

TOP DOWN CONSTRUCTION

BY

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INTRODUCTION

The speed of construction is one of the most important factors in the building Industry. Even if the project gets a green signal to be started the progress of the construction does not really keep pace because of factors like inadequate availability of power .and water at site, constraints due to non-availability of funds in time etc. Even through lot of high value projects have been completed by the Indian construction industry after independence, still the speed of construction is lower than projected. In a very minute fraction of projects, modern technology has been made use of and applied.

On the contrary, comparing with other developing countries, in the Middle East or to the Far East, a marked difference is evident in this country. The preference to using large number of work force scores over adequate equipment and modern technology. It is believed that providing large work force at site will help in speeding up the construction and that it will work out to be cheap because of the assumption that the labour is very cheap in India. This is erroneous because in the overall cost of the project this very factor of a large work force available at cheap price becomes counter productive. One of the modern methods discussed here is 'top down' construction which is not in vogue so far in India.

The method of “Top Down Construction” for a Commercial Building in the heart of the city of Bangkok. The Building had four basements and ground plus 33 three floors above the ground. The total floor area for this building was approx. 62000 m². There was parking provided for over 500 cars. All the four basements and eight floors above the ground were required to be used for parking. It was one of the first cases where structural steel was used for constructing super structure of the building. Steel plates and structural members of 500 Ksc strength were used. To speed up the construction Top Down Construction was used. By using this method the building was being constructed both below and above ground simultaneously resulting in its early completion, and usage, thereby ensuring considerable savings.

To avoid co-ordination problems, the work for the sub-structures was awarded to one single Company which included the diaphragm walls, bored piling and civil construction from ground level to the main foundation level.

Construction Sequence

The sequence of construction for this method was:

- The construction of RCC diaphragm walls 80 cms thick x 20 m deep enclosing the entire plot area.
- Providing bored piles 1.2 m and 1.5 m dia 63 m deep. The piles were provided right from the ground floor level with the top 13.9 m being hollow. The concrete in the piles was provided upto a level of 1 m above the cut off levels (the raft level).

- Laying of the R C Concrete Slab at the ground floor level with pre-determined openings.
- Providing platform for movement of machinery and equipment.
- Scooping earth under the ground floor slab by lower-ing the equipment for earth excavation through the pre-determined openings. The earth was excavated to the second basement slab level.
- Laying of the second basement slab with pre-deter-mined openings.
- Scooping of the earth under second basement by low-ering the equipment through the pre-determined open-ings.

- Excavation upto fourth basement and raft foundation level.
- Laying of the raft slab.
- Casting of the third basement slab.
- Filling up the openings at the second basement.
- Casting of the 1st basement slab.
- Filling of the openings at the ground level.

A platform was erected above the ground floor slab without transferring any load to the ground floor slab for movement of the concrete pumps, concrete carrier mixers and for the movement of the crane and other earth moving equipments (Fig 2). The total number of piles was 115 and there were 35 structural steel columns supporting the entire super structure. A novel method was found out by lowering the structural steel columns into freshly laid concrete in the piles to a depth of 3 m within the pile itself. This had to be done for providing sufficient anchorage of the structural steel columns in the piles itself and below the foundation level because the work in the super structures had to be started during the progress of the work for the sub-structures area. The structural steel columns were kept about 1 m above the ground floor slab-level and the work of super structure also started using these columns as the base for the super structure. For lowering the structural steel columns into piles guided were fixed on the steel casing for the piles to keep a true alignment of the columns and the piles.

An admixture was provided to retard the setting time of concrete in the piles, so that the structural steel column could be provided before the initial set of concrete has taken place. The structural steel stanchions were lowered in the piles in a period of upto 2 hours of the laying of the concrete.

The thickness of the raft foundation was 2.5 m. The raft foundation was done in two layers each being 1.25 m deep. There has been lot of research available on casting of mass concrete. Care was taken for the bond between the two layers by providing shear keys.

The concreting was started from the central area and carried on towards the sides to take care of the shrinkage. In fact, the concrete was done in small widths of the concreting area so as to minimise the stresses developed on account of shrinkage of the concrete after setting. The diaphragm walls were self supporting resisting the earth pressure only and not de-signed to take care of any shrinkage or any other stresses in the foundations.

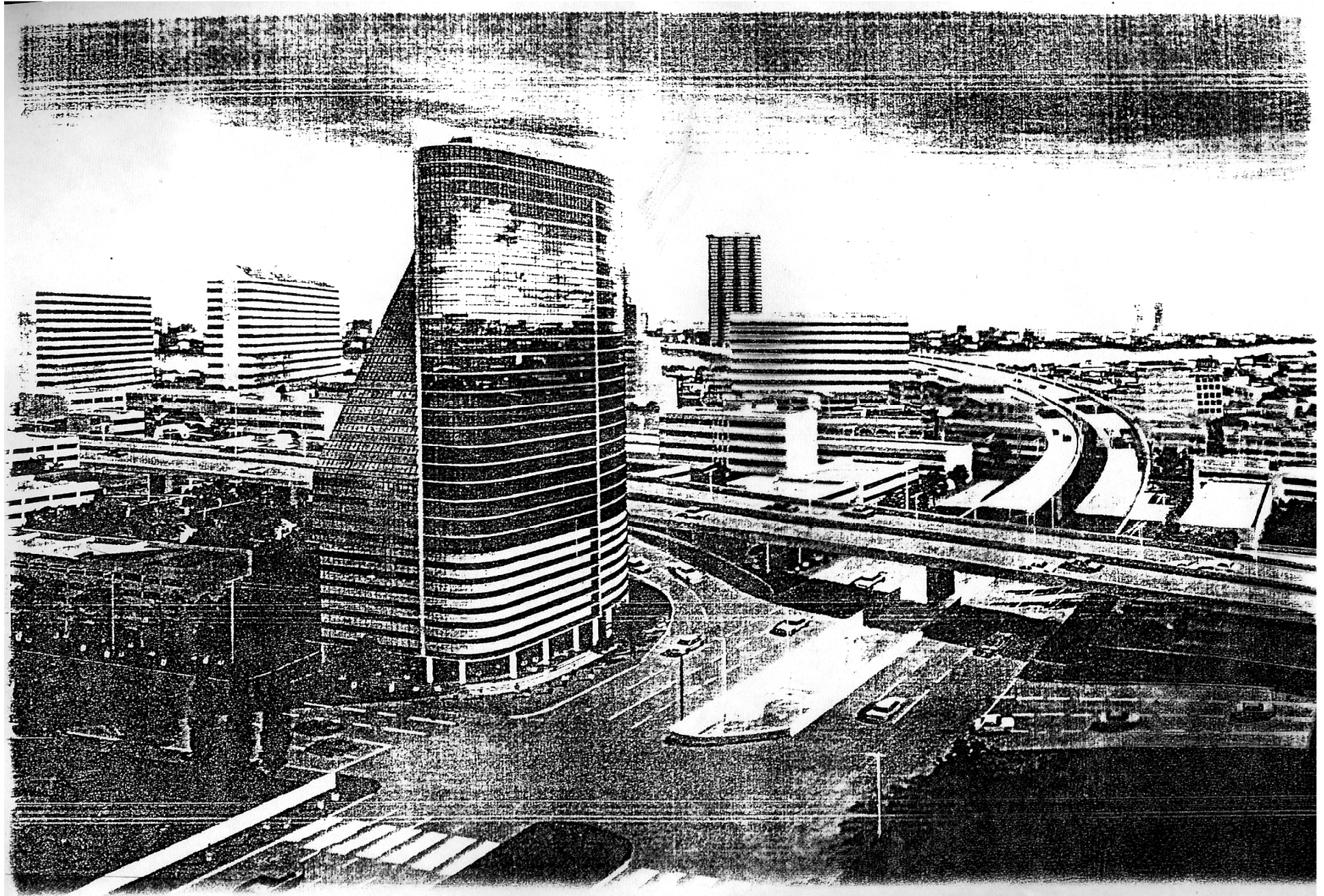
The diaphragm walls were designed to take the earth pressure for a length of 10 m. This is why the slab at the second basement level was provided and then the next bracing was through the raft at the fourth basement level. At the time of construction in the diaphragm walls inclinometer readings were taken by providing devices in the diaphragm walls itself at a number of pre-determined points.

Since there is high degree of heat generated in the body of mass concrete, readings for temperature at the bottom level, near the top surface of the concrete and atmosphere were recorded at regular intervals and at quite a few places in the area. The top surface of the concrete was covered immediately after the initial set with two layers of matting to contain the heat within the concrete and not to allow the heat to dissipate. This was done to avoid shrinkage cracks being developed. High wattage electrical heaters were provided to heat the top surface of the concrete to keep the temperature difference within the limit of work between the bottom most and top most layers.

The mass concreting was done by mobile concrete pumps, truck mixers. The concrete was fed from several batching plants within a radius of 10-15 kms. The concrete for both the layers was started around mid-night on Saturdays and completed around mid- night on Sundays. This was done to avoid very heavy traffic during the working days. The total quantity of concrete for each layer was approx. 2800 m³.

Apart from the normal load test for the bored piles non-destructive tests (ultra sound tests) was performed on all the piles to check the continuity and the uniformity of the concrete in the entire length of the piles.

