CLIENT:

APPAREL EXPORT LTD

REPORT ON:

ULTRASONIC PULSE VELOCITY

NAME OF PROJECT:

APPAREL EXPORT LTD

Tested By:

MM ENGINEERING
Quality Engineering Lab Equipment Importer & Provider

M M Engineering
Corporate Office:
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FIELD RECONNAISSANCE

Project Details:
UPV Test Report on Apparels Exports Ltd.

Location of the Site:
Technical, Darus Salam, Mirpur, Dhaka

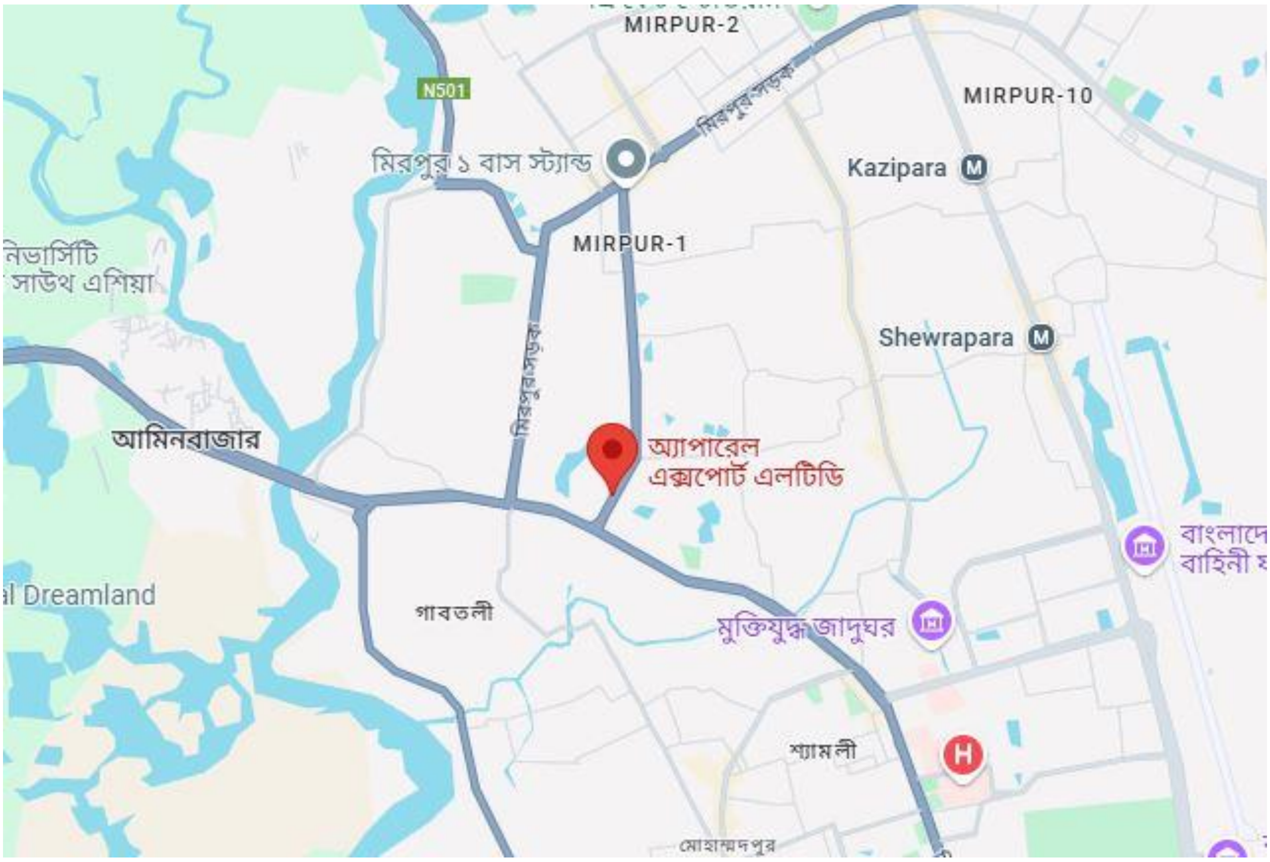


Figure: Project Location Map

Status of the Construction Works

We performed UPV test on this Bridge in 08-05-2025

PULSE VELOCITY TEST

Purpose of the Investigation

The pulse velocity method is an excellent means for investigating the uniformity of concrete. The testing procedures have been standardized by ASTM and IS with other organizations, and test equipment is available from several commercial sources.

