SR#147

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3437
October 27, 2003

Mr. Ken Earle
Historic Preservation Division
Office of Cultural Affairs
228 EastPalace Avenue
Santa Fe, New Mexico 87501

Dear Mr. Earle:

At your request I accompanied you to the St. Vrain Mill located in Mora, New Mexico for a condition inspection on May 22, 2003. The purpose was to perform a condition inspection to aid in an evaluation of the existing structure. The purpose of this report is to describe the conditions observed and propose measures that will be required to fully evaluate the structure and outline rehabilitation options that may be considered for future implementation.

Background.

The mill is a stone block structure believed to have been built in 1864 by Ceran St. Vrain. It was one of several mills he operated in northern New Mexico and southern Colorado over a long period of time in the mid-1800s. The building footprint is rectangular approximately 40 feet by 51 feet. The top of the stone walls is about 32 feet above ground and the roof peak is approximately 43 feet high. The third floor is at the top of the rock wall and the second floor is about 4 feet below the window sills in Photo 1. Photo 1 shows the building looking from the southwest. Note that the stone blocks are larger on the lower levels and the wood components exposed on the west end are deteriorated. A loading platform that extended below the second floor doorway is completely missing. Photo 2 shows the east end of the building and the water wheel that is dismounted and resting on the bottom of the pit at the east side of the building. As in the previous photo wood deterioration is apparent.

The block walls are supported on stone foundations formed by excavating a shallow trench and placing rock in the trench. Photo 3 shows an excavation made at the northeast corner of the building to expose the rock foundation. Soils are sandy silt based on visual-manual examination. No soil sampling or testing was performed as part of this investigation.

Two major distresses are apparent based on visual inspection. The first is the east wall has moved down relative the remainder of the building, probably due to soil settlement, long ago. This has produced rotation of wall outward causing major separations in the stone wall on the south side, Photo 4 and the north side, Photos 5 and 6. The wood structure across the east end under the roof is bowed outward. The second major distress is the rotting of wood lintel beams over the window openings. Photo 6 shows the second floor window on the east end of the north wall, where the lintel is completely missing over the upper level window. All of the lintels are rotted to some extent and will have to be replaced to support the rock wall components above.

Condition Descriptions.

Wood framing-interior

In general the wood framing on the interior is in good condition. The building is supported on load bearing stone walls and interior wood columns that support girders running north/south. Floor joists are supported on the girders and run east/west with flooring supported directly on the joists. All of these members are in good condition except as described below. The wood is rough sawn and does not comply with modern lumber sizing. The dimensions vary depending on the specific structural member and in numerous cases connections are made by cutting notches into the connecting members to form a socket. These connections will require careful inspection to develop a basis for structural analysis because the member cross sections are reduced. Based on visual inspection there is no apparent distress associated with these types of member connections. Photos 7(**P9**) and 8 (**P20**) illustrate the framing of the second and third floor. Photo 7 shows the second floor columns supporting the third floor framing. Photo 8 shows the second floor joists notched into the girder supporting the floor.

Floor boards are in good condition except on the third floor where some are deteriorated and on the ground floor and second floor where some are missing because they have been

removed. Floor joists, girders and columns are in good condition generally throughout the building.

Based on visual inspection there is no evidence of load related distress in any of the framing members that were accessible or inspection. The third floor wall beneath the roof enclosing the east end of the building is bowed outward due to rotation of the east wall resulting in rotation of the wall outward. Photo 9 shows the wood structure that is bowed outward on the third floor due to the wall settlement and rotation. Photo 10 shows the stone wall east end beneath the third floor where the wall has moved out from under the framing. This is the area where the foundation has se the third floor that has moved outward. This movement is also the result of rotation of the east stone wall of the building.

Roof

The roof is a hipped structure made of 5x5 inch members 24 inches on center and covered with spaced 1 x 8 inch sheathing in turn covered with corrugated metal. Photo 2 shows an overall exterior view of the roof structure. Photo 11 shows the rafters, roof sheathing and metal roof between the sheathing. Some deterioration of the rafters is apparent due to moisture penetration although this is isolated. In general the roof framing and sheathing are in good condition based on visual inspection. Those areas that are deteriorated must be carefully inspected and the need for some replacement of components is expected. The area that is most likely is at the hip point of the roof, apparently due to water leaks in this part of the roof.