CHARTERED SQUARE-BANGKOK



CHARTERED SQUARE (UNDER CONSTRUCTION) -BANGKOK



PILES LOAD TESTING – FOR CHARTERED SQUARE

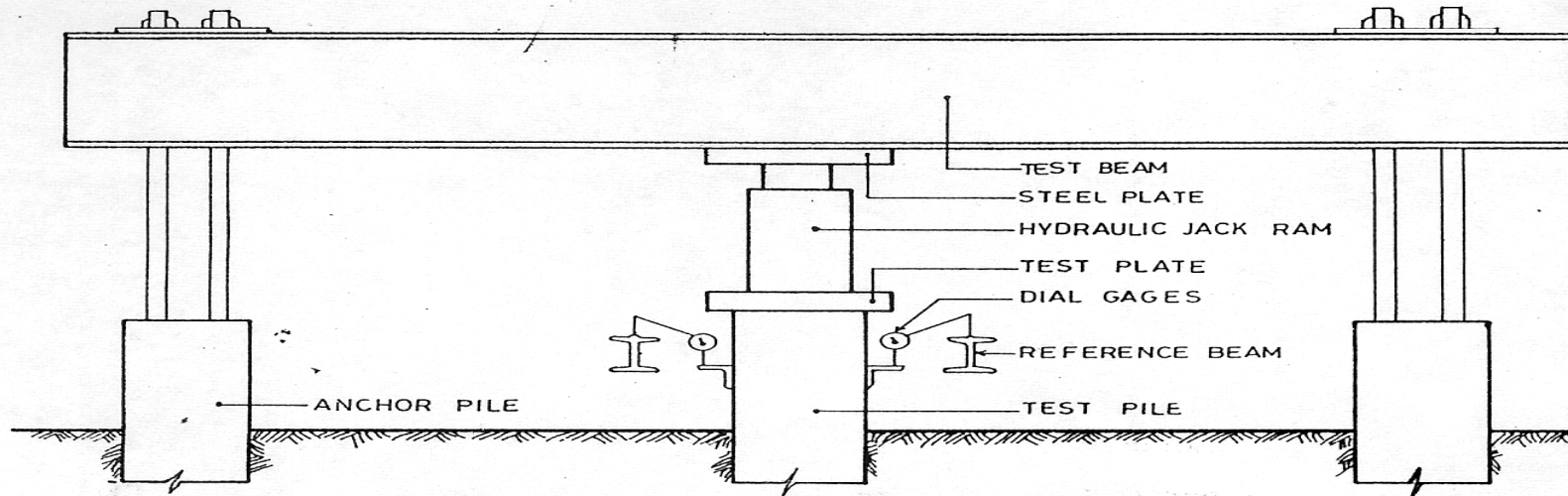


FIG. 1.

SCHEMATIC SET UP FOR APPLYING LOADS TO PILE –
USING HYDRAULIC JACK ACTING AGAINST ANCHORED REACTION FRAME

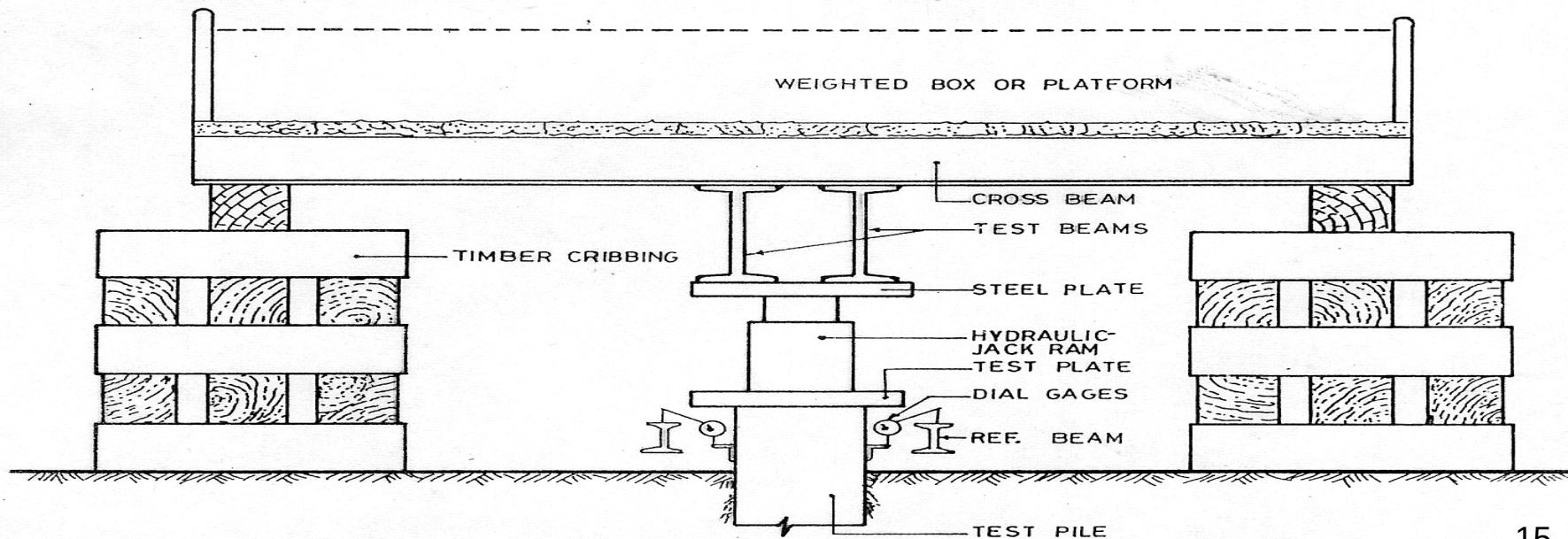


FIG. 2.

SCHEMATIC SET UP FOR APPLYING LOADS TO PILE USING –
HYDRAULIC JACK ACTING AGAINST WEIGHTED BOX OR PLATFORM

PILES LOAD TESTING – FOR CHARTERED SQUARE

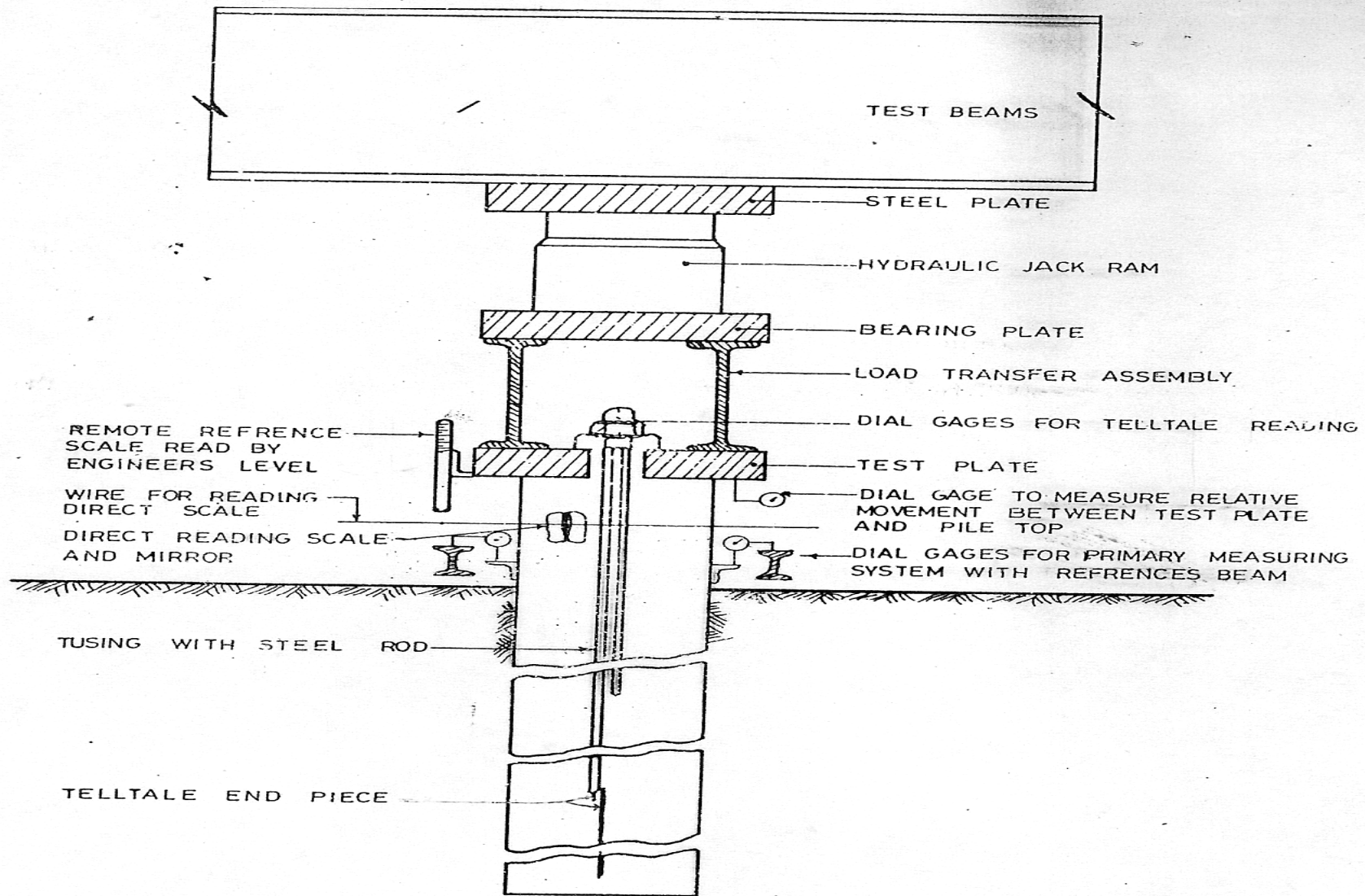


FIG. 5

SKETCH SHOWING POSSIBLE ARRANGEMENT -
OF INSTRUMENTATION FOR MEASURING VERTICAL MOVEMENT OF PILE.

