Army Regulation 570–5

Manpower and Equipment Control

Manpower Staffing Standards System

Headquarters
Department of the Army
Washington, DC
30 June 1989

UNCLASSIFIED

SUMMARY of CHANGE

AR 570–5
Manpower Staffing Standards System

This revision--

- Restructures the existing regulation and incorporates much of the material formerly contained in the appendixes as text material.

- Expands the responsibilities area and includes a new paragraph on the Army Functional Dictionary (chap 1).

- Changes guidance on the preparation of the work center description, and expands guidance on the SDP and MEAS-PLAN (chap 2).

- Revises examples of representative frequency and per accomplishment time (chap 3).

- Changes the rounding rules, adds a paragraph on computation of extrapolation limits for mobilization standards, changes the instructions for the Manpower Standard and Table Report, and changes the format of the Final Report (chap 4).

- Adds a new chapter covering application, documentation, publication, and maintenance of manpower staffing standards. Adds seven new forms developed for the application of manpower staffing standards (chap 5).

- Revises DA Form 5276-R (Program Management Data), and redefines the required information (app E).

- Adds two new review lists for the Study Development Plan (SDP) and Measurement Plan (MEAS-PLAN) (apps F and G).

Headquarters
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Effective 31 July 1989

Manpower and Equipment Control

Manpower Staffing Standards System

By Order of the Secretary of the Army:

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Chief of Staff

Official:

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History. To make this publication compatible with the Army electronic publishing database, Glossary Section II, Mathemathical Symbols was changed to Appendix O. Also, figures F–1, G–1, and N–1 were converted and renamed to table F–1, G–1, and table N–1. No other content has been changed.

Summary. This regulation prescribes detailed policies and procedures for the development of manpower staffing standards. The regulation provides valuable orientation and guidance for those whose responsibilities require their participation in the development of manpower staffing standards.

Applicability. This regulation applies to the Active Army, the Army National Guard, and the U.S. Army Reserve. It applies to all commands, agencies, and activities assigned responsibilities for developing and maintaining manpower staffing standards.

Proponent and exception authority. The proponent agency of this regulation is the Office of the Deputy Chief of Staff for Personnel.

Impact on New Manning System. This regulation does not contain information that affects the New Manning System.

Internal control systems. This regulation is subject to the requirements of AR 11–2. DA Circular 11–87–2 contains internal control provisions and a checklist for conducting internal control reviews.

Army management control process. Not applicable.

Supplementation. Supplementation of this regulation and establishment of command and local forms are prohibited without prior approval from HQDA (DAPE–MB), WASH DC 20310–0300.

Interim changes. Interim changes to this regulation are not official unless they are authenticated by the Administrative Assistant to the Secretary of the Army. Users will destroy interim changes on their expiration dates unless sooner superseded or rescinded.

Suggested Improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commander, USAMARDA (PEMS–RO), Ft Belvoir, VA 22060–5587.

Distribution. Distribution of this publication is made in accordance with the requirements on DA Form 1209 E, block number 3577, intended for command level D for the Active Army, ARNG, and USAR.

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*This regulation supersedes AR 570–5, 15 April 1984.

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Chapter 1
Introduction

Section I
General

1–1. Purpose
This regulation prescribes policies, responsibilities, and procedures for the development and maintenance of manpower staffing standards for functions performed by TDA organizations, including Augmentation TDAs. It is a comprehensive document intended as the primary reference for any Army element engaged in the development and maintenance of manpower staffing standards. This regulation establishes a system for manpower requirements determination which directs the use (where feasible) of workload based standards as replacements for the traditional staffing guides and manpower survey procedures.

1–2. References
Required and related publications and prescribed and referenced forms are listed in appendix A.

1–3. Explanation of abbreviations and terms
Abbreviations and special terms used in this regulation are explained in the glossary.

1–4. Waivers
a. Uniform Manpower Staffing Standards System (MS–3) procedures and guidance are prescribed in this regulation; however, commanders and agencies are encouraged to find new and innovative techniques in the standards development process.

b. Requests for waivers to provisions of this regulation must be submitted to Commander, USAMARDA (PEMS–RO), Bldg 2588, Fort Belvoir, VA 22060–5587 for approval. Innovations to improve the methodology of the MS–3 must be fully documented. This documentation must include justification for the approach, assumptions, and a full explanation of the technique.

1–5. Records disposition
The regulation governing the retention and disposition of records resulting from MS–3 studies is AR 25–400–2. USAMARDA is designated as the Army master studies repository and maintains on a permanent basis manpower staffing standards study final reports in hard copy or microfiche. Proponent command lead teams must retain records until a standard is superseded; measurement teams must retain records for 2 years.

1–6. Reports
a. Study Development Plans, Measurement Plans, Measurement Reports, and Final Reports prescribed by this regulation are exempt from requirements control by AR 335–15 paragraph 5–2*e*(7).

b. Reports having classified information are appropriately classified and submitted intact (see AR 380–5). If they have only small amounts of classified information, remove the classified pages and send them under separate cover. In place of the classified pages, insert a brief explanation for their removal. If forms are removed, insert a blank form with an explanation.

1–7. Freedom of information
Information obtained while doing studies under the MS–3 is covered by the Freedom of Information Act and implementing Army directives. For specific guidance and assistance on this procedure, see AR 340–17 or consult the appropriate adjutant general's office.

Section II
Responsibilities

1–8. Deputy Chief of Staff for Personnel
The Deputy Chief of Staff for Personnel (DAPE–MB) will—

a. Provide overall program management for the MS–3.

b. Provide overall program management for the Methods and Standards (M&S) program.

c. Develop and issue policy guidance.

1–9. Commander, U.S. Army Manpower Requirements and Documentation Agency (USAMARDA)
The Commander, USAMARDA will—

a. Determine priorities and establish manpower staffing standards development goals.

b. Recommend to HQDA resource levels to achieve established goals.

c. Prescribe and enforce manpower staffing standards development policy, methodology, and procedures.

d. Develop study schedules (including maintenance efforts) designed to achieve established goals.

e. Evaluate progress in compliance with schedules and established goals.

f. Evaluate existing manpower staffing standards and ensure standards are properly maintained.

g. Provide assistance to the command functional proponent in identification of the universe to be studied.

h. Coordinate standards development projects and study reports and application results with HQDA functional staff proponents.

i. Review standards development projects to assure that prescribed procedures are followed.

j. Review completed Study Development Plans (SDPs), Measurement Plans (MEAS–PLANs) and Final Reports (FIN–REPs) for compliance with prescribed procedures.

k. Approve for publication those standards developed according to prescribed procedures.

l. Ensure all approved standards are in the appropriate format for publication.

m. Maintain the master repository for all manpower staffing standards studies and reports.

n. Assist functional proponents in the development of workload reporting systems to support annual application of approved standards.

o. Supplement command standards development projects as required.

p. Serve as the primary point of contact within the Army for dealing with manpower staffing standards activities of other services.

q. Evaluate the selection, assignment, training, education, and career progression of personnel in the manpower staffing standards system from a Program manager's point of view.

r. Provide primary representation on any joint committee when the Army is tasked by the Secretary of Defense to participate in the development of joint service manpower staffing standards, and coordinate all aspects of Army participation in such joint standards development efforts.

s. Review and approve standards application results.

t. Act as approval authority for command proposed exceptions, i.e., additives, exclusions, and deviations.

u. Ensure Army-wide application of all standards.

v. Schedule annual application dates for all standards and notify commands of data collection reporting periods.

w. Review documents in TAADS to ensure approved requirements are accurately reflected.

x. Perform quality control procedures and evaluation of plans, reports, and exceptions.

y. Forward functional directives/regulations to the Proponent Command for interpretation and effect on existing/projected workload as it applies to standards maintenance.

z. Provide civilian and military personnel centers with initial forecasts of manpower adjustments resulting from standards application in series/MOS detail.

aa. Perform selected or random on-site validation of MACOM or installation standards application data, to include verification of actual work counts, additives, exclusions, deviations, and determination of manpower requirements.

ab. Review and approve MACOM schedules for MS–3 and forward to the Director of the Army Staff for incorporation in the Master Study Schedule.

ac. Ensure that MS–3 analysts participate in all categories of ER studies to the extent necessary to assure a smooth transition from the ER study to the measurement phase of the MS–3 study.

ad. Establish approved manpower requirements determination methods and procedures to be used in developing MEO manpower requirements during all OERP studies.

ae. Monitor MACOM documentation of MEO manpower requirements in TAADS.

af. Provide staff supervision for the development, implementation, maintenance, and utilization of the products of the M&S Program in the management of manpower resources and the assimulation into MS–3 studies and for justifying manpower requirements.

ag. Serve as the Army manager for implementing and carrying out, through Army, MACOM, and agency channels DOD Directive 5010.31 and DOD Instruction 5010.34.

1–10. The Director of the Army Staff

The Director of the Army Staff will—

a. Coordinate and publish a consolidated Master Study Schedule which properly sequences JIRSG (DRIS), OERP, and MS–3 studies.

b. Review and approve ER study reports for Army-wide joint OERP/MS–3 studies in coordination with ODCSPER and functional proponents.

1–11. Chief, National Guard Bureau (CNGB)

The Chief, National Guard Bureau will—

a. Plan, program, budget, allocate, and control the Army National Guard (ARNG) full-time support program (which includes military technicians) in the States and subordinate staff agencies. This includes the determination of full-time support requirements.

b. Manage allocated manpower, including programming and development of requirements for the National Guard Bureau (NGB) and its FOAs. Validation of requirements for NGB and its FOAs is the responsibility of the OCSA (DACS–DM).

c. Ensure that a supportable manpower program exists for the ARNG, including the review, analysis, and validation of manpower for affordability and personnel supportability.

d. Control the manpower staffing standards system for the ARNG, in accord with policies issued by the Office of the Deputy Chief of Staff for Personnel (ODCSPER).

(1) For ARNG-unique functions, CNGB establishes priorities and schedules of manpower staffing standards, as described in NGB Pamphlets 570–1 and 570–3. CNGB has review and approval authority for study development plans, measurement plans, final reports, initial application of standards, and reapplication of standards for ARNG-unique functions. CNGB reviews and approves standards for ARNG-unique functions. ODCSPER reviews above to ensure compliance with AR 570–5.

(2) ARNG participates in the development of the schedule for studies of Army-wide functions.

1–12. Managers of Proponent Command manpower staffing standards systems

Table 1–1 identifies command proponency for functional areas for the development and maintenance of manpower staffing standards. Managers of Proponent Command manpower staffing standards systems will—

a. Establish and supervise manpower staffing standards development teams.

b. Recommend to USAMARDA priorities and goals for manpower staffing standards development.

c. Recommend to USAMARDA resource levels to achieve established goals.

d. Participate with USAMARDA in the development of study schedules.

e. Review progress in compliance with schedules and established goals. Provide program status information to USAMARDA as required.

f. Evaluate existing manpower staffing standards and recommend to USAMARDA the scheduling of maintenance efforts as needed.

g. Coordinate standards development plans and reports with command functional staff proponents.

h. Review in-progress standards development projects for which the command has proponency to assure that prescribed procedures are being followed.

i. Review completed standards study reports (SDPs, MEAS–PLANs, and FIN–REPs) for compliance with prescribed procedures.

j. Brief the MS–3 process to the MACOM functional proponent and ensure that the MACOM functional proponent is kept apprised of field input or changes which have an effect on the staffing standard.

Table 1–1
MS–3 study proponents

Responsible command	Functional area*
FORSCOM	Administration**, Command and Command Support, Resource Management, Installation Facilities Engineer, Logistics**, Manpower, Millitary Personnel, Acquisition, Security–Law Enforcement, Operations–Plans and Forces, Reserve Components
TRADOC	Training and Education, Civilian Personnel
ISC	Information Systems Management, Printing, Publications
USACE	Engineering
ASA(FM)	Fiscal Management
HSC	Health Services
INSCOM	Intelligence, Security–Physical Security/Policy Operations
AMC	Research and Developement, Central Supply, Material Acquisition, Depot Maintenance, Safety
CIDC	Security–Criminal Investigations
MTMC	Military Traffic Management, Terminal Ops

Table 1–1
MS–3 study proponents—Continued

Responsible command	Functional area*
TSA	Commissary Operations

Notes:
* Reference Army Functional Dictionary.
** Other than those listed under another command.

k. Coordinate the initial application of standards and recommend any adjustments needed to improve the utility of the standard.

l. Review and verify all standards application package results.

m. Review proposed exceptions and recommend approval/disapproval to USAMARDA.

n. Update standards as required to incorporate changes in mission, organization, technology, or MEM procedures.

o. Submit results of application packages to USAMARDA.

p. Consolidate USAMARDA comments on the standards application to include additives, exclusions, and deviations, and resolve any problems identified as a result of the comments.

q. Submit revised manpower impacts to USAMARDA.

r. Perform standards maintenance to include adjustments to work center description, workload factor definitions, sources of count, and incorporation of any approved exceptions to the standards.

s. Develop necessary application instructions for proponent standards.

1–13. Chiefs of manpower staffing standards lead teams

Chiefs of manpower staffing standards lead teams will—

a. Develop manpower staffing standards as directed by the Proponent Command manpower staffing standards system manager.

b. Prepare the SDP.

c. Prepare the MEAS–PLAN.

d. Conduct test measurement.

e. Collect data according to the scheme published in the MEAS–PLAN.

f. Analyze collected data to determine which are compatible for use in producing a manpower equation that gives total manpower required for various workload volumes.

g. Compute various manpower equations and select the most appropriate equation for use as the peacetime standard.

h. Compute manpower equations for use as mobilization standards.

i. Determine the civilian-military mix appropriate for the function and the needs of the Army.

j. Construct a manpower table which depicts the number of positions by skill for the man-hour range of the standard.

k. Identify any special adjustments that must be made to the standard to accommodate individual locations and/or conditions.

l. Develop program estimating equations, if appropriate, to provide the capability of using program oriented variables in forecasting future manpower needs in the functional area covered by the standards.

m. Prepare the FIN–REP.

n. Coordinate study reports with MS–3 managers of Participating Commands.

o. Submit final standards study reports to USAMARDA for review.

p. Submit standards to all users for initial application and incorporate any necessary changes.

1–14. Managers of Participating Command manpower staffing standards systems

Managers of Participating Command manpower staffing standards systems will—

a. Review and certify work center description disparities.

b. Review installation workload factor data provided in installation package submission.

c. Verify installation computations.

d. Submit approved installation application results on appropriate DA forms 5696–R – 5696–6–R to USAMARDA and the Proponent Command. Periodic or selected on-site appraisal by MACOM manpower staffing standards officials will be necessary to ensure valid application of manpower staffing standards.

e. Review draft and final standards study reports (SDPs, MEAS–PLANs, and FIN–REPs) to provide comments and recommendations, as appropriate, when standards study projects involve Participating Command requirements.

1–15. Chiefs of manpower staffing standards measurement teams

Chiefs of manpower staffing standards measurement teams will—

a. Participate in the development of manpower staffing standards as directed by the Proponent Command manpower staffing standards system manager.

b. Review SDPs prepared by other teams and provide comments and/or recommendations as appropriate.

c. Review MEAS–PLANs prepared by other teams and provide comments and/or recommendations as appropriate.

d. Conduct test measurement.

e. Collect data according to the scheme published in the MEAS–PLAN.

f. Recommend the civilian-military mix appropriate for the function.

g. Submit Measurement Reports to the lead team.

h. Identify any special adjustments that must be made to the standard to accommodate individual locations and/or conditions.

i. Review FIN–REPs prepared by other teams and provide comments and/or recommendations as appropriate.

j. Evaluate the initial application of standards developed by other teams and their applicability to local functions.

1–16. HQ functional staff proponents

Functional staff proponents at HQDA and command levels will—

a. Assist the managers of Proponent Command manpower staffing standards systems in increasing functional effectiveness and achieving the most feasible standardization prior to standards studies work measurement.

b. Recommend to USAMARDA priorities and goals for manpower staffing standards development and maintenance.

c. Advise subordinate units of scheduled manpower staffing standards system (MS–3) efforts in the functional area to be studied so as to ensure cooperation and participation at required locations.

d. Review and coordinate manpower staffing standards study MEAS–PLANs for compliance with functional policy. Assure that the basic work center description has minimum required tasks, and that valid exceptions are identified.

e. Review manpower staffing standards study reports.

f. Support all workload factor (WLF) collection and reporting requirements.

g. Support and defend in the Army budget, functional manpower resource requirements identified through the MS–3.

h. Review proposed exceptions.

i. Forward supplemental functional directives/regulations to USAMARDA and the Proponent Command to ensure USAMARDA and the Proponent Command are cognizant of any changes in the functional area that would impact on workload.

1–17. Installation functional proponent

Installation functional proponent will—

a. Review the work center description, WLF definitions, and sources of count, and provide an evaluation of their accuracy.

b. Collect monthly workload factor data from required sources.

c. Provide monthly workload factor data to the local Manpower/Resource Management Office on a monthly/quarterly basis as required. Controls for submission of this information will be specified by the MACOM.

d. Justify all proposed exceptions to the current standards (i.e., additives, exclusions, and deviations).

1–18. Managers of Installation Manpower Management/Resource Management Offices

Managers of Installation Manpower Management/Resource Management Offices will—

a. Review and verify the work center description, workload factor definitions, and sources of count with the installation functional proponent and report any discrepancies to the Proponent Command.

b. Brief and provide technical guidance to the installation functional proponent on the application process.

c. Review and verify proposed exceptions, (i.e., additives, exclusions, and deviations).

d. Determine the availability of data to support the stated workload.

e. Verify the accuracy of required work counts.

f. Provide interface with the command during the data collection and reporting phase.

g. Provide interface between the command and the local functional proponent in resolving issues.

h. Provide certification of submitted data. Details are provided in chapter 5.

i. Compute manpower requirements as required.

j. Forward application packages to the Proponent Command.

k. Ensure accurate documentation of approved manpower requirements in The Army Authorization Documents System (TAADS).

Section III
Manpower Staffing Standards Program Overview

1–19. General
A manpower staffing standard is an expression of the quantitative and qualitative manpower requirements for the performance of a given set of functionally homogeneous tasks at varying levels of workload. It is normally stated both as a mathematical equation relating required man-hours to workload factors, and in tabular format showing numbers and skills of people required for a range of incremental workload factor values. Manpower staffing standards are usually developed at the work center level of functional activity.

1–20. The Army Functional Dictionary
The Army Functional Dictionary (AFD) is work center oriented and presently consists of 19 functional categories, e.g., Administration, Logistics, and Training. These functional categories are aligned hierarchically so that they may be applied at any command level, from installation to MACOM to HQDA. The functional hierarchy provides for a logical grouping of work center definitions without attempting to depict organizational structure. DA Pam 570–5 contains the Army Functional Dictionary Codes, Standard Work Center Codes, and definitions.

a. These codes are used to—

(1) Help in the identification of the universe for MS–3 studies.

(2) Identify in The Army Authorization Documents System (TAADS) those work centers covered by standards.

(3) Allow for the verification and monitoring of standards-based manpower requirements and authorizations.

(4) Facilitate comparative analysis during review of TAA issues.

b. Each manpower staffing standard must have an approved AFD code and all requirements determined through the use of the standard must be identified on the TDA with that code. Requirements are to be coded with this unique AFD code regardless of organizational configuration or even if the requirements covered by the standard appear under separate paragraphs of the TDA. This coding requirement is of the utmost importance. If other work centers which are not included in the universe are using the same AFD code, requests should be made to the Proponent Command to include them in the universe if the standard is applicable. If the standard is not applicable, requests should be made to USAMARDA by the MACOM for new AFD definitions which more accurately reflect those work centers not covered.

c. The AFD coding structure will be of considerable value in the development and maintenance of manpower staffing standards. Part IV of the SDP requires a matrix showing relevant work centers by command. Further, activities are to be identified by unit identification code (UIC) and location. For Army common standards, the HQDA Functional Proponent or the Proponent Command may submit a request to USAMARDA (PEMS–RO) to assist in identifying, through TAADS, those specific Army-wide work centers to be considered during the preliminary phase. This information will be provided by command, UIC, and location. For command unique standards, the MS–3 community should use the AFD coding structure in VTAADS to identify the universe. Additionally, the availability of this information from TAADS and VTAADS will also be of considerable value during the quarterly update and maintenance of the MS–3 schedule.

d. When definitions for titles contained in DA Pam 570–5 warrant revision as required by the MS–3 community, DA Form 2028, Recommended changes to Publications and Blank Forms, will be submitted to USAMARDA (PEMS–RO). When proposing new titles and definitions, DA Form 2028 will identify the category and function (e.g., L–Logistics and LE–Supply), in which the new proposed work centers should be placed. Specific codes, such as "LEA," need not be proposed. These will be assigned by USAMARDA as appropriate. Further, if the proposed work center titles and definitions are to replace existing ones, this will be specifically noted on the DA Form 2028. A list of applicable UICs should be submitted with the request. To expedite the approval process, a DA Form 2028 containing the proposed changes that are not command unique must be coordinated with the Proponent Command. When a manpower staffing standards study is underway, any changes to existing work center definitions and/or titles, or proposals for new work centers, will be held in abeyance until the direct categories of work and the work center description have been fully developed.

e. As proposed changes to the AFD are received by USAMARDA, TAADS will be queried to determine if any commands will be affected by the changes if they are approved. All available information from MS–3 studies (i.e., final reports) will be reviewed to ensure that no conflicts exist. If any command will be negatively affected or if inconsistencies are found, the command proposing the changes will be informed of those findings.

f. As final reports are being reviewed, work center titles and AFD codes will be compared and direct categories of work will be automatically placed in the appropriate work center definition in the AFD. Current definitions must highlight at a minimum the direct categories of work. In those instances where this is not the case, a DA Form 2028 will be required.

1–21. Relationship to the budget process
a. The Army must justify its manpower requirements annually to the Office of the Secretary of Defense, (OSD), Office of Management and Budget (OMB), and the Congress. Increasing emphasis on personnel costs and national

manpower resources has led each of these agencies to insist that budget requests be based on a realistic analysis of the work to be done, and that staffing needs be established with an accepted workload-based requirements determination process. Congressional Armed Services and Appropriations Committees made it clear that requirements based on manpower staffing standards at the functional and subfunctional level are viewed with higher credibility than those not so based.

b. To provide this requirements determination and justification capability, the Army must have a standardized requirements determination process that is—

(1) Compatible with the planning, programming, budgeting, and execution system (PPBES).

(2) Functionally oriented, to deal with the basic elements of mission workload and the need for reacting to mission or workload changes.

(3) Based on a validated and accepted process to develop credible statements of manpower requirements.

c. In addition to justifying manpower requirements in the budget, there is a need to provide to managers the tools and data needed at all levels to make resource tradeoff decisions effectively in—

(1) Total resource planning, programming, budgeting, and allocation.

(2) Reviewing the results in terms of efficiency and effectiveness of mission accomplishment.

(3) Evaluating decisions to use a particular combination of resources.

1–22. Functional approach

a. One of the principal functions of manpower management is the efficient and effective use of Army manpower. Through the use of industrial engineering techniques, the MS–3 provides the Army with the ability to standardize manpower requirements for functional activities. This functional approach in relating requirements to workloads is the basis for more credible and effective distribution and use of Army manpower resources.

b. Manpower staffing standards are built on the premise that there is commonality within functions. Functional directives, comparable equipment, and similar facilities tend to standardize work so that manpower staffing standards can be built for use at more than one location. On the other hand, where there are great variations in missions, policies, equipment, or facilities, a separate standard may be needed for a specific location or for a group of locations. Where there are less significant variations at certain locations, an exception to the standard may be needed.

1–23. The orders of standards

a. Manpower staffing standards constitute one of a variety of standards that are developed over a range of work or activity aggregation and serve related but differing purposes. It is pertinent to note here where a manpower staffing standard fits in the order of standards.

b. From the early days of industrial engineering work unit standards development, the approach has involved breaking down the work unit or work process into the component parts or elements which contribute to the completion of the work unit. In this fashion, the contribution of each element could be quantified and weighted and a standard time developed for the work unit in a structured and orderly procedure.

c. As the development and use of standards progressed beyond the purely industrial areas, this ordered concept has been expanded to encompass not only the elements of an individual work unit, but also multiple work units themselves, at ascending levels, as they contribute to larger products or services. The concept is appropriately labeled the order of work units approach. It provides a logical, ordered framework within which the various activities and products—both intermediate and final—of an organizational or functional entity can be viewed in a clear, hierarchical perspective. This is consistent with the structured, aggregating approach used in the PPBES. It is vital to the development and use of functionally-oriented manpower staffing standards in the Army.

d. Under this concept, a manpower staffing standard is a higher order standard than a work unit/detailed standard. As such, it reflects an aggregation of multiple detailed standards and lower order summary standards, each of which makes a defined and quantified contribution to the description of a work center and to the development of a manpower staffing standard. This relationship is highly significant to the Army MS–3. Any existing standards that are of a lower order than the proposed manpower staffing standard become potential candidates for use in manpower staffing standard development, thereby precluding or reducing the actual measurement workload for the manpower staffing standard development team. When lower order standards do not exist, measurement of lower ordered work units during manpower staffing standard development can produce standards and data of the type and level needed for productivity measurement, work planning and control, performance evaluation, and related uses which require lower order tools.

e. Overall, there exists an order of standards that parallels the order of work units. Since the orders of work units are associated with the levels of functional aggregation (such as task, work category, and work center), there is also a correlation between the standards and the functional levels, with successively higher orders of standards for each higher level of aggregation. The orders of standards of relevance to the MS–3, the functional/activity levels to which they generally apply, and examples of the typical roles of each are presented in table 1–2.

f. The development of manpower staffing standards involves work measurement at various levels of activity aggregation within the work center. While the general objective is determination of total work center man-hours, the data resulting from these lower order measurements of work categories and tasks can be used in conjunction with related work unit counts to develop summary and detailed standards of the type needed for productivity measurement, performance analysis, scheduling, and related work center level management functions.

Table 1–2
Pertinent orders of standards and associated level of functional aggregation from higher to lower

Orders of standards	Functional level	Illustrative uses
Program estimating equations	Function/major subfunction	— Out-year manpower requirement estimates — PPBS
Manpower staffing standards	Work center	— Manpower requirements determination — Manpower resource allocation
Lower-order summary standards	Work category	— Job estimating — Cost accounting — Performance measurement/evaluation
Detailed standards	Task	— Work Scheduling — Shop loading — Performance measurement/evaluation

1–24. Classification of manpower staffing standards

Two classifications of manpower staffing standards are established for the MS–3. The distinguishing differences between the two classifications relate primarily to the data used to compute a standard and, secondarily but significantly, to the difference in study effort required for each. There is a clear trade-off between precision and economy that must be considered on a case-by-case basis in deciding which type of standard is most appropriate for development at a given point in time. In some cases, preliminary study may prompt a decision to develop a less precise type standard.

a. A Type I standard is characterized by the following:

(1) It is developed using collected data measured to the desired level of detail. The principal characteristic is that the developer prescribes, measures, and therefore controls the level of information to be collected for use in the development of a standard.

(2) Full scale application of the three-phase standards development procedures, including a full measurement phase, is required for Type I standards.

(3) Minimum statistical criteria must be met; the coefficient of determination (r^2) must be equal to or greater than .75 and the coefficient of variation (V) must be equal to or less than .15.

b. A Type II standard is characterized by the following:

(1) It is developed using validated existing statistical data. The principal characteristic is that the developer uses already available data (with its existing level of detail and accuracy) to develop a standard. Standards based on ratio unit times (i.e., the ratio of man-hours required to workload accomplishment) are classified as Type II standards.

(2) It is considered for activities that cannot feasibly be accurately measured or for which requirements change frequently.

(3) It may be built from an abbreviated preliminary phase.

(4) Minimum statistical criteria must be met; the coefficient of determination (r^2) must be equal to or greater than .50 and the coefficient of variation (V) must be equal to or less than .25.

1–25. Other requirements determination tools

As outlined above, manpower staffing standards which relate manpower to workload provide the most credible statement of manpower requirements. When standards are not available, or development is infeasible, other techniques are used for establishing manpower requirements. Those most commonly prescribed to supplement the use of manpower staffing standards within the Army are:

a. Staffing criteria. Criteria are formulated to express manpower allowed over a set range of workload. Staffing criteria are used to estimate manpower requirements where development of manpower staffing standards is not practical or economically feasible. These estimates express requirements from a historical or actual experience standpoint. Staffing criteria are most suitable for use when lack of experience with new equipment or a system makes a standards study infeasible or when standards would be short-lived due to equipment or a system that is approaching phase out.

b. Surveys. Requirements for organizational or functional areas not susceptible to manpower staffing standards or criteria (for example, headquarters activities or functions that are not workload-driven) are determined on a case-by-case basis. In these situations, the types of analyses inherent in manpower and management surveys are used.

1–26. Relationship to efficiency reviews

a. MS–3 studies usually follow efficiency reviews. In cases where MS–3 studies precede efficiency reviews, the following apply:

(1) During the preliminary phase of a manpower staffing standards study, MS–3 personnel will make every effort to improve the efficiency and effectiveness of functional activities. Some appropriate improvement techniques include organizational analysis, layout analysis, work distribution analysis, work simplification, systems and procedures analysis, flow process charting, flow and string diagrams, linear responsibility charting, and shift profile analysis. Improvements made feasible through use of more efficient equipment and improved facilities will be aggressively pursued.

(2) For those improvements which apply to a single location and can be immediately implemented within existing equipment, facilities, and funding constraints, MS–3 personnel will make every effort to have the improvements implemented prior to work measurement. Such improvements do not require documentation in study development plans.

(3) Improvements of a policy and procedures nature or those which apply to more than one installation will be fully documented in study development plans. Generally, these kinds of improvements can be implemented within existing equipment, facilities, and funding constraints, but will require intervention of the functional proponent at the appropriate level. Every effort will be made to implement such improvements prior to work measurement.

(4) Some improvements will require planning, programming, and budgeting for procurement of more efficient equipment or improved facilities. These longer range improvements will be fully documented in study development plans and will be supported by a cost-benefit analysis. Functional proponents at the appropriate level will ensure that approved recommendations are integrated into the planning, programming, and budgeting system.

b. Regardless of the sequencing of efficiency reviews and MS–3, work measurement will not be delayed pending implementation of long range improvements. A standards maintenance effort should be scheduled after improvements are made if significant manpower savings are indicated.

1–27. Manpower staffing standards in Augmentation TDAs

Manpower staffing standards are developed for functions performed in TDA organizations, including Augmentation TDAs. In instances where the universe for an MS–3 study includes work centers which are partially staffed with modified tables of organization and equipment (MTOE) positions, the study effort should include measurement of the workload for the entire work center. Workload for those functions unique to the MTOE mission must be excluded from measurement. Additional information is contained in paragraph 1–29 on the Manpower Requirements Criteria (MARC) Program.

1–28. Peacetime versus wartime manpower staffing standards in TDA units

a. For full utility, manpower staffing standards must express requirements in terms of both manpower/manhours for a given workload range or capability for both peacetime and wartime (including mobilization) environments. Many similarities exist between peacetime and wartime requirements analysis; however, the uncertainty of wartime operations requires flexibility and added consideration during standards development. Thus, during standards development, the ability of a standard to accurately reflect wartime requirements should be assessed.

b. Wartime requirements should be based on the most manpower intensive scenario as documented in Army war plans. In this context, peacetime policy directives can be reviewed for wartime applicability and their consistency with current policy in war and mobilization plans. When a functional category or task of work has not been addressed, the functional proponent must determine essentiality of that work during war. Also, responsibilities applicable only during war must be identified.

c. Since applicable historical data are extremely limited, the method of formulating and measuring work required in wartime will primarily be based on an evaluation of a function's—

(1) Documentation in wartime manpower planning.

(2) Wartime role and operating conditions.

(3) Change between peacetime and wartime operations.

(4) Detailed specifications of wartime tasks.

(5) Mobilization exercise afteraction reports (lessons learned).

d. Requirements determination for a wartime environment is normally formulated using the functional proponent's approved wartime guidance. Based on this guidance, it must be established whether the work center description does or does not change under wartime conditions.

(1) If the work center description does not change under wartime conditions, apply the projected wartime workload against the peacetime standard and adjust requirements consistent with the extended workweek prescribed for the condition (for example, 6–day workweek or 7–day workweek and location. See table B–2 for Army Availability Factors for mobilization.

(2) If the work center description does change under wartime conditions, compare the wartime and peacetime tasks and categorize them as follows:

(a) Peacetime-only tasks.

(b) Wartime-only tasks.

(c) Peacetime tasks which are also needed in wartime but will undergo a change in level of service, frequency, accomplishment time, or procedures in wartime environment.

e. Based on the above categorization of tasks, each work center description should be structured in such a manner as to recognize the difference between wartime and peacetime. To provide the ability to meet wartime standards needs, it may be necessary to develop separate peacetime manpower staffing standards for work centers with different levels of wartime involvement. One valid method for dealing with these situations is the use of modular equations which are also used to treat independent work based on operating concept and/or location.

f. Proponent commands must develop mobilization equations along with peacetime equations unless granted a waiver. A waiver may be appropriate where the work center description changes under wartime conditions and a major study effort is required to develop mobilization equations. Waiver requests should be forwarded to Commander, USAMARDA (PEMS–RO). The determination to request a waiver must be made when the study is originally scheduled or during the preliminary phase of the study.

1–29. Relationship to the Manpower Requirements Criteria (MARC) program for TOE/MTOE units

a. Manpower requirements criteria (MARC) are based on wartime workloads and functions for deployed TOE/MTOE unit manpower requirements. MS–-3 standards are based on peacetime workloads and functions for TDA units. In many instances there are similarities of functions between like TOE and TDA organizations; for example, finance. However, to apply the standards or requirements criteria from one organization (TDA) to another (TOE) is not appropriate. TOE organizations are structured for a wartime mission and are based on a 24–hour day. TDA organizations are peacetime oriented and are based on a work day of 8 hours. The availability and nonavailability factors are different for peacetime and wartime. Consequently, the personnel requirements to perform similar functions are different in TOE and TDA organizations.

b. Although the initial definition of the populations supported by MARC and MS–3 seem distinct, they do overlap. Some MTOE units do not deploy in current war scenarios; these unit manpower requirements should be determined by MS–3. Some MTOE units with deployment missions also have peacetime missions whose manpower requirements exceed their wartime requirements. These units requirements should be developed by MARC, but have standards developed by MS–3 which cover the unit and an augmentation TDA for accomplishment of the peacetime mission. Additionally, many of the CS, CSS workloads, functions, tasks, and tasks times observable and measurable in peacetime (MS–3) are transferable to wartime requirements determination (MARC).

c. The MS–3 and MARC manpower requirements developers must work in coordination to capture those areas that are transferable. Both programs stress manpower requirements based on measurable standards, workloads, or criteria. The two programs must interface their data collection efforts in order to avoid duplication of efforts and improve the productivity of the analysts in both programs.

d. All MS–3 studies must indicate in the study development document and the final report that coordination for data collected with the MARC program has been made and incorporated where appropriate.

Section IV
Manpower Staffing Standards Development and Maintenance Process Overview

1–30. General

This section presents an overview of the process used to develop and maintain manpower staffing standards. The sequence of events for the manpower staffing standards process is provided at appendix C. Subsequent parts of this regulation contain detailed instructions on the conduct of the major study phases.

1–31. The manpower staffing standards development concept

Standards are developed through manpower staffing standards studies, using a team concept and a phased approach. A single study may cover one or more manpower staffing standards, but is always limited to a specific function or subfunction. The manpower staffing standards development concept is further characterized by the following:

a. It provides for the use of measured inputs and outputs, obtained from a representative sample of locations. It provides for the establishment of a defined statistical relationship between required work center man-hours and the volume of workload factors which are indicative of the effort required in the work center.

b. It adheres to the order of work units approach in defining the workload to be included in a particular manpower staffing standard. It takes full advantage of existing lower order standards. It prescribes work measurement only to the level of detail required to ensure adequate capability and flexibility in computing the standard.

c. It relies on an integrated team approach to ensure the inclusion of both trained work measurement personnel and the continuing participation of designated functional representatives from the function being studied.

d. It stipulates the use of detailed, standardized procedures in all manpower staffing standards development, both Army-common and command-unique.

1–32. MS–3 phases

The phases of a manpower staffing standard are:

a. Preliminary

b. Measurement

c. Computation

d. Application and maintenance

1–33. The development and maintenance process

a. Preliminary phase. Planning of the study is done in the preliminary phase. Conduct of this phase is critical because the success of the next two phases depends materially on its quality. During the preliminary phase, the objectives are to become thoroughly familiar with the functional area, formulate a study development plan and a measurement plan, test the measurement plan, and prepare thoroughly for the measurement phase.

b. Measurement phase. This phase encompasses the actual collection of data required for development of manpower staffing standards, as stipulated in the measurement plan. The level of effort and the precise actions vary with the type of standard being developed, the specific measurement instructions, and the size and complexity of the functional area being studied. Regardless of the scope, strict adherence to the measurement plan and close coordination between lead and participating input teams are vital to a successful development effort. The primary product of this phase is a comprehensive set of standards input data, reflecting pertinent information on inputs and outputs of the defined work centers at a representative number of locations. Additionally, the results include information on situations not identified in the preliminary phase and that could signal necessary changes or exceptions to the work center descriptions to ensure full standards coverage.

c. Computation phase. This phase includes the computation of the manpower staffing standards by the lead team, using the data and supporting information accumulated from the measurement phase. The computation phase includes thorough analysis and validation of the input data, selection of the mathematical models deemed most suitable, development of manpower tables, validation and quantification of exceptions to the basic standards, and preparation of the final report.

d. Application and maintenance phase. During initial application, standards are applied for the first time to the entire universe for which they were developed, using the application instructions in chapter 5 and specialized instructions in part two, chapter 6 of the final report. Results of this application may be used to make final adjustments to the standards. Following incorporation of any final adjustments, USAMARDA approves the standards and instructs commands to document their manpower data base to reflect the manpower requirements determined during the application phase. The Proponent Command prepares the manpower staffing standard for publication in the appropriate DA pamphlet according to guidelines contained in chapter 5. Standards application occurs again 1 year after the standard is approved and begins the annual application cycle. The process is basically the same as in initial application. Maintenance commences with the approval of a manpower staffing standard and continues throughout the life of the standard. Maintenance is necessary to ensure that the standard is current and still applicable to the function for which it was developed.

e. Table 1–3 shows the four phases and their associated products.

Table 1–3
MS–3 phases

Phase	Product
Preliminary	Study Developement Plan (SDP) Measurement Plan (MEAS–PLAN) Test Measurement Report
Measurement	Measurement Report (MEAS–REP)
Computation	Final Report (FIN–REP)
Application & Maintenance	Initial Application Reports Final Report (Update) Published Standard Annual Application Reports Published Standard (Update)

1–34. The lead team concept

a. If two or more teams are scheduled on a given study, one team will be designated to carry the major responsibility and play the lead team role in the study. The concept applies equally to large teams that are organized into subteams or elements, in which event one element functions in the capacity of lead team.

b. Commands are encouraged to use the lead team concept whenever such action will reduce the cost and/or accelerate the development of standards. Study procedures as prescribed in this regulation accommodate the lead team/participating input team approach. If only a single team is involved in a study, the full spectrum of lead and participating input responsibilities is performed by that team.

Chapter 2
The Preliminary Phase

Section I
Manpower Staffing Standards Study Planning

2–1. General

a. This section gives the initial decisions normally needed in planning manpower staffing standards studies.

b. A preliminary phase is used to set up liaison between study participants, gather information that concerns the function to be studied, and decide how to build the standards.

c. This and other sections of this chapter show the complete preliminary process used in a study designed to produce manpower staffing standards. Other studies may use fewer actions. However, all issues critical to properly determining manpower requirements are looked at in the preliminary phase. The detailed preliminary phase also covers coordinating these actions with the appropriate functional proponent. Specific requirements of a preliminary phase are—

(1) Analyze the organization. Methods for analysis include flow charts, PERT charts, and input process output. This analysis is important for use in preparation of the WCD, MEAS–PLAN, and the statement of conditions.

(2) Identify management improvements which should be implemented prior to work measurement.

(3) Select work centers to study.

(4) Select the study approach.

(5) Select measurement locations.

(6) Identify work units and potential workload factors.

(7) Identify significant standards of operations.

(8) Develop work center descriptions.

(9) Identify and install, where required, a work count system.

(10) Plan a method to determine skill and grade distribution requirements.

(11) Develop a manpower staffing standards study development plan.

(12) Develop a manpower staffing standards study measurement plan.

2–2. Identifying management improvements

a. Manpower management analysts will actively participate in all OERP studies to assist in establishing the MEO and recommending minimum essential qualitative and quantitative manpower. MS–3 analysts will participate in all categories of studies to the extent necessary to assure a smooth transition from the ER study to the measurement phase of the MS–3 study.

b. In cases where joint OCOA and ODCSPER approval has been obtained to conduct MS–3 studies where no efficiency review has been conducted, the following applies:

(1) During the preliminary phase of a manpower staffing standards study, MS–3 personnel will make every effort to improve the efficiency and effectiveness of functional activities. Some appropriate improvement techniques include organizational analysis, layout analysis, work distribution analysis, work simplification, systems and procedures analysis, flow process charting, flow and string diagrams, linear responsibility charting, and shift profile analysis. Improvements made feasible through use of more efficient equipment and improved facilities will be aggressively pursued.

(2) For those improvements which apply to a single location and can be immediately implemented within existing equipment, facilities, and funding constraints, MS–3 personnel will make every effort to have the improvements implemented prior to work measurement. Such improvements do not require documentation in study development plans.

(3) Improvements of a policy or procedures nature or those which apply to more than one installation will be fully documented in study development plans. Generally, these kinds of improvements can be implemented within existing equipment, facilities and funding constraints, but will require intervention of the functional proponent at the appropriate level. Every effort will be made to implement such improvements prior to work measurement.

(4) Some improvements will require planning, programming, and budgeting for procurement of more efficient equipment or improved facilities. These longer range improvements will be fully documented in study development plans and will be supported by a cost-benefit analysis. Functional proponents at the appropriate level will ensure that approved recommendations are integrated into the planning, programming, and budgeting system.

c. Regardless of the sequencing of efficiency reviews and MS–3, work measurement will not be delayed pending implementation of long range improvements. A standards maintenance effort should be scheduled after improvements are made if significant manpower savings are indicated.

2–3. Selecting the functional area of study

Detailed analysis and research provide study personnel with the information required to divide the function under study into specific work centers.

a. Work centers represent groups of related job responsibilities and tasks. These tasks are accomplished by people working together and normally in close proximity to one another. Approved organization structures are usually based on this concept.

b. While current organizational lines usually provide logically defined work centers, they may not ensure economical ones. Therefore, existing organizational segments can be combined or divided for work measurement purposes if a more economical and accurate standard will result.

(1) An organization with many small work centers could have excessive overspecialization. If this condition is not offset during work center selection, unnecessary additional requirements may be indicated when the manpower staffing standards are applied.

(2) Examples of functions where work center consolidation would be appropriate are section-level or unit-level activities grouped under branch-level activities, and several work centers manned with personnel of the same MOS/series.

(3) On the other hand, an organization with a few large work centers could be too generalized. If not offset during work center selection, under-specialization may result in job dilution, such as highly skilled employees performing lower skilled work.

c. Another characteristic of a work center is its ability to produce an output that can be measured by one or more factors or indexes. As a general rule, the broader these factors or indexes are, the more tasks that can be put together in a work center.

d. It is also important that the work center identification process address the potential post-measurement impact to ensure that the standards application will not create implementation problems.

2–4. Identifying the universe

To develop manpower staffing standards covering functional requirements, Proponent Commands must identify, by location, command, and UIC, the work centers and functions within the TDA Army which have potential for MS–3 coverage. Methodology for universe identification encompasses the identification and definition of similar functions and related work centers, the grouping of similar functions for comprehensive coverage, and the separation of dissimilar and/or exempt functions. Universe identification provides MACOM, the ability to schedule and track progress of MS–3 efforts, enables USAMARDA to monitor MACOM progress and to prioritize the Army MS–3 effort in relation to stated goals, and provides the basis for annual application and documentation of requirements determined through the application of standards.

2–5. Establishing liaison with various activities

a. Briefing. Briefings must be kept simple, unbiased, and factual. Clearly identify any assumptions and highlight the importance of the functional proponent/manager in a manpower staffing standards study. The purpose of these briefings at the various levels is to—

(1) Introduce to the HQDA functional proponent the objectives and study sequences.

(2) Present to the functional proponent an explanation of the pending study and its objectives.

(3) Establish the first contacts with installation operating officials for proper clearance, to explain the manpower staffing standards system (MS–3) objectives and methods, and to gain additional information about the function to be studied.

(4) Make work center personnel aware of MS–3 objectives and study techniques.

b. Team and function relations. Follow the authority chain of command in the first contacts with a function. The team chief begins with the prime commander or functional manager, then meets with the subordinate commanders and supervisors of each lower organizational element before making any other contact in the element. When the team is through with its work in each organizational element or area, the above process is reversed. Meetings that have people from several levels are best to save time. The team chief asks the commander or functional manager to pick a liaison official who is familiar with the function and its key personnel. This liaison official is the communications link

between the team and the function. This makes team relationships with operating personnel better and speeds up coordination.

2–6. Becoming familiar with the function

a. Research. The lead team must—

(1) Research the directives on organizational placement, mission, and internal organization of the function. Work instructions, local procedures, and higher headquarters directives must be cross-checked for compatibility. The research objectives are to become very familiar with the function under study and to find possible management improvements. This means that the team needs a close liaison with the appropriate functional proponent. To ease the overall research effort, ask the functional proponent for an appropriate bibliography of functional directives.

(2) Include the contents of existing standards (Air Force, Navy, commercial, or industrial) in this familiarization. The lead team also will obtain and review all available standards to see if the data from these studies can be used to build a new standard as well as review internal work measurement programs and management information systems. When time or labor standards exist that are based on officially recognized work measurement systems, such as time study or work sampling, attempts will be made to change the data into manpower staffing standards.

(3) Contact the commercial activities (CA) office for planned reviews in the function under study. The lead team also will examine past CA review reports as a means of determining the needs of the staff office to be considered in formulating the work center descriptions and selecting the workload units to be collected.

b. Questionnaires. In some studies, it may be necessary to develop and send out questionnaires. Questionnaires will be—

(1) Used to get directly related information that is not readily available, cannot be obtained by other means, and is vital to develop plans.

(2) Used to collect routine information during study development plan review.

(3) Limited to simple factual matters that are noncontroversial.

(4) Developed to include a list of questions in the SDP as an interview aid or a checklist if needed.

c. Occupational measurement data. An occupational survey may be required as part of the preliminary phase before developing detailed task-level descriptions. To keep from duplicating efforts and to take advantage of already completed descriptions, the lead team should determine if an occupational survey which includes detailed descriptions has already been completed. These surveys, if available can decrease the time needed to build work center descriptions and help in determining skill and grade requirements.

d. Functional model. The functional model is a statistical tool that shows the actual distribution of manpower to handle the workload; not necessarily the manpower needs for that workload. That is, it shows what functions and where more study effort is needed. The size of the standard error and the number of extreme deviations from the model's derived equation indicate how much analysis and work is needed. The analysis depends on management's goals and objectives for functional standardization, manpower accounting and control, as well as on precision in programming manpower requirements. Procedures for building a functional model will be discussed in chapter 4.

2–7. Selecting the study approach

a. Scope and depth of the preliminary phase.

(1) The objective for doing extensive preliminary planning is to guarantee that the correct type of data will be economically and efficiently obtained during the measurement phase.

(2) A study designed to produce Type I standards normally requires the highly detailed preliminary phase described in this regulation.

(3) The detail of the preliminary phase for Type I standards is based on factors such as—

(a) Manpower staffing standards. The type of manpower staffing standards to be built needs more preliminary work than staffing pattern analysis. Operational audit work measurement would be an example where more preliminary work is needed.

(b) Previous functional studies. They could give information that otherwise would have to be gained through a detailed preliminary process.

(c) The complexity of the function. A more complex function may need a lot of research to properly design a measurement plan.

(d) Functional characteristics. The size of a function, the number of authorizations, or the diversity of locations may dictate the level of effort needed for developing a standard.

(e) The stability of the function. An agency or function subject to frequent reorganization, great changes in workload, or shifts in responsibilities may not warrant a long-term, costly study.

(f) Cost-effectiveness of the study. Review ways to keep the study costs low but consistent with an acceptable level of accuracy and confidence.

b. Selecting the type of standard to develop. To select the right type of standard to accurately predict the manpower requirements for a work center, consider the factors shown below.

(1) The degree of standardization in organization, procedures, equipment, and layout in the function. The less commonality throughout the function, the less chance of success in an attempt to build a manpower staffing standard.

(2) The feasibility of adopting other command/service standards in place of developing an entirely new standard needs to be looked at. If a cross-utilization of standards is thought to be feasible, analyze the available standards to find out if modifications are needed.

c. Selecting the appropriate measurement method.

(1) Once the type of standard to be developed has been selected, the next step is to decide which measurement method can produce the data to satisfy that standard's statistical requirements.

(2) The primary measurement techniques and their criteria for use are in chapter 3. When methods or techniques other than those listed in this regulation are chosen, USAMARDA approval must be obtained. When a technique is documented in a text, summarize it and give the appropriate reference. Otherwise, document the technique by explaining all steps, and provide the rationale for selecting the approach.

(3) Choose the method or combination of methods that economically gives an accurate standard; economy and accuracy seldom go hand-in-hand. Weigh the benefits that are associated with precise and detailed measurement methods, such as time study, against the economies of work sampling.

(4) After the work center description has been developed, recheck the measurement method that was selected. Analyze each activity in the description referring to the measurement method selection guidelines in this regulation. The activities for which a representative work sampling measurement is possible can be isolated from those measurable by operational audit or time study. Using the latter methods may be indicated by such factors as irregular or infrequent occurrence of the activity, the location where the work is done, or the need for a separate costing of a particular activity.

2–8. Selecting measurement locations

a. The lead team, in consultation with USAMARDA and the Participating Commands, is responsible for selecting measurement locations for Army common standards studies.

b. Commands and agencies are responsible for selecting measurement locations for their own command-unique standards studies.

c. Whether it is an Army common or command unique standards study, perform the following:

(1) First identify all of the locations at which the work center standard will apply.

(2) From this population, select a sample that will reflect a representative distribution of the range (such as high, medium, and low) of work center sizes and the range of workload volumes.

d. Use table 2–1 to determine the minimum number of input locations (based on total universe).

Table 2–1
Minimum and maximum number of locations to be measured

Total work center locations	Minimum number to be measured	Maximum number to be measured
1—4	ALL	ALL
5—7	4	4
8—13	5	5
14—20	6	6
21—30	7	7
31—44	8	9
45—47	9	10
48—65	9	20%
66—100	10	20%
101 & more	10%	20%

Notes:

This table should be applied to the universe. Application of this table to each MACOM produces an unacceptable study cost and length. Exceptions to this table should be submitted to USAMARDA prior to submitting the MEAS–PLAN for approval.

Section II
Work Center Description Process

2–9. General

This section gives the tasks to be done after the study planning is complete. The comprehensiveness and quality of the preliminary phase are critical to the success of the measurement and computation phases. Properly identifying the required work is a key element in developing an effective measurement plan.

2–10. Defining the activities of a work center

a. Once the work centers have been identified, a detailed description of their activities can be developed. A major reason for producing this work center description is to simplify subsequent work measurement. On this basis, the WCD is formulated so that it presents an unfolding of the work center responsibilities in a descending order of work units, specific work categories, tasks, and subtasks. Also, any task, subtask, or element is structured so that each clearly identifies a specific start and stop point and precisely defines the standard procedure for accomplishing the activity in understandable terms.

(1) Categories are the major subdivisions of the work center descriptions. Each category serves to describe groupings of tasks that are done in combination to accomplish a major mission responsibility. When establishing the categories for a work center, keep in mind the need to simplify future updates to the standard and possible uses for portions of the standard for productivity improvement measures as well as CA reviews.

(2) Tasks are the major parts of categories.

(3) Subtasks are further subdivisions of detailed task amplification.

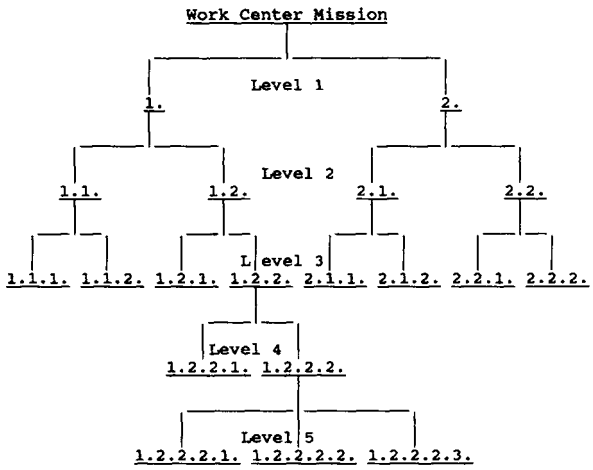
(4) Dividing subtasks gives elements.

b. As shown in figure 2–1, each successive level in the pyramidal relationship is a breakout of the next higher level. The degree of detail increases with each subdivision of the mission. The primary reason for increasing the detail is to help in accurate measurement.

(1) Descriptions that are purposely broad to cover as many input locations as possible decrease the chance for accurate measurement. Measurement errors are more common when the work center description does not group organizational duties and responsibilities as they exist. Work that is not correctly identified stands little chance to be correctly measured.

(2) Resolving duties into even finer detail can become counterproductive when the descriptions cover highly variable work.

(a) Management, research, and problem-solving activities may follow different steps that can only be described in general terms.



Level 1 = Category description.
Level 2 = Task description.
Level 3 = Subtask description
Level 4 = Element description
Level 5 = Subelement description

Figure 2–1. Graphic portrayal of WCD structure

(b) Over-refining may result in an unreal sequence of steps. The dividing line between task, subtask, or element may then become impossible to set up.

(c) Treating them apart can lead to arbitrary divisions of time that are later judged to be in error during the data analysis phase,

c. A condensed, hypothetical example of a detailed analysis extending through basic motions is given in figure 2–2.

(1) Although this amount of detail may not be needed, the example shows that an analysis can be carried to a very fine degree when it is needed.

(2) When activities are correctly arrayed, as in this example, potential variable activities are easier to identify for analysis during the computation phase.

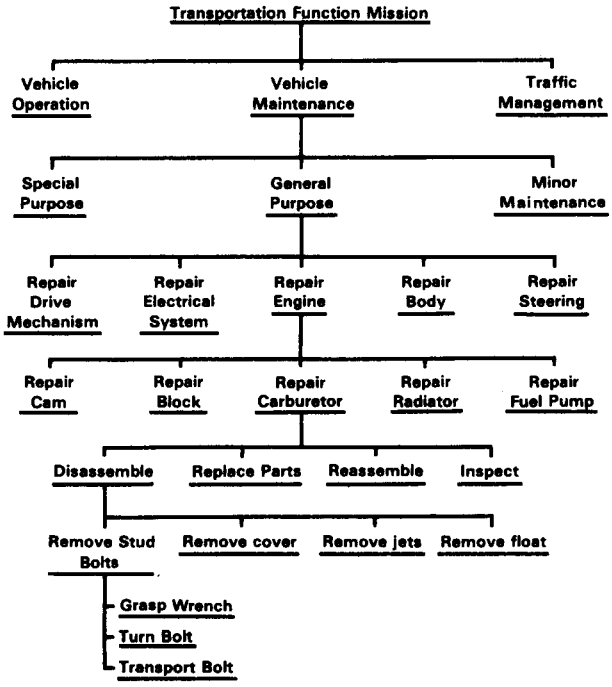


Figure 2–2. Example of activity structure

2–11. Classifying work center assigned time

a. As the detailed activity analysis progresses, it will become apparent that some activities are accomplished in the work center which cannot be directly tied to one of its assigned missions. For example, these could be activities required of all Army personnel regardless of the work center; activities that are necessary because of the nature of the work environment or that are required of work center personnel because of resource limitations in other work centers.

b. To ensure that the man-hours required to do a work center's missions will be correctly accounted for during the measurement phase, it is important to understand all of the activity classifications for which assigned time can be expended. (See fig. 2–3.)

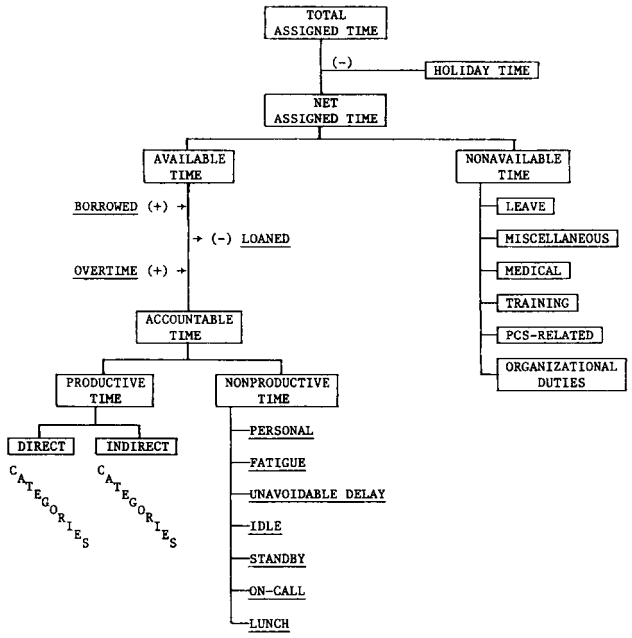


Figure 2–3. Time classifications

2–12. Defining direct and indirect categories of productive work

Categories of work that result from the activity analysis include those activities that are necessary and essential to accomplishing the work center mission. The number of these categories depends on the scope and diversity of the work center's responsibilities.

a. Categories are structured so they can be allied with either a major work unit or an MOS/series. Identifying work units with a specific category allows better analysis during the computation phase. It also aids in developing multivariate standards when a single-factor manpower relationship cannot be set up.

(1) Developing categories linked with a specific MOS/series makes skill and grade determinations easier during the standards computation phase. However, use caution when putting work into categories around MOS/series because this does not always give the same categories as those structured around work units or the general concept of direct versus indirect.

(2) When conflicts arise, categorization around the work unit is preferred. However, categories are still subdivided to a level needing only one specialty or skill level if it agrees with the measurement method.

b. During the work center description process, certain work may not be done at all locations. This work is treated in one of two ways:

(1) If use of equivalent workload factors is anticipated, and a certain category describes the activities associated with an equivalent item, include this type work in the basic or main work center description.

(2) In all other cases, the "peculiar" categories of work are listed on a separate WCD for possible treatment as an exception. Restrict exceptions to identifying major differences in operations among like work centers, such as special requirements due to location, climate, or tenant support demands. The difference must be significant enough to make the use of a single standard impractical.

c. Categories are grouped and classified as direct and indirect in the work center description. (The definitions for "Direct Time" and "Indirect Time" in the glossary of this regulation govern the classification of categories.) Appendix D has several standard indirect categories and definitions that are used where applicable. Depending on the type of standard and anticipated development methods, it may be useful to further identify the definitions by other classifications such as "fixed" (f), "variable" (v), "personnel generated" (G), "transferable" (T), and "nontransferable" (NT).

2–13. Following Army work classification rules

a. The category in which a task belongs can vary with the work center mission. Proper categorization for direct categories will, in most cases, be based on the analyst's judgment and knowledge of the work center. However, there are activities for which Army-wide classification rules have been established. These are listed in paragraphs 2–14 through 2–19.

b. Any deviation from these rules must be specifically authorized by USAMARDA acting as the field proponent for HQDA (DAPE). Commands must contact USAMARDA for guidance on those classification situations not covered below that could affect more than one study.

2–14. Classifying work center aviation position requirements

a. Criteria for operational versus nonoperational flying positions are established at HQDA; therefore, aviation positions require special attention. Thoroughly document the need for all aviation positions in part two of the final report.

b. If the work center requires the performance of operational flying duty, allow time for accomplishment of flight training and flight evaluation.

c. For positions requiring commissioned officer aviators, refer to AR 570–1. For warrant officer aviator positions, refer to AR 611–112.

d. For other restricted military positions refer to AR 570–4, table B–1.

2–15. Classifying work center mobility/emergency deployment readiness exercises

a. This paragraph applies to those work centers that regularly participate in mobility exercises, emergency deployment readiness exercises, and installation-directed exercises. Include a separate direct category of work for the following requirements in the WCD:

(1) Developing mobility and unit-tasking plans.

(2) Maintaining a day-to-day mobility capability in accordance with the mobility and unit-tasking plans.

(3) Work that is done by assigned work center personnel during exercises that would be normally allowed in the same work center performing the task.

(4) Activities that are required to conduct an emergency deployment readiness exercise that are either administrative or support in nature. Ensure that man-hours accounted for in this category of work are not duplicated in tasks of other categories or work (for example, the standard indirect tasks of maintaining an alert recall roster or maintaining status charts). Documentation of man-hours for support of work, as defined in (3) above, must be in sufficient detail to discriminate between work center normal requirements and exercise requirements.

b. Man-hours for augmentation of a work center are not allowed for standards development purposes. Therefore, these duties are not defined in the work center description.

2–16. Classifying work center travel requirement

a. Time spent for travel between work centers or between the work center and the job site is included in the WCD as a separate task under the applicable category of as an integral part of the task for which the travel is required.

b. This same procedure applies to temporary duty (TDY) travel when the purpose of the TDY is to do official, mission-oriented tasks listed in a direct category.

c. For TDY travel connected with training, see paragraph 2–22c.

2–17. Classifying work center supervisory activities

a. The indirect category of supervision is limited to those productive indirect work activities that are purely supervisory in nature. (See app D.)

b. When a work center is set up to manage two or more subordinate work centers, the supervisory tasks necessary to support the subordinate work centers are classified as a productive direct category called “Management.”

c. As a result, a management or overhead work center could have both categories, each with the same tasks. The “Management” category reflects time spent dealing with people outside the work center and the “Supervisory” category reflects time spent dealing with people assigned to the work center.

d. All subordinate work centers would only have the standard indirect category of “Supervision.”

2–18. Classifying work center training requirements

a. On-the-job training (OJT) is set up as a productive, indirect category. It is used to account for time used by a worker in a directly supervised, OJT proficiency training status when the worker is being advised or assisted by the supervisor. This category applies when the worker is receiving OJT even though no productive work is being accomplished.

(1) If a worker is “learning while producing,” his or her time is put in the appropriate productive direct or indirect category and not in OJT. OJT is included as in-house proficiency training or group training given in a classroom environment when that approach is used in place of numerous individual OJT sessions on one subject.

(2) Study of career development courses and MOS testing references is not included unless it is used as a reference for one of the aforementioned conditions of OJT.

b. Treat training given by mobile training activities as productive indirect when the training is of a recurring nature similar to, or in place of, normal OJT or proficiency training.

c. For all other training, see paragraph 2–22.

2–19. Classifying work center cleanup activities

a. The clean-up productive indirect category includes those tasks listed in paragraph D–10.

b. When custodial service is not authorized by AR 420–81, performance by work center personnel of the minimum required services can be included in this category.

c. Time used to mow grass immediately around a work center's building is not included. (See para 2–21*b*(3).)

d. Time used to police and clean grounds around a work center's building is not included. (See para 2–22.)

2–20. Identifying nonproductive accountable time

There are certain activities or conditions that can exist in a work center that will affect the time needed to accomplish required productive tasks. These activities or conditions, listed below, do not result in productive work being done but cause task time to be increased. It is important that this category of time, known as nonproductive, be properly identified during the preliminary phase so that it can be thoroughly analyzed during the measurement phase. Statements of nonproductive time are not included in the WCD.

a. Personal, fatigue, and unavoidable delay.

(1) These classifications define the nonproductive time that is needed by a worker to take care of personal needs, to adjust for fatigue resulting from the nature of the work, and to account for delay resulting from situations outside the worker's control, for example, a delay awaiting authorized transportation.

(2) Policy on how this nonproductive time is built into manpower standards is given in chapter 3.

b. Idle.

(1) This category includes time spent by a worker either in an avoidable delay status or in doing unnecessary work when required work is available.

(2) Time for personal, fatigue, and unavoidable delay is not included in this category.

(3) Idle time is not included in any manpower standards.

c. Standby. This is time spent in a ready status to do work but for which no work is available. This condition can be classified as standby only when its existence is essential to mission accomplishment. (See chap 3.)

d. On-call.

(1) On-call is a period of time an off-duty worker is available at a prearranged location, other than the work center, and can be reached by telephone or other means.

(2) When authorized work that is required and cannot be held over to the next duty day is done, the work center will be credited with the actual productive time expended and the travel time required to get to and from the job site.

(3) This productive time and travel time are credited to their specific tasks in the WCD.

(4) Examples of on-call time are—

(a) A photographer who is needed to take photos periodically after duty hours.

(b) A maintenance specialist who is needed infrequently to repair or replace a critical item of equipment.

(c) An information officer who responds to local press inquiries upon notification.

(5) Time spent waiting for a call is not measured or included in the manpower standard.

2–21. Identifying potential effects of borrowed time, loaned time, and overtime

a. Borrowed time.

(1) This is time provided by personnel assigned outside the work center that is used to accomplish productive work within the work center.

(2) Man-hours that support this effort will be included in the standards development process under the appropriate work center task.

b. Loaned time.

(1) This is time expended by work center personnel to do work that is the responsibility of another function.

(2) Man-hours that are loaned to another function cannot be included in the manpower staffing standard of the loaning work center.

(3) An example of loaned time deals with the mowing of grass around an office building.

(a) The facilities engineer function has the responsibility to accomplish grounds maintenance. If the installation commander decides that the people occupying a building should mow the grass around that building, the man-hours spent doing this are considered loaned to the facilities engineer.

(b) The loaned time will not be considered in any manpower staffing standards for the building occupants.

c. Overtime.

(1) Overtime is the time worked in excess of regularly scheduled duty hours. To be included in this definition, the additional time must be used to accomplish productive work and cannot be offset by supervisor-authorized compensatory time.

(2) The need for overtime must be thoroughly analyzed and validated during the preliminary phase. Official time

and attendance records are the principal source of information. Where overtime is determined to be a continual requirement, a work center log must be started to provide enough documented data for measurement.

(3) Validated overtime will be included as part of the appropriate work center task times.

2–22. Identifying work center nonavailable time

a. Nonavailable time is generated by work center personnel when they participate in activities directed, recognized, or approved by the Army that render them unavailable for assigned primary duties.

b. The major groupings of nonavailable activities are titled Leave, Medical, Training, Organizational Duties, PCS Related and Orientation, and Miscellaneous.

c. Examples of activities that classify work center personnel as nonavailable are—

(1) General military training.

(2) Any official details such as cleaning and policing grounds.

d. Nonavailable activities, which have been measured Army-wide, are included in the man-hour availability factors. (See fig. 2–3 for a list of categories of nonavailable time.)

(1) As a result, activities that are included in these classifications of nonavailable time are not included in the WCD.

(2) These activities are not measured with any MS–3 measurement method except work sampling. Since work sampling must account for all man-hours expended in a work center, a nonavailable category must be established and sampled. However, the resulting nonavailable time is not included with the man-hours used to construct the work center manpower staffing standard.

2–23. Identifing significant standards of operation

a. In developing a work center description, identify variances in standards of operation that give inappropriate levels of service. Setting up these levels of service is a management prerogative. In a standards study, the study technician is in an ideal position to quantify the manpower costs for various levels. Through this approach, management attention can be directed toward better efficiency, which is reached by modifying the level of service.

b. To improve the identification and costing process, give (in detail) the significant standards of operation that have a potential impact on the manpower requirements. Examples of factors to examine for their impact on work center manpower requirements are minimum response rates, minimum manpower levels, standardized crew complements, safety considerations, equipment turnaround times, length of waiting periods, various task frequencies, levels of backlog, and hours of operation. Analyze these levels of service to find their relationship to man-hour expenditures.

c. Base the selection of appropriate service requirements on joint functional proponent and study team analysis. If available, conduct research into relevant publications to make sure that the selected values conform to applicable policies. If the requirement is not in a specific directive, document the background rationale for inclusion in the measurement plan.

d. For illustrative purposes, think of the following hypothetical situations:

(1) Current installation policy sets up a desired maximum average response time of 5 minutes for a post taxi system (that is, the time between call for service and taxi dispatch). During the preliminary phase of a manpower staffing standards study, the study analyst identifies this specified level and the basis for setting it up. Based on this information, it is relatively easy to find the manpower costs needed in varying the response policy. This information is of value to management in determining if the established maximum average response time is realistic.

(2) Current Army policy sets up a desired error-free rate for posting issues in a supply work center. To reach this goal, the work center instituted a quality review step that caused a lengthening of the processing time for each issue. By structuring the work center description to have a category of "Quality Review," the measurement data can show the man-hours associated with the process. If historical data are available on the error rates experienced before instituting the quality review, then a comparison can be made between the manpower costs of the review process and the number of errors missed without such a review. In this manner, management attention is directed toward the costs of reducing posting errors.

2–24. Planning a method to determine grade and skill requirements

a. During the preliminary phase, address the problem of determining work center grades and skills.

b. After evaluating various alternatives, choose a method for selecting the grade/skill mix that is appropriate to the work center environment. Chapter 4 presents a logical and systematic method.

c. If an alternative method is selected, it must be thoroughly documented in the input instructions for the measurement plan.

2–25. Instructions for preparing work center descriptions

a. Task, subtask, or element titles must be clearly stated in terms that can readily support a work count. The work count is best supported by historical data easily available at all measurement locations. Task, subtask, or element titles are stated in single unit form. This increases the chances of getting accurate unit times and frequencies at time of measurement. Titles that are vague or written in plural form increase the chances for error in the associated frequency of occurrence and unit time values. In turn, subsequent analysis of data becomes more difficult. Examples of acceptable and unacceptable tasks are listed below.

Table 2–2
Acceptable and unacceptable tasks

Acceptable	Unacceptable
Types letter	Type letter
Inspects facility	Perform facility inspections
Attends meeting	Monitor activities
Prepares Report No. A	Prepare reports
Repairs pump	Repair pump
Takes sample	Take samples

b. The work center description shows the work center responsibilities and is prepared for each work center in a manpower staffing standards study. It is also used to show exceptions (additives, exclusions, or deviations) to the work center responsibilities. The WCD is prepared in three sections as follows:

(1) *WCD Summary Direct.* This section contains category and task titles for all direct categories of work within the work center for which it is prepared. This section will be titled "WCD Summary Direct" and will always be section I.

(2) *WCD Detail Direct.* This section expands the WCD Summary Direct, in that the tasks are defined at the lowest level for which the WCD was prepared. This section will be titled "WCD Detail Direct" and will always be section II.

(3) *WCD Detail Indirect.* This section identifies all of the standard indirect categories at the detail level. It will be titled "WCD Detail Indirect" and will always be section III. However, when there is more than one work center, the "WCD Detail Indirect" will be placed after the last WCD. The placement will be cited in each section III.

c. Use the following detailed procedures in completing the WCD:

(1) Use standard size 8 1/2– by 11–inch bond paper. Continue on additional sheets as necessary. When local reproduction capabilities exist, image reduction of the WCD is authorized.

(2) Identify each page by centering the work center title and the Army Functional Dictionary code at the top of the page.

(3) Type definitions single-spaced, but double-spaced between categories, tasks, subtasks, elements and subelements. (When preparing manuscripts for publishing, double-space the entire description.)

(4) If more than one work center description is being prepared for enclosure in the same study development plan, capitalize and center the words "WORK CENTER DESCRIPTION" on the first page. Two lines below these words, center the work center's title and then center the AFD (SWC) code two lines below this.

(5) The number of categories depends on the scope and diversity of the work center responsibilities. Make sure that the category and task titles match between sections I and II, such as category 1 of section I will be the same as category 1 of section II and the first task under category 1, section II will be the same as the first task listed for category 1, section I.

(6) Use a noun (or noun form) or an adjective and noun (or noun form) for category titles, for example, Management, Minor Maintenance, Office Classification, or Record Processing. Use descriptive and easily identifiable titles.

(7) Group tasks under appropriate categories, subtasks under appropriate tasks, and elements under appropriate subtasks. Rarely is it necessary to go to the subelement level. Use a singular action verb followed by a single noun to describe task level and below titles, for example, repairs pump. Follow this verb-noun tense convention in any narrative descriptions that follow the title.

(8) Number categories consecutively within the sections and precede each entry of the indirect categories with the letter "I."

(9) Omit nonproductive categories, such as personal, fatigue, unavoidable delay, and standby.

(10) At section beginnings, capitalize titles and omit all underlines.

(11) Capitalize all category titles.

(12) Use periods after titles.

(13) Omit superfluous information, such as measurement instructions, excessive verbiage like "includes all productive time to," and vague references. However, completely describe the task or element so that the reader will know what work is included and what is not. For example, the task "REVIEWS TECH MANUAL FOR EDUCATIONAL SOUNDNESS AND GRAMMATICAL ACCURACY" is more accurate than "REVIEWS TECH MANUAL" because it tells the reader that the performer of the task does not have the responsibility to review the tech manual for technical accuracy or conformance to doctrine.

(14) The first time an acronym or abbreviation is used in a document, enter the words the acronym or abbreviation is to represent and follow the words with the acronym or abbreviation in parentheses.

(15) Do not use the same word to define work center description (WCD) task, subtask, or element titles.

d. Examples of WCDs and their preparation are shown in figures 2–4 and 2–5.

(1) Use the format shown in figure 2–4 for all basic WCDs.

(2) Use the format shown in figure 2–5 for a WCD when prepared for exceptions.

Work Center Title
AFD (SWC) Code

Section I
WCD Summary Direct

1. Category title. *(Task titles)*

2. Category title. *(Task titles)*

Section II
WCD Detail Direct

1. Category title.

1.1. Task title. *(Description at the task level).*

1.2. Task title.

1.2.1. Subtask title. *(Description at the subtask level.)*

1.2.2. Subtask title.

1.2.2.1. Element title. *(Description at the element level.)*

1.2.2.2. Element title. *(Description at the element level.)*

1.2.2.2.1. Subelemental title. *(Subelement level descripiton.)*

1.2.2.2.2. Subelemental title. *(Subelemental level description.)*

2. Category title.

2.1 Task title. *(Description at the task level.)*

2.2 Task title. *(Description at the task level).*

Section III
WCD Detail Indirect

List the detail indirect categories here using the same format in section II above. Precede each number by the letter "I."

