The major purpose of this guide is to elicit the information necessary for writing educational specifications for facilities to house technical education programs in metallurgy. It is organized in these parts: (1) Part I discusses the major purpose, underlying assumptions, recent instructional trends, and guiding principles utilized in the preparation of the guide, (2) Part II provides data collection instruments for basic program features, educational objectives, and the training program, (3) Part III provides data collection instruments for quantitative and qualitative facility needs, and (4) Part IV includes an annotated bibliography of 21 items published between 1959 and 1968. A total of 17 data collection instruments and instructions for their use are included. (EM)
A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS in METALLURGY TECHNOLOGY
The Center for Vocational and Technical Education has been established as an independent unit on The Ohio State University campus with a grant from the Division of Comprehensive and Vocational Education Research, U. S. Office of Education. It serves a catalytic role in establishing consortia to focus on relevant problems in vocational and technical education. The Center is comprehensive in its commitment and responsibility, multidisciplinary in its approach, and interinstitutional in its program.

The major objectives of The Center follow:

1. To provide continuing reappraisal of the role and function of vocational and technical education in our democratic society;

2. To stimulate and strengthen state, regional, and national programs of applied research and development directed toward the solution of pressing problems in vocational and technical education;

3. To encourage the development of research to improve vocational and technical education in institutions of higher education and other appropriate settings;

4. To conduct research studies directed toward the development of new knowledge and new applications of existing knowledge in vocational and technical education;

5. To upgrade vocational education leadership (state supervisors, teacher educators, research specialists, and others) through an advanced study and inservice education program;

6. To provide a national information retrieval, storage, and dissemination system for vocational and technical education linked with the Educational Resources Information Center located in the U. S. Office of Education.
A GUIDE FOR PLANNING FACILITIES FOR OCCUPATIONAL PREPARATION PROGRAMS IN METALLURGY TECHNOLOGY

CARL GERMAN, JR.

THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY • 1900 KENNY ROAD
COLUMBUS, OHIO 43210

MARCH 1969
FOREWORD

One of the most fundamental concerns in planning for vocational and technical education facilities is that of assuring that educational requirements dictate the nature of the facilities. Other concerns include planning a sufficiently adaptable and flexible structure to permit needed modifications and programmatic changes over the lifetime of the building. Experiences have shown that adequate manuals and guide materials can provide substantial assistance in planning educational facilities. This document is a guide for planning facilities for occupational preparation programs in metallurgy technology. The information recorded in the guide is to be used in the preparation of educational specifications.

The guide lists a series of pivotal questions about the educational program to be offered. The answers to these program questions bear directly on the numbers and kinds of instructional areas needed in the contemplated facilities. After program decisions are recorded, the guide provides for the description of instructional areas needed to meet program requirements. Much of the material is presented in a checklist format which allows for consideration of alternatives in facility planning.

The guide was designed for use by any person or groups of persons responsible for planning metallurgy technology training facilities. It is anticipated that knowledgeable persons such as metallurgy technology instructors, state supervisors, university school plant planners, and local administrators will find the guide a useful planning tool. The guide can also be used for instructional purposes at universities, colleges, seminars, and institutes.

This guide is the sixth in a series being developed by the Center. Subsequent guides will be published for automotive services, dental technology, electrical technology, and medical technology. The first five guides developed were in the fields of home economics, machine trades, data processing, business and office occupations, and animal science technology. All guides follow the general format developed by the Center project staff and M. J. Conrad, head, Administration and Facilities Unit, College of Education, The Ohio State University. Vocational educators should also refer to the basic guide, A Guide to Systematic Planning for Vocational and Technical Education Facilities.

The Center for Vocational and Technical Education, The Ohio State University, worked cooperatively with Carl German, Jr., department head, Norwalk Technical College, Norwalk, Connecticut, in preparing this planning guide. Center project staff members were Richard F. Meckley, Ivan E. Valentine, and Zane McCoy.

The Center is grateful to the many individuals and groups whose assistance and suggestions led to the successful conclusion of the project. Special appreciation is due Frank A. Gourley, educational consultant, Engineering Technologies, Department of Community Colleges, Raleigh, North Carolina and James G. C. Sweeney, Technical Institute of Alamance, Burlington, North Carolina, for their thoughtful and helpful review of the initial draft of the guide.

Robert E. Taylor, Director
The Center for Vocational and Technical Education
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A GUIDE FOR PLANNING FACILITIES FOR
OCCUPATIONAL PREPARATION PROGRAMS
IN METALLURGY TECHNOLOGY
PART I

INTRODUCTION

PURPOSE OF GUIDE

The major purpose of this guide is to elicit the necessary information for the writing of educational specifications for facilities to house needed technician training programs in metallurgy.

In addition to the major purpose of providing important and comprehensive information to be incorporated in educational specifications, the guide is designed to:

- Assist planners in the formation of creative solutions to the housing of desired educational programs.
- Prevent important considerations from being overlooked in the facility planning process.
- Encourage logical and systematic facility planning.

ORGANIZATION OF GUIDE

The facility planning guide is organized under four major headings or parts. Part I (Introduction) is a discussion of the major purpose, the underlying assumptions, recent instructional trends, and the guiding principles which were utilized in the preparation of the guide.

In Part II (The Instructional Program) important information is sought on the metallurgy department's basic objectives, and the kinds of technician training programs which will be organized to implement them.

In Part III (Distinct Types of Instructional Areas to be Provided) the actual spaces desired to house the technician training programs are described in detail.
Part IV is an annotated bibliography of reference sources which offer a more detailed treatment of the various phases of facility planning.

UNDERLYING ASSUMPTIONS

Important assumptions were made in the preparation of this guide. They were:

- Major educational program decisions have or are being made. Content of instruction has been determined through educational surveys, advisory committees, school board study, etc. Instructional methods have been determined by qualified instructors and other appropriate staff members. To assure adequate educational program planning, the guide will ask important questions which may serve as guidelines to such planning.

- A cooperative and collaborative relationship has been established with knowledgeable local agencies who are aware of economic, political, and social conditions which must be taken into account in short- and long-range educational planning.

- Educational, economic, political, and social planning has revealed the approximate numbers and kinds of students (school-age and adult) to be served by the proposed school. Such information has been provided by enrollment projections, census tract data, student interest studies, etc.

- The information recorded in this document will be used in the preparation of educational specifications for use by an architect(s) in facility design.

- Sufficient funds are or can be made available to support both the provision of facilities and the operation of the desired occupational preparation programs.

RECENT INSTRUCTIONAL TRENDS

- Expanded programs to reach not only the average and those who are college bound, but also the unusually gifted, the physically handicapped, the mentally retarded, and the culturally disadvantaged are needed and being provided by occupational preparation programs.

- Cooperation among instructors in developing interdisciplinary units or courses is increasing. Cooperative instruction is encouraged and facilitated by the proximity of instructional and work areas where the teachers can plan together and produce instructional materials.
Mobile equipment and convenient space for storing it is making the same space available for many purposes and resulting in more effective and efficient use of space.

Mechanical and electronic teaching aids are being utilized to a greater degree by instructors in occupational preparation programs. To some extent, the effective use of such devices depends upon the accessibility and convenience of storage.

GUIDING PRINCIPLES

In planning facilities to house occupational preparation programs, it is suggested that educational program and facility decisions be consistent with the following guiding principles.

- The educational program is the basis for planning space and facilities.
- Space and facilities should be planned to accommodate changes in the educational program.
- The program should be planned to serve the needs of a variety of groups in the community.
- Space and facilities for the program can be extended through the use of community resources.
- Safe and healthful housing must be provided for all students.
- Space and facilities for occupational preparation programs should be considered in context with the total educational program of the institution and the community.
PART II

THE INSTRUCTIONAL PROGRAM

In Part II of the guide, important instructional program decisions with respect to basic program features, objectives, and needed information on technician training programs to be housed are recorded.

BASIC PROGRAM FEATURES

Basic features of the educational program are determined greatly by a school or department's educational philosophy. A philosophy of education provides a base from which program objectives and teaching and learning activities designed to meet these objectives can be derived. In the final analysis it is the kinds of teaching and learning activities to be carried on which should determine facility needs.

In this section, planners have an opportunity to express basic program features which will serve as guidelines for the planned technician preparation programs in metallurgy.

Indicate below the relative degree of emphasis to be placed on each of the program features stated by circling the appropriate number. The scale provided for this purpose ranges from 1 for major emphasis, 2 for some emphasis, 3 for slight emphasis, to N for no emphasis. This same scale will be used frequently throughout the planning guide.

1. Purpose of program

   a. The purpose of the program will be the preparation of students for gainful employment.

   1 major emphasis
   2 some emphasis
   3 slight emphasis
   N no emphasis
b. The purpose of the program will be the preparation of students for entry into further training programs. The nature of this further training is 1 2 3 N

c. The purpose of the program will be the training of employed adults to advance in their fields. The nature of this further training is 1 2 3 N

d. The purpose of the program will be the replacement of unemployable skills in appropriate evening or night school courses. The nature of this adult training is 1 2 3 N

e. Other program purposes which should be included are:
   1) 2) 3) 4)

2. Students

a. Student admission to the program is on the basis of selective criteria which include:
   1) 2) 3) 4)

b. The program will place emphasis on skill acquisition. 1 2 3 N
c. The program will place emphasis on the learning of theory. 1 2 3 N
d. The students will have freedom of movement and access to learning materials. 1 2 3 N
e. Students will be encouraged to act independently. 1 2 3 N
f. Students will be provided with cooperative work experience outside the school. 1 2 3 N
g. Other basic program features relating to students which should be included are:
   1) 2)
3. Instruction

a. The instructional approach will be single discipline (metallurgy) as opposed to inter-disciplinary (metallurgy, science, etc.). If not a single discipline approach, describe the inter-disciplinary approach and the disciplines involved.

b. Cooperative or team instruction will be used. If this mode of instruction is to be extensively emphasized, describe in general terms.

c. Community resources will be utilized in instruction. If a high emphasis is to be placed on use of community resources, describe some of these resources.

d. Instructional flexibility is required. If a high emphasis is to be placed on instructional flexibility, describe the kinds of flexibility desired.

4. Highly specialized technical courses on new processes and/or equipment (e.g., instrumentation) will be made available based on demand. Practicing experts in the field will be used as instructors (see page 6, Basic Program Features--1. c.).

5. Other basic program features important to the planned instructional program:

a. 

b. 

c. 

d. 

Yes No
EDUCATIONAL OBJECTIVES

Educational objectives are often identified as goals or outcomes of the educational program. An objective should describe a desired educational outcome that is consistent with a school's philosophy.

Objectives are important to both the planner and the architect since they determine the school's program and related activities. They provide important implications which when translated into facilities can both enhance as well as adequately house the desired program. Thus it becomes imperative to clearly establish the program objectives prior to embarking on educational specifications and subsequent building design.

The purpose of this part of the guide is to bring together these elements in a way to provide direction and understanding for both planner and architect. Space is provided below to indicate degree of emphasis by circling the appropriate number for each of the objectives, and to list additional objectives. The scale provided for this stated purpose ranges from 1 for major emphasis down to N for no emphasis.

