International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

AN EMPHATIC TIME AND COST SAVER TECHNIQUE- KUMKANG ALUMINUM FORMWORK SYSTEM

Pujari Bharagvi S.[1], D. B. Bhosale[2], Shinde R. D.[3]

[1] student, Civil Engineering Department, RMD Sinhgad School of Engineering, Pune, Maharashtra, India
[2] Professor, Civil Engineering Department, RMD Sinhgad School of Engineering, Pune, Maharashtra, India
[3] Professor (H. O. D), Civil Engineering Department, RMD Sinhgad School of Engineering, Pune, Maharashtra, India

---

Abstract - *The rising demands of housing in INDIA mandates a clearer understanding of and the increasing interest of developers to invest in housing projects. A lot of research is being done in field of construction now days to provide cost and time saving techniques to strengthen nations infrastructure. Also, developing infrastructure is an integral part of development in country's economy. 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 Aluminum. 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 aluminum formwork (AF) with conventional formwork.*

Key Words: Aluminum form-works (AF), Kumkang Formwork, cost, Speed, Quality, Safety of works.

1. INTRODUCTION

Self-owned houses as a concept is very generic and could have different meanings for different people based on differences in income levels. Affordability of house refers to any housing that meets some form of affordability criterion. Housing Affordability can be defined using three key parameters viz. income level, size of dwelling unit and affordability. Urbanisation has resulted into increase in no of slums that has detoriated housing condition in India. Skyrocketing prices of land and real estate has forcefully increased dwelling slums. 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.

Among the total cost of construction a major part is occupied by formwork. Therefore, the cost of construction can be reduced by proper planning of system of formwork to be used. Usage of Formwork technology has increased extensively in construction industry as it enables faster execution and better results. Indian construction industry has eventually adopted some of the world class formwork technologies which are reasonably economical and easy for operation using semi skilled labour. Some of the leading formwork systems are Doke, Mascon systems, MEF formwork technology, and Peri construction systems. This paper shall deal with a form work technique called KUMKANG TECHNIQUE.

2. KUMKANG ALUMINUM FORM-WORK TECHNOLOGY

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. This technique is specially invented for earthquake prone regions.

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.

2.1 Components of Kumkang Form-work Technology

1. *SLAB PANELS*- The slab panel will be used to support the concrete weight during concrete pouring and casting. The standard sized in which the slab panels are available:

STANDARD SIZES OF SLAB PANELS	
1. 400 x 2300	5. 600 X 1200
2. 400 X 2450	6. 450 X 1200
3. 450 X 2300	7. 400 X 1200
4. 450 X 2450	8. 300 X 1200

Fig -1: Slab panel

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. Some of the standard sizes are:

STANDARD SIZES OF WALL PANELS			
1.	600 x 2450	5.	400 x 2450
2.	600 x 2300	6.	400 x 2300
3.	450 x 2300	7.	300 x 2450
4.	450 x 2400	8.	300 x 2300

Fig -2: Wall panel

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. The sizes in which the prop pipe support:

i. 1800- 3200 iii.2000- 3400

ii. 2400-3800 iv.2600- 4000.

Fig -3: Prop Support

4. *SLAB* CORNER- Acts as a connection wall panel and slab panel. Slab corner is of two types slab corners inner and outer. Size: 150H Weight: 6.6 kg/m.

Fig -4: Slab Corner

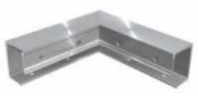

Fig -5: Inner Corner(IC)

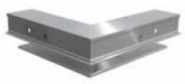

Fig -6: Slab Outer Corner

5. PROP HEAD: Used to join mid beam and end beam, pipe support is placed under the prop.

Fig -7: Prop Head

2.2 Various types of connectors used in Assembly of form-work.

1. *WEDGES, ROUND PINS, AND LONG 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

2. *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. This flat tie is first greased and then used in wall panels along with a round pin. Maximum of 7 to minimum of 3 flat ties are used in each wall depending on the wall height.

Fig -8: Flat Tie

3. *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 with in the concrete.

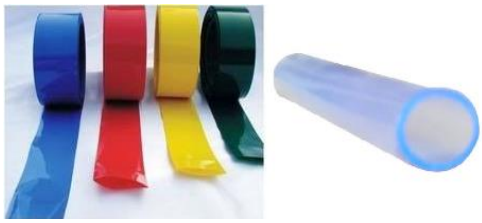

Fig -9: PVC Sleeves

4. 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.

Fig -10: Waller bracket and square tie

3. CYCLE OF KUMKANG FORM-WORK TECHNIQUE

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

Kumkang King Aluminum Formwork System Provides a very fast construction cycle. In which a floor can be erected with in 8 days .

Fig -11: Kumkang formwork work cycle.

