EVALUATION OF EXTERIOR DOOR ASSEMBLIES FOR RESISTANCE TO FORCED ENTRY

This project was funded by Canada Mortgage and Housing Corporation but the views expressed are those of FORINTEK Canada Corporation of Ottawa, Ontario.

The principal objective of this test series was to determine the performance from a physical security point of view of exterior swinging door assemblies available in the Canadian marketplace. The test conditions are described in the report.

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EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

Prepared for

CANADA MORTGAGE AND HOUSING CORPORATION

by

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MANDATE

This study was undertaken under contract No. 55-68-745. The work to be performed was:

1. To determine the performance from a physical security point of view of exterior swinging door assemblies available in the Canadian marketplace.
2. To built a test frame.

EXECUTIVE SUMMARY

This study was undertaken under contract No. 55-68-745.

The test results indicated that four of ten doors tested in impact (using long screws on all hardware and with doors kept closed by a key-in-knob and a vertical-drop-deadbolt lock set) failed to meet the minimum security requirements of swinging door assemblies.

Three other door assemblies tested with either a single key-in-knob lock set or in conjunction with an inappropriate secondary lock system also failed to meet the minimum requirements.

Moreover, the jamb/wall stiffness test results indicated that shim location was of the utmost importance and that the addition of a vertical deadbolt lock set increased the rigidity of the assembly by as much as 40 percent.

This study also revealed the need to carry out testing of locks available in Canada for their resistance to forced entry, and to optimize the performance of hardware through proper installation.

INTRODUCTION

The increasing number of burglaries in Canadian urban centers is causing some concern among police and housing agencies on the ability of current residential exterior doors to resist forcible entry. Since the door standards of the Canadian Standards Association (CSA) and the Canadian General Standards Board (CGSB) do not include criteria for resistance to forcible entry, Canada Mortgage and Housing Corporation (CMHC) has requested Forintek Canada Corp. to conduct a series of security tests on a number of exterior swinging doors and door assemblies sold in the Canadian market place.

The results of this initial study is intended to show what physical performance may be expected from a wide range of exterior swinging doors being marketed today under the standards of CSA and CGSB. Classification was tentatively made according to an ASTM* suggested set of acceptance criteria formulated for modest burglary pay-off targets like single and multi-family residential housing. Moreover, the exercise is expected to provide experience and documentation that will become useful in the development of a Canadian Standard.

The study was carried out in accordance with ANSI/ASTM F476-76* with modifications suggested from a meeting with CMHC and a representative of the crime prevention unit of the Ottawa Police department.

Fourteen door samples were tested and individual results are submitted. A set of recommendations for future work and discussion has been added after the conclusion.

* ANSI/ASTM F 476-76. Standard Test Methods for Security of Swinging Door Assemblies.

MATERIALS

Fourteen door samples were tested, representing 11 types previously identified by CMHC. Sample No. VII was used in the initial phase of the program for familiarization with the equipment and procedure. It is identified in the program as a "Preliminary Test".

Sample # I:	Steel door with wood stile and rails, pre-mounted in a wood door frame.
Sample # IA:	Steel door with wood stiles and rails, pre-hung to a wood frame.
Sample # IB:	Same as IA.
Sample # II:	Steel door with steel stile and rail, pre-hung in a metal-covered door frame.
Sample # III:	Solid-core door (plywood faces with an interior core of glued wood strips).
Sample # IV:	Solid-core door (plywood faces with a particle-board interior).
Sample # V:	Solid-core door (hardboard faces with a particle-board interior).
Sample # VI:	Cedar-plank door.
Sample # VII:	Hollow-core door with plywood faces.
Sample # VIIA:	Same as VII.
Sample # VIII:	Flush-faced plywood insulated door.
Sample # IX:	Cedar stile and rail door (panel door).
Sample # X:	Old stile and rail door (panel door) (used door).
Sample # XI:	Steel door, and steel frame (fire door).

TEST METHODS

The standard test methods for security of swinging door assemblies described in ANSI/ASTM F476-76 include over a dozen tests to be carried out on individual components, such as the hinge, lock, door, jamb/strike and jamb/wall.

Since it was not the intention of this series of tests to conduct any testing of locking devices or hinges, the contract initially called for impact tests to be carried out on the centre of the door as described in Section 18 of the standard. These tests were to be carried out initially by installing all hinges and locks using the screws provided by the manufacturers, and to test each door with only the key-in-knob lock set engaged. Following a failure due to either the locking device or the use of short screws, the screws were to be replaced by the longer screws and with the deadbolt lock engaged.

Changes to this test procedure became necessary when preliminary results indicated that testing the doors mounted with short screws and with a single lock will result in either frame or lock failure and will provide little information on the level of security offered by the doors. A representative of the Ottawa Police Crime Prevention Unit further recommended that testing should also include impacts on the other potentially vulnerable areas of the doors, especially near the lock and the bottom hinge.

The vertical door assembly support fixture built according to ASTM F476-76 did not appear to provide the necessary rigidity to carry out impact tests.

For the above reasons, on November 16, 1981, Canada Mortgage and Housing Corporation (CMHC) agreed to amend the test procedures to the following:

A. Door Impact Test

All doors were to be mounted with three butt hinges. The hinges were installed 180 mm (7") from the top of the doors, 280 mm (11") from the bottom; a third hinge was to be spaced midway between the top and bottom hinges. The location of the hinges was slightly different in the metal doors that came pre-mounted in wood frames.

All doors were to be tested in finger-jointed pine frames.

The key-in-knob lock sets were to be installed 915 mm (36") from the bottom of the doors, and the drop deadbolt lock sets 15 mm (6") above them.

All hinges, strike plates and locks were to be installed with 64-mm (2.5"), No. 8 wood screws.

The impact tests were to be carried out by dropping a cylindrical weight, having a hemispherical impact nose approximately 15 mm (6") in diameter, on each of the following door areas (see Figure 1).

Area # 1: A point defined by the intersection of the vertical centre line of the door, and a line from the centre of the bolt to the centre of the mid-height hinge. In the case of panel doors, the impacts were to be carried out on the corner of the panel closest to the lock at a point 75 mm (3") from the horizontal and vertical edges of the panels. This test is similar to that described in Section 18 of the ANSI/ASTM Standard.

Area # 2: A point 150 mm (6") below the door knob and 150 mm (6") from the edge of the door. This test is somewhat similar to that described under "Bolt Impact Test" in Section 21 of the ANSI/ASTM Standard, except that the target area is slightly lower.

Area # 3: A point 200 mm (8") from the bottom hinge on a horizontal line through the mid-point of the hinge. This is similar to the "Hinge Impact Test" described in Section 19 of the ANSI/ASTM Standard.

The tests were to be carried out in sequence on areas 1, 2 and 3, striking each designated area twice at each impact level described in Table Al.1 of ANSI/ASTM F476-76 (Table 1).

The drops were to be made directly over a 50-mm-thick (2") polystyrene impact buffer.

B. Jamb/Wall Stiffness Test

A hollow-core door assembly equipped with a key-in-knob lock set, a drop deadbolt lock set, and three 89 x 89-mm butt hinges, was to be mounted in the rough opening of the jamb/wall test fixture. When necessary or called for, the door frame was to be shimmed to fit.

Each test was conducted by positioning the jamb-spreading device between the door jambs at lock height (key-in-knob), and by applying an increasing force, as required, until the lock (or locks) were disengaged and the door could be pushed open.

APPARATUS

A. Door Impact Test Device

As mentioned previously, the door support fixture built as described in ANSI/ASTM F476-76 did not seem to provide the necessary rigidity to carry out the impact tests for rating door performance.

The vertical support fixture was therefore converted to a horizontal bed supported directly by a concrete floor and the tests were carried on as drops rather than by a swing from a pendulum system.

The door frames were mounted between two laminated beams, made up of three 38 x 138-mm (2" x 6") wood members each, and nailed in place.

The laminated beams were adjustable to accept any size door.

The 129-kg cylindrical steel weight consisted of a 190-mm-diameter (7.5") cylinder, 510 mm (20") long, with a 150-mm-diameter (6.0") hemispherical nose at its business end. A foamed polystyrene buffer pad 200 mm (8") square and 50 mm (2") thick was used over the door surface area that was to be impacted. The testing apparatus is shown in Figure 1 below.

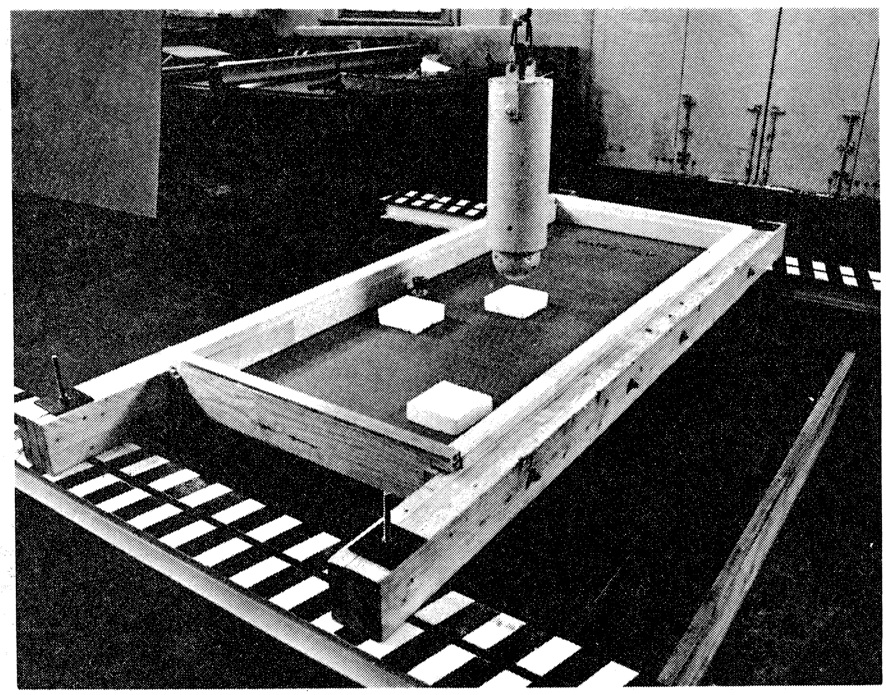

Figure 1. Door impact tester.

B. Jamb/Wall Stiffness Test

The jamb-spreading device was built to be capable of delivering and measuring spreading forces of up to 25.6 kN.

The device is composed of a lever (having a member with a load-bearing plate on each end) that provides a minimum contact surface of 40 by 120 mm.

The load is applied by pulling on the end of the lever using an 8:1 ratio pulley system, the load is measured by a tension dynanometre installed between the end of the lever and the ratio pulley system.

The test fixture for the jamb/wall test consists of a vertical wall section constructed from 2 by 4 wood studs, 410 mm on centre, with a rough entry door opening. The exterior is covered with 13-mm exterior-grade plywood sheathing, and 13-mm gypsum board on the interior.

The jamb-spreading device and the test fixture are shown in Figure 2.

Figure 2. Apparatus for jamb/wall stiffness test.

The tests were carried out not only to determine the stiffness of the door frames, but also to determine the importance of shim location, the addition of a drop-deadbolt lock set as a secondary locking system, and the incorporation of horizontal members between studs adjacent to the door.

The tests were carried out using two door frames according to the following procedure:

Frame # 1 (only key-in-knob lock is engaged):

a) Jamb shimmed opposite each hinge and on the lock side, 200 mm from top of the door and 270 mm from the bottom.

b) In addition to a), add a shim 300 mm on each side of the lock.

c) In addition to b), a shim opposite the lock.

Frame # 2 (key-in-knob lock only, then drop-deadbolt added):

a) Same as a) above.

b) Same as b) above.

c) Same as c) above.

d) In addition to c), two doubled 2 x 4's were installed horizontally between studs on each side of the door.

e) In addition to d), drop deadbolt lock was engaged.

DOOR ASSEMBLY PERFORMANCE REQUIREMENTS

The following relevant, acceptance criteria and classification schedule recommended by "Annex A1" of the ANSI/ASTM Standard was used for grading the doors tested:

Table 1. Door Assembly Performance Requirements

TEST	MEASURED PARAMETER	GRADE 10	GRADE 20	GRADE 30	GRADE 40
Door Impact (Area #1)	Impact resistance at centre.	Two impacts of 80 J (59 ft. lb.).	Grade 10 plus two impacts of 120 J (89 ft. lb.).	Grade 20 plus two impacts of 160 J (118 ft. lb.).	Grade 30 plus two impacts of 200 J (148 ft. lb.).
Bolt Impact (Area #2)	Impact resistance at bolt.	Two impacts of 80 J (59 ft. lb.).	Grade 10 plus two impacts of 120 J (89 ft. lb.).	Grade 20 plus two impacts of 160 J (118 ft. lb.).	Grade 30 plus two impacts of 200 J (148 ft. lb.).
Hinge Impact (Area #3)	Impact resistance at hinge.	Two impacts of 80 J (59 ft. lb.).	Grade 10 plus two impacts of 120 J (89 ft. lb.).	Grade 20 plus two impacts of 160 J (118 ft. lb.).	Grade 30 plus two impacts 200 J (148 ft. lb.).