Figure 2–4. Example work center description

Additive (Subtractive) for Work Center Title
AFD (SWC) Code

For additives that supplement existing work center categories or tasks:

3.A. Category title. *(from basic WCD)*

3.3.A. New task title. *(description)*

4.A. Category title. *(from basic WCD)*

4.3.A. Task title. *(description)*

4.3.1.A. New subtask title. *(description)*

For additives that are independent of existing basic work center categories or tasks:

A1. New Category title. *(description)*

A2. New Category title. *(description)*

A2.1. New Task title. *(description)*

A2.2. New Task title. *(description)*

For subtractives based on exclusions to basic work center categories or tasks:

S1. Category title. *(from basic WCD)*

S1.3.2. Subtask title.

S1.3.2.1. Element title. *(description) (from basic WCD)*

S3. Category title. *(from basic WCD)*

Continue with category titles and task titles for all additives and subtractives until complete.

When both types of additives exist for the same work center and are put on the same WCD, list the supplemental type first, followed by the independent type, as shown.

Figure 2–5. Example work center description (exception)

Section III
Workload Identification

2–26. General

This section shows how to identify work units and potential workload factors. It is very important to have these definitions and sources of work count because events that take place in the computation phase depend on workload data accuracy.

2–27. Identifying work units

a. Study the work center activity structure to identify significant processes and the output products or unit of production for each order of work activity in the work center. This leads to a hierarchical structure of work units, sets the stage for picking potential workload factors, and identifies work units for which standards or production data would be useful in productivity measurement, work planning, and performance evaluation.

b. Where feasible, identify work units for each direct category of the work center description. If measurement is at the task or subtask level, identify work units for each task or subtask. This allows a good look at like-category time variances during the first steps of the computation phase.

c. The items listed below apply to work unit selection. To be of maximum utility, work units should be—

(1) Directly related to the time and effort spent on the associated activity.

(2) Economical and convenient to report and use.

(3) Mutually exclusive, so that no item is counted under more than one work unit.

(4) Open to audit, so that the accuracy of a work count is readily verified through setting up a work count system or through existing internal work measurement programs or management information systems.

(5) Readily understood by those who plan, schedule, and control the work.

(6) Readily identifiable when produced.

(7) Individually standardized in terms of the procedures needed for accomplishment.

d. Each of the above attributes assumes a varying degree of importance, depending on the established or intended use of the work unit. The most important characteristic of a work unit is that it must define a specific amount of work. Vague work unit titles are to be avoided.

2–28. Identifying potential workload factors

a. An ideal workload factor has two significant attributes.

(1) It relates to manpower requirements to the extent that any change in the value of the factor produces a corresponding change in the man-hours needed to do the work.

(2) The value of the factor can be predicted for future time periods to make the standard useful as a programming tool.

b. The relative importance of these two attributes, relatability and predictability, can be debated. But, if a stated manpower requirement is based on a workload factor that does not relate to that requirement, then a standard manpower relationship does not exist. As a result, the predictability and the standard credibility are undermined.

c. The predictability of a factor can usually be learned during the preliminary phase by studying the available program information. Relatability poses a more difficult problem because accurate data for correlation analysis are rarely available this early in the study. For this reason, the best workload factors are normally identified only after the measurement phase. The selection problem is compounded by the relationship that often exists between accuracy and programmability. This general relationship is shown in figure 2–6. With a highly finite, precisely defined unit, there is a high probability of correlation, but the chance of predicting the future workload volume is usually small. As the definition of the unit is broadened, the chance of accurately predicting the future volume increases, but the chances of getting an acceptable degree of correlation goes down. The linear relationships shown in the figure are for illustration purposes only.

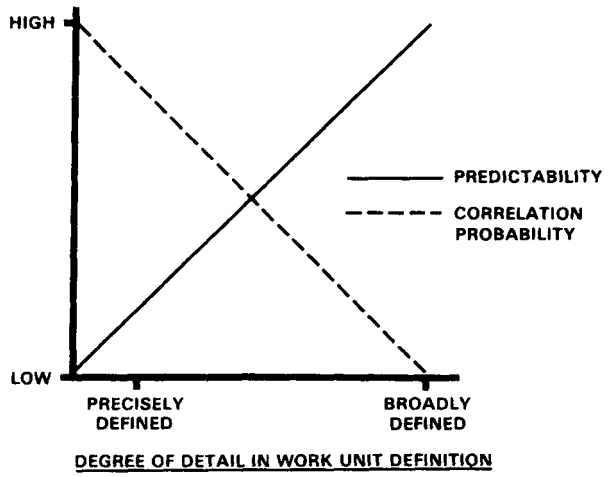


Figure 2–6. General relationship of volume predictability and correlaton probability to work unit detail

d. The problem that goes with determining relationships between work units and man-hours is less severe where there are existing resource management systems, output measurement programs, or management information systems. This information can help study personnel pick potential workload factors.

e. Workload factors should be both accurate and programmable. If a compromise must be made, use the factors that have the highest probability of correlation with the manpower requirement. Factors that are also used for programming are preferred over those that are not. Do not give up accuracy for programmability in setting the basic standard. When it is needed, a separate equation can be built for programming the manpower requirements.

f. Potential workload factors may be identified by the following procedure:

(1) First, identify work generator type factors. (See the definition of workload factor in the glossary.) Typical examples are number of vehicles assigned, monthly flying hours, or military population served. All of these have the advantage of being highly programmable.

(2) Second, refer to work units identified during the analysis of input to the work center (that is, those associated

with categories with the greater man-hour requirement). These are the internal or production-type workload factors, such as an engine overhauled, a vehicle repaired, an item issued, or a form processed.

g. Prepare a list of the potential workload factors identified from the above procedures, listed in the order of development, such as the external or work generator type first. Leave out any that are not readily identified or easily counted and any internal ones that are relatively insignificant. Counts for the rest of the potential workload factors must be collected during the measurement phase. (Also, get counts for all work units needed for category analysis at all measurement locations.)

h. In making the final list of potential workload factors, use terms that give actual experience, not programmed workload. For example, use assigned strength (not authorized strength) for population factors, miles driven (not miles programmed), or munitions stored (not storage capacity). Get actual workload experience for both man-hours and workloads to see if a true relationship exists.

i. The following information must be derived for each workload factor picked through the above process. The format applies to work units as well.

(1) *Title.* Identify briefly what is to be counted. Use singular form—such as "a vehicle repaired"—not "vehicles repaired."

(2) *Definition.* Define the count and tell what is to be kept in or left out from the count, in precise terms. Vague definitions are not good enough. For example, if "population served" is the workload factor, it must be clear whether the count includes tenants, on-post authorizations, off-post assignment, transients, etc. Do not use the WLF title as its definition.

(3) *Source of count.* Identify the source from which the count is to be obtained. This includes the report number and title and column(s) number or title. Because the format of the source may change, include the date or edition of the report where applicable.

(4) *Rationale.* Include reasons for selecting work units or workload factors.

2–29. Identifying existing lower order standards

Existing standards are to be reviewed and used in the manpower staffing standards development process whenever feasible. The formality of documentation of these standards may vary among installations, but it will generally reside in those activities where detailed standards development was performed. All standards with potential relevance to the functional area under study should be evaluated and identified with the appropriate order of activity in the developing WCDs. In some cases, the definition and parameters of an existing standard might suggest a change in the descriptive terminology of the WCD. These changes should be made to ensure compatability of the WCD with existing standards and to enchance the contribution of the existing standards to the manpower staffing standards development process.

2–30. Planning a work count system

a. Make a list of work units and potential workload factors for which a work count is needed. (See chap 4 for WLF selection.)

b. During this phase, find which of those items are adequately reported by existing management reporting or information systems.

(1) Ensure that existing instructions are being followed according to functional directives. Local compliance with reporting instructions is essential if existing systems are to be used.

(2) Ensure that the required items are reported in defined form and for compatible time periods. If the reported information differs only slightly from what is needed, consider working with the functional proponent to decide if it is more economical to change the existing report or redefine the items reported. Do not set up additional systems unless they are essential to standards development.

c. Follow the guidance below to get usable and accurate work counts.

(1) Clearly define a unit of count.

(2) Set up the source of count, or the point in a process at which a unit of count results.

(3) Make sure that the frequency of count reporting is compatible with, or adjustable to, the measurement period's anticipated length. This is especially important if the work sampling method is used.

(4) Set up safeguards that minimize the possibility of a duplicate or missed count. An example is a random external audit of the workload reports.

d. When possible, have the work count procedures call for a minimum of 6 months' historical data. This is in addition to the daily or short-term counts to be made during the measurement period. (If it can be shown that the work center responsibilities did not change in the past year, 12 months of data is better.) This historical information is of value later in the computation phase, when the representativeness of the measurement period is evaluated. However, do not mix data that contain very different modes of operation.

Section IV
Manpower Staffing Standards Study Development Plan (SDP)

2–31. General

a. The study development plan (SDP) is the first of two planning documents prepared during the preliminary phase. The SDP is formulated to address study considerations for all or part of a function, or work center. It focuses on defining the scope and objectives of a proposed study, outlines a plan of action, and identifies associated resource requirements. The SDP serves to—

(1) Provide the framework for the conduct of a manpower staffing standards development study.

(2) Provide study planning information with which to refine initial budgeting and scheduling estimates for follow-on standards development efforts.

b. The thoroughness of the preliminary research and analysis and the accuracy of resource estimates will affect the realistic attainment of the standards development schedules. The development team should include in the plan all relevant information and appraisals of its effect. The more complete the study development plan the easier should be the balance of the preliminary phase.

2–32. Composition and functional analysis

a. Composition. The SDP can be prepared only after considerable research and analysis. The lead team should visit several installations within each command involved in the study to gather data for developing an SDP. Ultimately, the results of the research will become part of the measurement plan. As a minimum, the research necessary to provide the basic information for the SDP should address the following:

(1) Has a UIC listing been prepared to show who performs the function? Which commands are involved and who are the Command functional proponents?

(2) What does the mission, function, or work center consist of?

(3) What generates the workload and what is produced?

(4) How standardized is the function? How significantly will a forthcoming reorganization or procedural and equipment change affect the function?

(5) What measurement approach should be used? How extensively can Army common or other command unique manpower staffing standard(s) or those of other services be used?

(6) What significant standard of operation, policy, or procedural issues must be addressed before completion of the preliminary analysis?

(7) What major areas for potential management improvements should be addressed prior to standards development? All decisions regarding major areas for potential management improvements must be made prior to the measurement phase of the MS–3 study to ensure consistency of input data.

(8) What resources are required to complete each phase of the follow-on standards development effort?

(9) What are the estimates of potential work units, per accomplishment times, and frequencies?

b. Functional analysis. Major emphasis during the preliminary analysis is understanding WHAT functions are to be measured and WHO performs these functions. The process by which the necessary information is obtained will generally vary by function, and precludes a standardized step-by-step study process. However, close consultation with functional proponents at local, MACOM, and DA levels conducting on-site visits to representative field activities, and analysis of available manpower and workload information, to include work breakdown structure, flow process, PERT chart, and input-out analysis, will provide most of the basic information with which to formulate the SDP.

2–33. Format

The SDP is prepared in five parts. The following format may be varied to meet the needs of a particular study:

a. Cover

b. Table of contents

c. Part I—Introduction

d. Part II—Mission and Organization

e. Part III—Functional Diagram

f. Part IV—Universe Identification

g. Part V—Standards Development Planning

2–34. Preparation instructions

a. Cover. Using the format in figure 2–7 as a guide, provide on the cover the type of report, "MANPOWER STAFFING STANDARDS STUDY DEVELOPMENT PLAN (SDP)," the scope of the report, "ARMY COMMON STANDARD" or "COMMAND UNIQUE STANDARD," and the title of the function or the major subfunction under study. (The study must address only one major functional area.) List the work center titles and the respective Army Functional Dictionary (standard work codes) (AFD(SWC)) codes covered by the report. AFD (SWC) titles and codes

are contained in DA Pam 570–5. Show the Proponent Command, preparing activity, and the dispatch date in the lower right hand corner.

b. Pagination. Number page consecutively within each part as follows: Part I, 1–1, 1–2, and 1–3; Part II, 2–1, 2–2, 2–3, … and so forth. If required, include in the SDP the appropriate security classification with pages marked accordingly.

c. Table of contents. Number consecutively and list in the table of contents all five parts of the SDP. Number consecutively all required paragraphs discussed in each part, for example: Part I, Overview 1–1, Background 1–2, Applicability 1–3,… and so forth.

MANPOWER STAFFING STANDARDS STUDY DEVELOPMENT PLAN (SDP)

for

CIVILIAN PERSONNEL
ARMY COMMON STANDARDS

Work center title	AFD (SWC) code
Office of the Chief	RDC
Technical Services	RBA
Position and Pay Management	RBB
Recruitment and Placement	RBC
Labor/Management-Employee Relations	RCB
Training and Development	RDA

TRADOC
Ft Monroe
21 June 1988

Figure 2–7. Example of an SDP cover

d. Part I—Introduction. Include in the introduction, as a minimum, the following:

(1) *Overview.* State the function or major subfunction under study and the principal functional responsibilities. List the work center(s) under study. Indicate if the function is being studied in its entirety, or if the function is being studied in parts requiring more than one study. Provide a brief explanation of the study indicating that the SDP will be followed by the measurement plan, measurement report, and final report. State the total baseline requirements under study. State the total projected personnel and travel costs of the study and indicate whether the projected study costs agree with the master schedule projected study costs. Indicate any staffing guides that will be replaced by the standard. State the Proponent Command responsible for the study and identify the authority (i.e., AR 570–5 and/or tasking memorandum) for conducting the study.

(2) *Background.* State if there have been any previous MS–3 studies or any standards developed by other DOD activities for the work center(s) included in this study. Indicate other reports (e.g., manpower survey, CA, ER, or IG report) which were reviewed in developing the SDP. Also, indicate whether a MARC study has been conducted on similar MTOE work centers. If these studies have an impact on the standard(s) being developed, include comments addressing the impact in Part V of the SDP.

(3) *Applicability.* Identify the study scope (Army common or command unique) as well as the agencies and commands, by UIC, which are covered by the study.

(4) *Study participants.* Identify the following study participants:

(a) Proponent Command.

(b) HQDA Functional Proponent(s).

(c) Command Functional Proponent(s).

(d) USAMARDA point(s) of contact (POC).

(e) Lead team members.

(f) Measurement teams (by command).

e. Part II—Mission and Organization.

(1) *Mission.* Provide an overview of the mission and functional responsibilities.

(2) *Organizational charts.* An organizational chart(s) indicating the typical organizational structure(s) must be included. The organizational charts should reflect one level above and two levels below the work center(s) being studied, if applicable.

(3) *Organizational structure.* Address the appropriateness of the present organizational structure(s) and provide the rationale for restructuring, if necessary. Address the applicability of AR 5–3.

f. Part III—Functional Diagram. Submit a diagram demonstrating the relationship and hierarchies of the work center or function covered by a staffing standard, if the relationship and hierarchies differ from existing organizational charts. Identify all work centers with approved Army Functional Dictionary titles and codes. Indicate work centers under study.

g. Part IV—Universe Identification.

(1) *Matrix.* Provide a matrix showing work center TDA requirements and authorizations by location, command, UIC, and TDA EDATE. Identify measurement locations. This constitutes the baseline data which will be reported in the MEAS–PLAN and FIN–REP.

(2) *Site(s) visited.* List and provide the rationale for the sites visited during the development of the SDP.

(3) *Measurement location selection.* Show the number of measurement locations by MACOM and show that the number of measurement locations is consistent with the number specified in table 2–1 for total work centers for each standard under study.

h. Part V—Standards Development Planning. Provide the following for each work center under study:

(1) Work center title, AFD(SWC) code, and direct categories of work. (The titles and AFD(SWC) codes should agree with the functional diagram and the direct categories of work should agree with the definition(s) in the AFD. If necessary, update the AFD.)

(2) Type of standard to be developed and rationale. Address the measurement approach(es) and overall study approach. When there is more than one standard being developed for a single work center (i.e., single and multi-location standards), indicate the type of standard for each and provide the rationale.

(3) Proposed measurement approaches and justification. Cite all such measurement approaches in the SDP memorandum of transmittal and SDP.

(4) Statement of conditions (SOC).

(5) Workload reporting and performance measurement information systems which are likely to be a prime source of data.

(6) Potential workload factors (PWLF), work units (WU), sources of count and an indication of reliability/uniformity of counts throughout the universe.

(7) Policy, procedural or organizational issues of concern, equipment variances, and potential data reporting problems. Examples include situations—

(a) Where the organizational charts do not line up with the functional diagrams.

(b) Where word processing centers are used at only some locations.

(c) Where results of CA or ER studies impact on the standards.

(8) Efficiencies identified in the preliminary phase and discussion of how they will be addressed during measurement.

(9) Gantt chart, indicating the study phases and appropriate review periods. (The Gantt chart must agree with the approved study schedule.)

(10) Direct labor and support costs. Provide total personnel and travel costs for the study to date on DA Form 5276–R, Program Management Data. DA Form 5276–R will be locally reproduced on 8½ by 11 inch paper. A copy for local reproduction is located at the back of this regulation. Instructions for completing this form are found in appendix E. Update the master schedule to include actual direct labor used to date.

2–35. Staffing of the SDP

a. Submission for review.

(1) The lead team will forward four copies of each SDP to Commander, USAMARDA (PEMS–RA), who will provide a copy to the HQDA functional proponent. The memorandum of transmittal to USAMARDA will—

(a) Contain a summary of policy or procedural issues that require resolution before completing the preliminary phase. Examples of such issues are variances with Army directed organizational structures, unique measurement techniques or significant variations to approved techniques.

(b) Contain as an enclosure a completed SDP review list, appendix F, with rationale for all "No" responses.

(2) The lead team will forward two copies of the SDP to all participating command MS–3 managers. The MS–3

managers will forward one copy of the SDP to their functional proponent(s). Comments and recommendations requested from both the MS–3 managers and functional proponent(s) will be provided to the lead team.

b. Review process and objectives. The principal objectives of the review are to—

(1) Determine the suitability of the function for a standards development effort, its cost effectiveness, and the relative priority status.

(2) Ensure that the study scope and objectives are consistent with other planned standards development efforts, that the associated functional language is adequately defined, and that all known organizational, procedural, and significant equipment changes are being considered.

c. Results. The results of the review are provided by USAMARDA, participating command MS–3 managers, and the proponent command functional proponent to the lead team within 3 weeks of receiving the plan. It is anticipated that the preliminary phase analysis will continue during the SDP review period; consequently, significant findings affecting the conduct of the preliminary phase should be communicated to the study teams as early as possible.

Section V
Manpower Staffing Standards Study Measurement Plan (MEAS–PLAN)

2–36. General

This section prescribes procedures for developing the measurement plan (MEAS–PLAN), the second of the two planning documents. Preparing the MEAS–PLAN is the final act of the lead team's preliminary phase activities. The quality and design of the plan are determined by the manner in which it addresses the truly essential elements of the study—WHAT is to be measured and HOW is it to be measured.

2–37. Composition and format

a. Composition. After receipt of SDP review comments, the lead team develops the draft MEAS–PLAN. Final measurement instructions are based on the SDP review comments. To ensure quality standards, these instructions must meet the requirements of the selected measurement methods.

b. Format. The following format applies to all studies.

(1) Cover.

(2) Table of contents.

(3) Part I—Introduction,

(4) Part II—Work Centers.

(5) Part III—Bibliography and Glossary.

(6) Part IV—Measurement Instructions.

(7) Part V—Direct Labor and Support Costs.

2–38. Preparation Instructions

a. Cover. Use figure 2–8 as a guide. Indicate on the cover the type of report "MANPOWER STAFFING STANDARDS STUDY MEASUREMENT PLAN (MEAS–PLAN)" and the scope of the plan "ARMY COMMON STANDARD" or "COMMAND UNIQUE STANDARD." Address only one major functional area and indicate the title of the function or the major subfunction covered by the report. List the work center titles and the respective AFD(SWC) codes covered by the report. The Proponent Command, preparing activity, and dispatch date must appear in the lower right comer.

MANPOWER STAFFING STANDARDS STUDY MEASUREMENT PLAN (MEAS-PLAN)

for

U.S. ARMY RECEPTION STATIONS COMMAND STANDARD

Work center title	AFD(SWC) code
Receptive Processing	PVA
Receptor Control	PVB
Reception Station Support Services	PVC
Reception Station Management Staff	PVD

TRADOC
Ft Knox
16 September 1985

Figure 2–8. Example of a MEAS–PLAN cover

b. Pagination. Number each page consecutively within each part as follows: Part I, 1–1, 1–2, and 1–3,…; Part II, 2–1, 2–2, 2–3,…and so forth. If required, include the appropriate security classification with pages marked accordingly.

c. Table of contents. Identify and number consecutively each part of the MEAS–PLAN. Number consecutively all required paragraphs discussed in each part, for example: Part I, Overview 1–1, Background 1–2, Applicability 1–3,…and so forth.

d. Part I—Introduction. Include in the introduction, as a minimum, the following:

(1) *Overview.* State the function or major subfunction under study and the principal functional responsibilities. The total requirements being studied, and projected personnel and travel cost, must be addressed. State the work center(s) under study, indicate if the function is being studied in its entirety, or if the function is being studied in parts requiring more than one study. Provide a brief explanation of the study indicating that the MEAS–PLAN was preceded by the SDP and will be followed by the Final Report (FIN–REP). Identify the Proponent Command responsible for the study and identify the authority (i.e., AR 570–5 and/or tasking memorandum) for conducting the study. State that the SDP was reviewed by USAMARDA, the HQDA functional proponent, and all Participating Command's MS–3 elements and functional proponents. If resolutions were required as a result of the SDP review, discuss these in detail in the applicable section of the MEAS–PLAN. State whether and which staffing guides will be replaced by the standard.

(2) *Background.* Indicate if there have been any previous MS–3 studies or any standards developed by other DOD activities for the work center(s) included in this study. Indicate other reports (e.g., manpower survey, CA, ER, or IG report) which were used.

(3) *Applicability.* Identify the scope (Army common or command standard) of the study, as well as the commands and independent reporting agencies covered by the study.

(4) *Universe identification.* Provide a matrix showing work center TDA requirements and authorizations by location, UIC, and command. Identify the measurement locations. State whether or not changes were made to the SDP functional matrix and provide rationale for any change. The number of measurement locations identified must comply with the minimum number specified in table 2–1. Provide the rationale for their selection. Also, provide a list of the locations performing the function where the standard is not expected to apply and the supporting rationale for why the standard does not apply.

(5) *Mission and organization.* Provide an overview of the mission and functional responsibilities. Provide organizational chart(s) indicating the typical organizational structure(s). Indicate whether or not changes were made to the SDP organizational chart(s) and provide rationale for all changes. Include on the organizational chart(s) approved AFD(SWC) codes for each work center being measured If applicable, include a proposed organizational chart

indicating recommended change(s). Identify work centers which do not correspond to organizational elements on a one-to-one basis and include a discussion in Part V.

(6) *Functional diagram.* Provide a functional diagram of the entire function or major subfunction with a breakout by work center. Identify on this diagram all work centers with approved AFD(SWC) titles and codes. Identify work centers under study and state whether or not changes were made to the SDP functional diagram; provide rationale for any change.

(7) *Study participants.* Identify the following study participants:

(a) Proponent Command.

(b) HQDA Functional Proponent(s).

(c) Command Functional Proponent(s).

(d) USAMARDA point(s) of contact (POC).

(e) Lead team members.

(f) Measurement teams, by command.

(g) Participating commands.

e. Part II—Work Centers. Include a separate section with the following items for each work center:

(1) *Work center description.* Prepare the work center description as previously stated in this chapter and make it the first item in each work center section. The WCD title and AFD(SWC) codes must appear centered at the top of each subsequent page of the WCD.

(2) *Work center comments.* Address, as a minimum, the following items:

(a) Statement of conditions (SOC). Describe the normal work situation on which the study is based. Describe the standard of living for the work center(s). Identify the hours of operation and shift requirements for the work center(s) under study. State whether or not changes were made to the SDP SOC, and provide the rationale for any change. Describe such things as: response times, types and conditions of facilities, equipment types and age, availability of spare parts, climatic conditions, travel distances, seasonal workload, and any other condition having an impact on the work center(s) under study.

(b) Potential workload factors (PWLF). List external PWLFs first and internal PWLFs second. State titles in singular form. Each PWLF definition must be clear, concise, and mutually exclusive. Each PWLF source of count must be clearly defined and specifically collectible. Provide a matrix showing which PWLF relates to which specific direct category of work.

(c) Work units. State each work unit title in singular form. Each work unit must be clearly defined, concise, and mutually exclusive. Each work unit source of count must be clearly defined and specifically collectible. Provide a matrix showing which work unit relates to which specific task or category.

(d) Proposed measurement approach. State the measurement method(s) to be used during the study. If a method not discussed in AR 570–5 is to be used, obtain approval from USAMARDA. Identify any minimum manpower or standby requirements and provide rationale. If an internal production or man-hour accounting system(s) is to be used, provide the description and rationale. Discuss potential problem areas concerning policy, procedural, or organizational issues of concern, equipment variances and data reporting problems (e.g., those identified in Part V of the SDP and Part I of the MEAS–PLAN) and present possible solutions.

1. If time study is used, discuss the number of samples required and PF&D allowance factor development.

2. If work sampling is used, discuss the specific sampling period, number of samples required, and PF&D allowance factor development.

3. If operational audit is used, discuss expected frequencies of occurrence and per accomplishment time ranges (e.g., civilian time card frequency is 26/yr not 2/mo; and the per accomplishment time should reflect approximately 3 to 4 minutes per civilian employee assigned).

4. If "good operator" is used, identify tasks, subtasks, or elements and discuss PF&D allowance factor development.

5. Include instructions requiring an explanation when the per accomplishment time is extraordinarily high.

(e) Proposed grade and skill determination. Provide instructions requiring military grade and skill and civilian skill recommendations when appropriate. Include instructions requiring the rational for the measurement team grade and skill recommendation.

(f) Required and authorized strength. Provide a matrix form for the measurement teams to portray the required and authorized strength data by position title, MOS/series, and grade for each measurement site at the time of measurement.

(g) Miscellaneous. As a minimum, identify the following data as acquired during the preliminary phase of the study:

1. Locations with host-tenant support agreements that will impact manpower requirements.

2. Locations having contract services that will impact manpower requirements.

3. Locations which had aviator requirements at the time the study began.

(h) Changes. State whether changes have been made to the categories of work since the publication of the SDP.

f. Part III—Bibliography and Glossary. List only direct mission publications used for functional familiarization. List in the glossary only essential terms and definitions not normally listed in other Army publications, but include all abbreviations.

g. Part IV—Measurement Instructions. This part of the MEAS–PLAN has detailed instructions for work measurement and data collection procedures. It also contains the instructions for reporting the data to the lead team. These reporting instructions must be clear and concise, leaving no basis for misinterpretation, and limited to the essential items. Measurement procedures in this regulation may be supplemented, but not repeated. Include in the measurement instructions, as a minimum, the following:

(1) Identify the specific measurement period.

(2) Address the treatment of inferred or assumed workload.

(3) Address the treatment of locally directed requirements and/or standby time.

(4) Include provisions for documenting backlog workload.

(5) Include provisions for addressing either documented or undocumented overtime.

(6) Prepare sample workload data forms with categories and tasks of work for distribution to input teams.

(7) Provide instructions for the collection of PWLF and work unit counts. Provide sample matrices to the input teams under separate cover.

(8) Provide instructions for developing the skill and grade recommendation. Provide sample matrices to the input teams under separate cover.

(9) Provide specific instructions to ensure that, for each work center studied, all documents and explanations needed for analysis by the lead team are included in the MEAS–REP. For each work center, consolidate these data, including—

(a) DA Form 5274–R, Standard Input Data Computation, Include fixed, variable, and personnel generated breakouts for single point standards.

(b) Submit DA Form 5278–R, Work Sampling Record, for work sampling.

(c) Submit DA Form 5275–R, Time Study Record, DD Forms 2042, Work Measurement Time Study Worksheet, 2042–1, Work Measurement Time Study Worksheet (Continuous Method), or 2043, Work Measurement Project Non-Repetitive Time Study, for time study data. These forms will be locally reproduced on 8 ½ by 11 inch paper. Copies for local reproduction purposes are located at the back of this regulation. If asked for, work sampling data collection and recapitulation sheets as a separate package.

(d) Submit DA Form 5277–R, Operation Audit Data, for operational audit. DA Form 5277–R will be locally reproduced on 8½ by 11 inch paper. A copy for local reproduction purposes is located at the back of this regulation.

(10) Provide instructions for productivity control charts, workload factor control charts, and man-hour shift profile charts, as appropriate.

(11) Provide instructions for collection of assigned strength data by position title, MOS/series, and grade for the measurement period.

(12) Provide instructions for collection of the following:

(a) Work center description variations.

(b) Deviations from MEAS–PLAN organizational charts.

(c) Deviations or clarifications of the statement of conditions included in the MEAS–PLAN.

1. A list of any authorized and assigned equipment changes since the SDP. Limit this to major items that influence quantity or quality of work.

2. Flow charts, layout diagrams, maps, or other pertinent graphic media that aid in looking at the impact of such things as distances between work areas and work flow.

3. A description of conditions such as type of facility, transportation problems, and climate.

(d) Deviations from MEAS–PLAN PF&D allowances.

(e) Deviations from joint tenancy support given under cross service or other servicing agreements as discussed in the MEAS–PLAN.

(13) Provide instructions outlining what measurement data computations and adjustments must be made by the input team.

(14) Include a request for a memorandum of concurrence/nonconcurrence from the functional proponent at the measurement location.

(15) Include guidance concerning the inclusion of contract services.

h. Part V—Direct Labor and Travel Costs. Provide total personnel costs and temporary duty costs, showing the costs of the study since submission of the SDP up to and including submission of the MEAS–PLAN. Use a DA Form 5276–R for submission of this information. Update the master schedule to include actual direct labor used to date.

2–39. Staffing of the MEAS–PLAN

a. The load team will send one copy of the draft MEAS–PLAN to their command functional proponent and two copies to all participating command MS–3 managers. The MS–3 managers will then forward one copy of the draft MEAS–PLAN to their command functional proponents. Both the MS–3 managers and the functional proponents will review the draft MEAS–PLAN.

b. Command MS–3 managers will forward the result of this review to the lead team.

c. Required changes will be made to the draft MEAS–PLAN before it is forwarded to USAMARDA for final review.

2–40. Review of the final MEAS–PLAN

a. The lead team will send four copies of the final MEAS–PLAN through the supervising MACOM to Commander, USAMARDA (PEMS–RA). The memorandum of transmittal will contain—

(1) As an enclosure, the command functional proponent memorandum of concurrence/nonconcurrence.

(2) A discussion addressing all issues of nonconcurrence.

(3) A summary of policy or procedural issues that require resolution before beginning the measurement phase. Examples of such issues are variances with Army directed organizational structures, unique measurement techniques, or significant variances to approved techniques proposed by the SDP.

(4) As an enclosure, a completed MEAS–PLAN review list, appendix G, with the rationale for all "No" responses.

b. Commander, USAMARDA and the HQDA functional proponent will review the final MEAS–PLAN to make sure that—

(1) Basic work center descriptions and task definitions are portrayed correctly and are grammatically accurate.

(2) Potential workload factors and work units are appropriate.

(3) Identified command additives and exclusions are valid.

c. Commander, USAMARDA will forward the results of this review to the lead team within 45 days of receiving the final MEAS–PLAN. Commander, USAMARDA may give tentative approval of the final MEAS–PLAN, depending on the nature of the required changes.

d. After approval and prior to measurement, the lead team will forward four copies of the approved MEAS–PLAN to each input team.

2–41. Testing the MEAS–PLAN

The lead team will select sample locations for testing the MEAS–PLAN. Work measurement will be performed at the sample locations concurrent with the review of the MEAS–PLAN by the Commander, USAMARDA and the HQDA functional proponent(s). The lead team will document any changes or additions to measurement instructions as a result of the test measurement.

2–42. Revising the MEAS–PLAN

The lead team will include in the MEAS–PLAN the comments or recommendations made by the HQDA functional proponent(s), as well as necessary changes that were found during the sample measurement.

2–43. Approving the MEAS–PLAN

The lead team will submit the revised MEAS–PLAN to USAMARDA for final review and approval.

2–44. Distribution

The lead team will distribute the approved MEAS–PLAN as follows.

a. Four copies to USAMARDA.

b. Four copies to each measurement team.

c. Two copies to each participating command.

2–45. Coordination

Measurement team chiefs will review the MEAS–PLAN prior to work measurement. This will ensure a thorough understanding of all data requirements, measurement instructions, and the work center description.

Chapter 3
The Measurement Phase

Section I
Measurement Phase Data Collection

3–1. General

Work measurement, using any method or technique, provides the productive man-hours needed to build a product or give a service. This section gives an overview of the measurement methods and techniques that MS–3 commonly uses. Some of the general policies and procedures needed to collect man-hour and workload data per the MEAS–PLAN are given in this section.

3–2. Overview of data collection methods

Time study, work sampling, and operational audits are the main measurement methods used to obtain the man-hours for manpower staffing standards development.

a. It is seldom possible to get an accurate and representative measurement of all work center activities with a single measurement method. For example, the exclusive use of work sampling may be precluded by certain tasks not taking place during the measurement period or by abnormal times for those tasks that do take place. It is then necessary to support the work sampling results. An operational audit is used for support of these tasks that were not done.

b. For work that is done on a less frequent schedule, it may also be necessary to modify or adjust the man-hours measured during the sampling period. General discussions of measurement techniques are given in later sections of chapter 3.

3–3. Coordinating input data with the functional manager

There must be close coordination between the measurement team and the functional manager in the measurement phase. Through this coordination the functional manager has the chance to provide additional study information. This coordination also simplifies agreement on the contents of the MEAS–REP. Finally, it gives the functional manager a chance to study the input data for potential local management use.

3–4. Familiarizing personnel with the study

a. The analyst must know the work center responsibilities and environment.

(1) Regardless of the measurement method that may be used, the analyst must have an understanding of the work center mission and the responsibilities of assigned individuals.

(2) If considerable time has passed since the preliminary phase, items such as organizational structure, mission requirements, and directives need to be checked again.

(3) To do an accurate measurement there are other factors to consider. Examples are: backlog, work cycles, historical production, flow of work, and work center layout.

(4) It is wise to conduct trial or practice sampling, depending on the measurement method to be used in the study. Practice sampling helps the analyst learn about the work center.

b. Brief the work center supervisor and the workers on the measurement methods and techniques. Avoid briefings and illustrations with technical terms. Explain the principles of work measurement in simple terms.

(1) Cite some everyday examples of situations similar in principle to work sampling; for example, taking blood samples or testing antifreeze in a car radiator.

(2) The purpose for collecting the various work unit counts must also be explained.

(3) Put in the premeasurement briefing an explanation of how the data are to be used in developing manpower staffing standards.

(4) Be sure and remind work center personnel that the data do not show current or projected manpower requirements for the work center.

(5) The information given and the manner in which it is given greatly influence work center personnel opinions and attitudes that could affect the study results.

3–5. Establishing a work count system

Work count systems were discussed in chapter 2 as the means to collect historical data. It is also necessary to start a work count system for the rest of the measurement period.

a. The specific system depends on the type of measurement that is being used. The total work units produced and the corresponding monthly man-hours are used as one data point in the regression analysis process.

b. Studying the measurement period work count, and the historical work counts previously documented, helps to find whether or not the study period is representative.

c. Use a production report if it is available. However, make periodic checks to make sure that it is accurate. The period of the production report must be the same as the study period.

d. If it is decided that a daily work count system must be set up, then the analyst must make sure that the work center personnel know the definition of the completed work unit. This is necessary for proper counting. It ensures accurate collection of the data if the method used to get the data is watched.

3–6. Using existing standards and workload data

When valid standards and/or associated workload data exist, they will be used in place of remeasurement of those work units. The measurement plan will reflect those standards and data that were identified during the preliminary phase. Additional standards and data encountered during the measurement phase will be used in the development of manpower staffing standards input data. In these instances, the measurement report will identify the additional work units and the source of the data.

Section II
Pace Ratings

3–7. General

a. Standard studies use the conventional pace rating process to estimate the pace at which work is performed. The level of performance of work is limited to observed activity when using work sampling, time study, or the good operator technique of the operational audit method (see the glossary). Time values obtained from the directed requirement, historical experience, or technical estimate techniques are not pace-rated since they do not involve direct observation of the work. Pace rating is often referred to as *leveling*, and the average pace rating value as the *average leveling factor*. It is not possible or feasible to pace-rate some productive activities such as reading and receiving instructions telephone calls. When an entire productive category consists of activities that cannot be rated, no leveling factor is included in the computations for leveled time.

b. The actual use of pace rating in any study must be based on analyst proficiency. It is each team chief's responsibility to ensure the proficiency of all analysts who use pace rating. Periodic training is needed. If analysts are not skilled in pace rating, assume the work observed is done at the normal pace. Neither teams nor commands should set up ranges for average leveling factors because this negates the value of leveling.

c. The number of performance ratings needed varies with the work measurement method used.

(1) *Time study.* Rate each timed element.

(2) *Work sampling.* Rate a minimum of 25 percent of the observations of each worker.

(3) *Operational audit (good operator).* Rate each timed cycle.

3–8. The pace rating system

In the pace rating system, the analyst compares the observed pace, or speed, of work performance to a predetermined value of normal pace. This considers how difficult it is to do each task, then mentally adjusts to allow for inherent job difficulties. Unity (1.00) is used as the numerical value for normal pace, and all ratings are given a value that relates to it. For example, the analyst may give a rating of .95 to a certain observation. This rating, given with a sample, shows that at the time observed the worker was working at a speed 5 percent slower than normal for the activity observed. If the worker was rated 1.05, performance was 5 percent faster than normal. Pace rating should be performed as a part of the sampling observation, not as a separate operation.

3–9. Computing an average pace rating

Work measurement studies that use pace rating usually result in a number of separate ratings. At the end of the study, the average of these ratings is computed and is called the leveling factor. This is then used to determine leveled time. In the simplified example below, the computation of an average rating factor from six separate pace rating values is shown.

Average Pace Rating Computation

Rating No.	Pace Rating (R)
1	.95
2	.90
3	.95
4	1.05
5	.90
6	.95
	$\Sigma R = 5.70$

$$\text{Average Pace Rating } (\bar{R} \text{ or LF}) = \frac{\Sigma R}{N}$$

$$\bar{R} \text{ or LF} = \frac{5.70}{6} = .95$$

Figure 3–1A. Average Pace Rating Computation

3–10. Rater proficiency

Training to help analysts gain a "mental image" of normal and to rate in a consistent manner is a never ending job. The MS–3 analyst needs to have many images of normal, since he or she must study a wide variety of jobs. This makes the need for training greater and the training harder. While it is just about impossible to give the rater every possible "norm" that he or she may come upon, there are some point-of-departure norms that can be used. The following are suggested for this purpose:

a. Deal 52 playing cards in four piles in .50 minutes. To deal the cards, hold the deck in the left hand and, with the thumb, take off and move the top card each time. With the right hand, grasp the prepositioned corner of the top card between the thumb and first finger, carry it to the right pile, release it, and bring the hand back to the pack. Form the four piles in front of the dealer and the other three corners of a 1–foot square. This training method needs at least three people: the trainee, the card dealer, and a person with a stopwatch. The dealer deals the cards, the person with the stopwatch times the operation, and the trainee rates the operation. The true rating is found by dividing the known normal time (.50 minutes) by the stopwatch time as shown below. Comparing the true rating with the ratings given by the trainee is a good way to show where the trainee is rating in relation to the actual pace of the dealer.

$$\frac{\text{Normal time}}{\text{Stopwatch time}} = \frac{0.50}{0.40} = 1.25 \text{ (125 percent)}$$

b. A film is available which shows a man walking 3 miles an hour, taking 27–inch steps. Analysis of this film and the accompanying explanation is very helpful in setting up a good point of reference for normal pace.

c. For recording and analyzing analyst training, DD Form 2041 (Rating Comparison Worksheet) is used. An DD Form 2041 will be locally reproduced on 8½ by 11 inch paper. A copy for local reproduction can be found at the back of this regulation.

Section III
Personal, Fatigue, and Delay (PF&D) Allowances

3–11. General

a. Personal, fatigue, and delay time is the time allowed a worker to take care of personal needs, for fatigue, and for delay that takes place due to conditions that are not under the worker's control. This time is additive to the leveled time needed to do a job. This allowance is computed when certain measurement techniques are used.

b. Past ways to compute PF&D have resulted in varied interpretations of the factors being considered and of the techniques used to establish them.

(1) Variances in applying the techniques go from an allowance for each element in a standard to adopting a fixed or blanket allowance for all standards in an organization or activity. As a result, standards for identical work are not the same; they give different measurement criteria for identical jobs or functions as well as data that cannot be compared at the summary levels.

(2) The guidelines for developing allowances given here are accepted and set up as the standardized method. They have been widely used for some time throughout DOD.

c. Where appropriate, a fixed PF&D allowance based on the standardized method may be developed for a specific function or for groups of personnel doing similar work under similar conditions. The fixed allowance could apply to all standards in the function or group and precludes the need to individually compute the allowance for each standard. In work situations where the guidelines do not apply, the fixed allowance is developed through work measurement techniques such as time study or work sampling. Specific rules for applying allowances vary with the measurement method and, to a lesser extent, with the particular activity or category involved. Rules for application, by method are—

(1) *Time study.* Allowances are always applied to the separate tasks being timed.

(2) *Work sampling.* Allowances are applied to all appropriate productive categories. Some categories, because of the activities, may be given a higher or lower allowance factor than other productive categories in the same study. When this takes place, explain the special allowances.

(3) *Operational audit.*

(a) Allowances are not computed for man-hours developed as the equivalent of whole-man directed requirements.

(b) If the good operator technique is used, allowances are applied to the observed time values before they are recorded as "per accomplishment time."

(c) Historical performance and technical estimate time values usually are the result of man-hour accounting systems or developed data. They either do not separate personal and fatigue time from productive time or make accurate

identification of such values impossible. The time values that come from using either of these two techniques are considered to include PF&D time. PF&D allowances are not added when these techniques are used.

3–12. Conditions to consider

Developing and applying PF&D allowances require the analyst to look at and consider the various conditions under which the job is done. To make sure that all conditions are thought of, separate factors are given for each of the three areas: personal, fatigue, and delay. Analysts must be completely objective in setting up the allowances which correctly show the true situations that are in the job.

a. Allowances for personal time. Think of the surroundings, working conditions, and job requirements which cause the employee to stop work from time to time to take care of necessary personal needs (for example, go to the restroom, get a drink of water, and get fresh air). Since most operations give two breaks of 10 minutes each in a 480–minute shift, the basic allowance for this factor is normally 4.2 percent (20.0 minutes). If facilities layout or management policy dictates that different break periods are needed, it is necessary to recompute the percentage for the basic allowance. This is subject to the approval of higher authority. Percentage allowances for personal time are in tables 3–1 and 3–2.

Table 3–1
Personal time allowances (working conditions)

Working conditions Category	Percentages
Normal office conditions	0.0
Normal shop, central heat, slightly dirty or greasy	1.0
Slightly disagreeable conditions; exposed to inclement weather part of time, poor heating or poor cooling	3.0
Exposed to extremely disagreeable conditions most of time. Proximity to hot objects, continuous exposure to disagreeable odors and fumes, or to excessive temperature ranges	6.0

Notes:
The basic allowances for personal time is 4.2 percent. Additive personal time allowances are shown above.

Table 3–2
Personal time allowances (preparation and cleanup)

Category	Percentage
Allowed for preparation and cleanup	
5 minutes	1.0
10 minutes	2.1
15 minutes	3.1
20 minutes	4.2
In “super-clean” room conditions, supplement the allowance when operators must use special clothing, which includes caps, boots, etc., and remove it when leaving work area. This includes time to invest or divest special clothing at beginning and ending of shift, at lunch, and for personal requirements.	4.0
Where the work period is 8 consecutive hours and 20 minutes meal period is given at the expense of the Government	4.2

Notes:
Add preparation and cleanup allowances where time is given by management at the beginning of the shift to make ready and get tools, and at the end of shift to put away tools and equipment, clean up work area, or to don and remove work clothing (aprons, smocks, etc).

b. Fatigue allowances.

(1) *Weight allowances.* Consider the average weight handled per person and only those elements of time that the person is under load to determine percentage (total time for under load elements divided by base time), and use the closest percentage on the chart. Also, consider the height that load must be manually lifted (average situation). The percent allowance given in table 3–3 is based on the effective net weight being handled in the area between knees and chest. Table 3–3 also applies to laying the weight on the floor or a low skid, or to sliding or rolling the object along a plane. The values in table 3–3 are multiplied by the following factors as dictated by conditions:

(a) For picking up a load from the floor, multiply the basic allowance by 1.10.

(b) For placing a load above chest-height, multiply the basic allowance by 1.20.

(c) For getting a load from above chest-height, multiply the basic allowance by 0.50.

(2) *Realistic allowance.* When the factors from table 3–3 are used in the computation formula in paragraph 3–13 this usually provides a realistic PF&D allowance. However, in some instances, they give an unrealistic (zero or negative denominator in the formula) allowance. When this occurs, assuming that all factors are defined correctly, related elements or standards must be combined into higher levels until a realistic allowance is obtained. ("Realistic" is defined as an allowance acceptable to the worker, supervisor, and the analyst.)

(3) *Coefficient of friction.* To find the effective net weight for sliding or rolling objects, multiply the weight by the following coefficients of frictions:

Example: Worker sliding a 40 lb. casting from metal conveyor to wood bench (ENW = 40 lb. × .4 = 16 lb). When two hands are used to carry or slide an object, the weight of the object is divided by two. In the above example, the ENW when two hands are used is found in this manner (ENW = 40 lb divided by 2 times .4 = 8 lb).

Table 3–2A
Coefficients of frictions

Surface	Friction Coeffient
Wood on wood	0.4
Wood on metal	0.4
Metal on metal	0.3

Table 3–3
Fatigue allowances (weight)

	Percentage of time under load				
Effective net weight handled	1—12	13—25	26—50	51—75	76—100
	Percentage allowance				
1–10	0.0	1.0	2.0	3.0	4.0
11–20	1.0	3.0	5.0	7.0	10.0
21–30	2.0	4.0	9.0	13.0	17.0
31–40	3.0	6.0	13.0	19.0	25.0
41–50	5.0	9.0	17.0	25.0	34.0
51–60	6.0	11.0	22.0	X	X
61–70	7.0	14.0	28.0	X	X
71–80	8.0	17.0	34.0	X	X

Notes:
X—study individual job for improvement considering job enlargement, mechanical aids, worker rotation, or other stress relieving aids.

(4) *Fatigue allowances (position).* Consider the position the employees must be in to do the operation. Pick the class which best describes the average condition. It is assumed that the job is less tiresome if the position can be varied frequently. Percentage allowances are in table 3–4.

Table 3–4
Fatigue allowances (position)

Category	Percent allowance
Sitting or standing	0.0
Sitting	1.0
Walking	1.0
Standing	2.0
Climbing or descending ramps, stairs, or ladder	4.0
Working in close, cramped position	7.0

(5) *Fatigue allowance (mental).* Look at how much attention is needed to do the job and the amount of variety in the tasks. Highly repetitive jobs should be low in this factor. Table 3–5 gives percentage allowances for mental, lighting, noise, monotony, restrictive safety devices, and clothing.

c. Delay allowances. Consider the job in relation to adjacent jobs. How long can any adjacent job be shut down before the job being studied is affected? Also, consider other delays inherent in the job, such as supervisory interruptions, moving from one work station to another, and waiting for cranes. No delays which can be prevented by the employee should be considered here. Allowances are in table 3–6.

Table 3–6
Unavoidable delay allowance

Class	Percent
Isolated job. Little coordination with adjacent jobs.	1.0
Fairly close coordination with adjacent jobs.	2.0
Balancing delay. Where employees are required to move from one work station to another to balance adjacent stations, add a percentage from a through d of the following class as appropriate:	
—Move once each 5 minutes	5.0
—Move once each 30 minutes	3.0
—Move once each 60 minutes	2.0
—Move once each 2 hours	0.0

(1) Except for the delay allowances in table 3–6, there is no predetermined or generally used delay allowance percent that is applied without an engineered backup study. An appropriate study should be conducted in each shop or functional area to find out the additional delay allowance requirements. All noncyclical work elements are apportioned in the manner that most accurately add their cost to the product cost. Work elements such as cleaning chips and tool care and replacement, though occurring on an irregular basis, can be measured and the time required prorated directly to the machine operating portion of the work cycle rather than as an allowance. Certain other irregular occurring elements having a direct relationship to the job such as obtaining parts and materials and periodic inspection can be treated in one of two ways. They should be added to the cycle time, either on a prorated basis or as a separate work element, rather than added as an allowance. Again, take care to assure that there is no duplication between cycle time elements and allowance elements.

(2) Do not use the delay allowance as a "dumping ground" for operation activity that is not an integral part of the workload in the shop. Unavoidable delay allowance elements fall into two categories: those which occur but cannot be foreseen (power failure, minor repairs to defective parts, wait for job assignment), and those which occur on a time basis (daily, weekly, hourly). Examples of the type of unavoidable delay which can be considered for allowance are as follow:

(a) Obtain job information from supervisor, inspector, or production control.
(b) Wait for special tools already being used if waiting time cannot be eliminated.
(c) Power failure of nonreportable duration.
(d) Work interference.
(e) Minor rework elements if not caused by operator error.
(f) Extra work required due to hidden parts or material defects if minor.
(g) Unsuccessful hunt for parts or materials.
(h) Machine breakdown of nonreportable duration.

(3) Compute the allowance percentage for unavoidable delays by the following:

$$\frac{\text{Average daily time in delay status (minutes)}}{\text{480 minutes}} \times 100 = \text{Percent added to basic allowance}$$

(4) When an unavoidable delay allowance is included in the final report (FIN–REP), be sure to give a detailed explanation with the final allowance factor.

3–13. Applying allowances

a. Expressing as a percentage. The factors in this procedure are given as a percentage of 480 minutes (8 hours). The productive time in the workday is a variable inversely proportional to the amount of PF&D allowance. This means that all factors must be expressed as a percentage of the total workday in order to give a constant base. Thus, it becomes necessary that all locally determined factors be given in the same manner.

b. Computing allowances.

(1) *Percent of workday.* Applying the allowances requires that the total percent of PF&D allowance be figured first by adding the percentage for the applicable factors of the productive day before it can be applied. This is done by dividing the total workday by the productive day expressed as a percent of the workday; that is:

$$\text{Allowance factor} = \frac{100\%}{100\% - \text{allowance (\% of the workday)}}$$

(2) *Example.*

(a) Assume all factors total 15 percent allowance (this is 72 minutes of the 480–minute workday). Converting this allowance to a percentage of the productive day (408 min.) gives an allowance of 17.6 percent as follows:

$$\text{Allowance Factor} = \frac{100\%}{100\% - 15\%} = \frac{100\%}{85\%} = 1.176$$

(b) If allowances are expressed in minutes, then,

$$\text{Allowance Factor} = \frac{480 \text{ min.}}{480 - 72 \text{ min.}} = \frac{480 \text{ min.}}{408 \text{ min.}} = 1.176$$

c. Computing allowed time. The final step in applying the allowance is to multiply the leveled time by the allowance factor, to find the allowed time. This is done as follows: Allowed Time = (Allowance factor) × (leveled time). For example, assume the leveled time to be 34 hours and the allowance factor to be 1.176, the allowed time would be 1.176 × 34 = 39.98 hours.

3–14. Example of PF&D allowance

a. Unloading boxes from truck.

(1) *Job conditions.* A crew is unloading boxes from a truck and placing them on a pallet and the following conditions exist:

(a) The operation is done at a warehouse ramp.

(b) The boxes weigh 25 pounds each. The boxes are being taken from stacks slightly higher than his waist, and are put on pallets resting on the truck bed.

(c) The work is routine.

(d) The employee walks approximately 5 feet with each box.

(e) The cycle time (per box) is .500 minutes, actual under load elements equal .125 minutes (if per pallet the percent may be somewhat less).

(f) No restrictive safety devices are required.

(g) A forklift operator is considered a part of the unloading crew.

(2) *Computation of allowance.* The following table is an example of computation of allowance.

Table 3–6A
Example computation of allowance.

	Percent
Personal:	
Base	4.2
Class: slightly disagreeable, exposed to weather	3.0
Fatigue:	
Weight allowance—25 pounds handled 25% of the time (total under load element time, .125 divided by cycle time, .500 = 25%)	4.0
Mental—Class (work committed to habit)	0.0
Position—Class (walking)	1.0
Monotony—Class (0.5 minutes)	2.0
Delays:	
Class: little coordination with adjacent jobs	1.0
Total allowance	15.2

(3) *Computing the allowance factor (AF).*

$$AF = \frac{100\%}{100\% - 15.2\%} = \frac{100\%}{84.8\%} = 1.179$$

(4) *Computing the standard.* If this operation is studied and the leveled (normal) time is found to be 0.500 minutes, the allowed or standard time is computed as follows: 0.500 × 1.179 = 0.590 standard minutes. The number of decimal places used depends on the time increments used in the man-hour accounting system and the volume of production.

b. Aircraft instrument assembly.

(1) *Job conditions.* An employee receives a tray of parts and assembles a small aircraft instrument. The completed instrument is then delivered to the outgoing window in the clean room. The cycle time is 15 minutes.

(a) Work is done in the "super clean" room.

(b) No formal break periods have been set up, but employees are free to attend to personal needs as required.

(c) The instrument weighs less than 1. pound.

(d) The employee is primarily sitting but does change positions throughout the workday (that is, not restricted to a work table).

(e) Operations varying in cycle time and context.

(f) No restrictive devices are required.

(g) Delays are a part of the job. The employee has the ability to shift to other operations when delays occur.

(2) *Computing allowance.* The following table is an example of computing allowance.

Table 3–6B
Example of computing allowance.

	Percent
Personal:	
Basic	4.2
Fatigue:	
Mental—work requires deep concentration 50% of the time and concentrated attention 50% of the time	6.0
Position—sitting	1.0
Monotony	0.0
Delay:	
Isolated job	1.0
Total allowance	12.2

(3) *Computing allowance factor.*

$$AF = \frac{100\%}{100\% - 12.2\%} = 1.139$$

Section IV
Time Study

3–15. General
Time study is a work measurement method that records the time a worker takes to do each element of an operation and the pace at which he or she works. It also contains the analysis of the data and a determination of the time needed to do the operation at a defined standard of performance.

3–16. Applying the method
a. Time study is used primarily to measure operations that are repetitive, of short duration, and done at one work station.

b. Time study is also used to develop elemental standard data for use in synthesizing time standards for operations containing the same elements in different combinations, thus eliminating the need for remeasurement.

c. Although few situations meet the time study prerequisites of being both highly standardized and repetitive, the broad use and acceptance of the method, coupled with its accuracy, warrant its consideration. If the prerequisites are not met, the method is not to be used.

3–17. Verifying the work center description
Verify the standard work center description developed during preliminary phase. Since it is not practical to build an entire manpower staffing standard using time study, it is necessary to verify those tasks that are to be time studied.

3–18. Selecting work categories
Normally, detailed task and element descriptions are made during the preliminary phase. However, significant differences from location to location may cause variances in timing which may result in inaccurate values. It is important to verify each task and element description, sequence of operation, and beginning and ending points. Resolve any differences prior to beginning timing operations.

3–19. Determining the required number of good readings
a. The number of good readings needed can be estimated after a relatively small number of cycles. Take readings for 5 to 20 cycles and determine a factor for each element with the equation,

$$F = \frac{H - L}{H + L}$$

where: F = factor for an element.
H = highest good time value recorded.
L = lowest good time value recorded.

b. Refer to appendix G, table G–1 and find the computed value in the F column. Read across from the F factor to the value in the *Number of good readings available* column. The number found at this point is the number of good readings required. The initial good readings may be counted as part of the required total. Since complete cycles of an operation are observed, readings are taken on all elements of the cycle. The number of cyclical readings required is the highest number required for any one element.

c. The final check on the adequacy of the number of good readings obtained must be made with the following equation:

$$N' = \left[\frac{t_{.975,N-1} S_t}{E}\right]^2$$

where: N' = number of good readings required.
N = number of good readings taken.
S_t = sample standard deviation of element times.
E = allowed error (for type I standards, use $E = \pm.10T$, where T is the sample mean element time).
$t_{.975,N-1}$ = "t" table value at 95% confidence and $N - 1$ degrees of freedom.

d. The following time study example shows the computation:

(1) Ten cycles were observed.

(2) Each cycle has five elements. The F value for the first element is:

$$F = \frac{H - L}{H + L} = \frac{.14 - .11}{.14 + .11} = \frac{.03}{.25} = .12$$

(3) The estimated number of good readings required for element 1, table G–1, is 3.

(4) The final check on the adequacy of the number of good readings for element 1 is:

$$N' = \left[\frac{t_{.975,N-1}S_t}{E}\right]^2 = \left[\frac{2.262(0.994)}{.10(12.9)}\right]^2 = 3.038 = 4$$

$$\text{where: } S_t = \sqrt{\frac{NT^2 - (\Sigma T)^2}{N(N-1)}} \text{ and } E - .10\bar{T} = .10\frac{\Sigma T}{N}.$$

(5) Computations for the remaining four elements yield the following:

Table 3–6C
Computations for the remaining four elements

			Required Readings N′	
Element	N	F Value	(From table H–1)	(From equation)
2	10	.13	3	6
3	10	.06	1	3
4	10	.20	7	9
5	10	.11	3	6

(6) Both the table and computed values of N′ are less than or equal to N for each element, so no additional cycles are needed.

e. When the F value or the equation for N′ shows a need for additional readings, the timing is continued. Use either the newly established highest and lowest readings or the value of N′ to find the sample size for each element.

3–20. Procedures for doing a time study and for recording the study data

a. Set up a system to record daily work counts. If the work center activities do not allow this to be done, then record the work unit count as the work is finished. Production reports may be used, but get sufficient data to make valid comparisons and to set up an average workload level.

b. Do the following when conducting the study:

(1) Before starting the study, identify elements to be timed to make sure that they are recognizable and have obvious beginning and ending points. Audible beginning and ending points make the process easier.

(2) Make a sketch showing the equipment used, flow of work, significant distances traveled by the operator, and unusual working conditions.

(3) Record watch readings on DD Form 2042 or 2042–1. (See fig 3–1 for a completed sample of DD Form 2042–1.) The Industrial Engineering Handbook and the commercial texts on motion and time study listed in the bibliography explain the various timing techniques that may be used.

(4) Circle and do not use those readings that are obviously inaccurate because of fumbles, distractions, or changes in methods.

c. Do the remaining entries on DD Form 2042 or 2042–1 after all readings are recorded.

d. Prepare DA Form 5275–R for activities measured by time study. (See fig 3–2 for a completed sample.)

3–21. Instructions for completing DD Form 2042–1, Time Study Worksheet

DD Form 2042–1 (fig 3–1) is designed for the use of the continuous method of stopwatch time study. This method is useful for short element, short cycle operations and can be used for multiperson activities. The stopwatch is run continuously with readings recorded in the "R" block with the calculated time recorded in the "T" block. An example of a completed DD Form 2042–1 and the instructions for completion are at figure 3–1.

3–22. Instructions for completing DA Form 5275–R, Time Study Record

DA Form 5275–R is used to compute average allowed monthly man-hours for activities measured using time study techniques. An example of a completed DA Form 5275–R and the instructions for completion are at figure 3–2.

Section V
Work Sampling

3–23. General

a. This section gives the procedures for using work sampling as a work measurement and the manpower staffing standards data collection technique.

b. Work sampling is based on the principle that samples taken at random from a large group tend to show the same distributional characteristics as the whole group. Conclusions are drawn about the whole population or universe based on the sample.

(1) The sample is obtained by observing worker activity at random intervals and classifying the activity into predetermined categories.

(2) Briefly, the method involves identifying the universe (man-hour population) from which samples are to be taken; defining categories or tasks into which samples are placed; making actual observations, including periodic performance ratings; computing the percent of samples in each category to the total samples taken; and finally, applying these percentages to the total man-hours sampled to estimate the time spent on each designated category.

3–24. Applying the method

a. The economic desirability of work sampling increases with the size of the work force being sampled. The measured work force should consist of at least five persons who use most, if not all, of their available time in a location at which all work can be observed.

(1) For ease of sampling, dispersed activities may be combined or grouped into clusters to allow simultaneous sampling. Care must be used not to plan for more observations than an analyst can do in a reasonable time period. Giving too many work centers or personnel to the measuring analyst may not allow timely observations and may bias the sampling data.

(2) Because of individual study differences, specific guidelines for each possible situation are not wise. General guidelines that apply to most work sampling studies are in *b*, *c*, *d*, and *e* below.

b. Do each work sampling study over a representative period work cycle. Ideally, use work sampling only if it is set up so that a normal period of productivity is to be observed. An exception to this guideline may exist when directly relatable work units are available. When a work cycle longer than a work month is identified, then use work sampling only if economically practical.

c. Experience of work center personnel may be used to set up the average work cycle and pinpoint recurring periods of heavy productivity. A review of work center activity records may help to show major time consumers and their respective cycles of occurrence. Plotting these cycles over a time scale may show a pattern concerning their composite effect on the work center.

d. Delve into the operation of the work center before beginning the study. Recheck the organizational structure, the mission requirements, and the directives if any reorganization has taken place since the preliminary phase. After looking at these and other pertinent factors, such as backlogs, work cycles, historical production, etc., schedule a short discussion session with the work center supervisor to talk about the work measurement period.

e. Brief the work center supervisor and workers on the principle of work sampling. Work sampling, due to its statistical basis, is sometimes hard to understand. To help in understanding, use illustrations that do not have technical terms. Some examples of situations similar in principle to work sampling are testing antifreeze in a car radiator, taking a blood sample, or trying one package of cigarettes before buying a carton. Since all of these samples represent the source from which they came, the opinions formed from the samples are valid for the whole product.

3–25. Verifying the work center description

Look at the standardized work center description built and verified during the preliminary phase. Contact the lead team for guidance if previously unidentified tasks are found that are not in the approved work center description. Normally, the unidentified tasks are measured separately with the final decision to include or disallow these tasks in the manpower staffing standard made in the computation phase.

3–26. Selecting work sampling categories

a. Normally, categories for the work sampling portion of a study are built and approved during the preliminary phase. Make each category discrete and understandable to the observer. Failure to define a category specifically and clearly can make later analysis hard or impractical.

b. In addition to the productive categories, work sampling studies identify the time spent on nonavailable activities, unavoidable delay, personal fatigue, and idle time. Additional categories for management information may be identified and measured if work sampling categories identified in the MEAS–PLAN are not impacted.

3–27. Defining the man-hour population

The man-hour population from which samples are drawn is made up of the man-hours of personnel assigned, personnel borrowed, sampled overtime, and lunch time, minus loaned time. Man-hour population is found as follows:

MAN-HOURS SAMPLED = Assigned time

plus

Borrowed time

plus

SAMPLED OVERTIME (Includes lunch time)

minus

Loaned time

Figure 3–1B. Sample man-power population

3–28. Determining the sample required

a. Take sufficient samples to make sure of the accuracy at the required confidence level. Make an initial estimate of the number of required samples before the measurement is to start. One method to use to get this estimate is to figure the percentage of occurrence ($\overline{P}$) for the largest category. To do this, conduct a small sampling study to get 50 to 100 samples. Compute the $\overline{P}$s and compare the largest to the values on the chart in appendix I. The minimum number of samples is that which is listed under the "3%" column that relates to the largest computed $\overline{P}$.

b. Another method of estimating the required number of samples is to do a small sampling study like the one in the preceding paragraph. Compute the $\overline{P}$, and use the $\overline{P}$ for the largest category in the following equation:

$$N' = \frac{4(\overline{P}-\overline{P}^2)}{s^2}$$

where: N' = estimated number of samples required.
$\overline{P}$ = the decimal percentage of occurrence for the largest productive category.
a = the desired absolute accuracy expressed in decimal form.

c. The number of samples is figured by either of the preceding methods and is an estimated minimum. More samples may be needed to get the required accuracy. As the study nears completion, recalculate the percentages of occurrence ($\overline{P}$). Compare the largest $\overline{P}$ to the chart in appendix I or use the equation to compute the needed sample size. When accuracy is not met, make the sampling period longer to get enough samples. It is not permissible to increase the number of samples per hour per day to meet accuracy.

3–29. Procedures for doing work sampling studies

a. Set up a system to record work counts. If the activities of the work center do not allow daily compliance with this requirement, record the work count as the work is completed. If a production report is available, it may be used, but make periodic checks to make sure that the report is accurate. The period of the production report must correspond to the sampling period. Record correct values for work that starts before the study and work that goes on after the study.

b. Since it is desirable to equalize the number of daily observations, find the schedule of observations as follows:

(1) Divide the total samples needed by the number of planned sampling days for the study to find the required number of samples per day.

(2) Divide the required samples per day by the samples to be recorded during each observation to get the number of needed daily observations.

(3) Find the appropriate method of picking the times for the observations, and the routes, if applicable, as follows:

(a) Pick a series of three-digit numbers from any one of the random-number tables found in statistical text books. Discard those numbers which exceed the number of minutes in the daily work period. (If automatic data processing (ADP) capability is available, the numbers can be computer-generated.) Equate the random numbers to the corresponding clock times that are to be used for the observations.

(b) In a function where work activity changes hourly, it is good for every hour of the workday to have equal representation in the sample. This is done by stratified sampling which differs from the simple random method. For example, divide the number of observations to be made daily by the number of hours the work center is to be observed each day. (This gives the number of observations needed each hour.) Then, figure the observation times by picking the required number of two-digit numbers from a table of random numbers. Disregard all those over 60 and equate the selected numbers to corresponding clock times.

c. In some cases, the time schedule cannot be met because the locations in which samples are to be taken are so widely dispersed. Attempting to stay within the schedule makes unnecessary hardships or means an excessive number

of observers. One solution is to randomize the work locations by writing the titles of the locations on cards. They are then picked in a random manner and observed in the order drawn, starting at the random times previously determined.

(1) Follow the scheduled times as closely as possible to ensure randomness of the sample.

(2) Go into the work center and record the observed activities. Do not alert or distract the work force. If the approach route is in the open, the recorded observations have a good chance of being biased. One way to solve this problem is to make arrangements to stay in the work center for the entire shift.

(3) Each sample should be the result of an instantaneous observation. When it is not possible to positively identify the proper category of a sample, note it as productive or nonproductive. At the end of the sampling round, check out the sample for proper category classification.

(4) Record samples for every worker whose time is in the total sampled man-hours recorded. Pace rate the worker, when applicable, and record ratings for the category to which they apply. Save these ratings as the study goes on and average on completion for all observed categories.

(5) Record "lunch" as a separate "other" (nonproductive) category. If work hours are not uniformly distributed and the work center remains open during the lunch period, work sampling must occur during the lunch period. Sample any work done in this period in the corresponding productive category.

(6) Identify inferred, assumed, or questionable work and sample as nonproductive. This eases needed transfer or exclusion of samples at the end of the sampling period. Work identified as inferred, assumed, or questionable may rightfully belong to other work centers and is excluded from all sampled man-hour computations for this work center. However, credit the samples as productive samples to the work center to which the work does belong.

(7) Where certain tasks or categories are to be measured by methods other than work sampling, record the samples observed in the tasks or categories as "other" productive. Avoid double counting of this time. Do not transfer man-hours associated with these samples on DA Form 5278–R to DA Form 5274–R.

(8) After 5 days of sampling, build productivity charts from the accumulated data. From this point on, compute and plot daily percentages of occurrence ($\overline{\mathbf{P}}$). Look closely at any plots that fall outside the control limits and leave out that day's sampling when the data are unacceptable. (See section VII on how to build and use productivity charts.)

(9) Make a Workload Factor Control Chart when the workload factor count is available on a daily basis. This chart is to verify the accuracy of the work count and representativeness of the study period. Also, it is useful when trying to find the representativeness of any given day's productivity. How to build and use Workload Factor Control Charts is explained in section VIII.

(10) In some functional areas, personnel must be present even if no workload is available; thus a standard built from work sampling data normally results in underauthorizing. Since personnel in these work centers must be ready to meet a predetermined level of service, giving less manpower than needed will result in assigned personnel being overworked during peak periods. Also, it can cause split shifts, and lower the overall quality of the service given. In this case, a Man-Hour Shift Profile Chart can be used to figure the proper manpower. Design work sampling studies in this type of work center to give adequate data for building a Man-Hour Shift Profile Chart. How to build and use this chart is explained in section XI.

(11) Between sampling rounds, study analysts do the needed daily computations, get work unit counts and workload factors, or do operational audits. Use all other time between sampling rounds to become intimately familiar with the work center operation. This helps to come up with sound methods improvement recommendations.

(12) The study analyst records on the daily sampling sheet the opinion of the supervisor as to whether or not the work was normal. If other than normal, record the reasons given by the supervisor.

d. Work sampling data collection sheets are used to control sampling data. These sheets are treated confidentially and not shown to supervisors or managers. Sampling data must never be used by supervisors to evaluate individuals. However, work category percentages of occurrence or productivity indices can be released to management without compromising the study or violating individual privacy rights.

3–30. Instructions for completing DA Form 5278–R, Work Sampling Record

Report work sampling data on DA Form 5278–R (fig 3–3). Completion of this form is done in two stages: daily, during conduct of the sampling study, and at the end of the study period. At the end of the measurement, line out entries in section I for any data that are to be left out. Use extreme caution in discarding data. Do not include discarded data in the total computation. An example of a completed DA Form 5278–R and the instructions for completion are at figure 3–3.

Section VI
Productivity Control Charts

3–31. General

This section shows the use of productivity control charts.

a. Work sampling is used as the primary work measurement method in many manpower staffing standards studies. Work sampling data are valid and reliable for building standards if the samples are representative of the true

population. Productivity is one way to test this representativeness. Conscious or unconscious bias on the part of work center personnel can cause productivity to fluctuate. For example, work center personnel may be so aware of the study analyst during the study that they work extra hard. On rare occasions, they may even slow down in protest of the study. This and other types of worker bias may have a direct effect on the work center productivity.

b. Other factors that cause unreliable or unrepresentative data are changing work center operations or procedures and unpredictable situations outside the control of the work center. On the other hand, some productivity points may fall outside the established limits due to chance.

c. Other ways to test representativeness may be devised as required to satisfy specific requirements or circumstances.

d. Regardless of how unusually high or low productivity points are identified, analysis is required to find out the cause for change and to decide if that day's data should be retained.

3–32. Preparing control charts

After 5 days of work sampling, proceed as follows:

a. Step 1. Compute the average percent occurrence ($\bar{P}$) for indirect, direct, and total productive data (sec V). Sometimes a single calculation for total productive data is enough; however, if its two major parts are also calculated, problem areas can be pinpointed. When necessary, calculations at the category level are permissible.

b. Step 2. Compute the average number of samples per day ($\bar{N}$).

c. Step 3. Compute the standard deviation ($\sigma\bar{p}$) using the following formula:

$$\sigma\bar{p} = \sqrt{\frac{\bar{P}(1-\bar{P})}{\bar{N}}}$$

where: $\bar{P}$ = average percent occurrence.
$\bar{N}$ = average daily sample size.

d. Step 4. Calculate the upper control limit (UCL) and lower control limit (LCL) by:

$$UCL = \bar{P} + 2\sigma\bar{p}$$

$$LCL = \bar{P} - 2\sigma\bar{p}$$

e. Step 5. Prepare separate $\bar{P}$ control charts for Productive Direct, Productive Indirect, and Total Productive on graph paper. (See fig 3–4.) These charts are prepared as follows:

(1) Label the vertical axis "Percent" and the horizontal axis "Sampling Days."

(2) Draw the vertical axis from zero to approximately 20 percent to 25 percent above the $\bar{P}$ value.

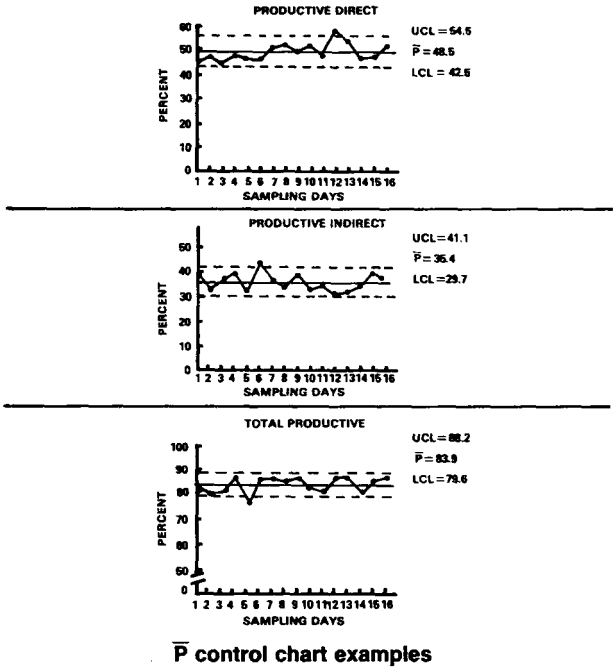


Figure 3–4. See caption in figure

(3) Extend the horizontal line for as many days as needed for measurement.

(4) Draw a solid horizontal line representing $\overline{P}$ and label with the computed value (Step 1).

(5) Draw broken horizontal lines representing the computed values of the UCLs and LCLs. Label each line with the proper value.

f. Step 6. Plot each day's percents of occurrence ($\overline{P}$) for the available data.

3–33. Using and analyzing control charts

a. As the sampling continues, plot each day's percents of occurrence (P) on the proper control chart. If the productivity points appear to show a stable pattern around $\overline{P}$ and are within the control limits, then assume the samples are from the same population and are representative and the resulting data are used to develop the standard.

b. If a plot occurs outside the control limits, this usually indicates that some abnormal condition was present during that period of sampling. Since there are only about 5 chances in 100 that a plot will fall outside the limits due to a chance cause, it is assumed that when a plot does occur outside the limits, there is a reason for it and it must be investigated for an assignable cause. Based on this investigation and analysis, the decision is made on the data representativeness and whether or not it should be retained.

(1) A review of past experience, trends, cycles, and workloads, may show that a high or low percentage of occurrence has an acceptable degree of regularity and is included in the computations.

