

Emerging Trend in Deep Basement Construction: Top-Down Technique

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ABSTRACT: Infrastructural requirements in urban area make mandatory construction of basements which serve as space for car parking and housing utilities of various kinds. Demand for underground space has increased exponentially and this has triggered several levels of basement. Invariably, majority of such projects are planned on fast track basis wherein, technology of any form that can reduce the construction period is always a preferred choice. In this context, Top-Down construction has been increasingly used in urban areas, particularly for high rise buildings with basements so that the sub-structure and super-structure works can be executed concurrently. Top-down construction is replacing the traditional bottom-up construction technique owing to several advantages this new technique offers.

This paper presents details of Top-Down construction technology. Important component of this technique is the Diaphragm wall, which is a specialized slender retaining wall constructed from the ground. Construction intricacies and methodology of execution of such wall also form part of this paper. Two case summaries are reported on Top-down construction executed by principle authors' firm. One such site comprised multi-level car parking facility in a crowded area of Delhi, while other formed a part of underground metro station at Kolkata. The paper concludes with words of indispensability of such technology for early commissioning of the structures.

Keywords: Top-Down Construction, Bottom-up Construction, Diaphragm wall, Barrette, Column, Pre-concreting and Post-concreting installation

1. INTRODUCTION

Conventionally, buildings with underground basements are built by Bottom-up method where sub-structure and super-structure floors are constructed sequentially from the bottom of the sub-structure or lowest level of basement to the top of the super-structure. Though this conventional method is simple in both design and construction, it is not feasible for the gigantic projects with limited construction time and/or with space and other site constraints. Top-down construction method as the name implies, is a construction method which builds the permanent structure members of the basement along with the excavation from the top to the bottom. Top-down method is mainly used for two types of urban structures, namely tall buildings with deep basements and underground structures such as car parks, underpasses and metro stations. In this case the basement floors are constructed as the excavation progresses. The Top-down method has been used for deep excavation projects where tieback installation is not feasible and soil movements have to be minimized. This construction method which provides the significant saving of the overall construction time, is showing increasing adoption for major projects where time factor is of primary importance. The sequence construction begins with flexible retaining wall installation and then load-bearing elements that will carry the future super-structure.

The present paper presents this emerging technology in the construction industry, giving details of the procedure involved, and their advantages compared to its predecessor namely the Bottom-up method. Construction of Diaphragm wall which is a key element in this form of technology is given specific attention. Two case summaries of Top-down construction, where the principle authors' firm were involved, have been reported. Both of these projects derived inspiration from the imminent financial gains due to reduced project time and early commissioning of the services for which the infrastructural projects were intended for.

2. CONVENTIONAL APPROACH TO UNDERGROUND CONSTRUCTION – BOTTOM-UP CONSTRUCTION

In a conventional Bottom-up approach, after the construction of basement piles and diaphragm wall, the construction agency excavates the enclosed area to the desired depth and then proceeds for installation of strutting/ bracing system to support the basement walls as the excavation proceeds which is followed by construction of the basement. Depending on the depth of the excavation, structural design may require one or

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