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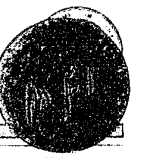

National Institute of Justice // Technology Assessment

Evaluating Investments in Law Enforcement Equipment: An Annotated Bibliography

NIJ Report 200-89

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The Technology Assessment Program is sponsored by the Office of Development, Testing, and Dissemination of the National Institute of Justice (NIJ), U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which created NIJ and directed it to encourage research and development to improve the criminal justice system and to disseminate the results to Federal, State, and local agencies.

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James K. Stewart, Director
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U.S. Department of Justice
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Evaluating Investments in Law Enforcement Equipment: An Annotated Bibliography

NIJ Report 900-89

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ACKNOWLEDGMENTS

This report was prepared by the Law Enforcement Standards Laboratory (LESL) of the National Institute of Standards and Technology (NIST) under the direction of Lawrence K. Eliason, Chief of LESL. The authors wish to thank Diane Cunningham of the Information Resources and Services Division of NIST for technical assistance in conducting the computerized literature search. Also deserving thanks are Marshall Treado of LESL and Stan Winkler of the Computer Systems and Communications Division, NIST, for providing useful comments during the review process.

FOREWORD

The Law Enforcement Standards Laboratory (LESL) of the National Institute of Standards and Technology (NIST) furnishes technical support to the National Institute of Justice (NIJ) program to strengthen law enforcement and criminal justice in the United States. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

LESL is: 1) Subjecting existing equipment to laboratory testing and evaluation and 2) conducting research leading to the development of several series of documents, including national voluntary equipment standards, user guides, and technical reports.

This document covers research on law enforcement equipment conducted by LESL under the sponsorship of NIJ. Additional reports as well as other documents are being issued under the LESL program in the areas of protective equipment, communications equipment, security systems, weapons, emergency equipment, investigative aids, vehicles, and clothing.

Technical comments and suggestions concerning this report are invited from all interested parties. They may be addressed to the Law Enforcement Standards Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899.

Lester D. Shubin, Director
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EVALUATING INVESTMENTS IN LAW ENFORCEMENT EQUIPMENT: AN ANNOTATED BIBLIOGRAPHY

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This is a guide to the literature and an annotated bibliography on evaluating investments in law enforcement equipment. Each entry includes the complete citation, an abstract, and in most cases, key words and information on availability. The search strategy is documented and a subject index and lists of references by author and by subject area are included. The main categories are evaluation methods and law enforcement equipment (including police vehicles, police armament, Automatic Vehicle Monitoring (AVM) systems, and police information systems). All 46 references to this literature address economic issues such as costs or benefits and are relevant to current decisions on procuring law enforcement equipment. The search focused on three primary sources: 1) the NCJRS (National Criminal Justice Reference Service) database; 2) the Criminal Justice Periodical Index (CJPI); and 3) the NTIS (National Technical Information Service) database.

Key words: ammunition; benefit-cost analysis; cost analysis; economic analysis; law enforcement equipment; operations research; police information systems; police vehicles; police weapons; protective equipment.

1. INTRODUCTION

This report is a guide to the literature on evaluating investments in law enforcement equipment. It is an annotated bibliography of 46 references to this literature. Each entry contains the complete citation, an abstract, and in most cases, key words and information on availability of the publication.

Extensive literature exists on economic methods of evaluating investments in equipment in general. Some of this literature addresses economic methods of evaluating law enforcement equipment. Thus the two main categories in this bibliography are: 1) evaluation methods; and 2) law enforcement equipment. The evaluation methods category contains the most recent widely used works on evaluating investments in general. The methods discussed are not designed specifically to evaluate law enforcement equipment, but they can be applied to such investments. The law enforcement equipment category includes publications related to the economic evaluation of equipment likely to be purchased by police departments. This category is divided into subcategories for different types of law enforcement equipment. The subcategory of general law enforcement equipment includes publications about more than one type of equipment or publications not specific to any one particular type of equipment. Other subcategories are: 1) police vehicles, including automobiles and aircraft; 2) police armament, including weapons and protective equipment; 3) Automatic Vehicle Monitoring (AVM) systems; and 4) police information systems, including computer hardware, software, and communications equipment.

To be included in this report a publication must satisfy two necessary conditions. It must address economic issues such as costs or benefits and be relevant to current decisions to procure law enforcement equipment. Older publications that describe enduring methods and approaches to evaluating equipment are included, while those that concentrate on the details of possibly obsolete equipment are not.

The literature search was begun by exploring three sources available through a computerized literature searching service, and one microcomputer-based catalog system. The approach followed in all of the computer file searches involved combining key words to retrieve publications relevant to the topic. The basic strategy used was to combine two groups of key words: one group relating to economic methods for evaluating investments; and the other group relating to the subject matter of law enforcement equipment. Any publication found to have at least one of the key words in the economic methods group and at least one of the key words in the law enforcement equipment group was selected for further scrutiny. If, upon reading its abstract, the publication satisfied both necessary conditions, it was included in the bibliography. For the few cases in which the abstract left some doubt, the publication was obtained before making the final selection decision.

The Information Resources and Services Division of the National Institute of Standards and Technology has available a computerized literature searching service, called DIALOG Information Retrieval Service.

Three of the most promising data files accessible through this service were selected to be searched. The following descriptions of these data files are based on the most recent information from the DIALOG catalog.

The National Criminal Justice Reference Service (NCJRS) database represents the document collection called NCJRS, the national and international clearinghouse of practical and theoretical information about criminal justice and law enforcement established by the U.S. Congress. Included are published and unpublished research reports, program descriptions and evaluations, books, dissertations, theoretical and empirical studies, handbooks and standards, journal articles, and audiovisual materials. The publications cover the period from 1972 to the present. Indexing of the collection is based on hierarchical subject terms from the "National Criminal Justice Thesaurus."

The Criminal Justice Periodical Index (CJPI), produced by University Microfilms International, is a reference guide to leading criminal justice journals in the areas of criminology, criminal law, family law, security systems, corrections, and police. The database provides access to all the information in the printed index of the same name. Indexing consistency is maintained throughout by the use of a controlled thesaurus. CJPI contains publications from 1975 to the present.

The National Technical Information Service (NTIS) database is produced by the National Technical Information Service of the U.S. Department of Commerce, and is a central source for the public sale and dissemination of U.S. Government-sponsored research. The database consists of unclassified Government-sponsored research, development, and engineering reports, as well as other analyses prepared by Government agencies, their contractors, or grantees, covering from 1964 to the present. Included in this coverage are federally generated machine-readable data files and software, U.S. Government inventions available for licensing, federally generated translations, and reports prepared by foreign governments and exchanged with Federal agencies. An increasing proportion of the database consists of unpublished material originating outside the United States. The NTIS database corresponds to several printed publications including "Government Reports Announcements & Index" (GRA&I) and 26 abstract newsletters such as "Government Inventions for Licensing." Most NTIS records include an indicative or informative abstract.

