



Detroit Testing Laboratory, Inc.

7111 E. 11 Mile Road, Warren, MI 48092-2709 • (586) 754-9000 • FAX (586) 754-9045 • www.dtl-inc.com

TEST REPORT

**REDDI-WALL INC.
1075 ROCHESTER RD.
OAKLAND, MI 48363**

**DTL REPORT NO5111052 REV1
REPORT DATE 03/22/06
RECEIVE DATE 06/30/05
CUSTOMER REF 517**

ATTN: MR. ROBERT MARTIN

SAMPLE DESCRIPTION

Two Insulated Concrete Wall Sections, 11 ft. long by 5 ft. wide by 10 in. thick. One concrete wall section was cut in half length-wise and tested at 11 ft. long by 2.5 ft. wide by 10 in. thick.

WORK REQUESTED/TEST SPECIFICATIONS

Compressive Load testing to 125,000 lbs. per Reddi-Wall, Inc. e-mail request dated 10/20/05 and as described in the procedure section of this report.

CONCLUSION

To be determined by Reddi-Wall, Inc.

TEST RESULTS

Procedure

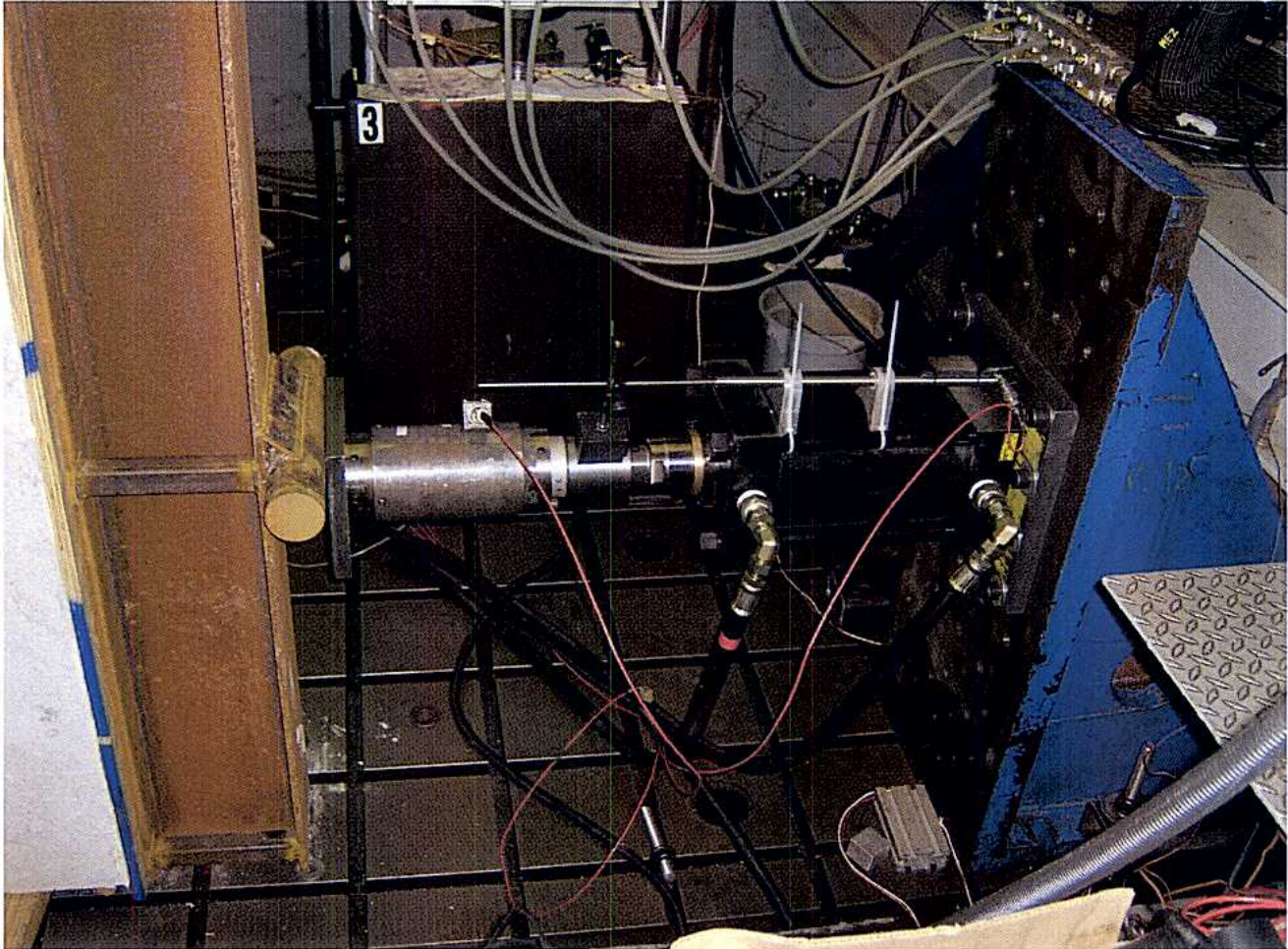
The test consisted of rigging the insulated concrete wall section onto its side (i.e. 5 ft. or 2.5 ft. width was oriented vertically), with one end fixed to ground and the other end attached to a compressive loading actuator. Quasi-static loading was applied in 10,000 lb. increments, under load control, to a maximum compressive load of 125,000 lbs.

The test was setup per the following setup photographs for both the full concrete wall section and the half concrete wall section. The concrete wall section was rigged into position on its side and a $\frac{3}{4}$ inch thick by 10 inch wide by 5 ft. long piece of plywood was set along each end to provide uniform loading. One end was reacted against ground via plywood and steel I-beam, and the other end was attached to a hydraulic actuator via plywood, steel I-beam and 3 inch diameter round steel bar. The round steel bar provided a horizontal line of contact between the actuator and concrete form at mid-height (2.5 ft. for the full wall section). The intent was to provide balanced loading above and below the line of actuator load application. However, this produced a hinge point and the concrete form raised up under 90,000 lbs. of compressive load. The 3 inch diameter round steel bar was therefore removed from the setup and the actuator 8 inch square loading plate was applied directly to the end of the concrete form (via plywood and steel I-beam). This removed the hinge point and the maximum required load of 125,000 lbs. was achieved. The same setup was used for the half wall section, with the line of actuator load application at the mid-height point, 1.25 ft.

