

JUN 23 2014

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June 3, 2014

Ms. Heather Carmichael, BA
Contract Administrator/Buyer
County of Johnson Texas
1102 E. Kilpatrick, Suite B
Cleburne, TX 76031**Re: Limited Roof Condition Assessment**Johnson County Corrections Center- Roof/Ceiling Condensation Assessment
1800 Ridgemar Drive
Cleburne, Texas
BES No. 6120

Dear Ms. Carmichael:

Building Exterior Solutions, LLC (BES) was requested to perform a condition assessment of the roof and ceiling for moisture related problems at buildings 2 and 3 of Johnson County Corrections Center located at 1800 Ridgemar Drive, Cleburne, Texas. The purpose of our roof and ceiling assessment was to observe the sloped metal roof system and the condensation problems present at the ceiling tiles on the interior.

Mr. Bruce A. Hall of BES performed our preliminary roof/ceiling assessment and Officer David Blankenship of Johnson County Corrections Center accompanied him inside the facility and on the roof of the structure. Representative photographs are included within Appendix A. This report summarizes our limited field observations, conclusions, and associated recommendations.

PROJECT INFORMATION:

The Johnson County Corrections Center buildings 2 and 3 were reportedly constructed in 2005 and 2007 respectively (Photograph 1). The walls consist of concrete and the roofing consists of "R" type metal profile panel. Each building observed had 4 quadrants (A-D) with a central control center between the 4 units. An attic area was present between the units. Drawings for the buildings were not available for review during the on-site assessment.

Mr. Bruce Hall, Senior Associate of Building Exterior Solutions visited the referenced site on April 3, 2014 to assess and observe the existing steep sloped metal roof and ceiling cathedral system. Cathedral and ceiling systems and other roofs on campus that were not associated with buildings 2 and 3 are not included in the scope of this site visit or report. Officer David Blankenship provided general information concerning the history of reported stains on the interior ceiling tiles.

Roof cores samples were not extracted from the metal roof. Mr. Turner of the maintenance staff made four inspection openings in the ceiling space of three units. The openings were reviewed and photographed and the maintenance team repaired the openings. For the purpose of this report the roof and ceiling construction will be divided into their construction for reference. Only a portion of the units was observed to gain a general understanding of the roof and ceiling conditions in buildings 2 and 3.



SCOPE OF SERVICES

Our services included observations of readily visible systems at accessible roof and ceiling areas from the ground, limited up-close ceiling observations with a scissor lift, and up-close observations of portions of the metal roof system. Four ceiling inspection openings were made within three units for observation of the ceiling and roof assembly.

The intent of this report was to provide our client with a roof and ceiling assessment and industry guidelines for corrective activities in reference to roof and ceiling moisture condensation on the interior ceiling in general accordance with industry standard-of-care. This report is not intended to be a specification for design or a scope of work for roof or ceiling repairs.

FINDINGS AND OBSERVATIONS

During our site visit, BES made visual observations and obtained relevant information about the building from Officer Blankenship and Mr. Turner of the Johnson County Corrections Center. A summary of the roof observations is as follows:

Ceiling Observations

In general, each quadrant was constructed with a wood-fiber tile finished ceiling that sloped up from the exterior wall toward the interior (Photograph 2). Climate control was provided by insulated ducts suspended just below the ceiling finish with downward-facing registers. BES observed shower stalls in the areas, which we understand are actively utilized (Photograph 3).

Distress including brown stains on the ceiling tiles, black residue on some tiles, displaced tiles, and evidence of some tile repair were observed throughout Buildings 2 and 3. The following is a summary of our findings:

Building 2-Area B

- General Observations (Photographs 4 through 8)
 - Brown stains on ceiling tiles throughout the area.
 - Displaced ceiling tiles.
 - Black residue on tiles and adjacent wall.
- Inspection Opening (Photographs 9 and 10)
 - Wood fiber tiles glued and screwed over paper-faced gypsum board.
 - Gypsum board and ceiling panels attached to steel zee framing.
 - Paper-faced fiberglass batt insulation (approximately 6-inches) was in the space between the metal roof and the paper-faced gypsum board.
 - Metal "R" profile type panel screwed down with metal fasteners to metal supports.
 - Moisture in core sample insulation (moisture not measured – wet to the touch in fiberglass insulation).
 - Stains and corrosion associated with a roof leak were not observed at this location.

Attic Space between Building 2-Areas A & B

- Black residue on the gypsum ceiling adjacent to a vent duct (Photograph 11).



Building 2-Area A

- General Observations (Photographs 12 and 13)
 - Brown stains on ceiling tiles throughout the area, though more limited than that noted at Area B.
 - Stains on gypsum wall finish adjacent to the ceiling.
- No inspection openings were made in this area.

Building 2-Area C

- General Observations (Photographs 14 and 15)
 - Brown stains on ceiling tiles throughout the area, similar to that found at Area B.
 - Displaced ceiling tiles.
- No inspection openings were made in this area.

Building 3-Area A

- General Observations (Photographs 16 and 17)
 - Limited brown stains on ceiling tiles throughout the area, primarily along suspect framing member lines.
- Inspection Openings (Photographs 18 and 19)
 - Wood fiber tiles fastened to framing members.
 - Foil-faced fiberglass batt insulation above the tiles.
 - No detectable moisture was present in the insulation.

