

Maintenance Software Review: The Art of Roofing Condition Inspections

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INTRODUCTION

THE BUILDING ENVELOPE Life Cycle Asset Management project (BELCAM) is a multi-year research activity sponsored by the National Research Council Canada (NRCC) and Public Works and Government Services Canada (PWGSC). The BELCAM project investigates life cycle asset management of the building envelope, but in this first phase of the project it is concentrating on roofing systems as a "proof of concept" domain. The BELCAM objectives are to assist asset managers in optimizing life cycle maintenance expenditures and to help them predict the remaining service life of roofing systems.

One of the deliverables of the BELCAM Project (www.nrc.ca/irc/belcam) is the evaluation of existing software used in roofing maintenance manage-

ment and service life prediction. This is the first of many software evaluation reports. Subsequent versions will follow as more software programs are made available and as the existing packages are enhanced. This paper focuses on four roof inspection packages available in North America and identifies their features and capabilities for approximately 50 pre-selected categories and criteria. It also provides background information on seven other roofing programs. This report does not rate or rank the four packages presented herein, but provides building owners, roofing contractors and roofing consultants with an objective review of systems currently available. The information herein is provided to assist users to locate software tools for decisions about roofing maintenance, to provide data about

the general nature of the available software, and to help building owners, contractors and consultants make decisions about automating data collection, monitoring and retrieval.

NRCC and PWGSC have considerable experience with the use of software tools, as well as the formal evaluation of software products (Vanier, 1985). Unfortunately, there have been few evaluations or comparisons of software in the construction industry (Amistadi, 1995) and only one or two reviews in the roofing industry (Novitski, 1992). It is hoped that this report will encourage others to use software tools in the industry and will act as a catalyst for others to report their findings about capabilities, features and problems with roofing maintenance management software.

Parameters of the review

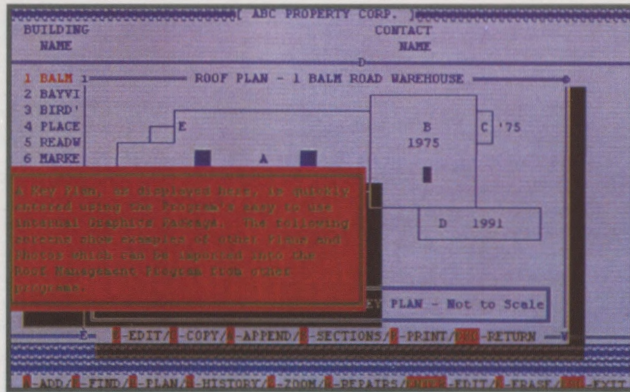
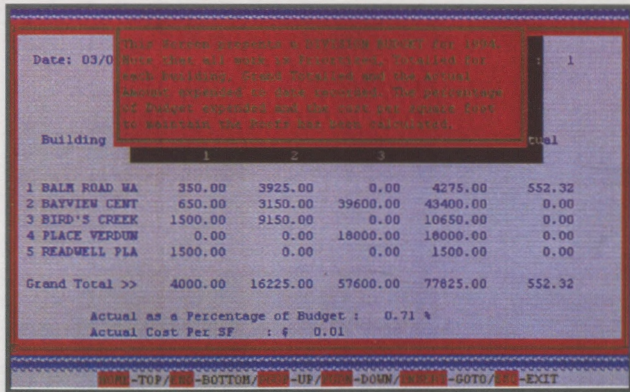
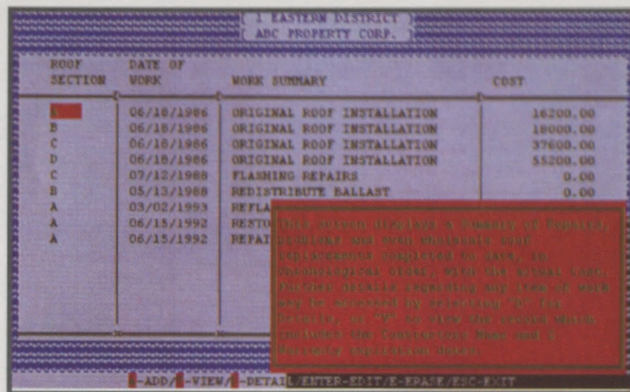
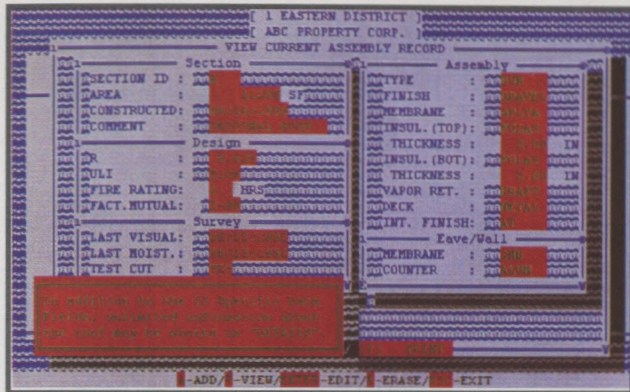
A wide variety of software has been developed for the roofing industry. This includes software tools for design, estimating, repair, sales support, evaluation and service life prediction. It could also include any preventative maintenance, maintenance management or financial information management system that claims to have something to do with roofing, roofing activities, roofing supplies or roofing systems. This type of software is beyond the scope of this report.