A dial indicator was placed at the center of the concrete wall section to measure lateral displacement under compressive load. The actuator compressive load and actuator compressive displacement were recorded. The usefulness of the actuator compressive displacement is questionable, because it includes the compression of the $\frac{3}{4}$ inch plywood and steel I-beams on each end of the loading form (i.e. it does not represent the compressive displacement of just the concrete form, it includes the compressive displacement of fixturing also).

A quasi-static load was applied in 10,000 lb. increments to a maximum of 125,000 lbs.

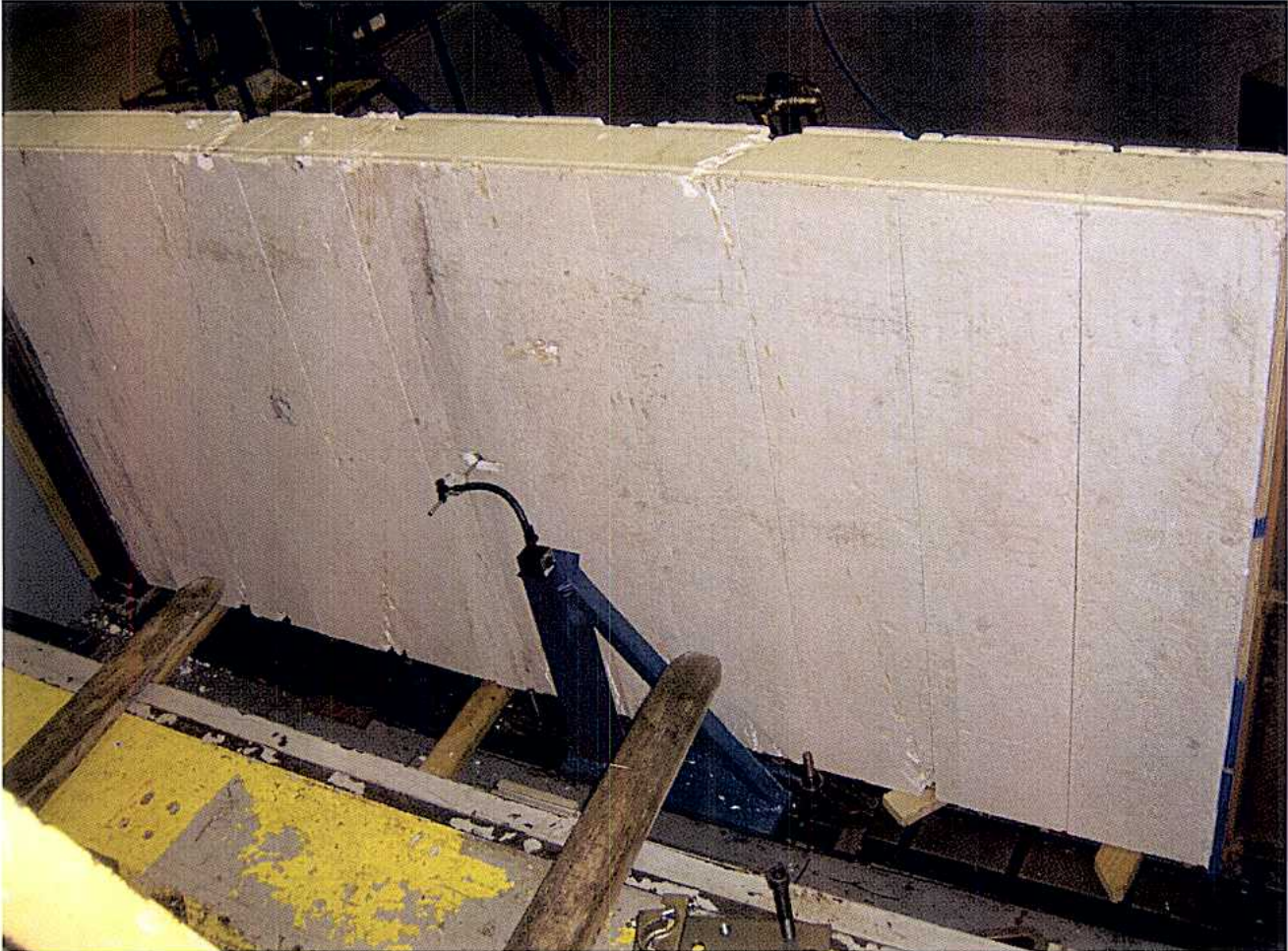
TEST RESULTS CONTINUED



Photograph 1: Full-Wall Test Setup – Actuator End

Note: Round steel bar was removed for final test setup used.

TEST RESULTS CONTINUED



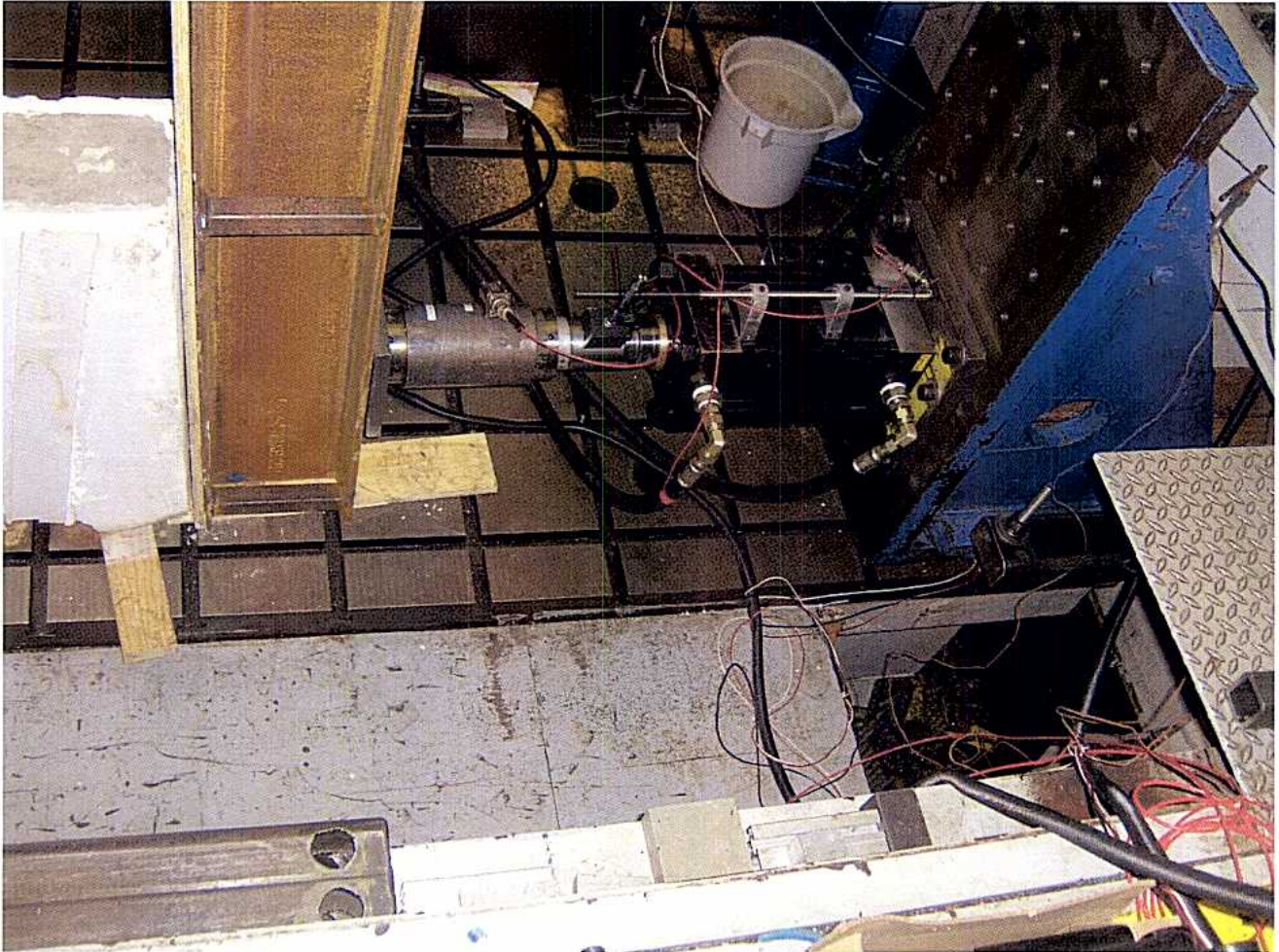
Photograph 2: Full-Wall Test Setup - Dial Indicator

