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PERFECT MOLDS FOR CONCRETE WORKS

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Abstract

The article refers to the implementation of works of mold structures with monolithic concrete and reinforced concrete. The work has been done within the framework of the specialty “New Technologies”. Both the description of the traditional technologies and the description of the reinforced concrete works with non-removable molds are given in detail considering it modern and effective. The topicality of the material is due to the need to combine traditional principles of organizational and technological design in the field of construction with modern requirements. In this regard, the work substantiates the problem of replacing the principle of capital investment distribution with hybrid versions in the calendar planning of the CMP versions including the use of technology cards.

The criteria for using the technology card and the requirements for the mold are also included in the work.

The tables show the characteristics of the molding elements, the choice of molding jigs and the composition and norms of the lubricants.

Key words: shield, slippery, fixed, carrier, mold, monolithic, brand, vibration.

Introduction

The description and details of the mold works are given in our article. It should be noted that the provision of the design dimensions of the building and the satisfaction of the requirements of architectural and aesthetic appearance of it are mainly conditioned by the

correct implementation of mold works. If we add the fact that buildings have complex configurations, the problem becomes more understandable.

Mold is a temporary supporting structure that serves to give a certain amount of strength to a constructed structure before the concrete is set.

The mold consists of formwork shields, fastening and support devices which ensure the shape, size and surface quality of the structure.

The mold must meet the following requirements: it must be strong and stable, it must not deform under the loads, it must be without significant holes (so that the cement mortar does not fall through them), it must provide a smooth surface of the structure, it must be technologically convenient for installation and montage of reinforcements and have high usage (i.e. to be used many times).

The following types of molds are widely used: destructed – removable which is used in the construction of basements, walls, columns, jigs and roof slabs, block which is used for large separate basements and sections, rising and transportable for construction of structures at high altitudes, removable in case of building roofs and construction of walls, sliding in case of construction of vertical constructions of buildings and structures, horizontally movable in case of construction of vertical structures and not removable when the mold is not demolished (for waterproofing, cladding, thermal and other purposes) [1, 2].

Steel, wood and plywood are more commonly used to make molds and recently artificial synthetic polymeric materials have also been used.

The combination of different materials is considered to be more effective when the carrying and supporting elements are made of metal and the parts in contact with concrete are made of board and waterproof plywood, wooden slabs and laminate. In modern conditions, metal molds are widely used which ensure a smooth concrete surface and have a large circulation.

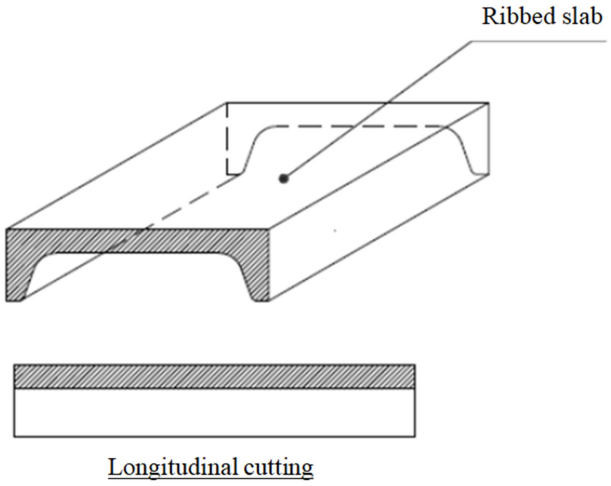

Fig. 1 Ribbed slab

It should be noted that among the described molds, polymer ribbed molds of small sizes 0.5x1.0 m, 0.6x1.2 m and others in modern conditions are a novelty. They can be used to strengthen buildings and structures in the war-damaged areas (Stepanakert, Gyumri, Spitak, Vanadzor etc). They are ribbed and light weighing 5… 6 kg with 3… 4 cm high ribs (Fig. 1).

Let's add that many buildings and structures are partially reinforced (any floor, pillar, wall etc.). It means that smaller molds are more efficient.

Topicality

Small sized «onix» polymer molds enable to:

a) carry out concrete works inside reinforced buildings by hand without lifting cranes and mechanisms,
b) get constructions of any configuration and geometric shapes (round, elliptical, conical etc.), which is extremely important for the desired architectural solutions and problems,
c) Molds made of polymeric materials have much larger circulation than metal, wood, plywood and other molds. Their operating costs are minimal - oil, cleaning, storage, etc. and they are not corroded.

The topicality is conditioned by the need to harmonize the traditional principles of organizational and technological design in the field of construction with modern requirements. In particular, the principle of capital investment allocation is not currently applicable to calendar planning in the CMP (construction management project). There is a need to develop hybrid versions and creative approaches.