This report focuses only on packages dealing with roofing evaluation and service life prediction. Complete evaluations of four commercially available software packages are included, however, background data have been provided to identify points of contacts and general information about proprietary

roofing inspection systems and well-known applications in other roofing domains, such as estimating and design.

Limitations of the review

The report is the first of a series dealing with the evaluation of roofing inspection software. It is not a comprehensive evaluation of ALL the technical and interface features of ALL available software packages, either commercial products or proprietary services. It is an overview of a number of commercial software packages that are well known to the industry, and that are currently available and supported. The report identifies only specific features and capabilities related to asset management and service life prediction, but does not rate or rank these products or their capabilities.



Sample Screen Captures from CAMP

THE REVIEW PROCESS

Software Selection

Selection of the software was made by the authors based on their extensive experience in the roofing industry, from information obtained from knowledgeable contacts in industry, and from data acquired from extensive searching of the Internet and other electronic databases. It was quickly discovered that there is precious little information available about roofing inspection software, and that the most reliable information came from knowledgeable individuals.

Only commercially-available software was evaluated in this report, owing to time, personnel and administrative constraints. It is hoped that some proprietary systems mentioned in this report can be evaluated in subsequent reports.

Four products were selected for a complete evaluation in this report:

- ▼ CAMP - Roofing Management program from CAMP, Inc.
- ▼ REVS - from Roofing EVALuation System by Bruco Enterprises, Inc.
- ▼ ROOFER - from U.S. Army Corps of Engineers, Civil Engineering Research Laboratories
- ▼ ROOFWORKS - from Jim D. Koontz & Associates, Inc.

Software Features and Capabilities

All the software products evaluated in this report were obtained directly from the developer and represent the most

current version of the software. The installations were carried out following the developers' instructions, and the features and capabilities were reviewed based on the software provided, the instructions from the developers, and the user manuals provided by the developer.

It must be emphatically noted that this review was initiated and designed to meet the goals of the BELCAM project; therefore, the evaluation, or even identification, of "interesting" features of specific products is omitted because these are outside the scope of this review.

Reviewer Selection

The reviewers (a.k.a. authors) are experienced construction engineers with considerable experience in the roofing industry. The reviewers all have extensive experience with software tools and considerable "hands-on" experience with at least one of the roofing packages evaluated in this report.

As one goal of this review is to enumerate the features and capabilities of a limited number of software products, no attempt was made in this process to represent users from any specific sector of the industry, level of experience, or classification of profession. In fact, the reviewers are all multi-disciplinarians; they have a collection of degrees in architecture, building engineering, or civil engineering; they are practicing as either researchers, educators, asset managers or roofing consultants, and all have been up on a roof to perform a roofing inspection.

