(12)

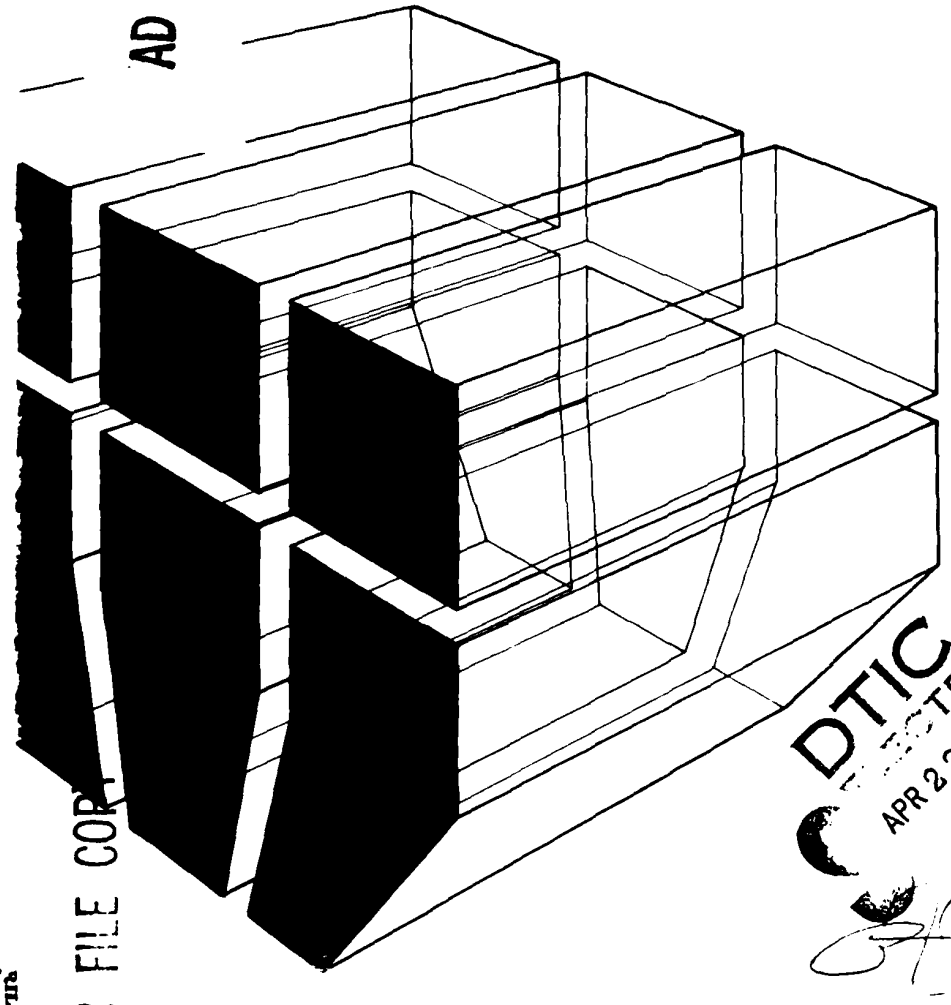
construction engineering research laboratory

United States Army Corps of Engineers
...Serving the Army
...Serving the Nation

TECHNICAL REPORT P-124
April 1982

Quantification of MCA/Facilities Readiness

FACILITIES READINESS QUANTIFICATION MODEL USERS MANUAL



by
John M. Deponai III
Laure Thomas
Craig Kukielski
Joe Sheffield

CERL

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CERL-TR-P-124	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* FACILITIES READINESS QUANTIFICATION MODEL USERS MANUAL		5. TYPE OF REPORT & PERIOD COVERED FINAL 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) John M. Deponai III Joe Sheffield Laure Thomas Craig Kukielski		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. ARMY CONSTRUCTION ENGINEERING RESEARCH LABORATORY P.O. Box 4005, Champaign, IL 61820		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A762731A141-B-031
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE April 1982 13. NUMBER OF PAGES 53
14. MONITORING AGENCY NAME & ADDRESS*(If different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Copies are obtainable from the National Technical Information Service
Springfield, VA 22161

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

construction
Force Readiness

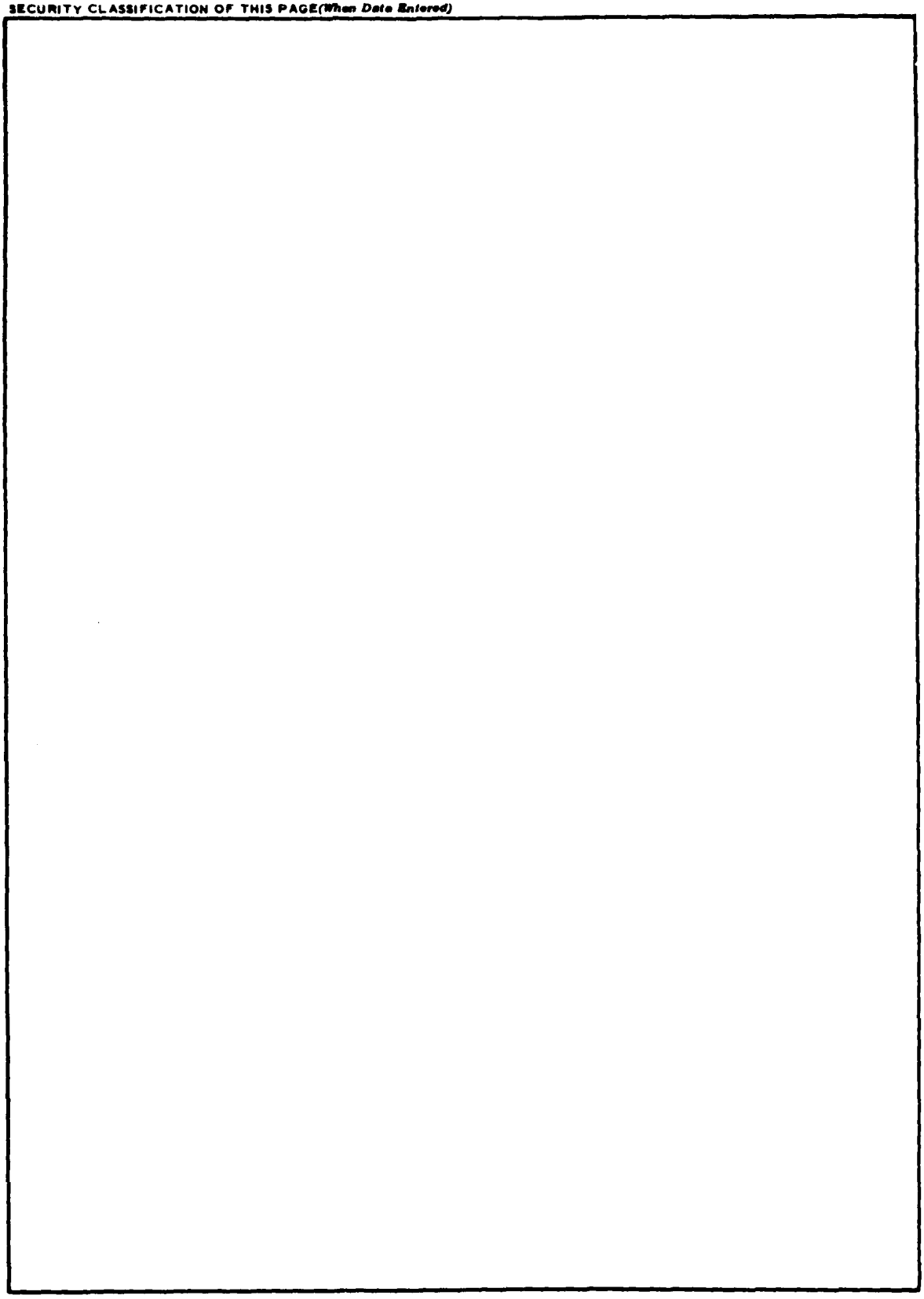
20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes how to use the Facilities Readiness Quantification Model developed by the U.S. Army Construction Engineering Research Laboratory. This model can be used by Army managers to determine the relative readiness merits of selected projects in the Military Construction, Army (MCA) program. The algorithms required for this model can be prepared manually, or on a programmable calculator.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*



FOREWORD

This investigation was conducted for the Directorate of Military Programs, Office of the Chief of Engineers (OCE), under Project 4A762731AT41, "Design, Construction, and Operation and Maintenance Technology for Military Facilities"; Task B, "Construction, Management, and Technology"; Work Unit 031, "Quantification of MCA/Facilities Readiness." The applicable STO is 81-8:7. The OCE Technical Monitors were COL Carpenter, COL Coats, LTC Godfrey, and LTC Edwards, all of DAEN-ZCP-R.

The cooperation and contributions of the Construction Requirements Review Committee are gratefully acknowledged.

The work was performed by the Facility Systems Division (FS) of the U.S. Army Construction Engineering Research Laboratory (CERL). Mr. E. A. Lotz is Chief of CERL-FS.

COL Louis J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

CONTENTS

TABLES

FIGURES

FIGURES (cont'd)

FACILITIES READINESS QUANTIFICATION MODEL USERS MANUAL

1 INTRODUCTION

Background

In July 1978, the U.S. Army Construction Engineering Research Laboratory (CERL) was tasked by the Directorate of Military Programs, Office of the Chief of Engineers, to develop a model to relate military construction to force readiness. By November 1980, a pilot model had been developed, tested, and evaluated. In December 1980, it was decided not to develop a computerized system to fully implement the concept. However, OCE directed that CERL develop a noncomputerized version of the model. This version would be used at the option of the Construction Requirements Review Committee (CRRC) to determine the relative readiness merits of a few marginal projects in the Military Construction, Army (MCA) program. CERL used the data obtained during development and testing of the pilot model to devise a noncomputerized model for the CRRC; the algorithms required for this model can be performed manually or on a programmable calculator (see Appendix A).

Purpose

The objective of this study was to develop a model that quantifies the relative impact of all MCA projects on the readiness state of the Army. The objective of this report is to provide user instructions for a model that quantifies the relative impact of *selected* MCA projects on Army readiness.

Approach

1. A comprehensive pilot Facilities Readiness Quantification Model was developed, tested, and evaluated.

2. Data obtained during Step 1 above were used to devise a noncomputerized Facilities Readiness Quantification Model.

a. Algorithms were developed for the noncomputerized model.

b. Programs were created for implementing the model's algorithms on a programmable calculator.

Outline of Report

Chapter 2 of this report gives instructions for CRRC members who will actually rate MCA facility projects using the model. Chapter 3 gives instructions for CRRC support personnel who will process model data. Processing aids, in the form of programs for a Texas Instruments (TI)-59 programmable calcualtor system, are described in Appendices A through D. Blank forms for reproduction are provided in Appendix E.

Mode of Technology Transfer

This report is the technology transfer medium for the results of this study.

2 INSTRUCTIONS TO RATERS

This chapter describes how the CRRC can use a noncomputerized Facilities Readiness Quantification Model to define the relative readiness worth of selected MCA projects. Figure 1 shows the seven-step procedure for implementing the model. To illustrate this procedure, five example MCA projects are compared in this chapter. Some basic information on the example projects is given in Table 1. Example ratings are assigned to *each* project for *each* variable and for *each* rater.* These example ratings will serve as the basis for the data processing examples in Chapter 3.

The following assumptions were made concerning rating authorities:

1. All 10 CRRC voting members would participate in determining mission weights.

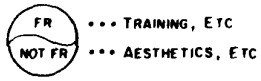
2. The special staff members of the CRRC who represent the Assistant Chief of Engineers (COE), the Comptroller of the Army (COA), The Adjutant General (TAG), and The Surgeon General (TSG) would rate only those projects for which they are the proponent.

3. Other CRRC members would rate all projects.

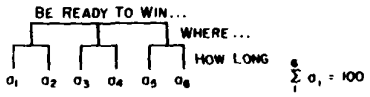
4. At least six or seven raters would participate each time the model was used.

*These ratings are arbitrary and do not represent the actual views of any member of the CRRC.

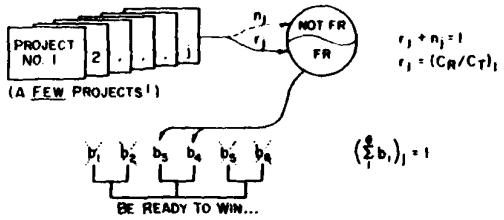
1 USE THE JULY 80 FIELD TEST DEFINITION OF FORCE READINESS (FR):



2 WEIGHT EXISTING 6-NODE MISSION HIERARCHY:

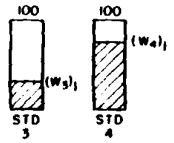


3 DECIDE EACH PROJECT'S RELEVANCE TO FR AND TO FR SUBOBJECTIVES:



4 DEFINE ONE MAX CONTRIBUTION PROJECT FOR EACH OF THE 6 MISSION AREAS:

5 COMPARE PROJECT WORTHS TO APPROPRIATE STANDARDS:



6 COMPUTE THE FINAL B_R/C_T:

$$\left(\sum_{i=1}^{6} a_i b_i w_i\right)_j \times r_j = (B_R/C_T)_j = (B_R/\$PA)_j$$

7 REVIEW AND DISCUSS RESULTS:

RANK	B/C
1	15
2	12
3	8
.	.
.	.
.	.
j	2

Figure 1. General procedure for using the noncomputerized Force Readiness Quantification Concept.

Table 1
Example Projects–Basic Information

Location	Project Number	Project Description	Proponent	MACOM	Program Amount ($K)
Germany	414	Igloo Storage (various)	DCSLOG	USAREUR	1,700
Korea	690	Tactical equip shop (Taegu)	DCSLOG	EUSA	1,000
Fort Benning	342	Tactical equip shops	DCSLOG	TRADOC	4,150
Turkey	203	Administration building (DET 67/168)	DCSPER	USAREUR	1,300
Germany	784	Banking facility (Frankfurt)	TAG	USAREUR	480

Step 1–Define Force Readiness

Table 2 gives a working definition developed by the CRRC of force readiness with respect to MCA facilities. For this report, force readiness is defined as the degree to which a force is capable of accomplishing the requirements of the specific missions or contingency plans for which it is responsible. Since a force is essentially an assemblage of resources, force capability can be viewed as a function of the level of fulfillment of those resources needed to accomplish the missions.

Table 2
Working Definition of Force Readiness

Force Readiness Includes:

- Training
- Maintenance
- Command, Control, Communication (C^3)
- Security
- Manning the Force
- Making Military Operations More Efficient

Force Readiness Does Not Include:

- Asthetics
- Occupational Health and Safety Act (OHSA) Compliance
- Pollution Abatement
- Energy Conservation
- Environment Enhancement
- Convenience of Operations

Step 2–Weight Mission Hierarchy

Using the mission subobjective definitions given in Table 3, each member of the CRRC decides the relative significance of five mission comparisons by entering a ratio on the appropriate line of Form A (Figure 2). This ratio represents the rater's opinion of the relative importance of being ready to win in Europe vs being ready to win in the United States, etc. To assign this ratio, the rater must make a subjective assessment of the relative consequences of losing in one mission area vs another, and of the probability that a conflict would actually occur that would involve the mission areas being considered.

Table 3
Readiness Mission Subobjective Definitions

	Where	Response Phase
Be Ready To Win In . . .	E: Europe (incl Turkey)	EI: Initial (first 30 days)
		ES: Sustaining (after 30 days)
	U: USA (50 States only)	UI: Initial (first day)
		US: Sustaining (after first day)
	O: All Other (anywhere else)	OI: Initial (first 30 days)
		OS: Sustaining (after 30 days)

Raters should assign ratio values independently and should not compare their values directly with those of any other rater. Seven hypothetical ratings for the missions described in Table 2 are shown in Figure 3. Note that ratios in the form of 4/1, 3/1, 5/1, etc. can also be expressed as the whole numbers 4, 3, 5, etc.

The ratios assigned by each rater are processed as described in Chapter 3 to obtain the low quartile, median, and high quartile feedback values for each of the five ratios. The median feedback values then are used to distribute an arbitrary 100 "readiness utiles" across the six mission subobjectives.

