Infrared scanning and computers take care of roofs before they leak!

A specially designed computer program maintains roofs and scopes out problem areas on roofs before leaks occur

At one time, only the noisiest of roofs at the University of Minnesota, Duluth (UMD)—those that leaked or failed—received attention. Unforeseen leaks and roof-section failures were frequent, straining the plant services' budget. Annual roof inspections, preventive repairs, and accelerated replacement of aging roofs—plus increased funding—combined to put UMD back on track in building maintenance. This was made possible, in part, by INSPEC Inc.'s use of ROOFER and infrared scanning to deliver results of unprecedented accuracy and detail to UMD. Foremost, the project represents the first nonmilitary use of ROOFER.

Roofer review

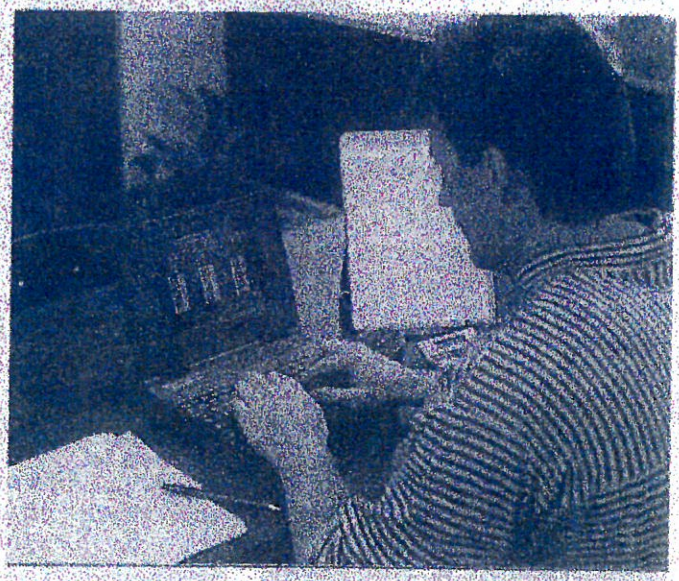
ROOFER is an engineering program developed by the U.S. Army Corps of Engineers to determine the need for maintenance, repair and replacement of both built-up and single-ply roof systems. This detailed program takes the guesswork out of roof analysis. Personnel input reference codes for every roof section, based on specific, well-defined deficiencies, yielding results less subjective and more consistent than otherwise possible. The computer-calculated numerical roof indexes allow annual comparisons and easy prioritizing of repairs and replacements.

Innovation/new application

The UMD project is the first of its kind to integrate infrared techniques and technologies with the engineering program into a complete roof management program. Infrared scanning reveals roof problems that might otherwise go undetected. Previously used mainly in electrical applications, military mapping, and energy applications, infrared technology is now used for roofing inspections.

Private use

In the case of the UMD building, numbers and roofing diversity alone made the project complex; the campus has 47 buildings, most installed in the '60s and '70s, with one million square feet of roofing of all makes and constructions. Initially, urgent problems and little or no information on existing roof conditions and types had to be faced, as it was important to get quickly up to speed and to prioritize. With many campus roofs nearing the end of their useful lives (and inadequate funding to replace them), the challenge was to stabilize the roof systems, while controlling costs and avoiding en masse emergency replacement. Furthermore,



Laptop computer used to input data for the ROOFER program.

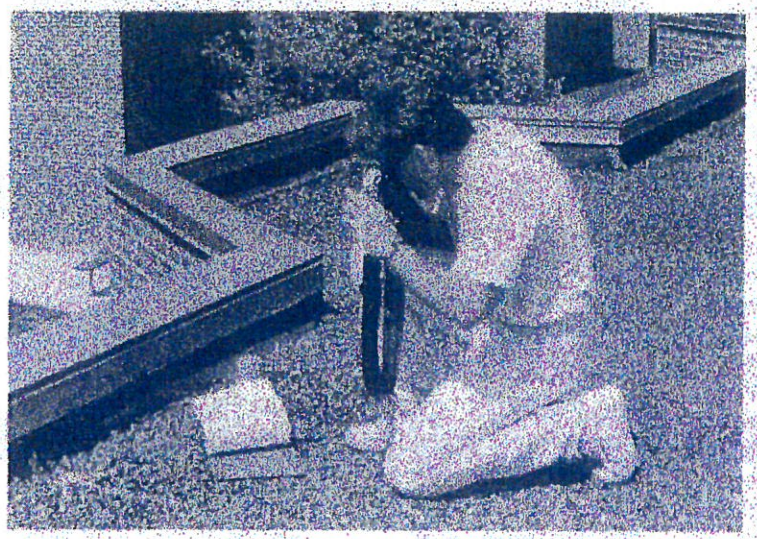
diverse manufacturer requirements and recommendations for annual roof repairs needed to be considered. The program helped combine all of these differentials so that the exact condition of every roof was known, and the big picture could be managed closely.