These three computer resources were searched using the same two sets of key words.[1] These key words are found in table 1. The table also indicates the number of selected references which contain each of the key words. Another database searched was the Cost Analysis Resources Reference System (CARRS), a microcomputer-based catalog system containing descriptions of cost analysis models and databases covering the period from 1975 to the present. CARRS is the result of an initiative by the U.S. Air Force's Air Force Cost Center to build an automated catalog of cost analysis resources. Information in the catalog is collected from Federal, academic, and commercial organizations.[2] Key words similar to those used in DIALOG were used here. Some of the key words used were software, helicopter, acquisition costs and cost data.

TABLE 1. *Key words used in DIALOG Information Retrieval Service literature search and the number of publications selected*

Economic methods		*Law enforcement equipment*	
Key words	*Publications selected*	*Key words*	*Publications selected*
benefit-cost analysis	16	ammunition	4
cost analysis	8	handgun	0
economic analysis	2	police car	0
financial management	1	police equipment	11
operations research	4	police information systems	5
user evaluation	0	police weapons	1
		protective equipment	1
		vehicle equipment	1

[1] The initial search of the CJPI data file with the key words from table 1 yielded no references. The list of economic methods key words was then broadened and seven references were identified. None of these, however, met the two necessary conditions defined above.

[2] Air Force Cost Center, U.S. Air Force, *Cost Analysis Resources Reference System (CARRS) User's Manual*, Version 1.0, February 1988.

The computer file searches yielded most of the entries to the main category dealing with law enforcement equipment. For the other main category, economic evaluation methods, resources available to the Applied Economics Group (AEG) were explored. The AEG maintains a library of basic texts and serial publications on engineering economics and benefit-cost analysis. In addition, a number of publications by AEG staff present economic methods applicable to investments in law enforcement equipment. One AEG publication, an annotated bibliography entitled *Economics Applied to Standards: A Guide to the Literature*, yielded several entries from its section "General Methods of Economic Evaluation." Another source is the set of standard methods for economic evaluations of buildings developed by the American Society for Testing and Materials (ASTM) Subcommittee E06.81 on Building Economics. These standards are designed for economic evaluation of buildings, but are applicable to a broad range of areas, including equipment acquisition.

For each of the four computer files searched, table 2 gives the number of publications found initially from combining the relevant key words, and then the number finally selected from these for inclusion in this bibliography. The table also shows the number of publications selected from other sources. Table 3 gives the number of selected publications in each of the categories.

TABLE 2. *Publications identified and selected by source*

Source[a]	*Identified*	*Selected*
NCJRS	66	22
CJPI	0	0
NTIS	181	4
CARRS	14	2
Other	18	18
Total	279	46

[a] NCJRS = National Criminal Justice Reference Service;
CJPI = Criminal Justice Periodical Index;
NTIS = National Technical Information Service;
CARRS = Cost Analysis Resources Reference System.

TABLE 3. *Publications selected by subject category*

	Category	*Selected*
2.1	Evaluation Methods	18
2.2	Law Enforcement Equipment	
2.2.1	General	3
2.2.2	Vehicles	
2.2.2.1	Automobiles	5
2.2.2.2	Aircraft	4
2.2.3	Armament	3
2.2.4	Automatic Vehicle Monitoring (AVM) Systems	6
2.2.5	Information Systems	7
	Total	46

2. ANNOTATED BIBLIOGRAPHY

2.1 Evaluation Methods

American Society for Testing and Materials, *Standard Guide for Selecting Economic Methods for Evaluating Investments in Buildings and Building Systems*, Report No. E 1185-87 (Philadelphia, PA: 1987), 5 pp.

Availability: American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

This guide identifies types of building design and building system decisions that require economic analysis and recommends American Society for Testing and Materials (ASTM) practices, adjuncts, and computer programs that may be used to implement the appropriate economic methods for each decision type. This guide can be used to: 1) identify types of building design and system decisions that require economic analysis; 2) match the technically appropriate economic method with the decisions; and 3) locate the methods in the ASTM practices and adjuncts. The guide identifies features and limitations of the methods that might influence choices under varying conditions.

American Society for Testing and Materials, *Standard Practice for Measuring Benefit-to-Cost and Savings-to-Investment Ratios for Buildings and Building Systems*, Report No. E 964-83 (Philadelphia, PA: 1983), 5 pp.

Availability: American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

This ASTM practice establishes a procedure for evaluating the benefit-to-cost ratio (BCR) and the savings-to-investment ratio (SIR) of buildings and building systems. The BCR and a variation thereof, the SIR, are part of a family of economic evaluation methods that provide measures of economic performance of an investment over some period of time. The BCR and SIR are numerical ratios that indicate the economic value of a project by the size of the ratio. The larger the ratio for any given project, the more the dollar benefits or savings exceed costs. The BCR is used when the focus is on positive benefits, such as revenues, relative to project costs. The SIR, a variation of the BCR, is used when the focus is on project savings (that is, cost reductions) relative to project costs.

American Society for Testing and Materials, *Standard Practice for Measuring Internal Rates of Return for Investments in Buildings and Building Systems*, Report No. E 1057-85 (Philadelphia, PA: 1985), 11 pp.

Availability: American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

This ASTM practice established a procedure for evaluating the internal rate of return (IRR) of buildings and building systems. The internal rate-of-return method is part of a family of economic evaluation methods that provide measures of economic performance of an investment over some period of time. The IRR provides the compound rate of interest that equates the stream of dollar benefits or savings to dollar costs over some defined study period. If that calculated rate of interest is greater than the investor's minimum acceptable rate of return (MARR), the investment is considered economically attractive. The IRR is used to determine whether a given project is cost effective, to compare the relative cost effectiveness of different purpose projects competing for a limited budget, and, when calculated on incremental changes in benefits and costs, to evaluate which size or design for a given purpose is most cost effective.

American Society for Testing and Materials, *Standard Practice for Measuring Life-Cycle Costs of Buildings and Building Systems*, Report No. E 917-83 (Philadelphia, PA: 1983), 43 pp.

Availability: American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

This ASTM practice establishes a procedure for evaluating the life-cycle costs (LCC) of buildings and building systems. The LCC method is one of several methods of economic evaluation that provide a measure of economic performance of an investment over some period of time extending into the future. The LCC method sums, in either present-value or annual-value dollars, all relevant costs associated with an investment or project during an appropriate time period. The result of applying the LCC method is an economic evaluation that encompasses the net effect, over time, of designing, purchasing, leasing, constructing, installing, maintaining, operating, repairing, replacing, and disposing of buildings or building systems. It is particularly suitable for analyzing investments whose major benefits are future cost reductions, such as reductions in future energy consumption from conservation projects. It can be used to identify cost-effective projects and to design and size individual projects.

American Society for Testing and Materials, *Standard Practice for Measuring Net Benefits for Investments in Buildings and Building Systems*, Report No. E 1074-85 (Philadelphia, PA: 1985), 4 pp.

Availability: American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

This ASTM practice establishes a procedure for evaluating the net benefits (NB) of buildings and building systems. The NB method is part of a family of economic evaluation methods that provide measures of economic performance of an investment over some period of time. The NB method, sometimes called the net present value method, calculates the difference between discounted benefits (or savings) and discounted costs as a measure of the cost effectiveness of a project. The NB method is used to decide if a project is cost effective (net benefits greater than zero) or which size or design competing for a given purpose is most cost effective (the one with the greatest net benefits).