DISCUSSION OF RESULTS

A. Impact Tests

Out of the fourteen doors tested, one (VII) was tested using the screws provided by the manufacturer in the hinges and the key-in-knob lock set. One door (II) was tested using longer screws in the hinges, and using the locks installed by the door manufacturer (a key-in-knob lock set and a horizontal deadbolt lock set). Two other doors were tested using long screws in the hinges and lock sets, but with only the key-in-knob lock set engaged during the impact test. The first (XI) because the metal frame could not accommodate the strike plate for the vertical drop-deadbolt lock set, and the second (1A) because we wanted to measure the degree of security offered by the high-security strike plate pre-mounted on the matching frame. The latter test could not be resumed using both locks because the door was too badly damaged during the first part.

All ten other doors were tested with the hinges, lock sets and strike plates mounted with long screws. Each door was kept closed by both a spring-loaded key-in-knob lock set and a vertical drop dead-bolt lock set.

Impact of doors closed by a spring-loaded key-in-knob lock set only (VII, XI and 1A) resulted in either premature door failure or in lock failure, and did not indicate the best possible performance of these doors.

For example door No. IB nearly qualified as a grade 20 door, while door IA failed in the first stages of the grade 10 test level. Both of these doors were the same models from the same manufacturer, but sample IB was tested with both locks engaged while sample IA was tested with only the key-in-knob spring-loaded latch engaged in a high-security strike plate.

The lock failure in door No. II indicated that the horizontal deadbolt lock set supplied by the door manufacturer was not as secure a secondary lock system as the vertical-drop-deadbolt lock sets used in testing the other ten doors. The test failed to rate the door.

Results of preliminary tests, such as those carried out on door No. VII, indicated that impacting doors (when the hinges and locks are fastened with short screws provided by the manufacturers), would most probably always result in frame failure, and rate low in security.

On the other hand, all ten doors tested with long screws and using a vertical drop deadbolt lock set as a secondary lock system, failed before either the frames or the locks did and thus provided a measure for comparing the levels of security offered by each door type. This seems to indicate that the doors are still the weakest component of door assemblies (when installed with proper locking devices and securely installed frames). When its construction is improved, the potential for increased performance capability is optimistic.

Both panel doors tested (IX, a cedar door; and X, a used old-type pine door), were found to offer the weakest level of resistance to attacks of any door type tested. This is largely due to the thin panels that could be easily broken, or knocked off from the door at their weak tongued-and-grooved joint.

The cedar plank door (VI) was also easily damaged mainly because the blind battens did not extend far enough across the outside stiles. The stile closest to the lock set split along the grain during the early stages of testing.

The hollow-core door failed because the door facings were very thin and could be punctured easily.

The remaining six doors all met the minimum level of security requirements for exterior doors.

The metal doors with wooden rails and stiles, pre-hung in wooden door frames (I & IB) were the doors offering the highest level of physical restraint of any door type tested with a drop-deadbolt lock set and using long screws on the door frame.

The flush-faced insulated door (VIII) performed well (nearly grade 20), especially when compared to conventional hollow-core doors. The foam appears to act as a buffer to protect the thin plywood facings.

The two solid-core doors with a particleboard interior (IV & V) demonstrated a similar level of protection but failed when the drop-deadbolt cylinder was pulled out of the door (shearing through the particleboard) as the stile was damaged at lock height.

The solid-core door (III), with cedar stiles and rails and an interior core of glued cedar strips, failed as its stile on the hinge side was split along the entire length, similar to the stile failure on the lock side of the cedar-plank door.

A summary of the results using the suggested ANSI/ASTM criteria is shown in Table 2. It is to be noted that the doors rated in this study had been sequentially impacted in three areas of the same door, rather than changing doors for every test sequence as prescribed by the ANSI/ASTM standard. The harsher schedule used in this study is preferred to that prescribed as it appears able to better classify each door using the cummulative sum of the work done by the ram as the independent variable for classification. This latter value is included in Column 2 of Table 2. More samples in a separate study are needed to establish further its ability to descriminate between grades and for regulatory agencies to determine the set of numbers for criteria to define the grades.

The study also revealed the weaker elements of the various door types and door assemblies and the virtues of certain arrangements such as:

Stiles: In general, all wood door stiles appeared to be too small to be effective against attacks on doors. Cedar stiles are intrinsically weak and cedar planks are especially weaker if they are not reinforced by battens, extending to the outer edges of the stiles or planks. Finger-jointed stiles are very vulnerable to breaks if the joint is located at lock height or opposite the hinges.

Panel Doors: The panels are generally too thin to resist attacks.

Hollow-Core Doors: The door faces are too thin to frustrate or delay burglars. They are too weak to resist puncture.

Solid-Core Doors: Particleboard core: Lock cylinders shear through particleboard, once stile is damaged.

Cedar-strips core: Core appears adequate but the cedar stiles split easily along the grain like the cedar plank doors.

Steel Doors: (wooden stile and rails) Very good when used with a vertical-drop deadbolt lock set that fits directly onto the door face to take advantage of the strength offered by the steel sheet.

Not much better than the other doors when used with a key-in-knob lock set only, since the stile can be damaged as easily as the less expensive door types.

Steel Door: (steel stile and rails) The key-in-knob lock sets failed too early in the testing to be able to properly rate these doors. They would probably do very well when the two lock sets are used.

Use of Single Lock Sets: (spring-loaded key-in-knob lock)	Latch or wood stile fail early.
Use of Two Locks: (vertical-drop-deadbolt type as a secondary lock)	Provides an adequate level of protection; delays wood stile failures.
Use of Two Locks: (horizontal-type lock as secondary lock)	Not as efficient as drop-deadbolt lock set. Both latches may pull from strike plates if door is bent at centre during impact, or if jambs are spread.
Use of Long Screws: (on hinges, strike plates)	Practically eliminates frame failures.

B. Jamb/Wall Stiffness Test

A summary of the jamb/wall test results is shown in Table 3.

The jamb/wall stiffness tests indicated early that shim location was to be of utmost importance, and that the ideal location of a shim was in that part of the frame jamb directly opposite the lock and at the same height of the jamb at the hinged side.

It became increasingly easier to spread the jambs as the shims were moved away from the lock area. As this was not the only reason for shimming, other shims can be positioned at other places afterwards. Any attempt to increase the rigidity of the system by stiffening the wall sections adjacent to the door by incorporating blocks made of doubled 2 by 4 between studs proved unsuccessful because there was sufficient play in the system to allow the latch to be released from the strike plate. Poor fit, and eventual shrinkage of green lumber, will leave gaps to allow the studs to be pushed with the jambs.

The performance of the system could be greatly increased by the incorporation of a vertical-drop-deadbolt-lock set to the door. In fact, the addition of the vertical deadbolt lock increased the rigidity of the assembly by as much as 40 percent, and testing had to be stopped, not because of lock failure, but because the lock block had been partially pulled away from the door through the interior face of the hollow-core door. The drop-deadbolt lock set aids considerably in keeping the door integral with the jamb/frame system. A vertical drop-deadbolt lock incorporated to a solid-construction door would logically increase the security of that assembly against jamb-spreading break-ins.

CONCLUSION

Of the ten doors tested in impact (using long screws on all hardware and with doors kept closed by a key-in-knob and vertical-drop-deadbolt lock sets), four failed to meet the minimum security requirements of swinging door assemblies and six met the requirements of grade 10 or better.

Three other door assemblies tested with either a single key-in-knob lock set, or in conjunction with an inappropriate secondary lock system, also failed to meet the minimum requirements.

The jamb/wall stiffness test results indicated that shim location was of the utmost importance, and that the rigidity of the assembly could be greatly increased by incorporating a vertical drop-deadbolt lock set in the lock system.

Testing also clearly showed the need for additional work in the area of hardware selection and installation since these were found to have a marked influence on the ability of entrance door assemblies to resist forcible entry.

RECOMMENDATIONS

Some tentative recommendations are submitted based on observations from the limited number of samples from this test program. They are noteworthy for those who contemplate choosing an exterior door, those interested in improving the security of their present doors, for builders interested in constructing high-security doors, and door manufacturers desirous of improving their present doors.

1. Recessed panel doors, hollow-core doors and certain types of plank-cedar doors do not offer an acceptable level of resistance to forced entry, and should not be used on residential buildings even if located in low-crime areas.

2. All doors, including the most secure steel doors, will be easily broken into if installed with conventional spring-loaded key-in-knob locking devices. The use of a vertical-drop-deadbolt lock set as a secondary lock is recommended as this lock type not only improves the resistance of doors to impacts, but also improves the resistance of the door frame to jamb spreading.

3. All hinges, strike plates, and lock fronts should be mounted with long screws (75 mm long, or longer #8 or #10) to prevent door frame failure. Screws furnished by door manufacturers are easily pulled from either the door or the jamb during a burglary attack.

4. Regulatory officials should work with door manufacturers towards improving door construction, for their resistance to forced entry. Special attention and caution should be paid to the use of cedar as a construction material for stiles. The dimension and the use of finger-jointed stiles should also be of concern. The use of particleboard as lock-block material is questionable, since it offers little resistance once the stile is damaged.

5. Future door testing should require impacting each door in three strategically defined areas, rather than the costly ASTM F476-76 method of using three doors to obtain similar data. However, a new table for grading doors will have to be prepared, since ASTM suggested values will probably not be applicable anymore. The doors could possibly be rated according to the accumulated amount of work required to allow entry to be gained.

6. Testing should also be carried out to rate locks available in Canada for their resistance to forced entry, and to optimize the performance of all other hardwares through proper installation and the use of more efficient fasteners.

Table 2. Summary of Door Impact Test Results

Door Tested	Grade Level/Area of Door: 10			20			30			40			Type of Failure	State of Door Assembly Following Test: Locking Devices	Frame	Hinges	Door	Grade Reached	Accumulated Work Required to Break In (joules)
	1	2	3	1	2	3	1	2	3	1	2	3							
VII	VV	-	-	VV	-	-	VX	-	-	-	-	-	frame failure	Key-in-knob strike plate was pulled from framed, lock intact.	Failed near lock.	OK	OK	20[1]	720
I	VV	VV	VV	VV	VV	VV	X-	-	-	-	-	-	door failure	Key-in-knob lock was disengaged. Deadbold OK.	Damaged near locks but held up because of long screws.	OK	Collapsed in centre exposing hinge pins.	20	1360
IA	VX	-	-	-	-	-	-	-	-	-	-	-	door failure[2]	Key-in-knob latch was bent. High-security strike plate OK.	OK	OK	Stile was badly damaged near the lock.	NA	160
IB	VV	VV	VV	VV	VV	VV	X -	-	-	-	-	-	door failure	Key-in-knob lock damaged. Dead-bolt OK.	OK	OK	Stile was bro-ken in 4 pieces. Door opened on hinge side.	10	1080
II	VV	VV	VV	VV	X-	-	-	-	-	-	-	-	lock failure[3]	Key-in-knob releas-ed early. Hori-zontal deadbolt lock released and door was opened.	OK Slightly damaged by horizontal deadbolt latch.	OK	OK	10	840
III	VV	VV	VV	X-	-	-	-	-	-	-	-	-	door failure	Key-in-knob was disengaged. Vertical deadbolt OK.	OK	OK	Stile was split along the whole length on the hinge side.	10	600
IV	VV	VV	VV	VV	VV	X-	-	-	-	-	-	-	door failure	Key-in-knob latch was bent. Vertical deadbolt pulled from door.	OK	OK	Stile was broken near locks. Ver-tical deadbolt cylinder was pulled from door.	10	1080
V	VV	VV	VV	VV	X-	-	-	-	-	-	-	-	door failure	Key-in-knob latch was bent. Vertical deadbolt pulled from door.	OK	OK	Stile was broken near lock. The deadbolt lock cy-linder pulled from the door.	10	840
VI	VV	X-	-	-	-	-	-	-	-	-	-	-	door failure	Both locks OK. Vertical-drop-dead bolt lock engaged.	OK	OK	Plank near the lock split along the whole length. Cross member too short.	NA	240

Continued

Table 2. (Continued)

Door Tested	Grade Level/Area of Door: 10			20			30			40			Type of Failure	State of Door Assembly Following Test: Locking Devices	Frame	Hinges	Door	Grade Reached	Accumulated Work Required to Break In (joules)
	1	2	3	1	2	3	1	2	3	1	2	3							
VIIA	VV	X-	-	-	-	-	-	-	-	-	-	-	door failure	OK	OK	OK	Door facing was damaged, could reach in and release lock.	NA	240
VIII	VV	VV	VV	VV	VV	VX	-	-	-	-	-	-	door failure	Key-in-knob was disengaged. Drop deadbolt OK.	OK	OK	Door split in two. Entry gained through lower part of door.	10	1200
IX	X-	-	-	-	-	-	-	-	-	-	-	-	door failure	OK	OK	OK	Panel near lock came off.	NA	80
X	X-	-	-	-	-	-	-	-	-	-	-	-	door failure	OK	OK	OK	Panel near lock came off.	NA	80
XI	X-	-	-	-	-	-	-	-	-	-	-	-	key-in-knob lock failure	Key-in-knob spring-loaded latch was bent.	OK	OK	OK	NA[4]	80

Notes: V = passed (single impact). X = point of failure. - = test not carried out or discontinued.

All hardware mounted with long screws, and both locks engaged during test, unless otherwise mentioned.

[1] Preliminary test only. Manufacturer's screws used, leading to frame failure. Would likely have failed earlier if lock area (#2) had been tested since strike plate was mounted using short screws. Only key-in-knob engaged for first part of test.