- The pulse velocity method may provide a means of estimating the strength of both in situ and precast concrete.
- The pulse velocity method is suitable for the study of homogeneity of concrete, and, therefore, for relative assessment of quality of concrete. Heterogeneities in a concrete member will cause variations in the pulse velocity.
- Aggressive environments will damage the structure of concrete and decrease the pulse velocity.
- It is possible to compute the modulus of elasticity of a material if UPV measured where the values of Poisson's ratio and density are known or assumed.

Purpose of the Investigation

This test method covers the determination of the propagation velocity of longitudinal stress wave pulses through concrete. This test method does not apply to the propagation of
other types of stress waves through concrete. The pulse velocity (V) of longitudinal stress waves in a concrete mass is related to its elastic properties and density according to the following relationship:

$$V = \sqrt{\frac{E\,(1-\mu)}{\rho\,(1+\mu)(1-2\,\mu)}}$$

Where,
E = dynamic modulus of elasticity,
μ = dynamic Poisson's ratio, and
ρ = density.
After traversing through the concrete, the pulses are received and converted into electrical energy by a second transducer located a distance L from the transmitting transducer. The transit time T is measured electronically. The pulse velocity V is calculated by dividing L by T. The values stated in SI units are to be regarded as standard.

This test method is applicable to assess the uniformity and relative quality of concrete, to indicate the presence of voids and cracks, and to evaluate the effectiveness of crack repairs. It is also applicable to indicate changes in the properties of concrete, and in the survey of structures, to estimate the severity of deterioration or cracking. This test method can be used to assess the strength of concrete. A correlation can be processed through which compressive strength of concrete can be predicted without destruction of the concrete. Many factors are governing UPV including the richness of the mix with cement, w/c ratio, aggregate content, moisture condition and the existence of steel reinforcement.

METHODOLOGY OF INVESTIGATION

Introduction

An Ultrasonic Pulse Velocity (UPV) test is an in-situ, nondestructive test to check the quality of concrete and natural rocks. In this test, the strength and quality of concrete is assessed by measuring the velocity of an ultrasonic pulse passing through a concrete structure. This test is conducted by passing a pulse of ultrasonic through concrete to be tested and measuring the time taken by pulse to get through the structure. Higher velocities indicate good quality and continuity of the material, while slower velocities may indicate concrete with many cracks or voids.

Fundamental principle

A pulse of longitudinal vibrations is produced by an electro — acoustical transducer, which is held in contact with one surface of the concrete under test. When the pulse generated is transmitted into the concrete from the transducer using a liquid coupling material such as grease or cellulose paste, it undergoes multiple reflections at the boundaries of the different material phases within the concrete. A complex system of stress waves develops, which include both longitudinal and shear waves, and propagates through the concrete. The first waves to reach the receiving transducer are the longitudinal waves, which are converted into an electro signal by a second transducer. Electronic timing circuits enable the transit time T of the pulse to be measured.

Longitudinal pulse velocity (in km/s or m/s) is given by:

$V=L/T$

Where,

V is the longitudinal pulse velocity, L is the path length,
T is the time taken by the pulse to traverse that length.

Equipment for pulse velocity test

The equipment consists essentially of an electrical pulse generator, a pair of transducers, an amplifier and an electronic timing device for measuring the time interval between the initiation of a pulse generated at the transmitting transducer and its arrival at the receiving transducer. Two forms of electronic timing apparatus and display are available, one of which uses a cathode ray tube on which the received pulse is displayed in relation to a suitable time scale, the other uses an interval timer with a direct reading digital display. Time equipment should have the following characteristics. It should be capable of measuring transit time over path lengths ranging from about 100 mm to the maximum thickness to be inspected to an accuracy of ± 1%.

Generally, the transducers used should be in the range of 20 to 150 KHz although frequencies as low as 10 KHz may be used for very long concrete path lengths and as high as I MHz for mortars and grouts or for short path lengths.

High frequency pulses have a well-defined onset but, as they pass through the concrete, become attenuated more rapidly than pulses of lower frequency. It is therefore preferable to use high frequency transducers for short path lengths and low frequency transducers for long path lengths. Transducers with a frequency of 50 KHz to 60 KHz are suitable for most common applications

Measuring with Ultrasonic Instrument

The Ultrasonic Instrument can be used several applications including the following:

- Pulse velocity measurement
- Path length measurement
- Surface velocity measurement
- Crack depth measurement
- Estimating the dynamic elastic modulus of samples (with the shear wave transducer)
- Ultrasonic Instrument only. Estimating compressive strength using pulse velocity alone or in combination with a rebound hammer.