American Society for Testing and Materials, *Standard Practice for Measuring Payback for Investments in Buildings and Building Systems*, Report No. E 121-86 (Philadelphia, PA: 1986), 15 pp.

Availability: American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103

This ASTM practice establishes a procedure for calculating and applying the payback method in evaluating building designs and building systems. The payback method is part of a family of economic evaluation methods that provide measures of economic performance of an investment. This method accounts for all monetary values associated with an investment up to the time at which cumulative net benefits, discounted to present value, just pay off initial investment costs. The method is typically used to decide whether a project recovers its investment cost within its expected life or within a specified maximum acceptable payback period (MAPP) less than its expected life.

Au, Tung, and Au, Thomas P., *Engineering Economics for Capital Investment Analysis* (Boston, MA: Allyn and Bacon, Inc., 1983), 506 pp.

This book presents the basic concepts and the analytical techniques for the economic evaluation of engineering projects in both the public and private sectors. It develops a thorough understanding of the decision-making process in capital investment planning. It emphasizes the application of analytical techniques to a great variety of problems that may confront engineers and managers who are concerned with capital budgeting. Some topics covered are the benefit-to-cost ratio method, internal rate-of-return method, estimation of costs and benefits, and uncertainty and risk.

Canada, John, R., and White, John A., *Capital Investment Decision Analysis for Management and Engineering,* 2nd ed. (New York, NY: Prentice-Hall, 1980).

Capital budgeting topics covered in this book include interest computations, equivalent worth methods, rate-of-return methods, benefit-cost analysis, income taxes and depreciation, replacement analysis, risk and sensitivity analysis, and mathematical programming techniques for government agencies and public utilities. The discussion is concise and is based primarily on explicit mathematical equations. Little detail about the theories behind the equations is included. The authors assume the user will have more than an introductory knowledge of capital budgeting and finance techniques before using this text. A thorough knowledge of algebra and probability is required. Each chapter closes with a set of problems, some of which are answered at the end of the book. The appendices contain a good selection of mathematical tables and an extensive bibliography. The text serves as an excellent reference on quantitative methods for capital decisions. [This annotation is based on a review in *Choice*, Vol. 18, November 1980, p. 434.]

Grant, Eugene L., Ireson, W. Grant, and Leavenworth, Richard S., *Principles of Engineering Economy,* 7th ed. (New York, NY: John Wiley and Sons, 1982), 687 pp.

This comprehensive text explains the principles and techniques needed for making decisions about the acquisition and retirement of capital goods by industry and Government. Emphasis is placed on the following

two points: 1) only differences between alternatives are relevant in their comparisons; and 2) the fundamental question regarding a proposed investment in capital goods is whether the investment is likely to be recovered plus a return commensurate with that obtainable from other opportunities of similar risk. This question is answered by calculations involving the time value of money. This text is useful not only for engineering students but also for students of economics, accounting, finance, and management. This book also can serve as a working manual for engineers, management personnel, government officials, and others whose duties require them to make decisions about investments in capital goods.

Mishan, Edward J., *Cost-Benefit Analysis*, 3rd ed. (London: George Allen and Unwin, 1982), 447 pp.

This work is a comprehensive presentation of all aspects of benefit-cost analysis applied to the public sector investment projects. What is the public (or social) value foregone elsewhere when economic resources are channeled into a projected economic activity? What are the real effects on the consumer and the environment? Through carefully selected case studies, the various ways to allocate costs and benefits are described, drawing on present-day techniques of economic analysis, including operations research, decision theory, and game theory. These case studies illustrate the fundamental principles of benefit-cost analysis. This book includes a section on the choice of a benefit-cost criterion.

Newnan, Donald G., *Engineering Economic Analysis*, 3rd ed. (San Jose, CA: Engineering Press Inc., 1988), 578 pp.

This book is designed to teach the fundamental concepts of engineering economy to engineers. The primary focus is on engineering decision making, the examination of the economic consequences of alternative engineering designs. Analysis methods (present worth, uniform annual cost, rate of return, etc.) for comparing alternatives in economic problem solving are examined in detail. Special topics covered include: equipment replacement; methods and difficulties of estimating the future consequences of alternatives; rationing money among competing projects when there are more good projects than money; complex rate-of-return computations; and continuous compounding. The final chapter describes six microcomputer programs and, together with a program diskette supplied with the book, illustrates how they work. Example problems, solutions and figures are provided along with a full set of compound interest equations.

Nilsson, E. K., *Police Systems Analysis*, Ph.D. Dissertation, Northwestern University, Industrial Engineering and Management Science Department (Ann Arbor, MI: University Microfilms, 1969), 160 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 018890

This publication presents a systems analysis of resource allocation in the Chicago Police Department. It defines the police system, develops a structure for allocating costs, and develops production models for the response force. The analysis has three major parts. The first part develops a conceptual model of the police system and defines the resource allocation problem. Objectives and measures of effectiveness are determined. The second part defines a program budget and applies it to the Chicago Police Department. This structure was designed to facilitate the development of production models and the evaluation of benefits. The third part consists of production models for the response force. The response force is the subsystem which responds to calls for service. Simulation models of the communications center and the mobile part of the field response subsystem are used to determine efficient combinations of resources. The communications center simulation evaluates the efficiency of the current system and the need for extensive modifications. The field response simulation evaluates the benefits from a car locator system and several administrative changes, such as interdistrict dispatching and the screening of calls.

Key words: budgets; communications centers; communications units (police); dispatching; evaluation; Illinois; models; operations research; police cars; police resource allocation; simulation; systems analysis

Ruegg, Rosalie, T., *Life-Cycle Costing Manual for the Federal Energy Management Program*, Report No. NBS HB 135 (Gaithersburg, MD: National Bureau of Standards, November 1987), 291 pp.

Availability: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

This manual is a guide to understanding the life-cycle costing method and an aid to calculating the measures required for evaluating energy conservation and renewable energy investments in all Federal buildings. It expands upon the life-cycle costing criteria contained in the Program Rules of the Federal Energy Management Program (subpart A of Part 436, Title 10, U.S. Code of Federal Regulations) and is consistent with those criteria. Its purpose is to facilitate the implementation of the Program Rules by explaining the life-cycle costing method, defining the measures, describing the assumptions and procedures to follow in performing evaluations, and giving examples. It provides worksheets, data tables, and other computational aids for calculating the required measures.

Key words: building economics; capital investment decisions; economic analysis; energy conservation; energy economics; life-cycle costing; public buildings; renewable energy

Stermole, Franklin J., and Stermole, John M., *Economic Evaluation and Investment Decision Methods* (Golden, CO: Investment Evaluations Corporation, 1987), 479 pp.

This textbook is an introduction to the concepts of the time value of money and the application of time value of money considerations to the after-tax evaluation of virtually all types of investment situations. The text presents the development and application of economic evaluation techniques that can be used to compare systematically and quantitatively the relative economic merits of investment alternatives. The objectives of this text were first, to present clearly valid economic decision methods and second, to show the application of these economic evaluation methods using investment evaluation illustrations that are meaningful and realistic.

