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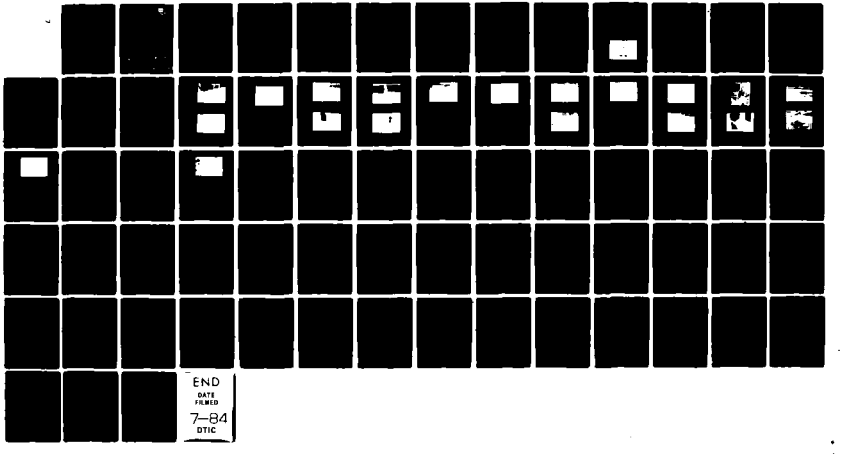

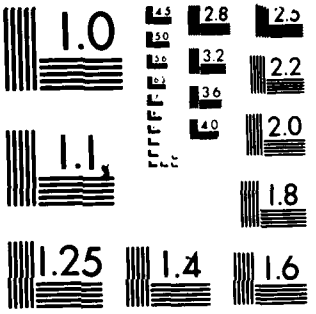

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March 1984

US Army Corps of Engineers
Cold Regions Research & Engineering Laboratory

U.S. Air Force roof condition index survey
Ft. Greely, Alaska

Barry A. Coutermarsh

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The United States Air Force Roof Condition Index Survey (RCI) procedure was studied and used on the roofs of Fort Greely, Alaska. Approximately 93 roof sections were inspected using this procedure. The results will be used in a comparison study between this method and the Army's method of infrared roof surveys and core samples. This report details the RCI method, discusses various aspects of the procedure and presents the results of the Fort Greely survey.

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PREFACE

This report was prepared by Barry A. Coutermarsh, Research Civil Engineer, of the Civil Engineering Research Branch, Experimental Engineering Division, U.S. Army Cold Regions Research and Engineering Laboratory.

The study was conducted under DA Project 4A762730AT42, Design, Construction and Operations Technology for Cold Regions; Task C, Cold Regions Base Support Maintenance and Operations; Work Unit 6, Maintenance and Rehabilitation of Military Facilities in Cold Regions.

W. Cox of the U.S. Air Force Institute of Technology and W. Tobiasson and C. Korhonen of CRREL technically reviewed this report.

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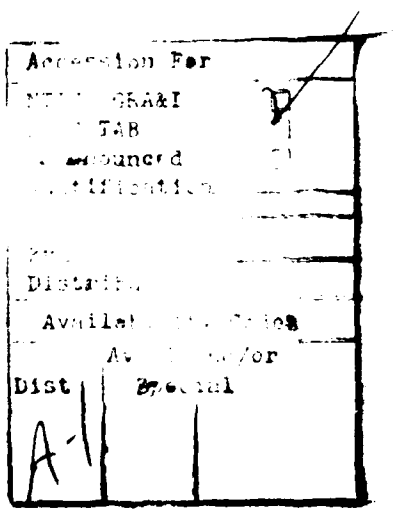

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U.S. AIR FORCE ROOF CONDITION INDEX SURVEY - FORT GREELY, ALASKA

by

Barry A. Coutermarsh

INTRODUCTION

The current Army method for determining the condition of built-up roofing systems relies on infrared roof moisture surveys, core samples for verification and visual inspections of the roofing components. This methodology was developed by the Cold Regions Research and Engineering Laboratory (CRREL), the Facilities Engineering Support Agency (FESA), and the Waterways Experiment Station (WES) (Tobiasson et al. 1977, Korhonen and Tobiasson 1978, Tobiasson and Korhonen 1978, Tobiasson 1982). It is currently being implemented throughout the Army by FESA survey teams (Knehans and Styer 1982).

The Air Force relies on a systematic visual examination of the roof membrane, flashings and, in limited cases, the roof deck to determine roof system condition. The results of these visual examinatons are then used to develop replacement priority lists. The Air Force method is handled at the base level as outlined in Air Force Manual (AFM) 91-36, Built-up Roof Management Program (U.S. Air Force 1980).

As part of our cold regions roof research, CRREL personnel conducted infrared roof moisture surveys on essentially all of the built-up roofs at Fort Greely, Alaska, during May of 1982. To compare the Army infrared method with the Air Force visual method, the Air Force procedure was also used on these same roofs. Captain W.J. Cox of the U.S. Air Force Institute of Technology (AFIT) participated in this work. He taught me the Air Force survey procedures and he participated in the Fort Greely surveys. At the time, Captain Cox was teaching roofing technology at AFIT and had traveled to many Air Force bases to teach their personnel how to conduct roof surveys using the procedures in AFM 91-36.

This report describes the Air Force survey method, includes our experience with it and presents the results of the Fort Greely surveys using that method.

U.S. AIR FORCE ROOF MANAGEMENT PROGRAM

The Air Force Built-Up Roof (BUR) Management program deals with two major areas as described in AFM 91-36:

1. "It establishes an in-house preventive maintenance program for roofs now in service by cataloging and quantifying roof serviceability and using proper in-house repair techniques."

2. "For contract work, it shows how to determine the best solutions, prepare construction documents that define and control construction quality, and hold suppliers accountable through contract management and coordination with the base contracting office."

The scope of this report is within area 1, using the Air Force procedure for cataloging and quantifying roof serviceability. A detailed visual inspection is performed on a roof to generate a number known as the Roof Condition Index (RCI). The RCI is a numerical rating of a roof determined by application of deduct values, as hereafter described, corresponding to the various defects in the roof that are identified in the inspection. The RCI number is used, along with building occupancy, to determine repair and replacement priority lists. It is also used to determine a Serviceability Forecast (SF). The SF is the projected useful life of the roof beyond the inspection date, assuming no work is done except to fix leaks. Chapter 3 in AFM 91-36 details the visual inspection method to be followed to obtain an RCI rating. This is the part of the manual that we evaluated during our research at Fort Greely. Chapters 1 and 2 in the manual outline the scope of and give general instructions for the overall management program while Chapters 4-6 contain information on repair techniques, specifications and construction management respectively.

RCI visual inspection procedure

The first step in the RCI inspection procedure is to make scale plan views of the roofs to be surveyed, with each roof divided into separate inspection areas showing any protrusions (fan housing, vent pipes, etc.). Area limits are determined by natural building divisions, such as expansion joints, firewalls, etc., and roof age. The roof within an inspection area must be the same age throughout. A typical roof drawing is shown in Figure 1 with a letter designator assigned to each inspection area. A Roof Inspection and Rating Worksheet (AF 1060) is used to record information about the roof and to list any problems found during the survey. An example of a filled-in

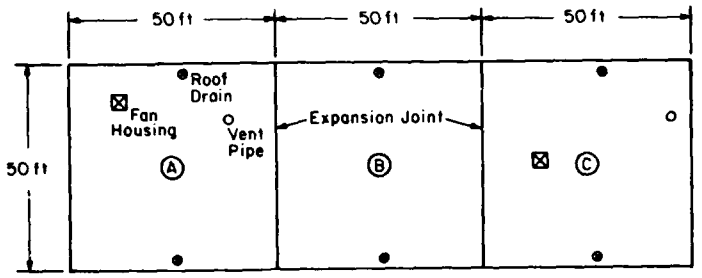

Figure 1. Example roof sketch suitable for an RCI survey.

Table 1. Ten problem categories used during the RCI inspection. Defect 4 relates to both flashing problems and membrane problems.

Flashing related problems	Problem number
Bituminous-base flashing defects	1
Bituminous-base flashing delamination or sliding	2
Metal flashing defects	3
Repairs to bituminous-base flashings	4
Membrane related problems	
Repairs to membrane	4
Splits	5
Ridges	6
Holes	7
Blisters	8
Exposed felts	9
Alligator cracking	10

AF-1060 is contained in Appendix A. The visual examination itself consists of looking for problems listed within the 10 categories outlined in Table 1. Four of these problem categories concern flashings while seven problem categories concern the membrane. Problem 4 has two components, one for the flashings and one for the membrane. The severity of each problem is also determined to be either low, medium or high, based upon the magnitude of the defect found. An example of a medium severity bituminous base flashing defect (problem 1) is worn felts with no holes present. A high severity defect would be a hole through the felts. There is no low severity defect associated with this problem. Problem categories and severity levels are fully defined in Chapter 3 of AFM 91-36.

A logical sequence for the visual inspection is to examine all the flashings, doing the perimeter of the roof area first. Next walk the entire roof looking for membrane defects. The flashings and membrane should be inspected separately since different procedures are used to count flashing and membrane problems. If problems 1, 2 or 4 are mixed together in one area of flashing, only the worst problem is counted (problem 1 is considered the worst, with severity decreasing as the number increases). If the problems occur in separate areas of flashing, then each is counted.

There is no problem priority for the membrane. All problem defects are counted, even if several are mixed together in one area. If a large quantity of one problem is present, a representative sampling technique can be used to determine problem quantity. The sample size should be at least 500 ft^2 and must be chosen with care to ensure that it is representative. When a defect is found, it is measured according to the specific method listed for the defect in Chapter 3 of AFM 91-36. For example, membrane ridges (problem 6) are measured by the linear foot of ridge, while membrane blisters (problem 8) are measured by the square foot of blistered area. The problem number, severity and quantity of each defect are recorded on AF 1060 as shown in Appendix A. The manual also requires that each defect location be marked on the roof with spray paint (Fig. 2). Defects are also shown on the roof sketch by writing

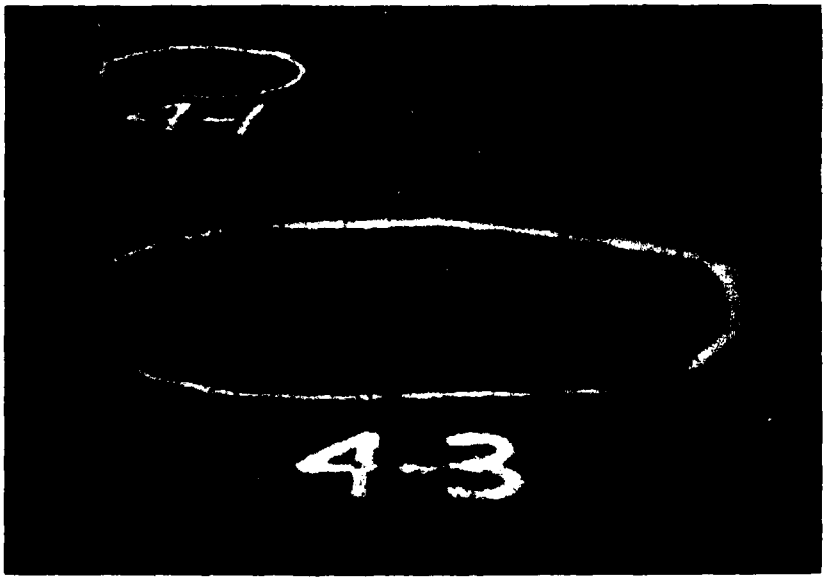

Figure 2. Problem number and quantity painted on a roof next to the outlined defect. Problem 4 (membrane repairs) has no severity level associated with it.

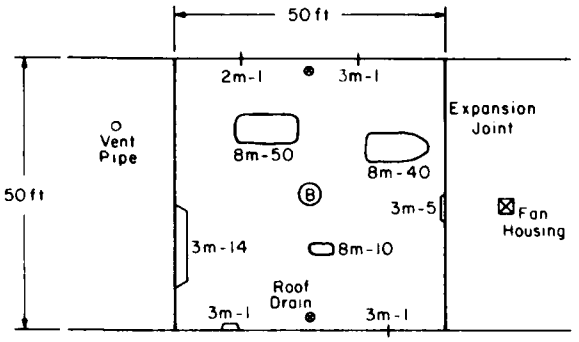

Figure 3. Roof sketch of section B of example roof shown in Figure 1, with defect locations and codes listed. A membrane code such as 8m-50 means problem 8, medium severity with a quantity of 50.

the problem number, severity level and quantity code next to an arrow (or hash mark) that indicates the approximate defect location (Fig. 3).

Before leaving the roof, the inspector collects a small sample of bitumen to be used in determining if it is asphalt or coal tar pitch.

Roof condition index and serviceability forecast calculations

Once the visual inspection of the roof is finished, the Roof Condition Index (RCI) and Serviceability Forecast (SF) numbers can be calculated in the office. The individual defect quantities listed on AF 1060 (Appendix A) are totaled and used to calculate a problem density value according to a formula given for each problem. For example, under problem 3, metal flashing defects, the problem density is determined with the following formula:

$$\text{Density} = \frac{A}{B + \frac{C}{100}} \times 100$$

where: A = length of metal flashing defects (ft)

B = total length of metal flashing (ft)

C = total area being rated (ft^2).

While recognizing that the above equation is dimensionally inconsistent, we make use of it in the form detailed in AFM 81-36. For the roof shown in Figure 3, there is a total of 25 ft of medium severity defect (problem 3). The problem density calculation for that defect is as follows:

A = 25 ft (length of metal flashing defects)

B = 200 ft (total length of metal flashing)

C = 2500 ft^2 (total area being rated)

$$\text{Density} = \frac{25}{200 + \frac{2500}{100}} \times 100$$

$$\text{Density} = \frac{25}{225} \times 100$$

$$\text{Density} = 11.11$$

The density number is used only as a relative indicator of problem magnitude, and units cannot be applied to the number.

The roof in Figure 3 also contains 100 ft^2 of medium severity blisters (problem 8). The density calculation for problem 8 is as follows:

$$\text{Density} = \frac{\text{Total area of membrane blisters } (ft^2)}{\text{Total area being rated } (ft^2)} \times 100$$

$$\text{Density} = \frac{100}{2500} \times 100$$

$$\text{Density} = 4.00.$$

The next step is to determine a deduct value for each problem by using the appropriate graph in AFM 91-36 and the problem density number. The deduct value for problem 3 in the above example is found by using the graph shown in Figure 4 and the density value of 11.11 found previously. The deduct value equals 5. The problem 8 deduct value is 50.5, found by using the graph shown in Figure 5 and the previously determined density of 4.00. The severity level of the problems determines which curve on the graphs is to be used.

After each deduct value is determined and recorded on AF 1060 they are added together and entered on AF 1060 as the Total Deduct Value (TDV). The number of individual deduct values of 4 or more (called q on AF 1060) is also entered on AF 1060. This number (2 in the example) and the TDV (54.5 in the

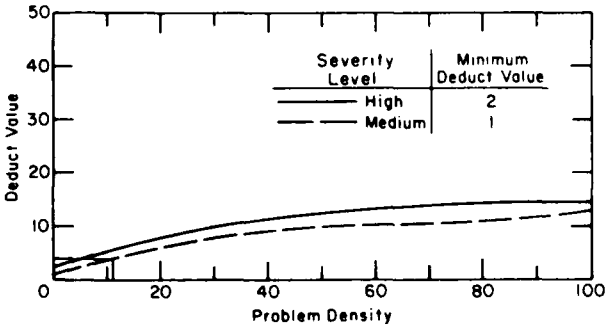

Figure 4. Deduct value curves for metal flashing defects, problem 3. The example in the text, with a density of 11.1, has a deduct value of 4.0 (after U.S. Air Force 1980).

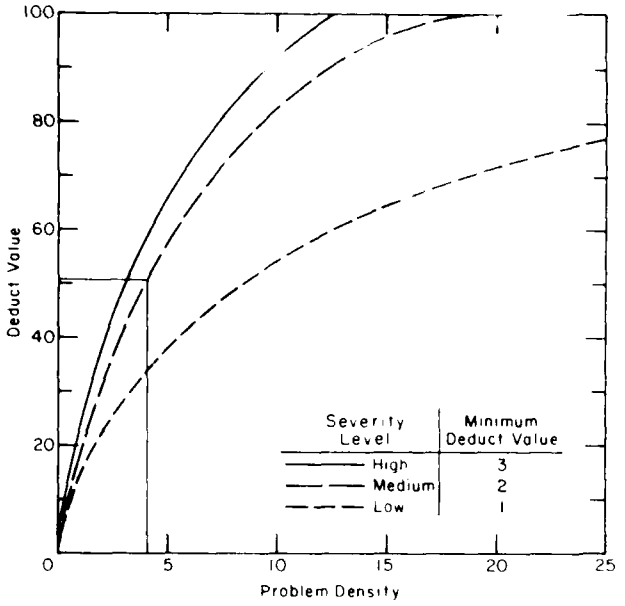

Figure 5. Deduct value curves for membrane blisters, problem 8. The example in the text, with a density of 4.0, has a deduct value of 50.5 (after U.S. Air Force 1980).

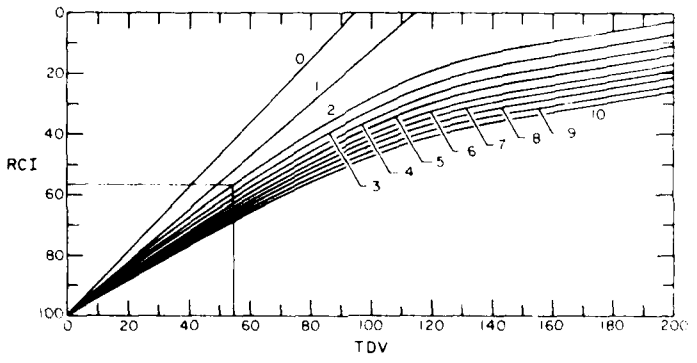

Figure 6. Roof Condition Index (RCI) curve (curve number is the q number). From the example in the text, where the Total Deduct Value (TDV) is 54.5 and q = 2, the RCI is 56.5 (after U.S. Air Force 1980).

example) are used to determine the RCI Index (Fig. 6). The RCI for the example roof is 56.5. The SF is determined from the RCI number, roof age and the bitumen type (Fig. 7). The example roof has an SF of 7 years (7.8 years x 0.85 since the bitumen is asphalt). The SF is .... "the anticipated useful life of the roof beyond the time of the rating, assuming no work is done except to fix leaks (U.S. Air Force 1980)."

The RCI number is the primary qualifier that is used in the Air Force management program to not only determine roof repair and replacement priorities, but also to decide in-house or contract alternatives for repair or re-

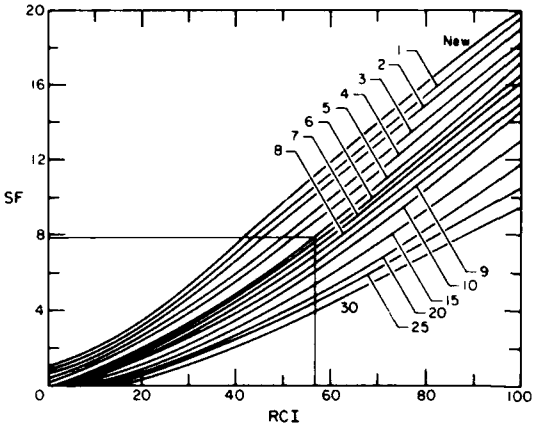

Figure 7. Serviceability Forecast (SF) curve (curve numbers are roof age in years; for asphalt roofs, multiply the serviceability forecast from the graph by 0.85). For the example roof with an RCI of 56.5 (see Fig. 6) and a roof age of 5 years, the SF value is 7.8 years. This value must be multiplied by 0.85 since the bitumen is asphalt, giving a final SF of about 7 years (after U.S. Air Force 1980).

placement. Chapter 3 in AFM 91-36 gives guidelines and a flow chart to use in considering the various options. The flow chart requires that the following be considered:

RCI $\geq$ 90 - In-house repair only.

90 > RCI $\geq$ 50 - In-house repair, contract repair or reroof based upon an economic analysis.

50 > RCI $\geq$ 20 - Recalculate the RCI assuming all needed repairs are made. If the recalculated RCI $\geq$ 50, consider in-house repair, contract repair or rercofing based upon an economic analysis. If the recalculated RCI < 50, consider only contract repair or reroofing.

RCI < 20 - Contract reroof only.

Chapter 3 also discusses economic considerations of various treatment alternatives with the estimated service life of each (Table 2). The manual recommends that roof areas requiring in-house repair be listed and given a priority separately from those requiring contracted repair or replacement. Normally, the roof area with the lowest RCI number is treated first but the Air Force Program recognizes that a building's occupancy may necessitate changing the priority somewhat.

To reflect the effect of building occupancy, the manual gives a table of roofing effect deduct values to be subtracted from the RCI number (Table 3). For each roof area rated, the inspector decides what categories would be affected if the roof area in question were not repaired (or replaced). The selected deduct values from Table 3 would be added up and the total would be subtracted from the roof area RCI to give a Roof Occupancy Condition Index (ROCI). The roof areas having the lowest ROCI should be treated first.

Table 2. Roof treatment service life alternatives from AFM 91-36. These can be used in economic feasibility equations when judging payback of various treatment alternatives (after U.S. Air Force 1980).

Treatment alternative	Estimated service life (years)
Cold repair	6-10
Hot repair:	
Asphalt	14
Coal tar	17
Superimposed:	
Asphalt	14
Coal tar	16
Remove and replace:	
Asphalt	17
Coal tar	20

Table 3. Roofing effect deduct values from AFM 91-36. The appropriate deduct values are subtracted from the RCI value to determine the Roof Occupancy Condition Index (ROCI) (after U.S. Air Force 1980).

Category	No negative effect	Low negative effect	Medium negative effect	High negative effect
Mission	0	10	20	30
Security, safety or environmental	0	5	10	15
Morale, welfare or health	0	3	6	9
Support activities (including potential loss of building contents)	0	3	6	9

FORT GREELY RCI SURVEYS

Captain W.J. Cox and I performed RCI visual inspections on 30 buildings at Fort Greely, Alaska, from 4-15 May 1982. Essentially, all the built-up roofs at Fort Greely were inspected, giving us a data base of 93 RCI roof sections.

The few roof plans that were available in the Fort Greely Facilities Engineer's shop were not detailed enough for our purposes. Consequently, we

drew most roof sketches on the roof before starting the visual survey, where we could measure distances and include the relative positions of drains, vents, fan housings and such.

We had difficulty in determining roof ages at Fort Greely. Roof ages obtainable from the Resource Management Office (RMO) were only available for roofing done under contract. In-house roofing jobs did not show up on these records and we could not find much information on in-house roofing work. This made it difficult to establish RCI areas according to age. The absence of roof age data also means that the serviceability forecast for a rated roof is based on an estimated roof age.

The equipment needed to perform a survey is minimal and can be carried in a small backpack. We used 2 clipboards, pencil and paper, a wire brush, a 100-ft cloth tape, a 16-ft steel tape, a pocket knife, solvent and a container for bitumen testing, spray paint, roof drawings, the RCI problem description and measurement guide (i.e., Chapter 3 of AFM 91-36) and roof inspection and rating worksheets (AF Form 1060).

The RCI surveys are best done by two people for safety, convenience and technical reasons. By discussing various defects as they are found, two individuals can check on each other and average out personal bias in their interpretation of the manual and identification of defects. One of us carried the roof sketch on a clipboard and the other carried the worksheet. Any defects found were recorded on both the roof sketch and the worksheet. AFM 91-36 also directs the inspectors to mark the roof with spray paint at each defect. Normally, the problem number, severity level and quantity are painted beside the defect, as shown in Figure 8. We did not mark the Fort Greely roofs in this manner, however, to avoid influencing the infrared comparison surveys which followed our RCI surveys. We did mark one roof though and found that this procedure substantially increases the time required for a survey. I feel it unnecessary to mark every defect. Showing the type, quantity and approximate location of each defect on the roof sketch should give anyone doing repairs adequate direction to find the problem. However, any problem that involves an opening into the roof system, such as holes (Fig. 9) or splits (Fig. 10), should be marked since such a problem can be hard to find and deserves immediate attention.

