TEST PROGRAM

"IMPACT RESISTANCE"

"STONETILE" CLADDING SYSTEM

Submitted To:

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Submitted By:

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AGRA Earth & Environmental

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1.0 INTRODUCTION

AGRA Earth & Environmental Limited (AEE) was retained by Stonetile (Canada) Ltd. to conduct a test program to evaluate the "Impact Resistance" of the "Stonetile" cladding system. All testing was conducted in accordance with evaluation requirements specified by the Canadian Construction Materials Centre (CCMC). The "Stonetile" system is an innovative cladding system designed by Stonetile (Canada) Ltd. to compete with the existing cladding systems on the basis of performance and cost. Testing was conducted December 16 1996.

2.0 DESCRIPTION OF "STONETILE" SYSTEM

The "Stonetile" system consists of concrete tiles with embedded steel inserts on the back side which are fastened to the substrate. The tile is produced in two sizes of 450x300x16 mm and 450x450x16 mm, and in various finishes and colours. Various other architectural shapes (i.e corbels, cornices, etc.) are also available.

The fasteners are made of 0.5 mm thick, 25 mm wide galvanized steel strips. These strips are punched out to have a spine 6 mm wide and 3 mm deep and gang nails protruding into the concrete. The gang nails are embedded in concrete during casting. The top of the fasteners protrude about 10 mm above the tile with a hole for a screw that will fasten the tile to the substrate. The bottom part of the insert protrude about 5 mm below the tile so that it will slide into the fastener of the tile below it. Steel channels made out of 30 gauge galvanized metal are provided at the base and top. These channels are perforated to ensure adequate ventilation between the tiles and the substrate.

Detailed drawings of the "Stonetile" wall system attached as Appendix 'A', were submitted by Stonetile (Canada) Ltd. and reviewed by (AEE).

3.0 MATERIALS

3.1 CONCRETE

The concrete used to cast the Stonetile was designed to meet the following specifications:

Compressive Strength	20 MPa
Slump	100 mm

The following mix proportion was used to achieve the above specification:

	kg/m^2
Cement	335
Water	185
Aggregate - Coarse	878
Aggregate - Fine	799

Superplasticizer was used to achieve the design slump and air content. All the material used in producing this concrete conformed to CSA-A23.1 - "Concrete Materials and Methods of Concrete Construction".

Tiles of different colours were obtained by adding colouring pigments supplied by IMASCO - International Marble and Stone Company Ltd. These pigments are widely used in stucco and have been acceptable for external application.

3.2 GROUT

Grout used in this system was Tremco "Dymonic" urethane caulking. Acceptable durability of Dymonic Urethane caulking was proven by others in independent test programs.

3.3 STEEL INSERTS

The steel inserts were made from 0.5 mm thick and 25 mm wide galvanized steel. The length of the inserts was determined by the size of the tile and the length of extensions of the fasteners above and below the tile.

3.4 MOUNTING SCREWS

The screws used in this system were 12 mm #8 galvanized steel.

4.0 TESTING

4.1 TEST SAMPLE

One 2 meter x 2 meter test specimen was constructed by Stonetile (Canada) Ltd. for testing purposes. The test sample comprised a 2x4 framed wall with four 2x4 internal studs at 16" on centre. The wall was covered with 3/8" plywood sheathing and building paper in accordance with common building practices. The exterior surface of the wall was covered with the "Stonetile" panel system (natural colour). To represent the worst case scenario, the grout was not installed. Diagrams #1 & #2 illustrate the test specimen. Please note that, prior to the impact resistance test, the specimen was subjected to water penetration and wind load resistance testing. No damage to the specimen was evident from these test procedures. Reporting of the previous test results is presented separately.

4.2 TEST PROCEDURE

Testing was conducted in accordance with the Canadian Construction Materials Centre document "Technical Guide for Prefabricated, Concrete Brick/Tiles, Exterior Cladding System" and ISO 7892-88, "Vertical Building Elements - Impact Resistance Tests - Impact Bodies and General Test Procedures". For this test, two impact regimes were specified; 'Safety' and 'Retention of Performance' impacts.