Taylor, George A., *Managerial and Engineering Economy*, 3rd ed. (New York, NY: D.Van Nostrand Company, 1980), 538 pp.

This text provides a sound introduction to the theory and practice of making decisions based on economic criteria. It is intended for students of engineering, business administration, economics, accounting, and finance. It provides in-depth treatments of topics such as the rate of return, the time value of money, annual- and present-worth measures, the cost of capital, economic life, replacement decisions, and risk and uncertainty. A chapter is devoted to economic decision making for public sector organizations.

Todaro, John B., and Robinson, George B., *Analysts' Manual for the Multiple-Bid Evaluation Model for Procurement Planning and Placement*, Report No. JCAP-DM-T710 (Rock Island, IL: Joint Conventional Ammunition Program Coordinating Group, Decision Models Directorate, November 1977), 66 pp.

Availability: National Technical Information Service, Springfield, VA 22161

This report documents the Multiple-Bid Evaluation Model (MBEM). The model uses dynamic programming to conduct bid analyses for selection of a combination of suppliers to be awarded portions of a total contract. These analyses include the finding of least-cost and next least-cost solutions for the total requirement and for fractions of the total requirement. In the case of procuring a single item for a single buy period, the model can also find least- and next least-costs for each possible number of suppliers. This additional analysis enables management to evaluate the costs of using additional suppliers in order to have a broader production base. The model consists of four independent computer programs for the following situations: 1) a single buy period and a single type item; 2) two buy periods, or two items for one buy period; 3) three buy periods, or three items for one buy period; and 4) a version of Program 1 which finds least-cost and next least-cost solutions for each possible number of bidders to be selected. This volume contains: MBEM mathematical formulations and the computational methods used, flowcharts for each program, and computer listings complete with comments and identification of variables.

Key words: allocations; ammunition; Army equipment; Army procurement; assessment; computer program documentation; computerized simulation; contracts; cost analysis; costs; decision making; dynamic programming; flowcharting; logistics management; logistics planning; management information systems; mathematical models; military requirements; multimode; operations research; programming manuals; ranking; selection

Todaro, John B., *Users' Manual for the Multiple-Bid Evaluation Model for Procurement Planning and Placement*, Report No. JCAP-DM-T711 (Rock Island, IL: Joint Conventional Ammunition Program Coordinating Group, Decision Models Directorate, August 1977), 71 pp.

Availability: National Technical Information Service, Springfield, VA 22161

This report provides useful information to ammunition managers on the Multiple-Bid Evaluation Model (MBEM). The purpose of the MBEM is to enable management to evaluate the economic and base protection impacts of available alternative solutions for complex procurement actions involving large numbers of multiple bidders, multiple bid levels, and multiple buy periods. The model can be used for single or multiple item buys. The sequence of steps by which the model achieves this objective is as follows: input data for the model, including the procurement objectives (items, quantities, and time periods); bidder information (all costs associated with selecting a specific bidder); and base protection costs. These base protection costs are total costs of layaway and maintenance of Government-furnished equipment at those facilities which are not selected for a portion of the contract. The data conversion module accepts the verified input data and converts it into usable form for the main processing module. The main processing module uses dynamic programming techniques to identify least-cost and alternative solutions. Dynamic programming is an efficient solution technique for multi-stage problems. In the model, the method used employs an approach in which any two bidders are considered. Then, only those bids which can enter into the final solution are carried forward as a combination to compete against the next bidder. This procedure is repeated until a final combination is obtained. This final combination represents the least-cost solution.

Key words: ammunition; Army procurement; computer programs; computerized simulation; costs; economics; input; logistics planning; logistics support; manuals; multimode; operations research; output; user needs

U.S. Department of Defense, "Economic Analysis and Program Evaluation for Resource Management," DOD Instruction 7041.3 (Washington, DC: 1972), 38 pp.

This reference outlines policy guidance and establishes a framework for consistent application by Department of Defense (DOD) personnel of: 1) economic analysis on proposed programs, projects and activities; and 2) program evaluation of on-going activities. This policy guidance is to be applied in comprehensive and continuous management reviews of the cost and effectiveness of resource requirements for DOD activities. Such management reviews are to include the use of economic analyses and program evaluations, as appropriate.

2.2 Law Enforcement Equipment

2.2.1 General

Shaw, Dennis F., and Jackson, John S. (eds.), *Final Proceedings of the 2nd International Conference on Crime Countermeasures—Science and Engineering*, Report No. 77CH1230-2 AES, University of Oxford, Oxford, England, July 25-29, 1977 (Oxford, England: Oxford Microform Publications, Ltd., 1977), 263 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 056184

The proceedings of the 1977 International Conference on Crime Countermeasures contains articles and abstracts on modern technology and its application in law enforcement. The conference was sponsored by the University of Oxford, the University of Kentucky, and the Institute of Electrical and Electronics Engineers, Aerospace and Electronic Systems Society. Scientific evaluations in the field of security systems include modern speaker recognition systems, personnel access control devices, sensor technology for explosives

detection, and subsystems to enhance computer security. Crime detection articles include the topics of arson pattern recognition, police telecommunications equipment, computer-aided facial image identification devices, and police information systems. Subjects presented in abstracts include benefit-cost analysis of technological applications. Other topics covered include the control of vehicles and manpower, crime prevention and deterrence, and mathematical modeling.

Key words: automation; computer privacy and security; information dissemination; personnel identification systems; police information systems; technology

Stewart, J. K., "Analyzing Costs--An Aid to Effective Police Decisionmaking," *FBI Law Enforcement Bulletin*, Vol. 53, No. 7, July 1984, pp. 20–23.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 095349

This paper outlines ways that police managers can obtain cost information needed for an efficient and effective administration, based on a report published by the National Institute of Justice (NIJ) on police cost analysis. NIJ surveyed 50 police agencies and found that over half rated their cost analysis capability as either fair or poor. Only 27 percent said they used cost information to examine the merits of alternative strategies for meeting their objectives. While almost all police agencies routinely monitor crime rates and other statistics, they rarely track the costs of police services on a regular basis. Depending on the level of complexity required, a cost analysis plan will include the following steps: measuring direct personnel costs by computing the time required to deliver the service and calculating the cost of that time in salaries and fringe benefits; determining direct nonpersonnel costs such as equipment; and tracking the indirect costs of utilities, data processing, and other support functions. The final steps in the analysis involve calculating the total cost of a service and reporting it in a format decision makers can understand and use. Such data can be used for planning expenditures, assessing alternatives, and justifying expenses. They also reveal critical relationships among individual budget items. The article includes a sample cost analysis proposal of a burglary prevention program and examples of cost analyses undertaken by four different police departments. One department conducts periodic analyses of particular services such as domestic calls or bank escorts, while others have used cost data to obtain compensation for their work at special events and to help decide whether to buy, lease, or rent unmarked police cars.

