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Laboratory Test Report

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Client: **Ferro Construction Products Co., Ltd.**
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Test: Hydrostatic Pressure Test on Cast-in Place Concrete Construction Joints with **FERROSTOP 415** Waterstop

1 INTRODUCTION

The main objective of this test is to determine the hydrostatic pressure capacity of **FERROSTOP 415** waterstop in preventing water leakages along construction joints of cast-in-place concrete. The test was designed to simulate jobsite conditions wherein the waterstop sample was installed along the construction joints of a specially made concrete test chamber and subjected to controlled hydrostatic pressures in the laboratory.

2 TEST SET-UP PREPARATION

A cylindrical concrete test chamber Ø0.60 m in diameter and 1.10 m high was prepared using conventional construction techniques. The concrete test chamber had a wall thickness of 200 mm (8") and reinforced by two rows of Ø12 mm steel bars with Ø9 mm lateral ties. In preparing the concrete test chamber, the following design mix was implemented:

Mix proportion of concrete per cubic meter:

Cement Type 1 (Elephant Brand)	*350 kg*
Fine aggregate, sand	*720 kg*
Coarse aggregate, 3/8"	*1,100 kg*
Water, W/C (0.46)	*160 kg*

The above concrete design mix had an average compressive strength of 292 kgf/cm^2 (4,153 psi) at curing age of 7 days based from previous tests conducted at the AIT Structural Engineering Laboratory.

The construction was carried out in three stages, i.e., base, lower wall and upper wall. For each construction joint, a sample of **FERROSTOP 415** waterstop was installed. To avoid displacement during concrete pouring, the waterstop material was fixed along the construction joints using nails. The installation was carried out following the instructions set by the manufacturer.

Before the upper wall was cast, a Ø0.35 m steel cylinder was welded on the vertical reinforcements such that about 0.30 m of its length will be left embedded during the final concrete pouring. To provide an airtight cover, a 20-mm thick steel plate was welded at the top of the steel cylinder.

After construction, the concrete test chamber was filled with water and allowed to cure for 14 days prior to the hydrostatic pressure tests. The sketch of the complete hydrostatic pressure test set-up is shown on Figure 1.

