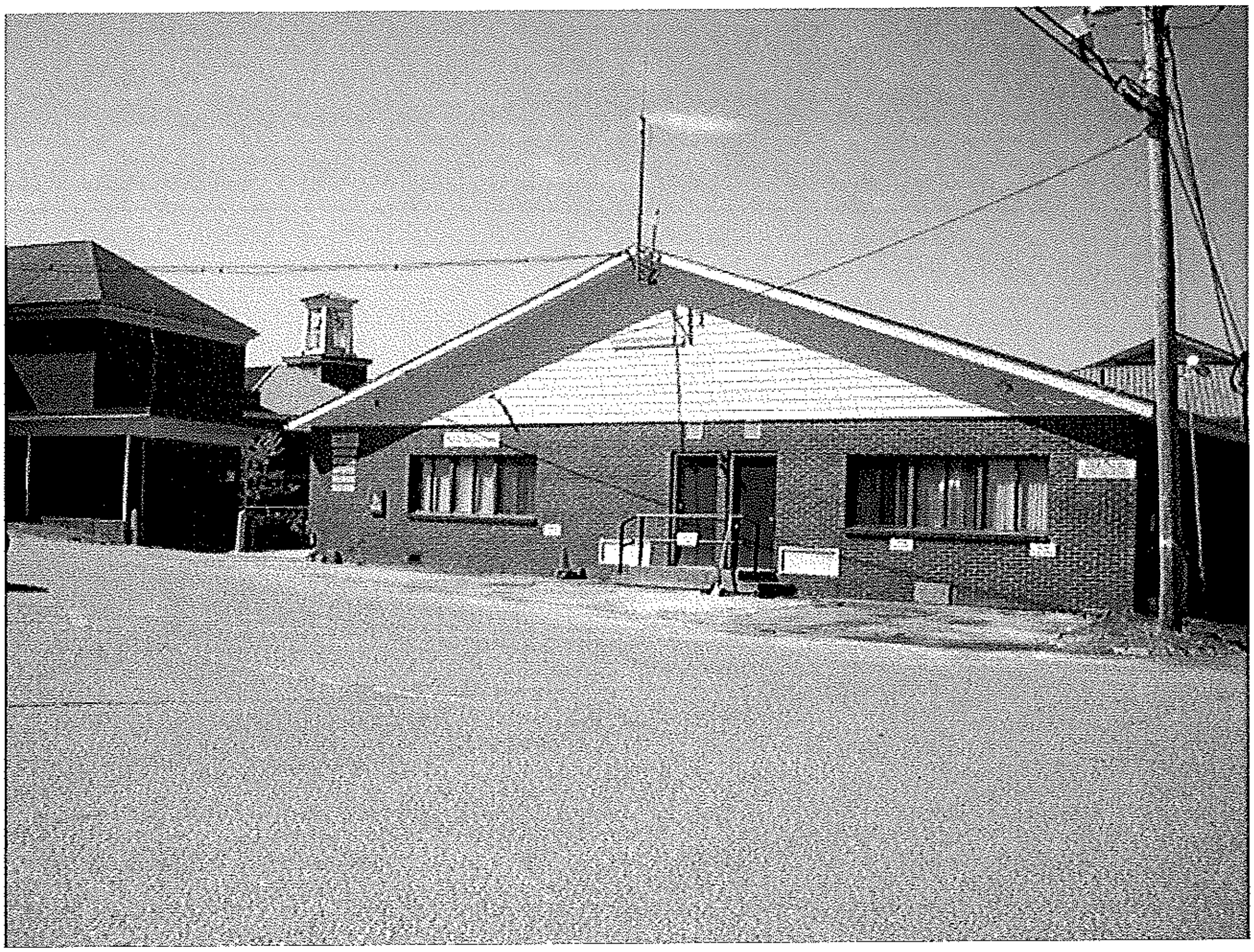
Willard A. Slade Building
Hubbardston Town Offices

Assessment of Veneer Brick Deformation May 2009



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Member of the American Institute of Architects

Investigation by Chenot Associates, Inc., Architects, with Bolton & DiMartino, Structural Engineers, into the cause and extent of severe deformation of veneer brick facing.

CAUSES

1. Ice damming and resulting leakage

Reference: excerpts of drawings by Cilcius Associates, AIA, Architects, dated 1973. Evidence of severe ice dam problems since original construction.

Ice dams have caused water to leak into the building and into the cavity between the non-structural brick veneer and the wood-framed walls. As water inside the cavity froze, expansion of the ice exerted outward pressure on the brick veneer, causing partial shifting outward to the east (front) and the south (ramp side). Repetition of the freeze-thaw cycle many times each winter, over more than 35 years, has resulted in the present state of masonry deterioration.

We are told that the roof was replaced about three years ago. If work included ice belt, leakage into the building may have stopped. The upper brick deformation now visible hasn't advanced much for about ten years. Remedial work did not address prevention of ice dams.

2. East / front grade is too high

Deformation of veneer brick along the grade line continues through winter seasons due to surface runoff and melt from snow and ice.

Along the east wall, the grade is higher than the top of the concrete foundation. There is no perimeter drainage. Although the paving slopes down northward, water pools at the southeast corner, penetrates the wall behind the brick, and freeze-thaw expansion gradually destroys the brick veneer along the bottom. Photos taken inside the crawl space 5-22-09 show foundation cracking from freeze expansion, with subsequent seepage of water through the cracks into the crawl space.

3. Police Department steps and landing improperly constructed

Landing was constructed with no step at the door, so original clearance for door swing was only the height of the threshold, about one inch.

1973 plans show a foundation and footing for the steps and landing. Either it was not built, or was not built to full depth, so the entire concrete mass of steps and landing has been lifted by freeze-thaw each season.

Result of these two deficiencies is that the Police Department doors now won't open more than eight inches in the peak of a severe winter. Each year when warm weather returns the deformation does not return completely to the pre-winter position, but remains worse, increasing the slope of the landing toward the building and causing water to pass between the concrete and the brick. Trapped water causes freeze-thaw deformation in the veneer brick surrounding the landing.

BDI BOLTON & DiMARTINO, INC.
CONSULTING STRUCTURAL ENGINEERS
100 Grove Street Worcester, MA 01605
Tel. 508-756-8972 Fax 508-757-9750

May 28, 2009

Mr. Phil Warbasse
260 Brooks Station Road
Princeton, MA 01541

Re: Slade Building
Brick Veneer Assessment
Hubbardston, MA

Dear Mr. Warbasse,

On May 22 we visited the site of the Slade Building in Hubbardston to assess the cracking and deterioration of the brick veneer at the south-east corner of the building. The structure is a one story wood framed building with gabled roofs and a brick veneer exterior. The perimeter foundation is a 10" unreinforced concrete frost wall, and the first floor is framed with wood joists with a crawl space below. Certain existing drawings of the building as prepared by Cilcius Associates, AIA, Architects, dated 1973 were available for review.

From within the crawlspace, visual inspection of the foundation at the south-east corner of the building shows that there are relatively few cracks in the concrete wall. The cracks that are present are probably due to usual concrete shrinkage and the freeze-thaw cycles of the earth placed against the exterior of the wall. These minor cracks are clearly not the result of settlement, and have had no effect on the deterioration of the brick veneer that the wall supports.

The distressed brick veneer at the south-east corner of the building exhibits cracks that are indicative of the brick being forced to move outward from the plane of the wall. The cause of this cracking is due to water getting into the cavity behind the brick and freezing. The result is the sum of movements that have occurred each year during the freeze thaw cycles. With the existing grades, surface runoff water and melting snow can easily infiltrate the brick cavity because it can pool against the face of the brick veneer. The top of the concrete wall should have been about six inches above the exterior grades. Instead, the paving is at the level of the top of the foundation wall or higher, and the water flows toward the building rather than flowing away from the building.

The areas of brick veneer that are cracked and deflected out of plane can be disassembled and rebuilt to restore the wall to its original condition. However, the cause of the problem must be addressed beforehand. That is, the grades at the east side of the building must be lowered and sloped so that the water runoff cannot enter the brick cavity.

BOLTON & DiMARTINO, INC

Joseph DiMartino

REMEDIAL WORK

Short-term repair ineffective

Disassembly and reconstruction of the brick veneer could probably be accomplished for the amount budgeted on Town Meeting warrant, but the repair would not last. Water will continue to enter the cavity where the east and south walls meet the front paving and the side ramp.

Long-term remedial work

Cost-effective remedial work involves much more than repair of the brick veneer. It requires altering the grade at the east wall of the building, and eliminating ice buildup along the roof edge.

Suggested scope of work

1. Remedy surface water at the building face.

Establish the invert of the existing catch basin in the north driveway.

Remove the concrete steps and landing at Police Department doors.

Sawcut and remove paving about four feet parallel to the east wall, from the southeast corner of the building to the northeast corner of the building.

Sawcut and remove a strip of paving from the northeast corner of the building to the existing catch basin in the north driveway.

For the full length of the east wall, excavate to the top of the footing. Clean the foundation wall. Inspect for cracks. Rake out and seal all foundation wall cracks from the exterior.