TEST RESULTS CONTINUED



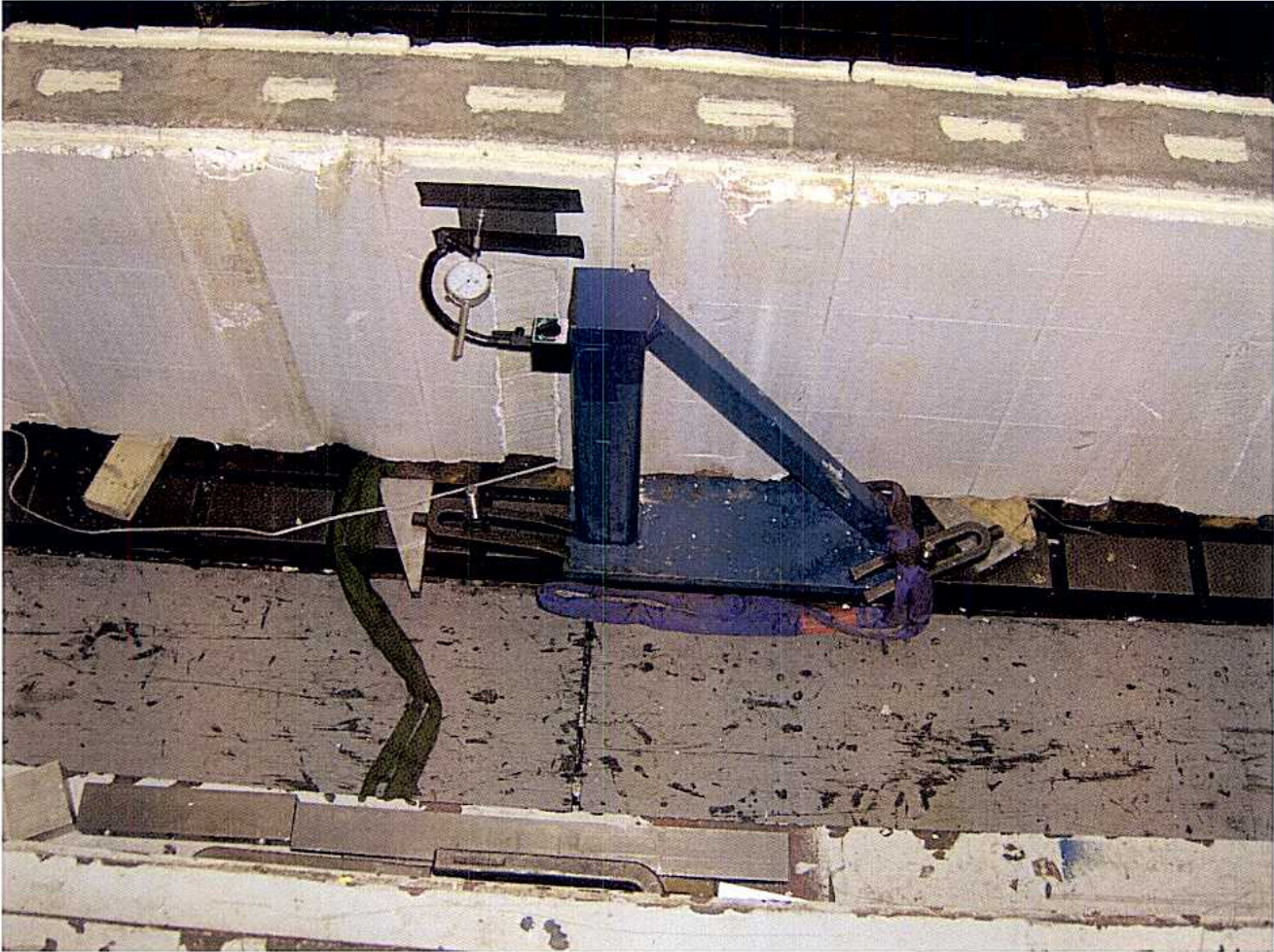
Photograph 3: Full-Wall Test Setup - Grounded End