During our surveys, we first inspected the flashings and then the membrane.

Figure 8. Defects found during the RCI inspection should be marked on the roof with spray paint, according to AFM 91-36. Problem 3H is a high severity metal flashing defect and problem 7 is a hole. Unflashed protrusions, such as the ladder legs, are counted as holes in the RCI inspection.

Figure 9. Membrane holes (problem 7) should be marked on the roof so repairmen can find them easily.

Figure 10. Barely visible split on this gravel covered roof. An ink pen is protruding from the split.

Inspecting flashings

Bituminous base flashing defects (e.g., deteriorated felts or holes) are normally easy to spot. Figure 11 shows a bituminous-base flashing defect with a high severity rating (problem 1). Flashing delaminations (problem 2) are also looked for (Fig. 12). We would carefully press against the flashings to check for delaminations that might not be readily apparent. Under metal flashing defects, problem 3, we made a decision that any flush-mounted gravel stop and fascia edge detail that didn't utilize a clip over the joints was considered a high severity defect. Our rationale was that, in very many observed cases, this split the strip-in during expansion and contraction (Fig. 13). We also classified holes in expansion joint covers as high severity metal flashing defects (Fig. 14).

Problem 4 covers repairs to bituminous-base flashings and membranes. We encountered some difficulty in determining if a flashing had been repaired or simply coated as a normal maintenance procedure (Fig. 15). Maintenance coatings are not to be included as repairs under the RCI definition.

Figure 11. Example of a bituminous-base flashing defect, problem 1. This is a high severity defect since the felts have deteriorated to the point where water can enter the roof system there.

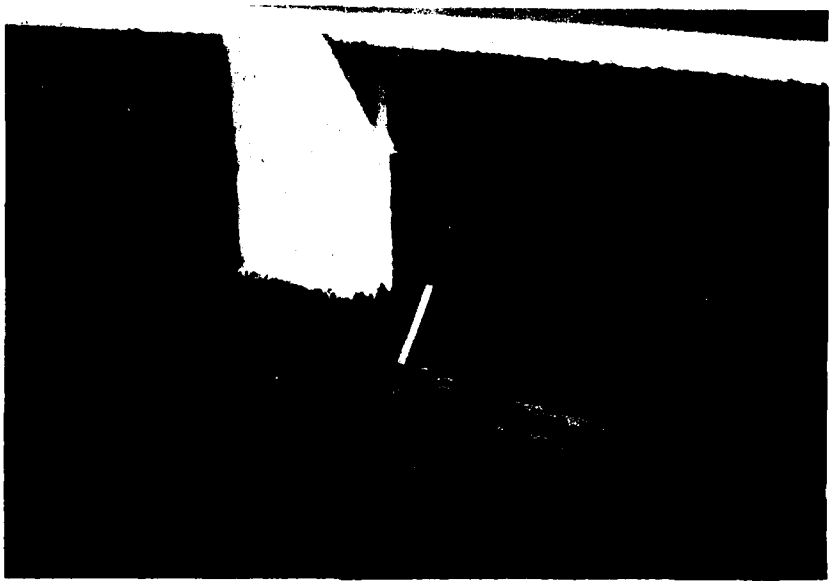

Figure 12. Bituminous-base flashing delamination or sliding, problem 2. The flashing has slipped down the vertical surface, which in this case is an old window. Since it appears watertight, it is classified as a medium severity defect.

Figure 13. Metal flashing defect, problem 3. Since water can enter the roofing system at this split, it is classified as a high severity defect.

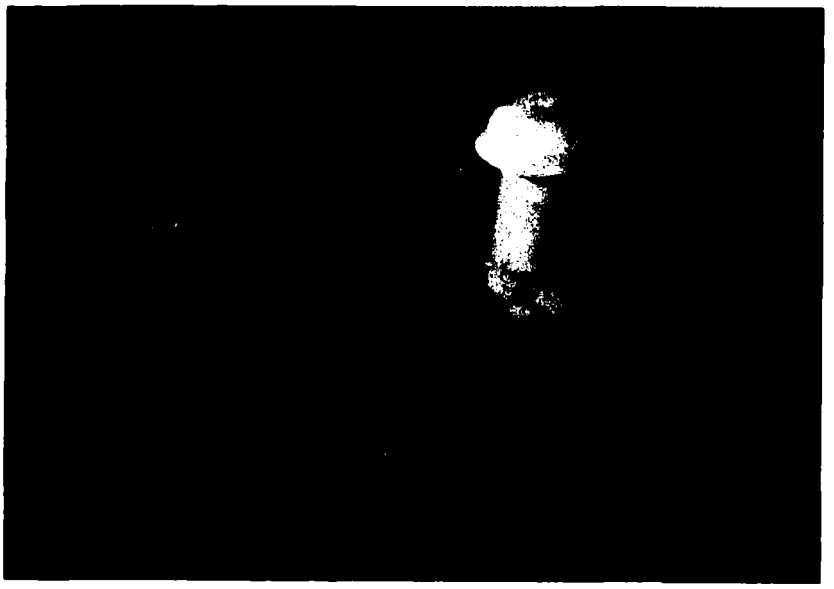

Figure 14. Metal flashing defect, problem 3. This split expansion joint is a high severity defect.

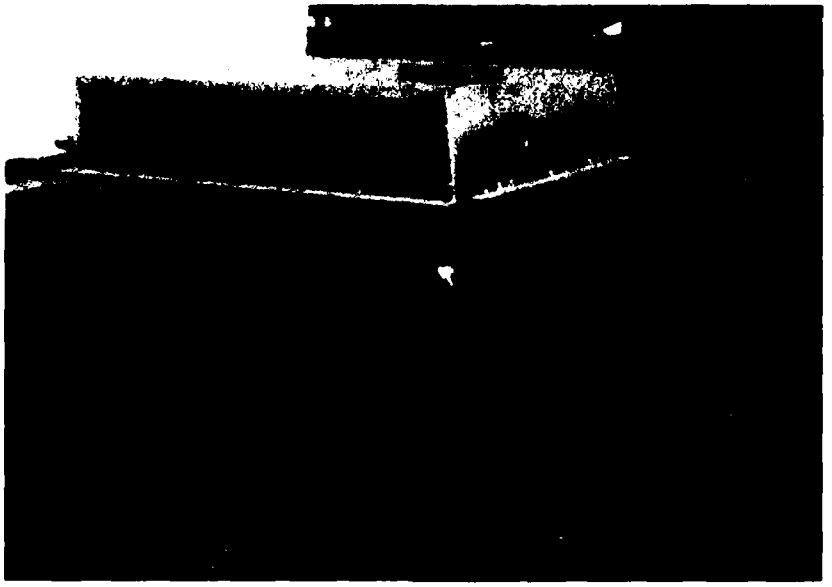

Figure 15. Repairs to bituminous-base flashings, problem 4. We considered the coating shown above to have been applied as a normal maintenance practice and therefore we did not count it as a defect.

Inspecting the membrane

The membrane must be inspected carefully to avoid overlooking small defects and to avoid counting the same defect twice. We established a walking pattern to accomplish this. We walked side-by-side about 4 ft apart, each of us inspecting a path about 4 ft wide. By using the method shown in Figure 16, we inspected an 8-ft wide area on each traverse. And when a new traverse is begun, the person that scrutinized the last swath is adjacent to it on the new traverse. This helps to prevent counting the same defect twice.

Membrane repairs, problem 4, are generally easy to see, especially on bare membranes (Fig. 17).

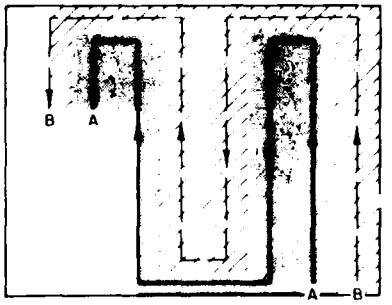

Figure 16. Inspection pattern. After the first traverse, inspector B swings around inspector A to maintain his position to the right of A. On the second traverse, A is therefore inspecting an area of membrane adjacent to the area that he last inspected. Inspector A can remember defects counted on the first traverse and avoids counting them again.

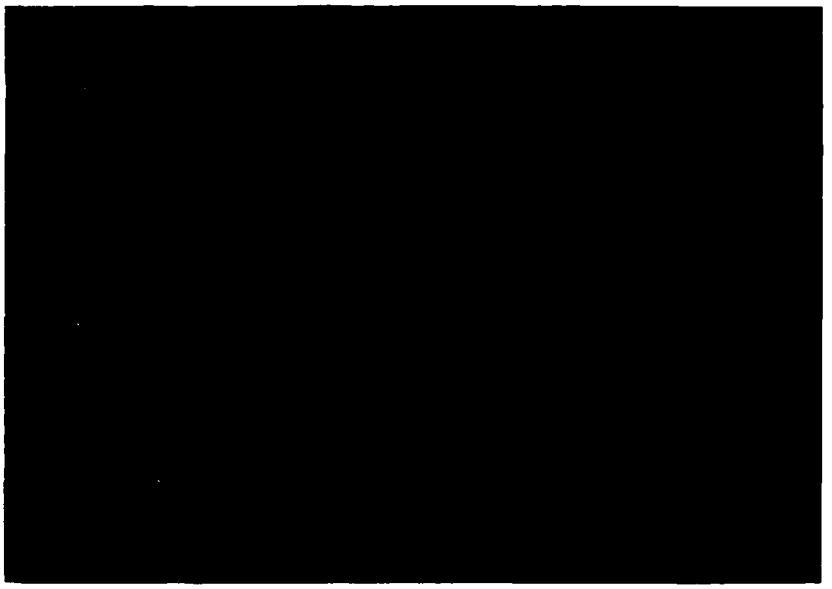

Figure 17. Membrane repairs, problem 4. Patches are visible under the glaze coating of bitumen on this bare membrane.

Problem 5, membrane splits, requires that the cause of the split be determined before the severity level can be decided upon. Splits resulting from structural movement that can be solved by an expansion joint or splits at abrupt changes in roof elevation are classified as medium severity (Fig. 18). Splits that appear to have no relation to the above reason are rated high severity (Fig. 19). To establish the severity of a split, we would examine the building inside and out. Splits can be difficult to see on a gravel covered membrane and are not to be confused with ridges that have broken open (Fig. 20).

Three well-defined severity levels are established for membrane ridges (problem 6). However, on several occasions we had difficulty distinguishing ridges from narrow blisters. The extent of this difficulty varies with time of day, temperature of the roof and whether the roof is bare or gravel surfaced. When the defects were oriented in a regular pattern over insulation board joints and were solid, we called them ridges. When there was less regularity and they and the adjacent membrane were "spongy," they were classified as blisters.

Membrane holes, problem 7, can be difficult to spot yet they need to be looked for carefully because of their adverse impact on roof performance. On

Figure 18. Membrane splits, problem 5. These were called medium severity splits because investigation of the tongue and groove wood deck indicated that an expansion joint would have probably prevented the splits.

Figure 19. High severity split. We called it this since it was not associated with an elevation change nor apparently related to structural movement.

Figure 20. Close-up of a broken-open ridge (problem 6, high severity). Care must be taken to differentiate between splits and broken-open ridges or blisters.

some bare membranes, small fishmouths, as shown in Figure 21, could only be seen when we were standing downslope of them. Gravel on a roof can easily hide small holes, as might any debris that happens to be present. An item such as a pipe, wire or support that passes unflashed through the membrane is counted as a hole even if the bitumen around it is uncracked. Holes are shown in Figures 22 and 23. Partially filled pitch pans (Fig. 24) are also classified as holes.

The Fort Greely roofs had a lot of blisters, problem 8 (Fig. 25). We found that the representative sampling technique was a time saver on many of these heavily blistered roofs. We cross-checked a couple of areas that we sampled representatively by also measuring all of the blisters there and found that with reasonable care the representative sampling technique gave good results.

It was difficult to measure the areas where the membrane contained exposed felts, problem 9. Since many of these areas were caused by wind erosion, they occurred at the corners of buildings, were irregular in shape (Fig. 26) and were interspersed with areas of embedded gravel. Notable exceptions to this were two buildings that had entire roof sections of exposed felts (buildings 503 and 655). It appears that a flood coat was never applied to these roofs nor were they covered with mineral-surfaced cap sheets.

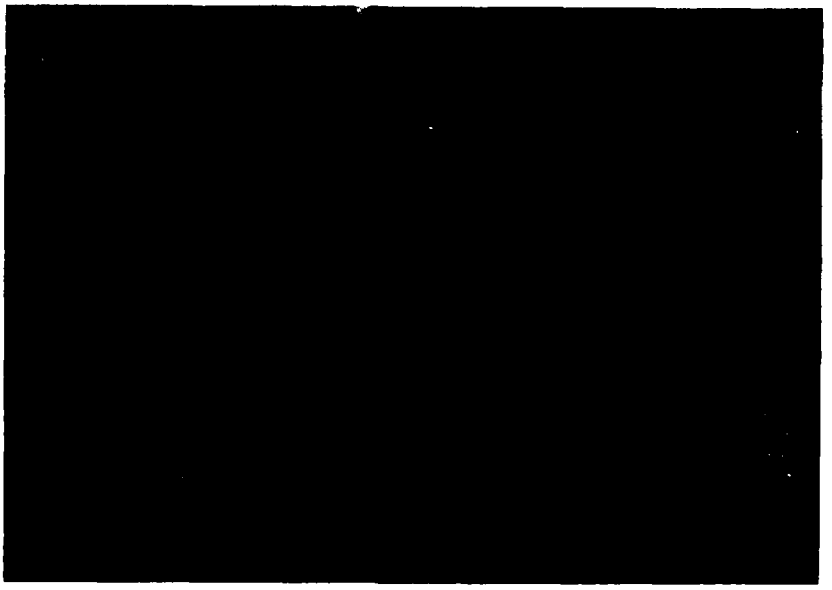

Figure 21. Small fishmouths may only be visible from downslope. If they provide a channel for water to enter the roofing system, they should be counted as holes (problem 7).

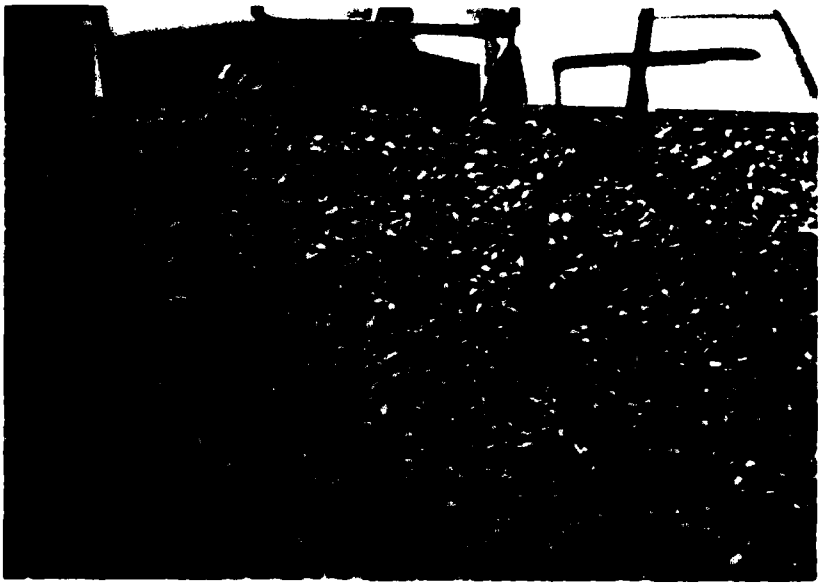

Figure 22. Unflashed penetrations, such as these ladder supports, are counted as holes (problem 7).

Figure 23. Another example of an unflashed penetration. Both the pipe and the wires to the right are unflashed.

Figure 24. Partially filled pitch pans are counted as holes.

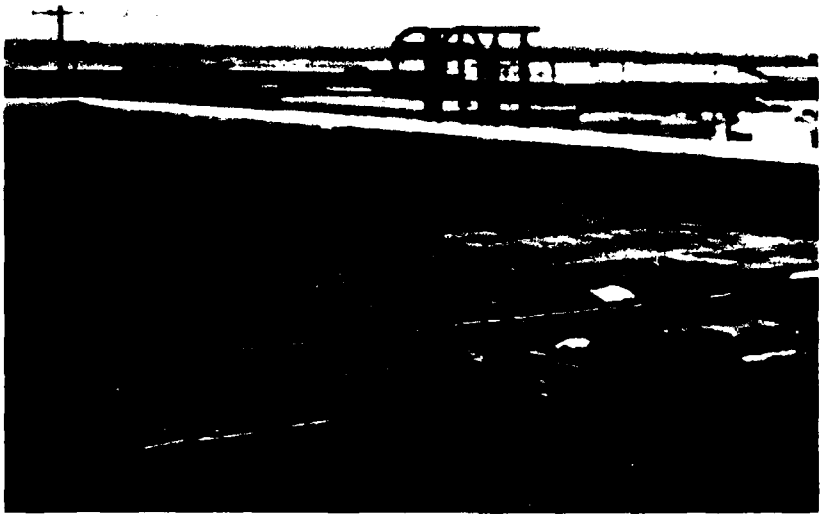

Figure 25. Heavily blistered roof (problem 8). The representative sampling technique is a time saver when surveying these roofs.

Figure 26. Exposed felt area (problem 9). Measuring the area of an exposed felt section in wind scoured sections can be difficult.

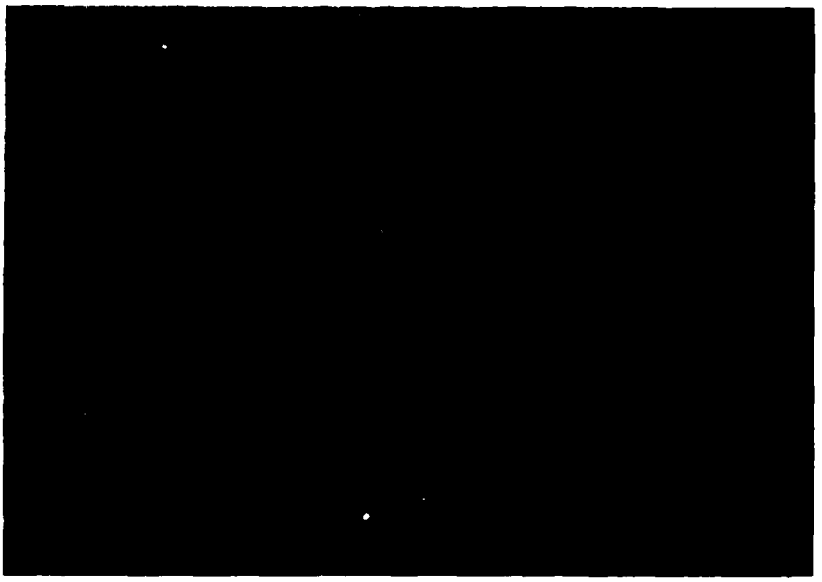

Figure 27. Alligator cracking on the membrane (problem 10).

Problem 10, alligator cracking of the membrane, was easy to locate and classify. We found extensive alligator cracking (Fig. 27) on bare-surfaced roofs.

After inspecting a roof for the 10 categories of defects (see Table 1), we took a sample of the bitumen to see if it was coal tar pitch or asphalt. AFM 91-36 recommends that turpentine, gasoline or kerosene be used as a solvent to determine bitumen type. The bitumen is dropped in the solvent and the mixture is stirred. If the solvent turns black, the bitumen is asphalt, if it only turns slightly yellow or yellow green, the bitumen is coal tar pitch. We tried using various solvents found in the Fort Greely paint shop without knowing their composition and we obtained inconclusive results. A second set of samples was brought back to Hanover for testing where conclusive results were obtained.

Once the visual inspection of a roof was complete, we returned to the Facilities Engineer's office to compute RCI values and SF numbers for each roof area inspected.

Appendix A contains a drawing of each roof area surveyed with our RCI findings marked on it and a written summary of the RCI, SF and course of action necessary for each roof area. I have not conducted an economic analysis of the various repair or replace options available to each roof area. Consequently, I cannot establish separate priority lists (i.e. in-house repairs and contract repair or reroof) as AFM 91-36 requires.

Table A1 is a combined priority list with clear courses of action established for roofs with an RCI greater than or equal to 90 (in-house repairs) or with an RCI less than 20 (contract reroof). From this table it is obvious that an economic analysis is needed for most roof areas before the decision to repair in-house or to contract for repair or replacement can be made.

I also did not develop an ROCI for each roof area since I do not know the function of each building in enough detail to assign the proper negative effect deduct values as listed in Table 3. This step would best be done by Fort Greely's Facilities Engineer personnel using the RCI values in Tables 3 and A1.

Table 4 is a time chart developed for five of the days we surveyed at Fort Greely when the weather allowed us to work for 9 hours per day, except as indicated on 8 May 1982. As one can see, the survey rate varies considerably. Our first day using the procedure was 4 May and therefore we expected to be slow. Survey times were also affected by the number of RCI sections involved (with more sections there are more flashings to inspect) and by the condition of the membranes and flashings being inspected. The times in Table 4 also include travel between buildings, dimensioning and drawing roof sketches but do not include spray painting every defect found. The numerous variables make it difficult to determine a rate to use as a reliable survey time guide; however, our overall average survey rate was about 6000 ft^2/hr. Spray painting each defect could decrease this by a factor of one-third to one-half, dropping the average survey rate to between 4000-3000 ft^2/hr.

Table 4. Time chart for roof survey.

	Number of buildings surveyed	Total number of RCI sections	Total area	Survey rate (ft^2/hr)
4 May 82	3	5	13,382	1487
5 May 82	3	6	107,144	11905
6 May 82	4	13	30,102	3345
7 May 82	5	12	77,420	8602
8 May 82	2	10	47,103	5234 (7 hrs of work)

DIFFICULTIES WITH AND QUESTIONS ABOUT THE RCI INSPECTION SYSTEM

AFM 91-36 states that the RCI inspection procedure is not valid on roofs that have membrane slippage (Fig. 28). These roofs are referred to the Major Command Headquarters for further guidance. We had four roof areas at Fort Greely that we were unable to rate because of slippage problems.

We experienced some confusion over the need to record different severity levels of the same problem. AFM 91-36 Paragraph 3-4(7) states: "For any single problem, separating areas having different severity levels is often difficult, since more than one level can exist within an area. In these cases, rate the entire area at the highest severity level present." There is some question as to the meaning of the word "area." Does it refer to just the immediate area of the roof where that problem is present or does it refer to the entire roof area being inspected as previously defined?

Figure 3-98 in AFM 91-36 (Fig. 29 in this report) suggests that the former definition of "area" is correct since that example lists two severity levels for problem 1, both within area A. However, Captain Cox explained that the real intent is to allow only one severity level perproblem within each area reported on a worksheet. His opinion is supported by the absence of a specific, different definition for the word "area" in paragraph 3-4(7) of AFM 91-36. In addition to this problem, it seems wrong to rate the entire problem based on "the highest severity level present." Instead, we determined which severity level of a problem was most prevalent and designated all of that specific problem to that severity level. This avoids weighting a problem too heavily as would be the case if there were only a few occurrences of high severity and numerous occurrences of medium or low severity.

There is no consideration given in the survey to a roof system that ponds water. Proper drainage of a roof system is acknowledged as a very important aspect in determining the long-term viability of the system, and it should be included as a factor in any visual survey.

The RCI value obtained from the visual inspection is stated to be a "Roof Condition Index." It would seem more appropriate to call this a membrane (or membrane system) condition index since only the membrane and flashings are being rated while the roof is a complete system consisting of structural supports, deck, insulation, membrane and flashings.

