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**DEVELOPMENT OF THE ENVIRONMENTAL TECHNICAL INFORMATION
SYSTEM**

R. D. Webster, et al

**Army Construction Engineering Research Laboratory
Champaign, Illinois**

April 1975

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the research to date on the development and refinement of two computer-aided technical information systems that the Army can use in environmental assessments. The Computerized Environmental Legislative Data System (CELDS) catalogues abstracts of environmental laws and statutes by geographic scope and keyword designation. CELDS includes quantifiable and objective standards and report or permit		

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requirements of all active laws or regulations that may concern the Army. CELDS is complete for six states and for areas of federal jurisdiction, and data for another ten states are currently being collected and analyzed. The system will eventually include all 50 states.

The Economic Impact Forecast System (EIFS) uses census bureau information on over 360 counties to calculate environmental impacts for construction on 64 Army installations. EIFS predicts how the expenditure of federal construction dollars will affect local businesses, households, and governments in the areas of employment, personal income, total business volume, housing revenues, housing and business investments, and government expenses. EIFS uses export-based location quotient techniques as the basis for its predictions. The system will be expanded in the future to cover areas other than construction and to include additional regions.

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FOREWORD

This project was performed for the Research and Development Office, Office of the Chief of Engineers, under Project 4A762720A896, "Environmental Quality for Construction and Operation of Military Facilities," Task 01, "Environmental Quality Management for Military Facilities," Work Unit 002, "Development of Environmental Technical Information System." Mr. D. B. Baldwin served as the OCE Technical Monitor.

This study was resulted in the development of three computer-based data systems, two of which are discussed in this report. The third, The Environmental Impact Computer System, is a fundamental tool for the preparation of environmental impact statements. A report on this system is in publication.

The research was made possible through the efforts of Army personnel, the staff of the Library Research Center at the University of Illinois, consultants from Battelle Columbus Laboratories, and scientists and engineers at CERL.

Administrative support and counsel was provided by Mr. R. G. Donaghy (Chief, Environmental and Energy Systems Division), Dr. L. R. Shaffer (Deputy Director, CERL), and COL M. D. Remus (Commander and Director, CERL).

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DEVELOPMENT OF THE ENVIRONMENTAL TECHNICAL INFORMATION SYSTEM

1 INTRODUCTION

Background

Although a vast amount of environmental information is scattered in various publications, reports, standards, and technical manuals, it is neither possible nor economically feasible to scan all these sources to find specific environmental data for environmental impact analysis. There are a few environmental information systems in existence (described in Chapter 3), but they are so general and voluminous that it would require considerable time and effort to extract relevant information for Army needs. The specific needs of the Army demand that an environmental information system be developed for users who will be:

1. Preparing environmental impact assessments and statements (EIA, EIS) as required by the National Environmental Policy Act (NEPA).

2. Designing, constructing, and operating facilities in a way that meets appropriate environmental standards and regulations.

Objective

This research effort was undertaken to develop and maintain an environmental technical information system consisting of:

1. A data bank of environmental information—including laws, regulations, and impact forecast systems (such as the Economic Impact Forecast System described in Chapter 4)—that meets the Army's needs.

2. An efficient information storage, retrieval, and display system that would provide selected information to the Army personnel who plan, design, construct, and operate Army facilities.

Approach

Steps in building the system were as follows:

1. Determine the need for environmental information and data among personnel at the working,

execution, and review levels, as described in this report.

2. Survey existing data sources to establish whether the data are applicable to Army programs.

3. Work with other Army agencies, armed services, and federal agencies in collecting, evaluating, and disseminating environmental information.

4. Collect and store relevant environmental data developed by this and other work units in the environmental research programs. These data include: environmental impact assessment information, economic impact forecast data, environmental laws and regulations, environmental baseline data and procedures for acquiring this data, and environmental planning data and information.

5. Evaluate existing information storage, retrieval, and display systems to select an appropriate model for the Army's information system.

6. Collect and evaluate other necessary data such as the sources, quantities, and effects of emissions or effluents; life-cycle cost and related design data on pollution control equipment; and critical environmental elements.

7. Document, classify, and index the data collected.

8. Construct the data base, which includes defining data structures, preparing and loading data, verifying data loaded, constructing retrieval commands, and designing updating procedures.

9. Develop training materials and conduct training sessions for Corps personnel to acquaint them with the proper use of the data base and the retrieval display system.

10. Survey users periodically to obtain information on the acceptability, flexibility, and improvements needed in the system.

11. Update and revise the data base in light of any new environmental information so that the system is useful to Corps personnel who deal with environmental problems.

2 USERS AND USER NEEDS

A useful information system must take account of the users' specific data requirements. Users have been classified into three levels: working, execution, and intermediate and staff review.

Working Level

The working level is represented by staffs of the Installation Commanding Officer (CO) and the District Engineer.

Installation Commanding Officer Staff

At any Army installation the working level staff dealing with environmental protection and enhancement may consist of one or more of the following branches: Environmental Quality Control, Post Sanitary Engineering, Planning, and Utilities. The Environmental Quality Control Branch identifies pollution problems and proposes solutions, coordinates environmental aspects of programs, and formulates policies for protecting and preserving the environment.

The Installation Chief of Utilities and Pollution Control monitors the facility's operations for violation of pollution standards by analyzing and comparing samples to the standards.

The facility engineer Planning Branch analyzes plans for future developments, changes in mission, or disposition of facilities. It also analyzes the post's environmental performance in providing utilities and determining facility sites, and predicts environmental impacts.

The Utilities Branch of the facility engineer's staff operates and maintains pollution abatement devices.¹

District Engineer Staff

Project engineers of the district engineer's staff coordinate and prepare contracts. They are concerned with meeting all the applicable laws and

standards and insuring cost-effective solutions to problems.

The district engineering staff must make sure that design criteria yield satisfactory designs that will meet the performance criteria required. Field engineers should make sure that the construction is executed with a minimum of environmental impact.²

Execution Level

The commander and the district engineer form the first line of policy decision. They make decisions and exercise controls through the use of staff studies, reports, and inspections.

Intermediate and Staff Review Levels

This level is a consolidation of the control function performed at the execution level which is carried out via inspection and includes reviewing personnel at higher headquarters.

An analysis of users' responsibilities reveals their individual needs. Table 1 summarizes the data needed by various types of users. USAEHA Exploratory Development Proposal, Project No. 99-024-72-74 explains these needs in greater detail.³

Table 2 lists the data banks and other sources reviewed for this report and categorizes the major types of environmental information they provide.

3 COMPUTER-AIDED ENVIRONMENTAL LEGISLATIVE DATA SYSTEM (CELDS)

One part of the Environmental Technical Information System is a data bank of laws and regulations called the Computer-aided Environmental Legislation Data System (CELDS). Appendix A explains the various sources of national, state, and local laws and regulations. Figure 1 shows a flow chart of the overall indicated plan for developing and maintaining a data base of environmental laws and regulations. Appendix B discusses the master plan for CELDS in detail.

¹USAEHA Exploratory Development Proposal, Unpublished Document, Project No. 99-024-72-74 (U.S. Army Environmental Hygiene Agency, 1973).

²USAEHA Exploratory Development Proposal
³USAEHA Exploratory Development Proposal

Table 1
Data Needs of ETIS Users*

NEEDS OF USERS

JOB DESCRIPTIONS	Baseline	Emission & Effluent Monitoring	Ecological	Source Inv.	Site	Pgm. Summary	Design Criteria	(Operating Guide	Envir. A. Guide	Abate. System Guide	Monit. System Guide	Hazardous Mat'l Guide	Install. Summary	Predict. Model
Working Level:														
Environmental Quality Control Officer	x	x	x	x	x	x			x				x	
Facility Engineer - Planning	x		x	x	x				x					x
Facility Engineer - Utilities		x			x		x	x	x	x		x		
Post Sanitary Engineer		x			x							x		
Project Engineer					x		x							
Design Engineer		x			x		x	x	x	x				
Field Engineer					x									
					x									
Execution Level:		x†			x**	x			x†				x	
Intermediate and Staff:		x†			x†	x			x†				x	

*USAEHA Exploratory Development Proposal. Unpublished Document, Project No. 99-024-72-74 (U.S. Army Environmental Hygiene Agency).

**This monitoring of pollution from Construction.

†Information needed in a Summary Form.

Table 2
Sources of Environmental Information

Air Quality	Earth Sciences	Ecology	Ground Water	Health Science	Land Use	Noise	Economics	Sociology	Surface Water	
x	x		x						x	Aerospace Research Appl Center
x										AET Pollution Tech. Info. Center
		x		x						Bio Science Info Center
x			x	x		x			x	Computer Search Center
	x	x	x		x		x		x	Engineer Agcy for Resources Inventories
x	x	x	x	x	x	x		x	x	Envirofiche
x	x	x	x	x	x	x		x	x	Environment Info. Center, Inc.
x			x		x		x	x	x	Environmental Info Analysis Center
x	x	x	x	x	x	x	x	x		Environmental Info System Office
				x						Environmental Mutagen Info Center
x	x	x	x	x	x	x	x		x	Environmental Protection Agency
x	x								x	Environmental Science Info Center
x	x	x	x	x	x				x	Environmental Studies Institute
x	x	x	x	x	x	x	x		x	Environmental Systems Appl. Center
x	x				x					Environmental Technical Appl Center
				x						Highway Research Info Service
										Informatics, Inc.
			x		x		x		x	Maritime Research Info Service
x									x	Min Land Management Info. System
	x									National Air Data Info Center
x	x	x	x	x	x		x	x	x	National Climatic Center
					x		x			National Environmental Res. Center
										National League of Cities - U.S.
										Conference of Mayors
	x								x	Nat'l Oceanographic Data Center
x	x	x	x	x	x	x	x	x	x	Nat'l Referral Center
x	x	x	x	x	x	x	x	x	x	Nat'l Technical Info Service
			x						x	Nat'l Water Data Program
	x				x				x	Natural Resource Info System
						x				Noise Info Retrieval System
x			x	x	x	x			x	Pollution Abstracts
x			x							Predicasts
				x	x					Solid Waste Info Retrieval Sys.
						x				Transp. Noise Research Info Serv
			x						x	Water Qual. Tech. Data and Info Sys
			x						x	Water Resources Scientific Info Center

Background

In the development of CELDS, several existing retrieval systems for legislative documents were reviewed for adequacy. The most significant of these are the LITE, JURIS, and Aspen Systems.

Legal Information Through Electronics (LITE)^{4,5,6}

The LITE System is a "full-text" legislative retrieval system for the statutory decisional, treaty, and regulatory laws of the federal government. It is available free of charge to all individuals or departments within the Department of Defense. LITE performs searches for entire documents by recognizing user-selected keywords. This system is not practical for the specific needs of the Army as addressed in this report because:

1. Only federal laws are included.
2. Full-text retrieval is too cumbersome and lengthy to be practical since a given statute will also include much irrelevant information.
3. Legal language in the documents may obscure the meaning and possible applicability of the legislation for nonlegal personnel.
4. The comprehensiveness of the search depends upon the choice of words for search items.

*Justice Retrieval and Inquiry System (JURIS)*⁷

JURIS is a computer-based storage and retrieval system for federal statutory laws. It is specifically designed to serve federal lawyers, but for Army use it suffers much the same drawbacks as LITE: it covers only federal laws, it is designed for legal personnel, and it is too voluminous to be useful.

*Aspen System 50*⁸

System 50 is a data bank containing the full texts of statutes for all 50 states. The output options available with this system are full-text printouts,

context printouts with only the line of the specified keyword printed, citation and title line printout, and citation only. None of these outputs are directly usable by Army personnel, although a citation listing will be useful for updating and checking on the completeness of the CELDS data base.

One shortcoming of all the above systems is that they provide complete texts of laws and statutes but do not provide standards and criteria recommended by regulatory agencies. Most state environmental legislation grants some specific organization the authority to establish standards but does not specify what the standards are, so a statutory record alone is inadequate.

Pilot Study for CELDS

A pilot study on the legislative retrieval system examined the feasibility of the system and began development of a practical data file of environmental laws, regulations, and standards. This research also tried to determine the feasibility of ultimately establishing a computerized environmental data file for all states. The output from this pilot study was a user guide and two tapes with an associated printout containing the pilot's data bases and indices.

The research was divided into two phases. In Phase I the time, costs, and obstacles of developing such a system were considered. In Phase II the feasibility of creating an on-line interactive data file was examined. The study then tested the system under practical conditions and obtained detailed cost estimates.

The data base was set up in scope-indexed sequential format with Battelle's Basis-70 Record Manager Software.⁹ The pilot's legal data base included the laws of California, Illinois, New York, Tennessee, Kentucky, and Virginia, as well as federal laws.

Data Collection and Indexing

The accessibility and organization of the data varied considerably from state to state. Some states do not broadly categorize their laws under land use, earth science, ecology, noise, regional economics, sociology, or health.

⁴*JAG Law Review*, Vol XIV, No. 1, pp 10-13.

⁵*JAG Law Review*, Vol XIV, No. 1, pp 25-34.

⁶*JAG Law Review*, Vol XIV, No. 1, pp 35-67.

⁷Department of Justice.

⁸Aspen Systems Corp., 1025 Connecticut Ave., NW, Washington, D.C. 20036.

⁹*Basis 70 User Guide* (Battelle Columbus Laboratories, July, 1972).

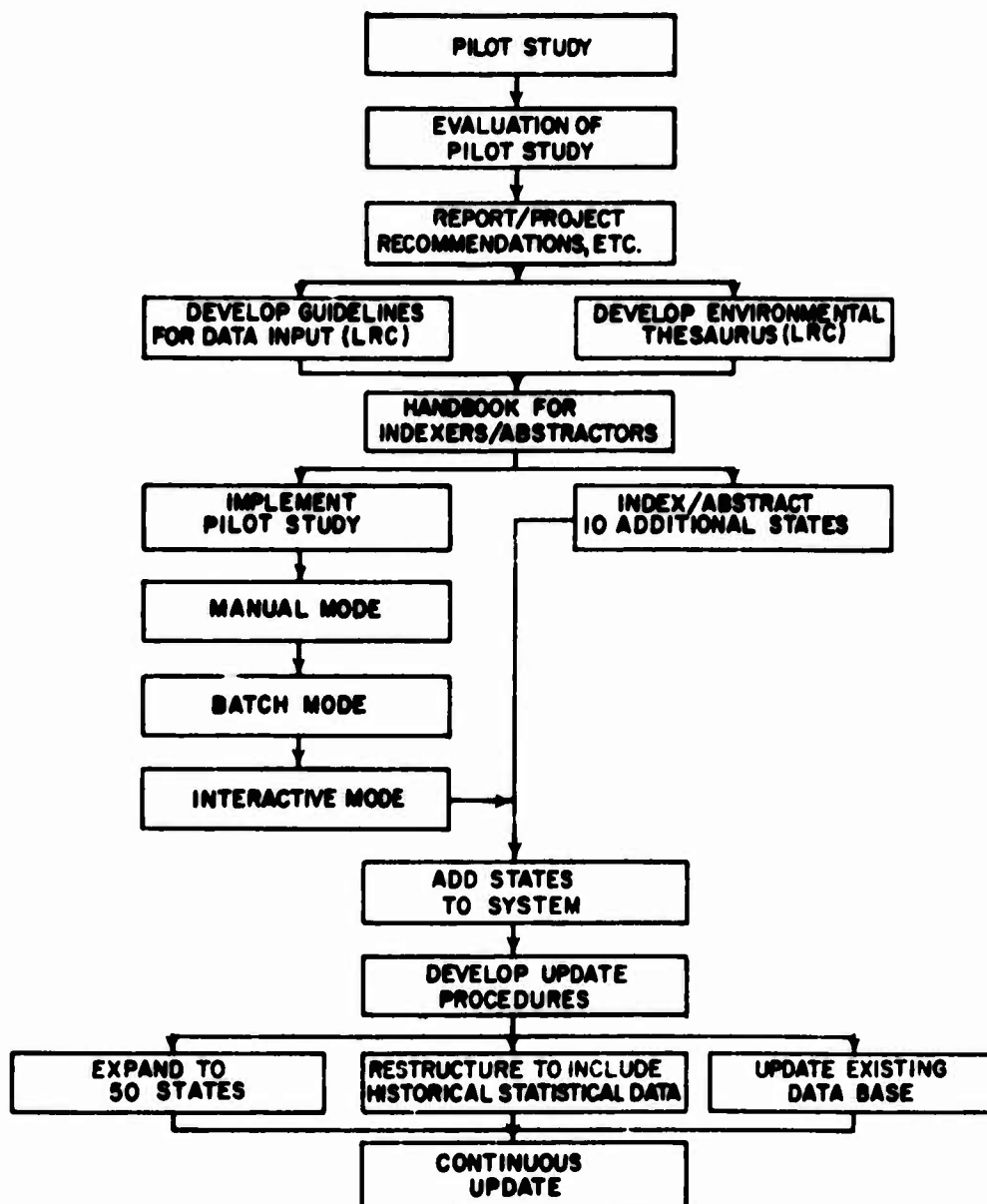


Figure 1. Computerized environmental legislative data system.

The lack of a firm set of index terms also complicated the cataloging of legislation. Environmental attributes were adequate for referring to impacted sectors of the environment, but a separate keyword list was necessary in order to include more frequently used or widely accepted terms for activities that tend to cause environmental problems.

The study exercised only rudimentary vocabulary control, but this simplification occurs in the early stages of development of all information systems, particularly when different people with widely divergent backgrounds, experiences, and attitudes toward the subject matter attempt to simultaneously index material.

Using a thesaurus is normally the best solution to the problem of vocabulary control. A thesaurus, however, evolves from a concentrated period of trial-and-error during which terms are selected, reviewed, and modified to a dynamic hierarchical structure that is continually modified and refined. Selection of index terms for the CELDS data file has progressed to the trial-and-error stage, and the list of terms is now adequate to permit the reviewing and structuring that will eventually lead to a thesaurus.

Creation of the Data File

Developing a format for reporting collected information was essential to filing the records for easy and rapid retrieval. The procedure for collecting data partially predicated this format. All information was recorded in one of 15 fields for each record, and generally a law or set of standards constituted a single record. The information recorded in each field was as follows:

1. Accession Number—Gives accession number assigned sequentially as the documents were recorded.

2. Accession Date—Gives accession date (calendar date on which the data form was received for keying).

3. Title—Consists of phrases or terms that identify the primary subject area of legislation (i.e., LEGISLATIVE CODE 2, 4—TRASH BURNING, and CONTROL OF JUNKYARDS). Information in this field comes from either the title of the legislation or, if the title does not suggest the contents, from a

phrase that indicates what the abstract is about.

4. Enactment Date—Lists date the legislation becomes effective. However if more than 6 months in the future, it may be the date legislation was enacted into law.

5. Legislative References—Identifies the legislative source of the entire legislation covered by the document abstract.

6. Major Environmental Category—Contains the primary subject area addressed by the legislation. In its research on the preparation of comprehensive environmental impact assessments and statements CERL has developed a scheme for categorizing all impacted attributes of the environment. CERL calls the major categories in this scheme technical specialty areas and identifies detailed attributes within each of these areas. This study adopted the CERL framework¹⁰ to classify all laws that were abstracted but changed the label from "technical specialty area" to "major environmental category" (MEC).

Selected documents were classified according to the following MEC's, the first four of which received the greatest emphasis:

- Air quality
- Surface water
- Groundwater
- Land use
- Noise
- Ecology
- Earth science
- Regional economics
- Health
- Sociology
- Transportation.