[2] This door was tested with only the key-in-knob lock engaged to establish the value of the high-security strike plate. Test could not be carried out with both locks engaged due to the extent of door damage. Would likely have done significantly better with both locks engaged.

[3] The door sample was received from the manufacturer with the locks already installed. The door assembly would probably have done better if the secondary lock had been a vertical rather than an horizontal deadbolt lock set.

[4] The door sample was tested with only a key-in-knob lock, since there was no provision on the metal frame for a vertical-drop-deadbolt striking plate.

Table 3. Summary of Jamb/Wall Test Results

Door Frame	Test Number	Jamb Installation	Force Required to open Door N
1	A	Shim opposite each hinge and one shim 200 mm from top edge of door and 270 mm from bottom edge on lock side (Figure 3).	747
1	B	Same as A, plus one shim 300 mm on each side of lock (Figure 4).	1,624
1	C	Same as B, plus a shim opposite the lock (Figure 5).	2,989[1]
2	A	Same as A above.	939
2	B	Same as B above.	2,562
2	C	Same as C above.	6,149
2	D	Same as C, plus four doubled 2 by 4's installed horizontally between studs near door, 2 sets on each side (Figure 6).	5,978
2	E	Same as D, plus deadbolt lock engaged (Figure 7).	10,249[2]

NOTES:

1. The lower values obtained with frame #1 are due to a slight prying action damaging the jamb at lock height (Figure 8). The situation was corrected before frame #2 was tested. Also, the striking plates were installed with long screws to prevent any damage to the side jamb.

2. The door had not yet opened up. Test had to be discontinued since the lock block was being pulled through the door facing by the drop deadbolt lock set. (Door failure) see Figure 9.

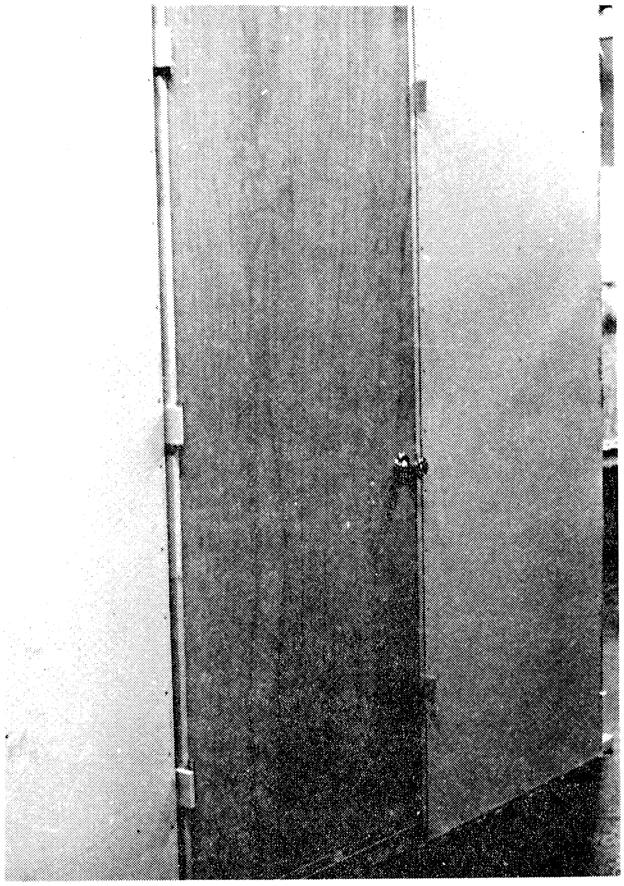

Figure 3.
Shim location test "A".

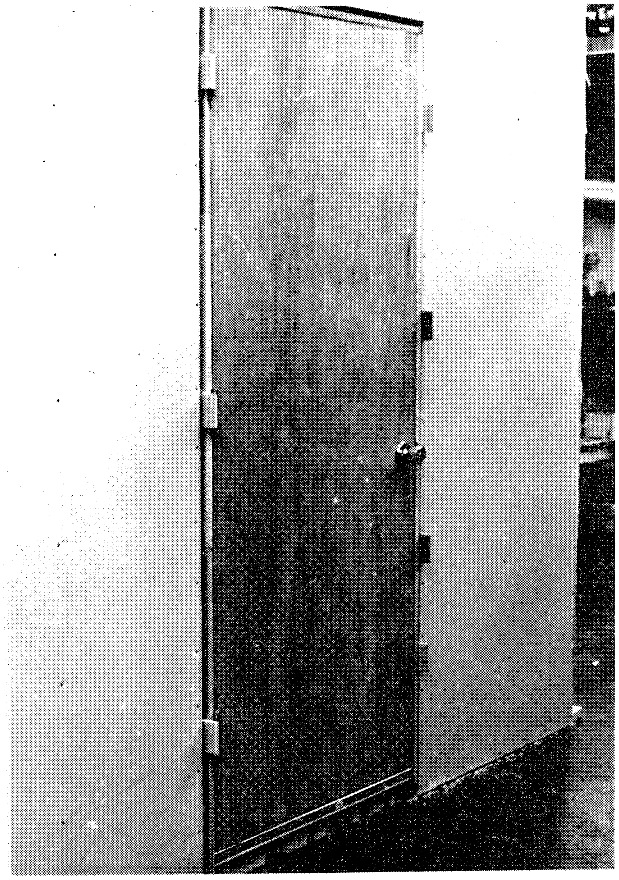

Figure 4.
Shim location test "B".

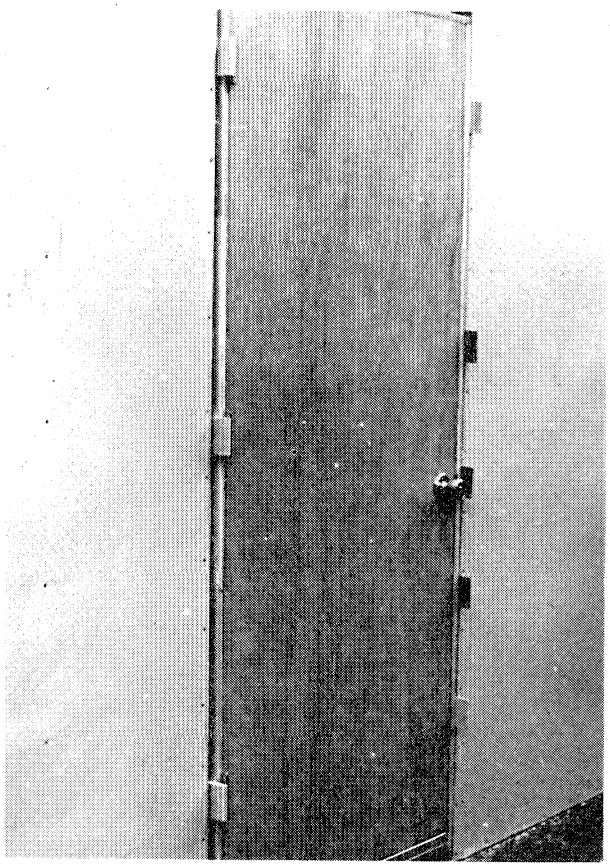

Figure 5.
Shim location test "C".

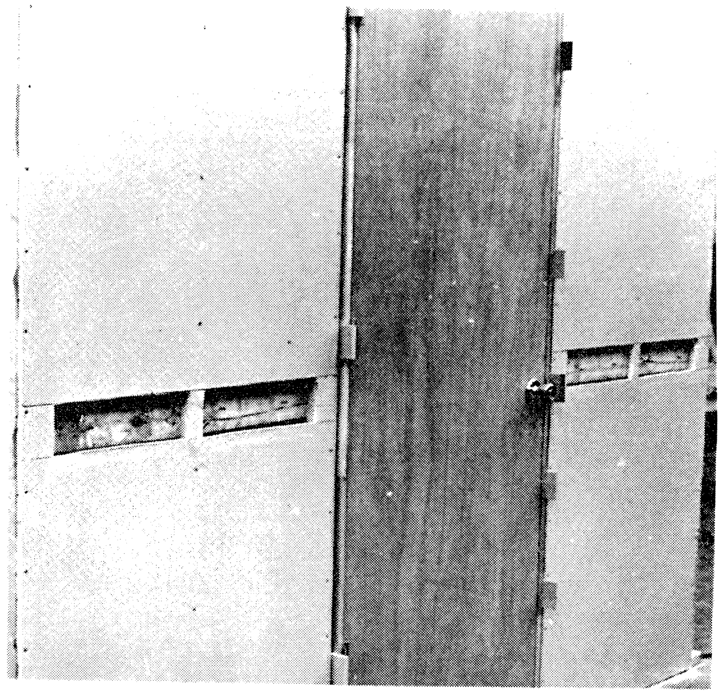

Figure 6.
Shim location test "D".

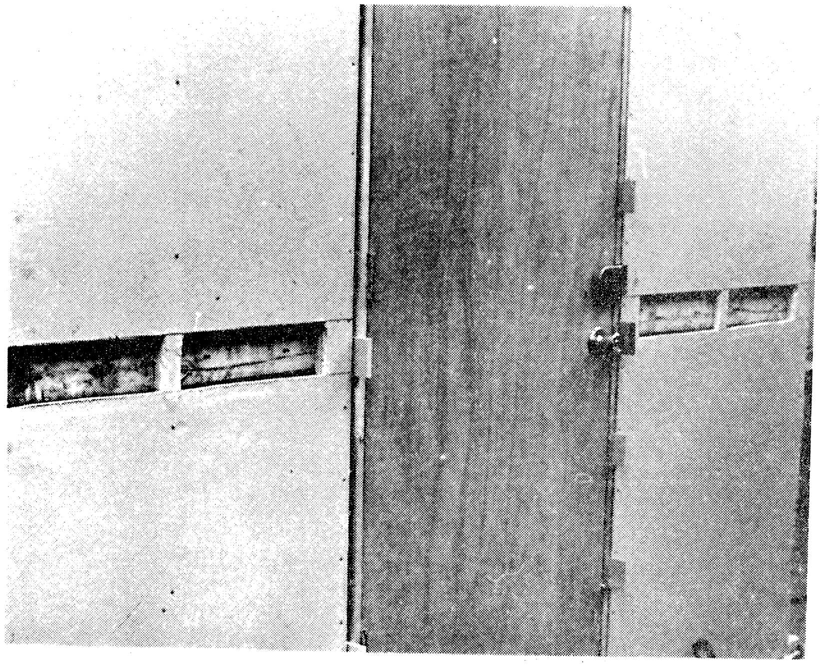

Figure 7.
Shim location test "E".

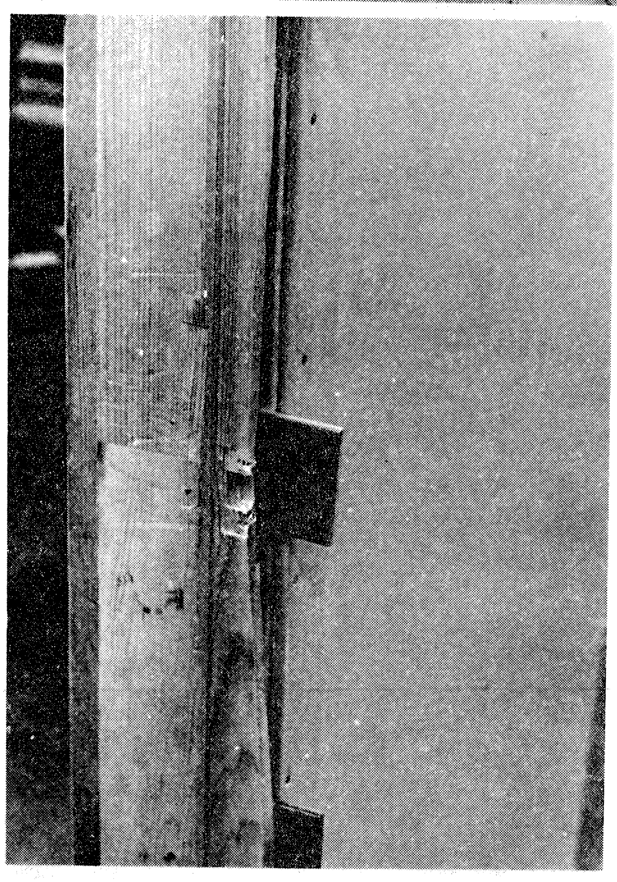

Figure 8.
Damaged side jamb.

Figure 9.
Lock block being pulled from door.

REFERENCES

American Society for Testing and Materials. 1976. Standard test methods for security of swinging door assemblies. ANSI/ ASTM F476-76. Annual book of ASTM Standards Part 46. American Society for Testing Materials, 1916 Race Street, Philadelphia, PA. 19103, U.S.A. pp. 726-749.

INDIVIDUAL DOOR RESULTS

EVALUATION OF EXTERIOR DOOR ASSEMBLIES FOR

RESISTANCE TO FORCED ENTRY

"PRELIMINARY TEST"

DATE OF TEST: November 10, 1981

DOOR NUMBER: VII

DOOR TYPE: Hollow-core door with plywood faces

DOOR CONSTRUCTION

The sample tested was a hollow-core door, with plywood faces, 810 x 2030 x 45 mm (2'8" x 6'8" x 1 3/4"). The door frame was made of clear softwood lumber. The rail and stiles were 42 x 39 mm. Strips of edge-oriented corrugated fibreboard were incorporated in the core to provide a certain degree of support for the plywood faces.