Key words: cost analysis; police expenditures; police management

Varrelman, D. A., "Facilities and Materiel," *Local Government Police Management*, 2nd ed., edited by B. L. Garmire (Washington, DC: International City Management Association, 1982), pp. 335–362.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 088291

The management of facilities and materiel for the police department includes the management of buildings as well as administrative and financial management for police department property, automotive equipment, personal and departmental armament, and other personal property. The facilities and materiel provided for a police agency will affect its overall operational efficiency. The police building reflects the community's philosophy towards the accomplishment of police service goals. A police building that is functionally sound will eliminate duplication in personnel and economic waste and will thus reflect a sound police organization. Police vehicles will also provide a major capital outlay each year. Proper specifications achieved through adequate design and functional considerations will provide for a comfortable habitation for the police officer and an economic savings to the community. Police armament has been overemphasized in the past, but it is still a necessary aspect of police materiel. Careful consideration should be given to the types of weapons and protective equipment used by a police department and specifications should be drawn to ensure the quality of equipment. All of these items should be managed through a property control system that allows for identification and accounting for all pieces of equipment or property that come within the control of the police department.

Key words: facilities; police cars; police equipment; police facilities; police management; police weapons

2.2.2 Vehicles

2.2.2.1 Automobiles

Byrd, A. P., *Motor Vehicle Management Study* (Columbus, OH: Columbus Police Department, 1972), 34 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 009468

This study covers an analysis of police fleet operations in Columbus, Ohio, including a benefit-cost analysis of vehicle maintenance, replacement, and disposal. Functioning of the police fleet was compared to vehicle management in other cities and states. Recommendations include the adoption and adherence to a periodic motor vehicle replacement schedule according to specified criteria, adherence to a preventive maintenance schedule, the creation of a police fleet supervisor, and the implementation of a system of cost accounting records. Additional tables contain data on cost analyses and replacement assignments.

Key words: equipment maintenance and storage; Ohio; police cars; police equipment; vehicle safety inspection

Lindquist, John Abner, "Comparative Analysis of Police Transportation Systems in California Cities With Populations of 50,000 or More," thesis for Master of Criminology, Report No. U, University of California, Berkeley, CA, 1961, 177 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 009463

The purpose of this study is to ascertain the best operational method of police motor vehicles. This thesis discusses the value of one-man car patrols, regulations governing fleet operation, and transportation charges. It considers the number of police cars necessary for adequate transportation and the manner in which they should be distributed, as well as vehicle purchasing, maintenance, repair, and replacement. The problems of supervising the police fleet, assigning automobiles, and installing special and accessory equipment are examined.

Key words: benefit-cost analysis; California; equipment maintenance and storage; police cars; police equipment; vehicle equipment; vehicle safety inspection

Ruegg, Rosalie T., "Life-Cycle Cost Evaluation of the Personal Car Program," *Journal of Police Science and Administration*, Vol. 5, No. 2, October 1977, pp. 290–298.

This paper is designed to assist the police fleet administrator in evaluating the desirability of a Personal Car Program (PCP) relative to other vehicle plans. It identifies the costs and benefits usually associated with a PCP, and presents a general method which police administrators can use to evaluate the costs and benefits of a PCP in light of the particular circumstances of their departments. It also compares the life-cycle costs of a PCP with a Multi-Shift Pool Car Program, calculated for a given set of conditions. Application of the demonstrated method of evaluation will promote more efficient selection of police vehicle programs.

Ruegg, Rosalie T., *Police Patrol Car—Economic Efficiency in Acquisition, Operation, and Disposition*, Report No. NBS SP 480-15 (Gaithersburg, MD: National Bureau of Standards, 1978), 135 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 041026 and National Technical Information Service, Springfield, VA 22161; order number PB281805

This report utilizes life-cycle costing techniques to examine the costs of some alternative approaches to patrol car acquisition, operation, maintenance, and disposition. Specifically, this study addresses the cost effect of purchasing different sizes of patrol cars and different optional equipment, the advantages and disadvantages of direct ownership of vehicles compared with leasing vehicles, the costs of contracting out

maintenance compared with the costs of in-house servicing, and the effects on fleet costs of alternative utilization practices, vehicle replacement scheduling, and methods of vehicle disposition. Life-cycle costing methodology and police fleet management are discussed, with attention to both life-cycle costing and break-even models. The life-cycle costs of a typical patrol car are noted. Appended materials include police fleet practices data, sample leasing and maintenance agreements, and selected references.

Key words: comparative analysis; cost analysis; evaluation; management; police cars; police equipment; police patrol

St. Louis County Police Department, *Personal Car Program—Evaluation* (Clayton, MO: 1980), 37 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 073488

This report focuses on the costs and benefits associated with the St. Louis County Police Department's Personal Car Program. This program, which was established in August 1977, allows the assignment of marked police vehicles to commissioned employees in the Division of Field Operations. The vehicles can be used both on- and off-duty. Program objectives included: increased visibility of marked department vehicles as a crime prevention measure; improved response time to crimes in progress; greater availability of equipment for the mobilization of police officers in the event of an emergency; the elimination of on-duty time for obtaining routine gas and oil service, minor repairs, and vehicle maintenance; an increase in the life expectancy of department vehicles; and greater flexibility in the assignment of personnel for special events and programs. A benefit-cost evaluation demonstrated that because more vehicles were required for the program, total program cost was greater than the cost of the traditional pooling system. Program benefits included the following: lower per mile and per unit operating cost, longer life of vehicles, larger number of marked patrol cars available for service, 43.9 percent increased visibility, increased public contact, less interbeat dispatching, increased patrol time, reduced response time to crimes in progress, decreased on-duty vehicle service and maintenance, more timely mobilization of police officers, increased flexibility in assigning personnel for special programs and events, and improved employee morale. Data tables and an appendix containing the results of a personnel survey are included.

Key words: benefit-cost analysis; evaluation; Missouri; police cars; police crime-prevention; police take home car program

2.2.2.2 Aircraft

American Society of Planning Officials, *Helicopters*, Report No. PAS 198 (Chicago, IL: 1965), 40 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 008952

This report covers the factors relevant to the planning of the use of helicopters within a municipal setting. Such items as the costs and benefits of operating helicopters, necessary regulatory measures, zoning controls, and planning considerations are discussed. The report concludes that the helicopter can play a useful role in the urban transportation system if its operating requirements are properly understood and regulated. Appended material includes standards for roof-top helicopter landing facilities and a list of zoning districts of selected cities in which helicopter landing facilities are permitted.

Key words: benefit-cost analysis; facilities; helicopters; licensing; planning; police equipment; specifications; urban planning

J. Watson Noah Inc., *Delta Research Corporation Cost Estimating System User's Manual* (Washington, DC: 1984).

Availability: Air Force Cost Center, AFCSTC/ADT, Cafritz Building, 1211 South Fern Street, Arlington, VA 22202

The software for a cost estimating system described in this publication matches normalized costs with physical and performance characteristics in order to develop cost-estimating relationships and perform other statistical analyses. The system includes databases for fixed-wing aircraft, helicopters, engines, and missiles.