Experience of working with foreign clients has shown that it is often necessary to include episodes of technology cards in the construction project. The technological card shows the field of application, the technology and organization of work, quality and general requirements, safety equipment requirements and the demand for logistical resources.

The technological card includes organizational-technological and technical solutions for the installation of roofing and mold jig which will help to reduce the time of completion of works and to improve the quality of structures.

The aim of research is to develop an organizational project of modernized construction. For mold works and their improvement it is necessary to solve a number of tasks. They are:

- Development of network model of the object on the bases of the volume of construction activities and development of calendar schedule on their bases,
- Development of organizational-technological scheme of land works,
- Development of motion schemes of montage mechanisms.

Mold work is one of the main processes in the implementation of monolithic concrete the quality of which greatly depends on the reliability of the frame construction. It is necessary to develop the technology of work and organization, lubricants (Table 1) and their types [4] and their cost norms (Table 2), quality and acceptance requirements, environmental and fire-fighting measures, calculation of labor and time spent and schedule of work performance.

Baseline data and constructive solutions are necessary to implement according to Construction Norms and Rules and State standards (GOST) and other normative documents.

Card should be developed according to:

- CN and R and GOST 3.03.01-87 «Carrying and supporting constructions»,
- CN and R 12-03-2001 «Security in construction. Part 1. General demands»,
- GOST 12-03-2001 «Security in construction. Part 2.Constructive production»,
- CN and R RACN 52-01-2003 «Concrete and reinforced concrete constructions. Basic theses»,
- GOST 10180-90 «Concrete. Methods of determining the strength according to experimented samples»,
- GOST 18105-86 «Concretes. Basic rules of strength»,
- GOST P52085-2003 «Mold. General technical conditions».

The field of application of the technological card is the installation and dismantling of the roof and mold jig of the given building. The technological card contains the requirements for the mold, the technological sequence of assembly, disassembly and production processes

which must be taken into account during the implementation of the work. The technology card is intended for engineering workers involved in the installation of molds for monolithic concrete structures.

Table 1

Content of lubricants

Lubricant	Ingredients	Massa netto %	Instructions for application
Pure emulsion	Oil Nitrol House soap Water	9…14 0.6…1 1 84…89.4	For metal and wood
Opposite emulsion	Emulsion ЭКС Starch Water	20 0.5 79.5	For metal and wood
ЭСО-6ХХ	Burnt oil Calcium hydroxide Water	21 3 76	For metal and wood
ЭСО-9ХХ	Burnt oil Calcium hydroxide of 5% NaChl solution Water	18 3 16 63	For only wood
ЭСО ГИС-30	Zinc solution of 10 % Nitric acid Polyethylene emulsion Burnt oil	21 2…3 49 17	Guaranteed for all types of molds

Table 2

Norms of lubricant costs

Mold types	Lubricant cost, kg	
	For 1m^2 mold surface	For 1m^3 concrete
Plywood	0.35…0.50 / 0.50…0.65	3.5…5.0 / 5.0…6.5

Note. *Numerator shows the case of norm in developing with pneumatic cleaner and denominator shows the case of applying with brush or roller.*

The frame of the multi-storey private house and the residential building is made of monolithic reinforced concrete. Mold of the roof should consist of carrying columns of wooden jigs of different length (primary and secondary) of 200m high made of plywood of 21m thickness. Prior to the construction of this floor, the preparatory and organizational measures must have been carried out according to CN and R 3.03.01-87 (carrying and bearing structures), including:

- Cleaning the places from engineering wastes and the sites for columns,
- Level measuring of the roof,
- Preparing the machines, tools and instruments for work.

The mold must be delivered to the construction site in a complete condition, suitable for installation and operation without additional repairs and completion works at the construction site. The resulting mold elements should be placed in the service area of the hand crane or truck crane. All elements must be stored under canopies to prevent damage. They should be sorted by their brand and size [3].

Roof mold is consisted of the following elements:

- Laminated plywood

- Wooden primary and secondary jigs
- Jig quarterly
- Telescopic stand
- Tripod

The element description of the mold is given in Table 3.

Table 3

Element description of the mold

N	Element	Item	Measuring unit	Amount
1	Telescopic stand	028---	Piece	
2	Quadrangle	028870	Piece	
3	Tripod	203036	Piece	
4	Jig	074---	Piece	
5	Laminate plywood 18x2440 F/FI 120 g/m^2	30302	m^3	

The choice of primary and secondary jigs is from Table 4.