7. Geographical/Political Scope—Identifies the state or federal origin of the legislation. Although all data collected in this study pertain to one of the six selected states or to the federal government, it may prove necessary in the collection of local data to provide for a geographical/political scope (GPS) to cover parts of two or more states. Some Standard Metropolitan Statistical Areas (SMSA's), for example, include parts of more than one state.

¹⁰R.K. Jain et al., *Handbook for Environmental Impact Analysis*, Technical Report E-59 ADA006241 (CERL, 1974).

8. **Administrative Agency**—Identifies the subject area for the agency that administers the specified environmental legislation or enforces the standards.

9. **Agency Address**—Contains the address of the administrative agency from Field 8.

10. **Bibliographical Reference**—Consists of the bibliographical citation for the source from which the legislation was extracted.

11. **Abstract**—Provides an indicative abstract of the legislation.

12. **Environmental Attributes**—Consists of index terms selected from CERL's list of environmental attributes.

13. **Key Words**—Consists of word phrases or single word terms selected to enhance the search capabilities of the data file.

14. **Environmental Standards**—Consists of tabular data covering various environmental standards imposed by selected laws.

15. **Environmental Attribute Code**—Gives number assigned by CERL to each attribute.

Evaluation of Pilot Study

The CERL staff working on environmental impact analysis, potential users, and an independent information science consultant¹¹ all evaluated the data base in eight major areas: users, alternatives to CELDS, software availability, comprehensiveness of data, currency of data, data organization and entry, methods of access, and cost of the system.

The major problem is data entry. Evaluation of the system revealed the following problem areas:

1. **Lack of Original Documents**—Documents often enter the CELDS data base in abstracted form. Occasions may arise when the full text of the document will be required, so that it should be readily available.

2. **Incomplete Document Information**—The fact

that not all the fields for each document record contain data is frustrating to the user, for he does not know whether the information does not exist, or whether it has not been entered into the data base.

3. **Inconsistent Document Division**—The lack of uniformity in the way documents are divided into data records may confuse the CELDS user. For example, one data record of the data base includes both sections 1.01 and 1.02 of the Virginia State Water Control Board rules; another includes section 1.03. Section 1.04 is missing altogether, and section 1.05 encompasses four separate data records.

4. **Lack of Uniform Entry Format**—Computers do not have the capacity that humans possess for identifying variations in spelling and punctuation. Many of the original errors in data entry were caused because CELDS indexers were inconsistent in entering data on coding sheets to be keypunched. Format of the entry varied, as well as word choice.

5. **Lack of Proofreading for Data Entries**—The print-out of the CELDS data base was laden with misspellings, keypunch errors, and extraneous and misfiled cards.

The CELDS retrieval system also needs improvement in the areas of referral capacity, inventory of data base contents, hierarchical searching capability, and keyword indexing.

Conclusions and Future Plans

Appropriate steps are being taken during fiscal year 1975 to correct errors in the pilot study. Some of these modifications include:

1. Development of a guide sheet to local resources for locating documents.

2. Review of the data fields and entries made unavailable, or unindexed data.

3. Creation of specifications for input into the CELDS system.

4. Training on CELDS indexes.

5. Use of standardized coding sheets.

6. Proofreading of the final computerized files.

¹¹Nancy Lane, *Environmental Quality Data Base*. Unpublished Report (Construction Engineering Research Laboratory, 1973).

In cooperation with the Library Research Center of the University of Illinois, CERL is continuing to work on other problem areas in the development of CFIIDS.

This pilot study included federal laws and laws for six states. Work is currently underway to include an additional ten states and to update information on the six already in the system. Future plans include expanding the data base to cover all 50 states and updating information on a continuing basis.

4 ECONOMIC IMPACT FORECAST SYSTEM (EIFS)

In many communities the presence of an Army installation may significantly influence the well-being of the local economy, as well as the quality of the air, water, and land. The surrounding community often sees the base as a source of revenue and employment. Purchases by Army personnel frequently represent sizeable proportions of the community's retail sales, which in turn may generate substantial income and employment. Not all the influences are positive, however; members of the community may view the base as a source of great expense since it occupies tax-exempt land, yet benefits from various tax-supported services such as police and fire protection, libraries, street maintenance, and utilities.

To measure the effect of an Army installation, it is necessary to quantify the economic relationships that exist between the installation and the private community. The Economic Impact Forecast System (EIFS) is an experimental computer-based system for assessing the impact of Army activities on the local economy. EIFS estimates the magnitude of effects caused by changes in the level of activity at the base. This system is specifically designed to assist in the preparation of Army environmental impact assessments and statements as required by Section 102 (2) (c) of NEPA.

Use of the word "assist" in the paragraph above is deliberate. The economic impacts described in succeeding sections are highly aggregative and based on secondary data sources. EIFS is intended to estimate the *orders of magnitude* of economic impacts, not to provide exact values. This approach has distinct advantages over others in that new data collection

and analysis are not required for each new impact statement, and the results of each analysis are directly comparable.

Some kinds of economic or related impacts are not evaluated by the models presented in this study. These models are basically short-term; questions about long-term impacts of activities on the economic structure or growth of an area are not answered. In addition, these models take no account of areas other than the ones indicated—or of intangible attributes. Although a guide for interpreting the study's results is provided, the final interpretation rests with the user.

Application of the System

Some of the questions that EIFS can answer are:

- What are the likely effects on the local community of constructing 100 units of family housing?
- Will local merchants suffer undue hardships from the construction of new PX and canteen facilities?
- Will a decision to lower military strength at an installation severely harm the local economy?

Currently, EIFS has socioeconomic data available for 64 Army installations. Information on more than 350 counties, which has been gathered from the census, governmental sources, and Standard Metropolitan Statistical Areas (SMSA's), is the basis for EIFS forecasts.

The data files are stored by installation names, by initial displays presenting socioeconomic profiles of the economic region, and by maps indicating the locations of the installations. The user of the system selects the functional area of the project to be evaluated. Information and detailed descriptions of the functional areas follow the guidelines presented in CERL's *Environmental Impact Study for Army Military Programs*.¹² After the user selects the functional area and subcategory, the system displays a series of questions pertaining to the project. The

¹²R. K. Jain et al., *Environmental Impact Assessment Study for Army Military Programs*, Interim Report D-13 AD 765476 (CERL, 1973).

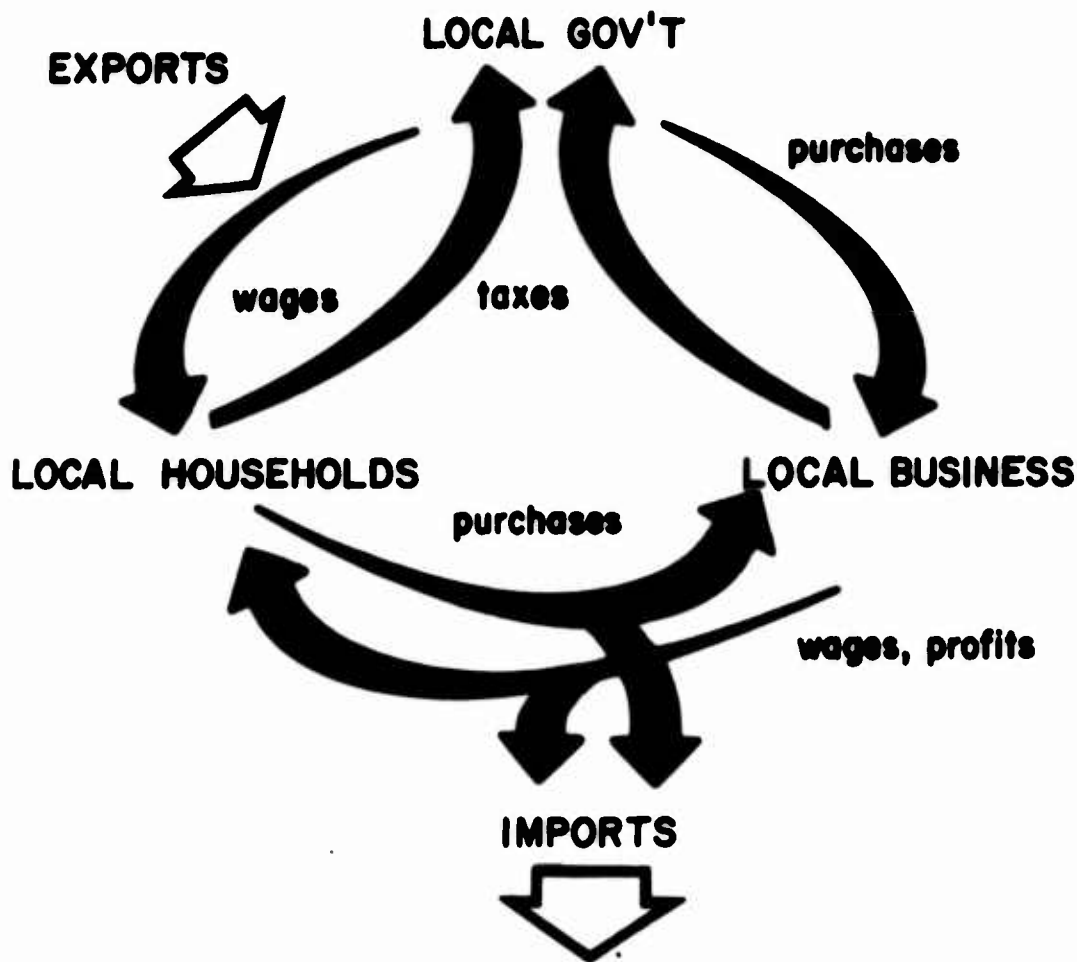


Figure 2. Interrelationship of main sectors.

user's answers, together with the stored data, are then used to calculate and display economic impacts on the local business community, individuals, and local governments. The system also tells whether these impacts are substantial, significant, or insignificant. The user should consult professional economists and planners if the impact is judged substantial. Significant impacts require the project director to consider possible mitigating actions, but additional impact assessments need not be undertaken at this time.

The creation of the impact prediction model is illustrated in Figure 2. The interrelationships between local government, households, and businesses are illustrated by the arrows connecting the sectors. Figure 2 is meant to illustrate one simple point: "Interdependence is the rule in any economy." What affects the business community affects every other sector and, due to the circular nature of this economy, an initial impact will always be less than the sum total of all the effects. In assessing the impact of a change in the level of economic activity

at an installation, one must first discover the affected part of the puzzle (i.e., What are the mechanisms by which the Army's activities affect the local community?). The second part of the problem is more difficult. Given this initial discovery, what will be the total repercussions in the local economy? Diagrammatically, this manual traces the initial impact through the various sectors, recording the level of impact at each stage, and listing the secondary impacts.

After establishing the theoretical relationships, a series of equations was developed and is presented to provide the desired information.

User's Guide to EIFS

EIFS provides both data and interpretations of data to the user's prospective clients. After the user enters information on the proposed activity, EIFS supplies a list of baseline economic and social data for the region and predicts the effects of that activity upon that region.

Two methods of interaction are allowed. The user can:

1. Relay information to a central site by mail or phone and receive the results in a similar manner.
2. Convey the information directly to the computer using modern teletype equipment and receive the output in a few minutes.

EIFS contains three basic types of programs that help to acquaint the user with the system and the data files: system information programs, data file information programs, and economic impact forecast programs.

System Information Programs

The first system information program is called EIFS. To use it type *EIFS?* As seen from the copied printout below, *EIFS?* describes the impact program and leads the user into DATA/XXX series, which comprises the rest of the system information programs.

EIFS?

THE ECONOMIC IMPACT FORECAST SYSTEM IS AN EXPERIMENTAL PROGRAM DEVELOPED AT THE CONSTRUCTION ENGINEERING RESEARCH LABORATORY TO ASSIST IN THE PREPARATION OF ENVIRONMENTAL IMPACT ASSESSMENTS AND ENVIRONMENTAL IMPACT STATEMENTS. EIFS ALSO CONTAINS A WIDE VARIETY OF INFORMATION ABOUT THE ECONOMIC COMMUNITY ASSOCIATED WITH EACH OF THE INCLUDED INSTALLATIONS. YOU CAN LEARN MORE ABOUT THE COMPONENTS OF THE SYSTEM BY TYPING EIFS/XXX WHERE XXX IS THE CODE FOR THE TOPICS:

CODE	TOPIC
INS	A LISTING OF THE INSTALLATIONS COVERED
FUC	A LISTING OF THE FUNCTIONAL AREAS COVERED
PRO	A LISTING OF AVAILABLE PROJECT CATEGORIES
IMP	A DESCRIPTION OF THE ECONOMIC IMPACT FORECAST
END.	

For example, to find out about the Economic Impact Forecast Program, type EIFS/IMP.

EIFS/IMP

THE ECONOMIC IMPACT FORECAST PROVIDES AN ANNUAL DOLLAR FORECAST OF THE EFFECTS ON THE LOCAL COMMUNITY OF A CHANGE IN THE CURRENT LEVEL OF ACTIVITY AT AN ARMY INSTALLATION. THE USER MUST BE ABLE TO SUPPLY AN ESTIMATE OF THE ANNUAL DOLLAR VALUE OF THE PROJECT. THE OUTPUT OF THE ECONOMIC IMPACT FORECAST CONTAINS:

CHANGE IN LOCAL BUSINESS VOLUME -

LOCAL EXPENDITURES BY MILITARY INSTALLATION

LOCAL EXPENDITURES BY MILITARY PERSONNEL

HOUSING

NONHOUSING

LOCAL EXPENDITURES BY OTHERS

HOUSING

NONHOUSING

CHANGE IN LOCAL PERSONAL INCOME

CHANGE IN LOCAL EMPLOYMENT

CHANGE IN VALUE OF LOCAL PROPERTY

CHANGE IN LOCAL INVESTMENT

BUSINESS

HOUSING

ECONOMIC IMPACT ON LOCAL GOVERNMENTS

CHANGE IN TAX-RELATED REVENUES

CHANGE IN STATE AID RECEIVED BY LOCAL GOVERNMENT

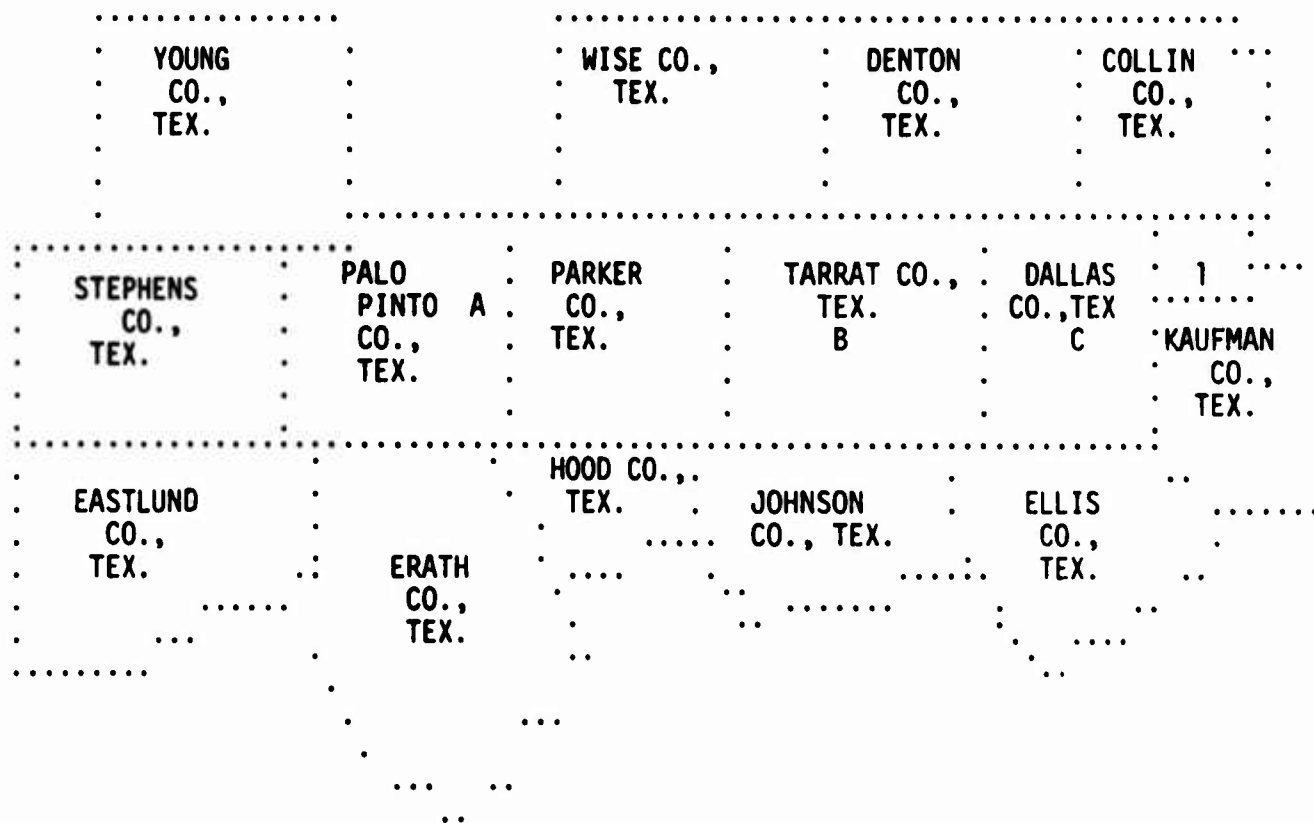
CHANGE IN COSTS OF LOCAL GOVERNMENT SERVICES

FOLLOWING THE ABOVE INFORMATION WILL APPEAR ONE OF THE FOLLOWING WORDS: INSIGNIFICANT, SIGNIFICANT, SUBSTANTIAL.

Data File Information Programs

EIFS currently has socioeconomic data for 64 Army installations including over 350 counties and Standard Metropolitan Statistical Areas (SMSA'S). Appendix C contains a list of the Army installations included in EIFS and the counties which comprise their regions of influence.

After the user types the Army installation code on



- 1 ROCKWALL CO., TEX.
- A FORT WOLTERS, TEX.
- B FORT WORTH, TEX.
- C DALLAS, TEX.

Figure 3. Computer-printed regional map from EIFS.

the keyboard, the following question will appear:

**DO YOU WANT A MAP OF THE REGION
TO BE PRINTED? ANSWER YES OR NO.**

If your answer is yes, the computer will print a map indicating the location of the Army installation, the principal counties comprising the economic area, and the major communities. Figure 3 is an example of the output.

Regardless of the answer to the above question, the following socioeconomic data and characteristics of the installation will be presented:

**PRINCIPAL COUNTIES COMPRISING ECO-
NOMIC REGION**

COUNTY	COUNTY AREA	POPULATION DENSITY (NO. PERSONS PER SQ. MI.)
--------	-------------	--

MAJOR COMMUNITIES

COMMUNITY	1970 POPULATION
PCT. CHANGE 1960-1970	MEDIAN INCOME

SOCIOECONOMIC CHARACTERISTICS OF_____

REPLACEMENT VALUE_____

LAND AREA IN ACRES:

POST POPULATION:

**MILITARY STRENGTH:
ARMY DEPENDENTS:
CIVILIAN STRENGTH:**

Economic Impact Forecast Programs

After the data display of socioeconomic characteristics of the installation, the following information will appear:

FUNCTION CODE	FUNCTION NAME
1	CONSTRUCTION
2	OPERATION, MAINTENANCE
3	TRAINING
5	REAL ESTATE
6	PROCUREMENT
7	INDUSTRIAL

TYPE DESIRED FUNCTIONAL AREA CODE
(01, 02, 09)

Information and detailed descriptions of functional areas follow the guidelines presented in CERL's *Environmental Impact Study for Army Military Programs*.¹³

Following the selection of the functional area, an option to print the project categories and project types appears:

**DO YOU WANT A LIST OF AVAILABLE
PROJECT CATEGORIES?**

RESPOND YES OR NO

A yes response will cause the following to be printed:

CODE	PROGRAM NAME
1100	OPER AND TRAIN FAC
1200	MAINT & PROD FAC
1300	RESEARCH, DEV + TEST FAC
1400	SUPPLY FACILITIES
1500	HOSP + MEDICAL FAC
1600	ADMINISTRATIVE-FACILITIES
1700	HOUSING + COMMUNITY FAC
1800	UTILITIES + GROUND IMPR

¹³R.K. Jain et al. *Environmental Impact Assessment Study for Army Military Programs*. Interim Report D-13 (CERL, 1973).