The RCI procedure requires that if a RCI rating is less than 50 but greater than or equal to 20, the RCI should be recalculated assuming that all

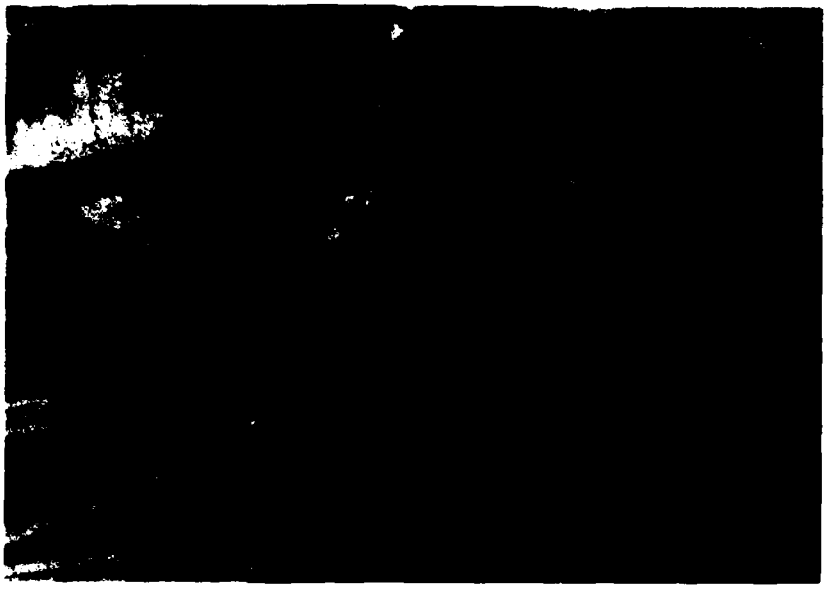

Figure 28. Membrane pulled away from the gravel stop.

ROOF INSPECTION AND RATING WORKSHEET

BASE NAME: K. I. SAWYER	INSPECTION DATE: 5-6-79 — INSPECTED BY: ERICKSON & LOBBESTAEL
BUILDING NUMBER: 205	BUILDING NAME: ALERT FACILITY

ROOF AREA INFORMATION (SEE ATTACHED ROOF PLAN DRAWING)

AREA DESIGNATION	AGE (Years)	AREA SIZE (Sq Feet)
A	4	4620

BITUMINOUS BASE FLASHING TOTAL LENGTH (Lin Feet): 305	METAL FLASHING TOTAL LENGTH (Lin Feet): 6
INSULATION BOARD WIDTH (Lin Feet) (For problems 3 and 6): N/A	BITUMEN TYPE: ☐ COAL TAR ☒ ASPHALT

PROBLEMS

1 - BITUMINOUS BASE FLASHING DEFECTS
2 - BITUMINOUS BASE FLASHING DELAMINATION OR SLIDING
3 - METAL FLASHING DEFECTS
4 - REPAIRS TO BITUMINOUS BASE FLASHING AND MEMBRANE
5 - MEMBRANE SPLITS
6 - MEMBRANE RIDGES
7 - MEMBRANE HOLES
8 - MEMBRANE BLISTERS
9 - MEMBRANE EXPOSED FELTS
10 - MEMBRANE ALLIGATORING

PROBLEM NUMBER (1)	SEVERITY LEVEL (2) L	M	H	QUANTITIES (3) INDIVIDUAL	TOTAL	PROBLEM DENSITY (4)	DEDUCT VALUES (5)
1		X		12+12+15	39	11	4
1			X	12+8+10+28+12	70	20	10
4	—	—		48+76+28+32+13	197	4	7
7	·	—		5	5	0.1	3
8	X			12+11+17+9+48+76+38+28+			
8	X			34+27+15+18+29+8	370	8.01	48
9		X		57+83+21+28+34+18+13	254	5.5	13

Figure 29. Figure 3-98 from AFM 91-36. It shows two severity levels, medium and high, listed for problem 1.

needed repairs have been done. Table A1 shows six instances where the recalculated RCI was lower than the original. This is opposite from what would normally be expected. Repairs are made to a roof to improve the condition of the roof. I would therefore expect a higher, not lower, RCI rating after accomplishing repairs.

There is a question in my mind as to how much value the serviceability forecast (SF) is. AFM 91-36 specifies that once a management program is started the roofs are to be inspected and rated every 3 years while "problem and suspect roofs" may require more frequent inspection. These recurring inspections are presumably to guard against a rapidly deteriorating roof membrane catching the Facilities Engineer unaware by failing before the SF claims it will fail. If a membrane is deteriorating rapidly and requires a recurring inspection, why lull anyone into a false sense of security by assigning a misleading "years of life left" number to it?

CONCLUSION AND SUMMARY

The Air Force roof management program is designed to not only give facilities engineers a numerical indicator of roof condition but also to pinpoint defects needing immediate repair, to outline proper in-house repair techniques, to review design details and contract specifications, and to detail good construction management procedures. The overall program does, however, hinge on the visual inspection and rating procedures as described in this report. For this reason, the accuracy that can be obtained from this visual inspection procedure will significantly influence the accuracy of the overall program.

Although there were a few conditions that we encountered on the Fort Greely roofs that were not well outlined in AFM 91-36, the problem categories are generally clear and complete. The pictures included in the manual are quite valuable. They allow the rater to define defects and establish their severity levels. Generally speaking, the manual conveys the inspection procedures to the reader well, and is arranged so that it can be easily used as a reference guide while actually on the roof. In this respect the implementing portion of the program seems to be well suited for its intended users. However, this is a visual survey alone, and thus misses examining the roof as a complete system. I have heard it argued that what it misses is statistically insignificant, since most roof problems are a result of flashing de-

fects and flashings are scrutinized closely. Certainly, flashings cause a lot of problems with roofs. However, the way to quantify the impact of visual imperfections in a flashing or a membrane is to inspect below them, checking for wet insulation. From the research done at CRREL with infrared surveys, it can be shown that frequently there is little correlation between the visual condition of a membrane and the presence of wet insulation. When the RCI surveys discussed in this report were compared to infrared surveys, core cuts and brief visual inspections of these same roofing systems done at the same time, the two survey techniques gave significantly different answers about the condition of the roofing system and consequently the method of maintaining it.

With the limited information obtained, and the time and effort required to conduct an RCI survey, the value of this system is questionable. A more effective approach might be to perform an infrared survey with core samples, along with a general membrane and flashing visual inspection. This type of survey would yield information on the condition of the entire roofing system being studied.

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APPENDIX A: FORT GREELY RCI DATA

Figure A1 is an example of a filled-in Roof Inspection and Rating Worksheet (AF Form 1060) for Building 503, Section B, at Fort Greely, Alaska. Table A1 is a summary of the surveys. Behind the worksheet is a drawing of each roof surveyed at Fort Greely along with a written summary of the RCI, SF and course of action necessary for each area according to the guidelines in the Roof Condition Index and Serviceability Forecast Calculations section of this report.

AFM 91-36 lists the problems that need repair as follows:

Problem	Severity level(s) requiring repair	Description
1	Medium and high	All bituminous-base flashing defects.
2	High	Base flashings that have sagged, slipped or fallen.
3	Medium	Base flashings less than 6 in. high. Include in contact repair or re-roofing.
3	High	All high severity metal flashing defects.
4	-	Membrane and flashing repairs. Only loose patches.
5	Medium and high	Membrane splits. Contract repair is the only permanent solution, but emergency repairs should be done to prevent water entry.
6	Medium and high	Membrane ridging.
7	-	All holes or partially filled pitch pans.
8	High	Blisters.
9	Medium and high	Exposed felts. If the area of exposed felt is localized, repair in-house; if extensive include in contract repair or reroofing.
10	-	Alligator cracking. Repair is needed only if the top layer of felt is cracked.

The appropriate repair procedures for each defect are also outlined in AFM 91-36.

In the following surveys, A in the Bitumen column stands for asphalt, CT stands for coal tar.

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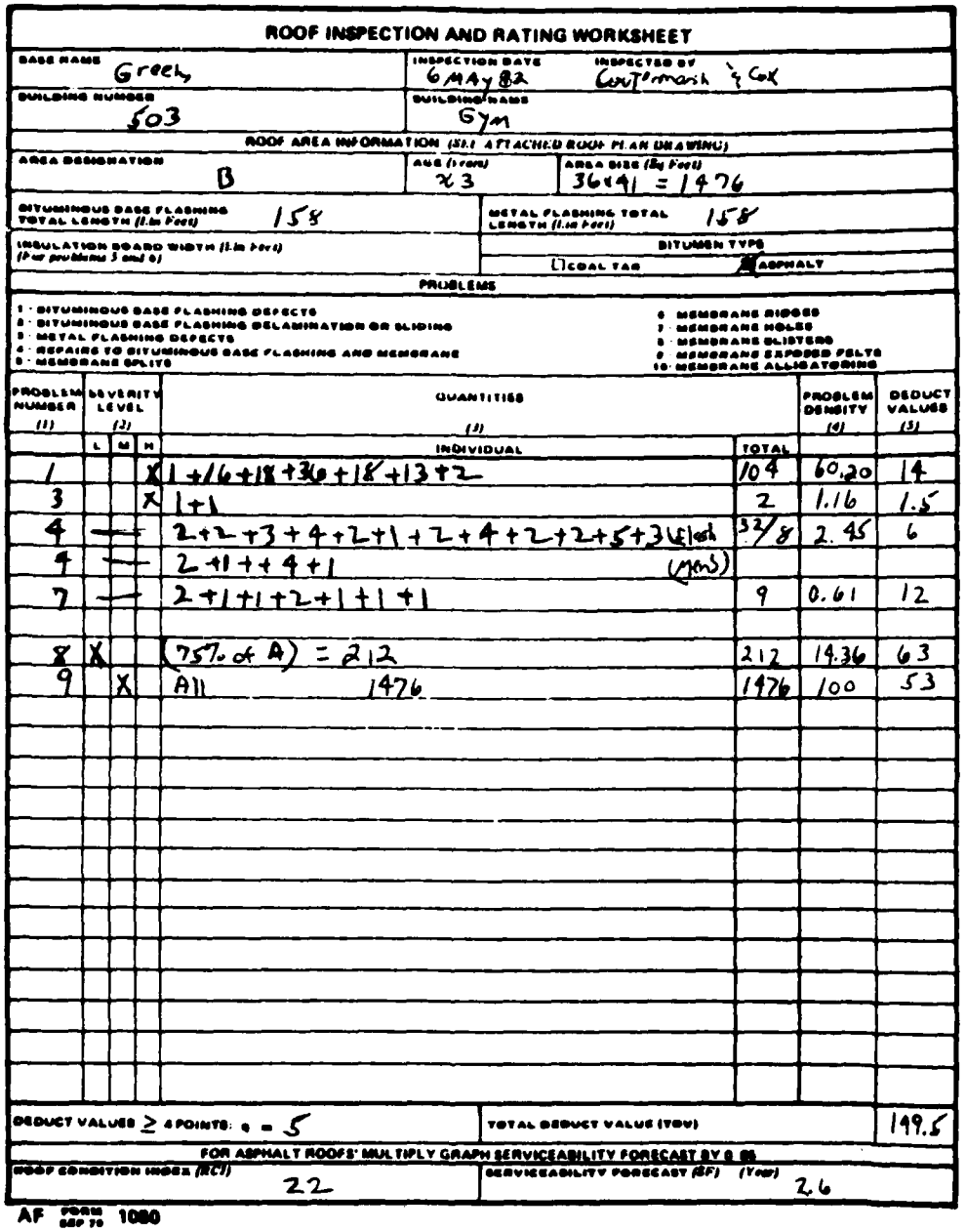


ROOF INSPECTION AND RATING WORKSHEET

BASE NAME: Greely
INSPECTION DATE: 6 MAY 82
INSPECTED BY: Contromarsh & Cox
BUILDING NUMBER: 503
BUILDING NAME: Gym

ROOF AREA INFORMATION (SEE ATTACHED ROOF PLAN DRAWING)

AREA DESIGNATION: B
AXIS (From): x3
AREA SIZE (By Feet): 36 x 41 = 1476

BITUMINOUS BASE FLASHING TOTAL LENGTH (Lin Feet): 158
METAL FLASHING TOTAL LENGTH (Lin Feet): 158

INSULATION BOARD WIDTH (Lin Feet) (For problems 3 and 6):

BITUMEN TYPE: ☐ COAL TAR ☒ ASPHALT

PROBLEMS

1 - BITUMINOUS BASE FLASHING DEFECTS
2 - BITUMINOUS BASE FLASHING DELAMINATION OR SLIDING
3 - METAL FLASHING DEFECTS
4 - REPAIRS TO BITUMINOUS BASE FLASHING AND MEMBRANE
5 - MEMBRANE SPLITS
6 - MEMBRANE RIDGES
7 - MEMBRANE HOLES
8 - MEMBRANE BLISTERS
9 - MEMBRANE EXPOSED FELTS
10 - MEMBRANE ALLIGATORING

PROBLEM NUMBER (1)	SEVERITY LEVEL (2) L	M	H	QUANTITIES (3) INDIVIDUAL	TOTAL	PROBLEM DENSITY (4)	DEDUCT VALUES (5)
1			X	1+16+18+36+18+13+2	104	60.20	14
3			X	1+1	2	1.16	1.5
4	—			2+2+3+4+2+1+2+4+2+2+5+3 (Ridge)	32/8	2.45	6
4	—			2+1++4+1 (Mans)			
7	—			2+1+1+2+1+1+1	9	0.61	12
8	X			(75% of A) = 212	212	14.36	63
9		X		All 1476	1476	100	53

DEDUCT VALUES ≥ 4 POINTS: q = 5
TOTAL DEDUCT VALUE (TDV): 149.5

FOR ASPHALT ROOFS MULTIPLY GRAPH SERVICEABILITY FORECAST BY 0.85

ROOF CONDITION INDEX (RCI): 22
SERVICEABILITY FORECAST (SF) (Years): 2.6

AF FORM SEP 79 1060

Figure A1. Example of filled-in AF 1060.

Table A1. Summary of Fort Greely RCI findings.

Building	Roof area	RCI	RCI expected after repairs	Course of action
725	A	99		
606	F	94		
612	A	93		In-house repair.
501	B	92		
725	I	92		
612	B	90		
802	-	90		
606	D	89		
725	F	89		
605	B	88		In-house repair, contract
701	A	88		repair or reroof based
605	A	86		upon an economic analysis.
606	C	86		
609	C	86		
650	C	86		
609	A	84		
650	D	84		
602	-	83		
662	A	82		
609	B	81		
663	C	79		
601	B	78		
652	E	78		
662	C	78		
662	B	77		
725	D	77		
606	H	76		
661	D	76		
606	I	75		
659	B	75		
608	-	74		
653	-	74		
659	C	74		
658	A	73		
662	E	73		
725	G	73		
601	A	72		
662	D	72		
701	B	72		
601	C	38	71	
626	-	71		
658	B	69		
663	E	69		
606	G	68		
652	B	68		
607	A	66		
650	A	66		
652	C	66		

Table A1 (cont'd).

Building	Roof area	RCI	RCI expected after repairs	Course of action
725	H	66		
652	D	65		
607	B	64		
610	-	64		
659	A	61		
660	B	61		
651	-	60		
606	E	59		
652	A	59		
652	F	59		
650	B	57		
606	B	56		
661	A	47	56	
725	E	56		
504	B	54		
661	C	54		
663	D	54		
725	C	53.5		
614	-	53		
725	B	53		
661	B	52		
660	A	51		
504	A	50		
603	A	44	48	
503	E	23	43	
606	A	39	42	
625	-	36	42	Contract repair or reroof-
503	B	22	40	ing based on an economic
663	B	37	40	analysis.
603	B	32	39	
503	F	21	38	
501	A	30	28	
655	C	25	26	
655	E	28	26	
655	D	25	24	
655	B	23	21	
503	C	21	20	
655	A	22	18	
503	D	19		
663	A	19		
503	A	18		
503	G	17		Reroof only.
503	H	16		
503	I	15		
656	-	14		

Figure A2. Building 501, RCI sections A and B.

Surveyed by: Coutermarsh-Cox on 10 May 1982

AREA A

Bitumen: A Age: ? Area: 5207 ft^2
Bituminous flashings: 78 ft Metal flashings: 402 ft

RCI = 30 SF = ?
RCI - recalculated assuming repairs made = 28

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 24 ft
Pitch pans - 8
Holes - 4
Exposed felts - 72 ft^2
Membrane - 12 ft

AREA B

Bitumen: A Age: ? Area: 3156 ft^2
Bituminous flashings: 10 ft Metal flashings: 290 ft
RCI = 92 SF = ?

Course of action:
In-house repair

Repairs needed:
Metal flashings - 1 ft
Membrane holes - 2
Exposed felts - 5 ft^2

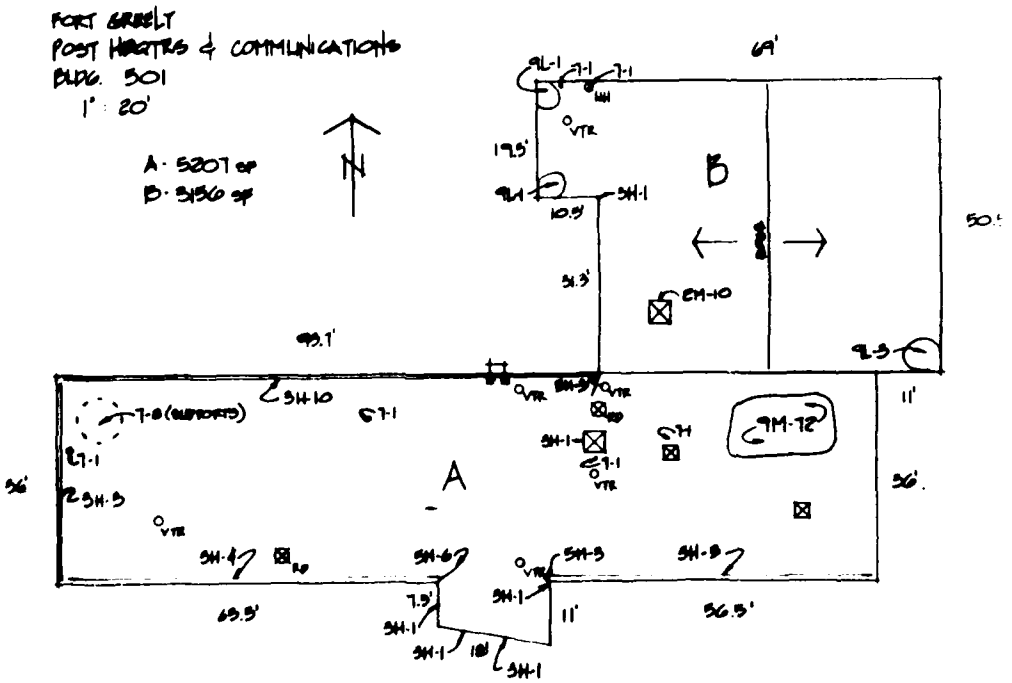


Figure A3. Building 503.

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA A

Bitumen: A Age: 3 yr Area: 1373.5 ft^2
Bituminous flashings: 153 ft Metal flashings: 153 ft
RCI = 18 SF = 2.1

Course of action:
Contract reroof

Repairs needed:
Emergency repair:
Bituminous base flashings - 66 ft
Membrane holes - 8

AREA B

Bitumen: A Age: 3 yr Area: 1476 ft^2
Bituminous flashings: 158 ft Metal flashings: 158 ft
RCI = 22 SF = 2.6
RCI - recalculated assuming repairs made = 41

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 2 ft
Exposed felts - All 1476 ft^2
Membrane holes - 9
Bituminous base flashings - 104 ft

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA C

Bitumen: A Age: 3 yr Area: 1373.5 ft^2
Bituminous flashings: 153 ft Metal flashings: 153 ft
RCI = 21 SF = 2.6
RCI - recalculated assuming repairs made = 20

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 71 ft
Exposed felts - 2 ft^2
Membrane holes - 17

AREA D

Bitumen: A Age: 3 yr Area: 1373.5 ft^2
Bituminous flashings: 153 ft Metal flashings: 153 ft
RCI = 19 SF = 2.1

Course of action:
Contract reroof

Repairs needed:
Emergency repair:
Bituminous base flashings - 32 ft
Membrane holes - 9

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA E

Bitumen: A Age: 3 yr Area: 1476 ft^2
Bituminous flashings: 158 ft Metal flashings: 158 ft
RCI = 23 SF = 2.6
RCI - recalculated assuming repairs made = 43

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 27 ft
Metal flashings - 1 ft
Exposed felts - All 1476 ft^2
Membrane holes - 9

AREA F

Bitumen: A Age: 3 yr Area: 1373.5 ft^2
Bituminous flashings: 153 ft Metal flashings: 153 ft
RCI = 21 SF = 2.6
RCI - recalculated assuming repairs made = 38

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 24 ft
Metal flashings - 1 ft
Exposed felts - All 1373.5 ft^2
Membrane holes - 15

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA G

Bitumen: A Age: 3 yr Area: 990 ft^2
Bituminous flashings: 142 ft Metal flashings: 142 ft
RCI = 17 SF = 2.1

Course of action:
Contract reroof

Repairs needed:
Emergency repair:
Bituminous base flashings - 6 ft
Membrane holes - 29

AREA H

Bitumen: A Age: 3 yr Area: 924 ft^2
Bituminous flashings: 127 ft Metal flashings: 127 ft
RCI = 16 SF = 1.7

Course of action:
Contract reroof

Repairs needed:
Emergency repair:
Bituminous base flashings - 16 ft
Membrane holes - 8

Surveyed by: Coutermarsh-Cox on 6 May 1982

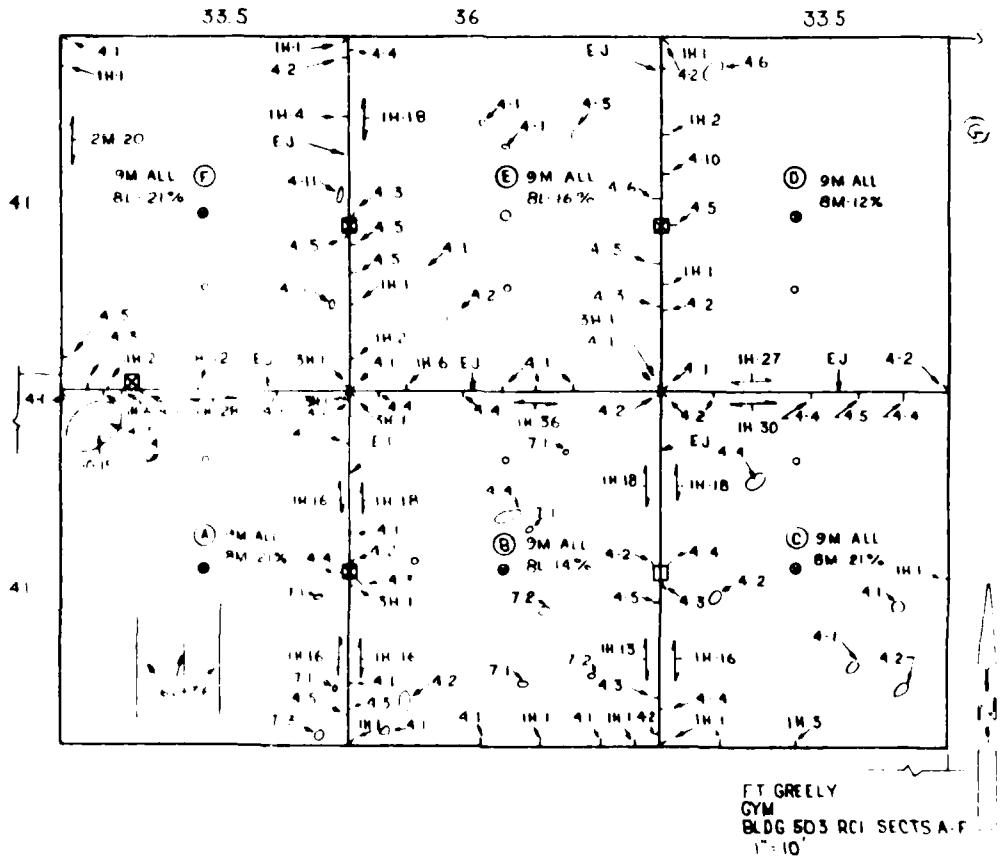
AREA I

Bitumen: A Age: 3 yr Area: 952 ft^2
Bituminous flashings: 133 ft Metal flashings: 133 ft
RCI = 15 SF = 1.7

Course of action:
Contract reroof

Repairs needed:
Emergency repair:
Bituminous base flashings - 31 ft
Membrane holes - 5

Figure A3 (cont'd).