(2) When no assignable cause is determined for a point falling outside the control limits, the occurrence is assumed to be due to chance and is retained.

(3) Occurrences that have little chance of recurring (for example, natural disasters) are not predictable and are not included.

c. Other reasons for including or excluding data are:

(1) *Total productive.*

(a) High percentages of occurrences detected the first 2 or 3 days, when due to the beginning of the study, are excluded.

(b) Low percentages of occurrences for the 3rd through 5th days, if they are due to work shortages caused by an initial speed-up at the beginning of the study, are excluded.

(c) If desired, percentages in (a) and (b) above may be used, provided both are included.

(2) *Direct productive.*

(a) High percentages of occurrence due to increases in workload are included.

(b) Low percentages of occurrence due to shortages of workload are included.

(3) *Indirect productive.*

(a) Low percentages of occurrence due to the nonaccomplishment or deferment of work to complete higher priority direct productive work are included.

(b) High percentages of occurrence due to an increase in authorized work moved from one time to another, to keep busy, are included.

d. The initial ($\overline{P}$) value on the control chart is based on a small sample and may not represent the true work center productivity. During the sampling period, the validity of the initial estimate is verified by recomputing the P value and corresponding control limits. Recomputation is accomplished—

(1) Each time a plot falls outside the control limits, not due to chance alone, and the decision is made to retain that day's samples. If an assignable cause is not determined and the data are retained, no recomputation is made.

(2) After every 5 usable days of work sampling to ensure sample statistical quality.

(3) At the end of the sampling period to ensure all retained sampled days are representative.

3–34. Documenting control chart data

If a sampling day's data are excluded, prepare and include an explanation as to its exclusion in the MEAS–REP. If a sampling day's plot falls outside the control limits and the data are included, explain the analytical process that went into the retention decision.

Section VII
Workload Factor Control Charts

3–35. General

This section shows how to make workload factor (WLF) control charts during the work measurement phase of a manpower staffing standards study. WLF control charts add to the review of productivity ($\overline{P}$) control charts by showing work output that relates to measured work center productivity. These charts also aid in deciding if the measurement is representative or not. They also aid in verifying the accuracy of the work count and showing abnormal workloads.

3–36. Preparing the chart

Make a workload factor control chart when it is possible to get a daily workload factor count. Use the following steps:

a. Step 1. Get the historical workload (6 to 12 months) that is most like the workload range that is expected to be done during the study.

b. Step 2. Compute the average monthly historical workload (X_m) by the following equation:

$$\overline{X}_m = \frac{\Sigma X_m}{N}$$

where: ΣX_m = monthly workload
N = number of months.

c. Step 3. Compute the average daily historical workload (X_d) by the following formula:

$$\overline{X}_d = \frac{\overline{X}_m}{\overline{N}}$$

where: $\overline{X}_m$ = average monthly workload (step 2)
$\overline{N}$ = average number of days of work center operation.

d. Step 4. Put the chart on standard graph paper with "Sampling day" as the horizontal axis and "Workload" as the vertical axis. The range of the horizontal axis is the number of sampling days planned. The range of the vertical axis is from zero to the maximum workload expected during the sampling period noted on the horizontal axis, plus 20 for variance.

e. Step 5. Compute the adjusted historical workload total (X_t) by the following equation:

$$X_t = (\overline{X}_d)\,(N)$$

where: X_d = average daily historical workload (step 3)
N = number of sampling days intended.

f. Step 6. Build the historical average workload line by plotting the adjusted historical workload (X_t) as the vertical

coordinate and the last day of the sampling period as the horizontal coordinate. Connect this point and the origin with a solid straight line.

g. Step 7. As the sampling period continues, plot the cumulative sum of each day's workload factor count on the prepared chart.

3–37. Analyzing the chart

The shape of the cumulative daily plot shows the work pattern during the sampling period. When cycles end at or near the historical average workload line, the work center is doing its work at the average workload volume. The following questions are of value in analyzing points that deviate to a large degree from the historical workload line:

a. Are the daily and historical counts of the same workload factor? Check the definition of the workload factor.

b. Is a regular cycle appearing? Plan the start and stop sampling points as nearly as possible at the corresponding points in the cycle(s); for example, at the beginning or midpoint of two or more succeeding cycles.

c. If the current workload trend varies from the historical trend, could the deviation be caused by a change in productivity? Check productivity rating factors for indications of high or low ratings.

d. Is something affecting the unit productivity (for example, exercise or operational readiness test)? Refer to the $\overline{P}$ control chart to find if certain days should be excluded from the study.

3–38. Example of a workload factor control chart

Figure 3–5 shows a completed workload factor control chart. The information in *a* through *g* below was used to prepare the chart.

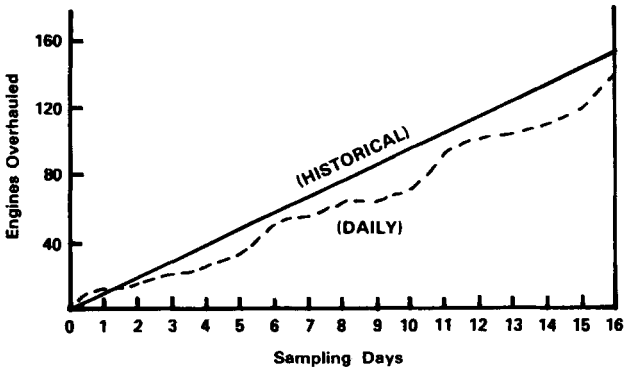


Figure 3–5. Workload factor control chart

a. Step 1. Assume the following data were obtained from work center records:

Table 3–6D
Example work center data

Month	Workload (X_m)
Jul82	245
Aug82	230
Sep82	194
Oct82	202
Nov82	185
Dec82	156
Jan83	180
Feb83	145
Mar83	235
	$\Sigma X_m = 1772$

b. Step 2.

$$\bar{X}_m = \frac{\Sigma X_m}{N} = \frac{1772}{9} = 196.89$$

c. Step 3.

$$\bar{X} = \frac{\bar{X}_m}{\bar{N}} = \frac{196.89}{20.91^*} = 9.42$$

*Note: Assumes the work center operates 5 days a week.

d. Step 4. See figure 3–5.

e. Step 5.

$$X_t = (\bar{X}_d)\,(N) = (9.42)\,(16) = 150.72$$

f. Step 6. See figure 3–5.

g. Step 7. Assume the following data were accumulated during the course of the sampling study. The data are plotted daily and are shown by a broken line on figure 3–5.

Table 3–6E
Sample data collected

		Workload	
Day	Date	Daily	Cum.
1	8 Sep	10	10
2	9 Sep	6	16
3	10 Sep	5	21
4	11 Sep	4	25
5	14 Sep	7	32
6	15 Sep	21	53
7	16 Sep	4	57
8	17 Sep	6	63
9	18 Sep	0	63
10	21 Sep	9	72
11	22 Sep	22	94
12	23 Sep	6	100
13	24 Sep	3	103
14	25 Sep	5	108
15	28 Sep	10	118
16	29 Sep	21	139

Section VIII
Operational Audit

3–39. General

a. Operational audit is the most flexible work measurement method used in the MS–3.

b. Operational audit integrates five primary techniques—good operator, historical performance, standard time data, technical estimate, and directed requirement—to make a systematic method of work measurement. The integration is done with the mathematical model $T = \Sigma f_i t_i$, where T is the number of man-hours needed for a given activity under study, and f_i and t_i are the frequency of occurrence and unit time, respectively, of the subordinate activities.

(1) To find each separate frequency and unit time, use the technique that gives the most accurate and realistic data. Find the man-hours by using good operator or historical performance.

(2) The technical estimate and directed requirement techniques are used only when it is not practical or it is not cost-effective to get man-hours using the first three techniques.

(3) It is not uncommon to use one technique for figuring task frequency and another to figure task time. However, make every effort to find task frequencies by techniques other than technical estimate.

3–40. Applying the method

The multi-technique, multi-source nature of operational audit gives it a degree of flexibility that is not in time study or work sampling. This makes the method useful as a supplement to work sampling. A specific application of an

additional role is to measure activities that are not feasibly covered by work sampling and to make data adjustments that are dictated by follow-on quality-of-service decisions. There are various uses of operational audit techniques.

a. The first technique is the good operator. Use the following for picking this one:

(1) This technique is the best for getting unit time values. Functional managers believe in man-hours from actual timed observations more than those from less objective means. This technique gets time values through the selection of a qualified individual (ideally one who does the task at a normal pace) and measuring the time that an individual uses for a given activity. If at all possible, watch several qualified individuals doing the same tasks. Time developed by the good operator technique is taken as representative of the time that others need to do the same work.

(2) A PF&D allowance factor is applied to values obtained by this technique.

b. The second is the historical performance technique. This technique draws on documented past work performance of the work center. Examples of this information are in manpower utilization, man-hour reporting systems, facilities engineer work order documentation, and class curriculums.

c. A third technique is technical estimate.

(1) The analyst must rely on estimates when there are times and frequencies that cannot be attained using the other operational audit techniques. These time estimates are based on the combined experience and background of the measurement team member, the worker, and supervisory personnel.

(2) Make time estimates at the highest level of activity that gives confidence in the validity of the estimate. There is no need to go into more detail if a task time can be estimated confidently.

(3) Some tasks that require a large number of man-hours are composed of several subelements, each with varying frequencies and unit times. Occasionally, the tasks are not sufficiently broken down in the task definitions to measure separately. It is hard, if not impossible, to estimate total task man-hours with any degree of confidence in these situations.

(a) A more detailed measurement approach is used with tasks of this type.

1. Reduce the task to the lowest levels of subactivity that allow confident measurement. Generally, this means breaking the task down to subtask and element levels. In some cases, it means going to the subelement level.

2. Figure the per accomplishment time, frequency, and measured monthly time for each of the subactivities.

3. Total the subactivity monthly allowed time to find the total man-hours spent in doing the task.

4. Develop a representative per accomplishment time and frequency per month to support the total monthly allowed time.

(b) A typical example follows:

1. Given: Task 2A, unit time unknown, six subtasks and elements.

Table 3–6F
Sample per accomplishment time and frequency per month

				Allowed Man-hours		
Activity frequency	Conversion factor	Adjusted monthly frequency		Per accomplishment		Per month
1/D1	20.91	20.91	×	.17	=	3.55
1/WK	4.348	4.348	×	.50	=	2.17
3/WK	4.348	13.04	×	.25	=	3.26
1/MO	1.000	1.000	×	1.33	=	1.33
2/MO	1.000	2.000	×	.50	=	1.00
1/QT	.3333	.3333	×	1.00	=	.33
					Total (Σ measured monthly time)	11.64

2. The frequency to be recorded on DA Form 5277–R should then be 1/mo.

3. The per accomplishment time to be recorded on DA Form 5277–R (fig 3–6) should reflect 11.64 measured monthly time.

(4) Keep in mind that, although some use of the technical estimate is almost always necessary, its sole use is strongly discouraged. Check as many times as possible by other techniques. Make sure the study schedule has enough time to cross-check operational audit data. When tasks cannot be directly observed or when reliable historical data are unavailable, it may be possible to get reliable data by simulating some of the tasks.

d. The fourth technique is the directed requirement technique.

(1) This technique recognizes that many activities and some positions are directed requirements. The directed requirement may apply to a whole-man position; to directed frequencies, such as inspections; or directed time values, such as the periodic run-up of a standby electrical power generator.

(2) Document whole-man position requirements with this technique (with no further study needed) if the following conditions are met:

(a) The position is directed by HQDA or the position is one-of-a-kind in a work center (for example, a data automation specialist assigned to a personnel work center).

(b) There is not enough workload to justify one position of that particular specialty.

(c) The specialty in question cannot effectively do other basic work center duties.

(3) A directed requirement position cannot be one that is directed solely to establish responsibility (for example, a supervisor). In this case, study the incumbent's actual duties, using other techniques or methods, along with the other positions in the work center to determine total work center man-hour requirements.

(4) Document whole-man requirements set up with the directed requirement technique on DA Form 5277–R. (See figures 3–6 and 3–7 for completed samples of DA Form 5277–R.) Do this by entering the appropriate availability factor multiple (for example, 145) directly in the allowed man-hours per month column.

(5) While a directed requirement may cause a minimum manpower requirement, it is not the sole determinant. Minimum manpower is given to a work center to ensure uninterrupted services, even if the personnel may not be continuously productive. The minimum requirement may be identified as a result of a detailed work measurement study, and can be dictated by factors other than a directed requirement.

(6) The authority for a directed requirement must be cited in the Manpower Staffing Standards Study Final Report.

e. The last technique is standard time data. Maximum use of predetermined time (standard time data) for task times greatly improves the accuracy of the standard and simplifies its development. Sources include previous MS–3 studies, DOD 5010–15.1–M, "Standardization of Work Measurement," Volumes 1 through 10, Technical Bulletin 420 Series, and existing local standards. It is critical that any source utilized does not take from the accuracy of the operational audit being performed. Fully document sources of standard time data task times in the final report. Conditions to check for correct application of standard time data are:

(1) Existence of an audit trail of how the original standard was set. Definition of a good audit trail would include: definition of standard time, record of the standard practice or method, a record of the observed time values used in determining the final standard time, a record of computations used to determine the statistical reliability of the standard, a record of the pace rating when the time values were recorded, an explanation of the allowance for personal fatigue and delay time, and a record of how the standard was computed.

(2) Most importantly, the working environment (tasking, lighting, layout, etc.) of the standard must match the new application. DOD 5010–15.1–M and Technical Bulletin 420 Series have the advantage of containing both criteria. In addition, both are automated (DOD 5010–15.1–M is on the Computer-Aided Time Standards (CATS) system, and Technical Bulletin 420 Series is on the Facility Engineering Job Estimating (FEJE) system) which speeds application.

3–41. Determining the frequency of the tasks

a. Make every effort to get accurate frequencies of occurrence. Generally, the best source of this information is in historical reports, such as those showing work units produced, daily supply transactions, and personnel assigned.

(1) A review of available documentation (for example, records, letter, messages, and rosters) often gives needed frequencies.

(2) Some indirect task frequencies are found by sampling during the time the analyst is in the work center. This is done by noting the time of arrival in the work center, observing the activity while there, recording each time a task occurs, and noting the time of departure.

(3) A work center is usually visited several times during the course of a study. By sampling the activity every time the analyst is in the work center, enough data can be obtained to find the frequency of occurrence. A small sample like this can be extrapolated to a weekly or monthly frequency, as required.

b. In some cases it is possible to relate unknown frequencies to reliable recorded data to find more objective estimates. For example, if there is no record in a work center to show the frequency with which a particular part is replaced on a piece of equipment, a check of supply issue records may verify the frequency.

3–42. Verifying the work center description

Verify the standardized work center description built during the preliminary phase. If tasks are found that are not in the work center description, input teams should immediately contact the lead team for guidance. Normally these tasks are measured separately and the final decision made to keep or disallow these tasks in the manpower staffing standard in the computation phase.

3–43. Selecting work categories

Normally work center descriptions are done in the preliminary phase. If suspected additive requirements are found, state the work in definitive terms easily understood by other analysts and functional managers. It is equally important to define the work unit or workload factor that goes with any additive or excluded work.

3–44. Data collection guidance

a. When using the good operator technique, make sure that sufficient samples or observations are taken to give accurate estimates of the task time. The number of observations taken should be comparable with the number of man-hours associated with the task. Where the task is infrequently done or the task time is relatively small, fewer observations may be appropriate. However, where the task is done often, or a large amount of the effort of the work center is spent on that task, more observations are justified.

b. Research production and man-hour accounting records before using the data with the historical performance technique. Look at a sample of 6 to 12 months' data. Discuss fully the work situation with the supervisor to find out whether changes were made in methods, product, or type of services during the period covered by the records. Also, find out what effect any changes may have had on the data. In some cases the effects of changes are not significant; in others, the records and data may no longer be valid and should not be used.

c. The technical estimate technique relies on judgment and experience. A more confident estimate is reached by sampling the judgment and experience of at least two work center personnel. Where two similar work centers exist at the same location in separate organizations, get estimates from both. Take out extreme estimate values and compute the average per accomplishment time and frequency from the remaining values.

3–45. Procedures for doing operational audits

a. When performing an operational audit, get the workload data and associated work counts before determining average per accomplishment time and frequencies. This aids in the completion of the measurement. For the historical performance technique, get the historical work count from the same time period as the man-hours. Normally, these are from the 12–month period preceding the measurement; however, a minimum of 6 months' data is acceptable. Trend analysis of the historical work counts is useful in setting up the representativeness of the measurement period.

b. Conduct the study as follows:

(1) Build a tentative study schedule and make necessary appointments with work center personnel. Brief all assigned personnel on the objectives and methods of the study. Make sure this is done. Do not monopolize the work center for any long period of time. Get support data, do computations, and analyze data without upsetting work center operations.

(2) Get the audit data systematically. Normally, begin at the top of the organization and work down. This will ensure that the study analyst is aware of management policies and procedures.

(3) Document all sources of count, backup data, derived man-hour computations, etc., in clear terms. Analysts must not assume that everyone knows as much about the subject as they do.

3–46. Instructions for completing DA Form 5277–R, Operational Audit Data Record

DA Form 5277–R (fig 3–6) is used to document the result of operational audit measurement techniques. When handwritten completion is contemplated, horizontal lines may be entered in columns a through h to correspond with the information typed in column a. An example of a completed DA Form 5277–R for basic work center measurement and the instructions for completion are at figure 3–6. An example of a completed DA Form 5277–R for additive measurement is at figure 3–7 (instructions for completion are the same as those found in fig 3–6). Use table 3–7 to determine the symbol for activity frequency (col c) and frequency conversion factor (col d).

Table 3–7
Determination of symbol and conversion factor

Activity frequency	Symbol	Conversion factor
Per day (5 workday week)	D1	20.91
Per day (5.5 workday week)	D2	23.08
Per day (6 workday week)	D3	25.26
Per day (6.5 workday week)	D4	28.26
Per day (7 workday week)	D5	30.44
Per week	WK	4.348
Per month	MO	1.000
Per quarter	QT	.3333
Per year	YR	.08333

Section IX
Minimum Manpower

3–47. Importance of minimum manpower and standby

Management decisions often generate minimum manpower levels that derive standby time. Standby time is nonproductive and costly. Therefore, all standby time included in Army manpower staffing standards must be justified. Standby time that is mission essential is allowed in standards studies. However, to merely describe the computations used to

derive standby time is not sufficient. The management decision leading to minimum manpower requirements along with the associated standby time must be completely explained.

3–48. Standby levels

Standby, delay, and on-call time are defined in the glossary. Standby time can occur at any workload volume, and minimum manpower requirements may vary from location to location.

a. Figure 3–8 is a Venn Diagram that depicts minimum manpower requirements at low (case 1) and high (case 2) workload volume. In both cases, the minimum manpower requirements are constant and are represented by circles of the same size.

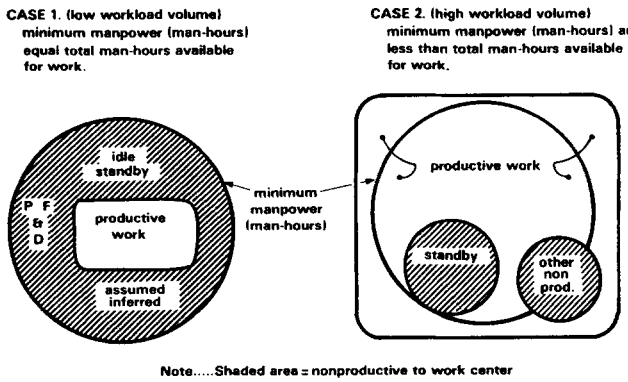


Figure 3–8. Depiction of input measurement data

(1) In case 1, the minimum manpower requirement is equal to the total man-hours available to perform work, such as, universe is equal to man-hours generated by minimum manpower requirements. Standby is the difference between man-hours generated by minimum manpower and man-hours generated by productive work.

(2) In case 2, the minimum manpower requirement is less than the total man-hours available for productive work, such as, universe is equal to total hours available to perform productive work. Derivation of standby in this case is more difficult.

b. Figure 3–9 (example A) is a scattergram depicting a similar situation. Note that installations A and B, whose workload volume is less than X_i, represent a case 1 situation, while installation C, D, and E represent case 2. For installations A and B, standby time may be derived as in a(l) above (case 1). At installations C, D, and E, however, this procedure cannot be applied.

c. Minimum manpower requirements may be constant for each shift (figs 3–8 and 3–9 (example A) show this condition) or they may vary with workload volume. Figure 3–9 (example B) shows minimum manpower at two levels: one for workload volumes less than X_i, and one for workload volumes greater than X_i. This situation is possible, for example, in the central issue facility operation where a second issue crew is needed to meet specified turn-around time. Note in figure 3–9 (example B) that each column on the chart shows varying amounts of standby time.

3–49. Observations regarding standby time

a. Minimum manpower requirements maybe the same at all locations or may vary with workload volume.

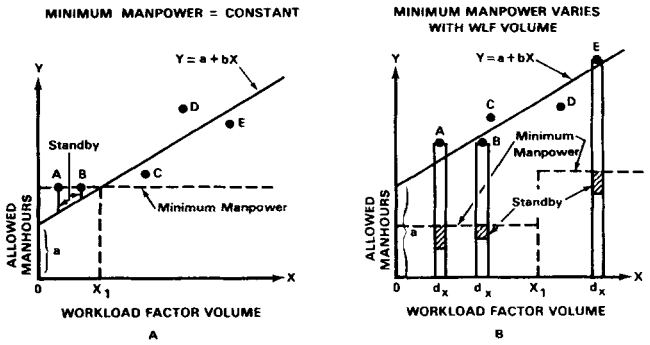


Figure 3–9. Minimum manpower relationships

b. Minimum manpower requirements can be identified by MS–3 work measurement methods if levels of service are properly defined before measurement.

c. The only standby time that should be allowed is that necessary for essential mission accomplishment.

d. In many cases, standby time can be reduced by transferring productive work to replace measured standby man-hours.

e. Standby tasks inherent in one's assigned duty (for example, a technician continuously observing instruments) will not be categorized as standby time for standards development purposes.

3–50. Rationale for minimum manpower

a. Drivers. Numerous factors contribute to establishing minimum manpower requirements. Some of these factors, often the result of management decisions, are—

(1) Mission requirements.
(2) Standard of living.
(3) Machine design.
(4) Facility limitations.
(5) Hours of operation.
(6) Shift size and necessity.
(7) Crew size.
(8) Post position manpower requirement (guard post, desk SGT, dispatcher, etc).
(9) Safety factors.
(10) Security factors.

b. Evaluating minimum manpower requirements. The requirements for minimum manpower must be carefully analyzed. The basic need must be questioned, alternatives offered, and the cost of such service clearly defined. Study documentation must contain a rationale to justify minimum manpower requirements. After the functional proponent at the review level confirms the management decision that results in minimum manpower requirements, quantifying standby time is generally straightforward. Standby time can often be reduced or minimized through improved shift scheduling, reorganization, or planning and workload control techniques. When this is the case, MS–3 personnel should be prepared to show the manager how to accomplish the required standard of living with minimum standby time. When standby time is minimized, the total manpower requirement is also minimized.

Section X
Standby Determination with Man-Hour Collection Methods

3–51. Designing the study

a. A well-designed study can accurately show minimum manpower requirements and true standby time. The MEAS–PLAN tells how to measure minimum manpower requirements and how to identify standby time during work measurement. Necessary standby man-hours cannot be identified during the computation phase when they are lumped in with other nonproductive categories of time and when the minimum manpower requirements have not been accurately documented.

b. When the possibility of standby time exists, the method for measuring standby time must be defined. MS–3 data collection and work measurement procedures can be used to identify standby; however, some innovation is required with these methods. Do not simply state in the MEAS–PLAN that shift profile analysis will be used to quantify

standby time. The measurement instructions must tell how to use these techniques at the input level. Standby time is discussed in conjunction with various data collection and analysis procedures in paragraph 3–52.

c. Standby time derived in accordance with the procedures of this section may be included as input to regression analysis when developing the standard man-hour equation. If standby time does not exist at all locations, consider developing an additive standard for standby.

3–52. Data collection and analysis procedures

When work sampling is used and standby time exists, use a man-hour shift profile chart to aid in analyzing standby time. (See sec XI.)

a. Work sampling. Standby time can be identified during work sampling studies when minimum manpower requirements are previously defined and readily identifiable during work sampling observation rounds.

(1) For example, suppose a finance office requires that customer pay inquiries be answered within 30 minutes of customer arrival. It has been predetermined that two finance clerks are necessary to provide this level of service at the finance counter between 0900 and 1500.

(2) When the work sampler knows this information before the study begins, provisions can be made to isolate and identify the required standby time. On each observation round, the work sampler merely tallies each worker in his or her respective category. The observer may enter a maximum of two standby tallies during each observation round; however, this could occur only if both service clerks were waiting for customers.

(3) The standby time thus collected represents the result of the minimum manpower requirement. Standby time derived in this manner can be used to show management the manpower cost of providing that level of service. Analysis of work sampling observation sheets and waiting time data (for example, the time finance customers actually wait for answers to inquiries) may reveal that the specified level of service has been exceeded or that the second service clerk is needed only during peak periods, such as pay days.

(4) Standby time collected in this manner represents adjusted or derived standby time and can be put on the DA Form 5274–R. If the standard of living is not clearly defined, it is impossible to identify whether the worker should be sampled as idle or standby. When this is the case, always build a man-hour shift profile chart as described in section XI.

(5) Show on the DA Form 5278–R, section II, under "Other" nonproductive categories, the standby time derived through this procedure. Do not level or apply allowances to this time. The standby time may reduce the need for some or all PF&D allowances for the other productive man-hours. Transfer measured standby man-hours from the DA Form 5278–R to DA Form 5274–R. (See figure 3–3 for a completed sample DA Form 5278–R and figures 3–14, 3–15, and 3–16 for completed samples of DA Form 5274–R.)

b. Operational audit.

(1) When operational audit (OA) is used as the primary work measurement method, include sufficient rationale in the FIN–REP to support the minimum manpower requirement. If the minimum manpower requirement represents the total man-hour universe as in case 1, figure 3–8, then it is not necessary to measure standby time. Justify and compute the minimum manpower requirement and enter it on DA Form 5274–R. (See fig 3–16.)

(2) when the total man-hour universe is greater than the minimum manpower requirement (case 2, fig 3–8), minimize and fully explain all standby time allowed in the study. Developing a man-hour shift profile chart from OA measurement may be difficult because "per accomplishment" times are not associated with each hour of the duty day. Therefore, consider using short cycle work sampling to collect man-hours for a man-hour shift profile chart as backup for OA man-hours. (See sec XI.)

c. Time study. Time study cannot be used to measure standby time. If standby time occurs between work cycles during a timing operation, record the observed standby time for later analysis.

d. Position manpower factors (PMFs). Standby time is normally an inherent part of positions that are based on PMF application, for example, military police assigned to post access gate.

Section XI
Man-Hour Shift Profile Analysis

3–53. Introduction to the man-hour shift profile chart

Man-hour shift profile charts are an effective way to identify and minimize standby time. They aid the analyst in defining the minimum essential manpower levels by—

a. Leveling workloads to economize on nonproductive standby periods.

b. Identifying the minimum standby time based on the accepted level of service.

3–54. Using the man-hour shift profile chart

a. The man-hour shift profile chart can help functional managers realize economies of operation and help MS–3 personnel build accurate manpower staffing standards. This process can be used as a data analysis technique in conjunction with other data collection methods during a manpower staffing standards study.

b. MS–3 personnel use the man-hour shift profile to justify standby requirements. Input teams use the chart to determine the proper amounts of standby to include in measurement reports when work sampling is the primary work measurement method and standby time cannot be distinguished from other nonproductive categories during the sampling period. (See paragraph 3–52a.)

3–55. How to develop the present man-hour shift profile chart

The profile chart can be constructed from data obtained during work measurement if certain provisions are taken during data collection. For example, data should be collected so that they can be summarized by category on a stratified time basis (normally, hour-by-hour).

a. When man-hour shift profile charting is anticipated, identify tasks in the WCD as transferable and nontransferable. This helps in making the shift profile chart, which shows productive work for the stratified time increments.

b. The three basic steps in developing man-hour shift profile charts are collecting necessary data, performing end-of-study computations, and constructing the chart. The average man-hours for each hour of the day, which are used in the profile chart, may be derived from work sampling data. When the shift profile chart will be used to minimize standby time, ensure that the sample size is sufficient to support the recommendations that are based on the chart. (See sec V for discussion on sample size in relation to work sampling.) The procedures for developing a shift profile chart using work sampling data are as follows:

(1) *Step 1.* Accumulate the transferable and nontransferable time on a daily basis for each hour or half-hour of each shift. Average this time for the study period. This time may be extracted from the daily observation accumulation sheets during a normal work sampling study. On some occasions, a separate work sampling study may be conducted for the sole purpose of developing the profile chart. When this is the case, take enough samples to reach required accuracy, and collect only the productive time. Classify the productive work into transferable or nontransferable work. Consult work center personnel when making this classification if suspected tasks have not been identified in MEAS–PLAN input team instructions.

(2) *Steps 2 and 3.* Construct the man-hour shift profile chart on graph paper as follows (fig 3–10):

(a) Identify average man-hours required per hour on the vertical axis.

(b) Identify each stratified period for each shift (hourly or half-hourly) on the horizontal axis.

(c) Extend a vertical line downward from the duty hour corresponding to each shift change and state the minimum manpower requirement for that shift.

(d) Plot, from bottom to top, the average nontransferable and transferable man-hours computed for each stratified period.

(e) Identify the nontransferable and transferable time within each stratified period. Different colored pencils are helpful in this identification when the charts do not have to be reproduced.

(f) Group the various periods that make up each existing shift. Find the largest requirement within each shift and extend a dark horizontal line over the entire shift.

(g) Extend vertical lines from each stratified period up to the next whole hour above the plots for transferable time. When there is only nontransferable time within the strata, extend the vertical line from that plot to the next whole hour. The extended portion of the column is potential standby time. In most cases, the total man-hours per shift period will include both potential standby time and other nonproductive time.

(h) Prepare a legend for the chart that identifies nontransferable, transferable, standby, and other nonproductive time.

(i) Figure 3–10 is an example of a properly constructed man-hour shift profile chart.

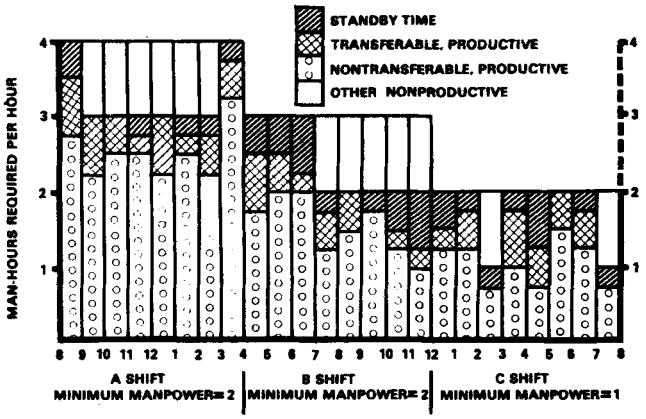


Figure 3–10. Man-hour shift profile chart, present

3–56. How to analyze the man-hour shift profile chart

Shift profile analysis may point out deficiencies in scheduling practices, or it may point out excessive minimum manpower levels. Further study of the actual shift profile chart may lead to additional benefits, such as more efficient choices for shift hours.

a. Input teams analyze the actual shift profile chart to determine the proper adjustments to make to standby time before constructing the proposed shift profile chart. An analysis of the chart may indicate the need for overlapping or split shifts. Although split shifts are sometimes necessary, they should be kept to a minimum. During analysis, keep in mind that—

(1) Evenly spread workload often reduces manpower needs.

(2) A related work center with standby man-hours may be able to accept some transferable work. This can take place only if the work can be done by the individuals receiving the work.

(3) Adjustments to existing standby time should be coordinated with local functional proponents. Adjustments will not provide manpower to exceed the required level of service.

b. Lead teams analyze the charts submitted by measurement teams. This analysis is conducted from a command point of view when developing a command standard and from an Army point of view when developing an Army common standard. A large amount of standby time at one location may mean that an exception (additive) is required at that location. On the other hand, it may mean that the input team did not properly adjust the standby time. The lead team should not adjust standby time without coordination with the input team to prevent unjustified dual adjustments of the same time. The lead team should not average or prorate standby time during the data analysis and adjustment step of the computation phase.

3–57. How to develop the proposed man-hour shift profile chart

a. A proposed shift profile chart will be constructed whenever an improvement can be made to the actual shift configuration. This chart is constructed the same way as the present profile chart; however, it is done in conjunction with the analysis step. The proposed chart often identifies faults in the analysis.

b. Figure 3–11 is an example of a proposed man-hour shift profile chart. The following procedures and explanations tell how to develop this chart:

(1) *Step 1.* For purposes of this example, assume that the minimum manpower required for the "A" and "B" shift is two and the minimum manpower required for the "C" shift is one. (See figure 3–10.) The proposed chart must accommodate this minimum manpower requirement.

(2) *Step 2.* Examine the "present" man-hour shift profile chart in figure 3–10. Examination shows large standby and nonproductive time within shifts A and B. This is a logical place to look for improvements.

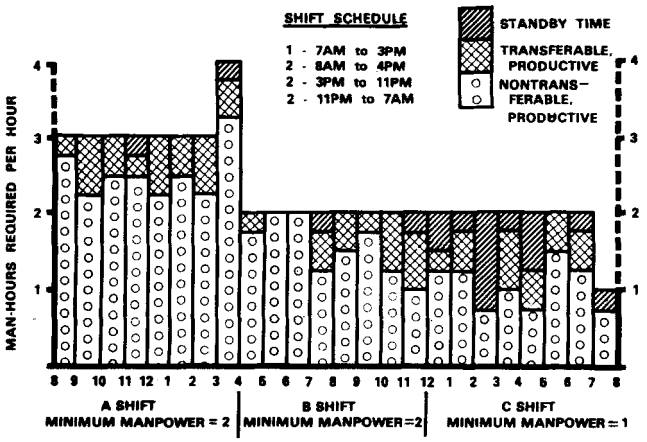


Figure 3–11. Man-hour shift profile chart, proposed

(3) *Step 3.* Experiment with different arrangements by moving transferable man-hours into periods with large amounts of standby. Move the transferable time to nearby hours within the same shift if possible. The objective is to reduce the nonproductive time, which results when each column on the chart is extended up to the total "man-hours required per shift line."

(4) *Step 4.* Experiment with different shift hours or with overlapping shifts as a means of reducing nonproductive time. Consider this possibility whenever a large "man-hour required per shift column" exists near a proposed shift change period. Figure 3–12 shows where transferable man-hours were moved within the same shift. Figure 3–13 shows how overlapping shifts were used to reduce man-hours required per shift.

(5) *Step 5.* Compute the derived standby time from the proposed chart.

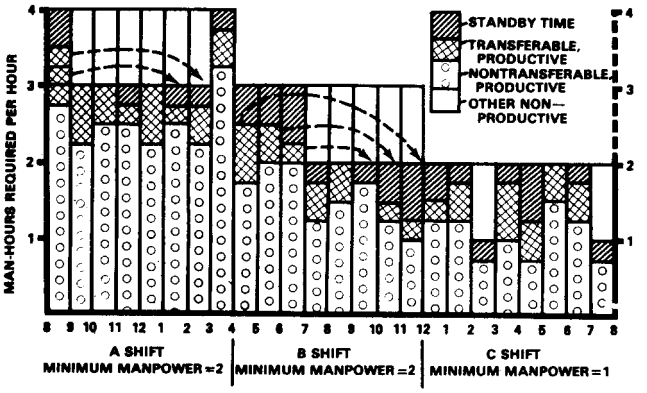


Figure 3–12. Man-hour shift profile chart, time movements

3–58. Comparing the present and proposed charts

a. Compare the proposed chart with the actual chart to determine:

(1) If the proposed chart fully accounts for all transferable and nontransferable time.

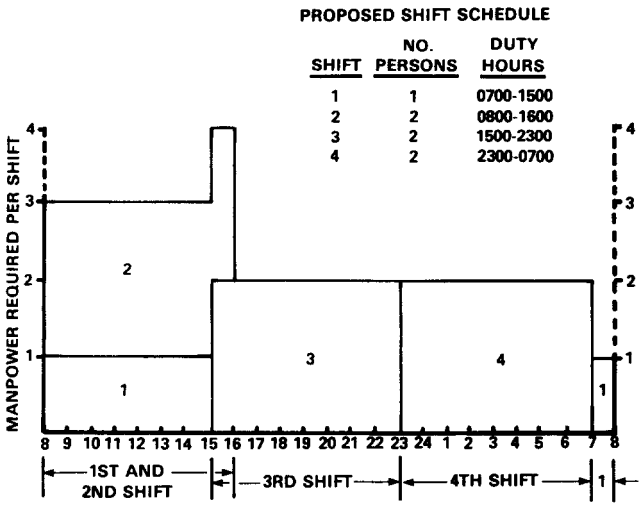


Figure 3–13. Proposed shift profile

(2) If minimum manpower requirements have been satisfied for all shifts.

(3) The extent of shift man-hour savings on the proposed chart.

b. A comparison of man-hour savings for the "present" and "proposed" charts, shown in figures 3–10, 3–11, and 3–12 is summarized below.

This comparison reflects a man-hour savings of 16 hours per day or 487.04 hours per month (16 × 30.44 = 487.04).

Table 3–8
Sample "actual" and "proposed" chart

Actual			Proposed	
Shift	Personnel	Shift hours	Shift hours	Reduction
A	4	32	25	7
B	3	24	16	8
C	2	16	15	1
Totals		72	56	16

c. Input teams use the proposed man-hour shift profile chart to—

(1) Support the standby time included in the MEAS–REP.

(2) Justify the derived (reduced) standby time to the local functional proponent.

Section XII
Manpower Staffing Standards Study Measurement Report (MEAS–REP)

3–59. General

This section gives the responsibilities and procedures on how to formulate the MEAS–REP. The MEAS–PLAN gives instructions for preparing the MEAS–REP. All data collection personnel must use these instructions. The submitted data must give an accurate account of the monthly man-hour requirements and the related workload. Include any support data and rationale that aid in the analysis by the lead team. This section also gives the coordination and submission requirements for the MEAS–REP.

3–60. Lead team and participating team responsibilities

a. The lead team—

(1) Coordinates the collection effort and updates/clarifies the MEAS–PLAN as needed.

(2) Issues any needed supplementary guidance to analysts who will collect data.

(3) Prepares the MEAS–REP when all data are collected.

b. Each participating input team prepares a MEAS–REP and submits it to the lead team as called for in the MEAS–PLAN.

3–61. Composing the measurement report

The MEAS–REP is made up of—

a. A memorandum of transmittal.

b. The following information for each work center in the standards study:

(1) Work center comments.

(2) Workload counts.

(3) Collection and reporting forms.

(4) Data adjustments and allowances.

(5) Standard input data computations.

c. Program management data.

d. Functional proponent coordination.

3–62. Participating team work center comments

Information in the work center comments part aids the lead team in input data analysis. There are no limitations but, as a minimum, the information requested must be provided. This includes—

a. A discussion of any organization changes or deviations since the SDP review.

b. An array of the personnel (by grade and MOS/series) authorized and assigned during the measurement period.

c. The rationale that supports the grade and MOS/series recommendations.

d. A listing of any major equipment changes to the work center since the SDP review.

e. An explanation, if it applies, of how standby time was determined. If a man-hour shift profile chart was used, explain the analysis done in finding standby time. Backup data may have—

(1) A list of tasks normally designated as transferable and nontransferable.

(2) The present and proposed shift operation, as applicable.

f. An explanation of the documented shift requirements for minimum computations on the DA Form 5274–R.

g. A list of the study analysts and the specific work centers that they measured.

h. Any flow charts, layout diagrams, maps, or other pertinent graphic media that aids the lead team in studying the data.

i. A statement of conditions that has items such as type of facility, transportation problems, and climate.

j. Locally directed requirements that affect the work center.

k. Specific comments that show the joint tenant support and/or contractual impact.

3–63. Getting workload counts and making control charts

a. Give the workload factor and work unit counts when they are asked for by the lead team. Preparing the MEAS–REP does not mean to stop the collection of workload data. The lead team decides when to stop the collection of data. These data must be collected, quality checked by the study analysts, and sent to the lead team in the format requested.

b. Workload factor or work unit control charting may have been used based on the type of measurement used. Give any charts and explanations to support the collected work counts that are to be included or the necessary adjustments.

3–64. Forms for data collection and reporting

The forms and documents used to record the measured man-hours have already been identified in previous sections of this chapter. Instructions for preparing them are given in the various sections. Supplemental instructions given in the MEAS–PLAN must also be followed. Also, these forms and documents must be in the MEAS–REP for each collection method used.

a. Time study. Include a completed DA Form 5275–R and supporting DD Forms 2042 or 2042–1 for all elements of work measured.

b. Work sampling. Include a completed DA Form 5278–R. Backup data are composed of—

(1) Recapitulation sheets showing daily totals of sampling periods and accumulative totals for Direct, Indirect, total Productive, and Nonproductive categories.

(2) $\overline{\mathbf{P}}$ charts and supporting calculations for total Direct, total Indirect, and total Productive categories.

(3) An explanation of each sample day out of control.

(4) A narrative commenting on borrowed or loaned time, overtime identified, use of rating and allowance factors, and analyst and proponent assessments with regard to the representativeness of sampling time.

(5) The work sampling data collection and recapitulation sheets, if asked for. These are sent as a separate package.

c. Operational audit. Include completed DA Forms 5277–R or other documents used to show the allowed monthly man-hours. The lead team may use a different method of documenting the measured time in place of the DA Form 5277–R. Backup data include—

(1) Supporting data for deriving each task line entry on the audit document where several frequencies exist. If the

task is done at various frequencies (for example, monthly, weekly, or daily), show in the supporting data the computed time for each frequency of occurrence, and how it was summed to get at a measured monthly total time. Based on this total time, monthly allowed man-hours are derived and put on the audit document.

(2) Data documenting audited overtime, cyclic work (during or out of the measurement period), and borrowed or loaned time in supporting work sampling.

3–65. Reporting data adjustments and allowances

In the MEAS–REP, tell how the applicable adjustments and allowances were applied to the measured man-hours for each work center. Make comments on how the adjustments and allowances were determined and applied. Several adjustments to the data may be needed. This depends on the measurement method used.

a. Pace rating. Tell how the procedure was rated. Also, list the categories where it was applied.

b. PF&D allowances. In all cases, use the factor built by the lead team. However, if during the measurement period it is found that the factor needs to be changed, then put in the documentation to support the proposed factor.

c. Monthly workload data adjustment. When work sampling is done for a period other than a normal work month, adjust the counts of production-type work units to a monthly count. Make this adjustment by multiplying the actual count produced by the same adjustment factor used to adjust the Monthly Allowed Man-Hours.

d. Special adjustment factors. There may be a need to build a special adjustment factor to adjust an individual category time or associated work unit count.

(1) This takes place when the time and count are not comparable with the data.

(2) This adjustment is applied in place of the factor discussed in *c* above.

(3) The way to build this adjustment factor is to divide the normal monthly work count by the work count during the sampling period and apply it to the category man-hours documented during the measurement period. The historical work count, as well as the sampling period count, must be correct, and the definition of the work units must be the same.

3–66. Computing standard input data

Sum the measured man-hours collected and adjusted by the input measurement analyst on DA Form 5274–R. Data obtained from time study and operational audit are in monthly man-hours and need no adjustment to a normal work month. However, work sampling measured man-hours need to be adjusted to a normal work month and are made on the DA Form 5278–R. Minimum manpower computations and the proposed manpower distribution for the measured man-hours are also shown on this form.

3–67. Instructions for completing DA Form 5274–R, Standard Input Data Computation Record

a. The DA Form 5274–R (fig 3–14) is used to show adjustments; to combine man-hour data obtained from work sampling, operational audit, and time study, and to show minimum manning calculations. The form shows the conversion of total monthly allowed man-hours to manpower authorizations. It also lists recommended MOS/series, skill level, and grade distribution for the measured manpower requirement.

b. Several ways of consolidating the measurement data on this form are shown in figures 3–14 through 3–16. Instructions for completion of DA Form 5274–R are at figure 3–14.

(1) See figure 3–14 for an example of data summary where work sampling was the main work measurement method with supplemental data acquired using time study and operational audit methods. There is no standby time in this work center.

(2) See figure 3–15 for an example of where the measured man-hours for a specific location are based on an operational audit for a given workload. However, this time does not give the manpower needed to support the work center. This is documented by the minimum manning computation in section III. The difference between the measured time and the minimum manning requirement is standby time.

(3) See figure 3–16 for an example of a minimum manning computation. If it is found that a minimum manning situation exists and work measurement is not of any benefit, then the computation in section III, as shown, gives the requirements.

3–68. Reporting program management data

Each input team fills out DA Form 5276–R and sends it as part of the MEAS–REP to the lead team. Instructions for completing this form are in appendix E.

3–69. Proponent coordination on the MEAS–REP

Once the MEAS–REP is completed, coordinate the contents with the functional proponent. It is a good idea to brief the proponent on the MEAS–REP data. Additionally, explain to the proponent how the data inputs are used in the standard development process. Also clearly indicate that the data do not show either the function's current or projected manpower requirements. Make this point in the correspondence requesting functional coordination on the MEAS–REP. A copy of the proponent memorandum of concurrence/nonconcurrence becomes part of the MEAS–REP. Functional

proponent nonconcurrence with the data must be specifically documented and the input team comments on the nonconcurrence submitted as part of the MEAS–REP.

3–70. Submitting the MEAS–REP

The participating input team sends to the study lead team the number of copies of the MEAS–REP as shown in the MEAS–PLAN.

Table 3–5
Other fatigue allowances

Class	Percent
Mental	
Work largely committed to habit; i.e., simple calculations on paper, reading easily understood material such as routine or familar instructions, counting and recording, simple inspection requiring attention but little discretion, arranging papers by letter or number.	0.0
Work needs full attention; i.e., copying number, addresses or instructions, memory or part number, name while checking stock or parts list, simple division of attention between work at hand and jobs of others, conveyor or time schedule, simple calculations in head, filing papers by subject of familiar nature.	2.0
Work needs concentrated attention; i.e., reading of nonroutine instructions, routine calculations on paper such as long division and four-place multiplication, checking numbers, parts, papers, etc., requiring cross-check or double check, division of attention between three components such as accounting, inspecting, and grading or driving over unfamiliar route, watching vehicle, traffic and route signs.	4.0
Work needs deep concentration; i.e., swift mental calculations on paper, memorizing, inspection work requiring interpretation and discretion against nonroutine specifications, highly divided attention between phases of work, operations of others, hazards, etc.	8.0
Lighting	
Look at the amount of light on the working surface in relation to the fineness of details upon which the operator works. Look at the amount of glare on the work surface and rapid changing or “hypnotic” effect on the work surface. The following situation applies: Add the percentage to the mental allowance. Continual glare on work areas—Work requiring constant change in light on work area. Less than 75 foot candle power on work surface for normal job. Less than 125 foot candle power on work surface for close work.	2.0
Noise factor	
Consider the general noise of the working areas as well as any annoying, sharp, staccato, or intermittent noises occurring during more than 50 percent of the workday. If ear plugs or ear muffs are worn, their sound deadening effect must be considered when using this allowance. If the conditions apply, add the percentage to the mental allowance.	
Constant, loud noises such as in machine shops, motor test shops, etc. (over 50 decibels).	1.0
Average constant noise level but with loud, sharp, intermittent, or staccato noise such as nearby riverters and punch presses (for example: sheet metal shop.)	2.0
Monotony	
Consider the fatigue resulting from fast, highly repetitive operations. The cycle is the time elapsed from starting one element until the same element is started again. If these conditions apply, add the percentage to the mental allowance.	
Cycle Time	
0.00–0.20 minutes	4.0
0.21–0.40 minutes	3.0
0.41–0.80 minutes	2.0
0.81–2.50 minutes	1.0
2.51 Minutes or more	0.0
Restrictive safety devices and clothing	
Consider those devices which are required by the job and which cause fatigue when worn. No allowance is made here unless it is necessary to remove the device occasionally for relief, or if wearing them causes fatigue. If more than one device is required, add the allowance for each class to the mental allowance.	
Face shield	2.0
Rubber boot	2.0
Goggles or welding mask	3.0
Tight, heavy protective clothing	4.0
Filter mask	5.0

Table 3–5
Other fatigue allowances—Continued

Class	Percent
Safety glasses	0.0

WORK MEASUREMENT TIME STUDY WORKSHEET *(CONTINUOUS METHOD)*

1. OPERATOR NAME OR NUMBER: Ft Bragg
2. ELEMENT DESCRIPTION
3. REFERENCE NUMBER: Immunization Clinic/847792.2
4. DATE OF STUDY: 11 Oct 81
5. NAME OF ANALYST: MSGT Smith
6. APPROVED *(Initials and Date)*: CPT Jones/12 Oct 81

CYCLE

7. NUMBER	1 Pick up swab, swab arm, dispose			2 Pick up syringe, plunge into patients arm			3 Inject serum			4 Withdraw syringe place in tray			5 Get cotton, place on arm			6			7		
	R	T	P	R	T	P	R	T	P	R	T	P	R	T	P	R	T	P	R	T	P
1	13	13	90	20	7	1	29	9	80	34	5	95	39	5	90						
2	51	12	90	59	8	80	67	8	95	72	5	90	77	5	95						
3	13	13	95	20	7	90	28	8	90	33	5	1	37	4	90						
4	51	14	1	M	–	–	72	–	–	76	4	85	81	5	80						
5	93	12	1	A	–	–	34	9	95	M	–	–	M	–	–						
6	11	11	1	18	7	1	26	8	1	31	5	105	36	5	90						
7	49	13	1	57	8	1	65	8	1	69	4	95	74	5	1						
8	88	14	90	97	9	95	06	9	90	12	6	90	24	12	–	Fumble					
9	38	14	80	45	7	90	54	9	90	59	5	1	64	5	1						
10	77	13	1	85	8	90	93	8	95	98	5	95	02	4	1						
9. TOTAL TIME	1.29			.61			.76			.44			.38								
10. NO. OF OBSVS	10			8			9			9			8								
11. AVG/SEL	.129			.076			.084			.049			.048								
12. LEVELING FACTOR	.94			.93			.93			.95			.93								
13. NORMAL TIME	.121			.071			.078			.047			.045								
14. OCCURANCE	1.0			1.0			1.0			1.0			1.0								
15. BASE TIME	.121			.071			.078			.047			.045								

8. FOREIGN ELEMENTS

	S	F	T	DESCRIPTION
A	93	25	32	Patient Frightened
B				
C				
D				
E				
F				
G				
H				
I				
J				

16. TOTAL BASE TIME *(Minutes)*: 0.362
17. PF & D ALLOWANCE: % 11.6; TIME 0.042
18. STANDARD TIME *(Minutes)*: 0.404
19. STANDARD TIME *(Hours)*: 0.00673
20. WORK UNITS: One innoculation
21. UNITS PER HOUR: 149

22. START TIME: 0800
23. STOP TIME: 0810
24. ELAPSED TIME: 10 min
25. TYPE OF TIMING DEVICE: Decimal minute stopwatch

26. REMARKS

M- Missed
7p: 1 - 100%

LEGEND: R – READING T – TIME P – PACE RATING

DD FORM 1 DEC 76 2042-1 EDITION OF 1 SEP 76 IS OBSOLETE. REPLACES ALL SIMILAR PURPOSE LOCAL FORMS WHICH MAY BE USED UNTIL EXHAUSTED. PAGE 1 OF 1 PAGE(S)

Legend for Figure 3–1;

Block 1. Enter the location where the study is being conducted.

Block 2. Give a brief description of each element (continue on additional forms if needed).

Block 3. Enter the work center title and the AFD(SWC) code.

Block 4. Enter the data started and completed.

Block 5. Enter the grade and name of the analyst performing the study.

Block 6. Initials or name of analyst's approving supervisor or team chief and date.

Block 7. Enter the appropriate data as follows:

Number. Indicates number of readings (continue on additional forms if needed).

R. Clock time (continuously running). Beginning or ending time of element being timed.

T. Element time (calculated after study).

P. Pace rating.

Block 8. Enter the appropriate data as follows:

S. Reading on clock at start of foreign element.

F. Reading on clock at finish of foreign element.

T. Element time (F minus S).

Description. Brief description of foreign element.

Block 9. Sum of element times.

Figure 3–1. Example of a completed DD Form 2042–1

Block 10. Number of acceptable readings.
Block 11. Average or selected time. Normally, Block 9 divided by Block 10.
Block 12. Percentage value of leveling factor. Factor equals sum of individual element ratings divided by block 10.
Block 13. Product of block 11 (average or selected time) multiplied by block 12 (leveling factor).
Block 14. Occurrence per week unit (number of times element occurs divided by the number of cycles observed).
Block 15. Product of block 13 (normal time) multiplied by block 14 (occurrence per work unit).
Block 16. Sum of element base times (block 15).
Block 17. Enter the appropriate data as follows:
%. Computed allowance. (See section III of this chapter.)
Time. Product of block 16 multiplied by block 17 (%).
Block 18. Sum of block 16 (total base time) and block 17 (PF&D allowance time).
Block 19. Quotient of block 18 divided by 60 (three significant digits.)
Block 20. Unit of count.
Block 21. Quotient of 1 hour divided by block 19.
Block 22. Reading on clock at start of study.
Block 23. Reading on clock at completion of study.
Block 24. Difference of block 23 minus block 22.
Block 25. Type of watch (decimal minute or decimal hour watch).
Block 26. Comments to explain abnormalities of study.

Figure 3–1. Example of a completed DD Form 2042–1—Continued

TIME STUDY RECORD For use of this form, see AR 570-5; the proponent agency is DCSPER.	COMMAND, LOCATION, ORGANIZATIONAL LEVEL	DATE STARTED	DATE COMPLETED
	USAISC, Ft Huachuca, AZ Post	8 Jan 85	19 Jan 85

FUNCTION/CODE	SUBFUNCTION/CODE	WORK CENTER
Administration/.N0000	Administrative Services/.N6000	Duplicating/.N6200

CATEGORY (a)	WORK UNIT OR ACTIVITY (b)	ALLOWED UNIT TIME (c)	MONTHLY		CATEGORY TOTALS (f)
			PRODUCTION OR FREQUENCY (d)	ALLOWED TIME (c x d = e) (e)	
1.	Record incoming work order	.017	552	9.38	9.38
3.	A. Complete a job on type A duplicating machine requiring less than 100 but more than 30 copies.	.121	450	54.45	
	B. Complete a job on type A duplicating machine requiring less than 200 but more than 100 copies.	.150	381	57.15	111.60
4.	Record completed work order	.012	552	6.62	6.62
8.	Clean reproduction drum for AJAX copier.	.095	65	6.18	6.18
			TOTAL ALLOWED MANHOURS		133.78

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Legend for Figure 3–2;

Command, Location. Enter the command, location, and organization level.

Date started. Enter the date started.

Date completed. Enter the date completed.

Function/Code. Appropriate title and AFD(SWC) code.

Subfunction/Code. Appropriate title and AFD(SWC) code.

Work Center. Enter the work center title and AFD(SWC) code.

Category *(a).* In ascending order, the number of the tasks or operations which were time studied.

Work Unit or Activity *(b).* Task or operation description.

Allowed Unit Time *(c).* Total work unit allowed time from DD Form 2042, 2042–1, or 2043.

Monthly Production or Frequency *(d).* Average production or frequency of occurrence for the task or operation.

Monthly Allowed Time *(e).* Product of column *(c)* and *(d).*

Category Totals *(f).* Total of column *(e)* task entries for a given category.

Total Allowed Man-hous. Sum of all values of column *(f).*

Figure 3–2. Example of a completed DA Form 5275–R

WORK SAMPLING RECORD

For use of this form, see AR 570-5; the proponent agency is DCSPER.

1. DATE STARTED	2. DATE COMPLETED
8 May 85	26 May 85

SECTION I – DAILY RECORD

3. WORK CENTER TITLE/CODE	4. COMMAND/INSTALLATION
Personnel Management Section/.N5514	TRADOC Ft Bliss, TX

5. SUMMARY

SAMPLING DAY (a)	DAY OF MONTH (b)	MANHOURS SAMPLED (c)	TOTAL NUMBER SAMPLES (d)	NUMBER OF PRODUCTIVE SAMPLES (e)	PRODUCTIVITY (f)	AVERAGE LEVELING FACTOR (g)
1	8 May	81	162	138	.852	1.02
2	9	81	162	150	.926	1.02
3	10	90	180	157	.872	1.00
4	11	81	162	156	.963	1.01
5	12	90	180	155	.856	1.00
6	15	81	162	147	.907	1.02
7	16	81	162	149	.920	1.01
8	17	81	162	148	.914	1.00
9	18	90	180	156	.867	1.02
10	19	90	180	148	.822	1.00
11	22	81	162	145	.895	1.00
12	23	81	162	147	.907	1.00
13	24	81	162	135	.833	1.01
14	25	81	162	136	.840	1.02
15	26	81	162	139	.858	1.01
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
6.	TOTAL	1251	2502	2206		15.14
7.	AVERAGE					1.01

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Legend for Figure 3–3;

Block 1. Date of the first sampling day.

Block 2. Date of the last sampling day.

Figure 3–3. Example of a completed DA Form 5278–R

Block 3. Enter the work center title and AFD(SWC) code.

Block 4. Enter the command and installation of the input location.

Block 5a. The beginning day of the sampling period is day 1. Continue to number the days consecutively until the last days of the sampling period. The form is already numbered for 31 days.

Block 5b. Enter the calendar day and month, for example 8 May. After the first day and month, the month is not required to be entered again unless a change of month occurs. Draw a line through the study date that has been excluded for cause, but do not exclude days just because they fall outside of established control limits.

Block 5c. Enter man-hours for assigned personnel (includes nonavailable), personnel borrowed, and sampled overtime (includes lunch time). Do not include loaned time.

Block 5d. Enter total sample recorded each day. As a check, divide the number of samples taken by the number of man-hours sampled. This number should remain constant throughout the study.

Block 5e. Enter total productive samples recorded each day (from the daily observation worksheet).

Block 5f. Divide the number of productive samples (5e) by the total samples (5d). Round results to three decimal places.

Block 5g. In decimal form, rounded to two decimal places, the arithmetic average of pace ratings recorded for each day.

Block 6. Enter the sum of the values for each of the columns (5c, d, e, and g). This gives the total man-hours sampled, total number of samples, toal number of productive samples, and total leveling factors.

Block 7. Enter the result of dividing the total for column 5g by the number of good sampling days. Round the average leveling factor to two decimal places.

Figure 3–3. Example of a completed DA Form 5278–R—Continued

Legend for Figure 3–3;

Block 8. Enter the same information that was entered in Block 3.

Block 9. Enter the same information that was entered in Block 4.

Figure 3–3. Example of a completed DA Form 5278–R—Continued

SECTION II - WORK SAMPLING COMPUTATIONS

8. WORK CENTER TITLE/CODE	9. COMMAND/INSTALLATION	10. DATE
Personnel Management Section/.N5514	TRADOC, Ft Bliss, TX	26 May 85

11. CATEGORY (a)	NUMBER OF SAMPLES (b)	PERCENT OCCUR (P) (c)	MAN-HOURS MEASURED (d)	MAN-HOURS LEVELED (e)	MAN-HOURS ALLOWANCE FACTOR (f)	MAN-HOURS ALLOWED (e x f) (g)	MAN-HOURS TOTAL (AF (*) x g) (h)
1. OFFICER CLASSIFICATION	638	.255	319.00	322.19	1.116	359.56	503.02
2. ENLISTED CLASSIFICATION	535	.214	267.71	270.39	1.116	301.76	422.16
3. TESTING	353	.141	176.39	178.15	1.116	198.82	278.15
4. OCCUPATION ANALYSIS	82	.033	41.28	41.69	1.116	46.53	65.10
5. PAY PROGRAM	50	.020	25.02	25.27	1.116	28.20	39.45
6. CLASSIFICATION BOARD	115	.046	57.55	58.13	1.116	64.87	90.75
7. CONGRESSIONAL INQUIRIES	10	.004	5.00	5.05	1.116	5.64	7.89
11. SUPERVISION	210	.084	105.08	106.13	1.116	118.44	165.70
12. ADMINISTRATION	80	.032	40.03	40.43	1.116	45.12	63.12
13. MEETINGS	30	.012	15.01	15.16	1.116	16.92	23.67
14. TRAINING	25	.010	12.51	12.64	1.116	14.11	19.74
15. SUPPLY	13	.005	6.26	6.32	1.116	7.05	9.86
16. OFFICE EQUIPMENT MAINTENANCE	20	.008	10.01	10.11	1.116	11.28	15.78
17. CLEAN-UP	45	.018	22.52	22.74	1.116	25.38	35.51
12. TOTAL PRODUCTIVE	2206	.882	1103.37	1114.40		1243.68	1739.90
13.							
NONAVAILABLE	73	.029	36.28				
UNAVOIDABLE DELAY	2	.001	1.25				
PERSONAL REST	100	.040	50.04				
IDLE	91	.036	45.04				
Lunch	30	.012	15.01				
14. TOTAL	2502	1.000	1250.99				

15.	16. PRECISION OBTAINED FOR LARGEST	17.
SAMPLES REQUIRED N = 845	P OF .255 = .0171	(*) ADJUSTMENT FACTOR (AF) AF = 1.399

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Block 10. Enter the date the computations are completed.

Block 11a. Enter all productive direct categories. Draw a horizontal line through all columns two lines below the last direct category. Start productive indirect categories one space below this line. When tasks are sampled, enter the task titles under the associated category in the same manner as in the WCD.

Block 11b. Enter total samples recorded for each category and/or task. Exclude samples from any day lined out in Part I. Do not enter total samples for a category that is measured by individual tasks. Enter the total samples for the individual task. Cross-check the total and total productive lines with Part I, columns 6d and e totals for continuity.

Block 11c. Enter in decimal form, the percent occurrence of each category. Percent of occurrence is the quotient of the number of samples in a given category divided by the total number of samples in block 6d. If individual tasks are sampled, enter the percent occurrence for each task. Sum the percent of occurrence for each task and enter the total P for the respective category. Enclose this category total P value in parentheses and do not use in computing total productive percent occurrence (12c). This category total P is used in computation of samples required and precision computations. This is the only line entry made for a category sampled at the task level.

Block 11d. Enter the measured man-hours for each category and/or task. Compute by multiplying the percent occurrence for each category and/or task by total man-hours sampled (6c).

Block 11e. Enter leveled man-hours for each productive category and/or task. This is computed by multiplying the average leveling factor (block 7) by each category/task measured man-hours. If leveling is inappropriate for a task/category, repeat the measured man-hour in this column.

Block 11f. Enter the appropriate allowance factor for each category/task. (See section III for allowance factor computations.)

Block 11g. Enter the allowed category/task man-hours. This is found by multiplying the appropriate allowance factor (11f) by the leveled category/task man-hours (11e). If category/task allowances are inappropriate, repeat the leveled category/task man-hours in this column.

Block 11h. Enter the total monthly allowed man-hours. This is found by multiplying the adjustment factor (AF) (block 17) by allowed man-hours (11g). If separate adjustment factors are used, they are shown on a separate page by category and/or task. The need for separate factors depends on the sampling time and period vs. the work center hours of operation, such as shift hours for a specific category and/or task by work.

Block 12. Enter the sum of each column. Cross-check the total for blocks 12b and c with information from Part I. The total number of productive samples (12b) must agree with the total reported in block 6e. The entry in 12c must agree, allowing for rounding error, with the result of dividing the value in block 6e by the value in block 6d.

Block 13. Enter data for these categories from the final work sampling data collection and/or compilation worksheets. Complete columns c and d with the same procedures used for productive categories.

Block 14. Enter the sum (by columns b, c, and d) of the values in blocks 12 and 13. Cross-check these totals. The total number of samples (14b) must agree with the total reported in block 6d. The total percent occurrence (14c) must equal 1.000, with allowance for rounding errors. The total measured man-hours (14d) should agree, with allowances for rounding, with the total reported in 6c for man-hours sampled.

Block 15. Enter the samples required to obtain the degree of accuracy desired. (See app I).

Block 16. Absolute accuracy, in decimal form, is found by applying the total number of samples obtained and the largest percent of occurrence for a single category to the formula:
(See figure 3–3a below for formula.)

Block 17. Enter the adjustment factor ratio. The calculation for the monthly adjustment factor is: Adjustment factor equals the average number of work center working days per month, divided by the number of sampling days included in the study. Example: For a 5-day work week, and with 15 samples days included in the data the equation would be:
Adjustment factor (AF) = 20.91/15 = 1.394

Figure 3–3. Example of a completed DA Form 5278–R—Continued—Continued

$$S = \pm 2\sqrt{\frac{\bar{P}(1 - \bar{P})}{N}}$$

Where: S = absolute accuracy.
$\bar{P}$ = largest percent occurence for a single category.
N = total number of samples.

Values for the expression $2\sqrt{\bar{P}(1 - \bar{P})}$ for given values of $\bar{P}$ may be obtained from appendix I.

Figure 3–3A. Block 16 formula

OPERATIONAL AUDIT DATA For use of this form, see AR 570-5; the proponent agency is DCSPER.	COMMAND, LOCATION, ORGANIZATION LEVEL TRADOC Ft Bliss, TX Post	FUNCTION, SUBFUNCTION, WORK CENTER Personnel Personnel Management Pers Mgmt Activities/PAC	COMPLETION DATE 31 May 81 PAGE NO. 1

ACTIVITY TITLE (a)	NUMBER OF PERSONS REQUIRED (b)	ACTIVITY FREQUENCY (c)	FREQUENCY		ALLOWED MANHOURS		
			CONVERSION FACTOR (d)	PER MONTH (c x d = e) (e)	PER ACCOMPLISHMENT (f)	PER MONTH (e x f = g) (g)	TOTALS (h)
DIRECT							
1. Officer Classification							
1.2. Reviews Duty Assignment							
1.2.1. Reviews duty assignment		25/QT	.3333	8.333	1.00	8.33	
1.2.2. Awards entry level SSI		25/QT	.3333	8.333	.07	.58	
1.2.3. Assigns suspense data		25/QT	.3333	8.333	.04	.33	
1.2.4. Updates data		25/QT	.3333	8.333	.03	.25	
1.10. Reviews MACOM Reject Listing							
1.10.1. Researches directive		1/WK	4.348	4.348	2.00	8.70	
1.10.2. Issues document		1/WK	4.348	4.348	.50	2.17	
1.10.2. Annotates reject listing		1/WK	4.348	4.348	.33GA	1.43	
					Category Man-Hour Total		21.79
					Direct Man-Hour Total		21.79
INDIRECT							
I2. Administration							
I2.1. Types communication							
I2.1.1. Types letter		1/D	20.91	20.91	.17SA	3.55	
I2.1.2. Types message		3/WK	4.348	13.04	.08	1.04	
			Activity Standard	Man-Hours	Direct 21.79	Indirect 4.59	26.38

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Legend for Figure 3–6;

Command, location, organization level. Enter the appropriate command, location, and organization level. Abbreviations from AR 310–50 may be used.

Function, subfunction/code, work center/code. Enter the function, subfunction, and work center titles. Also enter the AFD(SWC) codes for each.

Completion date. Enter the date work measurement was completed.

Page. Enter the page number. If more than two pages are used, number the pages 1 of 10, 2 of 12, e.g.

Column a. Enter the direct and indirect categories, tasks, subtasks, and elements as shown in the detailed task definitions using the same numerical identifiers.

Column b. Certain tasks need more than one individual at any given time. Examples are the “two-man” policy or “no lone-zone” concept of some maintenance activities, tasks where heavy materials are handled, or tasks are involved with some utilities operations. Supporting documentation is required in the work center comments. No entry is necessary if only one person is needed.

Column c. Enter the whole number occurrence per time period which expresses the actual frequency: for example, 1/D1 for one per day for a 5 workday week. Normally, no computations or conversions are made in the activity frequency column. An exception is made for an activity which occurs less than once a year. For example, an activity occurring every 2 years is shown as .50/YR. The activity frequency used reflects the expected natural rate of occurrence. For example, a monthly frequency is expressed as 1/MO, not 12/YR. A quarterly report is shown as 1/QT, whereas, an activity which occurs at four random times throughout the year is shown as 4/YR. Do not mix natural task frequencies. A task titled “checks voucher” is shown as 15/D1 at 2 minutes rather than 1/D1 at 30 minutes duration. This allows valid comparisons of frequencies and unit times for the respective entries. Use the frequency conversion factor symbols in table 3–7. Inherent rounding errors are recognized; however, the exclusive use of the symbols in table 3–7 is required for standardization.

Column d. Enter the applicable conversion factor from table 3–7.

Column e. Enter the values by multiplying the entries in column c by column d. Round to four significant digits if this column is used.

Figure 3–6. Example of a completed DA Form 5277–R (basic work center measurement)

Column f. Enter the allowed time values required to complete one occurrence of the activity listed in column a. If the derived time does not inclued allowances, multiply the time value by the appropriate allowance factor and only enter the total. Express this time in decimal hours rounded to two places. A table for converting minutes and seconds to decimal hours is provided at appendix J. Exceptions are—

a. Where rounding frequency and man-hours per accomplishment to two decimal places results in a significant difference (1 hour per month) in the total montly time.

b. Where approved Standard Time Data exist. In these instances, the man-hours per accomplishment can be carried out to three decimal places. Entries in this column include man-hours of all personnel required to complete the activity. If a two man team requires an elapsed time of 1.00 hour to accomplish an activity, the correct entry is 2.00 man-hours. If the per accomplishment time is derived through Standard Time Data, enter the letter "S" following the last digit. If the per accomplishment time is derived through the good operator technique, enter the letter "G" following the last digit. In either case, when allowances are included, enter the letter "A" following the "S" or "G."

Column g. Enter the product of column e multiplied by column f. This value depicts the allowed man-hours to perform the activity in column a. Man-hours are entered in two decimal places. If column e is not used, this value is the product of column c times column d times column f.

Column h. Category man-hour totals. Enter the total of category man-hour expenditures one line below the last activity entry—direct and indirect man-hour totals. Enter the respective totals one line below the last applicable category man-hour total—activity man-hour standard total. Enter the sum of the direct and indirect man-hour expenditures for the work center two lines below the indirect man-hour total. In the case of an additive, two totals are used. Enter the additive totals and, immediately below, enter the activity man-hour standard total.

Figure 3–6. Example of a completed DA Form 5277–R (basic work center measurement)—Continued

OPERATIONAL AUDIT DATA
For use of this form, see AR 570-5; the proponent agency is OCSPER.

COMMAND, LOCATION, ORGANIZATION LEVEL	FUNCTION, SUBFUNCTION, WORK CENTER	COMPLETION DATE
TRADOC	Personnel	31 May 81
Ft Bliss, TX	Personnel Management	PAGE NO.
Post	Pers Mgmt Activities/PAC	1

ACTIVITY TITLE (a)	NUMBER OF PERSONS REQUIRED (b)	ACTIVITY FREQUENCY (c)	FREQUENCY		ALLOWED MANHOURS		
			CONVERSION FACTOR (d)	PER MONTH (c x d = e)	PER ACCOMPLISHMENT (f)	PER MONTH (e x f = g)	TOTALS (h)
ADDITIVE DIRECT							
A1. Officer Classification							
A1.1. Conducts class interview							
A1.1.1. Army		1/WK	4.348	4.348	.08	.35	
A1.1.2. Navy		1/WK	4.348	4.348	.08	.35	
A1.1.3. Air Force		1/MO	1.000	1.000	.08	.08	
				Activity Category Total			.78
				Additive Direct Total			.78
			Activity	Man-Hours	Direct	Indirect	
				Standard	21.79	4.59	26.38
				Additive	.78		.78
				Total	22.57	4.59	27.16

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Figure 3–7. Example of a completed DA Form 5277–R (additive measurement)

STANDARD INPUT DATA COMPUTATIONS

For use of this form, see AR 570-5; the proponent agency is DCSPER.

SECTION I - INPUT DATA COMPUTATIONS

1. WORK CENTER TITLE/CODE	2. COMMAND/LOCATION	3. DATE
Real Property Branch/.M6100	MDW/Ft. Myer, VA	3 Aug 85

4. PRODUCTIVE CATEGORIES (a)	MONTHLY ALLOWED MAN-HOURS: WORK SAMPLING (b)	TIME STUDY (c)	OPERATIONAL AUDIT (d)	OTHER (e)	TOTAL (b + c + d + e) (f)
Direct:					
1. Real Estate Management	513.14		22.51		535.65
2. Acquisition of Real Estate	426.02				426.02
3. Disposal of Real Estate	277.93				277.93
4. Utilization of Real Estate	212.30				212.30
5. Real Property Accountable Records	65.04	27.55			92.59
Total Direct	1,494.43	27.55	22.51		1,544.49
Indirect:					
11. Supervision	103.93				103.93
12. Administration	63.08			4.96	68.04
13. Meetings	23.66				23.66
14. Training	19.70				19.70
15. Supply	9.85				9.85
16. Equipment Maintenance	15.77				15.77
17. Clean-up	21.14				21.14
Total Direct	257.13			4.96	262.09
Productive Total	1,751.56	27.55	22.51	4.96	1,806.58
5. TOTAL MAN-HOURS	1,751.56	27.55	22.51	4.96	1,806.58

10. REMARKS		
	6. MAN-HOUR AVAILABILITY FACTOR	145
	7. SUB-TOTAL REQUIRED MANPOWER	12.459
	8. WHOLE MAN REQUIREMENTS (Staffing Pattern)	0
	9. TOTAL REQUIRED MANPOWER	12

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Figure 3–14. Example 1 (work sampling) of a completed DA Form 5274–R

SECTION II - PROPOSED MANPOWER DISTRIBUTION

SPECIALTY TITLE (a)	MOS (b)	GRADE (c)	NUMBER (d)
Civil Engineering Officer	21C	CPT	.975
Real Estate - Cost Management Analysis Superintendent	51Z	E-8	1.025
Real Estate - Cost Management Analysis Specialist	51Z	E-7	1.664
Real Estate - Cost Management Analysis Specialist	51Z	E-6	3.050
Real Estate - Cost Management Analysis Specialist	51Z	E-5	4.165
Real Estate - Cost Management Analysis Specialist	51Z	E-4	1.580
		TOTAL	12.459

SECTION III - MINIMUM MANNING COMPUTATIONS

SHIFT HOURS (a)	REQUIRED PERSONS (b)	MANHOURS PER SHIFT (c)	DAYS PER MONTH (d)	MONTHLY MANHOURS (e)

TOTAL MANHOURS PER MONTH

MINIMUM MANNING

AVAILABILITY FACTOR = 145

REMARKS

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Legend for Figure 3–14;

Block 1. Enter the appropriate work center title and AFD(SWC) code.