PILES LOAD TESTING – FOR CHARTERED SQUARE

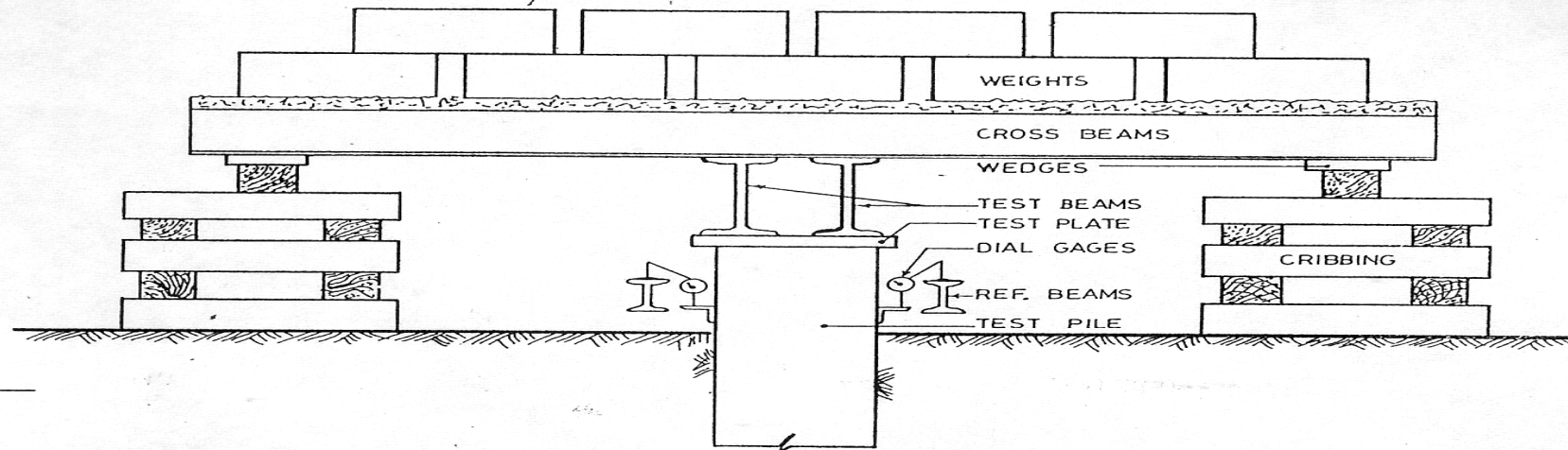


FIG. 3.

SCHEMATIC SET UP FOR APPLYING LOADS -
DIRECTLY TO PILE USING WEIGHTED PLATFORM.

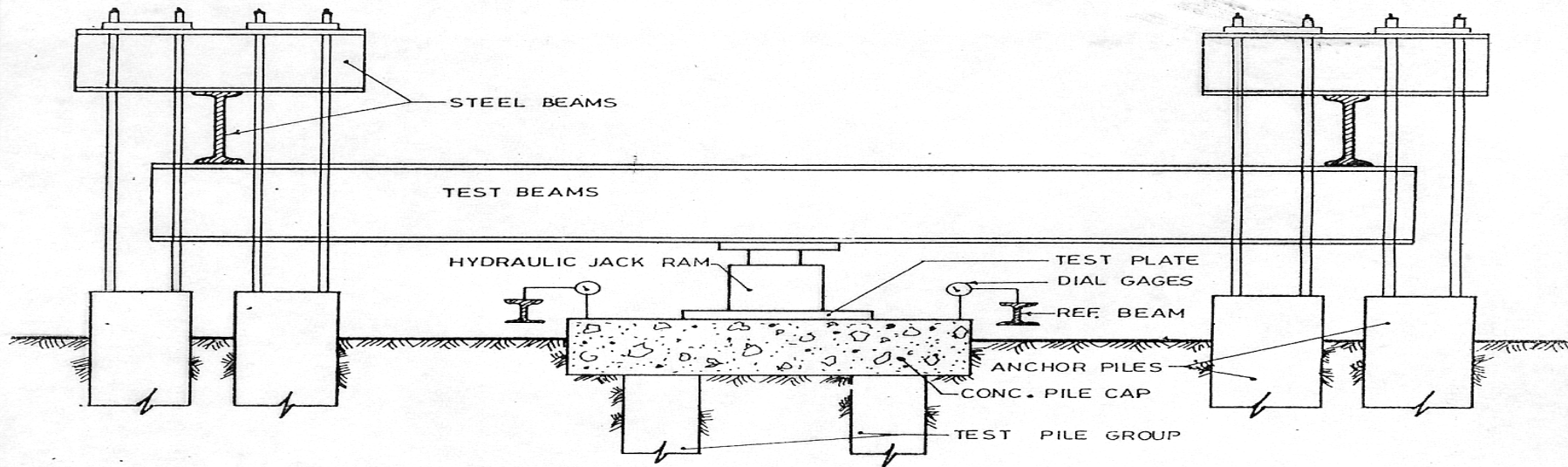
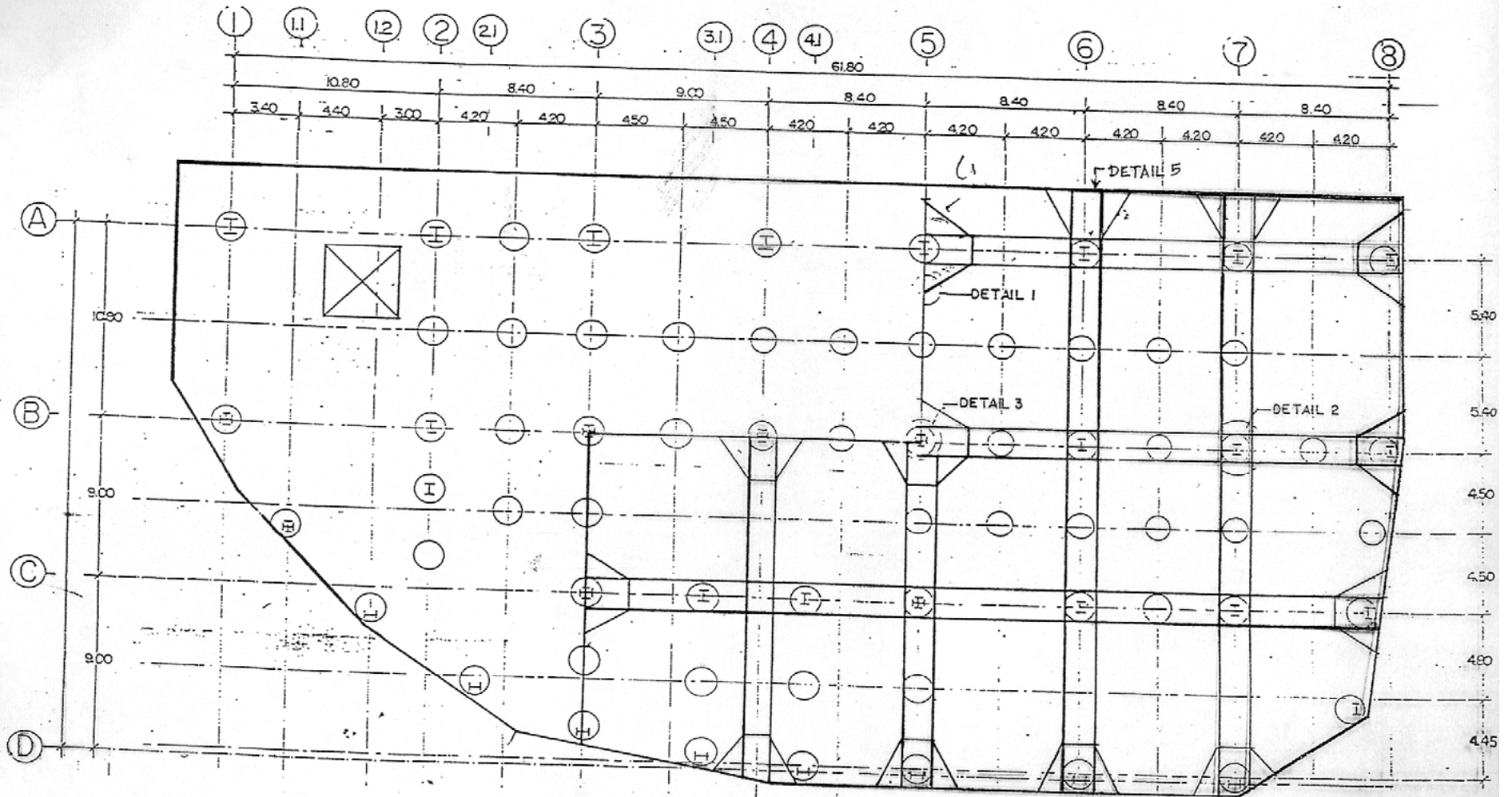


FIG. 4.