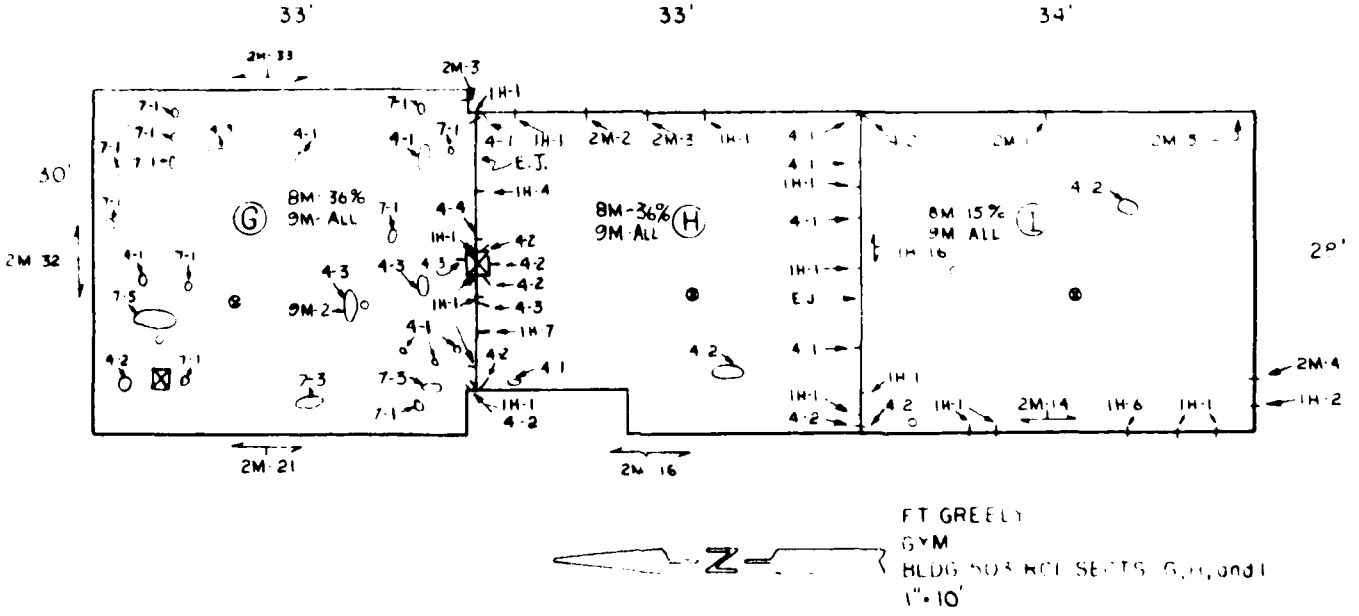


Figure A4. Building 504.

Surveyed by: Coutermarsh-Cox on 4 May 1982

AREA A

Bitumen: A Age: 27 yr Area: 2257 ft²
Bituminous flashings: 190.5 ft Metal flashings: 39 ft
RCI = 50 SF = 3

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 45 ft
Membrane holes - 13

AREA B

Bitumen: A Age: 25 yr Area: 4446 ft²
Bituminous flashings: 154 ft Metal flashings: 41 ft
RCI = 54 SF = 3

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 33 ft
Sagged and slipped base flashings - 18.5 ft
Metal flashings - 42 ft
Exposed felts - 6 ft²
Membrane holes - 7

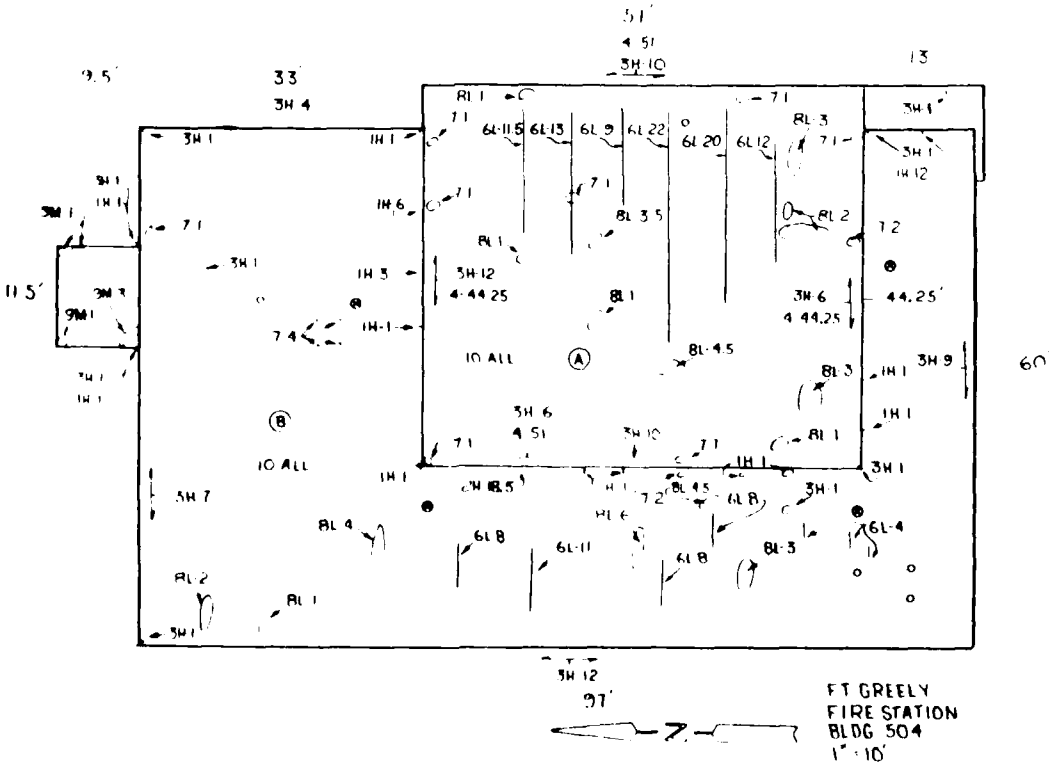


Figure A5. Building 601.

Surveyed by: Coutermarsh-Cox on 5 May 1982

AREA A

Bitumen: A Age: 8 yr Area: 19,698 ft^2
Bituminous flashings: 213 ft Metal flashings: 501 ft
RCI = 72 SF = 8.7

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 19 ft
Metal flashings - 58 ft
Exposed felts - 12 ft^2
Membrane holes - 4
Membrane ridging - 291 ft

AREA B

Bitumen: A Age: ? Area: 39,798 ft^2
Bituminous flashings: 560 ft Metal flashings: 956 ft
RCI = 38 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

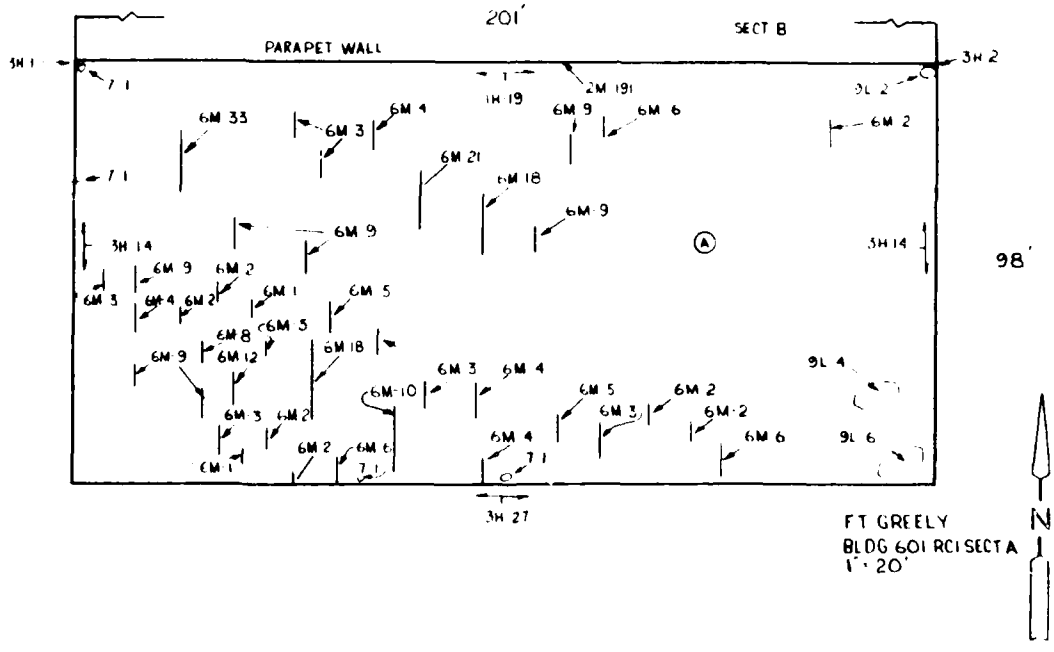
Repairs needed:
Bituminous base flashings - 31 ft
Metal flashings - 90 ft
Exposed felts - 396 ft^2
Membrane holes - 110
Membrane splits (contract repair is the only permanent solution) - 231 ft

AREA C

Bitumen: A Age: ? Area: 31,356 ft^2
Bituminous flashings: 207 ft Metal flashings: 513 ft
RCI = 38 SF = ?
RCI = recalculated assuming repairs made = 71

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 20 ft
Metal flashings - 204 ft
Membrane splits (contract repair is the only permanent solution) - 228 ft



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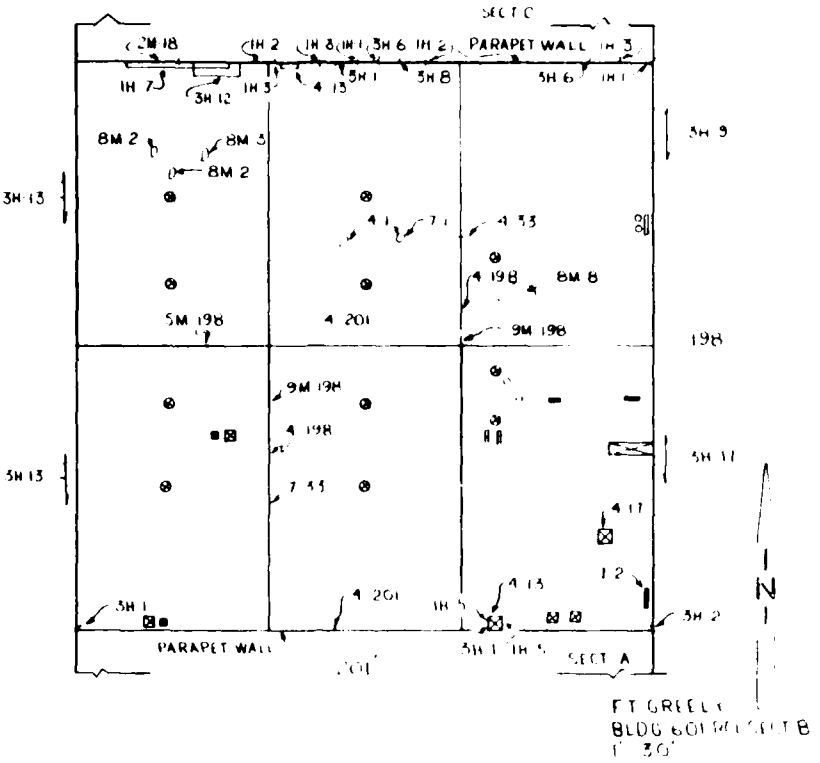


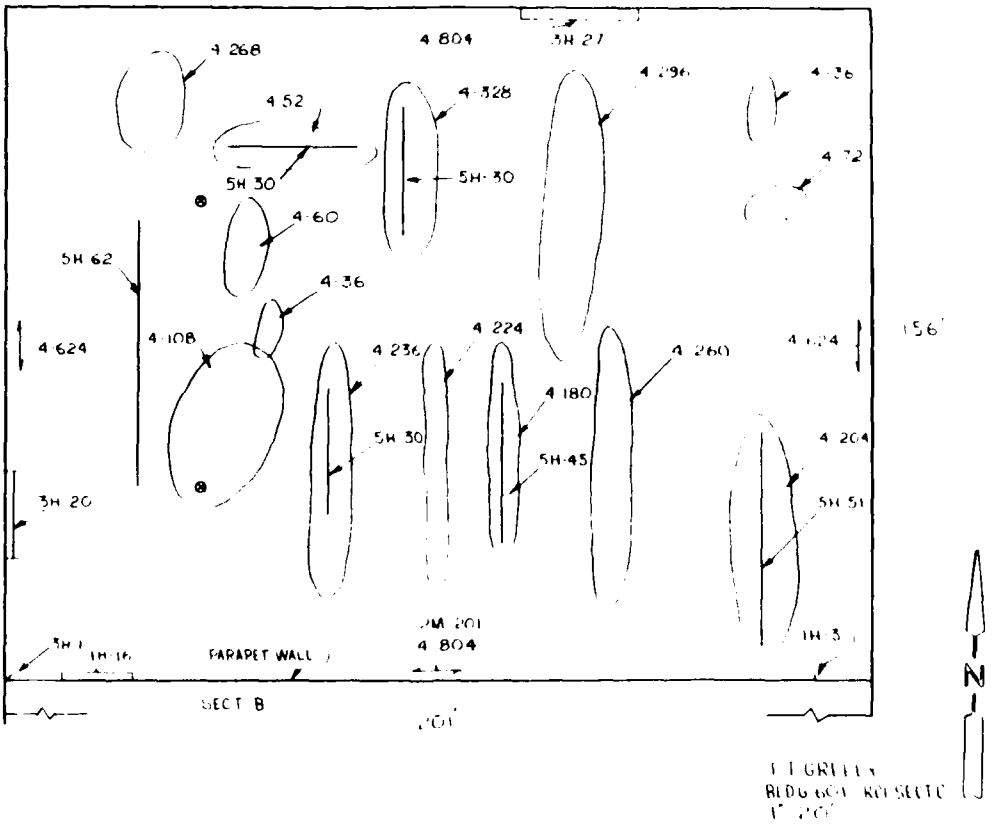


Figure A6. Building 602.

Surveyed by: Coutermarsh-Cox on 4 May 1982

AREA A

Bitumen: A Age: 27 yr Area: 1138 ft^2
Bituminous flashings: 3 ft Metal flashings: 146 ft
RCI = 83 SF = 6.6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 21 ft
Membrane holes - 6

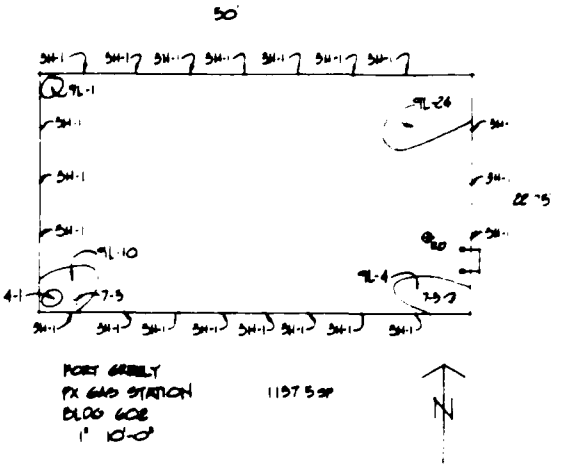


Figure A7. Building 603.

Surveyed by: Coutermarsh-Cox on 5 May 1982

AREA A

Bitumen: A Age: ? Area: 8280 ft^2
Bituminous flashings: 85 ft Metal flashings: 451 ft
RCI = 44 SF = ?
RCI - recalculated assuming repairs made = 48

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 162 ft
Membrane holes - 7
Exposed felts - 79 ft^2

AREA B

Bitumen: A Age: ? Area: 2191 ft^2
Bituminous flashings: 13 ft Metal flashings: 192 ft
RCI = 32 SF = ?
RCI - recalculated assuming repairs made = 39

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Exposed felts - 125 ft^2
Membrane holes - 37
Raise base flashings above 8 in. height - 27 ft

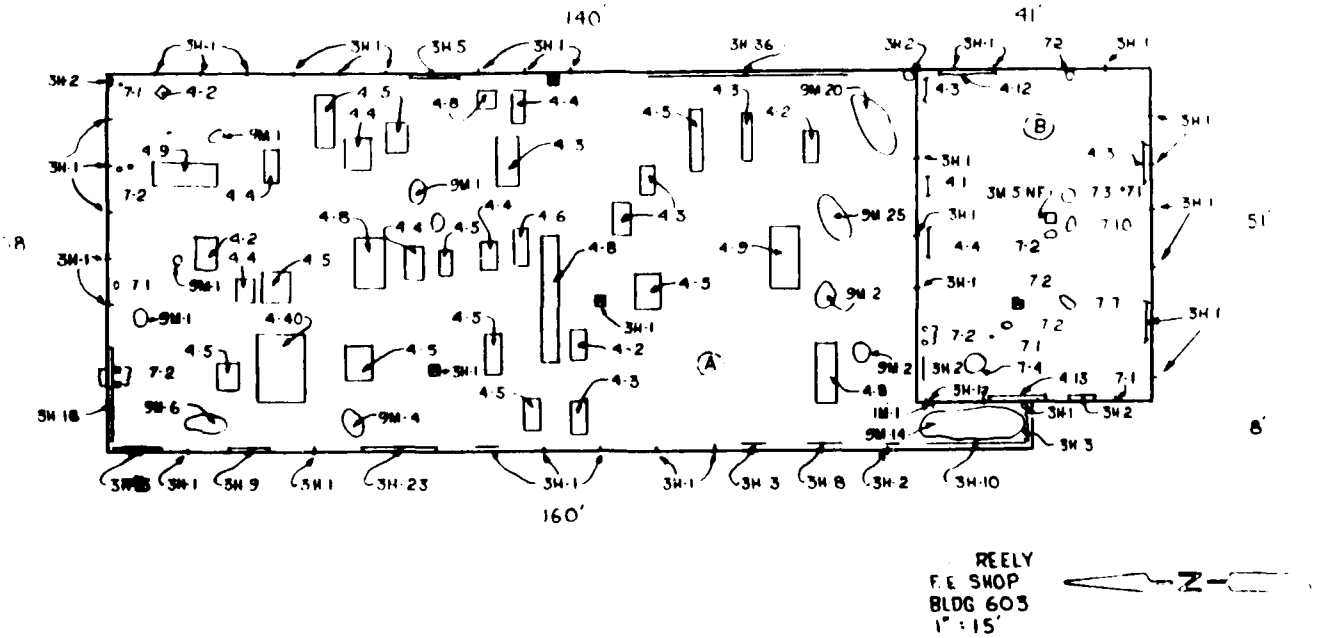


Figure A8. Building 605.

Surveyed by: Coutermarsh-Cox on 7 May 1982

AREA A

Bitumen: A Age: 27 yr Area: 12,330 ft²
Bituminous flashings: 68.5 ft Metal flashings: 497 ft
RCI = 86 SF = 6.8

Course of action:
In-house repair or contract repair or reroof based on economic analysis

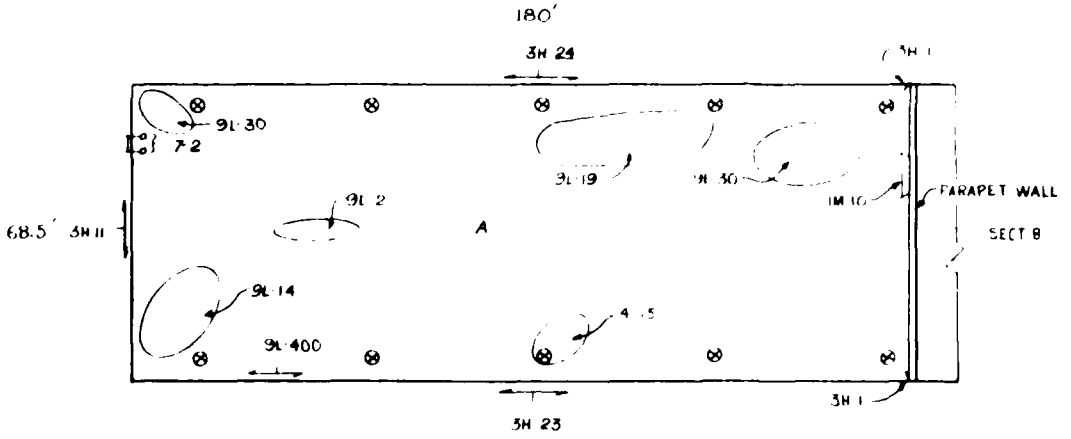
Repairs needed:
Bituminous base flashings - 19 ft
Metal flashings - 60 ft
Exposed felts - 495 ft²
Membrane holes - 2

AREA B

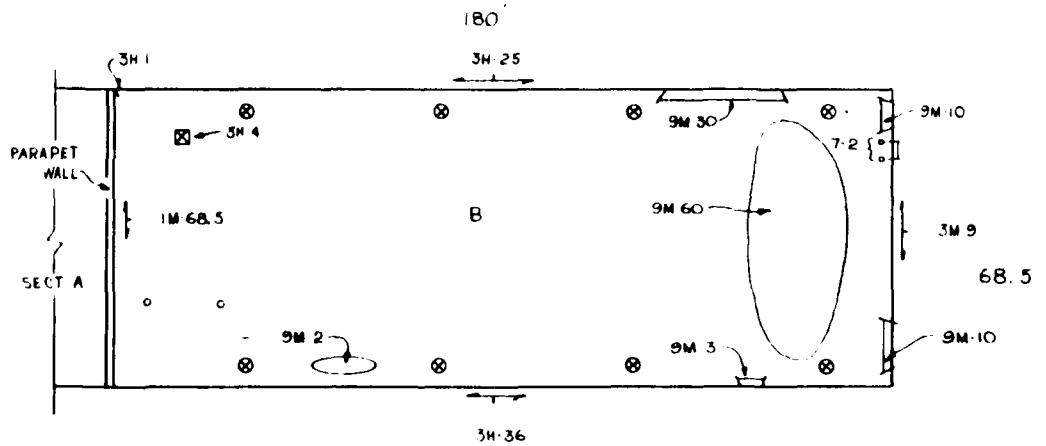
Bitumen: A Age: 27 yr Area: 12,330 ft²
Bituminous flashings: 68.5 ft Metal flashings: 501 ft
RCI = 88 SF = 7.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 68.5 ft
Metal flashings - 75 ft
Exposed felts - 142 ft²
Membrane holes - 2



FT GREELY
BLDG 605 RCI SECT A
1" 20'



FT GREELY
BLDG 605 RCI SECT B
1" 20'

Figure A9. Building 606.