Backfill with 1½" washed crushed stone to 24 inches below the top of the concrete foundation.

Excavate to the existing catch basin in the north driveway.

Install 4" perforated PVC drainage pipe parallel to the east wall, sloping down toward the north driveway. Turn the corner and connect to the existing catch basin in the north driveway.

Cover the perforated sections of pipe with geotextile fabric to prevent clogging by siltation. Provide cleanouts at the surface.

Backfill with 1½" washed crushed stone to no higher than 6" below the top of the concrete foundation, not obstructed by the new steps and landing at Police Department doors.

Form a bituminous curb along the edge of the cut paving, for a wheel stop and to direct surface water northward as originally designed.

Remove both Police Department doors. Install pan flashing for a watertight seal at the new door thresholds. Install two new Police Department doors, insulated galvanized steel commercial grade exterior doors.

Disassemble the deformed and cracked brick veneer. Set aside and clean the brick of mortar. Obtain a quantity of new brick to match the existing.

Clean the wall cavity to the top of the concrete foundation. Remove existing fabric flashing. Install new asphalt-coated copper through-wall masonry flashing. Rebuild the veneer brick to the original lines.

Replace the steps and landing at the Police Department doors with either concrete or pressure-treated wood, with steps exiting straight out rather than parallel to the building as now configured.

Set top of the new landing 6" below the threshold. Pitch 1/8" per foot away from the building.

If concrete, form to span the new drainage swale. Provide an adequate foundation wall and footing, and a 10" space between the building wall and the back of the new concrete. Bridge the short space with pressure-treated wood for air circulation and control of surface water.

For weather protection, add a gable canopy fully covering the steps and landing.

2. Remedy the ice damming conditions

Extending the ramp roof is advisable for full-length weather protection of people and the south face of the building, but it will simply relocate the ice damming. Reliable prevention of ice damming requires improvements to the attic insulation, both to air barrier integrity and to overall thickness above the ceiling, particularly at the junction of roof and exterior wall.

Ice melt cables are a Band-Aid remedy, to create channels in an ice dam allowing meltwater to flow through. Until the roof is properly insulated, ice dams will still build and icicles will still form along the roof edge. Installing temperature monitoring sensors in the attic will confirm heat loss above the existing insulation. When temperature conditions are right for damming, this heat loss is sufficient to cause a trickle of melt under snow cover, which freezes at the roof edge, gradually increasing in thickness.

Remedial work requires increasing the R-value of the insulation above the lay-in tile ceiling. More importantly, since air moves through fiberglass insulation, a continuous air barrier is required directly above the ceiling. If a polyethylene sheet barrier was originally installed, it should be inspected for a complete seal. If faced batts were installed, there was no barrier integrity, and the insulation has been disturbed during 35 years of occupation and maintenance.

Ice dam prevention could be addressed as part of a second floor addition, at which time the entire roof can be jacked up to cap an addition, and insulation redone properly, ideally as foamed-in-place (Icynene or an equivalent) on the underside of the roof sheathing, to eliminate heat flow through the roof.

3. Modify east crawl space venting

Crawl space vents provide passive control of moisture within the space. Venting to the exterior causes extensive condensation in conditions of high humidity, even in sudden winter temperature transitions, resulting in constant damp, musty, moldy conditions.

Ideal passive crawl space ventilation is to share dry air with an interior space, by appropriately sized openings to a basement or to the floor above the space.

Alternatively, with active air circulation and dehumidification the Slade Building east crawl space can be brought to appropriately dry, mold-free conditions for preservation of the first floor structure and insulation.

Remove the exterior vents from the perimeter of the east crawl space and seal the openings. Seal foundation cracks as described above, to end the entry of exterior water.

Completely cover all existing gaps in the crawl space ground moisture barrier with additional sheet polyethylene.

Install a high capacity April Aire or Santa Fe dehumidifier (horizontal configuration, 2,000 square foot capacity) in the east crawl space near the access panel, ducted to the far side of the east crawl space. Equip the crawl space with remote-read humidity monitor and alarm, and a water alarm.

Willard A. Slade Building: Assessment of Brick Veneer Cracking May 2009
Preliminary Conceptual Estimate

ITEM	ALLOW
TASK 1: REMEDY SURFACE WATER AT EAST WALL	
Survey grades and catch basin invert	$2,000
Remove east PD steps and landing	$500
Sawcut and remove paving east wall and north driveway	$2,200
Excavate east wall to top of footing	$2,800
Excavate to north catch basin	$2,800
Seal cracks in east foundation wall	$600
Install PVC drainage pipe to catch basin	$800
Geotextile filter and 1 1/2" crushed stone	$3,200
Bituminous concrete curb at edge of pavement cut	$1,300
Remove police department east doors	$500
Disassemble/rebuild east and south brick	$12,250
New police department doors	$2,400
New wood or concrete steps and landing	$5,200
New gable canopy at police department steps and landing	$8,800
✓ **TASK 1**	**$45,350**
TASK 2: REMEDY ICE DAM CONDITIONS (MINIMUM)	
Ice melt cables, auto sensors, south roof and gutter	$1,650
Electrical: power, sensors, alarm	$3,450
✓ **TASK 2**	**$5,100**
TASK 3: REMEDY EAST CRAWL SPACE VENTING	
Additional ground vapor barrier in east crawl space	$2,500
Remove and seal east crawl space vents	$400
April Aire or Santa Fe dehumidifier	$1,950
Ductwork for dehumidifier	$2,200
Electrical: dehumidifier power	$3,100
Electrical: controls, sensors, alarm	$2,800
TASK 3	**$12,950**
Subtotal: Tasks 1, 2 and 3	**$63,400**
Contractor general conditions 15% OH&P	$9,510
Subtotal	**$72,910**
Add 30% for public bid process (prevailing wage applies)	$21,873
Total	**$94,783**
RELATED COSTS	
Architect / Engineer fee and RFP: budget approx. 10%	$9,478
Conceptual Project Total	**$104,261**

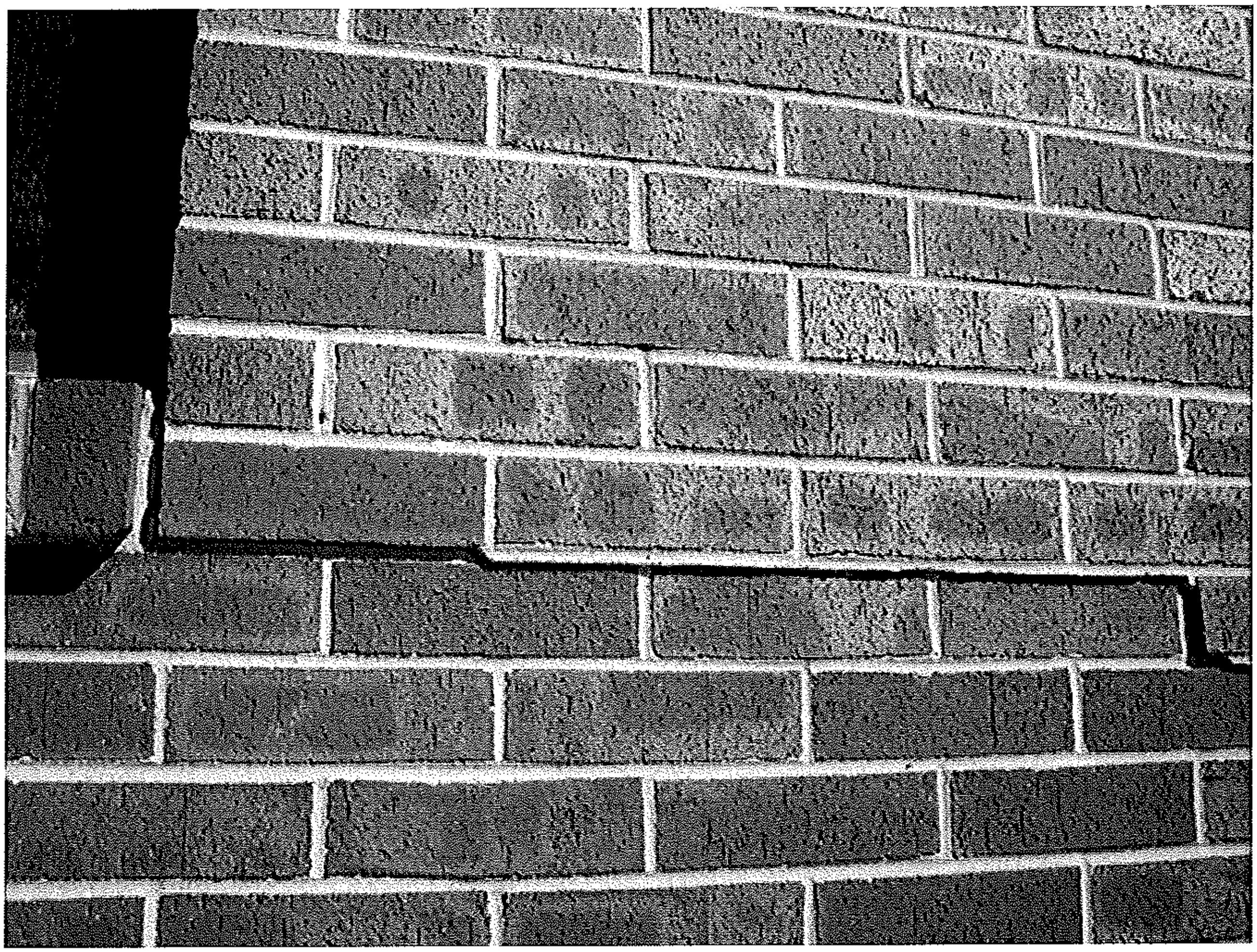
Task 1+2
50,450.
7,586.
58,036.
17,411.
75,447
7,500

B1 8304
South wall at Police Department window.