TEST RESULTS CONTINUED



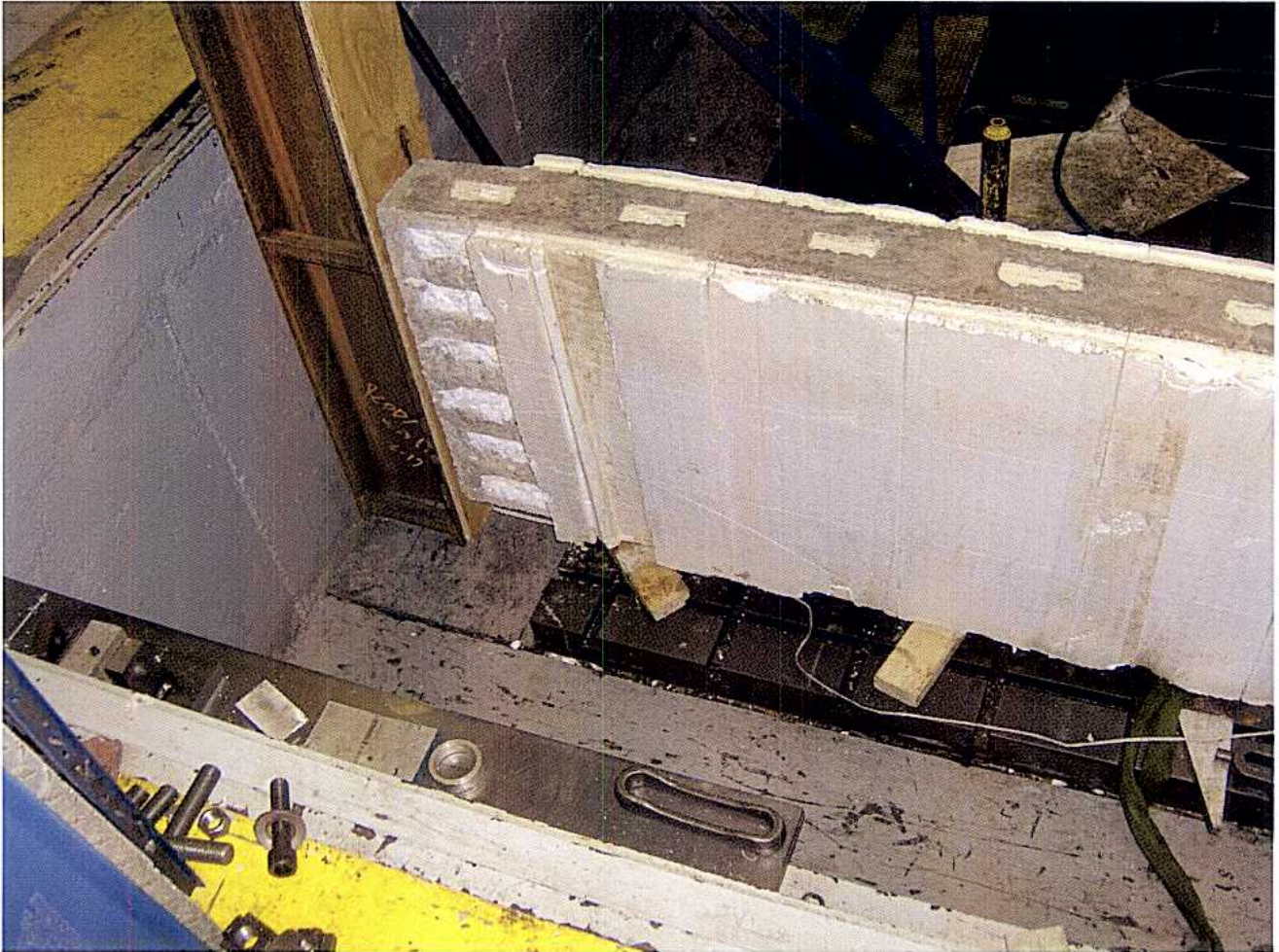
Photograph 4: Half-Wall Test Setup – Actuator End

TEST RESULTS CONTINUED



Photograph 5: Half-Wall Test Setup - Dial Indicator

TEST RESULTS CONTINUED



Photograph 6: Half-Wall Test Setup - Grounded End

TEST RESULTS CONTINUED

Results

All testing was performed from 02/14/06 to 02/17/06.

The concrete full-wall section sustained a maximum load of 125,120 lbs. without incident and the concrete half-wall section sustained a maximum load of 121,510 lbs. without incident.

The half-wall section was retested by rotating the $\frac{3}{4}$ inch plywood 90 degrees on both ends so that a 10 inch square section of the half-wall concrete section was loaded at mid-height. A maximum load of 68,000 lbs. was achieved at which time the support fixturing came loose as a result of the hinge effect caused by the relatively small contact area for load application.

The cross section of the insulated concrete wall section consisted of 2 inches of insulation, 6 inches of concrete and another 2 inches of insulation. The cross-sectional area of the load bearing concrete for the full wall section was therefore 6 inches x 60 inches = 360 in², and for the half wall section was 6 inches x 30 inches = 180 in². The maximum compressive stress for the full wall section and half wall sections were:

Full-wall max compressive stress: $125,120 \text{ lb}/360 \text{ in}^2 = 360 \text{ psi}$

Half-wall max compressive stress: $121,510 \text{ lb}/180 \text{ in}^2 = 675 \text{ psi}$