A sample of a Form A listing feedback results for the ratios assigned in Figure 3 is shown in Figure 4. After receiving these results, the raters meet to discuss the pros and cons of the issues. Those members who wish to change their ratings enter revised ratings on the feedback sheet. These revised ratings are combined with the original ratings of members who elect not to change their ratings. Then, a new round of feedback results is computed using the most current values

Rater's Initials: _____

Date: _____
(Day/mo/yr)

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PRIOR RATIOS ASSIGNED

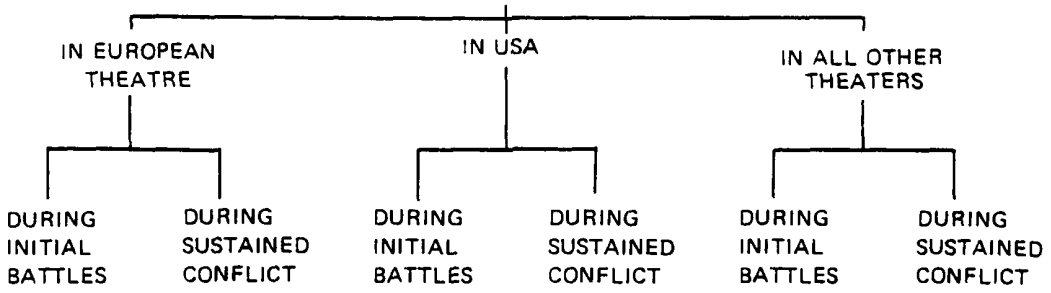
(as of:)

Low Q	Median	High Q
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

RELATIVE IMPORTANCE OF READINESS SUB-OBJECTIVES

Mission Sub-Objectives Being Compared	Relative Significance (Ratio)
European Theater / USA	_____
All Other Theaters / USA	_____
Europe: Initial / Sustained	_____
USA: Initial / Sustained	_____
Other: Initial / Sustained	_____

ARMY READINESS TO ACCOMPLISH MISSIONS

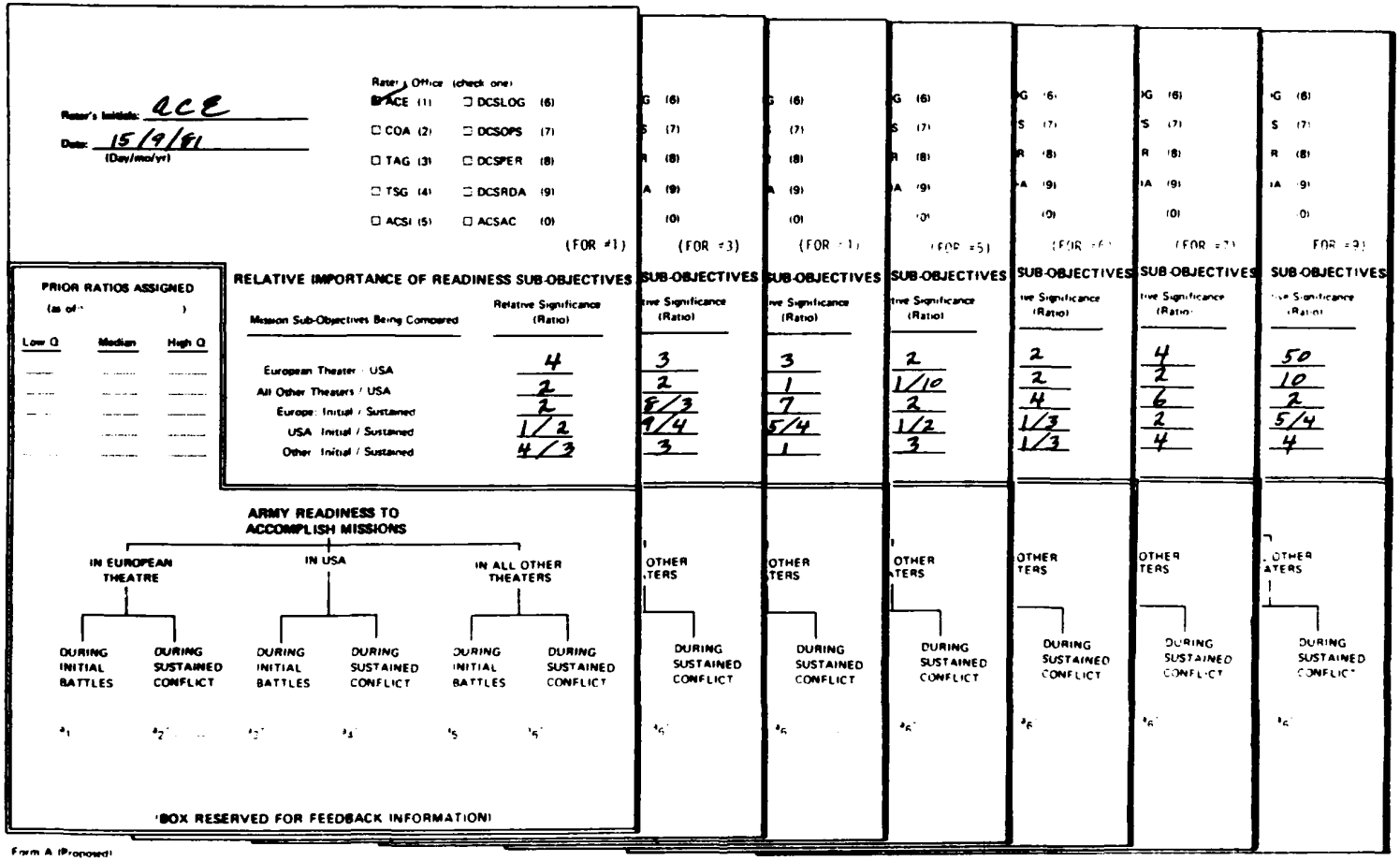


a_1=..... a_2=..... a_3=..... a_4=..... a_5=..... a_6=.....

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form A (Proposed)

Figure 2. Form A.



Form A (Proposed)

Figure 3. Hypothetical mission weights assigned by CRRC raters.

Rater's Initials: _____

Date: _____
(Day/mo/yr)

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

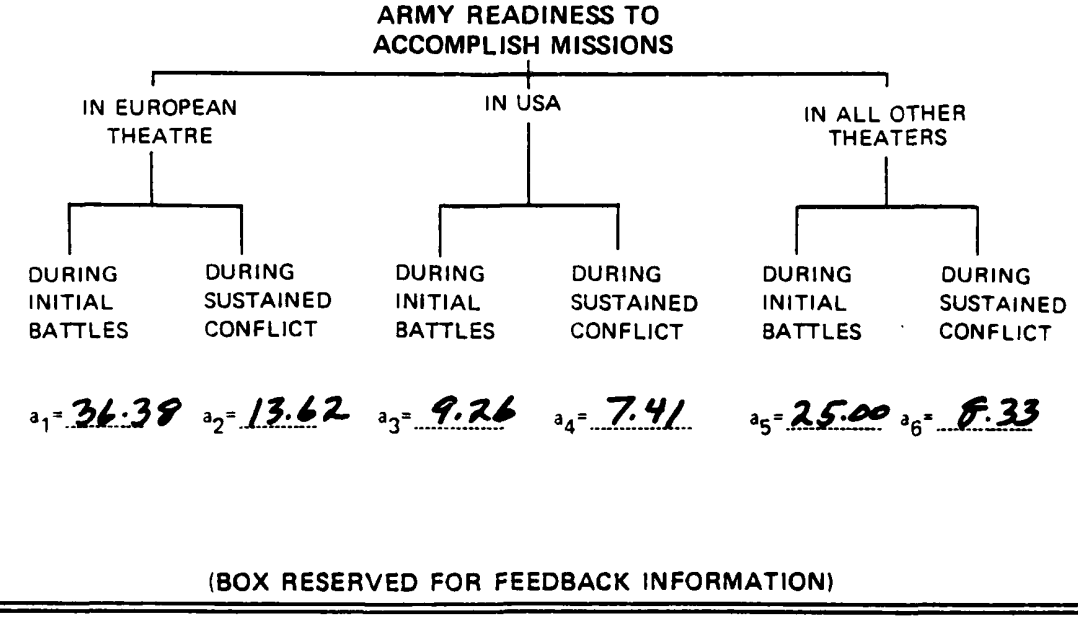
PRIOR RATIOS ASSIGNED

(as of: 22/9/81)

Low Q	Median	High Q
2	3	4
1	2	2
2	2.67	6
0.5	1.25	2
1	3	4

RELATIVE IMPORTANCE OF READINESS SUB-OBJECTIVES

Mission Sub-Objectives Being Compared	Relative Significance (Ratio)
European Theater / USA	
All Other Theaters / USA	
Europe: Initial / Sustained	
USA: Initial / Sustained	
Other: Initial / Sustained	



(BOX RESERVED FOR FEEDBACK INFORMATION)

Form A (Proposed)

Figure 4. Processed data results for the ratios assigned in Figure 3–sample.

Table 4
Summary of Final B/C Ratios for the Five Sample Projects in Table 1

Location	Project Number	Project Description	$PA ($K)	B_R/$PA
Germany	414	Igloo storage (various)	1,700	27.7
Korea	690	Tactical equipment shop (Taegu)	1,000	19.8
Fort Benning	342	Tactical equipment shops	4,150	15.2
Turkey	203	Administration building (Det 67/168)	1,300	7.6
Germany	784	Banking facility (Frankfurt)	480	0.3

from each of the 10 raters. This can be done at any time and as many times as desired.* However, any change in the median mission weights will change each project's final benefit/cost (B/C) ratio. Thus, every time the median values of the mission weights change, the final B/C ratios for *all* projects must be recomputed. These computations are discussed in Chapter 3.

Steps 3 through 6—Determine Project Values

Each rater uses Form B to record the set of weights assigned to each project (Figure 5). Figure 6 shows how each of six raters might have scored Project Number 414 (from Table 1) as to what percentage (r) of its cost is credited to the procurement of readiness benefits (Step 3 in Figure 1); as to what percentage (b_i) of the total project benefit is attritutable to each readiness subobjective (Step 3 in Figure 1); and as to what the relative worth (w_i) of each benefit is compared to some arbitrary maximum contribution facility (Step 4 in Figure 1) for each readiness subobjective (Step 5 in Figure 1). Again, to ensure the integrity of the data, all raters must assign these values independently, *without* comparing values directly with any other raters.

After all Forms B are completed, they are processed (Step 6 in Figure 1) as described in Chapter 3 to obtain low quartile, median, and high quartile feedback values for each of the variables r, b_i, and w_i. The final project B/C ratio also is computed at this time. All this information is recorded on a blank Form B along with the location, project number, and description of the project to which the feedback applies. Figure 7 shows feedback results for the values assigned in Figure 6.

Hypothetical ratings for Project Numbers 690, 342, 203, and 784 from Table 1 are shown in Figures 8, 10, 12, and 14, respectively. The corresponding feedback data are shown in Figures 9, 11, 13, and 15. Note that if the computations are based on the median value, the effect of unusually high or unusually low scores is eliminated. If *mean* values are used, extreme ratings could have a dramatic effect on the outcome; however, using median values ensures that no one rater can dominate the outcome.

Step 7—Review Results

Table 4 summarizes the final B/C ratios for all five projects listed in Table 1. After final B/C ratios are computed, raters should meet to (1) review these data, (2) identify and resolve any glaring discrepancies, (3) argue the merits and demerits of the various projects in light of the final B/C ratios, and (4) determine whether any rater wishes to change a rating. Assuming at least one member does change a rating - whether mission weight or any project variable - the data would have to be reprocessed. If a median value of any *mission weight* changes, the B/C must be recomputed for *all* projects. However, if only the median *project values* change, only those projects whose median values are affected need to have their B/C ratios recomputed.

3 DATA PROCESSING INSTRUCTIONS

Form A Data

This section describes how to process the data entered by the raters on the right side of the Form A data sheets. Before processing these data, make sure that there is one Form A data sheet for each rater. Although it is not necessary that a full set of 10 be used, at least six are needed to ensure the model will deliver reliable results. The seven Form A rating sheets shown in Figure 3 are used below as an example of how to process Form A data.

1. Convert the ratios to decimal format.

*Obviously, no single rating will remain stable over a long period of time; during periods of high international tension, a rating may change significantly in a short period of time.

Rater's Initials: _____

Date: _____
Day/mo/yr

Rater's Office. (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION PN DESCRIPTION

PRIOR RATING RESULTS

(as of)

r VALUES

Low Q	Median	High Q
.....	.....	.....

b VALUES

Low Q	Median	High Q

w VALUES

Low Q	Median	High Q
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

Note. Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe Initial	b_1= _____
Europe-Sustained	b_2= _____
USA Initial	b_3= _____
USA-Sustained	b_4= _____
Other-Initial	b_5= _____
Other-Sustained	b_6= _____

(Total 100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

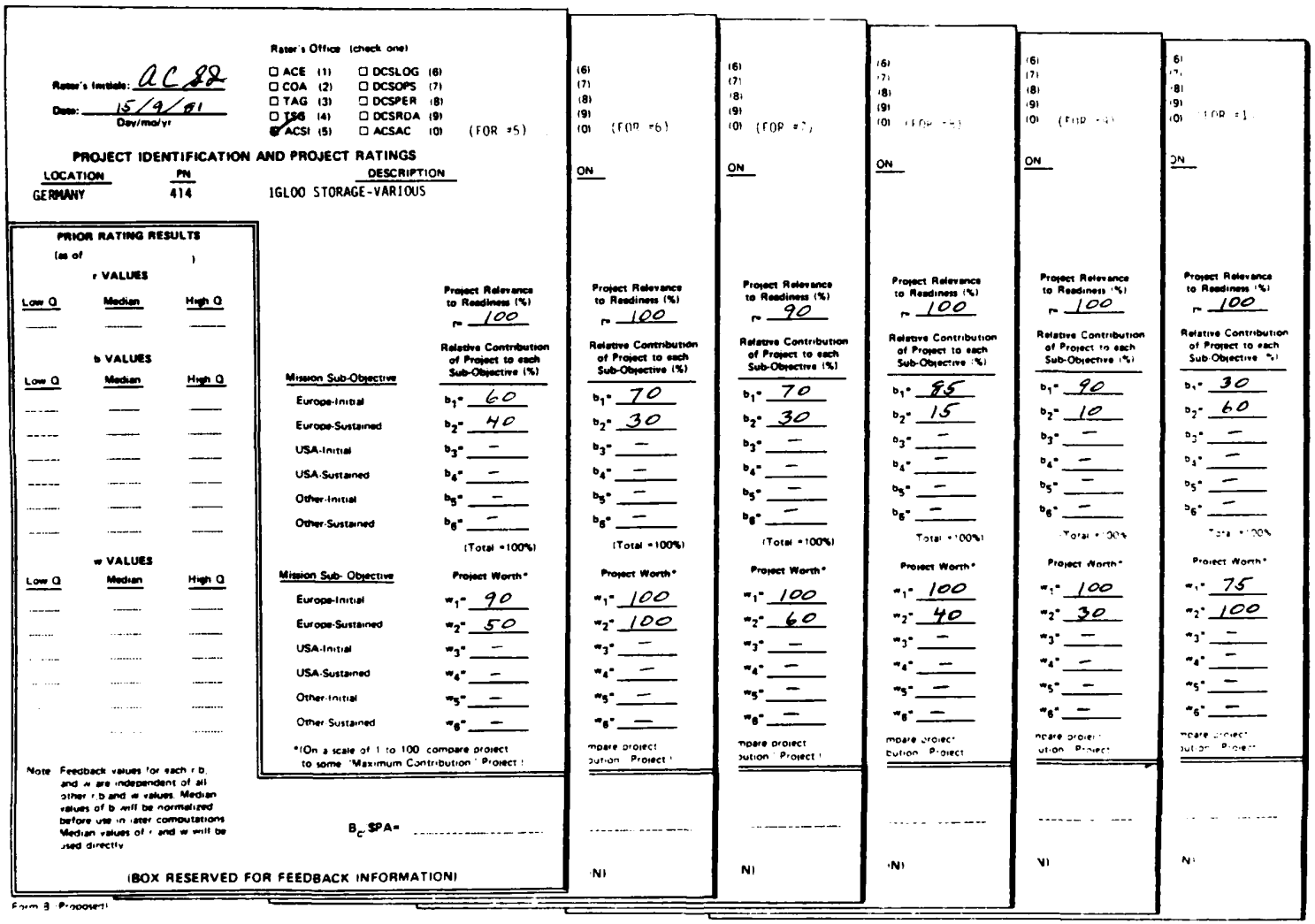
*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

$B_c/\$PA$= .....

