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Review on U Boot Technology in Construction

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ABSTRACT
The slab is a major part of the structural factor for building a foundation and also one of the great demand of consuming concrete in most constructions. These are the reasons for the creative development of a reinforced concrete concept that reduces weight and offers a wider span. U Boot Technology is proposed to obtain larger-span slabs or to accommodate heavy loads without beams. It is the technique used where U-Boots Beton with proper arrangement can be put in slab together with concrete and steel. U-boot beton is a box-like formwork structure made of recycled polypropylene, a by-product of industry built in reinforced concrete to create lightened void slabs and raft foundations. Building slabs with wide spans with more bearing power is a solution. The use of U-boot forms helps to minimize the quantity of concrete and steel needed to lay the slabs. Thus, by using U Boot technology, we are protecting natural resources for future generations.
Keywords :- Box-like formwork, raft foundation, recycled polypropylene, slab, U-boot beton

I. INTRODUCTION

In most constructions, the slab is a significant part of the structural element for the construction. And the slab is one of the highest factors for the use of concrete. These are the reasons for innovative development of the idea of reinforced concrete to minimize weight and to have greater reach. U Boot Beton is a shell made of recycled polypropylene for the purpose of lightening intermediate slabs and reinforced concrete rafts. The use of U boot formwork enables unique mushroom slabs to be built: the mushroom is part of the thickness of the slab. The U-boot stays submerged in the concrete casting. Thus a grid of orthogonal beams, upper and lower sealed by plane slabs of differing heights, is formed without the execution of two separate concrete castings, all of which means a remarkable saving of concrete and reinforcement.

II. U BOOT BETON

U-Boot Beton is a recycled polypropylene formwork built to create two-way emptied slabs and rafts. It is used to construct slabs that have a wide span or are capable of carrying large loads without beams. A lightweight cellular concrete that is developed by infusing a mixture of unhardened concrete or producing gases within the mixture. The U boot is used for various kinds of structural components, such as slabs or foundations. Technically and economically, they grant solutions for substantial designs. U-boot beton formwork is shaped like a drunken pyramid and measures 52 x 52 sq. centimetre normally width and 10, 13, 16, 20, 24, and 28 centimetres in height. The sandwich type superimposing two or more basic elements allows the loading of elements of different heights to be carried out. Single Beton and double Beton are the two distinct forms of betons. When laying single reinforced slabs, the single u boot beton is usually used and double U boot beton is used for the laying of doubly reinforced slabs. Single U beton boot is usually an open polypropylene box style that can be closed to resist the intrusion of concrete into the beton by the use of a closing plate. Double U Boot beton consists of two boxes that are closed to each other.

Fig.1. U-Boot Beton

III. COMPONENTS OF U BOOT

The U-Boot components are the connection bridge, the spacer joint, and closing plate. The U-Boot Sandwich U-boot Beton is a combination of different components. The spacer joint is used to attach two or more U boot betons when fixing on the shutter, so that the distance between the gaps of U-boot betons cannot be changed. The closing plate is used to close the U boot's concrete box that can withstand the flow of concrete into the box. The closing plate and its quality play a major role as it creates problems if concrete appears to move from damaged plate to beton after concrete is mounted, the connection bridge is required to link two betons longitudinally wherever it was necessary to increase the length of the beton. The significant element in U-Boot technology is the spacer joint. The U-boots supported in perpendicular directions may not be rigidly seated and therefore may cause disruptions in the U-boots. To stop these disruptions, the U-boots must be connected to each

other by a spacer joint. So when the concrete is poured, the U-boots will not be affected.

Fig.2. Connection Bridge, Spacer Joint, Closing Plate

IV. INSTALLATION PROCEDURE

- With wood decking, the entire surface of the slab to be cast on site is shuttered, then the lower reinforcement bars are placed according to the plan in two mutually perpendicular directions and the lattice is arranged for the upper reinforcement.
- Place lower reinforcement over the formwork, which acts as compression reinforcement for slab.
- Place the triangular reinforcement as a beam for work purposes. It provides a space to fix U-boot betons and also to align betons properly.
- Place the U-boot betons among the triangular reinforcement now. Spacer joints, connection bridges and closing plates are used if necessary.
- Complete the upper reinforcement above the U boot betons correctly, which acts as tension reinforcement for slab.
- Place concrete on the shutter after placement of the upper tensile reinforcement. Initially, concrete is mounted on the shutter so that the concrete is filled only with the spacers of the U boots. The total area of the slab had to be put in this way.
- As the concrete that has been placed begins to be set, restart the installation of concrete entirely on the U-boot concrete, so that it is absolutely submerged in the concrete. Once properly set, the casting can be restarted and the U-Boot Beton is completely buried from the starting point.
- When the structure has been hardened, the formwork can be removed. In the correspondence of the soffit the surface is smooth.

