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MODERN TECHNOLOGIES OF RECEIVING THE FACILITATED REINFORCED CONCRETE STRUCTURES

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This work is an economic rationale for the use of non-retrievable hollow cores, in monolithic floor slabs directly at the construction site. Questions of technical and economic efficiency, with similar types of overlapping are considered. The pros and cons of this technology are reflected.

One of the possible directions for obtaining lightweight structures is the use of technology arrangement of floors with non-removable inserts-voids. Reducing the weight of the structure by removing the material from it (by 20-40 %), which does not participate in the robot, without worsening, at the same time, the strength characteristics, in conjunction with the procedure of delivery to the object of a smaller amount of concrete mix for concreting the structure determines the corresponding economic effect. In addition, the effectiveness of this approach is enhanced by reducing the level of loading of the supporting elements of the structure and its foundations.In recent years, standardized modules made of polymeric materials of various shapes have been widely used abroad as non-removable void-forming liners. Such systems include

According to the ***Air deck technology*** [1], the plant produces the lower covering of the floor slab in the form of a precast concrete structure with embedded polypropylene inserts Figure. 1. Working dimensions of inserts-cartons of 20×20 cm, and the height varies from 12 to 35 cm Step liners-boxes is constant and equal to 30 cm.

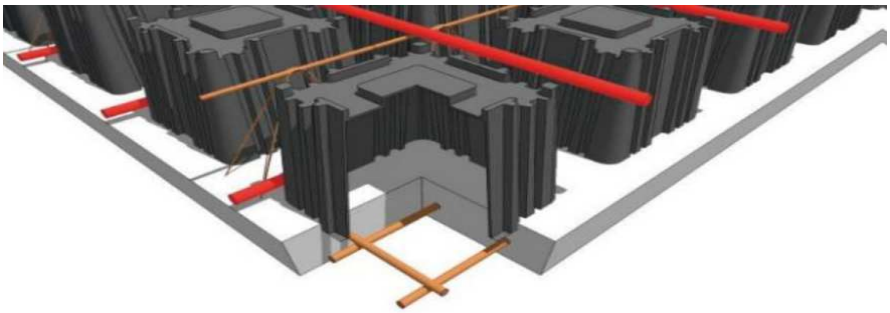

Figure 1. – According to The airdeck technology, the concrete mixture is first placed in the formwork

Bubble Deck technology [2] is divided into three types:

a. analogue of Airdeck technology, differs only in reinforcement and the shape of the liner Figure. 2.;
b. flat reinforcement modules the size of the plate consisting of liners and reinforcement cage are installed in the formwork on the construction site, and carry out concreting on a two – stage technology;
c. ready prefabricated reinforced concrete slabs with liners for delivery to the construction site.

Figure 2. – The device is light weight concrete slab by bubble deck technology

Hollow balls of spherical or elliptical shape made of recycled plastic (polyethylene, polyvinyl propylene or polyvinyl chloride) with a diameter of 18 to 36 cm, depending on the thickness of the concrete slab, are used as inserts.

The inserts are located inside the reinforcement module and are held in the design position due to the special shape of the lower and upper mesh cells

Cobiax technology [3] uses two types of linear reinforcement modules (up to 250 cm long) with inserts in the form of an ellipsoid of rotation ("Slim-Line" system) for concreting slabs with a thickness of 20 to 35 cm and in the form of a spherical ball ("Eco-Line" system) for slabs with a thickness of 30 to 60 cm Figure. 3.

The main difference from the previously listed technologies is the layout manually reinforcement modules with the ear bud cavities prior to the placement of concrete in the formwork.

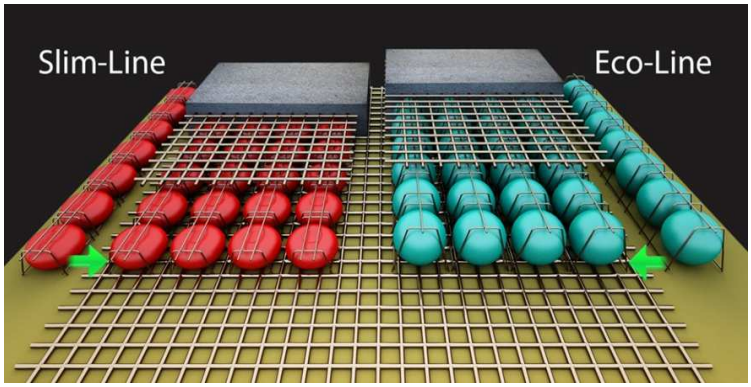

Figure 3. – cobiax system: "Slim-Line and Eco-Line»

Daliform Group [4] is one of the Cobiax technology is similar, but with significant differences. It has two *systems U-Boot Beton* and U-Bahn Beton Figure. 4. System U-Boot Beton applies ear block form made of recycled polypropylene, with working dimensions of 52×52 cm and a height of from 10 to 56, see using the ear system U-Boot Beton allows to concrete slab thickness from 20 to 76 cm distance between the ears exposed with the aid of spacer couplings with a graduated scale.

Figure 4. – The device is light weight concrete slab u BootBeton system

The U-Bahn Beton system uses U-shaped inserts with working dimensions of 120×40 cm and a height of 20 cm from recycled polypropylene, the ends of the inserts can be closed with standard plugs. This system is specially designed for the implementation of unidirectional slabs of reinforced concrete.

