



STRUCTURAL AND MATERIAL TESTING LABORATORY
CIVIL ENGINEERING DEPARTMENT, KMUTT

CERTIFICATE OF TESTING

Client : Hilti (Thailand) Ltd.
Address : 1858/107-108 Interlink Tower, 24th Fl., Bangna-Trad Road Bangna Bangkok 10260
Place of testing : King Mongkut's University of Technology Thonburi (KMUTT)
Subject : Pull-out Test of Mechanical Anchor
Code or standard : ASTM E488
Date of testing : 1/2/2017 – 21/3/2017

Our Report as Follow :

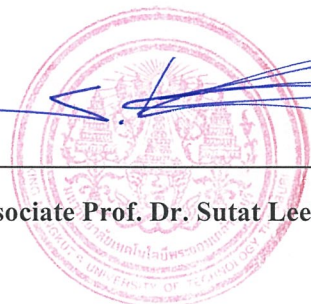
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Tested By : _____

(Dr. Raktipong Sahamitmongkol)

Checked By : _____

(Associate Prof. Dr. Sutat Leelataviwat)





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TEST REPORT

PULL-OUT STRENGTH OF MECHANICAL ANCHOR (ASTM E488)

Test Arrangement & Procedures :

1. The concrete specimens with size of 2400×1200×300 mm were produced and drill holes were made by using rotary hammer on the top surface (see Figure 1)
 2. The mechanical anchors (see Figure 2) were installed into the drilled holes by using tightening torque are following Table.1.
 3. The testing device as described in ASTM E488 was then installed to perform pull-out test (see Figure 3).
- The test configuration for each size of anchor is summarized in Table 1 and 2.



Figure 1: Concrete specimen with anchor bolt on top surface

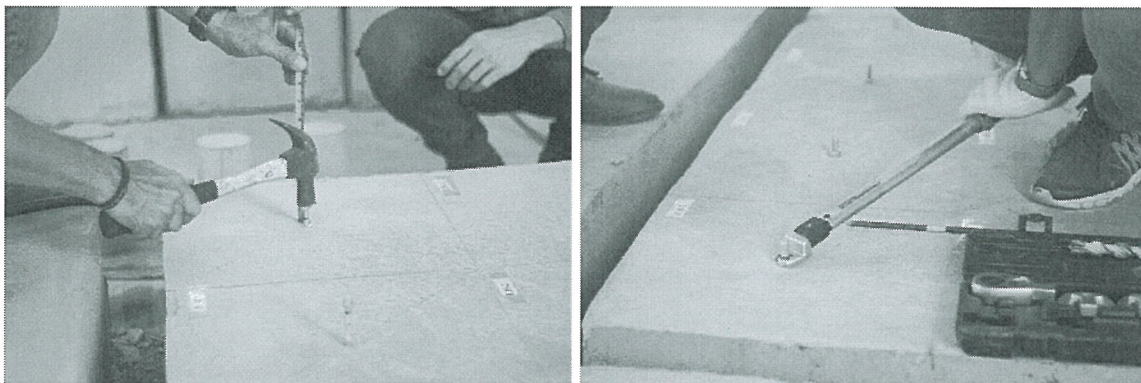


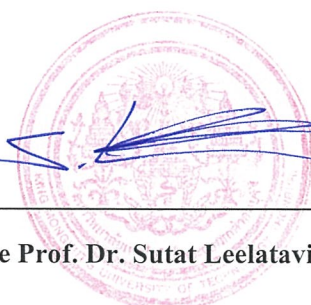
Figure 2: Mechanical Anchors (HST3)

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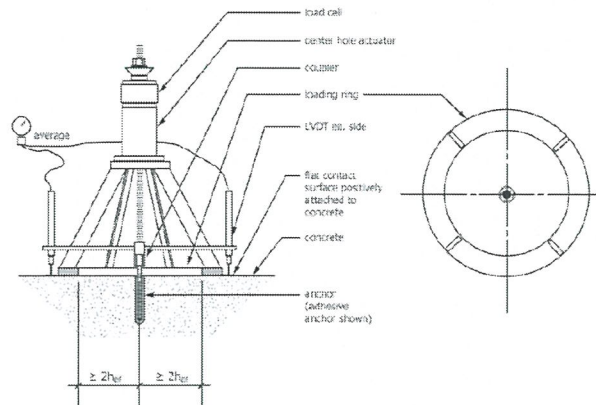


Figure 3: Unconfined pull-out test arrangement according to ASTM E488

- 4. Start the test by loading and recording until the measured load reaches the maximum value.
- 5. During the loading, the loads were recorded at the rate of 2 Hz.

Table.1 Test Configuration for Mechanical Anchor

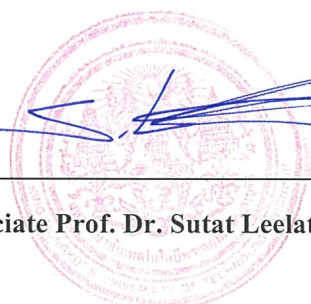
Type of Anchor	Dill Bit (mm)	Dia. Bolt (mm)	Embedment Length (mm)	Controlled Installation Torque (N.m)
Expansion	8	8	50	20
	10	10	60	45
	12	12	70	60
	16	16	85	110
	20	20	125	180

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Pull-out Strength of Mechanical Anchors :

Table.2 Pull-out Strength of Mechanical Anchors

No.	Bolt Diameter (mm)	Embedment Length (mm)	Peak Load (kN)	Average Peak Load (kN)	Failure Mode
1	M8	50	12.75	13.28	CB
2			14.53		CB
3			12.55		CB
1	M10	60	22.44	19.21	CB
2			17.99		CB
3			17.20		CB
1	M12	70	27.58	27.45	CB
2			30.25		CB
3			24.52		CB
1	M16	85	42.41	43.40	CB
2			40.53		CB
3			47.25		CB
1	M20	125	63.66	69.72	CB
2			69.29		CB+SP
3			76.21		CB+SP

Note : CB = Concrete Breakout , SF = Steel Failure , BF = Bond Failure , SP = Splitting of Concrete

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PULL-OUT STRENGTH OF MECHANICAL ANCHOR (ASTM E488)

Properties of Concrete :

Table.3 Mix Proportion of Concrete Used in the Pullout Test (Ready-Mixed Concrete).