TEST METHODS

Hinges were mounted on the door, 180 mm (7") from the top, 279 mm (11") from the bottom, and a third hinge midway between the top and bottom hinges.

The key-in-knob lock set was installed 910 mm from the bottom edge of the door and the drop-deadbolt lock set 150 mm above it.

All hardware was installed using the screws provided by the manufacturers.

Impact testing was carried out at the centre of the door only, and was done in two parts.

Part 1

Impact tests were carried out over a 50-mm-thick buffer pad. The door was impacted twice at each performance grade level described in ASTM F476-76 under Table A1.1. Only the key-in-knob lock was engaged during test.

Part 2

Following the test described in part 1, the door was closed using the drop-deadbolt lock set since the key-in-knob lock set was damaged during the first test. The door was then subjected to a single impact of 340 joules (250 ft. lb.), without the use of a buffer, on each of the following areas:

Area # 1: Near the centre of the door.

Area # 2: A point 150 mm below the door knob and 150 mm from the edge of the door.

Area # 3: A point 150 mm from the bottom hinge on a horizontal line through the mid-point of the hinge.

When the drop deadbolt lock set was also damaged, the door was kept closed with a 39 x 89 mm (2 x 4 in.) piece of lumber standing upright below the lock area of the door.

TEST RESULTS

The test results in part 1 indicate that the door sample will meet the requirements of a grade 20 door when impacted in the center only (Figure 10). When the door was impacted twice at grade 30 level, the jamb split near the lock, the strike plate came off, and the door opened up. The failure was noted as a jamb failure.

Following these tests, the relatively intact door was subjected to the series of tests described in part 2 of the testing methods.

On the first impact, the door ram punctured the center of the door (Figure 11) making it possible to reach in and disengage the drop-deadbolt lock. On the second impact (area #2), the side jamb was damaged near the lock area, and the deadbolt plate came off, again allowing entry to be gained (Figure 12).

Testing was resumed near the lower hinge after securing the door lock area with a piece of 39 x 89-mm (2" x 4") lumber standing upright and resting on the floor. The side jamb on the hinge side failed along its entire length, and all three hinges were pulled out (Figure 13).

CONCLUSION

The results of the part 1, indicated that the centre of the door was not necessarily the most vulnerable area of the door and that testing should probably be carried out on other areas as suggested in ASTM F476-76 and as recommended by the Ottawa Police Crime Prevention Unit.

Testing according to part 2 clearly showed that the use of short screws would invariably result in jamb failure. Furthermore, the use of impact levels in the order of 340 joules, without the use of buffer pads, did not seem realistic, especially in the case of weaker doors, and would fail to classify these doors.

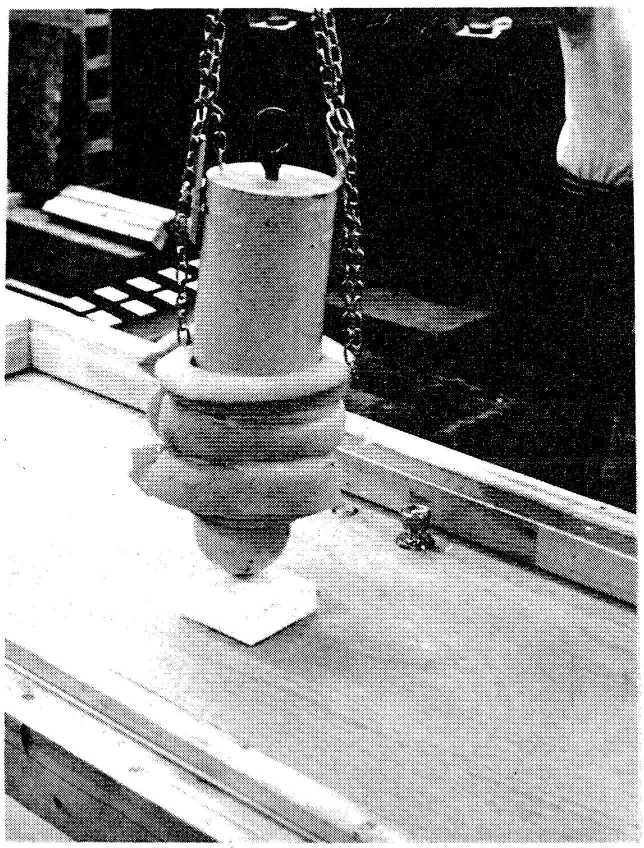

Figure 10.
Test set-up.

Figure 11.
Punctured door
after test.

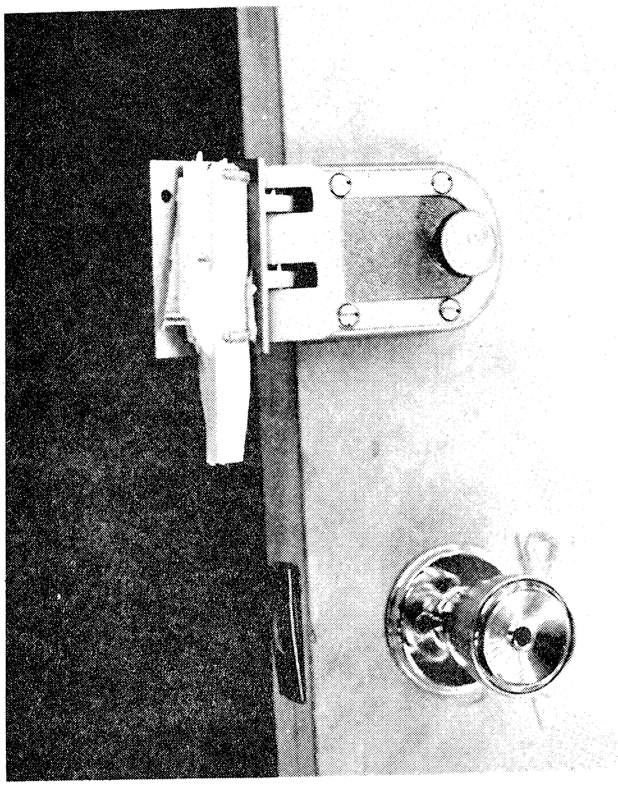

Figure 12.
Deadbolt striking plate pulled from side jamb.

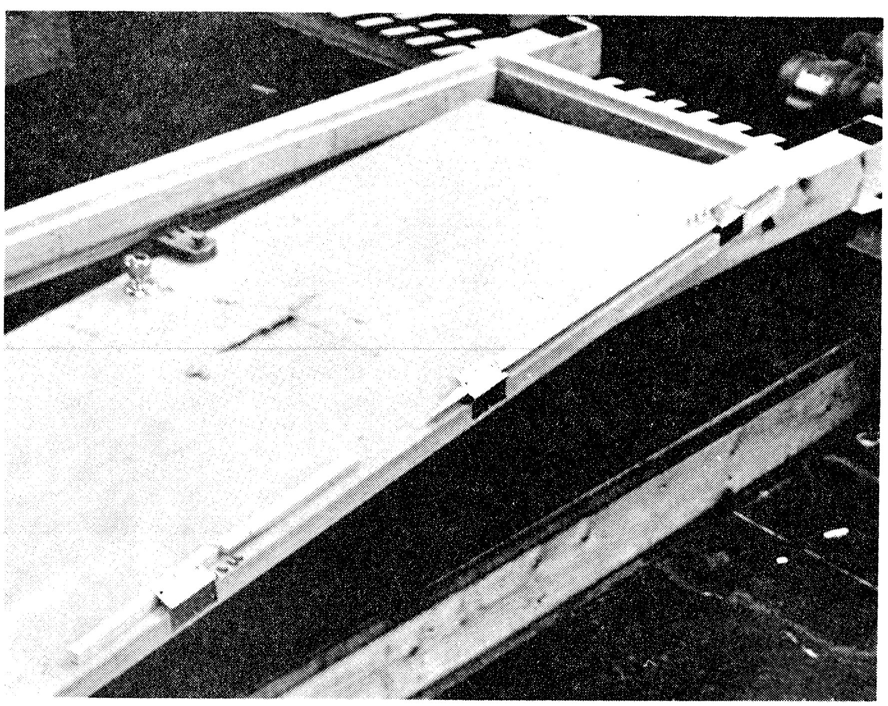

Figure 13.
Side jamb failure.

TESTING OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST:	December 17, 1981
DOOR NUMBER:	I
DOOR TYPE:	Steel door with wood stile and rail, pre-hung to a wooden door frame.

DOOR CONSTRUCTION

The sample tested was a foam-insulated steel door 810 x 2030 x 44 mm (2'8" x 6'8" x 1 3/4") with wood stiles and rails pre-mounted to a wood door frame. The 24 gauge steel door facings, 0.6 mm thick, were bent over the stiles. The 42.5 x 30 mm rails and 42.5 x 29 mm stiles were finger-jointed softwood. The rails appeared to be merely butted against the sides of the stiles. This door is shown in Figure 14.

Hardware

102 x 102 mm but hinges, 2.5 mm thick. One key-in-knob Weiser #A500 DLB lock set; one dominion drop deadbolt #602 lock set.

TEST METHODS

Hinges were mounted on the door 165 mm (6.5") from the top, 165 mm (6.5") from the bottom, and a third one, midway between the top and bottom hinges.

The key-in-knob lock set was installed 910 mm (36") from the bottom of the door, and the drop deadbolt lock set 150 mm (6") above it.

All hinges, strike plates, and lock sets were installed using 60 mm #8 wood screws.

The impact tests were carried out by dropping a cylindrical weight having an hemispherical impact nose approximately 150 mm in diameter into a foam buffer pad located at various designated areas on the door.

The impact tests were carried out on three areas:

Area # 1: A point defined by the intersection of the vertical centre-line of the door and a line from the centre of the bolt to the centre of the mid-height hinge.

Area # 2: A point, 150 mm (6") from the edge of the door.

Area # 3: A point, 200 mm (8") from the bottom hinge on a horizontal line through the mid-point of the hinge.

The impact buffer was a rigid foamed polystyrene (150 mm in diameter, 50 mm thick).

Each area was impacted twice at each impact level described in Table A1.1 of the ANSI/ASTM standard.

TEST RESULTS

Access could be gained following the first impact at the centre of the door (Area #1) at grade 30 level. At this point, the rails that were butted against the stiles, came off on the hinge side. As a result, the exterior door facing was bent in the centre, along its entire length (Figure 15) exposing all three hinges. The hinge pins could then be removed from the exterior.

The door jamb/frame did not suffer any major damage, except for a narrow split approximately 750 mm (30") in length, near the lock sets. The long screws kept the frame together and limited the damage to that area.

It is also worth noting that the drop-deadbolt lock set was intact following the test, while the key-in-knob bolt was released from the strike plate.

CONCLUSION

The door sample met the minimum requirements of a grade 20 door (as described in Table 1).

In all, 13 impacts were required before entry could be gained, for an accumulated force of 1360 joules (1,006 ft. lb.).

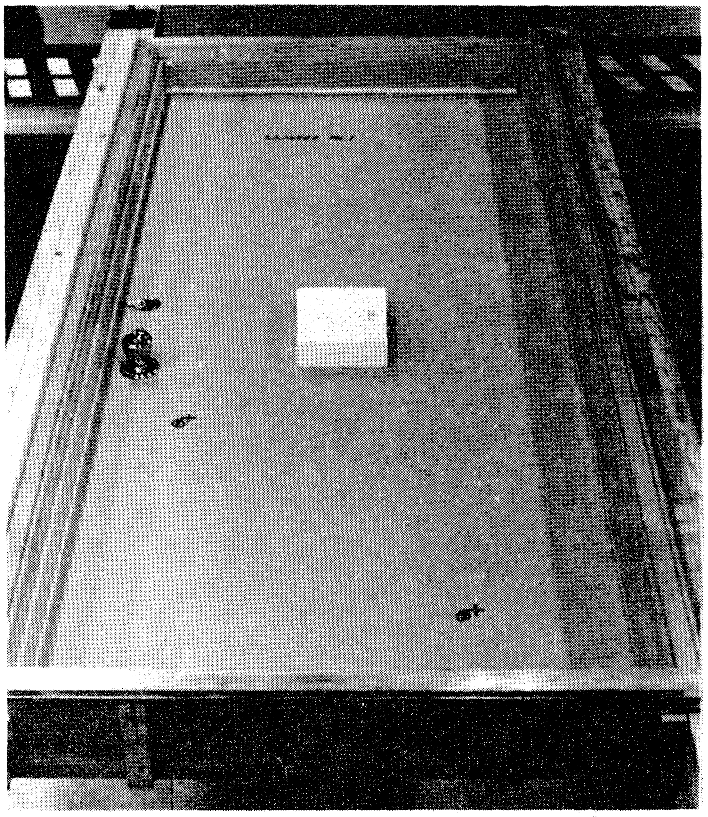

Figure 14.
Door No. I before test.