Building 3-Area D

- General Observations (Photograph 20)
 - Brown stains on ceiling tiles throughout the area, slightly less than that observed at building 2 noted above.
- Inspection Opening (Photograph 21)
 - Wood fiber tiles fastened to framing members.
 - Un-faced fiberglass batt insulation above the tiles
 - No detectable moisture was present in the insulation

Roof Observations

Two roof areas were surveyed including Building 2 (approximately 17,000 square feet) and Building 3 (approximately 27,000 square feet). The two roof systems appeared to be similar in construction and age and are referred to in this report as the roof (Photograph 22). At the time of our observations, no roof leaks had been reported.

The roof consists of a painted metal panel mechanically fastened to the steel zee structural supports beneath the roof. The roofs drain into perimeter gutter systems. Some deficiencies were observed; however, these are considered common maintenance items for roofs of this type.

- Gap between the vertical flashing and the counter flashing at a roof penetration (Photograph 23).
- Missing or displaced foam closure strips at several locations (Photograph 24).
- Cracked mastic or sealant flashing in various locations (Photograph 25).

CONCLUSIONS AND RECOMMENDATIONS

At Building 2, Area B, the presence of significant and widespread stains on the ceiling finish, absence of stains on the roof framing members, and wet conditions present in the fiberglass insulation is consistent with condensation forming within and/or above the ceiling line. At this location gypsum sheathing and paper-faced fiberglass insulation were present above the wood fiber ceiling tiles.



At Building 3 Area A, less staining was observed on the ceiling, and at this location we noted that gypsum sheathing was not present above the ceiling tiles and the fiberglass batt insulation was foil-faced with the foil facing downward toward the ceiling. At Building 3, Area D, more ceiling tile stains were observed than at Building 3 Area A and at this location no gypsum board was present and the fiberglass insulation was unfaced.

Building envelope 'hygrothermal' behavior (migration of water vapor and temperature through building envelope systems) is complex and involves an interaction of a number of materials with varying resistance to transmission of temperature and water vapor. However, the principals of condensation are fairly simple. Basically, when air meets a surface or region where the temperature is less than the dewpoint of the air, condensate (liquid water) forms. Proper building envelope performance involves combining construction components to push the point of condensation outside of the building envelope. This can be accomplished through the use and placement of insulation, use and placement of vapor retarding materials and membranes, and reduction of interior humidity (or dewpoint). The above noted conditions point to a situation where the condensation point of the system is within the ceiling finish or insulation layer.

The significant reduction in staining at Building 3, Area A appears to be associated with the presence of the foil vapor retarding membrane. It is likely that this layer is reducing the amount of vapor moving from the interior environment into the fiberglass insulation. Operational showers within the areas would contribute significantly to the humidity within the indoor environment and would exacerbate the condensation and visible damage. Therefore, the conditions resulting in the condensation are likely associated with high interior humidity and cooler exterior temperatures. Additionally, at Building 3 Area A, the limited patterns of stains on the tiles are consistent with 'ghosting' along the framing member lines. This often results when the temperature of the framing members is cooler than the adjacent insulation area. The above-noted conditions point toward fall, winter, spring type conditions.

One obvious measure to mitigate this condition is to reduce the humidity of the interior environment. This can often be accomplished through increased number of air exchanges and/or dehumidification. Measures such as pre-drying fresh air can also help to reduce interior moisture. Another method of controlling the vapor drive is the use of interior vapor retarding membranes. Care must be exercised in using interior vapor retarding membranes in generally southern or mixed climates in conjunction with a vapor barrier (metal) roof system. Improper design can actually trap moisture and make conditions far worse.

A mechanical engineer should be retained to review the existing HVAC systems capacities, configuration and operations to determine appropriate modifications to reduce the indoor humidity. BES can coordinate and the services of the engineer. Changes to the system may include adjustment of coil temperatures, operating times, air flow rates, locations of supply and return ducts and/or possible additions such as dehumidification systems or fans to circulate the air more effectively. It may also be possible to modify the shower areas to vent/direct interior moisture to the exterior. Combinations of a 'hooded' ceiling configuration along with high-flow ventilation systems fixed to humidistats or timers may significantly reduce the humidity of the indoor environment.

At locations where two layers of ceiling finish and/or wet ceiling materials/insulation are present (wood fiber tile and gypsum), the entire ceiling finish and wet insulation should be removed. These materials pose a falling hazard and may contribute to the presence of mold growth. Steel framing should be inspected and areas with minimal to moderate rust should be brushed and painted to protect the steel. Members with significant steel distress should be remediated under the guidance of a qualified Professional Engineer. Additionally, the underside of the steel deck and framing should be inspected to determine if sources of water infiltration through the roof are present. After roof and framing member remediation is complete, a suspended gypsum ceiling system should be installed. The ceiling system



should utilize wire hangers/straps to suspended cold-formed steel ceiling framing, and batt insulation should be present above the ceiling. Pending determinations by the mechanical engineer and associated final ceiling system design, a vapor retarding membrane or foil-faced insulation may necessary.

At locations where the ceiling system is generally dry, it may be feasible to perform required mechanical system modifications and/or application of appropriate high-performance coatings to the ceiling to significantly reduce or prevent the majority of the condensation. However, given the direct attachment of the fiber tiles to the steel roof framing, it is likely that some degree of continued condensation will occur. If it is desired to significantly reduce the potential of this condition from occurring in these areas, removal of the current ceiling system and construction of an insulated-suspended ceiling system should be constructed as noted above.