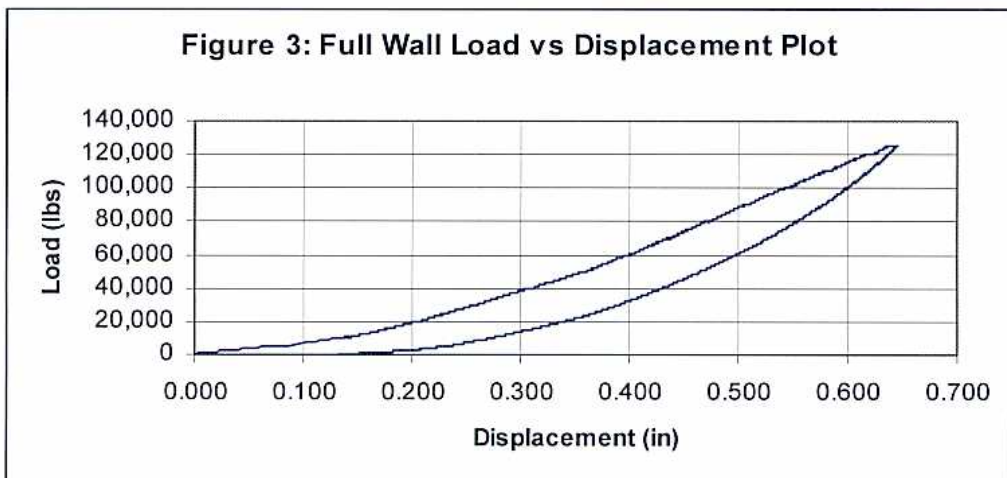
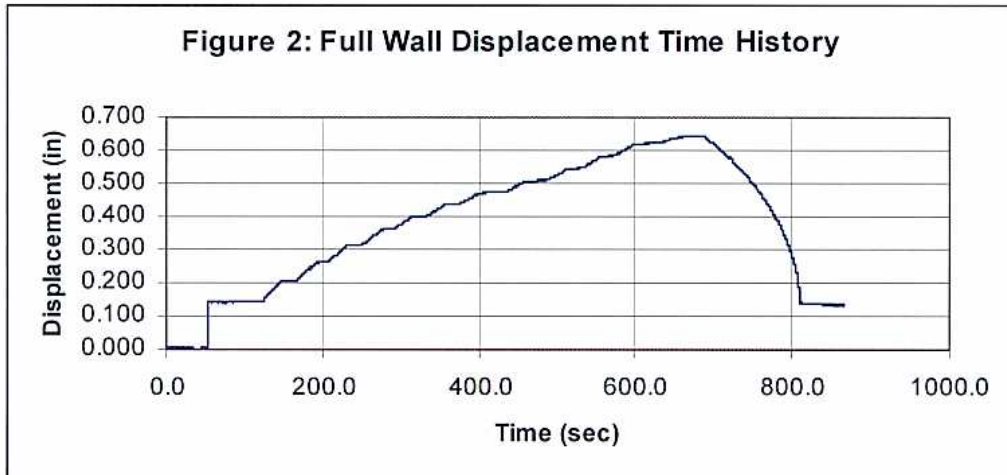
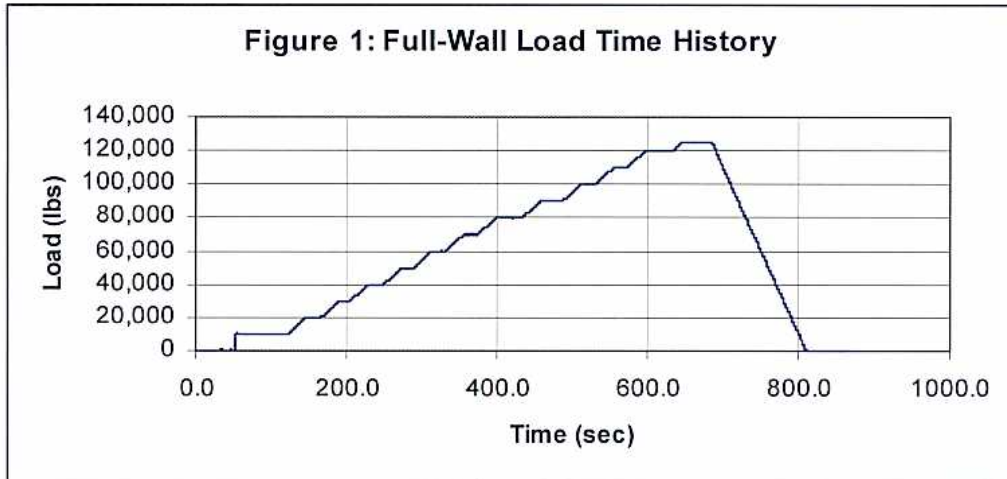
The actuator compressive load and displacement time histories and actuator compressive load vs. displacement plots are shown in Figures 1 - 6 for both full and half wall tests.

The lateral displacements for the full and half wall sections are listed in Tables 1 and 2, respectively.

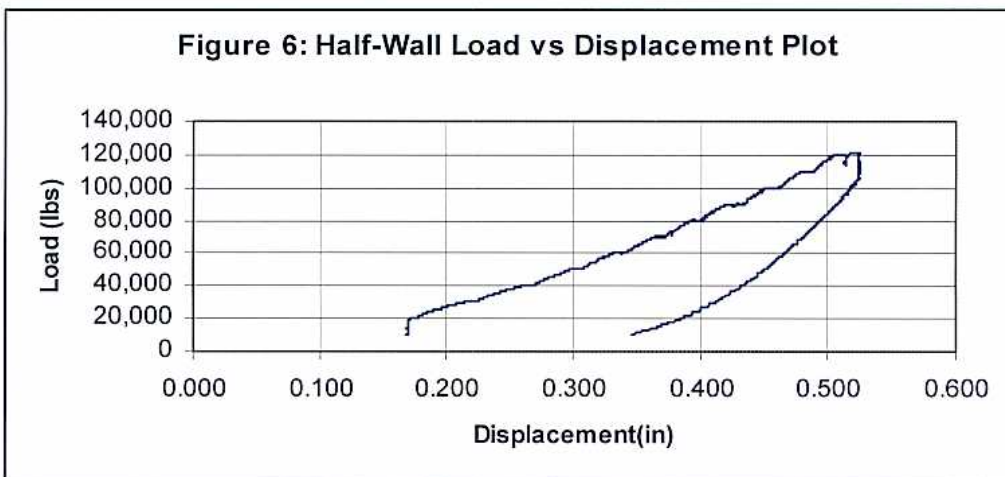
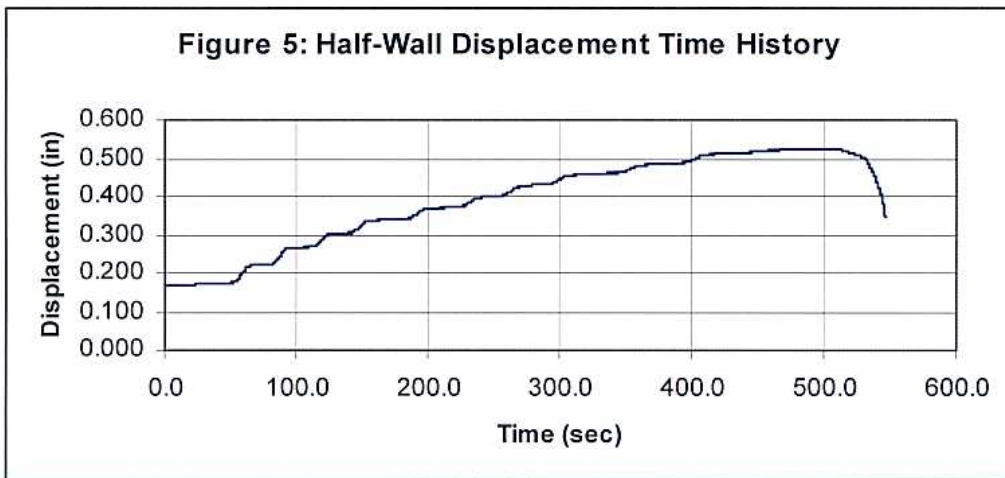
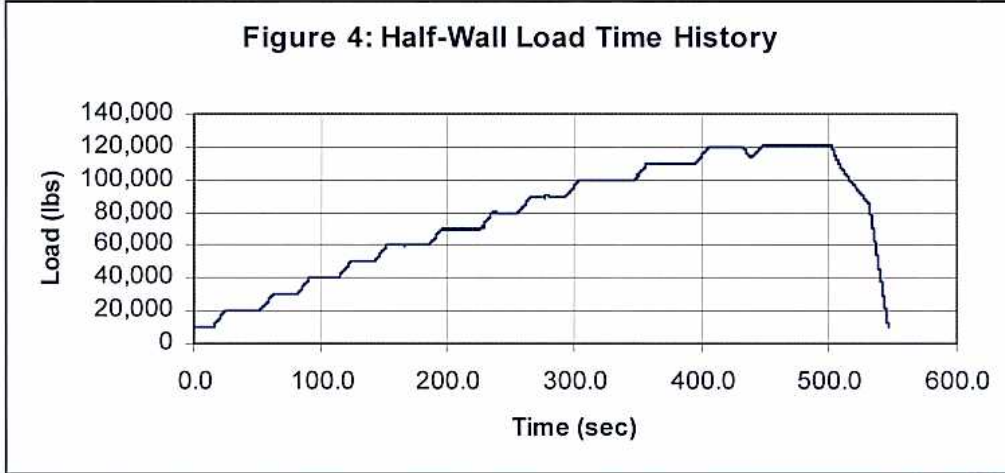
All of the data collected are in Excel spreadsheets which are supplied on a CD in Attachment A. All of the setup photographs are also on the CD in Attachment A.