Surveyed by: Coutermarsh-Cox on 14 May 1982

AREA A

Bitumen: A Age: 9 yr Area: 2376 ft^2
Bituminous flashings: 32 ft Metal flashings: 228 ft
RCI = 39 SF = 3.75
RCI - recalculated assuming repairs made = 42

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 4 ft
Metal flashings - 4 ft
Membrane holes - 3

AREA B

Bitumen: A Age: 9 yr Area: 2268 ft^2
Bituminous flashings: 64 ft Metal flashings: 260 ft
RCI = 56 SF = 5.5

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 5 ft
Exposed felts - 22 ft^2

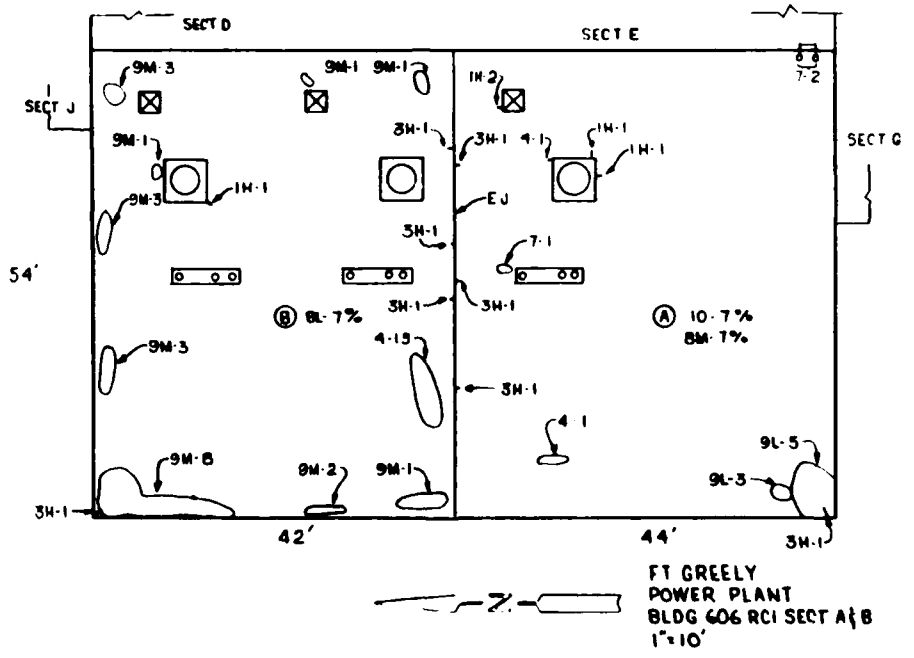
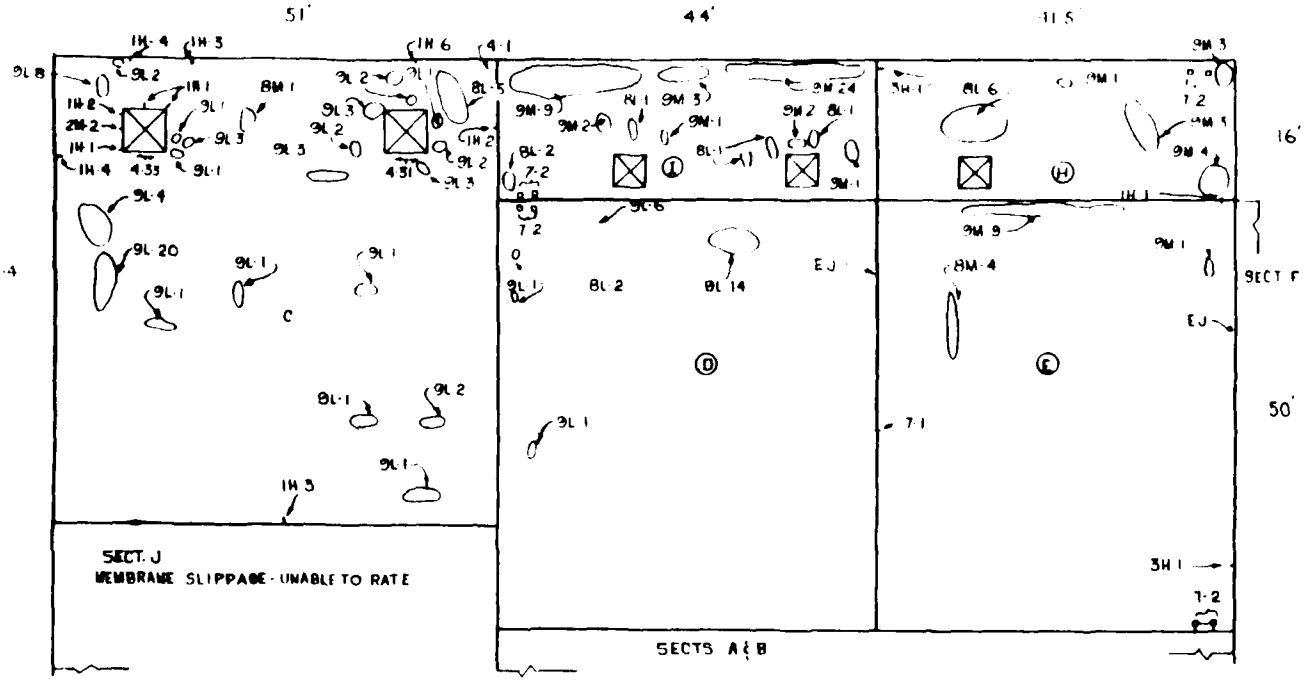
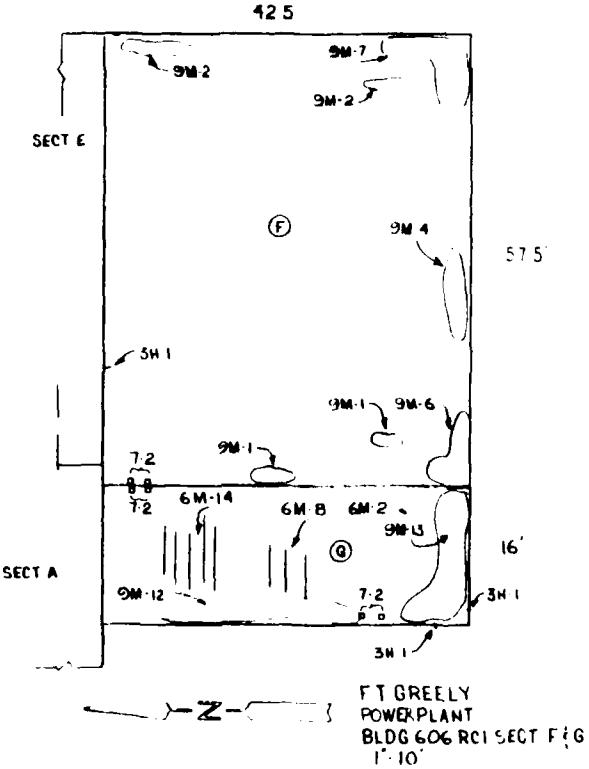


Figure A9 (cont'd).



FT GREELY
POWER PLANT
BLDG 606 RCI SECTS. C, D, E, H, I & J
1" = 10'



FT GREELY
POWERPLANT
BLDG 606 RCI SECT F & G
1" = 10'

AREA C

Bitumen: A Age: 9 yr Area: 2754 ft²
Bituminous flashings: 273 ft Metal flashings: 273 ft
RCI = 86 SF = 13.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 27 ft

AREA D

Bitumen: A Age: ? Area: 2222 ft²
Bituminous flashings: 83.2 ft Metal flashings: 189.4 ft
RCI = 89 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Membrane holes - 2

AREA E

Bitumen: CT Age: ? Area: 2095 ft²
Bituminous flashings: 41.9 ft Metal flashings: 183.8 ft
RCI = 59 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 1 ft
Exposed felts - 10 ft²
Membrane holes - 3

Figure A9 (cont'd).

AREA F

Bitumen: CT Age: 9 yr Area: 2231 ft^2
Bituminous flashings: 2.5 ft Metal flashings: 190.5 ft
RCI = 94 SF = 14

Course of action:
In-house repair

Repairs needed:
Metal flashings - 1 ft
Exposed felts - 23 ft^2
Membrane holes - 2

AREA G

Bitumen: A Age: 9 yr Area: 680 ft^2
Bituminous flashings: 58.5 ft Metal flashings: 117 ft^2
RCI = 68 SF = 7.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 2 ft
Exposed felts - 25 ft^2
Membrane holes - 4
Membrane ridging - 24 ft

AREA H

Bitumen: A Age: ? Area: 664 ft^2
Bituminous flashings: 48 ft Metal flashings: 167 ft
RCI = 76 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 1 ft
Exposed felts - 12 ft^2
Membrane holes - 2

AREA I

Bitumen: A Age: ? Area: 704 ft^2
Bituminous flashings: 81 ft Metal flashings: 141 ft
RCI = 75 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Exposed felts - 42 ft^2
Membrane holes - 2

AREA J - Unable to rate because of membrane slippage.

Figure A10. Building 607.

Surveyed by: Coutermarsh-Cox on 14 May 1982

AREA A

Bitumen: CT Age: 20 yr Area: 2282.5 ft^2
Bituminous flashings: 24 ft Metal flashings: 245 ft
RCI = 66 SF = 6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 35 ft
Membrane holes - 4

AREA B

Bitumen: CT Age: 20 yr Area: 2029 ft^2
Bituminous flashings: 132 ft Metal flashings: 252.5 ft
RCI = 64 SF = 6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 11 ft
Metal flashings - 67 ft
Exposed felts - 16 ft^2
Membrane holes - 7
Membrane ridges - 8 ft

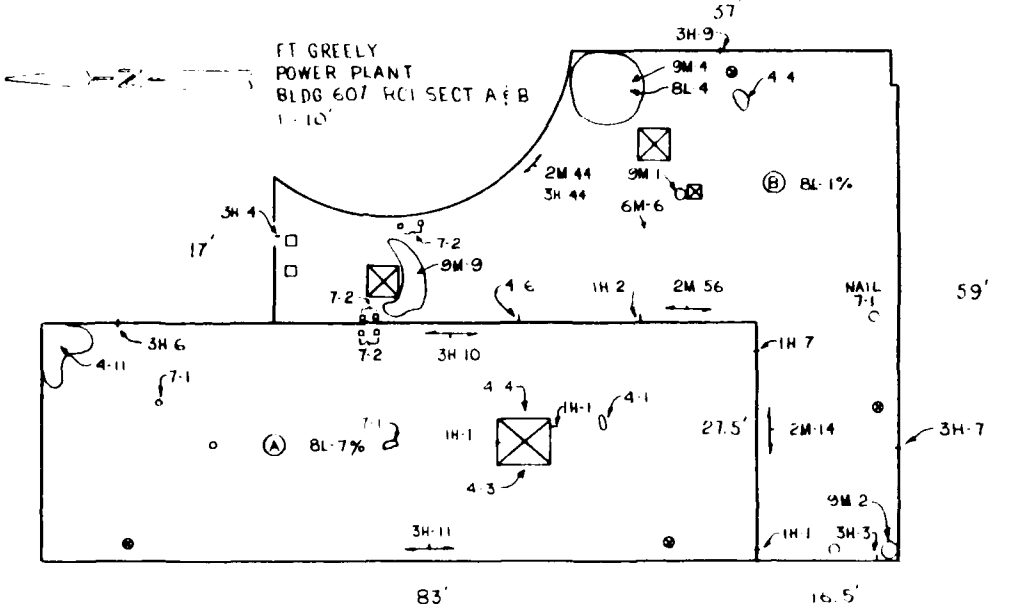


Figure A11. Building 608.

Surveyed by: Coutermarsh-Cox on 7 May 1982

AREA A

Bitumen: A Age: ? Area: 12,627 ft^2
Bituminous flashings: 73 ft Metal flashings: 508 ft
RCI = 74 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 69 ft
Metal flashings - 151 ft
Membrane holes - 2

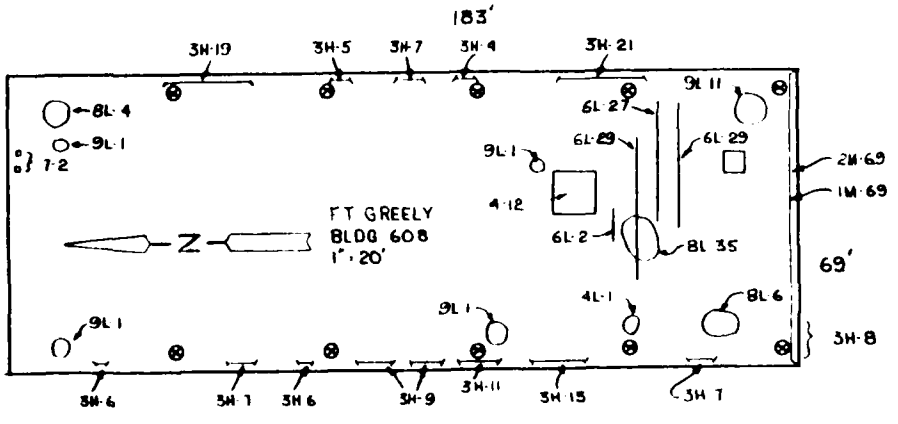


Figure A12. Building 609.

Surveyed by: Coutermarsh-Cox in May 1982

AREA A

Bitumen: A Age: 9 yr Area: 1155 ft^2
Bituminous flashings: 103 ft Metal flashings: 103 ft
RCI = 84 SF = 10.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 6 ft
Metal flashings - 5 ft

AREA B

Bitumen: A Age: 9 yr Area: 1452 ft^2
Bituminous flashings: 88 ft Metal flashings: 154 ft
RCI = 81 SF = 9.6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 5 ft
Metal flashings - 7 ft

AREA C

Bitumen: A Age: 9 yr Area: 1221 ft^2
Bituminous flashings: 101 ft Metal flashings: 66 ft
RCI = 86 SF = 10.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 4 ft
Metal flashings - 6 ft
Membrane holes - 2

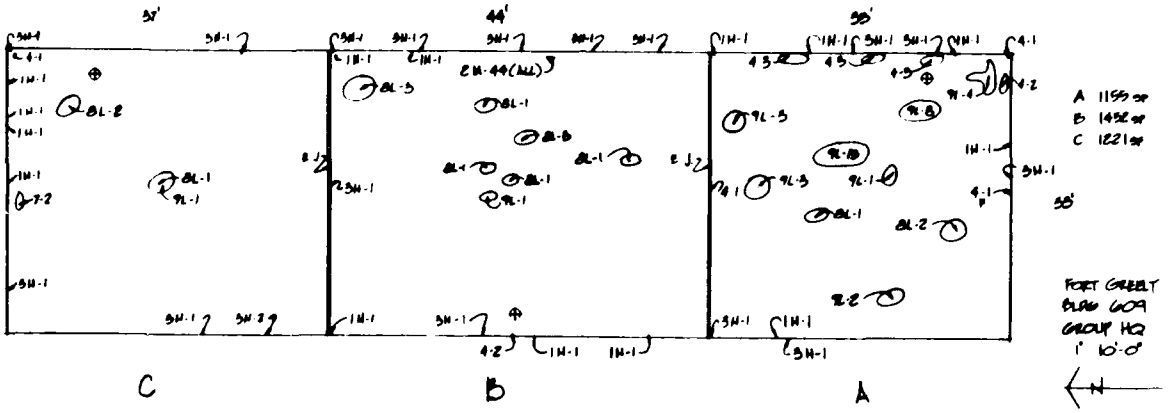


Figure A13. Building 610.

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA A

Bitumen: A Age: 27 yr Area: 4949 ft^2
Bituminous flashings: 12 ft Metal flashings: 300 ft
RCI = 64 SF = 4.3

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 39 ft

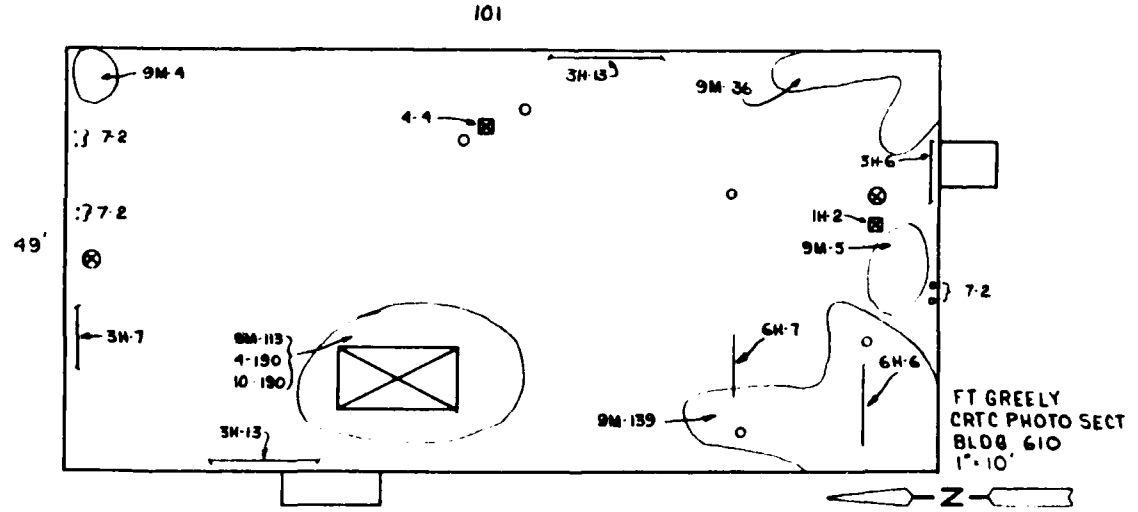


Figure A14. Building 612.

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA A

Bitumen: A Age: 8 mo Area: 9737 ft^2
Bituminous flashings: 120 ft Metal flashings: 515 ft
RCI = 93 SF = 15.7

Course of action:
In-house repair

Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 7 ft
Membrane holes - 13

AREA B

Bitumen: A Age: 8 mo Area: 2904 ft^2
Bituminous flashings: 121 ft Metal flashings: 290 ft
RCI = 90 SF = 14.9

Course of action:
In-house repair

Repairs needed:
Bituminous base flashings - 3 ft
Metal flashings - 27 ft

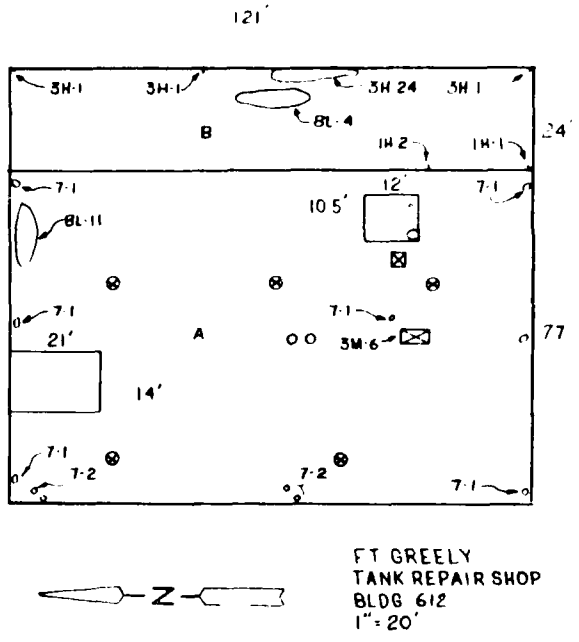


Figure A15. Building 614.

Surveyed by: Coutermarsh-Cox on 6 May 1982

AREA A

Bitumen: A Age: 27 yr Area: 1200 ft^2
Bituminous flashings: ? ft Metal flashings: 300 ft
RCI = 53 SF = 3.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 32 ft
Exposed felts - 85 ft^2
Membrane holes - 5

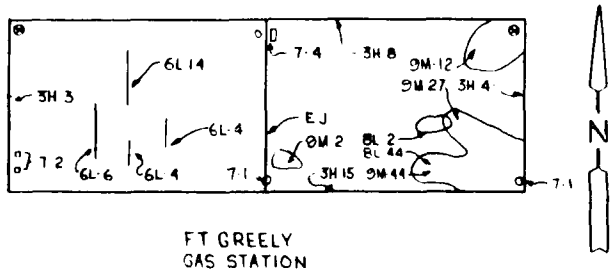


Figure A16. Building 625.

Surveyed by: Coutermarsh-Keller on 17 May 1982

AREA A

Bitumen: A Age: ? Area: 240 ft^2
Bituminous flashings: 18 ft Metal flashings: 90 ft
RCI = 36 SF = ?
RCI - recalculated assuming repairs made = 42

Course of action:
Contract repair or reroof

Repairs needed:
Bituminous base flashings - 3 ft
Metal flashings - 10 ft
Exposed felts - 4.5 ft^2
Membrane holes - 3

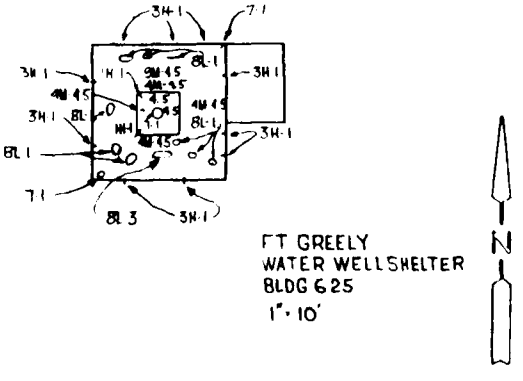


Figure A17. Building 626.

Surveyed by: Coutermarsh-Cox on 5 May 1982

AREA A

Bitumen: A Age: 3 yr Area: 5921 ft^2
Bituminous flashings: 0 ft Metal flashings: 315 ft
RCI = 71 SF =10.4

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 117 ft

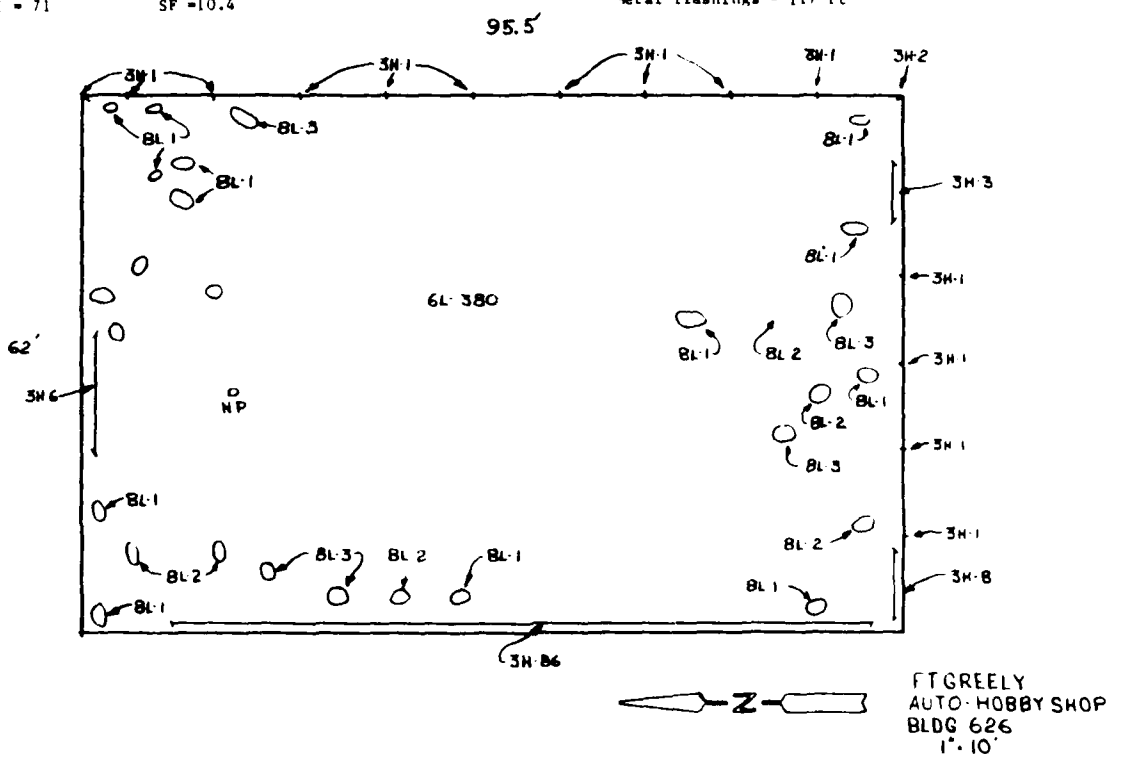


Figure A18. Building 650.