Lintels over windows

Lintels over the windows are rotted badly and have deteriorated to the point that most will require replacement. Photo 6 shows one lintel on the North side is missing completely. Some of the stone masonry supported by the lintels has also been damaged due to loss of support from the lintels. Each of the lintels must be carefully inspected and sampled or tested for condition to determine whether or not they are serviceable and may remain in place.

Foundation

Photo 3 shows the foundation for the rock walls is a shallow stone foundation. This excavation was made at the northeast corner to reveal the depth and nature of the foundation. Stone foundations were made by excavating a shallow trench into the site soils, placing stones, then placing the wall structure on the stones. Based on the limited excavation it appears to accurately describe the foundation for the mill. The foundation has performed well except on the east end of the building. That area exhibits relative movement that indicates the east wall has settled several inches and rotated outward from the building. As a result of settlement the north and south walls are severely cracked near the East end. Based on my visual inspection it is my opinion this distress occurred long ago has been stable for some time. Photos 4 and 12 show cracking on the South wall due to settlement of the East wall. Photos 5 and 6 show separations at the East end of the North wall due to settlement of the East wall of the building. Two factors have contributed to the distress on this end of the structure. First, the water wheel and therefore a source of water were located close to the south end. Water may have affected the soils contributing to loss of support. Second, the working machinery for the mill was concentrated at this end of the facility. Machine vibrations may have been transferred to the wall structure and caused wall settlement.

A stability analysis of the wall should be completed to evaluate whether it is in danger of collapse. Based on the visual analysis it appears the wall is severely distorted but stable. However, the distortion of the wall is severe enough that repairs must be made, even if it is found to be stable, in order to correct the displacement of the wall components, especially on the third floor.

Repairs may be accomplished by underpinning the rock blocks forming the wall. Since there is no foundation structure beneath the rock a beam structure of sort must be installed beneath the rock blocks to distribute loads over several blocks so the wall can be lifted. Once the beam is in place piers may be installed to jack against for lifting the wall back near its original position. The likely type of pier for this purpose is a steel shaft helical pier that is installed by using torque to screw the helical plates into the ground. Because of the heavy loads involved, an engineering analysis will be required to establish the pier spacing, type of plates and verify the capacity. Some framing will also be required to maintain stability of the wall during the repair process.

Rough Hewn Rock Walls

Cracks are apparent around the building on all sides. The most dramatic distress is the East end of the structure discussed above. The rock at the top along the north side has deteriorated at several of the lintels and must be repaired once the lintels have been replaced. Throughout the building a complete inspection of the rock and re-pointing of the mortar is a minimum requirement. Some areas will require removal and replacement of portions of the stone wall, such as the east end of the south wall.

Mortar

The mortar should be carefully investigated to determine a compatible mortar to be used for repair work. The existing mortar is likely to be chemically incompatible with modern cementitious mortars and could cause distress if they are combined. I recommend retaining an expert in historical mortar composition to evaluate the materials and recommend mortar composition for use in repair work.

Summary

The wood frame structure is in relatively good condition. Inspection of those specific areas identified above to evaluate the extent of rotting must be accomplished. Any change of loading that may result in increases will require a careful evaluation of the wood framing to determine capacities. This will be complex and non-traditional because of the notched connections between most of the load bearing framing members.

The stone walls and wood components on the east end of the structure have been damaged by settlement and rotation of the east wall. This wall must be underpinned and lifted to stabilize the structure. This work will require some further investigation and design to properly accomplish. A geotechnical investigation must be performed to establish soils types and condition below the foundation to determine the depth to competent bearing soil layers. A system for distributing lifting loads applied beneath the wall must be designed. A load analysis is required to select and design the under pinning method for lifting and stabilizing the east wall. The east wall must be stabilized by constructing a frame during lifting. This will serve to

prevent the wall from becoming unstable during lifting and protect workers conducting the underpinning.