For this test, the test specimen was clamped into a large heavy steel frame constructed of 75 mm (6 mm wall thickness) hollow square steel tubing. Measurements of the frame movement during impact were less than the maximum allowable 0.1 mm.

The wall was subject to the following three impacts.

4.2.1 Hard Body Impact

Testing involved impacting the specimen with a 1 kg ball bearing (62.5 mm dia.) with a specified impact energy. This was accomplished by suspending the ball bearing from a 3 m cord above the specimen and by use of another cord pulling the ball bearing back such that the centre line of the ball bearing was the required height above the impact point. The bearing was then released and allowed to swing and impact the specimen. Diagram #2 illustrates the test setup and Table #1 lists the required impact energies and drop heights for each impact regime. For this test, the "T" joint between three panels was chosen as the impact location as this area would provide the worst case scenario.

4.2.2 Small Soft Body Impact

Testing involved impacting the specimen with a 3 kg leather ball filled with lead shot (100 mm dia.) with a specified impact energy. This was accomplished by suspending the ball from a 3 m cord above the specimen and by use of another cord pulling the ball back such that the centre line of the ball was the required height above the impact point. The ball was then released and allowed to swing and impact the specimen. Diagram #2 illustrates the test setup and Table #1 lists the required impact energies and drop heights for each impact regime. For this test, the "T" joint between three panels was chosen as the impact location as this area would provide the worst case scenario.

4.2.3 Large Soft Body Impact

Testing involved impacting the specimen with a 50 kg leather bag filled with gravel (400 mm dia.) with a specified impact energy. This was accomplished by suspending the bag from a 3 m cord above the specimen and by use of another cord pulling the bag back such that the centre line of the bag was the required height above the impact point. The bag was then released and allowed to swing and impact the specimen. Diagram #2 illustrates the test setup and Table #1 lists the required impact energies and drop heights for each impact regime. For this test, the "T" joint between three panels was chosen as the impact location as this area would provide the worst case scenario.

5.0 TEST RESULTS

Test results are tabulated in Table #1.

5.1 HARD BODY IMPACT

For both the "Safety" and "Retention of Performance" test regimes, the specimen failed as the 1 kg ball bearing passed easily through the specimen, breaking off both exposed corners of the panels at the impact location.

5.2 SMALL SOFT BODY IMPACT

The specimen was only subjected to the "Retention of Performance" impact regime as specified. For this test regime, the specimen failed as the 3 kg ball passed easily through the specimen, breaking off both exposed corners of the panels at the impact location.

5.3 LARGE SOFT BODY IMPACT

For both test regimes, the specimen passed as the 50 kg bag did not pass through or damage the specimen.

Table #1

Impact Resistance Test Data

Impact Regime	Impact Type	Dynamic Mass (kg)	Energy (Nm)	Drop Height (mm)	Test Result
Safety	Large Soft	50	100	204	Pass
	Hard	1	10	1019	Fail
Retention of Performance	Large Soft	50	34	69	Pass
	Small Soft	3	60	2039	Fail
	Hard	1	10	1019	Fail

6.0 DISCUSSION

The "Stonetile" system passed the large soft body test. This test is to represent impacts from a human body (ie. shoulder, fist, knee). The specimen failed both the 'small soft body' and 'hard body' impact tests.