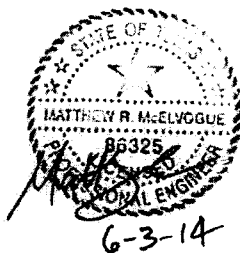
Based on our experience with similar projects, removal and replacement of ceiling systems as noted above may range from \$30 to \$40 per square foot provided no or minimal mold abatement is required. Costs for modifications of mechanical systems, installation of venting assemblies for showers, and installation of high-performance coatings will likely vary widely depending on the extent of modifications required. Other costs that should be considered are professional fees associated the assessment and performance modification design of the HVAC systems, additional assessment and modification design of suspended ceiling and shower ventilation systems, and desired construction administration. BES recommends that a phased approach be taken to clearly identify the extent of the problem ceiling conditions and incompatible HVAC systems or operation. This should include prioritization of actions first to mitigate potential health or safety issues, next to address the greatest contributing factors, and finally to determine long-term approaches to ensuring proper building envelope performance for year-round operation.

CLOSING

It has been a pleasure working with Johnson County Corrections Center on this project. Please contact us if we can answer any questions concerning this matter or be of any further assistance.

Very truly yours,

BUILDING EXTERIOR SOLUTIONS, LLC
TBPE Firm Registration No. 10833



Matthew McElvogue, PE, RWC
Associate Principal/Project Manager

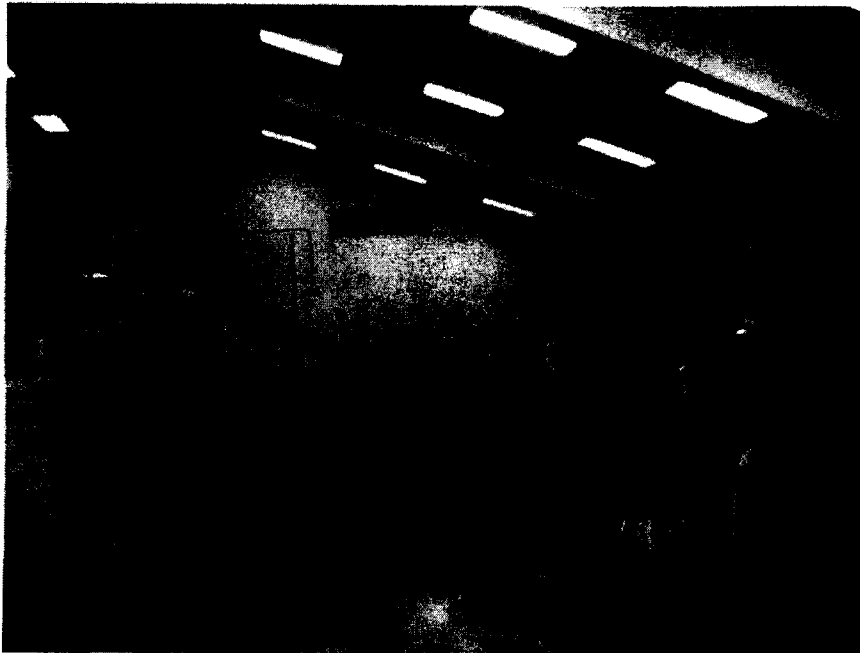
Jerry L. Abendroth
Jerry L. Abendroth, RRC, RWC, REWC, RBEC
Senior Principal/Partner