Key words: aircraft; cost data; cost estimates/analyses; cost-estimating relationships; database; engines; helicopter; statistical analysis; tactical missiles; technical characteristics data

Raub, Richard A., and Henry, Bobby L., *Aircraft Used for Law Enforcement: An Analysis of Costs* (Springfield, IL: Illinois Department of Law Enforcement, Division of Administration, 1981), 42 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 081542

The costs of operating airplanes for law enforcement are examined and compared with a similar type of enforcement by officers on the ground. All fixed and variable costs associated with an airplane's operation are included: pilots' salaries, cost of facilities, cost of assistance by officers on the ground, and depreciation. Cost data were obtained from sources kept by the Illinois Department of Law Enforcement. Total aircraft operation costs were $96 per hour. When the airplanes are used for line highway patrol, including the cost of assistance by officers on the ground, the average cost per mile of patrol is $1.33 compared to an average cost per mile of $1.08 for the same type of patrol performed by a solo police officer on ground patrol; however, the pilots produce more police actions, such as stopping traffic violators and assisting motorists, for the miles patrolled than an equivalent number of officers on the ground. From this perspective, aerial patrol is less costly than ground patrol for traffic law enforcement. The primary benefit of the airplane is its ability to observe violations in different sections of the highway separated by several miles while remaining undetected by violators. Tabular data and references are provided.

Key words: aircraft; benefit-cost analysis; police equipment; traffic law enforcement; traffic monitoring equipment

Whisenand, P. M., and Robinson, R. O., *Project ACE (Aerial Crime Enforcement), Riverside Police Department, Final Report* (Long Beach, CA: California State University, Long Beach Institute for Police Studies, 1972), 110 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 007110

This report contains the results and recommendations of a 12-month study on a police helicopter patrol program. The primary mission of the Aerial Crime Enforcement (ACE) program was to assess the impact and use of police helicopters as a technological adjunct for combatting crime in Riverside, California. The research data indicated that of the major crimes, the greatest amount of time was devoted to the handling of burglaries. The results indicated that crime (robbery, burglary, and auto theft) decreased in target areas thought to be most vulnerable to helicopter patrol. A community attitude survey was conducted at the beginning and the end of the evaluation period and in both instances the results were greatly in favor of ACE. More than 95 percent of the officers believe that the helicopter was an aid to them on their particular assignment. In general, project ACE was evaluated as being cost effective when compared to the number of patrol cars which could be fielded with equivalent funds.

Key words: aerial patrol; aerial patrol techniques; benefit-cost analysis; California; crime statistics; evaluation; helicopters; police equipment; public attitudes

2.2.3 Armament

"A Case for Bulletproof Vests," unpublished research paper prepared by Richard L. Olson of the New York State Assembly Ways and Means Committee, Albany, NY, 1980, 12 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service, Document Loan Program, Box 6000, Rockville, MD 20850; NCJRS No. 077891

A legislative budget analyst in New York urges approval of State legislation to provide bulletproof vests to police officers. A revised bill would appropriate funds to supply soft-body armor for every police officer in the State assigned to patrol duty. A study regarding the life-saving potential of the vests found that of the 93 law enforcement officers killed in the United States in 1978, soft-body armor would probably have saved the lives of 37 (39.8 percent) of these officers since their fatal wounds were received in the front and rear upper torsos. Moreover, death benefits and other awards to the widows and beneficiaries of these officers would have been better spent on body armor. In addition to detailing the efficacy of the vests in stopping bullets from various handguns, rifles, and shotguns, their usefulness in protecting police officers from a variety of instruments such as bayonets, pitchforks, or explosives and from car crashes, police motorcycle crashes, and electrical accidents is outlined. The soft-body armor protection covers potential injuries caused by hands, fists, or feet, and blunt instruments. A bulk purchase of soft-body armor at about $100 per vest would enable outfitting the entire New York State Police Force for about $300,000, far less than the $685,000 paid out in widows' benefits. Although the cost of extending this coverage to every law enforcement officer in the State could run as high as $4.5 million; the return on this investment in terms of direct lives saved, will more than outweigh its cost. Tabular data, related correspondence, and a press release are provided.

Key words: benefit-cost analysis; body armor; legislation; New York; police deaths; police equipment; police safety

Brunton, Loren F., *Feasibility Study: Use of Reloaded Caliber .45 M1911 Ball Cartridges for Military Training*, Report No. DRSAR-LE/82-1 (Rock Island, IL: Army Armament Materiel Readiness Command, Logistics Engineering Directorate, January 1982), 32 pp.

Availability: National Technical Information Service, Springfield, VA 22161

A contract was awarded to a licensed reloader to reload 250,000 Government-furnished, once-fired, .45 caliber cartridge cases. The reloaded cartridges were subjected to performance, safety, and user evaluations. Simultaneously, the economic practicality of substituting reloaded cartridges for new cartridges was evaluated. Technically, it was found to be feasible to use reloaded cartridges for training purposes, but an economic analysis demonstrated that it was cheaper to buy new cartridges which are suitable for both combat and training usage.

Key words: ball ammunition; cartridge cases; cost analysis; deficiencies; economic analysis; feasibility studies; firing tests (ordnance); limitations; performance (engineering); pistols; reusable equipment; safety; small arms; test and evaluation; training ammunition; user needs

Turk, Daniel R., *Models for Ammunition Management*, Report No. JCAP-DM-T703 (Rock Island, IL: Joint Conventional Ammunition Program Coordinating Group, Decision Models Directorate, August 1977), 45 pp.

Availability: National Technical Information Service, Springfield, VA 22161

This report provides information to ammunition managers on nine modern computer models specifically developed to support the conventional ammunition management decisions. The models have been applied in numerous studies at the request of functional managers. They have provided significant contributions to ammunition management in the areas of: production base planning and operations; the planning, programming, and budget cycle; procurement; and other special areas such as demilitarization. The nine models, all of which are operational and available are: 1) the Item Acquisition/Production Trade-Off Model for maximizing item readiness at least cost; 2) the Materiel Acquisition Planning Model for maximizing overall readiness within budget constraints; 3) the Industrial Preparedness Model for mobilization planning; 4) the Maintenance Model for least-cost layaway and maintenance policy for idle facilities; 5) the Production Facilities Life-Cycle Cost Subsystem for least total cost modernization, expansion, and workloading of the production base; 6) the Priorities Model for multi-objective management problems (economic and non-economic goals); 7) the Multi-Bid Evaluation Model for economic analysis of complex procurement actions; 8) the Demilitarization and Disposal Model for integrated demilitarization planning and workloading at least total cost; and 9) the Ammunition Packaging/Containerization Life-Cycle Cost Model for evaluation from design through disposal.