RoofWorks
Renov Cost Report - Last 5 Years (All Projects)

Property Code	Building	Size (Sq Ft)	1997	1996	1995	1994	1993	1992
1-1-2	Example Bld	10,000			\$35,000			
4-1-2	Vail Retail	10,000				\$35,000		
6-1-1	Main Ward	7,000					\$28,500	
3		27,000	\$0	\$0	\$35,000	\$35,000	\$28,500	\$0
Total Size		0	0	10,000	10,000	7,000	0	0
Total Cost per Square Foot				\$3.50	\$3.50	\$4.07		

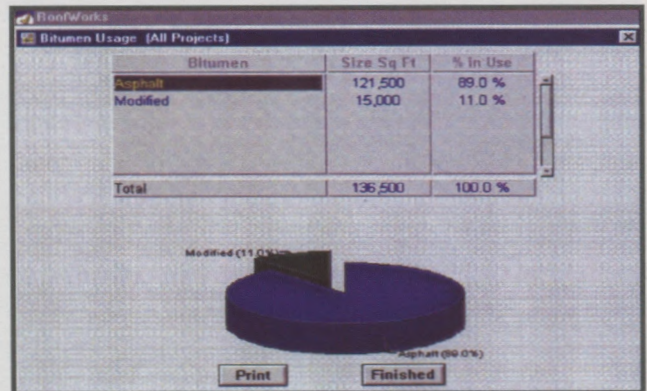
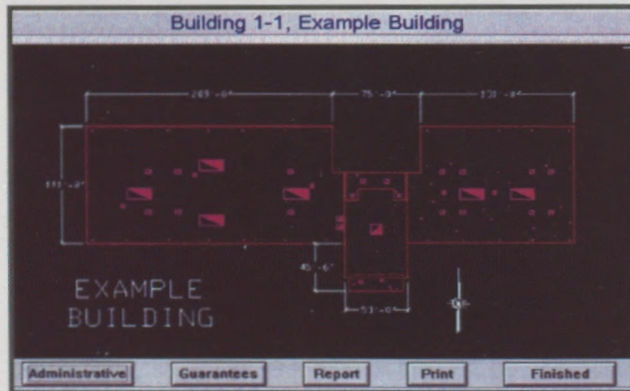
Print Finished

RoofWorks
Ratings by System and Age (All Projects)

Roof System	Age of Roof (Years)					Average
	0 - 5	6 - 10	11 - 15	16 - 20	21+	
Built Up Roof	80		70			63
Metal	100				80	70
Modified BUR				80		46
Polyurethane Foam		25				25
Single Ply		80				50
Average	80	27	70	80	77	46

Values shown are Roof Condition Index ratings

Print Finished



Sample Screen Captures from RoofWorks

Background Software Information

Evaluated Software

Roof EVALuation System (REVS)

Contact: C. Bruce Cotton, Bruco Enterprises Inc. (491659),
P.O. Box 2556, Spring, TX 77383-2556
Tel: (281) 353-9541 Fax: (281) 353-3845
E-mail: bruco@flash.net Web Site: www.flash.net/~bruco

CAMP — Roof Management Program

Contact: Michael Reynolds, Computer Assisted
Management Programs, Inc., 36 Elynhill Drive, North York,
ON, M2R 1C6
Tel/Fax: (416) 222-6105

ROOFER

Developed by: U.S. Army Construction Engineering,
Research Laboratories, CECER-FL-M, P.O. Box 9005,
Champaign, IL 61826-9005
Supported by: University of Illinois at Urbana-Champaign,
Technical Support Center
Contact: Lynn Brownfield, ROOFER Technical Support
Center, University of Illinois at Urbana-Champaign, 302 E.
John Street, Suite 202, Champaign, IL 61820
Tel: (217) 333-2882 Fax: (217) 333-9561
E-mail: padilla@ux1.cso.uiuc.edu
Web site: www.conted.ceps.uiuc.edu/support_center

RoofWorks

Contact: Jim D. Koontz, Jim D. Koontz & Associates, Inc.,
P.O. Box 1054, Hobbs, NM 88240
Tel: (505) 392-7676 Fax: (505) 392-7602
E-mail: in process of changing; please check web site
Web Site: http://www.jdkoontz.com

Software NOT evaluated

In the authors' quest for locating available software in the roofing domain, it was quickly discovered that good information about roofing software is hard to find and these leads are difficult to track down. In some cases, for example, off-shore products were tracked down but were found to be design or estimating applications. In order to save others from having to duplicate our investigative work, the authors provide background data about products or services that are currently available but do not fall into the scope of the evaluation.