In parallel are widely used in modern construction technology produce lightweight structures using as unrecoverable liners-hole-forming cores of the panels are made of polystyrene.

A striking example of the use of such technologies is the construction of the highest residential building in Mexico, the skyscraper "Santa Fe II" height of 167 m, built in 2013 Figure 5. [5].

Reinforced concrete slabs have a thickness of 250 mm and an average weight of only 3.5 kN / m^2. The 80×80 cm Styrofoam liners are placed in the slab in two directions in increments of 100 cm, providing concreting of the inner ribs with a thickness of 20 cm Figure. 6.

Figure 5. – Mexico skyscraper "Santa Fe II" height 167 m, built in 2013

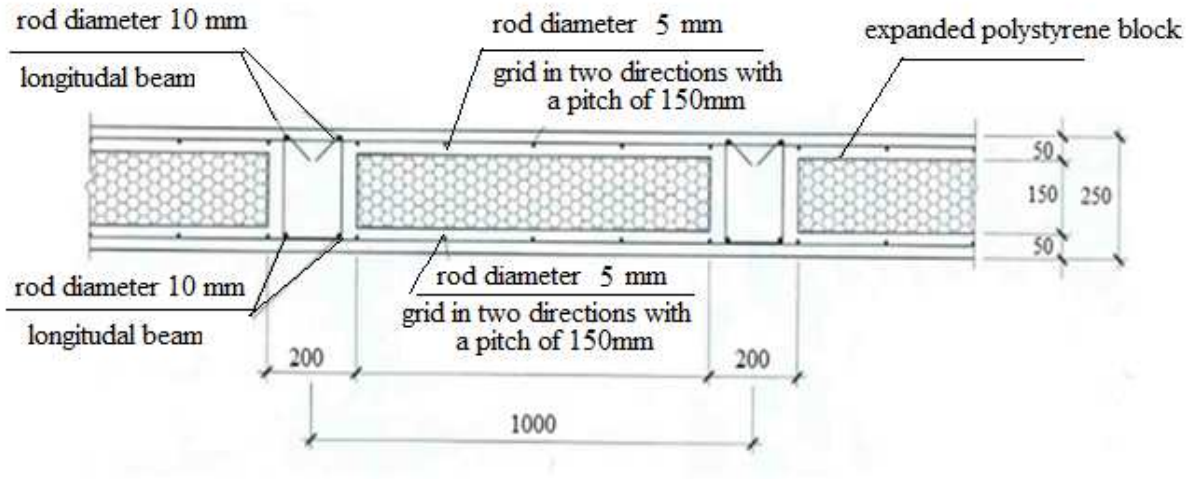

Figure 6. – Cross-section of reinforced concrete floor of a skyscraper

The modern industrial and civil building of Ukraine considered the technology with inserts from polymeric materials, standard forms were not used, and there is widespread concreting of constructions with unrecoverable liners-hole-forming cores made of Styrofoam.

This technology, developed under the leadership of Professor V. S. Schmookler successfully applied in the construction of buildings systems "RAMP", "ICARUS", "DOBOL" and "Monofont" [6, 7].

We present a comparison of technical and economic indicators of different technologies for the use of inserts (table. 1).

Table. – Technical and economic indicators of floor structures

Name technology	structural thickness of the slab, cm	Volume of the liner, cm^3	Step liners, cm	number of inserts, PCs / m^2	volume of inserts, m^3 / m^2	thickness of the floor, cm
Airdeck	25	4100	30	11	0,045	20,4
Cobiax	25	3100	20	25	0,076	17,2
BubbleDeck	25	9100	35	8,2	0,075	17,5
U-Boot Beton	25	28000	64	2,44	0,068	18,2
Monofont	25	121500	100	1	0,1215	12,85

Table 1 shows that the given thickness of the overlap with the use of non-removable inserts-hollow polystyrene foam is much less than for other technologies, which ultimately minimizes the weight of the structures.

Fewer liners per 1 m2 of the slab facilitates the reinforcement and the concrete process, at the same time predetermining the rationalization of the sections without reference to a standard form liners made of polymer materials.

REFERENCES

1. Air Deck® System. [Electronic resource.] – Mode of access: http://www.airdeck.com/.
2. Bubble Deck® System. [Electronic resource.] – Mode of access: http://www.bubbledeck-uk.com/.
3. Cobiax® System. [Electronic resource.] – Mode of access: http://www.cobiax.com/startseite.
4. DALIFORM group. [Electronic resource.] – Mode of access: http://ru.daliform.com/prodotti/categorie.php.
5. Luis M. Bozzo. The Santa Fe II Tower. A central core, tall, slender building in Mexico / Luis M. Bozzo // Concrete international. – 2014. – Vol. 36 No. 36. 9. – P. 51–54.
6. Shmukler, V.S. The frame system is lightweight / V.S. Shmukler, Y.A. Klimov, N.P. Buryak. – Kharkiv : Golden pages, 2008. – 336 p.
7. Pat. 89464 Ukraine, IPC E04B 1/18. Frame budula "Monofont" / Shmukler V. S., Babau V. M., Bugaevsky S. O., Gentle, K. V., Karyakin I.A., Kondrashchenko V. I., I Sercc.M.; Savnik I patentovannym Shmukler V. S., No. u201311919; Appl. 10.10.2013; publ. 25.04.2014, Byul. No. 8.