Block 2. Enter the major command and the measurement location.

Figure 3–14. Example 1 (work sampling) of a completed DA Form 5274–R—Continued

Block 3. Enter the preparation date.

Block 4a. Enter the productive categories in the order listed on the WCD. Total Direct, Total Indirect, and Productive Total headings are also entered. If standby time was measured, enter standby time below the Productive Total heading and explain in block 10. Enter monthly allowed man-hours under the appropriate measurement method.

Block 4b. Enter the category adjusted man-hours and the total from DA Form 5278–R.

Block 4c. Enter the monthly allowed man-hours, by category, from DA Form 5275–R, Time Study Record.

Block 4d. Enter the monthly allowed man-hours, by category, from DA Form 5277–R for activities that were measured by operational audit techniques.

Block 4e. Enter the monthly allowed man-hours, by category, for activities that were measured (determined) by minimum manpower or other specialized methods. Identify the types of measurements in block 10 or include an attachment containing supporting data.

Block 4f. Enter the sum of entries in columns 4b, c, d, and e, by category, to establish monthly allowed man-hours for the work center.

Block 5. Enter the total man-hours in columns 4b, c, d, e, and f.

Block 6. Enter the applicable man-hour availability factor to be used to compute required manpower.

Block 7. Enter the result of dividing the total man-hours from block 5f by the man-hour availability factor (block 6).

Block 8. Enter the whole man requirements when a staffing pattern techique is used for documentation, such as a directed organization position.

Block 9. Enter the sum of block 7 and block 8. Round to the whole man requirement in accordance with appendix B.

Block 10. Enter the explanation of the method used in column 4e, or any other pertinent data. Reference supporting documents and rationale as necessary.

Sec II, col a. Enter the appropriate position or specialty title.

Sec II, col b. Enter the MOS code or civilian series number.

Sec II, col c. Enter the proposed military or civilian grade.

Sec II, col d. Enter the number of proposed positions in fractional amounts rounded to three decimal places.

Sec II, Total. Enter the sum of the values entered in column d. This value must equal the sum of blocks 7 and 8 before rounding.

Sec III, col a. Enter the shift hours that the work center requires a minimum manning requirement, for example, 0800–1600, 1600–2400, 2400–0800.

Sec III, col b. For each shift, enter the minimum number of persons that must be in the work center.

Sec III, col c. Enter the total man-hours per shift. This is obtained by multiplying the number of persons required by the number of hours per shift.

Sec III, col d. Enter the number of days per month that the specific shift works.

Sec III, col e. Enter the total monthly man-hours for each shift. This is obtained by multiplying man-hours per shift by the days per month.

Sec III, Total Man-hours Per Month. Enter the sum of all entries in column e.

Sec III, Minimum Manning. Enter the fractional minimum manpower requirements rounded to three decimal places. This value is determined by dividing total man-hours per month by the appropriate man-hour availability factor.

Sec III, Availability Factor. Enter the man-hour availability factor to be used in determining minimum manpower requirements.

Sec III, Remarks. Enter remarks as appropriate. May be used as a continuation for block 10.

Figure 3–14. Example 1 (work sampling) of a completed DA Form 5274–R—Continued—Continued

STANDARD INPUT DATA COMPUTATIONS

For use of this form, see AR 570-5; the proponent agency is DCSPER.

SECTION I - INPUT DATA COMPUTATIONS

1. WORK CENTER TITLE/CODE	2. COMMAND/LOCATION	3. DATE
Emergency Medical Care/HPF	MDW/Ft. Myer, VA	3 Aug 84

4. PRODUCTIVE CATEGORIES (a)	MONTHLY ALLOWED MAN-HOURS: WORK SAMPLING (b)	TIME STUDY (c)	OPERATIONAL AUDIT (d)	OTHER (e)	TOTAL (b + c + d + e) (f)
DIRECT:					
1. Subprofessional Medical Care			997.84		997.84
2. Transportation Services			680.19		680.19
3. Vehicle Maintenance			74.32		74.32
TOTAL DIRECT			1,752.35		1,752.35
INDIRECT:					
I1. Supervision			91.76		91.76
I2. Administration			32.15		32.15
I3. Meetings			15.35		15.35
I4. Training			24.70		24.70
I5. Supply			21.78		21.78
I6. Equipment Maintenance			19.57		19.57
I7. Clean-Up			37.18		37.18
TOTAL INDIRECT			242.49		242.49
PRODUCTIVE TIME			1,994.84		1,994.84
STANDBY TIME				135.40	135.40
5. TOTAL MAN-HOURS			1,994.84	135.40	2,130.24

10. REMARKS

Minimum manpower used to derive standby time.

6. MAN-HOUR AVAILABILITY FACTOR	145.0
7. SUB-TOTAL REQUIRED MANPOWER	14.691
8. WHOLE MAN REQUIREMENTS (Staffing Pattern)	0
9. TOTAL REQUIRED MANPOWER	14

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Figure 3–15. Example 2 (operational audit) of a completed DA Form 5274–R

SECTION II - PROPOSED MANPOWER DISTRIBUTION

SPECIALTY TITLE (a)	MOS (b)	GRADE (c)	NUMBER (d)
Medical Service Technician	91B50	E-8	.872
Medical Service Specialist	91B40	E-7	2.128
Medical Service Specialist	91B30	E-6	3.260
Medical Service Specialist	91B20	E-5	2.720
Medical Service Specialist	91B10	E-4	5.711
		TOTAL	14.691

SECTION III - MINIMUM MANNING COMPUTATIONS

SHIFT HOURS (a)	REQUIRED PERSONS (b)	MANHOURS PER SHIFT (c)	DAYS PER MONTH (d)	MONTHLY MANHOURS (e)
0800 - 1600	4	32.00	20.91	669.12
0800 - 1600	2	16.00	30.44	487.04
1600 - 2400	2	16.00	30.44	487.04
2400 - 0800	2	16.00	30.44	487.04

TOTAL MANHOURS PER MONTH	2130.24
MINIMUM MANNING	14.691

AVAILABILITY FACTOR = 145

REMARKS

Minimum Man-hours/Month (Sec III) - 2130.24
Less Measured Man-hours (sec I) - 1994.84

Derived Standby Time - 135.40

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Figure 3–15. Example 2 (operational audit) of a completed DA Form 5274–R—Continued

STANDARD INPUT DATA COMPUTATIONS

For use of this form, see AR 570-5; the proponent agency is DCSPER.

SECTION I - INPUT DATA COMPUTATIONS

1. WORK CENTER TITLE/CODE	2. COMMAND/LOCATION	3. DATE
Provost Marshal Activities Staff/TFE	MDW/Ft. Myer, VA	3 Aug 84

4. PRODUCTIVE CATEGORIES (a)	MONTHLY ALLOWED MAN-HOURS: WORK SAMPLING (b)	TIME STUDY (c)	OPERATIONAL AUDIT (d)	OTHER (e)	TOTAL (b + c + d + e) (f)
"See minimum manning computations"					
5. TOTAL MAN-HOURS					

10. REMARKS		
	6. MAN-HOUR AVAILABILITY FACTOR	
	7. SUB-TOTAL REQUIRED MANPOWER	
	8. WHOLE MAN REQUIREMENTS (Staffing Pattern)	
	9. TOTAL REQUIRED MANPOWER	

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Figure 3–16. Example 3 (minimum manning) of a completed DA Form 5274–R

SECTION II - PROPOSED MANPOWER DISTRIBUTION

SPECIALTY TITLE (a)	MOS (b)	GRADE (c)	NUMBER (d)
Military Police	95B10	E-4	5.432
Military Police	95B10	E-3	6.324
		TOTAL	11.756

SECTION III - MINIMUM MANNING COMPUTATIONS

SHIFT HOURS (a)	REQUIRED PERSONS (b)	MANHOURS PER SHIFT (c)	DAYS PER MONTH (d)	MONTHLY MANHOURS (e)
0800 - 1600	4	32.00	30.44	974.08
1600 - 2400	2	16.00	30.44	487.04
2400 - 0800	1	8.00	30.44	243.52

TOTAL MANHOURS PER MONTH	1704.64
MINIMUM MANNING	11.756

AVAILABILITY FACTOR = 145

REMARKS

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Figure 3–16. Example 3 (minimum manning) of a completed DA Form 5274–R—Continued

Chapter 4
The Computation Phase

Section I
Manpower Staffing Standards Input Data Analysis

4–1. General

Other than single-location standards, manpower staffing standards are most often built from multiple input values of both measured man-hours and potential workload factors. In multilocation studies, each measurement input gives a man-hour and manpower requirement at one workload value. The manpower staffing standard, in the form of a regression equation, gives the man-hour requirement at any workload level in the extrapolation range of the model.

a. The input data and input team comments are reviewed by the lead team. It is very important that adherence to procedures and mathematical accuracy is checked. Research the data to find the representativeness and to set apart significant work center differences. See if they can be made into additive standards or excluded work. Look at the mathematical relationship between category and task times and work unit counts through comparative and regression analyses. Review the data to ensure they really give a representative statement of work center requirements.

b. After reviewing the input data, test all regression models that might be used for "best fit" and compatibility with the model selection criteria in section II.

c. The rest of this section tells how to do the detailed analysis. How to pick the manpower model is explained in section II. Other computation phase tasks, such as skill and grade determination, program estimating equation development, and manpower table construction procedures are given in later sections.

4–2. Manpower exceptions

a. Exceptions to manpower staffing standards are sometimes required because of added or excluded workloads and because of valid manpower deviations. The following paragraphs describe the difference between the three types of manpower exceptions and specify the minimum essential requirements for each.

b. All exceptions are published in the Army Manpower Standards Publications (DA Pam 570–100 series). During standards development, some statistical deviation is built into the standard man-hour equation. Such deviation is both positive (+) and negative (−); therefore, emphasis is placed on the net manpower impact when quantifying potential standard exceptions. (See the glossary for definitions of exception, additive, exclusion, and deviation.)

4–3. Differences among manpower exceptions

It is important to distinguish between the different types of exceptions to quantify and document the manpower requirements properly.

a. Additives generally exist at particular locations if work center personnel are required to accomplish a category or task which is not a part of the standard's work center description.

b. Exclusions may exist when a category or task is not accomplished at a particular location.

c. Deviations, on the other hand, generally exist because of climatic conditions, travel distances, unique mission requirements, and equipment or procedural differences. A manpower deviation is an exception which results in an additive standard or a subtractive standard.

4–4. Essential elements of exceptions

Essential elements for each exception (summarized in table 4–1) are basically the same as those required in the published manpower staffing standard. In addition, the applicable requirements of section V must be satisfied. The following definitions of essential elements apply:

a. Objective statement. A concise statement that tells the purpose of the exception; that is, what it does, why it is needed, and what it is for.

b. Authority. A paragraph or statement that—

(1) Describes any Army policy guidance affecting the exception.

(2) Lists the pertinent publication or directive supporting the exception.

c. Applicability. A statement that indicates where the, exception applies and, if appropriate, does not apply.

d. Classification. A categorization of standards into difference levels. Each manpower exception must be classified as to the basis for exception. The classification of an exception is independent of the classification of the basic standard.

e. Application instructions. A narrative telling exactly how the exception is to be applied. It includes both general and specific application instructions. Typical instructions are as follows:

(1) How to compute man-hours using the exception.

(2) How the exception relates to the basic standard.

(3) How to extrapolate using the exception equation.

(4) How to use grades, MOS/series for requirements, contracted workload, and flying positions when these items are appropriate.

f. Exception equation. A mathematical formula which quantifies the man-hours or manpower required for the exception. An exception equation is always required. If the equation is for constant manpower or constant man-hours, state the equation in those units (for example, Y = 1), and provide the rationale for why a bivariate or multivariate relationship is not appropriate. If the exception equation is bivariate or multivariate, state concisely the workload factor title, definition, and source of count.

g. Statement of conditions. Narrative information relating to the work center environment. It describes the average or normal situation on which the manpower staffing standard is built. It is the standard of living for the work center. Do not requote the SOC in the basic standard, but tell how the exception SOC differs. The following items are typical, but not all inclusive, of the information in the SOC:

(1) Response times.

(2) Types and conditions of facilities.

(3) Equipment types and ages.

(4) Availability of spare parts.

(5) Climatic conditions.

(6) Travel distances.

h. Work center description. A work center description prepared in accordance with figure 2–5 is required for each exception classified as an additive or as an exclusion.

i. Manpower table. An exception manpower table is required when the exception causes changes to the grade, skill, or extrapolation limits of the basic standard. When a manpower table is not used for the exception, state in the application instructions how the exception is to be applied in conjunction with the manpower table of the basic standard.

Table 4–1
Essential elements of exceptions, by type

	A	B	C
Rule	If the exception is —	then the resultant standard will be classified as —	and the minimum essential elements required are —
1	an additive	an additive standard	objective statement
2	an exclusion	a subtractive standard	authority
3	a manpower deviation	an additive standard or a subtractive standard (See note 4.)	applicability classification application instructions exception equation WCD (See note 1.) statement of conditions (See note 2.) manpower table (See note 3.)

Notes:

[1] A WCD is not required for manpower deviations.

[2] The SOC is required if the exception is based on those conditions. Do not requote the SOC in the basic standard but tell how the exception SOC differs.

[3] An exception manpower table is required when the exception causes changes to the grade, skill, or extrapolation limits of the basic standard. When a manpower table is not used for the exception, state in the application instructions how the exception is to be applied in conjunction with the manpower table of the basic standard.

[4] Type of standard is dependent on the sign (+ / −) of the net manpower deviation.

4–5. Identifying potential manpower exceptions

a. Standard exceptions are developed by manpower management personnel during normal standards development or application cycles. However, mission or policy changes could require that exceptions be developed during other time frames. Standard development techniques discussed in this regulation are also applicable for use in developing exceptions.

b. Additive work or excluded work can generally be identified by comparing the work center activity with that of the basic work center manpower staffing standard. Identification of a potential manpower deviation, however, is more

difficult because of the averaging effect which is built into the standard equation. Furthermore, work measurement data will not usually be available at a nonparticipating location. Thus, a valid comparison may not be possible.

c. Use the SOC contained in the FIN–REP and the manpower standard as a basis for identifying potential exceptions. If conditions at a particular location depart significantly from the conditions in the SOC and the work center description does not change, then a potential manpower deviation may exist at that location.

d. When identifying potential manpower deviations, consider the work measurement method which was used to develop the basic standard. Work sampling, by its nature, can be very accurate at the category level. However, it is difficult to establish a deviation at the task level when category work sampling is used to collect man-hours. Operational audit is used to collect man-hours at the task level, but task times generally vary widely with this work measurement method. Regardless of whether the measurement method lends itself to deviation determination, the causative factors must be determined. If the causative factors are temporary (for example, summer turnover, one-time mission, or peak workload), then a manpower deviation is not appropriate.

e. The following is a hypothetical example of a potential manpower deviation:

(1) Installation Y was a nonparticipating location during development of the work center manpower staffing standard. The workload factor average value for Installation Y is 19,950 widgets. Installation X was a participating location during standard development. Installation X, similarly, has a workload factor average value of 20,000 widgets. The work centers at Installation X and the other participating installations are located in single facilities. However, the work center at Installation Y is located in two separate facilities. Therefore, although no additional categories or tasks are generated at Installation Y, the amount of time to perform administration, supervision, communication, coordination, and cleanup varies significantly. This situation is not forecast to be resolved within the foreseeable future due to current funding and space limitations.

(2) The man-hours required for this deviation at Installation Y are displayed below.

Table 4–1A
Sample manpower deviation

Category/task	Man-hours standard	Man-hours required	Deviation man-hours
Administration	135.00	205.00	+ 70.00
Supervision	144.00	187.00	+ 43.00
Communication	80.00	123.00	+ 43.00
Coordination	75.00	105.00	+ 30.00
Cleanup	135.00	95.00	− 40.00
	569.00	715.00	+ 146.00

f. The approach in *e* above requires measurement at the category level to determine the net deviation. This approach will not be appropriate in all cases and is only one of the many which could be used for identifying manpower deviations. The various curvilinear equations used in the MS–3 make one standardized statistical procedure impractical for all situations.

g. Because of the diversity of standard exceptions and for reasons mentioned previously, each exception (additive, exclusion, or deviation) must be evaluated and approved on its own merit.

4–6. Processing manpower exceptions

Manpower exceptions which are developed and validated during normal standards studies are processed with the basic manpower staffing standards. Exceptions developed by commands which are independent of Army manpower staffing standards development studies will be submitted for approval according to chapter 5 and will be in FIN–REP format as described in section V.

4–7. Guidelines for data analysis

a. Even if a study is set up to recognize major differences among study locations, variations in man-hour data at all levels of activity aggregation will take place. It is not possible to explain the variations on the basis of these differences alone.

(1) In a sampling study, one study location may have had more people on OJT with a very large and unusual amount of time spent in training. Another may have stopped OJT altogether, showing very little time spent in training. Abnormal weather conditions may have occurred at another. Seasonal, special, or onetime workloads may have been unknowingly measured at a third. At a fourth location, technicians may have been in training and may not have been sensitive to situations that had an influence on the measurement data. A fifth may have used different methods of operation, and so forth. Inefficient and uneconomical practices evolve at the same time with streamlined ones.

(2) Regardless of the reasons for variation, data must be studied to make sure the time was put in only for

authorized work done at an acceptable level of performance. The lead team, with the functional proponent, must decide whether the methods used are worth the man-hour costs.

b. Comparative analyses may show procedures that are not needed and require time that goes beyond reasonable limits. Do not set up rules picked at will to reduce the dispersion of data values so that the sample coefficient of variation can be reduced. This defeats the purpose of requirements determination.

(1) A rule that leaves out man-hour and workload values that go beyond a specified number of standard deviations from a mean or standard errors from a regression line is not a good substitute for finding whether valid reasons exist to keep or leave out the data. This is very true when category level man-hours are being related to work units. Variability of man-hours to work unit ratios can come from many causes, not all of which imply bad data.

(2) There are several factors that can mix with each other to give high or low work count ratios. Examples are poor category construction, lack of association between category man-hours and the chosen work units, or man-hours and work counts that do not relate to the same time period. Also, differences in ways used to do the work that are not apparent from the way the category is defined, fall into this category of factors.

(3) The ratio values alone do not show what changes need to be made.

4–8. Procedures for data analysis

The following procedures help when looking at data that are to be used as input data to build the regression equation. The degree to which some of these procedures can be used depends on how much data are available for analysis.

a. Check the inputs to make sure that the measurement instructions were followed and that calculations are right. Note the exceptions to the work center description that were identified by the input team(s). See if man-hour and workload data are for like time periods for each measurement location.

b. Arrange the input data for comparative analysis. This means the use of spread sheets, graphs, charts, and various arrays.

(1) Numerous man-hour data arrays are possible. These include total work center productive direct, by total productive indirect, by category, by groups of related categories, and by separate activity.

(2) Input team comments that concern the work center should be arrayed to ease comparisons.

c. Next, compare the input data. One way is to start the analysis of measurement data at the level of activity where the measurement was done (that is, category, task, subtask, etc.). Find variations, inconsistencies, and contradictions that make the data unusable in building a standard. Some ways to find problem areas are the use of scattergrams, percentage arrays, and regression of category-task man-hours with work counts.

(1) When scattergrams or percentage arrays for the category allowed man-hours versus their respective work units are built, certain patterns or consistencies should be clear. Research the study points that do not follow this pattern to find the cause of the variance.

(2) Use an alternative basis for the comparative analysis for categories that cannot be associated with a work unit, for example, the ratio of man-hours in the category to total productive man-hours. This can be done by a scattergrarn for each category, plotting category man-hours against total man-hours, or by using an array of the ratios of category to the total man-hours. With each approach, look into the very high or low values.

d. Identify tasks that can be or are standardized in terms of procedures used.

(1) When possible, think about developing standard times and frequencies. However, document the decisions made and put the backup in the FIN–REP. Also, in a like manner, identify highly variable tasks and place them into two categories: controllable and uncontrollable. For controllable tasks, such as issuing a part, think of standard times and frequencies. For tasks that are largely uncontrollable (for example, maintenance troubleshooting), identify factors that help to explain the variances.

(2) See if procedures at one location are more efficient than those at another. If so, think about basing time on the most efficient methods. This helps to throw out widely varying standards of living. It is done by focusing attention on procedures, management policies, and other areas that cost manpower. At the time of the analysis, make the decisions, with the functional proponent's help, on the most efficient procedures.

e. Identify the tasks that have an effect on one another (for example, scheduled and unscheduled maintenance). Properly performing scheduled maintenance helps to reduce unscheduled maintenance.

f. Look at the values and supporting rationale for any personal and fatigue allowances that go beyond the established norm. (See chap 3.) Unavoidable delay allowances must be firmly set up as inherent and long lasting.

g. Looking at workload factors focuses on the accuracy of the reported values for each of the previously identified potential workload factors. It also focuses on the evaluation of any additional possibilities suggested by the input data. Find out if the prescribed methods were used and if all potentially useful workload factors were obtained.

h. Where enough data values were obtained to have a credible sample, set up various hypotheses to test for significant differences between data from different locations.

(1) If the basic assumption is that man-hours per category or task accomplishment follow the same statistical distribution, then hypothesis testing helps find out whether a particular value can be assumed to come from that distribution.

(2) Tests such as the chi-square goodness of fit test may be used as a means of determining the representativeness of

sample values to overall population values. It is specifically used to test whether or not the sample was drawn from a population that follows some specified distribution. Chi-square table values are provided at appendix K.

(3) Also, tests can be made to see if means from installations having one set of characteristics come from the same statistical population as means from installations with a different set of characteristics.

(4) Similarly, study locations may be grouped by common identifying characteristics (for example, geographically or by size) and tests done to see if differences can logically be assumed to exist. The stratification may be done in the same manner as those used for picking study input locations.

(5) Where test results show that significant differences exist, find the reasons. Either data come from one population justifying common treatment or from different populations needing separate treatment.

(6) If the sample size is too small to draw reliable conclusions, input teams may have to get additional data. Do not do this too often so as to keep from interfering with other efforts. Depending on the urgency of the need for additional information, lead teams may contact input teams by using message or memorandum communications. In either case, send an information copy of the request to the input team's parent command manpower management element.

i. Statistical tests cannot make up for study design faults that may result in—

(1) Man-hours determined in aggregate for a large grouping of activities.

(2) Man-hours covering poorly or very broadly defined categories.

(3) Man-hours based on activities that are nonstandardized.

(4) Man-hours that have been found by poor measurement discipline (for example, exclusive use of technical estimate technique).

(5) Workload factors that were picked and do not relate to man-hours.

(6) Too few workload factors collected.

(7) Too small a number of input locations for the activity being studied.

4–9. Adjusting input data

Document adjustments to input data and coordinate the changes with the Commander, USAMARDA before final standards computation. This documentation is put in the work center comments section of the FIN–REP.

a. Exceptions may have been identified by the lead team during analysis. Initially, include exceptions from questionable measurement locations in the regression analysis to find out the impact. Adjust significant exceptions prior to the entry of the data into regression equations. This will ensure that the manpower model will be uncontaminated by additive or excluded work.

(1) For those locations where additive man-hours are included, adjust the measurement data downward by the amount of the additive.

(2) When valid exclusions are recognized, adjust the input data upward by the amount of the exclusion. The amount of the exclusion is found by regressing excluded category or task man-hours on workload factor volumes at the locations where those categories and tasks are done. The resulting equation is then applied to exclusion locations to find out the amount of the adjustments.

b. Prepare manpower tables and application instructions so that valid additives and exclusions are recognized and compensated for. In the final analysis, it is the responsibility of the lead team and the Commander, USAMARDA to find out if the significance of the workload needs more study. If the final manpower staffing standard equation is to be used at an installation with a major exception, the total authorizations for the appropriate work center(s) are adjusted based on the validated exception man-hours. The lead team identifies the number of man-hours to adjust along with the locations affected. The disposition of exceptions is found through coordination with the HQDA functional proponent.

4–10. Rounding calculations

a. Unless otherwise directed, final calculations are rounded as follows:

(1) Round to four decimal places: accuracy, standard error, standard deviation, correlation coefficient, and coefficient of determination.

(2) Round to three decimal places: manpower figures, allowance factor, P in work sampling studies, student "t" values, Fisher's "F" values, and fractional man-hour breakpoints.

(3) Round to two decimal places: man-hours on standard input data computation, time study record, operational audit data, and work sampling record; leveling factor; and coefficient of variation.

(4) Round to four significant digits: coefficients in regression equations, for example: 12,340., 1,234., 123.4, 12.34, 1.234, .1234, and .0001234.

b. To round a number, discard all digits to the right of the number specified for that particular computation. If the discarded digit immediately to the right of the last retainable digit is less than five, leave the last retainable digit unchanged; if it is greater than or equal to five, add one to the last digit. (Exception: If you are using devices that make intermediate rounding inefficient, it is permissible to carry extra digits and round only the final calculation.) Examples (rounded to three decimal places) are as follows:

(1) 27.16446. In this case, the digit immediately to the right of the last retainable digit is less than five, so the number rounds to 27.164.

(2) 27.16461. In this case, the digit immediately to the right of the last retainable digit is more than five, so the number rounds to 27.165.

(3) 27.164500. In this case, the digit immediately to the right of the last retainable digit is exactly five, so the number rounds to 27.165.

Section II
Manpower Model Selection

4–11. General

This section gives detailed guidance needed in the development of manpower staffing standards using multiple location data. Also, methods are given for computing a manpower equation for a single measurement location. Parameters are set up for evaluating multiple location regression equations for acceptability as manpower staffing standards.

4–12. The functional model

a. General. The functional model shows the actual distribution of manpower to handle the workload; not necessarily the manpower needs for that workload. That is, it shows what the functions are and where more study effort is needed. The size of the standard error and the number of extreme deviations from the model's derived equation show how much analysis and work is needed. The analysis depends on management's goals and objectives for functional standardization and for manpower accounting and control, as well as on precision in programming manpower requirements. To build a functional model, follow the steps outlined below.

b. Step 1. Pick a function at the desired level of aggregation; for example, Facilities Engineer, Ground Safety, or Operations.

c. Step 2. Pick a candidate workload and program variables which logically relate to manpower authorizations in the TAADS.

d. Step 3. Get the manpower data from the TAADS for the selected function, by location, for each time period under consideration. Get the volume of the selected variables for the same time periods.

e. Step 4. Analyze the data and compute the models.

(1) Identify and correct improper coding of manpower data and erroneous workload data.

(2) Do correlation, regression, and other forms of statistical analysis to find the relationship between manpower authorizations and the candidate workload and program variables.

(3) Pick the equation form and workload and program variable(s) which best give the corrected manpower distribution in the TAADS and compute the individual deviations (the $Y - Y_C$ residuals). The selected equation and deviations represent the functional model for the functional account and level of aggregation.

(4) Look at the extreme deviation and the data points that are near the standard error boundary lines to find probable cause. This may involve participation of several staff offices, such as the functional manager and his or her staff, manpower requirements and organizational monitors, manpower programming and allocation offices, workload and mission programming, budget, and the plans offices. The purpose of this inquiry is to find whether the deviation and high standard error are by management design with well documented reasons. If this is so, then include those reasons as part of the functional model backup data. Major causal factors are:

(a) Mixing, data from different organizational levels.

(b) Functions and organizations are not defined well enough to separate unrelated activities.

(c) Geographic population differences.

(d) Use of contract services at some locations.

(e) Management philosophy and personnel utilization policy differences.

(f) Incorrect manpower authorizations.

(g) Organization structural differences.

(h) Manpower utilization not consistent with the indicated function.

(i) Authorized manpower is not proper.

(j) Lack of relationship between manpower and selected program and workload variables.

(5) When attempts to document the reasons showing management design fail to explain the size of the deviations, think of doing a management study.

(6) The inquiry should give some clues to the expected benefit of alternative study approaches. (See step 5.) These include return on investment, improved manpower distribution, bringing deviations into line with accepted limits, more accurate manpower programming.

f. Step 5. Schedule a management study in line with the desired results, expected benefits, and resource availability if the inquiry in step 4 shows that a study is needed.

(1) For example, changes made through a small-scale manpower review study may lessen the unexplained deviations enough for the functional model to be valid.

(2) On the other hand, a detailed manpower staffing standards study may be needed to significantly reduce and explain the deviations.

(3) A detailed study of the functions at selected locations may be needed to verify large deviations and to have management accept them.

g. Step 6. Do step 5 over periodically, to keep a current functional model.

h. Example. Figure 4–1 is a hypothetical example of a functional model. Note that the equation, all data points, and the one-standard error boundary lines are plotted. The functional model shown was not built from a credible data base and is not considered acceptable for a standard. This functional model shows an extremely large standard error—12 percent of the average manpower authorization. Data used to develop the function model example are shown in table 4–2.

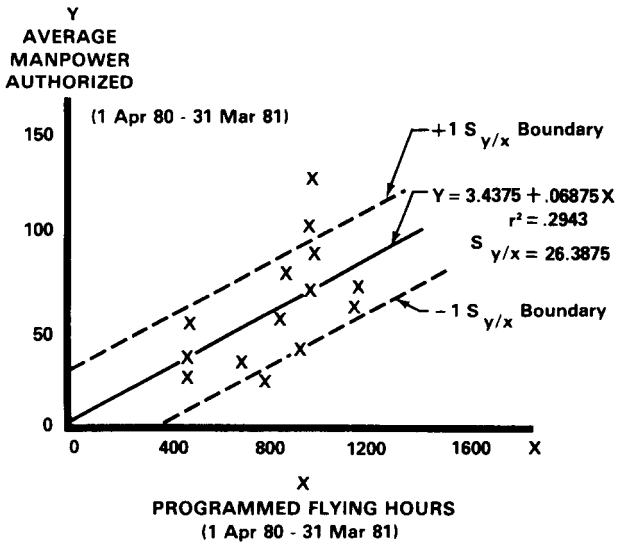


Figure 4–1. Functional model example

Table 4–2
Data used to develop the functional model

Airfield	Manpower (Y)	Flying hours (X)
1	28	500
2	35	500
3	55	500
4	33	700
5	59	850
6	30	800
7	40	950
8	80	900
9	130	1000
10	100	1000
11	65	1200
12	60	1200
13	70	1000
14	95	1000

4–13. Regression analysis

The following guidance for performing linear regression analysis is provided. It places special emphasis on developing relationships between required manpower and workloads, and using input data from development teams.

a. There are many uses for regression analysis in the MS–3. Some of these are the analysis of category times as input data, selection of workload factors, development of manpower equations, selection of program estimating factors, development of manpower models, and application of manpower criteria.

b. Regression analysis results in mathematical relationships between two or more variables. It shows how valid the relationships are for prediction purposes. For example, suppose that the number of line items processed in an installation supply activity affects the number of required man-hours in the function. Regression analysis is then used to get a mathematical relationship between man-hours and the number of line items processed. If the relationship of the number of items processed is acceptable, then the number of line items processed can be used as the workload factor, and required man-hours (the dependent variable) are said to depend on the number of line items processed (the independent variable). In manpower relationships, the dependent variable is normally expressed in terms of man-hours or manpower positions.

c. The basic steps for developing regression equations are similar regardless of the model used, but the calculations become more complex by going from linear bivariate equations to multivariate linear and curvilinear equations.

d. After computing the regression equation, compare it with other types of regression equations.

(1) Two measures which are used to make this comparison are the standard error of the estimate and the correlation coefficient. The standard error of the estimate is measured in units of the dependent variable, and it is only useful for comparison when the dependent variable is the same in all analyses. The correlation coefficient is an index number which has no units attached to it. Therefore, it is a comparative measure which is consistent regardless of the units in which the dependent variable is expressed.

(2) Before making comparisons, test the results to see if they are significant. The significance tests used are the "F" test and the "t" test. The type of test will depend on the particular situation. If the results are not significant, discard one or more of the following: the model, the workload factor, or the input data.

4–14. Graphical analysis

a. When a series of numerical values of the dependent variable are plotted against values of the independent variable, the result is a scatter diagram or scattergram. On the graph in figure 4–1 the X (horizontal) axis is used for the independent variable (workload factor) and Y (vertical) axis for the dependent variable (man-hours or manpower).

b. The form taken by a scattergram gives the analyst some insight into the relationship between two variables. For example, figure 4–2 shows five different scattergrams.

(1) In A and B, the relationship is positive and linear, but they differ in that the relationship between the two variables in A is closer than the relationship in B.

(2) In C, the relationship is negative and linear. The scatter in D shows that the relationship between the two variables is nonlinear because the trend of points first goes up, then curves over, and finally levels off. If the trend was linear, it would maintain a straight direction.

(3) If there is no relationship between two variables, the scatter of the points may be of the pattern shown in E. A scattergram can save time in picking the proper model by pointing out obviously unacceptable or implausible relationships.

c. From scattergrams, independent variables can be picked which show a positive relationship to the dependent variable. The dependent variable can be predicted by one or more independent variables. The scattergrams usually indicate whether one independent variable is sufficient. Equations using one independent variable are called "bivariate" (one dependent and one independent variable). Equations using more than one independent variable are called "multivariate." The general forms of the bivariate and multivariate linear equations are, respectively, $Y_c = a + bX$, and $Y_c = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$.

d. In each equation, Y is the dependent variable (usually man-hours) and X (or the X_i's) is the independent variable. The a is a constant and b (or b_i's) is a regression coefficient. Their specific values must be found for each regression problem. For example, if a scattergram supports the hypothesis that an equation of the form $Y_c = a + bX$ is right, the next step is to find the numerical values of "a" and "b" which sets up the best linear fit to the data.

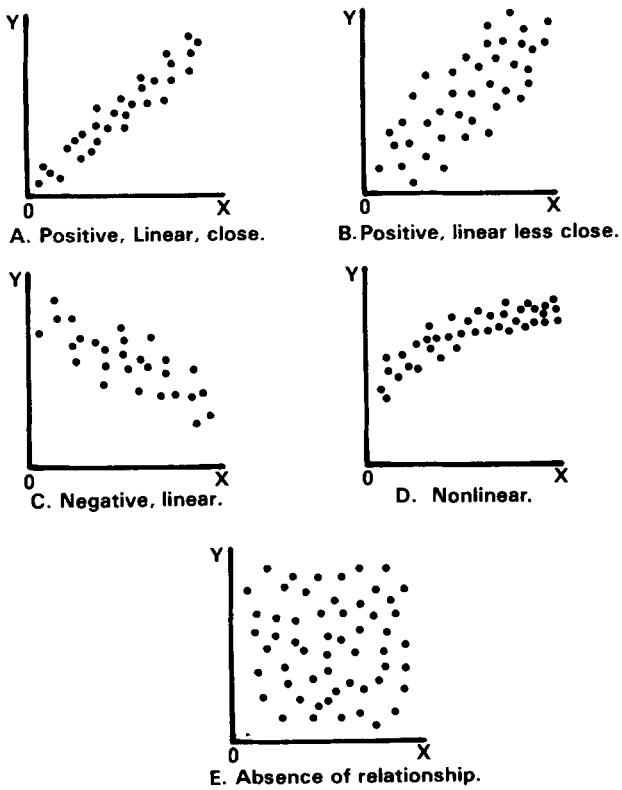


Figure 4–2. Types of correlation as shown in various hypothetical scattergrams

4–15. Linear regression analysis

a. For an equation to qualify for linear regression analysis, it must be of the form $Y_c = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$, or be of a form that can be reduced to an equation of this type, such as linear with respect to the regression coefficients.

(1) An equation of the form $Y_c = aX^b$ is all right because it can be changed into the correct form by taking the logarithm of both sides of the equation as follows: $\log Y_c = \log a + b \log X$. This transformed equation is linear in its coefficients and can be studied using linear regression analysis techniques.

(2) There are many nonlinear equations that can be linearized, with a proper choice of transformation, and made suitable for linear regression analysis. Another example is the equation $Y_c = X/(a + bX)$. By taking the reciprocal of both sides of the equation and multiplying through by X, the linearized equation $X/Y_c = a + bX$ is obtained.

(3) The equation $Y_c = a + bX + cX^2$ is already linear in its coefficients and can be analyzed in the same manner as the multivariate equation $Y_c = a + b_1X_1 + b_2X_2$, where the coefficients b_1 and b_2 correspond to b and c respectively, and the independent variables are $X_1 = X$ and $X_2 = X^2$.

(4) There are other equation forms that are suitable manpower models which can also be linearized; however, the ones shown above are used most often.

b. The simplest regression equation is an equation of the type $Y_c = a + bX$, where Y_c represents all points on the line in figure 4–3.

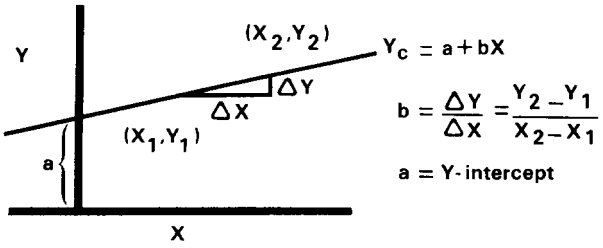


Figure 4–3. Graph of simple regression equation

c. If there are a number of points, not all of which lie exactly on a straight line, then a straight line, then a straight line can be estimated by drawing a scattergram and fitting a line of best fit. One method of defining the "best fit" is to use the criterion of least squares. In the least squares method, the quantity given by $\Sigma(Y - Y_C)^2$ in the graph shown in figure 4–4 is minimized. The line which we pick as the regression line has values for a and b which give the smallest total squared deviation of the original data points clustered about the calculated line. Thus, there are an infinite number of straight lines which can be drawn on the scattergram, but only one of the lines satisfies the criterion of least squares.

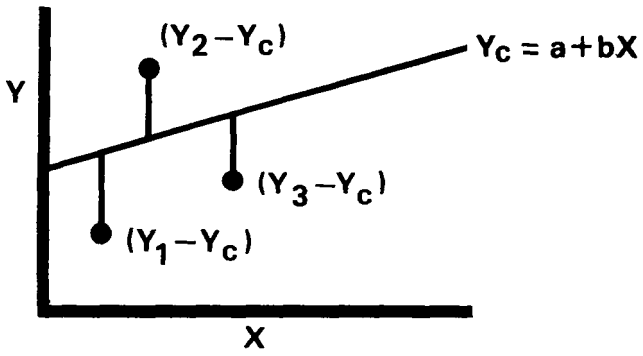


Figure 4–4. Line of best fit

d. To figure the values for a and b which satisfy the least squares criterion, we must minimize the basic function, $\Sigma(Y - Y_C)^2$. The procedure involves differential calculus and always results in a set of linear equations referred to as "normal" equations. There are as many normal equations as there are constants in the model. Thus, a $Y_C = a + bX$ type equation requires two normal equations corresponding to the two constants a and b (Y-intercept and slope). An equation of the form $Y_C = a + bX + cX^2$ requires three normal equations because there are three constants, (that is, a, b, and c). The normal equations are solved simultaneously to fine the values of the constants. For the equation $Y_C = a + bX$ the solution of the normal equations yields:

$$\text{Equation (1)} \quad a = \frac{\Sigma Y - b\,\Sigma X}{N}$$

$$\text{Equation (2)} \quad b = \frac{N\,\Sigma XY - \Sigma X\,\Sigma Y}{N\,\Sigma X^2 - (\Sigma X)^2}$$

e. At this point, it must be stressed that a straight line regression equation can be fitted to any set of data points, but this does not mean that there is a logical relationship between the variables in the regression analysis. Also, the best fitting straight line may still give very poor fit and not be good as a manpower equation. A curvilinear equation could be more appropriate.

4–16. Sample standard error of the estimate

a. Since another model may be better than a straight line, then there must be a way to compare the straight line with other models. The measure used for this comparison is the sample standard error of the estimate, which is shown as S_{yx}.

Equation 3

$$S_{yx} = \sqrt{\frac{\Sigma(Y - Y_c)^2}{N - M}}$$

Y = measured man-hour value.
Y_c = computed man-hour value.
N = number of data points on scattergram.
M = number of constants in regression equation.

b. From the equation for S_{yx}, it can be seen that the standard error of the estimate is related to the amount of variation about the optimal least-squares regression line. The variation $\Sigma(Y - Y_C)^2$ is usually referred to as unexplained variation, since it is the variation left over after the optimal regression line has been calculated. (Here, the word "unexplained" is used only to indicate that the relationship between X and Y is not completely explained mathematically, by the calculated line.)

c. Computation of S_{yx} is shown below, using the equation Yc = 2.938 + .5654X and the following data:

Table 4–2A
Computation of S_{yx}

X	Y
1	3.0
2	4.3
4	5.8
6	6.4
7	6.5

(1) The Y values are known (from the original data), but the Y_c values are computed from the regression equation. To compute the Y_c values, substitute the given X values into the established regression equation, $Y_c = 2.938 + .5654X$, as follows:

$Y_{c1} = 2.938 + .5654(1) = 3.503$
$Y_{c2} = 2.938 + .5654(2) = 4.069$, and so on through Y_{c5}

(2) To compute Syx, calculate:

$$S_{yx} = \sqrt{\frac{\Sigma(Y - Y_c)^2}{N - 2}}$$

$$S_{yx} = \sqrt{\frac{0.82808}{3}} = 0.5254$$

(Two degrees of freedom are lost since the estimating equation is in the form of a straight line. The two constraints are that every straight line must have a slope and Y-intercept.)

Table 4–2B
To compute S_{yx}

Y	Y_c	$Y - Y_c$	$(Y - Y_c)^2$
3.0	3.503	−.503	0.25300
4.3	4.069	+.231	0.05336
5.8	5.200	+.600	0.36000
6.4	6.330	+.070	0.00490
6.5	6.896	−.396	0.15682
		$\Sigma(Y - Y_C)^2 =$	0.82808

4–17. Confidence limits for linear regression equations

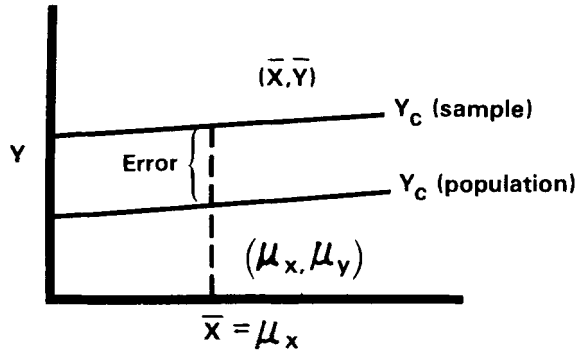
a. A relatively small number of data points are used to estimate the true relationships between X and Y. The calculated regression line is a sample line being used to estimate the population relationship, and there will always be some sampling error in the estimate. The standard error of the estimate shows how much unexplained deviation there is if the regression line is the true population relationship. It does not reveal anything about the sampling error.

b. An important characteristic of the regression line is that it must pass through the point ($\overline{X}$, $\overline{Y}$). This can be seen by referring to equation (1) (in para 4–15*d*) and rewriting it as $\overline{Y} = a + b\overline{X}$. The values for a and b are the same as in Y_C = a to bX because equation (1) was used in an intermediate step to calculate the constant in the least squares regression line. If $\overline{X}$ is substituted for X, then $Y_C = a + b\overline{X} = \overline{Y}$. This characteristic is important because it gives a reference point which helps one to study the regression line.

(1) The first type of error in the regression line is the sampling error in the value of the point ($\overline{X}$, $\overline{Y}$). The population regression line passes through the point (μ_x, μ_y), and the sample regression line is not the same as the population line unless ($\overline{X}$, $\overline{Y}$) = (μ_x, μ_y). It is assumed all through the analysis that the values of X, the independent variable, can be measured exactly with no sampling error. This means the sampling error in the point ($\overline{X}$, $\overline{Y}$) reduces to sampling error in the value of $\overline{Y}$, as shown in figure 4–5. The standard deviation of the sampling error is the standard error of the mean ($\overline{Y}$) where

$$S_{\bar{y}} = S_{yx}/\sqrt{N}.$$

It is seen from figure 4–5 that the error in $\overline{Y}$ affects the value of the Y-intercept.



Sampling error in the value of $\overline{Y}$

Figure 4–5. See caption in figure

(2) Figure 4–5 was drawn so that both lines have the same slope, but it is probable that the estimate of b has a sampling error also. If it is now assumed that the value of ($\overline{X}$, $\overline{Y}$) is the same as (μ_x, μ_y) (that is, $S_y = 0$), the concept of slope error can be illustrated as in figure 4–6. The lines shown in figure 4–6 are only two of the possible sample regression lines that could have been drawn through the point ($\overline{X}$, $\overline{Y}$). If Y_{c2} is the true population line, and if Y_{c1} is the regression line obtained from the sample, then the estimate of the slope has a significant sampling error. The actual size of this error for a given sample is related to the standard error of the estimate and is figured from the following equation:

Equation (4)

$$S_b = \frac{S_{yx}}{\sqrt{(X - \overline{X})^2}}$$

S_b = standard error of the slope.
S_{yx} = standard error of the estimate.
X = X values for all original data points.
$\overline{X}$ = mean of X values for original data points.

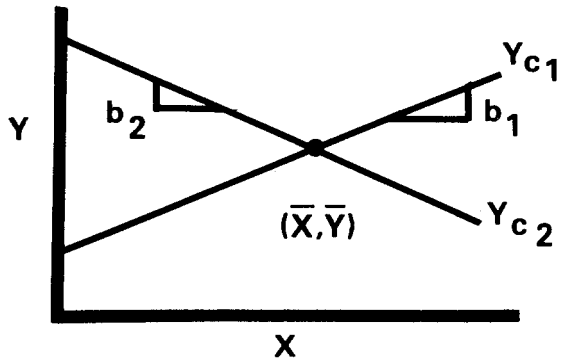


Figure 4–6. Concept of slope error

(3) The total sampling error for the regression line is a combination of the errors in ($\overline{X}$, $\overline{Y}$) and in the value of b. Both of these errors combined, in turn, determine the amount of error in the estimate of a, the Y-intercept. Since the error in a is already accounted for by the other two errors, it can be ignored and the total sampling error is given as:

$$\text{Equation (5)} \quad S_{yc} = \sqrt{\frac{S_{yx}^2}{N} + \frac{S_{yx}^2(X - \overline{X})^2}{\Sigma(X - \overline{X})^2}}$$

(4) Paragraph not used.

(a) Confidence limits for the regression line are given by the following relationship:

$$\text{Equation (6) Confidence limits} = Y_c \pm tS_{yc}$$

where t is the value from the Student "t" distribution corresponding with N − M degrees of freedom and the designated level of confidence. The following calculations show the procedures for setting confidence limits on the regression line using the previous example regression equation.

X	$(X - \bar{X})$	$(X - \bar{X})^2$
1	−3	9
2	−2	4
4	0	0
6	2	4
7	3	9
20	—	26

$$\bar{X} = \frac{\Sigma X}{N} = \frac{20}{5} = 4$$

$$S_{yc} = \sqrt{\frac{S_{yx}^2}{N} + \frac{S_{yx}^2(X - \bar{X})^2}{\Sigma(X - \bar{X})^2}}$$

$$S_{yc} = \sqrt{\frac{.27603}{5} = \frac{.27603(X - \bar{X})^2}{26}}$$

$$= \sqrt{.055206 + .010617(X - \bar{X})^2}$$

Confidence Limits = $Y_x \pm tS_{yc}$

t = 3.18 (95 percent confidence and N − M = 3 degrees of freedom)

X	$(X - \bar{X})^2$	S_{yc}	tS_{yc}	Y_c	$Y_c - tS_{yc}$	$Y_c + tS_{yc}$
1	9	.388277	1.235	3.503	2.268	4.738
2	4	.312528	0.9938	4.069	3.075	5.063
4	0	.234960	0.7472	5.200	4.453	5.947
6	4	.312528	0.9938	6.330	5.336	7.324
7	9	.388277	1.235	6.896	5.661	8.131

Figure 4–6A. Example calculations for setting confidence limits

(b) The limits shown are expected to have the true population regression line with a 95 percent probability. If limits were calculated for all values of X, smooth curves looking something like those shown in figure 4–7 are obtained.

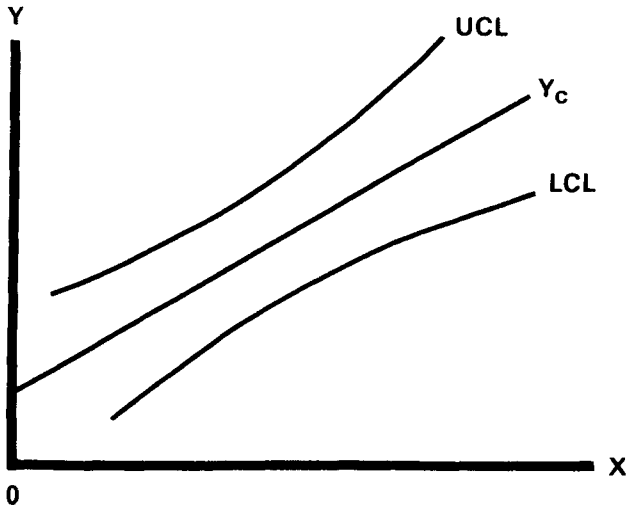


Figure 4–7. Confidence limits

(5) To obtain confidence limits for predicted values for a Y given a single observed X value using the regression line, the amount of unexplained variation in the system must be taken into consideration as well as the sampling error. Calculate a new standard error for predicted values, designated as S_V, using the following equation:

Equation (7) $$S_v = \sqrt{\frac{S_{yx}^2}{N} + \frac{(X - \bar{X})^2}{\Sigma(X - \bar{X})^2}}$$

The standard error of the estimate, S_{yx}, is simply added into equation (5) where only the sampling error was considered. To figure confidence limits, calculate $Y_C \pm tS_V$ at each point as follows:

$$S_v = \sqrt{.055206 + .010617(X - \bar{X})^2 + .27603}$$
$$= \sqrt{.331236 + .010617(X - \bar{X})^2}$$

t = 3.18 (95% confidence and 3 degrees of freedom)

$(X - \bar{X})^2$	S_v	tS_v	Y_c	$Y_c - tS_v$	$Y + tS_v$
9	.653291	2.077	3.503	1.426	5.580
4	.611313	1.944	4.069	2.125	6.013
0	.575531	1.830	5.200	3.370	7.030
4	.611313	1.944	6.330	4.386	8.274
9	.653291	2.077	6.896	4.819	8.973

Figure 4–7A. Example of confidence limit

4–18. Sample coefficient of determination

The total variance in the regression system is analyzed as follows, using the mean of the dependent variable, $\overline{Y}$, as a reference point.

a. The total variation of all values of Y about $\overline{Y}$ is given by the term $\Sigma(Y - \overline{Y})^2$.

b. The unexplained portion of the total variation is expressed as $\Sigma(Y - Y_C)^2$, which is the value used in the numerator of equation (3).

c. The explained portion of total variation is simply the difference between the total variation and the unexplained variation, which is equal to $\Sigma(Y_C - \overline{Y})^2$.

d. These relationships are shown in figures 4–8, 4–9, and 4–10.

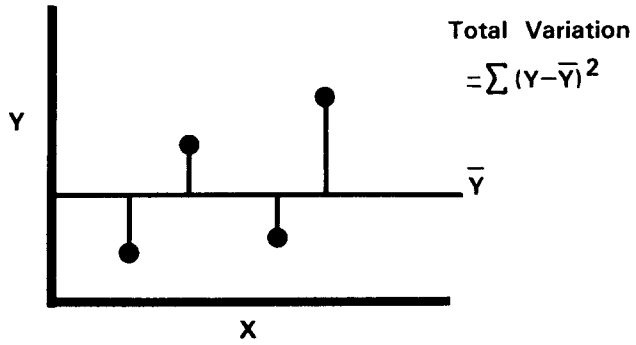


Figure 4–8. Total variation

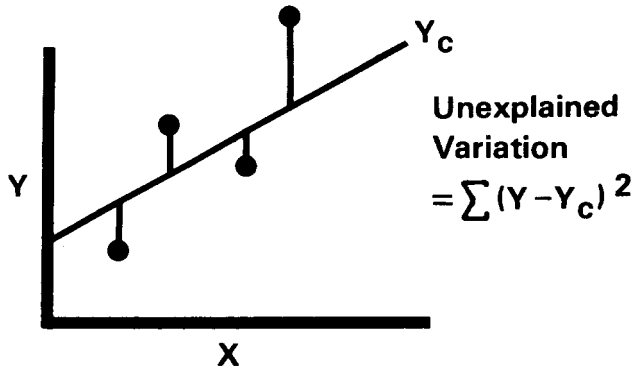


Figure 4–9. Unexplained variation

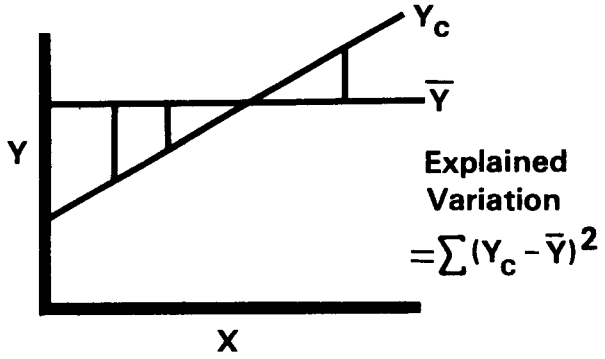


Figure 4–10. Explained variation

e. The ratio of explained variation to total variation is defined by the coefficient of determination, where the sample coefficient of determination is given by:

$$= 1 - \frac{\text{unexplained variation}}{\text{total variation}}$$

Equation (8)
$$= 1 - \frac{\Sigma(Y - Y_c)^2}{\Sigma(Y - \bar{Y})^2}$$

f. The square root of the sample coefficient of determination is the sample coefficient (or index) of correlation r, where

Equation (9)
$$r = \sqrt{1 - \frac{\Sigma(Y - Y_c)^2}{\Sigma(Y - \bar{Y})^2}} = \pm\sqrt{1 - \frac{S_{yx}^2(N - M)}{S_y^2(N - 1)}}$$

g. If all variation is explained, r = 1, then correlation is perfect. The sign of r is the same as the sign of the slope of the regression equation, as determined by the sign of coefficient b in the linear model or by inspection of the scattergram. If none of the variation is explained, r = 0, this then indicates there is no correlation. The correlation coefficient, even the perfect correlation of r = ±1, does not indicate a cause-and-effect relationship between dependent and independent variables. Rather, the correlation coefficient is an indication of covariation. One or more of several mechanisms may actually be in operation.

(1) A variation in either variable may be caused by variation in the other. There is not always a clear distinction between variables, as to which is independent.

(2) Both variables may be varying due to a common, external, cause. For example, there may be covariation between linen exchanged and rations served, but both variations may be caused by changes in installation population.

(3) The value of r may be due to chance, hence the necessity for applying tests of significance.

4–19. Multivariate linear regression equation

a. In many situations, the man-hours expended cannot be related to a single work unit or workload factor. The linear regression equation for two independent variables is $Y_c = a + b_1X_1 + b_2X_2$. As in the case of one variable, the least squares method is used. The optimum line, again, is found by using differential calculus to derive the normal equations.

$\Sigma Y = Na + b_1\Sigma X_1 + b_2\Sigma X_2$
$\Sigma X_1Y = a\Sigma X_1 + b_1\Sigma X_1^2 + b_2\Sigma X_1X_2$
$\Sigma X_2Y = a\Sigma X_2 + b_1\Sigma X_1X_2 + b_2\Sigma X_2^2$

b. Consider the following example, where values of X_1 and X_2 at various values of Y are known.

Table 4–2C
Values of multivariate linear regression equation

Y	X_1	X_2	X_1X_2	X_1Y	X_2Y	X_1^2	X_2^2
3	1	2	2	3	6	1	4
5	2	5	10	10	25	4	25
6	4	7	28	24	42	16	49
8	5	9	45	40	72	25	81
22	12	23	85	77	145	46	159

(1) The three normal equations are the following:

$22 = 4a + 12b_1 + 23b_2$
$77 = 12a + 46b_1 + 85b_2$
$145 = 23a + 85b_1 + 159b_2$

(2) Solving the equations simultaneously (using determinants) for the constants gives the following:

$$a = \frac{\begin{matrix}22 & 12 & 23\\ 77 & 46 & 85\\ 145 & 85 & 159\end{matrix}}{\begin{matrix}4 & 12 & 23\\ 12 & 46 & 85\\ 23 & 85 & 159\end{matrix}} = \frac{67}{46} = 1.457$$

$$b_1 = \frac{\begin{matrix}4 & 22 & 23\\ 12 & 77 & 85\\ 23 & 145 & 159\end{matrix}}{46} = \frac{-7}{46} = -0.1522$$

$$b_2 = \frac{\begin{matrix}4 & 12 & 22\\ 12 & 46 & 77\\ 23 & 85 & 145\end{matrix}}{46} = \frac{36}{46} = 0.7826$$

$$Y_c = 1.457 - 0.1522X_1 + 0.7826X_2$$

Figure 4–10A. Example of solving the equations simultaneously

(3) Solving for S_{yx} results in the following:

$$Y_c = 1.457 - 0.1522X_1 + 0.7826X_2$$
$$Y_3 = 1.457 - 0.1522(1) + 0.7826(2) = 2.870$$
$$Y_5 = 1.457 - 0.1522(2) + 0.7826(5) = 5.066$$
$$Y_6 = 1.457 - 0.1522(4) + 0.7826(7) = 6.326$$
$$Y_8 = 1.457 - 0.1522(5) + 0.7826(9) = 7.739$$

Y	Y_c	$(Y - Y_c)^2$
3	2.870	0.01690
5	5.066	0.00436
6	6.326	0.10628
8	7.739	0.06812
		0.19566

$$S_{yx} = \sqrt{\frac{0.19566}{4 - 3}} = 0.4423$$

Figure 4–10B. Solving for S_{yx}

c. When additional variables are put into a regression equation, the concept of partial regression is introduced. Partial regression shows the relationship between one of the independent variables with the dependent variable if all other independent variables in a regression equation are held constant. In other words, partial regression indicates the relative importance of each variable in the regression if the overlapping effects of independent variables on each other are removed. The partial regression coefficients are simply the "b" values associated with each independent variable in the regression equation. Thus, if $Y_c = 3 + 1.5X_1 + 6X_2$, the partial regression coefficient of Y on X_1 is 1.5 and the partial regression coefficient of Y on X_2 is 6. (Take care, in developing the equation, to position the independent variables in the order that will give the highest degree of correlation.)

d. When there are more than two independent variables the general form of the regression equation is, $Y = a + b_1X_1 + b_2X_2\ldots + b_nX_n$, and the normal equations for the general form of the multivariate linear equation can be expressed as follows:

Equation (10)

$$\Sigma Y = Na + b_1 \Sigma X_1 + b_2 \Sigma X_2 \ldots + b_n \Sigma X_n$$
$$\Sigma X_1 Y = a \Sigma X_1 + b_1 \Sigma X_1^2 + b_2 \Sigma X_1 X_2 \ldots + b_n \Sigma X_1 X_n$$
$$\Sigma X_2 Y = a \Sigma X_2 + b_1 \Sigma X_1 X_2 + b_2 \Sigma X_2^2 \ldots + b_n \Sigma X_2 X_n$$
$$\Sigma X_n Y = a \Sigma X_n + b_1 \Sigma X_1 X_n + b_2 \Sigma X_2 X_n + \ldots + b_n \Sigma X_n^2$$

The solution of extensive systems of simultaneous equations needs the use of a computer.

e. The curvilinear model $Y_C = a + bX + cX^2$ is analyzed in the same manner as the model $Y_C = a + b_1X_1 + b_2X_2$. The normal equations are as follows:

Equation (11)

$$\Sigma Y = Na + b \Sigma X + c \Sigma X^2$$
$$\Sigma XY = a \Sigma X + b \Sigma X^2 + c \Sigma X^3$$
$$\Sigma X^2 Y = a \Sigma X^2 + b \Sigma X^3 + c \Sigma X^4$$

4–20. Significance tests

a. Regression analysis incorporates significance testing. The testing is used to measure the reliability of either the sample regression coefficients, the sample coefficient of determination, or both.

(1) The reliability aspect is pertinent, because the input data are only a sample of values usually taken from an infinitely large population. The sample values are subject to error and may not be representative of the range and distribution of population values.

(2) Much of the theory of significance testing is beyond the scope of this regulation. The theory also requires that several assumptions about the nature of the $Y - Y_C$ values be fulfilled. When they are not, simple tests of significance such as the "t" and the "F" tests may be unreliable.

(3) The usual assumptions are that the $Y - Y_C$ residuals are normally distributed around the regression line and that as X goes up or down, the amount of dispersion does not correspondingly go up or down.

b. The "F" test is used to test the hypothesis that the regression model and independent variable (workload factor) combination do not account for any of the variation in the dependent variable (man-hours). The "F" statistic is calculated as follows:

Equation (12)

$$F = \left(\frac{r^2}{1 - r^2}\right)\left(\frac{N - M}{M - 1}\right)$$

where the terms in this equation are the same as previously defined. This equation is the ratio of explained variance to unexplained variance, where,

Equation (13)

$$\text{explained variance} = \frac{r^2}{M - 1}$$

and

Equation (14)

$$\text{unexplained variance} = \frac{1 - r^2}{N - M}$$

c. The factors in the denominator of the two expressions above are corrections for loss in degrees of freedom caused by making small sample estimates of explained and unexplained variance. It is important to note that equations (13) and (14) are the ones to look at when determining degrees of freedom for the numerator and denominator of the F ratio to use the F table. Thus, it is M − 1 which is the degrees of freedom for the numerator and N − M the degrees of freedom for the denominator. The rearrangement of terms in equation (12) is just for simplicity in doing the calculation rather than to indicate which correction goes with the numerator and which with the denominator.

d. The F distribution is skewed and has a range from zero to infinity. To use this distribution for significance tests the rejected region is established in the infinite tail.

(1) The procedure for doing an F test is shown below.

$Y_C = 3 + 2X$
$r = .90$
$N = 10$
$\alpha = .05$
Degrees of freedom are, the numerator = M − 1 = 2 − 1 = 1, and the denominators = N − M = 10 − 2 = 8, and the

table value of the test statistic is F_{1-}, M − 1, N − M = $F_{.95,1,8}$ = 5.32, where the level of significance, α = .05.

$$F = \left(\frac{r^2}{1 - r^2}\right)\left(\frac{N - M}{M - 1}\right) + \left(\frac{.81}{.19}\right)\left(\frac{8}{1}\right)$$

$$F = 34.11$$

$$F > F_{.95,1,8}$$

(2) The hypothesis that the regression model and independent variable combination do not account for any of the variance in the dependent variable is rejected, when F is greater than the table "F." In this example, the result indicates that the regression model and the workload factor combination account for some of the variance in the man-hours.

e. When the regression equation has more than one independent variable (e.g., $Y_c = a + b_1X_1 + b_2X_2$) or one or more differently ordered terms (e.g., $Y_c = a + bX + cX^2$), it is necessary to test the regression coefficients for significance in addition to the "F" test. The test used is a "t" test. It test the hypothesis that the regression coefficient is equal to zero, and consequently does not add anything to the regression equation. The test statistic for the "t" test is the following:

Equation (15)

$$t_{bi} = \frac{b_i}{S_{bi}}$$

where the i subscript identifies the independent variable being tested and S_{bi} is the standard error of that independent variable. When the regression equation is of the form $Y_c = a + b_1X_1 + b_2X_2$ then

Equation (16)

$$S_{bi} = \sqrt{\frac{S^2_{yx}}{(N - 1)S^2_{xi}(1 - r^2_{x1.x2})}}$$

where $r_{x1,x2}$ is the sample coefficient of correlation between X_1 and X_2, and S_{xi}^2, is the sample variance of

$$X_1, S^2_{xi} = \frac{N\Sigma X_i^2 - (\Sigma X_i)^2}{N(N - 1)}$$

f. Using the example introduced in paragraph 4–19*b*, the procedures for the "t" test of the regression coefficient are shown below.

$$Y_c = 1.457 - 0.1522X_1 + 0.7826X_2$$

$$S^2_{yx} = 0.195652$$

$$S^2_{x_1} = 3.33333$$

$$S^2_{x_2} = 8.91667$$

$$r^2_{x_1x_2} = 0.957009$$

$$S_{b_1} = \sqrt{\frac{0.195652}{3(8.33333)(1 - 0.957009)}} = 0.67461$$

$$T_{b_1} = \frac{-0.1522}{0.67461} = -0.226$$

$$S_{b_2} = \sqrt{\frac{0.195652}{3(8.91667)(1 - 0.957009)}} = 0.41247$$

$$t_{b_2} = \frac{0.7826}{0.41247} = 1.897$$

The table value of the test statistic is

$t_1 - \alpha/2, N - M = t_{.975.1} = 12.706$, where $\alpha = .05$.

(1) Since both $t_{b1}$and t_{b2} are not greater than the table value, the hypothesis that the regression coefficients are equal to zero cannot be rejected. These results and the high intercorrelation between X_1 and X_2 indicate that only one of the independent variables is needed.

(2) Additional study shows that r_{yx1} = 0.96476 and r_{yx2} = 0.99206. Using the variables with the higher sample coefficient of correlation gives the equation Y_c = 1. 523 + 0.6916X_2. Testing this combination for significances gives F = 124.5. The table value at α = .05 is $F_{.95,1,2}$ = 18.5. The hypothesis that the combination has no effect is rejected.

g. The higher order term in the model $Y_c = a + bX + cX^2$ can be tested for significance using the "t" test in the

same manner as shown for $Y_c = a + b_1X_1 + b_2X_2$. The standard error for the regression coefficient, c, is given by—

Equation (17)

$$Sc = \sqrt{\frac{S_{yx}^2}{(N-1)\,S_{x2}^2,\,(1-r_{xx2})}}$$

Where S_{x2}^2 is the sample variance of X_2 and r_{xx2} is the coefficient of correlation between X and X^2, and

Equation (18)

$$t_c = \frac{c}{S_c}.$$

4–21. The single location standard

a. The single location standard is usually based on data from one installation, although data from several sources or locations may be used. It is used when the function under study is peculiar to one location, or the service given or mode of operation is very different from that needed at other locations. Single location standards may be built from a single point (X, Y) data pair, obtained through some form of work measurement, or from multiple data sets obtained from historical records or different time periods.

b. In studies involving only one (X, Y) data pair regression analysis is not possible, yet a workload factor must be picked and a Y-intercept (fixed cost) found before a manpower table is built. A logical basis for picking a particular workload factor and model is essential if the standard is to show variability and have utility in the manpower allocation and programming process.

(1) In many cases, a preliminary phase is necessary to identify fixed, variable, and personnel generated tasks, and to identify appropriate measurement techniques to be used.

(2) The actual measurement of the function under study is accomplished according to guidelines in chapter 3.

(3) The development of the standard manpower equation is based on building the relationship between workload and man-hours from the one measurement input location. This is done by separating the man-hour data into three groups—fixed, variable, and personnel generated—according to the various categories and tasks in the WCD. The man-hours associated with each grouping could be the total time spent in particular categories and tasks, or a portion of the total time. The equation takes the general form of $Y_c = (a + b_1X_1 \ldots + b_nX_n)G$, where "a" is fixed, the "b's" are coefficients developed from tasks considered variable with the respective work units, and "G" is a factor for personnel generated man-hours.

(a) Fixed man-hours should be associated with categories and tasks which do not significantly vary with the picked workload factor(s) that are in the range of data used in the study and are independent of the work center size. If fixed hours are a large part of total measured man-hours, some man-hours which are variable may have been identified as fixed or may vary with some other workload factor that has not been identified.

(b) Variable man-hours are associated with categories and tasks and vary with the picked workload factor(s). Think about the use of multiple workload factors to increase the sensitivity and accuracy of the resultant equation where possible.

(c) Personnel generated man-hours should be associated with those categories and tasks which are not expected to show a direct relationship to the picked workload factor(s), or stay constant, but are expected to be related to the total fixed and variable man-hours spent in the work center. Stated another way, personnel generated man-hours are expected to vary with the number of personnel assigned. Excessive personnel generated man-hours could be an indication of assumed work or an inaccurate classification of tasks. Tasks which vary with the number of people in the work center include: receives instruction, counsels personnel, prepares EER, maintains training record, or reads publication.

(d) The example below shows how the manpower equation coefficients, a, b_1, b_2,…, b_n, and G are estimated. Assume that the measurement data have been classified as follows:

Fixed man-hours	$a = 100$
X_1 associated variable man-hours	$V_1 = 50$
X_2 associated variable man-hours	$V_2 = 150$
X_3 associated variable man-hours	$V_3 = 100$
Personnel generated man-hours	$PG = 40$
X_1 work count	$X_1 = 10$
X_2 work count	$X_2 = 15$
X_3 work count	$X_3 = 5$

$$b_1 = \frac{V_1}{X_1} = \frac{50}{10} = 5.000$$

$$b_2 = \frac{V_2}{X_2} = \frac{150}{15} = 10.00$$

$$b_3 = \frac{V_3}{X_3} = \frac{100}{5} = 20.00$$

$$G = 1 + \frac{PG}{a + \Sigma V_1} = 1 + \frac{40}{100 + 300} = 1.100$$

$$Y_c = (a + b_1X_1 + b_2X_2 + b_3X_3)G$$

$$Y_c = 110.0 + 5.500X_1 + 11.00X_2 + 22.00X_3$$

c. Multiple data sets for a single location can be obtained from monthly man-hour and workload accounting records. A minimum of 6 months can be regressed on monthly workload data for a corresponding period. Measurement of the function may be done to give a basis for adjusting the historical man-hour data.

(1) This example shows how to use regression analysis to build a manpower staffing standard at a single location, from historical data. Assume the following historical data:

Table 4–2D
Sample historical data

Month	Reported flying hours (X)	Reported productive man-hours (Y)
Jan	230	5500
Feb	190	4400
Mar	190	4800
Apr	170	4100
May	190	3900
Jun	180	4300
Jul	170	4700
Aug	220	5500
Sep	200	5100
Oct	240	5500
Nov	230	5300
Dec	240	6000

(2) The procedures used to analyze these data are given in the first part of this section. A scattergram of the data shows a strong linear trend and later regression analysis supported this indication. The model that was picked is $Y_C = a + bX$, and the computed equation and associated statistics are as follows:

$Y_C = 498.808 + 21.679X$
$V = 0.069$
$r^2 = 0.7559$
$F = 30.97$

(3) The computed value of "F" is larger than $F_{.95,1,10} = 4.96$. This shows that the regression model and workload factor combination account for some of the variance in the man-hours.

(a) The sample coefficient of determination shows the model picked ($Y_C = a + bX$) and the independent variable used (reported flying hours) accounts for approximately 76 percent of the variance in the reported productive man-hours.

(b) The sample coefficient of variation shows that the standard error of the estimate is approximately 6 percent as large as the average reported productive man-hours.

4–22. The multiple location standard

Regression analysis is the main tool used to build manpower staffing standards from input data gathered from a cross-section of installations throughout a command or the Army. Regression analysis is done using selected mathematical models to find estimates of the coefficients of the models selected. Correlation analysis measures the strengths of the relationships between the measured manhours and the workload factor. The relationships that come from the analyses are given various tests to find out whether or not desired statistical attributes were achieved. The test also evaluates the model with respect to economic and realistic criteria which have been set up and are documented in paragraph 4–23.

a. The general form of the most common mathematical models used in the MS–3 to estimate manpower requirements is the following:

Table 4–2E
Most common mathematical model

General form of equation	Description
$Y_c = a + bX$	Linear
$Y_c = a + b_1X_1 + b_2X_2 \ldots + b_nX_n$	Multivariate linear
$Y_c = aX^b$	Power curve
$Y_c = \frac{X}{a + bX}$	Ratio curve
$Y_c = a + bX + cX^2$	Parabola

(1) In each equation the dependent variable represents man-hours and the independent variables workload factor volumes. Each of these equations is either linear in its coefficients, or can be given as a set of simultaneous linear equations. This fact allows the use of linear regression procedures to figure the values of the coefficients.

(2) When transformation of the dependent variable is needed to produce linearity in the coefficients (and, subsequently, estimates of the coefficients), then it is required that the dependent variable be restored to its original form before followup analysis is done.

b. Two of the equations listed in a above need transformation of the dependent variable, $Y_c = aX^b$ and $Y_c = X/(a + bX)$.

(1) $Y_c = aX^b$ is linearized by taking the logarithm of the equation and becomes: log Y = log a + b log X. The dependent variable was transformed from Y to log Y and the independent variable was transformed to log X. The coefficients of the transformed equation (log a and b) are estimated in exactly the same manner as the coefficients for the equation $Y_c = a + bX$. Applying the regression analysis procedures yields the following equations for b and a. The values found for these coefficients are used in the equation $Y_c = aX^b$ for all subsequent analysis.

$$b = \frac{N \Sigma \log X \log Y - (\Sigma \log X)(\Sigma \log Y)}{N \Sigma (\log X)^2 - (\Sigma \log X)^2}$$

$$a = \text{antilog} \frac{\Sigma \log Y - b \Sigma \log X}{N}$$

(2) $Y_c = X/(a + bX)$ is linearized by taking the reciprocal of the equation and multiplying it by X, which gives X/Y = a + bX. The dependent variable was transformed from Y to X/Y and the independent variable is unchanged. Using the procedures for regression analysis, the equations for b and a are the following:

$$b = \frac{N \Sigma \frac{X^2}{Y} - (\Sigma X)\Sigma \frac{X}{Y}}{N \Sigma X^2 - (\Sigma X)^2}$$

$$a = \frac{\Sigma \frac{X}{Y} - b \Sigma X}{N}$$

(3) The parabola, $Y_c = a + bX + cX^2$, is evaluated in a similar manner as the multivariate where $b = b_1$, $X = X_1$, $c = b_2$, and $X^2 = X_2$.

c. The power curve, ratio curve, and parabola are not only curvilinear models that can be used, but they do show a characteristic that should be predominant in any curvilinear model that is picked. This characteristic is the ability of the model to show a deceleration in the rate at which manpower is increased for increased workload.

d. Using the computational procedures given in this section, the following set of example data was analyzed and the results of the analysis are shown in figure 4–11.