If others are aware of additional roofing inspection products or services, they are asked to contact Dana Vanier by e-mail at dana.vanier@nrc.ca or by telephone at (613) 993-9699 (Fax 954-5984).

The following software tools were not evaluated in this report owing to time restraints, because of the proprietary nature of the product, or because the software was outside of the established scope of the report. The information provided herein was received from the developers, web pages or printed literature. In the case of TRIM, a full evaluation was

Building 7118 Section A

General Structure Insulation Membrane Flashing Remarks Pictures

Section ID: A

Section Name: COLD STORAGE

Occupancy: COLD STORAGE

Roof Area: 6523 Inventory Date: 03/01/1995

Date Constructed: 01/01/1988 Date Last Replaced: / /

Perimeter: Parapet: 126 Roof Access: EXTERNAL LADDER: Temporary

Roof Edge: 112 Adjacent Sections: B

Expansion Joint: 98

Area Divider: 0

Adjacent Wall: 0

Other: 0

Building 7118 Section A Visual 01/04/92

Inspection Date: 04/01/1992

Perimeter Flashing: 326 Curb Flashing: 178

Inspection Data

ID	Distress	Severity	Defect	Quantity
1	BF	L	1	3
2	BF	H	1	2
3	BF	H	1	1
4	BF	H	1	2
5	BF	H	1	1
6	BF	L	1	8
7	BF	H	1	1

Remarks:

Last Modified: October 03:47 PM

Date: OCT01/1997 RCI Report Page 1

Installation: 99999 - Fort XXX

Building ID/Name Category	Sec ID/Slope/Membrane Insulation Type(s) Deck Type	Set Area (SqFt)	Last Cons Year	Last Insp Year	MC/FC/MCI	RCI
7118 COLD STORAGE FACILITY Supply Facilities	C 1/8 BUR: Asphalt WOOD FIBERBOARD CONCRETE STD: Cast-In-Place	7861	---	1992	96/60/100	71
	A 1/4 BUR: Asphalt NONE WOOD BOARDS	6523	1988	1992	95/63/---	67
	B 1/8 BUR: Asphalt NONE CONCRETE STD: Cast-In-Place	7979	1941	1992	96/91/---	92

Totals: Buildings = 1 Sections = 3 Area = 22363

10 Year Budget Plan

10 Year Program for Built-Up & Single-Ply Roofs (Costs in Thousands)

Installation: 99999 - Fort XXX Buildings: 1 Sections: 3 Total Area: 22363

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Totals
Immediate Repairs											
Major Repair Projects	\$1	\$1	\$1	\$1							\$4
Replacement Projects	\$41									\$34	\$75
Intermediate M&R		\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$9
Insulation Inspection											
Visual Inspections	\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$10
Totals	\$43	\$3	\$3	\$3	\$2	\$2	\$2	\$2	\$2	\$36	\$2

Buttons: Print Recalculate Cancel Help

Sample Screen Captures from ROOFER

attempted, but the results are not presented owing to the proprietary nature of the software and the fact that only a demonstration version, and not a fully-operational application, was provided. It is hoped that in the publication of subsequent reports that a few of these software packages can be included in the evaluation.

Proprietary Systems

Bradford Management System

Contact: Dane Bradford, Bradford Roofing Management, P.O. Box 20502, Billings, MT 59104
Tel: (406) 252-2278

Application: Proprietary software used for roofing management. The developer provides copies of the software to its roofing clients in order for them to maintain the data on their own roofs. Bradford's clients include many large industrial and governmental agencies.