AGRA Earth & Environmental Limited

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Apr 14/97

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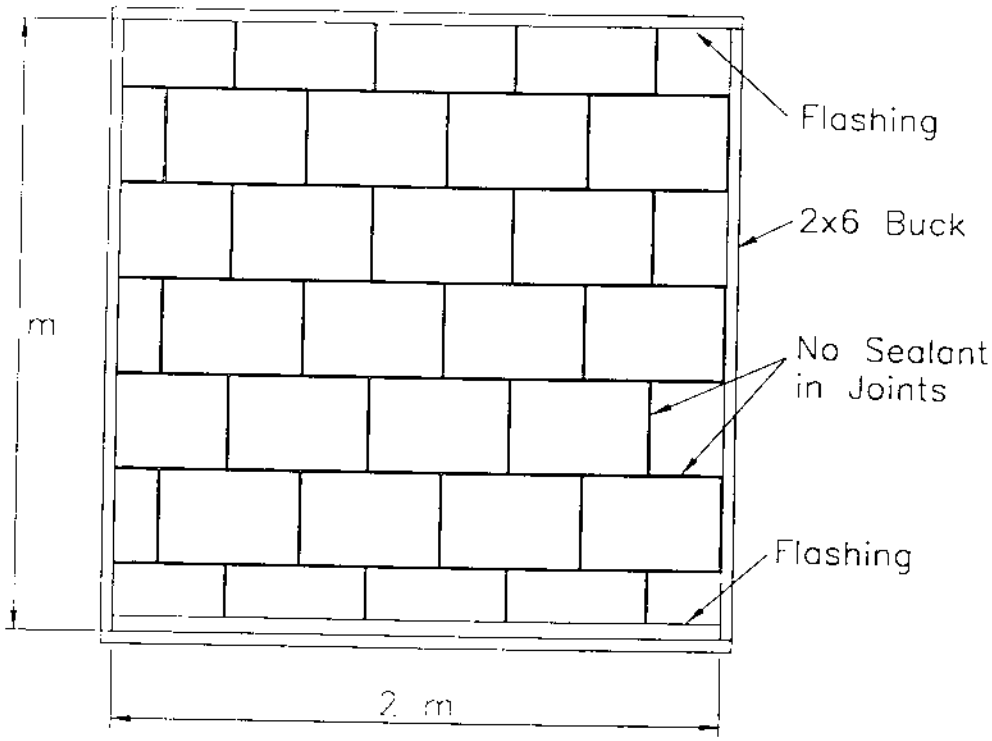
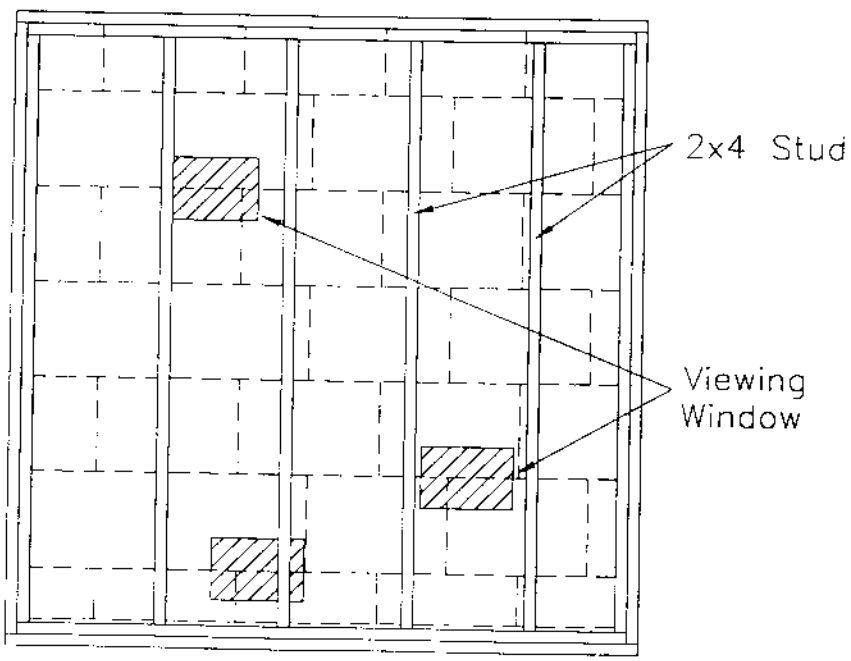
Front View