Appendix A: Photographs



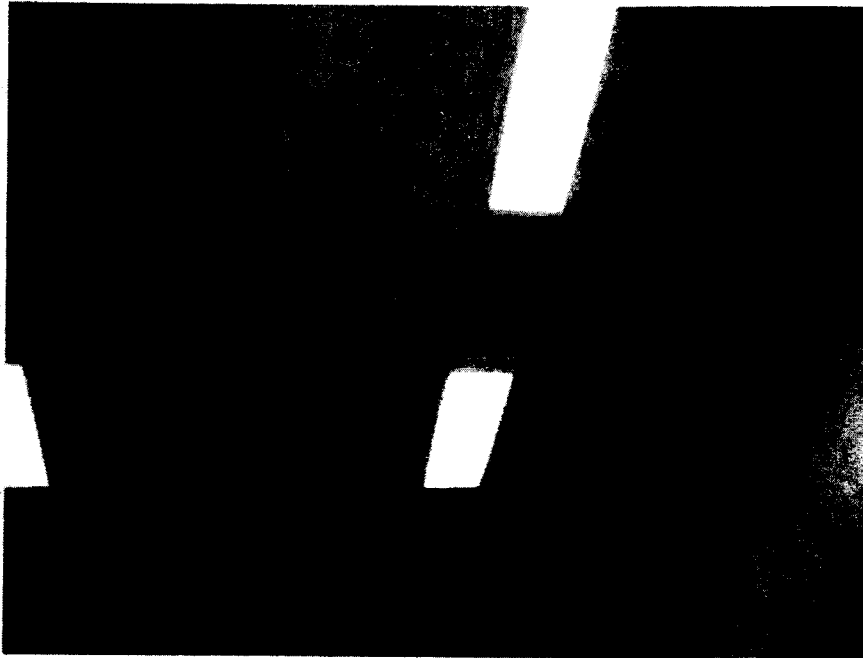
Photograph 1: General Site



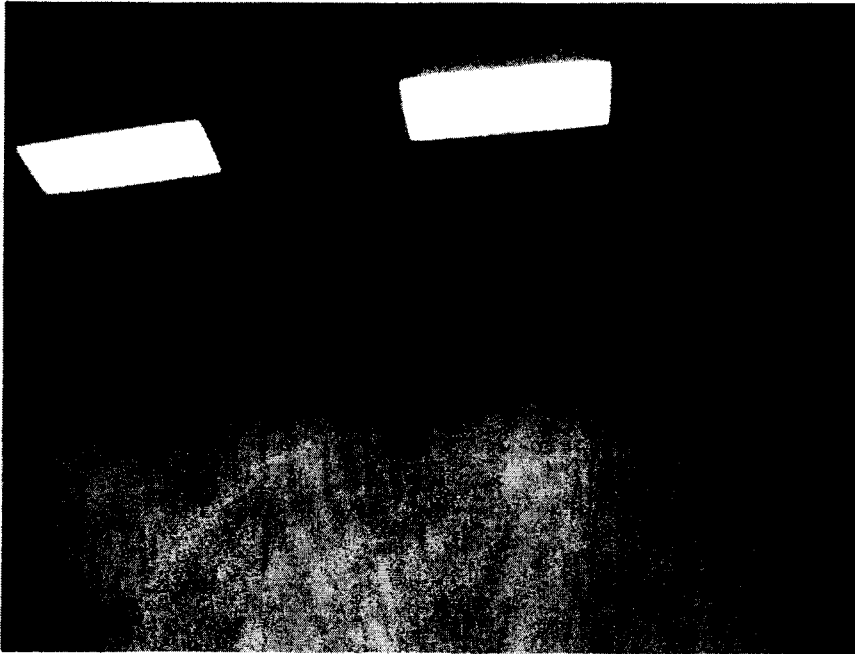
Photograph 2: Area 2-B - General Interior



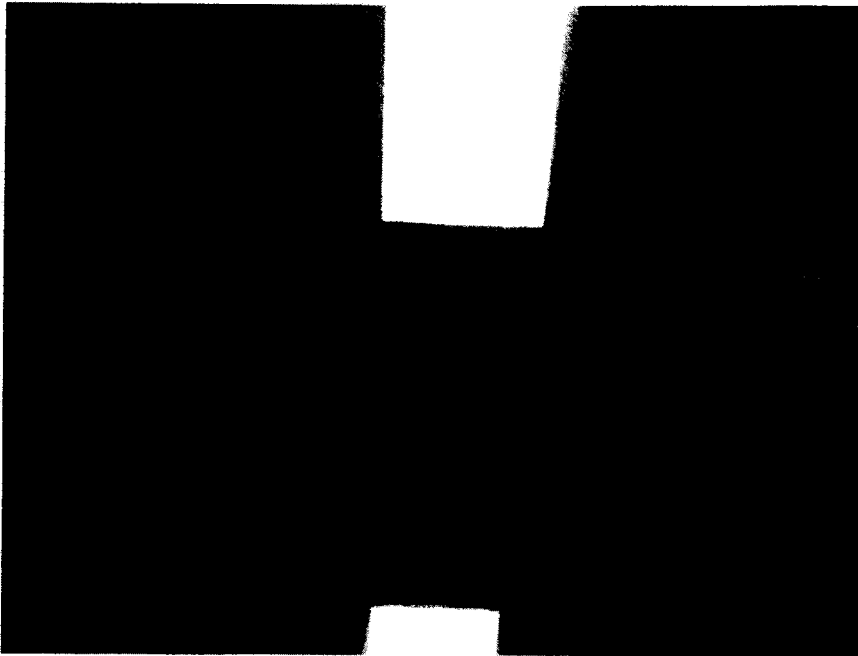
Photograph 3: Area 2-B - General Interior



Photograph 4: Area 2-B - Stains at Ceiling



Photograph 5: Area 2-B – Stains and Partially Detached Tile



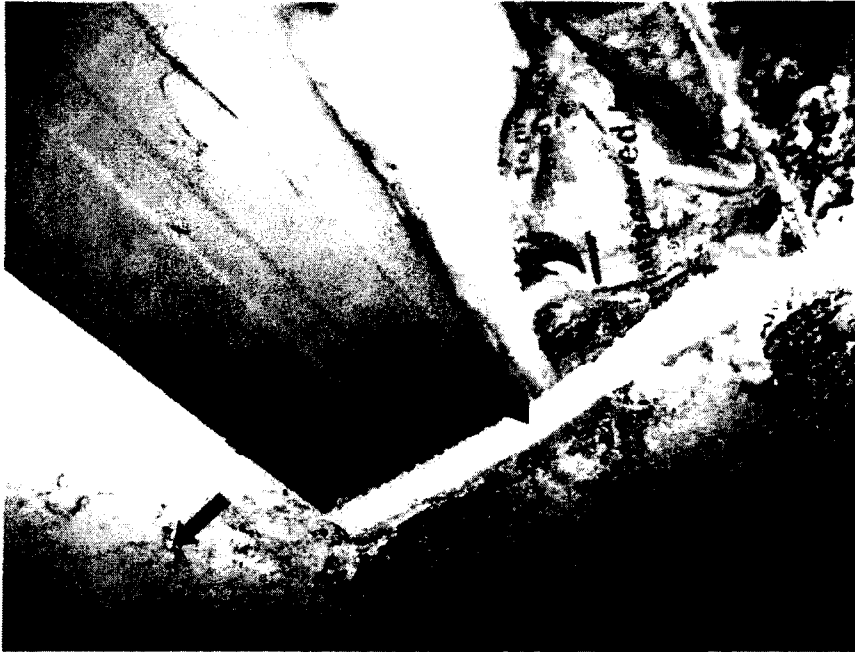
Photograph 6: Area 2-B Stains and Partially Detached Tile