Again, the *Environmental Impact Study*¹⁴ fully explains program names and their relationships to the functional areas. Corresponding to each program name is a list of types of projects specific to that program. For example, if the user had selected 1700, Operation and Training Facilities, as the specific program of concern, the following list of project types would appear (if the user requests it by an affirmative answer):

**DO YOU WANT A LIST OF AVAILABLE
PROJECT TYPES?**

ANSWER YES OR NO

YES CODE	PROJECT TYPE-NAME
1711	FAMILY HOUSING SINGLE
1712	FAMILY HOUSING DUPLEX
1713	FAMILY HOUSING ROW
1714	FAMILY HOUSING ROW 2-3 STORIES
1720	BACHELOR HOUSING

After the user selects the functional area, project category, and project type, a series of questions will appear requesting information on the dollar volume and duration of this activity:

**ENTER DOLLAR VALUE OF PROJECT PER
YEAR**

**EXAMPLE: FOR \$105,000 VALUE, ENTER
105000**

ENTER NUMBER OF YEARS

At this point, questions specific to each project category may be asked of the user. For example, project type 1711 asks:

**ESTIMATE NUMBER OF FAMILIES WHO
CURRENTLY LIVE OFF-POST BUT WITHIN
THE ECONOMIC REGION THAT WILL MOVE
ON-POST. FOR EXAMPLE: FOR 200 FAMILIES
ENTER 200?**

With this information and the information stored in the data banks of the computer, EIFS presents an economic impact forecast relating changes in the given activity to changes in the level of business

¹⁴R.K. Jain et al.

activity, changes related to individuals in the community, and changes related to the operation of local government. An example of an economic impact forecast is presented below (minus signs indicate negative values or decreases in that category):

ECONOMIC IMPACT FORECAST
FUNCTIONAL AREA = CONSTRUCTION
CATEGORY = HOUSING & COMMUNITY
FACILITIES
TYPE = FAMILY HOUSING SINGLE
\$ VALUE/YEAR = 6670000
NO. OF YEARS = 1
CHANGE IN LOCAL BUSINESS
VOLUME \$ 5343910.
LOCAL EXPENDITURES BY
MILITARY INSTALLATION \$ 2071421.
LOCAL EXPENDITURES BY
MILITARY PERSONNEL \$-775299.
HOUSING \$ -21549.
NONHOUSING \$-753750.
LOCAL EXPENDITURES BY
OTHERS \$ 4047788.
HOUSING \$ 480586.
NONHOUSING \$ 3567203.
CHANGES IN LOCAL PERSONAL
INCOME \$ 3524843.
CHANGE IN LOCAL EMPLOY-
MENT (MAN-YEARS) 286.
CHANGE IN VALUE OF LOCAL
PROPERTY \$ 5155655.
CHANGE IN LOCAL INVESTMENT
BUSINESS \$ 586185.
HOUSING \$ 213452.
ECONOMIC IMPACT ON LOCAL
GOVERNMENT
CHANGE IN TAX-RELATED
REVENUES \$ 128747.
CHANGE IN STATE AID RE-
CEIVED BY LOCAL GOVERN-
MENT \$ -85228.
CHANGE IN COSTS OF LOCAL
GOVERNMENT SERVICES \$ 43519.

An evaluation of this output in terms of whether these impacts are significant, substantial, or insignificant is then displayed by the simple statement, "THIS IMPACT IS (INSIGNIFICANT, SIGNIFICANT, OR SUBSTANTIAL)." These terms denote the ability of the local economy to absorb these changes without difficulty. Insignificant impacts mean that the absorption will occur without any

difficulty. Significant impacts mean that the project director should give additional consideration to the method through which the project is undertaken, but no additional study is required. Substantial impacts indicate that the desired project will create difficulties in the local economy. It is recommended that substantial impacts be explored further; that is, the director should undertake a more detailed case study.

Next the user can obtain the basic information used in the prediction by answering the question:

DO YOU WANT A TABLE OF BASELINE ECONOMIC INFORMATION?

If the answer is yes, the following display is obtained:

THE FOLLOWING IS THE BASELINE ECONOMIC INFORMATION WHICH IS CONTAINED IN THE EIFS SYSTEM FOR THE SELECTED REGION. THIS TABLE REPRESENTS CENSUS INFORMATION FOR THE YEARS 1967 AND 1970.

TOTAL BUSINESS VOLUME =	\$555092000.
MEDIAN RENT =	\$ 67.
TOTAL PERSONAL INCOME =	\$927750000.
TOTAL FULL AND PART TIME	
EMPLOYMENT =	\$ 106528.
AVERAGE YEARLY CHANGE IN	
TOTAL PERSONAL INCOME =	\$ 49975000.
AVERAGE YEARLY CHANGE IN	
TOTAL FULL AND PART TIME	
EMPLOYMENT =	\$ -106.
ASSESSED TO MARKET VALUE	
RATIO =	\$.1400
EXPORT EMPLOYMENT	
MULTIPLIER =	\$ 3.6000
TOTAL ASSESSED VALUE OF	
REAL PROPERTY =	\$115841000.

Theoretical Analysis

The principal objective of this section is to answer the question, "What will happen to the local economy if _____?" The term omitted could be any one of a number of activities occurring at the Army installation. To answer this question, however, one must be able to describe a local economy, identify the participants, and specify how the economic components interact.

The three basic participants in the local economy are local government, households, and businesses. Figure 2 represents the interrelationship between these sectors. Local households purchase some goods and services from local business, receive wages and profits from selling their services, pay taxes, and consume services provided by local government. Local businesses sell goods and services, purchase materials and labor, pay taxes, and receive services from local government. Local government purchases goods and services from business and labor from households, collects taxes, and provides public goods and services, such as police, fire protection and libraries.

Suppose that one household in this economy wins a lottery; how will this event affect the local economy? As this money works its way through the various sectors of the local economy, part of it will be put into the household's savings while the major portion will be used to finance purchases. Some of the products will be purchased locally; others will be purchased elsewhere. Purchases made from other regions cause dollars to flow out of the local economy and therefore are not important in this analysis. Most of the money received by local business will be used to hire labor, purchase products, and pay taxes; the rest is profit. The wages received by labor will be partly spent and the remainder will be saved. Some of the products purchased were produced in that region, while others were produced elsewhere. The owners of this business may be local residents, in which case their profits will remain in the local economy; or they might live elsewhere, in which case some additional money has left the local economy.

The general concept is that money injected into or withdrawn from a local economy will be partly retained and respent in the area, and will partly dissipate into other regions. The total effect of the initial injection will depend upon many factors, but the total will be greater than the initial injection because of the multiplier effect upon the local economy.

To illustrate the mechanics of the multiplier, consider the following example: Suppose that from every dollar spent on a construction project, \$.40 is spent locally. In addition, assume that consumers spent \$.80 out of every dollar they receive. What will happen if somehow a new dollar finds its way into this region?

First, \$.80 will be spent by the household, the remaining \$.20 going for savings and taxes. Out of the \$.80 spent locally, 40 percent or \$.32 will find its way back to local residents in the form of wages, rents, and/or profits. The remaining \$.48 is used to purchase materials from outside the economic region or is devoted to taxes. The \$.32 received by local residents is partly respent locally, partly saved and partly devoted to taxes. Again, 80 percent of the \$.32, or \$.26, will be spent and an additional \$.10 will be received as local income. This process in theory will continue until all of the \$1 is spent on imports, savings, or taxes. The total increase in income can be shown by observing that the initial increase in income of \$1 caused a second-round increase of $(.80)(.40)$1, a third-round increase of $(.80)(.40)(.80)(.40)$1$, and so on.$

Letting $s = (.80)(.40)$, the following infinite geometric series can be expressed:

$$\$1 + (S \times \$1) + (S^2 \times \$1) + (S^3 \times \$1) + \dots$$

Since the sum of an infinite geometric series is $1/1 - S$, income will change by an amount equal to $1/1 - S$ times the original change in income. The expression $1/1 - S$ is called the multiplier because any change in a parameter or exogenous variable will lead to a multiple change in income.

This model was presented as an example of a multiplier effect, but in practice one cannot ascertain S directly. Fortunately, though, there are a number of ways in which the multiplier can be estimated, as demonstrated in the following sections.

Isolating The Export Industries: Direct Methods

If detailed information on the flows of goods and services in any region can be collected, an input-output table can be used to determine exports. This table traces the demands and supplies of each sector in the region, thus allowing the user to estimate the increase in income and employment.

This analysis makes the following assumptions:

1. Marginal propensity to consume each commodity equals the average propensity to consume.
2. Production originates in the industry rather than the firm.

Table 3
Transactions in Region R

Purchases From	Sales To					
	Interindustry Demand		Final Demand		Totals	
	Services	Manufacture	Local Consumption	Exports	Final Demand	Gross Output
Services	50	200	210	40	250	500
Manufacture	100	300	140	460	600	1000
Households	350	500				850
Imports			500			500
Total Gross Outlays	500	1000	850	500	850	

3. A constant percentage of each available input is used to produce a unit of output; there are no alterations in scale.

4. Prices, wages, and tastes are given and fixed, and there are no resource constraints.

Table 3 describes the transactions occurring in a simple economy. In this economy there are two sectors: the final demand sector consists of local consumption and exports and is exogenously determined; interindustry demand, which is endogenously determined, consists of the demand by each of the two industries, services, and manufacturing.

Each row gives the sales of that industry to other industries and to final demand. For example, the service sector sells \$50 worth of output to other firms dealing in services and \$200 of it to manufacturers. Final demand is \$210 in local consumption and \$40 in exports.

The columns indicate the input purchases by the various industries. In this table, services purchases \$50 worth of inputs from firms in the service sector, \$100 worth from the manufacturing sector, and \$350 worth from households, which largely consists of wages for labor.

Assuming that the percentage of purchases from any industry is constant no matter what the volume of production, the total gross output from each sector will be:

$$q_{1i} = a_{1i} q_1 + a_{2i} q_2 + d_{1i} + d_{12} \quad [\text{Eq 1}]$$

where

q_1 = the gross output of good 1

a_{1i} = percent of industry i's sales going to industry 1

a_{2i} = percent of industry i's sales going to industry 2

d_{11} = the final demand for local consumption

d_{12} = the final demand for exports.

Table 4 gives the coefficients representing inter-industry sales.

Table 4
Technical Coefficients

Purchases From	Sales To	
	Services	Manufacturing
Services	.10	.20
Manufacturing	.20	.30
Value Added	.70	.50

These coefficients were derived by dividing each entry in a column by the corresponding industry's gross outlays. Using these coefficients, for example, a unit of services is produced by combining 10 percent of a unit of service and 20 percent of a unit of labor. Total gross output of services, as indicated in Eq 1, is given by:

$$q_1 = .10 (q_1) + .20 (q_2) + d_{11} + d_{12} \quad [\text{Eq 2}]$$

since

$$q_1 = 500, q_2 = 1,000, d_{11} = 210, \text{ and } d_{12} = 40,$$

we have

$$500 = .10 (500) + .20 (1,000) + 250. \quad [\text{Eq 3}]$$

Table 5
Effects of \$1 Increase in Manufacturing Exports

Rounds	Manufacturing	Services	Total
Initial	= \$1		
First	.3 x \$1 = .30000	.2 x \$1 = .20000	.50000
Second	.3 x (.30) + .2 (.20) = .13000	.2 x (.30) + .1 x (.20) = .08000	.21000
Third	.3 x (.13) + .2 (.034) = .05500	.2 x (.13) + .1 x (.08) = .03400	.08900
Fourth	.3 x (.055) + .2 (.034) = .02330	.2 x (.055) + .1 x (.034) = .01440	.03770
Fifth	.3 x (.0233) + .2 (.0144) = .00987	.2 x (.0233) + .1 x (.0144) = .00610	.01597
Total	1.51817	.33450	1.85267

Suppose now that there is a \$1 increase in the demand for manufacturing goods in the export sector. How will this increase be met? The dollar increase in manufacturing exports will mean that \$.20 will have to be purchased from the service sector, and manufacturing production will have to increase by \$.30. The \$.20 increase in the demand for services will lead the service sector to purchase 10 percent of \$.20 or \$.02 more of its own product and 20 percent of \$.20 or \$.04 more from manufacturing, which will, in turn, increase the demand for services. Table 5 traces some of the increases in manufacturing and service demand as a result of the \$1 increase in exports. After five rounds of transactions, the total increase in manufacturing demand will be \$1.51817 and the total increase in services \$.33450.

In practice, using this model would require a great deal of information from each firm in the economy about the location of their customers, their suppliers, as well as about the dollar volume of purchases and sales. This data can be gathered only from individual interviews—a time-consuming and costly process. Followup interviews are necessary because not all the questionnaires are returned. Compiling and processing the data takes time; an input-output (I-O) study for the State of Kansas took two years to complete and cost \$120,000. Industry coverage varied from 22.4 to 92.6 percent.¹⁵

I-O models do present considerable information on the interaction and workings of a local economy. Whether the benefits derived are worth the additional cost depends upon the individual case.

Exports are basic to economic growth since they

are most subject to short-term changes.¹⁶ Other activities in this region are nonbasic in the sense that they do not result in any money inflows, at least under the assumptions made in our short-term model.

If the relationships postulated in our multiplier analysis are constant, and if the average propensity to consume locally is equal to the marginal propensity, then the multiplier can be rewritten as:

$$\frac{1}{1-S} = \frac{1}{\frac{\text{nonbasic income}}{1 - \text{total income}}} = \frac{1}{\frac{\text{basic income}}{\text{total income}}}$$

$$= \frac{\text{total income}}{\text{basic income}}$$

To use this multiplier one need only derive an estimate of the proportion of the region's total income that is based upon export sales. By isolating the export industries, it is possible to derive a relationship between a change in these industries (for example, employment) and the total change in the local economy.

Many techniques can provide indirect estimates at a significantly lower cost. The central assumption of indirect techniques is that there is a fixed relationship between the export industries in a region and the other local businesses. Location quotients are a widely used technique for isolating export industries. Location quotients compare a region's allocation of employment with the entire nation's employment allocation. This comparison assumes that since the

¹⁵Jarvin Emerson, *The 1969 Kansas Input-Output Study* (State of Kansas, 1969).

¹⁶Charles M. Tiebout, *The Community Economic Base Study*, Supplementary Paper No. 16 (Committee for Economic Development, December 1962).

Table 6
Location Quotients for Monroe County

Industry or Sector	Percent of National Employment	Regional Employment	Percent of Regional Employment	Location Quotient	$\frac{LQ-1}{LQ}$	No. of Export Employees
Services	.40	400	.40	1.00	—	
Durable Goods Manuf.	.20	75	.075	.375	—	
Nondurable Manuf.	.10	25	.025	.25	—	
Trade	.30	500	.50	1.667	.40	200

$$\text{Multiplier} = \frac{\text{Total Employment}}{\text{Basic Employment}} = \frac{1,000}{200} = 5$$

United States is basically self-sufficient, any region having a greater percent of its employment in a particular industry than does the nation as a whole must specialize in the production of that commodity. Any region that produces more than its own requirements must export its extra commodities to other regions.

Table 6 gives a hypothetical example of the calculation of location quotients. Next to each industry is the percent of the total national employment in Monroe County for each industry. The percent of total regional employment that industry contains is in column 3. Dividing column 3 by column 1 gives the location quotient. A location quotient greater than one means that Monroe County exports that commodity to other regions. A location quotient less than one means that not enough is produced locally, and some must be imported to satisfy local needs. Location quotients equal to one indicate that the region neither imports nor exports that commodity.

Once exporting industries have been identified, employment allocated to exports can be calculated by subtracting one from the location quotient and dividing by the original location quotient. Multiplying column 5 by column 2 gives the number of export employees for each industry. The multiplier is the ratio of total regional employment to export employment. In this example, the multiplier would be five, indicating that a \$1 increase in export demand would increase regional business volume by \$5.

The size of the multiplier depends directly upon the size and population of the region and the diversity of its industrial and commercial base. The greater the size, the larger the population, and the more diverse the economic base, the more likely it is

that products and services purchased are made locally rather than imported. Thus money injected into the economy is "recycled" more often, causing larger changes in income.

EIFS depends upon an economic base analysis with location quotients used to calculate multipliers. The advantages of this technique—reliance on published data sources, incorporation of indirect as well as direct exports, and the negligible costs involved—far outweigh the disadvantages.

Description of the Models

Having broadly described the interrelationships that exist within a local economy, one must now develop a methodology for measuring how the various military-related activities affect the local economy. The first step is to define the geographical environment. Although the availability of published data is a practical issue that must be considered, many theoretical issues are also pertinent since there is no consensus on how to define an economic region. Here the extent of the local labor market was considered to be the relevant area, with counties used as the observation unit. Both distance and the availability of employment were criteria for selection. The impact areas of immediate concern are those relating to the local business community, local individuals, and local government.

Economic Impact on Local Businesses

A military installation influences local business volume directly by purchasing services and supplies from the local community; and indirectly by causing local firms to purchase materials, supplies, and labor locally, thus adding to local business volume.

Both the military and civilian payroll increase local business activity as the income received is spent and respend locally. The relationship between local business volume and the Army installation is given in Eq 4.

$$BV_{MR} = LE_{MR} + IBV_{MR} \quad [Eq 4]$$

where

BV_{MR} = military-related business volume

LE_{MR} = military-related local expenditures

IBV_{MR} = induced business volume related to the military installation.

Local expenditures are the sum of those indirectly undertaken by the installation, those attributable to the military and civilian payroll and, finally, those expenditures made by visitors to the area.

$$LE_{MR} = IL_{MR} + PL_R + VL_{MR} \quad [Eq 5]$$

where

IL_{MR} = direct local expenditures by the installation

PL_{MR} = local expenditure by military and civilian personnel

VL_{MR} = local expenditures by visitors to the installation.

Not all direct expenditures by the installations (IL_{MR}) contribute equally to the local business community. Money spent on equipment produces less additional activity than that spent on services because it is much more likely that materials and supplies will have to be imported, while services are almost all supplied locally. Eq 6 expresses IL_{MR} as:

$$IL_{MR} = IL_s + IL_p + IL_c \quad [Eq 6]$$

where

IL_s = local expenditures on services

IL_p = local expenditures on materials and supplies

IL_c = expenditures for construction.