(1) Example data.

Table 4–2F
Example data

Post	Workload (X)	Man-hours (Y)
1	17	288.05
2	6	431.95
3	22	575.89
4	37	576.11
5	50	719.97
6	39	864.03
7	31	1005.37
8	48	1007.92
8	57	1008.08
10	40	1154.63

(2) Summations and general results.

$\Sigma X = 347$	$\Sigma Y = 7632.00$
$\Sigma X^2 = 14313$	$\Sigma Y^2 = 6{,}574{,}077.56$
$\Sigma X^3 = 640{,}325$	$\Sigma XY = 294{,}362.26$
$\Sigma X^4 = 30{,}104{,}613$	$\Sigma X^2 Y = 12{,}691{,}404.80$
$\Sigma \log X = 14.739797$	$\Sigma \log Y = 28.481279$
$\Sigma (\log X)^2 = 22.499289$	$\Sigma (\log X)(\log Y) = 42.345302$
$\Sigma \frac{X}{Y} = 0.459562$	$\Sigma \frac{X^2}{Y} = 17.386531$
$\bar{X} = 34.7$	$\bar{Y} = 763.20$
$S_x^2 = 252.46$	$S_y^2 = 83259.46$
$S_x = 15.89$	$S_y = 288.55$

(3) Specific model results.

(a) $Y_c = a + bX$

$Y_c = 312.18 + 13.00X$
$V = 0.2801$
$r^2 = 0.5122$
$F = 8.402$

(b) $Y_c = aX^b$

$Y_c = 142.32X^{0.4714}$
$V = 0.2830$
$r^2 = 0.5020$
$F = 8.065$

(c) $Y_c = X/(a + bX)$

$Y_c = X/(0.02397 + 0.0006337X)$
$r^2 = 0.4813$
$F = 7.423$

(d) $Y_c = a + b - cx^2$

$Y_c = 170.13 + 24.77X - 0.1862X^x$
$V = 0.2917$
$r^2 = 0.5370$
$F = 4.059$

$t_b = 1.250$
$t_c = -0.1612$

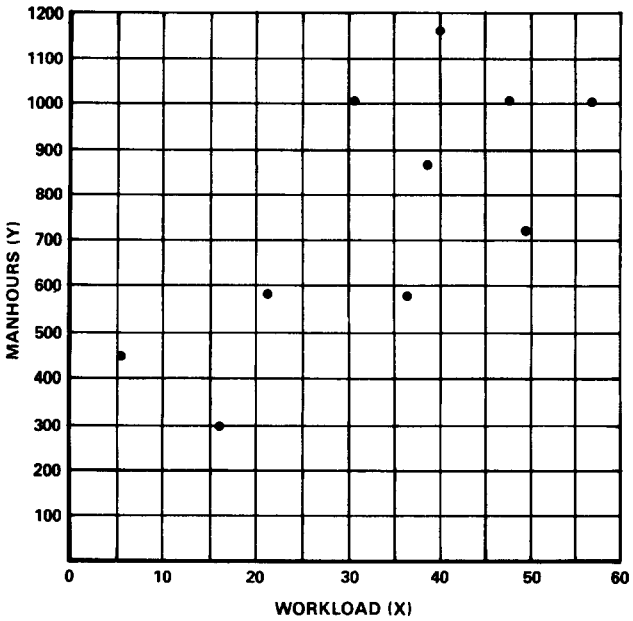


Figure 4–11. Scattergram of example data

4–23. Constraints for model selection

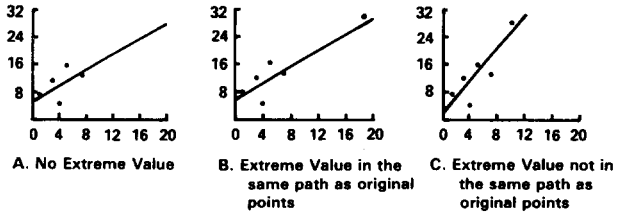
When several workload factors are analyzed and the evidence hints that there are curvilinear relationships with one or more of the factors, regression analysis can lead to many possible equations. A preliminary analysis of possible relationships using scattergrams can remove many bivariate relationships that are not acceptable. Once all plausible regression relationships are found, identify those acceptable as manpower models. There are three tests that must be applied to the data, an extreme value test of the workload data, an "F" test of the regression equation, and "t" tests of the regression coefficients in multivariate or parabolic equations.

a. When one or a few extreme values are used in data for regression analysis, the regression equation, the correlation coefficient, or both, may be influenced to the extent that they do not describe the true relationship between the dependent and independent variables. Some of the effects of extreme values are shown in figure 4–12.

(1) The data used to develop the statistic for A in figure 4–12 are shown below. To obtain the statistics for B and C in figure 4–12 a sixth sample, X = 18, Y = 26 and X = 10, Y = 30, respectively, was added to the original set of data.

Table 4–2G
Data for figure 4–12

Sample	Workload	Requirements
(N_i)	(X)	(Y)
1	1	7
2	4	4
3	5	15
4	3	11
5	7	13



CASE	EQUATION Yc =	COEFFICIENT OF CORRELATION (r)	STANDARD ERROR OF THE ESTIMATE (Syx)
A. No Extreme Value	5.6 + 1.1(X)	0.55	4.3
B. Extreme Value in Original Path	5.5 + 1.1(X)	0.90	4.4
C. Extreme Value not in Original Path	1.1 + 2.4(X)	0.85	5.4

Figure 4–12. Scattergrams illustrating the effects of extreme values on measures of correlation and regression

(2) Regression analysis users should avoid the distortive impact of extreme values by using samples that are like the entire spectrum of the independent variable (workload). A statistical test to objectively test the hypothesis that the extreme workload values are part of the same population as the other data points is used. If the hypothesis is rejected at $\alpha = .05$, then the regression equation must be tested with and without the extreme value included. The lead team will make this evaluation. They will support their decision as to whether or not to retain the extreme value in the equations. If the extreme value is retained, the lead team will justify the classification of the standard as a manpower staffing standard. To use this test arrange the workload values by magnitude, that is, lowest first, highest last. Then compute the value of the test statistic (R) as follows:

(a) When the number of data points is from 3 to 7:

$$R = \frac{X_2 - X_1}{X_k - X_1}$$

(b) When the number of data points is from 8 to 10:

$$R = \frac{X_2 - X_1}{X_{k-1} - X_1}$$

(c) When the number of data points is from 11 to 13:

$$R = \frac{X_3 - X_1}{X_{k-1} - X_1}$$

(d) When the number of data points is from 14 to 30:

$$R = \frac{X_3 - X_1}{X_{k-2} - X_1}$$

(e) Where X_1 represents the extreme value; X_2 the observation nearest to it; X_3 the next; and so on to the other end of the series, which is represented by X_k.

(3) Using table 4–3, find the table value for R.

(4) Compare the computed value of R with the table value corresponding to the number of data points used in the computations. If the computed value is numerically larger than the table value, reject the hypothesis. The test assumes observations are from a normal distribution. In cases that may only approximate the normal, the table probability values are not exact.

(5) Given the example data above, find if the point at X = 18 is an extreme value and cannot be used in the regression analysis for a manpower standard.

Table 4–3
Criteria for testing extreme value

Statistics	Number of data points (N)	(1−α) .95(α = .05)
$R = \frac{X_2 - X_1}{X_k - X_1}$	3	.941
	4	.765
	5	.642
	6	.560
	7	.507
$R = \frac{X_2 - X_1}{X_{k-1} - X_1}$	8	.554
	9	.512
	10	.477
$R = \frac{X_3 - X_1}{X_{k-1} - X_1}$	11	.576
	12	.546
	13	.521
$R = \frac{X_3 - X_1}{X_{k-1} - X_1}$	14	.546
	15	.525
	16	.507
	17	.490
	18	.475
	19	.462
	20	.450
	21	.440
	22	.430
	23	.421
	24	.413
	25	.406
	26	.399
	27	.393
	28	.387
	29	.381
	30	.376

(a) Step 1. List the X values by magnitude, lowest to highest: 1, 3, 4, 5, 7, 18.

(b) Step 2. The questioned value is represented by X_1, the value in the series nearest to X_1 is X_2, with the value in the series furthest from X_1 assigned X_k. Therefore, $X_1 = 18$, $X_2 = 7$, and $X_k = 1$.

(c) Step 3. Using the equation for 3 to 7 data pairs, compute R.

$$R = \frac{X_2 - X_1}{X_k - X_1} = \frac{7 - 18}{1 - 18} = \frac{-11}{-17} = .0647$$

(d) Step 4. From table 4–3, at N = 6, a table value of .560 for R at = .05 is derived. ($1 - \alpha = .95$)

(e) Step 5. Compare the computed R value to the table value obtained in step 4 above. Since the calculated value, .647, is greater than the table value, .560, the value is extreme at $\alpha = .05$ and cannot be used in the regression analysis for a manpower staffing standard.

(6) For the example data in paragraph 4–22d, the application of the extreme values test (for N = 10) yields an R = .175, and the table value at $\alpha = .05$ is .477. In this example, the workload data are acceptable with respect to the criterion of extreme values and may be used in regression analysis for a manpower staffing standard.

b. In addition to the extreme values test, the model and (in multivariate equations) regression coefficients are tested for significance. For bivariate equations, the "F" test is used to test the hypothesis that the workload factor and model combination do not account for any of the variance in the measured man-hours. For the resulting equation to be acceptable as a manpower staffing standard, the hypothesis must be rejected at α is less than or equal to . 10.

c. For multivariate equations, in addition to the "F" test, each regression coefficient is tested for significance using a "t" test. Reject the hypothesis at the same level of significance as designated above for the "F" test.

d. For the example data in paragraph 4–22d above, all of the regression equations except the last, $Y_c = a + bX + cX^2$, have "F" values that are significant at $\alpha = .05$, for example, greater than $F_{.95,1,8} = 5.32$. (See app L.) For the unacceptable model, both "t" values are insignificant at $\alpha = .05$ since they are less than $t_{.975,8} = 2.306$. (See app M.) The same can be said for these values at $\alpha = .10$ since $t_{.95,8} = 1.860$. From this analysis, the first three models are acceptable with respect to the "F" and "t" test criteria.

e. The following are attributes for realistic and economy criteria:

(1) A manpower model is considered realistic when—

(a) Manpower is positive for all values of workload in the extrapolation range of the model. Negative Y-intercepts are allowed; however if Y_1 is less than 0, where Y_1 would be the lower extrapolation limit of the model based on the

procedures of section III, then Y = 0 becomes the lower extrapolation limit and the model is usable to that point. The value of X corresponding to Y = C is called the X-intercept and is obtained by substituting Y = 0 in the regression equation and solving for X. If Y_1 is greater than 0 for a model having a negative Y-intercept, then no adjustment of the lower extrapolation limit is necessary.

(b) There is no net loss of manpower for an increase in workload in the extrapolation range of the model. If the first derivative of manpower with respect to workload, dY/dX, is non-negative throughout the allowable extrapolation range of the model, then there is not a net loss of manpower for an increase in workload anywhere within the extrapolation range. The slope of the regression equation at the value X is dY/dX. The slope measures how much Y changes per unit change in X. If Y changes a positive amount for a unit change in X, then dY/dX is greater than 0 at that particular point. Realistic constraints based on dY/dX for the common manpower models are in paragraph 4–25. For example, the model Y = a + bX, has dY/dX = b which says that the slope of the model is constant (that is, an increase of one unit of X always results in an increase of b units of Y). If b is positive for a particular equation, then the second realistic attribute is possessed.

(2) A manpower model is economical if at any point in the model a unit increase in workload causes a constant increase in manpower or a lesser increase when compared to all previous per unit changes in manpower. For example, in the $Y_C = a + bX$ model, a change of one unit of X always leads to a change in Y of b units. For curvilinear models, the second derivative of manpower with respect to workload, d^2Y/dX^2, is computed. Where d^2Y/dX^2 is zero or negative, Y is increasing at a constant or decreasing rate per unit change in X. Economy constraints based on d^2Y/dX^2 for the common manpower models are given in paragraph 4–25.

(3) Equations that do not satisfy the realistic and economy criteria are not acceptable as manpower models. Reasons why a model may not have the desired attributes include such things as incorrect input data, nonrepresentative input data, limited range of workload values, two or more distinct levels of operation included in the data, nonstandardization of the system under study, extreme values included in the data, and inappropriate model picked.

(4) For the example data in paragraph 4–22*d*, all the models have the realistic and economic attributes needed of manpower models. However, the fourth model, $Y_C = a + bX + cX^2$, becomes unrealistic for X is greater than 66.

f. The sample coefficient of determination, r^2, and the sample coefficient of variation of the residual, V (S_{yx} divided by $\overline{Y}$), must satisfy the constraints shown below for the resulting regression equation to be acceptable as a manpower standard. Looking at the values of r^2 and V for the example in paragraph 4–22*d*, it can be seen that three of the models satisfy the constraints for r^2 for a Type II standard and none satisfies constraints for V for a Type II standard. The third model does not satisfy the constraint for r^2.

Table 4–4
Acceptable criteria type

Sample statistic		Acceptable Type II criteria	Acceptable Type I criteria
r^2	≥	.50	.75
V	≥	.25	.15

g. Use the following guidance in selecting models:

(1) The acceptable models must be looked at with the objective of picking the best one. Other things being equal, the equation with the lowest sample coefficient of variation of the residual, V, is best. When transformations are used in a curvilinear model, S_{yx} must be in units of the dependent variable Y instead Y transformed to get a real comparison of V among the various equations.

(2) The coefficient of variation is not always the deciding factor. If preliminary analysis was not complete, the acceptability criteria may have to address the ease with which the workload factors can be counted or reliably obtained.

(a) What might otherwise be the best relationship may not be feasible because of an inadequate (or nonexistent) workload accounting system. It is also recognized that a statistical analysis, in itself, is not always sufficient to ensure a logical selection. As such, additional factors such as reasonability, reliability for extended periods, and timely results should be carefully weighed.

(b) The cost of maintaining and managing the standard and the plausibility of the model (the willingness of those who use and are affected by the model to believe in what the model prescribes for certain situations) should also be considered.

(3) None of the models for the example data of paragraph 4–22*d* is acceptable as a manpower staffing standard. Using the criterion of smallest sample coefficient of variation, the first model, $Y_C = a + bX$, would be considered the best of the four models shown.

4–24. Workload factors (WLFs) used for standard man-hour equations

a. During the preliminary phase, potential workload factors were described and listed. During later phases, actual experience WLF volumes were collected and each of these volumes (X-values) was tested with the measured man-hours to find out the proper equation.

b. Potential WLFs are selected as workload factors for the standard based on the statistical procedures of this chapter. These selected WLFs are in one of two forms—

(1) *Programmable WLF.* If the definition of the potential WLF matches the definition of a program variable found in programming documents, then the WLF is programmable. For example, if the WLF is "Military Population Served," then the population elements that make up (or are contained in) the potential WLF must also be present in the programmable version of the WLF. Specifically, both should consist of exactly the same component parts. If they do, simply revise the titles and definitions to reflect program terminology.

(2) *Nonprogrammable WLF.* If the selected WLF is not in programming documents or if the transition of a potential WLF to a programming variable cannot be made due to differences in definitions, then the WLF is nonprogrammable. In this case, historical workload factor volumes are used for standards application and a program estimating equation (PEE) (See sec VI) based upon a program estimating factor (PEF) is normally built to project future manpower requirements. The potential PEF must also consist of the same component parts as the programmable version. Actual values of the PEF are used to build the PEE; for example, actual flying hours—while the programmed values of the PEF are used to predict future requirements.

4–25. Realistic economy criteria

Both the realistic and economy criteria are passed when the following circumstances are met:

a. The no-intercept model ($Y = bX$) meets both criteria if b is positive.

b. The linear model ($Y = a + bX$) meets both criteria when the b coefficient is positive. Increases in workload will result in a constant positive increase in manpower.

c. The parabolic model ($Y = a + bX + cX^2$) meets these criteria when b is positive and c is negative, for workload values up to the point where $X = -b/2c$. Up to this point increased workload will produce a positive, yet lessening increase in manpower. After this point, increased workload will result in decreasing manpower, hence the model stops being realistic.

d. The power model ($Y = aX^b$) meets both criteria when a is positive and b is between zero and one ($0 \; b \; 1$). This restricts the model to an increasing function that increases more slowly as X increases.

e. The ratio model

$$\left(\frac{X}{Y = a + bX}\right),$$

which is based on a hyperbolic curve, meets the criteria when both a and b are greater than zero. Because the hyperbola has an asymptote at $Y = 1/b$, caution in the computation of extrapolation limits is required.

Section III
Extrapolation Limits

4–26. General

Extrapolation extends the applicability of a manpower staffing standard and increases the standard's shelflife as workload volume increases or decreases. Extrapolation limits represent the upper and lower man-hour values that set the limits of the applicability range. These limits represent the maximum amount an equation may be extended. It does not preclude the use of more limited extrapolation when the total amount would be unrealistic.

a. Primarily, the amount of extrapolation allowed is 30 percent $\overline{Y}$. This amount is added to the largest predicted value (maximum Y_C) and subtracted from the smallest value (minimum Y_C). Extrapolation is always in terms of the value of interest, which is man-hours. By placing a reasonable limit on the amount that the observed man-hour range may be extended, control is maintained.

b. Remember an equation used in a standard represents the observed data (the X-values). Therefore, extrapolation with respect to workload (X-values) is considered whenever possible. Limits from the primary method of extrapolation (30 percent $\overline{Y}$) are compared with limits based on workload (30 percent of the range of X-values). The most conservative set of limits is used for the extrapolation limits of a standard.

4–27. Computation of extrapolation limits for peacetime standards

Use the following steps to compute a standard's extrapolation limits. The following data are provided for use as an example. For all calculations, carry four or more decimal places during computations, then round the final answer to two decimal places.

a. Step 1.

(1) Determine from the data and equation the following:

(a) Max Y_C = highest predicted man-hours.

(b) Min Y_c lowest predicted man-hours.
(c) $\overline{Y}$ = average measured man-hours.
(2) Linear equation sample.
(a) Max Y_c = 2232.3168
(b) Min Y_c = 926.5452
(c) $\overline{Y}$ = 1504.4900
(3) Parabolic equation example.
(a) Max Y_c = 1636.5651
(b) Min Y_c = 335.0571
(c) $\overline{Y}$ = 1010.4195
b. Step 2.
(1) Determine the amount of extrapolation allowed according to the Y-values (Y-extrap = 30 percent $\overline{Y}$).
(2) Linear equation example.
(a) Y-extrap = .30(1504.4900)
(b) Y-extrap = 451.3470
(3) Parabolic equation example.
(a) Y-extrap = .30(1010.4195)
(b) Y-extrap = 303.1259
c. Step 3.
(1) Calculate the upper extrapolation limit (Y_u) based on man-hours (Y_u = Max Y_c + Y-extrap).
(2) Linear equation example.
(a) Y_u = 2232.3168 + 451.3470
(b) Y_u = 2683.6638 = 2683.66
(3) Parabolic equation example.
(a) Y_u = 1636.5651 + 303.1259
(b) Y_u = 1939.6910 = 1639.69
d. Step 4.
(1) Calculate the lowest extrapolation limit (Y_L) based on man-hours (Y_L = Min Y_c − Y-extrap). If Y_L is less than 0, set Y_L = 0.
(2) Linear equation example.
(a) Y_L = 926.5452 − 451.3470
(b) Y_L = 475.1982 = 475.20
(3) Parabolic equation example.
(a) Y_L = 355.0571 − 303.1259
(b) Y_L = 51.9312 = 51.93
e. Step 5.
(1) Determine from the observed workload the following:
(a) Max X = highest workload value.
(b) Min X = lowest workload value.
(c) Range = Max X − Min X.
(2) Linear equation example.
(a) Max X = 2432
(b) Min X = 948
(c) Range = 2432 − 948 = 1484
(3) Parabolic equation example.
(a) Max X = 181
(b) Min X = 19
(c) Range = 181 − 19 = 162
f. Step 6.
(1) Determine the amount of extrapolation allowed according to the X-values (X-extrap = 30 percent range).
(2) Linear equation example.
(a) X-extrap = .30(1484)
(b) X-extrap = 445.2000
(3) Parabolic equation example.
(a) X-extrap = .30(162)
(b) X-extrap = 48.6000

g. Step 7.

(1) Calculate the upper extrapolation limit (X_U) based on workload (X_U = Max X + X-extrap).

(2) Linear equation example.

(a) X_U = 2432 + 445.2000

(b) X_U = 2877.2000 = 2877.20

(3) Parabolic equation example.

(a) X_U = 181 + 48.6000

(b) X_U = 229.6000 = 229.60

h. Step 8.

(1) Calculate the lower extrapolation limit (X_L) based on workload (X_L = Min X − X-extrap). If X_L is less than 0, set X_L = 0.

(2) Linear equation example.

(a) X_L = 948. − 445.2000

(b) X_L = 502.8000 = 502.80

(3) Parabolic equation example.

(a) X_L = 19 − 48.6000

(b) X_L = −29.6000 = 0.0

i. Step 9.

(1) For linear equation, go to step 11.

(2) For parabolic equation, compute apex (Apex = −b/2c).

(a)

$$\text{Apex} = \frac{-(15.014)}{(2)(-0.0349)}$$

(b) Apex = 215.1003 = 215.10

j. Step 10.

(1) Compare the apex to Max X and X_U and make one of the following decisions:

(a) If apex is less than Max X, then the parabola is not an acceptable model.

(b) If apex is greater than X_U, then X_U remains the upper extrapolation limit for X.

(c) If apex is between Max X and X_U, then apex becomes the upper extrapolation limit for X.

(2) Parabolic equation example.

(a) Max X = 181

(b) Apex = 215.10

(c) X_U = 229.60

(d) Therefore, the apex becomes the upper extrapolation limit for X and X_U is set equal to the apex. X_U = Apex = 215.10

k. Step 11.

(1) Compute Y_{XU} (the man-hours required at the upper extrapolation limit for workload, X_U), by the following:

(a) $Y_{XU} = a + b(X_U)$ for linear.

(b) $Y_{XU} = a + b(X_U) + -c(X_U)^2$ for parabola.

(2) Linear equation example.

(a) Y_{XU} = 92.40 + .8799(2877.20)

(b) Y_{XU} = 2624.0483 = 2624.05

(3) Parabolic equation example.

(a) Y_{XU} = 62.39 + (15.014) (215.10) + −(0.0349) $(215.10)^2$.

(b) Y_{XU} = 1677.1479 = 1677.15

l. Step 12.

(1) Compute Y_{XL} (the man-hours required at the lower extrapolation limit for workload, X_L) by the following:

(a) $Y_{XL} = a + b(X_L)$ for linear.

(b) $Y_{XL} = a + b(X_L) + -c(X_L)^2$ for parabolic.

(2) Linear equation example.

(a) Y_{XL} = 92.40 + .8799(502.80)

(b) Y_{XL} = 534.8137 = 534.81.

(3) Parabolic equation example.

(a) Y_{XL} = 62.39 + (15.014) (0.0) + −(0.0349) (0.0).

(b) Y_{XL} = 62.39

m. Step 13.

(1) Set the upper extrapolation limit at the smaller of Y_{XU} (the limit with regard to workload) and Y_U (limit for man-hours).

(2) Linear equation example.

(a) $Y_U = 2683.66$

(b) $Y_{XU} = 2624.05$

(c) Therefore; Y_{XU} is the upper extrapolation limit.

(3) Parabolic equation example.

(a) $Y_U = 1939.69$

(b) $Y_{XU} = 1677.15$

(c) Therefore; Y_{XU} is the upper extrapolation limit.

n. Step 14.

(1) Set the lower extrapolation limit at the larger of Y_{XL} (lower limit with regard to workload) and Y_L (limit for man-hours).

(2) Linear equation example.

(a) $Y_{XL} = 534.81$

(b) $Y_L = 475.20$

(c) Therefore; Y_{XL} is the lower extrapolation limit.

(3) Parabolic equation example.

(a) $Y_{XL} = 62.39$

(b) $Y_L = 51.93$

(c) Therefore; Y_{XL} is the lower extrapolation limit.

Figures 4–13 and 4–14 depict the extrapolation limits for the example linear and parabolic equations.

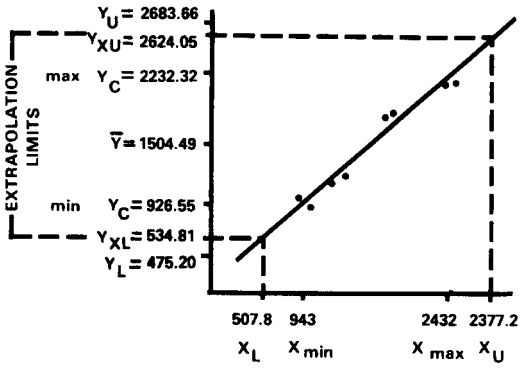


Figure 4–13. Data and extrapolation limits for linear equation

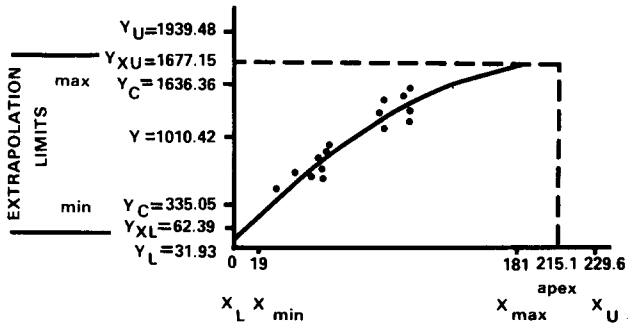


Figure 4–14. Data and extrapolation limits for parabolic equation

4–28. Computation of extrapolation limits for mobilization standards

a. The range of the staffing tables for mobilization standards will be based on instructions currently in paragraph 4–27, beginning with step 5 and substituting "projected mobilization" workload for "observed" workload. Steps 5 through 8 and 11 through 12 of paragraph 4–27 apply.

b. Application instructions on DA Form 5279–R must follow guidance for projecting the mobilization workload contained in Annex F to AMOPS and AR 310–49–1. All availability factors for mobilization should be listed on the DA Form 5279–R, since all will potentially be used for manpower requirements determination during mobilization. (Where work centers are shown as operating 24 hours a day, employee tours of duty in terms of hours per week must be identified to determine which AAF corresponds with which mobilization workweek.)

4–29. Special consideration in extrapolation

a. Multivariate equations. Due to the interrelatedness of the X-values, precise limits with regard to the X-values are difficult to obtain. Therefore, the extrapolation limits for multivariate equations are based on the predicted man-hours only (Y_u and Y_L) from steps 3 and 4 above.

b. Single location standards. Extrapolation for a single location standard is based on ±30 percent of the measured man-hours since min Y_c = max $\overline{Y}_c$ = Y = Y_c. Hence, the limits are Y_L = .70 Y_c and Y_u = 1.30 Y_c.

c. Modular equations. To determine the extrapolation limits for modular equations, aggregate the predicted man-hours for the modules at each location. This will result in the total predicted man-hours for each location. Establish extrapolation limits about these values in the same manner used for multivariate equations.

d. No-intercept model and power model. Follow the procedures set out for a linear equation. No special considerations are needed.

e. Ratio model. Follow the steps for the linear model with an additional check for the horizontal asymptote. This model will never exceed a horizontal asymptote, Y = 1/b . Therefore, if Y_u is greater than 1/b , then set Y_u equal to 1/b .

4–30. Use of extrapolation limits

After the extrapolation limits are determined, they are recorded as the "Standard Applicability Range" on DA Form 5279–R. This range is always stated in man-hours. However, there are two situations that require an upper workload value to be stated.

a. Parabolic equation. Because this equation starts to decrease after the apex value, there will be some large workload values that yield man-hours within the acceptable range.

b. Ratio equation. Because this equation approaches, but never crosses, an asymptote, workload can increase endlessly (after a certain point) and never yield any additional man-hours.

c. Calculation procedures. The basic procedures are the same for both the parabolic and the ratio equation. These procedures follow with references made to the steps above when needed values have already been computed.

(1) If the upper extrapolation limit is set at the man-hours required when only the workload is considered (Y_{xu} computed in step 13 for both), no additional calculations are needed. Report the upper workload limit (X_u as computed in step 10 for parabolic; step 7 for ratio) as the "Upper Workload Value" on the manpower table.

(2) If the upper extrapolation limit is set at the man-hours required when only man-hours are considered (Y_u computed in step 13 for both), compute the workload associated with these man-hours. Report this workload (X) as the "Upper Workload Value" on the manpower table. Use the following formula to compute the workload using the upper extrapolation limit (Y_u) in the computations:

(a) For the parabolic equation:

$$X = \frac{-b + v\, b^2 - 4c(a - Y)}{2c}$$

(b) For the ratio equation:

$$X = \frac{aY}{1 - bY}$$

Section IV
Skills and Grades Determination

4–31. General

This section gives guidelines for determining which skill and grade requirements to use on the DA Form 5279–R. The guidelines must be used in accordance with AR 570–4. The steps that both input and lead teams must use are given. If

there is any difference in grades published in MS–3 studies and those specified in the AR 611 series, the AR 611 series prevails.

4–32. Policy for determining required skills

a. The concept that worker spend the majority of work time at their highest skill level governs the determination of the needed skills. Therefore, the ratio of higher to lower skill levels will vary depending on the function of the work center.

b. Give particular attention to picking the proper category of positions. Officer and warrant officer positions must be justified by responsibilities or duties specifically needing an officer. Senior level NCOs will be used in place of lower grade officers or warrant officers when practical and feasible.

4–33. Criteria for skill levels

The criteria listed below give general guidance in finding the level of skill needed for each position.

Table 4–5
Criteria for skill levels

Types of specialties	Dominant type of duties
Commander	Commands a unit
Director	Administers sets of programs
Staff officer	Administers a program
Managerial officer	Manages an activity
Technical officer	Performs professional tasks
Superintendent	Manages a shop or office
Supervisor	Oversees a work team
Technician	Performs advanced tasks
Specialist/apprentice	Performs skilled and semiskilled tasks
Helper	Performs unskilled tasks

4–34. How input teams determine skills

a. Properly finding the skills that are needed means a thorough understanding of military and civilian classification systems.

b. In its broadest sense, identifying and distributing skills sorts the total manpower requirement into the proper types and qualifications of workers. It adds a quality factor to an otherwise pure quantity statement. While the past manpower history and views of supervisory personnel should be considered, the measured work should be given the most weight in the final determination.

c. Unless the position has been identified as requiring a military incumbent for reasons stated in AR 570–4, paragraph 4–1*a* (2), the position will normally be designated as civilian and the appropriate civilian series code will be identified. The following steps, logically listed, give an objective way for finding what skills are needed and how to distribute them:

(1) *Step 1.* Compare the composition of the work (for example, work sampling category definitions, work units, or operational audit tasks) with the utilization and career field descriptions in AR 611–101, AR 611–112, and AR 611–201. Identify the various specialty and associated fields with the total manpower requirement. For civilian positions, identify the series which is most closely aligned with the positions in the work center, and then conduct a comparative analysis similar to the one for military positions. To aid in this, go to the 609 series regulations and pamphlets as well as the Office of Personnel Management's Classification Standards, available at any civilian personnel office.

(2) *Step 2.* Do a similar comparative analysis within each of the utilization or career fields identified. Do this by referring to the specialty descriptions in AR 611–101, AR 611–112, and AR 611–201 to identify appropriate officer, warrant officer, and enlisted specialties (regardless of skill level) with the man-hours associated with each.

(3) *Step 3.* Find the best distribution of skill levels for each specialty identified. The applicable soldiers manuals will aid quite a bit in this. The detail shown in many well designed manpower staffing standard studies permits tasks to be associated with specific specialties and skill levels. In this case, the associated man-hours point out accurately the requirements for each MOS/series.

(4) *Step 4.* List fractional requirements on DA Form 5274–R exactly as they are computed. As such, the data are more useful for distributing the skills over the range of the standard manpower table.

4–35. How the lead team determines skills

a. The lead team must rely on the same specialty and skill criteria used by the measurement teams. The procedure is

slightly revised, however, because the recommended specialty and skill distributions from the various input points are available.

b. The following steps apply to both military and civilian requirements.

(1) *Step 1.* Prepare an array of the recommended specialty and skills distribution data. List all recommended MOSs/series in the first column. List the workload value and the fractional manpower recommended for each listed MOS in succeeding columns beginning with the smallest interval and going to the largest. This aids in detecting any obvious inconsistencies. These may be explained in the team's comments; if not, talk to the appropriate input team to find and evaluate the rationale for their recommendation.

(2) *Step 2.* Plot a scattergram for each MOS (with workload values on the horizontal axis and recommended manpower on the vertical axis), and then fit a regression line to the data. This aids both in identifying "mavericks" and in picking the phase points for increasing the manpower for each MOS.

(3) *Step 3.* Study the data array and the scattergram to find the workload values where there are significant changes in either specialty or skill requirements. Some examples of these are: the point at which an officer or warrant officer requirement first takes place, similar points for each skill level requirement, and the points at which multiple requirements for any of the foregoing are first encountered. Put these requirements in the appropriate workload columns of the manpower table. Complete the required entries in each workload column by using these entries as firm "fixes," and refer to the trends shown by the data array and scattergrams.

(4) *Step 4.* When there is more than one MOS some arbitrary decisions may be needed to solve fractional specialty problems. In many cases, a "give-and-take" agreement with the functional proponent will allow you to develop whole-man requirements for each MOS without increasing total requirements.

(5) *Step 5.* In the final analysis, the combined judgment of the lead team personnel and the functional proponent representatives weighs heavily in integrating the input recommendations. The results of array analyses, and the specialty descriptions are useful in finding the most realistic distribution of requirements. This task cannot be treated lightly. Quality is just as important as quantity in stating a manpower requirement.

4–36. Policy for determining required military grades

a. When skill level requirements are determined, identify the specific grade for each position. Show the grade needed for each position at each level of activity in the manpower table.

b. More than one grade for each qualification or skill level may be proper.

(1) To determine a specific grade within an MOS, place the more senior grades in positions that call for the most responsibility and experience.

(2) Identify the more junior grades where less responsibility and experience are needed. Also, in determining grades, keep in mind that like jobs require like grades.

(3) Use care in comparing to other grade structures. The lead team makes sure that the comparison is made against an actual grade requirement versus a grade authorization that was substituted because of funding constraints. TAADS gives this visibility via the required and authorized data fields.

c. In determining grades, the lead team documents the actual grade requirements without the influence of the career progression impact. USAMARDA, in conjunction with the personnel centers and HQDA (DAPE–MB), looks at the results of the manpower staffing standards study to determine final grade levels that consider career progression needs in terms of overall Army requirements. In this regard, external constraints or funding limitations must not affect the process of determining skill and associated grade requirements.

4–37. How input teams determine military grades

a. Grades cannot be determined without the use of subjective judgment. The process requires an extensive familiarity with AR 611–101, AR 611–112, and AR 611–201. The two factors shown below make the determination of military grades a highly complex process.

(1) Each skill level is normally associated with more than one grade.

(2) Work content of the specific position, external contacts, and existing comparable grade structures, among other factors, affect the grade determination.

b. Use the following steps for a Type I standard. Other grade determination techniques may be used for a Type II standard. A knowledge of the skills needed in a work center is essential to do these steps.

(1) *Step 1.* Compare MOS descriptions from AR 611–101, AR 611–112, and AR 611–201 that match the MOSs recommended in the study and approved work center descriptions.

(2) *Step 2.* Arrange, or otherwise identify, the tasks in a relative order as to the experience and ability needed to satisfactorily do each one. Soldiers manuals are helpful in ranking the tasks requiring enlisted skills. To rank order the officer tasks, the team has to rely primarily on its collective experience and best judgment. In either case, it may also be beneficial to get help from work center functional managers and classification specialists in personnel.

(3) *Step 3.* Find those points in each task list where the transition is made from one grade to another. One means of doing this is—

(a) Find the grade spread that goes with each MOS concerned in the appropriate regulation. Assume that the lowest grade specified for each MOS is needed to do the lowest ranking task identified on that MOS task list.

(b) Refer to the rank-ordered task lists for each MOS. Using the lowest ranking task for each MOS as a point of departure, estimate the amount of time in the functional area needed to get the necessary experience and ability to satisfactorily do the succeeding higher ranking tasks. Base these estimates on the anticipated experience of an average individual progressing through a typical technical education, on-the-job training, and career assignment pattern in the specialty concerned. Also, assume that this individual served in the same career field throughout his or her career. These tasks then make up those points on each MOS task list where the transition is made from one grade to another.

(4) *Step 4.* Check each task list with the work measurement data to find the man-hours spent at the different levels of task difficulty. Based on this comparison, make the first decision for the recommended grades for each MOS.

(5) *Step 5.* Evaluate other pertinent factors to find if the initial grade needs adjusting. Specifically, consider the following:

(a) The working relationship between the work center studied and other agencies (such as higher echelons, other units, or other work centers within the same organization). The scope and sensitivity of these interfaces may mean some degree of grade equality between working counterparts.

(b) The grade structures of other activities at the same or equivalent level of organization. The grades of at least supervisory positions in the work center studied should, as a rule, be close to those in other activities having similar missions or a closely equal degree of responsibility. Because of the limited view of overall needs that is at a single location, looking at and deciding on grade comparability may only be practicable at the command headquarters level or higher. In any event, grade comparability is not the sole basis for adjusting the original determination.

(6) *Step 6.* Document fractional grade requirements as they are derived. The data, as such, are more accurate for use in finding the needed grades for an entire manpower table.

c. Work measurement categories are often written in broad terms. They do not always show in detail some of the tasks done in a work center by a specific MOS. As a result, the man-hours cannot be measured at the various levels of task difficulty for an MOS. Consequently, the following steps give a suggested approach for determining the required grades:

(1) *Step 1.* Review the present manning to find the MOSs assigned to each work center. Compare the skill descriptions from AR 611–101, AR 611–112, and AR 611–201 that match those MOSs presently assigned.

(2) *Step 2.* For each MOS, build a task list made up of all the tasks that are in the corresponding skill description.

(3) *Step 3.* Give to each of the work center personnel the task list which goes with his or her MOS. Have each person check those tasks he or she actually does. Add any tasks which he or she must do but which are not shown on the list. Show the approximate percentage of time he or she spends on each task.

(a) Where there are large numbers of the same MOS in a work center, not everyone need fill out a task list. Instead, have the work center supervisor(s) identify those personnel who do essentially the same jobs.

(b) Once these groupings are known, the task lists can then be sent to and done by a representative portion of each group.

(4) *Step 4.* For each MOS bring together the tasks added by work center personnel. Add these to the basic task list first built for each MOS. Fix the relative order of the tasks and corresponding grades according to the experience and ability needed to satisfactorily do each one.

(5) *Step 5.* Using the task lists filled out by work center personnel, find the average percentage of time spent by a person in an MOS on each task that goes with that MOS. Multiply these average percentage factors by the total man-hours identified for the corresponding MOS. This gives an approximation of the man-hours spent on all tasks done in the work center by each MOS.

(6) *Step 6.* Compare the man-hours for each task with the respective task-ordered task lists. Using this comparison, make an initial determination of the recommended grades for each.

(7) *Step 7.* Look at other pertinent factors to find if any change to the initial grade determinations is needed.

4–38. How the lead team determines grades

a. To find the overall grade structure, use essentially the same method prescribed for developing the distribution of MOSs for an entire manpower table. One way is described below.

(1) Prepare an array of the recommended MOS and grade distribution data. This aids in detecting the more obvious inconsistencies between data points. These may be explained in the team comments; if not, talk with the applicable input team to get and evaluate the rationale for their recommendations.

(a) In the first column, list all recommended MOSs.

(b) In the second column, list all recommended grades that go with each MOS.

(c) In succeeding columns, list the workload value and the manpower recommended for each grade and MOS beginning with the smallest interval and going to the largest.

(2) For each MOS build a scattergram for each grade recommended for that MOS. (In other words, there are as many scattergrams for an MOS as there are different grades recommended for that MOS.)

(a) Plot workload values on the horizontal axis and the recommended numbers of each grade on the vertical axis.

(b) Next, try fitting a regression line to the data. This is helpful in identifying "mavericks" and picking the workload values where changes in manpower take place.

(3) Apply the workload breakpoints (sec III) to the regression line equations built for each grade by MOS. This determines the corresponding grade requirements (normally in fractional form) for each MOS.

(a) Enter these in the standard manpower table exactly as derived—do not leave out fractional requirements at this point.

(b) Sum each column of these requirements to find out how these totals compare with the total man-hours computed for each column using the standard manpower equation.

(c) Where the totals do not match, adjust each fractional requirement so that there are no differences.

(4) Find the whole-man requirement for each grade and MOS. In doing this, two guidelines apply.

(a) First, do not resolve the fractional requirements so that there are more or less authorizations than the corresponding workload gives by the standard man-hour equation.

(b) Second, round up any fractional requirement to the next whole-man only when earned according to the fractional manpower breakpoints as in table B–1.

b. If the procedures shown in this section are not used, use a system that does not tend to stack supervisory grades.

(1) For example, the following distribution stacks supervisory grades:

Table 4–6
Supervisory grades

E8					1
E7			1	1	1*
E6	1	1	1*	1*	1
E5	1	1	1	1	1
E4	2	2	2	3	3
E3	2	3	3	3	3
	6	7	8	9	10

Notes:
* Denotes layered or stacked supervisory grades.

(2) In the example above, an E6 is required for a seven-position work center, but at the eight-man level, both an E7 and E6 are required. The need for both is doubtful. Similarly, going from a work center of size 9 to one of size 10, an E8 position is added and the E7 space is kept. Again, it is doubtful that both of these grades are needed.

(3) A more real life grade spread is shown below:

Table 4–7
Real life grade spread

E8					1
E7			1	1	
E6	1	1			
E5	1	1	1	1	2
E4	2	2	3	3	3
E3	2	3	3	4	4
	6	7	8	9	10

(4) Other examples could be given to show the point. The same problem occurs with officer level positions. There may be a few cases where retaining the higher grades is justified. Grade analysis establishes that layering of higher grades is fully justified by job content and that shifting lower level responsibilities does not delete the need for the layered grades.

c. Make sure that the required skill level and grades are available to do the mission requirements in multishift operations. For example, the required man-hours in a work center may call for only one E9 position. In fact, the true

requirement may call for these duties during each shift of a three-shift operation. Teams should find the number, by grade and skill, by considering both total man-hours and minimum requirements to cover multishift operations.

4–39. Determining civilian grades for mixed civilian and military work centers

In developing a manpower staffing standard, many teams will find work centers which need all civilians, or a mix of civilian and military requirements. The civilian personnel office determines appropriate civilian grades for work centers with civilian positions.

4–40. Instructions for completing DA Form 5279–R, Manpower Standard and Table Report

DA Form 5279–R (fig 4–15) gives pertinent information about the workload factor(s), the measurement approach used to develop the standard, the application instructions, and the standard equation. It has a table depicting manpower required by MOS and grade for the entire range of approved extrapolation limits. The depth of detail shown on it should be enough so that the user can readily understand the standard and can identify locations where the standard does or does not apply. An example of a completed DA Form 5279–R and the instructions for completion are at figure 4–15.

Section V
Manpower Staffing Standards Study Final Report (FIN–REP)

4–41. General

This section has the instructions on Manpower Staffing Standards Study Final Report (FIN–REP) preparation and composition. FIN–REPs will consist of two parts: Part I—Administrative Data, and Part II—Manpower Staffing Standard Data. Changes to these procedures must be approved by USAMARDA.

4–42. Providing program management information

To assess the MS–3 program costs and benefits, program data are required to be submitted on DA Form 5276–R as a part of the Standards Application Summary and prepared in accordance with instructions in appendix E. Data to be included will reflect costs associated with all phases of standards development from initial study planning through initial application. The intent is to identify total costs for requirements coverage and associated costs for standards refinement during initial application. Annual application and associated costs normally expended by the Force Structure community are not to be included.

4–43. Instructions for preparing the FIN–REP

The lead team prepares the FIN–REP according to the instructions, composition, and format contained in this section.

a. Submit standards to cover at least a complete subfunction. This policy does not apply to smaller segments that represent the overhead of a major function.

(1) FIN–REPs address no more than one major functional area.

(2) If it is more economical, several functions can be studied at the same time. When standards cover more than one major functional area, due to the interrelationship of two or more functions (such as a set of standards covering a small unit), additional copies of the FIN–REP are required.

b. Commands and USAMARDA are responsible for the quality of standards and the technical decisions made during the development. Therefore, a 100 percent quality assurance audit of the FIN–REP is required.

c. Reports having classified information are appropriately classified and submitted intact. (See AR 380–5.) If they have only small amounts of classified information, remove it and send it under separate cover. In its place, put a brief explanation for its removal. Also, this statement may be applied to any blank form prescribed by this regulation inserted in its proper place.

d. Detailed instructions for preparation of the FIN–REP are contained in the following paragraphs.

4–44. Cover

Use heavy white bond paper, 8½– × 11–inches, for both the front and back covers. On the front cover, show the scope of the report (Army or command designation; for example, TRADOC, HSC, etc.), the function or subfunction and the respective AFD(SWC) codes covered (where applicable), the preparing activity, and the dispatch date of the report. Figure 4–16 shows an example of a FIN–REP cover.

MANPOWER STAFFING STANDARDS STUDY
FINAL REPORT
(FIN-REP)

for

U.S. ARMY RECEPTION STATIONS
COMMAND STANDARD

Work Center Title	AFD(SWC) Code
Receptive Processing	PVA
Receptor Control	PVB
Reception Station Support Services	PVC
Reception Station Management Staff	PVD

TRADOC
Ft Knox
1 March 1986

Figure 4–16. Example of a FIN–REP cover

4–45. Table of contents and pagination

Use the table of contents in this regulation as a guide. Beginning with chapter 1, number pages consecutively within each chapter as follows: chapter 1; 1–1, 1–2, and 1–3; chapter 2; 2–1, 2–2, 2–3, and so forth. Tabs for each chapter are optional.

4–46. Part One—Administrative Data

This part consists of five chapters and contains all of the information used in the development of the standard that is not necessary for the application of the standard.

4–47. Chapter 1—Introduction

In this chapter, give the following:

a. An overview of how the standards were developed (for example, measurement method, management systems from which data were extracted, summary of analysis conducted, and mathematical models tests).

b. A list of input measurement locations where data were collected by work measurement. If all work centers were not measured at a given installation, list the exceptions.

c. A list of the activities (commands, installations by UIC) to which the standards are applicable.

d. A list of all known locations to which the standard does not apply and the rationale for these exceptions.

e. A list of the contract services that have made an impact on the study. Put detailed discussion in chapter 4.

f. A list that has the names of the lead team members and other key personnel who were involved in the study and helped to prepare the FIN–REP.

g. An organization chart that shows the relationships of the activity under study to other activities within the same function (or subfunction), at the beginning of the preliminary phase. Include a similar chart that shows any changes resulting from the study. Have these charts show at least one level above and one below each work center in the study.

4–48. Chapter 2—Standards Development Information

a. Work measurement standards. Have a separate section for each work center (tabs for each section are optional). Arrange the section to give a logical step-by-step development of each standard for analysis. Include the following, in the order shown:

(1) The work center description followed by DA Form 5279–R. If required, put the WCD and DA Form 5279–R for additives following the basic standard forms.

(2) When practical, a graph of the equation used in the development of the manpower table. On the face of the graph, show the equation, the standard error of the estimate (S_{yx}), the coefficient of determination (r^2), and the

coefficient of variation (V). Show inputs on the graph as small "Xs." Encircle points not used in computing the standard manpower equation, and show $\pm 2S_{yx}$ on the graph.

(3) A comprehensive explanation of the analysis and computations done.

(4) Any adjustments made to the study data if data were not used exactly from the input locations' DA Form 5274–R.

(5) Any data points that were excluded before the regression analysis. State the reasons for exclusion.

(6) A summary of the regression analysis that was done. Use the following sequence:

(a) A summary of monthly allowed man-hours and the corresponding value of each workload factor tested for each study location. Arrange the summary in a matrix with a row for each installation, and columns for allowed man-hours and workload factor values. List the workload factor(s) used in the final standard, first and place an asterisk by them.

(b) The criteria used to find acceptable models if regression analysis was used. If not, show the step-by-step procedures of how the standard was built.

(c) A list of all equations found acceptable and show r^2, V, and the results of significance tests done for each acceptable model. List the one to be used as the manpower standard equation first.

(d) A list of equations tested but found not acceptable based on any of the purely statistical considerations (that is, the coefficient of determination, coefficient of variation, test of significance, and realistic and economy attributes).

(e) A list of equations which passed the statistical tests but were found unacceptable based on other criteria (for example, logical use to which the model would be applied).

(f) A list of data points that were excluded from subsequent regression analyses, with the rationale given for exclusion. Give the rationale for data points lying beyond $\pm 2S_{yx}$ from the regression line, but which were included in the regression of the accepted equation.

(7) The arrays listed below.

(a) The authorized and assigned strengths for each measurement point during the measurement period.

(b) The historical data, by location, of the workload factor(s) picked for standard development. Normally, 12 months' data should be given.

(8) A detailed explanation of the methodology used to determine skills and grades. The explanation should permit reviewing and approving officials to analyze the approach used.

(9) Completed DA Forms 5274–R for each measurement location.

(10) The source of predetermined or standard time data when used.

(11) A detailed explanation of the establishment and measurement of work categories requiring rated expertise.

b. Nonmeasurement standards. Have a separate section for each standard. Put the following in the order shown:

(1) A logical analysis of the development, acceptability, and applicability of each standard. For standards that are work center oriented, have a description of the duties for which manpower is required.

(2) A functional statement for standards that are not work center oriented (for example, applicability is by function or crosses functions and organized units). It must identify coverage by location, function, program element, and organization.

(3) Completed DA Forms 5279–R, section I, in accordance with applicable preparation instructions, for each standard.

(4) The derivation of the percentage of directed man-hours used. This percentage identifies the maximum man-hours allowed.

(5) DA Form 5279–R, section II, when the activity covered was studied in such a manner that skill and grade requirements can be determined.

(6) Equations that are built by correlation and regression analysis. (See the requirements of *a* above.)

(7) The data base and an explanation of the development of that data base if regression analysis was not used to develop the manpower equation.

(8) The authorized and assigned strength, and workload data arrays.

(9) A bibliography of current functional directives.

(10) Any information on source and reliability of input data that might aid in evaluation and acceptance of the standard.

4–49. Chapter 3—Program Estimating Equations

a. When using the guidance in section VI to develop PEEs, include the work center PEEs or a total study PEE. Regardless of which type is used, a PEE covers the aggregation of requirements covered by the manpower staffing standard study.

(1) *Work center PEEs.* This is one method of projecting manpower requirements at the work center level. Develop separate equations so that they can be applied individually, if desired. In some cases, the best program estimating factor (PEF) may only apply to one work center. If work center PEEs are developed, show PEE analysis and development on a work-center-by-work center basis. Follow the procedure used for reporting standard development as closely as possible. Include the following:

(a) A summary of manpower and PEF volumes used in the analysis. Arrange the summary in a matrix with column one listing installations, column two listing manpower values, and remaining columns listing PEF values. List the PEFs used in the PEE first and place asterisk by them.

(b) A list of criteria used to determine acceptable PEEs including the realistic and economy attributes. No minimum r^2 and V values are prescribed for PEEs by this regulation. If regression analysis was not used in PEE development, show the procedure used.

(c) A list of all equations found acceptable and r^2, S_{yx}, and V. Show the results of any significance tests done for each equation. List the selected PEE first.

(d) A list of the regression equations found to be not acceptable.

(e) A list of data points that were excluded from regression analysis, and an explanation concerning their exclusion.

(f) A detailed explanation of the application of the PEE to include deviation factors to be used.

(2) *Total study PEEs.* Use the above procedure in showing the analysis and selection process. Additionally, show the method of distributing totals among work centers. If a percentage distribution is to be used as described in section VI, give the actual percentages by work center.

b. If the method of programming command manpower authorizations is not through the use of PEEs, then fully explain the system to be used.

4–50. Chapter 4—General Additions

This part is reserved for comments or data considered to be of significance but not covered elsewhere in the report. Information listed below is required, when applicable.

a. Any improvements in methods or procedures installed during the study.

b. An explanation of how tenant-associated workload was handled. For example, was it treated as part of the standard workload, or did it need separate categorization and possibly a separate workload factor?

4–51. Chapter 5—Program Management Data

Instructions for this part are different for Army-wide and command standards.

a. Army-wide standards. A DA Form 5276–R with only study cost information and known improvement savings entered is submitted. The remaining portions are done by the lead team after the applicable commands have applied the standard, developed exceptions, and submitted the aggregate manpower summaries.

b. Command standards.

(1) Include a completed DA Form 5276–R.

(2) A manpower impact summary must accompany each command standard.

(3) Explain manpower adjustments, if any, on the manpower summaries that are not apparent from the study detail.

(4) If applicable, explain the impact of joint tenancy agreements on the application of the standards. Information that aids in this explanation and later evaluation includes items such as the tenant unit supported and the command to which it belongs, the work center, and the location to which each agreement applies. Also, include the average monthly workload generated by the tenant (in terms of the workload factor), and the significant fluctuation in tenant-support workload that would present problems in programming manpower for the work center.

c. Update the master schedule to include actual direct labor used to date.

4–52. Part Two—Manpower Staffing Standard Data

Part Two consists of the manpower staffing standard data and all necessary instructions needed for application of the standard. Information that is not consistent with this need will not be included in Part Two.

4–53. Chapter 6—Manpower Staffing Standard

Refer to chapter 5 of this regulation, which provides specific instructions on the application of manpower staffing standards. Use this part of the FIN–REP to provide any specialized instructions for a particular standard. Include instructions to submit additional forms if those provided in this regulation are not sufficient for submitting application data.

4–54. Submitting and coordinating the FIN–REP

a. Procedures for submitting the FIN–REP for review, coordination, and approval are the same for both Army common and command unique standards.

b. The proponent command will send four copies of the FIN–REP to USAMARDA. The letter of transmittal will indicate functional proponent concurrence at the proponent command level.

c. USAMARDA will prepare a request for coordination and send one copy of the FIN–REP to the appropriate HQDA functional proponent for review and comment.

d. USAMARDA will perform a quality assurance audit of the FIN–REP. This is usually done simultaneously with the HQDA functional proponent staffing.

e. USAMARDA will use the functional proponent comments and results of the quality assurance audit to decide whether or not the FIN–REP can be approved.

(1) If the FIN–REP is approved, USAMARDA will prepare and submit a notification of approval to the proponent command and HQDA functional proponent.

(2) If changes to the FIN–REP are needed, USAMARDA will prepare detailed instructions on the required changes and send these to the proponent command and HQDA functional proponent.

(3) The responsible lead team will make the necessary changes and resubmit the FIN–REP through their command channels to USAMARDA for final review and approval.

4–55. Backup data

Backup data to be maintained by the responsible lead team will consist of the following:

a. Productivity control charts for inputs measured by work sampling (total productive only).

b. DA Forms 5275–R.

c. DA Forms 5277–R.

d. DA Forms 5278–R.

e. A complete audit trail of adjustments made to man-hour and workload data recorded on original work measurement data collection forms. The audit trail will document the amount of each adjustment and explain the rationale for making the adjustment. A record of coordination of adjustments with the participating input team will also be maintained.

Section VI
Manpower Requirements Prediction

4–56. General

Manpower staffing standards tell how much manpower is needed to do the work described in a given work center. To make them more useful, they should also include the effect future workload volumes will have on a function's manpower requirements. To use manpower staffing standards in this way, the ability to either estimate future workload or to relate workload in some manner to another factor that can be estimated is necessary. This section discusses the recognized Manpower Staffing Standards System (MS–3) methods for predicting future manpower requirements.

4–57. Predicting future manpower requirements

The MS–3 predicts future manpower requirements by building manpower staffing standards that have programmable workload factors (WLFs), forecasting WLF volumes for standards that do not have programmable WLFs, and developing program estimating equations which relate the results of standards application to some workload volume that is programmable.

4–58. Selecting the prediction method

a. The order of preference for selecting a manpower requirements prediction method is as follows:

(1) Develop standards with programmable WLFs.

(2) Develop standards with nonprogrammable WLFs for which accurate and fully supported estimates of future WLF volumes can be made. Coordination by manpower with the functional proponent is necessary with workload forecasting.

(3) Develop a PEE.

b. To help evaluate the alternative manpower predicting methods, do preliminary planning and coordination with both the manpower requirements function and the functional proponent.

4–59. Defining programmable manpower staffing standards

A programmable manpower staffing standard has WLFs that are defined the same as the variables in Army programming documents. Specifically, a WLF and a program variable must consist of exactly the same elements, each with no more or no less elements than the other. When WLFs meet this criterion, future manpower requirements can be found by directly applying the programmed workload to the standard. For example, the standard man-hour equation for a maintenance function is $Y_C = 1008 + .08504X$, where X is the number of flying hours for the type of aircraft supported (a programmable WLF). The programming document states that for a future fiscal quarter, 2000 flying hours are programmed per month.

a. The manpower requirement for each month in this future fiscal quarter is then—

$Y_C = 1008 + .08504(2000)$
$Y_C = 1008 + 170.08$
$Y_C = 1178.08$ man-hours

b. If the Army availability factor (AAF) is 145, 1178.08/145 = 8.125 or 8 positions are required.

4–60. Defining workload forecasting

a. A nonprogrammable manpower staffing standard has either all nonprogrammable WLFs or a mixture of programmable and nonprogrammable WLFs. One approach to finding future manpower requirements using these kinds of standards is workload forecasting. To forecast workload means to obtain, or make, an estimate of what the WLF volume will be in some future time period. Once these estimated WLF values have been validated, future manpower requirements can be found by a direct application of the standard man-hour equation.

b. One way to determine future workload is to have the functional proponent estimate it. This estimated workload can either be in the form of actual total figures or as an expected percentage increase or decrease in workload from a past time period. For example, the standard man-hour equation for a maintenance function is $Y_c = 1008 + .08504X_1 + .6755X_2$, where X_1 is the number of flying hours (programmable) and X_2 is the number of aircraft engines repaired (nonprogrammable). For a future fiscal quarter, a programming document states that 2000 flying hours are programmed per month. For the same future fiscal quarter, the functional proponent estimates, and manpower validates, a monthly workload increase of 35 percent over the number of aircraft engines repaired per month in the last fiscal quarter of last year.

(1) Historical records state that 300 engines were repaired per month in the last fiscal quarter, of last year.

$300 \times 1.35 = 405$ engines to be repaired
$Y_c = 1008 + .08504(2000) + .6755(405)$
$Y_c = 1008 + 170.08 + 273.58$
$Y_c003 = 1451.66$

(2) If the AAF is 145, 1451.66/145 = 10.011 or 10 positions are required.

c. Another way to get future workload is to assume that there will be no change from what has occurred in the past. This is called straight lining past workload. It should be used only when the functional proponent forecasts no change from historical workload.

(1) For example, using the equation in *b*(1) above.

$Y_c = 1008 + .08504X_1 + .6755X_2$
X_1 = 1850 flying hours actually flown (baseline time period)
X_2 = 300 engines reparied
$Y_c = 1008 + .08504(1850) + .6755(300)$
$Y_c = 1008 + 157.32 + 202.65$
$Y_c = 1367.97$ man-hours
1367.97/145 = 9.434 or 9 positions are currently required.

(2) Notice that in applying the standard for the baseline time period, the number of flying hours actually flown was used and *not* historical program data. However, since X_1 is programmable, use the number of flying hours programmed per month for the *future* fiscal quarter (2000) and straight-line only X_2 when determining future manpower requirements.

4–61. Selecting program estimating equations

Another way of finding future manpower requirements with nonprogrammable standards is to develop a PEE. A PEE may be developed for a single nonprogrammable standard or for a group of related manpower staffing standards. This group may consist of either all nonprogrammable standards or a mixture of programmable and nonprogrammable standards.

4–62. Developing a program estimating equation

a. Use the following procedure to build a PEE.

(1) *Step 1.* Select the functions, subfunctions, and work centers to be covered by the PEE. PEEs are usually built at the division or directorate level. Consider program element codes, normal funding practices, and future utility in selecting the number and type of functions to be covered by each PEE.

(2) *Step 2.* Select the organizational level at which the PEE is to be used (such as an installation or MACOM).

(3) *Step 3.* Identify potential program estimating factors. This is similar to identifying potential workload factors except that the PEFs must be variables found in official Army programming documents. Identify as many plausible PEFs as possible.

(4) *Step 4.* Gather historical data for all PEFs identified in step 3. These data are actual experience data and not historical programmed data. Make two decisions at this point—

(a) Pick an appropriate historical time period as the baseline.

(b) Decide how this time period should be broken up for regression analysis.

(c) Gather data at the organizational level selected in step 2 and from all points to which the PEE will apply.

(5) *Step 5.* Determine the required man-hours of each location for the same time period selected in step 4. Where work centers are covered by manpower staffing standards, apply them using historical actual WLF data and validate any exceptions. When standards are not available, use some form of a manpower guide to estimate the man-hour requirements.

(6) *Step 6.* Run a regression analysis testing linear and curvilinear models with the PEF data gathered in step 4 and required man-hours calculated in step 5. Choose the equation which has the smallest coefficient of variation and also satisfies the realistic and economy criteria stated in section II as the PEE.

b. An example of this procedure follows:

(1) *Step 1.* The PEE in this example will cover three work centers within a maintenance function.

(2) *Step 2.* Use the PEE at the command level only.

(3) *Step 3.* Only one program estimating factor (PEF) is used in this example—flying hours.

(4) *Step 4.* The example time frame is January 1980 through December 1980. A monthly average of the actual experience data is used in the regression analysis. The PEE will apply to all six airfields in this command. The data values are—

Table 4–8
Example time frame

Airfield	X PEF
A	2200
B	2600
C	2950
D	3300
E	3500
F	4100

(5) *Step 5.*

(a) The three work centers have the following hypothetical man-hour equations:

Table 4–9
Hypothetical man-hour equations

Work center	Equation	Workload factor
X	$Y_C = 295.8 + .004959X$	Flying hours
Y	$Y_C = 108.6 + 19.74X$	Engines repaired
Z	$Y_C = 153.4 + .3560X$	Tires replaced

(b) To find the man-hours required at each location, apply the standards and sum the man-hours.

Table 4–10
Man-hours required at each location

Work centers Airfield E	Man-hours derived from standards
X	313.16
Y	4000.00
Z	870.84
	5184.00*

Notes:

* Total maintenance function man-hour requirement (Airfield E)

(c) Repeat this process for each location:

Table 4–11
Man-hour requirement for each location

Airfield	Man-hour requirement
A	3744
B	4032
C	4464
D	4752
E	5184
F	5328

(6) *Step 6.* Combine the data obtained from steps 4 and 5, and run them through regression models.

Table 4–12
Regression model from steps 4 and 5 data

Airfield	X PEF	Y Required man-hours
A	2200	3744
B	2600	4032
C	2950	4464
D	3300	4752
E	3500	5184
F	4100	5328

c. The linear PEE from the above data is $Y_c = 1768 + .9060X$. This equation has the smallest coefficient of variation and satisfies the realistic and economy criteria.

4–63. Applying and using program estimating equations (PEEs)

PEEs can provide commands and HQDA with a means of projecting and programming manpower. Several methods for using PEEs are available depending on the desired results. While these methods apply to PEEs at any level, they will be explained in terms of the command maintenance function example provided in paragraph 4–59*b*.

a. Predicting manpower for a specific location using the PEE. When a PEE is used to project authorizations for a specific organization, retain that organization's dispersion from the program estimating regression line. To do this, build a deviation factor equal to the actual vertical deviation from the regression line and combine it with the original PEE. The following example explains this process:

(1) Deviations for the maintenance example are in figure 4–17.

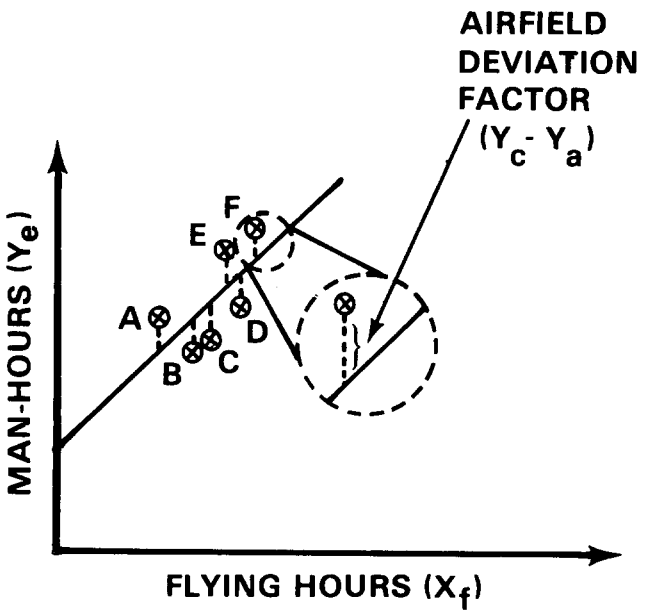


Figure 4–17. Base deviation factors

(2) Compute deviation factors by subtracting the man-hours computed by the PEE from the man-hours computed by the standards manpower equation ($Y_c - Y_e$). (The deviation factor can be either positive or negative. It will be negative when the standards application data point is below the PEE regression line.) The calculation for airfield E is—

Man-hours computed from PEE
$Y_e = 1768 + .9060(3500)$
$Y_e = 4939$

Man-hours computed from standard equations
$Y_c = 5184$

Airfield deviation factor
$5184 - 4939 = 245$

(3) Calculate a deviation factor for each base, then merge it with the computed program estimating equation. The result is a combined equation for each location. This computation for Airfield E produces—

PEE + airfield deviation factor
$Y_e = 1768 + .9060X + 245$
$Y_e = 2013 + .9060X$

(4) The combined equation for each location is used to program that location's manpower requirements. For example, if Airfield E were scheduled in 1978 to have an increase in programmed flying hours from 4000 to 5000 per month, and if the appropriate Army availability factor is 145, 45 positions would be required in the maintenance function. The following computation, using Airfield E's combined equation, gives the answer:

$Y_e = 2013 + .9060(5000)$
$Y_e = 6543$
$6543/145 = 45.12 = 45$

b. Distributing PEE requirements to the work centers. Once total authorizations for a location have been determined from the PEE, the next is to decide how these authorizations should be handed out to the various work centers. Two distribution processes can be used.

(1) The first method is based on the concept that each work center gets a pro rata share of the total installation

requirements provided by the PEE. Figure 4–18 shows this process using the previous maintenance example. Percentages, based on the standards application results used to build the PEE, are determined for each work center. These are then applied to the total airfield PEE manpower requirements to determine each work center's share of the installation total. To prevent the total PEE requirements from being exceeded, forced rounding may be necessary when converting the work center results to whole manpower requirements.

(2) The second method uses regression analysis to distribute bulk PEE requirements to each work center.

(a) Using a different example, assume standards application results in requirements of 100, 140, 155, and 210 at the four locations covered by a PEE. Also, assume that there are two work centers in this function.

(b) The following percentages represent each work center's portion of the standards application total at each location:

Table 4–13
Work center's portion of the standards application total at each location

		Work centers	
Location	Required	(1)	(2)
A	100	.10	.90
B	140	.12	.88
C	155	.12	.88
D	210	.14	.86

(c) These work center percentages are dependent variables and each location's standards application total is an independent variable. Regression analysis on these data produces an equation for every work center except one. For example, for two work centers, one would have an equation and one would not; for five work centers, four would have equations and one would not. In this example, an equation relating percentages in one work center is $Y_1 = .06649 + .0003538X$ where Y_1 = work center's percentage of the location's total PEE requirements and X = location's total PEE requirements. If the PEE gave a location 300 requirements (X = 300), then $Y_1 = .1726$ and $Y_2 = 1 - Y_1 = .8274$. The manpower distribution thus becomes 51.78 (300 × .1726) for one work center and 248.22 (300 × .8274) for the second work center.

(d) Three work centers can be shown by dividing the second work center above into two work centers. The following example shows these three work centers:
The regression equations are—

$Y_1 = .06649 + .0003538X$
$Y_2 = .4505 - .0004663X$
Assume the PEE would give a location 400 requirements. Then the work center percentages would be $Y_1 = .2080$, $Y_2 = .2640$ and $Y_3 = 1 - Y_1 - Y_2 = .5280$.

Table 4–14
Percentages representing three work centers

		Work centers		
Location	Required	(1)	(2)	(3)
A	100	.10	.40	.50
B	140	.12	.39	.49
C	155	.12	.38	.50
D	210	.14	.35	.51

Airfield E	Program Estimating Factor X_f = Flying Hours		Airfield Deviation Factor + 245		Airfield Program Estimating Equation $Y_e = 2013 + .9060X_f$
Work Centers	Airfield Manpower Used to Compute PEE		Manpower Requirements for $X_f = 5000$ $Y_e = 2013 + .9060(5000) = 6543/144 = 45$		
	Manpower Supported by Standard	%	%	Programmed Manpower	
				Computed	Whole Manpower Authorizations
X	3	08%	08%	3.60	4
Y	27	75%	75%	33.75	33
Z	6	17%	17%	7.65	8
TOTAL	36	100%	100%	45.00	45

Figure 4–18. Program estimating equation distribution schedule

c. Predicting total manpower for all points in the PEE. Two approaches can be used to project manpower requirements for a summary organization (for example, a command when the airfield data were used to develop the PEE). The first approach is total program oriented and gives the total manpower required; the second is workload change oriented and gives net manpower adjustments.

(1) The first method is the total program approach for linear PEEs. This takes total workload volume and puts it into a summary PEE to find the total manpower requirement.

(a) A total command-oriented PEE may be developed by combining the installation linear PEEs. When this is done, the Y-intercept must be multiplied by the number of locations used in developing that PEE. In the example, to find the total command manpower requirements associated with the six airfields and an aggregate PEF volume of 18,650, the following calculations apply:

$Y_e = 1768 + .9060X$
$Y_e = 1768(6) + .9060X$
$Y_e = 10{,}608 + .9060(18{,}650)$
$Y_e = 27504.90$ man-hours/145 = 189.69 or 189 requirements

In the example shown in *b*(2)(d) above, the command needs a total of 189 requirements for its maintenance function.

(b) Curvilinear PEEs cannot be combined. Instead, apply the PEE to each airfield and add the individual airfield manpower requirements to get a command total.

(2) The second method is used when a change to the PEE determined total manpower requirement is necessary because of a change in the total PEF value. This manpower change, (Y_e), becomes the product of the regression coefficient(s) times the change in PEF volume(s), that is $Y_e = b_1X_1 + b_2X_2 \ldots + b_nX_n$, where X is the change of PEF volume.

(a) Continuing the above maintenance example, $Y_e = 10{,}608 + .9060X_f$, with X_f now equaling the total monthly flying hours for the six bases covered by the PEE. If for some reason, the currently programmed command total of 18,650 monthly flying hours is increased by 2000, the change (Y_e) in command maintenance requirements would be:

$Y_e = b_1X_1$
$Y_e = .9060(2000)$
$Y_e = 1812$ man-hours

If the AAF is 145, 1812/145 = 12.49 or a 12 requirements increase to the 189 total requirements established using the first method.

(b) Although this manpower change method can be used to compute airfield, command, or Army net changes by using the appropriate "A" value and X_f for linear PEEs, it cannot be used with curvilinear PEEs.

4–64. Building PEEs for single location standards

In single location studies which consist of more than one work center, a PEE covering all of the work centers may be convenient for programming purposes.

a. If the method in paragraph 4–21*b* is used to develop the work center standard equations, PEF selection becomes very critical. The PEF(s) selected must directly relate to the WLF(s) contained in the work center standards. Increases or decreases in PEF volume must imply similar changes in WLF volumes.

b. Once the PEF is finalized, a PEE of the form $Y_e = 1 + b_1X_1 \ldots + b_nX_n$ can be developed in the following manner:

(1) Sum the fixed man-hours ("a" values) from the standard to determine the PEE "a" value.

(2) Find the "b" value for the PEE by multiplying the "b" value in each of the standard equations by the respective workload values for the selected time period. Add the resultant man-hours. Divide this total by the respective actual PEF value for the same time period.

(3) The following example demonstrates this procedure.

(a) Work center equations—

$Y_c = 120.0 + 1.077X_1$
$Y_c = 110.2 + 2.501X_2 + 3.000X_3$
$Y_c = 242.0 + 5.500X_4 + 1.006X_5$
$(PEF)_1$ relates to X_1, X_2, and X_5
$(PEF)_2$ relates to X_3 and X_4
$X_1 = 10$
$X_2 = 15$
$X_3 = 5$
$X_4 = 8$
$X_5 = 4$
$(PEF)_1 = 100$
$(PEF)_2 = 75$

(b) Step 1: Sum the "a" values.
120.0 + 110.2 + 242.0 = 472.2

(c) Step 2: Compute the b_1 value associated with $(PEF)_1$.

$$\begin{aligned} 1.077X_1 &= 1.077(10) = 10.77 \\ 2.501X_2 &= 2.501(15) = 37.52 \\ 1.006X_5 &= 1.006(4) = \underline{4.02} \\ b_1 &= 52.31/100 = 0.5231 \end{aligned}$$

(d) Step 3: Compute the b_2 value associated with $(PEF)_2$.

$$\begin{aligned} 3.000X_3 &= 3.000(5) = 15.00 \\ 5.500X_4 &= 5.500(8) = \underline{44.00} \\ b_2 &= 59.00/75 = 0.7867 \end{aligned}$$

(e) Resulting PEE. The resulting PEE is $Y_e = 472.2 + 0.5231X_1 + 0.7867X_2$, where X_1 and X_2 are now $(PEF)_1$ and $(PEF)_2$. This PEE will yield total man-hour requirements for all three work centers. Distribute requirements to individual work centers as discussed in paragraph 4–60*b*.

c. Another way of developing a PEE for a single location standard is to use multiple data sets. Obtain these sets by applying work center standards over different time periods, e.g., for each month, within a baseline time frame. Collect corresponding historical PEF volumes for the same time periods. Regress the resulting data pairs as described in paragraph 4–59*a*(6).