Transducer arrangement

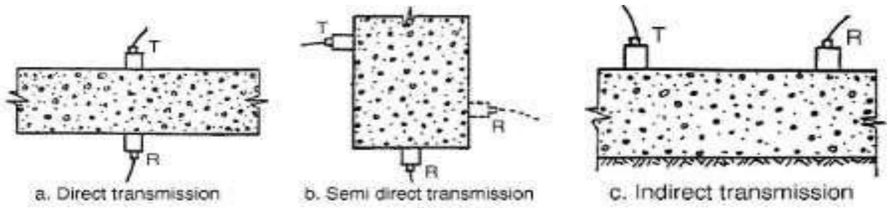
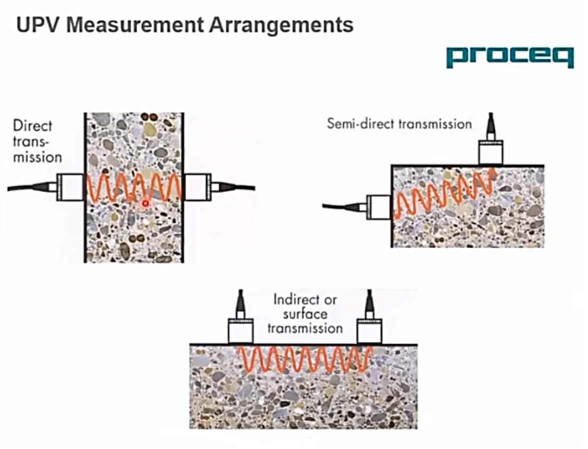


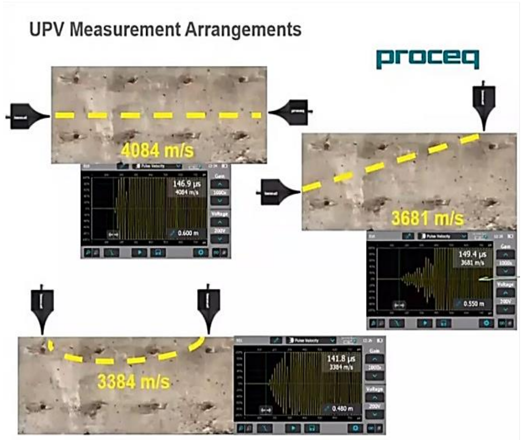
Fig. 3-18

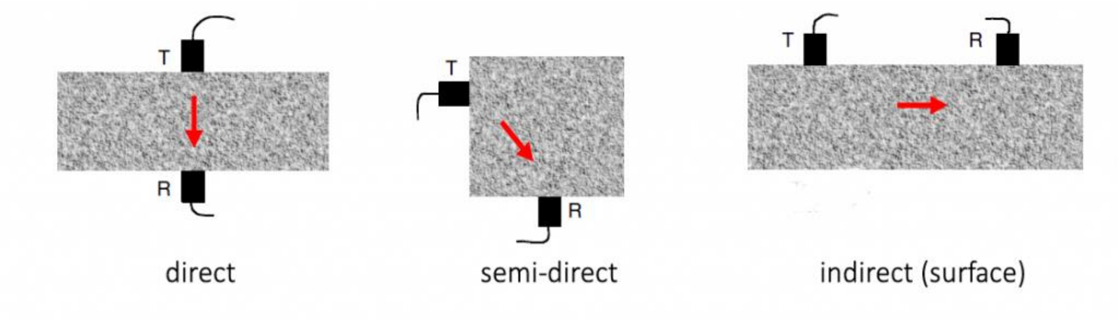
Three transducer arrangements are commonly used.

Wherever possible use the direct arrangement as this ensures the maximum signal transmission between the transducers. The semi-direct arrangement is less sensitive the distance between the centers of each transducer.

The indirect method is particularly useful for determining crack depth, surface quality or in the case when only one surface is accessible.







Preparation

Basic preparations are common to each application. The distance (path length) between the transducers should be measured as accurately as possible. It is very important to ensure adequate acoustic coupling of the transducers to the surface under test. A thin layer couplant should be applied to the transducer and the test surface. In some cases it may be necessary to prepare the surface by smoothing it. For compound measurements and uniformity, testing a test grid should be drawn out on the surface.