Local expenditures by military personnel will vary according to the individual's location. Individuals

and families living on-post will buy most items at the PX or commissary, since these sources are closer and provide goods at lower prices. Conversely a family living off-post, but within the local economic region, will purchase locally a larger amount of goods and services than an on-post family. Housing is a major expense for these off-post families. Off-post, non-local families will purchase relatively little locally since purchases tend to be made either on the base or near their homes. An estimate of local purchases, as made by a survey of a representative installation,¹⁷ can be expressed as:

$$PL_{MR} = PL_{FN} + PL_O + PL_{FL} \quad [Eq 7]$$

where

PL_{FN} = local purchases by off-post, nonlocal, military personnel

PL_O = local purchases by on-post military personnel

PL_{FL} = local purchases by off-post, local, military personnel.

Eq 8 further divides local purchases into off-post expenditures for housing and for other purchases:

$$PL_{FL} = PL_{FH} + PL_{FO} \quad [Eq 8]$$

where

PL_{FH} = local expenditures on housing by off-post personnel

PL_{FO} = other local expenditures by local off-post personnel.

Eq 5 considers money spent by visitors to the installation. In general, there are two types of visits: those undertaken for personal reasons (parents, friends, etc.) and those for business. The total number of visits multiplied by the average amount spent per visit gives the total amount spent by visitors (Eq 9). Money spent on hotels, motels, restaurants, etc., is assumed to be related to the population of the installation and will therefore be considered as an impact only if the post population changes.

$$VL_{MR} = V \times E_v \times M \quad [Eq 9]$$

¹⁷Saul Pletter, *Impact on Proposed Construction at Fort Riley, Kansas on the State and Regional Economics*. Unpublished Report (CFRI, 1973)

where

V = number of visits per military personnel
 E_v = average expenditure per visit
 M = number of military personnel.

If, for example, the Army were to construct 100 units of family housing, some construction materials would be purchased locally, and local labor would be hired for this project. The sum of local purchases of materials and labor constitutes local expenditures for construction, or IL_c , in Eq 6. As individuals are transferred from the local economy to the base to occupy these family housing units, housing allowances previously received by local landlords will be withdrawn and some local purchases made by these families will now be made at the PX or commissary. These effects will be incorporated in PL_{MR} . If no other changes occur, LE_{MR} will be equal to PL_{MR} plus IL_c .

These expenditures have a multiple effect on the local economy as initial spending filters down to firms and households and induces further spending. A meal purchased by a visitor to the installation, for example, will be used to pay wages, rent, and interest, buy materials, and result in some profit for the owner. These receipts, in turn, will be spent partly in the local economy, continuing a line of transactions that result in higher business receipts by local merchants, greater income, and increased employment. The total induced business volume is derived using Eq 10:

$$IBV_{MR} = (m - 1) (LE_{MR}) \quad [\text{Eq 10}]$$

where

m = coefficient representing the degree to which money received by local business is respent locally.

The magnitude of this multiplier coefficient will vary with the size of the community. The smaller the community and the less diversified its economic base, the smaller the amount respent locally. Larger communities, on the other hand, tend to have larger multipliers.

The total change in business volume directly increases the personal income of local residents. The relationship between the change in business volume

and the change in personal income is given by Eq 11:

$$YP = BV_{MR} \times V \quad [\text{Eq 11}]$$

where

YP = change in personal income
 V = coefficient representing the degree to which individual income is received from local business activity.

Increases in personal income go toward housing and other goods when received. Eqs 12 and 13 express the relationship between personal income and expenditures on housing and other goods. These increased expenditures have already been included in BV_{MR} and should not be counted again.

$$HE = h \times YP \quad [\text{Eq 12}]$$

where

h = coefficient representing the proportion of income devoted to housing.

$$OE = c \times YP \quad [\text{Eq 13}]$$

where

c = coefficient representing the proportion of income devoted to other goods.

The total change in business volume attributable to the presence of the military is the sum of direct and indirect changes, as given in Eq 4.

Change in Value of Local Property

When business activity in the local community increases, both the value of the assets held by individuals and the amount of assets devoted to business activity will increase. Because direct dollar measures of the capital and land devoted to business activity are typically unavailable, assessed valuation statistics are used and converted to market value by means of an assessed-to-market-value ratio. The ratios, though available, vary both among and within jurisdictions. The accuracy of these ratios in reflecting market values depends upon the accuracy of the assessment and the frequency of reassessment. Eq 14 gives these estimates as:

$$\Delta P = BV_{MR} \times \frac{V_B}{BV} \times \frac{1}{a_{mv}} \quad [\text{Eq 14}]$$

where

ΔP = change in property values
 BV_{MR} = military-related business volume
 BV = total business volume
 V_B = assessed value of property
 amv = ratio of assessed to market value.

Change in Local Investment

In order to meet the demands of changed business volume and housing expenditures, investment in business capital and housing will similarly have to be changed. Based upon data for corporations reported to the Internal Revenue Service,¹⁸ the ratio between business volume and investment is treated as a constant as is the ratio of housing investment and expenditures. Eq 15 gives these relationships as:

$$IN_{MR} = .12 \times BV_{MR} + .06 (PL_{FH} + HE) \quad [Eq 15]$$

where

IN_{MR} = change in investment
 PL_{FH} = local expenditures on housing by off-post personnel.

Individual Impacts

Individuals are also influenced by the activities of the military installation. As money related to local military expenditures is respend within the region, payrolls and profits increase, and individuals are affected in the form of increased personal income and employment.

Eq 11 represents the change in local personal income as a function of local business income.

$$YP = BV_{MR} \times v \quad [Eq 11]$$

where

YP = local personal income
 BV_{MR} = military-related business volume
 v = coefficient representing payroll and profit per dollar of local expenditures.

¹⁸Annual Statistical Summary: 1967, Table 40B (U.S. Department of Health, Education and Welfare, Federal Housing Administration); and Statistics of Income, 1965 Business Income Tax Returns (U.S. Internal Revenue Service).

Increased income implies increased employment either through the creation of new jobs or through more working hours for currently employed persons. Multiplying dollars of direct expenditure by a coefficient representing the number of man-years of employment per \$1 of direct expenditures yields the total employment:

$$E = j \times BV_{MR} \quad [Eq 16]$$

where

j = coefficient representing man-years of employment per dollar of local expenditure.

This coefficient varies from region to region because of industrial diversity and size. One study by S. J. Weiss and E. L. Gooding¹⁹ has estimated that each million dollar change in business volume creates 70-90 man-years of employment.

Military-related practical training gives individual participants skills which increase their earnings over their working lives. This impact is different from the others, however, because not all of the recipients will remain in the local economy. The economic value of this training is measured by the following formula:

$$HK = \sum_{i=S}^t \frac{SK_i - UK_i}{(1+r)^i} \quad [Eq 17]$$

where

HK = total value of training to the individual over lifetime
 SK_i = yearly wages of skilled workers at year i
 UK_i = yearly wages of unskilled workers at year i
 S = year of training completion
 r = interest rate
 t = working life expectancy.

Impacts on Local Government

Changes in military-related activities may affect the tax base and income of local governments. Two models explain changes in local government revenues resulting from changes in the sales tax, prop-

¹⁹S.J. Weiss and E.C. Gooding, "Estimation of Differential Employment Multiplier in a Small Region Economy," *Research Report to the Federal Reserve Bank of Boston*, No. 37 (1966), p. 38.

erty tax, or federal, state, and local governmental expenditures.

Eq 18 divides local governmental revenues and expenditures into their component parts:

$$GR_L = TR_L + AD_L + XP_L \quad [\text{Eq 18}]$$

where

GR_L = local government revenues
 TR_L = tax-related revenues
 AD_L = federal and state aid to the community
 XP_L = local governmental expenditures.

Tax revenues arise mainly from property and sales taxes which are given in Eq 19:

$$TR_{L\text{revenues}} = TP_L + TS_L \quad [\text{Eq 19}]$$

where

TR_L = tax
 TR_P = property tax revenues
 TS_L = sales tax revenues.

Changes in property tax revenues are related to changes in property values as indicated in Eq 20:

$$TP_L = PV_{MR} \times P \times amv \quad [\text{Eq 20}]$$

where

p = property tax rate
 amv = assessed-to-market-value ratio.

As local business volume changes, so will the sales tax revenue collected by the county. This relationship is given in Eq 21:

$$TS_L = s \times SR \times BV_{MR} \quad [\text{Eq 21}]$$

where

s = applicable sales tax rate
 SR = proportion of sales tax collected and retained by local government.

Federal and State Aid to Local Government

Eq 22 summarizes another source of local govern-

ment revenues: federal and state aid. For military-related activities, the only source of federal aid is through funds provided to underwrite the cost of schools attended by the children of military personnel living off-post. Federal aid to local schools under Public Law 874 provides funding for approximately 50 percent of the cost per student. In addition to federal aid, state aid for schools is typically based upon the number of school children; the level of funding varies from state to state.

Other forms of state aid depend upon the individual state-local relationship. In some states, local highway funds are based upon local automobile registrations and/or gasoline tax collected. Other areas funded by the state include the judiciary and police.

$$AD_L = (f + a) \times CS \times NS_{MR} + AD_O \quad [\text{Eq 22}]$$

where

f = coefficient representing fractional percentage federal aid per child expressed as fraction of total
 a = coefficient representing percent state aid per child expressed as fraction of total
 CS = yearly school costs per child
 NS_{MR} = number of school children of military personnel
 AD_O = other state aid.

Local government expenditures for schools and other services are assumed to be related to changes in county population and business volume. The latter, open-ended, category could conceivably be used to estimate funding of various functions such as police, fire, and sanitation. The data required for such projections are not readily available, although the following analysis could be used if data does become available.

$$XP_L = XS_L + XO_L \quad [\text{Eq 23}]$$

where

XP_L = change in local government expenditures
 XS_L = expenditures for schools
 XO_L = expenditures for other local governmental services.

School expenditures are given as:

$$XS_L = NS_{MR} \times OB / NS \quad [\text{Eq 24}]$$

where

NS_{MR} = military-related school enrollment
 OB = operating budget for schools
 NS = total school enrollment.

Other expenditures are derived as indicated in Eq 25:

$$XO_L = \frac{BV_{MR}}{BV} \times OB_O \quad [\text{Eq 25}]$$

where

OB_O = operating budget for other services
 BV_{MR} = military-related business volume
 BV = total local business volume.

Description of the EIFS Model

Having worked through the general theoretical properties of determining economic impacts, we can now describe in detail the model actually used in determining the economic impact of constructing family housing units at an Army base:

$$(\$ \text{VOL OF CONSTR PER YR}) \times (\% \text{ LABOR})$$

$$\times (1 - 1/m) = \$ \text{ LOCAL LABOR}$$

$$(\$ \text{VOL OF CONSTR PER YR}) \times (\% \text{ MATLS})$$

$$\times (1 - 1/m) = \$ \text{ LOCAL MATLS}$$

The user supplies the dollar volume of construction per year. The % labor and % materials are stored in the system according to category of construction. In the $(1 - 1/m)$ term, m designates the income multiplier. The entire term represents that proportion of the labor or materials to be supplied by the local region.

$$(\$ \text{ LOCAL LABOR}) + (\$ \text{ LOCAL MATLS})$$

$$= \$ \text{ DIRECT MILITARY EXPENDITURES}$$

The addition of both these terms gives the value which is, in this case, the same as IL_C and IL_{MR} in

the theoretical discussion.

$$(\text{NO. OF FAMILY UNITS MOVING ON POST})$$

$$\times (\text{MEDIAN RENT}) = (-\$ \text{ LOCAL HOUSING})$$

The user furnishes the number of family units moving on-post as a result of the construction activity. EIFS stores median rent values for each region. The product above represents rental money removed from the region by the construction project.

$$(\text{NO. OF FAMILY UNITS MOVING ON POST})$$

$$\times (\text{AVG INCOME}) \times (\% \text{ SPENT LOCALLY})$$

$$= (-\$ \text{ LOCAL EXPEND.})$$

Families moving on-post will buy more items at the PX and commissary. The approximate percentage of income transferred to federal facilities (and out of local facilities) is stored in EIFS. This number, the average income of the family (also stored), and the number of families involved represent expenditures other than housing which will be removed from the local money flow.

$$|(-\$ \text{ LOCAL EXPEND.})$$

$$+ (\$ \text{ DIRECT MILITARY EXPEND.})$$

$$+ (-\$ \text{ LOCAL HOUS.})]$$

$$\times (\text{ECONOMIC EXPORT MULTIPLIER})$$

$$= \Delta \$ \text{ LOCAL Y}$$

The summation of the results of preceding relations and the subsequent multiplication indicate the net change in income to the region as a result of the military activity.

$$(\Delta \$ \text{ LOCAL Y}) - [(\$ \text{ LOCAL EXPEND.})$$

$$+ (\$ \text{ DIRECT EXPEND.})$$

$$+ (-\$ \text{ LOCAL HOUSING})] = IBV_{MR}$$

Taking the preceding results and subtracting the net first order effects of the military activity yields a measure of the induced or indirect business volume resulting from the activity

$$(\$ \text{ LOCAL LABOR}) + [(\Delta \$ \text{ LOCAL Y} - \$ \text{ LOCAL LABOR}) \times V] = \$ \text{ LOCAL PERSONAL INCOME}$$

In this equation, V is a coefficient representing the degree to which individual income is received from local business activity. The result of this equation represents the total change in personal income to be received by individuals residing in the local economy.

$$(\$ \text{ LOCAL PERSONAL INCOME}) \times h = \$ \text{ HOUS. EXPEND.}$$

As total personal income increases, part of it will be passed on in terms of increased housing expenditures. Multiplying the total change in personal income by h, or the marginal propensity to consume for housing, gives the amount of this increase.

$$(\$ \text{ LOCAL PERSONAL INCOME}) \times C = \$ \text{ OTHER EXP.}$$

The same rationale applies to other expenditures. In this equation, C represents the marginal propensity to consume for other items. This value does not include savings or taxes.

$$\Delta \$ \text{ LOCAL Y} \div \text{VALUE ADDED LOCALLY PER EMPLOYEE} = \Delta \text{ EMPLOYMENT}$$

This relation establishes the change in employment attributed to an Army-related change in business activity. Value added locally per employee indicates the number of dollars of local business required to support one employee.

$$\frac{(\Delta \$ \text{ LOCAL Y})}{(\text{LOCAL BUSINESS VOL.})} \times \frac{(\text{TOTAL ASSESSED VALUE OF PROPERTY})}{(\text{ASSESSED TO MKT VALUE RATIO})} = \Delta \text{ PROPERTY VALUE}$$

The division of the local business activity associated with Army activity by the total local business volume gives a percentage which can be multiplied

by the total value of property to approximate the change in property values. Dividing total assessed valuation by assessed to market value ratio determines the total value of property.

$$[(\$ \text{ DIRECT MILITARY EXPEND.}) + (-\$ \text{ LOCAL EXP}) + (\text{IBV}_{\text{MR}})] \times (.12) = \text{NONHOUSING INVESTMENT}$$

The sum of those terms associated with net change in dollar inflow multiplied by the propensity to invest in nonhousing gives the projected change in nonhousing investments. The major component of this investment is inventory accumulation.

$$[(-\$ \text{ LOCAL HOUSING}) + (\$ \text{ HOUSING EXPEND.})] \times (7.75) \times (.06) = \text{HOUSING INVESTMENT}$$

Net housing revenue change multiplied by the propensity to invest in housing approximates the anticipated value of investment. The constant 7.75, which relates rental values to assessed housing value, comes from Table 40B of the 1967 *Annual Statistical Summary*, U.S. Department of Housing and Urban Development, Federal Housing Administration.

$$(\Delta \text{ PROPERTY VALUE}) \times (\text{PROPERTY TAX RATE}) \times (\text{ASSESSED TO MKT VALUE RATIO}) = \Delta \text{ PROPERTY TAX REVENUE}$$

Assessed-to-market-value ratio multiplied by the change in property value gives the change in assessed value. This product multiplied by the property tax rate approximates the change in property tax revenues which can be attributed to Army activity.

$$(\Delta \$ \text{ LOCAL Y}) \times (\text{SALES TAX RATE}) \times (\text{PERCENT RETAINED BY LOCAL GOV'T}) = \Delta \text{ SALES TAX REVENUE}$$

Sales tax rate multiplied by the proportion re-

tained locally gives the proportion of each dollar the region will gain or lose due to the activity. Multiplication by the change in local volume gives the dollar volume of change in sales tax revenue.

(Δ PROPERTY TAX REVENUE)

= (Δ SALES TAX REVENUE)

= Δ TAX REVENUE

This relation represents the total change in tax revenues to be expected as a result of this activity.

(NO. OF FAMILIES MOVING ON POST)

$\times$ (CHILDREN PER FAMILY)

$\times$ (% ATTENDING SCHOOL)

= NO. OF SCHOOL CHILDREN

This equation gives the number of school children who will move onto the installation as a result of the family unit construction project.

(NO. OF SCHOOL CHILDREN)

$\times$ (COST OF EDUCATION PER CHILD)

$\times$ (% FEDERAL + % STATE FINANCED)

= ($-\Delta$ STATE + FEDERAL AID)

This equation relates the change in the number of school children to the state and federal aid which will be withdrawn from the local school system.

(NO. OF SCHOOL CHILDREN)

$\times$ (COST OF EDUCATION PER CHILD)

$\times$ [1 - (% FEDERAL + % STATE FINANCED)]

= $-\Delta$ SCHOOL COSTS

This equation estimates the decrease in the local tax burden as a result of supporting fewer children with local funds.

$\frac{(\Delta S \text{ LOCAL Y})}{\text{TOTAL BUSINESS VOLUME}}$

$\times$ (OPERATING BUDGET OTHER)

= Δ OTHER COSTS

The change in local volume divided by the total volume and multiplied by the operating budget for other expenses gives the change in other governmental costs attributed to the activity.

($-\Delta$ SCHOOL COSTS) + (Δ OTHER COSTS)

= Δ COSTS

The total change in costs is represented by the sum of the change in costs for education and other local budgetary items

Appendix D should answer questions that may arise as to the origin of the stored numbers.

Interpreting the Results

What significance can be attached to any of the numbers derived, especially given the weaknesses in the data? In this instance, the regional and urban economics literature is not very helpful—there are no hard and fast rules that can be used. The descriptive categories presented below should be considered tentative criteria for interpreting results. They will be revised in light of experience with the system and of the individual interpretations of those familiar with the subject area.

The three categories of evaluation are insignificant, significant, and substantial. Insignificant impacts relate to changes in the local economy that occur without, *in the aggregate*, undue hardships and friction. The local economy will absorb these impacts with practically no structural changes. Although one landlord, for example, may lose considerable income if his tenants are Army personnel who transfer to the base, *in the local economy as a whole*, landlords will not suffer significantly.

Significant impacts are those that occasion minor changes in the structure of the economy or represent influences that cannot be moderated within a year. In other words, the local economy will typically be capable of absorbing the stated impacts but probably not within a year or without congested or unused facilities. Any methods of ameliorating these difficulties—for example, constructing a 1000 unit

housing project over five years rather than one—should be explored.

Substantial impacts represent either major alterations in structure or hardship for a major segment of the population in the local area. EIFS is not currently capable of providing the detailed data necessary for an investigation of remedial measures. Individual studies should be undertaken for those projects determined by EIFS to yield substantial impacts.

The procedure used by EIFS to categorize economic impacts as insignificant, significant, or substantial is based upon a comparison of the historical annual growth rate of employment and personal income with the implied growth rate resulting from the project. If the ratio of the implied to the historical growth rates is between minus one hundredth or plus 10 percent, then the impact is deemed to be insignificant. A ratio of implied to historical that is between minus 1 percent and minus 10 percent or between plus 10 percent and plus 20 percent, then the impact is considered significant. Substantial impacts are those that reduce the historical growth rate by more than 10 percent or increase it by more than 20 percent.

