrete weight during concrete pouring and casting.
2. **WALL PANELS -** Wall panels are available in various sizes and in Kumkang formwork technique they can be customized as per the need of the architectural design. .
3. **PIPE PROP SUPPORT-** It remains under the prop head. Pipe support along with prop head remains in place until two levels are casted. The pipe support is used to support the weight of slab during pouring and casting.
4. **SLAB CORNER-** Acts as a connection wall panel and slab panel. Slab corner is of two types slab corners inner and outer.
5. **PROP HEAD:** Used to join mid beam and end beam, pipe support is placed under the prop.
6. **WEDGS, LONG PINS AND ROUND PINS:** Long pin along with wedge pin is used to fix joint pin with prop head and beams. Round pin and Wedge pins are used in securing flat ties.
7. **FLAT TIES:** Flat tie is used to join the wall panel to opposite side panel. Use of no, of wall panels depends on wall panel's height.
8. **PVC SLEEVES:** PVC Sleeve as name suggests is a sleeve parse PVC material coating. Flat tie is inserted inside this sleeve; its function is to protect the flat tie to be casted within the concrete.
9. **WALLER BRACKET AND SQUARE TIE:** The Waller bracket and square pipes are used to allow the horizontal straightness of the wall panel as well as wall surface after casting.

Working cycle of Kumkang Aluminium Formwork.

DAY 1 – Erecting wall reinforcement.

DAY 2- Erecting Formwork

DAY 3- Slab reinforcement and electrical fittings

- DAY 4- Completing Electrical works and overall checking
- DAY 5- Concrete pouring
- DAY 6- De-shuttering and vertical formwork
- DAY 7- De-shuttering slab and beam panels
- DAY 8- Overall checking and finishing works

III. METHODOLOGY

KUMKANG ALUMINIUM FORMWORK WORKING METHOD EXECUTED INSITU:

1. Once the freeze versions of architectural and structural drawings are obtained, detail drawing of Mock up shuttering is obtained. Based on mockup drawing the formwork panels are assembled.

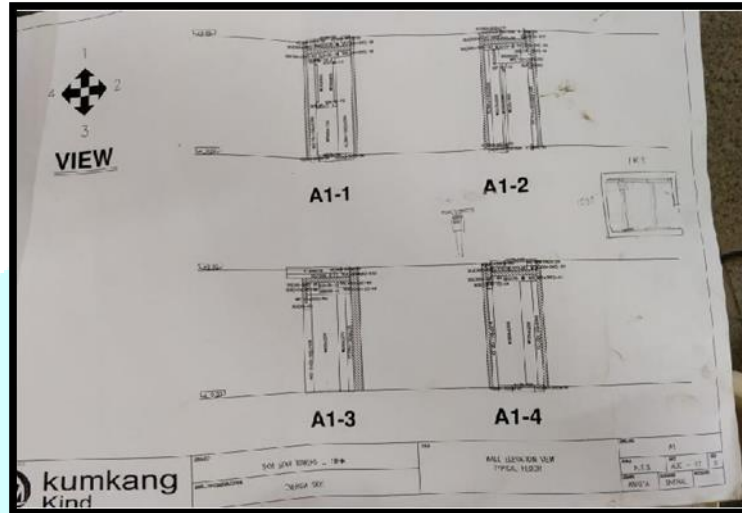


Figure 1 :Mock-Up Shuttering Drawing – All walls.

It would be cumbersome while execution if there is any revision in architectural and structural drawing.



Figure2: Mock-Up Shuttering according to Drawing.

2. Surveyor provides marking on columns, reinforcement of columns work start after that THECI is done which is to keep formwork in line, and then fixing of shuttering is done.
3. Once the wall panels are erected, Slab panels are erected, then reinforcement of slab and beam is conducted after checking of reinforcement is done, slab along with beams, columns and wall is done.



Figure 3: Monolithic slab, beam and wall casting.