Lintels over the window openings are rotted and most will have to be replaced. Some stone wall components over the windows have been damaged and some repair to these areas is necessary. Re-pointing of mortar around the building is needed.

Any use changes for the building should be evaluated carefully for the imposed loading on the building floor and framing. The new requirements should be subjected to a load analysis of the framing to assure adequate capacity is available based or current code design requirements.

Very truly yours,
McKeen Consulting Engineers, LLC

R. Gordon McKeen, P. E.

ROBERT G. McKEEN NEW MEXICO 7351 10/15/03 REGISTERED PROFESSIONAL ENGINEER

Enclosures

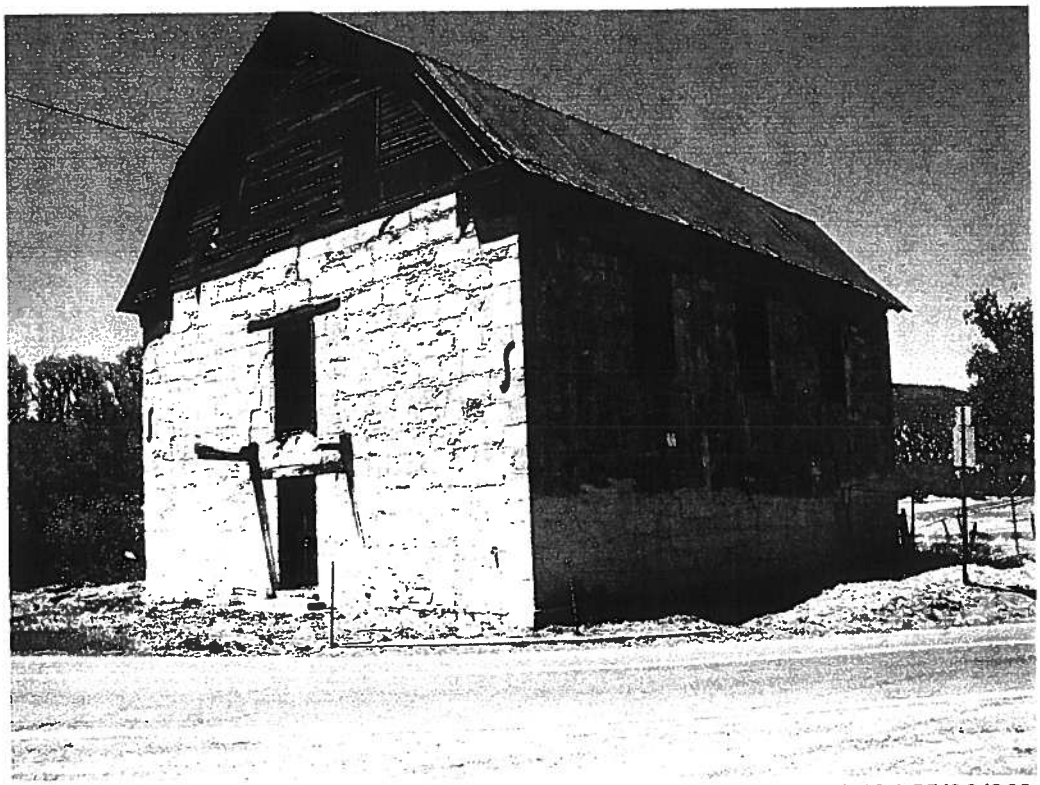

Photo 1 Looking at the southwest corner from across State Road 434 [5/22/03].

Photo 2. East end of the building and the water wheel [5/22/03].

Photo 3. Foundation made of stones placed in a shallow trench [5/22/03].