Rear View



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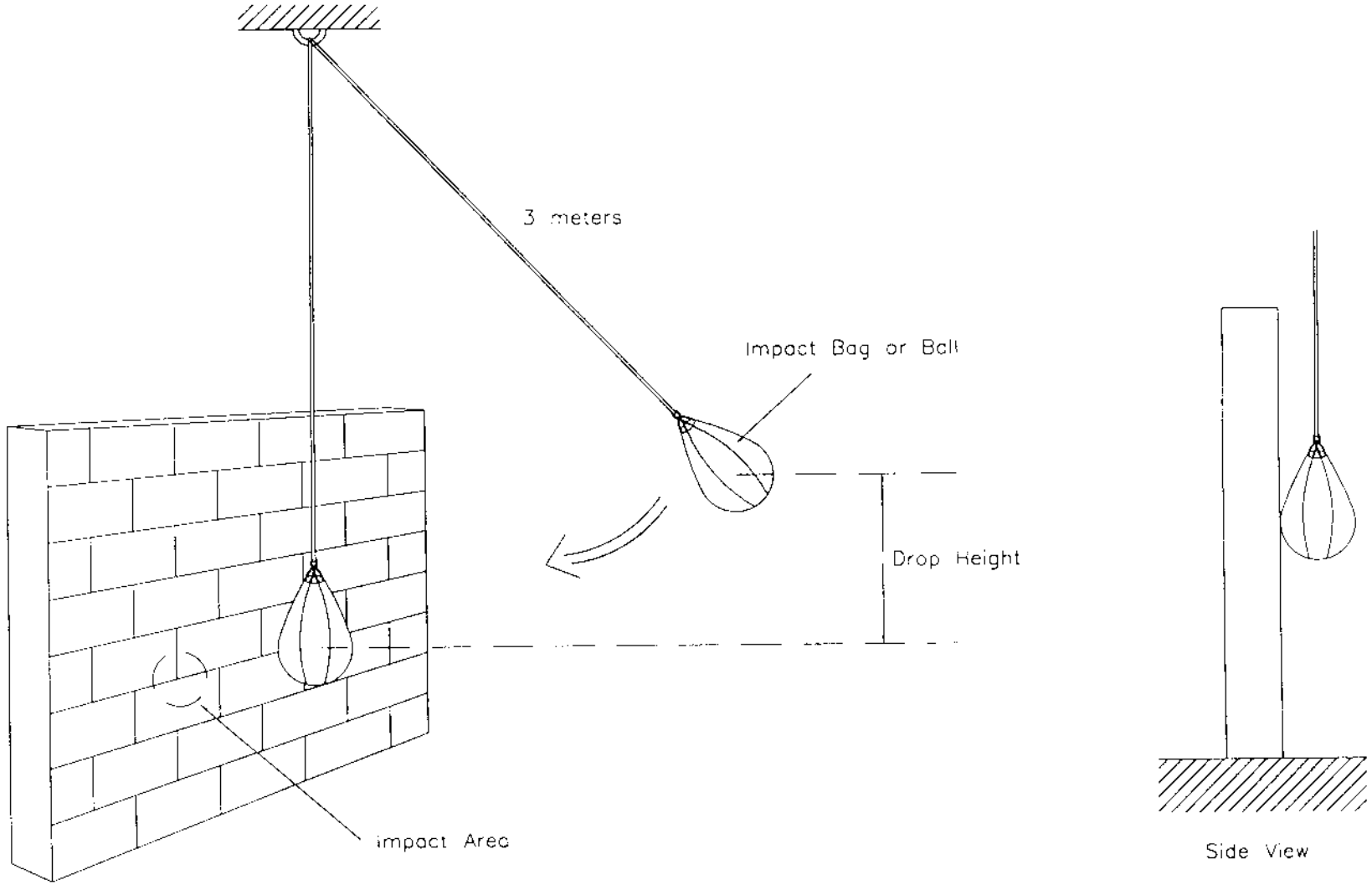
Earth & Environmental Ltd.
ENGINEERING & ENVIRONMENTAL SERVICES

CLIENT:	Stonetile (Canada) Ltd.
PROJECT:	C.C.M.C. Panel Evaluation
	Test Panel Layout
DATE:	Mar 10 1997
JOB No.	CA-12207
CAD FILE:	
	Diagram #1
REV.	-



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