(1) For example, assume the following data:

Table 4–15
Example of another way of developing a PEE

Month	X_f PEF volumes (actual flying hours)	Y_c standars application results
Jan	230	5500
Feb	190	4400
Mar	190	4800
Apr	170	4100
May	190	3900
Jun	180	4300
Jul	170	4700
Aug	220	5500
Sep	200	5100
Oct	240	5500
Nov	230	5300
Dec	240	6000

(2) The linear PEE resulting from the data in (1) above is $Y_e = 498.8 + 21.68X$, where X_f is flying hours

4–65. Using installation population as a program estimating factor

a. This can present some problems when trying to develop or apply a PEE because the PEF actual experience data (assigned strength) may be made up of more population elements than the PEF program data (TAADS authorizations). These additional elements may include transients, students, patients, prisoners, and holdees. Because of these problems, exercise caution when using base population as a PEF. However, if it is used as a PEF, ensure that the data used to build the PEE are defined in the same way as the data that will be used to apply the PEE. Examples of procedures used to apply the PEE follow:

(1) Subtract all the elements of paragraph 4–62*a* from the assigned PEF. This means that the adjusted assigned strength values used to build the PEE will contain only those population elements contained in the PEF program data.

(2) Include all programmable population elements (for example, students) in the PEF. To do this, obtain necessary program data from the past level and add them to TAADS authorizations that will be used in applying the PEE. Use the actual experience values for the programmable elements in the PEF value used in the correlation and regression analysis done to develop the PEE.

b. One of the population elements that is not programmable and does not have base level assigned data available for adjusting is transients. Since the past level assigned data include transients, to determine the base assigned transient value that is subtracted from the base historical assigned PEF data before the correlation and regression analysis, follow the procedures listed below.

(1) *Step 1.* Understand at least the summary definition of transients which says transients include active duty military personnel in travel, leave en route, temporary duty en route, or certain other types of status while on permanent change of station orders between duty stations.

(2) *Step 2.* Obtain the command transient entitlements.

(3) *Step 3.* Calculate distribution percentages for each installation by dividing their standards application results by the command total application results.

(4) *Step 4.* Multiply the total transient entitlements obtained in step 2 by each of the distribution percentages calculated in step 3. This results in an estimate of the transient assigned personnel for each installation.

(5) *Step 5.* Subtract the values obtained in step 4 from the actual experience PEF value of their corresponding installation.

c. An example of this procedure, using data from the earlier maintenance example, follows.

(1) *Step 1.* The definition of transient entitlement is understood.

(2) *Step 2.* Total command transient entitlements = 690.

(3) *Step 3.* Compute post percentages based on standard application results as follows:

Table 4–16
Example percentages based on standard application

Post	Standard application results
A	3,744
B	4,032
C	4,464
D	4,752
E	5,184
F	5,328
Command total	27,504

Table 4–17
Distribution percentage

Post	Distribution percentage		
A	3744 / 27,504	=	13.61
B	4032 / 27,504	=	14.66
C	4464 / 27,504	=	16.23
D	4752 / 27,504	=	17.28
E	5184 / 27,504	=	18.85
F	5328 / 27,504	=	19.73
	27,504		100.00%

(4) *Step 4.* Distribute post transient entitlements as follows:

Table 4–18
Post transient entitlements

Post	Distribution percentage	X	Command transients	=	Post transients entitlements*
A	13.61	X	690	=	94
B	14.66	X	690	=	101
C	16.23	X	690	=	112
D	17.28	X	690	=	119
E	18.85	X	690	=	130
F	19.37	X	690	=	134
Total	100.00%				690

Notes:
* Nearest whole number.

(5) *Step 5.* Adjust PEF values. (The adjusted PEF values are the data that will be used in the regression analysis.)

Table 4–19
Adjusted PEF values

Post	Historical PEF data*		Post transient		Adjusted PEF values
A	2200	−	94	=	2106
B	2600	−	101	=	2499
C	2950	−	112	=	2838
D	3300	−	119	=	3181
E	3500	−	130	=	3370
F	4100	−	134	=	3966
Total	18,650		690		17,960

Notes:
* Assigned personnel.

4–66. Reporting and documenting results

a. The lead team will report the method recommended for predicting future requirements in chapter 3 of the FIN–REP. The rationale for the proposed method will be fully explained. When using workload forecasting, include the source from which the forecast was obtained. When using a PEE, include the data required by paragraph 4–49.

b. The method selected for predicting future requirements will be published with the appropriate manpower staffing standard. The DA manpower staffing standards publication will include the PEE, definition of the PEF, the source of count, and activities the PEE covers.

MANPOWER STANDARD AND TABLE

For use of this form, see AR 570-5; the proponent agency is DCSPER.

SECTION I – MANPOWER STANDARD

WORK CENTER TITLE/CODE
Mail Room/AMA

CLASS OF STANDARD	SCOPE	TYPE
[X] TYPE I [ ] TYPE II	[X] ARMY COMMON [ ] COMMAND UNIQUE	[X] MILITARY [ ] CIVILIAN

APPLICABILITY STATEMENT
This standard applies to Central Mail Rooms (CMR).

APPLICATION INSTRUCTIONS
When more than one CMR is located at an installation, add lockboxes assigned to those CMRs having fewer than 500 boxes and treat the result as a separate CMR for manpower determination purposes. For example, a post having CMR #1 with 1002 boxes, CMR #2 with 477 boxes, and CMR #3 with 298 would be treated as a base having two CMRs, one with 1002 and one with 755 boxes. These two CMRs could be manned separately.

NORMAL HOURS OF OPERATION	WORK WEEK	MANHOUR AVAILABILITY FACTOR
0730-1700 Mon-Fri (9.5) 0800-1230 Sat (4.5)	5 1/2 days/week	145

MANHOUR DATA SOURCE
[ ] WORK SAMPLING [X] OPERATIONAL AUDIT [ ] MANPOWER REPORTING
[ ] MANPOWER FILES [ ] TIME STUDY [ ] OTHER (specify)

STANDARD	APPROVAL DATE	CURRENCY REVIEW DATE
Y = 50.00 + .1000X	1 Sep 81	

WORKLOAD FACTOR IDENTIFICATION

TITLE
A lockbox assigned.

DEFINITION
Total number of lockboxes assigned to postal patrons who are eligible for postal service.

SOURCE

DA FORM 5279-R, Dec 83

Legend for Figure 4–15;

Section I — Work Center Title/Code block. Enter the descriptive title of the work center and the appropriate AFD(SWC) codes.

Class of Standard block. Place an "X" in the appropriate block.

Figure 4–15. Example of a completed DA Form 5279–R

Scope block. Place an "X" in the appropriate block.

Type block. Place an "X" in the appropriate block. Classify as "civilian" only if all positions covered by the standard are civilian.

Applicability Statement block. Enter a statement which explains the scope of the standard's applicability (for example, "This standard applies only to TRADOC Training Centers.") Validated exceptions to the standard should be identified by location. For single location standards, identify the installation to which the standard applies.

Application Instructions block. Enter special instructions concerning the application of the standard (for example, "standard must be applied using a 12 month average of the workload factor.") For nonprogrammable workload factors, state whether of not the standard is to be used in PEE development. State if other uses are contemplated.

Normal Hours of Operation block. Enter the normal hours of work center operation (for example, 8 hrs/day, 16 hrs/day, 24 hrs/day).

Work Week block. Enter the normal work week associated with each shift (for example, 5 days/week, 6 days/week, etc.)

Man-hour Availability Factor block. Enter the appropriate man-hour availability factor from which the manpower table was constructed. If multiple availability factors are appropriate, enter "multiple MAF" in this block. If the table is based on minimum manning, enter "N/A" in this block.

Man-hour Data Source block. Place an "X" in the appropriate block(s) corresponding to the applicable standards development method(s).

Standard Equation block. Enter the standard equation in terms of man-hours (for example, Y = 50.00 + .1000X).

Approval Date block. Enter the date USAMARDA approves the standard.

Currency Review Date block. Enter the last currency review date for the standard. For new standards, the date is omitted.

Workload Factor Identification Title block. Enter a descriptive title of the workload factor used in the standard equation. If a multivariate standard was developed, indicate the title of each workload factor and identify each by number (for example, X_1, X_2, etc.).

Definition block. Enter the workload factor(s) definition in sufficient detail to ensure complete understanding of the factor(s).

Source block. Identify the source from which the workload is obtained.

Figure 4–15. Example of a completed DA Form 5279–R—Continued

SECTION II – STANDARD MANPOWER TABLE

WORK CENTER TITLE/CODE		STANDARD APPLICABILITY MAN-HOUR RANGE											
Mail Room/AMA		50.000 - 598.376											
POSITION TITLE	MOS	GRADE	MANPOWER REQUIRMENT										
Mail Supervisor (Postal NCO)	GS0305 (71L30)	CIV (E-6)	1	1	1	1							
Sr Mail Clerk (Sr Postal Clerk)	GS0305 (71L20)	CIV (E-5)		1	1	1							
Mail Clerk (Postal Clerk)	GS0305 (71L10)	CIV (E-4)			1	1							
Mail and File Clerk (Postal Clerk)	GS0305 (71L10)	CIV (E-3)				1							
		TOTAL	1	2	3	4							
POSITION TITLE	MOS	GRADE	MANPOWER REQUIREMENT										
		TOTAL											

DA FORM 5279-R, Dec 83

Legend for Figure 4–15;

Section II — Work Center Title/Code block. Enter the same information here as was entered in section I for the same block.

Figure 4–15. Example of a completed DA Form 5279–R (Section 2)

Standard Applicability Man-hour Range block. Enter the valid man-hour data range for this standard. Boundaries are the lower and upper man-hour extrapolation values. For a standard that yields a constant manpower requirement, enter the words, "Constant Manpower." When a parabola or ratio equation form is used for the standard, specify the upper limit for the workload. Do this by putting the message "Upper Workload Value = XXX" in this block.

Position Title block. Show the appropriate position/specialty title. For requirements which can be designated as either militrary or civilian, show the civilian position title on the first line, and on the next line show the military specialty title in parentheses. (Position/ specialty titles are contained in AR 611–101, AR 611–112, AF 611–201 and AF 690–500.)

MOS block. Show the appropriate MOS code or civilian series number. For requirements which can be designated as either military or civilian show the civilian series number on the first line, and show the appropriate MOS code on the next line in parentheses. MOS code and civilian series numbers are contained in AR 611–101, AR 611–112, AR 611–201 and AR 690–500. Military position titles applicable to more than one MOS (e.g., instructors, educators and training developers) will be explained in footnotes, to include use/ applicability of multiple MOS.

Grade block. Show the appropriate military grade or "Civ" for civilian. For requirements which can be designated as either military or civilian show "Civ" on the first line and show the appropriate military grade on the next line in parentheses.

Manpower Requirement block. Enter the appropriate distribution of reqirements for each grade within the range bounded by the lower and upper extrapolation limits. Manpower requirements should not be shown for alternate positions. To ensure that all levels of manpower are covered on the table, consider all of the man-hour availability factors that apply, then:

a. The smallest number of positions shown on the table is the number required (for the largest applicable MAF) at the lower extrapolation.

b. The largest number of positions shown is computed for the smallest applicable MAF at the upper extrapolation limit. Continue on additional forms as necessary.

Total block. Enter the total requirement reflected by distributed MOSs and grades in the column. The first and last total will reflect the manpower associated with the extrapolation limits.

Figure 4–15. Example of a completed DA Form 5279–R (Section 2)—Continued

Chapter 5
The Standards Application and Maintenance Phase

Section I
Standards Application RCS: CSGPA–1723

5–1. General

This section contains instructions and procedures for applying Manpower Staffing Standards.

5–2. Application of manpower staffing standards

a. General. The application process begins when the standard is submitted by USAMARDA to all commands for application. The standard is then applied by the installation manpower representative in conjunction with the local functional proponent. This is referred to as initial application. Results of the initial application may cause adjustments to the standards. After adjustments have been submitted to USAMARDA by the Proponent Command, and reviewed and coordinated in conjunction with the HQDA functional proponent, USAMARDA will approve or disapprove the standard. If approved, USAMARDA will direct documentation of the application results in TAADS. If disapproved the standard will be forwarded to the lead team for further adjustments, coordination, and resubmission. A standard is not considered to be an approved MS–3 standard until after the initial application has been completed and exceptions and adjustments approved by USAMARDA. It is important to note that the process used for initial application and annual application of the manpower staffing standard is essentially the same.

b. Army common manpower staffing standards.

(1) *Initial application.* After review and approval of the FIN–REP, the lead team will provide to all commands a copy of the FIN–REP to include the standard, instructions for application, and the appropriate data collection reporting period. The standard is then applied to the entire universe. On receipt of the initial application results and proposed adjustments, the lead team for the manpower standards study does the following:

(a) Arrays and analyzes the standard application results, makes necessary adjustments, and coordinates adjustments with the appropriate command, as necessary.

(b) Reviews and analyzes documented command proposed exceptions to the manpower staffing standard, makes necessary proposed adjustments, and coordinates with the appropriate commands, as necessary.

(c) Submits to USAMARDA a DA Form 5696–R (Standards Application Summary), summarizing the data from the various commands.

(d) Submits to USAMARDA on DA Form 5696–5–R (Manpower Exception), documentation of proposed adjustments made to include recommended concurrence/nonconcurrence of command proposed exceptions and lead team comments on these exceptions.

(e) Submits to USAMARDA an updated DA Form 5696–6–R (Manpower Grade and Skill Distribution Summary).

(2) *Annual application.* Distribution of manpower staffing standards for annual application will be made in the form of a DA pamphlet and in accordance with the guidance provided on DA Form 12–9A–R (Subscription for DA Unclassified Administrative Publications) requirements for 570-series publications. USAMARDA will provide the appropriate data collection reporting period along with any required supplemental instructions. Once received, the standard is applied to the entire universe. On receipt of annual application results and proposed exceptions, the Proponent Command for the manpower staffing standards study does the following:

(a) Arrays and analyzes the standard application results, and makes appropriate adjustments.

(b) Reviews and analyzes documented command proposed exceptions to the manpower staffing standard, and makes the required adjustments.

(c) Submits to USAMARDA a DA Form 5696–R, summarizing the data from the various commands.

(d) Submits to USAMARDA on DA Form 5696–5–R documentation of proposed adjustments made to include recommended concurrence/nonconcurrence of command proposed exceptions and lead team or Proponent Command comments on these exceptions.

(3) *General.* Whether initial or annual application, once the standard is applied and the requirements computed, the installation results, to include proposed adjustments, are then entered on the applicable DA Forms (DA Forms 5696–R through 5696–6–R). Two copies of the entire application results package are to be provided to USAMARDA and two copies to the lead team or Proponent Command by the suspense date indicated in the instructions.

c. Command unique standards.

(1) *Initial application.* The command provides the installations with a copy of the standard, instructions for application, and the appropriate data collection reporting period. The standard is then applied to all installations within the command, requirements are computed, and results are submitted to the command. After the results are reviewed by the command, they are then forwarded as part of the FIN–REP to USAMARDA and the lead team for review and approval.

(2) *Annual application.* Distribution of command manpower staffing standards for annual application will be made in the form of a DA pamphlet (see chap 5, sec III). The command will provide the appropriate data collection reporting period along with any required supplemental guidance. The standard is then applied to the installations. Standard application results are then submitted to the command. On receipt of the annual application results and proposed exceptions, the Proponent Command does the following.

(a) Arrays and analyzes the standard application results, makes the appropriate adjustments, and coordinates adjustments with the appropriate installation, as necessary.

(b) Reviews and analyzes documented installation proposed exceptions to the manpower staffing standard, makes the required adjustments, and coordinates with the appropriate installation, as necessary.

(c) Submits to USAMARDA and the lead team a Standards Application Summary (DA Form 5696–R), summarizing the data from the various installations.

(d) Submits to USAMARDA and the lead team on DA Form 5696–5–R documentation of proposed adjustments made to include recommended concurrence/nonconcurrence of command proposed exceptions and installation comments on these exceptions.

(3) Whether initial or annual application, once the standard is applied and the requirements computed, the results, to include proposed adjustments, are then entered on the applicable DA forms (DA Forms 5696–R through 5696–6–R). Four copies of the entire application results package are to be provided to USAMARDA not later than 30 days after the standard is applied.

5–3. Concluding manpower staffing standards

a. After collecting data, identifying command proposed exceptions, and analyzing the results, the impact and proposed exceptions must be reviewed and approved. The HQDA functional proponent and USAMARDA review the standards application summary for adequacy and completeness. Written comments, recommendations, and concurrence are then provided to the lead team.

b. The lead team takes the final actions on the manpower staffing standards study by—

(1) Consolidating USAMARDA comments on the standards application summary to include additives, exclusions, and deviations and resolving any problems identified by these comments.

(2) Revising, if required, the proposed manpower staffing standard.

(3) Submitting the revised manpower impact to USAMARDA on DA Form 5696–6–R.

(4) Advising commands, in separate correspondence, of USAMARDA disposition of their proposed exceptions and standards requirements determination.

c. USAMARDA provides civilian and military personnel centers with initial forecasts of manpower adjustments in series/MOS detail that come from the standards application.

5–4. Procedures for applying manpower staffing standards

a. Evaluating the work center description (WCD). The WCD describes in summary and in detail the functions and tasks required to perform the work. Man-hours necessary to perform these functions and tasks are accounted for in the manpower staffing standard equation(s). Proper application of a manpower staffing standard requires a thorough evaluation of the WCD for accuracy and completeness. This evaluation must be performed jointly by the work center supervisor or his or her representative and the manpower representative responsible for applying the standard. Care must be taken to ensure that every category contained in the WCD is evaluated. If work is being performed in a work center that has not been identified in the WCD, nor covered by an exception, and it has been determined that the work center is required by higher headquarters to perform the work, this discrepancy must be carefully documented. If applicable, a copy of the policy memorandum, regulation, or directive that directs the work to be performed is to be included as part of the application documentation. Likewise, if work is no longer being performed in a work center that has been identified in the WCD, and it has been determined that this work center is no longer required by higher headquarters to perform the work, this also must be documented. If applicable, a copy of the policy letter or directive that directs that the work no longer be performed is to be included as part of the application documentation.

b. Collecting workload factor (WLF) data.

(1) Using the appropriate source of count, 12 months of historical WLF data are to be collected. The application data collection reporting period for Army common standards will be specified by USAMARDA. The command will specify the application data collection reporting period for command unique standards. The WLF data collected will be entered on DA Form 5696–4–R (Workload Factor/Man-Hour Collection). If 12 months of data are not available, an explanation of the extenuating circumstances is to be provided under the remarks section of DA Form 5696–4–R when submitting WLF data. For more detailed information on workload factor data refer to chapter 2.

(2) Monthly workload factor data should be submitted by the functional proponent at the installation to the local manpower office to ensure a joint validation of workload and to facilitate data collection when required. Data should then be forwarded to the MACOM for consolidation and approval. Given the lack of an existing system, commands should establish a data collection system to obtain the monthly workcounts. DA Form 5696–4–R is provided to assist in the collection of this data.

(3) Once the workload information has been submitted, it must be analyzed to ensure it is representative of normal workload periods or suitable for projecting manpower requirements. When analyzing historical workload, a control chart of the available historical data must be made to determine if there is enough stability to justify using averages. The Manpower Management/Resource Management Office is responsible for periodic evaluation/validation of workcounts, and is the installation point of contact for questions and clarification of the standard.

(4) All workload factor data collection reports and summary forms used for the submission of data are to be signed by the installation functional proponent, the installation manpower representative, and the command manpower officer. This coordination will ensure validity of WLF data submitted.

(5) Where there is a basis for determining that historical workload is not representative of workload projections, projected rather than historical WLF, data are to be used. When projecting WLF, data follow the procedures outlined in chapter 4, section VI, Manpower Requirements Prediction.

c. Identification of potential manpower staffing standard exceptions.

(1) There are times when certain tasks or categories of work are not performed at all locations where the manpower standard applies. There are also times when the work center conditions at some locations are significantly different from those described in the statement of conditions, or when the workload changes as a result of a change in mission, organization, or technology. When these situations exist, an exception to the manpower standard may be warranted. There are three kinds of exceptions to a manpower standard: additives, exclusions, and deviations. For more definitive information on these exceptions refer to chapter 4, section I.

(2) Standard exceptions are documented by installation manpower personnel in conjunction with the installation functional proponent during the application process. However, mission or policy changes may require that exceptions be developed during other time periods.

(3) Additive work or excluded work can generally be identified by comparing the work performed with that described in the manpower staffing standard WCD. Identification of a potential manpower deviation, however, is more difficult because of the average effect which is built into the standard equation. Furthermore, work measurement data will not usually be available at a location which was not included as a measurement site. Thus, a valid comparison may not be possible.

(4) Use the SOC contained in the FIN–REP and the manpower staffing standard as a basis for identifying potential exceptions. If conditions at a particular location depart significantly from the conditions in the SOC and the work performed is not described in the work center description, then a potential manpower deviation may exist at that location.

(5) Once all potential manpower exceptions are identified and documented, the manpower manager will forward

workcounts, documentation, and justification on the appropriate DA forms to the command for review and approval. The information provided should be per the essential elements outlined in chapter 4. Once approved by the command, the documented exceptions will then be submitted to Commander, USAMARDA, ATTN: PEMS–RA, Bldg 2588, Fort Belvoir, Virginia 22060–5587 for comment and approval and the HQDA Functional Proponent for review and comment.

(6) Requirements based upon additional identified potential manpower exceptions, whether, additives, exclusions, or deviations, will not be documented until approved by USAMARDA. At the beginning of the standard application cycle, USAMARDA will provide to the command information concerning those potential exceptions which are known to require evaluation based upon programmed changes to equipment or facilities or changes to regulatory or procedural guidance provided by the functional proponent. Once the new manpower exceptions are approved for use, written notification will be forwarded to the command. A copy of the approval will be retained on file at USAMARDA, the command, and the installation. The only exception to this procedure would be those manpower exceptions previously approved by USAMARDA.

d. Determining manpower requirements.

(1) *Determining military/civilian mix.* Included as part of the manpower staffing standard application is a determination of the military/civilian mix. Military essentiality is the prime consideration used in establishing this mix. Policy on the identification of manpower that must be military is set forth in AR 570–4, paragraph 4–2. There is no need to maintain an existing ratio between military and civilian manpower if application of the military essentiality criteria would dictate a change in this ratio. DA Form 5696–6–R is to be completed for each work center in which the standard is applied.

(2) *Adjustments for contract personnel.* Some work centers may have a portion of their workload performed by contractors. An adjustment for the "contracted-out" workload must be made. This adjustment is made by subtracting a contract man-hour equivalent value from the man-hours obtained from applying the equation. Once total man-hours are computed, and divided by the appropriate Army availability factor, refer to the procedure in appendix B to interpret fractional manpower for military and civilian requirements.

(3) *Dispersed work centers.* When two or more work centers belong to the same organization and come under the same management, the workload for these work centers should be collected separately, then combined before the availability factor is applied. The availability factor is to be applied at the highest level.

(4) *Determining work center impact.*

(a) After the work center requirements have been calculated, the next step is to determine if there are any changes in requirements as a result of the standards application. Manpower personnel applying the standard need to look at the difference between the application results and the TDA requirements, and the application results and the TDA authorizations (funded requirements).

(b) If there are any changes, the analyst needs to look at what caused the overall increase or decrease in total manpower requirements, i.e., increased workload, new work, decreased workload, productivity improvements, policy changes, etc. DA Form 5696–1–R is to be prepared for each work center in which the standard is applied. Instructions for completing this form are found in figure 5–2.

e. Preparation of application results.

(1) *Installation.* Each installation applying a manpower staffing standard must submit the results of the standards application to its parent command. The submission will include the following:

(a) DA Form 5696–1–R (Installation Work Center Summary).

(b) DA Form 5696–2–R (Work Center Standard Computation).

(c) DA Form 5696–3–R (Additive/Exclusion/Deviation Computation) (if applicable).

(d) DA Form 5696–4–R (Workload Factor/Man-Hour Collection).

(e) DA Form 5696–5–R (Manpower Exception) (if applicable).

(f) DA Form 5696–6–R (Manpower Grade and Skill Distribution Summary).

(2) *Command.*

(a) Each command is to prepare a consolidated Standards Application Summary on DA Form 5696–R.

(b) Copies of all application results forms prepared at the installation level are also to be forwarded with the Command Summary. These forms will be submitted to Commander, USAMARDA, ATTN: PEMS–RS, Bldg 2588, Fort Belvoir, Virginia 22060–5587.

f. Submission of application results.

(1) Two copies of the installation application results package and the Command Standards Application Summary are to be submitted to Commander, USAMARDA, ATTN: PEMS–RA, Bldg 2588, Fort Belvoir, Virginia 22060–5587, and two copies to the lead team/proponent command NLT 20 working days following the scheduled completion date of the application at the installation.

(2) All application results forms are to be completed and submitted to USAMARDA each time a standard is applied.

g. Criteria for approval.

(1) All application results packages will be reviewed by USAMARDA in conjunction with the proponent command

for accuracy and completeness. The proponent command will then be notified within 40 working days from the receipt of the package of any adjustments that are required as a result of the review.

(2) If the application results are approved by USAMARDA, the commands will be notified and told to document the approved requirements in TAADS in the next MOC window.

(3) If the application requirement results are adjusted by USAMARDA the commands will be notified of the adjustments and the rationale to support the changes.

(4) Failure to submit the required forms with the appropriate justification/documentation will result in returning the application package to the proponent command for corrective action.

5–5. Standard application forms

a. The instructions provided in the following paragraphs are to be used for completing all DA forms in the standards application process. Examples of these forms are also provided to assist in the preparation of these reports. All standards application results information is to be provided to USAMARDA and the proponent command on the applicable forms stated herein. Failure to provide the required information on the appropriate forms will result in returning the application results package to the command for corrective action.

b. The following forms are to be used when submitting application results information. These forms will be locally reproduced on 8½ by 11 inch paper. Copies of these forms for local reproduction purposes are located at the end of this regulation.

(1) DA Form 5696–R.
(2) DA Form 5696–1–R.
(3) DA Form 5696–2–R.
(4) DA Form 5696–3–R.
(5) DA Form 5696–4–R.
(6) DA Form 5696–5–R.
(7) DA Form 5696–6–R.

5–6. Instructions for completing DA Form 5696–R, Standards Application Summary

DA Form 5696–R is to be used by the command for submitting installation total requirements as determined during the standards application process. An example of a completed DA Form 5696–R and the instructions for completion are located at figure 5–1.

5–7. Instructions for completing DA Form 5696–1–R, Installation Work Center Summary

DA Form 5696–1–R is to be used by the installation for summarizing work center requirements as determined during the standards application process. An example of a completed DA Form 5696–1–R and the instructions for completion are located at figure 5–2.

5–8. Instructions for completing DA Form 5696–2–R, Work Center Standard Computation

DA Form 5696–2–R is provided to calculate the total work center requirements, and is to be used when computing requirements for any work center. Space is provided to compute the basic standard equation and to summarize all additive and exclusion man-hours. An example of a completed DA Form 5696–2–R and the instructions for completion are located at figure 5–3.

5–9. Instructions for completing DA Form 5696–3–R, Additive/Exclusion/Deviation Computation

DA Form 5696–3–R is used to calculate Army common or command unique additive, exclusion, or deviation total man-hours. The total computed man-hours are then transferred to the appropriate block on DA Form 5696–2–R. Limit entries on each form used to exceptions of the same type, i.e., enter all additives on the same form, and enter all exclusions on another form. An example of a completed DA Form 5696–3–R and the instructions for completion are at figure 5–4.

5–10. Instructions for completing DA Form 5696–4–R, Workload Factor/Man-hour Collection

DA Form 5696–4–R is used for the collection of all workload factor data and exceptions. An example of a completed DA Form 5696–4–R and the instructions for completion are at figure 5–5.

5–11. Instructions for completing DA Form 5696–5–R Manpower Exception

The identification and collection of data on new manpower exceptions are to be documented on DA Form 5696–5–R. An example of a completed DA Form 5696–5–R and the instructions for completion are at figure 5–6.

5–12. Instructions for completing DA Form 5696–6–R, Manpower Grade and Skill Distribution Summary

DA Form 5696–6–R is to be used for submitting requirements by occupational specialty code and grade. An example of a completed DA Form 5696–6–R and the instructions for completion are at figure 5–7.

Section II
Standards Documentation

5–13. General

This section outlines the documentation process that is to be complied with after the standards application packages have been reviewed and approved by USAMARDA.

5–14. Documenting manpower requirements

Once a command is notified of the standards application results, the approved requirements are to be documented in TAADS, with the appropriate AFD(SWC) code. Each manpower staffing standard must have an approved AFD(SWC) code and all standard requirements must be identified on the TDA with that code. Requirements are to be coded with the unique AFD(SWC) code regardless of organizational configuration or even if the requirements covered by the standard appear under separate paragraphs. Documentation of approved application requirements is to take place in the management of change (MOC) window following receipt of the results.

5–15. Documentation review

Within 60 days after the application results have been forwarded to the command, USAMARDA will review the appropriate documents to ensure changes in requirements have been accomplished. If the changes have not been accomplished, the command will be notified to adjust appropriate requirements in the next MOC window.

Section III
Standards Publication

5–16. General

This section outlines the procedures to be followed once initial application has been completed and the manpower staffing standard has been approved for Army-wide publication by USAMARDA. All approved manpower staffing standards will be published in the 570–100 series (570–101 thru 570–119) of DA pamphlets. The pamphlets will be entitled according to the present major functional categories contained in the Army Functional Dictionary—Manpower (DA Pam 570–5).

5–17. Publication approval

a. Once a standard has been approved for application by USAMARDA, the standard is applied to the entire universe and results forwarded to USAMARDA and the Proponent Command concurrently.

b. Once the application results are approved by USAMARDA, the Proponent Command will be notified that the manpower staffing standard is ready for Army-wide publication. Within 60 days following this notification, the Proponent Command is to provide USAMARDA with four copies of the staffing standard in manuscript form along with any required artwork. The manuscript should be submitted in the format indicated in AR 310–3 and DA Pam 310–20.

c. USAMARDA will review the manuscript to ensure conformance with prescribed format. Failure to prepare the manuscript in the required format will result in the return of the manuscript to the Proponent Command. Once approved by USAMARDA, the manuscript will be forwarded to the U.S. Army Publications and Printing Agency for printing in the appropriate DA pamphlet.

5–18. Publication requirements

a. To decrease the number of adjustments required when preparing the manpower staffing standard manuscript for publication, action has been taken to minimize the number of data entries required by assigning standardized numbers to certain parts/chapters of the MEAS–PLAN, FIN–REP, and the published standard. MACOMs should contact PEMS–RA for proper numbering of the manuscript before submitting the standard for publication.

b. In addition to entering the work center title and Army Functional Dictionary code on the upper left hand corner of the first page, the following information is required for each standard and each manpower exception to the basic standard. Major items shown in (1) through (10) below will be identified as new paragraphs.

(1) *Objective.* A statement describing the purpose of the manpower staffing standard.

(a) Authority. List all DOD, Army and command directives/regulations governing the standard.

(b) Applicability of the manpower staffing standard. Indicate to whom the staffing standard does or does not apply.

(2) *WCD Summary Direct.* Enter the same information contained in the FIN–REP.

(3) *WCD Detail Direct.* Enter the same information contained in the FIN–REP.

(4) *Standard Indirect Categories.* Enter the same information contained in the FIN–REP for WCD Detail Indirect.

(5) *Standard data.* This entry will identify the following:

(a) Classification of the standard (Army common or command unique).

(b) Date approved—Date standard was approved by USAMARDA.

(c) Man-hour data sources—Specify the method or technique used.

(6) *Application.* This statement deals with the computation of the basic standard, any adjustments as a result of additives, exclusions, or deviations, and the division by the appropriate Army availability factor.

(7) *Workload factors and equations.* The following information is required for all workload factors and equations:

(a) Workload factor title.

(b) Workload factor definition.

(c) Source of count.

(d) Standard man-hour equation.

(e) Programmability.

(8) *Statement of conditions (SOC).*

(9) *Application instructions.* Forms required for the application process are contained in AR 570–5. If required, provide additional application instructions here.

(10) *Manpower table.* If applicable, provide an interpretation of the manpower table. Insert the following statement in response to this heading. "Table____-____ depicts manpower required by MOS/occupational series code."

c. All additives, exceptions, and deviations require the same information as the basic standard.

d. An example of the information required is in DA Pam 570–101–1.

5–19. Publication format required

When submitting a standard for publication, the manuscript will be prepared in accordance with AR 310–3 and DA Pam 310–20. Each WCD will be prepared as a figure using the standard DOD numbering system; i.e., 1., 1.1., 1.2., 2., 2.1., and 2.2.

a. The WCD figures will be incorporated in the manuscript at the appropriate point rather than prepared as separate documents as required by DA Pam 310–20. They will be separated from the rest of the standard by a bar line at the beginning and ending. Additionally, the figure number, title, and AFD code will be placed immediately below the first bar line. The placement of this information at the beginning of the figure is a departure from normal publication procedures and has been approved by the U.S. Army Publications and Printing Agency.

b. Each WCD prepared as a figure should contain only the detail direct information approved in the FIN–REP.

c. Standard indirect categories need not be submitted with the manuscript as they will always be contained in appendix B of the published standard. A statement must be made in the manuscript that "the standard indirect categories can be found in appendix B." A separate figure is required for the detail indirects if the standard indirect categories are not used. This figure will follow the detail direct figure.

d. Manpower tables will also be incorporated in the manuscript at the appropriate point rather than prepared as separate documents as required by DA Pam 310–20.

Section IV
Standards Maintenance

5–20. General

Once the standard has been applied and results have been approved, the standards maintenance process takes place annually. Maintaining standards is a continuous process influenced by various sources of information. This section provides information on maintenance responsibility and how to determine whether approved standards are valid and how to revise those that are outdated.

5–21. Staffing standards review

The currency of a standard must be established at least once a year. If a command desires, they may apply the standard twice a year following the same procedures outlined in the annual application instructions. Application results are to be submitted on the applicable forms (see para 5–6 through 5–12) to USAMARDA for review and approval. A new annual cycle begins upon approval of the manpower staffing standards application results. The annual review cycle applies to—

a. Newly approved staffing standards.

b. Standards requiring an update.

c. The man-hour equation.

d. Standards requiring administrative change.

5–22. Currency of standards

a. USAMARDA and the proponent command will ensure standards are current. They accomplish this by continuously monitoring functional areas covered by Army common manpower staffing standards. This monitoring consists of the following:

(1) Maintaining copies of functional directives.

(2) Reviewing published bulletins.

(3) Obtaining changes and revisions to workload reporting and management information systems.

(4) Reviewing organizational change proposals.

(5) Reviewing research studies.

(6) Reviewing command exceptions.

(7) Performing trend analysis on workload factor volumes.

(8) Obtaining and reviewing DA functional policy or procedural memorandums and forwarding them to the proponent command.

(9) Participating in functional proponent conferences.

b. The proponent command is to set up controls to ensure Army-wide standards and approved exceptions are monitored and reviewed at least once a year. The starting point for analysis is to verify the fact that nothing has changed in the work center that would impact key parts of the standard.

c. The proponent command along with manpower analysts responsible for standards application at all staff levels must specifically analyze the currency and accuracy of the following items in the manpower standard:

(1) Work center description.

(2) Statement of conditions.

(3) Workload factor definitions.

(4) Sources of count.

(5) Manpower tables (description titles and series codes/MOSs).

(6) Extrapolation limits (in terms of whether or not installations are falling outside these limits).

(7) Applicability statements.

(8) Application instructions.

(9) All exceptions.

d. The proponent command, upon receipt of information received from USAMARDA, is responsible for ensuring that the appropriate MACOM is informed of all known changes, directives, or environmental changes significantly affecting the functional area. The MACOM in turn will notify the local manpower office and installation functional proponent.

e. The MACOM, in conjunction with the installation functional proponent, is responsible for identifying any new work not identified in the WCD to determine the accuracy of the standard and to answer questions such as the following:

(1) Have approved mission changes occurred that altered the work being done at the time the standard was developed or updated?

(2) Have directives changed, causing procedures to change?

(3) Is the activity still operating with the approved organizational structure that existed at the time of development or update? If not, have the realigned responsibilities or workload made the standard invalid?

(4) Is the work center description current? If not, do the changes required to update the description show actual changes in work being done? For example, in some cases, all that is required is changing work content. Many minor changes may be made which do not make the manpower staffing standard equation invalid.

(5) Is the workload factor definition still current and is the indicated workload factor source of count current? Has it proved reliable?

5–23. Evaluating currency results

a. Exceptions.

(1) USAMARDA must approve all additives, exclusions, and deviations.

(2) Proponent Commands will develop or revise exceptions using appropriate measuring techniques in AR 570–5 whenever circumstances warrant. Results of these revisions are sent to USAMARDA for review and approval.

b. Standards.

(1) Some functional standards may need complete remeasurement because of major changes in mission or organization procedures, or when extrapolation limits are exceeded. No set rules are specified; however, each case must be evaluated in light of available information, and remeasurement is to be completed by the command functional proponent. Whenever feasible the basic standard should be adjusted in lieu of developing additives and subtractives.

(2) Commands will inform USAMARDA in writing when a command standard is considered outdated and requires remeasurement.

5–24. Measuring changed work

Complete remeasurement of the entire standard is not always required. Do not measure more than is necessary. For a partial measurement, measure only the changed work (categories, tasks, and subtasks) where possible. In this case, a new manpower staffing standard equation should be derived using the adjusted man-hour determination. Follow the guidance outlined in chapter 2 to obtain usable and accurate work counts. The following procedure is one way to measure changed work. It is not intended to preclude the use of other methods.

a. Step 1. Measure the added and changed tasks and add the new tasks times for each study location. Call the sum Y_1,i where i = 1, 2, 3, ….n and represents each study location. Thus Y_1,i is the man-hour total of added or changed tasks for the 1st study location, Y_1,2 is the total for the 2nd location, etc.

b. Step 2. Identify tasks which are no longer applicable plus the original times for added or changed tasks which are being remeasured. Adjust the category times to the current WLF volume at each location and add their respective man-hours and call the sum Y_2,i where i again represents study location. Thus Y_2,i is the sum at the i-th location, of man-hours for tasks which are no longer done plus tasks which are being remeasured.

c. Step 3. Collect current workload data.

d. Step 4. Compute man-hours allowed by the standard for each study location using the existing standard man-hour equation. Call these man-hour totals $Y_{3,i}$ where i denotes study location.

e. Step 5. Compute $Y_i = Y_{3,i} + (Y_{1,i} - Y_{2,i})$ for each value of i.

f. Step 6. Recompute the manpower staffing standard equation using (X_i, Y_i) data pairs and determine its acceptability.

5–25. Man-hour equation adjustment

When the selected course of action is to adjust the man-hour equation, the objective is to decide how findings can be incorporated into the manpower standard. If some type of measurement or data collection is required, the normal standards study process is used as a guide with specific actions tailored by the adjustment requirements. The time required to adjust the equation will depend on factors such as the following:

a. How the man-hour equation will be adjusted. This decision is based on what work needs to be measured, how much measurement will be required, and how work in the WCD was originally measured. In those cases where work that does not impact other work in the WCD is added to or subtracted from the work center, options are available for adjusting the man-hour equation. For example, new work can be—

(1) Merged into the man-hour equation using the technique described in this chapter under “Measuring Changed Work.”

(2) Combined with originally measured man-hours to get new totals that are used to recompute the man-hour equation.

b. Type of standard. It must be decided if the existing standard classification is to be maintained.

c. Locations for work measurement and data collection. The requirements for a minimum sample size of input locations must be met.

(1) When possible, use the same locations that were used as input locations to the original study. The use of the original locations will simplify computations. When an original location cannot be used, replace it with a location of similar size and with similar work center conditions.

(2) If the man-hour equation is recomputed, WLF data must be collected from all original input locations, even if they are not being measured. This requirement applies to both the collection of data for existing WLFs and the collection of data for any new WLFs to be used.

d. Who will do the measurement.

(1) In those cases where only limited measurement is needed, the proponent command is to do the measurement. However, savings in study time and costs must be assessed against study objectives, functional proponent desires, and the amount of work to be measured to determine the most beneficial measurement tasking.

(2) If measurement requires input teams, they must be scheduled per the same procedures used in scheduling standards development studies.

STANDARDS APPLICATION SUMMARY

For use of this form, see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYSMBOL CSGPA-1723

SECTION I - HEADER INFORMATION

1 MACOM	2. REPORTING PERIOD	3 TITLE OF STANDARD
USAREUR	Aug 84 - Jul 85	Finance & Accounting Office - Military Pay Standard (FCA)

SECTION II - SUMMARY DATA

4. INSTALLATION/UIC/TDA CCNUM/EDATE	5. TOTAL STD APPL REQUIREMENTS a	CURRENT TDA REQUIREMENTS b	NET CHANGE (a - b) c	CURRENT TDA AUTHORIZATIONS d	NET CHANGE (a - d) e	ACTUAL STRENGTH f
USAFACEUR (6333)/OGHAAA E10286/851217	64	80	16	69	-5	104
18th AFSC (6458)/BGFAAA E10285/841115	52	50	+2	47	+5	41
10th AFSC (6335)/BFYAAA E10386/851220	17	32	-15	32	-15	32
FAO, HQ US Army Berlin (6334) DPMTOA/E10685/841120	20	29	-9	27	-7	28
503d AFSC (3d AD) (6579) HOBAAA E10286/851228	41	62	-21	59	-18	46

DA FORM 5696-R, AUG 88

Figure 5–1. Example of completed DA Form 5696–R

4. INSTALLATION/UIC/TDA CCNUM/EDATE	5 TOTAL STD APPL REQUIREMENTS a	CURRENT TDA REQUIREMENTS b	NET CHANGE (a - b) c	CURRENT TDA AUTHORIZATIONS d	NET CHANGE (a - d) e	ACTUAL STRENGTH f
6 OVERALL TOTALS	194	253	-59	234	-40	251

7 REMARKS

NAME AND TITLE OF MACOM MANPOWER APPROVING OFFICER		PHONE NUMBER
SIGNATURE OF MACOM MANPOWER APPROVING OFFICER	☐ CONCUR ☐ NONCONCUR	DATE

REVERSE OF DA FORM 5696-R, AUG 88

Legend for Figure 5–1;

Section I

Block 1. Enter the name of the command completing this form.

Block 2. Enter the period of time covered by this report as specified by USAMARDA.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Section II

Block 4. List all installations under the command at which the standard was applied. Include the UIC, TDA, CCNUM, and EDATE for each installation identified.

Block 5a. Enter the installation's total requirements as determined by application of the standard.

Block 5b. Enter the installation's total current TDA requirements for the functional area as documented on the last approved TDA.

Block 5c. Compute the difference between the total standard application requirements and the current TDA requirements (a − b) and enter the results.

Block 5d. Enter the installation's current TDA authorizations for the functional area as documented on the last approved TDA. If changes have occurred since documentation, indicate the source of the change and the approved authorization level.

Block 5e. Compute the difference between the total standard application requirements and the current TDA authorizations (a − d) and enter the results.

Block 5f. Enter the installation's (funtional area) actual on-board strength as of the last day of the reporting period.

Block 6. Enter the sum of the values for each of the columns.

Block 7. Enter any appropriate remarks.

Block 8. Obtain indicated signature, concurrence/nonconcurrence, applicable date, title, and phone number.

Figure 5–1. Example of a completed DA Form 5696–R—(Reverse)

INSTALLATION WORK CENTER SUMMARY

For use of this form see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYSMBOL CSGPA-1723

SECTION I - HEADER INFORMATION

1. MACOM	2. INSTALLATION/UIC	3. TITLE OF STANDARD
USAREUR	USAFACEUR (DSSN-6333)/OGHAAA	Finance & Accounting Office - Military Pay Standard

4. TDA CCNUM/EDATE (Use last approved TDA)	5. REPORTING PERIOD
E10286/851217	Aug 84 - Jul 85

SECTION II - SUMMARY DATA

6. AFD CODE/WORK CENTER TITLE/TDA PARA	7. TOTAL STD APPL REQUIREMENTS a	CURRENT TDA REQUIREMENTS b	NET CHANGE (a - b) c	CURRENT TDA AUTHORIZATIONS d	NET CHANGE (a - d) e	ACTUAL STRENGTH f
FCA - Military Pay (011, 011A, B, C, D)	64	79	-15	69	-5	104
8. OVERALL TOTALS	64	79	-15	69	-5	104

9. REMARKS

N/A

10. SIGNATURES

a. SIGNATURE OF FUNCTIONAL PROPONENT	b. SIGNATURE OF INSTALLATION MANPOWER OFFICER	c. SIGNATURE OF MACOM MANPOWER OFFICER
☐ CONCUR ☐ NONCONCUR	☐ CONCUR ☐ NONCONCUR	☐ CONCUR ☐ NONCONCUR
DATE	DATE	DATE
TITLE AND PHONE NUMBER OF FUNCTIONAL PROPONENT	TITLE AND PHONE NUMBER OF INSTALLATION MANPOWER OFFICER	TITLE AND PHONE NUMBER OF MACOM MANPOWER OFFICER

DA FORM 5696-1-R. AUG 88

Legend for Figure 5–2;

Section I

Block 1. Enter the name of the parent command.

Block 2. Enter the name of the installation and UIC where the standard is being applied.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Block 4. Enter the TDA CCNUM and EDATE for the installation identified in block 2. Ensure that the latest approved TDA is used.

Block 5. Enter the period of time covered by this report as specified by USAMARDA.

Section II

Block 6. Enter the AFD(SWC) code, work center title, the TDA paragraph number that applies to the work center where the standard is being applied.

Block 7a. Enter the work center's total requirements as determined by the application of the standard.

Block 7b. Enter the work center's total current TDA requirements as documented on the last approved TDA.

Block 7c. Compute the difference between the total standard application requirements and the current TDA requirements (a − b), and enter the results by work center.

Block 7d. Enter the current TDA authorizations as documented on the last approved TDS. If changes have occurred since documentation, indicate the source of the change and the approved authorization level in the remarks section. In addition, indicate the number of authorizations, whether there was an increase or decrease, and the number of authorizations approved on the TDA noted above.

Block 7e. Compute the difference between the total standard application requirements and the current TDA authorizations (a − d), and enter the results by work center.

Block 7f. Enter the actual on-board strength for each work center as of the last day of the reporting period.

Block 8. Enter the sum of the values for each of the columns.

Block 9. Enter any appropriate remarks.

Block 10. Obtain indicated signatures, concurrence/nonconcurrence, applicable dates, titles, and phone numbers.

Figure 5–2. Example of a completed DA Form 5696–1–R

WORK CENTER STANDARD COMPUTATION

For use of this form, see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYMBOL CSGPA-1723

SECTION I - HEADER INFORMATION

1. MACOM	2. INSTALLATION/UIC	3. TITLE OF STANDARD
USAREUR	USAFACEUR (DSSN-6333)/0GHAAA	Finance & Accounting Office - Military Pay Standard

4. AFD CODE/WORK CENTER TITLE	5. TDA CCNUM/EDATE/PARA (Use last approved TDA)	6. REPORTING PERIOD
FCA - Military Pay	E10286/851217/011, 011A, B, C, D	Aug 84 - Jul 85

SECTION II - COMPUTATION DATA

7. BASIC EQUATION

$Y = 854.0312 + .2809x_1 + 1.3943x_2 + 2.0792x_3$

8.

	WORKLOAD FACTOR TITLE(S) (a)	AVERAGE MONTHLY COUNT (b)	COEFFICIENT (c)	COMPUTED HOURS (b x c) (d)
x_1	Total EOM strength - # mil pay accounts maintained on JUMPS-AA at end of processing month	19260.25	.2809	5410.204
x_2	Total ARV-PCS & DEP-PCS transactions input to JUMPS-AA during the processing month	1121.4167	1.3943	1563.591
x_3	Total # of manual regular and manual separation vouchers (MPV's) for Active Army mbrs manually processed & paid	30.00	2.0792	62.376

9.	TOTAL COMPUTED HOURS	7036.171
10.	Y-INTERCEPT	854.031
11.	TOTAL BASE EQUATION MAN-HOURS	7890.202
12. ADDITIVES		
a. TOTAL USAMARDA APPROVED ADDITIVE HOURS: 1514.747		
b. TOTAL MACOM UNIQUE ADDITIVE HOURS: 0.00		
13.	TOTAL ADDITIVE HOURS	1514.747
14. EXCLUSIONS		
a. TOTAL USAMARDA APPROVED ADDITIVE HOURS: 0.00		
b. TOTAL MACOM UNIQUE ADDITIVE HOURS: 0.00		
15.	TOTAL EXCLUDED HOURS	0.00
16. TOTAL ALLOWED MAN-HOURS (line 11 + line 13 - line 15)		9404.949
17. MANPOWER REQUIREMENTS (line 16 ÷ AAF) (Availability Factor Use:)		64.862
18. TOTAL WORK CENTER REQUIREMENTS (line 17 rounded IAW Table B-1)		64

DA FORM 5696-2-R, AUG 88

Legend for Figure 5–3;

Section I

Block 1. Enter the name of the parent command.

Block 2. Enter the name of the installation and UIC where the standard is being applied.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Block 4. Enter the AFD(SWC) code and work center title that apply to the work center where the standard is being applied.

Block 5. Enter TDA CCNUM, EDATE, and paragraph number for the work center identified in block 4.

Block 6. Enter the period of time covered by this report as specified by USAMARDA.

Section II

Block 7. Enter the basic work center equation. Do not include an additive or exclusion equation on this line.

Block 8a. Enter the abbreviated WLF titles. If a WLF does not apply, enter NA. Each entry will correspond with the WLF titles on DA Form 5696–4–R, block 11.

Block 8b. Enter the appropriate average monthly WLF count. (These figures are obtained from DA Form 5696–3–R, block 13.)

Block 8c. Enter the coefficient corresponding to each WLF.

Block 8d. Multiply each average monthly WLF count by the corresponding coefficient and enter the results.

Block 9. Enter the sum of the values of column 8d.

Block 10. Enter the Y-intercept (“a” values) from the appropriate standard equation.

Block 11. Sum of the results of blocks 9 and 10 and enter the results.

Block 12.

Line a. Enter the sum of all USAMARDA approved additive hours.

Line b. Enter the sum of all command unique approved additive hours.

Block 13. Add lines a and b in block 12 and enter the results.

Block 14.

Line a. Enter the sum of all USAMARDA approved excluded hours.

Line b. Enter the sum of all command unique approved excluded hours.

Block 15. Add lines a and b in block 14 and enter the results.

Block 16. Enter the results of line 11 + line 13 − line 15.

Block 17. Divide line 16 by the approved Army availability factor (AAF) and enter the results. (Show what AAF was used.)

Block 18. Refer to table B–1, Fractional Manpower Breakpoint table, and round accordingly.

Figure 5–3. Example of a completed DA Form 5696–2–R

ADDITIVE/EXCLUSION/DEVIATION COMPUTATION
For use of this form, see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYMBOL
CSGPA-1723

SECTION I - HEADER INFORMATION

1 MACOM	2 INSTALLATION/UIC	3 TITLE OF STANDARD
USAREUR	USAFACEUR (DSSN-6333) OGHAAA	Finance & Accounting Office Military Pay Standard

4 AFD CODE/WORK CENTER TITLE	5 TDA CCNUM/EDATE/PARA (Use last approved TDA)	6 REPORTING PERIOD
FCA - Military Pay	E10286/851217/011,011A,B,C,D	Aug 84 - Jul 85

SECTION II - COMPUTATION DATA

7 TYPE EXCEPTION ☐ ARMY COMMON ☐ COMMAND UNIQUE
☒ ADDITIVE ☐ EXCLUSION ☐ DEVIATION

8

WORKLOAD FACTOR TITLE(s) (a)	AVERAGE MONTHLY COUNT (b)	COEFFFICIENT (c)	COMPUTED HOURS (b x c) (d)
Additive for PFR/LES: Total end of month strength - The number of military pay accounts maintained on JUMPS-AA at the end of the processing month	19260.25	.0758	1459.927
Additive for Reserve Component Manual Pay (Documented Man-hours	---	---	54.82

9 TOTAL COMPUTED MAN-HOURS 1514.747

10. REMARKS
Additive for PFR/LES: This standard applies to all military pay (JACS-AA) sites and covers the functions of PFR pulling/filing/recycling and LES filing/PFR purging. This standard results in additive hours to the basic equation and is identified as $Y = .758x_1$. Data for 8b was obtained from DA Form 5696-4-R, block 13.

Additive for Reserve Component Manual Pay (Documented Man-hours): This standard applies to all military pay (JACS-AA) sites responsible for processing manual payments for members of the Reserve Components. This standard results in additive hours to the basic equation and is identified as Y = Documented Man-hours.

DA FORM 5696-3-R, AUG 88

Legend for Figure 5–4;

Section I

Block 1. Enter the name of the parent command.

Block 2. Enter the name of the installation and UIC where the standard is being applied.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Block 4. Enter the AFD(SWC) code and work center title that applies to the work center where the standard is being applied.

Block 5. Enter TDA CCNUM, EDATE, and paragraph number for the work center identified in block 4. Ensure that these data are obtained from the last approved TDA.

Block 6. Enter the period of time covered by this report as specified by USAMARDA.

Section II

Block 7. Place an "X" in the appropriate block that identifies the type of exception to be calculated.

Block 8a. Enter the abbreviated WLF title of the exception.

Block 8b. Complete a DA Form 5696–4–R as prescribed by paragraph 5–10. Enter the appropriate average monthly WLF count as it appears in block 13 on the DA Form 5696–4–R.

Block 8c. Enter the coefficient corresponding to the WLF.

Block 8d. Multiply each average monthly WLF count by the corresponding coefficient and enter the results. If documented man-hours are used as the WLF, enter those man-hours here. DA Form 5277–R must be submitted when documented man-hours are used as the WLF.

Block 9. Enter the sum of the values from column 8d.

Block 10. Enter any appropriate remarks.

Figure 5–4. Example of a completed DA Form 5696–3–R

WORKLOAD FACTOR/MAN-HOUR COLLECTION
For use of this form, see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYMBOL CSGPA-1723

SECTION I - HEADER INFORMATION

1. MACOM	2. INSTALLATION/UIC	3. TITLE OF STANDARD
USAREUR	USAFACEUR (DSSN-6333)/OCHAAA	Finance & Accounting Office - Military Pay Standard

4. AFD CODE/WORK CENTER TITLE	5. TDA CCNUM/EDATE/PARA (Use last approved TDA)	6. REPORTING PERIOD
FCA - Military Pay	E10286/851217/011, 011A, B, C, D	Aug 84 - Jul 85

SECTION II - WORKLOAD FACTOR/MAN-HOUR DATA

7. WORKLOAD FACTOR TITLE(s)	8. SOURCE OF COUNT	9. EXCEPTION TYPE
X_1 End of month strength (Mil Pay Accts)	X_1 JUMPS Army Status Report (CSCFA 292)	☐ ADDITIVE NA
X_2 Arr PCS & Dprt PCS Transactions	X_2 JUMPS Army Status Report (CSCFA 292)	☐ EXCLUSION
X_3 Manual Regular & Manual Separation pymnts	X_3 Centralized Tax Stat Rpt JUMPS-AA-Army (RIN HAH60B)	☐ DEVIATION

10. MONTH/YEAR	11. WORKLOAD FACTOR/MAN-HOUR DATA		
	X_1 WLF TITLE Total EOM strength - # mil pay accounts maintained on JUMPS-AA at end of processing month	X_2 WLF TITLE Total ARV-PCS & DEP-PCS transactions input to JUMPS -AA during processing month	X_3 WLF TITLE Total # of manual reg & manual sep vouchers (MPV's) for AA mbrs manually processed & pd
Aug 84	19192	1493	24
Sep 84	19446	1340	37
Oct 84	19372	936	24
Nov 84	19365	776	22
Dec 84	19127	725	29
Jan 85	19207	1497	27
Feb 85	19423	1087	34
Mar 85	19378	1009	25
Apr 85	19320	1049	54 (*2)
May 85	19298	971	39
Jun 85	19118	1031	17
Jul 85	18877 (*1)	1543	28
12. TOTALS	231123	13457	360
13. MONTHLY AVERAGE	19260.25.	1121.4167	30

DA FORM 5696-4-R, AUG 88

Figure 5–5. Example of a completed DA Form 5696–4–R

14. REMARKS

Ref block 11: (*1) - Low count for Jul 85 resulted from Congressional constraints which imposed an "Overseas Manpower Ceiling Limit" and delayed the arrival of replacement personnel until after the new fiscal year began. The count is accurate, has been verified, and should be used as is.

(*2) - High count for Apr 85 resulted from delayed processing of arrival transactions. The count is accurate, has been verified, and should be used as is.

15. SIGNATURES		
a. SIGNATURE OF FUNCTIONAL PROPONENT ☐ CONCUR ☐ NONCONCUR	b. SIGNATURE OF INSTALLATION MANPOWER OFFICER ☐ CONCUR ☐ NONCONCUR	c. SIGNATURE OF MACOM MANPOWER OFFICER ☐ CONCUR ☐ NONCONCUR
DATE	DATE	DATE
TITLE AND PHONE NUMBER OF FUNCTIONAL PROPONENT	TITLE AND PHONE NUMBER OF INSTALLATION MANPOWER OFFICER	TITLE AND PHONE NUMBER OF MACOM MANPOWER OFFICER

REVERSE OF DA FORM 5696-4-R, AUG 88

Legend for Figure 5–5;

Section I

Block 1. Enter the name of the parent command.

Block 2. Enter the name of the installation and UIC where the standard is being applied.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Block 4. Enter the AFD(SWC) code and work center title that applies to the work center where the standard is being applied.

Block 5. Enter TDA CCNUM, EDATE, and paragraph number for the work center identified in block 4. Ensure that these data are obtained from the last approved TDA.

Block 6. Enter the period of time covered by this report as specified by USAMARDA.

Section II

Block 7. Enter the title(s) of the WLF(s) from the approved standard. Abbreviate as needed.

Block 8. Enter the source of count used to gather the WLF count.

Block 9. Place an “X” in the appropriate box, if applicable; otherwise enter NA.

Block 10. Enter the reporting month and year beginning with the first month of the reporting period.

Block 11. Identify by the appropriate X_n number and provide an abbreviation of the WLF title. Provide the actual monthly workload count for each WLF that applies to the work center. If a WLF does not apply to the work center, provide the WLF title and enter NA.

Block 12. Enter the sum of all workload factor counts by column.

Block 13. Enter the results obtained from dividing the total WLF count by the appropriate total number of months (e.g., 12 months of data) (include months which have no WLF counts).

Block 14. Enter any comments that explain WLF values with a footnote (months without data shown or other comments about WLF values reported).

Block 15. Obtain indicated signatures, concurrence/nonconcurrence, applicable dates, titles, and phone numbers.

Figure 5–5. Example of a completed DA Form 5696–4–R (Reverse)

MANPOWER EXCEPTION
For use of this form, see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYMBOL
CSGPA-1723

SECTION I - HEADER INFORMATION

1. MACOM	2. INSTALLATION/UIC	3. TITLE OF STANDARD
USAREUR	USAFACEUR (DSSN-6333)/0GHAAA	Finance & Accounting Office - Military Pay Standard

4. AFO CODE/WORK CENTER TITLE	5. TDA CCNUM/EDATE/PARA (Use last approved TDA)	6. REPORTING PERIOD
FCA - Military Pay	E10286/851217/011, 011A, B, C, D	Aug 84 - Jul 85

SECTION II - EXCEPTION DATA

7. WORKLOAD FACTOR TITLE(s)	8. SOURCE OF COUNT
x N/A	x N/A
x	x
x	x
x	x

9. PRESCRIBING DIRECTIVE/REGULATION/POLICY LETTER (If none, so state.)
USAFACEUR Policy Letter 8-5 dated 2 Aug 85

10. CLASS OF STANDARD	11. SCOPE	12. TYPE	11. EXCEPTION TYPE
[X] TYPE I [ ] TYPE II	[ ] ARMY COMMON [X] COMMAND UNIQUE	[X] MILITARY [ ] CIVILIAN	[ ] ADDITIVE [X] EXCLUSION [ ] DEVIATION

14. **IDENTIFICATION DATA**

DESCRIPTION OF TASK(s) (a)	ALLOWED TIME PER UNIT (b)	MONTHLY FREQUENCY (c)	MONTHLY ALLOWED TIME (b x c) (d)	TASK TOTAL (e)
Performs special management directed audits of --				
a. complicated pay accounts	0.50	15	7.50	
b. PFR's	0.50	40	20.00	27.50

15. TOTAL ALLOWED MAN-HOURS 27.50

DA FORM 5696-5-R, AUG 88

Figure 5–6. Example of a completed DA Form 5696–5–R

16. APPLICABILITY STATEMENT

Management directed special audits of complicated pay accounts and PFR's are not being performed by the Military Pay Branch. The total allowed man-hours of 27.50 should be excluded from the total allowed man-hours of this standard. This work has been documented as being performed in another work center (Special Audits Branch). This is a command unique exception in the form of an exclusion and is applicable to the USAFACEUR Military Pay Branch only.

17. APPLICATION STATEMENT

N/A

18. SIGNATURES

a. SIGNATURE OF FUNCTIONAL PROPONENT	b. SIGNATURE OF INSTALLATION MANPOWER OFFICER	c. SIGNATURE OF MACOM MANPOWER OFFICER
☐ CONCUR ☐ NONCONCUR	☐ CONCUR ☐ NONCONCUR	☐ CONCUR ☐ NONCONCUR
DATE	DATE	DATE
TITLE AND PHONE NUMBER OF FUNCTIONAL PROPONENT	TITLE AND PHONE NUMBER OF INSTALLATION MANPOWER OFFICER	TITLE AND PHONE NUMBER OF MACOM MANPOWER OFFICER

REVERSE OF DA FORM 5696-5-R, AUG 88

Legend for Figure 5–6;

Section I

Block 1. Enter the name of the parent command.

Block 2. Enter the name of the installation and UIC where the standard is being applied.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Block 4. Enter the AFD(SWC) code and work center title that applies to the work center where the standard is being applied.

Block 5. Enter TDA CCNUM, EDATE, and paragraph number for the work center identified in block 4. Ensure that these data are obtained from the last approved TDA.

Block 6. Enter the period of time covered by this report as specified by USAMARDA.

Section II

Block 7. Enter the workload factor title of the new exception.

Block 8. Enter the source of count used to gather the WLF.

Block 9. Cite the applicable directive, regulation, or policy memorandum which states the work is to be performed. If none, so state.

Block 10. Place an “X” in the appropriate block.

Block 11. Place an “X” in the appropriate block.

Block 12. Place an “X” in the appropriate block.

Block 13. Place an “X” in the appropriate block.

Block 14a. Enter a description of the task being performed.

Block 14b. Enter the actual time (or technical estimate of the time) required to complete the task one time. (If conditions permit and the analyst is qualified, a good operator timing is recommended.)

Block 14c. Enter the frequency of occurrence per month.

Block 14d. Multiply 14b by 14c and enter the results.

Block 14e. Total all subtask entries for a given task and enter the total task time.

Block 15. Enter the sum of all values of column 14e for task times.

Block 16. Enter a statement which explains the scope of the exception to the standard and identify the location(s) to which it applies or does not apply.

Block 17. Enter a statement identifying all special instructions concerning the application of the exception.

Block 18. Obtain indicated signatures, concurrence/nonconcurrence, applicable dates, titles, and phone numbers.

Figure 5–6. Example of a completed DA Form 5696–5–R (Reverse)

MANPOWER GRADE & SKILL DISTRIBUTION SUMMARY
For use of this form, see AR 570-5, the proponent agency is DCSPER

REQUIREMENT CONTROL SYMBOL
CSGPA-1723

SECTION I - HEADER INFORMATION

1. MACOM	2. INSTALLATION/UIC	3. TITLE OF STANDARD
USAREUR	USAFACEUR (DSSN-6333)/OGHAAA	Finance & Accounting Office - Military Pay Standard
4. AFD CODE/WORK CENTER TITLE	**5. TDA CCNUM/EDATE/PARA (Use last approved TDA)**	**6. REPORTING PERIOD**
FCA - Military Pay	E10286/851217/011, 011A, B, C, D	Aug 84 - Jul 85

SECTION II - GRADE AND SKILL DATA

7. OCCUPATIONAL SPECIALTY CODE/ POSITION TITLE	8. GRADE	9. DISTRIBUTION DATA					
		TOTAL STD APPL ROMTS (a)	CURRENT TDA ROMTS (b)	NET CHANGE (a - b) (c)	CURRENT TDA AUTH (d)	NET CHANGE (a - d) (e)	ACTUAL STRENGTH (f)
a. OFFICER/WARRANT OFFICER							
44A00 - Chief, Mil Pay Op	CPT	0	1	-1	1	-1	1
b. ENLISTED							
73Z50 - Chief, Mil Pay	MSG	1	1	0	1	0	1
73Z50 - Chief, Fwd Spt Br	MSG	1	1	0	1	0	1
73C40 - Chief	SFC	3	3	0	3	0	3
73C30 - Finance NCO	SSG	1	2	-1	2	-1	2
73C30 - Team Chief	SSG	5	6	-1	6	-1	6
73C30 - Chief	SSG	0	1	-1	1	-1	1
73C30 - Audit NCO	SSG	2	3	-1	3	-1	3
73C20 - Sr Pay Spec	SP5	6	5	+1	5	+1	12
73C20 - QA Spec	SP5	5	4	+1	4	+1	10
73C10 - Pay Spec	SP4	11	11	0	10	+1	23
73C10 - Pay Spec	PFC	6	6	0	6	0	18

DA FORM 5696-6-R, AUG 88

Figure 5–7. Example of a completed DA Form 5696–6–R

SECTION II - GRADE AND SKILL DATA CONT'D							
7 OCCUPATIONAL SPECIALTY CODE/ POSITION TITLE	8 GRADE	9. DISTRIBUTION DATA					
		TOTAL STD APPL RQMTS (a)	CURRENT TDA RQMTS (b)	NET CHANGE (a - b) (c)	CURRENT TDA AUTH (d)	NET CHANGE (a - d) (e)	ACTUAL STRENGTH (f)
c. CIVILIAN							
GS-0545 - Mil Pay Clk (USDH)	CIV	5	10	-5	6	-1	1
GS-0545 - Mil Pay Exam (USDH)	CIV	16	21	-5	17	-1	15
GS-0305 - Mail & File Clk (FNDH)	CIV	1	3	-2	2	-1	2
GS-0318 - Secretary (FNDH)	CIV	1	1	0	1	0	1
10. MILITARY/CIVILIAN MIX SUMMARY							
OFFICERS		0	1	-1	1	-1	1
WARRANT OFFICERS		0	0	0	0	0	0
ENLISTED		41	43	-2	42	-1	80
CIVILIANS-							
USDH		21	31	-10	23	-2	20
FNDH		2	4	-2	3	-1	3
11 OVERALL TOTAL		64	79	-15	69	-5	104
12 TOTAL NOT COVERED BY THE STANDARD			4		3		

REVERSE OF DA FORM 5696-6-R, AUG 88

Legend for Figure 5–7;

Section I

Block 1. Enter the name of the parent command.

Block 2. Enter the name of the installation and UIC where the standard is being applied.

Block 3. Enter the title of the standard as it appears in the approved manpower staffing standard.

Block 4. Enter the AFD(SWC) code and work center title that apply to the work center where the standard is being applied.

Block 5. Enter TDA CCNUM, EDATE, and paragraph number for the work center identified in block 4. Ensure that these data are obtained from the last approved TDA.

Block 6. Enter the period of time covered by this report as specified by USAMARDA.

Section II

Block 7.

Block a. Enter the MOSC and position title for all officers/warrant officers assigned to the work center.

Block b. Enter the military occupational specialty code (MOSC) and position title for all enlisted personnel assigned to the work center.

Block c. Enter the occupational series and position title for all civilian personnel assigned to the work center and if applicable, indicate if the individual is “USDH” (U.S. Direct Hire) or “FNDH“ (Foreign National Direct Hire).

Note—If more than one individual is assigned with the same MOSC/occupational code and position title, only one entry is requred, provided they are the same grade.

Block 8.

Enter the rank for all military personnel assigned to the work center corresponding to the previous entry.

Enter the appropriate grade for all civilian personnel assigned to the work center corresponding to the previous entry.

Block 9a. Enter the total work center manpower requirements as determined by the application of the standard.

Block 9b. Enter the total work center manpower requirements as documented on the last approved TDA.

Block 9c. Compute the difference between the total standard application requirements and the current TDA requirements (a − b), and enter the results.

Block 9d. Enter the current TDA authorizations as documented on the last approved TDA. If changes have occurred since documentation, indicate the source of the change and the approved authorization level.

Block 9e. Compute the difference between the total standard application requirements and the current TDA authorizations (a − d), and enter the results.

Block 9f. Enter the installation’s (functional area) actual on-board strength as the last day of the reporting period.

Block 10. Summarize the total number of officers, warrant officers, enlisted, and civilian personnel under the applicable column.

Block 11. Enter the sum of values for each of the columns.

Figure 5–7. Example of a completed DA Form 5696–6–R (Reverse)

Block 12. Enter the total number of requirements/authorizations not covered by the standard. This figure should equal the number of requirements/authorizations for civilians identified as “FNDH.”

Figure 5–7. Example of a completed DA Form 5696–6–R (Reverse)—Continued

Appendix A
References

Section I
Required Publications

AR 25–400–2
The Modem Army Recordkeeping System (MARKS). (Cited in para 1–5.)

AR 310–3
Preparation, Coordination, and Approval of Department of the Army Publications. (Cited in paras 5–17 and 5–19.)

AR 310–49–1
The Army Authorization Documents System (TAADS) Documentation Procedures and Processing. (Cited in para 4–28.)

AR 310–50
Catalog of Abbreviations and Brevity Codes. (Cited in para 3–45.)

AR 335–15
Management Information Control System. (Cited in para 1–6.)

AR 340–17
Release of Information and Records from Army Files. (Cited in paras 1–7 and 1–26.)

AR 380–5
Safeguarding Defense Information, Department of the Army Supplement to DOD 5200.1–R. (Cited in paras 1–6 and 4–43.)

AR 420–81
Custodial Services. (Cited in para 2–19.)

AR 570–1
Commissioned Officer Aviation Position Criteria. (Cited in para 2–14.)

AR 570–4
Manpower Management. (Cited in paras 2–14, 4–31, 4–34, and 5–4.)

AR 611–101
Commissioned Officer Specialty Classification System. (Cited in paras 4–34, 4–37, and 4–40.)

AR 611–112
Manual of Warrant Officer Military Occupational Specialties. (Cited in paras 2–14, 4–34, 4–37, and 4–40.)

AR 611–201
Enlisted Career Management Fields and Military Occupational Specialties. (Cited in paras 4–34, 4–37, and 4–40.)

AR 690–500
Position Classification, Pay And Allowances. (Cited in para 4–40.)

DA Pam 310–20
Administrative Publications: Action Officers Guide. (Cited in paras 5–17 and 5–19.)

DA Pam 570–5
The Army Functional Dictionary-Manpower. (Cited in paras 1–20 and 2–34.)

NGB Pam 570–1
Full Time Support Manning for the Army National Guard. (Cited in para 1–11.)

NGB Pam 570–3
Manning Criteria—Army National Guard Major Training Areas. (Cited in para 1–11.)

Section II
Related Publications
This section contains no entries.

Section III
Prescribed Forms

DA Form 5274–R
Standards Input Data Computation. (Prescribed in para 2–38*e*.)

DA Form 5275–R
Time Study Record. (Prescribed in para 2–38*e*.)

DA Form 5276–R
Program Management Data. (Prescribed in para 2–34*h*.)

DA Form 5277–R
Operational Audit Data. (Prescribed in para 2–38*e*.)

DA Form 5278–R
Work Sampling Record. (Prescribed in para 2–38*e*.)

DA Form 5279–R
Manpower Standard and Table. (Prescribed in para 4–21*b*.)

DA Form 5696–R
Standards Application Summary Sheet. (Prescribed in para 5–2*b*.)

DA Form 5696–1–R
Installation Work Center Summary. (Prescribed in para 5–4*e*.)

DA Form 5696–2–R
Work Center Standard Computation Form. (Prescribed in para 5–4*e*.)

DA Form 5696–3–R
Additive/Exclusion/Deviation Computation Sheet. (Prescribed in para 5–4*e*.)

DA Form 5696–4–R
Workload Factor/Man-Hour Collection Form. (Prescribed in para 5–4*b*.)

DA Form 5696–5–R
Manpower Exception Form. (Prescribed in para 5–2*b*.)

DA Form 5696–6–R
Manpower Grade & Skill Distribution Summary. (Prescribed in para 5–2*b*.)

Section IV
Referenced Forms

DD Form 2038
Request for Review for Work Measurement Standard.

DD Form 2039
Standards Review Checklist (LRA).

DD Form 2041
Rating Comparison Worksheet (LRA).

DD Form 2042
Work Measurement Time Study Worksheet (Snapback) (LRA).

DD Form 2042–1
Work Measurement Time Study Worksheet (Continuous Method) (LRA).

DD Form 2043
Work Measurement Project Non-Repetitive Time Study (LRA).

Appendix B
Fractional Manpower Breakpoint Table

B–1. General

When allowed man-hours are divided by the Army availability factor, the resulting manpower determination usually consists of a whole number and a decimal fraction. Since manpower is allocated in whole numbers, a method for interpreting the fraction for military and civilian standards is given.

B–2. Military and civilian standards

Use this procedure to interpret fractional manpower for military and civilian requirements.

a. Consult table B–1 and choose the column that has the Army availability factor used to determine manpower.

b. Pick the entry in the column which has the same whole number part as the computed manpower requirement.

c. If the fractional part of the computed value is larger than the fraction part of the table value, round the computed value up to the next number; if not, round down.

B–3. Example

a. Assume allowed man-hours equal 1203.37. These hours convert to the manpower equivalent of 8.299 requirements, based on the 145 Army availability factor (1203.37/145 = 8.299). To find which way to round, compare 8.299 to 8.616, the table value. Since 8.299 is not greater than 8.616, round down. Thus 8.299 equates to 8 requirements.

b. Assume that the number of allowed man-hours is equal to 418.67. These hours convert to the equivalent of 2.192 requirements, based on the 191 Army availability factor for mobilization. (To find which way to round, compare 2.192 to 2.086, the table value. Since 2.192 is greater than 2.086, round up. Thus, 2.192 equates to 3 requirements).

B–4. Manpower to man-hour breakpoint conversion

To convert the applicable manpower breakpoints to man-hour breakpoints, multiply the manpower breakpoint by the appropriate Army availability factor (table B–2).