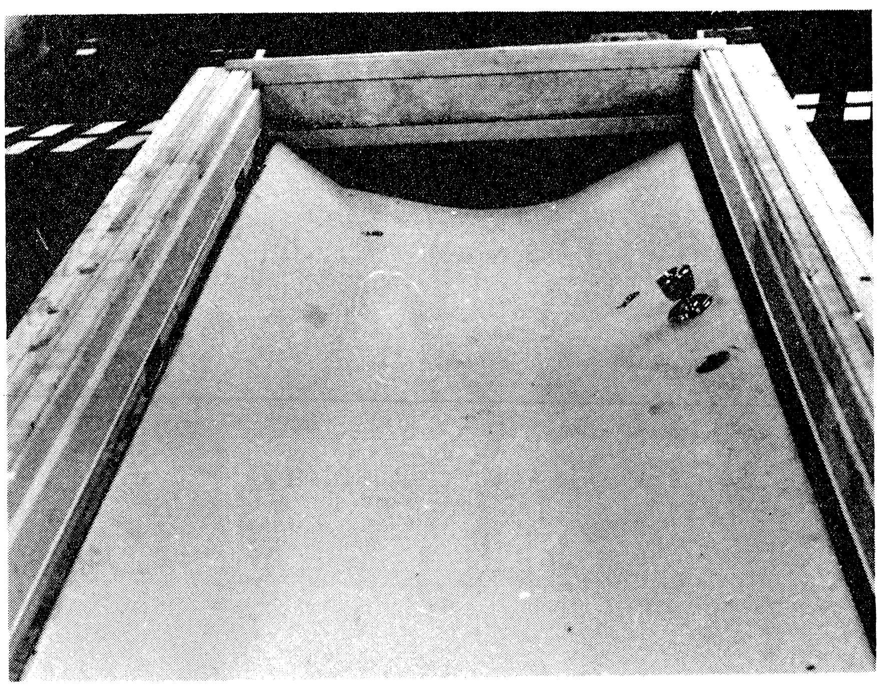

Figure 15.
Door after test.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE TESTED:	February 1982
DOOR NUMBER:	IA
DOOR TYPE:	Steel door with wood stiles and rails, pre-hung to a wood frame

DOOR CONSTRUCTION

The sample tested was a 806 x 2015 x 45 mm foam-insulated steel door, with wood rails and stiles, pre-hung in a wood door frame. The metal door facings were bent over part of the stiles. Both rails and stiles (approximately 32 x 45 mm) were of finger-jointed softwood. The door frame was equipped with a high security striking plate installed by the manufacturer (Figure 16).

NOTE

The test was carried out with only the key-in-knob lock engaged in the high-security strike plate.

RESULTS

The stile was badly damaged (approximately 450 mm long) near the lock, during the first impact (grade 1 level) at the centre of the door. The door broke open on the next impact at the same area; the stile was further damaged and the latch was bent (Figure 17).

The jamb and high security strike plate were not damaged in the test.

CONCLUSION

The door sample failed to meet the minimum security requirements for an exterior door when tested with a single key-in-knob locking device.

The wood stile on the lock edge appears to be responsible for the failure.

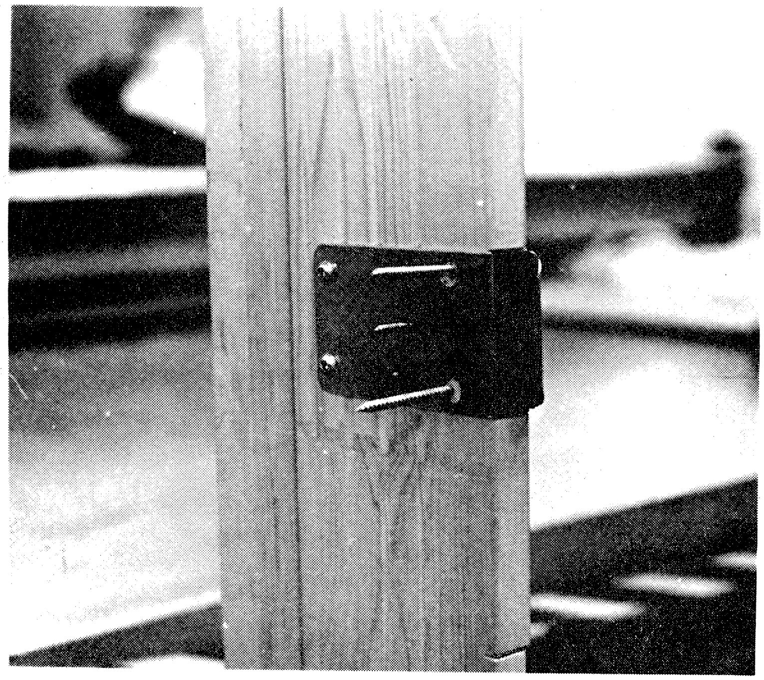

Figure 16.
High-security striking plate.

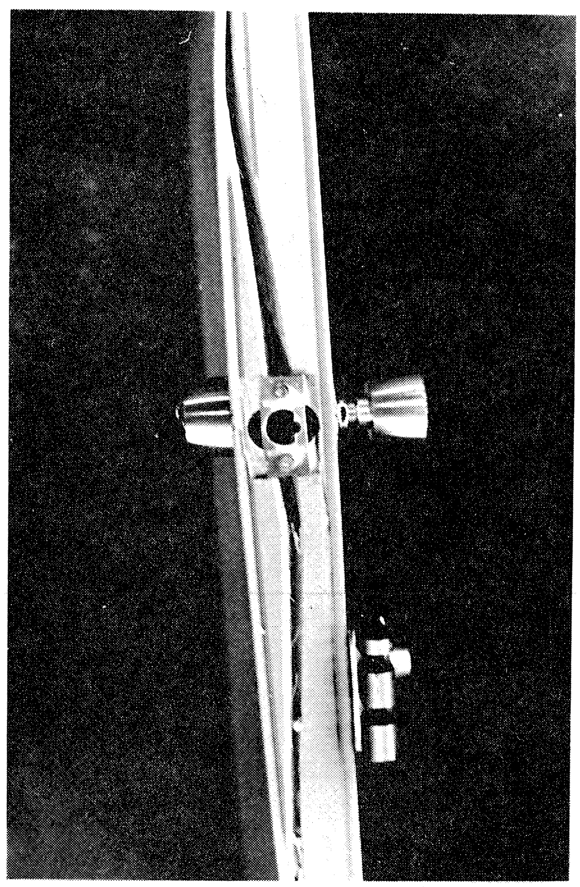

Figure 17.
Damaged stile after test.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST:	March 1982
DOOR NUMBER:	IB
DOOR TYPE:	Steel door with wood stiles and rails, pre-hung to a wood frame.

DOOR CONSTRUCTION

The sample tested was a 806 x 2015 x 45 mm foam-insulated steel door, with wood rails and stiles, pre-hung in a wood door frame. The metal door facings were bent over part of the stiles. Both rails and stiles (approximately 32 x 45 mm) were of finger-jointed softwood. The door frame was equipped with a high-security striking plate installed by the manufacturer (Figure 16).

NOTE

The test was carried out with two locks engaged. A key-in-knob lock set as a primary lock (Weiser #A500 DLB), and a vertical drop deadbolt lock set (Dominion #602).

TEST RESULTS

Grade Level	Area # 1	Area # 2	Area # 3
10	VV	VV	VV[1]
20	VV[2]	VV[3]	F[4]
30			
40			

V = passed.

F = failed.

[1] Stile was damaged on hinge side.

[2] Top rail was bent, stile on lock side was damaged.

[3] Stile on lock side was very badly damaged.

[4] Entry could be gained by opening the door on the hinge side. Stile was broken into four pieces; finger-joint at hinge gave way (Figure 18) and one hinge was pulled from the door (Figure 19). The jamb/frame was practically intact during the test. The drop-deadbolt lock set was still engaged.

CONCLUSION

This door sample met the requirements of a grade 10 door, and, when tested with two locking systems, nearly met that of grade 20. Altogether, 11 impacts were required before access could be gained, for a total accumulated force of 1080 joules (799 ft. lb.).

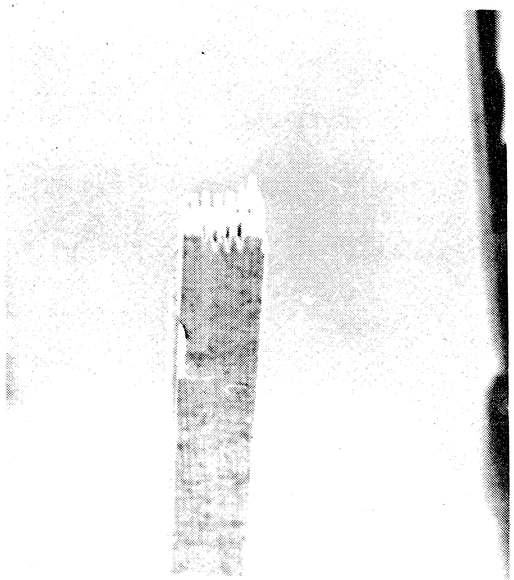

Figure 18.
Finger-jointed stile damaged during test.

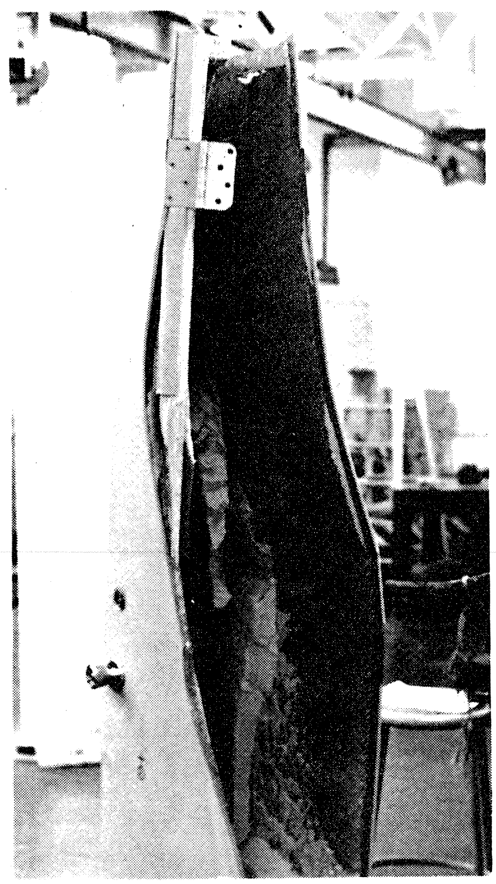

Figure 19.
Door after test.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST:	March 9, 1982
DOOR NUMBER:	II
DOOR TYPE:	Steel door with steel stile and rails pre-hung in a wood frame partially covered with sheet metal.

DOOR CONSTRUCTION

The sample was an insulated steel door 787 x 1990 x 45 mm (2'6" x 6'6" x 1 3/4") with steel stiles and rails, pre-hung in a metal-covered wood frame. The door was installed with 100 x 100 mm butt hinges. The top and bottom hinges were located 140 mm (5.5") from the edges of the door, and the third hinge was located at the centre of the door. The door came equipped with two locks. The key-in-knob lock set was located 914 mm (36") from the bottom of the door, and the horizontal deadbolt lock set 152 mm (6") above it. The door assembly is shown in Figure 20.

RESULTS

The spring-loaded latch was released from the striking plate on the first impact at grade 10 level (near the lock) leaving only the horizontal deadbolt lock set engaged.

The door finally broke open on the first impact near the lock at grade 20 level, when the horizontal deadbolt slipped from its striking plate, bending and tearing part of the metal that was covering the wood jamb behind the striking plate (Figure 21).

CONCLUSION

The door sample met with the[redacted]irements of a grade 10 door when tested in impacts on three locations of [redacted] door.

Failure was noted as a jamb failure brought about by the use of improper locking devices.

In all, nine impacts were required before access could be gained, for a total accumulated impact force of 840 joules (621 ft. lb.).

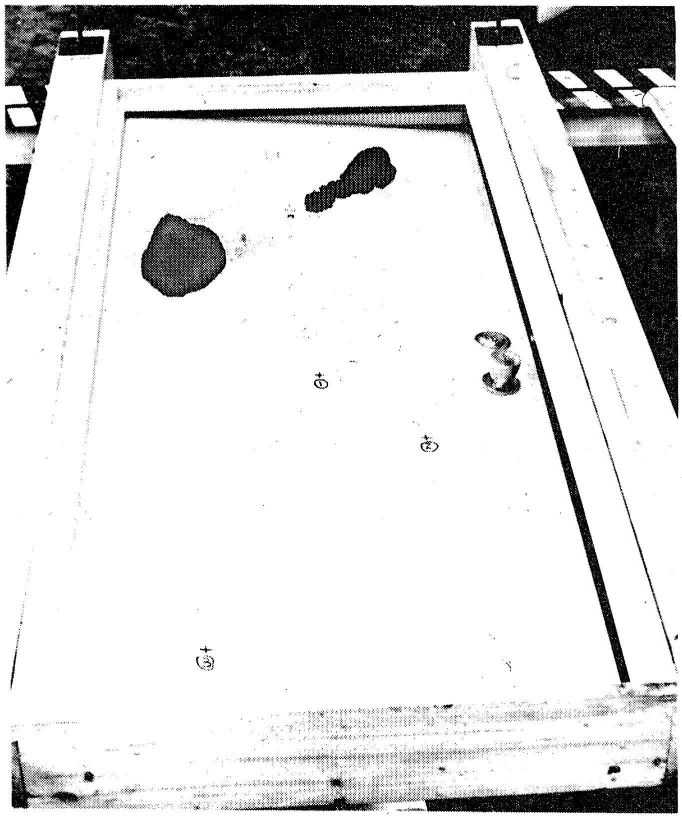

Figure 20.
Door No. II before test.