Table 4

Jig content of the mold

N	Brand according to the length	Item	Measuring unit	Length (m)
1	Jig PERI VT20K-490	074970	Piece	4.9
2	Jig PERI VT20K-390	074950	Piece	3.9
3	Jig PERI VT20K-360	074940	Piece	3.6
4	Jig PERI VT20K-330	074930	Piece	3.3
5	Jig PERI VT20K-290	074620	Piece	2.9

The length of the telescopic stands is determined depending on the loads: according to the carrying capacity of GOST P52085-2003, CM and R 3.03.01-87 on 2.7 m height.

The length of telescopic stands and secondary jigs is determined by applying «PERICAD20» program.

According to GOST P52085-2003, the following data are used for determining the mold for vertical loads:

The own weight of mold determined by drafts,

- Weight of concrete: for heavy one- 2500 kg/m^3, for other concretes according to factual weight,
- The weight of the jig is accepted as 100 kg/m^3 in the absence of design data
- Weight of people and means of transport as 250 kg/m^2,
- Concrete vibration load as 200 kg/m^2,
- Dynamic loads generated during the installation of concrete (400 kg/m^2 in the case of supply holes, 400 kg/ m^2 in the case of holes with a capacity of 0.8 m^3, 600 kg/m^2 in the case of holes with a capacity of more than 0.8 m^3 and 800 kg/m^2 in case of concrete pumps).

Besides, in the calculations of pressure of concrete mixture the supply coefficients should be taken into account.

- For mold own weight as 1.1,
- For concrete and reinforcements as 1.2,

- For people, means of transport and centralized loads as 1.3, for dynamic loads of concrete installation as 1.3.

Installation of molds is done in the following order:

- Tripod is installed,
- Telescopic stand is fastened in the tripod,
- Stand quarterly is installed,
- The main jigs are placed in the support quadrangle from the movable property platforms, then the package of secondary jigs is placed on them, the package is separated from the rope and the main jigs are installed manually by calculation.

Plywood sheets are also served on secondary jigs installed in the package, with the first package sheets installed on movable platforms. The plywood sheets are placed on the secondary jigs, fastened to them, the attachments are glued with a special tape and the surface of the sheets is covered with lubricants.

The installation of the main jigs and stands of mold is done according to the scheme shown in Fig. 2.

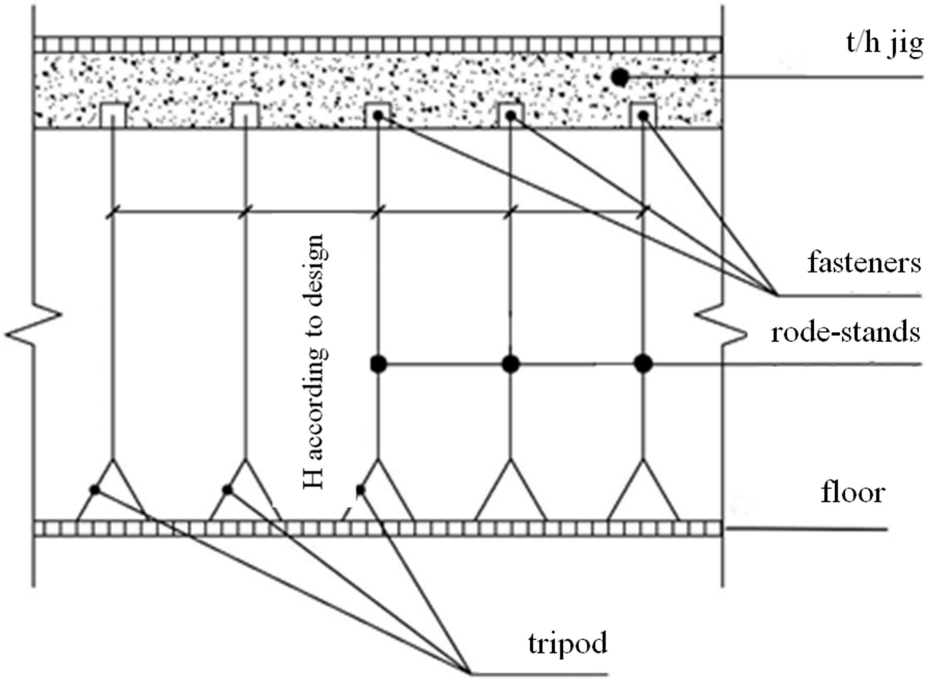

Fig. 2 Installation of stands and primary jigs of molds

The installation of secondary jigs is done according to the attached jig design.

For easier molding of the joints between the walls and columns, a 15…20 cm wide plywood strip is installed, which is not attached to the secondary jigs.

The surface of the mold is leveled and brought to the design position before the installation of reinforcement frame.

All wooden jigs must be branded, i.e. the length of the last jig must be written in paint. This is done for ease of installation. During the installation of the mold, protection is provided around the perimeter to prevent people and objects from falling during concreting.