Table B–1
Fractional Manpower breakpoints for various Army availability factors

Manpower	Peacetime	Mobilization	National Emergency
1	1.077	1.043	1.012
2	2.154	2.086	2.024
3	3.231	3.129	3.036
4	4.308	4.172	4.043
5	5.385	5.215	5.060
6	6.462	6.258	6.072
7	7.539	7.301	7.084
8	8.616	8.344	8.096
9	9.693	9.387	9.108
10	10.770	10.430	10.120
11	11.847	11.473	11.132
12	12.924	12.516	12.144
13	13.999	13.559	13.156
	Manpower		
14	+.999	14.602	14.168
15		15.645	15.180
16		16.688	16.192
17		17.731	17.204
18		18.774	18.216
19		19.817	19.228
20		20.860	20.240
21		21.903	21.252
22		22.946	22.264
23		23.989	23.276
24		24.999	24.288
		Manpower	
25		+.999	25.300
26			26.312
.			
.			
81			81.972
82			82.984
83			83.996
84			84.999
			Manpower

Table B–1
Fractional Manpower breakpoints for various Army availability factors—Continued

Manpower	Peacetime	Mobilization	National Emergency
85			+.999

Table B–2
TDA Army availability factors for U.S. civilians and military*

	(Man-hours per month available for work)				
Standard workweek	Normal (Peacetime)	Mobilization			
Computation of assigned & available hours	5 days 8 hrs/day 40 hr week	6 days 8 hrs/day 48 hr week		6 days 10 hrs/day 60 hr week	
Average calendar days/yr	365.25	365.25		365.25	
Less: Relief days/yr	104.375	52.375		52.375	
holidays	10.0				
Congressionally mandated work hrs/yr	2087				
Net assigned duty days/month	20.906	26.073		26.073	
Net assigned duty hours/day	X8	X8		X10	
Monthly assigned hours	167.25	208.58		260.73	
	MIL/CIV	MIL	CIV	MIL	CIV
Total nonavailable hrs (Leave, training, special duty, etc.)	22.25	17.58	11.58	15.73	9.73
Monthly hrs available for primary duty	145.0	191.0	197.0	245.0	251.0

Notes:

* Except in Panama, where the availability factor is the same (143.67) for both U.S. citizens and Local Nationals, based on provisions of the Panama Canal Code. Availavility factors for local nationals are developed by OCONUS commands and approved by USAMARDA on a country-by-country basis. Availability factors are for manpower requirements determination only; actual utilization is the policy of the local commander.

Appendix C
Manpower Staffing Standards Process

Table C–1 lists the Manpower Staffing Standards Process sequence of events.

Table C–1
Sequence of events

Step	Action	HQDA	USAMARDA	Proponent Command	Participating Command
1	Provides input for MS–3 Master schedule, provides preliminary universe identification to universe identification to USAMARDA			X	
2	Prepares MS–3 Master schedule, forwards to all proponent commands and HQDA		PEMS–RO		
3	Reviews Master Schedule, coordinates needed changes with USAMARDA	X		X	X
4	Conducts liaison with other activities	X	PEMS–RS	X	X
5	Conducts preliminary research with work center and local functional proponent			X	X
6	Monitors preliminary research, conducts on-site visits as required		PEMS–RS		
7	Concludes preliminary research			X	X
8	Forwards preliminary research input to proponent command				X
9	Reviews input received from participating commands, prepares SDP			X	
10	Forwards SDP to USAMARDA and participating commands, for review and comments			X	
11	Reviews and forwards SDP to HQDA for comments		PEMS–RS		
12	Conducts QA review on SDP		PEMS–RA		
13	Reviews and comments on SDP	X			X
14	Begins preparation of MEAS–PLAN			X	
15	Forwards comments on SDP to proponent command		PEMS–RA		
16	Reviews comments received on SDP, incorporates into MEAS–PLAN, forwards MEAS–PLAN for approval by USAMARDA and review by HQDA & participating commands			X	
17	Reviews and forwards MEAS–PLAN to HQDA for comments		PEMS–RS		
18	Conducts QA review on MEAS–PLAN		PEMS–RA		
19	Begins test measurement IAW MEAS–PLAN			X	X
20	Forwards comments on MEAS–PLAN to proponent command		PEMS–RA		X
21	Concludes test measurement			X	X
22	Forwards test measurement input data to proponent command				X
23	Reviews all comments & input data received, incorporates changes, prepares revised MEAS–PLAN			X	

Table C–1
Sequence of events—Continued

Step	Action	HQDA	USAMARDA	Proponent Command	Participating Command
24	Forwards revised MEAS–PLAN to USAMARDA for approval			X	
25	Reviews and forwards revised MEAS–PLAN to HQDA for comments		PEMS–RS		
26	Conducts QA review on revised MEAS–PLAN		PEMS–RA		
27	Forwards USAMARDA and HQDA comments to Proponent Command, or notifies Proponent Command of approval based on USAMARDA and HQDA comments		PEMS–RA		
28	Reviews USAMARDA & HQDA comments on revised MEAS–PLAN: if not approved, returns to step 23 and repeats actions from there; if approved, forwards revised MEAS–PLAN to participating commands for measurement			X	
29	Conducts measurement IAW MEAS–PLAN			X	X
30	Monitors measurement, conducts on–site visits as required		PEMS–RS		
31	Concludes measurement			X	X
32	Prepares MEAS–REP, coordinates with local functional proponent, forwards measurement data and MEAS–REP to proponent command				X
33	Reviews all measurement data received from input teams, begins analysis of data, incorporates adjustments as needed, selects manpower model, computes proposed standard, prepares FIN–REP with all necessary application instructions, submits FIN–REP to USAMARDA and participating commands for review and comments			X	
34	Reviews and forwards FIN–REP to HQDA for comments		PEMS–RS		
35	Conducts QA review on FIN–REP		PEMS–RA		
36	Forwards comments on FIN–REP to proponent command		PEMS–RA		
37	Reviews all comments, incorporates changes, prepares revised FIN–REP, forwards to USAMARDA for approval			X	
38	Reviews and forwards revised FIN–REP to HQDA for comments		PEMS–RA		
39	Forwards USAMARDA and HQDA comments to Proponent Command, or notifies Proponent Command of approval based on USAMARDA and HQDA comments		PEMS–RA		
40	Reviews USAMARDA and HQDA comments on revised FIN–REP: if not approved returns to step 37 and repeats actions from there; if approved, forwards revised FIN–REP to participating command			X	
41	Performs initial application IAW application instructions contained in the FIN–REP			X	X
42	Monitors initial application, conducts on–site visits as required		PEMS–RS		
43	Forwards results of initial application concurrently to the Proponent Command and USAMARDA (PEMS–RS)				X

Table C–1
Sequence of events—Continued

Step	Action	HQDA	USAMARDA	Proponent Command	Participating Command
44	Reviews & analyzes all initial application results, coordinates/clarifies adjustments as needed, prepares Standards Application Summary (SAS)			X	
45	Forwards SAS to USAMARDA and participating commands for review and comments			X	
46	Reviews SAS; evaluates impact and accuracy of standard application, additives, exclusions, & deviations; forwards copies of SAS & manpower table to military and civilian personnel centers and coordinates results; forwards proposed exceptions to HQDA Functional Proponent		PEMS–RS		
47	Reviews SAS, additives, exclusions, & deviations for format & procedure; forwards USAMARDA and HQDA comments to Proponent Command of approval based on USAMARDA and HQDA comments		PEMS–RA		
48	Reviews all comments, incorporates changes, makes further adjustments as appropriate, revises SAS, forwards to USAMARDA for approval			X	
49	Reviews revised SAS, changes, and adjustments, determines if proposed standard and exceptions are acceptable, decides if SAS can be approved or if it requires additional changes (if acceptable, approves standard; if not, repeats actions from step 48), notifies proponent command to forward approved standard in publication format		PEMS–RA		
50	Upon approval of standard, develops implementation instructions		PEMS–RS		
51	Instructs all commands to document approved manpower requirements, resulting from initial application in their ITAADS/VTAADS during the next MOC window		PEMS–RS		
52	Receives USAMARDA guidance to document approved manpower requirements, coordinates with command/installation Force Development & Manpower Offices for update of ITAADS/VTAADS during next MOC window			X	X
53	Monitors update of TAADS		PEMS–D		
54	Notifies all CPOs, PSCs, & HQDA of initial forecast of manpower adjustments		PEMS–RS		
55	Prepares standard for publication IAW USAMARDA guidelines, forwards prepared standard manuscript to USAMARDA			X	
56	Edits prepared standards manuscript, forwards to USAPPA publication		PEMS–RA		
57	Reviews TAADS documents after close of MOC window, contacts commands that failed to update TAADS as instructed		PEMS–D		
58	Responds to USAMARDA for failure to comply with directed documentation of manpower requirements			X	X
59	Top feeds TAADS to complete update of documents		PEMS–D		

Table C–1
Sequence of events—Continued

Step	Action	HQDA	USAMARDA	Proponent Command	Participating Command
60	Receives published standard through distribution system and posts in repository		PEMS–RA		
61	Updates Master Schedule for maintenance of new standard, forwards copies of the updated Master Schedule to all commands and HQDA		PEMS–RO		
62	Receives published standard through distribution system, receives and reviews Master Schedule	X		X	X
63	Performs maintenance			X	X
64	Requests all pertinent directives and proposed/approved changes to functions covered by the standard		REMS–RS		
65	Reviews all information received from HQDA, forwards copies of pertinent information to each command		PEMS–RS		
66	Reviews all information provided by HQDA and USAMARDA			X	X
67	Prepares Memorandum of instruction (MOI) for annual application of standard, forwards to all commands and HQDA		PEMS–RS		
68	Reviews MOI, advises USAMARDA of needed changes, prepares for application	X		X	X
69	Reviews MOI and standard with local functional proponent, work center, and manpower office			X	X
70	Conducts annual application, notifies USAMARDA of the need to update standard and schedules study			X	
71	Conducts annual application, notifies Proponent Command of need to update the standard				X
72	Monitors annual application, conducts on–site visits as required		PEMS–RS		
73	Documents any exceptions			X	X
74	Completes annual application			X	X
75	Prepares annual application results report, forwards report with all supporting documentation to proponent command and USAMARDA concurrently				X
76	Reviews all annual application results reports, clarifies all discrepancies			X	
77	Monitors review of annual application results reports, provides additional guidance as required		PEMS–RS		
78	Consolidates all annual application results reports, forwards all reports with all documentation to USAMARDA			X	
79	Reviews all applications results and forwards any proposed exceptions to HQDA Functional Proponent and PEMS–RA		PEMS–RS		
80	Performs QA review on proposed exceptions		PEMS–RA		

Table C–1
Sequence of events—Continued

Step	Action	HQDA	USAMARDA	Proponent Command	Participating Command
81	Approves/disapproves proposed exceptions based on HQDA and Proponent Command comments Advises HQDA of annual application results		PEMS–RA		
82	Reviews USAMARDA action on proposed exceptions and comments on annual application results reports	X			
83	Reviews USAMARDA action on proposed exceptions and comments on annual application results reports, advises participating commands under separate cover of USAMARDA action on their proposed exceptions; makes adjustments to the annual application results reports as required			X	
84	Coordinates adjustments with participating commands, submits revised annual application results reports to USAMARDA			X	
85	Reviews report of USAMARDA action on proposed exceptions				X
86	Determines if revised annual application results can be approved or if additional changes are required, notifies proponent command		PEMS–RS		
87	Reviews USAMARDA action on annual application results reports: if not approved, returns to step 85 and repeats actions from there; if approved, forwards copies of approval to all commands involved in the study			X	
88	Notifies proponent command to submit any administrative changes or exceptions in publication format		PEMS–RA		
89	Prepares changes/exceptions in manuscript format for publication IAW USAMARDA guidelines, forwards manuscript to USAMARDA			X	
90	Edits manuscript, forwards to USAPPA for pulication		PEMS–RA		
91	Instructs all commands to document manpower requirements resulting from the annual application in their ITAADS/VTAADS during the next MOC window		PEMS–RS		
92	Receives USAMARDA guidance to document manpower adjustments, coordinates with command/installation Force development and Manpower Offices for update of ITAADS/ VTAADS during the next MOC window			X	X
93	Monitors update of TAADS		PEMS–D		
94	Notifies all CPOs, PSCs, & HQDA of initial results on manpower requirements resulting from the annual application		PEMS–RS		
95	Reviews TAADS documents after close of MOC window, contacts commands that failed to update TAADS as instructed		PEMS–D		
96	Responds to USAMARDA for failure to comply with directed documentation of manpower requirements			X	X
97	Top feeds TAADS to complete update of documents		PEMS–D		

Table C–1
Sequence of events—Continued

Step	Action	HQDA	USAMARDA	Proponent Command	Participating Command
98	Receives published updates to standard through distribution system and posts in repository		PEMS–RA		
99	Updates Master Schedule, forwards copies of updated Master Schedule to all commands and HQDA		PEMS–RO		

Notes:

[1] The term “HQDA” used in this table refers to the HQDA functional proponent for the function being studied.

[2] The manpower standard should be scheduled for complete remeasurement every 4 years or sooner, if required.

[3] The annual application cycle begins with step 61.

[4] Manpower staffing standards maintenance is a continuous requirement that begins with the approval of the standard.

[5] Steps that may occur concurrently are seperated by broken lines.

Appendix D
Standard Indirect Categories

Section I
Overview

D–1. General
This appendix contains the categories and tasks common to most work centers that are normally classified as indirect work.

D–2. Specific instructions
a. When preparing a WCD, look carefully at the definitions given in section II of this appendix to see if they apply to the work center being studied. If the task conforms to the standard definition, use each definition in the WCD as given. If changes are necessary, revise or write a new definition for that specific WCD.

(1) Do not repeat the standard indirect category and task definitions in each WCD section of a Manpower Staffing Standards MEAS–PLAN or FIN–REP. Put the standard definitions in Part Three of the MEAS–PLAN or chapter 6 of the FIN–REP, and refer to each in the WCD section at the appropriate point.

(2) When preparing the FIN–REP, put the applicable standard or revised definitions for each work center standard in Part Two. Then, number the entire WCD as shown in chapter 2.

b. During measurement, use the following procedures to determine task time values:

(1) Include temporary duty and travel man-hours with the associated task time.

(2) Include man-hours expended obtaining, documenting, or returning replacement parts or supplies, in the respective Productive Direct task time.

(3) Telephone calls are usually made in conjunction with another task; therefore, put time for telephone calls with that task.

(4) Work-oriented discussions between supervisors and workers are sometimes needed in order to do a task. When needed, put this discussion time with that task time.

D–3. Standard indirect tasks
The standard indirect categories and tasks used in the MS–3 are defined in section II. Words enclosed in parentheses are not part of a WCD, but can be used as measurement instructions if required.

Section II
Standard Indirect Categories

D–4. Supervision
a. Administers personnel.

(1) *Indoctrinates personnel.* Conducts initial interview, makes original job assignment, and acquaints newly assigned personnel with the work center.

(2) *Rates performance.*

(a) Prepares evaluation. Writes evaluation (performance report) by researching, evaluating, drafting, proofreading typed copies, marking boxes, and signing completed report (excludes counseling and typing).

1. Prepares enlisted evaluation.

2. Prepares officer evaluation.

3. Prepares civilian evaluation.

(b) Endorses evaluation. Writes endorsement by researching, evaluating, drafting, proofreading typed copies, and signing completed report (excludes typing).

1. Endorses enlisted evaluation.

2. Endorses officer evaluation.

3. Endorses civilian evaluation.

(3) *Nominates personnel for award.* Prepares recommendation by researching, evaluating, drafting, proofreading typed copies and signing recommendations as required (excludes typing).

(4) *Monitors Management Improvement Program.*

(a) Assists subordinate. Assists subordinate in developing improvement suggestion.

(b) Processes suggestion. Processes suggestion received for evaluation.

b. Supervises personnel.

(1) *Schedules personnel.* Reviews work requirements and priorities, reviews personnel status, determines duty assignments, and prepares personnel schedules.

(2) *Develops directive.* Develops policy, procedure, plan, operating instruction, checklist, or performance standard by researching, drafting, proofreading typed copies, and signing completed directive as required.

(3) *Directs work center activity.*

(a) Inspects work. Inspects work in progress.

(b) Coordinates status. Coordinates with supervisor or other units or agencies on work center or personnel status.

(c) Informs work center personnel. Informs work center personnel on changes affecting individual or work center activity.

(d) Prepares correspondence. Prepares routine correspondence.

(4) *Counsels personnel.* Counsels subordinate personnel on performance and progress in career development and suggests areas for improvement. Counsels and assists individuals with morale, welfare, and disciplinary problems. Takes necessary corrective action required to maintain discipline.

c. Reviews incoming distribution. Reviews distribution for information and necessary action.

d. Reviews outgoing distribution. Reviews outgoing correspondence for completeness and accuracy and signs as required.

e. Reviews report and statistical data. Reviews information contained in reports and statistical data for impact on work center status and to identify possible trends which require management action.

f. Develops budget estimate. Prepares input to unit resource monitor by researching, evaluating, coordinating, drafting, and forwarding estimates. Includes answering follow-on inquiries on estimate.

g. Inspects facility. Periodically inspects for housekeeping, safety, fire hazards, or equipment conditions that require attention. This includes time to write a report.

h. Investigates accident or incident. Investigates accident or incident within work center. This includes preparing required report and associated correspondence.

i. Receives and assists visiting official. Receives visitors, inspectors, or other officials, assists visitors to accomplish their purpose, escorts visitors in restricted or controlled area as required.

D–5. Administration

a. Types communication. Obtains and assembles materials, inserts in typewriter, types, separates copies, collates, fastens, proofreads, releases to originator, and puts material away.

(1) Types memorandum.

(2) Types message.

(3) Types report.

(4) Types plan, schedule, or roster.

(5) Types enlisted evaluation.

(6) Types officer evaluation.

(7) Types civilian evaluation.

(8) Types endorsement to evaluation.

(9) Types statistical data.

b. Processes unclassified distribution. Includes time spent at delivery or pickup point.

(1) *Processes incoming distribution.* Receives and opens envelope, reviews for required action, marks and routes distribution.

(2) *Processes outgoing distribution.* Stamps, marks, seals, packages, and routes distribution.

c. Maintains unclassified correspondence file.

(1) *Establishes file.* Prepares file outline, folders, guides, and labels.

(2) *Files correspondence.* Receives material, marks, sorts, classifies, inserts in file, removes for reference, and refiles.

(3) *Maintains suspense file.* Determines need for suspense, assigns suspense, posts file, reviews file for compliance, reminds individual of suspense, annotates file at completion of action.

(4) *Disposes of records.* Removes records from file and disposes of them in accordance with AR 25–400–2.

(5) *Maintains log and register.* Obtains book or form, makes entry, puts book or form away.

(6) *Maintains security file.* Establishes, posts, and changes security record, access documentation, and the list of restricted area badge numbers for work center personnel. Destroys materials as required.

(7) *Maintains personnel locator file.* Prepares card or similar record. Posts, changes, and disposes of record as required.

d. Maintains classified material.

(1) *Controls material.* Prepares document receipt, routes file, and removes material for referral.

(2) *Inventories material.* Screens file, reviews retention criteria, removes obsolete or unnecessary material.

(3) *Safeguards material.* Opens and closes safe, performs safe area check, and changes safe combination.

(4) *Destroys material.* Prepares form, destroys material and annotates record. Includes time of witness.

e. Maintains unclassified publication file.

(1) *Obtains administrative publications.* Receives request, prepares requisition form, obtains authorizing signature, processes and files form.

(2) *Maintains index.* Posts new index, new publication, or change to index.

(3) *Maintains publication.* Posts or files new publication.

f. Operates copying machine.

(1) Operates machine.

(2) Collates copies.

g. Maintains stock of blank forms. Establishes requirements, prepares requisition, receives, routes and controls stock of blank forms.

h. Maintains status chart or bulletin board. Removes existing information and posts new information.

i. Maintains time and attendance card. Records time and attendance information, and forwards card.

j. Provides stenographic service.

(1) Takes dictation.

(2) Takes minutes.

(3) Transcribes notes and recordings.

k. Maintains appointment record. Posts calendar or book, coordinates appointment with supervisor, reminds supervisor of pending appointment, and makes changes as required.

l. Acknowledges visitor. Greets visitor, answers inquiries, and refers visitor to appropriate person or location.

m. Processes ADP card. Receives input data, punches card, verifies punched information, corrects error, and releases card to originator.

D–6. Meeting

a. Prepares for meeting. Gathers information, organizes material, prepares briefing chart or slide, and practices presentation.

b. Conducts or attends meeting. Conducts or attends a meeting, briefing, or conference.

D–7. Training

a. Administers training. Reviews training record, interviews and counsels trainee, determines training needs, designates trainer, and evaluates training progress.

b. Develops training material. Researches, drafts, reviews, and updates training outline, lesson plan, or test. This includes developing a chart, mockup, demonstrator, or other training aid.

c. Conducts training.

(1) *Prepares for training.* Obtains materials and prepares classroom and equipment.

(2) *Instructs trainee.* Instructs trainee on the job, conducts lecture, demonstration, and group discussion.

(3) *Administers test.* Administers and evaluates result of job related test given in the work center.

d. Receives training.

(1) *Receives instruction.* Attends lecture or demonstration, or participates in group discussion.

(2) *Takes test.* Takes locally devised oral, practical, and written test.

(3) *Reads publication.* Maintains job proficiency by reading applicable technical and standard publications.

D–8. Supply

a. Processes equipment request. Determines need and authorization for equipment, researches stock number or nomenclature, prepares justification, submits request and takes followup action. This includes receiving or returning equipment.

b. Conducts inventory. Inventories equipment on hand and ensures accuracy of records.

c. Maintains custodian document. Receives listing from supply, posts changes to records, and resolves inconsistencies.

d. Obtains expendable supplies. Determines need, researches stock numbers, orders, picks up, and distributes expendable supplies.

D–9. Equipment maintenance

a. Maintains office equipment. Cleans, dusts, changes ribbon, belt, or tape, or makes minor adjustment.

b. Maintains shop equipment.

(1) *Maintains machinery.* Cleans, lubricates, or makes minor adjustments.

(2) *Maintains test equipment.* Cleans, lubricates, or makes minor adjustment; establishes list of equipment requiring test, measurement, and diagnostic equipment (TMDE) calibration or testing; prepares equipment for TMDE; turns in and picks up equipment from TMDE; posts list as required; and returns equipment to storage location.

(3) *Maintains consolidated tool kit.* Establishes requirements, researches stock number and nomenclature; orders tools; takes followup action; and picks up tools. Replaces broken or lost tools and conducts periodic inventory.

(4) *Maintains individual tool kit.* Reports to supply for initial issue or a subsequent issue, replaces broken or lost tools, and conducts periodic inventory.

c. Maintains assigned vehicle. Cleans, washes, inspects, refuels, or makes minor adjustment.

D–10. Cleanup

a. Prepares work area. Places working tools or equipment in proper location at beginning of duty period, and arranges area to conform with any sanitary, safety, or security requirement. (Preparation time for a specific productive task should be included with that task time.)

b. Puts work away. Stores working tools or equipment in proper location at the end of the duty period, and arranges area to conform with any sanitary, safety, or security requirement. ("Put away" time for a specific productive task should be included with that task time.)

c. Cleans work area. Dusts, sweeps, mops, waxes, buffs, washes windows, and performs other associated janitorial tasks. (Use this task only when the work center is not authorized custodial services.)

Appendix E
Instructions for Preparing DA Form 5276–R, Program Management Data

E–1. General

a. DA Form 5276–R is the man-hour and cost accounting record that reflects the cost of a manpower staffing standards study. It is submitted with the SDP, MEAS–PLAN, FIN–REP, and Standards Application Summary by the lead team and reflects the costs and time expended by participating input teams, MACOM/agency personnel, and the lead team during the study process.

b. All time expended at team level is included in costs to establish an actual value for developing the study. Data are also submitted to the lead team by the MACOM/agency staff upon completion of the study review process to ensure that all MS–3 costs are reflected. This accountability extends to TDY travel, per diem rates, copyright fees, etc., associated with a particular study.

c. A man-hour accounting system will be maintained by all activities directly involved in manpower staffing standards development. Informal logs may be used for this purpose. The system will permit the recording of data at the appropriate level of detail to facilitate efficient preparation of DA Form 5276–R.

E–2. Reportable savings

a. A reportable savings is recognized when a reduction takes place in a validated and funded requirement; for example, manpower, materials, or facilities. Some studies may reduce only the manpower needed to do a particular task without affecting the cost of the material or facilities involved. They may reduce only the grades required to do a job or result in the deletion of whole manpower authorizations from the manpower document of the reporting activity. In all cases, savings are computed by comparing the cost to perform the job, function, or activity before the action with the cost to perform the same task after the action.

b. A reduction in a funded quantity or cost of an item or service to be purchased from a contractor or vendor also constitutes reportable savings. Moreover, eliminating the need for an asset on-hand can lead to a reportable savings. If a new or improved management system reduces such a requirement and that asset can be used somewhere else to fill a funded requirement, a savings is realized.

c. All elements of cost, labor, material, and facilities are included in the savings computation. Actual costs are used whenever practical. Average or standard costs may be used when actual costs are not reasonably available. For manpower savings, compute the dollar value in the same manner as study cost computations.

E–3. Special instructions

Use detailed instructions in figure E–1 for preparing DA Form 5276–R.

E–4. Example

An example of a complete DA Form 5276–R is shown in figure E–1.

PROGRAM MANAGEMENT DATA

For use of this form, see AR 570-5; the proponent agency is DCSPER

REQUIREMENT CONTROL SYMBOL: CSGPA-1723

1. MACOM/FOA	2. TEAM/MACOM IDENTIFICATION AND LOCATION
TRADOC	☒ LEAD TEAM ☐ INPUT TEAM ☐ MACOM Team 4, Ft Knox, KY

2. DATE PREPARED	3. REQUIREMENTS AFFECTED	5. WORK CENTERS
29 Oct 86	185	5

6. WORK CENTER TITLES/CODES

Community and Skill Development Coordination (QJA)
Arts and Crafts Operations (QJB)
Auto Hobby Shop (QJC)
Woodworking (QJD)
Audio/Photography (QJE)

8. TOTAL MAN-HOURS	9. TOTAL PERSONNEL COSTS
2325	$39,582
10. TEMPORARY DUTY COSTS	**11. TOTAL STUDY COSTS**
$492	$40,074

12. PRODUCTIVITY ENHANCEMENT STUDY

(a) TOTAL SAVINGS

(b) IMPLEMENTATION COSTS

(c) NET SAVINGS (a - b)

(d) STUDY COSTS

(e) NET SAVINGS TO COST RATIO (c ÷ d)

7. STUDY COST COMPUTATIONS

GRADE (a)	MAN-HOURS (b)	SALARY FACTOR (c)	PERSONNEL COSTS (d)
O-5	10	1) $40.59	$406
O-4	65	33.51	2178
O-3	155	27.02	4188
O-2	65	20.86	1356
E-8	45	24.71	1112
E-7	345	20.96	7233
E-6	280	17.86	5001
E-5	355	15.07	5049
GS9	380	2) 16.08	6112
GS7	225	13.15	2959
GS4	420	9.50	3988
Total	2325		$39,582

13. STANDARDS DEVELOPMENT STUDY

STUDY DEVELOPMENT (a)	MEASUREMENT/ DATA COLLECTION (b)	ANALYSIS/ COMPUTATIONS (c)	REPORT/ APPROVAL-(FIN-REP) (d)	INITIAL APPLICATION (e)	TOTAL COST (a+b+c+d+e) (f)	COST PER REQUIREMENT (f ÷ item 4) (g)
$10,019	$16,030	$8,015	$4,007	$2,003	$40,074	$217

14. REMARKS

Note 1) Salary Factor (Mil)

$$\frac{\text{Composite Rate - CA}}{\text{2087 (Avail man-hours per year)}} = \text{Salary Factor}$$

Example:
Salary Factor O-3

$$\frac{\$56,392}{2087} = \$27.02$$

Note 2) Salary Factor (Civ)

Regular Hourly Rate X Fringe Cost = Salary Factor

Example:
Salary Factor
GS9 Step 5

$11.84 X 1.3585 = $16.08

DA FORM 5276-R, AUG 88 EDITION OF DEC 83 IS OBSOLETE.

Legend for Figure E–1;

Block 1. Enter identification of MACOM/agency completing DA Form 5276–R.

Figure E–1. Example of a completed DA Form 5276–R

Block 2. Enter identification and location of activity preparing DA Form 5276–R. For example, “Team #4, Fort Knox, KY.” Check the appropriate box to identify the preparing activity as lead team, input team, or MACOM.

Block 3. Enter date DA Form 5276–R is completed. The lead team will designate when data are to be reported by input teams during a study.

Block 4. Enter the total number of requirements covered by the study. This number is obtained through the universe identification process and validated by USAMARDA at the beginning of the study.

Block 5. Enter the number of work centers covered by the study.

Block 6. Identify all work centers covered by the study by title and AFD code.

Block 7a. On separate lines, enter the military or civilian grade of each person who worked on the study. Include individuals involved in direct study supervision and administrative support.

Block 7b. Enter total man-hours expended by each respective grade. Man-hours are counted from the study start date. Total like grades and enter the man-hour result to the nearest whole number using the rounding rule.

Block 7c. Enter the respective man-hour composite rate (i.e., cost to the Government including fringe benefits). Military composite rates are published each year by ASA(FM) and distributed by message. Civilian composite rates will be obtained from the Comptroller and will include fringe bensfits. For comparative purposes average grades will be used at step 5 for costing.

Block 7d. Enter the dollar value of man-hours expended by each respective grade. Obtained by multiplying the man-hours by the associated salary factor. Round the result to the nearest whole dollar.

Block 8. Sum all man-hours expended by all personnel reported.

Block 9. Sum of the dollar value of all man-hours expended, rounded to the nearest dollar.

Block 10. Total TDY costs (travel, per diem, and reimbursable expenses) spent for completion of the study. Enter to the nearest whole dollar.

Block 11. Sum the personnel (block 9) and TDY (block 10) costs.

Block 12a. Total dollar value of improvements based on the implementation year plus the next 2 fiscal years. See paragraph E–2 for a discussion of reportable savings. Enter to the nearest whole dollar.

Block 12b. Enter the amount required to implement improvements in order to achieve reported savings, for example, the cost of new equipment or remodeled facilities. Enter the value to the nearest whole dollar.

Block 12c. Enter total savings minus implementation costs.

Block 12d. Enter dollar value of personnel and TDY costs expended in developing the change which produced the savings. These costs are also included in the total study costs reported in block 11.

Block 12e. Enter result of 3–year net savings (block 12(c)) divided by study costs (block 12(d)) rounded to two decimal places.

Block 13. Preparing this part of the form requires that total study costs be accumulated separately for each phase of the study.

Block 13a. Enter personnel and TDY costs expended to complete the study development phase.

Block 13b. Enter personnel and TDY costs expended to complete the measurement/data collection phase.

Block 13c. Enter personnel and TDY costs expended to complete the analysis/computation phase.

Block 13d. Enter personnel and TDY costs expended to complete the reporting/approval phase.

Block 13e. Enter personnel and TDY costs expended to complete the initial application phase.

Block 13f. Enter the sum of 13(a) through 13(e).

Block 13g. Enter the value of dividing total costs (block 13(f)) by requirements affected (block 4).

Block 14. Continuation of any required data that did not fit in the apropriate space. Also, enter any other information that may be necessary to clarify the data shown on DA Form 5276–R.

Figure E–1. Example of a completed DA Form 5276–R—Continued

Appendix F
Quality Assurance SDP Review List

F–1. General

a. Use this list in the quality assurance (QA) evaluations for the Manpower Staffing Standards Study Development Plan (SDP).

b. The list is to be used by both commands and USAMARDA before the SDP is approved. The proponent command is to submit a completed copy of this list with the SDP.

F–2. Instructions for use

Check the finished SDP against the review list. An answer to each question is required and an explanation in the SDP is required for each "no" answer. Local reproduction of table F–1 is authorized.

Table F–1
Quality Assurance SDP review list

Item	Yes	No
Memorandum of transmittal (para 2–35a)		
1. If appropriate, does it contain a summary of policy or procedural issues that require resolution before completing the preliminary phase?	____	____
2. Does it include, as an enclosure, a completed QA SDP review list with rationale for all "no" responses?	____	____
Cover (para 2–34a)		
1. Does it indicate the type of report, i.e., "MANPOWER STAFFING STANDARDS STUDY DEVELOPMENT PLAN (SDP)"?	____	____
2. Does it indicate the scope of the report, i.e., "ARMY COMMON" or "COMMAND UNIQUE"?	____	____
3. Does it address only one major functional area?	____	____
4. Does it indicate the title of the function or the major subfunction covered by the report?	____	____
5. Does it list the work center titles and the respective AFD codes covered by the report?	____	____
6. Does it indicate the study proponent command?	____	____
7. Does it indicate the preparing activity?	____	____
8. Does it indicate the dispatch date?	____	____
Pagination (para 2–34b)		
1. Are all pages numbered consecutively within each part?	____	____
2. If required, does it have the appropriate security classification and are pages marked accordingly?	____	____
Table of contents (para 2–34c)		
1. Are all five parts of the SDP identified and numbered consecutively?	____	____
2. Are all required paragraphs identified and numbered consecutively within each part?	____	____
Part I—Introduction (para 2–34d)		
1. Overview.		
a. Does the overview state the function of major subfunction under study and the principal functional responsibilities?	____	____
b. Does the overview state the work center(s) under study?	____	____
c. Does the overview state the total baseline requirements under study?	____	____
d. Does the overview state the total projected personnel and travel costs of the study?	____	____
e. Does the overview indicate if the function will be studied in its entirety, or if the function will be studied in parts requiring more than one study?	____	____
f. Does the overview provide a brief explanation of the study indicating how the SDP will be followed by the MEAS–PLAN, MEAS–REP, and FIN–REP?	____	____
g. Does the overview state if any staffing guides will be replaced by the standard(s)?	____	____
h. Does the overview state the Proponent Command responsible for the study?	____	____
i. Does the overview state the authority for conducting the study?	____	____
2. Background.		
a. Does the study indicate if there have been any previous MS–3 studies for the work center(s) included in this study?	____	____
b. Does the study indicate if there have been any standards developed by other DOD activities for the work center(s) included in this study?	____	____
c. Does the study indicate other reports which were used?	____	____
d. Does the study indicate whether a MARC study was conducted on similar MTOE work centers?	____	____
3. Applicability.		
a. Is the scope (ARMY COMMON or COMMAND UNIQUE) identified?	____	____
b. Are the agencies and commands covered by the study identified?	____	____
4. Study participants. Are the following identified?		
a. Proponent Command.	____	____
b. HQDA Functional Proponent(s).	____	____
c. Command Functional Proponent(s).	____	____
d. USAMARDA point(s) of contact (POC).	____	____
e. Lead team members.	____	____
f. Measurement teams by command.	____	____

Table F–1
Quality Assurance SDP review list—Continued

Item	Yes	No
Part II—Mission and Organization (para 2–34e)		
1. Mission. Is an overview of the mission and functional responsibilities provided?	____	____
2. Organization charts.		
a. Is an organization chart(s) indicating the typical organizational structure(s) provided?	____	____
b. Does it reflect one level above and two levels below the work center(s) being studied?	____	____
3. Organizational structure. Is the appropriateness of the present organizational structure(s) addressed and rationale for restructuring provided, if necessary?	____	____
4. AR 5–3. Has the applicability of AR 5–3 been addressed?	____	____
Part III—Functional Diagram (para 2–34f)		
1. Is a diagram of the entire function or major subfunction with a breakout by work center(s) provided?	____	____
2. Are all work center(s) identified with approved AFD titles and codes?	____	____
3. Are the work center(s) under study indicated?	____	____
Part IV—Universe Identification (para 2–34g)		
1. Matrix.		
a. Is a matrix showing work center TDA requirements and authorizations by location and command provided?	____	____
b. Are the activities identified by command and UIC?	____	____
c. Are the measurement locations identified?	____	____
d. Are the EDATEs for the TDA data provided?	____	____
e. Are sites visited during SDP development listed?	____	____
2. Measurement location selection.		
a. Is rationale for selecting the measurement locations provided?	____	____
b. Does it show that the number of measurement locations complies with the minimum number specified in AR 570–5, table 2–1, for each standard?	____	____
Part V—Standards Development Planning (para 2–34h)		
1. Work centers. Is the following information provided for each work center under study?		
a. Work center title, AFD code, and direct categories of work?	____	____
(1) Do the titles agree with the functional diagram?	____	____
(2) Do the AFD codes agree with the functional diagram?	____	____
(3) Do the direct categories of work agree with the definition(s) in the AFD?	____	____
b. Is rationale provided for the type of study to be conducted?	____	____
c. Is rationale provided for the proposed measurement approach(es) to be used?	____	____
d. If the proposed measurement approach is not covered in AR 570–5, is the measurement approach discussed and rationale for its use provided?	____	____
e. Is the statement of conditions (SOC) provided?	____	____
f. Are the workload reporting and/or performance measurement information systems which are likely to be a prime source of data provided?	____	____
g. Are the potential workload factors (PWLF), work units (WU), sources of count, and an indication of the reliability/uniformity of counts throughout the universe provided?	____	____
h. Are policy, procedural, or organizational issues of concern, equipment variances, and potential data reporting problems identified?	____	____
i. GaNTT chart.		
(1) Is a GaNTT chart indicating the study phases and appropriate review periods included?	____	____
(2) Does the GaNTT chart agree with the approved study schedule?	____	____
2. Direct labor and support costs.		
a. Are total personnel and travel costs provided showing the costs for the study to date?	____	____
b. Is DA Form 5276–R, Program Management Data, used?	____	____
c. Is it completed IAW the instructions provided in AR 570–5?	____	____
Master Schedule (para 2–34h(3))		
1. Has the master schedule been updated to include actual direct labor used to date?	____	____
2. Has the master schedule been updated to include latest revisions in study phases?	____	____
3. Has the master schedule been updated to include latest revisions to AFD codes?	____	____
Distribution (para 2–35a)		
Have four copies of the SDP been forwarded to USAMARDA (PEMS–RA)?	____	____

Appendix G
Quality Assurance MEAS–PLAN Review List

G–1. General

a. Use this list in the quality assurance evaluations for the Manpower Staffing Standards Studies Measurement Plan (MEAS–PLAN).

b. The list is to be used by both commands and USAMARDA before the MEAS–PLAN is approved. A completed copy of this list will be included with the MEAS–PLAN.

G–2. Instructions for use

Check the finished MEAS–PLAN against the list. An answer to each question is required and an explanation in the MEAS–PLAN is required for each "no" answer. Local reproduction of table G–1 is authorized.

Table G–1
Quality Assurance MEAS–PLAN review list

Item	Yes	No
Memorandum of transmittal (para 2–40a)		
1. Does it adress all issues of nonconcurrence surfaced during staffing of the draft MEAS–PLAN?	____	____
2. Does it include, as an enclosure, a completed MEAS–PLAN review list with rationale for all "no" responses?	____	____
Cover (para 2–38a)		
1. Does it indicate the type of report, "MANPOWER STAFFING STANDARDS MEASUREMENT PLAN (MEAS–PLAN)"?	____	____
2. Does it indicate the scope of the report, "ARMY COMMON" or "COMMAND UNIQUE"?	____	____
3. Does it address only one major functional area?	____	____
4. Does it indicate the title of the function or the major subfunction covered by the report?	____	____
5. Does it list the work center titles and the respective AFD codes covered by the report?	____	____
6. Does it indicate the Proponent Command?	____	____
7. Does it indicate the preparing activity?	____	____
8. Does it indicate the dispatch date?	____	____
Pagination (para 2–38b)		
1. Are all pages numbered consecutively within each part?	____	____
2. If required, does it have the appropriate security classification and are pages marked accordingly?	____	____
Table of contents (para 2–38a)		
1. Are all four parts identified and numbered consecutively?	____	____
2. Are all required paragraphs within each part identified and numbered consecutively?	____	____
Part I—Introduction (para 2–38d)		
1. Overview.		
a. Does the overview state the function or major subfunction under study and the principal functional responsibilities?	____	____
b. Does the overview state the work center(s) under study?	____	____
c. Does the overview state the total baseline requirements under study?	____	____
d. Does the overview state the total projected personnel and travel costs of the study?	____	____
e. Does the overview indicate if the function is being studied in its entirety, or if the function is being studied in parts requiring more than one study?	____	____
f. Does the overview provide a brief explanation of the study indicating that the MEAS–PLAN was preceded by the SDP and will be followed by MEAS–REP and FIN–REP?	____	____
g. Does the overview state if any staffing guides will be replaced by the standard(s)?	____	____
h. Does the overview state the Proponent Command responsible for the study?	____	____
i. Does the overview identify the authority for conducting the study?	____	____
j. Does the overview state the SDP was reviewed by USAMARDA, HQDA Functional Proponent, command functional proponent, and all participating command MS–3 elements and functional proponents?	____	____
k. SDP resolutions.		
(1) Does the overview state any resolutions required as a result of the SDP review?	____	____
(2) Are these resolutions discussed in detail in the applicable section of the MEAS–PLAN?	____	____
2. Background.		
a. Does the study indicate if there have been any previous MS–3 studies for the work center(s) included in this study?	____	____
b. Does the study indicate if there have been any standards developed by other DOD activities for the work center(s) included in this study?	____	____
c. Does the study indicate other reports which were used in the development of MEAS–PLAN?	____	____
d. Does the study indicate whether of not a manpower requirements criteria study was conducted on similar MTOE work centers?	____	____
3. Applicability.		
a. Is the scope (ARMY COMMON or COMMAND UNIQUE) identified?	____	____
b. Are the agencies and commands covered by the study identified?	____	____
4. Universe identification.		
a. Matrix.		
(1) Is a matrix showing work center TDA requirements by location and command provided?	____	____
(2) Are the activities identified by UIC?	____	____

Table G–1
Quality Assurance MEAS–PLAN review list—Continued

Item	Yes	No
(3) Are the measurement locations identified?	____	____
(4) Are the EDATEs for the baseline TDA data provided?	____	____
(5) Does it state whether or not changes were made to the SDP functional matrix?	____	____
(6) If changes were made to the SDP functional matrix, is rationale provided?	____	____
b. Measurement location selection.		
(1) Is rationale for selecting the measurement locations provided?	____	____
(2) Does it show that the number of measurement locations complies with the minimum number specified in AR 570–5, table 2–1, for each standard?	____	____
c. Does it list the locations to which the standard is not expected to apply and provide supporting rationale?	____	____
5. Mission and organization.		
a. Mission. Is an overview of the mission and functional responsibilities provided?	____	____
b. Organization charts.		
(1) Is an organization chart(s) indicating the typical organizational structure(s) provided?	____	____
(2) Does it reflect one level above and two levels below the work center(s) being studied?	____	____
(3) Does it show the approved AFD codes for each work center to be measured?	____	____
(4) Are work centers which do not correspond to organizational elements on a one-to-one basis identified?	____	____
(5) Is the appropriateness of the present organizational structure(s) addressed and rationale for restructuring provided, if necessary?	____	____
(6) Does it state whether or not changes were made to the SDP organization chart(s)?	____	____
(7) If changes were made to the SDP organization chart(s), is rationale provided?	____	____
6. Functional diagram.		
a. Is a diagram of the entire function or major subfunction with a breakout by work center provided?	____	____
b. Are all work centers identified with approved AFD titles and codes?	____	____
c. Are work centers under study indicated?	____	____
d. Does it state whether or not changes were made to the SDP functional diagram?	____	____
e. I changes were made to the SDP functional diagram, is rationale provided?	____	____
7. Study participants. Are the following identified?		
a. Proponent Command.	____	____
b. HQDA Functional Proponent.	____	____
c. Command functional proponent(s).	____	____
d. USAMARDA point(s) of contact (POC).	____	____
e. Lead team members.	____	____
f. Measurement teams by command.	____	____
Part II—Work Centers (para 2–38e)		
1. Sections. Is there a separate section for each work center?	____	____
2. Work center descriptions.		
a. Does the work center description appear first in each work center section?	____	____
b. Does the work center description title and AFD code appear on the upper right hand corner of each page of the WCD?	____	____
c. Does it show logical organization?	____	____
d. Do the categories describe groupings of tasks that are performed in combination to discharge a major mission responsibility?	____	____
e. Are categories structured so that they are associated with a major work unit or an MOS/series?	____	____
f. Does it describe work responsibilities at the appropriate level of detail to ensure accurate measurement?	____	____
g. Are task, subtask, or element titles stated in single unit form?	____	____
h. Have categories been grouped and classified as direct or indirect?	____	____
i. For those studies having only one work center, have applicable standard indirect categories been included?	____	____
j. Is temporary duty travel for accomplishment of official job-oriented duties included as a task under the applicable category or as an integral part of the appropriate task and not as a separate category?	____	____
k. Is travel time spent between work centers and between work centers and job sites included as a task under the applicable category as an integral part of the appropriate task and not as a separate category?	____	____
l. Is the supervision category identified as indirect?	____	____
m. Has training been established as a productive indirect category?	____	____
n. For overhead work centers, has the management category been established for those tasks relating to supervising subordinate work centers?	____	____
o. Have nonproductive categories, such as delay, standby, or on-call, been omitted?	____	____
p. Where necessary, were categories/tasks classified as transferable and nontransferable?	____	____
q. For single location standards, are the categories/tasks indentified as fixed, variable, or personnel-generated?	____	____
r. Does it state whether or not changes were made to the SDP categories of work?	____	____
s. If changes were made to the SDP categories of work, is rationale provided?	____	____
t. Is the complete list of standard indirect categories provided?	____	____
3. Work center comments.		
a. Statement of conditions (SOC).		
(1) Does it describe the normal work situation on which the study is based?	____	____
(2) Does it describe the standard of living for the work center(s)?	____	____
(a) Response time?	____	____
(b) Types and conditions of facilities?	____	____
(c) Equipment types and ages?	____	____
(d) Availability of spare parts?	____	____
(e) Climatic conditions?	____	____

Table G–1
Quality Assurance MEAS–PLAN review list—Continued

Item	Yes	No
(f) Travel distances?	____	____
(g) Seasonal workload?	____	____
(h) Significant standard or operation/levels of service?	____	____
(i) Any other conditions having an impact on the work center(s) under study?	____	____
(3) Does it reflect the hours of operation for the work center(s) under study?	____	____
(4) Does it state if there are shift requirements?	____	____
(5) Does it state whether or not changes were made to the SDP SOC?	____	____
(6) If changes were made to the SDP SOC, is rationale provided?	____	____
b. Potential workload factors (PWLF).		
(1) Is each PWLF title stated in singular form?	____	____
(2) Is each PWLF definition clear, concise, and mutually exclusive?	____	____
(3) Is each PWLF source of count clearly defined and specifically collectible?	____	____
(4) Is there a matrix showing which PWLF relates to which specific direct category of work?	____	____
(5) Are external PWLFs listed before internal PWLFs?	____	____
c. Work units.		
(1) Is each work unit title stated in singular form?	____	____
(2) Is each work unit clearly defined, concise, and mutually exclusive?	____	____
(3) Is each unit source of count clearly defined and specifically collectible?	____	____
(4) Is there a matrix showing which work unit relates to which specific task or category?	____	____
d. Proposed measurement approach.		
(1) Does it state the measurement method(s) which will be utilized during the study?	____	____
(2) If a method not discussed in AR 570–5 is going to be used, is a statement indicating USAMARDA approval included?	____	____
(3) Time study. If time study is going to be used, is the following discussed?		
(a) Number of samples required.	____	____
(b) PF&D allowance factor.	____	____
(4) Work sampling. If work sampling is going to be used, is the following discussed?		
(a) Specific sampling period.	____	____
(b) Number of samples required.	____	____
(c) PF&D allowance factor.	____	____
(5) Operational audit. If operational audit is going to be used, are expected frequencies of occurence and per accomplishment times (PAT) ranges discussed?	____	____
(6) Good operator. If good operator is going to be used, is the following discussed?		
(a) Tasks, subtasks, or elements to be “good operator timed” identified.	____	____
(b) PF&D allowance factor.	____	____
(7) Technical estimate. Is the treatment of an extraordinarily high PAT discussed?	____	____
(8) Are minimum manpower or standby requirements identified and rationale provided?	____	____
(9) If an internal production or man-hour accounting system(s) is used, is the description and rationale provided?	____	____
(10) Are potential problem areas concerning policy, procedural, or organizational issues of concern, equipment variances and data reporting problems discussed and possible solutions presented?	____	____
e. Required and authorized strength.		
(1) Is a matrix reflecting baseline TDA requirements and authorizations by position titles, MOS/series, and grade provided for each measurement site?	____	____
(2) Are the EDATEs for the baseline TDA data provided?	____	____
f. Miscellaneous.		
(1) Host-tenant/inter-service support agreements. Does it state if there are any support agreements having an impact on the work center(s) under study?	____	____
(2) Contract services. Does it state if there are any contract services having an impact on the work center(s) under study?	____	____
Part III—Bibliography and Glossary (para 2–38f)		
1. Are only direct mission publications used for functional familiarization listed?	____	____
2. Are only essential terms and definitions not normally listed in other Army publications listed in the glossary?	____	____
Part IV—Measurement Instructions (para 2–38g)		
1. Do the instructions identify the specific measurement period?	____	____
2. Is the treatment of inferred or assumed workload addressed?	____	____
3. Is the treatment of locally-directed requirements addressed?	____	____
4. Is the treatment of standby time addressed?	____	____
5. Are provisions for documenting backlog workload provided?	____	____
6. Are provisions for addressing either documented or undocumented overtime provided?	____	____
7. Workload data. Have sample workload data forms with categories and tasks of work been prepared for distribution to input teams? (Sample forms should be sent to the input teams under separate cover.)	____	____
a. DA Form 5274–R. (Do single point standards indicate fixed, variable, and personnel-generated category breakouts?)	____	____
b. For time study.		
(1) DA Form 5275–R.	____	____
(2) DD Form 2042, or	____	____
(3) DD Form 2042–1, or	____	____
(4) DD Form 2043.	____	____
c. For work sampling, DA Form 5278–R.	____	____
d. For operational audit, DA Form 5277–R.	____	____
8. Potential workload factors (PWLF) and work unit (WU) counts.		

Table G–1
Quality Assurance MEAS–PLAN review list—Continued

Item	Yes	No
a. Are instructions provided for collection of PWLF and WU counts?	____	____
b. Have sample matrices for PWLF and WU counts been prepared for the input teams?	____	____
9. Proposed grade and skill determination.		
a. Are instructions for developing the skill and grade recommendations provided?	____	____
b. Has a sample matrix for skill and grade data been prepared for the input teams?	____	____
10. Where applicable, are instructions for productivity control charts, workload factor control charts, and man-hour shift profile charts provided?	____	____
11. Are instructions provided for collection of assigned strength data (by position title, MOS/series, and grade) for the measurement period?	____	____
12. Are instructions provided for collection of the following?		
a. Work center description (WCD) variations.	____	____
b. Deviations from MEAS–PLAN organizational charts.	____	____
c. Deviations from, or clarification of, statement of conditions (SOC) included in the MEAS–PLAN.	____	____
(1) Provisions for reporting authorized and assigned equipment changes since the SDP.	____	____
(2) Provisions for flow charts, layout diagrams, maps, or other pertinent graphic media that aid in looking at the impact of such things as distances between work areas and work flow.	____	____
d. Deviations from the MEAS–PLAN PF&D allowances.	____	____
e. Host-tenant/inter-service support agreements having an impact on the work center as discussed in the MEAS–PLAN.	____	____
f. Contract services having an impact on the work center as discussed in the MEAS–PLAN.	____	____
13. Are there instructions outlining what measurement data computations and corrections must be made by the input team before sending the data to the lead team?	____	____
14. Do the instructions include a request for a memorandum of concurrence/nonconcurrence from the measurement location or command functional proponent concerning work measurement?	____	____
Part V—Direct Labor and Support Cost (para 2–38h)		
1. Is DA Form 5276–R included?	____	____
2. Does it update the cost of the study to date since submission of the SDP?	____	____
Distribution (para 2–40a)		
Have four copies of the MEAS–PLAN been forwarded to USAMARDA?	____	____

Appendix H
Estimated Number of Good Time Study Readings Required for a Relative Accuracy of ±1O Percent; Confidence Limits of 95 Percent

Table H–1 specifies the number of time study readings required.

Table H–1
Required number of time study readings

	Number of Good Readings Available															
F	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Number of Good Readings Required															
.05	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
.06	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
.07	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
.08	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1
.09	3	3	2	2	2	2	2	2	2	2	2	2	2	1	1	1
.10	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
.11	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2	2
.12	5	4	4	3	3	3	3	3	3	2	2	2	2	2	2	2
.13	5	5	4	4	4	3	3	3	3	3	3	3	3	3	2	2
.14	6	5	5	4	4	4	4	3	3	3	3	3	3	3	3	3
.15	7	6	5	5	5	4	4	4	4	4	3	3	3	3	3	3
.16	8	7	6	6	5	5	5	4	4	4	4	4	4	4	4	3
.17	9	8	7	6	6	5	5	5	5	4	4	4	4	4	4	4
.18	10	9	8	7	6	6	6	5	5	5	5	5	5	4	4	4
.19	11	9	8	7	7	7	6	6	6	5	5	5	5	5	5	5
.20	12	10	9	8	8	7	7	7	6	6	6	6	5	5	5	5
.21	14	11	10	9	8	8	8	7	7	7	6	6	6	6	6	6
.22	15	13	11	10	9	9	8	8	7	7	7	7	7	6	6	6
.23	16	14	12	11	10	9	9	8	8	8	8	7	7	7	7	7
.24	18	15	13	12	11	10	10	9	9	8	8	8	8	7	7	7
.25	19	16	14	13	12	11	10	10	9	9	9	9	8	8	8	8
.26	20	17	15	14	13	12	11	11	10	10	9	9	9	9	8	8
.27	22	19	16	15	14	13	12	11	11	11	10	10	10	9	9	9
.28	24	20	18	16	15	14	13	12	12	11	11	11	10	10	10	9
.29	25	21	19	17	16	15	14	13	13	12	12	11	11	11	10	10
.30	27	23	20	18	17	16	15	14	13	13	12	12	12	11	11	11
.31	29	24	22	19	18	17	16	15	14	14	13	13	12	12	12	12
.32	31	26	23	21	19	18	17	16	15	15	14	14	13	13	13	12
.33	33	28	24	22	20	19	18	17	16	16	15	14	14	14	13	13
.34	35	29	26	23	21	20	19	18	17	16	16	15	15	14	14	14
.35	37	31	27	25	23	21	20	19	18	17	17	16	16	15	15	15
.36	39	33	29	25	24	22	21	20	19	18	18	17	17	16	16	15
.37	41	35	30	28	25	24	22	21	20	19	19	18	18	17	17	16
.38	43	36	32	29	27	25	23	22	21	20	20	19	18	18	17	17
.39	45	38	34	31	28	26	25	23	22	21	21	20	19	19	18	18

Table H–1
Required number of time study readings—Continued

	Number of Good Readings Available															
F	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
.40	48	40	36	32	30	28	26	25	24	23	22	21	20	20	19	19
.41	50	42	37	34	31	29	27	26	25	24	23	22	21	21	20	20
.42	53	44	39	35	32	30	29	27	26	25	24	23	22	22	21	21
.43	55	47	41	37	34	32	30	28	27	26	25	24	23	23	22	22
.44	58	49	43	39	36	33	31	30	28	27	26	25	25	24	23	23
.45	60	51	45	40	37	35	33	31	30	28	27	26	25	25	24	24
.46	63	53	47	42	39	36	34	32	31	30	29	28	27	26	25	25
.47	66	56	49	44	41	38	36	34	32	31	30	29	28	27	26	26
.48	69	58	51	46	42	39	37	35	34	32	31	30	29	28	28	27
.49	72	60	53	48	44	41	39	37	35	34	32	31	30	29	29	28
.50	74	63	55	50	46	43	40	38	36	35	34	33	32	31	30	29

Appendix I
Work Sample Absolute Accuracy Table

Table I–1 specifies the required number of samples for a given degree of accuracy.

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.001/.999	40	10	4	.0632
.002/.998	80	20	9	.0894
.003/.997	120	30	13	.1094
.004/.996	159	40	18	.1282
.005/.995	199	50	22	.1411
.006/.994	239	60	27	.1545
.007/.993	278	70	31	.1667
.008/.992	317	79	35	.1782
.009/.991	357	89	40	.1889
.010/.990	396	99	44	.1990
.011/.989	435	109	48	.2086
.012/.988	474	119	53	.2178
.013/.987	513	128	57	.2265
.014/.986	552	138	61	.2350
.015/.985	591	148	66	.2431
.016/.984	630	157	70	.2510
.017/.983	668	167	74	.2585
.018/.982	707	177	79	.2659
.019/.981	746	186	83	.2730
.020/.980	784	196	87	.2800
.021/.979	822	206	91	.2868
.022/.978	861	215	96	.2934
.023/.977	899	225	100	.2998
.024/.976	937	234	104	.3061
.025/.975	975	244	108	.3122
.026/.974	1013	253	113	.3183
.027/.973	1051	263	117	.3242
.028/.972	1089	272	121	.3299
.029/.971	1126	282	125	.3356
.030/.970	1164	291	129	.3412
.031/.969	1202	300	134	.3466
.032/.968	1239	310	138	.3520
.033/.967	1276	319	142	.3573
.034/.966	1314	328	146	.3625
.035/.965	1351	338	150	.3676
.036/.964	1388	347	154	.3726

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.037/.963	1425	356	158	.3775
.038/.962	1482	366	162	.3824
.039/.961	1499	375	167	.3872
.040/.960	1536	384	171	.3919
.041/.959	1573	393	175	.3966
.042/.958	1609	402	179	.4012
.043/.957	1646	412	183	.4057
.044/.956	1683	421	187	.4102
.045/.955	1719	430	191	.4146
.046/.954	1755	439	195	.4190
.047/.953	1792	448	199	.4233
.048/.952	1828	457	203	.4275
.049/.951	1864	466	207	.4317
.050/.950	1900	475	211	.4359
.051/.949	1936	484	215	.4400
.052/.948	1972	493	219	.4441
.053/.947	2008	502	223	.4481
.054/.946	2043	511	227	.4520
.055/.945	2079	520	231	.4560
.056/.944	2115	529	235	.4598
.057/.943	2150	538	239	.4637
.058/.942	2135	546	243	.4675
.059/.941	2221	555	247	.4712
.060/.940	2256	564	251	.4750
.061/.939	2291	573	255	.4787
.062/.938	2326	582	258	.4823
.063/.937	2361	590	262	.4859
.064/.936	2396	599	266	.4895
.065/.935	2431	608	270	.4931
.066/.934	2466	616	274	.4966
.067/.933	2500	625	278	.5000
.068/.932	2535	634	282	.5035
.069/.931	2570	642	286	.5069
.070/.930	2604	651	289	.5103
.071/.929	2638	660	293	.5136
.072/.928	2673	668	297	.5170
.073/.927	2707	677	301	.5203
.074/.926	2741	685	305	.5235
.075/.925	2775	694	308	.5268
.076/.924	2809	702	312	.5300
.077/.923	2843	711	316	.5332

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.078/.922	2877	719	320	.5363
.079/.921	2910	728	323	.5395
.080/.920	2944	736	327	.5426
.081/.919	2978	744	331	.5457
.082/.918	3011	753	335	.5487
.083/.917	3044	761	338	.5518
.084/.916	3078	769	342	.5548
.085/.915	3111	778	346	.5578
.086/.914	3144	786	349	.5607
.087/.913	3177	794	353	.5637
.088/.912	3210	803	357	.5666
.089/.911	3243	811	360	.5695
.090/.910	3276	819	364	.5724
.091/.909	3309	827	368	.5752
.092/.908	3341	835	371	.5781
.093/.907	3374	844	375	.5809
.094/.906	3407	852	379	.5837
.095/.905	3439	860	382	.5864
.096/.904	3471	868	386	.5892
.097/.903	3504	876	389	.5919
.098/.902	3536	884	393	.5946
.099/.901	3568	892	396	.5973
.100/.900	3600	900	400	.6000
.101/.899	3632	908	404	.6027
.102/.898	3664	916	407	.6053
.103/.897	3696	924	411	.6079
.104/.896	3727	932	414	.6105
.105/.895	3759	940	418	.6131
.106/.894	3791	948	421	.6157
.107/.893	3822	956	425	.6182
.108/.892	3853	963	428	.6208
.109/.891	3885	971	432	.6233
.110/.890	3916	979	435	.6258
.111/.889	3947	987	439	.6283
.112/.888	3978	995	442	.6307
.113/.887	4009	1002	445	.6332
.114/.886	4040	1010	449	.6358
.115/.885	4071	1018	452	6380
.116/.884	4102	1025	456	.6404
.117/.883	4132	1033	459	.6428
.118/.882	4163	1041	463	.6452

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.119/.881	4194	1048	466	.6476
.120/.880	4224	1056	469	.6499
.121/.879	4254	1064	473	.6523
.122/.878	4825	1071	476	.6546
.123/.877	4315	1079	479	.6569
.124/.876	4345	1086	483	.6592
.125/.875	4375	1094	486	.6614
.126/.874	4405	1101	489	.6637
.127/.873	4435	1109	493	.6659
.128/.872	4465	1116	496	.6682
.129/.871	4494	1124	499	.6704
.130/.870	4524	1131	503	.6726
.131/.869	4554	1138	506	.6748
.132/.868	4583	1146	509	.6770
.133/.867	4612	1153	512	.6791
.134/.866	4642	1160	516	.5813
.135/.865	4671	1168	519	.6834
.136/.864	4700	1175	522	.6856
.137/.863	4729	1182	525	.6877
.138/.862	4758	1190	529	.6898
.139/.861	4787	1197	532	.6919
.140/.860	4816	1204	535	.6940
.141/.859	4845	1211	538	.6960
.142/.858	4873	1218	541	.6981
.143/.857	4902	1226	545	.7001
.144/.856	4931	1233	548	.7022
.145/.855	4959	1240	551	.7042
.146/.854	4987	1247	554	.7062
.147/.853	5016	1254	557	.7082
.148/.852	5044	1261	560	.7102
.149/.851	5072	1268	564	.7122
.150/.850	5100	1275	567	.7141
.151/.849	5128	1282	570	.7161
.152/.848	5165	1289	573	.7180
.153/.847	5184	1296	576	.7200
.154/.846	5211	1303	579	.7219
.155/.845	5239	1310	582	.7238
.156/.844	5267	1317	585	.7257
.157/.843	5294	1324	588	.7276
.158/.842	5321	1330	591	.7295
.159/.841	5349	1337	594	.7314

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.160/.840	5376	1344	597	.7332
.161/.839	5403	1351	600	.7351
.162/.838	5430	1358	603	.7369
.163/.837	5457	1364	606	.7387
.164/.836	5484	1371	609	.7406
.165/.835	5511	1378	612	.7424
.166/.834	5538	1384	615	.7442
.167/.833	5564	1391	618	.7460
.168/.832	5591	1398	621	.7477
.169/.831	5618	1404	624	.7495
.170/.830	5644	1411	627	.7513
.171/.829	5670	1418	630	.7530
.172/.828	5697	1424	633	.7548
.173/.827	5723	1431	636	.7565
.174/.826	5749	1437	639	.7582
.175/.825	5775	1444	642	.7599
.176/.824	5801	1450	645	.7616
.177/.823	5827	1457	647	.7633
.178/.822	5853	1463	650	.7650
.179/.821	5878	1470	653	.7667
.180/.820	5904	1476	656	.7684
.181/.819	5930	1482	659	.7700
.182/.818	5955	1489	662	.7717
.183/.817	5980	1495	664	.7733
.184/.816	6006	1501	667	.7750
.185/.815	6031	1508	670	.7766
.186/.814	6056	1514	673	.7782
.187/.813	6081	1520	676	.7798
.188/.812	6106	1527	678	.7814
.189/.811	6131	1533	681	.7830
.190/.810	6156	1539	684	.7846
.11/.809	6181	1545	687	.7862
.192/.808	6205	1551	689	.7877
.193/.807	6230	1558	692	.7893
.194/.806	6255	1564	695	.7909
.195/.805	6279	1570	698	.7924
.196/.804	6303	1576	700	.7939
.197/.803	6328	1582	703	.7955
.198/.802	6352	1588	706	.7970
.199/.801	6376	1594	708	.7985
.200/.800	6400	1600	711	.8000

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.201/.799	6424	1606	714	.8015
.202/.798	6448	1612	716	.8030
.203/.797	6472	1618	719	.8045
.204/.796	6495	1624	722	.8059
.205/.795	6519	1630	724	.8074
.206/.794	6543	1636	727	.8089
.207/.793	6566	1642	730	.8103
.208/.792	6589	1647	732	.8118
.209/.791	6613	1653	735	.8132
.210/.790	6636	1659	737	.8146
.211/.789	6659	1665	740	.8160
.212/.788	6682	1671	742	.8174
.213/.787	6705	1676	745	.8189
.214/.786	6728	1682	748	.8203
.215/.785	6751	1688	750	.8216
.216/.784	6774	1693	753	.8230
.217/.783	6796	1699	755	.8244
.218/.782	6819	1705	758	.8258
.219/.781	6842	1710	760	.8271
.220/.780	6864	1716	763	.8285
.221/.779	6886	1722	765	.8298
.222/.778	6909	1727	768	.8312
.223/.777	6931	1733	770	.8325
.224/.776	6953	1738	773	.8338
.225/.775	6975	1744	775	.8352
.226/.774	6997	1749	777	.8365
.227/.773	7019	1755	780	.8378
.228/.772	7041	1760	782	.8391
.229/.771	7062	1766	785	.8404
.230/.770	7084	1771	787	.8417
.231/.769	7106	1776	790	.8429
.232/.768	7127	1782	792	.8442
.233/.767	7148	1787	794	.8455
.234/.766	7170	1792	797	.8467
.235/.765	7191	1798	799	.8480
.236/.764	7212	1803	801	.8492
.237/.763	7233	1808	804	.8505
.238/.762	7254	1814	806	.8517
.239/.761	7275	1819	808	.8529
.240/.760	7296	1824	811	.8542
.241/.759	7317	1829	813	.8554

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.242/.758	7337	1834	815	.8566
.243/.757	7358	1840	818	.8578
.244/.756	7379	1845	820	.8590
.245/.755	7399	1850	822	.8602
.246/.754	7419	1855	824	.8614
.247/.753	7440	1860	827	.8625
.248/.752	7460	1865	829	.8637
.249/.751	7480	1870	831	.8649
.250/.750	7500	1875	833	.8660
.251/.749	7520	1880	836	.8672
.252/.748	7540	1885	838	.8683
.253/.747	7560	1890	840	.8695
.254/.746	7579	1895	842	.8706
.255/.745	7599	1900	844	.8717
.256/.744	7619	1905	847	.8728
.257/.743	7638	1910	849	.8740
.258/.742	7657	1914	851	.8751
.259/.741	7677	1919	853	.8762
.260/.740	7596	1924	855	.8773
.261/.739	7715	1929	857	.8784
.262/.738	7734	1934	859	.8794
.263/.737	7753	1938	861	.8805
.264/.736	7772	1943	864	.8816
.265/.735	7791	1948	866	.8827
.266/.734	7810	1952	868	.8837
.267/.733	7828	1957	870	.8848
.268/.732	7847	1962	872	.8858
.269/.731	7866	1966	874	.8869
.270/.730	7884	1971	876	.8879
.271/.729	7902	1976	878	.8890
.272/.728	7921	1980	880	.8900
.273/.727	7939	1985	882	.8910
.274/.726	7957	1989	884	.8920
.275/.725	7975	1994	886	.8930
.276/.724	7993	1998	888	.8940
.277/.723	8011	2003	890	.8950
.278/.722	8029	9207	892	.8960
.279/.721	8046	2012	894	.8970
.280/.720	8064	2016	896	.8980
.281/.719	8082	2020	898	.8990
.282/.718	8099	2025	900	.8999

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.283/.717	8116	2029	902	.9009
.284/.716	8134	2033	904	.9019
.285/.715	8151	2038	906	.9028
.286/.714	8168	2042	908	.9038
.287/.713	8185	2046	909	.9047
.288/.712	8202	2051	911	.9057
.289/.711	8219	2055	913	.9066
.290/.710	8236	2059	915	.9075
.291/.709	8253	2063	917	.9084
.292/.708	8269	2067	919	.9094
.293/.707	8286	2072	921	.9103
.294/.706	8303	2076	923	.9112
.295/.705	8319	2080	924	.9121
.296/.704	8335	2084	926	.9130
.297/.703	8352	2088	928	.9139
.298/.702	8368	2092	930	.9148
.299/.701	8384	2096	932	.9156
.300/.700	8400	2100	933	.9165
.301/.699	8416	2104	935	.9174
.302/.698	8432	2108	937	.9183
.303/.697	8448	2112	939	.9191
.304/.696	8463	2116	940	.9200
.305/.695	8479	2120	942	.9208
.306/.694	8495	2124	944	.9217
.307/.693	8510	2128	946	.9225
.308/.692	8525	2131	947	.9233
.309/.691	8541	2135	949	.9242
.310/.690	8556	2139	951	.9250
.311/.689	8571	2143	952	.9258
.312/.688	8586	2147	954	.9266
.313/.687	8601	2150	956	.9274
.314/.686	8616	2154	957	.9282
.315/.685	8631	2158	959	.9290
.316/.684	8646	2161	961	.9298
.317/.683	8660	2165	962	.9306
.318/.682	8675	2169	964	.9314
.319/.681	8690	2172	966	.9322
.320/.680	8704	2176	967	.9330
.321/.679	8718	2180	969	.9337
.322/.678	8733	2183	970	.9345
.323/.677	8747	2187	972	.9352

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.324/.676	8761	2190	973	.9360
.325/.675	8775	2194	975	.9367
.326/.674	8789	2197	977	.9375
.327/.673	8803	2201	978	.9382
.328/.672	8817	2204	980	.9390
.329/.671	8830	2208	981	.9397
.330/.670	8844	2211	983	.9404
.331/.669	8858	2214	984	.9411
.332/.668	8871	2218	986	.9419
.333/.667	8884	2221	987	.9426
.334/.666	8898	2224	989	.9433
.335/.665	8911	2228	990	.9440
.336/.664	8924	2231	992	.9447
.337/.663	8937	2234	993	.9454
.338/.662	8950	2238	994	.9461
.339/.661	8963	2241	996	.9467
.340/.660	8976	2244	997	.9474
.341/.659	8989	2247	999	.9481
.342/.658	9001	2250	1000	.9488
.343/.657	9014	2254	1002	.9494
.344/.656	9027	2257	1003	.9501
.345/.655	9039	2260	1004	.9507
.346/.654	9051	2263	1006	.9514
.347/.653	9064	2266	1007	.9520
.348/.652	9076	2269	1008	.9527
.349/.651	9088	2272	1010	.9533
.350/.650	9100	2275	1011	.9546
.351/.649	9112	2278	1012	.9546
.352/.648	9124	2281	1014	.9552
.353/.647	9136	2284	1015	.9558
.354/.646	9147	2287	1016	.9564
.355/.645	9159	2290	1018	.9570
.356/.644	9171	2293	1019	.9576
.357/.643	9182	2296	1020	.9582
.358/.642	9193	2298	1021	.9588
.359/.641	9205	2301	1023	.9594
.360/.640	9216	2304	1024	.9600
.361/.639	9227	2307	1025	.9606
.362/.638	9238	2310	1026	.9612
.363/.637	9249	2312	1028	.9617
.364/.636	9260	2315	1029	.9623

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.365/.635	9271	2318	1030	.9629
.366/.634	9282	2320	1031	.9634
.367/.633	9292	2323	1032	.9640
.368/.632	9303	2326	1034	.9645
.369/.631	9314	2328	1035	.9651
.370/.630	9324	2331	1036	.9656
.371/.629	9334	2334	1037	.9661
.372/.628	9345	2336	1038	.9667
.373/.627	9355	2339	1039	.9672
.374/.626	9365	2341	1041	.9677
.375/.625	9375	2344	1042	.9782
.376/.624	9385	2346	1043	.9688
.377/.623	9395	2349	1044	.9693
.378/.622	9405	2351	1045	.9698
.379/.621	9414	2354	1046	.9703
.380/.620	9424	2356	1047	.9709
.381/.619	9434	2358	1048	.9713
.382/.618	9443	2361	1049	.9718
.383/.617	9452	2363	1050	.9722
.384/.616	9462	2365	1051	.9727
.385/.615	9471	2368	1052	.9732
.386/.614	9480	2370	1053	.9737
.387/.613	9489	2372	1054	.9741
.388/.612	9498	2375	1055	.9746
.389/.611	9507	2377	1056	.9750
.390/.610	9516	2379	1057	.9755
.391/.609	9525	2381	1058	.9759
.392/.608	9533	2383	1059	.9764
.393/.607	9542	2386	1060	.9768
.394/.606	9551	2388	1061	.9773
.395/.605	9559	2390	1062	.9777
.396/.604	9567	2392	1063	.9781
.397/.603	9576	2394	1064	.9786
.398/.602	9584	2396	1065	.9790
.399/.601	9592	2398	1066	.9794
.400/.600	9600	2400	1067	.9798
.401/.599	9608	2402	1068	.9802
.402/.598	9616	2404	1068	.9806
.403/.597	9624	2406	1069	.9810
.404/.596	9631	2408	1070	.9814
.405/.595	9639	2410	1071	.9818

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.406/.594	9647	2412	1072	.9822
.407/.593	9654	2414	1073	.9825
.408/.592	9661	2415	1073	.9829
.409/.591	9669	2417	1074	.9833
.410/.590	9676	2419	1075	.9837
.411/.589	9683	2421	1076	.9840
.412/.588	9690	2423	1077	.9844
.413/.587	9697	2424	1077	.9847
.414/.586	9704	2426	1078	.9851
.415/.585	9711	2428	1079	.9854
.416/.584	9718	2429	1080	.9858
.417/.583	9724	2431	1080	.9861
.418/.582	9731	2433	1081	.9865
.419/.581	9738	2434	1082	.9868
.420/.580	9744	2436	1083	.9871
.421/.579	9750	2438	1083	.9874
.422/.578	9757	2439	1084	.9878
.423/.577	9763	2441	1085	.9881
.424/.576	9769	2442	1085	.9884
.425/.575	9775	2444	1086	.9887
.426/.574	9781	2445	1087	.9890
.427/.573	9787	2447	1087	.9893
.428/.572	9793	2448	1088	.9896
.429/.571	9798	2450	1089	.9899
.430/.570	9804	2451	1089	.9902
.431/.569	9810	2452	1090	.9904
.432/.568	9815	2454	1091	.9907
.433/.567	9820	2455	1091	.9910
.434/.566	9826	2456	1092	.9912
.435/.565	9831	2458	1092	.9915
.436/.564	9836	2459	1093	.9918
.437/.563	9841	2460	1093	.9920
.438/.562	9846	2462	1094	.9923
.439/.561	9851	2463	1095	.9925
.440/.560	9856	2464	1095	.9928
.441/.559	9861	2465	1096	.9930
.442/.558	9865	2466	1096	.9932
.443/.557	9870	2468	1097	.9935
.444/.556	9875	2469	1097	.9937
.445/.555	9879	2470	1098	.9939
.446/.554	9883	2471	1098	.9942

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

	Degree of Accuracy			
$\overline{P}$	1%	2%	3%	Value[1]
.447/.553	9888	2472	1099	.9944
.448/.552	9892	2473	1099	.9946
.449/.551	9896	2474	1100	.9948
.450/.550	9900	2475	1100	.9950
.451/.549	9904	2476	1100	.9952
.452/.548	9908	2477	1101	.9954
.453/.547	9912	2478	1101	.9956
.454/.546	9915	2479	1102	.9958
.455/.545	9919	2480	1102	.9959
.456/.544	9923	2481	1103	.9961
.457/.543	9926	2482	1103	.9963
.458/.542	9929	2482	1103	.9965
.459/.541	9933	2483	1104	.9966
.460/.540	9936	2484	1104	.9968
.461/.539	9939	2485	1104	.9970
.462/.538	9942	2486	1105	.9971
.463/.537	9945	2486	1105	.9973
.464/.536	9948	2487	1105	.9974
.465/.535	9951	2488	1106	.9975
.466/.534	9954	2488	1106	.9977
.467/.533	9956	2489	1106	.9978
.468/.532	9959	2490	1107	.9979
.469/.531	9962	2490	1107	.9981
.470/.530	9964	2491	1107	.9982
.471/.529	9966	2492	1107	.9983
.472/.528	9969	2492	1108	.9984
.473/.527	9971	2493	1108	.9985
.474/.526	9973	2493	1108	.9986
.475/.525	9975	2494	1108	.9987
.476/.524	9977	2494	1109	.9988
.477/.523	9979	2495	1109	.9989
.478/.522	9981	2495	1109	.9990
.479/.521	9982	2496	1109	.9991
.480/.520	9984	2496	1109	.9992
.481/.519	9986	2496	1110	.9993
.482/.518	9987	2497	1110	.9994
.483/.517	9988	2497	1110	.9994
.484/.516	9990	2497	1110	.9995
.485/.515	9991	2498	1110	.9995
.486/.514	9992	2498	1110	.9996
.487/.513	9993	2498	1110	.9997

Table I–1
Samples required for a given degree of absolute accuracy at 95.44 percent confidence, and values used in computing absolute accuracy—Continued

$\overline{P}$	Degree of Accuracy			
	1%	2%	3%	Value[1]
.488/.512	9994	2499	1110	.9997
.489/.511	9995	2499	1111	.9998
.490/.510	9996	2499	1111	.9998
.491/.509	9997	2499	1111	.9998
.492/.508	9997	2499	1111	.9999
.493/.507	9998	2500	1111	.9999
.494/.506	9999	2500	1111	.9999
.495/.505	9999	2500	1111	1.0000
.496/.504	9999	2500	1111	1.0000
.497/.503	10000	2500	1111	1.0000
.498/.502	10000	2500	1111	1.0000
.499/.501	10000	2500	1111	1.0000
.500/.500	10000	2500	1111	1.0000

Notes:
[1] See figure I–1 below for table note

[1] Numbers listed under the columns headed "Value" are solutions of the expression $2\sqrt{P(1-P)}$. These factors are used in solving the equation for absolute accuracy:

$$a = \frac{2\sqrt{P(1-P)}}{\sqrt{N}}$$

Figure I–1. Table note for table I–1

Appendix J
Conversion Table

Table J–1 provides the means for converting minutes and seconds to decimal hours.