Photograph 7: Area 2-B – Stains and Partially Detached Tile



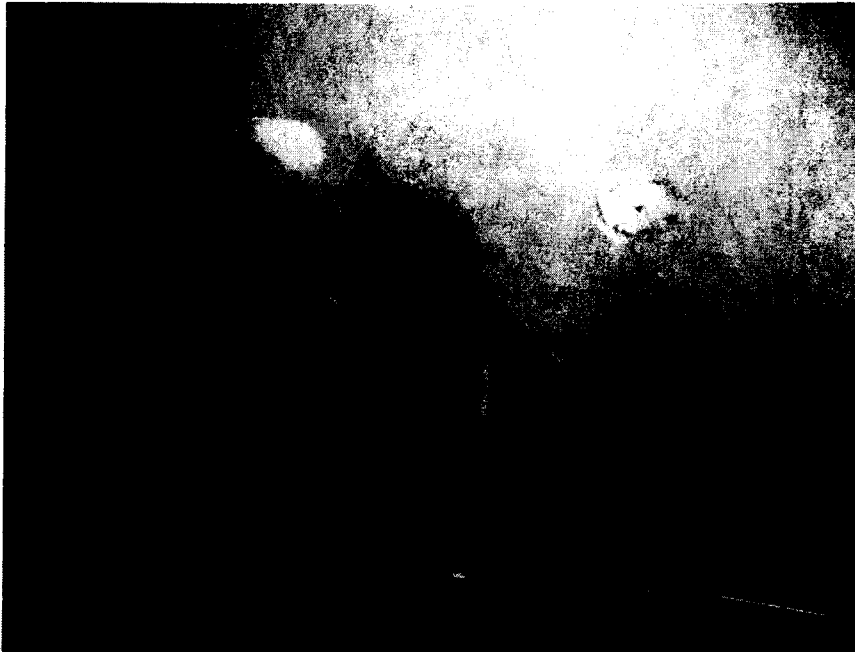
Photograph 8: Area 2-B – Stains and Missing Tile



Photograph 9: Area 2-B – Gypsum Sheathing (Red Arrow) with Wood Fiber Ceiling Tile (Blue Arrow)



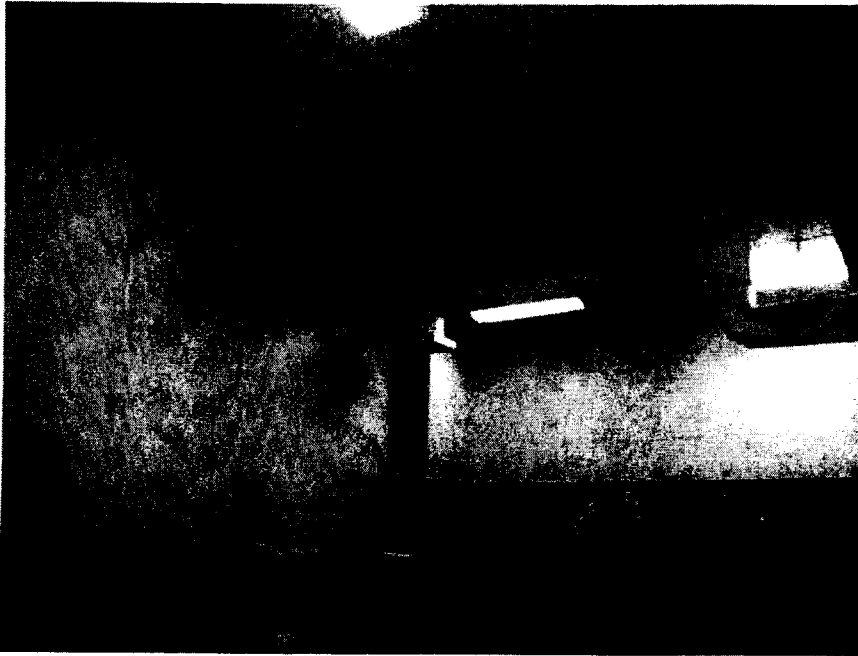
Photograph 10: Area 2-B – Corrosion at Zee



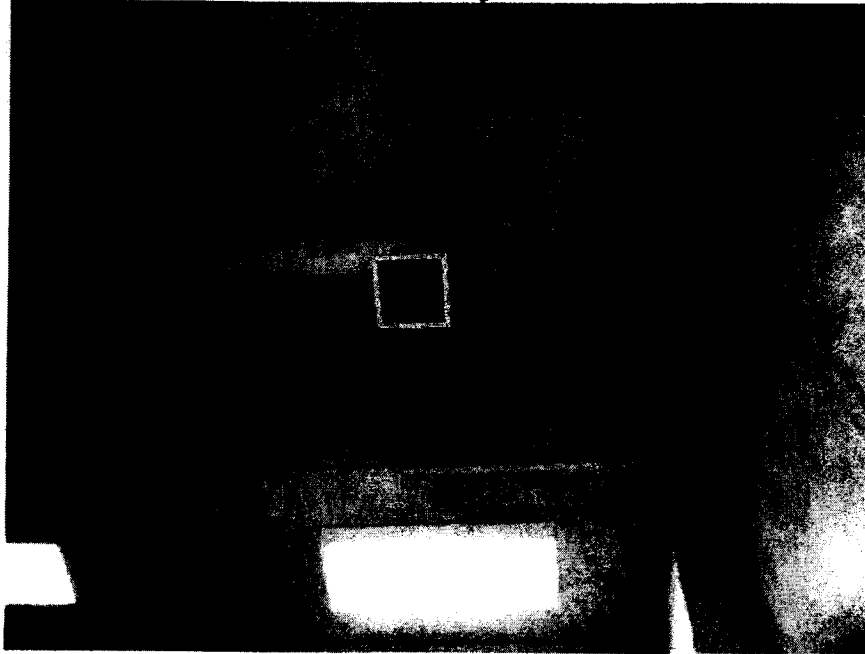
Photograph 11: Black Residue on Ceiling of Attic Space between Units 2-A and 2-B