1. To prepare students for entry into gainful employment  1 2 3 N

2. To motivate and recruit capable and qualified students to enroll in post-high school  1 2 3 N

3. To permit students to retrain or return to continue training  1 2 3 N

4. To provide pre-professional educational training for students who plan to enter colleges and universities  1 2 3 N

5. To develop in students specific and measurable knowledge and skills in manufacturing metallurgy which include:
   a. The ability to apply the principles of physical metallurgy  1 2 3 N
   b. Broad knowledge of manufacturing processes and materials fabrication  1 2 3 N
   c. The ability to apply statistical quality control procedures  1 2 3 N
   d. The ability to specify and/or monitor routine metallurgical control test procedures  1 2 3 N
   e. The ability to provide and monitor simulated field service tests on manufactured products  1 2 3 N
6. To develop in students specific and measurable knowledge and skills in foundry metallurgy which include:

   a. The ability to apply the principles of physical metallurgy 1 2 3 N
   b. Broad knowledge of the commercial casting processes 1 2 3 N
   c. Familiarity with the design requirements for castings, patterns, and mold materials 1 2 3 N
   d. The ability to specify and/or monitor control tests on molding materials 1 2 3 N
   e. The ability to specify and/or monitor control tests on metal melting and thermal treatments of castings 1 2 3 N
   f. The ability to specify and/or monitor inspection and control test procedures on the casting and finishing operations 1 2 3 N

7. To develop in students specific and measurable knowledge and skills in metallography which include:

   a. The ability to apply the principles of physical metallurgy 1 2 3 N
   b. Proficiency in sampling and specimen preparation techniques 1 2 3 N
   c. Proficiency in the field of photography 1 2 3 N
   d. The ability to prepare, interpret and report on photomacrophraphs and photomicrographs of specimens 1 2 3 N
   e. The ability to analyze service failures and investigate customer complaints 1 2 3 N
   f. ___________________________________________ 1 2 3 N

8. To develop in students specific and measurable knowledge and skills in powder metallurgy which include:

   a. The ability to apply the principles of physical metallurgy 1 2 3 N
   b. The ability to apply statistical quality control procedures 1 2 3 N
c. Knowledge of metal powder production methods, powder handling and storage techniques, and powder mixing methods  
   1 2 3 N

d. The ability to specify and/or monitor tests to control powder mixing, sintering parameters, furnace atmospheres, and finished parts quality  
   1 2 3 N

e. Knowledge of parts and tooling design as they affect briquetting practices  
   1 2 3 N

f. g. h.

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

9. To develop in students specific and measurable knowledge and skills in extractive metallurgy which include:

   a. The ability to apply the principles of ore refining (mineral extraction)  
      1 2 3 N
   b. Proficiency in sizing and sampling techniques  
      1 2 3 N
   c. Knowledge of the equipment and control procedures for roasting, leaching, and flotation of ore samples  
      1 2 3 N
   d. The ability to specify and/or monitor and report on control tests in the refining process  
      1 2 3 N

10. To develop in students specific and measurable skills and knowledge in physical metallurgy, research and development which include:

    a. The ability to apply the principles of physical metallurgy  
       1 2 3 N
    b. The ability to participate in research on new alloying methods on new alloys for specific properties or service requirements  
       1 2 3 N
    c. The ability to participate in research on control and testing procedures for quality assurance of new alloys  
       1 2 3 N
    d. The ability to participate in research on thermal treatments, surface treatments, and joining techniques  
       1 2 3 N
    e. The ability to participate in research on single crystal techniques, fiber reinforced alloys, and ultra-purity metal refining.  
       1 2 3 N
    f. The ability to participate in research on micro-integrated circuitry techniques  
       1 2 3 N
    g. h.

12
11. Other program objectives include:

a.  

b.  

c.  

d.  

PROGRAM CONTENT AREAS

The educational program for training technicians in metallurgy should be designed to meet its established objectives. All decisions made with respect to the educational program should be consistent with established philosophy and objectives. The training of a metallurgical technician to meet the above objectives will require an educational program of intensive study of the basic sciences and mathematics plus an intensive laboratory-oriented curriculum of technical specialties.

The courses will provide the ability to apply scientific principles to the processes, procedures, techniques, materials, and modern instrumentation of industry. The course content will enable the technician to communicate with the metallurgical engineer or scientist doing research, development, or production work and function as an assistant.

Instruction in technician training is usually given in discrete subject areas or courses. Subject matter is coordinated with appropriate field, laboratory, and work experience. Programs for technician training in metallurgy may be classified under six broad headings or content areas of 1) supporting services; 2) manufacturing processes; 3) materials testing; 4) heat-treating; 5) metallography; and 6) instrumentation.

These six content areas relate directly to the field of metallurgy and can be used to categorize most technician training programs in the field. However, students in these programs elect or are required to take courses in subjects such as English, mathematics, and physical education which are available to all students. For example, a student training to become a manufacturing metallurgy technician may pursue the following curriculum during one semester:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Content Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics I</td>
<td>Academic</td>
</tr>
<tr>
<td>Physics I</td>
<td>Science</td>
</tr>
<tr>
<td>Chemistry I</td>
<td>Science</td>
</tr>
<tr>
<td>Technical Report Writing</td>
<td>Academic</td>
</tr>
<tr>
<td>Metal Fabrication</td>
<td>Manufacturing Processes</td>
</tr>
</tbody>
</table>

The concept of content areas is used in this planning guide because different instructional content areas usually call for different instructional facilities and equipment. The following content areas which usually call for specialized instructional areas are used in this guide.
Supporting Services

Academic--English, math, social studies
Science--physics, chemistry, general electricity
Physical Education
Other--this category is used in the event that a course or unit to be offered will not fit into any of the above content areas

Manufacturing Processes--foundry, machine shop, presses, rolling equipment

Materials Testing--hardness testers, tensile testers, torsion testers, environmental testers, etc.

Heat-treating--ovens, atmosphere generators, vacuum equipment, quenching facilities, etc.

Metallography--cut-off wheels, mounting press, grinding and polishing wheels, microscopes, metallograph

Instrumentation--emission spectrograph, x-ray diffraction, gas analyzers, x-radiography, ultra-sonic testers, magnetic testing, etc.

PLANNING INSTRUCTIONAL AREAS BY MODES OF LEARNING

The planning of instructional areas for occupational preparation facilities can be substantially aided through utilization of the concept of modes of learning. Learning can be divided into three distinct modes--reaction learning, interaction learning, and action learning.

Reaction learning, which usually occurs in an instructional area designed for lecture and demonstration, is characterized by activities which tend to be largely teacher-centered with the central focus on instruction. Student activities include listening, observing, and the taking of notes. Group size may vary from one to a very large number as the number of students has little effect on the learning experience if proper technological aids such as television, microphones, projectors and the like are used. Because student activities are relatively passive in reaction learning, a short optimal time span is normally employed.

Lecture/demonstration areas can be used commonly for reaction learning in all subject areas. For example, in planning facilities for two diverse occupational preparation programs in foundry metallurgy and metallography, the planner should bear in mind that reaction learning for students in both programs can occur in the same kind of instructional area. This means that facility planning should be done in terms of the total program rather than its fractional parts. In many instances, lecture/demonstration areas can be shared not only by occupational preparation programs within vocational service areas, but also
shared by distinct and dissimilar service areas such as technician programs and business occupations. Where a great deal of facility sharing is planned the planner should consider the relative merits of optimal location within the total building and the advisability of clustering various instructional areas.

Interaction learning, which usually occurs in a seminar instructional area, is characterized by both teacher and learner activity participating as both listener and speaker. This mode of learning, of course, must occur in groups; however, sociological research suggests these groups should not exceed 15 persons for optimal effectiveness. Active interaction of all students generally requires a longer time span than reaction learning.

Seminar areas, like lecture/demonstration areas, are usually designed for common use by all vocational service areas. The same considerations which were outlined for lecture/demonstration areas also apply to seminar areas.

Action learning, which usually occurs in a laboratory-type instructional area, allows students to learn by doing. Students learn on an individual basis, but may, nevertheless, function in a group setting. Often in more flexible types of educational programs, students are scheduled for laboratory work on an individual basis. Since action learning involves overt action by individual students, the teacher's role is largely that of a consultant to the learner.

Laboratory areas, of necessity, are more specialized than lecture/demonstration areas used for reaction learning and seminar areas used for interaction learning. Since laboratory areas are designed to facilitate the learning of specific skills, there is less likelihood of sharing such areas by students in various training programs. However, wherever common elements of skill instruction are found among occupational preparation programs, the sharing and clustering laboratory facilities can be both expedient and economical.

SPECIALIZED AND MULTI-USE OF INSTRUCTIONAL AREAS

The relative amounts of time to be spent by students in a given occupational preparation program in reaction, interaction, and action learning has definite implications for the number and kind of spaces to be provided. These time considerations combined with decisions on the degree of specialization versus multi-use help determine the nature of facilities required. Since most occupational programs have concentrated on action learning experiences, facilities designed for a particular program have seldom provided adequate reaction and interaction facilities because of the limited utilization of such spaces. However, if the learning activities in any preparation program are broken down into the modes of learning, it will be noted that reaction and interaction spaces are the same regardless of the vocational area. Therefore, by providing common reaction and interaction spaces for all programs, the most modern technological aids can be justified which, in most cases, will permit lectures,
demonstrations and other group reaction learning experiences for groups larger than typically used in vocational education programs. Not only will group reaction learning be improved but more time will become available for the professional staff to work with individuals and small groups in interaction and action learning activities.

Scheduling group reaction and interaction learning experiences into specialized facilities permits complete flexibility in the use of action learning laboratories on an open individualized basis since students would no longer need to be scheduled into the action learning laboratories on a specific class basis. This will permit 100 percent room utilization of laboratories and also permit the introduction of differentiated staff assignments into vocational education.

The open laboratory concept also permits the planned sharing of certain specialized equipment which may be required by two or more occupational preparation programs.


OCCUPATIONAL PREPARATION PROGRAMS TO BE OFFERED

Information on each technician training program to be offered is entered on a separate Form A which follows. Directions for completing Form A(s) appear on pages 21-24. To assist planners, a sample, completed Form A is given on page 20. Data entered in the sample Form A are for a foundry metallurgy program. The data were assumed for purpose of illustration. Form A for each occupational preparation program should be filled out as completely as possible. However, it is realized, for example, that a metallurgy instructor completing Form A may be unaware of time allotments and methods of instruction in other subject areas. If such is the case, the instructor can only supply information on courses within the content areas of metallurgy.

16
INSTRUCTIONS FOR COMPLETING FORM A
BASIC PROGRAM INFORMATION

Item 1
Occupational Preparation Program--Enter here the name of the occupational program to be offered, e.g., foundry metallurgical technician.

Item 2
Yearly Enrollment--Enter here the projected maximum number of students to be enrolled yearly in the program.

Item 3
Nature of Students--Underline all categories which apply to the students to be enrolled in the program.

Item 4
Weeks of Instruction per Year--Enter here the number of weeks per year the school will be open for instruction, e.g., 36 weeks, 52 weeks.

Item 5
Total Weekly Periods or Modules--Enter here the total number of periods or modules (if modular scheduling is to be used) per week available for instructional purposes for each student. Do not count periods or modules scheduled for lunch and other non-instructional purposes.

Column 6
Courses of Instruction--List the courses or units of instruction to be offered either on a required or elective basis for the occupational preparation program.

Column 7
Content Area--Opposite each course of instruction, enter the appropriate content area as presented on page 13.

Column 8
Total Course Enrollment--Opposite each course of instruction, enter the projected maximum student enrollment.

Column 9
Maximum Group Size for Reaction Learning--Opposite each course or unit of instruction, enter the maximum group size in number of students for reaction (lecture/demonstration) type learning.
Column 10
*Estimated Weekly Periods or Modules of Reaction Level Learning*—Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to reaction learning per student.

Column 11
*Weekly Group-Periods or Modules (Lecture / Demonstration)*—To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 9 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 10.

Column 12
*Maximum Group Size for Interaction Learning*—Opposite each course or unit of instruction, enter the maximum group size in number of students for interaction (seminar) type learning.

Column 13
*Estimated Weekly Periods or Modules of Interaction Level Learning*—Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to interaction learning per student.

Column 14
*Weekly Group-Periods or Modules (Seminar)*—To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 12 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 13.

Column 15
*Maximum Group Size for Action Learning*—Opposite each course or unit of instruction, enter the maximum group size in number of students for action (laboratory) type learning.

Column 16
*Estimated Weekly Periods or Modules of Action Level Learning*—Opposite each course or unit of instruction, enter the estimated number of periods or modules per week to be devoted to action learning per student.