One last word of caution: an impact statement for a particular locale may be insignificant by itself, but if this project is one of many undertaken simultaneously, the impacts are accumulative and should be treated as such.

5 CONCLUSIONS AND RECOMMENDATIONS

In general this research program has demonstrated the feasibility of maintaining an on-line environmental information system. For CELDS, the main problem areas were collecting and indexing data, creating the data file, and interpreting user needs. Work is currently underway to improve these features of the system and to find the cost-effective means of updating. Future plans for CELDS include expansion to cover all 50 states.

For EIFS, problem areas are collecting the data, updating the existing data, and refining the theoretic

cal models used. Refinements of the models will be undertaken after field implementation and user input. Sociological data now being collected will be incorporated into the data base. Future plans for EIFS include adding more counties and eventually including all U.S. counties. Field tests of EIFS at Fort Bragg and Fort Benning have thus far indicated that it is a very useful system. Work is currently underway in southern Mississippi to prepare the economic section of an environmental impact assessment for a major military construction project using the output of EIFS.

An environmental technical information system can be quite useful, particularly in the areas of environmental impact assessments and statements, economic indicators of the interrelationship of Army installations and their surrounding communities, and compliance with state and federal standards pertaining to Army installations. As each existing system and its improvements are field-tested, system output and predictions will be tailored to provide more specific information in line with field results.

In the future, this system could include the following types of information:

1. Industrial waste classifications, treatments, and costs.
2. Existing facilities data regarding the numbers and conditions of installation facilities.
3. Soils and geologic data relevant to environmental impact assessment.

When the system is expanded and further developed, it could meet specific requirements of NEPA and CEQ guidelines through the presentation of "environmental setting" data and, where feasible, aggregates of quantifiable terms that would predict subsequent environmental changes.

At this time, CELDS is operational for environmental legislation concerning the federal government and 16 states; EIFS is operational for 64 military installations. This information is available to Army personnel through CERL for use in preparing EIA/EIS's and in meeting appropriate environmental standards and regulations when operating and building Army facilities.

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APPENDIX A:

SOURCES OF NATIONAL, STATE, AND LOCAL LAWS AND REGULATIONS

Much of the environmental quality data bank will consist of laws and regulations pertaining to the environment. This information comes from various sources. Federal, state, and local legislation is the legal authority for rules and regulations issued by the executive offices and various administrative agencies. Organizations affected by environmental quality laws use these rules and regulations to guide their conduct. Court decisions and administrative rulings supplement and redefine these laws, rules, and regulations.

There is, however, no single source of information containing all this material. The lack of uniformity in the data is a problem. The relative completeness of the sources depends upon who produces the data and for what type of organization they produce it. Therefore, it may be helpful to understand both the origins of laws and regulations and the sources from which these materials may be obtained.

Nature of Legal Material

At both the federal and state levels, legislation may be divided into conventional and subordinate legislation. Conventional legislation consists of the results of legislatures, constitutions, interstate compacts, and, at the federal level, treaties. Subordinate legislation is usually authorized by conventional legislation and delegates the authority to set up rules and regulations. Subordinate legislation consists of the rules and regulations of administrative agencies, orders and proclamations of the executive office, and rules of courts. Municipal ordinances are regarded as subordinate legislation in some states and conventional legislation in others.

Conventional Legislation

In the federal system the three types of conventional legislation are the act, the joint congressional resolution, and the treaty.

Acts are the most common form of conventional legislation. They may be introduced in either house of Congress as bills. Once passed by one house, they are introduced into the other house as an act. When passed by both houses and signed by the President, or when both houses override the President's veto,

the act becomes an Act of Congress and thus a public law. Each public law is given number, e.g., P.L. 90-135, with the first digits referring to the number of the Congress (90th) and the second digits referring to the bill number in the Congress (135th).

A joint resolution of Congress has the same effect as an act. Joint resolutions are usually submitted to the President and require his signature, except in cases such as proposed constitutional amendments. Joint resolutions are also public laws.

An interstate compact may either be approved by Congress through an act or a joint resolution or by the approval of the state legislative bodies which the compact included. Once approved they become public laws of the United States and also a part of the session laws of the states involved.

A treaty is an international agreement entered into by the President with the consent of the Senate. An "executive agreement" is an international compact by the President which does not require congressional approval. A formal treaty becomes part of the law of the land, while executive agreements may be upheld as the law of the land, but they usually will not supersede an Act of Congress.

Generally states basically follow the legislative form of the federal system. Joint resolutions in the state legislatures may or may not have the force of law, depending on the state. The legislative session laws are included in the public law body in all states and may be called Acts and Resolves, Public Laws, Acts, or Joint Resolutions.

Subordinate Legislation

Subordinate legislation at both the federal and state levels consists of the rules and regulations made by the President, state governors, administrative agencies, and the courts. The legal authority for this legislation comes from either the constitutions involved or the legislation authority delegated by law. Usually these laws govern the daily transactions occurring within and between government and the individual citizen or organization.

In the federal system the President has wide-ranging authority, much of which he entrusts to agencies under his control. The President may enter into treaties and executive agreements, form re-

organization plans, and issue proclamations and executive orders.

Reorganization plans pertain to the creation, modification or abolition of agencies below the rank of department. They go into effect unless disapproved by Congress.

Proclamations and executive orders are used by the President to carry out many of his functions. They may include minor changes such as the establishment of administrative agencies during periods of national emergency. This authority comes from the constitution or congressional law.

Many agencies outside the executive department are created by acts of law and charged with controlling and overseeing activities in specific areas. The Environmental Protection Agency and the Food and Drug Administration are examples of such agencies.

Subordinate legislation in the state system and local system is transacted mostly through administrative rules and regulations.

Court and Administrative Agency Decisions

The rules, laws, and regulations enacted by the executive and legislative branches guide the operations of governmental bodies, although the essence and substance of these rules, laws, and regulations are contained in the opinions given by the courts and administrative hearing officers. Usually federal and state court decisions of record refer primarily to those cases that have reached some appellate court, although occasionally some lower federal courts are included. The administrative agency's decisions and rulings are not recorded in any uniform format, however, and may not be easily available, depending upon the agency's customs. This lack of uniformity applies to both state and federal administrative agencies.

Federal Environmental Law Sources

Acts and joint resolutions of Congress are officially published by the U.S. Government Printing Office about three weeks after approval. They are known then as "slip laws." About 14 months later they are published in bound form in a volume of the official *Statutes at Large*. The proper citation of the law is the *Statutes-at-Large* designation.

Unfortunately, there are several problems in using these volumes. The laws are published by approval data in chronological order. They contain many acts having only local interest, making the data unwieldy. Many of the acts are soon outdated due to their repeal, amendment, or expiration. Because of these problems the publication *United States Codes* (USC) is probably the easiest to use. In this compilation of laws, published about every six years, items of minor interest are not included. Repealed or expired portions are not included, and amended parts are updated. The USC is divided into about 50 categories with air pollution, water pollution and other environmental categories having their own specific titles in the code.

Information about treaties and executive agreements first appear in the *Department of State Bulletin*. Later they are published in slip-law format in the *Monthly Catalog of Government Publications*. Collections of these treaties and executive agreements are then published in *Treaties and Other International Act Series* (TIAS).

Subordinate legislation for the federal government is published in the *Federal Register* daily Tuesday through Saturday, except on days following a legal holiday. It contains the literal texts of all documents officially promulgated under the law. It is part of the *Federal Register System*, which is comprised of the Federal Register, the Code of Federal Regulations, the weekly compilation of Presidential Documents, the Government's Organization Manual and the Public Papers of the President of the United States. The *Federal Register*, however, has many of the same limitations as the *Statutes at Large*.

At the end of each calendar year, the *Code of Federal Regulations* (CFR), a 100-plus volume set of codes, is updated. It contains the rules and regulations of all federal agencies cataloged by 50 titles. The title numbers differ between the CFR and the USC. In the CFR, the title will have a general name, e.g., transportation, and may include the rules and regulations for more than one agency (e.g., transportation included, among others, the Federal Railroad Administration and the Federal Highway Administration). A particular agency may have certain standards located under one title and others under another title. The Federal Highway Administration, for example, has separate and different listings under transportation and defense. Each volume

in the CFR includes two comprehensive indices in the back—one by title and the other by agencies—listed in alphabetical order.

In addition to these sources, many agencies publish their own rules in separate pamphlets, but these pamphlets tend to be out of date.

A collection of statutes, *Current Laws—Environmental Protection Agency*, is also published. This rather lengthy collection of laws includes all the authorizing legislation as well as the executive orders and United States treaties pertaining to the Environmental Protection Agency. It is divided into six sections—air, water, pesticides, solid waste, noise, and radiation—but because of its statutory nature, it does not include many of the objective standards that may be required by an environmental legislation data system.

State Environmental Law Sources

Every state publishes its legislative session's laws. Few states publish official slip laws, although several states publish an unofficial advance sheet of the latest legislation. The state's session laws usually are one volume in length and are in chronological order. The name of this publication varies from state to state. Resolutions are usually contained in the same volume, following the acts.

The *Environmental Reporter* is also of some help in obtaining state laws. This source is published by the Bureau of National Affairs, Inc. Several states also publish statutory compilations of laws, such as *McKinney's Consolidated Laws of New York, Environmental Conservation Law*, which provides a current, central source for all of New York's environmental conservation laws.

The publication of the state's administrative rules and regulations is not always satisfactory. Most state's agencies publish their rules and regulations separately. Only about 14 states now publish any form of compiled regulations similar to the *Code of Federal Regulations* (CFR).

Court Decisions

The results of court decisions contain much of the substantive content of the law. Usually only those cases that have reached the appellate level are found

in court report compilations. In fact, some courts do not report in any type of official publication, and interested groups must go elsewhere for information on these decisions.

United States Reports, a bound volume of decisions of the court, is the source of all written opinions of the Supreme Court of the United States. Slip decisions, which contain only the text of the opinions, are published each Monday during a term of the court. Also during the court's term, approximately a month to six weeks after a decision is handed down, advance sheets are published separately for each individual decision. These advance sheets (called preliminary prints) are usually identical to the printed decision as it appears in the bound volume of the *United States Reports*.

Most federal appellate courts publish slip decisions, and since there are no official reporters for most of these courts, unofficial systems, which will be discussed later, need to be used. The Court of Claims, Court of Customs and Patent Appeal, and other administrative courts still publish official reports.

In the state court system, most states have been publishing official reports. In the past few years, however, several states have discontinued official publication of these decisions. In these states an unofficial reporter series, which will be discussed later, can be used.

Administrative Agency Decisions

Issuance and compilation of administrative agency decisions is inconsistent, although in form they resemble decisions of the courts.

In the federal government system, administrative agency decisions may appear in several forms, including press releases, mimeographed reports, printed slip decisions, advance sheet pamphlets and bulletins, and bound volumes of agency rulings.

Press releases are usually mimeographed and appear within a day or two of the decision. They usually appear in abridged form and are circulated to newspapers and various other interested groups.

Mimeographed reports also follow the agency decision by a day or two and may be abridged.

Usually they have some form of serial designation by which they may be cited. Printed slip decisions are fairly common. They resemble court slip decisions in format, designation, and style.

The format, content, and frequency of advance sheet pamphlets and bulletins differ among various agencies. Some contain both agency and court decisions, other agency decisions and rules of practice, dockets, and other information, while other agencies may include only parts of this information.

Bound volumes of agency rulings are another form in which agency decisions may appear. These volumes are similar to bound court decisions.

State agency decisions follow much the same form as those of federal agencies, except official publication of state agency decisions is rare. The few exceptions to this rule include the Attorney General's opinions, which are found in a monthly *Digest of Opinions of Attorney Generals* published by the Council of State Governments, and annual utility commission decisions, which appear in *Public Utilities Reports*.

Unofficial Reporter Systems

Inadequacies, omissions, and delays in preparing official court and agency reports have led to the growth of unofficial reporter systems. Of the systems that have grown up in the United States, the *National Reporter System*, published by the West Publishing Company of St. Paul, Minnesota, is perhaps the best. Besides providing a current source of court decisions, it also provides a key number system, which relates points of law found in each court decision to the *West Digest System*. Hence, by knowing the key number referring to a point of law that is of interest, one may locate the applicable case law through the digest system.

The *National Reporter System* is a set of volumes containing court decisions from all appellate jurisdictions of the United States. The following volumes are available:

1. *Supreme Court Reporter*: Reports in full every decision of the Supreme Court of the United States, beginning with the October term of 1882.

2. *Federal Reporter*: Contains the full decisions of

the United States Circuit Courts from 1880 to 1912, the District Courts of the United States from 1880 to 1932, the United States Court of Claims from 1929 to 1932, the United States Court of Appeals from 1891, the United States Court of Customs and Patent Appeals from 1929, and the United States Emergency Court of Appeals from 1943.

3. *Federal Supplement*: Connects with Vol 60 of the *Federal Reporter*, second series. It reports decisions from the United States Court of Claims from 1932 to 1960, the United States District Courts since 1932, and the United States Customs Court since 1956.

4. *Federal Rules Decisions*: Reports in full opinions of the United States District Courts that are not designated for publication in the *Federal Supplement* and that involve federal rules of civil procedure (since 1939) and criminal procedure (since 1946).

5. *Regional Reporters*: Contain opinions of state courts. The set consists of:

a. *Atlantic Reporter* (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, Vermont);

b. *Northeastern Reporter* (Illinois, Indiana, New York, Ohio);

c. *Northwestern Reporter* (Iowa, Michigan, Minnesota, Nebraska, North Dakota, South Dakota, Wisconsin);

d. *Pacific Reporter* (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Kansas, Montana, Nevada, New Mexico, Oklahoma, Oregon, Utah, Washington, Wyoming);

e. *Southeastern Reporter* (Georgia, North Carolina, South Carolina, Virginia, West Virginia);

f. *Southern Reporter* (Alabama, Florida, Louisiana, Mississippi);

g. *Southwestern Reporter* (Arkansas, Kentucky, Missouri, Tennessee, Texas);

h. *New York Supplement* (All decisions of New York Court of Appeals since 1887 and all opinions of the Appellate Division of the Supreme Court of the State of New York);

i. *California Reporter* (All decisions of the California Supreme Court, the California District Court of Appeals, and the Appellate Division of the California Supreme Court since 1960).

The *West Digest System* consists of digest volumes for each state and the District of Columbia, except Nevada, North Dakota, and South Dakota; volumes

for each of the *Regional Reporters* and for the *Supreme Court Digest*, the *Federal Digest*, *Modern Federal Practices Digest*, and the *United States Court of Claims Digest*. In addition, all digest volumes are keyed to the *American Digest Volumes*, which has published seven decennial digests covering the period from 1887 through 1956, and a *General Digest Series* covering the period since 1956.

APPENDIX B:

PLAN FOR CELDS

1 PROBLEM STATEMENT

Persons in charge of preparing environmental impact assessments or statements (EIA, EIS), planners and designers at Corps Districts and Divisions, and facility engineers at Army installations often need quick access to current federal, state and local environmental laws, regulations, and standards. Currently there is no system to make these documents available in a clear concise manner. The alternative is search publications such as *Environmental Reporter* and all the laws and regulations pertaining to the given area to obtain the required information.

2 OBJECTIVE

CELDS provides Corps and Army users an easy access to current federal, state, and regional environmental laws, regulations, and standards in order that, with minimum searching, the users can obtain a clear and concise document related to a specific topic of interest to the user.

3 APPROACH

Original copies of all federal, state and regional environmental laws, regulations and standards are collected, cataloged, and stored in a central repository maintained by a competent library staff. The staff classifies, indexes, and abstracts each document before placing it in the CELDS data base. Access to the abstracted documents can be available in many different forms, depending upon the requirements of the users. For example, first level access can be through hard copy or microfiche of the abstracted document with a manual coordinate search index. Second level can be computer-based with batch processing capability only. Third level can be on-line direct access via remote terminals. Combinations of these methods are also possible.

An orderly development plan for CELDS should proceed in several stages and in two directions. The first direction is the scope of coverage. Since all the federal and state laws and regulations cannot be collected, indexed, and abstracted at the same time, a timetable must be set up for an orderly expansion

of coverage. The second direction is in the complexity of retrieval modes. A pilot study should be set up with coverage of up to six states to test the CELDS data base as it expands. The modes of access may have to be changed to allow more efficient use of the CELDS data base.

4 GENERAL SCOPE

Users and Their Requirements

There are many potential users of CELDS, but some specific types of users are:

- Engineers or comparable personnel in charge of preparing environmental impact assessments or statements (EIA, EIS) in Corps district and division offices.
- Planners and designers responsible for the master plans of installations at Corps district and division offices.
- Facility engineers or environmental quality control officers at Army installations.
- Any other staff-level personnel responsible for preparing EIA or EIS documents at Army installations.

The specific requirements of these users are as follows:

- Legal requirements dealing with permits and applications for permits for certain discharges.
- Legal requirements for filing EIA and EIS documents.
- State or regional requirements in connection with discharges and other activities affecting the environment.
- Awareness of trends and changing legal requirements concerning environmental laws and regulations.

A second class of potential users who may require CELDS as currently envisioned are:

- Personnel at the Corps division offices responsi-

ble for reviewing or commenting on EIA and EIS documents.

- Similar personnel at Army installations.
- Higher level staff personnel responsible for reviewing or commenting on EIA and EIS documents.
- HQ personnel responsible for making major decisions which will affect the environment. For example, the selection of sites for large-scale training exercises.

These users demand a wider scope of information, so their requirements may not be filled completely during the initial development of CELDS.

A third class of users may find certain uses of CELDS beneficial, although it may not meet all their needs. These users are:

- Lawyers interested in environmental laws and regulations.
- Librarians or other information specialists seeking references to certain environmental laws and regulations.

A fourth class of users consists of counterparts of the first and second class Army users in the Navy and Air Force and perhaps in other federal agencies. They can probably use CELDS to obtain the same benefits as the first and second class of users.

Modes of Operations of CELDS

To be flexible and responsive, CELDS must be available to users in both manual and automated access methods.

Manual Mode

Under the manual mode the first class of users can be served without delay. Hard copies of the abstracted documents for federal and a given state can be combined to form a one-volume CELDS data base. A coordinate search manual index will allow the user to obtain any document under the state or federal section. In some states, regional information can also be included in the data base if needed. To make manual search easy the scope of coverage

should be limited to federal plus one or two state and some regional laws and regulations. For the first class of users this limitation normally is not restrictive except perhaps with the division offices, for which the data base can be expanded to include all states under the jurisdiction of the division.

Batch Mode with Link to EICS

Most of the first class users will probably have access to the Environmental Impact Computer System (EICS) to assist them in preparing EIA's and EIS's. Based on the output of EICS, the first class users can obtain a computer print-out of relevant environmental laws and regulations since all these documents are indexed under environmental attributes. Presently the information system (EICS, EIFS, CELDS) can be accessed through CERL. Appropriate arrangements are being made to access these systems via terminals at Army facilities.

Geographical coverage under batch processing can go beyond federal plus one to two states. The first phase will probably involve a separate data base for each Corps division. Later expansion can include the states within one or more contiguous divisions and finally cover all states in the United States in one data base. Under the batch mode the users fill out a search form and send it in (or call in their requests) to CERL or another central site. Processed outputs will be reviewed briefly to see if the search was adequate and then mailed to the users who have requested them.

Some Class II users may be able to use CELDS data bases in the early phases if their search does not extend beyond geographical areas already available in the data base.