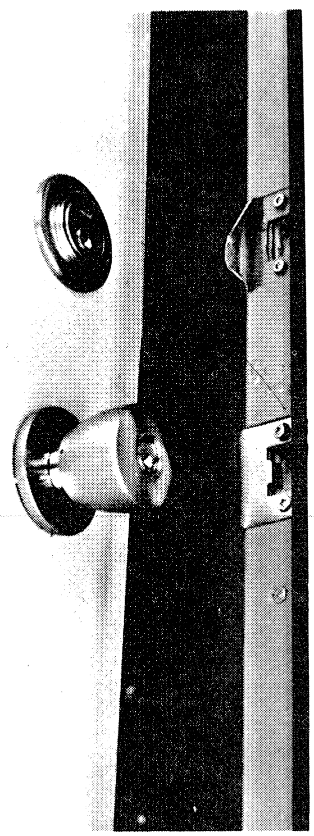

Figure 21.
Side jamb after test.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: January 6, 1982

DOOR NUMBER: III

DOOR TYPE: Solid-core door, plywood faces and core of glued wood strips.

DOOR CONSTRUCTION

The door sample was an 810 x 2030 x 44-mm (2'8" x 6'8" x 1 3/4") plywood-faced door with an interior core of glued cedar wood blocks with staggered end joints. The stile and rails were made of clear cedar measuring 38 x 32 mm, 38 and 42 mm, respectively.

Hardware

102 x 102-mm butt hinges, 2.5 mm in thickness. One key-in-knob lock set Weiser #A500 DLB. One Dominion #602 drop dead-bolt lock set.

TEST RESULTS

The door sample met the requirements of a grade 10 door. The stile on the hinge side was split along its entire length following the first impact in the centre of the door (Area #1) at grade 20 level (Figure 22). Part of the stile remained attached to the hinges on the jamb. Only a portion of the exterior plywood facing kept the door from opening (Figure 23).

The key-in-knob latch came off the striking plate. The door was kept closed by the drop deadbolt lock set. There was no apparent damage to the frame.

CONCLUSION

This door sample met with the requirements of a grade 10 door when tested in impact on three locations.

In all, seven impacts were required before entry could be gained, for a total accumulated impact force of 600 joules (443 ft. lb.).

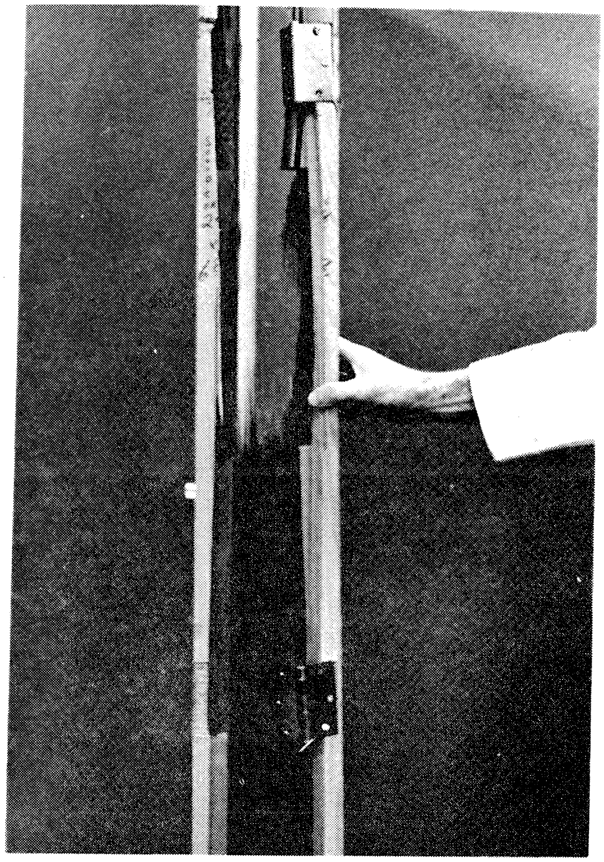

Figure 22.
Damaged stile after test.

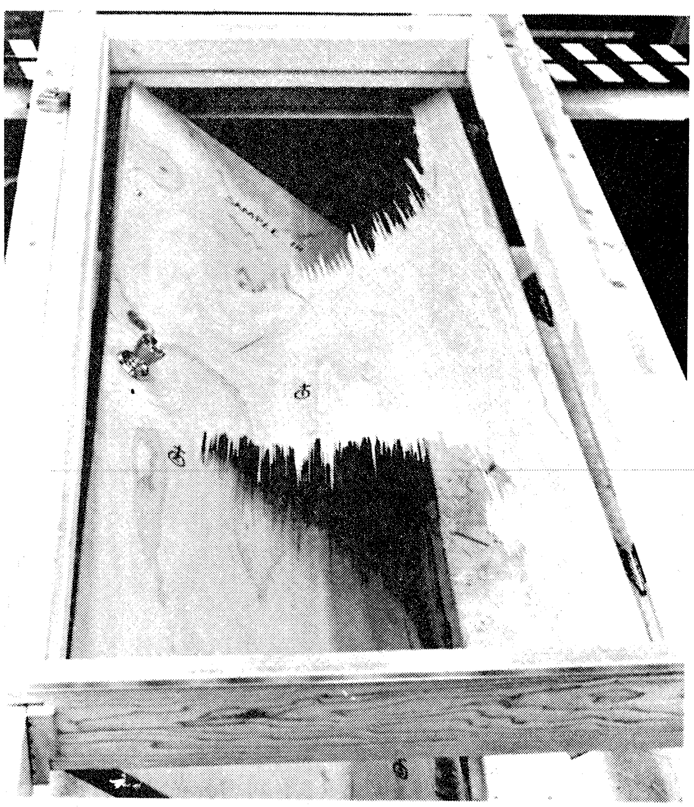

Figure 23.
Door facing after test.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: November 25, 1981

DOOR NUMBER: IV

DOOR TYPE: Solid core door with plywood faces and a particleboard interior.

DOOR CONSTRUCTION

The door sample was a 860 x 2080 x 44-mm (2'10" x 1'10" x 1 3/4") plywood-faced wood door with a particleboard interior.
The framework was made of solid softwood lumber. The stile and rails measured 38 x 38 mm.

RESULTS

The door became severely damaged following the two impacts near the locks at grade 20. The stile split and pulled away from the core material. The key-in-knob was disengaged, and the drop deadbolt lock set mounted on the face of the door was loosened (Figure 24).

Finally the door broke open on the first impact near the bottom hinge (area #3) at grade 20 level, as the deadbolt lock set was pulled from the face of the door (Figure 25). This was mainly due to the fact that screws were held by particleboard. There was no apparent damage to the jambs.

CONCLUSION

The door sample met with the requirements of a grade 10 door when tested in impacts on three locations.

Eleven drops were needed before access could be gained for a total accumulated impact force of 1080 joules (799 ft. lb.).

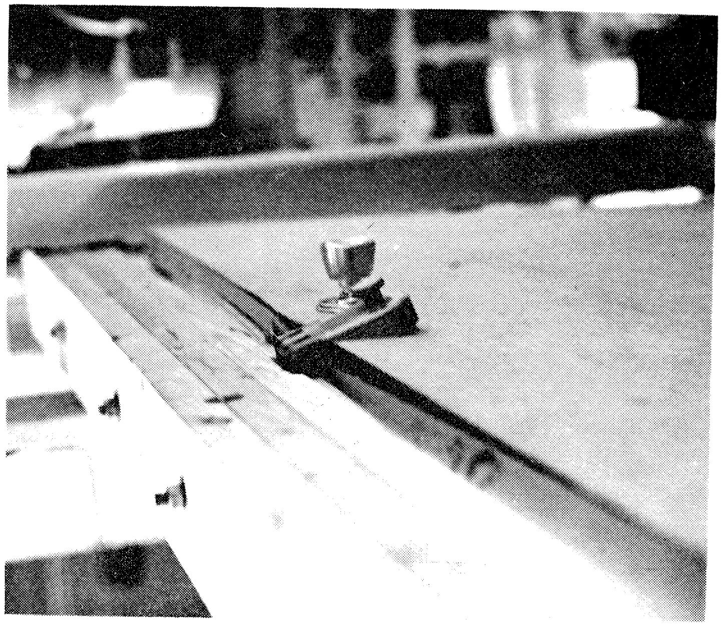

Figure 24.
Deadbolt lock set during test.

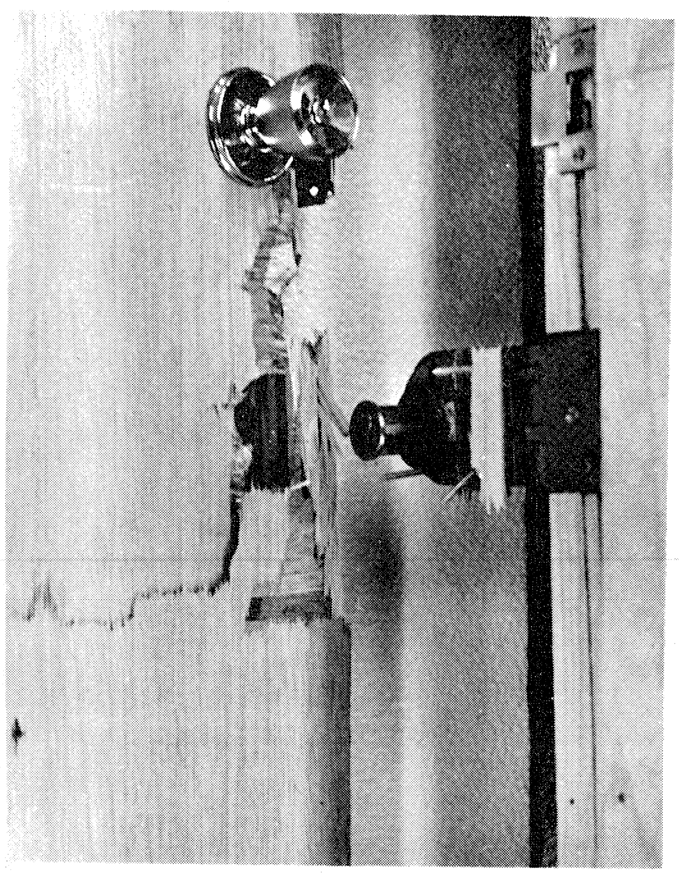

Figure 25.
Lock pulled from door.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: January 14, 1982

DOOR NUMBER: V

DOOR TYPE: Solid-core door, hardboard faces with a particleboard interior.

DOOR CONSTRUCTION

The sample tested was a 810 x 2030 x 44-mm (2'8" x 6'8" x 1 3/4") hardboard-faced door with a particleboard interior. The framework was made of clear softwood lumber rails and stiles measuring 39 x 32 mm. The hardboard facings were approximately 3 mm each in thickness.

RESULTS

The spring-loaded latch came off the striking plate at grade 10 level on the first impact near the lock area leaving only the vertical deadbolt lock set engaged. The door finally failed on the first impact near the lock at grade 20 level. The stile was broken in half at lock height and separated from the core material (Figure 26). The deadbolt cylinder came off the door as it sheared through the particleboard core (Figure 27). Figure 28 shows the interior face of the door, following test.

CONCLUSION

This door sample met with the requirements of a grade 10 door when impact-tested on three selected areas.

A total of nine impacts were needed before entry could be gained, for a total accumulated impact force of 840 joules (621 ft. lb.).

Figure 26.
Damaged stile.

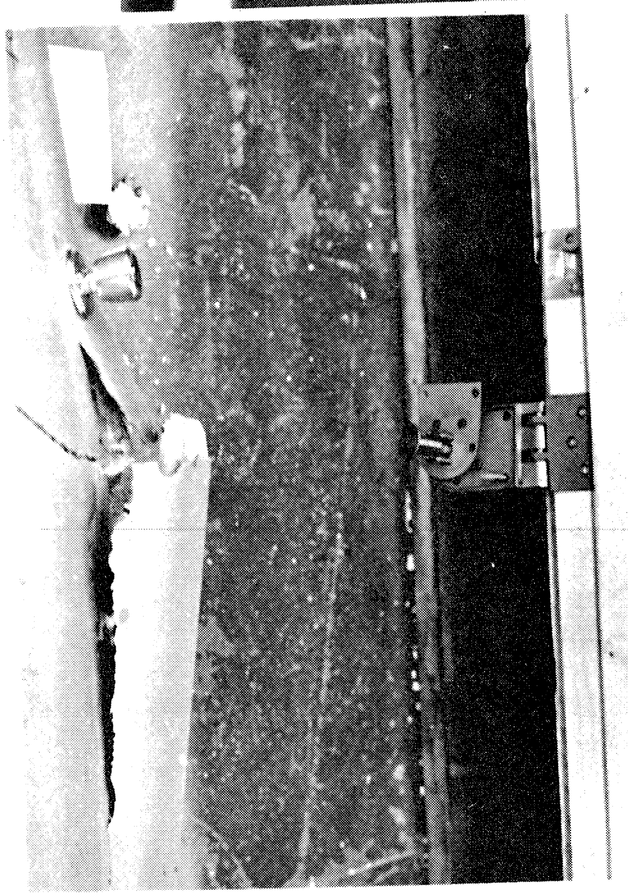

Figure 27.
Lock pulled from door.