Table J–1
Minutes and seconds converted to decimal hours

	Seconds			
Minutes	00	15	30	45
0	.0000	.0042	.0083	.0125
1	.0167	.0208	.0250	.0292
2	.0333	.0375	.0417	.0458
3	.0500	.0542	.0583	.0625
4	.0667	.0708	.0750	.0792
5	.0833	.0875	.0917	.0958
6	.1000	.1042	.1083	.1125
7	.1167	.1208	.1250	.1292
8	.1333	.1375	.1417	.1458
9	.1500	.1542	.1583	.1625
10	.1667	.1708	.1750	.1792
11	.1833	.1875	.1917	.1958
12	.2000	.2042	.2083	.2125
13	.2167	.2208	.2250	.2292
14	.2333	.2375	.2417	.2458
15	.2500	.2542	.2583	.2625
16	.2667	.2708	.2750	.2792
17	.2833	.2875	.2917	.2958
18	.3000	.3042	.3083	.3125
19	.3167	.3208	.3250	.3292
20	.3333	.3375	.3417	.3458
21	.3500	.3542	.3583	.3625
22	.3667	.3708	.3750	.3792
23	.3833	.3875	.3917	.3958
24	.4000	.4042	.4083	.4125
25	.4167	.4208	.4250	.4292
26	.4333	.4375	.4417	.4458
27	.4500	.4542	.4583	.4625
28	.4667	.4708	.4750	.4792
29	.4833	.4875	.4917	.4958
30	.5000	.5042	.5083	.5125
31	.5167	.5208	.5250	.5292
32	.5333	.5375	.5417	.5458
33	.5500	.5542	.5583	.5625
34	.5667	.5708	.5750	.5792
35	.5833	.5875	.5917	.5958
36	.6000	.6042	.6083	.6125

Table J–1
Minutes and seconds converted to decimal hours—Continued

	Seconds			
Minutes	00	15	30	45
37	.6167	.6208	.6250	.6292
38	.6333	.6375	.6417	.6458
39	.6500	.6542	.6583	.6625
40	.6667	.6708	.6750	.6792
41	.6833	.6875	.6917	.6958
42	.7000	.7042	.7083	.7125
43	.7167	.7208	.7250	.7292
44	.7333	.7375	.7417	.7458
45	.7500	.7542	.7583	.7625
46	.7667	.7708	.7750	.7792
47	.7833	.7875	.7917	.7958
48	.8000	.8042	.8083	.8125
49	.8167	.8208	.8250	.8292
50	.8333	.8375	.8417	.8458
51	.8500	.8542	.8583	.8625
52	.8667	.8708	.8750	.8792
53	.8833	.8875	.8917	.8958
54	.9000	.9042	.9083	.9125
55	.9167	.9208	.9250	.9292
56	.9333	.9375	.9417	.9458
57	.9500	.9542	.9583	.9625
58	.9667	.9708	.9750	.9792
59	.9833	.9875	.9917	.9958
60	1.000			

Appendix K
Chi-square (X^2) Table

K–1. Background

The values of X^2 for various degrees of freedom are shown here in table K–1. The degrees of freedom, d, are given in the first column and the X^2 values are given in the remaining columns. The proportion or probability of X^2 values less than or equal to the table values is shown as the subscript at the head of each column.

K–2. Example

The general shape of the distribution and the range of X^2 values are shown in figure K–1.

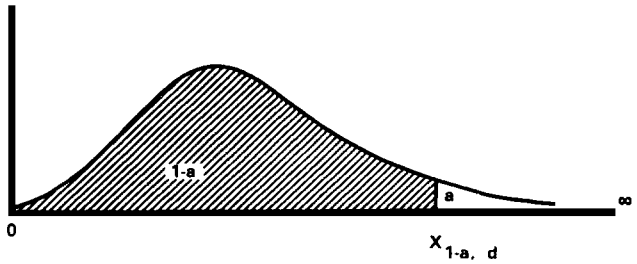


Figure K–1. General shape and range of X^2 values

Table K–1
Chi-square (X^2) values

d	X^2 .005	X^2 .01	X^2 .025	X^2 .05	X^2 .10	X^2 .90	X^2 .95	X^2 .975	X^2 .99	X^2 .995
1	.000039	.00016	.00098	.0039	.0158	2.71	3.84	5.02	6.63	7.88
2	.0100	.0201	.0506	.1026	.2107	4.61	5.99	7.38	9.21	10.60
3	.0717	.115	.216	.352	.584	6.25	7.81	9.35	11.34	12.84
4	.207	.297	.484	.711	1.064	7.78	9.49	11.14	13.28	14.86
5	.412	.554	.831	1.15	1.61	9.24	11.07	12.83	15.09	16.75
6	.676	.872	1.24	1.64	2.20	10.64	12.59	14.45	16.81	18.55
7	.989	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48	20.28
8	1.34	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09	21.96
9	1.73	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67	23.59
10	2.16	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21	25.19
11	2.60	3.05	3.82	4.57	5.58	17.28	19.68	21.92	24.73	26.76
12	3.07	3.57	4.40	5.23	6.30	18.55	21.03	23.34	26.22	28.30
13	3.57	4.11	5.01	5.89	7.04	19.81	22.36	24.74	27.69	29.32
14	4.07	4.66	5.63	6.57	7.79	21.06	23.68	26.12	29.14	31.32
15	4.60	5.23	6.26	7.26	8.55	22.31	25.00	27.49	30.58	32.80
16	5.14	5.31	6.91	7.96	9.31	23.54	26.30	28.85	32.00	34.27
17	5.70	6.41	7.56	8.67	10.09	24.77	27.59	30.19	33.41	35.72
18	6.26	7.01	8.23	9.39	10.86	25.99	28.87	31.53	34.81	37.16
19	6.84	7.63	8.91	10.12	11.65	27.20	30.14	32.85	36.19	38.58
20	7.43	8.26	9.59	10.85	12.44	28.41	31.41	34.17	37.57	39.40
21	8.03	8.90	10.28	11.59	13.24	29.62	32.67	35.48	38.93	41.40
22	8.64	9.54	10.98	12.34	14.84	30.81	33.92	36.78	40.29	42.80
23	9.26	10.20	11.69	13.09	14.85	32.00	35.17	38.08	41.64	44.18

Table K–1
Chi-square (X^2) values—Continued

d	X^2 .005	X^2 .01	X^2 .025	X^2 .05	X^2 .10	X^2 .90	X^2 .95	X^2 .975	X^2 .99	X^2 .995
24	9.89	10.86	12.40	13.85	15.66	33.20	36.42	39.36	42.98	45.56
25	10.52	11.52	13.12	14.61	16.47	34.38	37.65	40.65	44.31	46.93
26	11.16	12.20	13.84	15.38	17.29	35.56	38.89	41.92	45.64	48.29
27	11.71	12.88	14.57	16.15	18.11	36.74	40.11	43.19	46.96	49.64
28	12.46	13.56	15.31	16.93	18.94	37.92	41.34	44.46	48.28	50.99
29	13.12	14.26	16.05	17.71	19.77	39.09	42.56	45.72	49.59	52.34
30	13.79	14.95	16.79	18.49	20.60	40.26	43.77	46.98	50.89	53.67
44	23.55	25.12	27.56	29.78	32.49	56.36	60.48	64.21	68.73	71.93
171	127.10	130.92	136.67	141.75	147.77	195.09	202.52	209.11	216.96	227.61

Appendix L
"F" Tables

L–1. Background

The F–values for various combinations of degrees of freedom for numerator and denominator, are shown in tables L–1 and L–2. The degrees of freedom for numerator, d_1, are shown across the top of the table and the degrees of freedom for denominator, d_2, are shown along the left side of the table. The proportion of probability of F–values less than, or equal to the table values for table L–1 is .95, and for table L–2, .90.

L–2. Example

The general shape of the distribution and the range of F–values are shown in figure L–1.

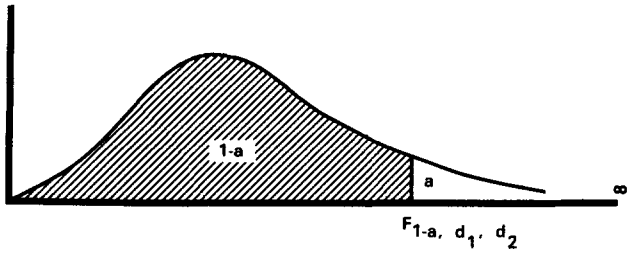


Figure L–1. General shape and range of F values

Table L–1
$F_{.95,d_1,d_2}$ values

	d_1									
d_2	1	2	3	4	5	6	7	8	9	10
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40
3	10.13	9.35	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.5	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30

Table L–1
$F_{.95,d_1,d_2}$ values—Continued

	d_1									
d_2	1	2	3	4	5	6	7	8	9	10
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91
	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83

Table L–2
$F_{.90,d_1,d_2}$ values

	d_1									
d_2	1	2	3	4	5	6	7	8	9	10
1	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86	60.19
2	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39
3	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23
4	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92
5	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30
6	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94
7	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70
8	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.50
9	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42
10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32
11	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25
12	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19
13	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14
14	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10
15	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06
16	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06	2.03
17	3.30	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03	2.00
18	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00	1.98
19	2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98	1.96
20	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94
21	2.96	2.57	2.36	2.23	2.14	2.08	2.02	1.98	1.95	1.92
22	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90
23	2.94	2.55	2.34	2.21	2.11	2.05	1.99	1.95	1.92	1.89
24	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88

Table L–2
$F_{.90,d_1,d_2}$ values—Continued

	d_1									
d_2	1	2	3	4	5	6	7	8	9	10
25	2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89	1.87
26	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86
27	2.90	2.51	2.30	2.17	2.07	2.00	1.95	1.91	1.87	1.85
28	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84
29	2.89	2.50	2.28	2.15	2.06	1.99	1.93	1.89	1.86	1.83
30	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82
40	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76
60	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71
120	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65
	2.72	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60

Appendix M
"t" Table

M–1. Background

The values of t for various degrees of freedom are shown here in table M–1. The degrees of freedom, d, are given in the first column and t–values are given in the remaining columns.

a. The proportion or probability of t–values less than, or equal to, the table values in the last row is the same as the Z–values under the standard normal distribution.

b. Since distributions are symmetrical about zero, the lower tail values are the negative of the values shown, when the subscript is interpreted as the area to the right of the value. For example, t–values for a 95 percent confidence level are under the $t_{.975}$ column.

M–2. Example

The general shape of the distribution and the range of t–values are as shown in figure M–1.

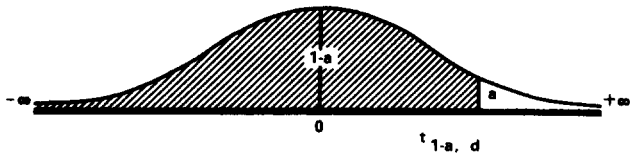


Figure M–1. General shape and range of t values

Table M–1
"t" values values

d	t_{90}	t_{95}	t_{975}
1	3.078	6.314	12.706
2	1.886	2.920	4.303
3	1.638	2.353	3.182
4	1.533	2.132	2.776
5	1.476	2.015	2.571
6	1.440	1.943	2.447
7	1.415	1.895	2.365
8	1.397	1.860	2.306
9	1.383	1.833	2.262
10	1.372	1.812	2.228
11	1.363	1.796	2.201
12	1.356	1.782	2.179
13	1.350	1.771	2.160
14	1.345	1.761	2.145
15	1.341	1.753	2.131
16	1.337	1.746	2.120
17	1.333	1.740	2.110
18	1.330	1.734	2.101
19	1.328	1.729	2.093
20	1.325	1.725	2.086
21	1.323	1.721	2.080
22	1.321	1.717	2.074
23	1.319	1.714	2.069

Table M–1
"t" values values—Continued

d	t_{90}	t_{95}	t_{975}
24	1.318	1.711	2.064
25	1.316	1.708	2.060
26	1.315	1.706	2.056
27	1.314	1.703	2.052
28	1.313	1.701	2.048
29	1.311	1.699	2.045
30	1.310	1.697	2.042
	1.282	1.645	1.960

Appendix N
Quality Assurance FIN–REP Review List

N–1. General

a. Use this list in the quality assurance (QA) evaluations for the Manpower Staffing Standards Studies Final Report (FIN–REP).

b. The list is to be used by both commands and USAMARDA before the FIN–REP is approved. A completed copy of this list will be submitted with the FIN–REP.

N–2. Instructions for use

Check the finished FIN–REP against the list. An answer to each question is required and an explanation in the FIN–REP is required for each "no" answer. Local reproduction of table N–1 is authorized.

Table N–1
Quality Assurance FIN–REP review list

Item	Yes	No
Memorandum of transmittal (para 4–54)		
1. Does the FIN–REP address all issues of nonconcurrence concerning the FIN–REP?	____	____
2. Does it include, as an enclosure, a copy of a completed FIN–REP review list with rationale for all "no" responses?	____	____
Master schedule (para 4–51)		
1. Has the master schedule been updated to include actual direct labor used to date?	____	____
2. Has the master schedule been updated to include any changes in study phases?	____	____
3. Has the master schedule been updated to include any changes to AFD codes?	____	____
Distribution (para 4–54)		
Have four copies of the FIN–REP been forwarded to USAMARDA (PEMS–RA)?	____	____
Cover (para 4–44)		
1. Does it indicate the type of report, "MANPOWER STAFFING STANDARDS FINAL REPORT (FIN–REP)"?	____	____
2. Does it indicate the scope of the report, "ARMY COMMON" or "COMMAND UNIQUE"?	____	____
3. Does it address only one major functional area?	____	____
4. Does it indicate the title of the function or the major subfunction covered by the report?	____	____
5. Does it list the work center titles and the respective AFD codes covered by the report?	____	____
6. Does it indicate the study Proponent Command?	____	____
7. Does it indicate the preparing activity?	____	____
8. Does it indicate the dispatch date?	____	____
Pagination (para 4–45)		
1. Are all pages numbered consecutively within each part?	____	____
2. Are all required paragraphs within each part identified and numbered consecutively?	____	____
Table of contents (para 4–45)		
1. Are all six required chapters identified and numbered consecutively?	____	____
2. If required, does it have the appropriate security classification and are the pages marked accordingly?	____	____
Part I—Administrative Data (para 4–46)		
Chapter 1—Introduction (para 4–47)		
1. Overview.		
a. Does the overview state the function or major subfunction under study and the principal functional responsibilities?	____	____
b. Does the overview state the work center(s) under study?	____	____
c. For command unique standards, does the overview state the total (original) baseline TDA requirements, total standard requirements (based on initial application), and discuss the difference? For Army common standards, does the overview state the total baseline TDA requirements and total standard requirements for the measurement sites, and discuss the differences?	____	____
d. Does the overview state the total cost of the study and address cost saving?	____	____
e. Does the overview indicate if the function was studied in its entirety, or if the function was studied in parts requiring more than one study.	____	____
f. For Army common standards, does the overview provide a brief statement of the study indicating that the FIN–REP was preceded by the SDP and the MEAS–PLAN and how the FIN–REP will be followed by initial application of the standards?	____	____
g. Does the overview state if any staffing guides will be replaced by the standard(s)?	____	____
h. Does the overview state the Proponent Command responsible for the study?	____	____
i. Does the overview identify the authority for conducting the study?	____	____
j. Does the overview indicate that the data adjustments were coordinated with the functional proponent(s) at all measurement locations?	____	____
k. MEAS–PLAN resolutions.	____	____
(1) Does the overview state any resolutions required as a result of the MEAS–PLAN review?	____	____
(2) Are the resolutions discussed in the applicable section of the FIN–REP?	____	____
2. Background.		

Table N–1
Quality Assurance FIN–REP review list—Continued

Item	Yes	No
a. Does the study indicate if there have been any previous MS–3 studies for the work center(s) included in this study?	____	____
b. Does the study indicate if there have been any standards developed by other DOD activities for the work center(s) included in this study?	____	____
c. Does the study indicate other reports which were used?	____	____
d. Does the study indicate whether or not a MARC study was conducted on similar MTOE work centers?	____	____
3. Applicability.		
a. Is the scope (ARMY COMMON or COMMAND UNIQUE) identified?	____	____
b. Are the agencies and commands covered by the study identified?	____	____
4. Universe identification.		
a. Does the MEAS–PLAN matrix show work center baseline TDA requirements by location, commond, and UIC?	____	____
b. Does it state whether or not changes to the MEAS–PLAN work center matrix were made?	____	____
c. If changes were made to the MEAS–PLAN matrix, is supporting rationale provided?	____	____
d. Does it list the locations to which the standard is not expected to apply and provide supporting rationale?	____	____
5. Mission.		
a. Mission. Is an overview of the mission and functional responsibilities provided?	____	____
b. Organization charts.	____	____
(1) Is the organization chart(s) from the MEAS–PLAN provided indicating the typical organizational structure(s) at the beginning of the preliminary phase?	____	____
(2) Does it state if changes were made to the MEAS–PLAN organization chart(s)?	____	____
(3) If changes were made to the MEASPLAN organization chart(s), is supporting rationale provided?	____	____
(4) If applicable, is there an organizational chart showing any change(s) resulting from the study?	____	____
6. Functional diagram.		
a. Is a copy of the MEAS–PLAN functional diagram provided?	____	____
b. Does it state whether or not changes to the MEAS–PLAN functional diagram were required?	____	____
c. If changes to the MEAS–PLAN functional diagram were requried, does it provide the following?	____	____
(1) A second functional diagram of the entire function or major subfunction with a breakout by work center?	____	____
(2) All work centers identified with approved AFD titles & codes?	____	____
(3) Work centers under study?	____	____
(4) Rationale for the changes?	____	____
7. Study partcipants. Are the following identified?	____	____
a. Study Proponent Command?	____	____
b. HQDA Functional Proponent(s)?	____	____
c. Command Functional Proponent(s)?	____	____
d. USAMARDA point(s) of contact (POC)?	____	____
e. Lead team members?	____	____
f. Measurement teams by command?	____	____
Chapter 2—Standards Development Information (para 4–48)		
1. Graph of the standard equation.		
a. Does the graph of the standard equation follow DA Form 5279–R in the FIN–REP?	____	____
b. Does it show the dependent variable representing man-hours and the independent variable representing workload factor volumes?	____	____
c. For standards using regression analysis with linear, power curve, or parabola models.		
(1) Does it indicate the measurement locations with small “x”s?	____	____
(2) Are points not used in computing the equation circled?	____	____
(3) Are $\pm 2S_{yx}$ boundaries shown?	____	____
(4) Are the equation, S_{yx}, r^2, and V shown?	____	____
(5) For Type I standard(s), is r^2 equal to or greater than .75?	____	____
(6) For Type I standard(s), is the coefficient of variation equal to or less than .15?	____	____
(7) For Type II standard(s), is r^2 equal to or greater than .50?	____	____
(8) For Type II standard(s), is the coefficient of variation equal to or less than .25?	____	____
d. For single-point standards using Fixed, Variable, and Personnel-generated ratio unit times—		
(1) Is the Y-intercept (fixed cost) computed?	____	____
(2) Is the personnel-generated man-hour factor computed and included in the equation computation?	____	____
(3) Does it have variable man-hour values computed for workload factor(s) that impact on manning requirements?	____	____
2. Explanation of measurement approach.		
a. Does the FIN–REP state if the MEAS–PLAN measurement instructions and data collection procedures were followed precisely?	____	____
b. Does the FIN–REP state if the man-hours and associated work counts collected on-site used approved MS–3 work measurement methods?	____	____
c. Are the measurement methods discussed?	____	____
(1) Directed requirement.		
(a) Are directed requirements identified and detailed discussion of each provided?	____	____
(b) If the position is one-of-a-kind in a work center, if sufficient workload does not exist to justify the position, and if the specialty in question cannot effectively perform other basic work center duties, does it show that a directed requirement position is not provided soley to establish responsibility?	____	____
(c) If the whole-man requirement is directed by HQDA, does it state the authority for the position?	____	____
(2) Locally-directed requirements. Does it identify and provide a detailed discussion of the treatment of any locally-directed requirements?	____	____
(3) Minimum manpower or standby requirements.	____	____
(a) Are minimum manpower of standby requirements identified?	____	____

Table N–1
Quality Assurance FIN–REP review list—Continued

Item	Yes	No
(b) Does it provide a detailed discussion of the treatment of any standby time?	____	____
(4) Does it identify and provide a detailed discussion on the treatment of any delay time?	____	____
(5) Does it identify and provide a discussion of the treatment of any on-call time, and show that only productive time expended during on-call status was included?	____	____
(6) Standard time data.	____	____
(a) If standard time data were used, does the FIN–REP identify sources of predetermined or standard time data used?	____	____
(b) Is rationale provided for using standard time data?	____	____
d. Does the FIN–REP state that the WCD was used as the point of departure for measurement?	____	____
e. Is there a discussion of whether categories/tasks not found in the approved WCD were included or disallowed?	____	____
f. Is there a discussion of any exceptions which were developed as a result of work measurement?	____	____
3. Analysis of completed measurement forms.		
a. DA Form 5274–R.		
(1) Does the FIN–REP include a DA Form 5274–R for each measurement location in Section II of the FIN–REP?	____	____
(2) Is it prepared IAW instructions contained in AR 570–5?	____	____
(3) Were fractional manpower requirements listed in the measurement teams DA Form 5274–R exactly computed?	____	____
(4) Does it show the minimum manpower calculations, if any?	____	____
(5) Does it show standby time, if any?	____	____
(6) Adjustments.		
(a) If adjustments were made to the measurement team(s) input DA Form 5274–R, is the adjusted DA Form 5274–R placed in front of the original DA Form 5274–R?	____	____
(b) Are the adjustments identified?	____	____
b. DA Form 5278–R (if work sampling was performed).	____	____
(1) Was DA Form 5278–R prepared IAW instructions contained in AR 570–5?	____	____
(2) Was the MEAS–PLAN sampling period followed?	____	____
(3) Were the required number of samples identified in the MEAS–PLAN collected?	____	____
(4) Was minimum of 25% of sampled observations of each worker pace rated?	____	____
(5) Was meal break (lunch) sampled as a separate nonproductive category?	____	____
(6) Was inferred, assumed, or questionable work identified and sampled as nonproductive?	____	____
(7) Was inferred or assumed work credited as productive samples to the work center to which it belongs?	____	____
(8) Were categories/tasks man-hours that were measured by other methods as part of a work sampling recorded as other productive time?	____	____
(9) Were productivity charts developed after 5 days of sampling and plotted daily?	____	____
(10) Was a WLF control chart completed during the work sampling?	____	____
(11) Do work sampling data have 3% absolute accuracy with a minimum of 2 weeks sampled?	____	____
(12) Was the largest productive category percent of occurrence used to determine the number of required samples?	____	____
(13) For single-location standard(s), were man-hour data separated into fixed, variable, and personnel-generated hours according to the various categories/tasks in the WCD?	____	____
(14) When required, was a shift profile chart developed to use in determining proper manpower?	____	____
(15) Has the lead team retained a copy of DA Form 5278–R for each measurement site?	____	____
c. DA Form 5275–R (if time study was performed).		
(1) Was DA Form 5275–R prepared IAW instructions contained in AR 570–5?	____	____
(2) Was the same task/element description identified for all measurement locations?	____	____
(3) Were the required number of samples identified in the MEAS–PLAN collected?	____	____
(4) Were there an adequate number of good readings obtained during the time study?	____	____
(5) Were PF&D allowances applied to separate activities?	____	____
(6) Was each timed element pace rated?	____	____
(7) Were appropriate DD Forms 2041, 2042–1, and/or 2043 included?	____	____
(8) Has the lead team retained a copy of each measurement form for each measurement site?	____	____
d. DA Form 5277–R (if operational audit was performed).		
(1) Was it prepared IAW instructions contained in AR 570–5?	____	____
(2) Directed requirement. Does it show, for whole-man requirements established by directed requirement, the appropriate availability factor multiple in column g?	____	____
(3) Good operator.	____	____
(a) Were sufficient samples taken to accurately estimate per accomplishment times?	____	____
(b) Were PF&D allowances applied to each task measured?	____	____
(c) Were MEAS–PLAN instructions for tasks, subtasks, or elements to be good operator timed followed?	____	____
(4) Were PF&D allowances excluded from man-hours developed by directed requirement, historical performance, and technical estimate techniques?	____	____
(5) If varying per accomplishment times and frequencies of occurrence were encountered, were supplemental DA Forms 5277–R submitted showing the documented frequency and time determination?	____	____
(6) If categories/tasks not in the WCD were measured, were supplemental DA Form 5277–R included with supporting rationale?	____	____
(7) Has the lead team retained a copy of DA Form 5277–R (and any supplementals) for each measurement site?	____	____
e. Were all data analyzed to ensure time has been included only for required work?	____	____
(1) Was time for study of career development material excluded?	____	____
(2) Was a worker's time learning-while-producing recorded in the appropriate productive category?	____	____
(3) Was OJT time expended by a worker in a directly supervised, on-the-job proficiency status treated as productive indirect?	____	____
(4) Training.	____	____
(a) Was training and associated travel that requires TDY attendance treated as nonavailable time?	____	____

Table N–1
Quality Assurance FIN–REP review list—Continued

Item	Yes	No
(b) Was training time treated as nonavailable if it was substitued for a one-time attendance at a formal residence course of instruction away from home installation?	____	____
(c) Was training time treated as productive indirect if it was of a recurring nature similar to, or in place of, normal OJT or proficiency training?	____	____
(d) Was general military training time treated as nonavailable?	____	____
(5) Cleanup.		
(a) Was time for work center cleanup treated as productive indirect?	____	____
(b) If cleanup time was included, were steps taken to ensure that it does not duplicate time in PF&D allowances?	____	____
f. Allowance factors.		
(1) Were PF&D allowances developed IAW instructions contained in AR 570–5?	____	____
(2) If allowance factors were developed by the lead team and included in the MEAS–PLAN, were they used by the input teams, or was rationale provided when another allowance factor was used?	____	____
(3) Were values and supporting rationale analyzed for any PF&D allowances that exceeded an established norm?	____	____
(4) Were allowance factors applied to all appropriate productive categories/tasks?	____	____
(5) Were allowance factors properly applied during work measurement?	____	____
(6) Is there an explanation when separate PF&D allowances were given to separate sampled productive categories/tasks within the same work center?	____	____
g. Were all measurement forms checked for calculation accuracy?	____	____
4. Comprehensive explanation of data analysis and computations.		
a. Is there a comprehensive explanation of the analysis and computations performs?	____	____
b. Representativeness of data.		
(1) Was an analysis of WLF control charts made to determine the representativeness of the measurement period, to verify work count accuracy, and to identify abnormal workloads?	____	____
(2) If different modes of work center operation were used, does the historical workload represent the current mode?	____	____
(3) When work sampling was used, was it conducted over a representative period of time or work cycle?	____	____
(4) Was an analysis made of the representativeness of the work counts?	____	____
(5) Do man-hours and workload data represent like periods of time?	____	____
c. Data adjustments.		
(1) Does it include a discussion of analysis of like category/task time variances?	____	____
(2) Does it identify any adjustments made to the study data if data were not used exactly from the measurement locations' DA Forms 5274–R and DA Forms 5277–R?	____	____
(3) If adjustments were made as cited above, is rationale provided?	____	____
(4) Were data adjusted only to ensure a representative statement of work center manpower requirements?	____	____
(5) Were exception adjustments made IAW procedures in AR 570–5?	____	____
(6) Were data adjustments coordinated with the measurement location or command functional proponent(s)?	____	____
5. Workload factor data.		
a. Is a matrix of the workload factor(s) used to develop the standard provided showing monthly counts and average monthly count by measurement location?	____	____
b. For standards using regression analysis, is a matrix of workload factors tested provided showing the value of the WLF tested and the corresponding allowed man-hours by measurement location?	____	____
(1) Is the workload factor(s) used in the standard asterisked and listed first?	____	____
(2) Do the workload factor values in the matrix reflect at least 6 months' (12 months' preferred) data?	____	____
6. Work unit data.		
a. Have the matrices reflecting the historical work unit count used in developing per accomplishment times for each measurement location been retained by the lead team?	____	____
b. Were at least 6 months' (12 months' preferred) data provided?	____	____
7. Regression analysis and model selection summary.		
a. Was an analysis of data reliability performed?	____	____
b. Were hypothesis formulated and tested for significant differences between data?	____	____
c. Model selection. Does it discuss how the criteria were used in determining acceptable models, if regression analysis was used?	____	____
(1) Does the selected equation pass the extreme value (R) test, the significance (F) test of the regression equation, and the student (t) test of the regression coefficients?	____	____
(2) Does it show the selected model is realistic?	____	____
(3) Does it show the selected model is economical?	____	____
(4) Does it list data points excluded from subsequent regression analysis with rationale for exclusion?	____	____
(5) If data points were excluded, were sufficient data collected to provide a representative sample?	____	____
(6) Does it provide rationale for data points included in the regression of the accepted equation which were beyond ± $1S_{yx}$ from the regression line?	____	____
d. Matrix of models tested.		
(1) Does it show a matrix of all models tested with S_{yx}, r^2, V, and significance test performed for each model?	____	____
(2) Is the equation selected for use in the standard listed first?	____	____
(3) Are equations tested but found not acceptable shown second with their statistical tests or parameters?	____	____
e. Matrix of residuals. Is a matrix with the WLF values used for the standard, computed man-hours, allowed man-hours, residuals (difference between the allowed and computed man-hours) by measurement site provided?	____	____
f. Required, authorized, and assigned strength.		
(1) Is a matrix provided showing the baseline TDA requirements, authorizations, assigned strength, standard requirements, standard exception requirements, and differences between TDA requirements and standard requirements (with exceptions) by MOS/series for each measurement location?	____	____
(2) Is the EDATE for the baseline TDA requirement and authorization data provided?	____	____
8. Single-point standard development summary.		

Table N–1
Quality Assurance FIN–REP review list—Continued

Item	Yes	No
a. Are fixed, variable, and personnel-generated man-hours and WLF values identified?	____	____
b. Are the procedures used to develop a single-point standard discussed?	____	____
c. Is the G factor identified?	____	____
9. Nonmeasurement (Type II) standards development summary. Is the following included?		
a. A logical analysis of the development, acceptability, and applicability of each standard.	____	____
b. Explanation of the data base/data source used to develop the standard.	____	____
c. Any additional information on the source and reliability of the data that might aid in the evaluation and acceptance of the standard.	____	____
10. Extrapolation limits computations.		
a. Are extrapolation limits determined IAW instructions in AR 570–5, Chapter 4?	____	____
b. Does it show the steps used to develop the extrapolation limits?	____	____
11. Skill analysis.		
a. Does it include a detailed explanation of the methodology used to determine skills?	____	____
b. Does the FIN–REP state if each measurement location recommended a skill distribution?	____	____
c. Do recommended skills comply with the concept that workers will spend the majority of work time performing tasks at the highest skill level?	____	____
d. Was the composition of measured work given the most weight in the final determination of skills?	____	____
e. Are officer positions justified by responsibilities and duties specifically requiring an officer?	____	____
f. Are senior level enlisted positions used in place of lower grade officers and warrant officers when practical and feasible?	____	____
g. Were skill-level criteria followed?	____	____
h. Were sufficient skills provided for multishift operations?	____	____
i. Were military MOSs and/or civilian series reflected in the final determination?	____	____
j. For non-measured (Type II) standards, when the activity covered was studied in such a manner that skill requirements cannot be determined, is an explanation provided?	____	____
12. Statement of conditions (SOC).		
a. Is a statement of conditions (SOC) provided?	____	____
b. Was it prepared IAW instructions contained in AR 570–5?	____	____
c. Does it agree with the MEAS–PLAN SOC?	____	____
d. Are there explanations and resolutions of various standard of living situations?	____	____
13. Aviation requirements.		
a. Does it include a detailed explanation for the establishment and measurement of work categories requiring aviation expertise?	____	____
b. Are aviation specialties required only when duties clearly require such expertise?	____	____
Chapter 3—Program Estimating Equations (PEE) (para 4–49)		
1. General.		
a. If PEEs are not used, is the method of programming manpower requirements shown?	____	____
b. Does it cover the aggregation of requirements covered by the standard?	____	____
c. Has a PEE been developed for the appropriate functional level?	____	____
d. Is the selected PEE programmable?	____	____
e. Were PEFs developed using data from all measurement locations to which the PEEs will apply?	____	____
f. Do the WLF data used in the standard application coincide with the same period covered by the historical PEF?	____	____
g. Was a deviation factor developed?	____	____
h. Was a separate equation developed for each location?	____	____
i. Are requirements properly distributed to work centers covered by the PEE?	____	____
2. Work center PEEs.		
a. Does it include PEE analysis and development on a work center-by-work center basis?	____	____
b. Do the procedures used follow those for reporting standards development?	____	____
c. For each PEF, was regression analysis performed using both linear and curvilinear models?	____	____
d. PEF values matrix.		
(1) Is a matrix provided showing manpower values and PEF values by location?	____	____
(2) Does it list PEF(s) used in the PEE first and show them asterisked?	____	____
e. Acceptable criteria.		
(1) Are the criteria used to determine acceptable PEEs listed?	____	____
(2) If regression analysis was not used, is the procedure used explained?	____	____
(3) Are all equations found acceptable listed with r^2, S_{yx}, V, and significance tests used?	____	____
(4) Is the accepted PEE listed first?	____	____
(5) Are unacceptable regression equations shown?	____	____
(6) Are excluded data points shown with explanation?	____	____
(7) Does it include a detailed explanation of the PEE application to include diviation factors?	____	____
3. Total study PEE		
a. Are all items required for work center PEEs included?	____	____
b. If used, are percentage distributions for manpower requirements shown?	____	____
Chapter 4—General Additions (para 4–50)		
1. Methods improvements. If there were any methods of procedures improvements installed during the study, are they discussed?	____	____
2. Host-tenant/inter-service support agreements.		
a. Is the effect of support agreements on the application of the standards explained?	____	____
b. Does it include a list of tenant units supported?	____	____
c. Are work centers and locations to which each agreement applies indicated?	____	____

Table N–1
Quality Assurance FIN–REP review list—Continued

Item	Yes	No
d. Is there significant fluctuation in tenant supported workload that would present problems in programming manpower explained?	____	____
e. Is average monthly workload generated by the tenant depicted?	____	____
3. Contract services. Were there any contract services having an impact on the work center(s) under study?	____	____
4. Other significant comments. Are there any other significant comments that do not appear elsewhere in this report?	____	____
Chapter 5—Program Management Data (para 4–51)		
1. Program management data, DA Form 5276–R.		
a. For Army standard(s), are personnel costs and temporary duty costs provided on DA Form 5276–R, showing the cost of the study to date?	____	____
b. For command standard(s), is the DA Form 5276–R completed in its entirety?	____	____
c. Has DA Form 5276–R been prepared IAW instructions in AR 570–5?	____	____
2. Manpower impact for command standards.		
a. Is a manpower impact matrix provided for each command standard showing baseline TDA requirements, standard requirements, standard exception requirements, and differences between baseline TDA requirements and standard (with exceptions) requirements for each locations?	____	____
b. Are the EDATEs for the TDA data provided?	____	____
c. Are any manpower adjustments made to the requirements in the manpower impact matrix explained?	____	____
Part II—Manpower Staffing Standard Data (para 4–52)		
Chapter 6—Manpower Staffing Standard (para 4–53)		
1. Sections. Is there a separate section for each standard and does Part Two start on a new sheeet of paper?	____	____
2. Content of standard data.		
a. Objective.		
(1) Is there a statement describing the purpose of the standard?	____	____
(2) Are there two subparagraphs showing—		
(a) Authority. Is there a listing of all directives/regulations governing the standard?	____	____
(b) Applicability. Does it identify who the standard does or does not apply to?	____	____
b. Standard data.		
(1) Scope and classification of the standard. Is the scope (ARMY COMMON or COMMAND UNIQUE) and classification (TYPE I or TYPE II) of the standard identified?	____	____
(2) Date approved. Is the approval date of the standard shown?	____	____
(3) Man-hour data sources. Is the technique for man-hour data sources shown?	____	____
c. Application.		
(1) Is the valid man-hour data range shown?	____	____
(2) Does it indicate if the extrapolation limits can exceed the manpower table limits?	____	____
(3) Does it indicate when to make man-hour adjustments?	____	____
d. Workload factor and equation.		
(1) Does it give the WLF title?	____	____
(2) Does it give the WLF definition?	____	____
(3) Does it give the sources of count?	____	____
(4) Does it give the standard man-hour equation?	____	____
(5) Does it indicate if there is a PEF and give the PEE?	____	____
e. Statement of conditions (SOC). Does it give the SOC?	____	____
f. WCD summary (direct). Does it give the WCD summary (direct) categories as required by AR 570–5?	____	____
g. WCD detail (direct). Does it give the WCD detail (direct) categories as required by AR 570–5	____	____
h. WCD detail (indirect). Does it give the WCD detail (indirect) categories as required by AR 570–5?	____	____
i. Application instructions.		
(1) Are all appropriate application instructions given?	____	____
(2) Is the standard statement required by AR 570–5 contained here?	____	____
j. Manpower table.		
(1) Has the manpower table been prepared correctly?	____	____
(2) Does it contain all of the required information?	____	____
k. Manpower exceptions.		
(1) Are all additives, exclusions, or deviations applicable to the standard shown next?	____	____
(2) Do they contain the same information as required in *a* through *j* above?	____	____
(3) Is a new manpower table required?	____	____

Appendix O
Mathematical Symbols

The following are mathematical symbols used in this document

Mathematical Symbols

AD	average deviation
D	delay
d_i	installation deviation factor
E	sampling error
F	F-value (time study), fixed time, fatigue, frequency
f	f-test statistic
G	personnel-generated factor
N	total number of samples, readings, days, widgets, etc.
N′	total number of estimated or required samples, readings, days, etc.
$\bar{N}$	average number of samples, readings, days, etc.
P	personal, probability
$\bar{P}$	percent occurrence—actual
$\bar{P}'$	percent occurrence—estimated
PG	personnel-generated man-hours
R	R-values for extreme value test, rating(s) (individual), ratio value (X/Y); running time
$\bar{R}$	rating(s)(average)
r	coefficient of correlation
r^2	coefficient of determination
s	accuracy of a sample (absolute)
S	deviation of sample standard
S_b	standard error for predicted values
S_x	standard deviation (sample), independent variable
S_y	standard deviation (sample), dependent variable
S_{yc}	total sampling error
S_{yx}	standard error of estimate
T	lapsed time
t	t-test statistic
V	coefficient of variation (S_{yx}/Y), variable time
X	independent variable
$\bar{X}$	arithmetic mean of X values
Y	dependent variable
$\bar{Y}$	arithmetic mean of Y values
Y_c	calculated value of dependent variable
Σ	(sigma) sum of
σ_y	standard deviation (dependent variable)
σ_x	standard deviation (independent variable)
$\bar{p}$	standard deviation of percentage
α	(Alpha) level of significance
μ	(mu) true population mean
$\sqrt{}$	(radical) square root

Figure O–1. Mathematical Symbols

Glossary

Section I
Abbreviations

AAF
Army availability factor

ADP
automatic data processing

AF
allowance factor

AFD
Army functional dictionary

AFD(SWC) code
Army functional dictionary standard work center code

AMOPS
Army Mobilization and Operations Planning System

ARNG
Army National Guard

ASA(FM)
Assistant Secretary of the Army (Financial Management)

CA
commercial activities

CCNUM
command control number

DF
deviation factor

EDATE
effective date

EER
enlisted efficiency report

ENW
effective net weight

ER
efficiency review

F
fixed

FIN–REP
Manpower Staffing Standards Study Final Report

FOA
field operating agency

G
power generated

IG
inspector general

ITAADS
Installation The Army Authorization Documents System

JIRSG
Joint Interservice Retail Study Group

LCL
lower control limit

MAF
manpower availability factor

MARC program
Manpower Requirements Criteria program

MEAS–PLAN
Manpower Staffing Standards Study Measurement Plan

MEAS–REP
Manpower Staffing Standards Study Measurement Report

MEO
most efficient organization

MOC
management of change

MOS
military occupational specialty

MS–3
Manpower Staffing Standards System

MTOE
modified table of organization and equipment

NGB
National Guard Bureau

NT
nontransferrable

OA
operational audit

OER
officer efficiency report

OERP
Organizational Efficiency Review Program

OJT
on-the-job training

OMB
Office of Management and Budget

OSD
Office of the Secretary of Defense

PAT
per accomplishment time

PEE
program estimating equation

PEF
program estimating factor

PERT
Program Evaluation and Review Technique

PF&D
personal, fatigue, and delay

PMF
position manpower factor

PPBES
planning, programming, budgeting, and execution system

PWLF
potential workload factor

QA
quality assurance

SAM
Society for Advancement of Management

SAS
standards application summary

SDP
Manpower Staffing Standards Study Development Plan

SOC
Statement of Conditions

SWC
standard work center

T
transferrable

TAADS
The Army Authorization Documents System

TDA
tables of distribution and allowances

TDY
temporary duty

UCL
upper control limit

UIC
unit identification code

USAMARDA
US Army Manpower Requirements and Documentation Agency

USAPPA
U.S. Army publications and Printing Agency

USAR
United States Army Reserve

VTAADS
Vertical The Army Authorization Documents System

WCD
Work center description

WLF
workload factor

WU
Work unit

Section II
Terms

Accountable time
Total man-hours for which the work center supervisor is held accountable in determining productive or operational efficiency. It equates to assigned time, plus borrowed time, plus overtime, minus nonavailable time, minus loaned time.

Activity sampling
Observing worker activity at random intervals and classifying the activity into predetermined groupings of work.

Actual data
Data obtained from existing data collection systems.

Actual time
Time taken to do a defined amount of work. In time study, it is the observed time recorded from the watch readings. In work sampling, it is the portion of total sampled time expended on each sampled category.

Additive
Work done that is not part of the basic work center description and therefore not part of the basic work center manpower staffing standard.

Additive standard
A manpower staffing standard for additive workload. Also, see additive.

Adjunctive allowance
Man-hours allowed for putting on and removing special clothing when required by the work performed. Used with personal, fatigue, and delay computation.

Adjustment factor
A specified computed value used to adjust an individual category time or associated work unit count.

Allowance
Work measurement: A time value of percentage of time by which the normal time is increased, or the amount of nonproductive time applied, to compensate for justifiable causes or policy requirements which necessitate performance time not directly measured for each element or task. Usually includes irregular elements, incentive opportunity on machine control time, minor unavoidable delays, rest time to overcome fatigue, and time for personal needs.

Allowance factor
A coefficient based on authorized allowances; for example, PF&D, which when applied to productive time (leveled time, if appropriate), results in the productive allowed time.

Allowed time
The leveled time plus allowances for fatigue and delays. If leveling is neither required nor feasible, the allowed time is the actual productive time plus necessary allowances for personal, fatigue, and unavoidable delays, as appropriate.

Ancillary training
See training (ancillary).

Application
See standard application.

Army availability factor
The average number of man-hours per month that an assigned individual is available to perform primary duties. Monthly required man-hours are divided by the AAF to determine the manpower requirements.

Army common manpower staffing standard
A manpower standard that applies to, and is prescribed for use by, two or more commands (MACOM and/or Agencies).

Army skills and grades determination process
A procedure used to evaluate work center tasks and relate them to specialty (series) skills and grades.

Army Staff participant
The HQDA functional representative with the responsibility to help develop a specific manpower staffing standard.

Assigned
State of belonging to a unit and being counted as part of that unit's assigned strength.

Assigned time
The normal duty hours prescribed for individuals assigned to TDA organizations. To facilitate the determination of work center capability (available time), total assigned time and net assigned time are used. Total assigned time is defined as the normal duty hours prescribed during a specified period of time for the total complement of persons assigned to a TDA organization (total assigned hours are the product of the number of people assigned and the number of duty hours stipulated for the period, e.g., 40 hours per week, an average of 174 hours per month, 2,087 hours per year). Net assigned time is defined as the total assigned time less the duty hours not scheduled for work because of approved holidays. (Borrowed personnel are not classified as assigned for purposes of this computation.)

Assumed workload
Work being done which is not necessary to work center productivity. Assumed workloads are not compensated for in a standard.

Asymptote
A straight line associated with a curve such that, as a point moves along an infinite branch of the curve, the distance from the point to the line approaches zero as the point moves an infinite distance from the origin.

Available time
The total hours that assigned personnel are available to the work center to perform work. See Army availability factor.

Average monthly workdays
The average number of days a work center operates during a month to cover states required weekly hours of operation.

Average monthly workload
The arithmetical average of the actual monthly workload volumes.

Avoidable delay
A time delay not allowed in standard time calculations because it is unnecessary and is due solely to factors under worker control and responsibility. See idle time.

Backlog
An accumulated workload volume, not yet done. That portion of "work in progress" which is behind schedule or beyond the immediate capability of the processing organizations.

Base time
Represents the time which would be required for completion of a task under the circumstances defined as standard except that it does not include any time for the operator's personal needs, time lost due to delays and interruptions, or time lost due to other miscellaneous causes.

Benchmark
A standard of measure with enough characteristics common to the individual units of a population to facilitate economical comparison of attributes for selected units from a sample.

Bivariate equation
An equation that contains only two variables (such as X and Y).

Borrowed time
Time on loan from another work center.

Breakpoint
a. A point in a work cycle readily distinguished by sight and/or sound which is selected as the boundary between two elements, for time recording in time study or element definition in motion study.
b. The value of workload (or man-hours) in a manpower table which separates differing levels of manpower requirements.

Coefficient of determination (r^2)
A measure representing the proportion of variation in data that is explained by a regression line fit to those data.

$$r^2 = \frac{\text{explained variation}}{\text{total variation}}$$

Total variation is based on the sum of the squared deviations of the observed values (Y) from the mean ($\overline{Y}$). Explained variation is based on the sum of the squared deviations of the predicted value (Y_C) from the mean ($\overline{Y}$). Unexplained variation is based on the sum of the squared deviation of the observed values (Y) from the predicted values (Y_C). It is also equal to the total minus explained variation.

Coefficient of variation (V)
Expresses the standard deviation as a percentage of the arithmetic mean. The coefficient of variation is equal to the standard error of the estimate (S_{yx}) divided by the mean ($\overline{Y}$).

Command-directed additional duty
Command-directed task assigned on a regular and/or permanent basis which has not been designated to be performed by a specific work center.

Command unique manpower staffing standard
A manpower staffing standard that is applicable to only one specific command (MACOM or agency).

Confidence limits
Probability statements concerning the likelihood that the value of the true population lies within the range specified by a selected standard.

Controllable workload
Any work that can be held in controlled banks or aggregated and scheduled as the volume of noncontrollable and semicontrollable workloads permits.

Correlation analysis
Measures the strengths of the relationships between the measured man-hours and the workload factor.

Cycle

a. In time study, a sequence of elements in the performance of a task. An interval or span of time in which one set of elements occurs regularly and in the same sequence.

b. An interval or span of time during which a representative composition and amount of work is done in a work center.

Delay allowance

a. A time increment to allow for contingencies and minor delays beyond the control of the operator. May be included in a time standard as a percentage or as nonproductive time.

b. A separate credit (in time or money) to compensate the operator on incentive for a specific instance of delay not covered by the piece rate or standard.

Delay time

Time during which the worker is prevented from accomplishing productive work due to an occurrence which is essential but outside the worker's control or responsibility. Example: Aircraft mechanic awaiting transportation to take him or her to pick up a part needed to complete repairs.

Deviation

a. In statistics, distances by which numbers depart from their mean between measured man-hours and man-hours predicted by regression line (see deviation factor).

b. A situation in or affecting a work center that causes man-hours required to do approved work to vary from man-hours established by a manpower staffing standard. Such deviations exist only within the framework of approved work center descriptions and result in added or subtracted man-hours to the basic standard (see deviation factor). Typical causes are travel distances, climatic conditions, work distribution, unique mission requirements, equipment differences, and procedural differences.

Deviation factor

A numerical value constructed from an identified deviation which indicates its magnitude and its relationship to a norm (for example, unit time average, regression line, and PEE. A deviation is significant when the net deviation factor results in a change in manpower requirements for the work center.

Direct labor

Work which alters the composition, condition, conformation, or construction of the product, the cost of which can be identified with and assessed against a particular part, product, or group of parts or products accurately and without undue effort and expense.

Direct time

Productive time expenditure which can be identified with and assessed against a particular end product (work unit, workload factor, etc.) or group of products accurately and without undue effort and expense.

Directed additional duty

An HQDA-directed task assigned on a regular and/or permanent basis which has not been designated to be performed by a specific work center.

Directed requirement position

A position requirement which is established by HQDA directive. Such positions are not automatically added to the validated requirements of a work center. The overall work center requirements are first determined, and the directed requirement is then identified within that total.

Directed requirement technique

An operational audit technique which recognizes that many activities and some positions are directed requirements. These requirements may apply to whole-man positions; to directed frequencies, such as monthly inspections; or to directed time values, such as the periodic run-up of a standby electrical power generator.

Effort

The apparent physical and mental exertion exhibited by the worker while performing a segment of work.

Element

A subdivision of the work cycle composed of a sequence of one or several fundamental motions and/or machine or process activities, which is distinct, describable, and measurable.

Equivalent workload factor
A single constructed workload factor value derived by a weighting of multiple work units. The weighting process is done by selecting one unit as the "prime" work generator, assigning a value of 1.00 to it, and giving all other applicable work units a weighted value in relation to that prime factor.

Estimated sample (N′)
The anticipated minimum number of samples required to ensure a specified statistical accuracy and confidence in work sampling studies and time studies.

Exceptions
Any one or combination of the following causes requiring a manpower change to a multilocation manpower staffing standard: additive workload, excluded workload, or deviation.

a. Command exception to a command standard. A USAMARDA-approved standard, for which an exception to its applicability at one or more locations has been granted.

b. Command exception to an Army common standard. An USAMARDA-approved standard for which an exception to its applicability to one command has been approved.

c. Army exception to an Army common standard. A USAMARDA-approved standard for which an exception has been granted for two or more commands.

Exclusion
Work categories or tasks not required in one or more activities but commonly required in other like activities.

a. Command exclusion to a command standard. See command exception to a command standard.

b. Command exclusion to an Army common standard. See command exception to an Army common standard.

c. Army exclusion to an Army common standard. See Army exception to an Army common standard.

Extrapolation
Extension of the regression line beyond the range of the input data to increase standards' utility, to expand standards' applicability, and to prevent rapid obsolescence due to workload changes.

Extreme value test
A test to determine if the largest and smallest data points of a sample are a significant distance from the main cluster of other points.

Fatigue
A physical or mental weariness, real or imaginary, adversely affecting an individual's ability to perform work.

Fatigue allowance
Time included in the production standard to allow for decreases or losses in production which might be attributed to fatigue. (This is usually applied as a percentage of the leveled, normal, or adjusted time.)

Final Report
See Manpower Staffing Standards Study Final Report.

Fixed man-hours
Man-hours associated with categories and tasks which do not vary with the selected workload factors within the range of data used in the study and are independent of the work center size.

Flow diagrams
A representation of the location of activities or operations and the flow of materials between activities on a pictorial layout of a process. Usually used with a flow process chart.

Flow process chart
A graphic, symbolic representation of the work performed or to be performed on a product as it passes through some or all of the stages of a process. Typically, the information included in the chart is quantity, distance moved, type of work done (by symbol with explanation), and equipment used. Work times may also be included.

Fractional manpower
Manpower requirements to do a specific workload, expressed in fractional parts of whole persons.

Fractional manpower breakpoints
Multiples of whole-man positions above which an additional position is authorized for that work center.

Frequency
a. The number of times a specific value occurs within a sample of several measurements of the same dimension or characteristics on several similar terms.
b. In work measurement, the number of times an element occurs during an operation cycle.

Good operator technique
The use of this technique establishes time values through the selection of a qualified individual and by measuring the time that an individual expends on a given activity.

Historical performance
Documented past work performance of the work center. Historical performance is synonymous with historical data.

Idle time
Any time expended by the worker either in an avoidable delay status, or in doing unnecessary work, when essential work is available. It does not include time for personal requirements, fatigue, and unavoidable delays. Idle time is not included in a manpower staffing standard. An individual going to the post exchange, commissary, barber shop, etc. with the above conditions met, is classified as being on idle time status.

Implementation
See standards implementation.

Implementation period
The fiscal quarter when a standard is made effective in TAADS.

Indirect time
Time that is expended rendering services necessary to production, but which cannot be specifically assessed against a particular product or group of products accurately or without undue effort and expense.

Industrial engineering
The design, improvement, and installation of integrated systems of human resources, materials, and equipment. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results to be obtained from such systems.

Inferred workload
Workload performed by a given work center but which is defined as the responsibility of another work center. It can be treated by transferring either the workload (before measurement) or the time expended on that workload (after measurement) to the appropriate work center.

Inflection points
A point where a curve changes the direction of its concavity from downward to upward or vice versa.

In-house activities
Activities operated and managed by Army inservice personnel to provide products or services.

Input data range
The scale distance from which input data is sampled.

Installation deviation factors
The deviation factor (DF) is equal to the actual vertical deviation from the regression line.

Installation population
The summation of all categories of assigned personnel at an Army installation. This definition may be expanded to include assigned personnel not located on but supported by the installation. It may also be modified to exclude certain categories of assigned personnel.

Job standard
Time required to accomplish or produce a particular end product or service, or a group of products or services. Job standard is synonymous with detailed labor standard.

Lead team
The team picked to do a study which is monitored by a command or USAMARDA. The lead team prepares the study development plan and the measurement plan, gives guidance and assistance to input teams during the measurement phase, computes the standard and prepares and publishes the final report.

Leveled time
Actual productive time adjusted to account for differences in pace of observed workers.

Leveling
Process whereby an analyst evaluates observed operator performance in terms of a concept of normal performance.

Liaison official
A person selected from the studies function who is familiar with the function and its key personnel. Performs as the communications link between USAMARDA and the function.

Loaned time
Time loaned to other work centers. This time is not accountable to the work center providing the loaned time.

Management work center
Set up to manage two or more subordinate work centers. Management work center is synonymous with overhead work center.

Man-hour
A unit of measure representing one man working for one hour. The combination of "n" men working for "h" hours produces "nh" man-hours. Exceptions include:
a. Designation of work effort as normal effort.
b. Designation of time spent as actual clock hours.

Man-hour population
Man-hours of assigned personnel, plus borrowed minus loaned man-hours.

Manpower authorizations
A manpower allocation that has been expanded to include all of the necessary position attributes and allotted to a specific unit based on recognition of the position as required to accomplish a specific workload.

Manpower mix
The combination of military inservice, civilians and contract services used for mission performance.

Manpower models
Mathematical equations which describe the relationship between independent variables, workload values, and manpower or man-hours.

Manpower requirements
Human resources needed to accomplish specified workloads of organizations. Manpower requirements is synonymous with required manpower.

Manpower resources
Manpower authorizations made available to the Army which can be applied against manpower requirements. Manpower resources is synonymous with authorized manpower.

Manpower staffing standard
An expression of the quantitative and qualitative manpower requirements for the performance of a defined set of functionally homogeneous tasks at varying levels of workload or services provided. Normally stated both as a mathematical equation relating required man-hours to workload factors, and in tabular format showing numbers and skills of people required for a range of incremental workload factor values.

Manpower Staffing Standards Study Final Report
Historical documentation consisting of the staffing standards, supporting comments, and computational data. This report also contains specific initial application instructions and required submission formats.

Manpower Staffing Standards Study Measurement Plan
Document prepared by the lead team addressing the essential elements of the study; WHAT is to be measured and HOW it is to be measured.

Manpower Staffing Standards Study Measurement Report
The response prepared by participating input teams as directed by the measurement plan. It consists of work center measurement data and comments.

Mavericks
A term used to describe those data points that do not conform to the general pattern or trend described by a data array or scattergram. For example, data points that are beyond established control limits or that are significantly divergent from an otherwise apparent trend.

Measurable area
A function or homogeneous grouping of work activities that can be described by a specific output and for which a relationship between input and output may be developed that will reflect the results of changes in efficiency, quality, or scope of work.

Measurement Plan
See Manpower Staffing Standards Study Measurement Plan.

Military workweek schedules.
Number of assigned man-hours scheduled to be worked by military personnel each week.

Minimum manpower
The lowest number of requirements necessary to ensure uninterrputed services, comply with governing policies and regulations, or otherwise meet management's stated objectives even though assigned personnel may not be continuously productive. (See standby time.)

Minimum response rates
A standard of operation which specifies a reaction time to a situation that can affect the work center manpower requirements.

Mission directive
Description of work that explains a work center responsibility.

Monthly allowed man-hour adjustment
Adjustment of work sampling data to the work center's average workdays per month to reflect a monthly manhour requirement.

Monthly workload data adjustment
Adjustment of the counts of production type work units to an average monthly count.

Multilocation standards
Standards that apply to more than one location and were developed from the data collected at two or more installations.

Multivariate equation
An equation that contains two or more independent variables.

Nonavailable time
The net assigned man-hours that are not usable by the work center supervisor because of the participation of work center personnel in activities directed, recognized, and sanctioned by the Army which render them unavailable for primary duties. The absences recognized as nonavailable are essentially beyond the immediate control of the work center supervisor.

Nonproductive time
Accountable time expended in either personal, fatigue, unavoidable delay, standby, on call, or idle (avoidable delay) status.

Nonprogrammable manpower staffing standard
See nonprogrammable workload factor.

Nonprogrammable workload factor
The selected WLF is not in programming documents or the transition of a potential WLF to a programming variable cannot be made due to differences in definitions. This results in a nonprogrammable manpower staffing standard.

Nontransferable work
Work that is essential to the work center and must be done at a specific time or period. It can be direct or indirect type work.

Observation
a. In time study, the act of noting and recording the time taken by a worker performing an operation or an element of an operation.
b. In motion study, the act of noting and recording the motions used by a worker to perform an operation or an element of an operation.
c. In work sampling, the act of noting and recording what a worker is doing at a specific instant.

Obsolete (outdated) standard
a. A manpower standard which has been superseded by another standard.
b. A manpower standard which does not adequately portray the prescribed mission responsibilities of the function. Such standards are deleted from the standards publication with the coordination of the appropriate functional proponent.

Occupational measurement data
Information obtained from occupational surveys to assist in the development of work center descriptions.

On call time
A nonproductive category of time in which an off-duty worker can be contacted by telephone or other means at a prearranged location other than the work station. Only the productive time performed by the worker in the work center or at the work location, including necessary associated travel on the job, is to be credited to the work center. It is to be credited to the category of productive work to which it relates. Examples are: a photographer needed to periodically take photos after duty hours, a maintenance specialist who infrequently is needed to repair or replace a critical item of equipment, an information officer who responds to local press inquiries.

Operational audit
A work measurement method consisting of one or a combination of the following techniques: good operator, historical performance, technical estimate, and/or directed requirement.

Operating instruction
A written instruction used to disseminate information to specific elements of an activity.

Overspecialization
Work centers that have become too specific in work description, thereby causing many small work centers to be established.

Overtime work
Time expended in excess of regularly scheduled working hours.

Pace rating
A method of rating workers' performance that judges the speed or pace of an operator relative to an established concept of normal speed for the type of work observed. The rating is given as a performance percentage above, below, or at normal, and the ratio or factor is applied to the actual time to compute leveled or normal time. (See leveling.)

Participating command
A command (such as a MACOM or agency) whose authorizations will be involved in a study. These authorizations may or may not serve as a data source for the manpower staffing standards study.

Participating installation
An installation whose activity serves as a data source for a participating input team or lead team during a manpower staffing standard study.

Participating input team
A team that furnishes information to the lead team for a manpower staffing standards study.

Performance
The degree with which a worker applies skill and effort to an operation under prevailing conditions.

Performance rating
a. Process whereby an analyst evaluates observed operator performance in terms of a concept of normal performance.
b. The performance rating factor. Performance rating is synonymous with leveling, pace rating, effort rating, or objective rating.

Performance rating factor
The number (usually a percentage) representing the performance rating.

Performance sampling
A technique for determining the performance rating factor to be applied to an operator or a group of operators determined by short, randomly spaced observations of the performance.

Personal allowance
Time included in a standard to permit a worker to attend to personal necessities, such as obtaining drinks of water or making trips to the restrooms. (Usually applied as a percentage of the leveled, normal, or adjusted time.)

Personnel generated man-hours
Those man-hours that vary with the number of personnel assigned to the work center. They are not expected to show direct relationship to the selected workload factors (unless personnel-assigned is the workload factor) nor remain constant. They are expected to be related to the total fixed and variable man-hours expended by the personnel in the work center.

Position manpower factors
Fractional manpower values which provide the man-hours that a position must be manned. These man-hour values are dictated by the need for one or more individuals to be on duty though they may not be continuously productive.

Practice sampling
A series of practice observations taken prior to actual sampling to help a technician learn about the work center.

Predictability
A significant attribute which allows predictions for future time periods to make the standard useful as a programming tool.

Preliminary phase
A basic part of the standards development process which is used to set up a liaison between study participants to gather information that concerns the function to be studied and to decide how to build standards.

Procedure
A sequence of written operations established to get uniform processing by telling what actions are to be taken, who takes them, the sequence to be followed, and the tools to be used.

Production count
See work count.

Productive direct category
See productive time.

Productive time
Time expended performing work that is useful and essential to the mission of the work center. (See direct time and indirect time.)

Productivity control charts
A graphical display pertaining to observations in terms of productive percentages showing whether or not the process is in control.

Program change
A change in a programming document which normally results in adjustments to resources allocated for certain commands, systems, or activities.

Program estimating equation
A mathematical equation that uses a broadly based, program-oriented, independent variable (program estimating factor) to forecast or program manpower requirements into future time periods.

Program estimating factor
A broadly based, program-oriented, independent variable used in an estimating relationship to forecast or program manpower requirements into future time periods.

Programmable workload factor
A workload factor and definition that matches a program variable found in programming documents.

Programmability
A resource is said to have the characteristics of programmability when it is identified in a programming document.

Programming document
Any document published by the Office of the Secretary of Defense or the Department of the Army which exhibits a program identifying the resources required, by time period, to provide defense capabilities necessary to support the national strategy.

Projected workload
An amount of work proposed or anticipated to meet the requirements of a program over a specified period.

Proponent command
A command (MACOM or agency) identified as having proponency for a functional area who will be responsible for developing and maintaining manpower staffing standards within that functional area.

Quality assurance
The review of completed MS–3 products to assure all requirements have been accurately accomplished in accordance with established procedures and/or practices.

Rater proficiency
Skill of a technician to gain a “mental image” of normal and to rate in a consistent manner.

Regression analysis
A mathematical examination of relations between two or more variables which shows how good the relationships are for prediction purposes.

Regression line
A sample line being used to estimate the relationship between paired values.

Relief day
Term applied to a day of compensation for overtime worked or scheduled day off from normal duty.

Required grade
The grade reflected in the required grade column of the TDA. The grades in this data element represent unconstrained requirements needed to do the job and are, where applicable, determined by the application of manpower standards.

Rest allowance
See fatigue allowance.

Revised standard
An approved standard which is changed as a result of additional measurement that normally produces a new estimating equation.

Rounding
The elimination of unwanted numbers in computations after intermediate calculations.

Sample
In work sampling, a single recorded status of one person during an observation of a work center. Usually, more than one sample comes from one observation. The number of samples needed affects the number of observations required for each work center.

Sampled time
The total man-hour population from which samples are drawn in a work sampling study. It is drawn from the sum of the hours each person was subject to observations during the study.

Scattergrams
A two-dimensional chart on which known values of two variables are plotted. Examination of the chart shows the form of relationship which may exist between the variables (for example, straight line or curvilinear).

Selected time
The time which is chosen by sample observation or by mathematical means as being representative of the adjusted time (prior to applying a performance rating factor) values obtained from the observations of an element or operation.

Significance test
As a test of hypothesis, it indicates whether or not to reject a null hypothesis. It tells whether the sample data are, or are not, significantly contrary to the null hypothesis.

Staffing patterns
Man-hours allowed, usually on a one-for-one basis, in positions that are not governed by rate of production or man-hour expenditure.

Standard (Generic)
An exact value, a physical entity, or an abstract concept, established and defined by authority, custom, or common consent to serve as a reference model, or rule in measuring quantities or qualities, establishing practices or procedures, or evaluating results. A fixed quantity or quality.

Standard time
A unit of time value for the accomplishment of a work task as determined by the proper application of appropriate work measurement techniques. Generally established by applying appropriate allowances to normal time. Standard time and normal time are identical when nonproductive time is granted in place of allowances. Standard time is synonymous with direct labor standard, output standard, production standard, or time standard.

Standards application
A systematic determination of required manpower for activities by use of manpower staffing standards. The process consists of relating prescribed workload factor volumes to manpower models or tables resulting in a numerical identification of whole requirements normally by military occupational specialty and grade, or civilian series.

Standards application summary
A document which summarizes the results of initial standards application and proposed exceptions.

Standards implementation
The entering of the results of standards application into the TAADS.

Standby time
Time in which the worker is required to be present to do time-sensitive work, and when the worker is in a ready status to perform work, but is prevented from performing work because none is available. Time can be classified as standby only when it is essential to mission accomplishment and no work can be done or made available during that period. Examples of standby time might be: emergency medical technicians awaiting patients, a commissary identification checker awaiting customers to enter the facility, and a taxi driver awaiting passengers at a dispatch office. (See minimum manpower.)

Straightening
A way to forecast future workload, which assumes that there will be no change in workload from what has occurred in the past.

Stratified random times
Random times selected to provide equal numbers for each specified time period, such as six random times per hour.

Subtractive standard
The manpower staffing standard based on excluded workload. (See exclusion.)

Subtask
A major part of a task described in work definition.

System
Any organized assembly of resources and procedures united and regulated by interaction of interdependence to accomplish a set of specific functions.

Task
A major part of a category of work described in any work definition.

Task list
A clear and complete description of the actions or duties performed by an individual.

Technical estimate
A determination of the standard hours required for a given task, based upon an estimate made by individuals technically and professionally competent to judge the time required.

Time hierarchy
A framework used to arrange various elements of time in such a manner as to show their relationship to each other.

Time study
A work measurement technique consisting of a time measurement of the task with a time measuring instrument, adjusted for any observed variance from normal effort or pace, and to allow adequate time for unavoidable or machine delays, rest to overcome fatigue, and personal needs. Learning or progress effects may also be considered. If the task is of sufficient length, it is normally broken down into short, relatively homogeneous work elements, each of which is treated separately as well as in combination with the rest.

Training (ancillary)
Authorized absences from the work center for training not directly related to job performance or a specific skill/job series (i.e., training prescribed for the general population of an organization). This category includes leadership training, together with program, refresher, integrated, and awareness training. (Specifically excludes attendance at technical schools in a TDY status or local training given for a particular military skill/civilian job series.)

Transferable work
Work that is essential to the work center but may be performed at any time or during any period. It can be direct or indirect type of work.

Unavoidable delay
An occurrence which is essential and outside the worker's control or responsibility that prevents the accomplishment of productive work.

Unavoidable delay allowance
See delay allowance.

Unexplained variation
See coefficient of determination.

Validating data
Making sure that analyses and recommendations are based on facts, not on unfounded rumors or misunderstandings.

Variable man-hours
Man-hours that have a direct relationship to the selected work units produced or selected workload factors.

Variation
A measure of the dispersion or scattering of values about the mean of a distribution.

Work category
A major subdivision of the work center description. Each category contains a number of associated tasks, which are unique to the category. The sum of all categories equates to all work authorized and required to be performed by the work center.

Work center
A group of personnel that use similar machines, processes, methods, and operations to perform homogeneous type work usually located in a centralized area. The term is used to identify a relatively small activity within a broad functional segment. Personnel within a work center perform work that basically contributes to the same end product or result and their duties are similar or closely related.

Work center description
Shows work center responsibilities structured by priority for easy measurement of work/categories, tasks, and subtasks. It is prepared for each work center in a manpower staffing standards study as follows:

a. Chapter 1. Description Summary—contains only category and task titles.

b. Chapter 2. Description Detail—This part expands chapter 1 in that tasks are defined at the lowest level for which the WCD was prepared.

Work count
A sum of the number of work units done during a specified time period.

Work cycle

a. A pattern or sequence of tasks, operations, and/or processes with a distinct beginning and ending point.

b. A pattern of manual motions, elements, activities, and/or operations that are repeated without significant variation each time a unit of work is completed.

Work measurement
A technique for the collection of data on man-hours and production of work units, so that the relationship between work performed and man-hours expended can be determined and used as the basis for personnel planning, scheduling, production, budgets, justification, performance evaluation, and cost control.

Work sampling
The application of statistical samping theory and techniques to the study of work systems to estimate universe parameters from sample data. It is commonly used in the work measurement and methods engineering area to produce statistically sound estimates of the percentages of time that a work system is in any of a variety of states to work activity. With appropriate procedures, work sampling can produce information from which time standards might be determined. Work sampling is synonymous with activity sampling, frequency study, or ratio delay study.

Work unit
The basic identification of work accomplished or services performed. A countable and tangible expression of output performance which can be identified and adequately described for the purpose of work measurement or cost accounting.

Work unit time standard
A standard that identifies the amount of time allowed to produce one work unit or a given end product.

Workload
An expression of the amount of work, identified by the number of work units or volume of a workload factor, that a work center has at hand at any given time or is responsible for performing during a specified period of time.

Workload factor
a. An index or unit of measure that is consistently expressive of, or relatable to, the manpower required to accomplish the quantitatively and qualitatively defined responsibilities of a work center.
b. An end product (or a combination of products) that represents the work done in a work center. It may be either something physically produced in the work center (referred to as a production-type workload factor) or something that is external to, but served by, the work center (referred to as a work generator-type workload factor).

Workload factor control charts
Shows work output that relates to measured work center productivity. Charts aid in deciding if the measurement is representative or not, verifying the accuracy of the work count, and in showing abnormal workload.

Workload forecasting
To obtain or make an estimate of what the WLF volumes will be in some future time periods.

Workload measurement
The identification and qualification of the amount of work imposed upon or assumed by a person or organization at a fixed point in time.

Workweek
The normal weekly hours of duty prescribed by directives for an organization or geographical location and the status of the forces (peacetime or wartime).

Section III
Special Abbreviations and Terms
This section contains no entries.

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This index is organized alphabetically by topic and by subtopic within a topic. Topics and subtopics are identified by paragraph number.

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