Key words: ammunition; computer programs; decision making; demilitarization; industrial production; life-cycle costs; management planning and control; manpower utilization; military procurement; mission profiles; model theory; munitions industry; operations research; organizations; packaging; production control; systems analysis

2.2.4 Automatic Vehicle Monitoring (AVM) Systems

California Institute of Technology, Jet Propulsion Laboratory, *Automatic Vehicle Monitoring Systems Study—Report of Phase O, V 2—Problem Definition and Derivation of AVM System Selection Techniques*, Report No. JPL 5040-26 (Pasadena, CA: 1976), 100 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 038370

This volume contains the results of systems analyses conducted in the first phase of a program to aggregate existing data on Automatic Vehicle Monitoring (AVM) systems in terms of performance, urban characteristics, operating modes, and cost. A set of planning guidelines is presented to help law enforcement agencies and vehicle fleet operators decide which AVM system could best meet their performance requirements. Improvements in emergency response times and corresponding costs of various operational and planned AVM systems may be synthesized and simulated by means of special computer programs for model city parameters applicable to small, medium, and large urban areas. Design characteristics of various AVM systems and the implementation requirements are illustrated and costed for the vehicles, the fixed sites, and the base equipment. Vehicle location accuracies for different radio frequency links and polling intervals are analyzed. Actual applications and coverage data are tabulated for seven cities whose police departments actively cooperated in the study.

Key words: automated vehicle monitors; benefit-cost analysis; planning; police equipment; studies; systems analysis; vehicle location monitors

Hansen, G. R., and Leflang, W. G., *Application of Automatic Vehicle Location in Law Enforcement—An Introductory Planning Guide*, Report No. JPL 5040-17 (Pasadena, CA: California Institute of Technology, Jet Propulsion Laboratory, 1978), 52 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 032263

In this report, some essential characteristics and applications of Automatic Vehicle Location (AVL) are outlined and systems in the operational or planning phases are discussed. Law enforcement interest in AVL systems stems from the rapid and accurate car location information provided to dispatching and police supervisory personnel. This information provides the ability to deploy patrol cars in such a way as to reduce the police response time to the scene of a crime, improve coordination of police activities, better supervise officers' daily actions, and improve officer safety by monitoring the location of patrol cars. All this is done without the need for location reporting by voice, thus reducing the work load of both the field officer and dispatcher, and reducing congestion on the crowded voice radio channels. The purpose of this introductory guide is to assist law enforcement agencies in understanding, planning for, and implementing AVL systems. Requirements and cost modeling are described and demonstrated with numerous examples. A chapter on the selection of system design presents several concepts for typical cities. A detailed description of a typical law enforcement AVL system, and a list of vendor sources are given in the appendices.

Key words: automated vehicle monitors; benefit-cost-analysis; computer aided operations; planning; police equipment; police response time; procedure manuals; vehicle location monitors

Larson, Richard C., Colton, Kent W., and Larson, Gilbert C., "Chapter 12: Evaluation of a Phase I Implementation of an Automatic Vehicle Monitoring (AVM) System in St. Louis," *Police Computer*

Technology, Urban Public Safety Systems, Volume III, edited by Kent W. Colton (Lexington, MA: D. C. Heath and Company, 1978), pp. 243-267.

This chapter summarizes the results of an intensive 18-month evaluation of an AVM system in the St. Louis Metropolitan Police Department. It looks beyond the purely technological features of the system to its impact on the operation of urban services and on the attitudes and behavior of police personnel. The evaluation focused on the four objectives of the AVM program: reduction in response time, improvement in officer safety, reduction in voice-band congestion, and enhancement of command and control capabilities. Some initial conclusions are drawn as to whether these four objectives were fulfilled. A cost-effectiveness analysis estimates that the total of amortized investment cost and operation and maintenance costs for the AVM system over a 10-year period approached $2000 per car per year, representing no more than 2 percent of the annual cost for fielding a round-the-clock one-person patrol car. Thus, for a two-person car fleet, an increase in the effectiveness of coverage of more than 1 percent would make the system cost effective.

Ritter, S., *Automatic Vehicle Monitoring—An Urban Technology Conference—Proceedings*, Report No. 731, Texas A&M University, College Station, TX, 1973, 24 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 010695

This publication is a review of the fundamentals and current status of Automatic Vehicle Monitoring (AVM) technology, and covers issues in the implementation of AVM for police command and control. The intent of the conference was to familiarize municipal officials with AVM techniques and operational potential. Three conference presentations review AVM techniques, discuss benefit-cost considerations for an AVM system, and report field test results of candidate systems. A summary of a panel discussion covers certain political, economic, and operational aspects of AVM systems.

Key words: automated police information systems; automated vehicle monitors; benefit-cost analysis; computer aided operations; police manpower deployment; police patrol; police response time

Sierra Research Corporation, *Automatic Vehicle Monitoring System—Final Report*, Report No. IT-06-0047-73-1 (Washington, DC: U.S. Department of Transportation, Urban Mass Transportation Administration, 1973), 395 pp.

Availability: National Technical Information Service, Springfield, VA 22161 and National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 012860

This report describes a design for a real-time Automatic Vehicle Monitoring (AVM) system which locates vehicles by phase multilateration. A vehicle's two-way radio transmits a tone in an assigned time slot, which is received by multiple sensors located around and within the test area, and then sent to the base station via dedicated telephone lines. At the base station the information is fed into a computer where the time difference-of-arrival computations are performed and the vehicle position is displayed. This report examines a baseline system configuration for the automatic monitoring of 1000 vehicles, including information on equipment description, system operation, system variations, a cost analysis, and detailed results of field testing in the Philadelphia area. Technical data and supplemental analyses are provided in 12 appendices. Although specifically designed for a public bus transit network, the system described offers general application to any vehicle fleet operation, especially police.

Key words: automated vehicle monitors; benefit-cost analysis; computer aided operations; Department of Transportation; digital communications; police cars; research and development; systems analysis; telecommunications equipment; transportation

Skomal, Edward N., *Automatic Vehicle Locating Systems* (New York, NY: Van Nostrand Reinhold Company, 1981), 323 pp.

This book describes and examines the performance of Automatic Vehicle Locating (AVL) systems. It discusses the benefits of AVL systems, measured either by a reduction in capital investment (usually the number of required vehicles) or in the time needed to respond to a dispatch, or both. The required fleet size for a stipulated time to respond to a dispatch is related to the positioning accuracy attainable with AVL systems. This information permits judgment of the potential tradeoff between performance and system cost from varying levels of AVL system sophistication. Further, it enables assessment of minimum requirements for positioning accuracy, based on costs and time savings.

2.2.5 Information Systems

Defense Communications Agency, *DCA Cost and Planning Factors Manual*, Report No. 600-60-1 (Washington, DC: 1988).

Availability: Defense Communications Agency, Cost Analysis Branch, Cost and Program Analysis Division, Code H610, Washington, DC 20305-2000

This report presents Defense Communications Agency (DCA) cost data, planning factors, estimating procedures, methods, and formats related to communications systems planning, programming, budgeting, and program evaluation. Chapter 44 discusses tactical radios. The report is updated annually. Primarily this is a hard copy report; however, some of the tables are available in Lotus spreadsheet form.

Key words: communications; cost data; cost factors; data base; planning factors

Evans, R. James, *Review of Radio Equipment Bids,* Police Technical Assistance Report No. 77-035-144 (McLean, VA: Public Administration Service, 1977), 88 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 042428

This report was prepared to assist the Overland Park, Kansas Police Department with the evaluation of two radio equipment bids and present a recommendation. The technical requirements involved reviewing each of the bids and the bid specifications in an effort to determine the best and most responsive system at the least cost. The first task involved background, nontechnical discussions with knowledgeable police personnel. The next task was to completely review each bid statement along with the specifications and their amendments. Since all bids vary to some extent, a chart was prepared that would assist in comparing the bids and visually indicate the item requested in the specifications, the quantity of items bid, and the price of the item. The final task was the preparation of an evaluation to accompany the bid chart.