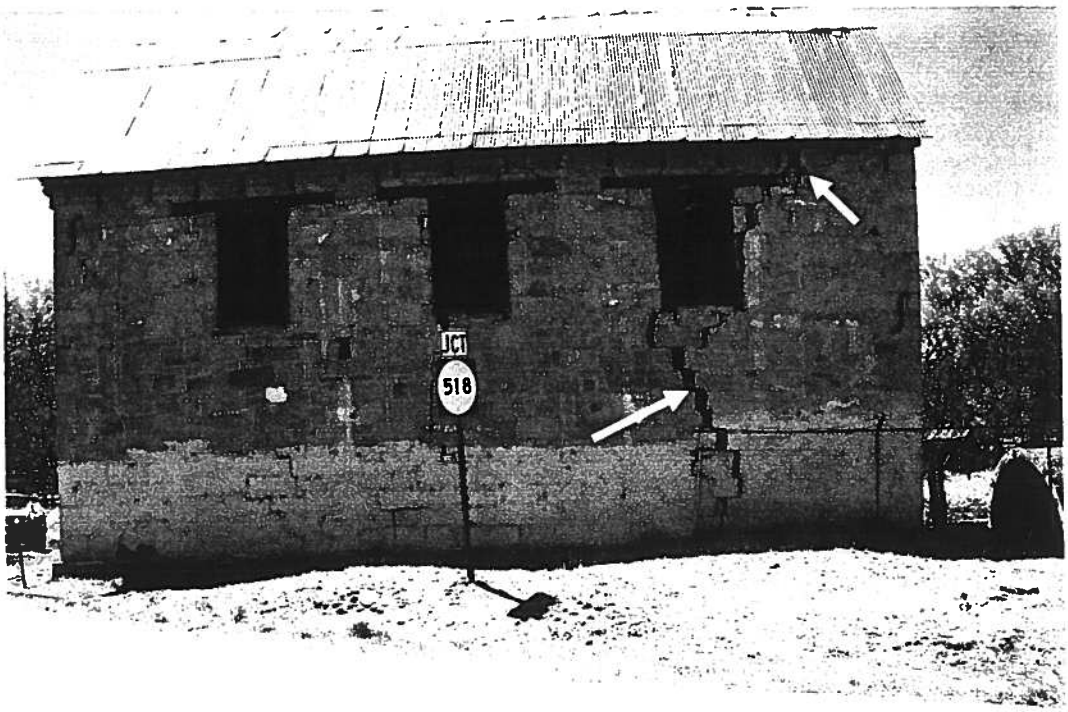

Photo 4. Wall separation on the south east side of the building [5/22/03].