Column 17
*Weekly Group-Periods or Modules (Laboratory)*—To compute weekly group-periods or modules, divide the entry in Column 8 by the entry in Column 15 and round up to the nearest whole number. Then multiply the whole number by the entry in Column 16.
SAMPLE FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: Foundry Metallurgist

2. Yearly Enrollment 120

3. Nature of Students (underline appropriate categories): a. day school; b. night school; c. school age; d. adults; e. males; f. females; other (specify)

4. Weeks of Instruction per Year 36

5. Total Weekly Periods or Modules 30

<table>
<thead>
<tr>
<th>Courses of Instruction</th>
<th>Content Areas</th>
<th>Total Course Enrollment</th>
<th>Maximum Group Size</th>
<th>Weekly Periods or Modules</th>
<th>Maximum Group Size</th>
<th>Weekly Periods or Modules</th>
<th>Maximum Group Size</th>
<th>Weekly Periods or Modules</th>
<th>Maximum Group Size</th>
<th>Weekly Periods or Modules</th>
<th>Maximum Group Size</th>
<th>Weekly Periods or Modules</th>
</tr>
</thead>
<tbody>
<tr>
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<td>60</td>
<td>100</td>
<td>1</td>
<td>15</td>
<td>2</td>
<td>8</td>
<td>25</td>
<td>7</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundry II</td>
<td>Man.Proc.</td>
<td>60</td>
<td>100</td>
<td>1</td>
<td>15</td>
<td>3</td>
<td>12</td>
<td>25</td>
<td>6</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math I</td>
<td>Academic</td>
<td>80</td>
<td>100</td>
<td>3</td>
<td>15</td>
<td>1</td>
<td>4</td>
<td>25</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math II</td>
<td>Academic</td>
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<td>8</td>
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<td>English I</td>
<td>Academic</td>
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<td>50</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

1 If both day and night school are to be offered, fill out separate forms for each.

* (Lecture/demonstration)

** (Seminar)

*** (Laboratory)
FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: ________________________________

2. Yearly En. ______

3. Nature of Students (underline appropriate categories): a. day school; b. night school; c. school age; d. adults; e. males; f. females; other (specify) ________________________________

4. Weeks of Instruction per Year ________________________________

5. Total Weekly Periods or Modules ________________________________

<table>
<thead>
<tr>
<th>Courses of Instruction</th>
<th>Content Areas</th>
<th>Total Course Enrollment</th>
<th>Maximum Group Size</th>
<th>Weekly Periods or Modules</th>
<th>Reaction</th>
<th>Interaction</th>
<th>Action</th>
</tr>
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<td>(6)</td>
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<td>(9)</td>
<td>(10)</td>
<td>(11)</td>
<td>(12)</td>
<td>(13)</td>
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</tbody>
</table>

Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning

**REACTION**

**INTERACTION**

**ACTION**

---

1 If both day and night school are to be offered, fill out separate forms for each.

**(Lecture/demonstration)**

**(Seminar)**

**(Laboratory)**
FORM A

BASIC PROGRAM INFORMATION

1. Technician Training Program for: ________________________________

2. Yearly Enrollment ____________________

3. Nature of Students (underline appropriate categories): a. day school1; b. night school1; c. school age; d. adults; e. males; f. females; other (specify) ____________________

4. Weeks of Instruction per Year ________________

5. Total Weekly Periods or Modules ________________

<table>
<thead>
<tr>
<th>Courses of Instruction</th>
<th>Content Areas</th>
<th>Total Course Enrollment</th>
<th>Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning</th>
</tr>
</thead>
<tbody>
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<td>REACTION1</td>
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<td></td>
<td>Maximum Group Size</td>
</tr>
</tbody>
</table>

1 If both day and night school are to be offered, fill out separate forms for each.
2 Lecture/demonstration
3 Seminar
4 Laboratory
1. Technician Training Program for: ____________________________

2. Yearly Enrollment _________________________

3. Nature of Students (underline appropriate categories): a. day school\(^1\); b. night school\(^1\); c. school age; d. adults; e. males; f. females; other (specify) _________________________

4. Weeks of Instruction per Year _________________________

5. Total Weekly Periods or Modules _________________________

<table>
<thead>
<tr>
<th>Courses of Instruction</th>
<th>Content Areas</th>
<th>Total Course Enrollment</th>
<th>Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td>Maximum Group Size</td>
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</tr>
</tbody>
</table>

\(^1\) If both day and night school are to be offered, fill out separate forms for each.

\(^\text{a}\) Lecture/demonstration

\(^\text{b}\) Seminar

\(^\text{c}\) Laboratory
**FORM A**

**BASIC PROGRAM INFORMATION**

1. Technician Training Program for: ____________________________________________

2. Yearly Enrollment ____________________________

3. Nature of Students (underline appropriate categories): a. day school\(^1\); b. night school\(^1\); c. school age; d. adults; e. males; f. females; other (specify) ____________________________

4. Weeks of Instruction per Year __________

5. Total Weekly Periods or Modules __________

<table>
<thead>
<tr>
<th>Courses of Instruction</th>
<th>Content Areas</th>
<th>Total Course Enrollment</th>
<th>Maximum Group Sizes, Estimated Weekly Periods or Modules and Calculated Group-Modules or Group-Periods by Levels of Learning</th>
</tr>
</thead>
<tbody>
<tr>
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<td>REACTION(^2)</td>
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<td>Weekly Periods or Modules</td>
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<td>(9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>INTERACTION(^3)</td>
</tr>
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<td></td>
<td></td>
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<td>(12)</td>
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<td></td>
<td></td>
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<td>ACTION(^4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weekly Periods or Modules</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(15)</td>
</tr>
</tbody>
</table>

\(^1\)If both day and night school are to be offered, fill out separate forms for each.

\(^2\)Lecture/demonstration

\(^3\)Seminar

\(^4\)Laboratory
PART III

DISTINCT TYPE OF INSTRUCTIONAL AREAS TO BE PROVIDED

QUANTITATIVE FACILITY NEEDS

The number of instructional areas to house the programs described in Part II (The Instructional Program) are recorded in this section of the guide.

As indicated in Part II, there are three principal types of instructional areas used to accommodate educational programs. They are:

- **Lecture/demonstration areas**—used principally for group reaction learning;
- **Seminar areas**—used principally for group interaction learning; and
- **Laboratory areas**—used principally for group or individual action learning.

In addition to these instructional areas, there are, of course, other school-wide auxiliary areas such as instructional materials centers, language laboratories, gymnasiums, and auditoriums which are part of the overall school plan. Requirements for such facilities are calculated as a part of total school planning and are not made in this guide.

It is recommended that facility needs, including technician training programs in metallurgy be made on a school-wide basis in order to provide planners with a balanced picture of the building to be constructed and in order to provide economy and convenience through the sharing and clustering of various kinds of facilities and equipment.
Forms B, C, and D can be used to compute the number of lecture/demonstration, seminar, and laboratory areas required, respectively, for the planned programs in technician training in metallurgy. The use of these forms requires some mathematical ability. Personnel responsible for completing the guide may want to utilize the services of individuals with this special competence.

Results of the computations on Forms B, C, and D are entered on Form E which is a summary of total instructional area requirements for metallurgy technology preparation programs.

In the event that instructional area requirements are already determined (e.g., it has been decided that one combination laboratory and lecture/demonstration area will be provided) the information can be recorded directly on Form E without making the computations on Forms B, C, and D.

It is strongly recommended that appropriate personnel be utilized to ensure that the number of instructional areas is sufficient to meet program requirements. After the number of each type of instructional area is determined and recorded on Form E, information can then be recorded in the next section of the guide concerning the nature of these instructional areas.
INSTRUCTIONS FOR COMPLETING FORM B
LECTURE/Demonstration AREA REQUIREMENTS BY CONTENT AREAS

Column 1
Content Area--Content areas are listed in Column 1.

Column 2
Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each content area as indicated in Columns 7 and 8 of all Form A(s) for all occupational preparation programs.

Column 3
Maximum Group Size--Opposite each content area, enter the maximum group size desired for a lecture/demonstration area to serve the content area (Form A, Column 9).

Column 4
Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5
Total Weekly Reaction Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to reaction learning as indicated in Column 11 of Form A(s) for all occupational preparation programs.

Column 6
Lecture/Demonstration Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7
Adjusted Lecture/Demonstration Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

Column 8
Totals--Since lecture/demonstration areas, unlike laboratory areas, can be utilized by nearly all content areas, the entries in Column 7 can be added for all lecture/demonstration areas with identical maximum group sizes as entered in Column 3. For example, 8a might read 2 lecture/demonstration areas with a student capacity of 60 each.
## SAMPLE FORM B

### LECTURE/DEMONSTRATION AREA REQUIREMENTS BY CONTENT AREAS

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Total Enrollment</th>
<th>Maximum Group Size</th>
<th>Total Weekly Reaction Group-Periods or Modules</th>
<th>Lecture/Demonstration Areas Required ( (5) \div (4) )</th>
<th>Adjusted Lecture/Demonstration Areas Required ( (6) \times 1.3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>II Manufacturing Processes</td>
<td>120</td>
<td>100</td>
<td>30</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>III Materials Testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV Heat Treating</td>
<td></td>
<td></td>
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<tr>
<td>V Metallography</td>
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<td></td>
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<tr>
<td>VI Instrumentation</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>I Supporting Services</td>
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</tr>
<tr>
<td>Academic</td>
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<td>0.09</td>
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<td>Music</td>
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<tr>
<td>Physical Education</td>
<td>65</td>
<td>25</td>
<td>30</td>
<td>0.13</td>
<td>0.17</td>
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<tr>
<td>Other (specify)</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 5.) Round off total to next higher whole number.

a. 1 lecture/demonstration areas with a student capacity of 100, each.
b. 1 lecture/demonstration areas with a student capacity of 50, each.
c. 1 lecture/demonstration areas with a student capacity of 25, each.
d. [Blank] lecture/demonstration areas with a student capacity of [Blank], each.

Note: The entries in Column 7 indicate clearly that the lecture/demonstration areas would only be used sparingly by students enrolled in each of the content areas. One possibility might be construction of a lecture/demonstration area with a student capacity of 100 which could be subdivided to meet program requirements of all content areas. Another possibility would be the sharing of lecture/demonstration with other students enrolled in various other programs.
<table>
<thead>
<tr>
<th>Content Area</th>
<th>Total Enrollment</th>
<th>Maximum Group Size</th>
<th>Total Weekly Periods</th>
<th>Total Weekly Reaction Periods or Modules</th>
<th>Adjusted Lecture/Demonstration Areas Required</th>
<th>Adjusted Lecture/Demonstration Areas Required X 1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>II Manufacturing Processes</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<td>IV Heat Treating</td>
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<td>V Metallography</td>
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<tr>
<td>VI Instrumentation</td>
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<tr>
<td>I Supporting Services</td>
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<tr>
<td>Other (Specify)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 5) rounded to next higher whole number.

a. lecture/demonstration areas with a student capacity of each, each,

b. lecture/demonstration areas with a student capacity of each, each,

c. lecture/demonstration areas with a student capacity of each, each,

d. lecture/demonstration areas with a student capacity of each, each.
INSTRUCTIONS FOR COMPLETING FORM C
SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

Column 1
Content Area--Content areas are listed in Column 1.

Column 2
Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each content area indicated in Columns 7 and 8 of Form A for all occupational preparation programs.

Column 3
Maximum Group Size--Opposite each content area, enter the maximum group size desired for a seminar area to serve the content area (Form A, Column 12).

Column 4
Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5
Total Weekly Interaction Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to interaction learning as indicated in Column 14 of Form A(s) for all occupational preparation programs.

Column 6
Seminar Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7
Adjusted Seminar Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.