Key words: cost analysis; Kansas; police agencies; police telecommunications systems; telecommunications equipment

Keenan, Brian et al., *A Socio-Economic Valuation Study for Automatic License Plate Scanning System* (Chicago, IL: IIT Research Institute, 1970), 278 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 000051

The Automatic License Plate Scanning System (ALPS) is a system to automatically detect automobiles that are wanted by law enforcement agencies. The purpose of this study was to evaluate the cost utility of an ALPS. The automatic system was about five times more efficient than the next best alternative. The analysis showed that the system could effectively impact problem areas, such as, auto-related crimes, auto theft, warrant servings, and cigarette smuggling. The areas most significantly impacted by auto-related crimes were selected and analyzed. A benefit-cost model for their deterrence was constructed and a performance and cost-effectiveness model for ALPS was developed. The system appears to be cost effective for locations corresponding to 95 percent of the wanted plate crimes. The cost-effectiveness ratios decline with the density of crime in the location.

Key words: Automated License Plate Scanning; automated police information; auto theft; benefit-cost analysis; computer aided operations; cost effectiveness analysis; evaluation; stolen vehicle costs

Pennell, S. et al., *Final Evaluation of the Automated Regional Justice Information System (ARJIS)* (San Diego, CA: San Diego Association of Governments, Criminal Justice Evaluation Unit, 1981), 80 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 087204

This report presents changes in the development, use, and effectiveness of the Automated Regional Justice Information System (ARJIS), designed to assist in the identification and apprehension of suspected criminals by increasing the exchange of information among San Diego County law enforcement personnel. It compares the cost of ARJIS to potential savings. Since November 1980, the use of ARJIS has increased as have the benefits received in terms of arrests and crime cases cleared with ARJIS information. System effectiveness will probably increase if officers receive additional training in data access, the quality of information is improved, components are fully used by all law enforcement agencies in the region, and proposed enhancements are carried out. Careful monitoring and periodic reports should be done to ensure that these problem areas are being addressed. These reports should include cost assessments compared to benefits received. Findings suggest cost savings associated with ARJIS, but whether savings will outweigh the expenditures when the system is fully operational is not known. Footnotes, study data, and 22 references are supplied. A list of ARJIS components, study methodology and instruments, and additional survey data are appended.

Key words: automated criminal justice system; cost analysis; police information systems; service effectiveness; systems analysis

Sharp, J., *Police Information System for Oxnard, California—A Cost/Benefit Analysis of Alternatives* (Sacramento, CA: Search Group, Inc., National Clearinghouse for Criminal Justice Information Systems, 1978), 137 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 074666

This report presents the findings of a benefit-cost analysis of feasible alternatives for developing an automated police information system for California's Oxnard Police Department. An analysis of current information processing at the Oxnard Police Department and the Oxnard City Data Processing Unit identified a number of automated applications of interest to the department. Two alternatives were found to be technically feasible: to upgrade Oxnard's computer to accommodate the record processing for the police department, and to purchase a minicomputer dedicated solely to police applications. Upgrading the city computer was found to be cost-prohibitive in terms of anticipated police usage. The report recommends: 1) purchase of a minicomputer dedicated solely to police usage, and 2) establishment of a system user's group, consisting of staff representatives from every major unit within the department as well as every other department or agency with which the information system will interact. The appendices include: information on the National Crime Information Center computerized criminal history program; current automated information systems for city-level police agencies serving under 250,000 people which could be candidates for system transfer; and the Standardized Crime Reporting System implementation criteria.

Key words: benefit-cost analysis; California; feasibility studies; police information systems

Sohn, R. L. et al., *Application of Mobile Digital Communications in Law Enforcement—An Introductory Planning Guide* (Pasadena, CA: California Institute of Technology, Jet Propulsion Laboratory, 1978), 82 pp.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 028581

This document offers planning guidelines to assist law enforcement agencies in selecting, evaluating, and developing operational plans for digital communications equipment. The document discusses potential applications, gives a brief review of system and equipment descriptions, and presents a planning methodology for: 1) establishing system requirements; 2) developing system concepts; 3) preparing an implementation plan, including costs and schedules; and 4) performing a benefit-cost analysis. The chapter on planning methodology contains several examples of system implementation and costs, and includes a computer simulation of a police patrol command and control system showing patrol unit utilization, communication channel loading, dispatcher loading, and other performance. System simulations are shown for a voice-only manual system and for a digital system to demonstrate the effects of digital transmissions. Equipment descriptions are presented in the appendices and can be consulted by the planner for details on specific system elements. A list of vendor contacts is also included.

Key words: benefit-cost analysis; digital communications; digital message entry devices; mobile radio equipment; planning; police equipment; police telecommunications systems; telecommunications equipment

University of South Carolina, College of Criminal Justice, and South Carolina Office of the Governor, Division of Public Safety Programs "Reorganization of the Court Docket Through Management Information System," *Innovations in South Carolina Law Enforcement* (Columbia, SC: 1982), pp. 60–72.

Availability: National Institute of Justice, National Criminal Justice Reference Service Microfiche Program, Box 6000, Rockville, MD 20850; NCJRS No. 092567

This paper describes a management information system used by the Charleston, South Carolina Police Department for handling traffic tickets. Under the Selective Traffic Enforcement Program instituted in 1981, the number of traffic tickets issued increased 122 percent, resulting in an overloading of the ticket processing and fine collecting system. On the recommendation of Court Administration Office representatives, the criminal docket was used for all case information, tickets were entered as soon as delivered to the court, ticket information was listed numerically, and revenue information about fines and forfeitures was included on the criminal docket sheet. Receipts were issued for cash received and defendants found not guilty received refunds by check. The information management system was able to handle accounting transactions. As a result of the new system, 97.2 percent more money was collected for traffic tickets in 1981 than in previous years. A description of the police department's Automatic Information System covers the hardware and software configuration and operation, a feasibility assessment for similar systems, a benefit-cost analysis of the system, the intangible benefits of the system, and problems of central computer facilities.

Key words: citations; management information systems; police information systems; records management; South Carolina; traffic courts

LIST OF REFERENCES, BY SUBJECT CATEGORY

Page

2.1 Evaluation Methods

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American Society for Testing and Materials, *Standard Practice for Measuring Benefit-to-Cost and Savings-to-Investment Ratios for Buildings and Building Systems*, Report No. E 964-83 (Philadelphia, PA: 1983), 5 pp. 4

American Society for Testing and Materials, *Standard Practice for Measuring Internal Rates of Return for Investments in Buildings and Building Systems*, Report No. E 1057-85 (Philadelphia, PA: 1985), 11 pp. 4

American Society for Testing and Materials, *Standard Practice for Measuring Life-Cycle Costs of Buildings and Building Systems*, Report No. E 917-83 (Philadelphia, PA: 1983), 43 pp. 4

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