Fig.3 Installation of U-Boot Beton

V. CONCEPT OF U BOOT TECHNOLOGY

Due to the U-boot betons, the voids formed in the central section and the cross section act like the I section (Double T). I section is the best section to take on more bending stress by saving concrete material. This is the bending stress principle of U boot technology. Shear Stress Concept U of boot technology is usually slabs are protected against shear stress. In this type of slab, a negligible amount of shear stress is taken at columns. So in corners, the column caps are supported to alleviate shear stress. This is accomplished by having a solid section (I section) for columns by avoiding U-boot betons at corners.

VI. ADVANTAGES

1) Construction Benefits

- Reduction within the general load of the structure weighing on the pillars and thus the inspiration.
- Reduced foundations thus less deep foundation excavation lower the costs for foundation excavations.
- Increased number of floors.
- Large span and great architectural freedom.
- No beams between pillars.
- Reduction within the amount of pillars thus the section of pillars get optimized.
- Improved acoustic behaviour.
- The concrete and steel material utilized in construction of slab are often greatly reduced because the betons which are inserted within the concrete are placed empty.
- Thanks to the high stiffness of the U-boot material, the structure gives the same amount of capacity.
- The self-weight of the structure are often reduced considerably as there is a loss of heavy amount of concrete and steel. This helps owners to make the project even where the soil bearing capacity (SBC) of the soil is low.
- The property of the polypropylene, because the melting point of the polypropylene is extremely

high to 230o c the structure are often thermally and fire resistant. It can't catch the fireside so easily.

2) ***Economic Benefits:***

- Compared to alternative systems, reducing the consumption of concrete and fittings.
- Optimal use of indoor space by reducing the quantity of columns.
- Possibility to provide additional parking lots to urge obviate additional columns.
- The flatness of the lower level of the slab, which ends up in ease and reduces the worth of plumbing and cutting under the ceiling.
- No need for a false ceiling and reduce the worth of fixing a false ceiling if necessary.

VII. CASE STUDIES

A. Bergamo (Italy) Itc – Lab and Research Centre

Bergamo is Located in the Rosso Science Park Kilometro in Bergamo, Italy. The i.lab research and innovation centre of Heidelberg Cement has a total surface area of 23,000 m2. The research and development of innovative technical, functional and aesthetic solutions for new building materials involves over 120 researchers. The building's key characteristic is daylight, with the roof of the structure forming a virtual fifth façade perforated by a system of skylights that guides light into offices, circulation corridors and laboratory spaces, and animates the interiors with changing natural light. Optimal use of indoor space by reducing the number of columns is achieved by using Beton U boot. There is no need for a false ceiling and if possible, reduce the costs of building by installing a false ceiling. Italcementi has built an advanced high-strength, pollution-reducing reinforced concrete mixture especially for the construction industry. This modern concrete technology is used for exterior wall facing the highway, the north screen, the curtain wall mullion device, and the precast wall and roof elements in the building.

B. Vertical Parking - At Mahila Baug, Gujarat

The case study is focused on a place called 'Mahila Baug' situated in the heart of the city in one of the most populated places, despite the day-to-day presence of the public. Since Bhavnagar as a city is not that well-developed in terms of engineering applications, the word 'parking management' is well beyond its reach. The region proposed here is also heavily populated in terms of vehicle density, and not a lot of well-maintained space is available to manage the same. They propose U Boot Technology, which will not only increase the scope of the engineering application in the area, but will also promise to prove to be one of the most effective systems when it comes to either the design of the structure and energy conservation or the management of parking. U boot offers the possibility of additional parking by eliminating additional columns. Thus the total spacing is improved and the conjuncture feels less. The total size of the area is 165.71X 99.42X171.34X98.74 M, which is more than adequate to construct the structure and to accommodate all of the following modernized engineering applications that we appear to propose.

Fig. 4. Multiple level parking

VIII. CERTIFICATION OF U BOOT

U Boot technology got various certifications from various authorities. The certifications of U Boot Technology are listed below:

- Environmental Compatibility Certification (CCA).
- Member of the Green Building Council Italia
- Certified for Fire Resistance under REI 180 for U-Boot Beton issued by the CSI institute in Bollate (MI).
- Certified for load test on a sample with U-Boot Beton issued by the University of Darmstadt.
- Acoustic test according to the standard UNI EN ISO 140-6.
- Loading and breaking test certified by the University of Padua

IX. CONCLUSION

U-boot technology is the most modern, economical, architectural, eco-friendly and quickest form of slab construction. Decreasing material consumption has made it possible to speed up the building time and increased overall structural costs. The use of U-boot technology is very rare because of a lack of knowledge in our region. This technology saves more concrete and reduce the use of iron in slab. Pillars and the foundation will save up to a limit of 15%. There are anti seismic advantages associated with decreased building weight of slimmer pillars and foundations, and there is little risk of a seismic impact on buildings. In modern construction, U Boot technology is very much appropriate, and maybe the future of civil engineering is part of this new form of hollow slab. U boot technology should be used more, because we all are

responsible to save natural and renewable resources for our future generation.

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