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form B (Proposed)

Figure 5. Form B.



Form 8 (Proposed)

Figure 6. Hypothetical values assigned to Project Number 414 from Table 1.

Rater's Initials: _____

Date: _____ Day/mo/yr

Rater's Office (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
GERMANY	414	IGLOO STORAGE-VARIOUS

PRIOR RATING RESULTS

(as of 22/9/81)

r VALUES

Low Q	Median	High Q
97.5	100	100

b VALUES

Low Q	Median	High Q
52.5	70	86.25
13.75	30	45
–	–	–
–	–	–
–	–	–
–	–	–
–	–	–

w VALUES

Low Q	Median	High Q
86.25	100	100
37.25	55	100
–	–	–
–	–	–
–	–	–
–	–	–
–	–	–

Note: Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub-Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe-Initial	b_1= _____
Europe-Sustained	b_2= _____
USA-Initial	b_3= _____
USA-Sustained	b_4= _____
Other Initial	b_5= _____
Other-Sustained	b_6= _____

(Total =100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

B_c/SPA= 27.72

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form B (Proposed)

Figure 7. Processed data results for the values assigned in Figure 6.

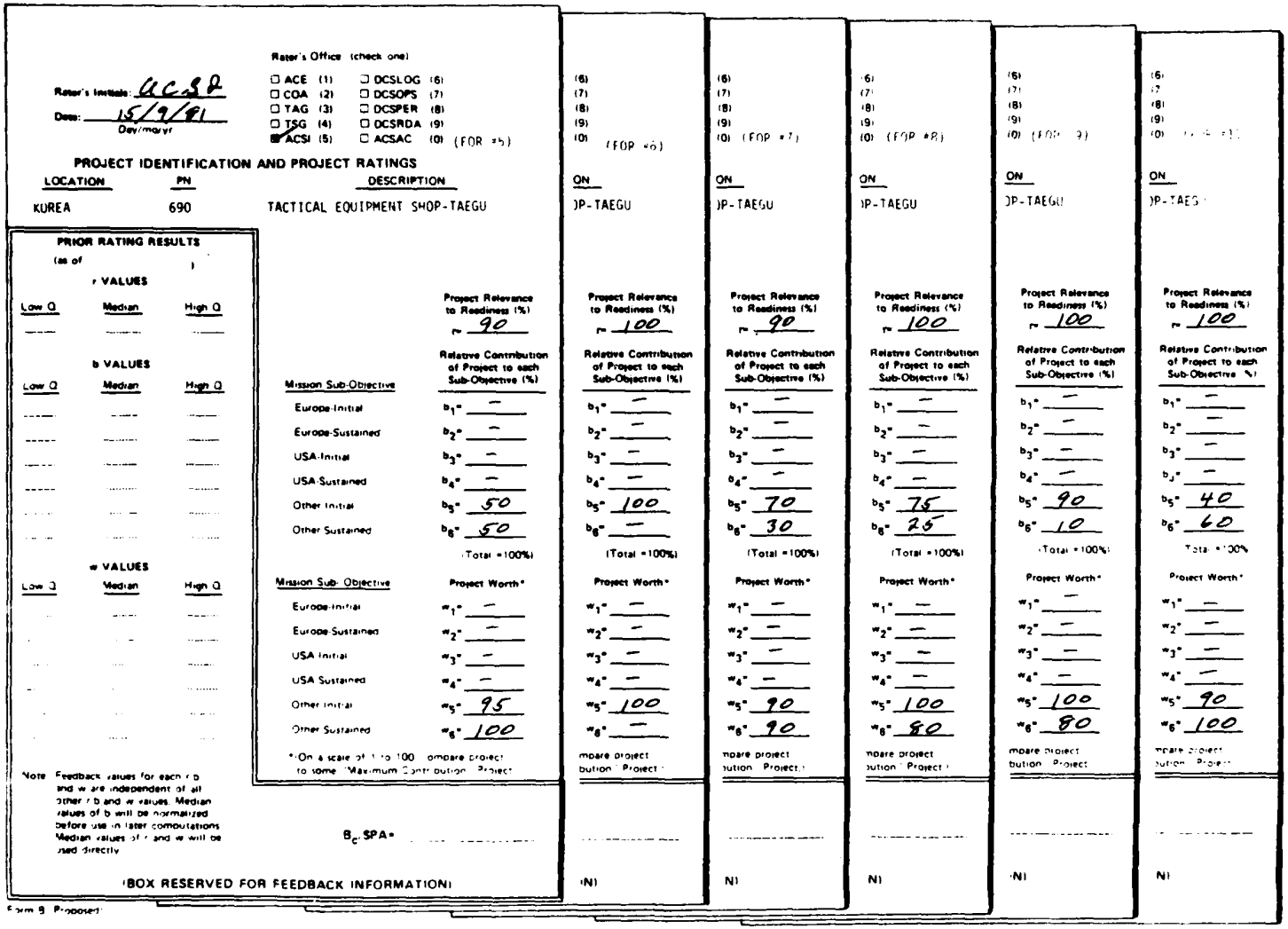


Figure 8. Hypothetical ratings for Project Number 690 from Table 1.

Rater's Initials: _____

Date: _____
Day/mo/yr

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
KUREA	690	TACTICAL EQUIPMENT SHOP-TAEGU

PRIOR RATING RESULTS

(as of 22/9/81)

r VALUES

Low Q	Median	High Q
90	100	100

b VALUES

Low Q	Median	High Q
–	–	–
–	–	–
–	–	–
–	–	–
47.5	72.5	92.5
7.5	27.5	52.5

w VALUES

Low Q	Median	High Q
–	–	–
–	–	–
–	–	–
–	–	–
90	97.5	100
60	85	100

Note: Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub-Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe-Initial	b_1= _____
Europe-Sustained	b_2= _____
USA-Initial	b_3= _____
USA-Sustained	b_4= _____
Other-Initial	b_5= _____
Other-Sustained	b_6= _____

(Total =100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

B_c/SPA= 19.77

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form 3 Proposed

Figure 9. Feedback results for the values in Figure 8.

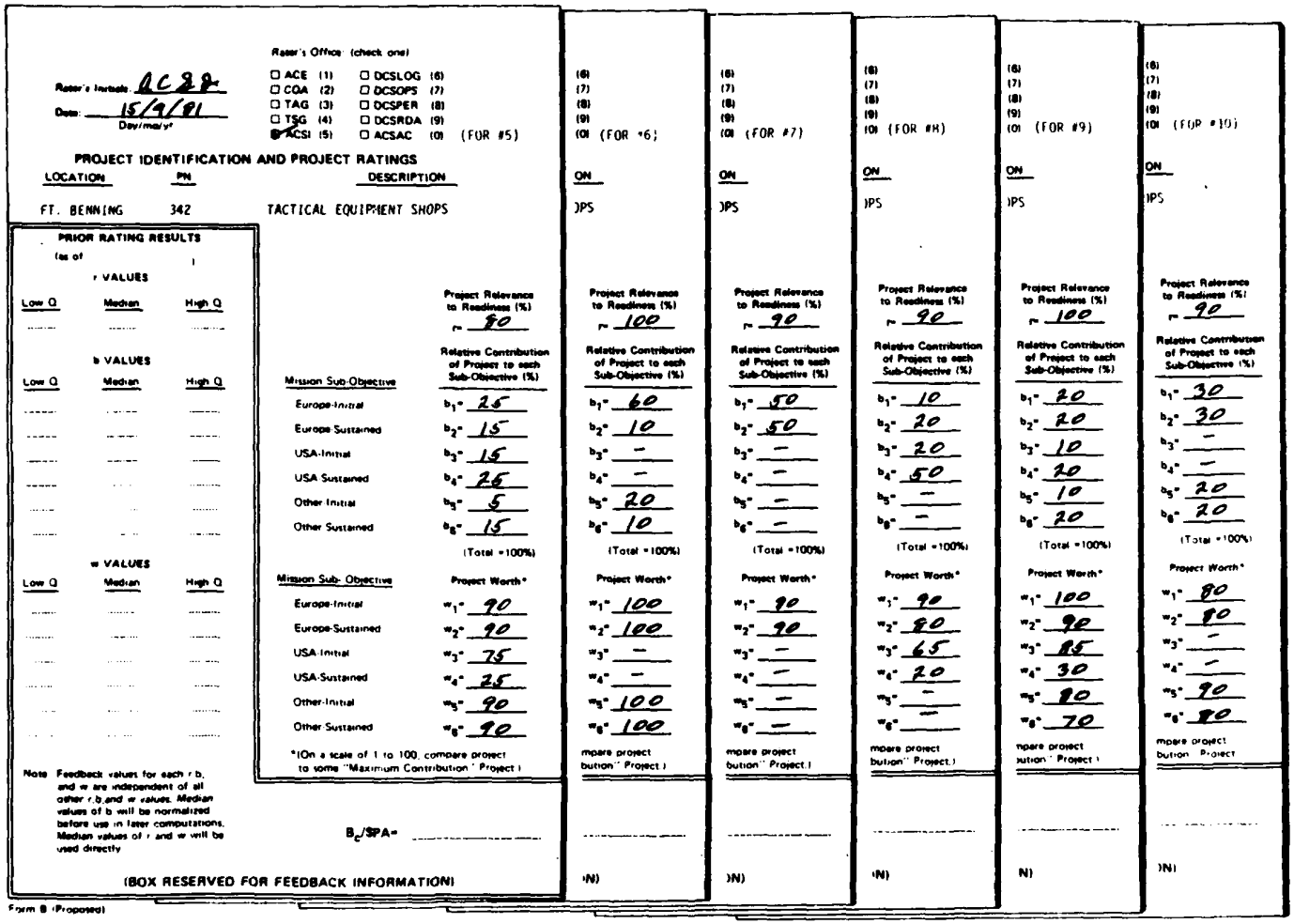


Figure 10. Hypothetical ratings for Project Number 342 from Table 1.

Rater's Initials: _____

Date: _____ Day/mo/yr

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
FT. BENNING	342	TACTICAL EQUIPMENT SHOPS

PRIOR RATING RESULTS

(as of 22/9/81)

r VALUES

Low Q	Median	High Q
87.5	90	100

b VALUES

Low Q	Median	High Q
17.5	27.5	52.5
13.75	20	35
0	5	16.25
0	10	31.25
0	7.5	20
0	12.5	20

w VALUES

Low Q	Median	High Q
80	90	100
80	90	92.5
0	32.5	77.5
0	10	26.25
0	85	92.5
0	75	92.5

Note: Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub-Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe-Initial	b_1= _____
Europe-Sustained	b_2= _____
USA-Initial	b_3= _____
USA-Sustained	b_4= _____
Other-Initial	b_5= _____
Other-Sustained	b_6= _____

(Total =100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

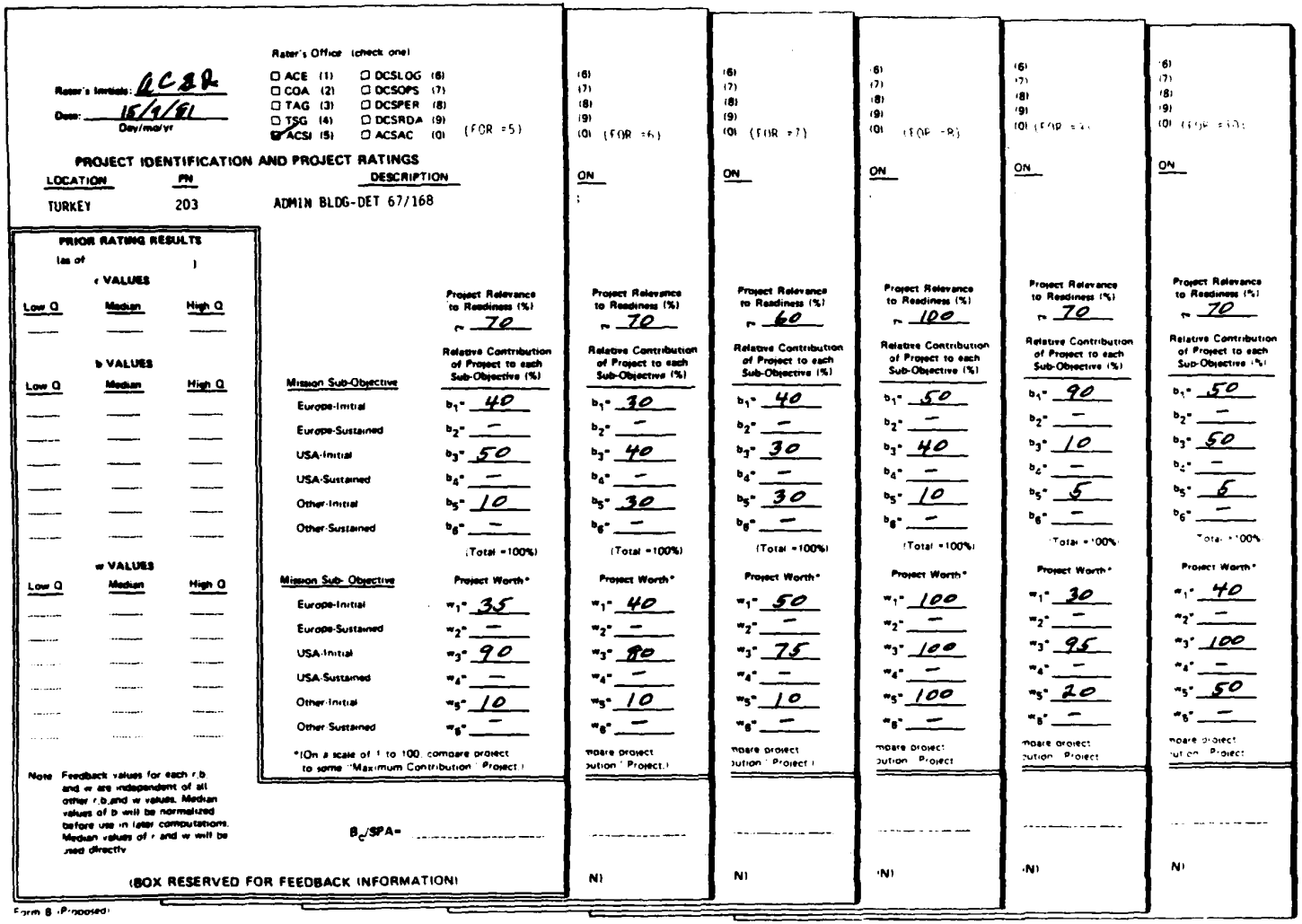
*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

$B_c/\$PA$= 15.17

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form B (Proposed)

Figure 11. Feedback results for the values in Figure 10.