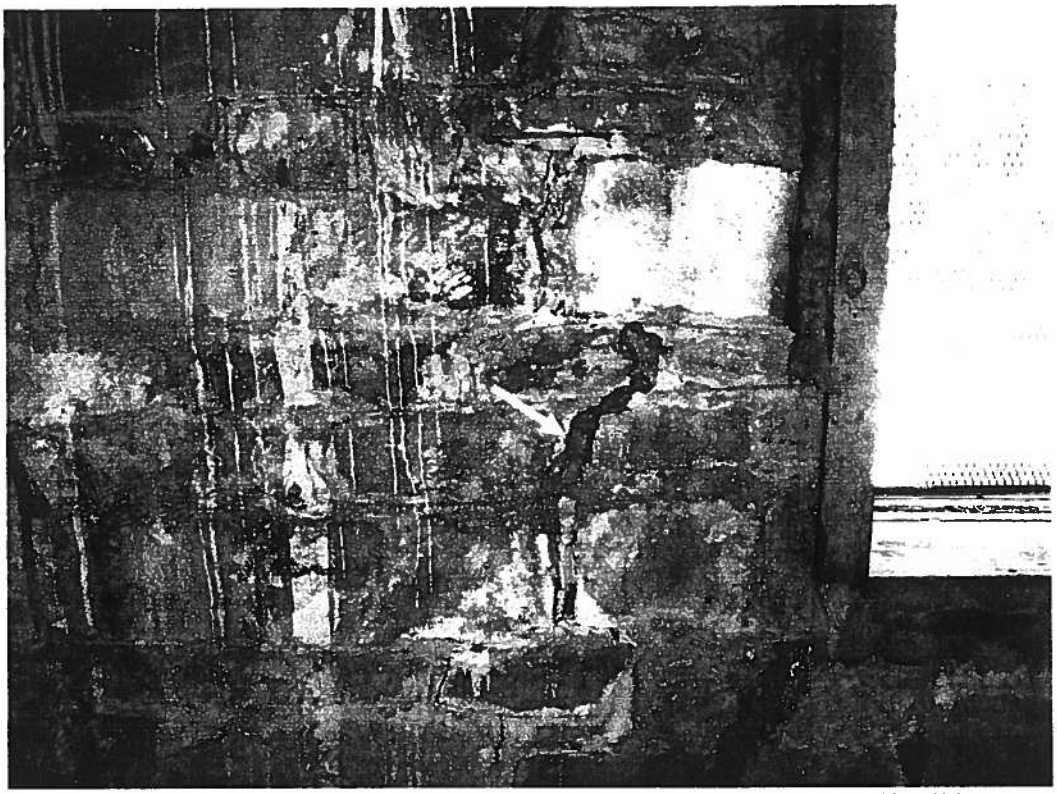

Photo 5. Wall cracking on the northeast side of the building [5/22/03].

Photo 6. Lintel beams are rotted and missing on the north wall [5/22/03].

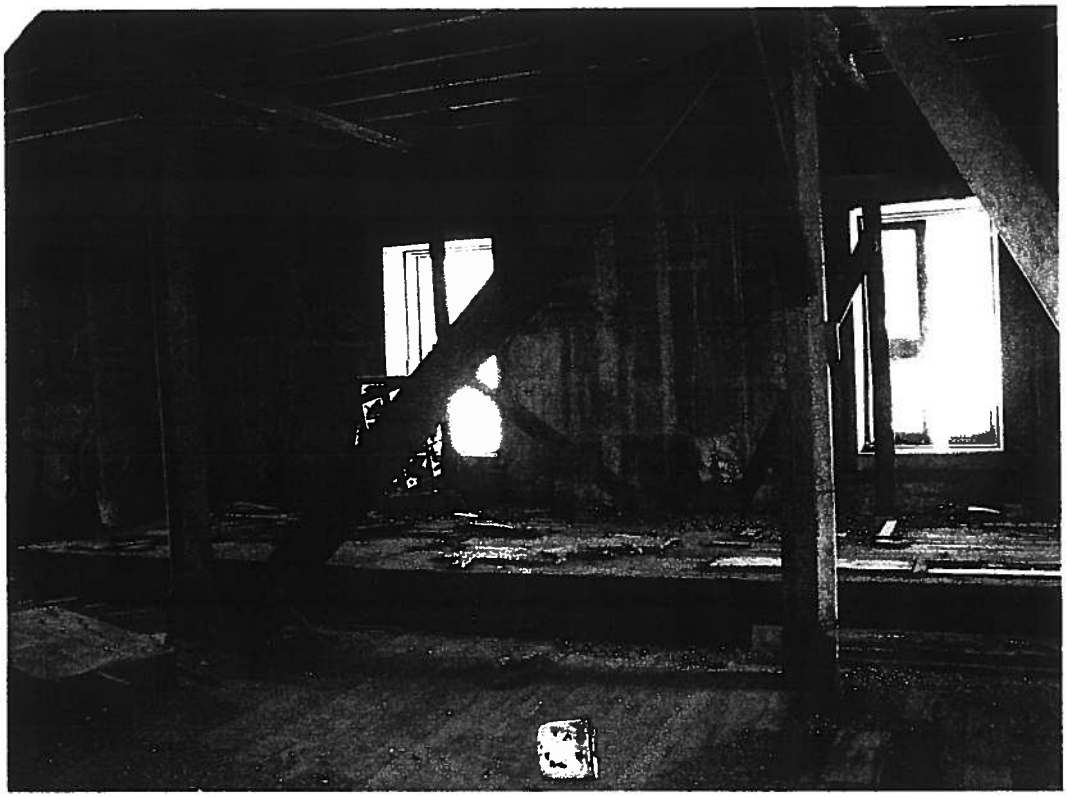

Photo 7. Second floor columns supporting third floor structure [5/22/03].

Photo 8. Notched connection of framing for floor support [5/22/03].