Column 8
Totals--Since seminar areas, unlike laboratory areas, can be commonly utilized by nearly all content areas, the entries in Column 8 can be added for all seminar areas with identical maximum group sizes or entered in Column 3. For example, 8a might read 2 seminar areas with a student capacity of 20, each.
### SAMPLE FORM C

#### SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Total Enrollment</th>
<th>Maximum Group Size</th>
<th>Total Weekly Periods or Modules</th>
<th>Total Weekly Interaction Group-Periods or Modules</th>
<th>Seminar Areas Required (5) ÷ (4)</th>
<th>Adjusted Seminar Areas Required (6) X 1.3</th>
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</thead>
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<td>20</td>
<td>0.87</td>
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<td>III Materials Testing</td>
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<td>30</td>
<td>1.00</td>
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<td>0</td>
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<td>15</td>
<td>30</td>
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<td></td>
</tr>
</tbody>
</table>

(6) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3.) Round up total to next higher whole number.

a. _______ seminar areas with a minimum student capacity of _______, each.

b. _______ seminar areas with a minimum student capacity of _______, each.

c. _______ seminar areas with a minimum student capacity of _______, each.

d. _______ seminar areas with a minimum student capacity of _______, each.
### FORM C

#### SEMINAR AREA REQUIREMENTS BY CONTENT AREAS

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Total Enrollment (1)</th>
<th>Maximum Group Size (2)</th>
<th>Total Weekly Periods or Modules (3)</th>
<th>Total Weekly Interaction Group-Periods or Modules (4)</th>
<th>Seminar Areas Required (5) ( \div (4) ) (6)</th>
<th>Adjusted Seminar Areas Required (6) ( \times 1.3 ) (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>II Manufacturing Processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>VI Instrumentation</td>
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<tr>
<td>I Supporting Services</td>
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<tr>
<td>Other (specify)</td>
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<td></td>
</tr>
</tbody>
</table>

(8) Totals (Figures in Column 7 can be added together for areas with same student capacity as entered in Column 3.) Round up total to next higher whole number.

a. \( \text{________} \) seminar areas with a minimum student capacity of \( \text{________} \), each.
b. \( \text{________} \) seminar areas with a minimum student capacity of \( \text{________} \), each.
c. \( \text{________} \) seminar areas with a minimum student capacity of \( \text{________} \), each.
d. \( \text{________} \) seminar areas with a minimum student capacity of \( \text{________} \), each.
INSTRUCTIONS FOR COMPLETING FORM D
LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

Column 1
Content Area--Content areas are listed in Column 1.

Column 2
Total Enrollment--To obtain total enrollment for content areas, find the total enrollment for each area as indicated in Columns 7 and 8 of Form A for all occupational preparation programs.

Column 3
Maximum Group Size--Opposite each content area, enter the maximum group size desired for a laboratory area to serve the content area (Form A, Column 15).

Column 4
Total Weekly Periods or Modules--Opposite each content area, enter the total periods or modules per week the school will be open for day school instruction. This entry will be identical for all content areas and identical to the number recorded for Item 5, Form A.

Column 5
Total Weekly Action Group Periods or Modules--Opposite each content area, enter the total group periods or modules per week to be devoted to action learning as indicated in Column 17 of Form A(s) for all occupational preparation programs.

Column 6
Laboratory Areas Required--Opposite each content area, enter the quotient of Item 5 divided by Item 4. Round up to the nearest hundredth.

Column 7
Adjusted Laboratory Areas Required--To adjust for scheduling difficulties which result in areas being less than 100 percent utilized, multiply the entry in Column 6 by 1.3 and enter the result, rounded up to the nearest hundredth, in Column 7 for each content area.
## SAMPLE FORM D
### LABORATORY AREA REQUIREMENTS BY CONTENT AREAS

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Total Enrollment</th>
<th>Maximum Group Size</th>
<th>Total Weekly Periods or Modules</th>
<th>Total Weekly Action Group-Periods or Modules</th>
<th>Laboratory Areas Required</th>
<th>Adjusted Laboratory Areas Required X 1.3</th>
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<tbody>
<tr>
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<td>Other (specify)</td>
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<td>IV Heat Treating</td>
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<td>V Metallography</td>
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<tr>
<td>VI Instrumentation</td>
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</table>
**FORM D**

**LABORATORY AREA REQUIREMENTS BY CONTENT AREAS**

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Total Enrollment (1)</th>
<th>Maximum Group Size (2)</th>
<th>Total Weekly Periods or Modules (3)</th>
<th>Total Weekly Action Group Periods or Modules (4)</th>
<th>Laboratory Areas Required (5) + (4) (6)</th>
<th>Adjusted Laboratory Areas Required (6) X 1.3 (7)</th>
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<td></td>
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<tr>
<td>IV Heat Treating</td>
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<td>V Metallography</td>
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</table>
### SAMPLE FORM E

**SUMMARY OF FACILITY REQUIREMENTS FOR TECHNICIAN TRAINING PROGRAMS IN METALLURGY**

<table>
<thead>
<tr>
<th>Instructional Areas</th>
<th>Number Required*</th>
<th>Required Student Capacity</th>
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<tbody>
<tr>
<td></td>
<td>Calculated Forms B, C, D Column 7</td>
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</tr>
<tr>
<td>Lecture/Demonstration</td>
<td>0.57</td>
<td>1</td>
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<tr>
<td>Seminar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing Process Laboratory</td>
<td>1.70</td>
<td>2</td>
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<tr>
<td>Manufacturing Process Laboratory</td>
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<td>Materials Testing Laboratory</td>
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<td>Heat Treating Laboratory</td>
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<tr>
<td>Metallography Laboratory</td>
<td></td>
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<tr>
<td>Instrumentation Laboratory</td>
<td></td>
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</tr>
<tr>
<td>Science Laboratory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Multi-purpose areas**

If any of the specialized areas entered above are to be combined as multi-purpose areas, indicate the combinations desired.

a. Combination manufacturing process laboratory & lecture/demonstration

b. _____________________________________________________________

c. _____________________________________________________________

d. _____________________________________________________________

**5 Summary of facility requirements for metallurgy technology training program.**

Based on the above entries, summarize the total quantitative facility requirements for the planned program.

---

*Enter the number of instructional areas needed for each student capacity required. In the event that the numbers required indicate that an area will be used only sparingly, consideration should be given to sharing lecture/demonstration and seminar areas with other training programs or the construction of high student capacity areas which are capable of being subdivided for instructional purposes.

---

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FORM E
SUMMARY OF FACILITY REQUIREMENTS FOR TECHNICIAN TRAINING PROGRAMS IN METALLURGY

<table>
<thead>
<tr>
<th>Instructional Areas</th>
<th>Number Required*</th>
<th>Required Student Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calculated Forms B, C, D Column 7</td>
<td>Next Higher Whole Number</td>
</tr>
<tr>
<td>Lecture/Demonstration</td>
<td></td>
<td></td>
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<tr>
<td>Lecture/Demonstration</td>
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<td>Lecture/Demonstration</td>
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<td>Lecture/Demonstration</td>
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<td></td>
</tr>
<tr>
<td>Seminar</td>
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<tr>
<td>Seminar</td>
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<tr>
<td>Seminar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminar</td>
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<td>Manufacturing Process Laboratory</td>
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</tr>
<tr>
<td>Science Laboratory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 Multi-purpose areas
If any of the specialized areas entered above are to be combined as multi-purpose areas, indicate the combinations desired.

a. 

b. 

c. 

d. 

5 Summary of facility requirements for metallurgy technology training program.
Based on the above entries, summarize the total quantitative facility requirements for the planned program.

*Enter the number of instructional areas needed for each student capacity required. In the event that the numbers required indicate that an area will be used only sparingly, consideration should be given to sharing lecture/demonstration and seminar areas with other training programs or the construction of high student capacity areas which are capable of being subdivided for instructional purposes.
QUALITATIVE FACILITY NEEDS

In this section, detailed information on the kind of instructional areas required is recorded. Special forms are provided for describing the nature of lecture/demonstration areas, seminar areas, laboratory areas, and auxiliary areas to be provided. For each general type of instructional area required information is sought in the following categories.

1. The relationship of the area to other instructional areas (specialized versus multi-purpose utilization of space).

2. The number of these kinds of areas needed.

3. The activities of students and teachers in the instructional area.

4. The spatial relationships within the area and the area's spatial relationships to other instructional areas and the building as a whole.

5. The furniture and equipment required for the area.

6. The environmental factors required for the area.

7. The special utility services required for the area.

8. The minimal space requirements for the area.
FORM F

DESCRIPTION OF LECTURE/DEMONSTRATION AREA(S)
TO BE USED PRINCIPALLY FOR GROUP REACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The lecture/demonstration area(s) should be planned:
   a. As independent unit(s)                                  Yes  No
   b. In combination with laboratory area(s) (specify)       Yes  No
   c. In combination with seminar area(s)                    Yes  No
   d. As an area within a single multi-use space             Yes  No

2. Number of lecture/demonstration areas required for the desired program (see Form E)

3. Student and teacher activities in this space. Indicate the extent to which each of the activities listed below will occur.
   a. Listening to lectures                                   1 2 3 N
   b. Observing demonstrations                                1 2 3 N
   c. Taking notes                                            1 2 3 N
   d. Viewing films, slides, overhead projections, etc.       1 2 3 N
   e. ____________________________________________________   1 2 3 N
   f. ____________________________________________________   1 2 3 N

4. Spatial relationships. Indicate the extent to which the lecture/demonstration area(s) should be accessible to the:
   a. Instructional materials center                          1 2 3 N
   b. Building entrance                                       1 2 3 N
   c. Delivery area                                            1 2 3 N
   d. Other instructional area
      1) ___________________________________________________   1 2 3 N
      2) ___________________________________________________   1 2 3 N
      3) ___________________________________________________   1 2 3 N
   e. Other building areas
      1) ___________________________________________________   1 2 3 N
      2) ___________________________________________________   1 2 3 N
      3) ___________________________________________________   1 2 3 N

5. Furniture and equipment
   a. Student seating

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**FORM F**

<table>
<thead>
<tr>
<th></th>
<th>Individual desks and chairs</th>
<th>Permanent-type desk</th>
<th>Desk and chair combination</th>
<th>Tables and chairs</th>
<th>Auditorium-type seating</th>
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</thead>
<tbody>
<tr>
<td>1)</td>
<td>a) Number of desks and chairs required</td>
<td>a) Number required</td>
<td>a) Number required</td>
<td>a) Number of tables required</td>
<td>Number of seats required</td>
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<tr>
<td></td>
<td>b) Provision for storage</td>
<td>b) Provision for storage</td>
<td>b) Provision for storage</td>
<td>b) Number of chairs required</td>
<td>b) Provision for storage</td>
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<tr>
<td></td>
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<td>Yes No</td>
<td>Yes No</td>
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<td>2)</td>
<td>Permanent-type desk</td>
<td>Permanent type</td>
<td>Portable type</td>
<td>The approximate area in square feet desired</td>
<td>Sound amplifying system</td>
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<tr>
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<td>P A NA</td>
<td>P A NA</td>
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<tr>
<td>3)</td>
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<td>Yes No</td>
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<td>4)</td>
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<td>Tables and chairs</td>
<td>Tables and chairs</td>
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<td>a) Number of tables required</td>
<td>a) Number of tables required</td>
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<td></td>
<td>b) Number of chairs required</td>
<td>b) Number of chairs required</td>
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<td>b) Number of chairs required</td>
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<td>5)</td>
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<td>Yes No</td>
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b. State

1) Permanent type
2) Portable type

The approximate area in square feet desired

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<th>b. State</th>
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<tr>
<td></td>
<td>2) Portable type</td>
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</table>

<table>
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<th></th>
<th>c. Sound amplifying system</th>
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<td>3) Provision for storage</td>
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<td>d. Controls for regulating light intensity</td>
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<td></td>
<td>e. Lectern</td>
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<td>2) Portable type</td>
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<td>3) Provision for storage</td>
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<td></td>
<td>f. Projection screen</td>
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<td>1) Built-in type</td>
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<td>2) Portable type</td>
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<td>4) Provision for storage</td>
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<td>g. Other equipment requirements for lecture/demonstration area(s) are:</td>
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<tr>
<td></td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td>2)</td>
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<td></td>
<td>3)</td>
</tr>
<tr>
<td></td>
<td>4)</td>
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</table>

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the lecture/demonstration area(s).

<table>
<thead>
<tr>
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<th>a. Environmental factors</th>
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<tr>
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<td>2)</td>
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<tr>
<td></td>
<td>3)</td>
</tr>
<tr>
<td></td>
<td>4)</td>
</tr>
</tbody>
</table>

*Code: P = Preferred; A = Acceptable; NA = Not acceptable. This scale is used frequently on the following pages.*

---

*Note: The code system is not fully consistent throughout the form. Some missing codes or values may need to be inferred based on the context.*
FORM F

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the lecture/demonstration area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the lecture/demonstration area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special consideration important to the planning of the lecture/demonstration area(s).

e. Safety. In planning a school building, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the lecture/demonstration area(s).