4. As rapid hardening cement is used, only 48 hrs curing is needed.

IV. WORKDONE AND RESULTS

CASE STUDY I:

The selected project for this case study is actually a project on development of a housing society (396 units). The STAR TOWER is basically consisting 4 towers of dwelling unit, which are tower1, tower2, tower3 and tower4. This project is developed by SKYi developers. These 4 blocks will be constructed in 8 level heights that locate 396 units of residential area, a ground level car park area and mechanical and electrical equipments. But for tower4, the number of residential area that will be constructed in actually 80 units. Other facilities compiled are a unit of guard post, playing courts, recreation area, playground and a unit of disposal area. The site location in bhugoon Pune.

The study has been carried out on Site were Kumkang Technique is being executed.

- Name of Project : “STAR TOWER” Manas Lake, Bhugoon, Pune.
- A housing society project by SkyI developers.
- Name Of Project Manager: Raju Shaikh
- No of Floors: G + 8/ 2BHK/ 3 towers, G+ /1BHK Tower
- Construction Method Adopted: Kumkang Aluminium Formwork Technology.
- Plan: plan of tower 1. (Rest similar as tower 1)

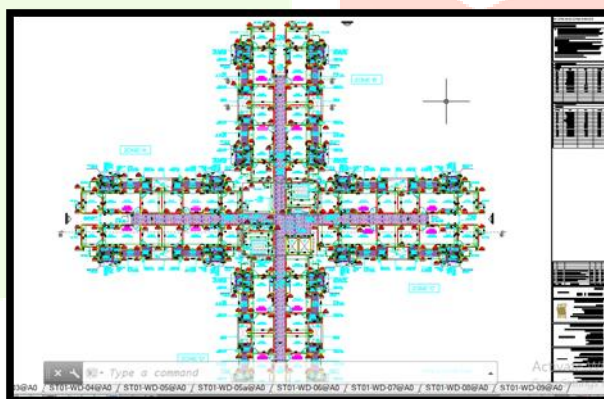


Figure 4: Plan of tower no 1.

The specifications of aluminum formworksystems is shown in the Table below

Table 1: Aluminium Formwork

Sir no.	Description	Unit of Measurement	Aluminum
1	Size Of Panel	Millimeter	L=2300-2450
			W= As per design
2	Cost of Product	Rs/sqm	110\$ i.e 7500
3	No. of repetition	No	150-300
4	Skilled Labour	Rs/day	550

5	Unskilled labour	Rs/day	400
6	Salvage value	Rs/kg	120Rs/KG
7	Additional items	---	Tie rod, Wing nut

Estimation of cost incurred in completion of major structural activities performed site by using Kumkang technique.

Table 1: Cost of construction by Kumkang technology.

	SCOPE OF WORK	UNITS	QUANTITY		KUMKANG CONSTRUCTION- STAR TOWER 15880SQFT		15880
			CONCRETE	STEEL	RATE/UNIT	TOTAL	SQ.FT
1	Laying Plain Cement Concrete	cum	72.775	--	4500	327487.5	20.63
2	Laying Reinforced cement concrete	cum	335.03	--	4525	1507635	94.94
3	Laying reinforcement (Footing)	Kg	--	11651	0	605852	38.16
4	Laying Reinforced cement concrete(column)	Cum	77.26	--	4525	347670	21.893577
5	Laying reinforcement (column)	Kg	--	20,223	58	1172934	73.87
6	Laying Reinforced cement concrete(beams)	Cum	56.71	--	4525	256612.75	16.16
7	LAYING RCC SLAB	Cum	111.21	--	4525	503225.25	31.69
8	Laying reinforcement (beams)	Kg	--	11,328	58	657024	41.37
9	Laying reinforcement (Slab)	Kg	--	6,761	58	392138	24.7
10	Shuttering	Sq ft		Consider 1 sqft	--		32.24
							395.65

CASE STUDY II:

The selected project for this case study is a residential cum commercial development. It is a housing society with 2 towers (64 units). The LAXMI NIVAS is basically a dwelling unit developed by Fortune Vastushilpa Developers LLP. The possession of the flats is in 2020. This block will be constructed in 8 level heights that locate 32 units of residential area, a ground level car park area, mechanical and electrical equipments. The site location in Alandi, Pune.