Rater's Initials: ACSR
Date: 15/9/81 (Day/mo/yr)

Rater's Office (check one)

☐ ACE	(1)	☐ DCSLOG	(6)
☐ COA	(2)	☐ DCSOPS	(7)
☐ TAG	(3)	☐ DCSPER	(8)
☐ TSG	(4)	☐ DCSRDA	(9)
☑ ACSI	(5)	☐ ACSAC	(0)

(FOR =5)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
TURKEY	203	ADMIN BLDG-DET 67/168

PRIOR RATING RESULTS

(as of)

r VALUES

Low Q	Median	High Q

b VALUES

Low Q	Median	High Q

w VALUES

Low Q	Median	High Q

Note: Feedback values for each r, b and w are independent of all other r, b, and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Mission Sub-Objective		(5)	(6)	(7)	(8)	(9)	(0)
			(FOR =6)				(FOR =7)
		ON	ON				ON
Project Relevance to Readiness (%)	r =	70	70				60
Relative Contribution of Project to each Sub-Objective (%)							
Europe-Initial	b_1 =	40	30				40
Europe-Sustained	b_2 =	—	—				—
USA-Initial	b_3 =	50	40				30
USA-Sustained	b_4 =	—	—				—
Other-Initial	b_5 =	10	30				30
Other-Sustained	b_6 =	—	—				—
		(Total =100%)	(Total =100%)				(Total =100%)
Mission Sub-Objective		Project Worth*	Project Worth*				Project Worth*
Europe-Initial	w_1 =	35	40				50
Europe-Sustained	w_2 =	—	—				—
USA-Initial	w_3 =	90	80				75
USA-Sustained	w_4 =	—	—				—
Other-Initial	w_5 =	10	10				10
Other Sustained	w_6 =	—	—				—
		*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)	mpare project ution" Project.)				mpare project ution" Project.)
	B_c/SPA =						
		(BOX RESERVED FOR FEEDBACK INFORMATION)	N)				N)

		(6)	(7)	(8)	(9)	(0)
						(FOR =8)
		ON	ON			ON
Project Relevance to Readiness (%)	r =	100	70			70
Relative Contribution of Project to each Sub-Objective (%)						
Europe-Initial	b_1 =	50	90			50
Europe-Sustained	b_2 =	—	—			—
USA-Initial	b_3 =	40	10			50
USA-Sustained	b_4 =	—	—			—
Other-Initial	b_5 =	10	5			5
Other-Sustained	b_6 =	—	—			—
		(Total =100%)	(Total =100%)			(Total =100%)
Mission Sub-Objective		Project Worth*	Project Worth*			Project Worth*
Europe-Initial	w_1 =	100	30			40
Europe-Sustained	w_2 =	—	—			—
USA-Initial	w_3 =	100	95			100
USA-Sustained	w_4 =	—	—			—
Other-Initial	w_5 =	100	20			50
Other Sustained	w_6 =	—	—			—
		mpare project ution" Project.	mpare project ution" Project.			mpare project ution" Project.
		N)	N)			N)

Form 8 (Proposed)

Figure 12. Hypothetical ratings for Project Number 203 from Table 1.

Rater's Initials: _____

Date: _____
Day/mo/yr

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
TURKEY	203	ADMIN BLDG-DET 67/168

PRIOR RATING RESULTS

(as of 22/9/81)

r VALUES

Low Q	Median	High Q
67.5	70	72.5

b VALUES

Low Q	Median	High Q
37.5	45	60
—	—	—
25	40	50
—	—	—
5	10	30
—	—	—

w VALUES

Low Q	Median	High Q
33.75	40	62.5
—	—	—
78.75	92.5	100
—	—	—
10	15	62.5
—	—	—

Note: Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub-Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe-Initial	b_1= _____
Europe-Sustained	b_2= _____
USA-Initial	b_3= _____
USA-Sustained	b_4= _____
Other-Initial	b_5= _____
Other-Sustained	b_6= _____

(Total =100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

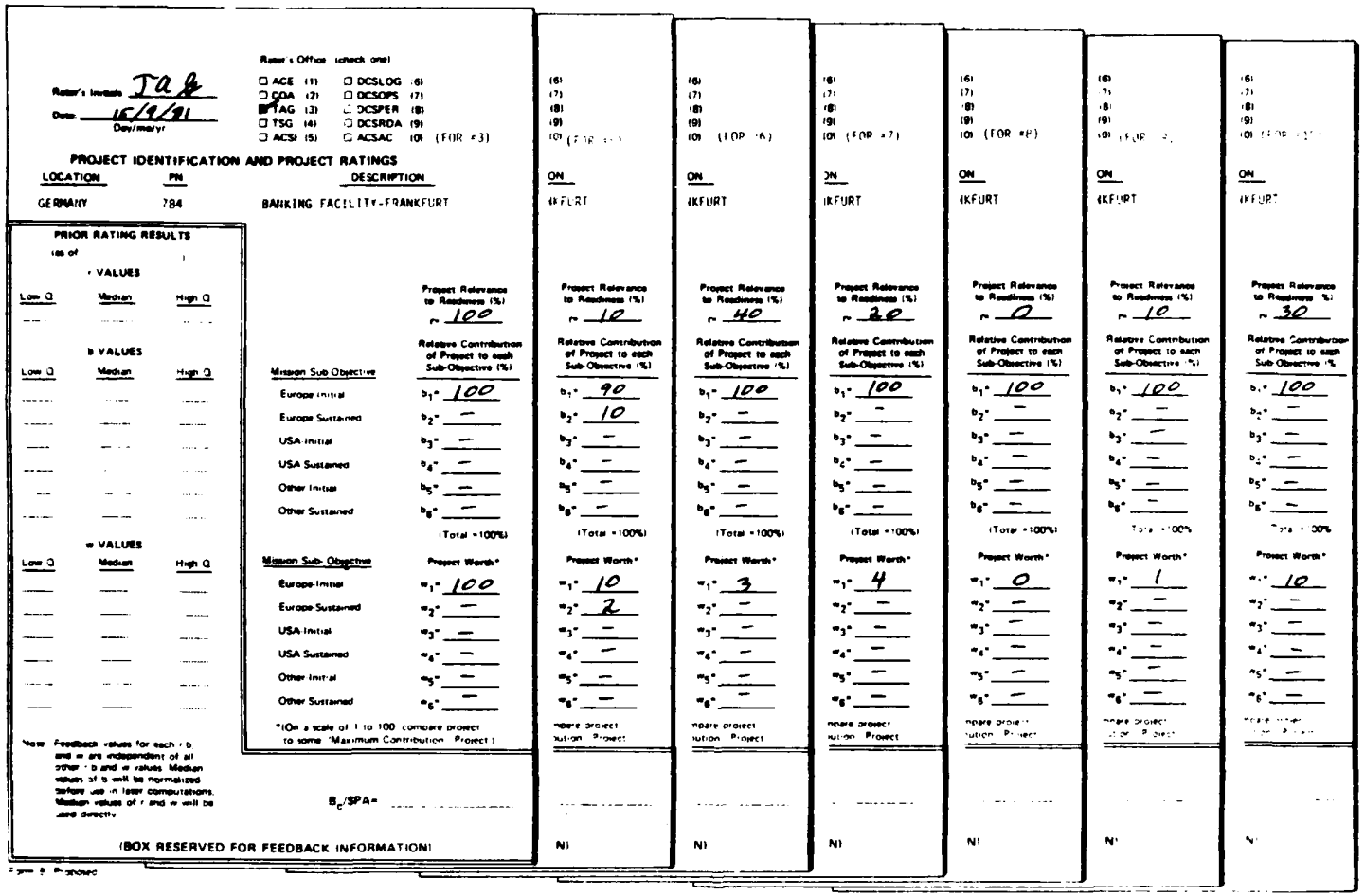
*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

$B_c/\$PA$= 7.60

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form B (Proposed)

Figure 13. Feedback results for the values in Figure 12.



PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
GERMANY	784	BANKING FACILITY-FRANKFURT

Rater's Office (check one)

☐ ACE (1) ☐ DCSLOG (6)
☐ COA (2) ☐ DCSOPS (7)
☒ TAG (3) ☐ DCSPER (8)
☐ TSG (4) ☐ DCSRDA (9)
☐ ACSI (5) ☐ ACSAC (0) (FOR #3)

Rater's Initials: JA &
Date: 16/9/91 (Dev/mo/yr)

PRIOR RATING RESULTS (as of)

r VALUES

Low Q	Median	High Q
---	---	---

b VALUES

Low Q	Median	High Q
---	---	---
---	---	---
---	---	---
---	---	---
---	---	---
---	---	---
---	---	---

w VALUES

Low Q	Median	High Q
---	---	---
---	---	---
---	---	---
---	---	---
---	---	---
---	---	---
---	---	---

Note: Feedback values for each r, b and w are independent of all other r, b and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Mission Sub Objective	Project Relevance to Readiness (%) r = 100	Relative Contribution of Project to each Sub-Objective (%)	Project Worth*
Europe Initial	b_1 = 100		w_1 = 100
Europe Sustained	b_2 = —		w_2 = —
USA Initial	b_3 = —		w_3 = —
USA Sustained	b_4 = —		w_4 = —
Other Initial	b_5 = —		w_5 = —
Other Sustained	b_6 = —	(Total =100%)	w_6 = —

*(On a scale of 1 to 100 compare project to some "Maximum Contribution" Project)

B_c/SPA= ---

(BOX RESERVED FOR FEEDBACK INFORMATION)

	(6) (7) (8) (9) (0) (FOR #3)	(6) (7) (8) (9) (0) (FOR #6)	(6) (7) (8) (9) (0) (FOR #7)	(6) (7) (8) (9) (0) (FOR #8)	(6) (7) (8) (9) (0) (FOR #2)	(6) (7) (8) (9) (0) (FOR #1)
	ON IKFURT	ON IKFURT	ON IKFURT	ON IKFURT	ON IKFURT	ON IKFURT
Project Relevance to Readiness (%)	r = 10	r = 40	r = 20	r = 0	r = 10	r = 30
Mission Sub Objective	Relative Contribution of Project to each Sub-Objective (%)					
Europe Initial	b_1 = 90	b_1 = 100	b_1 = 100	b_1 = 100	b_1 = 100	b_1 = 100
Europe Sustained	b_2 = 10	b_2 = —	b_2 = —	b_2 = —	b_2 = —	b_2 = —
USA Initial	b_3 = —	b_3 = —	b_3 = —	b_3 = —	b_3 = —	b_3 = —
USA Sustained	b_4 = —	b_4 = —	b_4 = —	b_4 = —	b_4 = —	b_4 = —
Other Initial	b_5 = —	b_5 = —	b_5 = —	b_5 = —	b_5 = —	b_5 = —
Other Sustained	b_6 = —	b_6 = —	b_6 = —	b_6 = —	b_6 = —	b_6 = —
	(Total =100%)	(Total =100%)	(Total =100%)	(Total =100%)	(Total =100%)	(Total =100%)
Mission Sub Objective	Project Worth*					
Europe Initial	w_1 = 10	w_1 = 3	w_1 = 4	w_1 = 0	w_1 = 1	w_1 = 10
Europe Sustained	w_2 = 2	w_2 = —	w_2 = —	w_2 = —	w_2 = —	w_2 = —
USA Initial	w_3 = —	w_3 = —	w_3 = —	w_3 = —	w_3 = —	w_3 = —
USA Sustained	w_4 = —	w_4 = —	w_4 = —	w_4 = —	w_4 = —	w_4 = —
Other Initial	w_5 = —	w_5 = —	w_5 = —	w_5 = —	w_5 = —	w_5 = —
Other Sustained	w_6 = —	w_6 = —	w_6 = —	w_6 = —	w_6 = —	w_6 = —
	compare project with Project	compare project with Project	compare project with Project	compare project with Project	compare project with Project	compare project with Project
	---	---	---	---	---	---
	NI	NI	NI	NI	NI	NI

Figure 14. Hypothetical ratings for Project Number 784 from Table 1.

Rater's Initials: _____

Date: _____ Day/mo/yr

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION	PN	DESCRIPTION
GERMANY	784	BANKING FACILITY-FRANKFURT

PRIOR RATING RESULTS

(as of 22/9/81)

r VALUES

Low Q	Median	High Q
10	20	40

b VALUES

Low Q	Median	High Q
100	100	100
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

w VALUES

Low Q	Median	High Q
1	4	10
–	–	–
–	–	–
–	–	–
–	–	–
–	–	–

Note: Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub-Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe-Initial	b_1= _____
Europe-Sustained	b_2= _____
USA-Initial	b_3= _____
USA-Sustained	b_4= _____
Other-Initial	b_5= _____
Other-Sustained	b_6= _____

(Total =100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

$B_c/\$PA$= 0.29

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form B (Proposed)

Figure 15. Feedback results for the values in Figure 14.

2. Enter the decimal equivalent of each ratio in the appropriate box of the STEP 1 TABLE on Form A1 (Figure 16). Carry fractions out to two decimal places.

3. If one or more of the raters do not submit ratings, *cross out* the appropriate column(s) of boxes in the STEP 1 TABLE of Form A1. (This is very important.)

4. Use the statistical analysis program described in Appendix B to compute the low quartile, median, and high quartile values for each row of the STEP 1 TABLE matrix.

5. Record these three values in the appropriate row of the STEP 2 TABLE on Form A1 and on a blank copy of Form A (as feedback information).

6. Use the m_i to a_j program in Appendix C to compute the values a_1 through a_6. The input to this program is the median column of values in the STEP 2 TABLE on Form A1.

7. Record the output (a_1 through a_6) of that program on Form A in the STEP 3 TABLE of Form A1 and on Form C for later use.

Figure 17 shows the STEP 1 TABLE results for the data in Figure 3. Figure 18 shows the a_1 through a_6 values from the STEP 3 TABLE of Form A1 entered onto Form C.

Form B Data

This section describes how to process the data entered by raters on the right side of the Form B data sheets. Each project will have six to 10 Form B rating sheets to be processed. The six example rating sheets for Project Number 414 shown in Figure 6 are used below as an example of how to process Form B data:

1. Transfer each value from each Form B to the appropriate box on the Form B1 worksheet (Figure 19).

2. If one or more of the raters does not submit ratings, *cross out* that column(s) on Form B1 for that rater(s). (This is very important.)

3. Use the statistical analysis program described in Appendix B to compute the low quartile, median, and upper quartile values for rows r, b_1 through b_6, and w_1 through w_6 on Form B1. If a box is *crossed off* do *not* include it in the set of numbers being processed for that row. However, *blank* boxes are equivalent to *zero entries* for processing purposes.

4. Enter the results of processing the Form B1 data on Form B2 (Figure 20). Also enter the respective project number on Form B2.

5. Enter these results in the feedback section of Form B along with the project identification information for the respective project.

6. Enter the decimal form of the median r value, the normalized b′ values, and the decimal form of the median w values in the correct boxes on Form C.

7. Enter the project number at the bottom of Form C.

Figure 21 is an example of a Form B1 filled in with values from Figure 6. Figure 22 shows the data from Figure 21 after being processed and recorded on Form B2.

Form C Instructions

For each project, certain data from Forms A1 and B2 are transferred to Form C:

1. Take the values a_1 through a_6 from the most recent mission weight evaluation that was done, i.e., from the STEP 3 TABLE of the most recent Form A1 data sheet. Each a_i should have a value between 0 and 100. If not, an error has been made.

2. Use the same a_1 through a_6 values for every project. The a_i values in Figure 18 were taken from Figure 17.

3. The b′, w, and r values in Columns 2, 3, and 4 of Form C vary from project to project; therefore, enter the appropriate project number on *each* Form C.

4. Use the decimal form of the median r values (not the % form). Take this value from the STEP 1 TABLE of the most recent Form B2 computation for that project.

5. Take the values b_1' through b_6' from the STEP 3 TABLE of the most recently created Form B2; the values w_1 through w_6 are the decimal form of the median values from the STEP 4 TABLE. These r, b′, and w variables can have values from 0 to 1. If they do not, an error has been made.

PROCESSING INSTRUCTIONS FOR FORM "A" INPUT DATA

Initials:_____ Date Processed:_____

STEP 1: Enter into the respective box below the decimal equivalent (to the nearest 0.01) of each ratio from basic input Form A.

STEP 1 TABLE

	ACE (1)	COA (2)	TAG (3)	TSG (4)	ACSI (5)	DCSLOG (6)	DCSOPS (7)	DCSPER (8)	DCSRDA (9)	ACSAC (0)
EUR/USA										
OTH/USA										
EUR: I/S										
USA: I/S										
OTH: I/S										

STEP 2: Using the program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for each row of numbers above and record results in the Step 2 table below and on Form A (as feedback information.)

STEP 3: Using the program, "m_i to a_j," compute a_1 through a_6 (to the nearest 0.01) and record the six values on Form A (as feedback information), in Step 3 table below, and on Form C.

STEP 2 TABLE

ROW	OBJECTIVE	LOW Q	MEDIAN	HIGH Q
1	EUR/USA	l_1:	m_1:	h_1:
2	OTH/USA	l_2:	m_2:	h_2:
3	EUR:I/S	l_3:	m_3:	h_3:
4	USA:I/S	l_4:	m_4:	h_4:
5	OTH:I/S	l_5:	m_5:	h_5:

STEP 3 TABLE

MISSION WEIGHTS
a_1:
a_2:
a_3:
a_4:
a_5:
a_6:

Form A1 (Proposed)

Figure 16. Form A1.