7. Vertical instructional surfaces
   a. Chalkboard
      1) Wall-mounted
         Number of lineal feet
      2) Portable
         Provision for storage
   b. Tack board
      Number of lineal feet
   c. Pegboard
      Number of lineal feet

8. Special utility services required
   a. Electricity
      1) Projection equipment
      2) Sound amplifying equipment
      3) Electrical needs for other equipment (specify)
FORM F

a) _____________________________

b) _____________________________
c) _____________________________
d) _____________________________

b. Other utility needs for the lecture/demonstration area(s)

1) _____________________________
2) _____________________________
3) _____________________________
4) _____________________________

9. The minimum space requirement in square feet for each lecture/demonstration area (optional). (The planner should be aware of any state or local regulation or recommendations concerning floor space requirements.)

10. Other important factors to be considered in the planning of the lecture/demonstration area(s) are:
FORM G

DESCRIPTION OF SEMINAR AREA(S) 
TO BE USED PRINCIPALLY FOR GROUP INTERACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The seminar area(s) should be planned:
   a. As independent unit(s) Yes No
   b. In combination with laboratory area(s) (specify) Yes No
   c. In combination with lecture/demonstration area(s) Yes No
   d. As an area within a single multi-use area Yes No

2. The number of seminar area(s) required for the desired program (see Form E)

3. Student and instructor activities in this space. Indicate the extent to which each of the activities listed below will occur.
   a. Small group discussing 1 2 3 N
   b. Viewing films, slides, overhead projections, etc. 1 2 3 N
   c. Demonstrating 1 2 3 N
d. Reporting 1 2 3 N
e. Working on projects 1 2 3 N
f. _____________________________ 1 2 3 N
g. _____________________________ 1 2 3 N

4. Spatial relationships. Indicate the extent to which the seminar area(s) should be accessible to the:
   a. Instructional materials center 1 2 3 N
   b. Building entrance 1 2 3 N
c. Delivery area 1 2 3 N
d. Other instructional areas
   1) _____________________________ 1 2 3 N
   2) _____________________________ 1 2 3 N
   3) _____________________________ 1 2 3 N
e. Other building areas
   1) _____________________________ 1 2 3 N
   2) _____________________________ 1 2 3 N
   3) _____________________________ 1 2 3 N

5. Furniture and equipment
   a. Seminar table Yes No
      1) Number required
      2) Seating for how many persons

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FORM G

3) Permanent type  P A NA
4) Portable type  P A NA
5) Provision for storage  Yes No

b. Chairs
1) Number required  P A NA
2) Straight-back type  P A NA
3) Folding type  P A NA
4) Provision for storage  Yes No

c. Other equipment requirements for seminar area(s) are:
1) 
2) 
3) 
4) 

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of seminar areas.

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the seminar area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the seminar area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the seminar area(s).

e. Safety. In planning a school building, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the seminar area(s).
FORM 6

7. Vertical instructional surfaces
   a. Chalkboard
      1) Wall-mounted
         Number of lineal feet
      2) Portable
         Provision for storage
   b. Tack board
      Number of lineal feet
   c. Pegboard
      Number of lineal feet

8. Special utility services required
   a. Electricity
      1) Projection equipment
      2) Sound amplifying equipment
      3) Electrical needs for other equipment (specify)
         a) 
         b) 
         c) 
         d) 
   b. Other utility needs for the seminar area(s)
      1) 
      2) 
      3) 
      4) 

9. Minimum space requirement in square feet for each seminar area (optional).
   (The planner should be aware of any state or local regulations or recommendations concerning floor space requirements.)

10. Other important factors to be considered in the planning of the seminar area(s) are:

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FORM H-1

DESCRIPTION OF MANUFACTURING PROCESSES LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING
(MACHINE SHOP AREA)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The machine shop area(s) should be planned:
   a. As independent unit(s) ____________________________ Yes No
   b. In combination with ____________________________ Yes No
      laboratory area(s) (specify)______________________
   c. In combination with seminar area(s) Yes No
   d. In combination with lecture/demonstration area(s) Yes No
   e. As an area within a single multi-use area Yes No
   f. As a building and grounds maintenance facility Yes No

2. Student capacity required for scheduled activities (see Form E) ________

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.
   a. Within the manufacturing processes laboratory area(s)
      1) Machine shop area to
         a) Foundry area 1 2 3 N
         b) Metal Forming area 1 2 3 N
      2) Foundry area to
         Metal forming area 1 2 3 N
   b. Machine shop laboratory area(s) to
      1) Instructional materials center 1 2 3 N
      2) Building entrance 1 2 3 N
      3) Delivery area 1 2 3 N
      4) Other instructional areas (specify)
         a) ____________________________ 1 2 3 N
         b) ____________________________ 1 2 3 N
         c) ____________________________ 1 2 3 N
         d) ____________________________ 1 2 3 N
      5) Other building areas (specify)
         a) ____________________________ 1 2 3 N
         b) ____________________________ 1 2 3 N
         c) ____________________________ 1 2 3 N
         d) ____________________________ 1 2 3 N

4. Equipment and furniture
   a. Lathes ____________ Yes No
      Specify type and number required

   [Signature] 49
FORM H-1

b. Grinders
   Specify type and number required
   Yes  No

c. Drill presses
   Specify type and number required
   Yes  No

d. Milling machines
   1) Specify types and number required
   Yes  No
   2) Specify type of accessory tape control equipment if desired:

  e. Electric discharge machining equipment
     Specify type and number required
     Yes  No

  f. Chemical milling equipment
     Specify type and number required
     Yes  No

  g. Band saws
     Specify type and number required
     Yes  No

  h. Layout and inspection equipment
     (ex. micrometers, calipers, comparator, layout plates, surface gages, optical flats, etc.)
     Specify type and number required

  i. Tool crib
     1) Number required
     2) Floor area required
        sq.ft.

  j. Work benches
     Specify type and lineal feet required
     ft.
     ft.
     ft.

  k. Stock rack
     Specify type and number required
     Yes  No

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FORM H-1

1. Filing cabinets
   1) Legal-size drawers
      Number of drawers required
   2) Letter-size drawers
      Number of drawers required

m. Magazine racks
   1) Number required
   2) Provision for storage

n. Provision for darkening area(s)
   1) Opaque blinds
   2) Flexible room partitions
      Provision for storage

o. Projection screen
   1) Wall-mounted
   2) Portable
      Provision for storage

p. Student seating
   1) Individual stools
   2) Other (specify)

q. Built-in locker for storage of students' coats, etc.

r. Other equipment required for machine shop area (ex. vises, hand tools, etc.)
   1) __________________________
   2) __________________________
   3) __________________________
   4) __________________________

5. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the machine shop laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the machine shop laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the
FORM H-1

visual environment of the machine shop laboratory area(s).

<table>
<thead>
<tr>
<th>Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications of the machine shop laboratory area(s).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

6. Vertical instructional surfaces

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Chalkboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Wall-mounted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lineal feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Portable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Number of lineal feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Provision for storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Tack board</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lineal feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Pegboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lineal feet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Special utility services required

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Electricity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Motor driven machines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 110 V AC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) 220 V AC, single phase</td>
<td></td>
<td></td>
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<tr>
<td>c) 220 V AC, three phase</td>
<td></td>
<td></td>
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<tr>
<td>2) Special lighting requirements (specify)</td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
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<td>c)</td>
<td></td>
<td></td>
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<tr>
<td>d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Electrical needs for other equipment (specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td></td>
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<td>b)</td>
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<td>c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Compressed air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Drinking fountain(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Sinks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Toilets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Minimum space requirements in square feet

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FORM H-1

Floor area in square feet for entire machine shop laboratory area

9. Other important factors to be considered in the planning of the machine shop laboratory area(s) are: (ex. separate master electrical distribution panel)
FORM H-2

DESCRIPTION OF MANUFACTURING PROCESSES LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING
(FOUNDRY AREA)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The foundry area(s) should be planned:
   a. As independent unit(s) Yes No
   b. In combination with laboratory area(s) (specify) Yes No
   c. In combination with seminar area(s) Yes No
   d. In combination with lecture/demonstration area(s) Yes No
   e. As an area within a single multi-use area(s) Yes No

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.
   a. Within the manufacturing processes laboratory area(s)
      1) Foundry area to
         a) Machine shop area 1 2 3 N
         b) Metal forming area 1 2 3 N
      2) Machine shop area to Metal forming area 1 2 3 N
   b. Foundry laboratory area(s) to
      1) Instructional materials center 1 2 3 N
      2) Building entrance 1 2 3 N
      3) Delivery area 1 2 3 N
      4) Other instructional areas
         a) 1 2 3 N
         b) 1 2 3 N
         c) 1 2 3 N
      5) Other building areas
         a) 1 2 3 N
         b) 1 2 3 N
         c) 1 2 3 N

4. Equipment and furniture
   a. Metal melting furnaces Yes No
      Specify type(s) and number required

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FORM H-2

b. Sand conditioning and mixing equipment
   (for molding sand and/or core sand)
   Specify type(s) and number required
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   Yes  No

c. Core 'baking ovens
   Specify type(s) and number required
   ____________________________________________________________
   Yes  No

d. Testing and control equipment for molding
   and core sands, molds and cores
   Specify type(s) and number required
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   Yes  No

e. Molding machine(s)
   Specify type(s) and number required
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   Yes  No

f. Sand blast equipment
   Specify type
   ____________________________________________________________
   Yes  No

g. Work benches
   Specify type(s) and lineal feet required
   ____________________________________________________________
   ____________________________
   Yes  No

h. Equipment and pattern storage racks
   Specify type(s) and number required
   ____________________________________________________________
   Yes  No

i. Student seating
   1) Mobile collapsible bleachers
      a) Specify type
         _________________________________________________________
      b) Provision for storage
         Yes  No
   2) Other (describe) _________________________________________
      P A  NA

j. Built in lockers for storage of students' coats, etc.
   Yes  No

k. Other equipment required for foundry area
   (ex. flasks, tongs, shovels, crucibles, platform scales, pyrometers, vibrators,
    safety clothing, etc.)
   1) _______________________________________________________
   2) _______________________________________________________
      5 5
5. Environmental factors
   a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the foundry area(s).

   b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the foundry area(s).

   c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the foundry area(s).

   d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special considerations important to the planning of the foundry area(s).

   e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special considerations which have implications for design of the foundry area(s).

6. Vertical instructional surfaces
   a. Chalkboard
      1) Wall-mounted Yes No P A NA
FORM H-2

Number of lineal feet

2) Portable
   a) Number of lineal feet
   b) Provision for storage

b. Tack board
   Number of lineal feet

   Provision for storage
   Yes No

   Number of lineal feet
   Yes No

c. Pegboard
   Number of lineal feet

7. Minimum floor areas required in square feet

   a. Floor area in square feet for the entire foundry area

   b. If distinct space divisions are desired according to function give minimum floor area requirements in square feet for each of the following areas if included in the desired program.