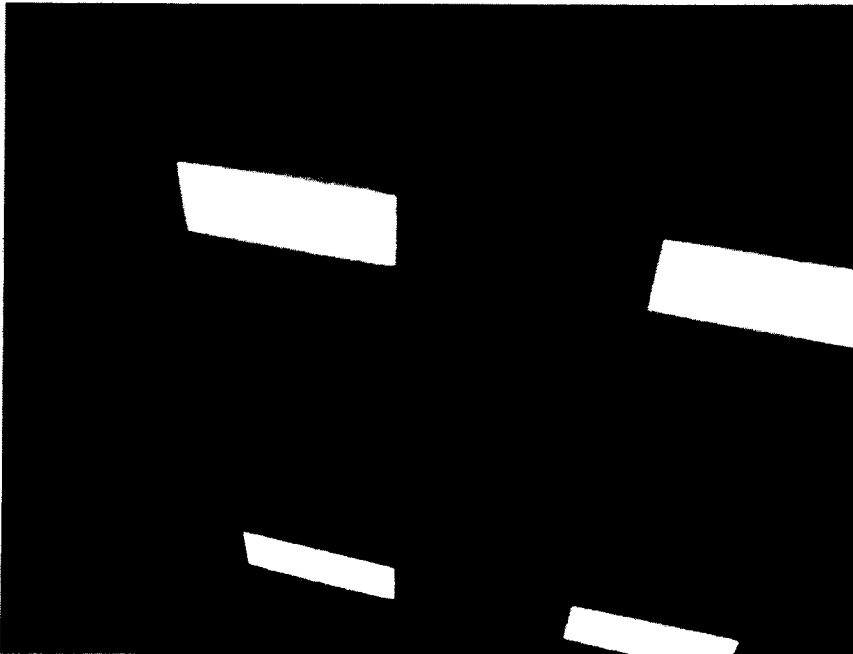
Photograph 12: Area 2-A – Stains at Ceiling



Photograph 13: Area 2-A - Stains at Ceiling



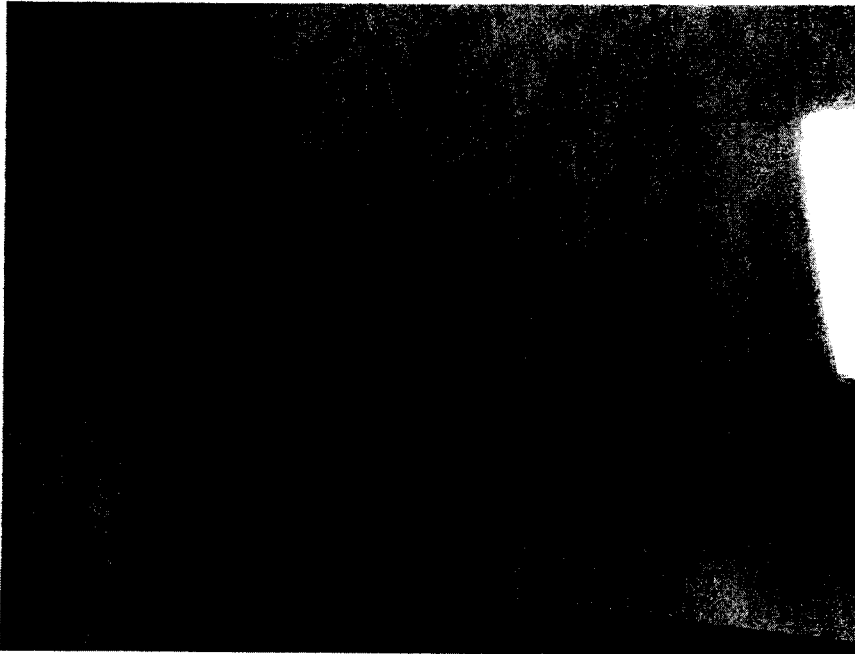
Photograph 14: Area 2-C - Stains at Ceiling



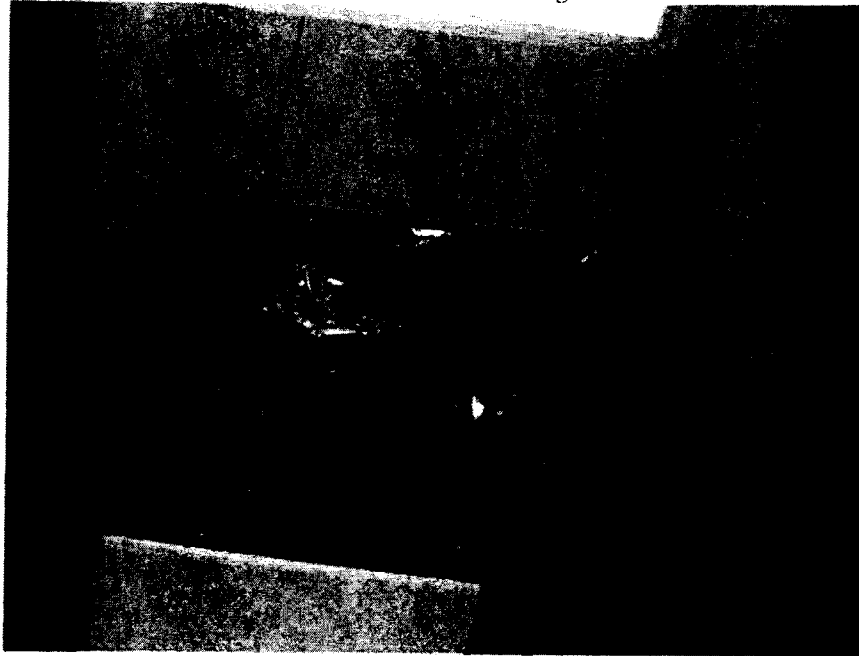
Photograph 15: Area 2-C – Stains at Ceiling