METHODS SHOWN IN FIGS. 2 AND 3 COULD BE USED
TYPICAL ARRANGEMENT FOR APPLYING LOAD TEST -
TO PILE GROUP USING METHOD ILLUSTRATED IN FIG. 1

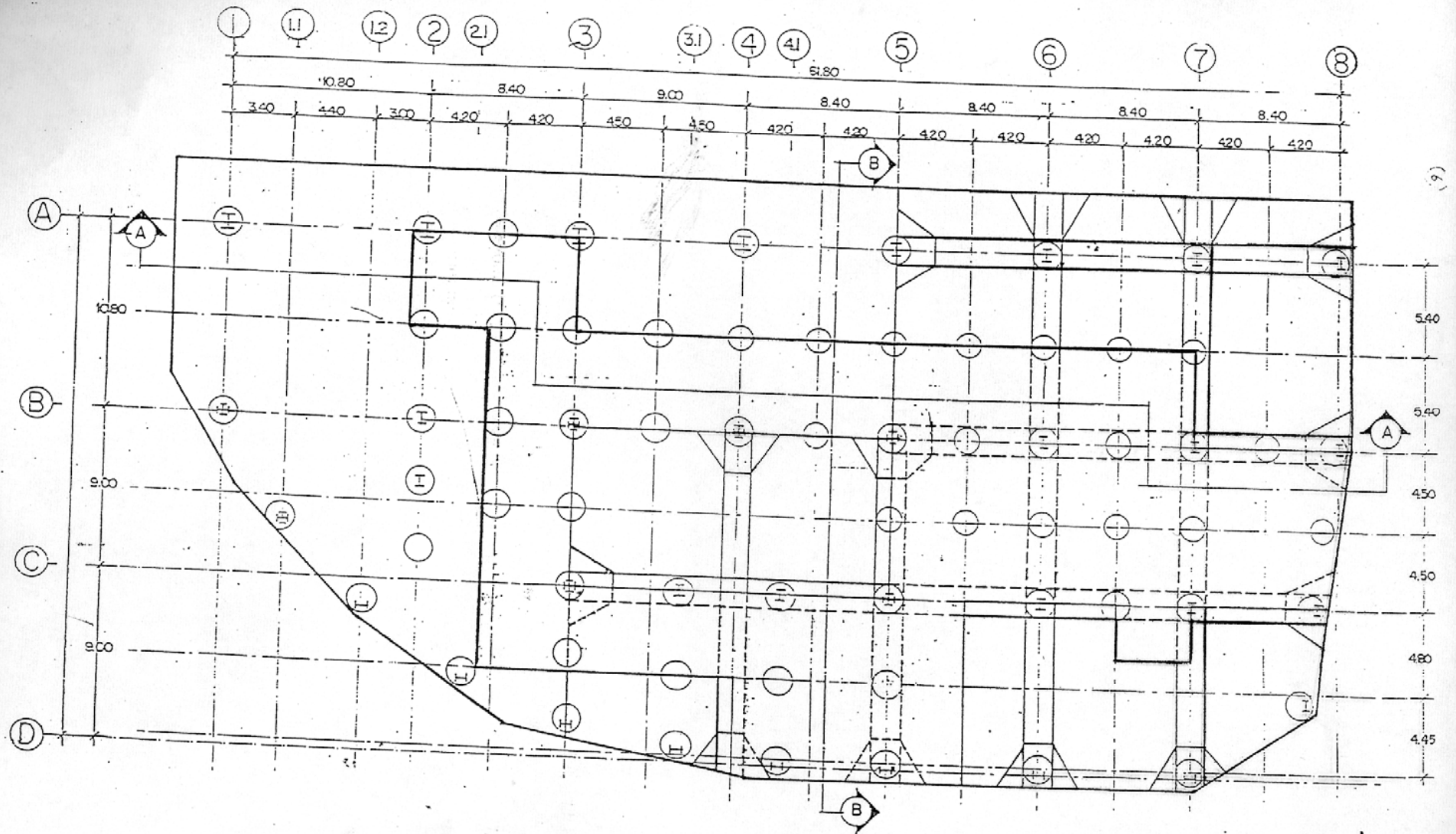
CHARTERED SQUARE – BANGKOK



BRACING OF BO ELEVATION

- ☒ STANCHION COL
☐ TEMPORARY COL

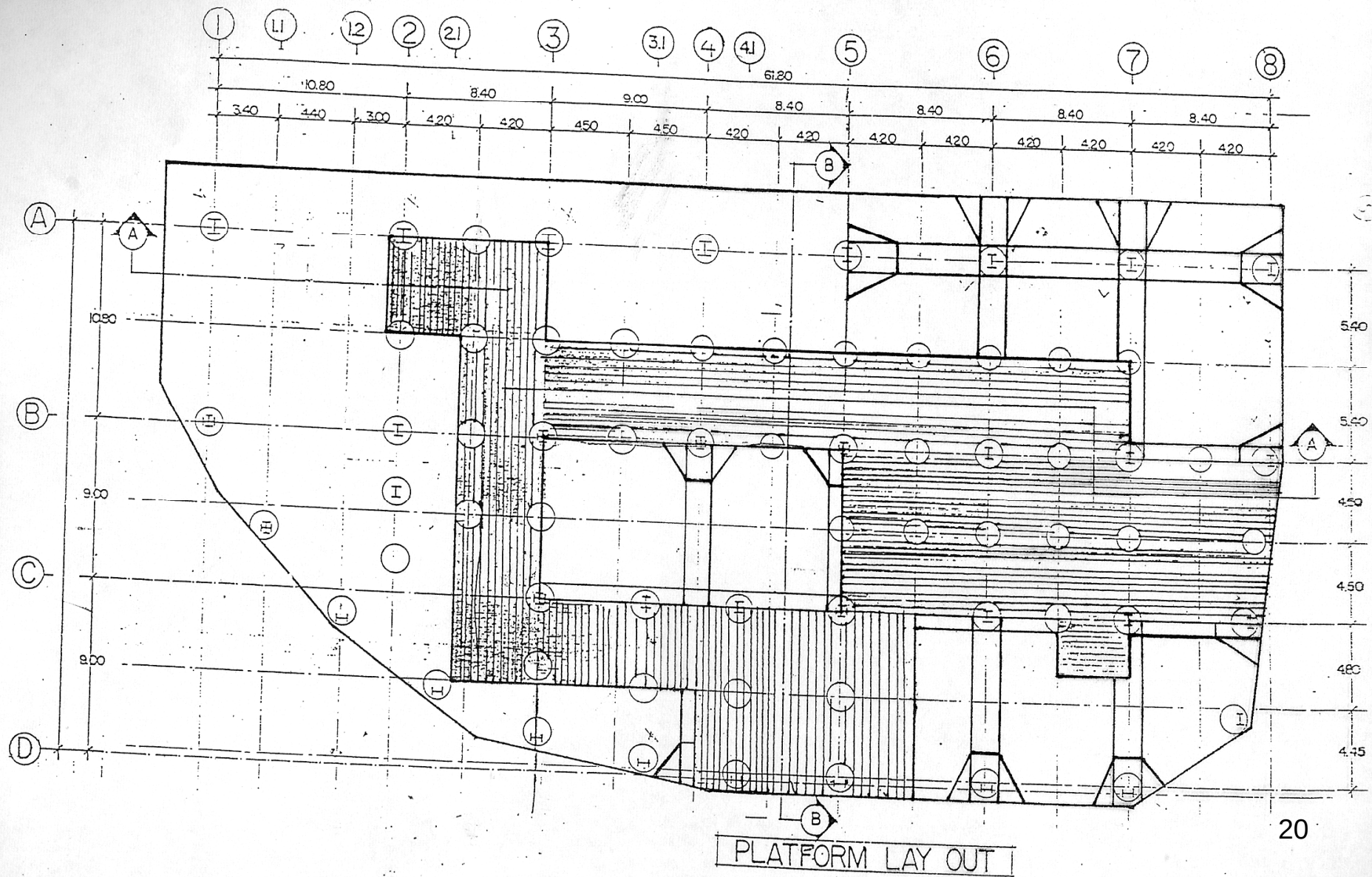
CHARTERED SQUARE BANGKOK



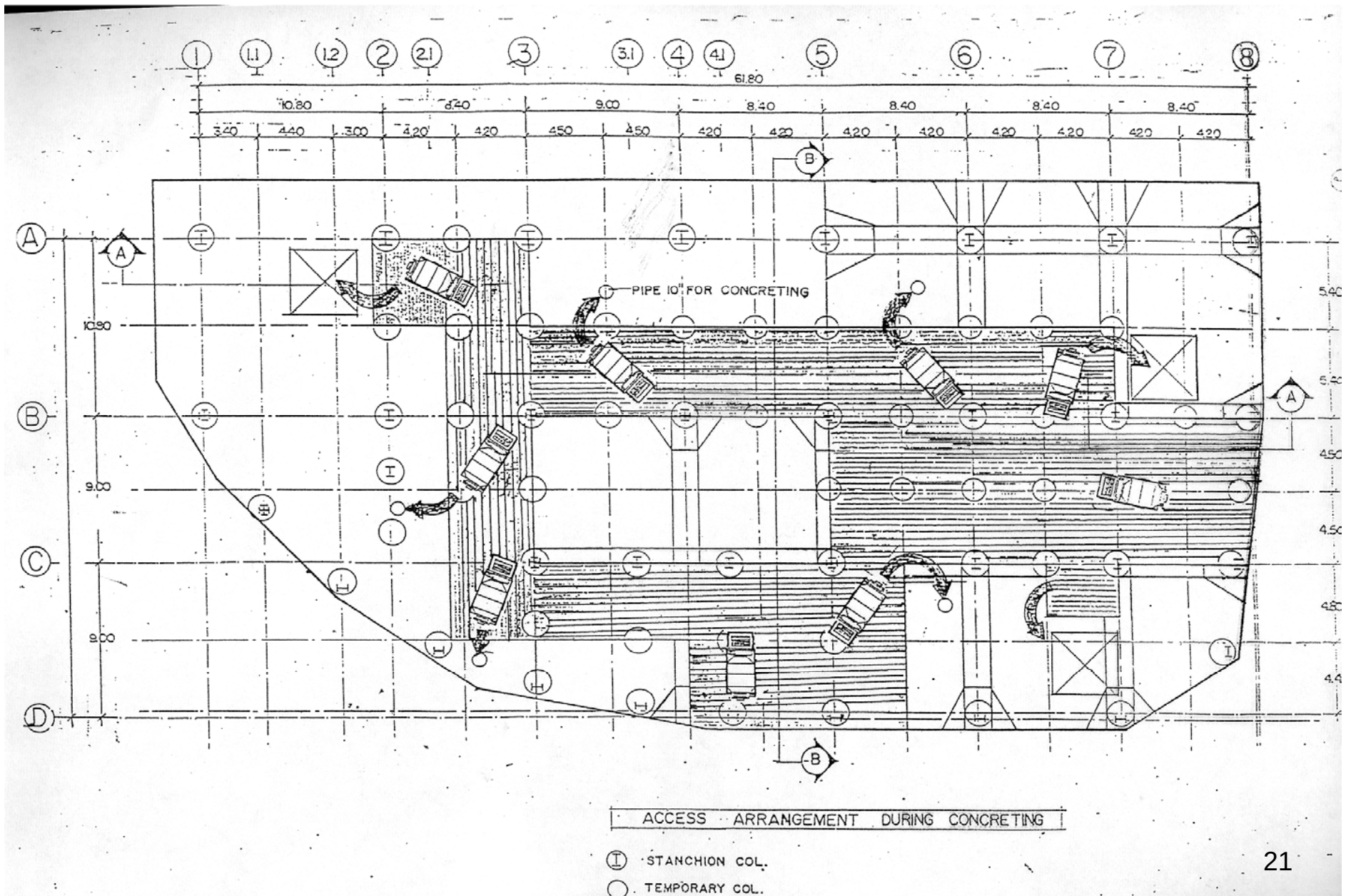
PLAN OF BRACING & PLATFORM OVER BO

- ⓘ STANCHION COL.
- TEMPORARY COL.