Surveyed by: Coutermarsh-Cox on 10 May 1982

AREA A

Bitumen: A Age: 2 yr Area: 1836 ft^2
Bituminous flashings: 182.5 ft Metal flashings: 182.5 ft
RCI = 66 SF = 10.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

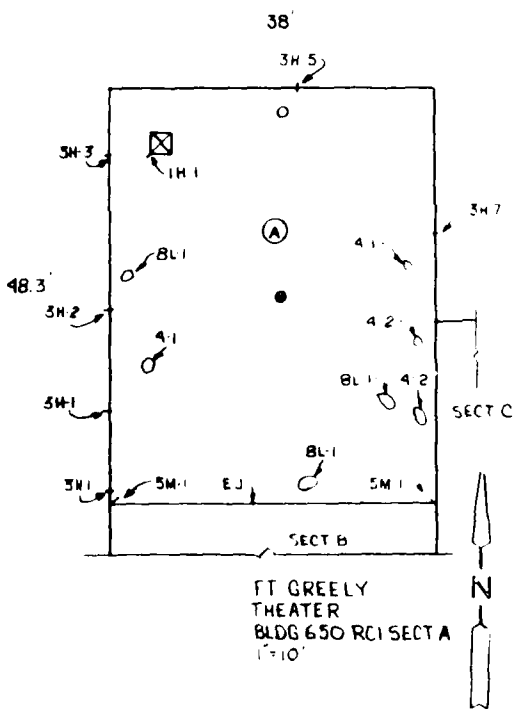
Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 19 ft
Membrane holes - 13
Membrane splits (contract repair is the only permanent solution) - 2 ft

AREA B

Bitumen: A Age: 2 yr Area: 1836 ft^2
Bituminous flashings: 182.5 ft Metal flashings: 182.5 ft
RCI = 57 SF = 8.7

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 9 ft
Exposed felts - 3 ft^2
Membrane holes - 9



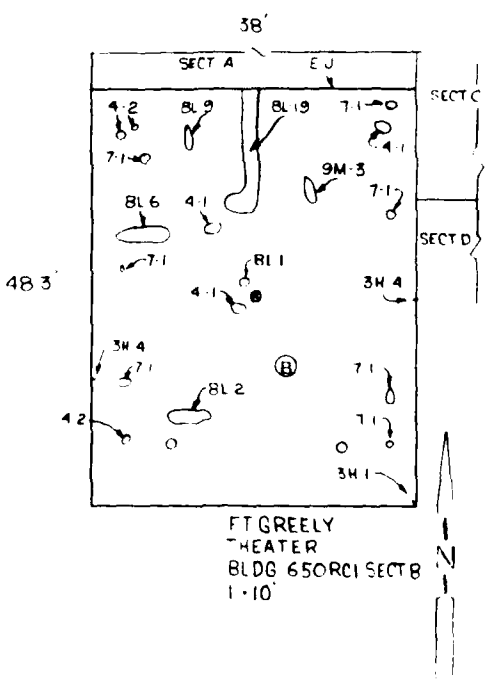


Figure A18 (cont'd).

Surveyed by: Coutermarsh-Cox on 11 May 1982

AREA C

Bitumen: A Age: ? Area: 1870 ft²
Bituminous flashings: 187 ft Metal flashings: 242 ft
RCI = 86 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 4 ft
Metal flashings - 1 ft
Membrane holes - 2

AREA D

Bitumen: A Age: ? Area: 1953 ft²
Bituminous flashings: 138 ft Metal flashings: 193 ft
RCI = 84 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 3 ft
Metal flashings - 1 ft
Membrane holes - 2

AREA E - Unable to rate because of membrane slippage.

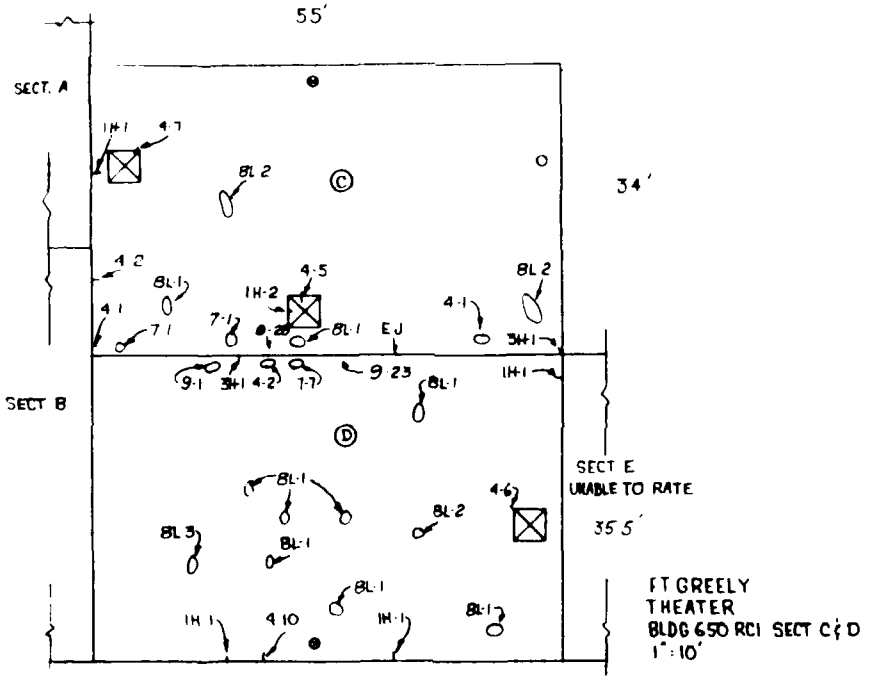


Figure A19. Building 651.

Surveyed by: Coutermarsh-Keller on 17 May 1982

AREA A

Bitumen: A Age: 23 yr Area: 2965 ft²
Bituminous flashings: 121 ft Metal flashings: 291 ft
RCI = 60 SF = 4.3

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 3 ft
Metal flashings - 7 ft
Sagged or slipped base flashings - 15 ft

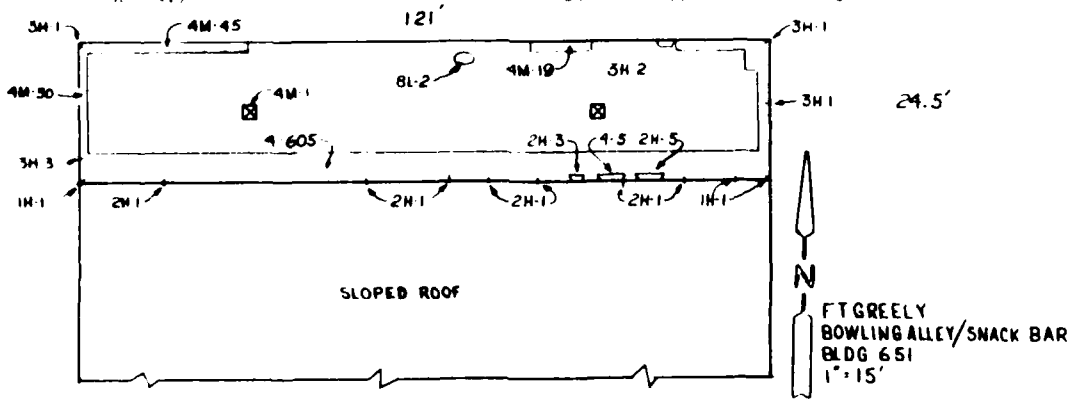


Figure A20. Building 652.

Surveyed by: Coutermarsh-Cox on 11 May 1982

AREA A

Bitumen: A Age: 2 yr Area: 1078.4 ft²
Bituminous flashings: 152 ft Metal flashings: 152 ft
RCI = 59 SF = 8.9

Course of action:
In-house repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 14 ft
Membrane holes - 2

AREA B

Bitumen: A Age: 2 yr Area: 1640 ft²
Bituminous flashings: 202 ft Metal flashings: 202 ft
RCI = 68 SF = 10.6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 7 ft
Exposed felts - 11 ft²
Membrane holes - 2

AREA C

Bitumen: A Age: 2 yr Area: 1658.4 ft²
Bituminous flashings: 180 ft Metal flashings: 154 ft
RCI = 66 SF = 10.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 15 ft
Exposed felts - 4 ft²
Membrane holes - 3

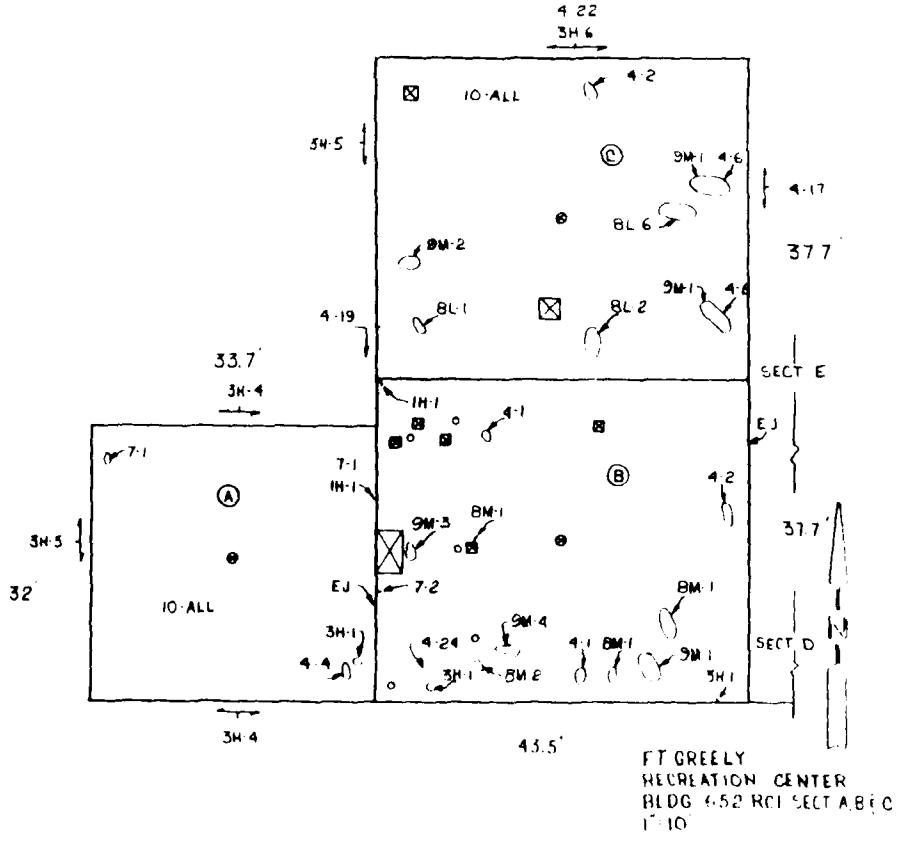


Figure A20 (cont'd).

Surveyed by: Coutermarsh-Cox on 11 May 1982

AREA D

Bitumen: A Age: 2 yr Area: 582.8 ft^2
Bituminous flashings: 132 ft Metal flashings: 132 ft
RCI = 65 SF = 10

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 11 ft
Exposed felts - 26 ft^2
Membrane holes - 5

AREA E

Bitumen: A Age: 2 yr Area: 1307.3 ft^2
Bituminous flashings: 146 ft Metal flashings: 146 ft
RCI =78 SF = 12.3

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 1 ft
Metal flashings - 15 ft
Blisters - 2 ft^2
Membrane holes - 6

AREA F

Bitumen: A Age: 2 yr Area: 1307.25 ft^2
Bituminous flashings: 146 ft Metal flashings: 146 ft
RCI = 59 SF = 8.9

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 3 ft
Metal flashings - 14 ft
Exposed felts - 3 ft^2
Membrane holes - 4
Membrane splits (contract repair is the only permanent solution) - 1 ft

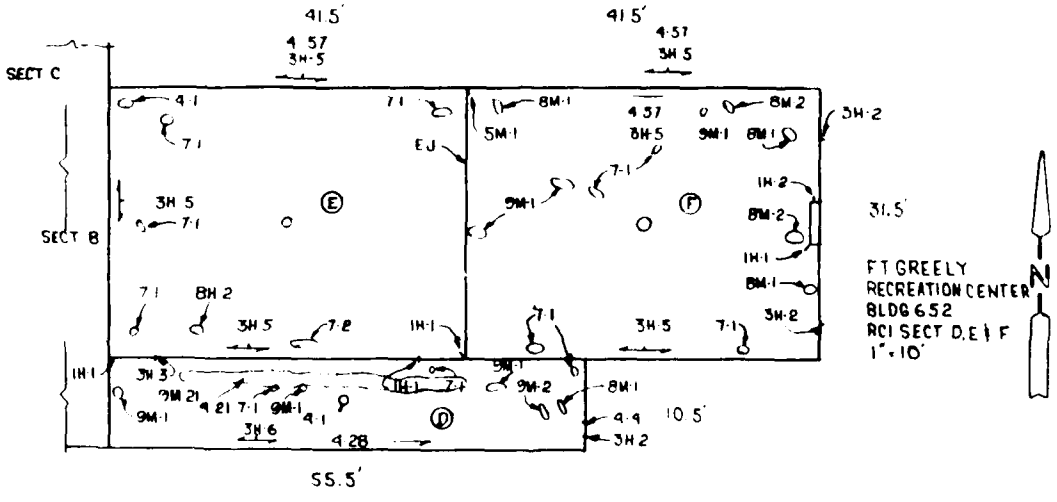


Figure A21. Building 653.

Surveyed by: Coutermarsh-Cox on 8 May 1982

AREA A

Bitumen: A Age: 24 yr Area: 5135 ft^2
Bituminous flashings: 58 ft Metal flashings: 430 ft
RCI = 74 SF = 6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 25 ft
Metal flashings - 50 ft
Exposed felts - 21 ft^2

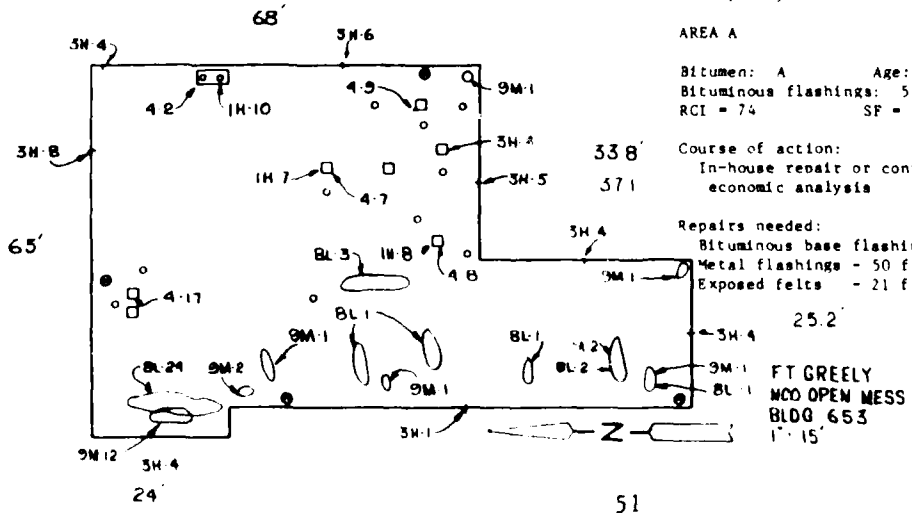


Figure A22. Building 655.

Surveyed by: Coutermarsh-Cox on 11 May 1982

AREA A

Bitumen: A Age: 3 yr Area: 2520 ft^2
Bituminous flashings: 202 ft Metal flashings: 202 ft
RCI = 22 SF = 28

Course of action:
Contract reroof

AREA B

Bitumen: A Age: 3 yr Area: 2520 ft^2
Bituminous flashings: 202 ft Metal flashings: 202 ft
RCI = 23 SF = 2.6
RCI = recalculated assuming repairs made = 21

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings = 4 ft
Metal flashings = 56 ft
Membrane holes = 8

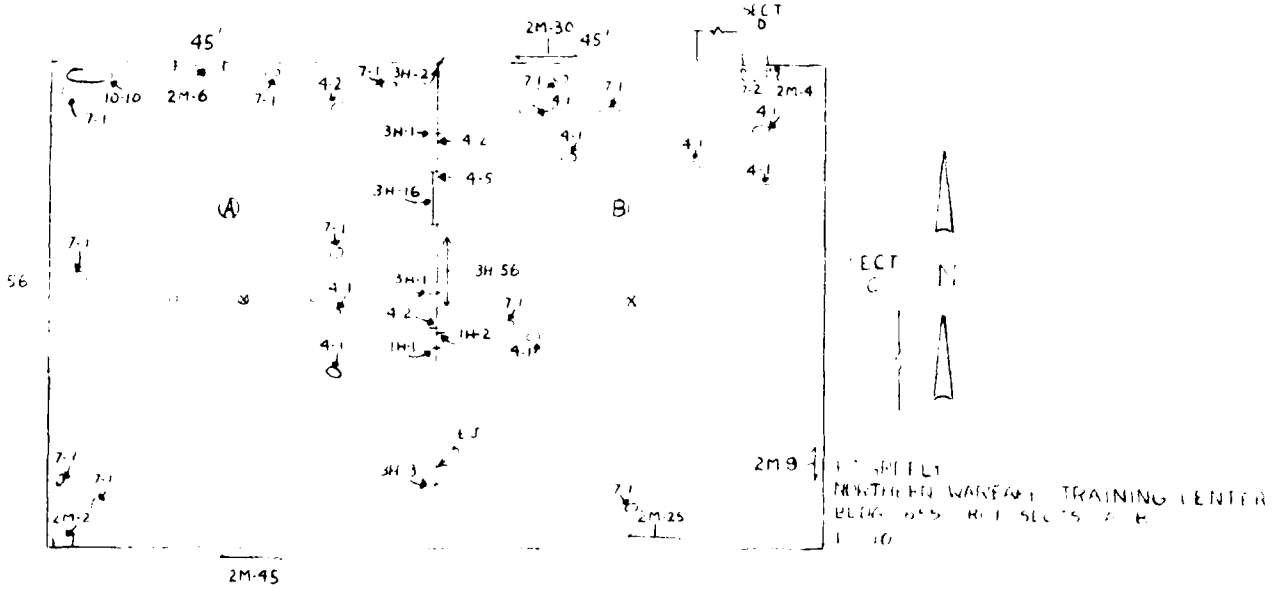


Figure A22 (cont'd).

AREA C

Bitumen: A Age: 3 yr Area: 856 ft^2
Bituminous flashings: 126 ft Metal flashings: 126 ft
RCI = 25 SF = 3
RCI - recalculated assuming repairs made = 26

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 6 ft
Metal flashings - 5 ft
Membrane holes - 3

AREA D

Bitumen: A Age: 3 yr Area: 1661 ft^2
Bituminous flashings: 163 ft Metal flashings: 163 ft
RCI = 25 SF = 3
RCI - recalculated assuming repairs made = 24

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 5 ft
Metal flashings - 16 ft

AREA E

Bitumen: A Age: 3 yr Area: 2066 ft^2
Bituminous flashings: 186 ft Metal flashings: 186 ft
RCI = 28 SF = 3.4
RCI - recalculated assuming repairs made = 26

Course of action:
Contract repair or reroof

Repairs needed:
Bituminous base flashings - 8 ft
Metal flashings - 9 ft
Membrane holes - 6

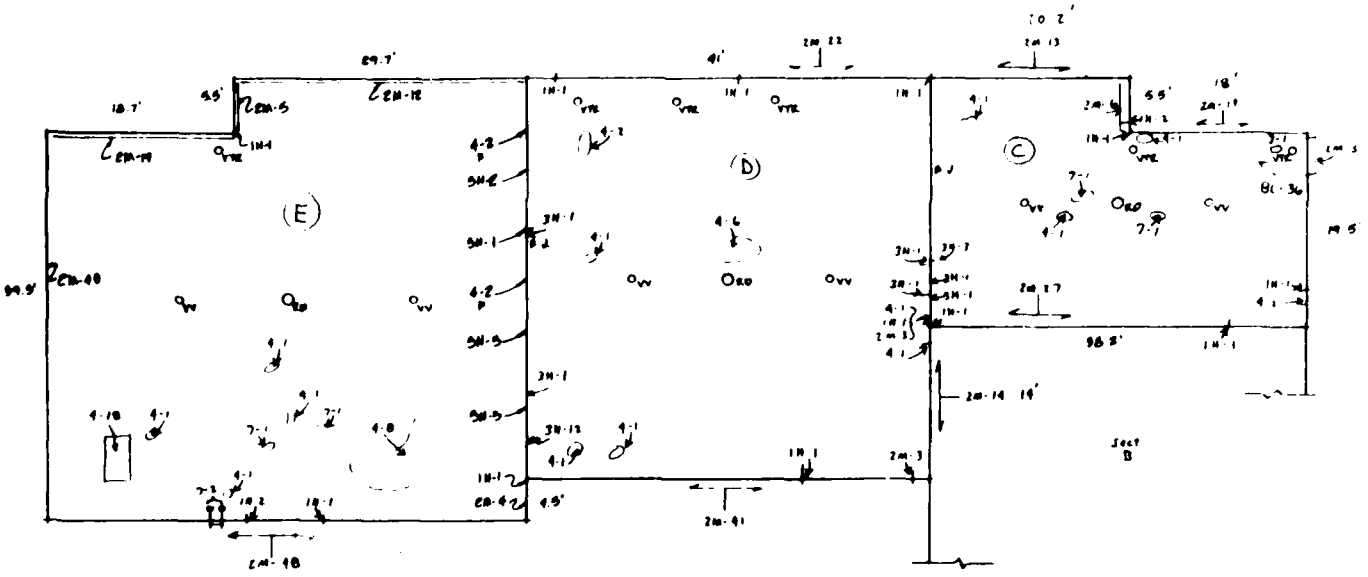


Figure A23. Building 656.

Surveyed by: Coutermarsh-Cox on 17 May 1982

AREA A

Bitumen: A Age: 26 yr Area: 11,202 ft^2
Bituminous flashings: 46.7 ft Metal flashings: 563 ft
RCI = 14 SF = 0

Course of action:
Contract reroof

Repairs needed:
Emergency repair:
Membrane holes - 12
Membrane splits - 68 ft

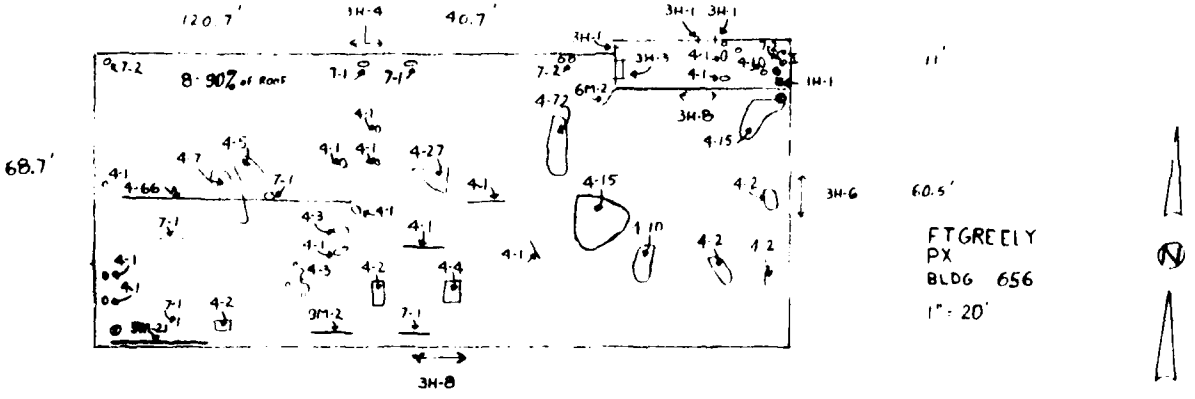


Figure A24. Building 658.