Photograph 16: Area 3-A – Limited Stains at Ceiling



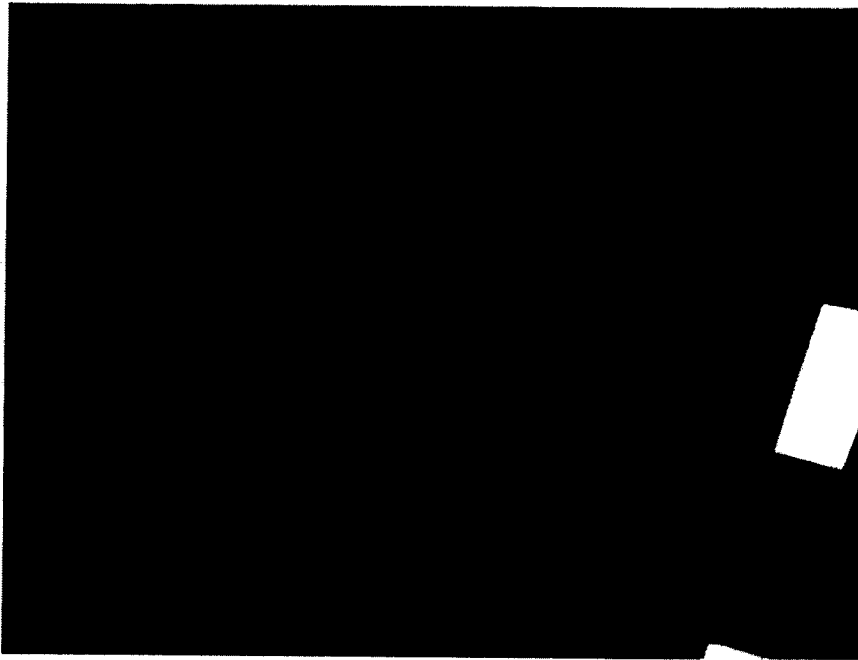
Photograph 17: Area 3-A - Limited Stains at Ceiling



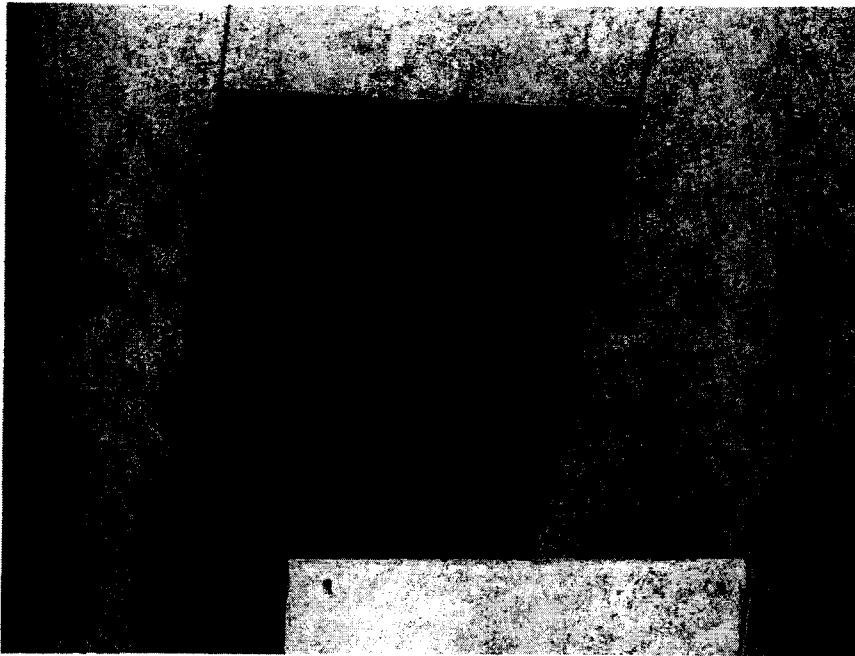
Photograph 18: Area 3-A - Foil-Faced Insulation above Ceiling Tile