PROCESSING INSTRUCTIONS FOR FORM "A" INPUT DATA

Initials: J.D Date Processed: 22/9/81

STEP 1: Enter into the respective box below the decimal equivalent (to the nearest 0.01) of each ratio from basic input Form A.

STEP 1 TABLE

	ACE (1)	COA (2)	TAG (3)	TSG (4)	ACSI (5)	DCSLOG (6)	DCSOPS (7)	DCSPER (8)	DCSRDA (9)	ACSAC (0)
EUR/USA	4		3	3	2	2	4		50	
OTH/USA	2		2	1	0.1	2	2		10	
EUR: I/S	2		2.67	7	2	4	6		2	
USA: I/S	0.5		2.25	1.25	0.5	0.33	2		1.25	
OTH: I/S	1.33		3	1	3	0.33	4		4	

STEP 2: Using the program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for each row of numbers above and record results in the Step 2 table below and on Form A (as feedback information.)

STEP 3: Using the program, "m_i to a_j," compute a_1 through a_6 (to the nearest 0.01) and record the six values on Form A (as feedback information), in Step 3 table below, and on Form C.

STEP 2 TABLE

ROW	OBJECTIVE	LOW Q	MEDIAN	HIGH Q
1	EUR/USA	l_1: 2	m_1: 3	h_1: 4
2	OTH/USA	l_2: 1	m_2: 2	h_2: 2
3	EUR:I/S	l_3: 2	m_3: 2.67	h_3: 6
4	USA:I/S	l_4: 0.5	m_4: 1.25	h_4: 2
5	OTH:I/S	l_5: 1	m_5: 3	h_5: 4

STEP 3 TABLE

MISSION WEIGHTS
a_1: 36.38
a_2: 13.62
a_3: 9.26
a_4: 7.41
a_5: 26.00
a_6: 8.33

Form A1 (Proposed)

Figure 17. STEP 1 TABLE results for the data in Figure 3.

PROJECT B/C COMPUTATION SHEET

Compute the Benefit Cost Ratios $(b/c)_1$ through $(b/c)_6$ by multiplying the values in the boxes. Blank boxes equal zero. Sum the six $(b/c)_i$ ratios to get $B_R/\$PA$.

Initials: JD

Date Processed: 22/9/81

RELATIVE IMPORTANCE (a_i) OF MISSION SUB OBJECTIVE		RELATIVE CONTRIBUTION (b_i') TO MISSION SUB OBJECTIVE (Normalized)		RELATIVE PROJECT WORTH (w_i) WITHIN SUB OBJECTIVE		PROJECT RELEVANCE (r) TO FORCE READINESS		$(b/c)_i$
36.38 (a_1)	X	0.7 (b_1')	X	1.0 (w_1)	X	1.0 (r)	=	25.47 $(b/c)_1$
13.62 (a_2)	X	0.3 (b_2')	X	0.55 (w_2)	X	1.0 (r)	=	2.25 $(b/c)_2$
9.26 (a_3)	X	0 (b_3')	X	0 (w_3)	X	1.0 (r)	=	0 $(b/c)_3$
7.41 (a_4)	X	0 (b_4')	X	0 (w_4)	X	1.0 (r)	=	0 $(b/c)_4$
25.0 (a_5)	X	0 (b_5')	X	0 (w_5)	X	1.0 (r)	=	0 $(b/c)_5$
8.33 (a_6)	X	0 (b_6')	X	0 (w_6)	X	1.0 (r)	=	0 $(b/c)_6$

(SUM TO GET $B_R/\$PA$)

PN: 414

SUM= 27.72 (Enter on Form B) = $B_R/\$PA$

Form C (Proposed)

Figure 18. Form C filled in with values from Forms A1 and B1.

PROCESSING INSTRUCTIONS FOR FORM "B" INPUT DATA

PN: _____ Initials: _____ Date Processed: _____

	ACE	COA	TAG	TSG	ACSI	DCSLOG	DCSOPS	DCSPER	DCSRDA	ACSAC
r:										

b_1:										
b_2:										
b_3:										
b_4:										
b_5:										
b_6:										

w_1:										
w_2:										
w_3:										
w_4:										
w_5:										
w_6:										

Transfer the individual ratings from Forms B to the respective boxes above. Cross out (x) any columns for which no ratings were made. Continue processing on Form B2.

Form B1 (Proposed)

Figure 19. Form B1.

PROCESSING INSTRUCTIONS FOR FORM "B-1" DATA

PN: _____ Initials: _____ Date Processed: _____

STEP 1: Using program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for the "r" values on Form B-1. Enter results here and on Form "B" (as feedback information.)

r: Low Q. _____ (%) Median _____ (%) High Q. _____ (%)

Enter the decimal form of the Median Value of "r" on Form C in six places.

STEP 2: Using the program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for rows b_1 through b_6 on Form B 1 and enter results in the Step 2 table below and on Form B (as feedback information.)

STEP 3: Using the program "Normalize b_i," compute the decimal form of the normalized values of b_i and enter them in the Step 3 table below and on the B/C Computation sheet, Form C.

STEP 2 TABLE

	Low Q (%)	Median (%)	High Q (%)
b_1			
b_2			
b_3			
b_4			
b_5			
b_6			

STEP 3 TABLE

Normalized Median	
b'_1	
b'_2	
b'_3	
b'_4	
b'_5	
b'_6	

STEP 4: Using program "Statistical Analysis" compute the Low Quartile, Median, and High Quartile values for rows w_1 through w_6 of Form B-1. Enter results in the Step 4 table below and on Form "B" (as feedback information.) Enter the decimal form of the Median w_i values on the B/C Computation sheet, Form C.

STEP 4 TABLE

	Low Q (%)	Median (%)	High Q (%)
w_1			
w_2			
w_3			
w_4			
w_5			
w_6			

Form B2 (Proposed)

Figure 20. Form B2.

PROCESSING INSTRUCTIONS FOR FORM "B" INPUT DATA

PN: 414 Initials: JP Date Processed: 22/9/81

	ACE	COA	TAG	TSG	ACSI	DCSLOG	DCSOPS	DCSPER	DCSRDA	ACSAC
r:	X	X	X	X	100	100	90	100	100	100
b_1:					60	70	70	85	90	30
b_2:					40	30	30	15	10	60
b_3:										
b_4:										
b_5:										
b_6:										
w_1:					90	100	100	100	100	75
w_2:					50	100	60	40	30	100
w_3:										
w_4:										
w_5:										
w_6:										

Transfer the individual ratings from Forms B to the respective boxes above. Cross out (x) any columns for which no ratings were made. Continue processing on Form B2.

Form B1 (Proposed)

Figure 21. Form B1 filled in with values from Figure 6.

PROCESSING INSTRUCTIONS FOR FORM "B-1" DATA

PN 414 Initials: JO Date Processed: 22/9/81

STEP 1 Using program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for the "r" values on Form B-1. Enter results here and on Form "B" (as feedback information.)

r: Low Q 97.5 (%) Median 100 (%) High Q 100 (%)

Enter the decimal form of the Median Value of "r" on Form C in six places.

STEP 2: Using the program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for rows b_1 through b_6 on Form B-1 and enter results in the Step 2 table below and on Form B (as feedback information.)

STEP 3. Using the program "Normalize b_i," compute the decimal form of the normalized values of b_i and enter them in the Step 3 table below and on the B/C Computation sheet, Form C.

STEP 2 TABLE

	Low Q (%)	Median (%)	High Q (%)
b_1	52.5	70	86.25
b_2	13.75	30	45
b_3	-	-	-
b_4	-	-	-
b_5	-	-	-
b_6	-	-	-

STEP 3 TABLE

	Normalized Median
b'_1	0.70
b'_2	0.30
b'_3	-
b'_4	-
b'_5	-
b'_6	-

STEP 4: Using program "Statistical Analysis" compute the Low Quartile, Median, and High Quartile values for rows w_1 through w_6 of Form B-1. Enter results in the Step 4 table below and on Form "B" (as feedback information.) Enter the decimal form of the Median w_i values on the B/C Computation sheet, Form C.

STEP 4 TABLE

	Low Q (%)	Median (%)	High Q (%)
w_1	86.25	100	100
w_2	37.5	55	100
w_3	-	-	-
w_4	-	-	-
w_5	-	-	-
w_6	-	-	-

Form B2 (Proposed)

Figure 22. Data from Figure 21 transferred to Form B2.

6. After all values are entered, compute the values $(b/c)_1$ through $(b/c)_6$ as the simple product of the numbers in the boxes in each row. Record these values on Form C to the nearest hundredth (0.00).

7. Sum the values $(b/c)_1$ through $(b/c)_6$ to get $B_R/C = B_R/\$PA$. Enter this sum at the bottom of Form C and at the bottom of Form B. The b', w, and r data from Figure 22 were processed in this manner; the results are shown in Figure 18 and in Figure 7.

Data Processing Exercise

The reader is encouraged to process the data from Figures 8, 10, 12, and 14. The correct $B_R/\$PA$ ratios for these data are shown in Figures 9, 11, 13, and 15, respectively.

4 CONCLUSION

The Facilities Readiness Quantification Model can be used to determine the relative readiness merits of selected MCA programs. If the model is to provide accurate results, at least six raters must participate. Rater data can be processed either manually, or by using the model algorithms on a programmable calculator.

GLOSSARY

a_i: mission weight of the i^{th} mission.

B_R: benefits to readiness.

B/C: benefit/cost.

b_i: the fractional portion of a project's benefits that are assigned to the i^{th} mission (expressed as a decimal).

C_R: that part of the cost of a funding entity attributable to readiness.

C_T: the estimated total cost of a funding entity.

CERL: U.S. Army Construction Engineering Research Laboratory.

COA: Controller of the Army.

COE: Chief of Engineers.

CRRC: Construction Requirements Review Committee.

DCSLOG: Deputy Chief of Staff, Logistics.

DCSPER: Deputy Chief of Staff, Personnel.

EUSA: Eighth U.S. Army.

FR: force readiness.

m_j the fractional part of the cost of the j^{th} funding entity that does not buy readiness benefits. Note: m_j also can be described as the "complement of r_j."

MCA: Military Construction, Army (appropriation)

r_j: the fractional part of the cost of the j^{th} funding entity that does buy readiness benefits.

STD: standard (maximum contribution standard).

TAG: The Adjutant General.

TI: Texas Instruments Corporation.

TRADOC: Training and Doctrine Command.

TSG: The Surgeon General.

USAREUR: U.S. Army, Europe.

$(w_i)_j$: the relative worth of the j^{th} funding entity when compared to the maximum contribution standard for the i^{th} mission area.

$PA: dollars, programmed amount.

APPENDIX A:
GENERAL INFORMATION ON THE TI-59 CALCULATOR*

Placing the TI-59 Calculator into Operation

The instructions in this appendix and Appendices B through D assume the user has access to a Texas Instruments (TI)-59 programmable calculator, a TI PC-100C print cradle, a TI Math Module, TI-59 magnetic cards, and the TI manuals listed below. (The system is shown in Figure A1.)

Personal Programming - A Complete Owner's Manual for TI Programmable 58/59 (Texas Instruments Corporation, 1977).

Math/Utilities - Using the Power of Your Solid State Software Module (Texas Instruments Corporation, 1978).

Texas Instruments-Print/Security Cradle PC-100 C (Texas Instruments Corporation, 1978).

First ensure that a TI math module is installed in the TI-59 calculator. Next, store the dust cover for the PC-100 calculator mounting bracket in the right side of the storage compartment on the PC-100 printer. Remove the battery pack from the calculator and put it into the left side of the storage compartment. The battery pack fits only one way. The flat side should face up and the slot should be to the left.

Put the key in the PC-100 lock and turn it fully counterclockwise. Then put the TI-59 on the mounting bracket and press down and toward the back of the PC-100. Hold the calculator in this position and turn the key a half turn clockwise to lock the calculator in place. If the calculator is correctly positioned, the key should turn easily (see Figure A1). Connect the printer to a standard 115-V outlet. Slide the switch on the right side of the printer to the rear to turn the printer on. Then turn the calculator itself on by putting the on/off switch in the "on" position. Both instruments must be "on" for the system to work. The programs listed in Appendices B, C, and D will not work without the printer attached to the calculator.

Recording a Program

Once the calculator is operational, any of the programs listed in Appendices B, C, and D of this report can be keyed-in. Only *one* of these programs should be stored at a time in the calculator, because all three programs use some of the same label keys. Certain *program data* also must be entered for the statistical analysis program described in Appendix B.

It is advisable to record all programs on magnetic cards so they will not have to be keyed-in each time they are needed.

*The instructions given in this appendix and Appendices B through D assume the user implements the program on a Texas Instruments (TI)-59 calculator. However, the algorithms described in this report can be adapted to programs for similar programmable calculators.

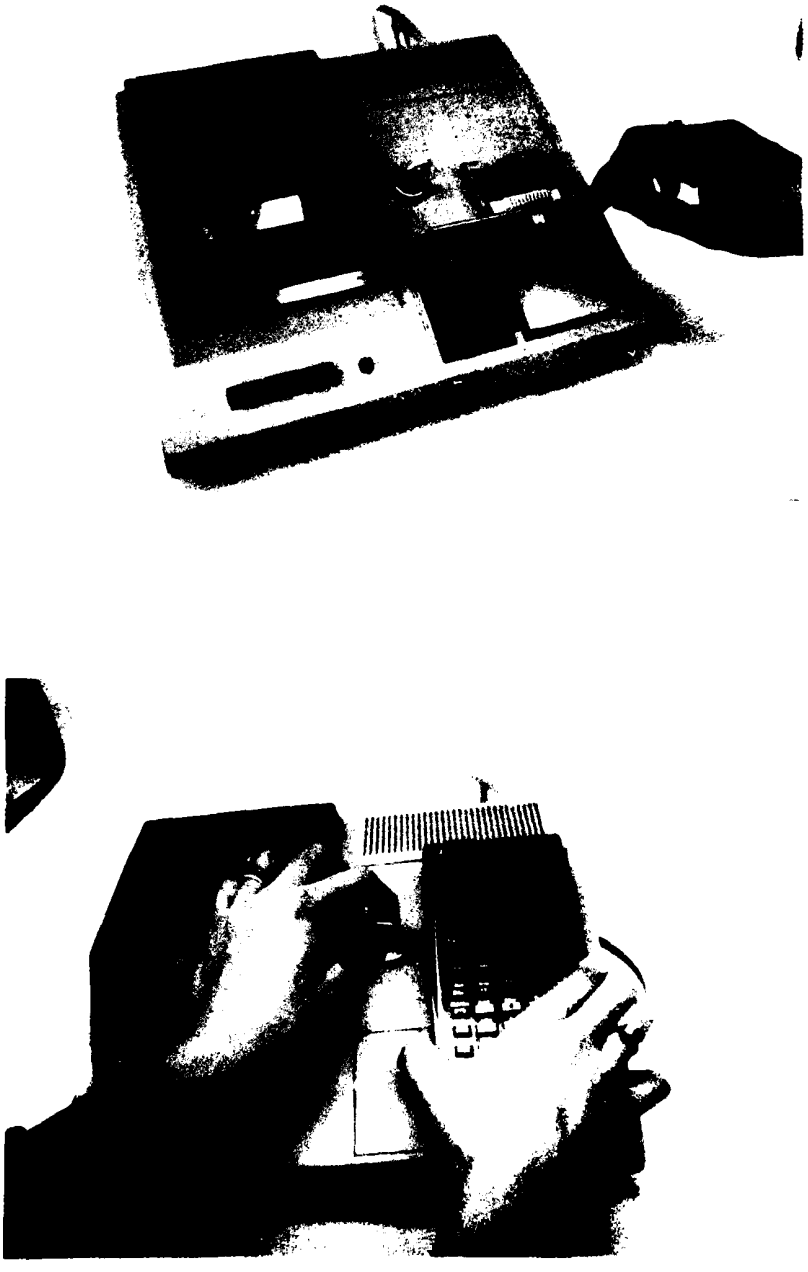


Figure A1. TI-59 system.