A dynamic load was inadvertently applied to the full wall during the first attempt at the compressive load test. The dynamic load occurred when the load loop went unstable due to the hinge effect of the 3 inch diameter round bar used at the actuator loading point. The 3 inch round bar was removed from the set up due to this hinge effect and resulting instability. The inadvertent dynamic loading was recorded and is presented in Attachment B.

TEST RESULTS CONTINUED



TEST RESULTS CONTINUED



Note: Recording on the Half-Wall started at 10,000 lbs.

TEST RESULTS CONTINUED

Table 1: Full Concrete Wall Section - Lateral Displacement

Compressive Load (lbs.)	Lateral Disp (in.)
10,000	0.000
20,000	0.031
30,000	0.060
40,000	0.079
50,000	0.093
60,000	0.094
70,000	0.087
80,000	0.078
90,000	0.063
100,000	0.044
110,000	0.028
120,000	0.010
125,000	0.000

Note: Dial indicator zeroed at 10,000 lbs.

Table 2: Half Concrete Wall Section - Lateral Displacement

Compressive Load (lbs.)	Lateral Disp (in.)
10,000	0.000
20,000	0.006
30,000	0.006
40,000	0.005
50,000	0.006
60,000	0.010
70,000	0.017
80,000	0.020
90,000	0.028
100,000	0.040
110,000	0.052
120,000	0.066
125,000	0.070
10,000	0.056

Note: Dial indicator zeroed at 10,000 lbs

TEST EQUIPMENT

Detroit Testing Laboratory, Inc.'s calibration system meets the requirements of ISO 17025:1999.

Digital ServoController, FCS-Moog, Model SmarTestone, Channel 1, I.D. #00842, Calibrated to 01/26/07.

Load Cell, Lebow , Model 100K, I.D. #10800, Calibrated to 10/18/06.

Digimatic Caliper, Mitutoyo, Model CD-12"C, I.D. #11178, Calibrated to 02/28/07.

LVDT 10 inch, I.D. #710063, Calibrated to 02/14/07.

Decade Resistor, Ohmite, Model 3416, I.D. #09708, Calibrated to 07/07/06.

ATTACHMENTS

Attachment A: One CD containing data, plots and photographs

Attachment B: Inadvertent Dynamic Loading of Full-Wall Section (1 page)

REMARKS

The original report date was 03/02/06. Attachment B was added.

SAMPLE DISPOSITION

The samples were returned to Reddi-Wall, DTL Shipper #5111052A.

Reported by:

DETROIT TESTING LABORATORY, INC.