Veneer brick has deformed to the right / eastward, opening the mortar joint at the sill, and a ladder crack down to the opening for an original classroom ventilator, removed and closed with plywood.

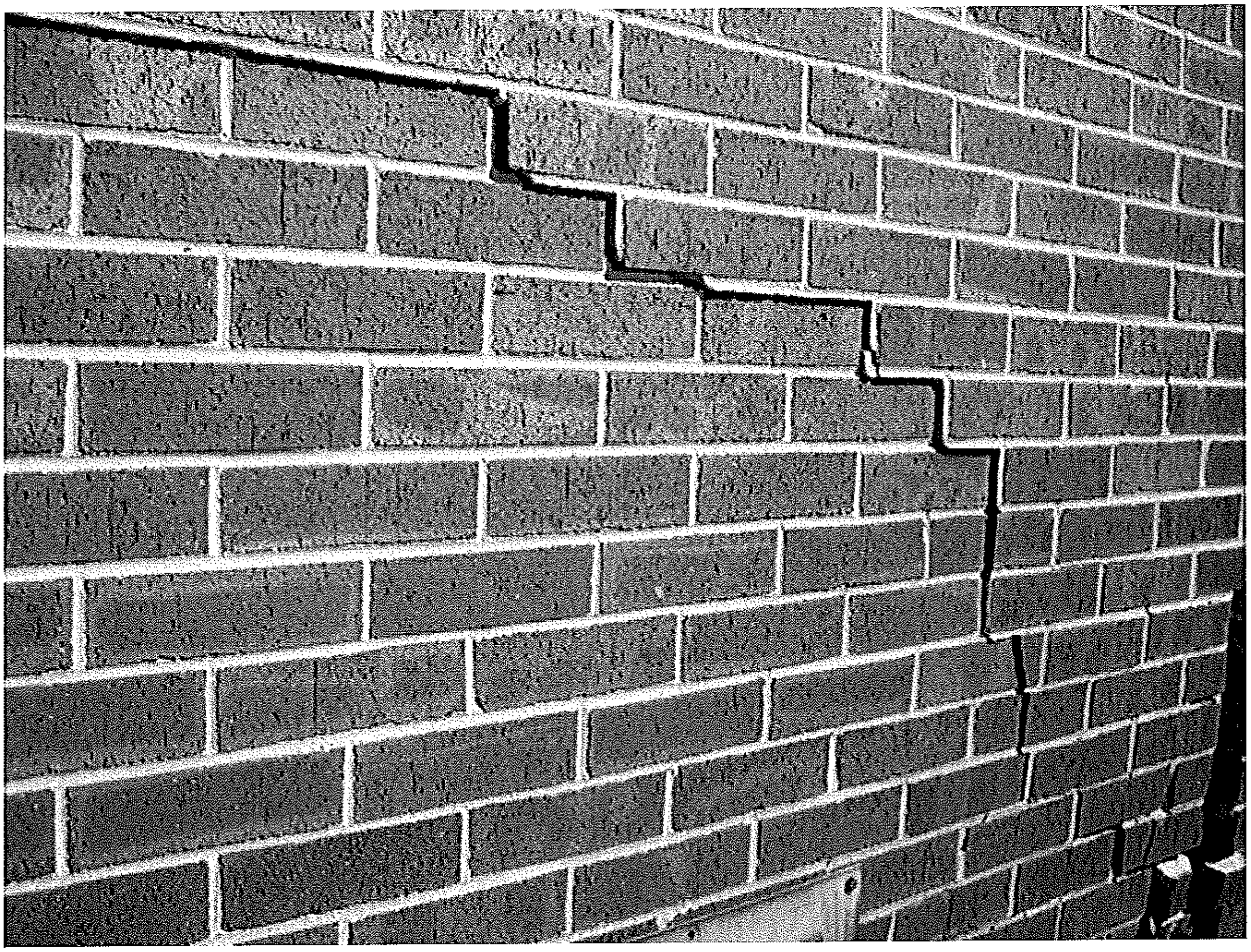
B2 8296
South wall at Police Department window.

Veneer brick has deformed to the right / eastward, opening the mortar joint at the window head, and a ladder crack up to the fascia trim.



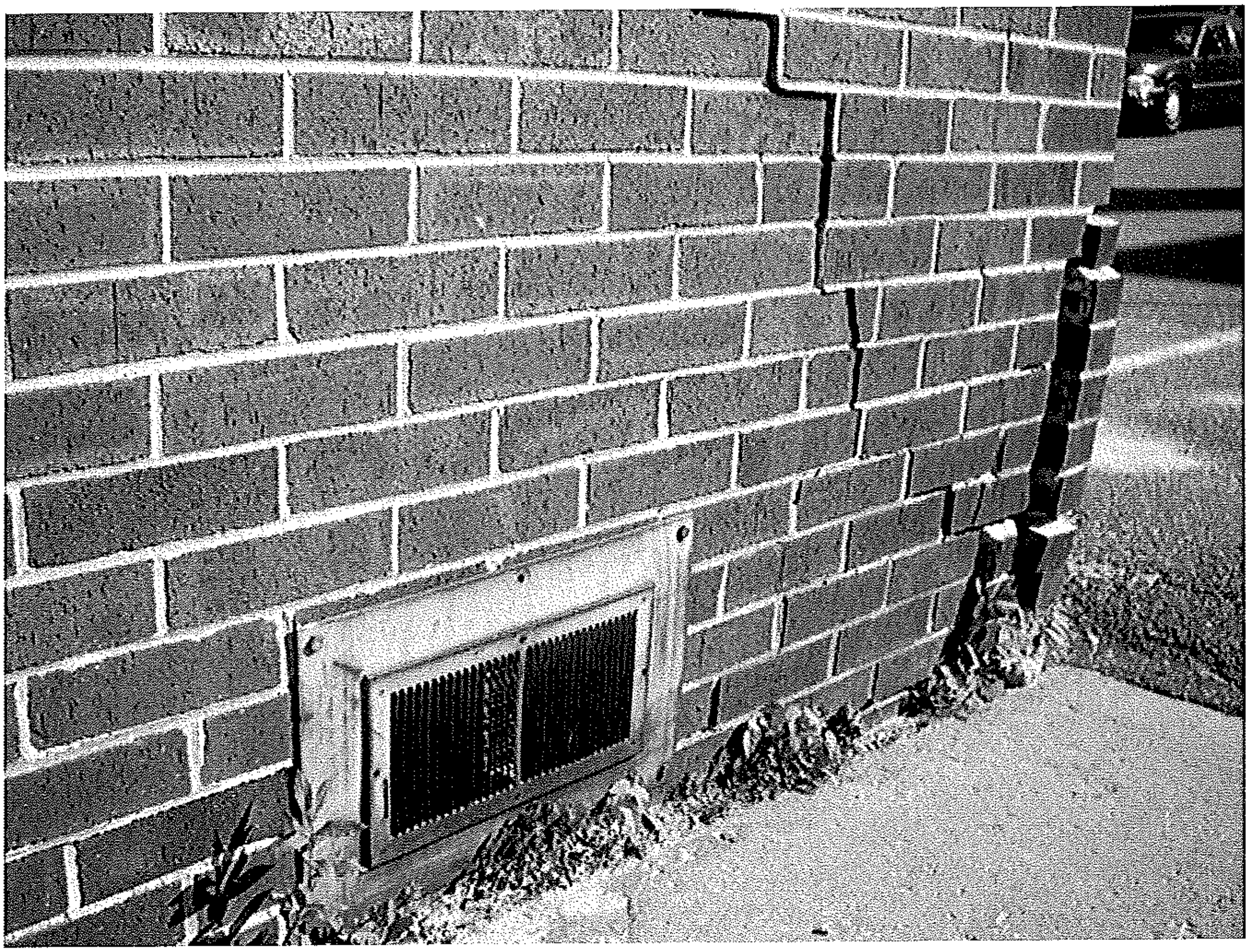
B3 8297
South wall at Police Department window.

Veneer brick has deformed to the right / eastward, opening the mortar joint at the window head, a horizontal crack to the right, and a ladder crack down to the southeast corner. The veneer panel above the crack has shifted outward about 3/8 inch.



B4 8298
South wall east of Police Department window.

Veneer brick has deformed to the right / eastward, opening a ladder crack down to the southeast corner. The veneer panel above and right of the crack has shifted outward about 3/8 inch.