APPENDIX B: STATISTICAL ANALYSIS PROGRAM

Using the Program

This appendix describes how to use the statistical analysis program after the program steps and program data have been entered into the calculator (as described in Appendix A). Figure B1 shows how to use the program to process the first line of data in Figure 17. The resulting printout is keyed to each step of the process. Figure B2 shows how the first line of data in Figure 21 would be processed. The program actually can be used to find the quartile value of a sequence of up to 32 input values. If more than 32 values are input, however, some of the program data in registers 33 and beyond will be erased. This will adversely affect the printout messages. On the other hand, at least *three* values must be input for the program to work correctly. Each row of data in Figures 17 and 21 would be processed separately, following steps 1 through 3 of Figures B1 or B2 for each row of data.

Program Steps/Data Required

Before using the statistical analysis program, the TI-59 steps in Figure B3 must be entered into calculator memory, and the data in Figure B4 must be entered into data storage registers 33 to 59. Note: this program also requires that the math module be in the calculator at the time the program is executed.

Algorithms Used

This section describes the algorithm for determining the low quartile values (V_l), the median value (V_m), and the high quartile value (V_h) for a sequence of numbers. First, the N input values (V_i) are sorted into low to high sequence (V_l to V_n). Then, $l = (n+1)/4$ is assigned as the low quartile index number; $m = (n+1)/2$ is assigned as the median index number; and $h = (n+1)(3/4)$ is assigned as the high quartile index number. These three index numbers—l, m, and h—are *all integers only* when N = 3, 7, 11, 15, 19, 23, . . . etc. For all other values of N, some of the index numbers will have a fractional component. For these cases, the index numbers (l, m, or h) are separated into two parts—an integer part (i) and a decimal part (0.d). The quartile *value* being computed is the value of the i^{th} number plus the quantity (0.d) $(V_{i+1} - V_i)$. The manual use of this algorithm is demonstrated in Figures B5 and B6.

Problem Statement: Compute the low quartile value (V_l), the median value (V_m), and the high quartile value (V_h) for the first row of data in Figure 17, i.e., for input values of 4, 3, 3, 2, 2, 4, and 50.

STEP	PROCEDURE	ENTER	PRESS	TI-59 DISPLAY	PC-100 PRINTER
1	Initialize the program		RST E	 0.	ENTER VALUE, PRESS A (FOR EACH VALUE) . . . THEN PRESS B TO COMPUTE. . . DO THIS NOW!
2	Enter each input value and press A in turn for each value entered	4	A	4.	4.
		3	A	3.	3.
		3	A	3.	3.
		2	A	2.	2.
		2	A	2.	2.
		4	A	4.	4.
		50	A	50.	50.
3	Compute/output answers		B		COMPUTING. . . WAIT!
					LOW Q VALUE=
					2.
					MEDIAN VALUE=
					3.
					TOP Q VALUE =
				4.	4.

Figure B1. Example problem no. 1 for the statistical analysis program.

Problem Statement: Compute the low quartile value (V_l), the median value (V_m), and the high quartile value (V_h) for the first row of data in Figure 21, i.e., for input values of 100, 100, 90, 100, 100, and 100.

STEP	PROCEDURE	ENTER	PRESS	TI-59 DISPLAY	PC-100 PRINTER
1	Initialize the program		RST E	 0.	ENTER VALUE, PRESS A (FOR EACH VALUE) . . . THEN PRESS B TO COM-
2	Enter each input value and press A in turn for each value entered	100 100 90 100 100 100	A A A A A A	100. 100. 90. 100. 100. 100.	PUTE. . . DO THIS NOW! 100. 100. 90. 100. 100. 100.
3	Compute/output answers		B		COMPUTING. . . WAIT! LOW Q VALUE= 97.5 MEDIAN VALUE= 100. TOP Q VALUE= 100.

Figure B2. Example problem no. 2 for the statistical analysis program.

```
000  76 LBL
001  11  A
002  99 PRT
003  36 PGM
004  06  06
005  11  A
006  91 R/S
007  76 LBL
008  13  C
009  36 PGM
010  06  06
011  13  C
012  25 CLR
013  91 R/S
014  76 LBL
015  15  E
016  03  3
017  69 DP
018  17  17
019  47 CMS
020  06  6
021  69 DP
022  17  17
023  00  0
024  42 STO
025  30  30
026  42 STO
027  31  31
028  42 STO
029  32  32
030  68 NOP
031  68 NOP
032  68 NOP
033  25 CLR
034  29 CP
035  69 DP
036  00  00
037  43 RCL
038  45  45
039  69 DP
040  01  01
041  43 RCL
042  46  46
043  69 DP
044  02  02
045  43 RCL
046  47  47
047  69 DP
048  03  03
049  43 RCL
050  33  33
051  69 DP
052  04  04
053  69 DP
054  05  05
055  69 DP
056  00  00
057  43 RCL
058  34  34
059  69 DP
060  01  01
061  43 RCL
062  35  35
063  69 DP
064  02  02
065  43 RCL
066  36  36
067  69 DP
068  01  01
069  43 RCL
070  37  37
071  69 DP
072  04  04
073  69 DP
074  05  05
075  69 DP
076  00  00
077  43 RCL
078  38  38
079  69 DP
080  01  01
081  43 RCL
082  39  39
083  69 DP
084  02  02
085  43 RCL
086  40  40
087  69 DP
088  03  03
089  43 RCL
090  41  41
091  69 DP
092  04  04
093  69 DP
094  05  05
095  69 DP
096  00  00
097  43 RCL
098  42  42
099  69 DP
100  01  01
101  43 RCL
102  43  43
103  69 DP
104  02  02
105  43 RCL
106  44  44
107  69 DP
108  03  03
109  43 RCL
110  50  50
111  69 DP
112  04  04
113  69 DP
114  05  05
115  25 CLR
116  91 R/S
117  76 LBL
118  12  B
119  03  3
120  32 X:T
121  43 RCL
122  00  00
123  22 INV
124  77  GE
125  86 STF
126  29 CP
127  43 RCL
128  00  00
129  42 STO
130  23  23
131  43 RCL
132  00  00
133  85  +
134  01  1
135  54  )
136  55  ÷
137  04  4
138  54  )
139  42 STO
140  26  26
141  43 RCL
142  00  00
143  85  +
144  01  1
145  54  )
146  55  ÷
147  02  2
148  54  )
149  42 STO
150  25  25
151  43 RCL
152  26  26
153  65  ×
154  03  3
155  54  )
156  42 STO
157  24  24
158  69 DP
159  00  00
160  43 RCL
161  51  51
162  69 DP
163  01  01
164  43 RCL
165  52  52
166  69 DP
167  02  02
168  43 RCL
169  48  48
170  69 DP
171  03  03
172  43 RCL
173  49  49
174  69 DP
175  04  04
176  69 DP
177  05  05
178  36 PGM
179  06  06
180  12  B
181  76 LBL
182  14  D
183  29 CP
184  25 CLR
185  43 RCL
186  26  26
187  22 INV
188  59 INT
189  67  EQ
190  16 A'
191  43 RCL
192  26  26
193  59 INT
194  42 STO
195  27  27
196  85  +
197  01  1
198  54  )
199  42 STO
200  28  28
201  73 RC*
202  28  28
203  75  -
204  73 RC*
205  27  27
206  42 STO
207  27  27
208  54  )
209  42 STO
210  28  28
211  43 RCL
212  26  26
213  22 INV
214  59 INT
215  65  ×
216  43 RCL
217  28  28
218  85  +
219  43 RCL
220  27  27
221  54  )
222  42 STO
223  28  28
224  76 LBL
225  19 D'
226  29 CP
227  43 RCL
228  25  25
229  22 INV
230  59 INT
231  67  EQ
232  17 B'
233  43 RCL
234  25  25
235  59 INT
236  42 STO
237  29  29
238  85  +
239  01  1
240  54  )
241  42 STO
242  30  30
243  73 RC*
244  29  29
245  85  +
246  73 RC*
247  30  30
248  54  )
249  55  ÷
250  02  2
251  54  )
252  42 STO
253  30  30
254  76 LBL
255  10 E'
256  43 RCL
257  24  24
258  22 INV
259  59 INT
260  67  EQ
261  18 C'
262  43 RCL
263  24  24
264  59 INT
265  42 STO
266  31  31
267  85  +
268  01  1
269  54  )
270  42 STO
271  32  32
272  73 RC*
273  32  32
274  75  -
275  73 RC*
276  31  31
277  42 STO
278  31  31
279  54  )
280  42 STO
281  32  32
282  43 RCL
283  24  24
284  22 INV
285  59 INT
286  65  ×
287  43 RCL
288  32  32
289  85  +
290  43 RCL
291  31  31
292  54  )
293  42 STO
294  32  32
295  76 LBL
296  99 PRT
297  98 ADV
298  69 DP
299  00  00
300  43 RCL
301  53  53
302  69 DP
303  01  01
304  43 RCL
305  54  54
306  69 DP
```

Figure B3. TI-59 steps required for the statistical analysis program.

```
307  02  02
308  43 RCL
309  55  55
310  69 DP
311  03  03
312  43 RCL
313  56  56
314  69 DP
315  04  04
316  69 DP
317  05  05
318  43 RCL
319  28  28
320  99 PRT
321  98 ADV
322  69 DP
323  00  00
324  43 RCL
325  57  57
326  69 DP
327  01  01
328  43 RCL
329  58  58
330  69 DP
331  02  02
332  43 RCL
333  59  59
334  69 DP
335  03  03
336  01  1
337  07  7
338  06  6
339  04  4
340  00  0
341  00  0
342  00  0
343  00  0
344  00  0
345  00  0
346  69 DP
347  04  04
348  69 DP
349  05  05
350  69 DP
351  00  00
352  43 RCL
353  30  30
354  99 PRT
355  98 ADV
```

```
356  69 DP
357  00  00
358  00  0
359  00  0
360  00  0
361  00  0
362  00  0
363  00  0
364  00  0
365  00  0
366  03  3
367  07  7
368  69 DP
369  01  01
370  03  3
371  02  2
372  03  3
373  03  3
374  00  0
375  00  0
376  03  3
377  04  4
378  00  0
379  00  0
380  69 DP
381  02  02
382  43 RCL
383  55  55
384  69 DP
385  03  03
386  43 RCL
387  56  56
388  69 DP
389  04  04
390  69 DP
391  05  05
392  43 RCL
393  32  32
394  99 PRT
395  98 ADV
396  98 ADV
397  98 ADV
398  91 R/S
399  76 LBL
400  16 A'
401  43 RCL
402  26  26
403  59 INT
404  42 STO
```

```
405  27  27
406  73 RC*
407  27  27
408  42 STO
409  28  28
410  61 GTO
411  19 D'
412  76 LBL
413  17 B'
414  43 RCL
415  25  25
416  59 INT
417  42 STO
418  29  29
419  73 RC*
420  29  29
421  42 STO
422  30  30
423  61 GTO
424  10 E'
425  76 LBL
426  18 C'
427  43 RCL
428  24  24
429  59 INT
430  42 STO
431  31  31
432  73 RC*
433  31  31
434  42 STO
435  32  32
436  61 GTO
437  99 PRT
438  76 LBL
439  68 NOP
440  36 PGM
441  02  02
442  10 E'
443  22 INV
444  58 FIX
445  91 R/S
446  76 LBL
447  86 STF
448  36 PGM
449  02  02
450  15  E
451  22 INV
452  58 FIX
453  91 R/S
```

Figure B3. (Cont'd).

```
1736360013.          33
5521323500.          34
1713152300.          35
4213274117.          36
5640404000.          37
3723173100.          38
3335173636.          39
  140037 32.         40
  153230 20.         41
3341371740.          42
-04000163 2.         43
  372324 36.         44
1731371735.          45
  421327 41.         46
.75700333 3.         47
-0404313 24.         48
377300000 0.         49
  313241 73.         50
153230032 41.        51
372431224 0.         52
           27.       53
3243003400.          54
4213274117.          55
540000000 0.         56
           30.       57
1715241331.          58
  421327 41.         59
```

Figure B4. Data required in data storage registers 33 to 59 for the statistical analysis program.

Problem: Determine the low quartile value (V_l), the median value (V_m), and the high quartile value (V_h) for the following numbers: 0, 22, 16, 16, 1, 5, and 0.

Step 1: Arrange numbers low to high.

i	1	2	3	4	5	6	7	(N = 7)
V_i	0	0	1	5	16	16	22	

Step 2: Compute l, m, and h.

$$l = \frac{N+1}{4} = \frac{8}{4} = 2; m = \frac{N+1}{2} = 4; h = (N+1)(3/4) = 6$$

Step 3: Compute V_l, V_m, and V_h.

$V_l = V_2 = 0$, i.e., the 2nd value in the chart;

$V_m = V_4 = 5$, i.e., the 4th value in the chart;

$V_h = V_6 = 16$, i.e., the 6th value in the chart.

Figure B5. Simple example of how quartile values are determined.

Problem: Determine the low quartile value (V_l), the median value (V_m), and the high quartile value (V_h) for the following numbers: 13.7, 12.1, 15.5, 11.5, 14.2, 8.1, 5.2, 21.3, and 15.5

Step 1: Arrange numbers low to high.

i	1	2	3	4	5	6	7	8	9 (N = 9)
V_i	5.2	8.1	11.5	12.1	13.7	14.2	15.5	15.5	21.3

Step 2: Compute l, m, and h.

$$l = \frac{N+1}{4} = 2\text{-}1/2; m = \frac{N+1}{2} = 5; h = (N+1)(3/4) = 7\text{-}1/2$$

Step 3: Compute V_l, V_m, and V_h.

$$V_l = V_{2.5} = V_2 + (0.5)(V_3 - V_2) = 8.1 + (.5)(11.5 - 8.1) = 9.8$$

$$V_m = V_5 = 13.7$$

$$V_h = V_{7.5} = V_7 + (0.5)(V_8 - V_7) = 15.5 + (0.5)(15.5 - 15.5) = 15.5$$

Figure B6. Complex example of how quartile values are determined.

APPENDIX C: m_i TO a_j PROGRAM

Using the Program

This appendix describes how to use the m_i to a_j program after the program steps have been entered into the calculator. Figure C1 shows how to use the program to process the median ratio values in the STEP 2 TABLE of Figure 17. The resulting printout is keyed to each step of the process.

Program Steps Required

Before using the m_i to a_j program, the program steps in Figure C2 must be entered into the calculator memory.

Algorithm Used

The median ratio values, m_1 through m_5, in the STEP 2 TABLE of Form A1 (see Figure 17) are converted to the mission weights, a_1 through a_6, in the STEP 3 TABLE (on the same form) according to the following algorithms:

$$a_1 = \frac{m_3}{m_3 + 1} \frac{m_1}{m_1 + m_2 + 1} \times 100 \quad [\text{Eq C1}]$$

$$a_2 = \frac{1}{m_3 + 1} \frac{m_1}{m_1 + m_2 + 1} \times 100 \quad [\text{Eq C2}]$$

$$a_3 = \frac{m_4}{m_4 + 1} \frac{1}{m_1 + m_2 + 1} \times 100 \quad [\text{Eq C3}]$$

$$a_4 = \frac{1}{m_4 + 1} \frac{1}{m_1 + m_2 + 1} \times 100 \quad [\text{Eq C4}]$$

$$a_5 = \frac{m_5}{m_5 + 1} \frac{m_2}{m_1 + m_2 + 1} \times 100 \quad [\text{Eq C5}]$$

$$a_6 = \frac{1}{m_5 + 1} \frac{m_2}{m_1 + m_2 + 1} \times 100 \quad [\text{Eq C6}]$$

Problem Statement: Compute the six values of a_j, given the five median values of m_i from the STEP 2 TABLE of Figure 17.