   1) Storage space
      a) Sand
      b) Sand Binders
      c) Metal ingot and scrap

   2) Core making area

   3) Moulding area

   4) Melting and pouring area

   5) Crucible cleaning and coating area

   6)

   7)

   8)

8. Special utility services required

   a. Electricity

      1) Motor driven machines
         a) 110 V AC
         b) 220 V AC, single phase
         c) 220 V AC, three phase

      2) Metal melting furnaces
         440 V AC

      3) Special lighting requirements (specify)
         a) ________________________________
         b) ________________________________
         c) ________________________________
         d) ________________________________

      4) Electrical needs for other equipment (specify)
         a) ________________________________
         b) ________________________________
         c) ________________________________
         d) ________________________________

   b. Compressed air

      1) High pressure
      2) Low pressure

   c. Fuel oil

   Yes No

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FORM H-2

d. Gas

e. Water

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Sand conditioning</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2) Drinking fountains</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3) Sinks</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4) Toilets</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

5) Other (specify) ____________________________

9. Other important factors to be considered in the planning of the foundry laboratory area(s) are: (ex. separate master electrical distribution panel)

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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FORM H-3

DESCRIPTION OF MANUFACTURING PROCESSES LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING (METAL FARMING AREA)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The metal forming area(s) should be planned:
   a. As independent unit(s)                        Yes  No
   b. In combination with laboratory area(s) (specify) Yes  No
   c. In combination with seminar area(s)                        Yes  No
   d. In combination with lecture/demonstration area(s)                        Yes  No
   e. As an area within a single multi-use area                        Yes  No

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.
   a. Within the manufacturing processes laboratory area(s)
      1) Metal forming area to
         a) Machine shop
         b) Foundry
      2) Machine shop to
         a) Foundry
      3) Metal forming laboratory area to
         1) Instructional materials center
         2) Building entrance
         3) Delivery area
         4) Other instructional areas
            a) __________________________
            b) __________________________
            c) __________________________
         5) Other building areas (specify)
            a) __________________________
            b) __________________________
            c) __________________________

4. Equipment and furniture
   a. Rolling mill
      Specify type(s) and number required                        Yes  No

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FORM H-3

b. Presses (metal stamping and/or metal powder briquetting)
   Specify type(s) and number required
   ________________________________ Yes No

c. Swaging equipment
   Specify type(s) and number required
   ________________________________ Yes No

d. Magdeforming equipment
   Specify type(s) and number required
   ________________________________ Yes No

e. Wire drawing bench
   Specify type(s) and number required
   ________________________________ Yes No

f. Shearing press
   Specify type(s) and number required
   ________________________________ Yes No

g. Press brake
   Specify type(s) and number required
   ________________________________ Yes No

h. Ovens (preheating and annealing)
   Specify type(s) and number required
   ________________________________ Yes No

i. Hardness testers
   Specify type(s) and number required
   ________________________________ Yes No

j. Welding equipment
   Specify type(s) and number required
   ________________________________ Yes No

k. Work benches
   Specify type(s) and lineal feet required
   ________________________________ Yes No

l. Welding booths
   Specify type and number required
   ________________________________ Yes No

m. Storage racks
   Specify type and number required
   ________________________________ Yes No

n. Student seating
   1) Stools
      Specify type(s) and number required
      ________________________________ Yes No

60
2) Other (describe)  

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>A</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>o.</td>
<td>Built in lockers for storage of students' coats, etc.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>p.</td>
<td>Other equipment required for metal forming laboratory (ex. tongs, micrometers, anvil, pyrometers, hand tools, etc.)</td>
<td>1)</td>
<td>2)</td>
</tr>
<tr>
<td></td>
<td>3)</td>
<td>4)</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td>6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are colors, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the metal forming area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the metal forming area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the metal forming area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound systems. Indicate any special considerations important to the planning of the metal forming area(s).

e. Safety. In planning a school building, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the metal forming area(s).
FORM H-3

6. Vertical instructional surfaces
   a. Chalkboard
      1) Wall-mounted
         Number of lineal feet
      2) Portable
         a) Number of lineal feet
         b) Provision for storage
   b. Tack board
      Number of lineal feet
   c. Pegboard
      Number of lineal feet

7. Minimum space requirement in square feet for the metal forming laboratory area(s).

8. Special utility services required
   a. Electricity
      1) Motor driven machines
         a) 110 V AC
         b) 220 V AC, single phase
         c) 220 V AC, three phase
      2) Special lighting equipment (specify)
         a)
         b)
         c)
         d)
      3) Electrical needs for other equipment (specify)
         a)
         b)
         c)
         d)
   b. Compressed air
      1) High pressure
      2) Low pressure
   c. Gas
      Yes No
   d. Water
      1) Drinking fountains
      2) Sinks
      3) Toilets
      4) Other (specify)

9. Other important factors to be considered in the planning of the metal forming area(s) are:

   ________________________________
   ________________________________
   ________________________________
   ________________________________
   ________________________________

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FORM I

DESCRIPTION OF MATERIALS TESTING LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The materials testing laboratory area(s) should be planned:
   a. As independent unit(s) Yes No
   b. In combination with laboratory area(s) (specify) Yes No
   c. In combination with lecture/demonstration area(s) Yes No
   d. In combination with seminar area(s) Yes No
   e. As an area within a single multi-use area Yes No

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The materials testing laboratory area(s) to:
   a. Instructional material center 1 2 3 N
   b. Building entrance 1 2 3 N
   c. Delivery area 1 2 3 N
   d. Other building areas 1) 1 2 3 N
      2) 1 2 3 N
      3) 1 2 3 N
   e. Other instructional areas 1) 1 2 3 N
      2) 1 2 3 N
      3) 1 2 3 N

4. Equipment and furniture
   a. Tensile-compression testers Yes No
      Specify type(s) and number required
      ________________________________
   b. Impact testers Yes No
      Specify type(s) and number required
      ________________________________
   c. Torsion testers Yes No
      Specify type(s) and number required
      ________________________________
### FORM I

<table>
<thead>
<tr>
<th>Item</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>d. Hardness testers (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>e. Fatigue testers (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>f. Creep testers (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>g. Ultrasonic tester (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>h. Eddy current tester (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>i. Magnetic particle tester (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>j. Corrosion chamber (Specify type required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>k. Electric strain gage readout equipment (Specify type required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>l. Radiographic equipment (Specify type required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>m. X-ray film processing darkroom (Specify type required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>n. Work benches (Specify type(s) and lineal feet required)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>o. Storage cabinets (Specify type(s) and number required)</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
| p. Student seating  
  1) Stools (Specify type(s) and number required) | P A NA |
  2) Other (describe) | P A NA |
| q. Built in lockers for storage of students' coats, etc. | Yes/No |
| r. Other equipment required for materials testing laboratory (ex. extensometers, | Yes/No |
FORM I

micrometers, hand tools, polarized light source, fluorescent penetrant kit, etc.)
1) 
2) 
3) 
4) 
5) 
6) 

5. Special utility services required

a. Electricity
1) Motor driven machines
   a) 110 V AC
   b) 220 V AC, single phase
2) Special lighting requirements (specify)
   a) 
   b) 
   c) 
   d) 
3) Electrical needs for other equipment (specify)
   a) 
   b) 
   c) 
   d) 

b. Compressed air

b. Gas

d. Water
1) Drinking fountains
2) Sinks
3) Toilets
4) Other (specify)

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the materials testing laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the materials testing laboratory area(s).
c. **Visual.** A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the materials testing laboratory area(s).

---

d. **Sonic.** Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the materials testing laboratory area(s).

---

e. **Safety.** In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the materials testing laboratory area(s). Radiation hazards—radiography equipment.

---

7. **Vertical instructional surfaces**

   a. **Chalkboard**

      1) Wall-mounted
         Number of lineal feet
      2) Portable
         a) Number of lineal feet
         b) Provisions for storage

   b. **Tack board**

   c. **Pegboard**

   

8. **Minimum floor areas required in square feet**

   a. Floor area in square feet for the entire materials testing laboratory area(s)

   b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.

      1) Laboratory space
      2) Darkroom
      3) 
      4) 

---
9. Other important factors to be considered in the planning of the materials testing laboratory area(s).
FORM J

DESCRIPTION OF HEAT TREATING LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The heat treating laboratory area(s) should be planned:
   a. As independent unit(s) 
      Yes  No
   b. In combination with laboratory area(s) (specify) 
      Yes  No
   c. In combination with lecture/demonstration area(s) 
      Yes  No
   d. In combination with seminar area(s) 
      Yes  No
   e. As an area within a single multi-use area(s) 
      Yes  No

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The heat treating laboratory area(s) to:
   a. Instructional material center 1 2 3 N
   b. Building entrance 1 2 3 N
   c. Delivery area 1 2 3 N
   d. Other building area
      1) ________________________________________ 1 2 3 N
      2) ________________________________________ 1 2 3 N
      3) ________________________________________ 1 2 3 N
   e. Other instructional areas
      1) ________________________________________ 1 2 3 N
      2) ________________________________________ 1 2 3 N
      3) ________________________________________ 1 2 3 N

4. Equipment and furniture
   a. Muffle furnaces
      Specify type(s) and number required
      ____________________________________________ 
      ____________________________________________ 
      Yes  No
   b. Combustion tube furnaces
      1) Specify type(s) and number required
         ____________________________________________ 
         ____________________________________________ 
         Yes  No
      2) Provision for atmosphere control
         Yes  No

68
c. Recirculating (forced draft) ovens
   Specify type(s) and number required
   Yes No

d. High vacuum equipment for melting, heat treating, and sputtering
   Specify type(s) and number required
   Yes No

e. Molten salt furnaces
   Specify type(s) and number required
   Yes No

f. Quench tanks
   Specify type(s) and number required
   Yes No

g. Atmosphere generator
   Specify type(s) and number required
   Yes No

h. Instrumentation (temperature and atmosphere controls and recorders)
   Specify type(s) and number required
   Yes No

i. Hardness testers
   Specify type(s) and number required
   Yes No

j. Work benches
   Specify type(s) and number required
   Yes No

k. Student seating
   1) Individual stools
   2) Other (describe)
   P A NA
   P A NA
   P A NA

l. Built in lockers for storage of students' coats, etc.

m. Other major equipment needs for the heat treating laboratory area(s). (ex. belt grinder vises, tongs, asbestos gloves, face shield, etc.)

69
6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the heat treating laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the heat treating laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the heat treating laboratory area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the heat treating laboratory area(s).

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the heat treating laboratory area(s).

7. Special utility services required

a. Electricity
   1) Motor driven machines
      a) 110 V AC
      b) 220 V AC, single phase
      c) 220 V AC, three phase
         Yes   No
         Yes   No
         Yes   No
FORM J

2) Special lighting requirements (specify)
   a) 
   b) 
   c) 
   d) 

3) Electrical needs for other equipment (specify)
   a) 
   b) 
   c) 
   d) 

b. Compressed air
   c. Gas
   d. Fuel oil
   e. Water
   1) Drinking fountains
     2) Sinks
     3) Toilets
     4) Other (specify) 

8. Vertical instructional surfaces
   a. Chalkboard
      1) Wall-mounted
         Number of lineal feet
      2) Portable
         Number of lineal feet
   b. Tack board
      Number of lineal feet
   c. Pegboard
      Number of lineal feet

9. Minimum floor areas required in square feet
   a. Floor area in square feet for the entire heat treating laboratory area(s)
   b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
      1) Laboratory space
      2) Classroom
      3) 
      4) 
      5) 

10. Other important factors to be considered in the planning of the heat treating laboratory area(s).
DESCRIPTION OF THE METALLOGRAPHIC LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The metallographic laboratory area(s) should be planned:
   a. As independent unit(s)
   b. In combination with laboratory area(s) (specify)
   c. In combination with lecture/demonstration area(s)
   d. In combination with seminar area(s)
   e. As an area within a single multi-use area

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other.
The metallographic laboratory area(s) to:
   a. Instructional material center
   b. Building entrance
   c. Delivery area
   d. Other building areas
      1) 
      2) 
      3) 
   e. Other instructional areas
      1) 
      2) 
      3) 

4. Equipment and furniture
   a. Specimen cut-off machines
      Specify type(s) and number required
   b. Grinders (disc and/or hand)
      Specify type(s) and number required
   c. Polishers
      1) Variable speed rotary
         Specify type(s) and number required

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FORM K

2) Vibratory
   Specify type(s) and number required
   ____________________________________________
   d. Sonic cleaner
      Specify type(s) and number required
      ____________________________________________
   e. Electrolytic polisher and/or etcher
      Specify type(s) and number required
      ____________________________________________
   f. Metallurgical microscopes
      1) Specify type(s) and number required
         _____________________________
         Yes No
   2) Television camera attachment
      Yes No
   3) Stereo microscope with polaroid
      attachment
      Yes No
   g. Metallograph
      Specify type
      Yes No
   h. Specimen mount press
      Specify type(s) and number required
      ____________________________________________
      Yes No
   i. Hardness testers
      1) Specify type(s) and number required
         _____________________________
         Yes No
      2) Micro-hardness adapter for metallograph
         Yes No
   j. Work benches
      Specify type(s) and lineal feet required
      Yes No
   k. Storage cabinets
      Specify types and number required
      _____________________________
      Yes No
   l. Photographic darkroom
      1) Specify size
         Yes No
      2) Location for metallograph
         Yes No
   m. Student seating
      1) Stools
         Specify type(s) and number required
         _____________________________
         Yes No
      2) Other (describe)
         _____________________________
         Yes No
   n. Built-in lockers for storage of students' coats, etc.
      Yes No

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FORM K

o. Other equipment required for metallographic laboratory (ex. hand tools, vises, photo developing and enlarging and printing equipment, specimen storage cabinet, etc.)