TABLE3: CONVENTIONAL FORMWORK

SR NO	Description	Unit of Measurement	Aluminum
01	Size Of Panel	Millimeter	L=3000

			W= As per design
02	Cost of Product	Rs/sqm	500
03	No. of repetition	No	5-7
04-	Skilled Labour	RS/day	451
05	Unskilled labour	Rs/day	258

Estimation of cost incurred in completing major construction activities by conventional technique.

Table5: Cost of construction by conventional technique

	SCOPE OF WORK	UNIT S	QUANTIY		CONVNTIONAL CONSTRUCTON-LAXMI NIVAS		14715
			CONCR ETE	STEEL	RATE/ UNIT	TOTAL	SQ.FT
1	Laying Plain Cement Concrete	cum	160	--	4000	640000	42.50
2	Laying Reinforced cement concrete	cum	330.00	--	5700	1881000	127.8
3	Laying reinforcement (Footing)	Kg	--	12000	0	756000	51.38
4	Laying Reinforced cement concrete(column)	Cum	95.00	--	5700	541500	36.80
5	Laying reinforcement (column)	Kg	--	23930	63	1507590	102.46
6	Laying Reinforced	Cum	130.00	--	5700	741000	50.36

	cement concrete(beams)						
7	LAYING RCC SLAB	Cum	145.00	--	5700	826500	56.17
8	Laying reinforcement (beams)	Kg	--	28000	63	1764000	119.88
9	Laying reinforcement (slab)	Kg	--	9500	63	598500	40.68
10	Shuttering	Sq ft		Consider 1 sqft	--		185.00
							814.00

Cost analysis:

Total cost analysis for material consumed and labor rates needed to complete the activity.

TIME COSTRENDS:

1. Kumkang aluminium system

For slab cycling that totally depend upon availability of workmanship for the shuttering work and we considering 8th floor only.

Here we are considering only one tower

1st slab – 21 days

2nd slab – 15 days

3rd to 8th slab – 48days (@ 8 days per floor)

Total – 87 days = 4 months + 2 months for finishing works approx considering 26 working days per month.

2. Conventional Formwork system.

For slab cycling that totally depend upon availability of workmanship for the shuttering work and we consider up to 8th floor only.

1st slab – 21days curing + 7 days scaffolding

2nd to 6th slab – 33.5 days/ slab

= 167 days

7th and 8th slab – 36 days / slab = 72 days

Total- 267 days ;

That is: 9 months + 2 months for finishing works .

V. RESULTS

It is seen that there is substantial cost and time saving by adopting Kumkang Formwork Technique.

Table 6: Percentage savings in time and cost

SR NO			PERCENTAGE DIFFERENCE
	STAR TOWER	LAXMI NIVAS	
1	V1= 395.65	V2= 814.06	30.82% COST SAVED
2	T1=87 days	T2= 267 days	23.09% TIME SAVED

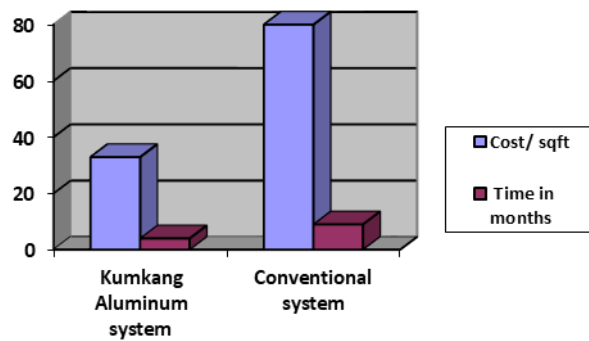


Chart 1: Comparative bar chart of Cost and Time consumed by Kumkang technique and Conventional technique

VI CONCLUSION

There significant changes in concrete construction as per the date. Pioneering companies in modern formwork system are Peri, doka, tunnel formwork, meva, Mivan. Trying to cover the major aspects Cost and Time then quality, aesthetics, speed, safety during construction I will infer that Kumkang Aluminium formwork provides a very high quality construction at a high speed. This Kumkang Aluminium Formwork technology has great potential for application in India to provide affordable housing to its rising population

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