The shield is a welded metal structure with angles which can be mounted on main and secondary jigs such as plywood deck.

Disassembly of the mold is allowed after reaching the required strength of concrete, according to CN and R 3.03.01-87 “Carrying-covering structures” according to the results of concrete tests. When molding the roofs, the mold is lowered with the help of screw cranes.

After that, the plywood sheets are removed after the secondary and then the main jigs. The stands are dismantled in the end.

A few words about non-removable templates. The latter are used in coastal areas when the structure is carried out directly in the water (anchors, shore structures, etc.).

The mentioned templates can be made from all the above mentioned materials without exception. The process is as follows:

The mold is immersed into water without excluding water from entering the mold. Concreting is done from the bottom up. Concrete placed at the bottom of the formwork pushes out water (because concrete is 2…2.5 times heavier than water). After a few hours, the mixture hardens under favorable conditions performing its function. The stakes which can act as a basement, are mainly concreted by this method.

Conclusion

During the implementation of monolithic concrete and reinforced concrete works in modern conditions, as a result of studies of various types of mold works and the latest technologies, it becomes clear that the sequence of traditional methods of organizational and technological design and current requirements in the field of construction is necessary.

Our research suggests ways to solve the above mentioned problem such as the importance to use small new non-removable molds of any configuration and geometric equine to be reinforced inside buildings. Let's add that the use of small mold in these areas is more efficient, faster and less expensive.

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ԿԱՏԱՐԵԼԱԳՈՐԾՎԱԾ ԿԱՂԱՊԱՐՆԵՐ ԲԵՏՈՆԱՅԻՆ ԱՇԽԱՏԱՆՔՆԵՐԻ ՀԱՄԱՐ

Արևշատյան Ն.Գ., Երոյան Ե.Պ., Գրիգորյան Թ.Վ., Արզումանյան Ս.Ս.
Շուշիի տեխնոլոգիական համալսարան

Աշխատանքը վերաբերում է միաձույլ բետոնե և երկաբետոնե տարրերով կառույցների կաղապարամածային աշխատանքների իրականացմանը: Այն կատարվել է «Նորագույն տեխնոլոգիաներ» մասնգիտության շրջանակներում: Մանրամասն բերված են ինչպես ավանդական տեխնոլոգիանների նկարագիրը, այնպես էլ անդրադարձ է արված չհանվող և մանրաչափ կաղպարներով երկաթբետոնե աշխատանքների նկարագրին, այն համարելով արդիական և արդյունավետ: Արդիականությունը պայմանավորված է շինարարության ոլորտում կազմակերպչատեխնոլոգիական նախագծման ավանդական սկզբունքների և ժամանակակից պահանջների համատեղման անհրաժեշտությամբ: Այս առումով աշխատանքում հիմնավորված է ՇՆԿ-ի տարբերակների կազմում օրացուցային պլանավորման ժամանակ կապիտալ ներդրումների բաշխման սկզբունքը հիբրիդային տարբերակներով փոխարինելու խնդիրը, այդ թվում, տեխնոլոգիական քարտերի կիրառումը:

Աշխատանքում բերված է նաև տեխնոլոգիական քարտի կիրառման չաձորոշիչները և կաղապարամածին ներկայացվող պահանջները:

Աղյուսակներում բերված են կաղապարամածի տարրերի մասնագիրը, կաղապարամածային հեծանների ընտրությունը և մածուկային քսուկների կազմն ու նորմերը:

Բանալի բառեր. վահան, սահող, չհանվող, կրող, կաղապարամած, միաձույլ, մակնիշ, թրթռացում:

УСОВЕРШЕНСТВОВАННЫЕ ОПАЛУБКИ ДЛЯ БЕТОННЫХ РАБОТ

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Работа относится к выполнению опалубочных работ при возведении монолитных бетонных и железобетонных конструкций. Она была выполнена в рамках специальности "Новейшие технологии". Дано подробное описание как традиционных технологий, так и описание железобетонных работ с несъемными и мелкощитовыми опалубками, считая их актуальными и эффективными. Актуальность обусловлена необходимостью совмещения традиционных принципов и современных требований организационно-технологического проектирования в сфере строительства. В связи с

этим в работе обоснована задача замены принципа распределения капитальных вложений гибридными вариантами при календарном планировании в составе вариантов ПОС, в том числе применение технологических карт.

Также в работе представлены критерии использования технологической карты и требования, предъявляемые к опалубку.

В таблицах приведены спецификация элементов опалубки, выбор опалубочных балок, состав и нормы пастообразных кремов.

Ключевые слова: щит, скользящий, несъемный, несущий, опалубка, монолитный, марка, вибрирование.

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