Facefacts (RAMP)

Contact: J. J. (Jim) Watson, Building Technology Associates, Inc., 21850 Greenfield Road, Oak Park, MI, 48237
Tel: (810) 967-4630 Fax: (810) 967-4640

Application: Economic evaluations of roof service life. The developer provides copies of the software to their roofing clients for them to maintain the data on their own roofs. Also does asset management for other applications. Facefacts is used by Building Technology Associates, Inc. to inspect roofs of industrial and governmental clients and to assist

them in evaluating the service life of roofing systems, based on sophisticated economic and technical models.

ROOFA - ROOFing Alberta Management System, Alberta Public Works

Contact: Barrie Dennis, Alberta Public Works, 3rd Floor, 6950 100th Street, Edmonton, AB T6H 5V7
Tel: (403) 422-7420 Fax: (403) 422-7479
E-mail: barrie.dennis@gov.ab.ca

Application: This is a DOS application written by Alberta Public Works (APW) that is based on the original ROOFER package from the Construction Engineering Research Laboratories. It is supported and updated by APW.

RoofMAP

Contact: Paul Mitchell, PSI, 6200 SOM Center Road, Suite C23, Solon, OH 44139
Tel: (440) 498-1234 Fax: 440 498-1236
E-mail: pmmitchell@compuserve.com
Web site: <http://www.psiusa.com/services/randp.htm>

Application: Proprietary software used for roofing management. The developer provides copies of the software to its roofing clients for them to maintain the data on their own roofs. Company is currently replacing the original DOS software with a completely redesigned Windows version.

TRIM

Contact: Joseph (Joe) H. Dandelé, Tremco, Roofing Division, 140 Graden Street, Gananoque, ON K7G 1H9

Roof Identification:

Agencies: Facilities: 1 of 3 Agencies

Site ID: 001.01 Site Name: Houston, TX 1 of 2 Agency Sites

Building ID: 001.01.02 Bldg. Name: Test 1 of 2 Buildings on Site

Roof ID: 001.01.02.01 Roof Name: Main Roof 1 Roof on Building

Budget Projections Cost Estimates Work Orders

General Roof Information:

Build Date: _____ EDL: _____ Age: _____ Years Area: _____ sq. ft. RCI: _____

Membrane: _____ Original Unit Cost: _____

Insulation Type: _____ Original Roof Cost: _____

Present Year Repair Cost Projections:

Repair Type	Unit Cost	Total Cost
Emergency		
Remedial		
Repair Cost Total		\$0.00

Note: There must be a roof area quantity number for calculation. The program will enter the Total cost.

Five Year Budget Projections:

Time Frame	Action Code*	Unit Cost	Total Cost
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			
Five Year Budget Total			\$0.00

*Action Code Descriptions:
 ER = Emergency Repairs RP = Remedial Repairs
 RR = Roof Replacement PM = Preventative Maintenance

Roof Identification:

Agencies: Facilities: 1 of 3 Agencies

Site ID: 001.01 Site Name: Houston, TX 1 of 2 Agency Sites

Building ID: 001.01.02 Bldg. Name: Test 1 of 2 Buildings on Site

Roof ID: 001.01.02.01 Roof Name: Main Roof 1 Roof Entered

Edge: Parapet Wall Adjoining Wall Drains Vent Pipes Pitch Pans Repairs

Edge Descriptions: (No Edges Entered)

Edge ID: _____ Length (FT): _____ Size (IN): _____

Edge Type: _____ Description: _____

Flashing Type: _____ Description: _____

Condition Assessment Comments:

Flashing: _____

Physical Condition: _____

Other: _____

Roof Identification:

Agencies: Facilities: 1 of 3 Agencies

Site ID: 001.01 Site Name: Houston, TX 1 of 2 Agency Sites

Building ID: 001.01.02 Bldg. Name: Test 1 of 2 Buildings on Site

Roof ID: 001.01.02.01 Roof Name: Main Roof 1 Roof Entered

Fans/Vents Curbed HVAC Non-Curbed HVAC Devices Accessories Repairs

Fans/Vents Descriptions: (No Fans/Vents Entered)