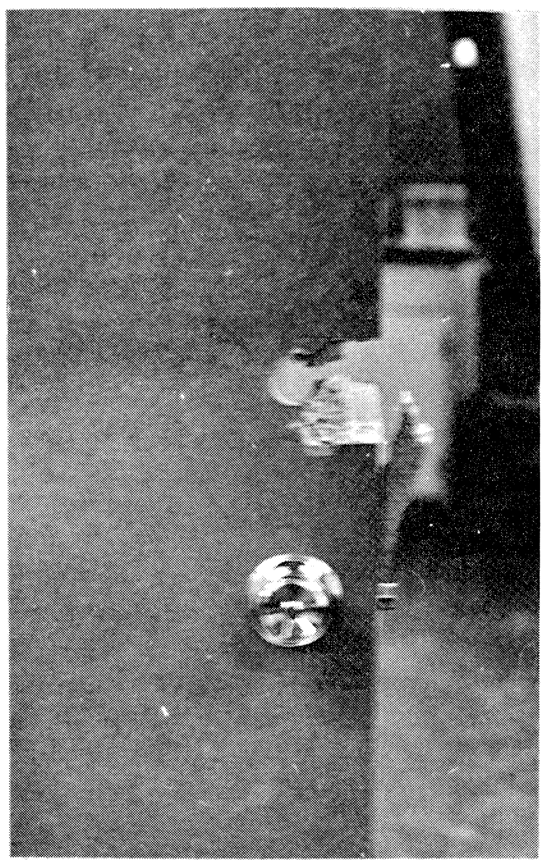

Figure 28.
Cylinder sheared through particleboard.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: January 13, 1982

DOOR NUMBER: VI

DOOR TYPE: Cedar plank door.

DOOR CONSTRUCTION

The sample was a cedar plank door, 810 x 2030 x 45 mm (2'8" x 6'8" x 1 3/4"). The two edge planks were 130 mm wide, and the five inside planks 110 mm each. The planks were jointed vertically and reinforced with four hardwood horizontal cross members, approximately 16 by 95 mm, extending to within 50 mm of the door edges. This door is shown in Figure 29.

TEST RESULTS

The edge plank on the lock side was split along its entire length, following the first impact near the locks, at the lowest grade level (Figure 30). Part of the plank remained attached to the jamb by the drop deadbolt lock set (Figure 31). Failure took place in the portion of the plank that is not supported by cross members (Figure 32).

CONCLUSION

The door sample failed to meet with the minimum security requirements for an exterior door. Three impacts at the minimum force level were sufficient to allow entry to be gained for a total accumulated impact force of 240 joules (177 ft. lb.).

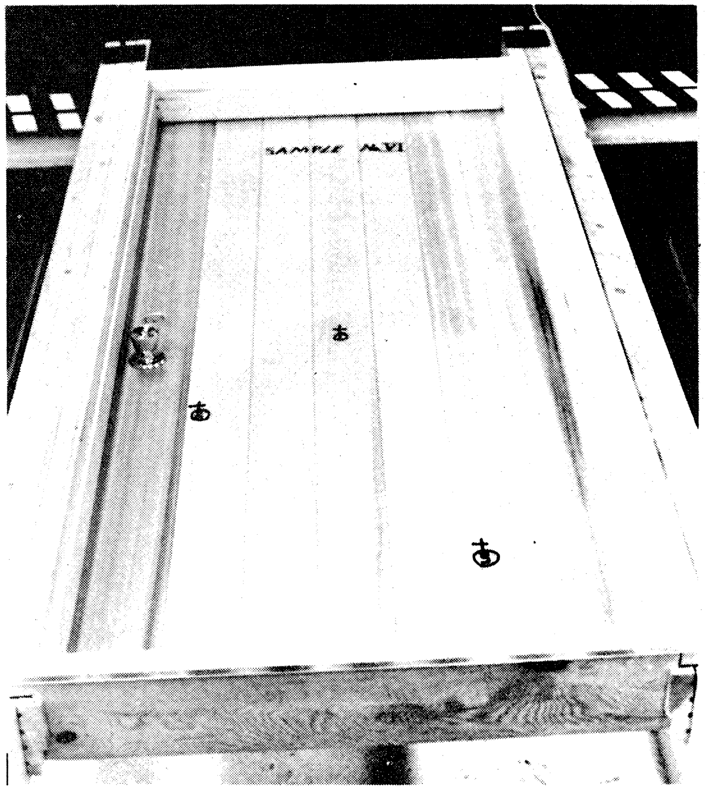

Figure 29.
Door No. VI before test.

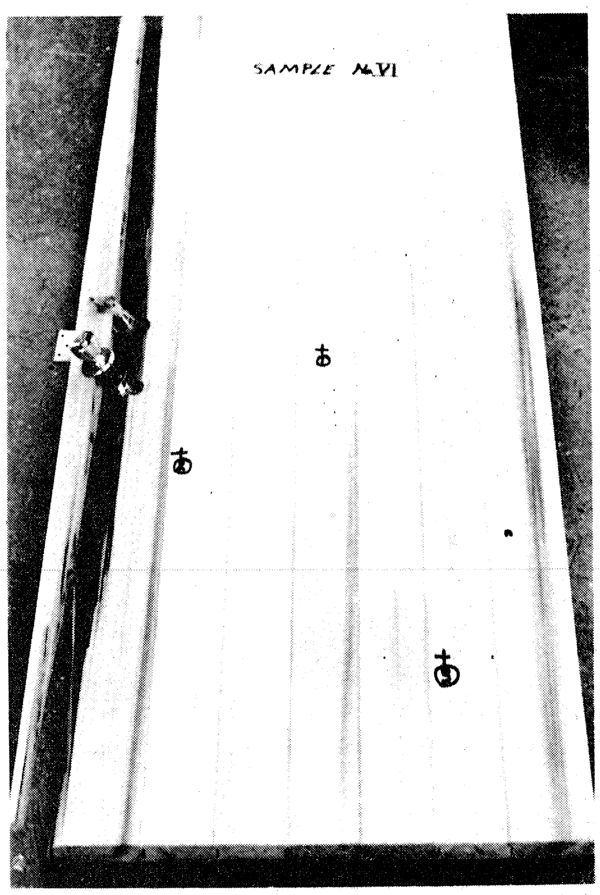

Figure 30.
Door failure.

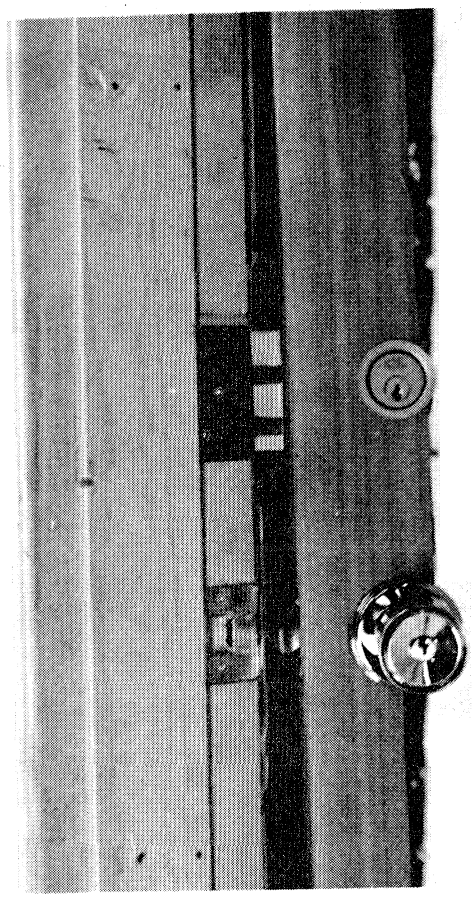

Figure 31.
Drop deadbolt lockset
after test.

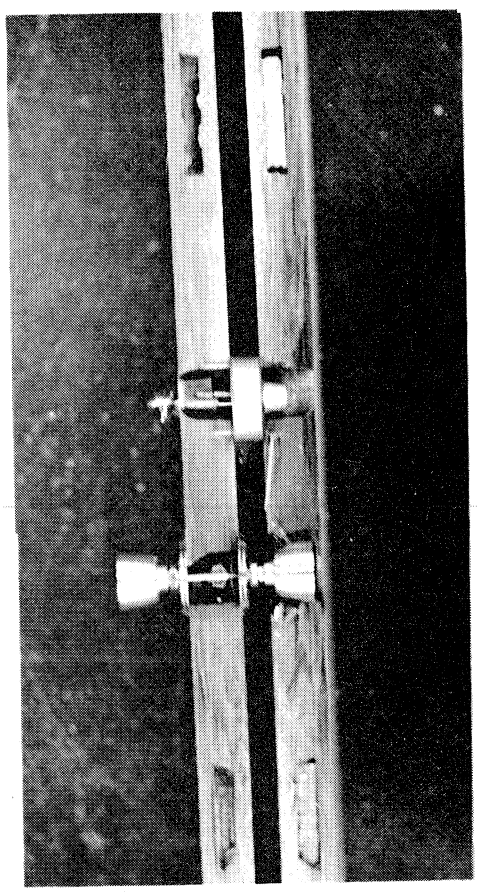

Figure 32.
Failure in the unsupported plank.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: November 19, 1981

DOOR NUMBER: VIIA

DOOR TYPE: Hollow-core door.

DOOR CONSTRUCTION

The sample tested was a hollow-core door, with plywood faces, 810 x 2030 x 45 mm (2'8" x 6'8" x 1 3/4"). The door framework was made of clear softwood lumber. The rails and stiles were 42 x 38 mm.

Strips of edge-oriented corrugated fibreboard were incorporated in the core to provide a certain degree of support to the plywood faces. The lock block was made of particleboard, and extended approximately 80 mm inside the stile.

TEST RESULTS

The sample tested failed on the first impact near the locks. Both the exterior and interior plywood faces were heavily damaged near the lock block making it possible to reach in and disengage the locks (Figures 33, 34).

Following door failure, the test near the hinge area was also carried out to accumulate more information. Once more, a single blow (at level 10) was sufficient to push the rail inside, tearing the plywood along the stile (Figure 35). Testing was discontinued.

The jambs and locks remained intact following tests.

CONCLUSION

This hollow-core door sample failed to comply with the minimum security requirements for an exterior door, based on the suggested grade performance levels of the standard.

In all, only three grade 10 blows were sufficient to allow entry to be gained, for a total accumulated force of 240 joules (177 ft. lb.).

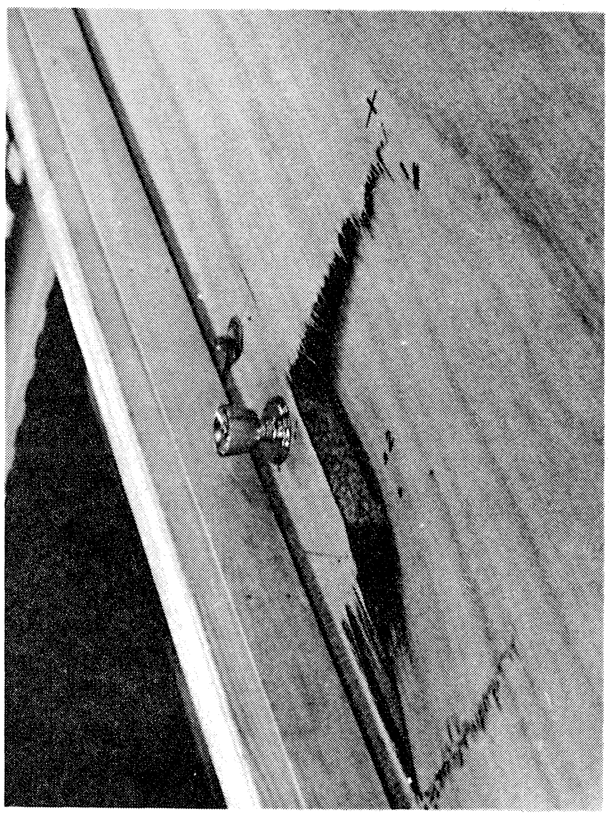

Figure 33.
View from the exterior.

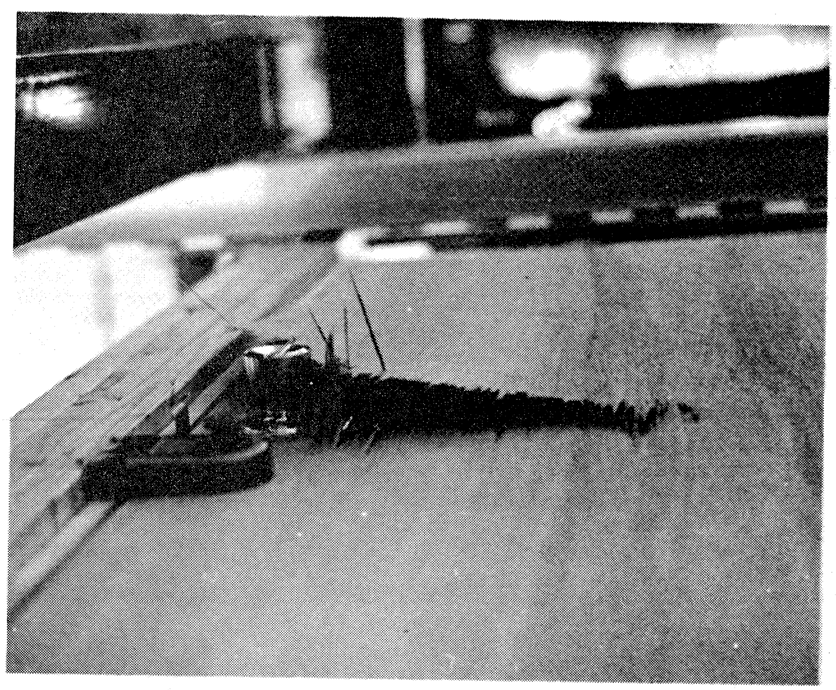

Figure 34.
View from the interior.