STEP	PROCEDURE	ENTER	PRESS	TI-59 DISPLAY	PC-100 PRINTER
1	Initialize the Program		RST E'		
2	Input m_1	3	A	3.	
3	Input m_2	2	B	2.	
4	Input m_3	2.67	C	2.67	
5	Input m_4	1.25	D	1.25	
6	Input m_5	3	E	3.	
7	Compute and Output a_i		A'		'M TO A' PROGRAM IS COMPUTING..... WAIT
					INPUT WAS :
					3.00 M1
					2.00 M2
					2.67 M3
					1.25 M4
					3.00 M5
					OUTPUT IS :
					36.38 A1
					13.62 A2
					9.26 A3
					7.41 A4
					25.00 A5
				999	8.33 A6

Figure C1. Example problem for the m_i to a_j program.

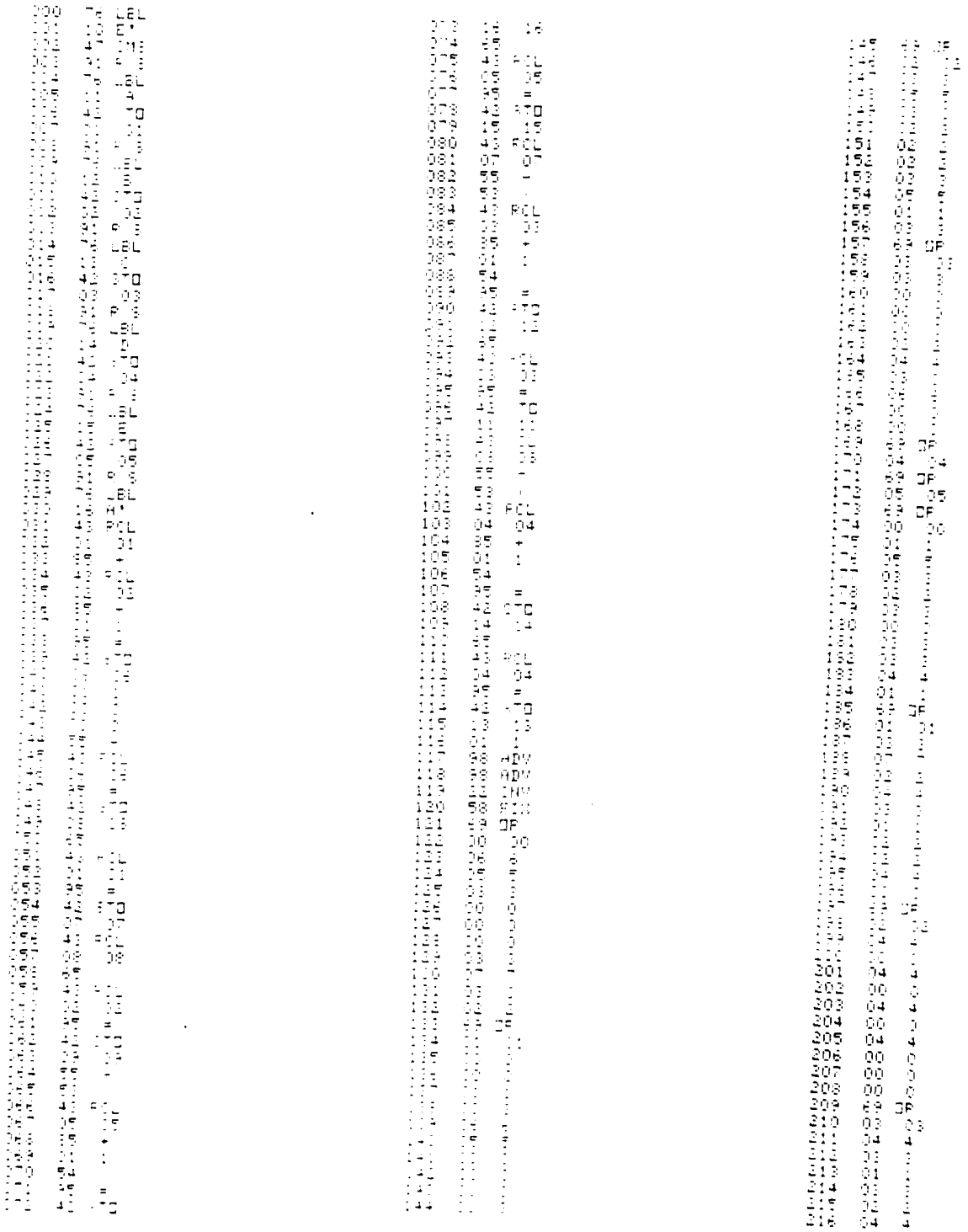


Figure C2. TI-59 steps required for the m_i to a_j program.

217	31	1
218	07	[illegible]
219	04	4
220	[illegible]	3
221	69	OP
222	14	04
223	69	OP
224	05	05
225	69	OP
226	00	00
227	98	ADV
228	02	2
229	04	4
230	02	2
231	01	1
232	03	3
233	03	3
234	04	4
235	01	1
236	01	1
[illegible]	[illegible]	1
238	69	OP
239	01	01
240	04	4
241	01	1
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
245	05	5
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
248	69	OP
249	[illegible]	01
[illegible]	[illegible]	[illegible]
251	03	3
252	00	0
253	00	0
254	00	0
255	00	0
256	00	0
257	00	0
258	00	0
259	00	0
260	69	OP
261	03	03
262	69	OP
263	05	05
264	69	OP
265	00	00
266	58	FIX
267	02	02
268	03	3
269	00	0
270	00	0
271	02	2
272	69	OP
273	04	04
274	43	FCL
275	01	01
276	69	OP
277	06	06
278	[illegible]	1
279	00	0
280	00	0
281	03	3
282	69	OP
283	04	04
284	43	FCL
285	02	02
286	69	OP
287	06	06
288	[illegible]	2
289	00	0
290	[illegible]	1
291	[illegible]	4
[illegible]	69	OP
[illegible]	14	04
[illegible]	43	FCL
[illegible]	[illegible]	13
[illegible]	[illegible]	OP
[illegible]	[illegible]	06
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
301	05	5
302	69	OP
303	04	04
304	43	FCL
305	04	04
306	69	OP
307	06	06
308	03	3
309	00	0
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	OP
[illegible]	14	04
[illegible]	43	FCL
315	05	05
316	69	OP
317	06	06
318	69	OP
319	00	00
320	22	INV
321	58	FIX
322	03	3
323	02	2
324	04	4
325	01	1
326	03	3
327	07	7
328	03	3
329	03	3
330	04	4
331	01	1
332	69	OP
333	01	01
334	03	3
335	07	7
336	00	0
337	00	0
338	02	2
339	04	4
340	[illegible]	[illegible]
341	06	6
342	10	0
343	[illegible]	[illegible]
344	69	OP
345	[illegible]	02
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
350	[illegible]	[illegible]
351	00	0
352	00	0
353	00	0
354	00	0
355	00	0
356	69	OP
357	03	03
358	69	OP
359	05	05
360	69	OP
361	00	00
362	58	FIX
363	02	02
364	01	1
365	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
367	[illegible]	[illegible]
[illegible]	[illegible]	OP
[illegible]	14	04
370	43	FCL
[illegible]	[illegible]	[illegible]
[illegible]	69	OP
[illegible]	[illegible]	06
[illegible]	01	1
[illegible]	02	2
376	00	0
[illegible]	[illegible]	[illegible]
378	69	OP
379	14	04
380	43	FCL
381	[illegible]	13
382	69	OP
383	06	06
384	01	1
385	[illegible]	[illegible]
386	00	0
[illegible]	04	4
388	69	OP
389	14	04
390	43	FCL
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	OP
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	OP
[illegible]	14	14
[illegible]	43	FCL
401	14	14
402	69	OP
403	06	06
404	01	1
405	03	3
406	00	0
407	06	6
408	69	OP
409	04	04
410	43	FCL
411	15	15
412	69	OP
413	06	06
414	01	1
415	03	3
416	00	0
417	[illegible]	1
418	69	OP
419	04	04
420	43	FCL
421	16	16
422	69	OP
423	06	06
424	22	INV
425	58	FIX
426	98	ADV
427	98	ADV
428	98	ADV
429	09	9
430	09	9
431	09	9
432	91	R/S
433	10	[illegible]
434	[illegible]	[illegible]
435	00	[illegible]
436	00	[illegible]
437	00	0

Figure C2. (Cont'd).

APPENDIX D:
NORMALIZE b PROGRAM

Using the Program

This appendix describes how to use the normalize b program after the program steps have been entered into the calculator. Figure D1 shows how to use the program to process the median b values in the STEP 2 TABLE of Figure 22. The resulting printout is keyed to each step of the process.

Program Steps Required

Before using the normalize b program, the program steps in Figure D2 must be entered into the calculator memory.

Algorithm Used

The median b values in the STEP 2 TABLE of Form B2 (see Figure 22) are in percentage form and do not always sum to 100 percent. The algorithm for this program is to sum the median b values in the STEP 2 TABLE of Form B2, to divide each median b value by this sum, and then to divide the results by 100 to convert to decimal form. The sum of the resulting six b′ values is 1. The following equation applies:

$$b/(100 \sum_{i=1}^{6} b_i) = b' \qquad \text{[Eq D1]}$$

Problem Statement: Compute the normalized values b′ for the median b_i values in the STEP 2 TABLE of Figure 22.

STEP	PROCEDURE	ENTER	PRESS	TI-59 DISPLAY	PC-100 PRINTER
1	Initialize the program		RST E		
2	Input median b_1	70	A	70.	
3	Input median b_2	30	B	30.	
4	Input median b_3	0	C	0.	
5	Input median b_4	0	D	0.	
6	Input median b_5	0	A′	0.	
7	Input median b_6	0	B′	0.	
8	Compute and output b′		D′		'NORMALIZE B' PGM IS COMPUTING. . . . . WAIT.
					INPUT WAS :
					70.00 B1
					30.00 B2
					0.00 B3
					0.00 B4
					0.00 B5
					0.00 B6
					NORMALIZED B VALUES=
					0.70 B1
					0.30 B2
					0.00 B3
					0.00 B4
					0.00 B5
				999	0.00 B6

Figure D1. Example problem for the normalize b program.

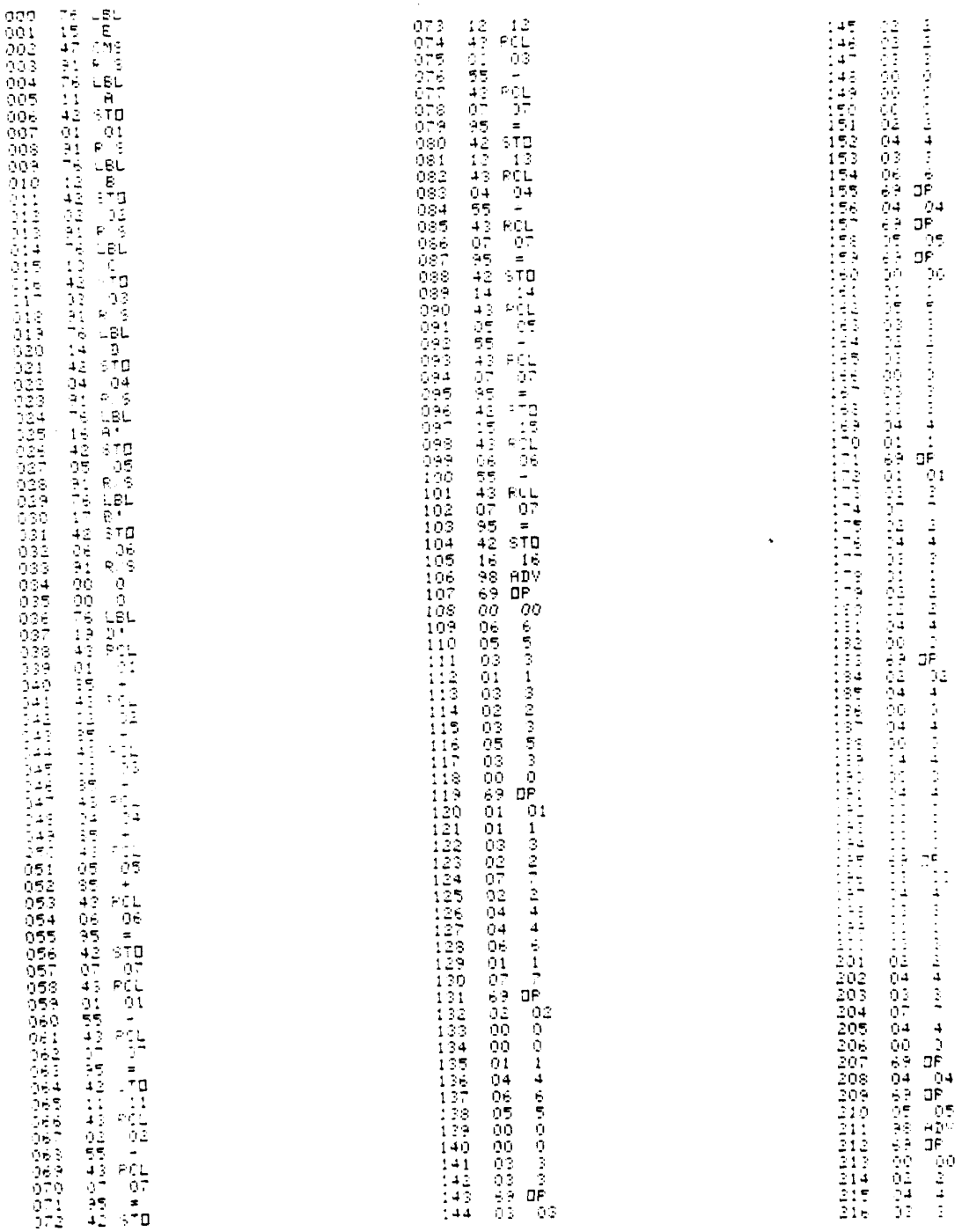


Figure D2. *TI-59* steps required for the normalize b program.

```
[illegible]
```

Figure D2. (Cont'd).

APPENDIX E:
BLANK FORMS

Rater's Initials: _____

Date: _____
(Day/mo/yr)

Rater's Office: (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PRIOR RATIOS ASSIGNED

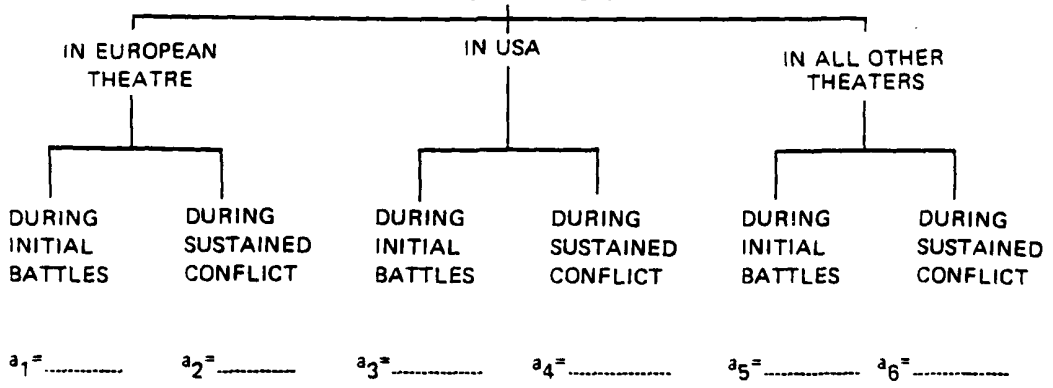
(as of:)

Low Q	Median	High Q
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

RELATIVE IMPORTANCE OF READINESS SUB-OBJECTIVES

Mission Sub-Objectives Being Compared	Relative Significance (Ratio)
European Theater / USA	_____
All Other Theaters / USA	_____
Europe: Initial / Sustained	_____
USA: Initial / Sustained	_____
Other: Initial / Sustained	_____

ARMY READINESS TO ACCOMPLISH MISSIONS



(BOX RESERVED FOR FEEDBACK INFORMATION)

Form A (Proposed)

PROCESSING INSTRUCTIONS FOR FORM "A" INPUT DATA

Initials:_____ Date Processed:_____

STEP 1: Enter into the respective box below the decimal equivalent (to the nearest 0.01) of each ratio from basic input Form A.