On-Line Interactive Mode

The on-line interactive mode can follow the same pattern of implementation as the batch mode. Since the computer hardware and software requirements differ for the two however, the cost benefits will also differ. Before implementing the batch mode, a detail study and survey of users' preferences should be made and the costs and benefits calculated.

Second class users can also employ the batch mode. Third and fourth class users can also employ the on-line interactive mode without any additional

changes if the hardware and software can support the projected load.

Choice of Sites for Implementing CELDS

The computer hardware and software resources of each proposed site should be analyzed in detail. At the same time the resources required to implement both the batch processing mode and the on-line interactive mode should be determined using projected numbers of users and frequency of access. The user can then compare the two sets of analyses to select one or more sites that can provide the best match in supply and demand of the resources.

Scope of Coverage of CELDS

During the pilot study, an effort should be made to clearly define the boundary of the environmental laws and regulations that should be included in the CELDS data base. Objective criteria are necessary to enable the indexer and abstractor to decide if a given document should be included. For example, decisions must be made on whether to include laws and statutes, but exclude bills and resolutions, to include regulations and standards, but exclude policies, etc. Other types of criteria are relevancy to Army activities and areas of environmental concerns such as air, surface and ground water, noise, radiation, etc. Investigators should see how many more documents would be included in the base for each criterion and how much total time and effort would be necessary to locate certain laws dealing with a given technical specialty, e.g., sociology.

Structuring and Indexing of Document

Development of Index Terms

The development of comprehensive but usable thesaurus or index terms is critical to the success of CELDS. Terms should be arranged in a hierarchical order, and the bank should include terms in both general and specific areas. It should be comprehensive enough to cover most of the environmental laws and regulations to be indexed yet compact enough so that indexers can use it without extensive searching.

Handbook for Cataloging, Indexing, and Abstracting

To maintain a uniform quality of cataloging,

indexing, and abstracting of documents, a detailed step-by-step handbook should be developed before these activities be undertaken. The objective criteria developed above should be included. There should be enough index terms to include the environmental attributes, but they should be selective enough to exclude irrelevant documents. Informative abstracts rather than indicative ones, or copies of original texts will be more helpful.

Although environmental laws differ greatly from state to state or from state to federal government, there should be as much uniformity as possible in the indexing system. Experienced indexers or others familiar with the handbooks should train all new indexers or abstracters to ensure uniform indexing.

Methods of Update

Any update, revision, or addition to documents in CELDS should be obtained as an original copy first. Constant monitoring of publications such as *Environmental Reporter: Air, Water and Noise Pollution Report*; and frequent contact with state and local environment agencies are two methods of getting up-to-date information. Of course any added original copies have to be screened and placed in the CELDS data base later. Under the most favorable conditions a six-month delay can occur from the initial publication of the changes to inclusion in the CELDS data base.

5 PLAN OF IMPLEMENTATION

Pilot Study

A pilot study should be performed using only the environmental laws and regulations of the federal government and several states. This study could validate the feasibility of structuring, indexing, and abstracting the documents to fulfill the requirements as outlined above. At the same time the different modes of CELDS could be tested to see if such operations are possible and responsive to the requirements of the various users. Research into the methodologies and procedures of collecting, cataloging, indexing, and abstracting the diverse sources of documents, as well as the required manpower and computer hardware and software, should also be conducted during the pilot study.

Evaluation of Pilot Study

During completion of the pilot study, a vigorous evaluation program should be set up involving outside consultants, in-house scientists and engineers, and prospective first and second class users. Criteria for evaluation should be set up for the various aspects of the CELDS data base as well as its tie-in relationship with EICS. All persons who would be involved in the evaluation should help set up the various aspects of the CELDS data base.

The results of the evaluation plus all the comments and suggestions should be carefully reviewed and applied to building the best plan.

Implementation

Phase 1

Coverage: All federal laws and up to 10 states' laws included in the pilot study plans.

Mode of Operation: Mainly manual mode with hard copies (paper or microfiche) and manual coordinate index for search. Users from a given state will be provided with environmental laws and regulations for that particular state plus federal and regional information. Combinations of more than one state will be developed as need arises. Initial trial conversion to computerized files will be attempted under Phase 1, but none of these will be operational.

Phase 2

Coverage: Same as Phase 1 with perhaps five additional states.

Mode of Operation:

1. Manual for those users who prefer that mode.
2. Computerized files for the states included in Phase 1 will be available for search by batch or remote batch processing.
3. Users who do not have access to a remote batch terminal have to either submit their search in the required form by mail or call in their request by telephone to the central site for processing. Output will be returned by mail.

4. Users who have access to a batch terminal

compatible to the central site computer can have the form filled out, keypunched, and submitted through the terminal. Output should be available at the terminal the same day.

5. Third and fourth class users may have access through the manual mode only.

Phase 3

Coverage: Same as Phase 2, plus any additional states required by users.

Mode of Operation:

1. All modes available under Phase 2, plus the following.
2. The computer files developed in Phase 2 will be available for on-line interaction search through teletypes or teletype-compatible terminals. Voluminous output can be printed at the nearest remote batch terminal that is compatible with the central site computer.
3. Third and fourth class users may be considered to allow access to CELDS on trial basis if resources are available under the batch and on-line interactive mode.

Phase 4

Coverage: Eventual coverage to include all 50 states plus some local ordinances and standards.

Mode of Operation: All three modes as selected by users' preferences.

Updates

Phase 1

1. Federal and state environmental laws and regulations included in the pilot study will be updated during this phase.

Phase 2

All state, regional and federal environmental laws and regulations covered in Phase 1 will be updated during this phase.

Phase 3

All state, regional, and federal environmental laws and regulations covered in Phase 2 will be updated during this phase.

Phase 4

Continuous updating on a regular basis of all documents in the CELDS data base.

6 MANPOWER AND OTHER REQUIREMENTS

Projected In-House Requirements

Pilot Study

4 man-months principal research
6 man-months research assistant
4 man-months computer specialist

Phase 1

6-12 man-months principal researcher
18 man-months research assistant
3 man-months computer specialist

Phase 2

6 man-months principal researcher
12 man-months research assistant
12 man-months computer specialist

Phase 3

Requirement same as Phase 2.

Phase 4

Continuous basis
4 man-month/year principal scientist or engineer
4 man-month/year assistant scientist or engineer
4 man-month/year computer specialist
Computer time:
Development phases: 120 hours (on CDC 6000 series or comparable computer)
Operational phases: Depending on user demand, estimated connect time/-user/month is 3-5 hours.

Projected Out-of-House Requirement

Consultants

1. Legal—pilot study and Phases 1-3, 40 man days.
2. Scientific—information storage and retrieval for pilot study and Phases 1-3, 40 man days.
3. Other consultants—40 man days.

For Phase 4 on continuous basis, 10 man days/-year.

Other Contractors (estimated amount of contract)

1. Pilot study
\$50K
2. Phase 1
\$30K
3. Phase 2 and 3
\$45K/per phase
4. Phase 4 continuous basis \$20K/year

7 COORDINATION WITH OTHER DOD OR FEDERAL AGENCIES

NCEL

The Navy Environmental Support Office at Port Hueneme is working on the Navy Environmental Protection Data Base (NEPDB). The Navy has collected a large volume of environmental laws and regulations in original document form in their Environmental Data Center (EDC). Effort is underway to abstract the data to form what they call legal files. Although their ultimate use of the legal files is different from CELDS, serious efforts should be made to coordinate our activities.

EPA

The federal Environmental Protection Agency maintains several data centers for federal and state environmental standards and regulations, and some

of this information can be obtained for CELDS. Their on-line interactive information system, called ENVIRON, was operated by an outside contractor named Informatics. Agencies from outside EPA can

obtain access to certain files in ENVIRON by signing a contract with Informatics. It is possible to operate CELDS similarly, especially for third and fourth class users during Phase 3 or 4 of the development.

APPENDIX C:

LIST OF COUNTIES AND SMSA's COMPRISING THE LOCAL ECONOMIC REGIONS

002 FORT BELVOIR, VA.	238
WASHINGTON, DC. SMSA	235
DISTRICT OF COLUMBIA	230
CHARLES CO., MD.	240
MONTGOMERY CO., MD.	270
PRINCE GEORGE CO., MD.	241
ALEXANDRIA CITY, VA.	242
FAIRFAX CITY, VA.	243
FALLCHURCH CITY, VA.	207
ARLINGTON CO., VA.	211
FAIRFAX CO., VA.	244
LOUDOUN CO., VA.	245
PRINCE WILLIAM CO., VA.	
004 FORT BENNING, GA.	56
STEWART CO., GA.	53
MARION CO., GA.	50
HARRIS CO., GA.	246
COLUMBUS, GA. SMSA	44
CHATTAMOOCHIE CO., GA.	54
WISCONGEE CO., GA.	4
RUSSELL CO., ALA.	
006 FORT BLISS, N.M.	101
MUDSPETH CO., TEX.	133
CONNA ANNA CO., N.M.	135
OTERA CO., N.M.	247
EL PASO, TEX. SMSA	106
EL PASO CO., TEX.	
008 FORT BRAGG, N.C.	140
SAMPSON CO., N.C.	152
MARNETT CO., N.C.	153
MOKE CO., N.C.	150
PORESON CO., N.C.	145
MOORE CO., N.C.	147
BLADEN CO., N.C.	248
FAYETTEVILLE N.C. SMSA	150
CHIMMERLAND CO., N.C.	
010 FORT CAMPBELL, KY.	88
CHRISTIAN CO., KY.	93
TRIGG CO., KY.	171
MONTGOMERY CO., TENN.	174
STEWART CO., TENN.	168
DICKSON CO., TENN.	169
HOUSTON CO., TENN.	172
ROBERTSON CO., TENN.	
CLARKSVILLE, TENN.	
HOPKINSVILLE, TENN.	
012 FORT CHAFFE, ARK.	12
GARLAND CO., ARK.	16
MONTGOMERY CO., ARK.	13
MOT SPRING CO., ARK.	
MOT SPRINGS, ARK.	
014 FORT DEVENS, MASS.	111
WORCHESTER CO., MASS.	249
LOWELL, MASS.-N.M. SMSA	107
MIDDLESEX CO., MASS. (PART)	250
WILSHOROUGH CO., N.M. (PART)	
AYER, MASS.	
016 FORT DIX, N.J.	132
OCEAN CO., N.J.	251
PHILADELPHIA, PA.-N.J. SMSA	252
RUCKS CO., PA.	253
CHESTER CO., PA.	254
DELAWARE CO., PA.	255
MONTGOMERY CO., PA.	256
PHILADELPHIA CO., PA.	131
BURLINGTON CO., N.J.	257
CAMDEN CO., N.J.	258
GLOUCESTER CO., N.J.	
MT. HOLLEY, N.J.	

010 FORT EUSTIS.VA.	217
ISLE OF WIGHT CO..VA.	221
SURREY CO..VA.	250
NEWPORT NEWS-HAMPTON.VA. SMSA	226
HAMPTON CITY.VA.	227
NEWPORT NEWS CITY.VA.	260
WILLIAMSBURG CITY.VA.	214
GLOUCESTER CO..VA.	210
JAMES CITY CO..VA.	224
YORK CO..VA.	310
NORFOLK-VA, BEACH-PORTSMOUTH.VA.-N.C. SMSA	225
CHESAPEAKE CITY.VA.	228
NORFOLK CITY.VA.	230
PORTSMOUTH CITY.VA.	231
VA, BEACH CITY.VA.	261
CHURCHILL CO..N.C.	
020 FORT GORDON.GA.	51
JEFFERSON CO..GA.	52
MCNIFFIE CO..GA.	43
BURKE CO..GA.	262
AUGUSTA.GA.-S.C. SMSA	46
COLUMBIA CO..GA.	55
RICHMOND CO..GA.	263
AIKEN CO..S.C.	
GROVETOWN.GA.	
022 FORT HARRISON.IND.	264
INDIANAPOLIS.IND. SMSA	265
ROONE CO..IND.	266
HAMILTON CO..IND.	267
HANCOCK CO..IND.	268
HENDRICKS CO..IND.	269
JOHNSON CO..IND.	68
MARION CO..IND.	270
MORGAN CO..IND.	271
SHELBY CO..IND.	
024 FORT HOOD.TEX.	195
LAMPASAS CO..TEX.	178
BURNETT CO..TEX.	188
FALLS CO..TEX.	272
KILLEN-TEMPLE.TEX. SMSA	175
BELL CO..TEX.	181
CORYELL CO..TEX.	273
WACO.TEX. SMSA	196
MC CLELLAN CO..TEX.	
026 FORT SAM HOUSTON.TEX.	274
SAN ANTONIO TEX. SMSA	176
BEXAR CO..TEX.	180
COMAL CO..TEX.	189
GUADALUPE CO..TEX.	
028 FORT HUachuCA.ARIZ.	7
COCHISE CO..ARIZ.	4
SANTA CRUZ CO..ARIZ.	275
TUCSON.ARIZ. SMSA	8
PIMA CO..ARIZ.	
GRANDE.ARIZ.	
SIFRA VISTA.ARIZ.	
030 MINTER LIGGET MILITARY RES..CALIF.	23
MONTFERRY CO..CALIF.	29
SAN LUIS OBISPO CO..CALIF.	
JOHNSON.CALIF.	

032 FORT IRVIN, CALIF.	
SAN BERNADINO CO., CALIF.	
BARSTOW, CALIF.	
034 FORT JACKSON, S.C.	
FAIRFIELD CO., S.C.	163
KERSHAW CO., S.C.	164
COLUMBIA, S.C. SMSA	276
LEXINGTON CO., S.C.	165
RICHLAND CO., S.C.	166
036 FORT KNOX, KY.	
HARDIN CO., KY.	89
MEADE CO., KY.	91
MELSON CO., KY.	92
HARRISON CO., IND.	67
LOUISVILLE, KY.-IND. SMSA	277
MILLITT CO., KY.	87
JEFFERSON CO., KY.	90
OLDHAM CO., KY.	278
CLARK CO., IND.	279
FLOYD CO., IND.	280
FORT KNOX, KY.	
038 LAKE CITY AMMO PLANT, MO.	
LAFAYETTE CO., MO	119
KANSAS CITY, MO.-KAN. SMSA	281
CASS CO., MO.	282
CLAY CO., MO.	115
JACKSON CO., MO.	116
PLATTE CO., MO.	123
RAY CO., MO.	283
JOHNSON CO., KAN.	284
WYANDOTTE CO., KAN.	86
INDEPENDENCE, MO.	
040 FORT LEAVENWORTH, KAN.	
ATCHISON CO., KAN.	72
LEAVENWORTH CO., KAN.	79
RICHMANAN CO., MO.	113
KANSAS CITY, MO.-KAN. SMSA	281
CASS CO., MO	2
CLAY CO., MO.	115
JACKSON CO., MO.	116
PLATTE CO., MO.	123
RAY CO., MO.	283
JOHNSON CO., KAN.	284
WYANDOTTE CO., KAN.	86
042 FORT LEE, VA.	
SUSSEX CO., VA.	222
SUPREY CO., VA.	221
RICHMOND, VA. SMSA	285
RICHMOND CITY, VA.	286
CHARLES CITY CO., VA.	287
CHESTERFIELD CO., VA.	289
GOOCHLAND CO., VA.	288
HANOVER CO., VA.	215
HENRICO CO., VA.	214
POWhatan CO., VA.	289
PRINCE GEORGE, VA.	
PETERSBURG, VA.	
044 FORT LEWIS, WASH.	
THURSTON CO., WASH.	234
TACOMA, WASH. SMSA	290
PIERCE CO., WASH.	233
OLYMPIA, WASH.	
046 FORT MC CLELLAN CO., ALA.	
CALHOUN CO., ALA.	1
CLERMONT CO., ALA.	3
TALLEDEGA CO., ALA.	6
CLAY CO., ALA.	2
ANNISTON, ALA.	

048 FORT MC PHERSON.GA.	
ATLANTA.GA. SMSA	291
BUTTS CO..GA.	292
CHEROKEE CO..GA.	293
CLAYTON CO..GA.	294
CORB CO..GA.	45
DE KALA CO..GA.	47
DOBLAS CO..GA.	295
FAYETTE CO..GA.	296
FORSYTH CO..GA.	297
FULTON CO..GA.	48
GWINNETT CO..GA.	298
HENRY CO..GA.	299
NEWTON CO..GA.	100
PAULDING CO..GA.	101
ROCKDALE CO..GA.	102
WALTON CO..GA.	103
050 FORT MEADE.MD.	
WASHINGTON SMSA	238
DISTRICT OF COLUMBIA	235
CHARLES CO..MD.	239
CHARLES CO..MD.	235
MONTGOMERY CO..MD.	240
PRINCE GEORGE CO..MD.	220
ALEXANDRIA CITY.VA.	241
FAIRFAX CITY.VA.	242
FALLS CHURCH CITY.VA.	287
ARLINGTON CO..VA.	287
FAIRFAX CO..VA.	211
LOUDDON CO..VA.	244
PRINCE WILLIAM CO..VA.	245
BALTIMORE.MD. SMSA	104
BALTIMORE CITY.MD.	105
ANNE ARUNDEL CO..MD.	100
BALTIMORE CO..MD.	101
CARPOLL CO..MD.	102
HARFORD CO..MD.	106
HOWARD CO..MD.	107
052 MEMPHIS DEFENSE DEPOT.TENN.	
MEMPHIS.TENN.-ARK.-MISS. SMSA	308
SHELBY CO..TENN.	173
TIPTON CO..TENN.	189
CRITTENDON CO..ARK.	11
DE SOTO CO..MISS.	112
054 FORT MONROE.VA.	
NEWPORT NEWS-HAMPTON.VA. SMSA	259
HAMPTON CITY.VA.	276
NEWPORT NEWS CITY.VA.	277
WILLIAMSBURG CITY.VA.	280
GLOUCESTER CO..VA.	214
JAMES CITY CO..VA.	218
YORK CO..VA.	274
NORFOLK-VA, BEACH-PORTSMOUTH.VA.-N.C. SMSA	310
CHESAPEAKE CITY.VA.	275
NORFOLK CITY.VA.	278
PORTSMOUTH CITY.CA.	270
VA. BEACH CITY.VA.	231
CURRITUCK CO..N.C.	261
056 PRESIDIO OF MONTERREY.CALIF.	
MONTERREY CO..CALIF.	23
MONTERREY.CALIF.	
058 FORT MEYER.VA.	
WASHINGTON SMSA	238
DISTRICT OF COLUMBIA	235
CHARLES CO..MD.	239
MONTGOMERY CO..MD.	240
PRINCE GEORGE CO..MD.	220
ALEXANDRIA CITY.VA.	241
FAIRFAX CITY.VA.	242
FALL CHURCH CITY.VA.	243
ARLINGTON CO..VA.	287
FAIRFAX CO..VA.	211
LOUDDON CO..VA.	244
PRINCE WILLIAM CO..VA.	245