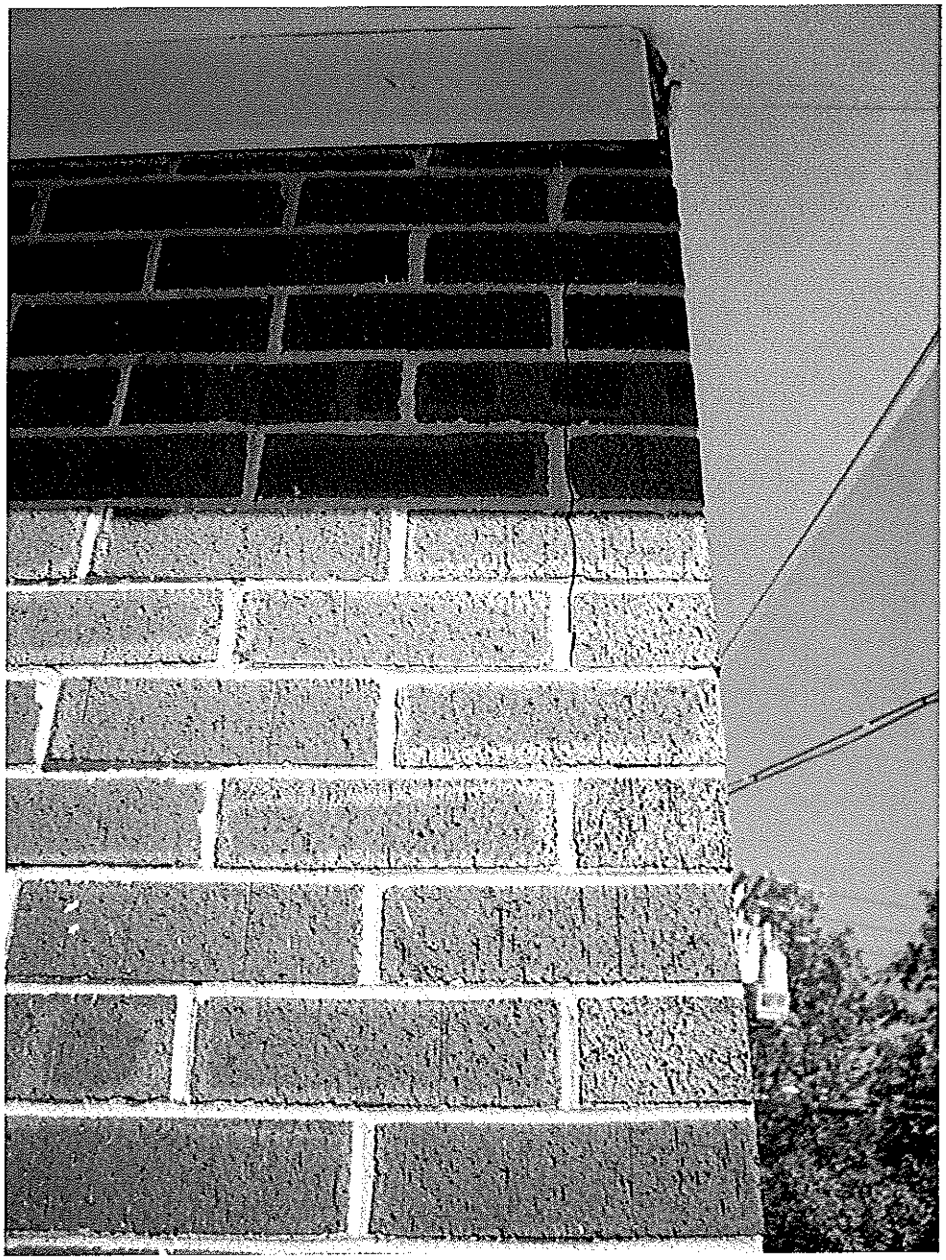


B5 8299
South wall east of Police Department window.

The ladder crack shown in previous photos extends down to the southeast corner. The veneer panel above and right of the crack has shifted outward, and the entire corner has separated.

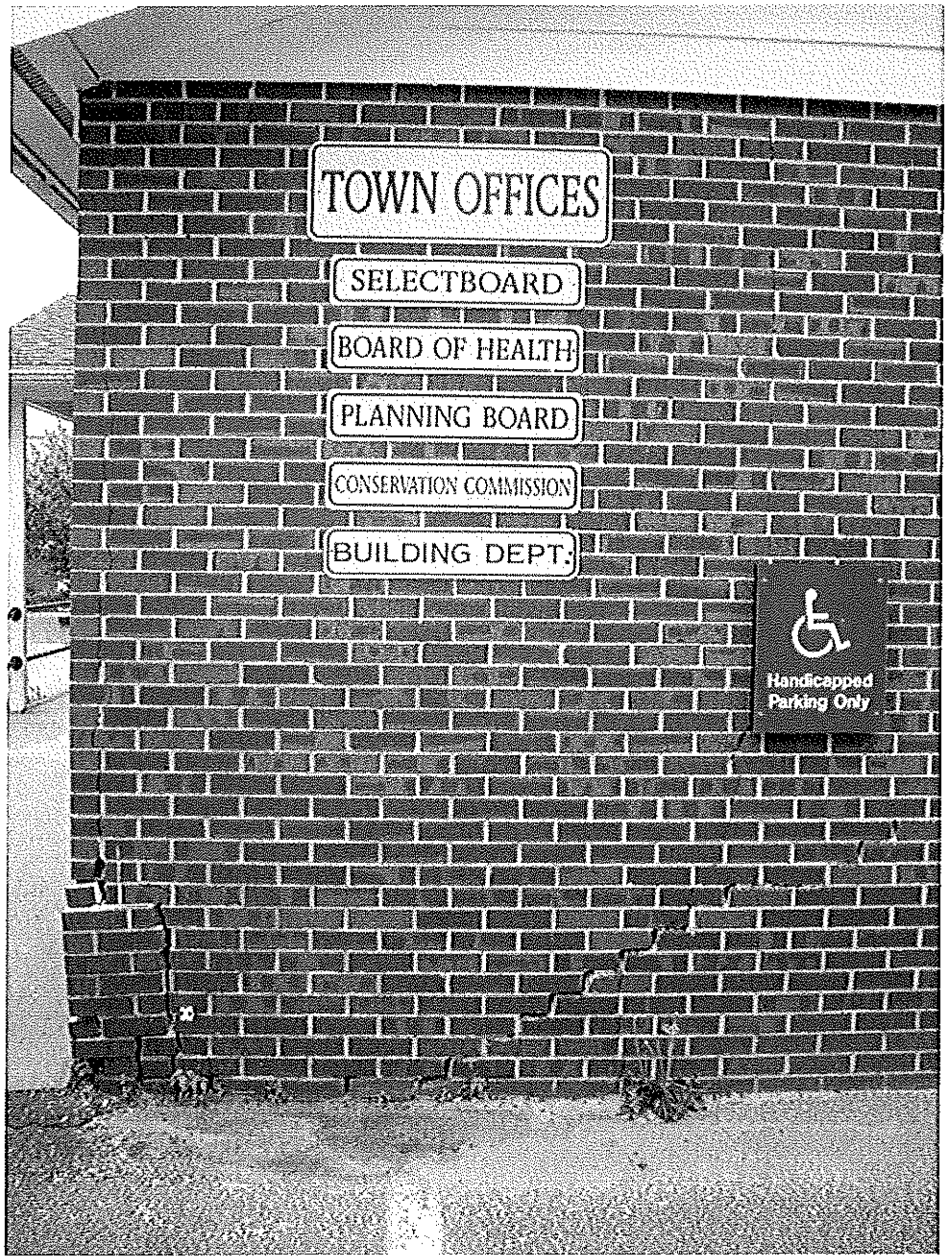
Water from rain and snow melt enters the wall cavity through opened mortar joints and through weep joints intended to let cavity moisture out.

When ice builds up along the face of the building, water also enters the crawl space through the ventilator.



B5a 8302
South wall east of Police Department window.

A hairline shear crack extends down eight brick courses from the fascia trim.



B6 8284
East wall at southeast corner.

South ramp is at left. At the base of the wall the entire veneer brick corner has separated. One brick to the right of the weep joint, a ladder crack extends upward beyond the parking sign. At the lower left of the parking sign is the bottom of a hairline shear crack that extends vertically up to the fascia trim.

The pavement is placed too high, covering the entire foundation. Water from rain and snow melt enters the wall cavity through opened mortar joints and through weep joints intended to let cavity moisture out.

B7 8328
East wall at southeast corner.

South ramp is at left. At the base of the wall the entire veneer brick corner has separated, removed for this photo. The band joist shows water staining. The black through-wall flashing is intended to carry minor condensation within the cavity out through weep joints in the base course.

The pavement is placed too high, covering the entire foundation. Water from rain and snow melt enters the wall cavity through opened mortar joints and through weep joints intended to let cavity moisture out. A fragment of downspout strap indicates previous gutter discharge here.