STEP 1 TABLE

	ACE (1)	COA (2)	TAG (3)	TSG (4)	ACSI (5)	DCSLOG (6)	DCSOPS (7)	DCSPER (8)	DCSRDA (9)	ACSAC (0)
EUR/USA										
OTH/USA										
EUR: I/S										
USA: I/S										
OTH: I/S										

STEP 2: Using the program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for each row of numbers above and record results in the Step 2 table below and on Form A (as feedback information.)

STEP 3: Using the program, "m_i to a_j," compute a_1 through a_6 (to the nearest 0.01) and record the six values on Form A (as feedback information), in Step 3 table below, and on Form C.

STEP 2 TABLE

ROW	OBJECTIVE	LOW Q	MEDIAN	HIGH Q
1	EUR/USA	l_1:	m_1:	h_1:
2	OTH/USA	l_2:	m_2:	h_2:
3	EUR:I/S	l_3:	m_3:	h_3:
4	USA:I/S	l_4:	m_4:	h_4:
5	OTH:I/S	l_5:	m_5:	h_5:

STEP 3 TABLE

MISSION WEIGHTS
a_1:
a_2:
a_3:
a_4:
a_5:
a_6:

Form A1 (Proposed)

Rater's Initials: _____

Date: _____
Day/mo/yr

Rater's Office. (check one)

☐ ACE (1)	☐ DCSLOG (6)
☐ COA (2)	☐ DCSOPS (7)
☐ TAG (3)	☐ DCSPER (8)
☐ TSG (4)	☐ DCSRDA (9)
☐ ACSI (5)	☐ ACSAC (0)

PROJECT IDENTIFICATION AND PROJECT RATINGS

LOCATION PN DESCRIPTION

PRIOR RATING RESULTS

(as of)

r VALUES

Low Q	Median	High Q
.....	.....	.....

b VALUES

Low Q	Median	High Q
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

w VALUES

Low Q	Median	High Q
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

Note: Feedback values for each r,b, and w are independent of all other r,b,and w values. Median values of b will be normalized before use in later computations. Median values of r and w will be used directly.

Project Relevance to Readiness (%)

r= _____

Mission Sub-Objective	Relative Contribution of Project to each Sub-Objective (%)
Europe-Initial	b_1= _____
Europe-Sustained	b_2= _____
USA-Initial	b_3= _____
USA-Sustained	b_4= _____
Other-Initial	b_5= _____
Other-Sustained	b_6= _____

(Total =100%)

Mission Sub- Objective	Project Worth*
Europe-Initial	w_1= _____
Europe-Sustained	w_2= _____
USA-Initial	w_3= _____
USA-Sustained	w_4= _____
Other-Initial	w_5= _____
Other-Sustained	w_6= _____

*(On a scale of 1 to 100, compare project to some "Maximum Contribution" Project.)

$B_c/\$PA$= _____

(BOX RESERVED FOR FEEDBACK INFORMATION)

Form 8 (Proposed)

PROCESSING INSTRUCTIONS FOR FORM "B" INPUT DATA

PN: _____ Initials: _____ Date Processed: _____

	ACE	COA	TAG	TSG	ACSI	DCSLOG	DCSOPS	DCSPER	DCSRDA	ACSAC
r:										
b_1:										
b_2:										
b_3:										
b_4:										
b_5:										
b_6:										
w_1:										
w_2:										
w_3:										
w_4:										
w_5:										
w_6:										

Transfer the individual ratings from Forms B to the respective boxes above. Cross out (x) any columns for which no ratings were made. Continue processing on Form B2.

Form B1 (Proposed)

PROCESSING INSTRUCTIONS FOR FORM "B-1" DATA

PN: _____ Initials: _____ Date Processed: _____

STEP 1: Using program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for the "r" values on Form B-1. Enter results here and on Form "B" (as feedback information.)

r: Low Q. _____ (%) Median _____ (%) High Q. _____ (%)

Enter the decimal form of the Median Value of "r" on Form C in six places.

STEP 2: Using the program "Statistical Analysis," compute the Low Quartile, Median, and High Quartile values for rows b_1 through b_6 on Form B-1 and enter results in the Step 2 table below and on Form B (as feedback information.)

STEP 3: Using the program "Normalize b_i," compute the decimal form of the normalized values of b_i and enter them in the Step 3 table below and on the B/C Computation sheet, Form C.

STEP 2 TABLE

	Low Q (%)	Median (%)	High Q (%)
b_1:			
b_2:			
b_3:			
b_4:			
b_5:			
b_6:			

STEP 3 TABLE

Normalized Median	
b'_1	
b'_2	
b'_3	
b'_4	
b'_5	
b'_6	

STEP 4: Using program "Statistical Analysis" compute the Low Quartile, Median, and High Quartile values for rows w_1 through w_6 of Form B-1. Enter results in the Step 4 table below and on Form "B" (as feedback information.) Enter the decimal form of the Median w_i values on the B/C Computation sheet, Form C.

STEP 4 TABLE

	Low Q (%)	Median (%)	High Q (%)
w_1:			
w_2:			
w_3:			
w_4:			
w_5:			
w_6:			

Form B2 (Proposed)

PROJECT B/C COMPUTATION SHEET

Compute the Benefit Cost Ratios $(b/c)_1$ through $(b/c)_6$ by multiplying the values in the boxes. Blank boxes equal zero. Sum the six $(b/c)_i$ ratios to get $B_R/\$PA$.

RELATIVE IMPORTANCE (a_i) OF MISSION SUB-OBJECTIVE		RELATIVE CONTRIBUTION (b_i) TO MISSION SUB-OBJECTIVE (Normalized)		RELATIVE PROJECT WORTH (w_i) WITHIN SUB-OBJECTIVE		PROJECT RELEVANCE (r) TO FORCE READINESS		
☐	(a_1)	☐	(b'_1)	☐	(w_1)	☐	(r)	= ____ $(b/c)_1$
☐	(a_2)	☐	(b'_2)	☐	(w_2)	☐	(r)	= ____ $(b/c)_2$
☐	(a_3)	☐	(b'_3)	☐	(w_3)	☐	(r)	= ____ $(b/c)_3$
☐	(a_4)	☐	(b'_4)	☐	(w_4)	☐	(r)	= ____ $(b/c)_4$
☐	(a_5)	☐	(b'_5)	☐	(w_5)	☐	(r)	= ____ $(b/c)_5$
☐	(a_6)	☐	(b'_6)	☐	(w_6)	☐	(r)	= ____ $(b/c)_6$

(SUM TO GET $B_R/\$PA$)

Initials: _____

Date Processed: _____

PN: _____

SUM= _____ = $B_R/\$PA$
(Enter on Form B)

Form C (Proposed)

Chief of Engineers
ATTN: Tech Monitor
ATTN: DAEN-ASI-L (2)
ATTN: DAEN-CCP
ATTN: DAEN-CW
ATTN: DAEN-CWE
ATTN: DAEN-CWM-R
ATTN: DAEN-CWO
ATTN: DAEN-CWP
ATTN: DAEN-MP
ATTN: DAEN-MPC
ATTN: DAEN-MPE
ATTN: DAEN-MPO
ATTN: DAEN-MPR-A
ATTN: DAEN-RD
ATTN: DAEN-RDC
ATTN: DAEN-RDM
ATTN: DAEN-RM
ATTN: DAEN-ZC
ATTN: DAEN-ZCE
ATTN: DAEN-ZCI
ATTN: DAEN-ZCM

FESA, ATTN: Library 22060

US Army Engineer Districts
ATTN: Library
Alaska 99501
Al Batin 09616
Albuquerque 87103
Baltimore 21203
Buffalo 14207
Charleston 29402
Chicago 60604
Detroit 48231
Far East 96301
Fort Worth 76102
Galveston 77550
Huntington 25721
Jacksonville 32232
Japan 96343
Kansas City 64106
Little Rock 72203
Los Angeles 90053
Louisville 40201
Memphis 38103
Mobile 36628
Nashville 37202
New Orleans 70160
New York 10007
Norfolk 23510
Omaha 68102
Philadelphia 19106
Pittsburgh 15222
Portland 97208
Riyadh 09038
Rock Island 61201
Sacramento 95814
San Francisco 94105
Savannah 31402
Seattle 98124
St. Louis 63101
St. Paul 55101
Tulsa 74102
Vicksburg 39180
Walla Walla 99362
Wilmington 28401

US Army Engineer Divisions
ATTN: Library
Europe 09757
Huntsville 35807
Lower Mississippi Valley 39180
Middle East 09038
Middle East (Rear) 22601
Missouri River 68101
New England 02154
North Atlantic 10007
North Central 60605
North Pacific 97208
Ohio River 45201
Pacific Ocean 96858
South Atlantic 30303
South Pacific 94111
Southwestern 75202

US Army Europe
HQ, 7th Army Training Command 09114
ATTN: AETTG-DEH (5)
HQ, 7th Army ODCS/Engr. 09403
ATTN: AEAEN-EH (4)
V. Corps 09079
ATTN: AETVDEH (5)
VII. Corps 09154
ATTN: AETSDEH (5)
21st Support Command 09325
ATTN: AEREH (5)
Berlin 09742
ATTN: AEBA-EN (2)
Southern European Task Force 09168
ATTN: AESE-ENG (3)
Installation Support Activity 09403
ATTN: AEUES-RP

8th USA, Korea
ATTN: EAFE (8) 96301
ATTN: EAFE-Y 96358
ATTN: EAFE-ID 96224
ATTN: EAFE-4M 96208
ATTN: EAFE-H 96271
ATTN: EAFE-P 96259
ATTN: EAFE-I 96212

416th Engineer Command 60623
ATTN: Facilities Engineer

USA Japan (USARJ)
Ch, FE Div, AJEN-FE 96343
Fac Engr (Honshu) 96343
Fac Engr (Okinawa) 96331

ROK/US Combined Forces Command 96301
ATTN: EUSA-HHC-CFC/Engr

US Military Academy 10996
ATTN: Facilities Engineer
ATTN: Dept of Geography & Computer Science
ATTN: DSCPER/MAEN-A

Engr. Studies Center 20315
ATTN: Library

AMMRC, ATTN: DRXMR-WE 02172

USA ARRCOM 61299
ATTN: DRCIS-RI-I
ATTN: DRSAR-IS

DARCOM - Dir., Inst., & Svcs.
ATTN: Facilities Engineer
ARRADCOM 07801
Aberdeen Proving Ground 21005
Army Matls. and Mechanics Res. Ctr.
Corpus Christi Army Depot 78419
Harry Diamond Laboratories 20783
Dugway Proving Ground 84022
Jefferson Proving Ground 47250
Fort Monmouth 07703
Letterkenny Army Depot 17201
Natick R&D Ctr. 01760
New Cumberland Army Depot 17070
Pueblo Army Depot 81001
Red River Army Depot 75501
Redstone Arsenal 35809
Rock Island Arsenal 61299
Savanna Army Depot 61074
Sharpe Army Depot 95331
Seneca Army Depot 14541
Tobyhanna Army Depot 18466
Tooele Army Depot 84074
Watervliet Arsenal 12189
Yuma Proving Ground 85364
White Sands Missile Range 88002

DLA ATTN: DLA-WI 22314

FORSCOM
FORSCOM Engineer, ATTN: AFEN-FE
ATTN: Facilities Engineer
Fort Buchanan 00934
Fort Bragg 28307
Fort Campbell 42223
Fort Carson 80913
Fort Devens 01433
Fort Drum 13601
Fort Hood 76544
Fort Indiantown Gap 17003
Fort Irwin 92311
Fort Sam Houston 78234
Fort Lewis 98433
Fort McCoy 54656
Fort McPherson 30330
Fort George G. Meade 20755
Fort Ord 93941
Fort Polk 71459
Fort Richardson 99505
Fort Riley 66442
Presidio of San Francisco 94129
Fort Sheridan 60037
Fort Stewart 31313
Fort Wainwright 99703
Vancouver Bks. 98660

HSC
ATTN: HSLO-F 78234
ATTN: Facilities Engineer
Fitzsimons Army Medical Center 80240
Walter Reed Army Medical Center 20012

INSCOM - Ch, Instl. Div.
ATTN: Facilities Engineer
Arlington Hall Station (2) 22212
Vint Hill Farms Station 22186

MDW
ATTN: Facilities Engineer
Cameron Station 22314
Fort Lesley J. McNair 20319
Fort Myer 22211

MTMC
ATTN: MTMC-SA 20315
ATTN: Facilities Engineer
Oakland Army Base 94626
Bayonne MOT 07002
Sunny Point MOT 28461

NARADCOM, ATTN: DRDNA-F 01760

TARCOM, Fac. Div. 48090

TECOM, ATTN: DRSTE-LG-F 21005

TRADOC
HQ, TRADOC, ATTN: ATEN-FE
ATTN: Facilities Engineer
Fort Belvoir 22060
Fort Benning 31905
Fort Bliss 79916
Carlisle Barracks 17013
Fort Chaffee 72902
Fort Dix 08640
Fort Eustis 23604
Fort Gordon 30905
Fort Hamilton 11252
Fort Benjamin Harrison 46216
Fort Jackson 29207
Fort Knox 40121
Fort Leavenworth 66027
Fort Lee 23801
Fort McClellan 36205
Fort Monroe 23651
Fort Rucker 36362
Fort Sill 73503
Fort Leonard Wood 65473

TSARCOM, ATTN: STSAS-F 63120

USACC
ATTN: Facilities Engineer
Fort Huachuca 85613
Fort Ritchie 21719

WESTCOM
ATTN: Facilities Engineer
Fort Shafter 96858

SHAPE 09055
ATTN: Survivability Section, CCB-OPS
Infrastructure Branch, LANDA

HQ USEUCOM 09128
ATTN: ECJ 4/7-LOE

Fort Belvoir, VA 22060
ATTN: ATZA-OTE-EM
ATTN: ATZA-DTE-SW
ATTN: ATZA-FE
ATTN: Engr. Library
ATTN: Canadian Liaison Office (2)
ATTN: IWR Library

Cold Regions Research Engineering Lab 03755
ATTN: Library

ETL, ATTN: Library 22060

Waterways Experiment Station 39180
ATTN: Library

HQ, XVIII Airborne Corps and 28307
Ft. Bragg
ATTN: AFZA-FE-EE

Chanute AFB, IL 61868
3345 CES/DE, Stop 27

Norton AFB 92409
ATTN: AFRCE-MX/DEE

NCEL 93041
ATTN: Library (Code L08A)

Tyndall AFB, FL 32403
AFESC/Engineering & Service Lab

Defense Technical Info. Center 22314
ATTN: DDA (12)

Engineering Societies Library 10017
New York, NY

National Guard Bureau 20310
Installation Division

US Government Printing Office 22304
Receiving Section/Depository Copies (2)

Chief of Engineers
ATTN: DAEN-ZCP
ATTN: DAEN-ZCP-P

USA Concepts Analysis Agency
Bethesda, MD 20814

Headquarters, DA
ATTN: SAIL-FM)OASA, I & L)
ATTN: SARD(OASA, R, D & A)
ATTN: DACS-FM
ATTN: DACS-DPM
ATTN: DACS-DPZ-B
ATTN: DACS-DPD
ATTN: DACS-DPA
ATTN: DACA-CAZ-A
ATTN: DACA-BUR
ATTN: DACA-CAW
ATTN: DAPE-ZXB
ATTN: DAPE-MBB
ATTN: DAPE-ZBR
ATTN: DAMO-ZD
ATTN: DAMO-SSY
ATTN: DAMO-ODR
ATTN: DAMO-RQR
ATTN: DAMO-ZF
ATTN: DAMA-PPR
ATTN: DAMA-PPZ
ATTN: DALO-SMR
ATTN: DALO-RMP
ATTN: DAMI-RMB
ATTN: DAAG-RM
ATTN: DASG-RMZ

HQ DOD
ATTN: ED2Q

Deponai, John M.
Facilities Readiness Quantification Model : Users manual / by John M. Deponai ... (et al.) -- Champaign, IL : Construction Engineering Research Laboratory ; available from NTIS, 1982.
53 p. (Technical report ; P-124)

1. U.S. Army - military construction operations. 2. Force Readiness. I. Thomas, Laure. II. Kukielski, Craig. III. Sheffield, Joe. IV. Title. V. Series : U.S. Army. Construction Engineering Research Laboratory. Technical report ; P-124.