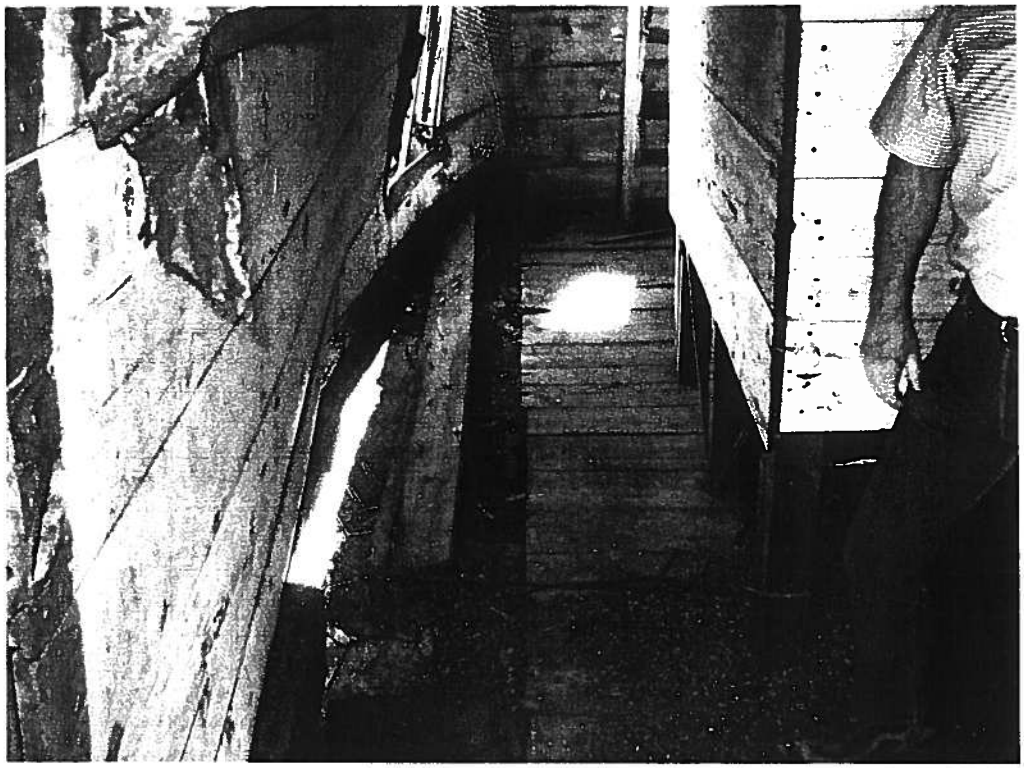

Photo 9. Third floor end all bowed out due to wall settlement and rotation [5/22/03].