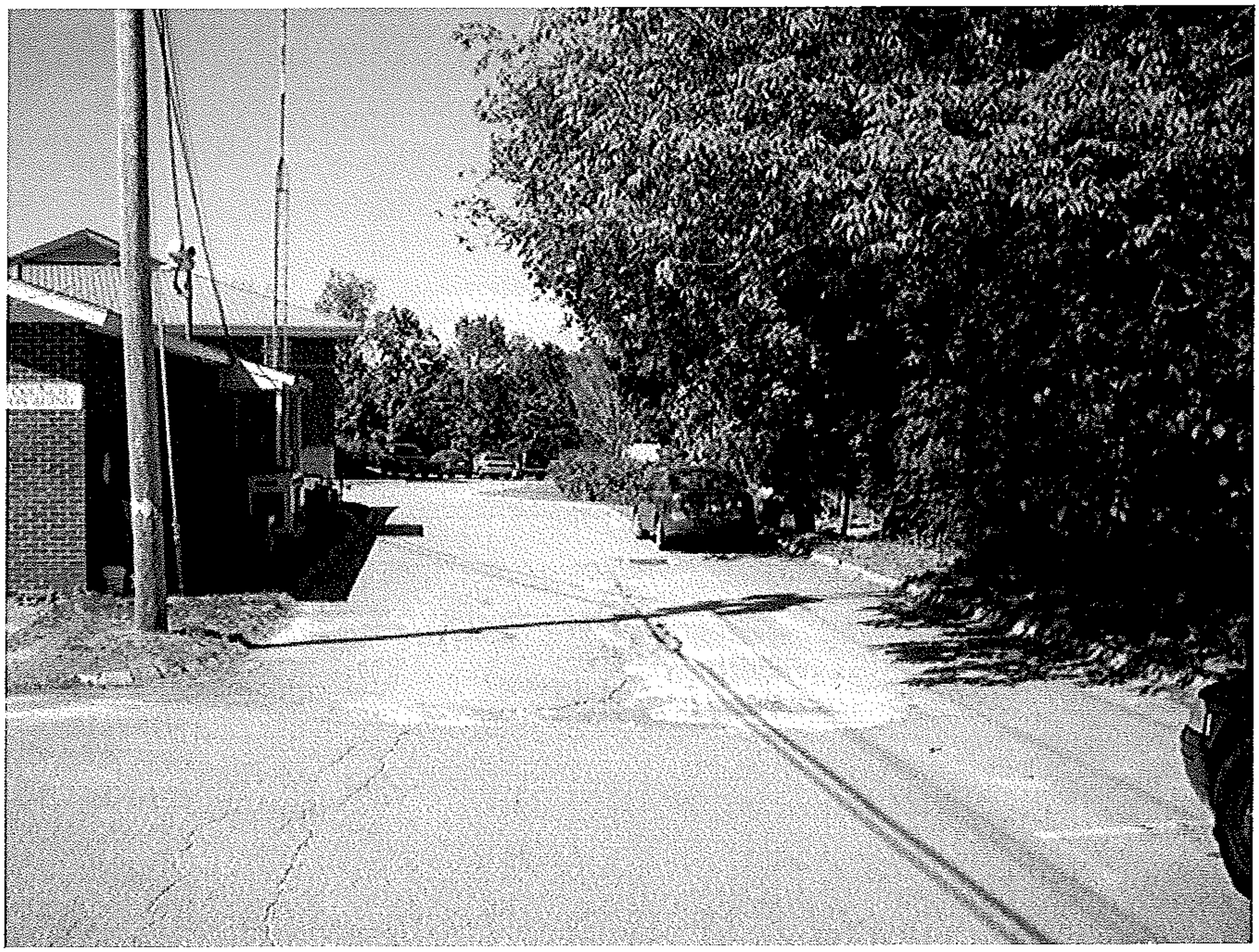
B8 8329
Southeast corner.

Looking along the front of the building. At the base of the wall the entire veneer brick corner has separated, removed for this photo. The band joist shows water staining. The black through-wall flashing is intended to carry minor condensation within the cavity out through weep joints in the base course. The base of the veneer cavity has filled with sand, visibly retaining moisture.

The pavement is placed too high, covering the entire foundation. Water from rain and snow melt enters the wall cavity through opened mortar joints and through weep joints intended to let cavity moisture out.

B9 8331
East elevation.

The pavement is placed too high, covering the entire foundation along the face of the building. Water from rain and snow melt enters the wall cavity through opened mortar joints and through weep joints intended to let cavity moisture out.



B10 8334
North driveway.

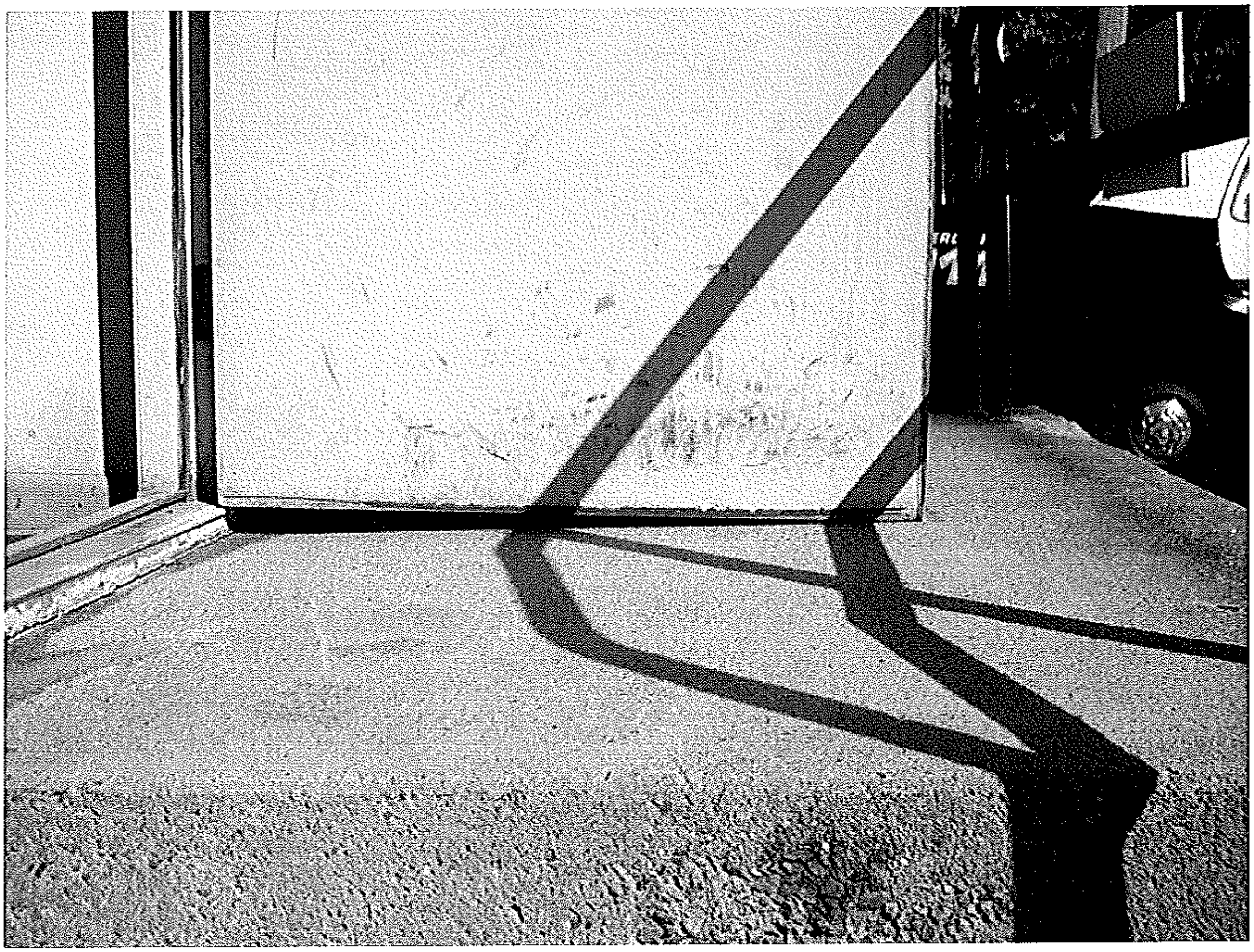
The pavement is graded to direct surface runoff northward and down the driveway to a catch basin at the left corner of the parked car.

B11 8306
Police Department steps and landing.

Landing was constructed with no step at the door, so the original clearance for door swing was only the height of the threshold, about one inch.

1973 plans show a foundation and footing for the steps and landing. Either it was not built, or was not built to full depth, so the entire concrete mass of steps and landing has been lifted by freeze-thaw each season.

Result of these two deficiencies is that the Police Department doors now won't open more than eight inches in the peak of a severe winter. Each year when warm weather returns the deformation does not return completely to the pre-winter position, but remains worse, increasing the slope of the landing toward the building and causing water to pass between the concrete and the brick.



B12 8307
Police Department doors bind at landing.

Landing was constructed with no step at the door, so the original clearance for door swing was only the height of the threshold, about one inch.

1973 plans show a foundation and footing for the steps and landing. Either it was not built, or was not built to full depth, so the entire concrete mass of steps and landing has been lifted by freeze-thaw each season.