4. ADAVNTAGES OF KUMKANG FORM WORK TECHNIQUE

1. Speed- Floor to floor cycle is achieved within 8 days.
2. Cost- very high no. of repetitions are possible (150-200). Therefore unit material cost achieved after 100 repetitions calculated comes to be as low as Rs. 100/sq.m.
3. Durability- Long life being non corrosive in nature, can perform upto 250 repetitions max. with proper maintenance and refurbishment.
4. High Labour Productivity- Very light weight, easy manual handling,.
5. High salvage value.
6. Work being repetitive easily understood by labours.
7. Speed- Floor to floor cycle is achieved within 8 days.
8. Speed- Floor to floor cycle is achieved within 8 days.
9. Cost- very high no. of repetitions are possible (150-200). Therefore unit material cost achieved after 100 repetitions calculated comes to be as low as Rs. 100/sq.m.
10. Durability- Long life being non corrosive in nature, can perform upto 250 repetitions max. with proper maintenance and refurbishment.
11. High Labour Productivity- Very light weight, easy manual handling, basically single type of panel joints, no carne dependency.
12. High salvage value.
13. Quality- Excellent concrete surface finish, enables elimination of plastering thereby saving project duration and cost.
14. Cost- very high no. of repetitions are possible (150-200). Therefore unit material cost achieved after 100 repetitions calculated comes to be as low as Rs. 100/sq.m.

DISADVANTAGES:

1. Very high investment (approx Rs 7500. Sq.m.).
2. Not cost effective for small construction projects where the no. of repetitions would be less.
3. Compatible only for thr projects where the design is repetitve. Customization as per demand is not possible.
4. RCC slab to be designed for stripping after 36 hours with props left under.

5. PROCEDURE OF ERECTING FORMWORK

1. As the panels arrive in the container they are unloaded to the desired location

2. Kumkang Kind supervisor along with client representative verify and check the material as per packing list and order list

3. As per requirement the panels are moved to the location where they are to be set up

4. The structural line is set up on the shell plan and based on structural line the rebar are set up.

5. The panels are set up on both the sides of the rebar, before installing the panels they have to be oiled first by formwork oil to avoid concrete to stick on panels.

6. The installation of panels is started by installing panels on one side (inner phase or outer phase) along with the flat ties. Once the installation of one side is completed then the other side is done with PVC sleeve that covers the flat ties.

7. The panel installation begins with the wall panels. On completion of installation of wall panels, the next is the opening areas which include window openings, door openings, ventilators etc. The installation for window opening is as follows:

   - Beam cap slab panel
   - Beam cap SC
   - Wall end panel
   - Beam cap SC
   - Prop and Prop Head
   - Beam panel

8. Once the wall panel installation is done the KICKER plate is installed, it is essential to ensure that the KICKER BOLTS are installed. Kicker panel is installed on top of wall panel.

9. Next comes the slab installation. In slab installation the slab corners (SC) are installed then the internal corners(IC). Slab installation starts from any one corner.

10. The Main beam is then installed. The installation of main beam includes installing

MIDDLE BEAM + PROP HEAD + END BEAM

11. Once the panels are installed they are verified whether they are installed correctly.

12. Then the concrete is poured.

13. After 24 hours of concrete pouring dismantling of panels is started. Dismantling is started with wall panels

14. Then the panels from the opening areas are removed ensuring the props remain in place up to next 2 installations.

15. Dismantling would start with walls, leaving rocker plate in place. Then the slab panels are removed very carefully assuring no free fall of the panels takes place. Props and prop heads are kept in place. Slab corners are removed last.

16. The upper floors are also assembled in same manner.
    NOTE: this procedure is a standardized Kumkang Kind aluminum formwork technique but may slightly vary according to suitable site conditions.

17. For assembly of formwork system on upper floors first the external working platforms are erected. The tie rods for the platforms are placed at a distance of 1.3 m along with safety rail and safety nets. These platforms are to be kept upto 2 levels.

18. Once again overall checking is performed.

6. COMPARING CHARACTERISTICS OF KUMKANG FORMWORK AND ALUMINUM FORMWORK.

FEATURES	KUMKANG FORMWORK	CONVENTIONAL FORMWORK
SPEED	Due to simultaneous casting of walls, columns and slab speed is much high.	Due to construction in order construction speed is lowered
ASTHETICS	As partition walls are made up of bricks the projections of columns and beams are seen in the interior of rooms.	As walls , columns are casted simultaneously there are no projection and have neat and clean corners
MAINTAINANCE	Too high	Negligile
QUALITY	Superior quality is obtained	Normal quality is obtained

7. CONCLUSION

This paper aims to save cost invested in construction and reduce the time required for construction by using Kumkang formwork system. This paper shows the benefits of the Kumkang formwork system on conventional formwork system. We thus infer that using Kumkang form-work system is cost effective and saves construction time proving better quality of construction.

8. REFERENCES

1. Jignesh Chotaliya, Hiren rathod. "Comparison of Aluminum formwork and conventional formwork systems" IJARESM , ISSN 2394- 1766.

2. Patil R.S, Pawale D.B, Tambe H.B, Pawar P.D and Wakchaure A.K . "Mivan technology using aluminum formwork" IJESM , ISSN 2277-5528

3. Prashant s . "Aluminum formwork system" Grand Edifice developers, www.grandedificedevelopers.in

4. K. Loganathan, K.E Vishwanatahn (2016). "A study report on cost, duration and quality analysis of different formwork in high-rise building" IJSER, Volume 7, Issue 4

5. Kaivan Kazerouni(2011), "Mivan Technology" Architecture update

6. Kaivan Kazerouni(2011), "Mivan Technology" Architecture update.