1) 
2) 
3) 
4) 
5) 
6) 

5. Special utility services required

a. Electricity

1) Motor driven machines
   a) 110 V AC Yes No
   b) 220 V AC, single phase Yes No

2) Special lighting requirements (specify)
   a) 
   b) 
   c) 
   d) 

3) Electrical needs for other equipment (specify)
   a) 
   b) 
   c) 
   d) 

b. Compressed air

   Yes No

c. Water

1) Drinking fountains Yes No
2) Sinks Yes No
3) Toilets Yes No
4) Other (specify) 

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the metallographic laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity,
and ventilation. Indicate any special considerations important to the planning of the metallographic laboratory area(s).

d. **Sonic.** Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the metallographic laboratory area(s).

e. **Safety.** In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the metallographic laboratory area(s).

7. **Vertical instructional surfaces**

   a. **Chalkboard**
      1) Wall-mounted
         Number of lineal feet
      2) Portable
         a) Number of lineal feet
         b) Provision for storage
   b. **Tack board**
      Number of lineal feet
   c. **Pegboard**
      Number of lineal feet

8. **Minimum floor areas required in square feet**

   a. Floor area in square feet for the entire metallographic laboratory area(s)
   b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each
FORM K

of the following areas, if included in the desired program.
1) Laboratory space
2) Classroom
3) 
4) 
5) 

9. Other important factors to be considered in the planning of the metallographic laboratory area(s): (ex. provision for darkening area)
FORM L

DESCRIPTION OF INSTRUMENTATION LABORATORY AREA(S) TO BE USED PRINCIPALLY FOR ACTION LEARNING

<table>
<thead>
<tr>
<th>1 major emphasis</th>
<th>2 some emphasis</th>
<th>3 slight emphasis</th>
<th>N no emphasis</th>
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<tr>
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</tbody>
</table>

1. The instrumentation laboratory area(s) should be planned:

   a. As independent unit(s) Y N

   b. In combination with laboratory area(s) (specify) Y N

   c. In combination with lecture/demonstration area(s) Y N

   d. In combination with seminar area(s) Y N

   e. As an area within a single multi-use area Y N

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The instrumentation laboratory area(s) to:

   a. Instructional material center 1 2 3 N

   b. Building entrance 1 2 3 N

   c. Delivery area 1 2 3 N

   d. Other building areas 1) 2) 3) 1 2 3 N

   e. Other instructional areas 1) 2) 3) 1 2 3 N

4. Equipment and furniture

   a. Atomic absorption spectrophotometer Specify type Y N

   b. Ultra-violet and visible light spectrophotometer Specify type Y N

   c. Emission spectrograph Specify type Y N

   d. Densitometer Specify type Y N

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FORM L

e. Bunsen spectrosopes
   Specify type(s) and number required
   
   Yes  No

f. X-ray diffraction (basic unit)
   Specify type
   
   Yes  No

g. X-ray diffractometer
   Specify type
   
   Yes  No

h. Dilatometer
   Specify type(s) and number required
   
   Yes  No

i. Vapor fractometer
   Specify type
   
   Yes  No

j. ORSAT gas analyzer
   Specify type(s) and number required
   
   Yes  No

k. Microderm thickness tester (betascope)
   Specify type and number required
   
   Yes  No

l. Electrographic porosity checker
   Specify type and number required
   
   Yes  No

m. Film processing darkroom
   Specify size
   
   Yes  No

n. Work benches
   Specify type(s) and lineal feet required
   
   Yes  No

o. Storage cabinets
   Specify type(s) and number required
   
   Yes  No

p. Student seating
   1) Stools
      Specify type(s) and number required
      
      Yes  No

   2) Other (describe)
      
      Yes  No

q. Built in lockers for storage of students' coats, etc.
   
   Yes  No

r. Other equipment required for instrumentation laboratory (ex. balances, chemical glassware, monochromatic light sources, etc.)
   1)
   2)
   3)
   4)

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FORM L

5. Special utility services required

a. Electricity
   1) Special lighting requirements (specify)
      a) __________________________
      b) __________________________
      c) __________________________
      d) __________________________
   2) Electrical needs for other equipment (specify)
      a) __________________________
      b) __________________________
      c) __________________________
      d) __________________________

b. Compressed air
   Yes No

c. Gas
   Yes No

d. Water
   Yes No
   1) Drinking fountains
   Yes No
   2) Sinks
   Yes No
   3) Toilets
   Yes No
   4) Other (specify) __________________________

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the instrumentation laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the instrumentation laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors
FORM L

which should be taken into account in planning the visual environment of the instrumentation laboratory area(s).

Provision for darkening area

---

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the instrumentation laboratory area(s).

---

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the instrumentation laboratory area(s).

---

7. Vertical instructional surfaces

a. Chalkboard
   1) Wall-mounted
      Number of lineal feet
   2) Portable
      a) Number of lineal feet
      b) Provision for storage

b. Tack board
   Number of lineal feet

c. Pegboard
   Number of lineal feet

---

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire instrumentation laboratory area(s)

b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
   1) Laboratory space
   2) Darkroom
   3) Classroom
   4) ___________________________
   5) ___________________________

---

9. Other important factors to be considered in the planning of the instrumentation laboratory area(s).

---

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FORM M-1

DESCRIPTION OF SCIENCE LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING
(BASIC PHYSICS)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The basic physics laboratory area(s) should be planned:
   a. As independent unit(s)  
   b. In combination with laboratory area(s) (specify)  
   c. In combination with lecture/demonstration area(s)  
   d. In combination with seminar area(s)  
   e. As an area within a single multi-use area

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The basic physics laboratory area(s) to:
   a. Instructional material center
   b. Building entrance
   c. Delivery area
   d. Other building areas
      1) 
      2) 
      3) 
   e. Other instructional areas
      1) 
      2) 
      3) 

4. Equipment and furniture
   a. Force tables (statics) Specifying type and number required
   b. Acceleration apparatus (linear and rotary) Specifying type(s) and number required
   c. Thermometry apparatus Specifying type(s) and number required
d. Linear expansion apparatus
   Specify type and number required
   Yes  No

e. Specific heat apparatus
   Specify type and number required
   Yes  No

f. Heat transfer apparatus
   Specify type(s) and number required
   Yes  No

 g. Geometric optics apparatus
    Specify type(s) and number required
    Yes  No

h. Physical optics apparatus
    Specify type(s) and number required
    Yes  No

i. Gas-ionization tubes (cathode ray, crookes, Geissler, etc.)
   Specify type(s) and number required
   Yes  No

j. Radioactivity apparatus
   Specify type(s) and number required
   Yes  No

k. Work benches
   Specify type(s) and lineal feet required
   Yes  No

l. Storage cabinets
   Specify type(s) and number required
   Yes  No

m. Student seating
   1) Stools
      Specify type(s) and number required
      P  A  NA

   2) Other (describe)
      P  A  NA

n. Built in lockers for storage of students' coats, etc.
   Yes  No

o. Other equipment required for basic physics laboratory (ex. balances, high voltage power supplies, weights, potentiometers, ammeters, voltmeters, etc.)
   1)
5. Special utility services required

a. Electricity
   1) Special lighting requirements (specify)
      a) ________________________________
      b) ________________________________
      c) ________________________________
      d) ________________________________
   2) Electrical needs for other equipment (specify)
      a) Main control panel with rectifier
      b) ________________________________
      c) ________________________________
      d) ________________________________

b. Compressed air
   Yes   No

   Gas
      Yes   No

d. Water
   1) Drinking fountains   Yes   No
   2) Sinks                Yes   No
   3) Toilets              Yes   No
   4) Other (specify)      ________________________________
                           ________________________________
                           ________________________________
                           ________________________________
                           ________________________________

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the basic physics laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special consideration important to the planning of the basic physics laboratory area(s).
c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the basic physics laboratory area(s).

Provision for darkening area

---

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the basic physics laboratory area(s).

---

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the basic physics laboratory area(s).

---

7. Vertical instructional surfaces

a. Chalkboard
   1) Wall-mounted
      Number of lineal feet
   2)Portable
      a) Number of lineal feet
      b) Provision for storage
   b. Tack board
      Number of lineal feet
   c. Pegboard
      Number of lineal feet

---

8. Minimum floor areas required in square feet

a. Floor area in square feet for the entire basic physics laboratory area(s)

b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.
   1) Laboratory space
   2) 
   3) Classroom
   4) 
   5) 

---

9. Other important factors to be considered in the planning of the basic physics laboratory area(s).

---
FORM M-2

DESCRIPTION OF SCIENCE LABORATORY AREA(S)
TO BE USED PRINCIPALLY FOR ACTION LEARNING
(BASIC CHEMISTRY)

1 major emphasis
2 some emphasis
3 slight emphasis
N no emphasis

1. The basic chemistry laboratory area(s) should be planned:

   a. As independent unit(s)                      Yes  No
   b. In combination with laboratory area(s)    Yes  No
       (specify)
   c. In combination with lecture/demonstration
       area(s)                                  Yes  No
   d. In combination with seminar area(s)       Yes  No
   e. As an area within a single multi-use area Yes  No

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The basic chemistry laboratory area(s) to:

   a. Instructional material center
   b. Building entrance
   c. Delivery area
   d. Other building areas
       1)                                              1 2 3 N
       2)                                              1 2 3 N
       3)                                              1 2 3 N
   e. Other instructional areas
       1)                                              1 2 3 N
       2)                                              1 2 3 N
       3)                                              1 2 3 N

4. Equipment and furniture

   a. Balances (platform and analytical)
       Specify type(s) and number required        Yes  No

   b. Centrifuges
       Specify type and number required          Yes  No

   c. Drying ovens
       Specify type and number required          Yes  No

   d. Muffle furnaces
       Specify type(s) and number required        Yes  No
FORM M-2

<table>
<thead>
<tr>
<th>e. Water distillation apparatus</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify type and number required</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>f. Work benches</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify type(s) and lineal feet required</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>g. Storage cabinets</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify type(s) and number required</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>h. Student seating</th>
<th>P</th>
<th>A</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Stools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specify type(s) and number required</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>i. Built-in lockers for storage of students' coats, etc.</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>j. Other equipment required for basic chemistry laboratory (ex. chemical glassware, voltmeters, milliammeters, gas burners, hotplates, refrigerator, etc.)</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td></td>
<td></td>
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<td>5)</td>
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<tr>
<td>6)</td>
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</tbody>
</table>

5. Special utility services required

<table>
<thead>
<tr>
<th>a. Electricity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Special lighting requirements (specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td></td>
<td></td>
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<tr>
<td>b)</td>
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<tr>
<td>c)</td>
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<td></td>
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<tr>
<td>d)</td>
<td></td>
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</tbody>
</table>

| 2) Electrical needs for other equipment (specify) |     |    |
| a)                                                                                                                                                                                                  |     |    |
| b)                                                                                                                                                                                                  |     |    |
| c)                                                                                                                                                                                                  |     |    |
| d)                                                                                                                                                                                                  |     |    |

<table>
<thead>
<tr>
<th>b. Compressed air</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>c. Gas</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>d. Water</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Drinking fountains</td>
<td></td>
<td></td>
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<tr>
<td>2) Sinks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Toilets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Other (specify)</td>
<td></td>
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</tr>
</tbody>
</table>

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6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the basic chemistry laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the basic chemistry laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the basic chemistry laboratory area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the basic chemistry laboratory area(s).

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the basic chemistry laboratory area(s).

7. Vertical instructional surfaces

a. Chalkboard
   1) Wall-mounted
      Number of lineal feet
   2) Portable
      a) Number of lineal feet
      b) Provision for storage

   Yes  No
   P    A    NA

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b. Tack board  
   Number of lineal feet

   Yes  No

c. Pegboard  
   Number of lineal feet

   Yes  No

8. Minimum floor areas required in square feet

   a. Floor area in square feet for the entire basic chemistry laboratory area(s)  

   b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.