Result of these two deficiencies is that the Police Department doors now won't open more than eight inches in the peak of a severe winter. Each year when warm weather returns the deformation does not return completely to the pre-winter position, but remains worse, increasing the slope of the landing toward the building and causing water to pass between the concrete and the brick. Trapped water causes freeze-thaw deformation in the veneer brick surrounding the landing.

B13 8308
Police Department doors delaminated.

Landing was constructed with no step at the door, so the original clearance for door swing was only the height of the threshold, about one inch.

There is no canopy above the landing, for weather protection. Both doors have delaminated from constant exposure.

Years of freeze-thaw cycle have sloped the landing toward the building, causing water to pass between the concrete and the brick. Trapped water causes freeze-thaw deformation in the veneer brick surrounding the landing.

1 8313
South wall from the southeast corner at extreme left.

Vertical stain near the left corner is from water and snow-melt salt entering through the south crawl space vent.

4 mil poly stapled to joists is hanging, with insulation, possibly pulled down in a previous investigation of water damage.

Foundation wall at footing shows wetness from heavy rain five days ago, and stain from seasonal standing water.

White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.

2 8312
Southeast corner.

Note horizontal crack on the east / front wall. Other lines are cobwebs.

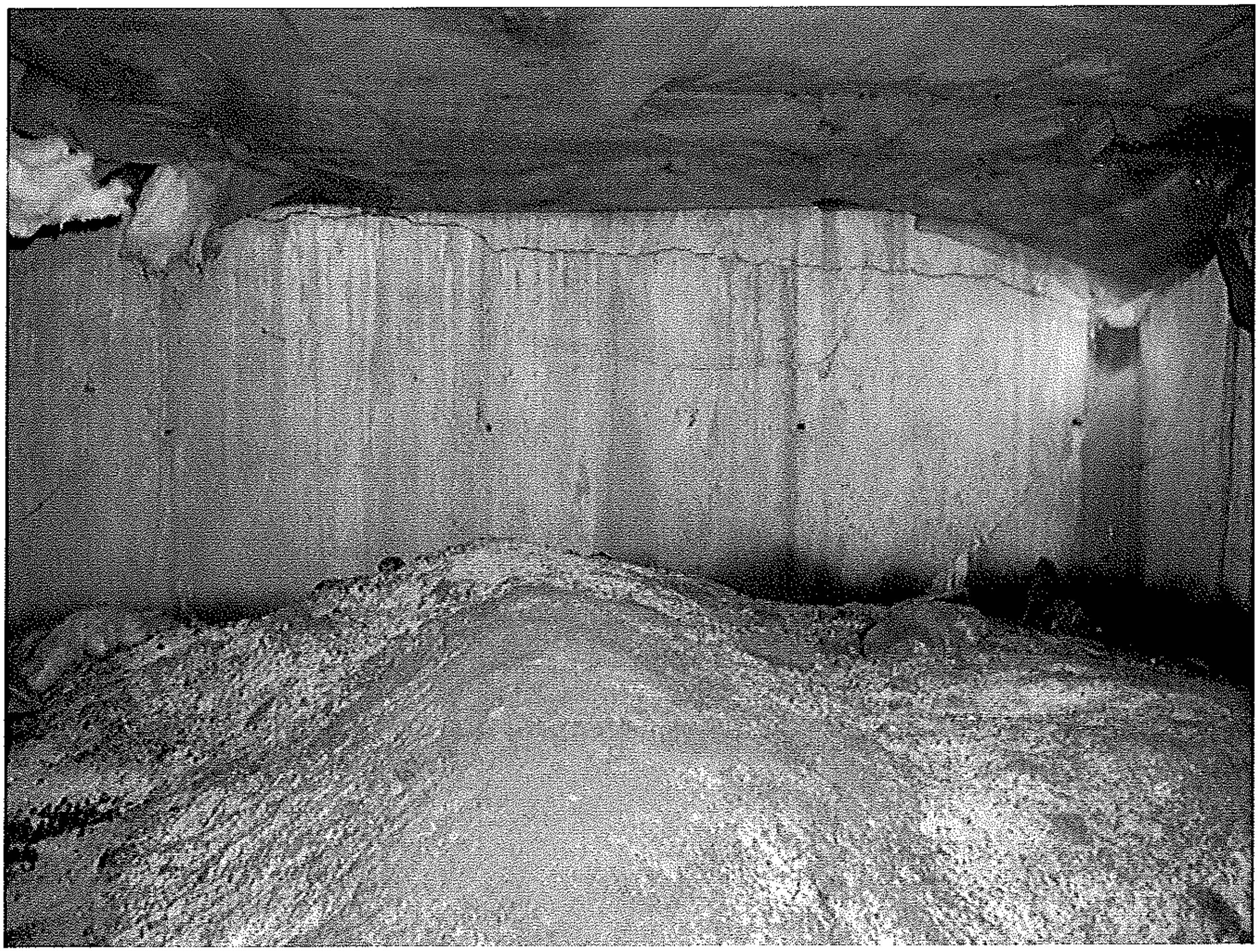
Also note diagonal crack angling downward from the wet stain at the low point of the horizontal crack.

Vertical stain on the south / ramp entrance wall to right of the corner is from water and snow-melt salt entering through the south crawl space vent.

Foundation wall at footing shows wetness from heavy rain five days ago, and stain from seasonal standing water.

4 mil poly stapled to joists is hanging, with insulation, possibly pulled down in a previous investigation of water damage.

White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.



3 8318
East / front wall at the southeast corner.

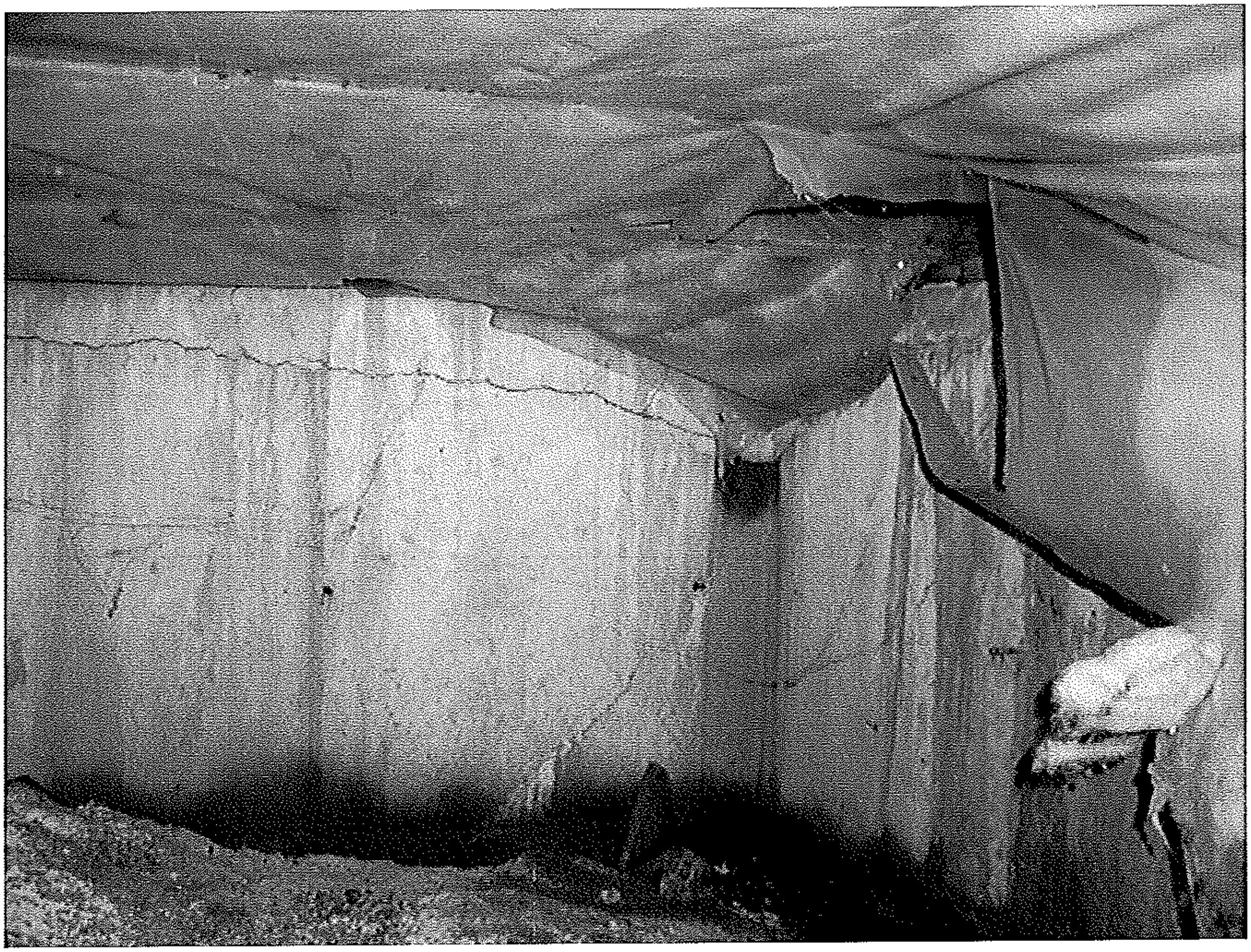
Note horizontal crack on the east wall. Other lines are cobwebs.