Following the field review and program analysis, roof sketches were

generated by computer-aided drafting (CAD) so that UMD would have a year-to-year, graphic record of deficiencies and repairs. Deficiencies and photo locations were noted (and photos attached) to take the owner "up on the roof."

The roofs are inspected on an annual basis, noting current problems, plus progress due to the previous year's repairs. The program's indexes help estimate the change from one year to the next, allowing UMD to allocate funds to low index roofs first. For example, in 1992, a "poor" ranking for the 1960-vintage upper roof of Tweed Hall at UMD was reported. The conditional index for this roof was 42 (on a scale of 1-100). A large area of wet insulation was found on this roof by infrared scanning. The previous index of 68 for this upper roof indicates that a leak developed between the 1991 and 1992 inspections.

Each spring, UMD gets a detailed report and drawing on each roof,



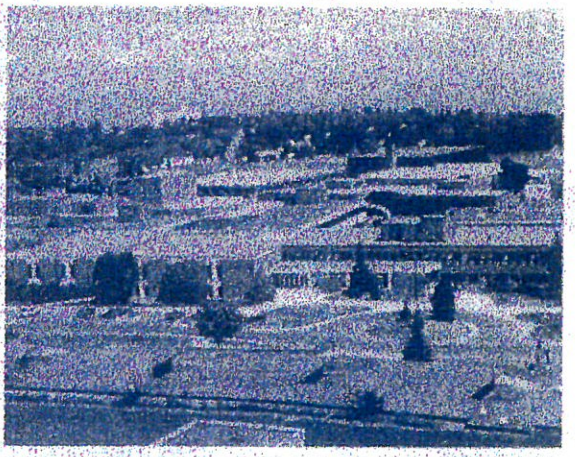
Infrared scanning helped to identify flashing problems as part of the building maintenance program used by the University of Minnesota, Duluth.

plus a five-year roof replacement schedule and cost estimate. The cover letter documents the date, purpose, and scope of the annual roofing review. Further, it introduces the roof replacement schedule and individual roofing observation reports. The individual roof management reports contain four parts: a roof construction/inspection summary, a listing of ROOFER-calculated condition indexes, a narrative on roof conditions and recommended repairs, and a computer-developed drawing of roof components and problems.

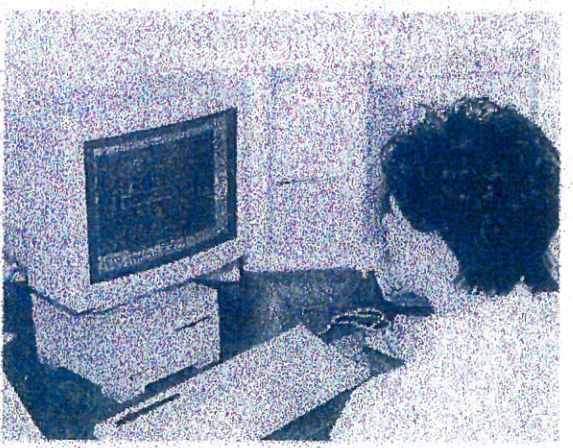
By replacing the worst roofs and repairing others, cost is being spread out over a period of time, allowing UMD to plan and budget for the work. By stressing preventive, as well as emergency repairs, the degeneration curve for functional roofs is being slowed.

Drips into buildings and walkways—and occasional flooding of classrooms—are no longer standard occurrences at UMD. Aggressive roof replacement, aided by the engineering program, will leave all rooftops in good order and save 1.6 million dollars in repair and replacement costs through 2006. Actual savings will be higher, as costs associated with emergency building disruption and cleanup related to roof failure and leakage are not included. With total roof repair expenses cut in half, more repair dollars now go back into the classroom, rather than out the roof. For more information on private use of ROOFER, contact Richard W. Phillips, INSPEC, Inc. at (612) 546-3434. **RSI**

Infrared scan—non-destructive testing to detect the presence of moisture.



University of Minnesota, Duluth where ROOFER program was used successfully on campus buildings.



CADD operator making modifications to plan.