Surveyed by: Coutermarsh-Cox on 7 May 1982

AREA A

Bitumen: A Age: 27 yr Area: 12,240 ft^2
Bituminous flashings: 68 ft Metal flashings: 500 ft
RCI = 73 SF = 5.5

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 13 ft
Metal flashings - 57 ft
Membrane holes - 3
Membrane splits (contract repair is the only permanent solution) - 21 ft

AREA B

Bitumen: A Age: 27 yr Area: 12,240 ft^2
Bituminous flashings: 68 ft Metal flashings: 496 ft
RCI = 69 SF = 4.9

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 4 ft
Metal flashings - 64 ft
Exposed felts - 237 ft^2
Membrane holes - 1
Membrane splits (contract repair is the only permanent solution) - 11 ft

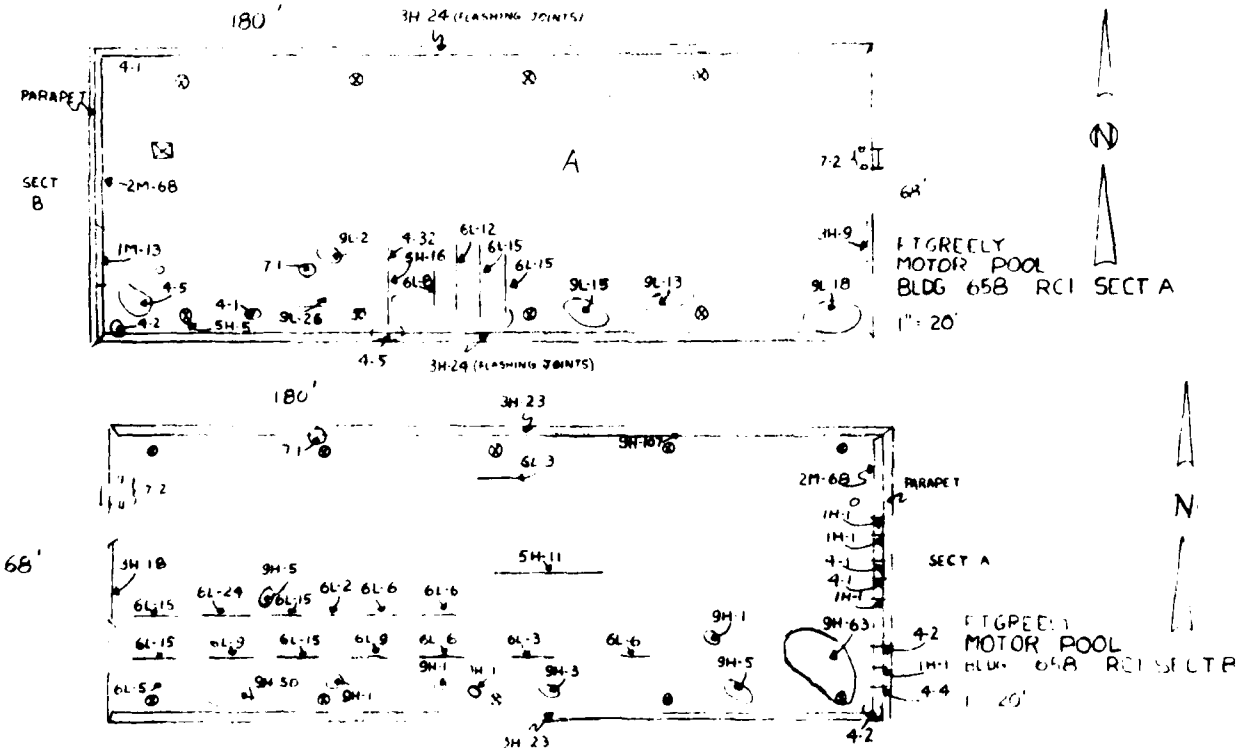


Figure A25. Building 659.

Surveyed by: Coutermarsh-Cox on 17 May 1982

AREA A

Bitumen: A Age: ? Area: 7077 ft^2
Bituminous flashings: 582 ft Metal flashings: 582 ft
RCI = 61 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 7 ft
Metal flashings - 15 ft
Membrane holes - 38
Sagged or fallen base flashings - 51.5 ft

AREA B

Bitumen: A Age: 10 yr Area: 2838 ft^2
Bituminous flashings: 190.4 ft Metal flashings: 225.4 ft
RCI = 75 SF = 9.5

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 9 ft
Metal flashings - 9 ft
Membrane holes - 1

AREA C

Bitumen: A Age: 10 yr Area: 1882 ft^2
Bituminous flashings: 152 ft Metal flashings: 99.2 ft
RCI = 74 SF = 9

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 23 ft
Metal flashings - 7 ft
Membrane holes - 7

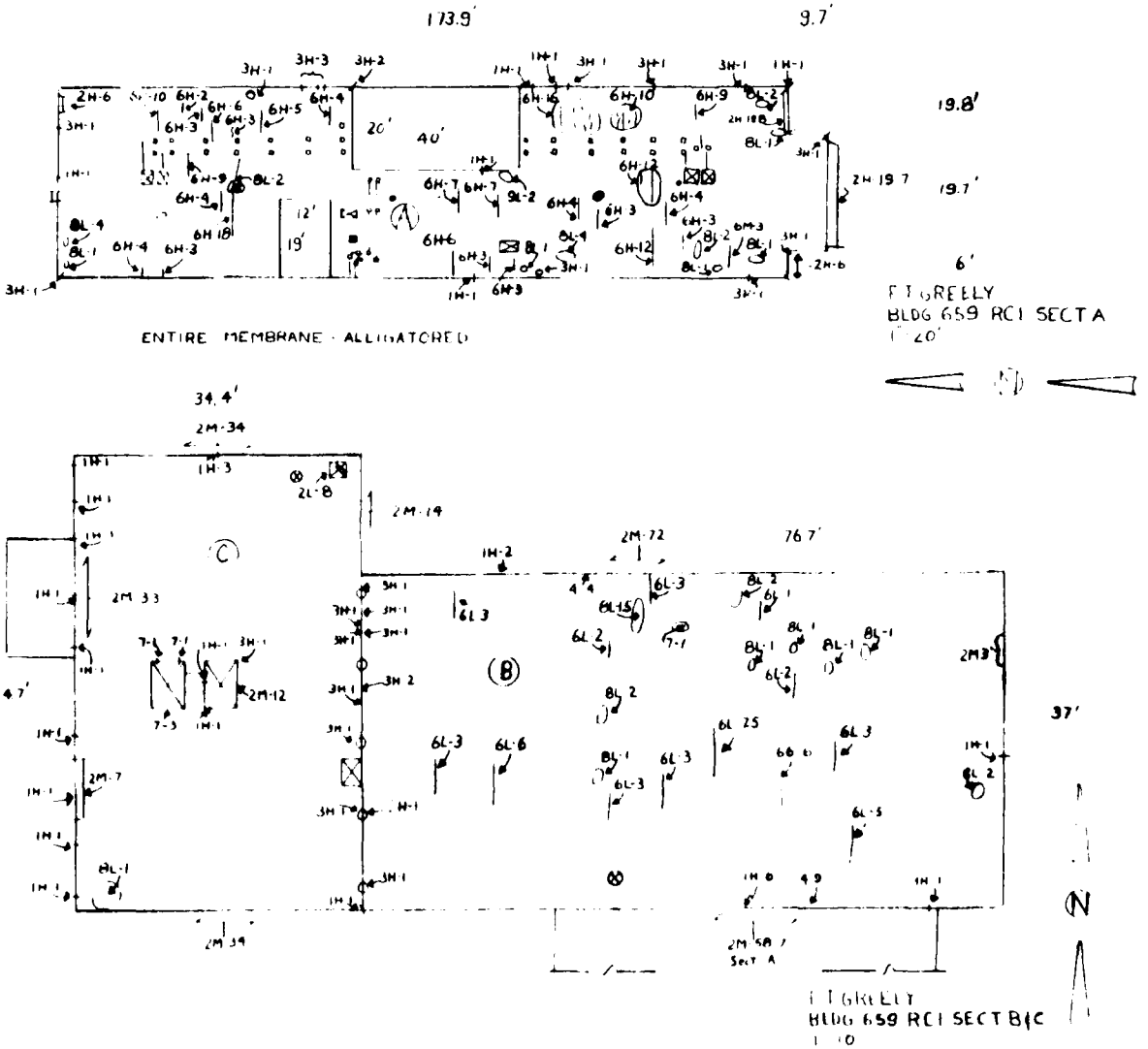


Figure A26. Building 660.

Surveyed by: Coutermarsh-Cox on 11 May 1982

AREA A

Bitumen: A Age: 21 yr Area: 7579 ft^2
Bituminous flashings: 248 ft Metal flashings: 632 ft
RCI = 51 SF = 3.4

Course of action:
In-house repair or contract repair or reroof based on economic analysis

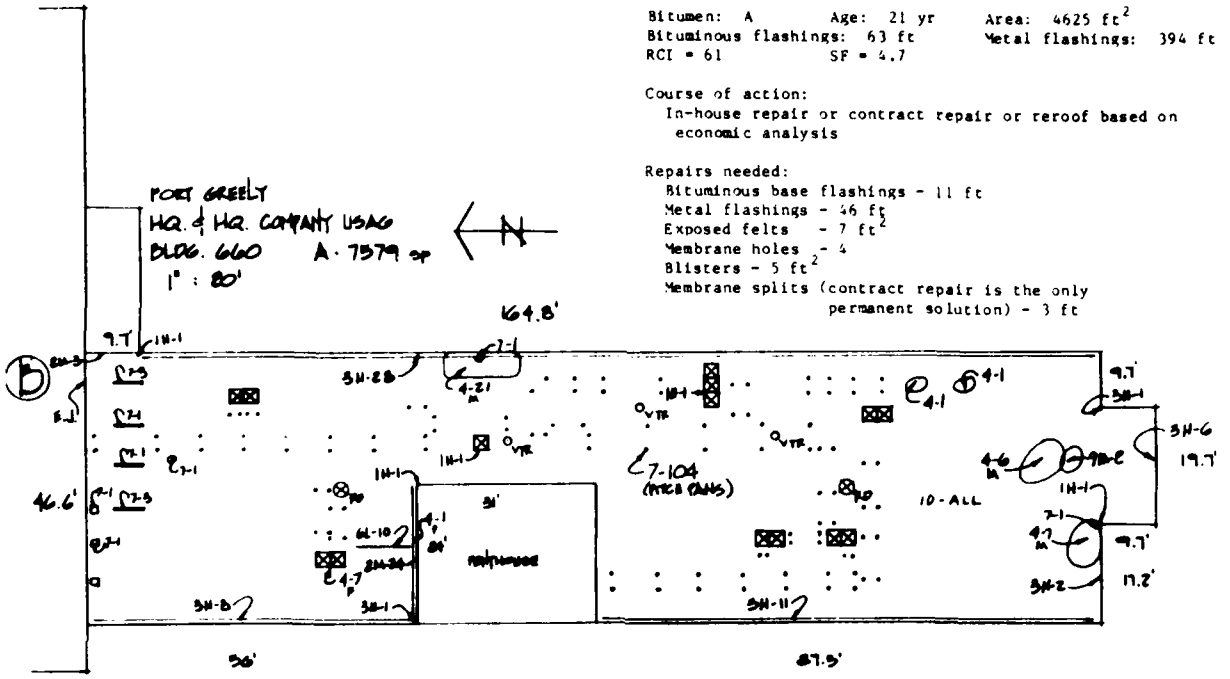
Repairs needed:
Bituminous base flashings - 5 ft
Metal flashings - 61 ft
Exposed felts - 19 ft^2
Membrane holes - 117

AREA B

Bitumen: A Age: 21 yr Area: 4625 ft^2
Bituminous flashings: 63 ft Metal flashings: 394 ft
RCI = 61 SF = 4.7

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 11 ft
Metal flashings - 46 ft
Exposed felts - 7 ft^2
Membrane holes - 4
Blisters - 5 ft^2
Membrane splits (contract repair is the only permanent solution) - 3 ft



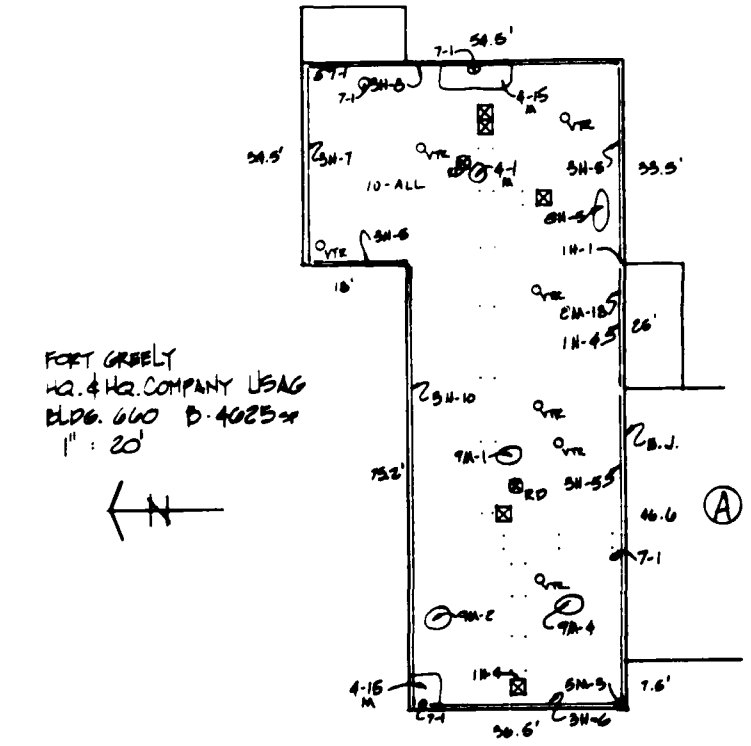


Figure A27. Building 661.

Surveyed by: Coutermarsh-Cox on 7 May 1982

AREA A

Bitumen: A Age: 10 yr Area: 3639 ft^2
Bituminous flashings: 299 ft Metal flashings: 325 ft
RCI = 47 SF = 3.8
RCI = recalculated assuming repairs made = 56

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 13 ft
Metal flashings - 3 ft
Membrane holes - 22
Membrane splits (Contract repair is the only permanent solution) - 2 ft

AREA B

Bitumen: A Age: 10 yr Area: 3439 ft^2
Bituminous flashings: 329 ft Metal flashings: 355 ft
RCI = 52 SF = 4.5

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 34 ft
Metal flashings - 4 ft
Membrane holes - 20

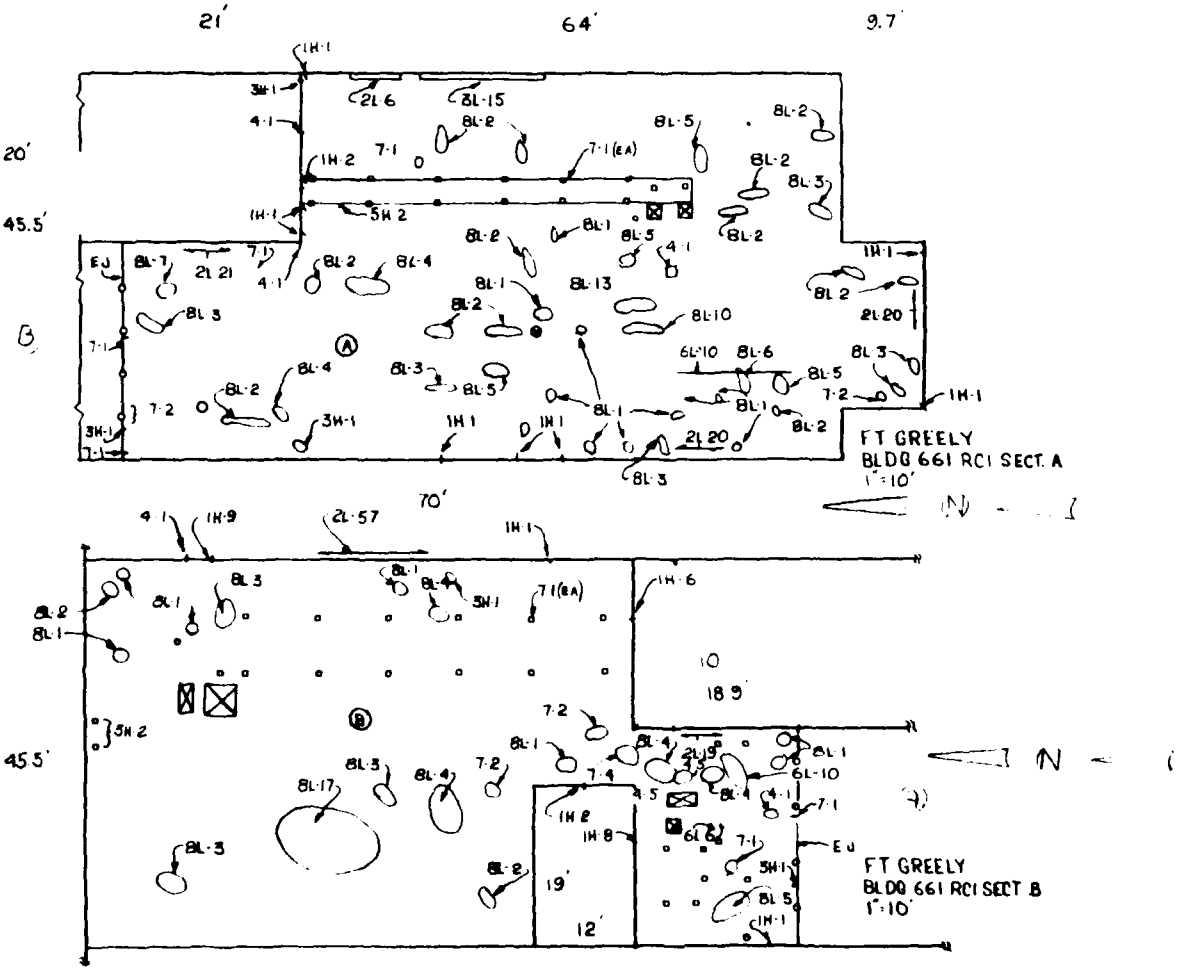


Figure A27 (cont'd).

Surveyed by: Coutermarsh-Cox on 7 May 1982

AREA C

Bitumen: A Age: 10 yr Area: 2849 ft^2
Bituminous flashings: 191 ft Metal flashings: 230 ft
RCI = 54 SF = 4.7

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 23 ft
Metal flashings - 6 ft
Membrane holes - 5
Membrane splits (contract repair is the only permanent solution) - 3 ft

AREA D

Bitumen: A Age: 10 yr Area: 1897.5 ft^2
Bituminous flashings: 170 ft Metal flashings: 207 ft
RCI = 76 SF = 8.1

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 24 ft
Membrane holes - 4

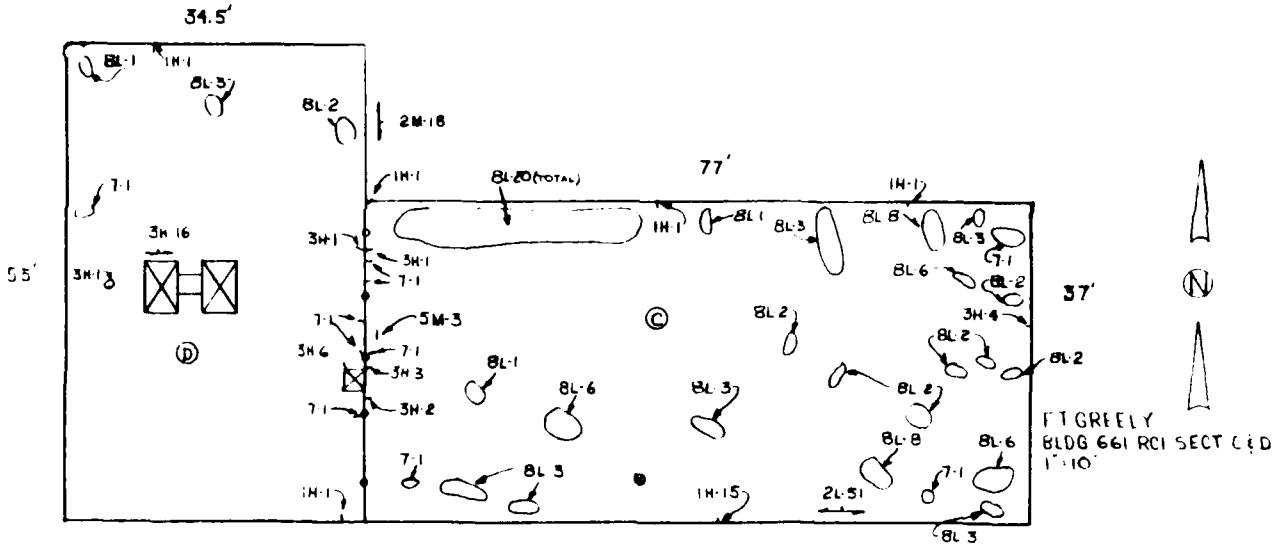


Figure A28. Building 662.