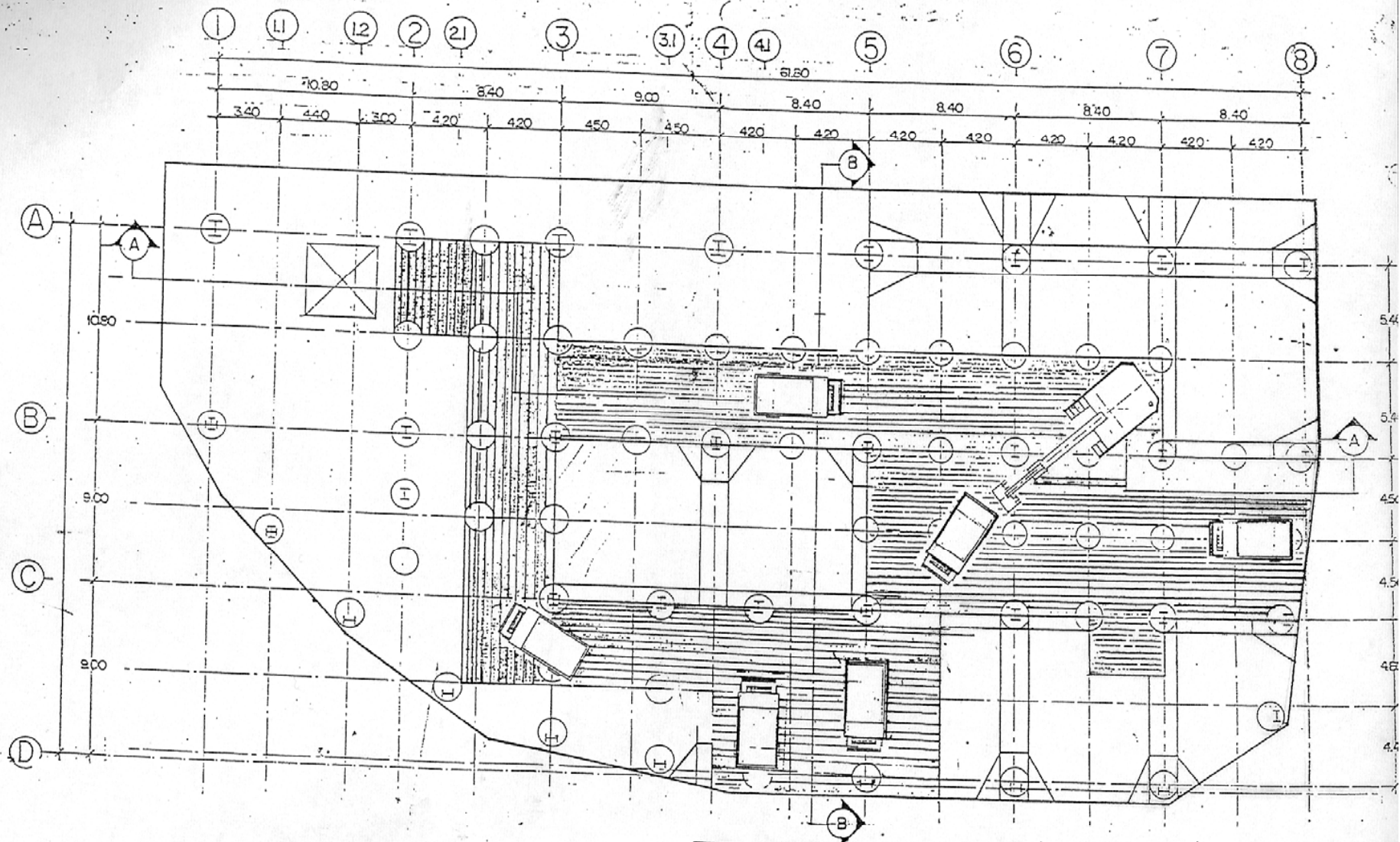
CHARTERED SQUARE – BANGKOK



CHARTERED SQUARE – BANGKOK



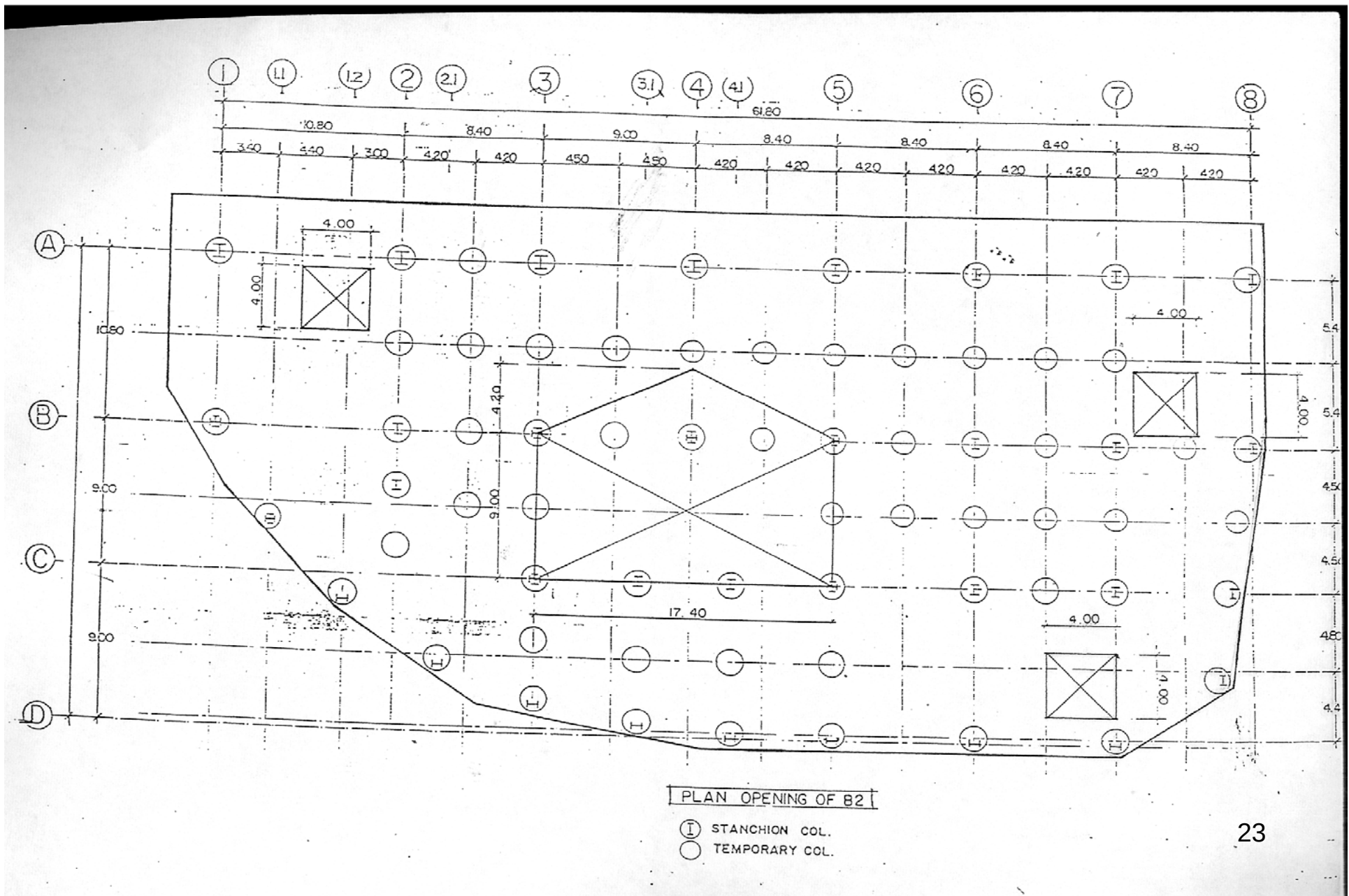
CHARTERED SQUARE BANGKOK



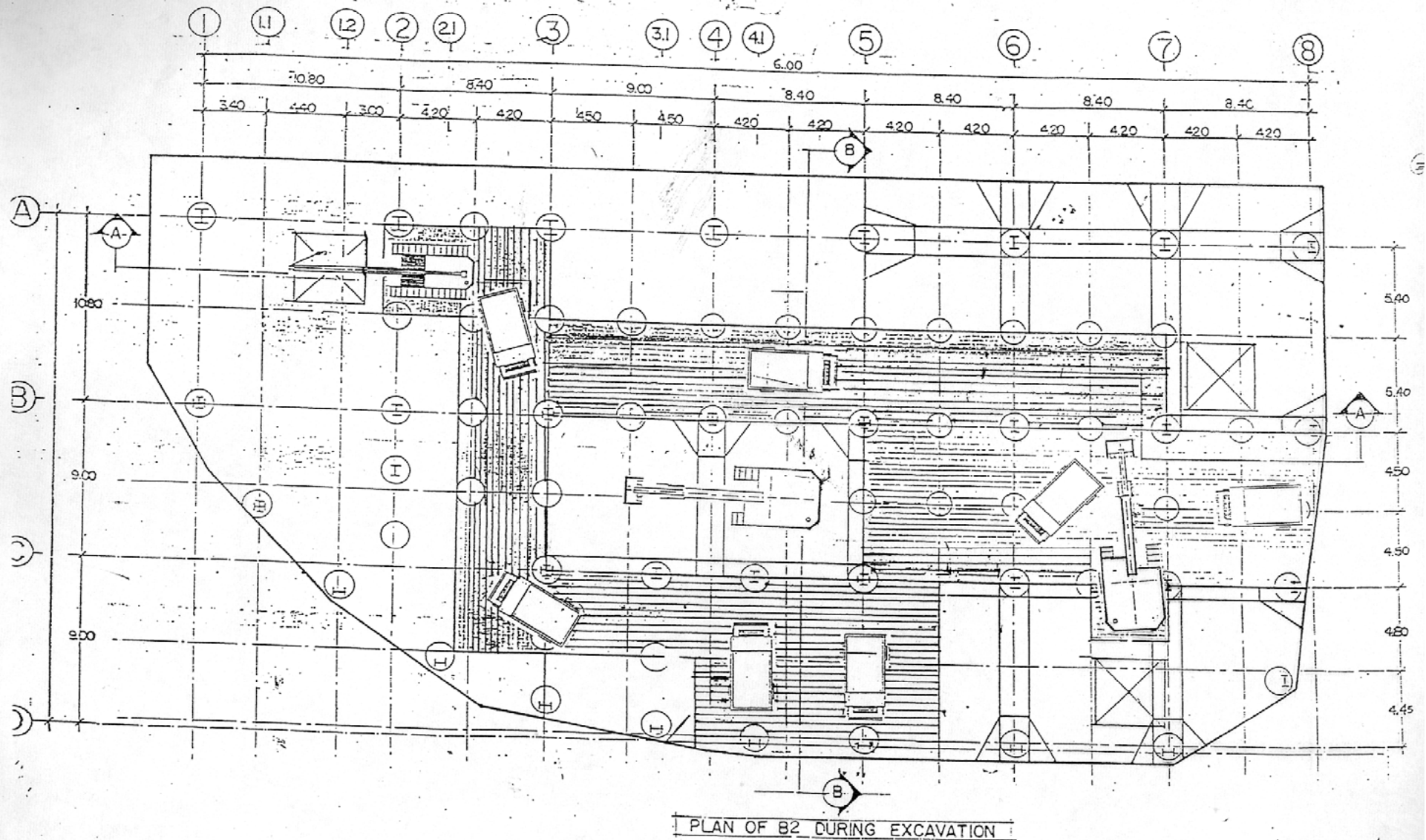