Equipment ID: _____ Number of Units: _____

Unit Length (FT): _____ Unit Width (FT): _____ Flashing Height (FT): _____

Equipment Type: _____ Description: _____

Flashing Type: _____ Description: _____

Counter-Flashing Type: _____ Description: _____

Condition Assessment Comments:

Base Flashing: _____

Counter Flashing: _____

Other: _____

Roof Identification:

Agencies: Facilities: 1 of 3 Agencies

Site ID: 001.01 Site Name: Houston, TX 1 of 2 Agency Sites

Building ID: 001.01.02 Bldg. Name: Test 1 of 2 Buildings on Site

Roof ID: 001.01.02.01 Roof Name: Main Roof 1 Roof Entered

Roof Description: Roof Assembly Surface Membrane Insulation Repairs

Date Recorded: _____ Area: _____ Elevation (FT): _____ Slope (Inches/FT): _____

Previous Roof: _____ Current Roof Built: _____ Priority: _____

Roof Access: _____

Under Roof Use: _____

Condition:

Estimated Design Life (EDL) (Years): _____ Current Roof Age: _____ Roof Condition Index (RCI): _____

Estimated Remaining Service Life (ERSL) (Years): _____

Asbestos Conditions:

Asbestos Testing Date: _____ Membrane has Asbestos: _____ Flashing has Asbestos: _____

Asbestos Comments: _____

Sample Screen Captures from REVS

Tel: (613) 769-3285 Fax: (613) 382-8357

Application: TRIM is a portfolio management tool provided by Tremco to do roofing inspection. The software received by the reviewers is a demonstration copy which does not allow the user to add or modify data. TRIM is provided by Tremco as part of contracted inspection services (membrane, insulation, flashing, etc.). TRIM runs on FoxPRO under Windows 3.1. and has an interesting feature that combines a glossary of roofing and defect terms with graphics.

Other Roofing Systems

PROS, Personalized Roofing Operations System

Contact: Gregg Steinbrenner, Texstar Computer Systems, 1111 South Main Street, Suite A, Duncanville, TX 75137

Tel: (972) 298-9596 Fax: (972) 298-6166

Web Site: www.roofingnet.com/PROS.HTML

Application: PROS is positioned as a sales support tool for roofing contractors and roofing product sales staff. It is also

a roofing replacement estimating and quantity take-off package. PROS also handles written estimates, work orders, purchase orders, accounts receivable, and has a report generator. It runs on DOS, Win95 and WinNT.

RoofMaster

Contact: Rowan Morgan, Rowan Morgan Computer, New Zealand

Tel: 64 (09) 268 2326

E-mail: rcl@ihug.co.nz

Application: Estimating software, along with Buildmaster, which has been selling for about 12 years. It is also a quantity calculation program. A residential quantity survey done manually would take most estimators about 3 to 4 hours, with Buildmaster software it should take only 30 to 40 minutes and that includes the full pricing along with quantities. It is currently available as a DOS product but the developers hope to have a Windows version soon.