060 NATICK LAB.MASS.	
BOSTON.MASS. SMSA	347
ESSEX CO.,MASS. (PART)	111
MIDDLESEX CO.,MASS. (PART)	107
NORFOLK CO.,MASS. (PART)	108
PLYMOUTH CO.,MASS. (PART)	109
SUFFOLK CO.,MASS.	110
NATICK.MASS.	
062 OGDEN DEFENSE DEPOT.UTAH	
SALT LAKE CITY-OGDEN.UTAH SMSA	312
DAVIS CO.,UTAH	113
SALT LAKE CO.,UTAH	114
TOOELE CO.,UTAH	115
WEAVER CO.,UTAH	204
064 FORT ORD.CALIF.	
MONTFREMERY CO.,CALIF.	23
MONTFREMERY.CALIF.	
066 FORT POLK.LA.	
VERNON PAR.,LA.	99
SABINE PAR.,LA.	98
NATCHITOCHES PAR.,LA.	96
BEAUREGARD PAR.,LA.	95
ALLEN PAR.,LA.	94
ALEXANDRIA.LA. SMSA	116
GRANT PAR.,LA.	117
RAPIDES PAR.,LA.	97
LEFESVILLE.LA.	
068 RFD RIVER ARMY DEPOT.TEX.	
CASS CO.,TEX.	179
TEXARKANA.TEX.-ARK. SMSA	218
HOWIE CO.,TEX.	177
LITTLE RIVER CO.,ARK.	14
MILLER CO.,ARK.	15
070 FORT RILEY.KAN.	
DICKINSON CO.,KAN.	74
GEARY CO.,KAN.	77
RILEY CO.,KAN.	83
POTTAWATOMIE CO.,KA.	82
CLAY CO.,KAN.	73
MORRIS CO.,KAN.	80
WARRENSEE CO.,KAN.	85
JUNCTION CITY.KAN.	
MANHATTAN.KAN.	
072 RIO VISTA STORAGE AREA.CALIF.	
SOLANO CO.,CALIF.	32
SAN JOAQUIN CO.,CALIF.	24
SACRAMENTO.CALIF. SMSA	119
PLACER CO.,CALIF.	25
SACRAMENTO CO.,CALIF.	26
YOLO CO.,CALIF.	34
SAN FRANCISCO-OAKLAND.CALIF. SMSA	120
ALAMEDA CO.,CALIF.	17
CONTRA COSTA CO.,CALIF.	18
MARIN CO.,CALIF.	27
SAN FRANCISCO CO.,CALIF.	121
SAN MATEO CO.,CALIF.	30

074 FORT RITCHIE, MD.	
FREDERICK CO., MD.	103
WASHINGTON CO., MD.	105
HAGERSTOWN, MD.	
076 RIVERBANK ARMY AMMO PLANT, CALIF.	
STOCKTON, CALIF. SMSA	122
SAN JOAQUIN CO., CALIF.	20
078 ROCK ISLAND ARSENAL, ILL.	
MERCER CO., ILL.	63
CLINTON CO., IA.	60
DAVENPORT-ROCK ISLAND-MOLINE, IA.-ILL. SMSA	123
SCOTT CO., IA.	71
HENRY CO., ILL.	60
ROCK ISLAND CO., ILL.	64
080 ROCKY MTN. ARSENAL, COLO.	
DOUGLAS CO., COLO.	78
ELBERT CO., COLO.	236
DENVER-ROULDER, COLO. SMSA	124
ADAMS CO., COLO.	35
ARAPAHOE CO., COLO.	36
ROULDER CO., COLO.	37
DENVER CO., COLO.	125
GILPIN CO., COLO.	40
JEFFERSON CO., COLO.	41
082 CAMP ROBERTS, CALIF.	
SAN LUIS OBISPO CO., CALIF.	29
CAMP ROBERTS, CALIF.	
084 FORT RODMAN, MASS.	
NEW BEDFORD, MASS. SMSA	126
BRISTOL CO., MASS. (PART)	106
PLYMOUTH CO., MASS. (PART)	109
086 SACRAMENTO ARMY DEPOT, CALIF.	
EL DORADO CO., CALIF.	10
SUTTER CO., CALIF.	33
SACRAMENTO, CALIF. SMSA	110
PLACER CO., CALIF.	25
SACRAMENTO CO., CALIF.	26
YOLO CO., CALIF.	34
088 SAGINAW ARMY AIRCRAFT PLANT, TEX.	
DALLAS-FT. WORTH, TEX. SMSA	127
COLLIN CO., TEX.	128
DALLAS CO., TEX.	182
DENTON CO., TEX.	183
ELLIS CO., TEX.	184
HOOD CO., TEX.	190
JOHNSON CO., TEX.	193
KAUFMAN CO., TEX.	129
PARKER CO., TEX.	199
ROCKWALL CO., TEX.	200
TARRANT CO., TEX.	202
WISE CO., TEX.	204
090 ST. LOUIS ARMY AMMO PLANT, MO.	
ST. LOUIS, MO.-ILL. SMSA	130
ST. LOUIS CITY, MO.	129
FRANKLIN CO., MO.	131
JEFFERSON CO., MO.	117
ST. CHARLES CO., MO.	125
ST. LOUIS CO., MO.	126
CLINTON CO., ILL.	132
MADISON CO., ILL.	133
MONROE CO., ILL.	134
ST. CLAIR CO., ILL.	135
092 CAMP SAN LUIS OBISPO, CALIF.	
SAN LUIS CO., CALIF.	29
SAN LUIS OBISPO, CALIF.	

094 SAVANNA ARMY DEPOT, ILL.	50
CARROLL CO., ILL.	67
JOE DAVIESS CO., ILL.	65
STEPHENSON CO., ILL.	66
WHITESIDE CO., ILL.	70
JACKSON CO., IA.	
SAVANNA, ILL.	
096 SCOFFIELD BARRACKS, MA.	336
HONOLULU, MA, SMSA	58
HONOLULU CO., MA.	
098 FORT SCOTT, CALIF.	
SANTA CLARA CO., CALIF.	31
NAPA CO., CALIF.	24
SAN FRANCISCO-OAKLAND, CALIF. SMSA	320
ALAMEDA CO., CALIF.	17
CONTRA COSTA CO., CALIF.	18
MARIN CO., CALIF.	22
SAN FRANCISCO CO., CALIF.	121
SAN MATEO CO., CALIF.	30
100 SCRANTON ARMY AMMO PLANT, PA.	
LACKAWANNA CO., PA.	162
SCRANTON, PA.	
102 SENECA ARMY DEPOT, N.Y.	
SENECA CO., N.Y.	143
SCHUYLER CO., N.Y.	142
YATES CO., N.Y.	145
CAYUGA CO., N.Y.	138
ROCHESTER, N.Y. SMSA	137
LIVINGSTON CO., N.Y.	338
MONROE CO., N.Y.	339
ONTARIO CO., N.Y.	140
ORLEANS CO., N.Y.	340
WAYNE CO., N.Y.	144
ROMULUS, N.Y.	
104 SHARPE ARMY DEPOT, CALIF.	
STOCKTON, CALIF. SMSA	322
SAN JOAQUIN CO., CALIF.	24
106 SIERRA ARMY DEPOT, CALIF.	
LASSEN CO., CALIF.	21
MERLONG, CALIF.	
108 SIOUX ARMY DEPOT, NEB.	
CHEYENNE CO., NEB.	130
SIDNEY, NEB.	
110 CAMP STANLEY, TEX.	
MEDINA CO., TEX.	197
WILSON CO., TEX.	203
KENDALL CO., TEX.	194
SAN ANTONIO, TEX. SMSA	274
BEXAR CO., TEX.	174
COMAL CO., TEX.	180
GUADALUPE CO., TEX.	189
112 FORT STORFY, VA.	
NEWPORT NEWS-HAMPTON, VA. SMSA	259
HAMPTON CITY, VA.	226
NEWPORT NEWS CITY, VA.	227
WILLIAMSBURG CITY, VA.	240
GLOUCESTER CO., VA.	214
JAMES CITY CO., VA.	218
NORFOLK-VA, BEACH-PORTSMOUTH, VA., -N.C. SMSA	110
CHEASAPEAKE CITY, VA.	225
NORFOLK CITY, VA.	228
PORTSMOUTH CITY, VA.	230
VA, RFACH CITY, VA.	231
CURPITICK CO., N.C.	261
114 SUNFLOWER AMMO PLANT, KAN.	
DOUGLAS CO., KAN.	75
LEAVENWORTH CO., KAN.	79
FRANKLIN CO., KAN.	76
MIAMI CO., KAN.	237
TOPEKA, KAN. SMSA	341
JEFFERSON CO., KAN.	78
OSAGE CO., KAN.	81
SHAWNEE CO., KAN.	84

11A TANNHILL ARMY MISSILE PLANT, N.C.	
ORANGE CO., N.C.	
CASWELL CO., N.C.	154
CHATHAM CO., N.C.	164
GIBBINGTON, N.C. SMSA	169
ALAMANCE CO., N.C.	162
GREENSHIRE-WINSTON-SALEM-HIGH POINT, N.C. SMSA	166
DAVIDSON CO., N.C.	161
FORSYTH CO., N.C.	166
GUILFORD CO., N.C.	165
HANDICAP CO., N.C.	151
STOKES CO., N.C.	152
YADKIN CO., N.C.	166
11B FORT TILDER, N.Y.	167
NEW YORK CITY, N.Y.-N.J. SMSA	
ROOSE CO., N.Y.	168
KINGS CO., N.Y.	169
NEW YORK CO., N.Y.	174
PUTNAM CO., N.Y.	160
QUEENS CO., N.Y.	151
RICHMOND CO., N.Y.	152
ROCKLAND CO., N.Y.	153
WESTCHESTER CO., N.Y.	156
WESSEX CO., N.J.	155
120 WEST POINT MILITARY RES., N.Y.	156
ORANGE CO., N.Y.	
WEST POINT, N.Y.	141
122 WHITE SANDS MISSILE RANGE, N.M.	
TARRANT CO., TEX.	
WISF CO., TEX.	202
124 FORT WOOD, MO.	206
ROCKWALL CO., TEX.	
OTERA CO., N.M.	200
SIERRA CO., N.M.	135
LINCOLN CO., N.M.	136
SACORRO CO., N.M.	134
DONA ANNA CO., N.M.	137
LAS CRUCES, N.M.	133
124 FORT WOLTERS, TEX.	
PALO PINTO CO., TEX.	
FRATH CO., TEX.	198
EASTLUND CO., TEX.	187
STEPHENS CO., TEX.	186
YOUNG CO., TEX.	201
DALLAS-FORT WORTH, TEXAS SMSA	205
COLLINS CO., TEX.	127
DALLAS CO., TEX.	128
DENTON CO., TEX.	182
ELLIS CO., TEX.	183
HOOD CO., TEX.	185
JOHNSON CO., TEX.	190
KAUFMAN CO., TEX.	193
PARKER CO., TEX.	129
MILASKI CO., MO.	199
TEXAS CO., MO.	124
LACLEDE CO., MO.	127
WRIGHT CO., MO.	118
CAMDEN CO., MO.	128
MILLER CO., MO.	116
MARTIN CO., MO.	121
WAYNESVILLE, MO.	120
12A YUMA PROVING GROUNDS, ARIZ.	
YUMA CO., ARIZ.	
IMPERIAL CO., CALIF.	10
YUMA, ARIZ.	20

APPENDIX D:

SOURCES OF EIFS DATA*

Data	Source
1. a. Total personal income by county or SMSA (several consecutive years)	U.S. Department of Commerce Social & Economic Statistics Admin. Bureau of Economic Analysis Attn: Edwin J. Coleman Room 307 2400 M Street, S.W. Washington, D.C. 202-343-8793
b. Total employment by county or SMSA (several consecutive years)	
2. Industry of employed persons by county	U.S. Department of Commerce Social & Economic Statistics Admin. Bureau of Census <i>General Social and Economic Characteristics</i> "Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Counties"
3. Assessed to market value ratios by county	U.S. Department of Commerce Social & Economic Statistics Admin. Bureau of Census <i>Taxable Property Values and Assessment—Sales Price Ratios</i> (Part 2, Assessment—Sales Price Ratios and Tax Rates) "Property Tax Rates and Assessment—Sales Price Ratios for Real Property Involved in Measurable Sales, for Selected Local Areas"
4. Housing characteristics by county	U.S. Department of Commerce Social & Economic Statistics Admin. Bureau of Census <i>Housing Characteristics for States, Cities and Counties</i> , Vol. 1, "Financial Characteristics for Counties"
a. Number of houses owner occupied	
b. Median value of owner occupied housing	
c. Number of houses renter occupied	
d. Median rent	
5. Total assessed value subject to tax by county	U.S. Department of Commerce Social & Economic Statistics Admin. Bureau of Census Census of Governments <i>Taxable Property Values</i> , "Assessed Value of Prop- erty Subject to Local General Property Taxation, by Class of Property, for States, Counties and Selected Major Cities"

*Tentative and incomplete at this time.

6. Property tax revenues from local sources by county

U.S. Department of Commerce
Social & Economic Statistics Admin.
U.S. Bureau of Census
Census of Governments
Government Finances, "Selected Items of Local Government Finances by County Areas"

7. a. Land area by county

U.S. Department of Commerce
Social & Economic Statistics Admin.

b. Population density by county

U.S. Bureau of Census
Census of Population
Number of Habitants, "Population and Land Area of Counties"

8. a. % of local labor

Cost Systems Engineers, Inc
Attn: William Orr
4907 Ohio Garden Road
Fort Worth, Texas
817-625-1177

b. % masonry composition

c. % concrete composition

d. % steel composition

e. % wood composition

f. % other composition

all by construction category

9. Value added by manufacture by county and SMSA for two census years (i.e., 1963 and 1967)

U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Manufactures
Manufactures Area Statistics
"General Statistics for Standard Metropolitan Statistical Areas, Counties, and Selected Cities"

10. Total retail trade sales by county and SMSA for two census years (i.e., 1963 and 1967)

U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Business
Retail Trade Area Statistics
"Counties, Cities of 2500 Inhabitants or More"

11. Selected services receipts by county and SMSA for two census years (i.e., 1963 and 1967)

U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Business
Selected Services—Area Statistics
"Counties, and Cities of 2500 Inhabitants or More"

- | | |
|---|---|
| 12. Wholesale trade sales by county and SMSA for two census years (i.e., 1963 and 1967) | U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Business
<i>Wholesale Trade—Area Statistics</i>
"Counties, Cities of 5000 Inhabitants or More" |
| 13. Educational statistics by county or SMSA | U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Population
<i>General Social and Economic Characteristics</i>
"Educational and Family Characteristics for Counties" |
| a. Total enrolled | |
| b. Number attending college | |
| c. Total under 18 years old | |
| 14. Cost per day for medical facilities by state for metropolitan and nonmetropolitan areas | American Hospital Association
<i>Hospital Statistics</i> |
| 15. Sales tax information by state | Commerce Clearinghouse
<i>State Tax Guide</i>
"Sales Tax Rate" |
| a. % retained by county | |
| b. Sales tax rate | |
| 16. Cost of education per child by state | |
| 17. % education financed by each governmental policy | |
| a. Federal | |
| b. State | |
| c. Local | |
| 18. Operating budgets by county or SMSA | U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Governments
<i>County Governments</i>
"Financial Statistics for Individual County Governments" |
| a. Total | |
| b. Education | |
| 19. Installation statistics | (1) DD Form 1390 (Primary reference)
(2) Army Times Publishing Company
<i>Military Market Facts Book</i>
"Active Duty and Dependent Population by Installation in the United States" (supplementary reference) |
| a. Number of Army personnel | |
| b. Number of civilian personnel | |
| c. Acres owned | |
| d. Acres leased | |

- e. Authorized construction
- f. Grand total evaluation
- g. Estimated cost of anticipated construction
- h. Number of active duty personnel
- i. Number of wives
- j. Total number of dependents

Information available varies from installation to installation

- | | |
|---|--|
| 20. Population by major community | U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Populations
<i>Number of Inhabitants</i>
"Population of Places" |
| a. Population (two census years; 1960 and 1970) | |
| b. % change | |
| 21. Median income by major community | U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Populations
<i>Census Tracts</i>
"Income Characteristics of the Population" |
| 22. % black by major community | U.S. Department of Commerce
Social & Economic Statistics Admin.
Bureau of Census
Census of Populations
<i>General Population Characteristics</i>
"Summary of General Characteristics" |

APPENDIX E:

EIFS DATA MANIPULATION

The following presentation presents the EIFS input numbers and discusses their origins and calculations.

A. Refinement of Raw Data into EIFS Inputs

% LABOR

% MAT'LS

These two values were obtained through Cost Systems Engineers, Inc., of Fort Worth, Texas. The % materials was calculated by summing appropriate % concrete and % masonry values. The % labor was used without modification. The following information was obtained by major construction category:

- % Labor
- % Masonry Composition
- % Concrete Composition
- % Steel Composition
- % Wood Composition
- % Other Composition

A list of the values furnished appears in Table E1.

B. Export Employment Multiplier

The standard location quotient techniques discussed in this report relied upon available census information.

Regional values were obtained by simply summing the respective values of employment for each category. For example, the regional agriculture employment was obtained by summing the values of agricultural employment for all counties included in the region. Tables E2-E6 are presented as examples.

C. Cost Per Day for Medical Facilities

This value was obtained from the American Hospital Association's "Hospital Statistics." It is stored as an installation specific number.

D. Length of Stay

An average value of 9.5 days was used. Additional research may provide a better estimate of this value.

E. Median Rent

Median rent was obtained for each basic unit (county or SMSA). The regional median rent was calculated as follows:

$$MR_R = \frac{\sum_{i=1}^n (MR_A)(R_A)}{n_A}$$

where

MR_R = regional median rent

MR_A = unit median rent

R_A = number of renter-occupied units

n = number of counties comprising the defined economic region.

F. Average Income

An assumed average income per family unit of \$7500 per year was used for calculations. Values for specific installations will be attempted soon. Since several inputs relating to the spending habits of families are based upon August income, additional work in these areas should begin. The following list indicates the relation obtained:

Salary Range/Yr	\$ SL	MPC _H
0 - 3000	.285	.290
3000 - 5000	.375	.240
5000 - 7000	.355	.200
7000 - 10000	.335	.180
10000 - 15000	.345	.150
15000 - 99000	.335	.150

where

% SL = percent of income spent in a local economy (discussed in more detail under "% Spent Locally")

MPC_H = percent spent for housing or the marginal/average propensity to consume for housing.

G. % Spent Locally

This is that percentage of income that a family moving onto an installation would spend on the installation and not in the local economy as a result of their move.