Also note diagonal crack angling downward from the wet stain at the low point of the horizontal crack.

Foundation wall at footing shows wetness from heavy rain five days ago, and stain from seasonal standing water.

4 mil poly stapled to joists is hanging, with insulation, possibly pulled down in a previous investigation of water damage.

White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.



4 8319
East / front wall at the southeast corner.

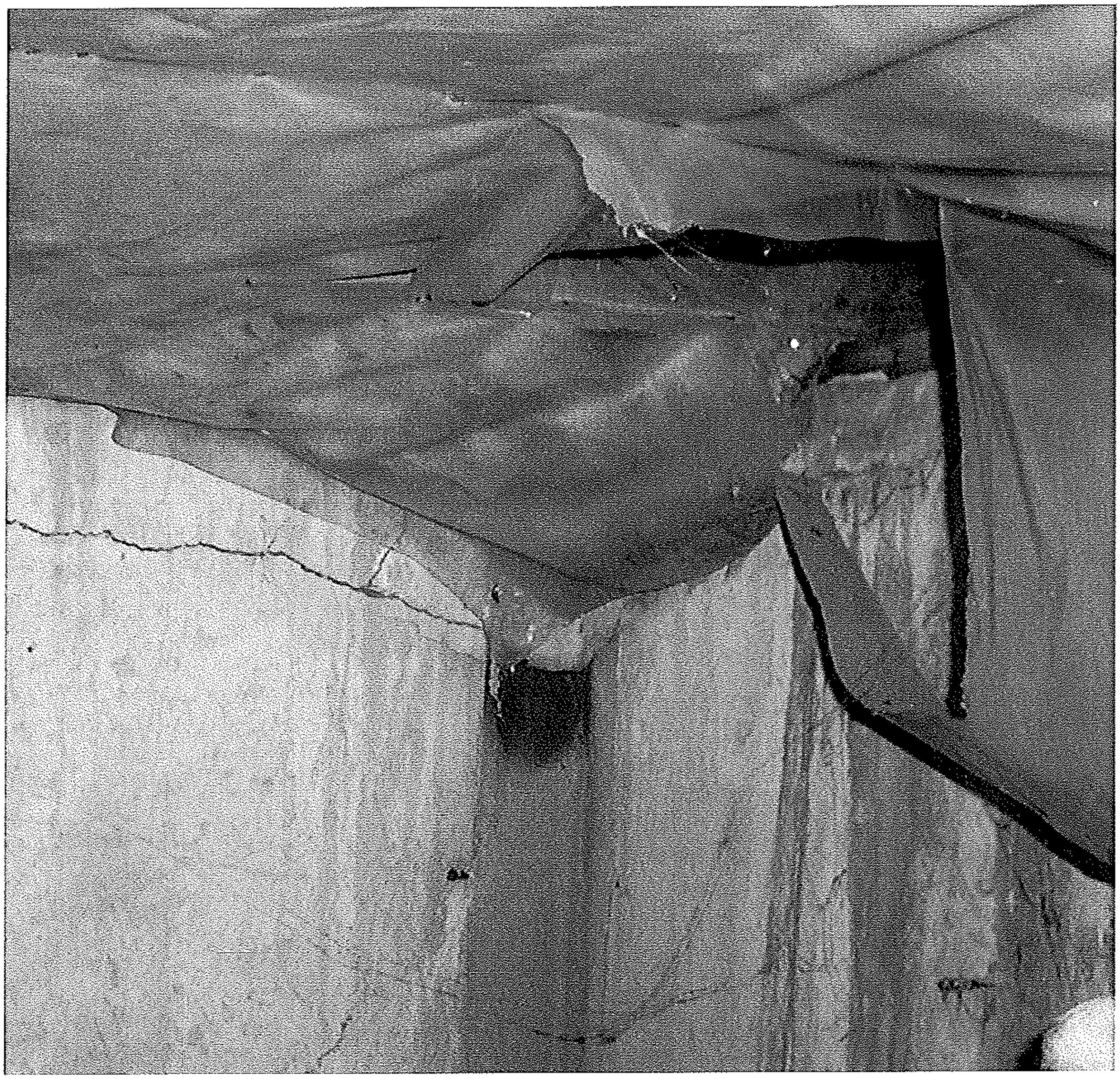
Note horizontal cracking on the east wall AND south wall. Other lines are cobwebs. Also note diagonal crack angling upward from the east wall horizontal crack, and the diagonal crack angling downward from the wet stain at the low point of the east wall horizontal crack.

Vertical stain on the south wall to right of the corner is from water and snow-melt salt entering through the south crawl space vent and the foundation crack. Joist end visible above the south wall crack is water-stained.

Foundation wall at footing shows wetness from heavy rain five days ago, and stain from seasonal standing water.

4 mil poly stapled to joists is hanging, with insulation, possibly pulled down in a previous investigation of water damage.

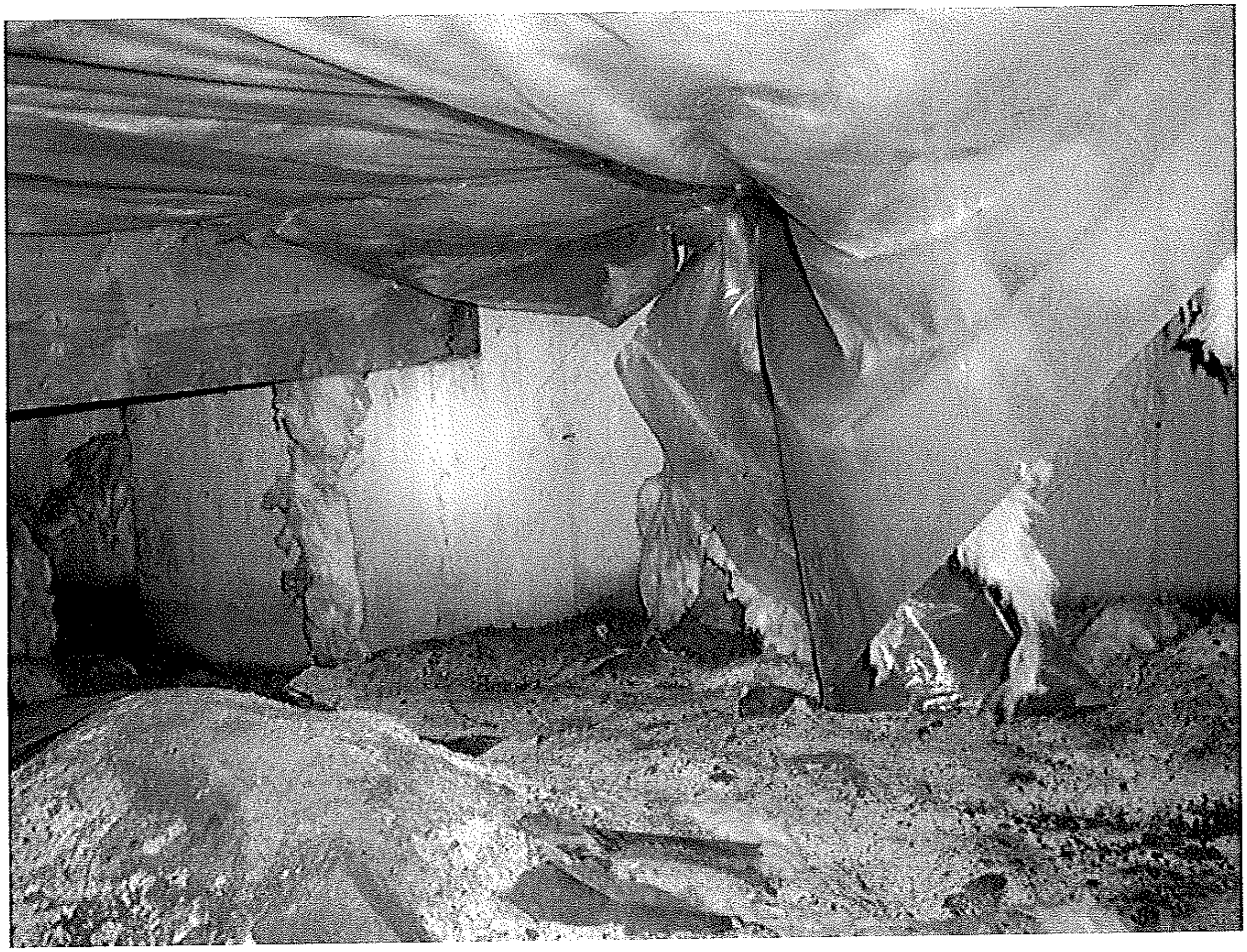
White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.



4 8319 detail
East / front wall at the southeast corner.

Note horizontal cracking on the east wall AND south wall. Other lines are cobwebs. Also note diagonal crack angling upward from the east wall horizontal crack, and the diagonal crack angling downward from the wet stain at the low point of the east wall horizontal crack.