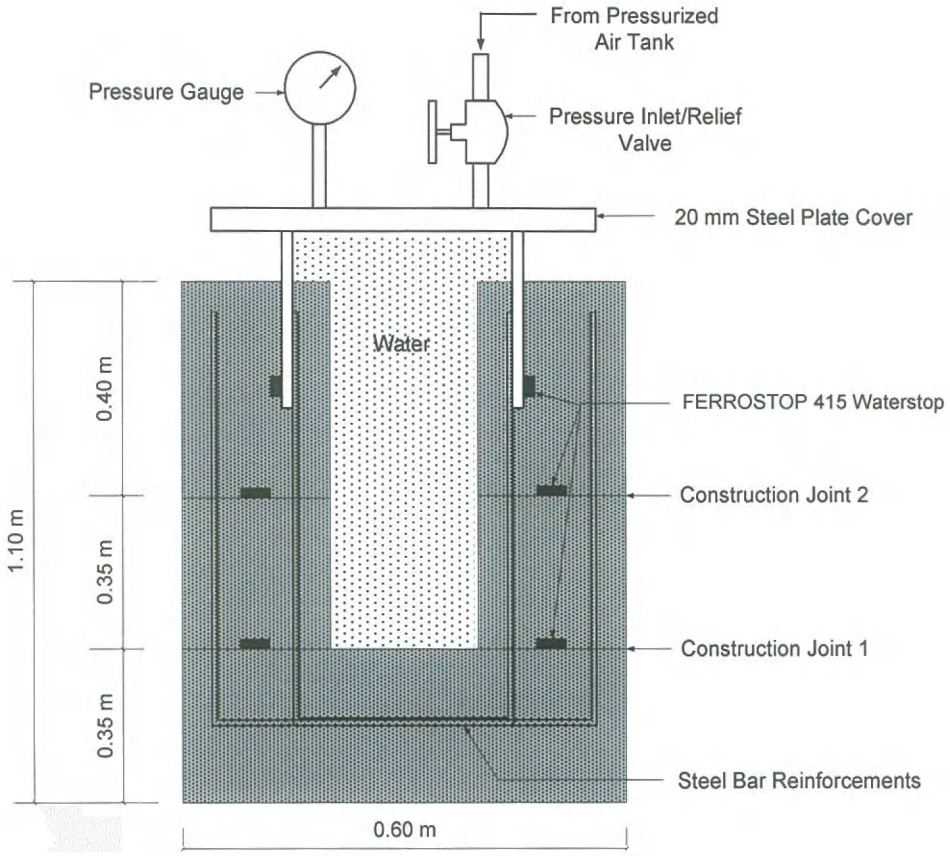

Figure 1. Sketch of the complete hydrostatic pressure test set-up

3 HYDROSTATIC PRESSURE TEST

The hydrostatic pressure test was carried out by supplying pressure inside the concrete test chamber starting at 40 psi (to facilitate testing) and gradually increasing by 10-psi increments every hour while monitoring the construction joints for any leakages. The pressure increments were continued until the waterstop material failed and leakages were detected along the construction joint.

4 TEST RESULTS

Time (hour)	Concrete Test Chamber Pressure (psi)	(m of water)	Remarks
Day 1, 10:00 hrs	40	28.2	no leakage at joints
Day 1, 11:00 hrs	50	35.2	no leakage at joints
Day 1, 12:00 hrs	60	42.3	no leakage at joints
Day 1, 13:00 hrs	70	49.3	no leakage at joints
Day 1, 14:00 hrs	80	56.3	no leakage at joints
Day 1, 15:00 hrs	90	63.4	no leakage at joints
Day 1, 16:00 hrs	100	70.4	no leakage at joints
Day 1, 17:00 hrs	110	77.5	no leakage at joints
Day 2, 8:00 hrs	120	84.5	no leakage at joints
Day 2, 9:00 hrs	130	91.5	no leakage at joints
Day 2, 10:00 hrs	140	98.6	Initial leakage at Joint 1
Day 2, 11:00 hrs	150	105.6	Leakage along Joint 1

** Pressure inside the concrete test chamber released after 17:00 HRS on Day 1. The hydrostatic pressure test was continued the following day with120 psi.*

5 CONCLUSION

Based from the sample tested and following the hydrostatic pressure test procedure described in this report, the **FERROSTOP 415** waterstop sample was found to be effective in preventing water leakage along the construction joints of the concrete test chamber up to a maximum hydrostatic pressure of 130 psi (91.5 m of water).

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Tests performed by:

Mr. Arturo G. Roa — *Senior Lab Supervisor*

30/9/2013
Date

Approved:

Prof. Mukand S. Babel — *WEM Coordinator*

30/9/2013
Date

Note:
Results obtained from this test are based on the material submitted as sample and testing conditions and procedures described in this report. No statement can be made on the precision or bias of this test method in relation with the actual performance in the field.

Reference:

Robert L. Nelson and Associates Inc. Construction Materials Laboratory, "A Study to Determine the Effectiveness of Swellable Waterstop Barriers in Concrete Joints".

Photograph 1 – **FERROSTOP 415** waterstop sample used in the test

Photograph 2 - **FERROSTOP 415** installed along the construction joint of the concrete test chamber.

Photograph 3 – Concrete test chamber with 140 psi (98.6 m water) pressure. No leakage along the construction joints were noted.

Photograph 4 – Concrete test chamber with 150 psi (105.6 m water) pressure. Initial Leakage occur along construction joint 1.

Photograph 5 – Increased leakage along the construction joint at 160 psi (112.7 m water) pressure.