



**Davroc Testing Laboratories Inc.'s
On-Site Lok-Testing
Protocol Testing and
Reporting Testing Results**

The following is Davroc Testing Laboratories Inc.'s Protocol for On-site Lok-Testing and Reporting of Test Results.

In severe cold weather conditions more care is required on projects where we are conducting Lok-Testing to determine the strength of concrete for formwork removal times and/or post tensioning times.

The following are some points to take into consideration.

1. No Lok-Testing of concrete is to take place in situations where concrete temperatures in-situ are suspected of being less than 0°C (frozen state).

Concrete that is approximately 10 MPa in an unfrozen state and then subjected to below 0°C temperature (ie. frozen state) will yield artificially high compressive strength results in the order of 30 to 35 MPa.

2. Site Lok-Test technician should gather the following data prior to performing Lok-Testing.
 - i) Enclosure temperature at random representative locations throughout the enclosure.
 - ii) Has top surface protection been provided, if so details, type and coverage.
 - iii) Ambient temperature at time of testing.
 - iv) Air temperature under the top surface protection.
 - v) Visually examine the top surface of the concrete for evidence of frost damage particularly at the edges for the slab at the worst exposed conditions. This visual examination should be made on pieces of concrete removed from the edges of the slab. Technician staff will be trained to distinguish concrete that has been subjected to frost damage. Examples of frost damaged concrete will be reviewed with Mr. Sal Fasullo.
 - vi) If the above observations yield no potential problems the Lok-Testing of the slab can commence.



Evaluation of Lok-Test Results

The following is our standard procedure to evaluate in-place Lok-Test results against limits set by the project structural engineer.

The steps detailed below must be followed without exception.

1. Make tests on site and record results. Use the pull-out force versus strength conversion chart established for the specific concrete mix being used on the project.
2. Calculate the "mean strength", "standard deviation" and "minimum strength".
3. "Minimum Strength" is the mean strength minus the standard deviation multiplied by a factor K (for 10 results - $k = 1.67$). Other k factors are listed at the end of the Protocol Document.
4. The "Minimum Strength" value is the minimum strength of any part of the concrete in the pour to 95 percent confidence limits.
5. The results are then back-checked by telephone to Davroc authorized persons in our office.

No Lok-Test results are to be released on site without back checking the test data and field observations with an authorized Davroc personnel (ie. project engineer, project manager etc.).
6. The results are then given to the authorized person on site, signed by our field representative who obtains the authorized person's signature on our copy. The form used designates the limits of the pour in questions and states whether or not the forms can be stripped/stressing can commence.
7. Copies of our report are subsequently sent to all interested parties.

The safety and liability implications of on site Lok-Testing are enormous and should not be taken lightly.

Attached is a copy of the Lok Test Site Data Sheet which should be completed each time we visit the site to carry out Lok-Testing.



File: L00-0194CM

Greater Toronto Airport Authority

April 10, 2000

Attn: Mr. ?

Dear Sir;

*Testing of In-Place Strength
Lester B. Pearson International Airport
Groundside Subproject - Parking Garage*

The following are the results of Lok-Test Tests on concrete at the above location.

Location: _____

	Date	Time	Individual Results (MPa)		
Pour			1.	6.	11.
Test			2.	7.	12.
			3.	8.	13.
Proposed time for from removal			4.	9.	14.
			5.	10.	15.
Number of Tests Made					
Mean In-Place Strength (MPa)					
Standard Deviation (MPa)					
Calculated Minimum In-Place Strength (MPa)					

Remarks

Requirements of XXX MPa mean and XXX MPa minimum prior to from removal/stressing/reshoring are/are not met by the above results.

We trust the above is satisfactory. Should you require any further information please do not hesitate to contact the undersigned.