Features and Capabilities of Selected Commercial Products

VERSION	Roof Management Program	REVS System 2000	MicroRoofer	RoofWorks 2nd Edition
Tested	Version 3.09e	Version 7.0	Version 1.3	Version 2.02
USERS				
Inspection	*	*	*	*
Maintenance	*	*	*	*
Other		Evaluation	Evaluation	Estimating, Costs
HARDWARE MIN. (tested)				
RAM	400 KB (486)	8 Mb (40Mb)	8 Mb (32)	16 Mb (40)
Platform	IBM PC and up (486)	386+ (Pentium)	386DX-33Mhz (P200MMX)	486+ (Pentium)
Operating system	DOS or DOS box (DOS)	95, NT 16/32 (95)	3.1, NT, 95 (95)	Win 3.1, 95 (95)
Monitor	640x480 (VGA req'd for display of roof plans)	640x480 or 800x600 (800x600)		640x480 (800x600)
Color		256 colors	256 colors	256 colors
Mouse		Mandatory	Mandatory	Mandatory
Disk supplied	1 Floppy	5 floppies for base program (CD ROM in near future)	2 Floppies	6 Floppies
Disk space (application-data)	1 Mb to 5 Mb	5 MB - 15 Mb	10 Mb	16 Mb - image-dependent
Other				Scanner
SOFTWARE				
Type of software shell	Flat file	Relational database shell	Relational database shell	Relational database shell
Shell (if applicable)		Paradox 7 Runtime	Access 1.X	Paradox 4.5 Runtime
Software interface (Graphical User Interface)	DOS Menus	GUI	GUI	GUI
Architecture (Client/server, mobile units)	Networkable, multi-user, records in use locked (not tested)	Networkable, multi-user, records in use locked (not tested)	Networkable, mobile edition available separately	Networkable, multi-user, only one user at a time (not tested)
Installation	Disk copying with installer	Disk copying with installer	Disk copying with installer	Disk copying with installer
Future Enhancements	Will be migrating to Windows	Program will be developed using Borland Delphi as stand-alone executable		V3.0 in Apr. '98, more reports, searching, NT
Other			Pen-based mobile	
PRICE	Approx. \$1000 CDN	\$500+ U.S. for base unit, \$800 for full version	\$375 U.S.	\$500 U.S. custom programming
TECHNICAL FEATURES				
Organizational structure	Client has divisions, buildings, roofs	Client has site, buildings, roofs, equipment, components	Multi-facility with many roof areas/facility	Client has properties, building, roofs
Max. # of sections/bldgs.	999	Unlimited	Unlimited	Unlimited
Creating components	Add, Modify, Delete	Add, Modify, Delete	Add, Modify, Delete	Add, Modify, Delete
Tracks roof leaks		Repairs are linked to all roofs and components	*	* with charts
Maint./repair tracking	*	*	Limited	*
Costing - Repair	Input costs & tracking	*	*	* with future projections
Costing - Maintenance	Input costs & tracking	*	*	* financial analysis
ADDITIONAL FEATURES				
Budgeting	5-year period	*	*	*
Library of components	*	*	Defaults and Categories	*
Charts		*	*	* for most reports
Roofing Condition Index (RCI)		Ratings 1-7 for membrane & insulation form the RCI in conjunction with user input of age and design life	Elaborate - based on years of empirical data. RCI based on deduct values and related to age and service life	RCI is based on user assigned 0-100. A subjective rating can also be entered; also red, yellow, green coding or remaining life
Condition assessment surveys		For all roof components, flashings, membrane, insulation, parapets, etc.	There are flashing, membrane, insulation condition indexes	General roofing data can be entered
Other	Unlimited amount of detail can be provided		Pictures, warranty information	Data on manufacturer, consultant, contractor, etc.

Features and Capabilities of Selected Commercial Products (cont.)

VERSION	Roof Management Program	REVS System 2000	MicroRoofer	RoofWorks 2nd Edition
LINKS TO OTHER APPLICATIONS	Stand-alone	Stand-alone	Stand-alone	Stand-alone
Financial information	Internal budgeting	Internal budgeting	Internal	Internal - projections
Preventative maintenance		Internal	Internal	Internal
Maintenance management	Internal	Internal	Limited Internal	Internal
Work orders		Internal	Limited Internal	Reports
Geographical Information Systems (GIS)			Prototypes have been developed	
Photos		*		*
CADD import	Import of Autocad files for display only (not tested)	Slick!(AutoCad reader).dwg, .gif or any scanned image	Can draw sketches	Roof drawings are integral to data entry. Photos tied to drawing location. AutoCAD, scanned images possible
CADD export		Redline printing		Printing, faxing
Other	Roof plans - PCX format			
EXPORT FEATURES		Custom work	Export to mobile Roofer	Custom work
Tab delimited		Paradox export	*	Paradox export
Other formats		Paradox export		Paradox export
SECURITY				
Passwords	*	*	*	*
Backup	*			Detailed instructions
Other	*			Data export to spreadsheets
REPORTS		(Not available for evaluation)		
Internal format		Printouts of screen output forms & reports	Printout of forms and reports	Printouts of screen output forms and reports
Data output in tab del. form	Standard & ad-hoc formats	Paradox engine		Paradox engine
Other	On-the-fly user comments may be added			Roofing warranty can be scanned for reports
HELP (On-line, off-line, balloon help, manuals)	Manual - 43 pages, includes screen captures	Manual - 50 pages, includes screen captures	4 manual	Manual- 120 pages, includes screen captures
Contents	*	On-line for Paradox		On-line for RoofWorks
How to use help	rudimentary	For Paradox		*
Context-sensitive help		For Paradox		For RoofWorks
Other		Phone support	Phone support & training through RIEI, UIUC. Price includes 1 yr. support. Renewal of sub. is \$300 US & includes all upgrades	1-800 service, one hour free for subscribers
NOTES (restrictions)		Only U.S. states		
		No extensions, yet	Recording a roof replacement, ROOFER deletes historical data	12 numeric characters for phones, etc.
	Imperial or SI (no conversion)	Only Imperial Units	Only Imperial Units	Only Imperial Units