Surveyed by: Coutermarsh-Cox on 12 May 1982

AREA A

Bitumen: A Age: 5 yr Area: 3483 ft²
Bituminous flashings: 0 ft Metal flashings: 240 ft
RCI = 82 SF = 11.3

Course of action:
In-house repair or contract repair or reroof based on economic analysis

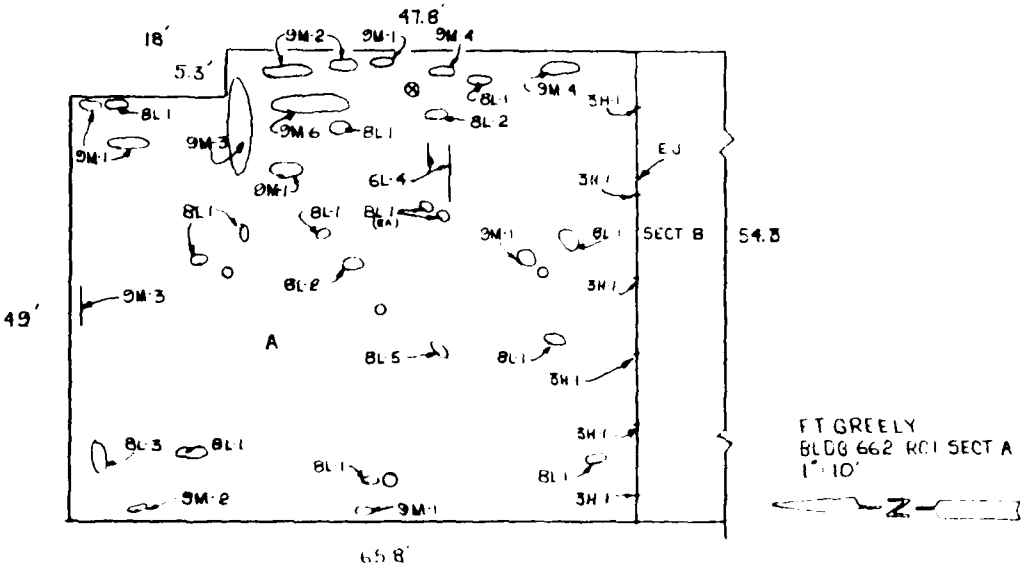
Repairs needed:
Metal flashings - 8 ft
Exposed felts - 36 ft²

AREA B

Bitumen: A Age: 5 yr Area: [illegible] ft
Bituminous flashings: [illegible] ft Metal flashings: [illegible] ft
RCI = [illegible] SF = 10.2

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 43 ft



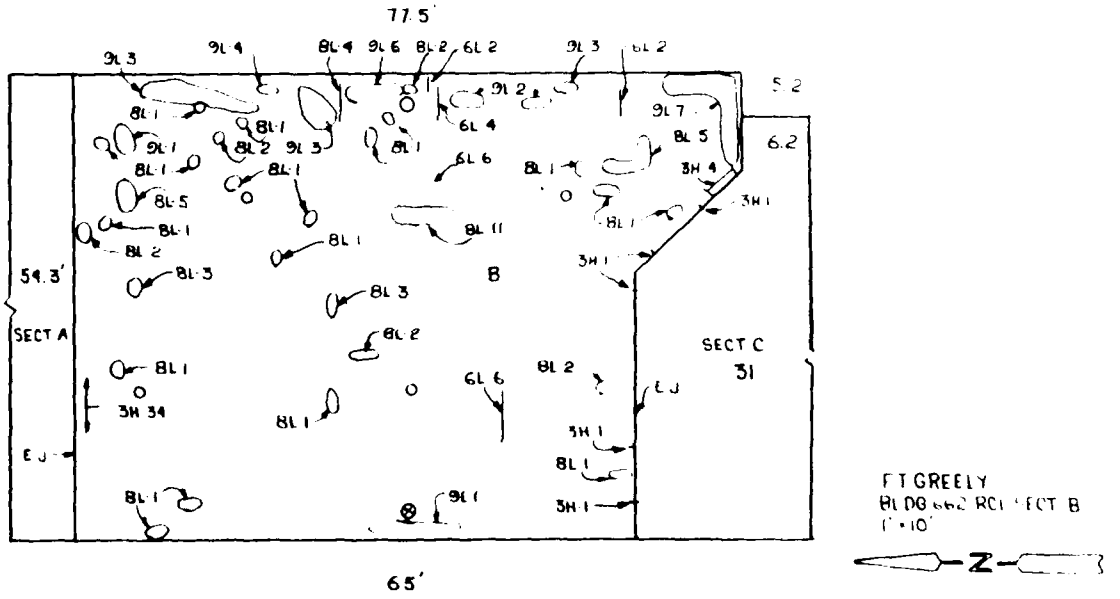


Figure A28 (cont'd)

AREA

[illegible]

Course of action:
[illegible]

Repairs needed:
[illegible]

AREA D

Bitumen A Age: 5 yr Area: 3340 ft^2
Bituminous flashings: 0 ft Metal flashings: 233 ft
RCI = 72 SF = 9.4

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 18 ft
Exposed felts - 60 ft
Membrane holes - 4

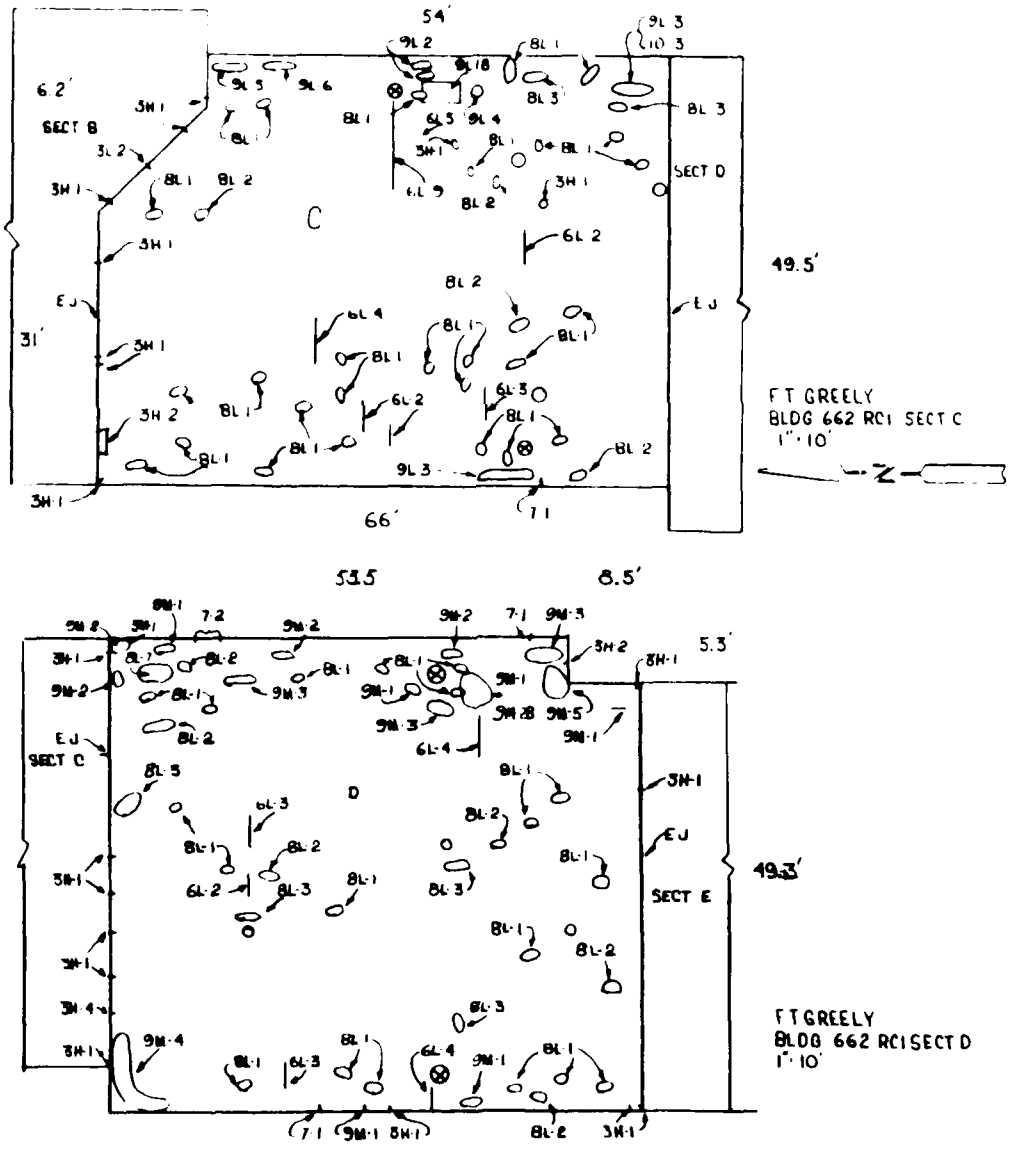


Figure A28 (cont'd).

AREA E

Bitumen: A Age: 5 yr Area: 3379 ft^2
Bituminous flashings: 0 ft Metal flashings: 235 ft
RCI = 73 SF = 9.6

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 9 ft
Membrane holes - 1

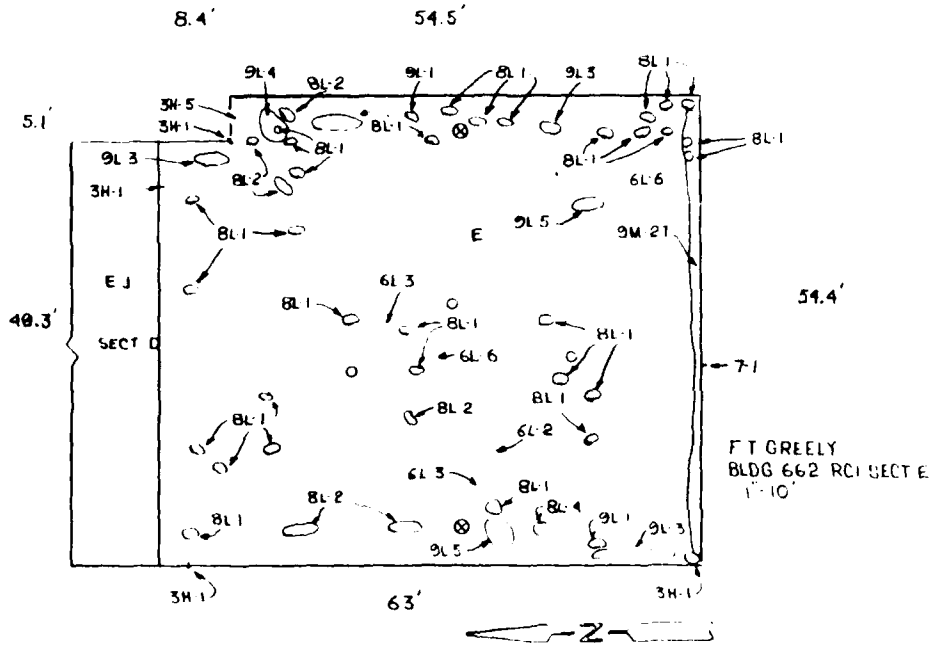


Figure A29. Building 663.

Surveyed by: Coutermarsh-Cox on 10 May 1982

AREA A

Bitumen: A Age: ? Area: 7454 ft²
Bituminous flashings: 641 ft Metal flashings: 641 ft
RCI = 19 SF = ?

Course of action:
Contract reroof

Repairs needed:
Emergency repairs:
Membrane holes - 22
Membrane splits - 2 ft

AREA B

Bitumen: A Age: ? Area: 7564 ft²
Bituminous flashings: 440 ft Metal flashings: 440 ft
RCI = 37 SF = ?
RCI - recalculated assuming repairs made = 40

Course of action:
Contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 9 ft
Exposed felts - 44 ft²
Membrane holes - 1

AREA C

Bitumen: A Age: ? Area: 982 ft²
Bituminous flashings: 126 ft Metal flashings: 126 ft
RCI = 79 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 8 ft
Metal flashings - 17 ft
Exposed felts - 9 ft²

AREA D

Bitumen: A Age: ? Area: 561 ft²
Bituminous flashings: 18 ft Metal flashings: 98 ft
RCI = 54 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 2 ft
Metal flashings - 11 ft
Membrane holes - 10

AREA E

Bitumen: A Age: ? Area: 435 ft²
Bituminous flashings: 6.5 ft Metal flashings: 9 ft
RCI = 69 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 13 ft
Membrane holes - 3

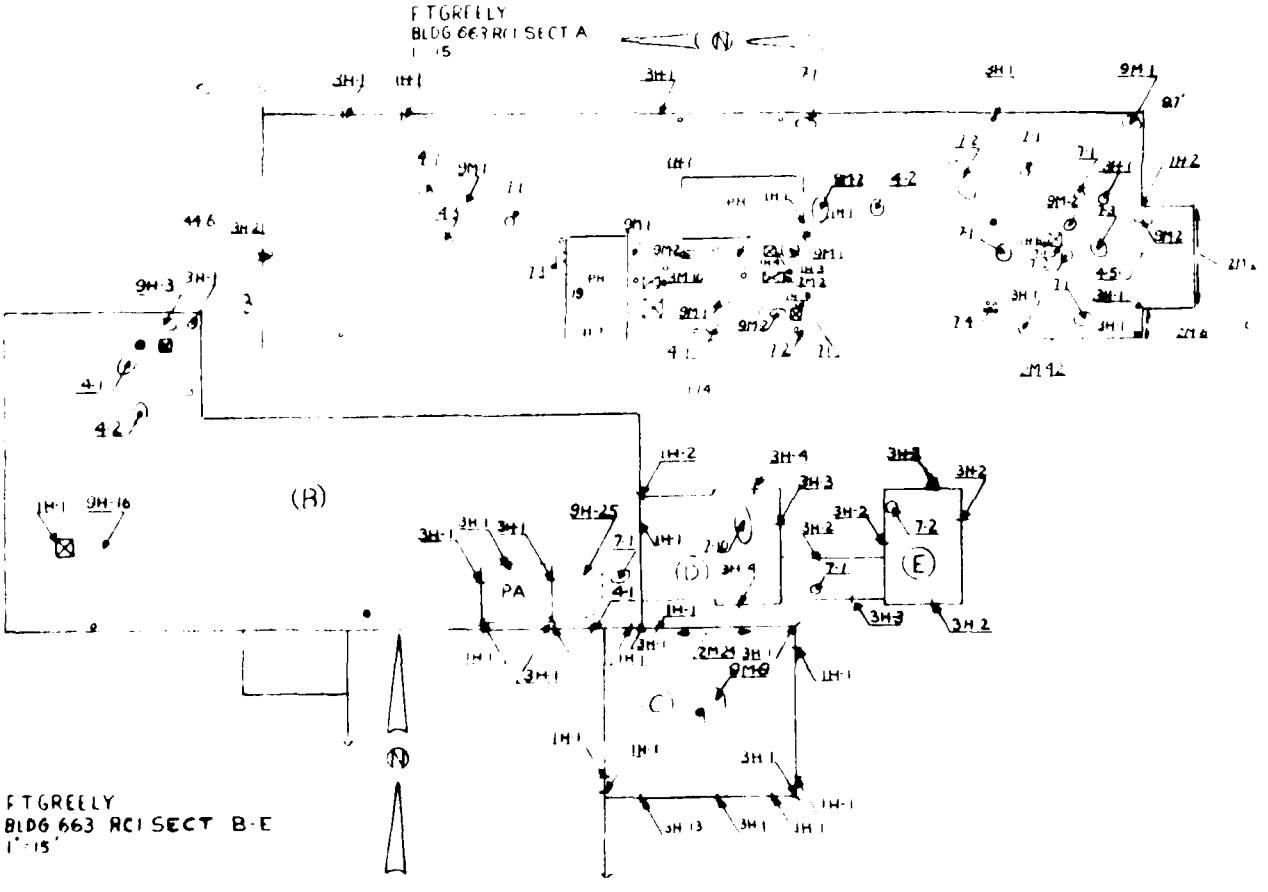


Figure A30. Building 701.

Surveyed by: Coutermarsh-Cox on 4 May 1982

AREA A

Bitumen: CT Age: ? Area: 2999 ft²
Bituminous flashings: 146 ft Metal flashings: 356 ft
RCI = 88 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 98.5 ft
Metal flashings - 31 ft
Exposed felts - 4 ft²
Membrane holes - 1

AREA B

Bitumen: CT Age:
Bituminous flashings:
RCI = 72 SF =

Course of action:
In-house repair or contract repair
economic analysis

Repairs needed:
Bituminous base flashings -
Metal flashings -
Exposed felts -

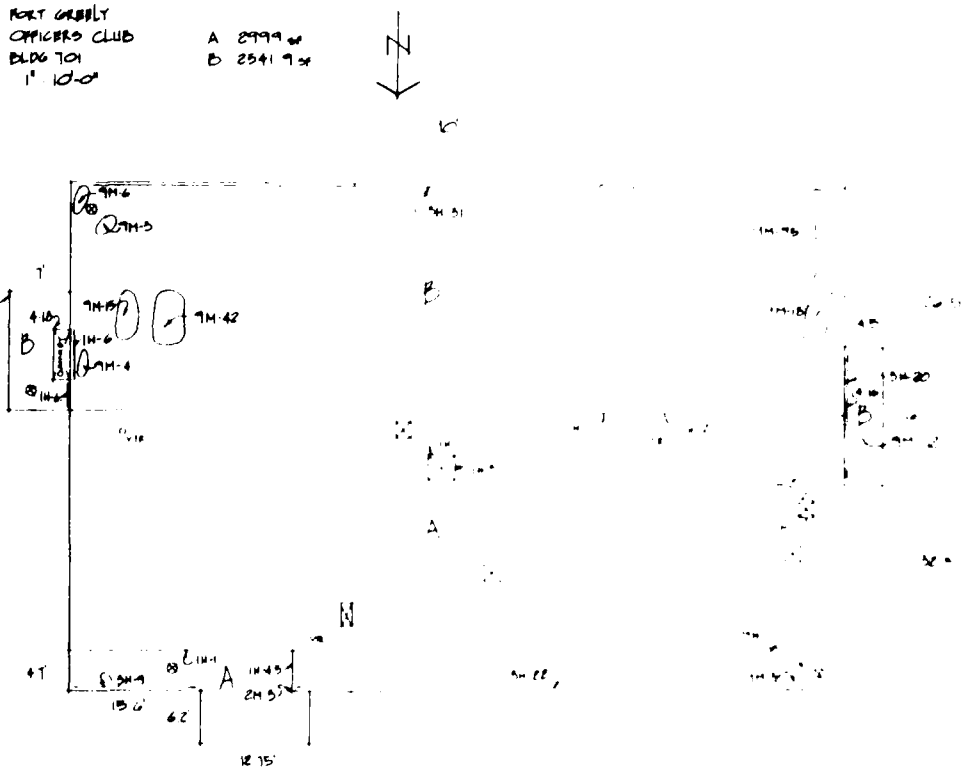


Figure A31. Building 725.

Surveyed by: Coutermarsh-Cox on 8 May 1982

AREA A

Bitumen: A Age: ? Area: 924 ft^2
Bituminous flashings: 0 ft Metal flashings: 87 ft
RCI = 99 SF = ?

Course of action:
None

Repairs needed:
None

AREA B

Bitumen: A Age: ? Area: 2625 ft^2
Bituminous flashings: 43 ft Metal flashings: 105 ft
RCI = 93 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 1 ft
Membrane holes - 1
Base flashings less than 6 in. high (include in contract repair or reroofing) - 62 ft

AREA C

Bitumen: A Age: ? Area: 3632 ft^2
Bituminous flashings: 62 ft Metal flashings: 254 ft
RCI = 93.5 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 19 ft
Membrane holes - 3

AREA D

Bitumen: A Age: ? Area: 11,835 ft^2
Bituminous flashings: 360 ft Metal flashings: 152 ft
RCI = 77 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 9 ft
Metal flashings - 34 ft

AREA E

Bitumen: A Age: ? Area: 492 ft^2
Bituminous flashings: 68.5 ft Metal flashings: 20.5 ft
RCI = 56 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 3 ft
Metal flashings - 20.5 ft
Membrane holes - 3

AREA F

Bitumen: A Age: ? Area: 1739 ft^2
Bituminous flashings: 1 ft Metal flashings: 5 ft
RCI = 89 SF = ?

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Metal flashings - 17 ft

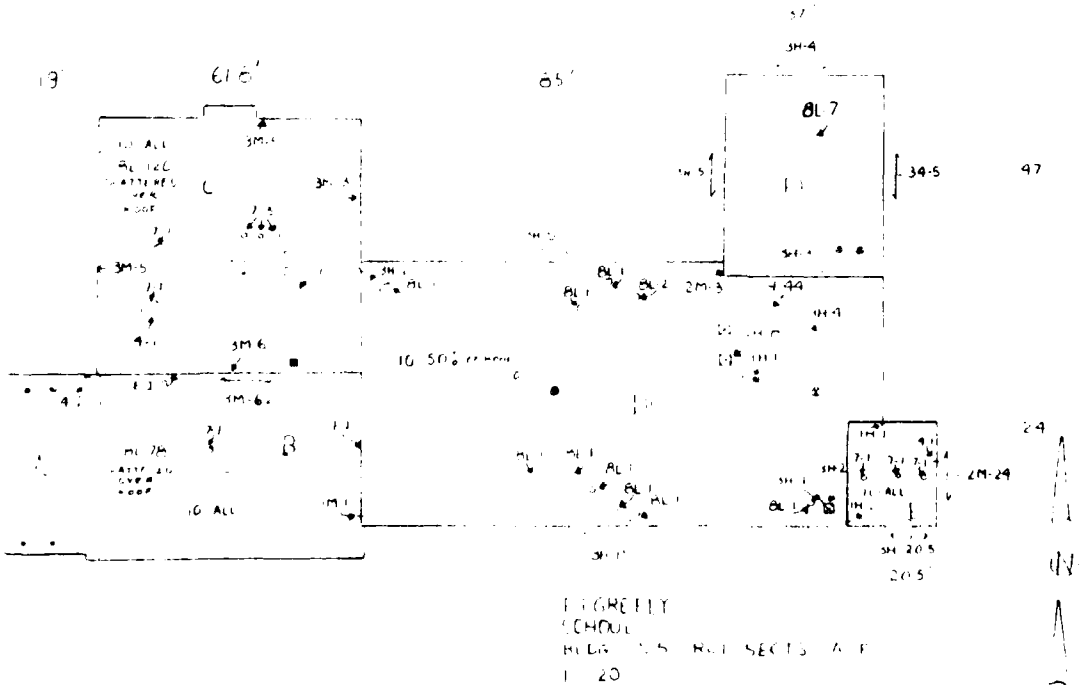


Figure A31 (cont'd).

AREA G

Bitumen: A Age: ' Area: 2772 ft²
Bituminous flashings: 84 ft Metal flashings: 216 ft
RCI = 73 SF = '

Course of action:
In-house repair or contract repair or reroof based on economic analysis

Repairs needed:
Bituminous base flashings - 5 ft
Metal flashings - 62 ft
Membrane holes - 1

AREA H

Bitumen: A Age: ' Area: 15,424 ft²
Bituminous flashings: 100 ft Metal flashings: 676 ft
RCI = 66 SF = '

Course of action:
In-house repair or contract repair or reroof based on economic analysis

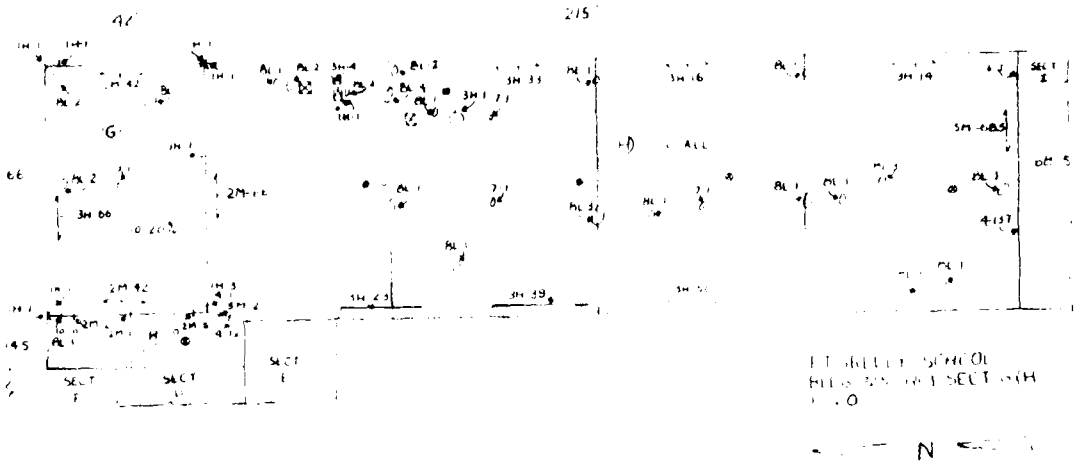
Repairs needed:
Bituminous base flashings - 4 ft
Membrane holes - 3
Membrane splits (contract repair is the only permanent solution) - 70.5 ft

AREA I

Bitumen: A Age: ' Area: 2555 ft²
Bituminous flashings: ' ft Metal flashings: 143 ft
RCI = 92 SF = '

Course of action:
In-house repair

Repairs needed:
Metal flashings - 47 ft



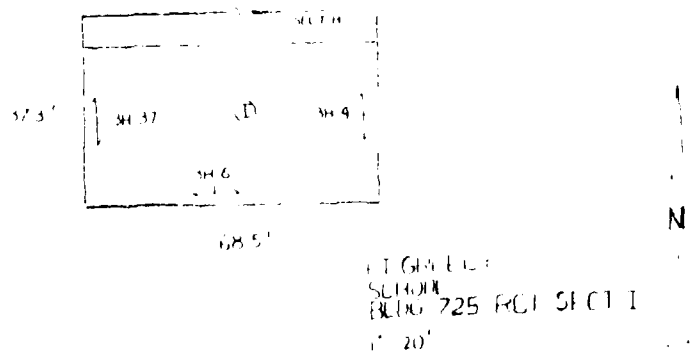


Figure A32. Building 802.

Surveyed by: Coutermarsh-Cox on 19 May 1982

AREA A

Bitumen: A Age: ? Area: 3679 ft^2
Bituminous flashings: 47 ft Metal flashings: 248 ft
RCI = 90 SF = ?

Course of action:
In-house repair

Repairs needed:
Metal flashings - 22 ft