Rebar's affect the ultrasonic measurements as the signal will travel faster through the rebar than through the concrete. The location of rebar should be determined.

The standard measuring producer is:

- Apply the couplet.
- Positions the transducers.
- Perform the measurement.
- Repositions the transducers (Compound measurements only)
- Save the result

Testing Equipment Details

Name: Proceq Pundit Lab Ultrasonic Pulse Velocity Concrete Flaw Detector
Country of Origin: Switzerland
Frequency: 50 KHz
Calibration Time: 25.4 micro second
Transmitter Output: 1200 V

Codes & References

1. IS 13311-1: Standard Test Method for Pulse Velocity Through Concrete,
2. prEN 12504-4: Testing concrete - Part 4: Determination of Ultrasonic Pulse Velocity.
3. Non- Destructive Testing in Civil Engineering, Edited By Taketo Uomoto, Year2000.
4. Measurement of Thickness and Crack Depth in Concrete by Ultrasonic Methods Tetsuo Yamaguchi and Tatsuo Yamaguchi, ToyokoElmes Co; Ltd, Tokyo, Japan.
5. Detection of Ultrasonic Pulse Echo Through Steel Bar in Concrete Crack Depth Measurement Takayoshi Hi and Taketo Uomoto, Obayashi Corporation. TechnicalResearch Institute, And Center for Collaborative Research, University Of Tokyo, Japan.
6. Use of Ultrasound To Estimate Depth Of Surface Opening Cracks In Concrete Structures, Roberto C. A. Pinto, Arthur Medeiros, Ivo J. Padaratz, Patrícia B. Andrade, Civil Engineering Department, Federal University Of Santa Catarina; Florianópolis; Brazil.
7. Guidebook on non-destructive testing of concrete structures (2002), International Atomic Energy Agency, Vienna, Austria.
8. Malhorta, V.M. and Carino, N.J., (2004), Nondestructive Testing of Concrete, Second Edition, CRC Press, Washington, DC.
9. ASTM 597 Standard Test Method for Pulse Velocity Through Concrete

Results and Comments

DATA SHEETS & LOCATION OF DATA

Sl. No	Method of test	Sample ID	Floor	Transducers Distance (m)	Transit time T1 [μs]	Transit time T2 [μs]	UPV Value [m/s]	Remarks & Comments
1	Beam/Direct	1427	4th	0.240 m	75.4	-	3570	Good
2	Beam/Direct	1429	4th	0.290 m	79.2	-	3662	Good
3	Beam/Direct	1431	3rd	0.275 m	74.3	-	3701	Good
4	Beam/Direct	1432	3rd	0.275 m	77.1	-	3567	Good
5	Beam/Direct	1446	5th	0.270 m	82.2	-	3785	Good
6	Beam/Indirect	1421	5th	0.150 m	54.7	100.2	3297	Medium
7	Slab/Indirect	1439	3rd	0.165 m	46.9	91.6	3691	Good
8	Slab/Indirect	1441	3rd	0.165 m	49.5	93.2	3776	Good
9	Slab/Indirect	1434	4th	0.165 m	53.9	101.3	3481	Good
10	Slab/Indirect	1436	4th	0.165 m	62.7	104.5	3947	Good
11	Slab/Indirect	1418	5th	0.210 m	78.4	172.7	3237	Medium
12	Slab/Indirect	1444	5th	0.165 m	72.9	121.6	3388	Medium

MM ENGINEERING
Quality Engineering Lab Equipment Importer & Provider

M M ENGINEERING Dhaka Bangladesh

Project Name: APPERALS Export Ltd.
Project Location: Technical, Darus Salam Road, Mirpur, Dhaka Date: 8-05-2025