Table E1
EIFS Values Furnished

Subprogram	Labor	Mas.	Con.	Stl.	Wood	Other
1110	Airfield Pavement					
1120	Liq Fuel & Disp Fac					
1130	Comm Navig Aid. Airt					
1140	Land Operation Fac					
1150	Waterfront Op Fac					
1160	Harbor & Coast Fac					
1170	Training Facilities	.38	.00	.17	.01	.00
1210A	Mainten Fac-Service	.32	.01	.00	.06	.00
1210B	Mainten Fac-Auto	.35	.00	.00	.33	.00
1220A	Production Heavy	.32	.01	.00	.21	.01
1220B	Production Light	.33	.01	.00	.13	.01
1310	R.D & Test Bldg					
1390	R.D & Test Nonbldg					
1410	Liq Stor Fuel Nondr					
1420	Ammo Stor					
1430	Cold Stor					
1440	Stor Covered	.27	.28	.00	.12	.01
1450	Stor Open					
1510	Hospital Bldg	.41	.02	.00	.13	.02
1520D	Dispens with Bed					
1530	Lab & Clinic	.42	.17	.00	.08	.00
1540	Dental Clinic	.42	.17	.00	.08	.00
1550	Dispensary	.42	.17	.00	.08	.00
1610A	Admin Bldg Hi-Rise	.35	.00	.05	.12	.01
1610B	Admin Bldg Low-Rise	.38	.00	.24	.00	.00
1620	Admin Strct Und-Grd					
1690	Admin Strct Other					
1710A	Family Hous Single	.37	.03	.01	.00	.07
1710B	Family Hous Duplex	.37	.03	.01	.00	.03
1710C	Fam Hous Row	.37	.01	.01	.00	.34
1710D	Fam Hous Row 2-3 Sty	.39	.01	.01	.00	.45
1720	Bach Troop Hous	.39	.01	.36	.01	.00
1730	Comm Fac-Per Int					
1740A	Comm Fac Int Rest	.39	.01	.35	.00	.01
1740B	Comm Fac Int Store	.34	.15	.00	.00	.01
1750	Comm Fac Mor Well Rec					
1810	Electric Power					
1820	Heat & Refrig					
1830	Sewage & Waste					
1840	Water					
1850	Roads & Streets					
1860	Railroad Tracks					
1870	Ground Imp Struct.					
1880	Fire Alarm Syst					
1890	Misc					
1910	Land					
1920	Other Rights					
1930	Improvements					

Table E.2
Explanation of Abbreviations

AFF AGRICULTURE, FORESTRY, FISH
 MIN MINING
 CON CONSTRUCTION
 MAN MANUFACTURING
 FLW FURN., LUMBER, WOOD
 MET METAL
 MAC MACHINERY
 EM ELECTRICAL MACHINERY
 TRA TRANS. EQUIP.
 OD OTHER DURABLE
 FK FOOD, KINDRED
 TFT TEXTILES, FAB. TEXTILE
 PPA PRINTING, PUB., ALLIED
 CA CHEM., ALLIED
 OTH OTHER
 RRE RAILROADS, RAILWAY EXPRESS
 TSW TRUCKING SERVICE, WAREHOUSE
 OT OTHER TRANSPORT
 COM COMMUNICATION
 USS UTILITIES SANITARY SERVICES
 WT WHOLESALE TRADE
 FBD FOOD, BAKERY, DAIRY
 ED EATING, DRINKING
 GMR GENL. MERCHANDISE RET.
 MVRs MOTOR VEH. RET., SER.
 OR OTHER RETAIL
 BC BANKING, CREDIT
 IREF INSURANCE, REAL ESTATE, FINANCE
 BRS BUSINESS, REPAIR SERV.
 PH PRIVATE HOUSEHOLDS
 OP OTHER PERSONAL
 ER ENTERTAINMENT, RECREATION
 HOS HOSPITALS
 EDG EDUCATION-GOVT.
 EDP EDUCATION-PRIV.
 OED OTHER EDUCATION
 WRN WELFARE, RELIGIOUS, NONPROFIT
 LEM LEGAL, ENGINEER, MISC.
 PA PUBLIC ADM.
 USPD U.S. PERCENTAGE DISTRIBUTION
 CE COUNTY EMPLOYMENT
 PCD PERCENTAGE COUNTY DISTRIBUTION
 LQ LOCATION QUOTIENT
 PE PERCENT EXPORT
 EE EXPORT EMPLOYMENT

Table E3

Calculation of Employment Export Multiplier for Garland Co., AR, 1970

INDUSTRY	USD	CF	PCD	LQ	PF	EF
AFF	3.710	527.000	2.437	.765	0.000	0.000
MIN	.820	139.000	.748	.912	0.000	0.000
CON	5.970	1570.000	8.451	1.416	.294	460.953
MAN	25.910	3703.000	19.933	.769	0.000	0.000
FLW	1.280	789.000	4.247	3.318	.699	551.214
MET	3.490	903.000	4.861	1.393	.282	254.663
MAC	2.600	475.000	2.557	.983	0.000	0.000
EM	2.490	38.000	.205	.082	0.000	0.000
TRA	2.790	18.000	.097	.035	0.000	0.000
OD	2.680	375.000	2.019	.753	0.000	0.000
FK	1.820	133.000	.716	.393	0.000	0.000
TFT	2.850	50.000	.269	.094	0.000	0.000
PPA	1.560	238.000	1.281	.821	0.000	0.000
CA	1.290	69.000	.371	.288	0.000	0.000
OTH	3.060	615.000	3.311	1.082	.076	46.544
RRE	.830	6.000	.032	.039	0.000	0.000
TSW	1.410	148.000	.797	.565	0.000	0.000
OT	1.450	210.000	1.130	.780	0.000	0.000
COM	1.400	215.000	1.157	.827	0.000	0.000
USS	1.680	386.000	2.078	1.237	.191	73.906
WT	4.090	566.000	3.047	.745	0.000	0.000
FBD	2.500	479.000	2.578	1.031	.030	14.575
ED	3.000	774.000	4.166	1.389	.280	216.690
GMR	2.730	387.000	2.083	.763	0.000	0.000
MVRS	2.220	442.000	2.379	1.072	.067	29.591
OR	5.540	1398.000	7.525	1.358	.266	368.834
BC	1.690	249.000	1.340	.793	0.000	0.000
IREF	3.320	429.000	2.309	.696	0.000	0.000
BRS	3.130	425.000	2.288	.731	0.000	0.000
PH	1.470	456.000	2.455	1.670	.401	182.918
OP	3.150	1803.000	9.706	3.081	.675	1217.824
ER	.820	451.000	2.428	2.961	.662	298.669
HOS	5.550	872.000	4.694	.846	0.000	0.000
EDG	5.650	1450.000	7.805	1.381	.276	400.399
EDP	1.950	114.000	.614	.315	0.000	0.000
OED	.440	61.000	.328	.746	0.000	0.000
WRN	1.520	277.000	1.491	.981	0.000	0.000
LEM	2.550	434.000	2.336	.916	0.000	0.000
PA	5.490	606.000	3.262	.594	0.000	0.000

THE TOTAL CO. EMPLOYMENT IS 18577.000

THE CO. EMPLOYMENT EXPORT MULTIPLIER IS 4.513

Table E4

Calculation of Employment Export Multiplier for Montgomery Co., AR, 1970

INDUSTRY	USPD	CE	PCD	LQ	PF	EE
AFF	3.710	230.000	12.306	3.317	.640	150.660
MIN	.820	-0.000	0.000	0.000	0.000	-0.000
CON	5.970	163.000	8.721	1.461	.315	51.421
MAN	25.910	625.000	33.440	1.291	.225	140.742
FLW	1.280	211.000	11.289	8.820	.687	167.077
MET	3.490	5.000	.268	.077	0.000	0.000
MAC	2.600	5.000	.268	.103	0.000	0.000
EM	2.490	19.000	1.017	.408	0.000	0.000
TRA	2.790	16.000	.856	.307	0.000	0.000
OD	2.680	31.000	1.659	.619	0.000	0.000
FK	1.820	10.000	.535	.294	0.000	0.000
TFT	2.850	158.000	8.454	2.966	.663	104.733
PPA	1.560	-0.000	0.000	0.000	0.000	-0.000
CA	1.290	-0.000	0.000	0.000	0.000	-0.000
OTH	3.060	170.000	9.096	2.972	.664	112.809
RRE	.830	6.000	.321	.387	0.000	0.000
TSW	1.410	38.000	2.033	1.442	.307	11.647
OT	1.450	29.000	1.552	1.070	.065	1.899
COM	1.400	23.000	1.231	.879	0.000	0.000
USS	1.680	28.000	1.498	.892	0.000	0.000
WT	4.090	44.000	2.354	.576	0.000	0.000
FBD	2.500	21.000	1.124	.449	0.000	0.000
ED	3.000	61.000	3.264	1.088	.081	4.930
GMR	2.730	37.000	1.980	.725	0.000	0.000
MVRS	2.220	38.000	2.033	.916	0.000	0.000
OR	5.540	70.000	3.745	.676	0.000	0.000
BC	1.690	21.000	1.124	.665	0.000	0.000
IREF	3.320	5.000	.268	.081	0.000	0.000
BRS	3.130	39.000	2.087	.667	0.000	0.000
PH	1.470	27.000	1.445	.983	0.000	0.000
OP	3.150	59.000	3.157	1.002	.002	.126
ER	.820	-0.000	0.000	0.000	0.000	-0.000
HOS	5.550	42.000	2.247	.405	0.000	0.000
EDG	5.650	98.000	5.243	.928	0.000	0.000
EDP	1.950	30.000	1.505	.823	0.000	0.000
OED	.440	-0.000	0.000	0.000	0.000	-0.000
WRN	1.520	43.000	2.301	1.514	.339	14.591
LEM	2.550	24.000	1.284	.504	0.000	0.000
PA	5.490	68.000	3.638	.663	0.000	0.000

THE TOTAL CO. EMPLOYMENT IS 1869.000

THE CO. EMPLOYMENT EXPORT MULTIPLIER IS 2.876

Table E5
Calculation of Employment Export Multiplier for Hot Spring Co., AR, 1970

INDUSTRY	USPD	CE	PCD	LQ	PF	EE
AFF	3.710	255.000	3.265	.880	0.000	0.000
MIN	.820	356.000	4.559	5.560	.820	291.966
CON	5.970	532.000	6.813	1.141	.124	65.803
MAN	25.910	3166.000	40.543	1.565	.361	1142.688
FLW	1.280	440.000	5.635	4.402	.773	340.045
MET	3.490	1206.000	15.444	4.425	.774	933.466
MAC	2.600	149.000	1.908	.734	0.000	0.000
EM	2.490	114.000	1.460	.586	0.000	0.000
TRA	2.790	128.000	1.639	.588	0.000	0.000
OD	2.680	517.000	6.621	2.470	.595	307.719
FK	1.820	32.000	.410	.225	0.000	0.000
TFT	2.850	162.000	2.075	.728	0.000	0.000
PPA	1.560	54.000	.692	.443	0.000	0.000
CA	1.290	41.000	.525	.407	0.000	0.000
OTH	3.060	323.000	4.136	1.352	.260	84.045
RRE	.830	30.000	.384	.463	0.000	0.000
TSW	1.410	105.000	1.345	.954	0.000	0.000
OT	1.450	20.000	.256	.177	0.000	0.000
COM	1.400	38.000	.487	.348	0.000	0.000
USS	1.680	242.000	3.099	1.845	.458	110.809
WT	4.090	173.000	2.215	.542	0.000	0.000
FBD	2.500	195.000	2.497	.999	0.000	0.000
ED	3.000	170.000	2.177	.726	0.000	0.000
GMR	2.730	144.000	1.844	.675	0.000	0.000
MVRS	2.220	307.000	3.931	1.771	.435	133.640
OR	5.540	299.000	3.829	.691	0.000	0.000
BC	1.690	56.000	.717	.424	0.000	0.000
IREF	3.320	99.000	1.268	.382	0.000	0.000
BRS	3.130	133.000	1.703	.544	0.000	0.000
PH	1.470	107.000	1.370	.932	0.000	0.000
OP	3.150	250.000	3.201	1.016	.016	4.016
ER	.820	47.000	.602	.734	0.000	0.000
HOS	5.550	196.000	2.510	.452	0.000	0.000
EDG	5.650	503.000	6.441	1.140	.123	61.791
EDP	1.950	53.000	.679	.348	0.000	0.000
OED	.440	37.000	.474	1.077	.071	2.640
WRN	1.520	72.000	.922	.607	0.000	0.000
LEM	2.550	58.000	.743	.291	0.000	0.000
PA	5.490	166.000	2.126	.387	0.000	0.000

THE TOTAL CO. EMPLOYMENT IS 7809.000

THE CO. EMPLOYMENT EXPORT MULTIPLIER IS 3.343

Table E6
Base Area Table

BASE AREA TABLE IS AS FOLLOWS						
INDUSTRY	USPD	CE	PCD	LO	PE	EE
AFF	3.710	1012.000	3.582	.965	0.000	0.000
MIN	.820	495.000	1.752	2.136	.532	263.309
CON	5.970	2265.000	8.016	1.343	.255	578.176
MAN	25.910	7494.000	26.523	1.024	.023	173.129
FLW	1.280	1440.000	5.096	3.982	.749	1078.336
MET	3.490	2114.000	7.482	2.144	.534	1127.900
MAC	2.600	629.000	2.226	.856	0.000	0.000
EM	2.490	171.000	.605	.243	0.000	0.000
TRA	2.790	162.000	.573	.206	0.000	0.000
OD	2.680	923.000	3.267	1.219	.180	165.766
FK	1.820	175.000	.619	.340	0.000	0.000
TFT	2.850	370.000	1.310	.459	0.000	0.000
PPA	1.560	292.000	1.033	.662	0.000	0.000
CA	1.290	110.000	.389	.302	0.000	0.000
OTH	3.060	1108.000	3.921	1.282	.220	243.397
RRE	.830	42.000	.149	.179	0.000	0.000
TSW	1.410	291.000	1.030	.730	0.000	0.000
OT	1.450	259.000	.917	.632	0.000	0.000
COM	1.400	276.000	.977	.698	0.000	0.000
USS	1.680	656.000	2.322	1.382	.276	181.316
WT	4.090	783.000	2.771	.678	0.000	0.000
FBD	2.500	695.000	2.460	.984	0.000	0.000
ED	3.000	1005.000	3.557	1.186	.157	157.350
GMR	2.730	568.000	2.010	.736	0.000	0.000
MVRS	2.220	787.000	2.785	1.255	.203	159.739
OR	5.540	1767.000	6.254	1.120	.114	201.673
BC	1.690	326.000	1.154	.683	0.000	0.000
IREF	3.320	533.000	1.886	.568	0.000	0.000
BRS	3.130	597.000	2.113	.675	0.000	0.000
PH	1.470	590.000	2.088	1.420	.296	174.651
OP	3.150	2112.000	7.475	2.373	.579	1221.967
ER	.820	498.000	1.763	2.149	.535	266.309
HOS	5.550	1110.000	3.929	.708	0.000	0.000
EDG	5.650	2051.000	7.259	1.285	.222	454.592
EDP	1.950	197.000	.697	.358	0.000	0.000
OED	.440	98.000	.347	.788	0.000	0.000
WRN	1.520	392.000	1.387	.913	0.000	0.000
LEM	2.550	516.000	1.826	.716	0.000	0.000
PA	5.490	840.000	2.973	.542	0.000	0.000

THE EMPLOYMENT EXPORT MULTIPLIER FOR THE BASE IS

4.503

H. Income Multiplier

This value was calculated by the following relation:

$$IM = (EEM) \frac{(VALE)_R}{(VALE)_{US}}$$

where

IM = income multiplier

EEM = employment export multiplier

(VALE)_R = value added per employee for the region

(VALE)_{US} = value added per employee for the United States

(VALE)_{US} was set equal to 10,265.3 from the indicated source. (VALE)_R was calculated through the following relation:

$$(VALE)_R = \frac{\sum_{i=1}^M E_i V_i}{\sum_{i=1}^M E_i} \frac{P_R}{P_{US}}$$

where

E_i = number employed under each employment category for the region

V_i = value added per employee in each category of employment (U.S. national values)

M = number of independent employment categories recognized (39)

P_R = personal income per employee for the region

P_{US} = personal income per employee for the U.S.

P_R was calculated as follows:

$$P_R = \frac{PI_R}{TE_R} = \frac{\sum_{i=1}^n PI_a}{\sum_{i=1}^n TE_a}$$

where

PI_R = total regional personal income

TE_R = total regional employment

PI_a = total personal income for each unit region

TE_a = total employment for each unit region

n = number of unit regions (counties for SMSA's) defining the economic region.

I. V

This is a coefficient representing the degree to which individual income is received from local business activity.

$$V = \frac{(PI)_R}{\sum_{i=1}^n (PI)_a} = \frac{\sum_{i=1}^n (PI)_a}{n (RS + WT + SS + VAM)_a}$$

where

(PI)_R = total personal income for the region

(TBV)_R = total business volume for the region

(PI)_a = total personal income for each unit region

RS = total retail sales for each unit region

WT = total wholesale trade for each unit region

SS = total selected services receipts for each unit region

VAM = total value added by manufacturer for each unit region

n = no. of unit regions defining the economic region.

J. H or MPC_H

H is a measure of the marginal or average propensity of a household to consume for housing. It is that percentage of personal income which is expected to be spent on housing, and it depends upon salary range to some extent.

K. MPC_O

This is the propensity (average or marginal) to consume for items other than housing, and it was calculated to be about 0.63 from a July 1969 *Survey of Current Business* reference. Additional research in this area may help relate this figure to average income.

L. Total Assessed Value of Property

This value was calculated as a simple summation of the unit values.

$$(TAV)_R = \sum_{i=1}^n (TAV)_a$$

where

$(TAV)_R$ = total assessed value for region
 $(TAV)_a$ = total assessed value for unit region
 n = no. of unit regions defining economic region.

M. Assessed to Market Value Ratio

The assessed to market value ratio was obtained along with the total assessed evaluation for each county or SMSA.

Total market value for each was calculated as follows:

$$TMV = TAV/AMVR$$

where

TMV = total market value
 TAV = total assessed valuation
 $AMVR$ = assessed to market value ratio.

The regional values were calculated accordingly.

$$(TMV)_R = \sum_{i=1}^n (TMV)_a \quad (TMV)_R = \text{Regional value}$$

and

$$(TAV)_R = \sum_{i=1}^n (TAV)_a \quad (TAV)_R = \text{Regional value}$$

n = number of units comprising the region

$(AMVR)_R = (TAV)_R / (TMV)_R$ was then used to ascertain the proper assessed to market value ratio for input into EIFS.

N. Property Tax Rate

The property tax rates were calculated according to the following relations:

$$(TC)_R = \sum_{i=1}^n (TC)_a$$

$$(TAV)_R = \sum_{i=1}^n (TAV)_a$$

$$(PTR)_R = \frac{(TC)_R}{(TAV)_R}$$

where

$(TC)_a$ = taxes collected (unit value)
 $(TC)_R$ = taxes collected (regional value)
 $(TAV)_a$ = total assessed valuations (unit)
 $(TAV)_R$ = total assessed valuations (regional)
 $(PTR)_R$ = regional property tax rate
 n = number of (units), counties, and SMSA's, comprising defined region.

O. Sales Tax Rates and Proportion Retained by State

These values were obtained and stored as installation specific values from indicated sources.

P. Children Per Family

This figure was obtained based upon age of the parents. The following relations were utilized:

<i>Age Range of Parents</i>	<i>Children/Family</i>
0 - 25 yrs	0.7
25 - 34 yrs	1.8

1.5 children per family was used as an average value. Additional work is anticipated to obtain numbers specific to each installation.

Q. Percent Children Attending School

This value was calculated as follows:

$$(TEN)_R = \sum_{i=1}^n (TEN)_a$$

$$(NAC)_R = \sum_{i=1}^n (NAC)_a$$

$$(UATE)_R = \sum_{i=1}^n (UATE)_a$$

$$PAS = \frac{(TEN)_R - (NAC)_R}{(UATE)_R}$$

where

- $(TEN)_a$ or R = total number enrolled in schools, colleges, etc.
 $(NAC)_a$ or R = number attending college
 $(UATE)_a$ or R = number under 18 years of age
 PAS = regional percent attending school
 n = number of units used to define economic region.

R. Cost of Education Per Child % Federally Financed % State Financed

These values were obtained and stored from indicated sources by installation

S. Operating Budget for Other Items

This value came from the following relations:

$$(OBUD)_a = (TOBUD)_a - (EDBUD)_a$$

$$(OBUD)_R = \sum_{i=1}^n (OBUD)_a$$

where

- $(OBUD)_a$ = operating budget of unit for other items
 $(TOBUD)_a$ = total operating budget of region
 $(EDBUD)_a$ = educational operating budget of unit
 $(OBUD)_R$ = operating budget for other item of region
 n = number of units comprising region.