Joseph Coppo, Senior Technician
Vehicle & Component Testing



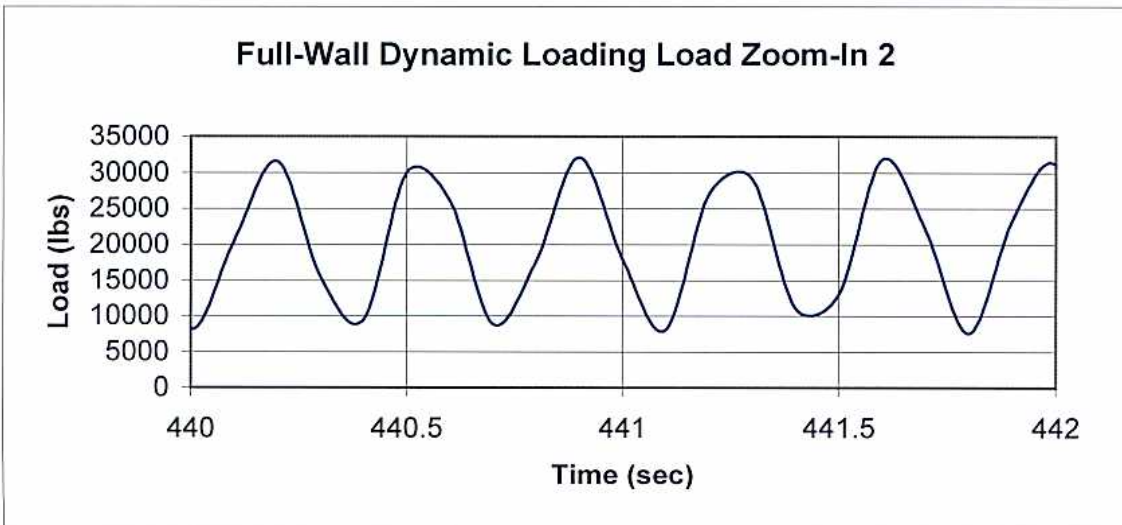
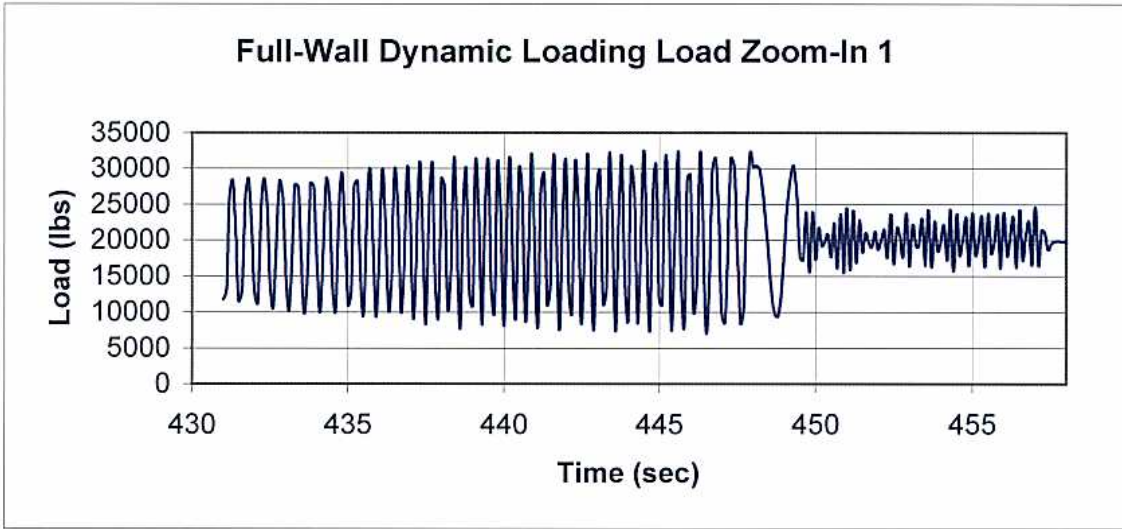
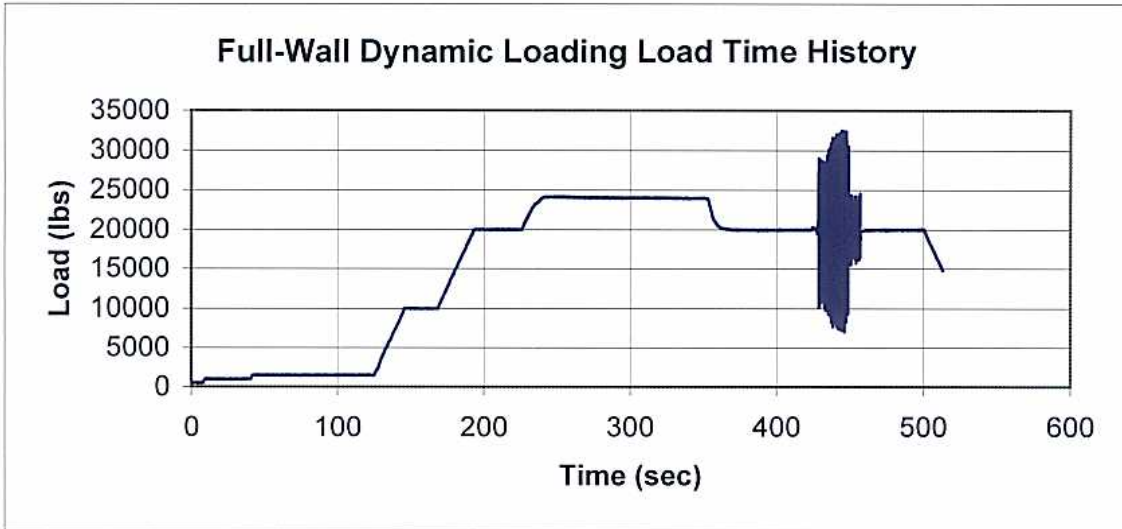
Cary Forton, Program Manager
Vehicle & Component Testing

JC/CF/sr

Attachment B

Reddi-Wall Compressive Load Test - Job No. 5111052 - Full Wall Section dynamic Loading

Max Disp	Max Load
(in)	(lbs)
0.488	32546



Detroit Testing Laboratory, Inc.

TERMS AND CONDITIONS

The following terms and conditions apply to all work performed by Detroit Testing Laboratory, Inc. (DTL), unless specifically exempted in writing by an officer of DTL.

1. **CONTRACT AGREEMENT/TERMS AND CONDITIONS:**

The Client, when placing an order with DTL, agrees that DTL's quotation, Terms and Conditions, the Client's purchase order, and DTL's agreement to perform testing shall constitute the entire contract between the Client and DTL. A purchase order issued to DTL shall not constitute a binding contract until it is accepted and acknowledged by DTL. It is assumed the Client accepts DTL's Terms and Conditions in lieu of the Client's Terms and Conditions on any orders placed with DTL.

2. **GOVERNING LAW:**

All contracts between DTL and the Client shall be deemed to be made and governed by the Laws of the State of Michigan. Any legal action brought by either the Client or DTL shall be brought in a court of competent jurisdiction in Macomb County, Michigan, or if the action is to be in federal court, in the U.S. District Court for the Eastern District of Michigan, Southern Division.

3. **QUOTATION PERIOD AND PRICING:**

Prices quoted by DTL remain in effect for thirty (30) days and are subject to change after that period. The prices contained in a quotation supplied by DTL apply specifically to the test or engineering program proposed in accordance with stated specifications and documentation provided to DTL at the time of quotation. DTL shall not be bound to this pricing for any subsequent testing, repeat testing, additions, and omissions to the test program or parts thereof. Pricing for materials purchased by DTL for use during the test program are subject to change as determined by the actual price paid by DTL upon delivery of material.

4. **PRICING REVISION:**

The Client representative requesting any testing or engineering quotation by DTL shall be considered an agent of the client and authorized to make technical and/or cost changes of any nature to the test procedures, specifications, or other Client documents. If DTL is required to submit a quotation without first receiving and reviewing applicable test specifications, any pricing submitted shall be subject to change when such specifications are made available to DTL.

5. **CREDIT TERMS AND PAYMENT:**

The acceptance of any purchase order by DTL shall be contingent upon approval of the Client's credit. Unless otherwise determined, terms of DTL's invoices shall be Net 30 days and payable in U.S. funds. Payment for the services rendered is the obligation of the Client issuing the purchase order or accepting the proposal. This obligation is not contingent on any specific result from DTL's services and may not be assigned without the written permission of DTL. If the Client fails to make payment within the agreed terms, DTL shall have the right to cease work and make all invoices immediately due and payable. In addition, DTL shall have the right to charge interest on all amounts not paid by the due date at the rate of 1% interest per month, compounded monthly, from the due date of payment.