Software Evaluation

The sample "screen captures" shown herein were selected by the authors to represent the software and demonstrate the graphical and technical capabilities of the product. They should be examined for content and presentation style, as they provide additional insight into the software capabilities.

The tables on pages 16 and 17 detail the features and capabilities of commercial products. These criteria were established prior to the evaluation process and were only slightly modified during the evaluation process. Whenever possible, explanations are provided by the reviewers. An asterisk (*) in the table indicates that the software provides this functionality. Because some of the review categories are

quite general, it may be difficult for the reader to determine the meaning of an asterisk in "Tracks Roof Leaks," for example. To the reviewers it means that the software has some way of recording when and where leaks occurred; the asterisk does not indicate that the product did it effectively or is able to locate that information easily.

Conclusion

It is encouraging to see such a fine selection of software products for roofing inspection. In general, the products are professionally designed, marketed, supplied and supported. All of the products were easy to install and stable in opera-

tion. Although most of the products have some very minor flaws (bugs), none of these prevented the reviewers (or users in general) from using the products as designed and represented. In addition, on a personal note, all of the product developers were friendly, helpful, informative and knowledgeable (of both their product and the roofing industry).

As stated earlier, it is not the intention of this report to rate or rank the products. However, the authors can state that none of the developers is misrepresenting his products in literature, and that the evaluations provided in this report are a fair representation of the listed software features and capabilities. Of course, there are features and capabilities of products that are not discussed or identified here, much to the disappointment of the developers; this is because these features are outside of the scope of the review.

It must be remembered that all of these products are moving targets, as they are all constantly being updated to enhance their capabilities and to meet ever-changing hardware and software requirements and opportunities. This review, therefore, is a snapshot of features and capabilities of these products as of January 1998.

All of the software products have a niche market. As can be gleaned from Appendix A, CAMP is an entry level system with minimal hardware requirements; REVS is a comprehensive roofing assessment, recording and reporting database; ROOFER is a sophisticated service life prediction tool, and RoofWork's strengths are in its data collection, financial modeling and portfolio analysis. This does not mean that the

above products do not possess any other functions, nor does it mean that the above products do not possess functionality attributed to their competitors; it simply means that, if potential users fall into one of these identified niches they should seriously investigate and evaluate that niche product. They should also obtain information about the others.

Acknowledgments

The authors acknowledge the support of the BELCAM project and the members of the BELCAM consortium. We also wish to thank the developers of the products for their evaluation software, their information and technical support, and for their cooperation in participating in this evaluation. Thank you to the staff at the other companies identified in this report for their time and information, and to Bruce Holman for contact names and information provided.

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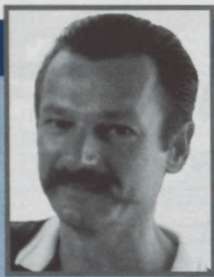
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Brian Kyle, of Public Works and Government Services Canada (PWGSC) Research, Development and Demonstration Directorate, has been involved with construction, maintenance and asset management issues for the past 15 years. As a senior research engineer specializing in reliability and risk analysis, Brian has been investigating solutions to the construction industry's problems related to service life prediction and product reliability—specifically, the development of analytical tools and databases for performance modeling of building components and systems.

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