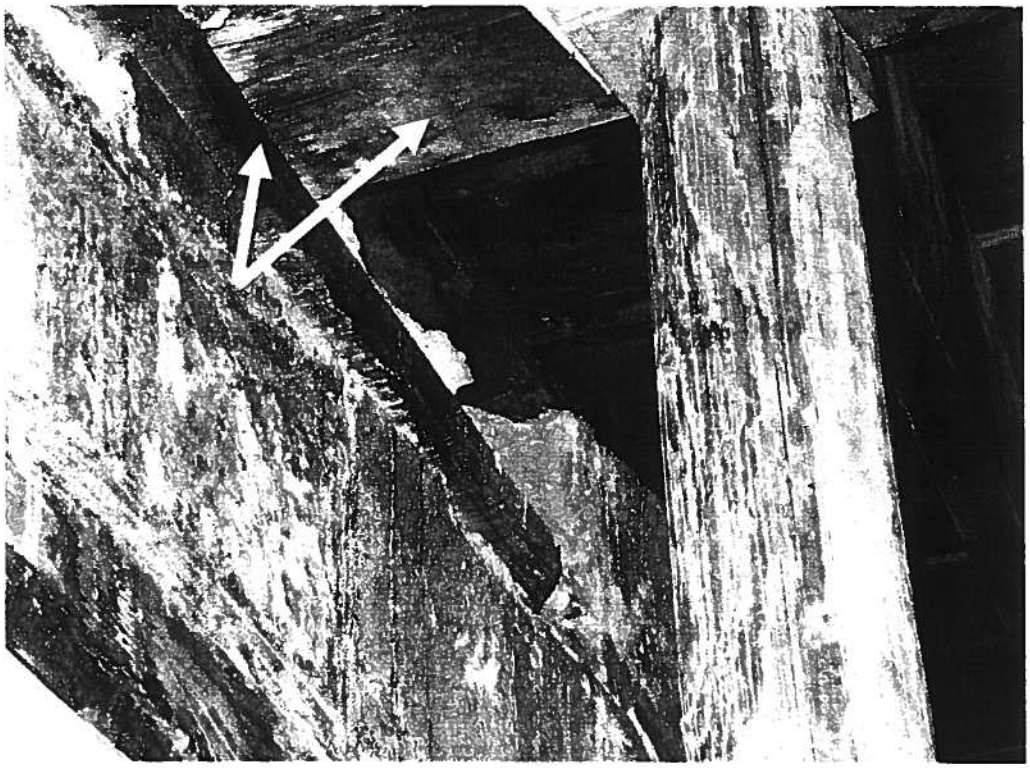

Photo 10. The East wall has moved out from under the framing [5/22/03].

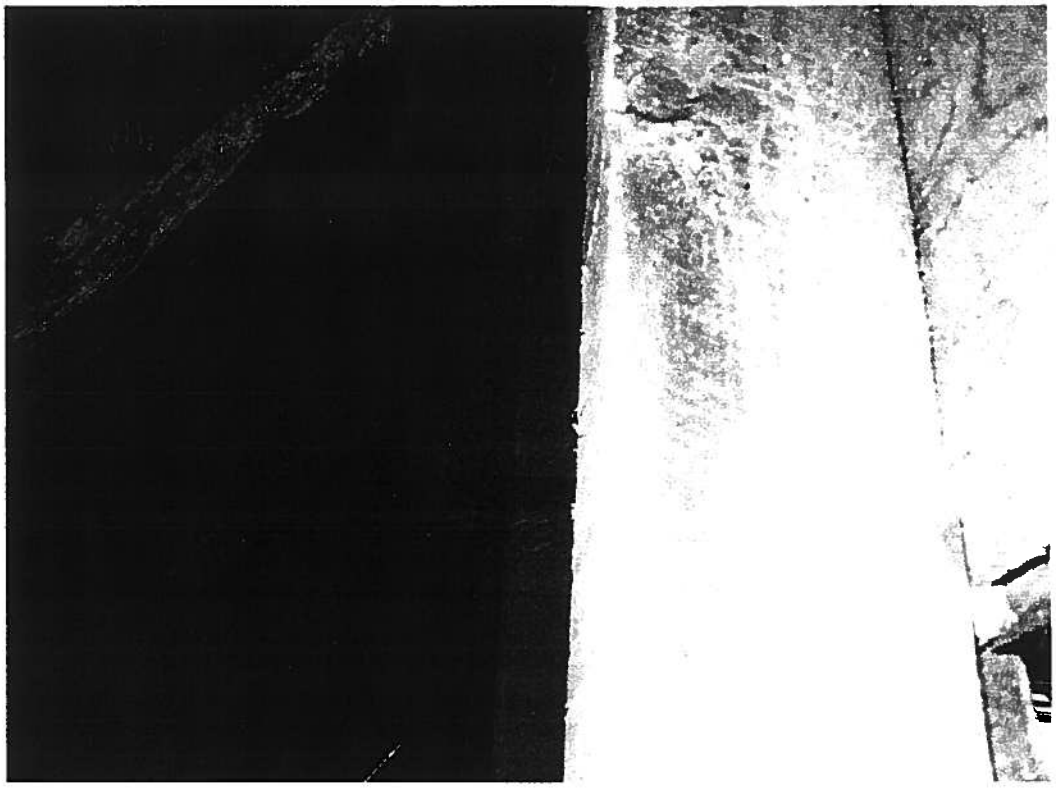

Photo 11. Roof framing, rafters and sheathing with corrugated metal covering [5/22/03].

Photo 12. Stone cracking on the East end of the south wall [5/22/03]