   1) Laboratory space  
   2)  
   3) Classroom  
   4)  
   5)  

9. Other important factors to be considered in the planning of the basic chemistry laboratory area(s).
FORM M-3

DESCRIPTION OF SCIENCE LABORATORY AREA(S) 
TO BE USED PRINCIPALLY FOR ACTION LEARNING 
(BASIC ELECTRICITY)

1 major emphasis  
2 some emphasis  
3 slight emphasis  
N no emphasis

1. The basic electricity laboratory area(s) should be planned:
   a. As independent unit(s)  
   b. In combination with laboratory area(s)  
      (specify)  
   c. In combination with lecture/demonstration area(s)  
   d. In combination with seminar area(s)  
   e. As an area within a single multi-use area

2. Student capacity required for scheduled activities (see Form E)

3. Spatial relationships. Indicate the extent to which spaces should be accessible to each other. The basic electricity laboratory area(s) to:
   a. Instructional material center
   b. Building entrance
   c. Delivery area
   d. Other building areas
      1)  
      2)  
      3)  
   e. Other instructional areas
      1)  
      2)  
      3)  

4. Equipment and furniture
   a. Motor-generator set
      Specify type(s) and number required
   b. Dynamometer
      Specify type and number required
   c. Servo-mechanism unit
      Specify type and number required
   d. Cathode ray oscilloscope
      Specify type(s) and number required
FORM M-3

e. Work benches
   Specify type(s) and lineal feet required
   
   Yes  No

f. Storage cabinets
   Specify type(s) and number required
   
   Yes  No

g. Student seating
   1) Stools
      Specify type(s) and number required
      
      Yes  No
      P  A  NA

   2) Other (describe)
      
      Yes  No
      P  A  NA

h. Built in lockers for storage of students' coats, etc.
   
   Yes  No

i. Other equipment required for basic electricity laboratory (ex. meters, strobotac, VTVMs, decade boxes, RLC bridges, galvonometers, variacs, etc.)
   1)
   2)
   3)
   4)
   5)
   6)

5. Special utility services required

a. Electricity
   1) Motor driven machines
      a) 110 V AC
      b) 220 V AC, single phase
      c) 220 V AC, three phase
      
      Yes  No
      Yes  No

   2) Special lighting requirements (specify)
      a)
      b)
      c)
      
   3) Electrical needs for other equipment
      (specify)
      a) Main control panel with rectifier
      b)
      c)
      
   b. Compressed air
   
   Yes  No

   c. Water
      1) Drinking fountains
      2) Sinks
      
      Yes  No
      Yes  No
FORM M-3

3) Toilets                                  Yes  No
4) Other (specify) ________________________

6. Environmental factors

a. Aesthetic. Factors to be considered in the aesthetic domain are color, light, style of architecture, design and the like. Indicate any special aesthetic considerations important to the planning of the basic electricity laboratory area(s).

b. Aerial. Factors to be considered in this category include air temperature, radiant temperature, relative humidity, and ventilation. Indicate any special considerations important to the planning of the basic electricity laboratory area(s).

c. Visual. A properly controlled and balanced visual environment is important. The visual environment affects such things as accuracy in perception, attention to tasks, and speed of performance. Indicate any special factors which should be taken into account in planning the visual environment of the basic electricity laboratory area(s).

d. Sonic. Factors to be considered in this category include such things as acoustical requirements and sound system. Indicate any special considerations important to the planning of the basic electricity laboratory area(s).

e. Safety. In planning school buildings, safety for students and instructors is of prime concern. Indicate any special safety considerations which have implications for design of the basic electricity laboratory area(s).

7. Vertical instructional surfaces

a. Chalkboard                                  Yes  No
1) Wall-mounted
   Number of lineal feet

2) Portable
   a) Number of lineal feet
   b) Provision for storage

b. Tack board
   Number of lineal feet

c. Pegboard
   Number of lineal feet

8. Minimum floor areas required in square feet

   a. Floor area in square feet for the entire basic electricity laboratory area(s)

   b. If distinct space divisions are desired according to function, give minimum floor area requirement in square feet for each of the following areas, if included in the desired program.

   1) Laboratory space
   2) 
   3) Classroom
   4) 
   5) 

9. Other important factors to be considered in the planning of the basic electricity laboratory area(s).
PART IV

ANNOTATED BIBLIOGRAPHY

GENERAL FACILITY PLANNING


Contributors to this publication were teachers, supervisors, administrators, architects, engineers, school board members, and school plant planning specialists. In addition to background material on school house construction, the book deals with specific topics including school surveys, analysis and computation of space and facility needs, enrollment projections, building designs, site selection, finance, and building maintenance and operation. Many pictures and illustrations are found, along with sample forms and outlines, which can be used in the facility planning process. No special consideration is given to unique problems faced in the planning for vocational and technical education facilities.


A textbook on overall planning procedures for new and improved school facilities. The typical topics (school surveys, building planning, site selection and acquisition, architectural planning, contracting for construction, and the equipping and furnishing of buildings) are covered. The only mention of vocational schools is on page 270 where the author quotes from another source:

Vocational training should be de-emphasized in the schools since this training often becomes obsolete before it can be used; also, special "trade" and "vocational" schools should be discontinued, unless the vocational curriculum is liberal in approach and broad in character. Such schools are often used as dumping grounds for students who are not wanted elsewhere and often more than custodial care is provided for them. When more is provided, the skills taught are frequently too partial in nature.

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Conrad, M. J.  

*Four Steps to New Schools.* Columbus, Ohio: Educational Administration and Facilities Division of the Bureau of Educational Research and Service, The Ohio State University.

A book prepared for the inexperienced school planner. The author emphasizes that a school building is an educational tool and should be designed to do the job it is intended to do. The four steps discussed are: 1) district-wide building survey; 2) educational planning; 3) architectural planning and construction; and 4) moving in and settling down. A glossary of important terms used in plant planning is located in the back of the book.

Conrad, M. J.; Wohlers, E. E.; and Griggs, Norman.  


A compilation of references in the following categories: general references; periodicals, overview of school plant field, district wide building survey, educational planning, the architect and his work, moving in and settling down, and related topics.

Finchum, R. N.  


This manual is intended to assist officials of school districts who are planning programs for maximum use of school properties and who must develop policies and regulations for efficient management of such programs. Various schedules of facility use are illustrated for nine different school systems.

Green, Alan C.  


This work is designed to meet the needs of three distinct groups interested in providing educational facilities. Report A: "A Guide for Policy Makers" is directed to boards, administrators, planning committees, and institutional planners. Report B: "A Guide for the Design of Professions" is designed for architects, planners, and design specialists and planning committees; and Report C: "A Technical Guide" is intended for design-architects, engineers, equipment and furniture suppliers, and media specialists.

National Council on School House Construction.  


A basic reference on school plant planning and construction for use by superintendents, school board members, school plant planners, state department of education personnel, local school system officials, collegiate institutions, architects, lay advisory groups, and graduate students. Major topics covered are: planning and programming educational plants; spaces and
equipment for learning; non-instructional systems; space organization and economy and resources. Much attention is given to plant planning through a description of a survey technique used to determine and satisfy school plant needs for a community. Site selection, kinds of instructional spaces, sonic, thermal, and visual environments, and best use of natural and plant resources are also treated.


The contents of this book include a description of what educational planning is, when it is done, who does it, and how it is done. The three steps of planning are identified as: 1) identification and analysis of educational and facility needs, 2) adapting and implementing plant improvement programs, and 3) completing and evaluating a process of the educational planning.


Basic principles of school design is the thrust of this publication. It focuses on the interrelationship of patterns of school activities, organization of activities on the site, design potentials for various sites, and the building design data necessary for communicating the school's needs to the architect.


This publication seeks to suggest which learning functions can be served electronically to symbolize the nature and progressive complexity of each electronic system, and finally to estimate budgets which will provide for adequate systems in relation to engineering and warranty costs.


A comprehensive textbook on the administration of the school plant program. The book is organized into three major parts: Part 1 - "Policy Decisions" deals with school building needs studies and long-range planning; Part 2 - "Program Recommendations" deals with local study of plant needs, evaluation of existing plant, determination of additional plant needs, site selection and development, and the preparation of educational specifications. Part 3 - "Project Administration" is concerned with the financial aspects of a building program and with public relations. There is a brief mention of the objectives of vocational education as contrasted with the objectives of general education on page 12.

This book deals with the cost of a schoolhouse and the process of planning and financing it. It provides median costs for various building elements, designates individual responsibilities in process of building, and discusses arrangement of space and environmental factors.

VOCATIONAL-TECHNICAL FACILITY PLANNING


The purpose of this publication is to reduce the broad principles and processes of school plant planning to those most applicable to vocational and practical arts education. Effective techniques for developing educational specifications are suggested. The committee provides a sequential treatment of program and administrative considerations, desired space and educational program, special site arrangement features, special physical aspects of building, and the financial requirements for the project.


A study of related literature on programmed instruction, instructional films, instructional television, and learning from various instructional media. It analyzes new instructional media approaches used at North Carolina's Fundamental Learning Laboratories System, and the integrated experience approach at Oakland Community College.


A general guide that describes important steps to be followed in the planning for and construction of vocational and technical education facilities. Important topics covered are: the impact of the Vocational Education Act of 1963; surveys of area educational needs; use of consultant services; basic planning considerations; educational specifications; general planning; and school construction cost and outlay. Sample floor plans and picture illustrations of vocational schools are included.

An account of the procedures followed in the establishment of a technical college within a period of less than 90 days. The entire planning process and implementation is described along with the PERT technique which was applied. The author concluded the PERT (Program Evaluation and Review Technique) was effective in assisting the planners in reaching their objectives within a short period of time.


The pamphlet emphasizes the need for a total flexibility concept in school building. Consideration is given to the use of building components to provide flexibility in space, lighting, air-conditioning, sewage system, and the like.


A report on new trends in the construction of vocational education facilities. Among topics covered are occupational clusters, teaching techniques such as micro-teaching and educational television, facilities for handicapped children, educational parks, and unique problems faced by large city school systems. Special consideration is given to maximum utilization of vocational education facilities on an around-the-clock basis.


A report which relates the thinking of six outstanding consultants on various topics relating current trends in vocational-technical education and facility planning. Reviews the work of a local consortium consisting of three Center vocational specialists, three school plant planners, three representatives from the State Department of Education, three local school officials, and three practicing architects in defining problems, clarifying issues, suggesting approaches to organizing planning guides, and establishing guidelines for a series of facility planning guides in selected vocational and technical subject areas.


A general facility planning guide for programs of vocational education. Principal topics covered include: 1) number of teaching stations, 2) types of teaching stations, 3) equipment needs, and 4) floor areas required. The planning manual also deals with spatial relationships of teaching facilities and the utilization of auxiliary areas such as libraries,
cafeterias, and administrative suites. Planners using the guide are directed to complete checklists and fill-in blanks with the necessary information pertinent to vocational facility planning.

METALLURGICAL TECHNICIAN FACILITIES PLANNING


This publication suggests a curriculum, brief description of all courses, and a summary of building and equipment costs. Although it is foundry oriented, it contains a detailed bibliography.


This publication suggests that "scientific and technical societies are the primary organizers and disseminators of scientific knowledge, procedures, techniques, and methods of application in the world of work. Technical educators turn to these societies to keep up to date and to guide students to an appreciation of their services as an essential part of preparation for employment as skilled technicians."
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<tr>
<th>No.</th>
<th>Name of Publication</th>
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OFF-FARM AGRICULTURAL OCCUPATIONS

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<tr>
<td>Agricultural Chemicals Technology (Course outline and eight modules)</td>
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<tr>
<td>Agricultural Machinery--Service Occupations (Course outline and and sixteen modules)</td>
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<td>Horticulture--Service Occupations (Course outline and twelve modules)</td>
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<td>Occupational Guidance for Off-farm Agriculture.</td>
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<td>Planning and Conducting Cooperative Occupational Experience in Off-farm Agriculture.</td>
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