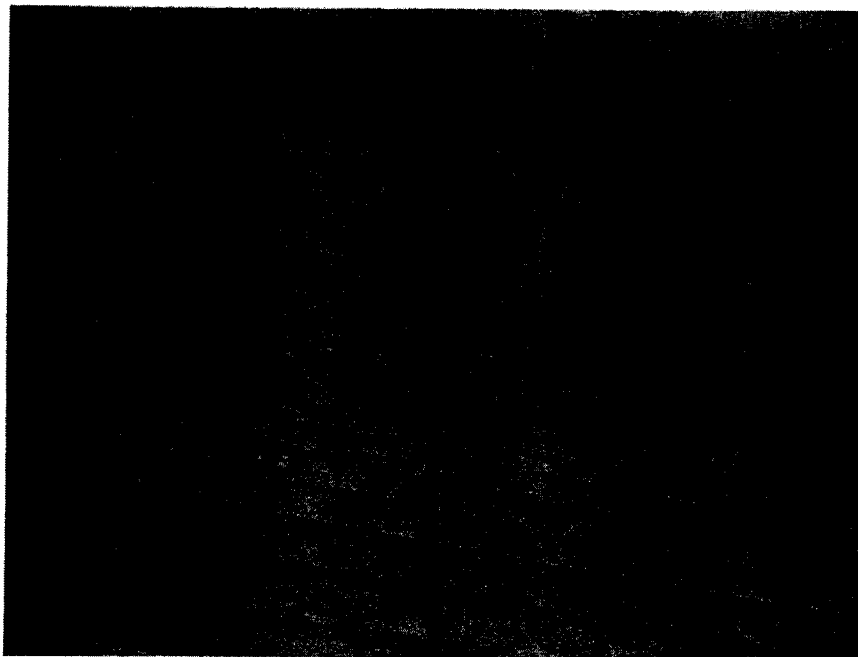
Photograph 19: Area 3-A – No Stains or Moisture Detected above Ceiling Tile



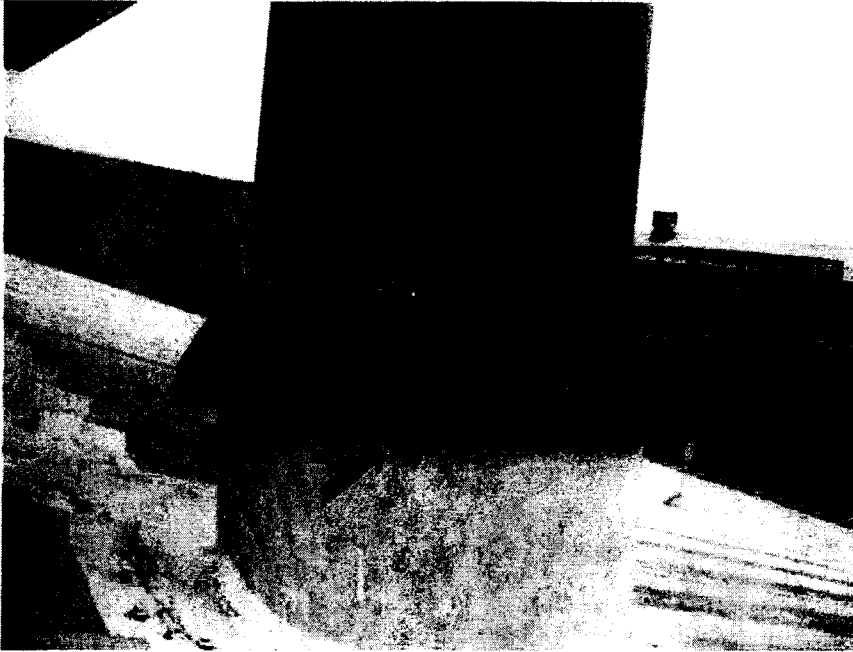
Photograph 20: Area 3-D – Stains at Ceiling



Photograph 21: Area 3-D Un-Faced Insulation above Ceiling Tile.



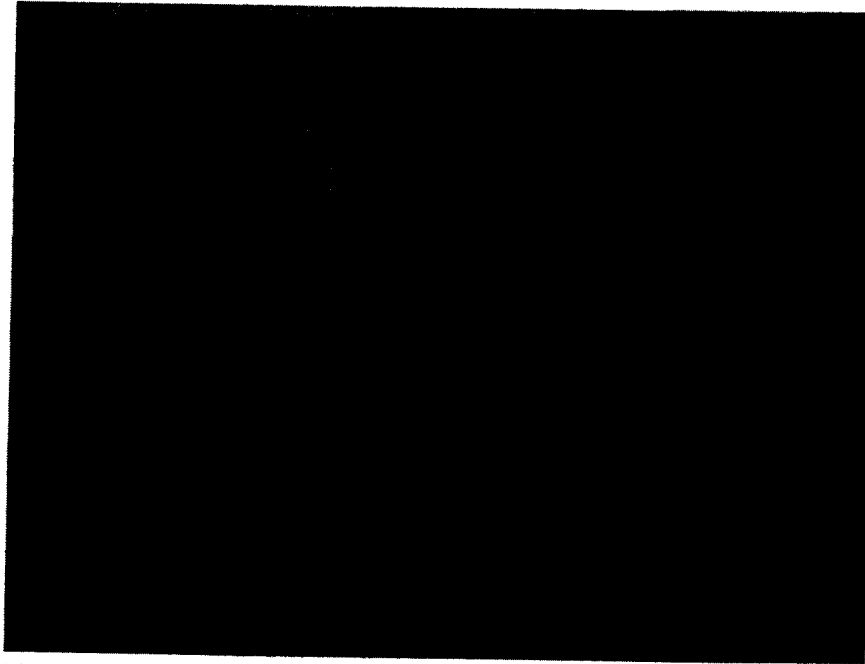
Photograph 22: Roof Area Over 2-B -- R-Panel Type Roofing



Photograph 23: Over Roof Attic Area 2-B – Gap between Flashing and Counter Flashing at Roof Penetration.



Photograph 24: Displaced Foam Closure Strips



Photograph 25: Opening Below Roof Flashing