PLAN OF BO DURING EXCAVATION

- ⊗ STATION COL.
- TEMPORARY COL.

CHARTERED SQUARE-BANGKOK

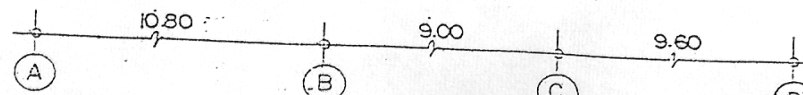
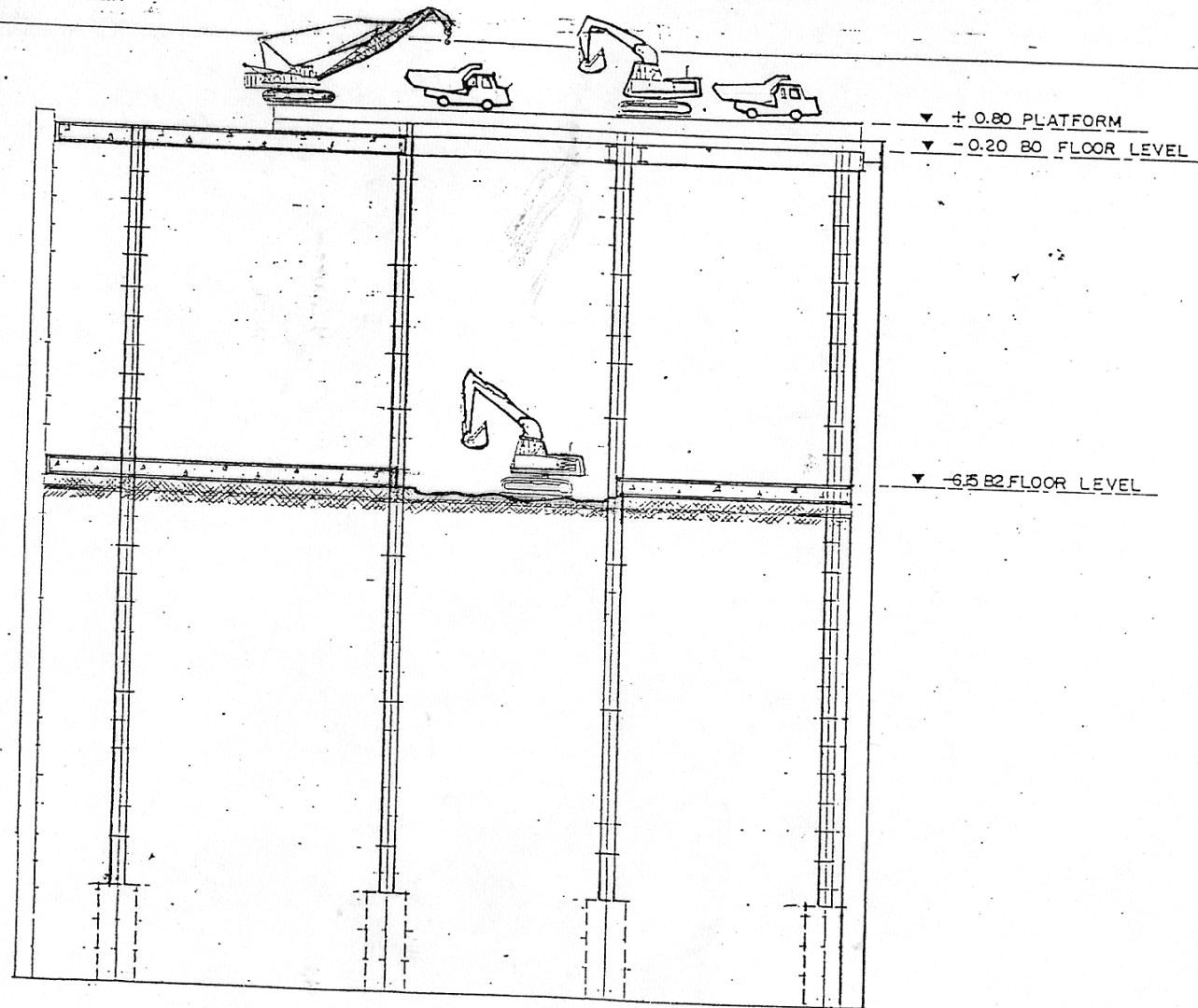