Figure 35.
Damaged door following impact at lower hinge.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: December 10, 1981

DOOR NUMBER: VIII

DOOR TYPE: Flush-faced plywood insulated door.

DOOR CONSTRUCTION

The sample tested was an insulated flush-faced plywood door 810 x 2030 x 45 mm (2'8" x 6'8" x 1 3/4"). The door framework was made of clear softwood lumber. The rails and stiles were 38 x 40 mm. This door is shown in Figure 36.

TEST RESULTS

This sample met with the security requirements of a grade 10 door when impacted on all three critical areas. It also met with grade 20 requirements when tested in the centre of the door and near the lock area. However the door was badly damaged following the last series of grade 20 tests near the lower door hinge. The bottom hinge was pulled from the door on the first impact (Figure 37). Both stiles were transversely broken at lock height, literally splitting the door in half on the second impact, since the lower part of the door was left unsupported (Figure 38). Entry could then be gained through the bottom part of the door.

The key-in-knob lock set was disengaged following the test. The door was kept closed by the drop deadbolt lock set only.

The jamb was also intact.

CONCLUSION

This sample tested met with the security requirements of a grade 10 door. It failed to meet with the grade 20 requirements by a single blow. In all, twelve impacts were needed to cause failure to the door, for a total accumulated impact force of 1200 joules (838 ft. lb).

Figure 36.
Door No. VIII.

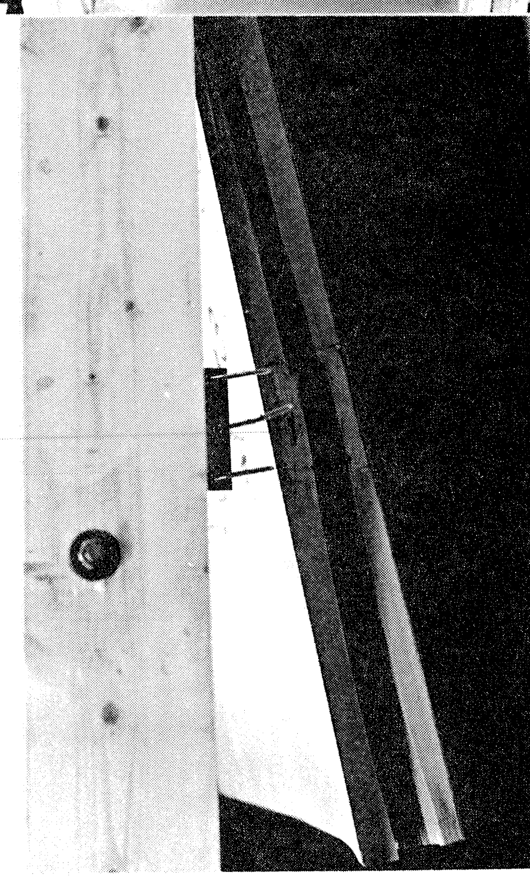

Figure 37.
Hinge pulled from door.

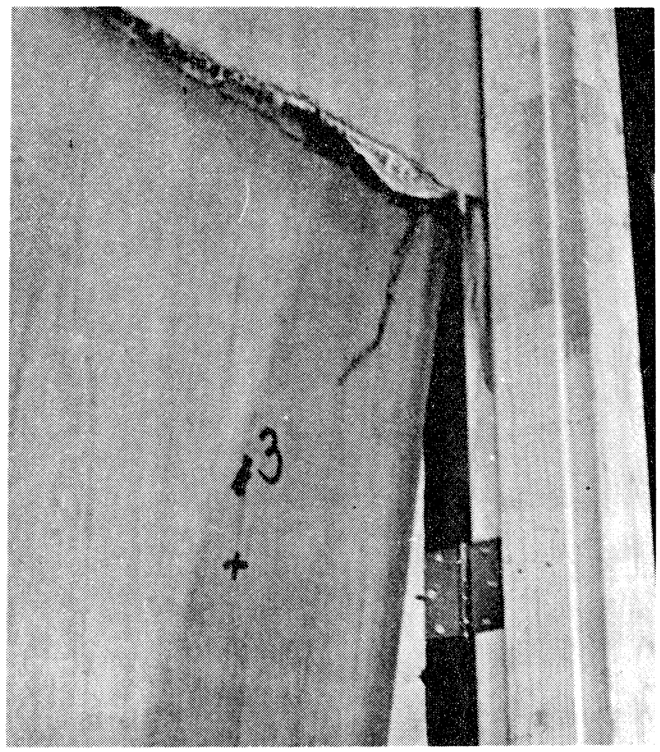

Figure 38.
Door damaged at lock height.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: December 17, 1981

DOOR NUMBER: IX

DOOR TYPE: Cedar panel door.

DOOR CONSTRUCTION

The sample tested was a cedar panel door 810 x 2030 x 45 mm (2'8" x 6'8" x 1 3/4"). The stile and rail were, respectively, 120 mm and 115 mm in width. The top recessed panel was 250 mm wide and 230 mm long, while the other four recessed panels were 250 by 710 mm in length. The panels were attached to the rails and stiles by a tongued-and-grooved joint. The panels were only 7 mm thick near the joint.

This door is shown in Figure 39.

TEST RESULTS

The door sample failed on the very first impact at the lowest grade level. The impact was directed at a point on the corner of the recessed panel closest to the lock, 75 mm in from the vertical and horizontal edges of the panel. The entire panel and part of the cross rail (Figure 40) came off the door, it was then possible to open the door by reaching through the opening and unlocking the door from the inside.

The jamb and locks were intact following test.

CONCLUSION

The sample tested failed to meet with the minimum security requirements for an exterior door when tested for resistance to impacts. A single impact of 80 joules (59 ft. lb.), was sufficient to allow entry to be gained.

Figure 39.
Door No. IX before test.

Figure 40.
Door after test.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE OF TEST: January 11, 1982

DOOR NUMBER: X

DOOR TYPE: Old-type panel door (used door).

DOOR CONSTRUCTION

The sample tested was an old stile used panel door 755 x 2030 x 35 mm (2'6" x 6'8" x 1 2/5"). All five panels were 540 mm wide and 275 mm high and had a minimum thickness of 10 mm. The stile and rail were 115 mm wide. The hardware was mounted on the reverse side of that found in the original installation. This door is shown in Figure 41.

TEST RESULTS

The door failed on the very first impact at the lowest grade level. The impact was directed in the centre of the door, which coincided with the centre of the middle recessed panel, near a lower cross rail. The impact almost tore the whole panel off the door (Figure 42), making it possible to open the door by reaching through the opening and unlocking the door from the inside.

Locks and jambs remained intact following test.

CONCLUSION

The used door tested failed to meet with the minimum security requirements for exterior doors. A single blow of 80 joules (59 ft. lb.) was all that was required to allow entry to be gained.

Figure 41.
Door No. X before test.

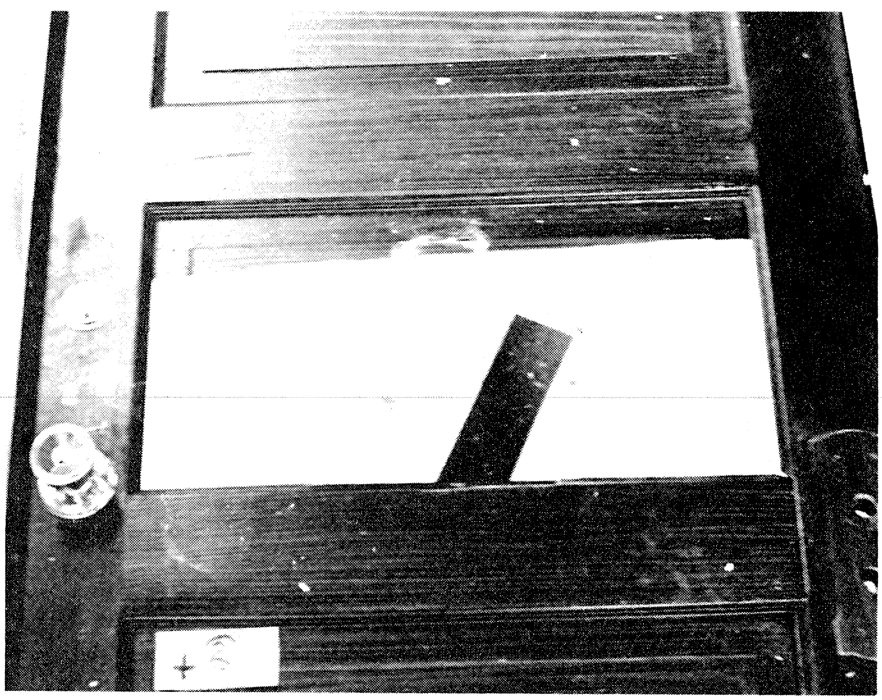

Figure 42.
Door after first impact.

EVALUATION OF EXTERIOR DOOR ASSEMBLIES

FOR RESISTANCE TO FORCED ENTRY

DATE TESTED:	March 1982
DOOR NUMBER:	XI
DOOR TYPE:	All-steel door, pre-hung in a steel frame (fire door).

DOOR CONSTRUCTION

The sample tested was a 810 x 2065 x 45 mm (2'8" x 6'9" x 1 3/4") steel door (fire door) pre-hung in a metal frame. The door was tested with a key-in-knob lock set only, since there was no provision for a vertical drop deadbolt strike plate on the metal frame. The door was hung with 3 sets of 115-mm butt hinges. The door assembly is shown in Figure 43.

RESULTS

The key-in-knob latch was damaged on the first impact at the centre of the door (at grade 10 level), allowing entry to be gained (Figure 44).

CONCLUSION

The door failed to meet with the minimum security requirements for an exterior door when tested with only one lock. A single impact of 80 joules (59 ft. lb) allowed entry to be gained.

This strongly built door would probably have done very well if the jamb had been built to accept a good quality secondary lock such as vertical drop deadbolt lock set.

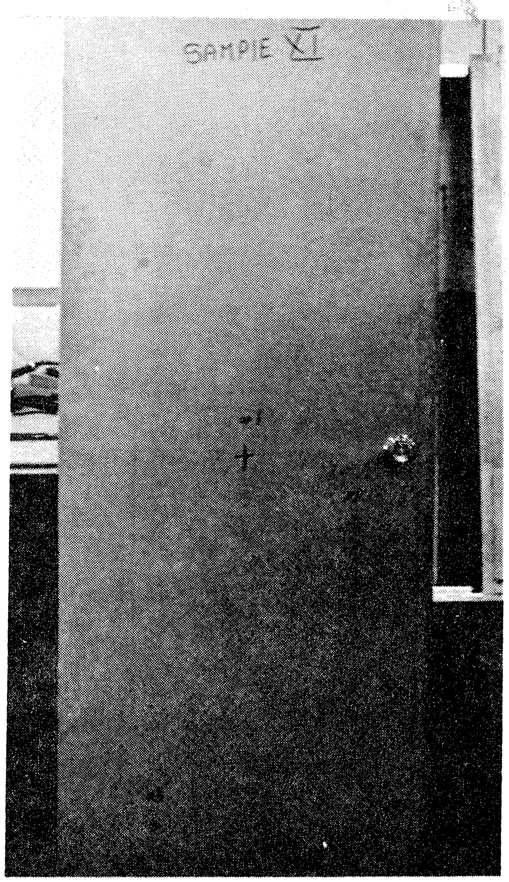

Figure 43.
Door No. XI before test.

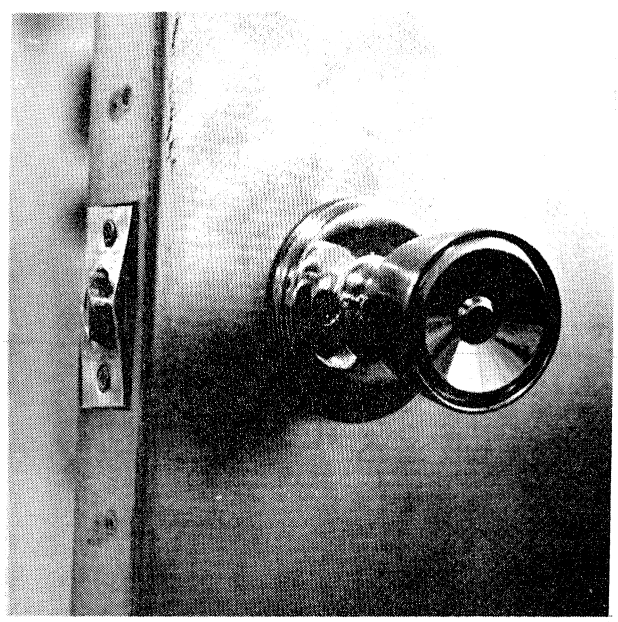

Figure 44.
Lock failure.