Materials	Content
Cementitious Materials (kg/m ³)	326
Fine Aggregate (kg/m ³)	860
Coarse Aggregate (kg/m ³)	1070
Water (kg/m ³)	180
Admixture (cc)	875
Slump (cm)	10

Table.4 Density and Compressive Strength of Concrete. (Cylinder)

Specimen	Age (days)	Diameter (cm)	Height (cm)	Weight (g)	Density (kg/m ³)	Avg. Density (kg/m ³)	Compressive Strength (MPa)	Avg. Compressive Strength (MPa)
CC-1	17	10.1	19.95	3670	2297.26		22.72	
CC-2	17	9.99	19.83	3620	2330.16		23.22	
CC-3	17	10.03	19.46	3610	2349.05	2326.34	25.34	24.02
CC-4	17	9.98	19.60	3560	2323.07		24.34	
CC-5	17	9.99	19.43	3550	2332.14		24.47	
CC-6	19	9.92	19.73	3628	2380.99		25.58	
CC-7	19	10.01	19.69	3649	2354.91		28.36	
CC-8	19	10.90	19.85	3724	2011.53	2293.49	25.22	24.97
CC-9	19	9.98	19.71	3651	2371.54		21.33	
CC-10	19	10.01	19.96	3689	2348.52		24.36	

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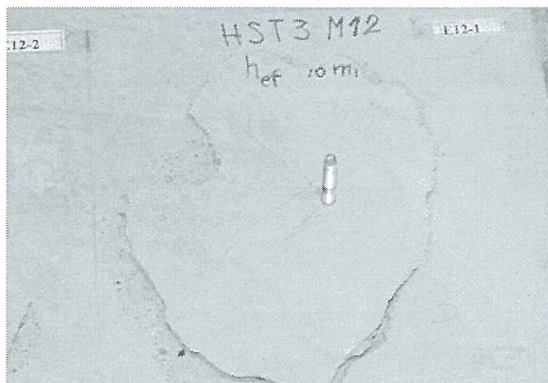
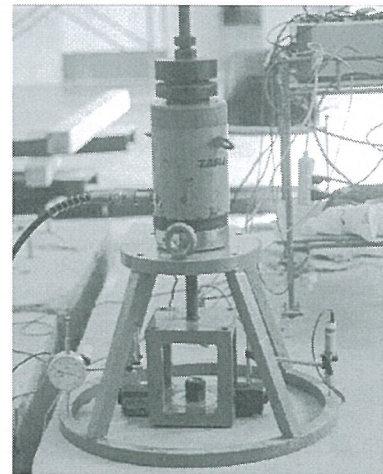
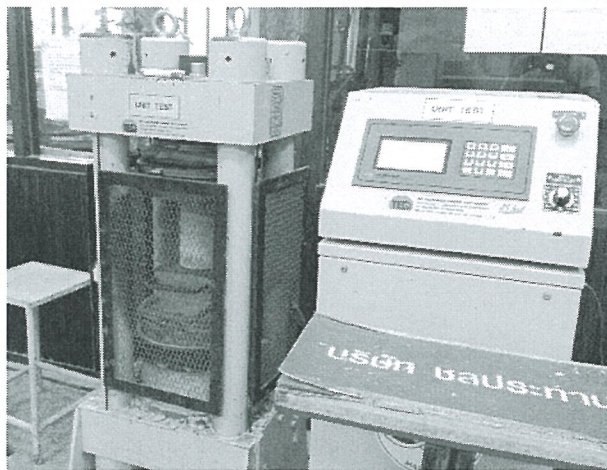
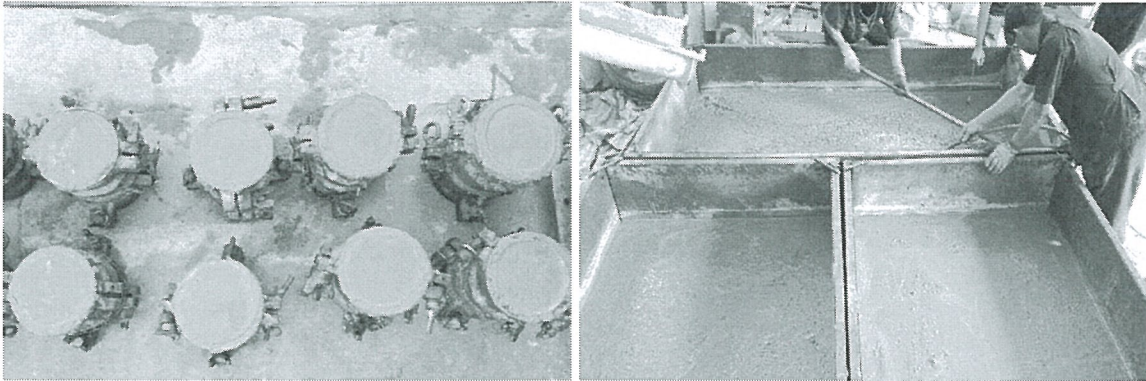


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PULL-OUT STRENGTH OF MECHANICAL ANCHOR (ASTM E488)

Photos of the Specimens and Testing :



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