CHARTERED SQUARE – BANGKOK



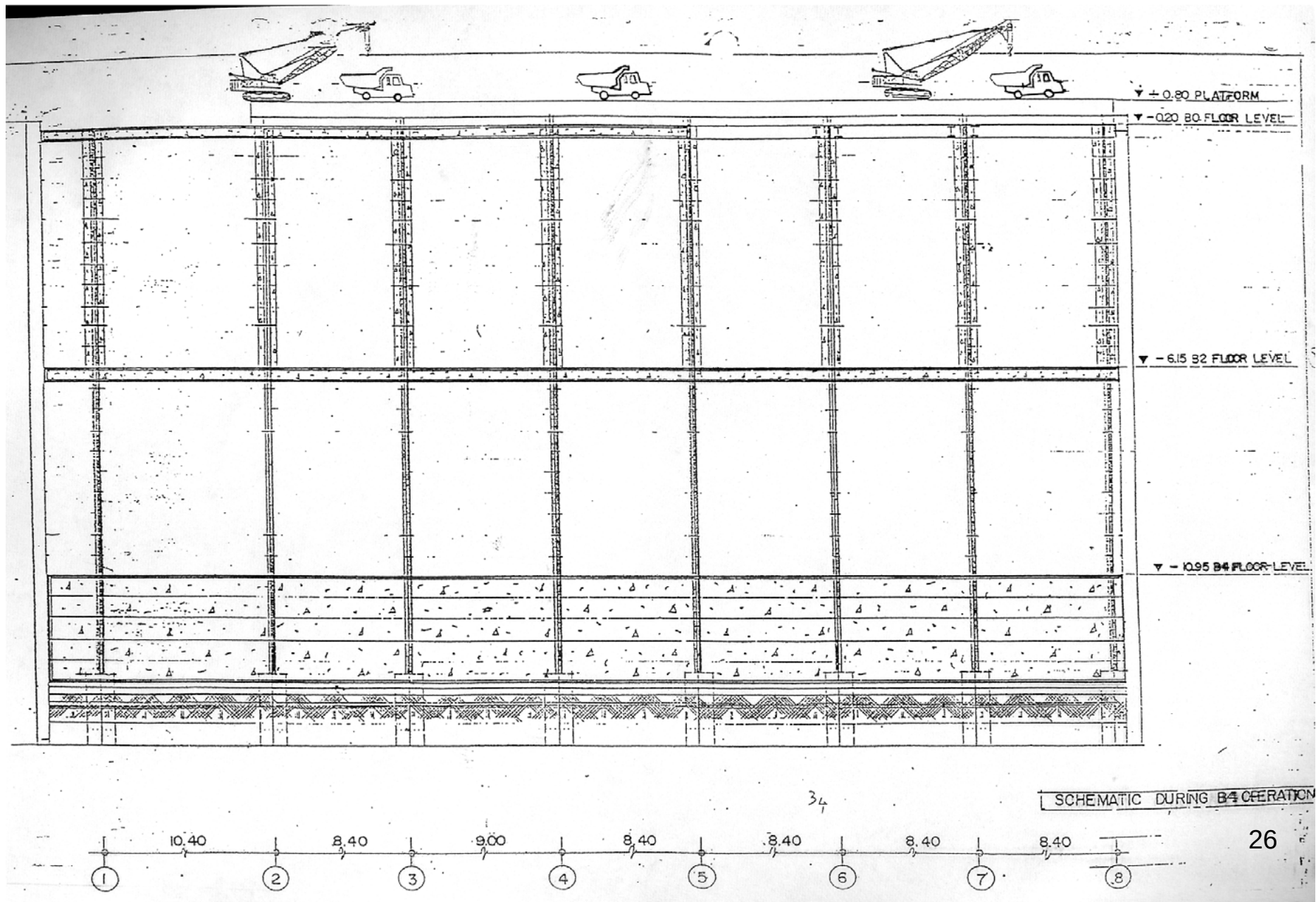
- ⊙ STANCHION COL.
- TEMPORARY COL.

CHARTERED SQUARE-BANGKOK

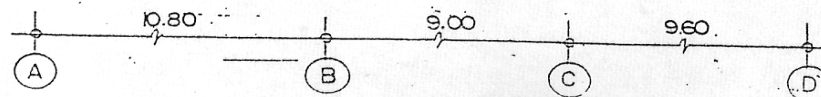
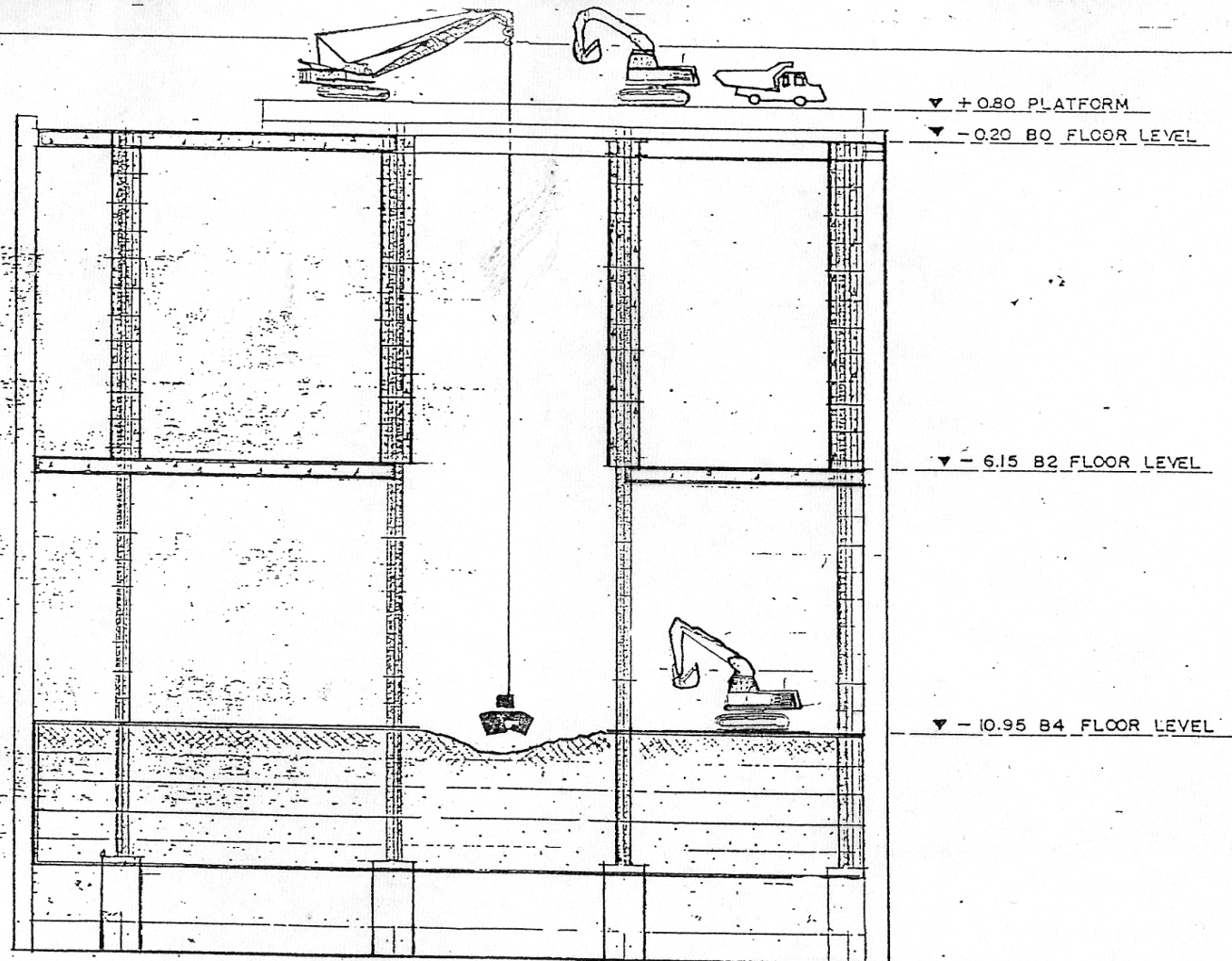