SF/ac

Dist: Client 2 copies
LE 4 copies
PM 2 copies
CM 2 copies
Contractor 1 copy

Yours very truly,

Sal Fasullo, C.E.T.
Vice President

Lok-Test On-Site Data Sheet



File No.:	Project Name:
Location on Structure:	
Date of Pour:	Time:
Date of Test:	Time:
Pour Size: _____ m ³	

Test Results

Bolt No.	Dial Reading (kN)	Strength (MPa)	Bolt No.	Dial Reading (kN)	Strength (MPa)
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

Calculations:

X Mean In-Place Strength: _____ MPa
 SD Standard Deviation: _____ MPa
 Minimum In-Place Strength: _____ MPa
 Minimum In-Place Strength _____ X - (k x SD)

Maturity Test:

Type of Meter: Coma/Electronic Meter Reading: 1. _____ Days/°C Hours
 2. _____ Days/°C Hours
 Calculated Maturity Strength: _____ MPa
 Calculated Average Slab Temperature: _____ °C

Curing Conditions:

Ambient Temperature at Time of Test: °C
 Enclosure Temperature at Time of Test: °C
 Top Surface of Slab Protected: Yes/No - Tarps/Insulation Blankets
 Appearance of Concrete on Top Surface:

Remarks: _____

Technician: _____ **Checked By:** _____

Table No. 1
Constants k for Different Numbers of
Pull-Out Inserts Tested in a Pour

n	3	4	5	6	7	8	9	10	11	12	13	14
k	2.50	2.13	1.96	1.86	1.79	1.74	1.70	1.67	1.65	1.62	1.61	1.59
n	15	16	17	18	19	20	25	30	35	40	45	50
k	1.58	1.57	1.55	1.54	1.54	1.53	1.50	1.47	1.46	1.44	1.43	1.43



2051 Williams Parkway
Units 20 and 21
Brampton, Ontario
Canada, L6S 5T4

Evaluation of LOK-TEST Results

The following is our standard procedure to evaluate in-place LOK-TEST results against limits set by the project structural engineer.

In presenting our results we follow the following steps:

1. Make tests on site and record results.
2. Calculate mean strength, standard deviation and "minimum strength".
3. "Minimum Strength" is mean strength minus the standard deviation multiplied by a factor k (for 10 results $k= 1.67$).
4. This value is the minimum strength of any part of the concrete in the pour to 95 percent confidence limits.
5. The results are then back checked by telephone by authorized persons in our office.
6. The results are then given to the authorized person on site, signed by our field representative who obtains the authorized person's signature on our copy. The form used designates the limits of the pour in question and states whether or not the forms can be stripped.
7. Copies of our report are subsequently sent to all interested parties.

I have read the above and understand that I must never deviate from this procedure.

Signed: _____

Witnessed by: _____

Name: _____

Date: _____



2051 Williams Parkway
Units 20 and 21
Brampton, Ontario
Canada, L6S 5T4

Project:

May __, 201_

Client's Name

Address

Address

Address

Attention:

Dear Sir:

In-Place Testing

Address

Address

With reference to our recent telephone conversation, we are pleased to provide you with our proposed in-place concrete testing services for the above mentioned project location.

From our discussions, we understand that there will be a total of _ slab pours of approximately 100m³ of concrete in size that will require in-place testing to determine form removal times.

PROPOSED IN-PLACE TEST METHOD

For the in-place testing of the structural floor slabs, we propose to use the Lok-Test system supplemented with disposable maturity meters.

We proposed to use a total of fifteen (15) Lok-Test inserts and two (2) disposable maturity meters per floor pour. The disposable maturity meters would be used to determine the approximate strength level of the concrete and the Lok-Test system would be used to physically measure the compressive strength of the concrete in-place.

Results of the Lok-Tests will be made available on-site at the time of testing through our on-site reporting form. A blank copy of this on-site form is attached for your information.

Project:

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The initial Lok-Test insert installations will be carried out by Davroc Personnel during which time the contractors personnel will be trained to carry-out the Lok-Test insert installation for subsequent slab pours.

We will require at least 48 hours notice for the initial Lok-Test inserts installation and at least 24 hours notice for Lok-Testing of slab pours.

We understand that the specified minimum 28 day compressive strength of the concrete is 30 MPa and that the following form removal strength limits will apply to the project.

Mean Lok-Strength	21 MPa minimum
*Calculated Minimum In-Place Strength	19 MPa minimum

*The minimum in-place strength is calculated as follows:

Minimum In-Place Strength $= \bar{x} - k \cdot sd$

X= Mean Lok-Test Strength (MPa)

K= Constant depending on the number of Lok-bolts tested

sd= Standard Deviation for the set of Lok-Tests.

The attached table outlines our summary of costs for the Lok-Test System.

We trust this provides you with the information you require, if not please do not hesitate to contact this office.

**Yours truly,
DAVROC TESTING LABORATORIES**

**Sal Fasullo, C.E.T
Vice President**