6. **STANDARD PROCEDURES AND ACCREDITATION:**

DTL represents to the client that testing is done in accordance with standard procedures as applicable and that reported test results are accurate within generally acceptable commercial ranges of accuracy, unless another measure of accuracy has been agreed to in writing by DTL and the client. DTL's testing laboratories are accredited by A2LA in accordance with ISO 17025. It is the client's responsibility to ensure DTL is aware of any testing requiring accreditation.

7. **WARRANTIES:**

DTL performs services and hence its work and reports are not governed by the Uniform Commercial Code. Except as stated in paragraph 6, DTL disclaims all warranties, express or implied, including any warranties of merchantability or fitness for a particular purpose. DTL shall have no liability for incidental or consequential damages of any nature whatsoever.

8. **LIABILITY FOR TEST ITEMS:**

Due to the inherent risks associated with product testing and the difficulty determining the value of test items, DTL will not be liable for damage to or loss or destruction of the Client's property while in the possession of DTL. In the event that insurance coverage is required for any of the above conditions, it shall be the responsibility of the Client to obtain such coverage.

9. **CLIENT FURNISHED EQUIPMENT:**

In the event that the Client provides equipment, tooling, material, etc. to DTL for use during a test program, the Client hereby represents to DTL and warrants that any such equipment, material and tooling shall conform to all applicable specifications and understandings between the parties and shall in all other respects be suitable for the intended purpose. In no event will DTL be responsible for any delays or damages resulting from nonconforming or otherwise unsuitable equipment or material furnished by the Client. Aside from the responsibility of DTL to use reasonable care in protecting and handling any such equipment and material furnished by the Client, DTL shall have no further liability with respect thereto. Any such equipment, material, and tooling furnished by the Client and not consumed in the performance of testing shall be returned to the Client upon completion of all work hereunder in the same condition as received, reasonable/normal wear and tear excepted. Unless otherwise expressly provided, DTL shall retain title to and possession of all jigs, fixtures, tools, test equipment etc. made for or obtained for the furnishing of the testing service covered by the purchase order.

10. SCHEDULING/INTERRUPTIONS:

DTL will provide the Client, upon request, with a schedule for any test or engineering program. If for any reason the test or engineering program is interrupted by the Client, or by the failure of items under test, for a period of thirty (30) days, the completed portion of the work, including (but not limited to) supplies, materials, labor, and equipment utilization shall be billed to the Client and be payable within the agreed upon payment terms. In such circumstances where DTL agrees to place the program on hold, DTL may bill the Client stand-by charges, up to the full cost of established testing rates, until the test program resumes or is terminated by the client. If the test or engineering program is terminated by the client, DTL may impose a cancellation fee of no less than 10% of the unbilled portion of the program.

11. PROGRAM DELAYS:

DTL shall not be liable for any failure or delay in performance which is caused in whole or in part by acts of God (fire, flood, earthquakes, etc.), strikes or other labor disturbances, shut-downs, equipment breakdowns, unforeseen engineering problems, fuel shortages, Government priorities, or any other cause beyond the control of DTL.

12. PERIODIC BILLINGS:

If the service to be performed requires more than one month for completion, DTL may make monthly billings of the approximate percentage of the work completed each month, upon request, supplying with the interim invoice a progress report showing accomplishments to date.

13. FORENSIC TESTING SERVICES:

If the client desires forensic testing services, the client must mark each test sample supporting document and the test authorization form conspicuously as "LEGAL". Unless otherwise indicated in writing, prices quoted or charged by DTL do not include charges for any court appearance, expert witness testimony, deposition or affidavit, or preparation thereof, in connection with forensic testing services. Such charges will be computed at DTL's then prevailing hourly rates, plus expenses. All such charges must be prepaid by the client prior to such appearance, testimony, deposition or affidavit and, where required by law, advance court approval of charges must be obtained by the client at the client's expense.

14. COURT APPEARANCE BY DTL:

In the event that DTL, as a result of an order or subpoena issued by a court, is called upon to produce or testify in respect to a report, DTL will advise the client of the fact and the time and place of the scheduled hearing, if reasonable advance notice is given to DTL. If the client has any objections to DTL complying with such order or subpoena, it will be the client's obligation to present such objections to the court at or prior to the time specified in such order or subpoena, and to give timely notice to DTL of the results.

15. USE OF TEST REPORTS:

Test reports by DTL and related data and documents remain the exclusive property of DTL and the Client shall, upon full payment of DTL's fees for the testing project, be granted permission to reproduce the report to provide to third parties provided that said report is reproduced in its entirety and without any modification(s). DTL, as an independent testing laboratory, does not directly or indirectly endorse any product or service provided, or to be provided, by any of its Clients. Clients shall not in any way imply that the test results they obtain as a result of this kind of testing is an endorsement of any such product or service they provide. The customer is free to use the test results for internal evaluation purposes. The client shall not advertise, publish or otherwise communicate in any manner, the name, the seal or service mark, reports, test results, documentation or procedures of DTL, in whole or in part, without prior written approval of an officer of DTL. The client's actual or threatened failure to abide by this paragraph 15 may result in legal action by DTL for injunctive and other relief. In the event DTL seeks injunctive relief, the client will not contest that DTL will suffer immediate and irreparable harm if such relief is not granted. DTL will not release information it obtains from performing engineering or testing services to any party other than the party contracting for the services provided, unless ordered to do so by cognizant legal authority.

16. ACCEPTANCE OF TEST REPORTS:

DTL reports apply only to the specific samples tested under stated test conditions and test results are not necessarily indicative of the qualities of apparently identical or similar test or operating conditions. DTL shall have no liability for any deductions, inferences or generalizations drawn by the client or others from DTL reports. If the Client requests verification of any part of the test report, DTL shall be notified within thirty (30) days of submission of the report to the Client. Failure to notify within this thirty (30) day period acknowledges acceptance of the report. Should additional work be required for verification purposes, DTL shall be entitled to the reasonable value of the additional work involved providing the original findings are verified. Payment for any test program and applicable test report shall not be contingent upon acceptance and/or approval of a third party.

17. SAMPLE/DATA RETENTION

Samples will be destroyed thirty (30) days after the date of the final report, unless the client indicates otherwise in writing and prepays before the expiration of said thirty (30) day period the entire cost of any storing, packaging and shipping the sample(s) by DTL. DTL shall have no obligation to retain its test reports or related data and documents beyond its normal retention periods.

18. SHIPPING/TRANSPORTATION

The Client shall be responsible for the transportation and any associated shipping costs of Client's property to and from DTL's Testing Laboratory.