SCHEMATIC DURING B2 OPERATION

CHARTERED SQUARE – BANGKOK

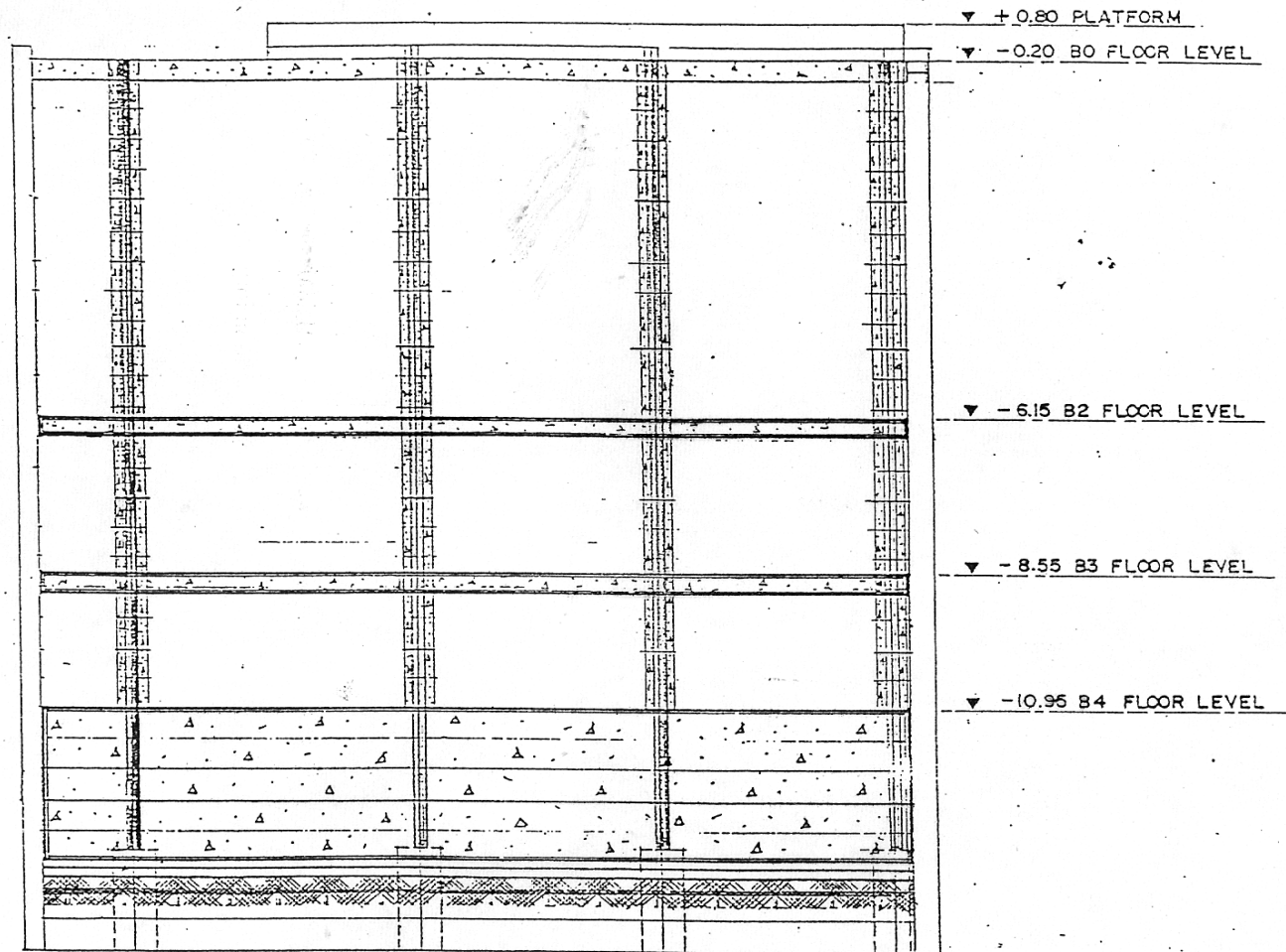


CHARTERED SQUARE – BANGKOK

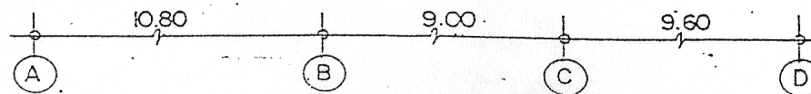


SCHEMATIC DURING B4 OPERATION

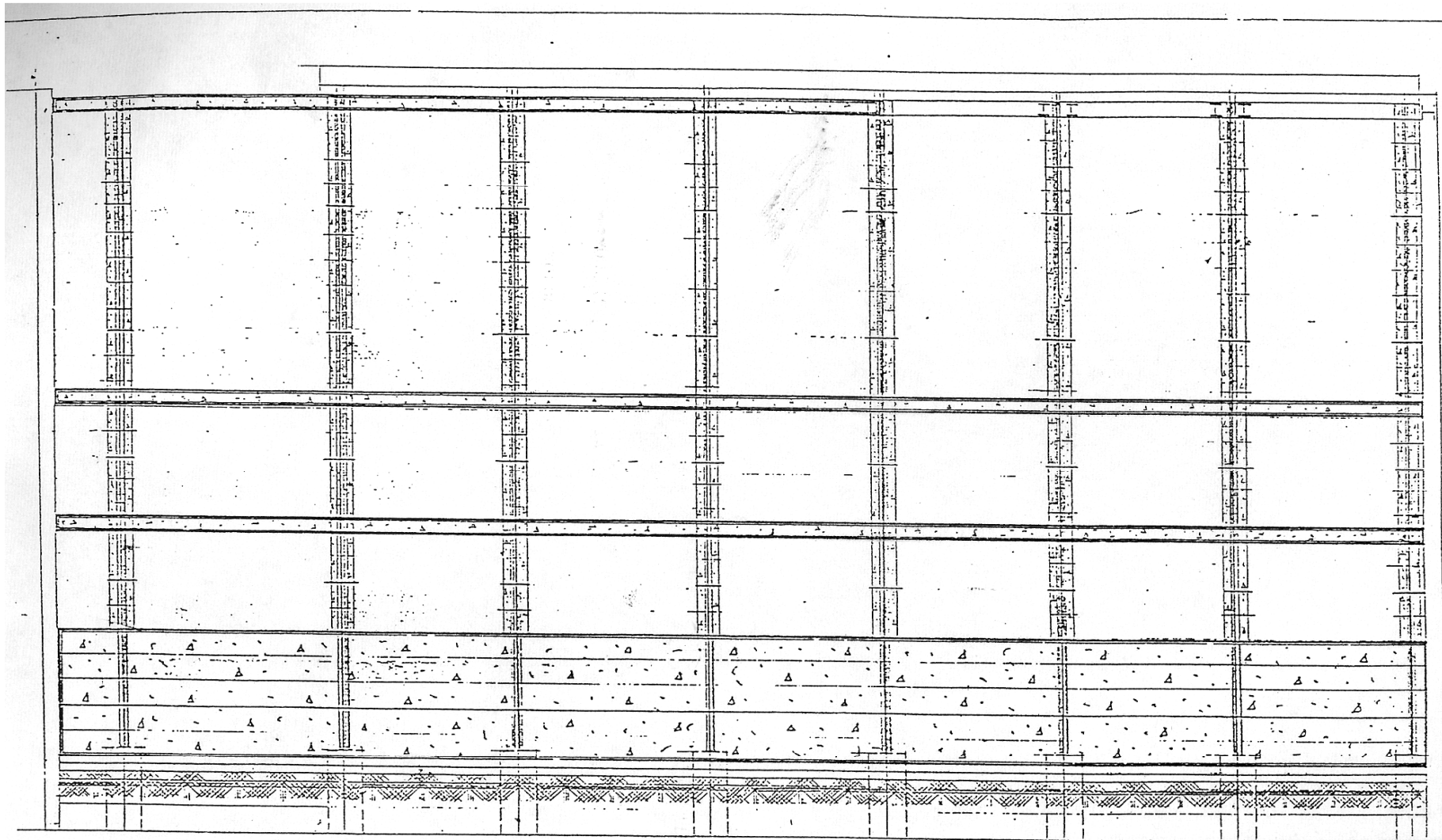
CHARTERED SQUARE – BANGKOK



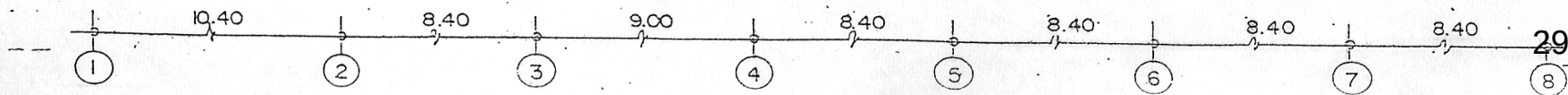
SECTION (B)-(B) AFTER COMPLETE B3



CHARTERED SQUARE – BANGKOK



SECTION (A) - (A) AFTER COMPLETE B3



THANK YOU

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