Vertical stain on the south wall to right of the corner is from water and snow-melt salt entering through the south crawl space vent and the foundation crack. Joist end visible above the south wall crack is water-stained.



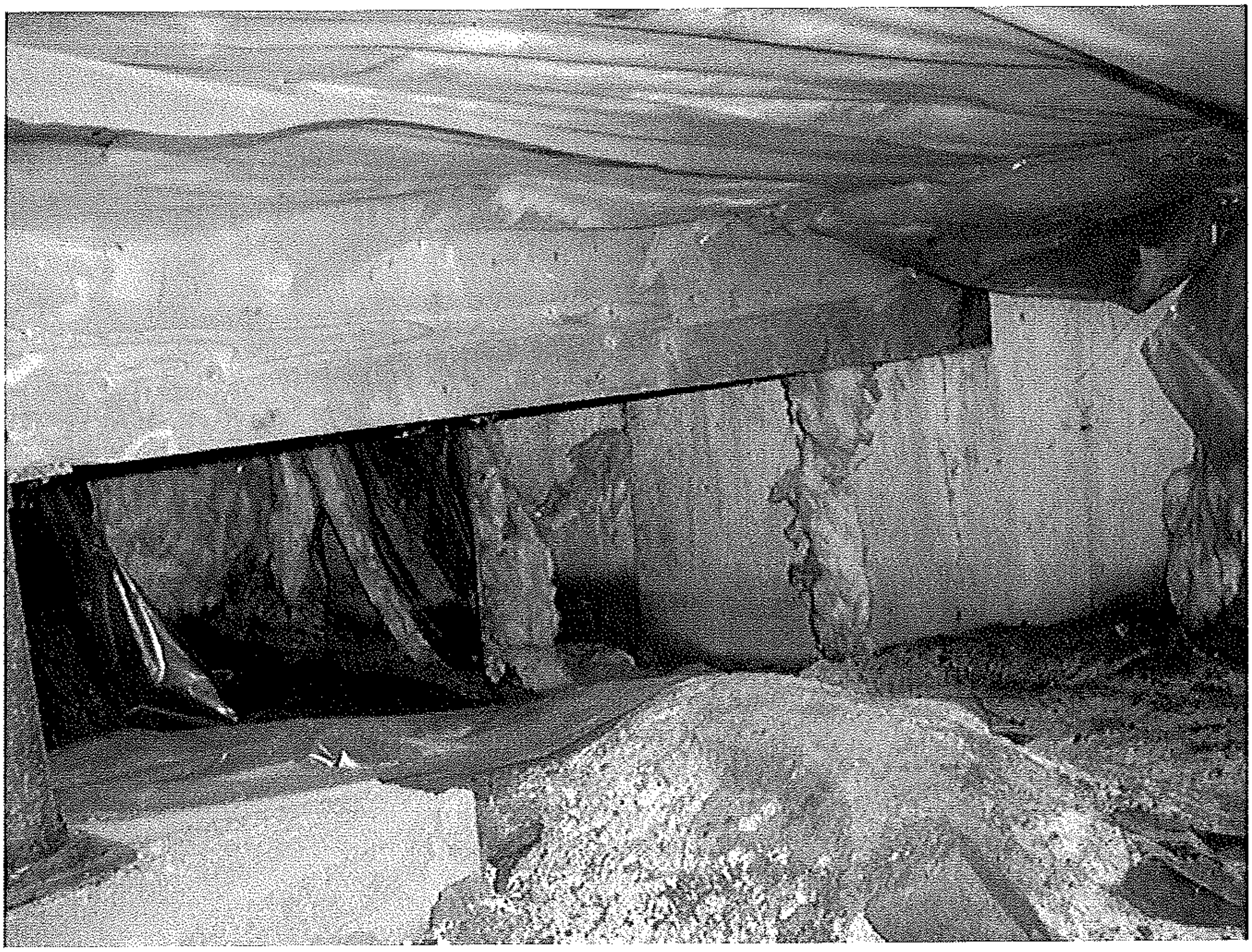
5 8320
East wall to left of the southeast corner, at the first beam pocket.

There appears to be a vertical crack from the left side of the beam pocket down to the footing. Beam end shows water staining.

Foundation wall at footing shows wetness from heavy rain five days ago.

White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.

4 mil poly stapled to joists is hanging, with insulation, possibly pulled down in a previous investigation of water damage.



6 8321
East wall to left of the southeast corner, at the first beam pocket.

There appears to be a vertical crack from the left side of the beam pocket down to the footing. Beam end shows water staining.

Foundation wall at footing shows wetness from heavy rain five days ago.

White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.

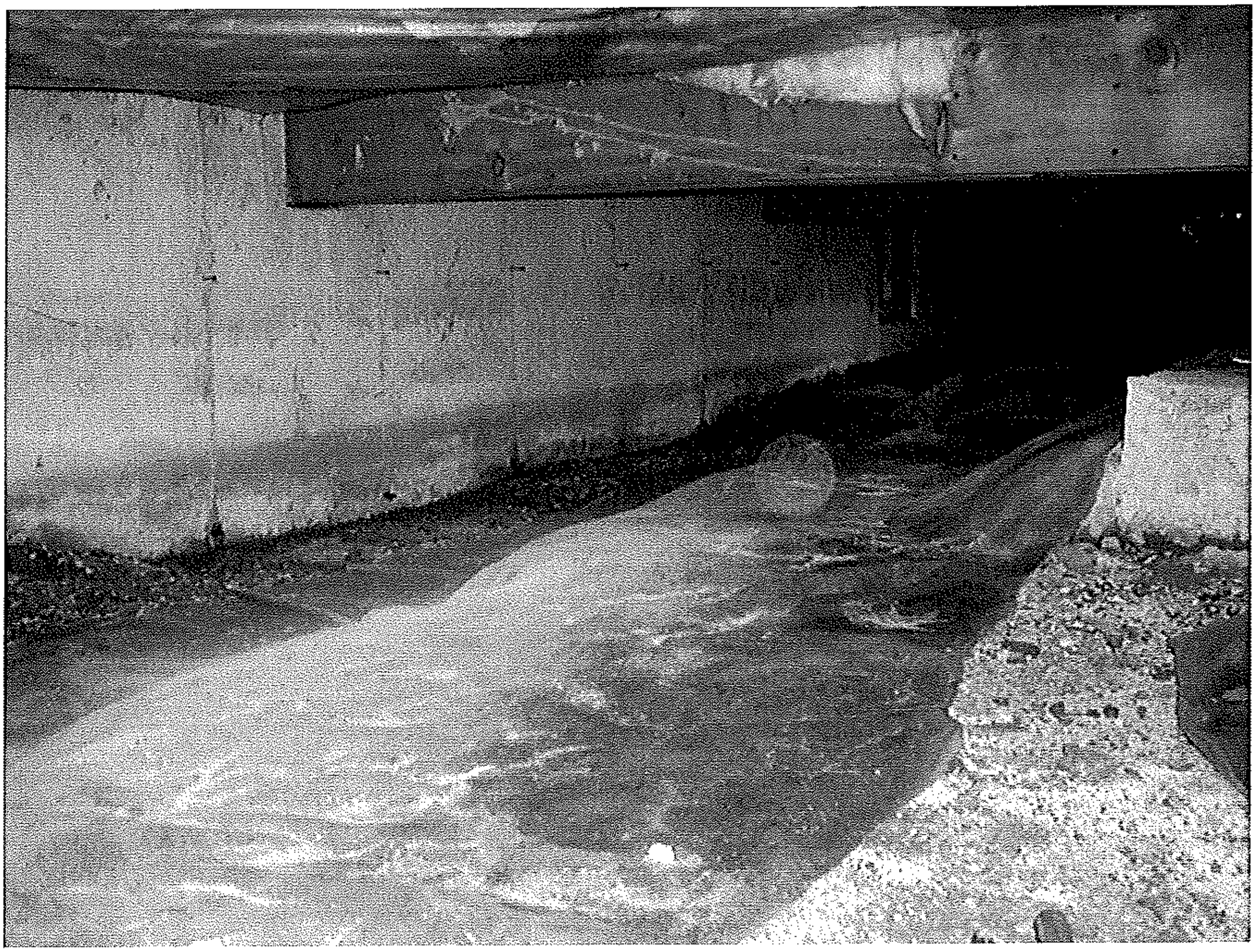
4 mil poly stapled to joists is hanging, with insulation, possibly pulled down in a previous investigation of water damage. Note end of hanging kraft paper is wet.

7 8324
East wall of the transverse crawl space, approaching the access panel.

Foundation wall at footing shows wetness from wicking ground moisture, and stain line from seasonal standing water.

All steel columns and plates are heavily rusted from condensation due to winter standing water and to summer humidity entering through the vents.

Note how 2x12s have crushed at bearing plate, possibly from long-term weight; but further investigation is recommended for early stage of dry rot.



8 8326
East wall of the transverse crawl space, approaching the access panel.

Foundation wall at footing shows wetness from wicking ground moisture, and stain line from seasonal standing water.

White mold is on all exposed earth not covered by 4 mil poly ground moisture barrier.