Sl No	Member Under Test	Sample Id	Transducer Distance (mm)	T1 (m/sec)	T2 (m/sec)	UPV Value (m/s)	Average Value (m/s)	
01	Beam/6: N-K	1927	240 mm	73.4	~~73.4~~	3570	–	4th/B
02	Beam/5+6: K	1429	290 mm	79.2		3662	–	4th/B
03	Beam/O-5:6	1431	275 mm	74.3		3701	–	3rd/B
04	Beam/O-5:6	1432	277 mm	77.1		3567	–	3rd/B
05	Beam/Q-6:9	1446	270 mm	82.2		3785	–	5th/B
06	Beam/C-9:12	1421	150 mm	54.7	100.2	3297	–	5th/B
07	Slab/O:N-6:9	1439	165 mm	46.9	91.6	3691	–	3rd/S
08	Slab/O:N-6:9	1441	165 mm	49.5	93.2	3776	–	3rd/S
09	Slab/Q:O-6:9	1434	165 mm	53.9	101.3	3481	–	4th/S
10	Slab/O:Q:5:6	1436	165 mm	62.7	104.5	3947	–	4th/S
11	Slab/O:N-6:9	1418	210 mm	78.4	172.7	3237	–	5th/S
12	Slab/O:Q-5:6	1449	165 mm	72.9	121.6	3888	–	5th/S
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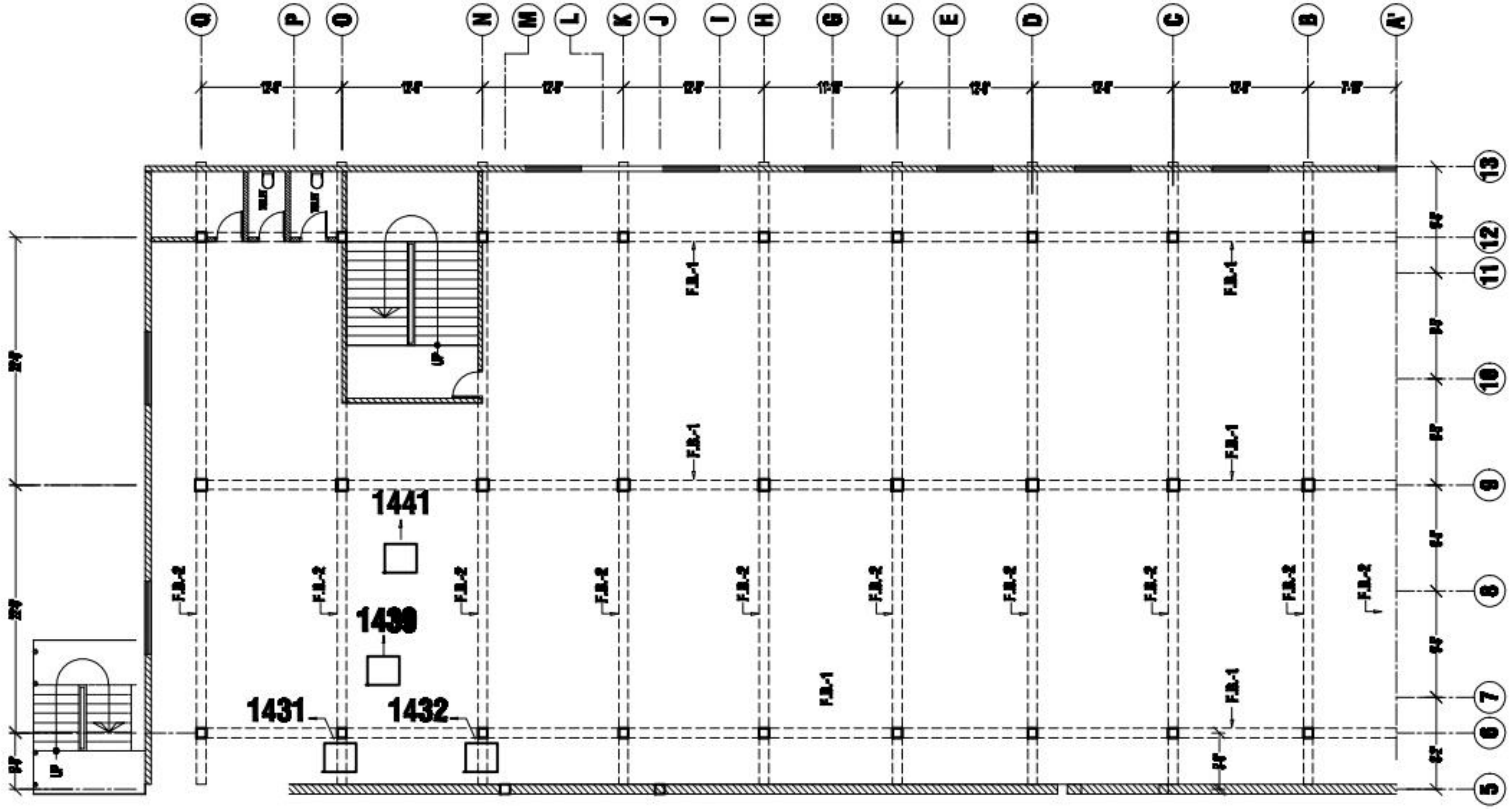
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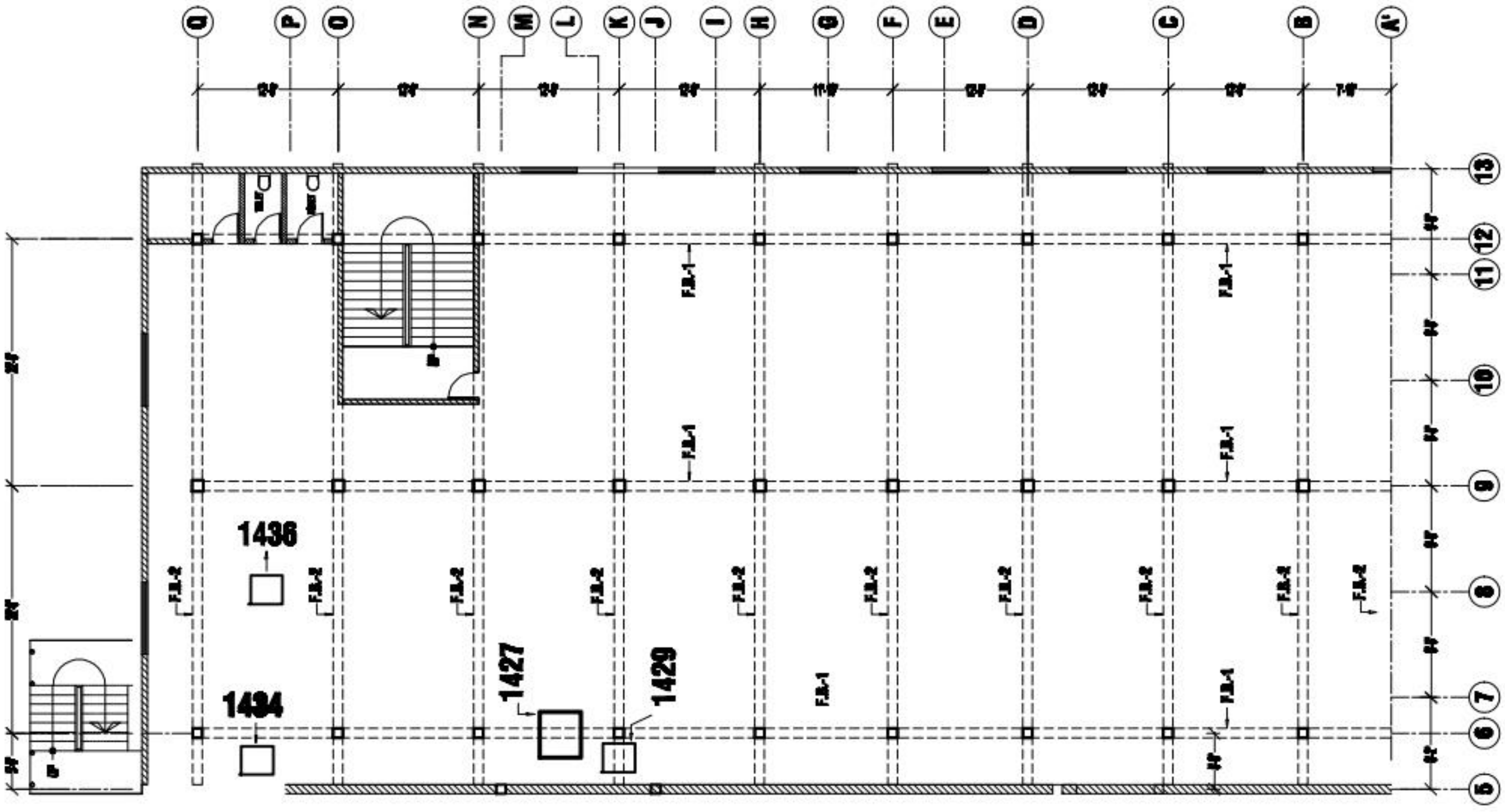
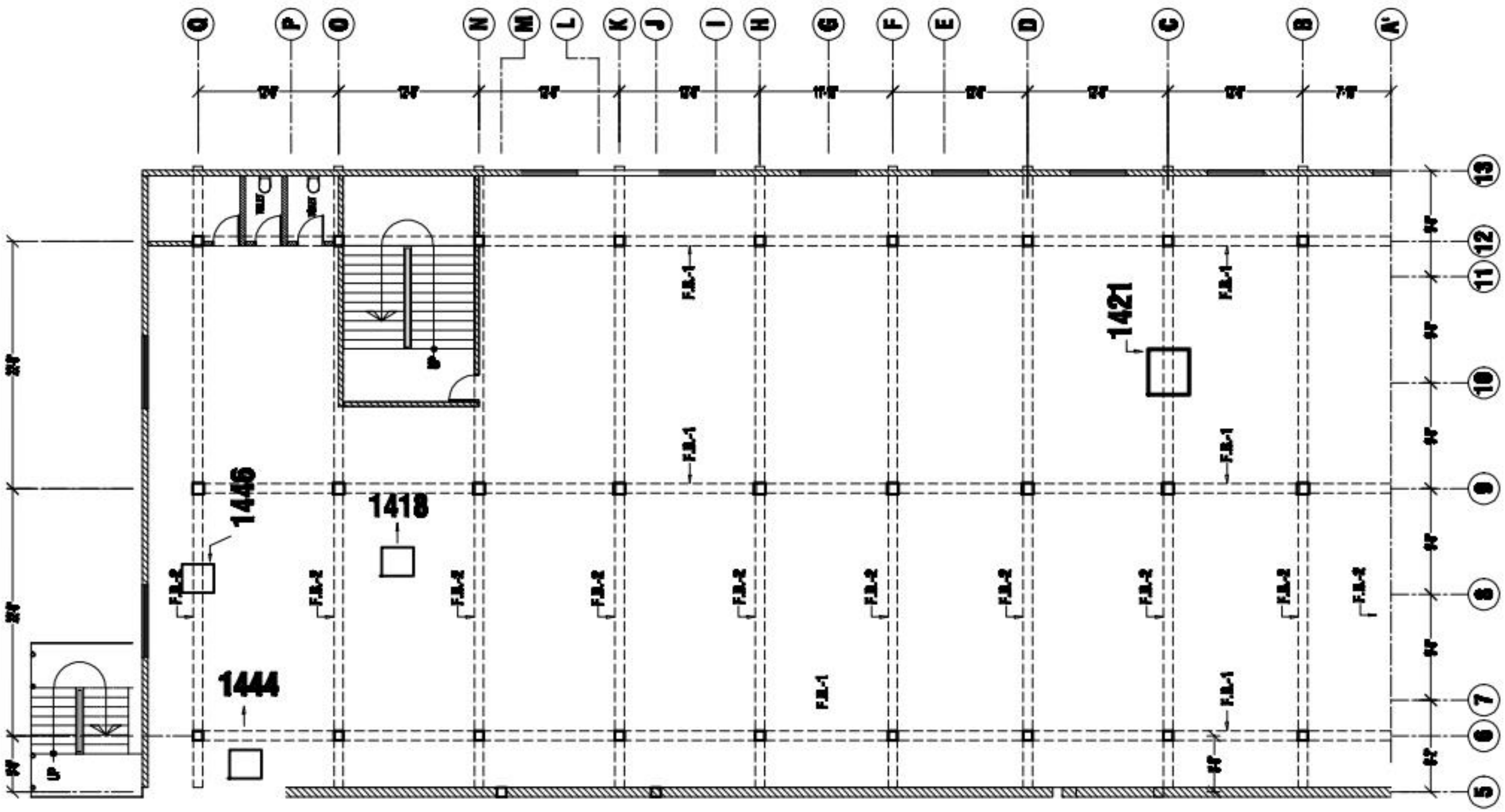
3rd Floor



4th Floor



5th Floor

Conclusions

According to ASTM Code C597 and Guidebook on non-destructive testing of concrete structures, International Atomic Energy Agency, Vienna, 2002, classification of the quality of concrete on the basis of pulse velocity are as follows:

Table: Velocity Criterion for Concrete Quality Grading:

UPV (m/s)	Concrete Quality
Above 4500	Excellent
3500 to 4500	Good
3000 to 3500	Medium
Below 3000	Doubtful

Results

Data	**Concrete Quality**	**Quality Percentage**
-	Excellent	-
9 Nos	Good	75 %
3 Nos	Medium	25%
-	Doubtful	-
	Total	**100 %**

Picture during Test: