Local School Construction Programs

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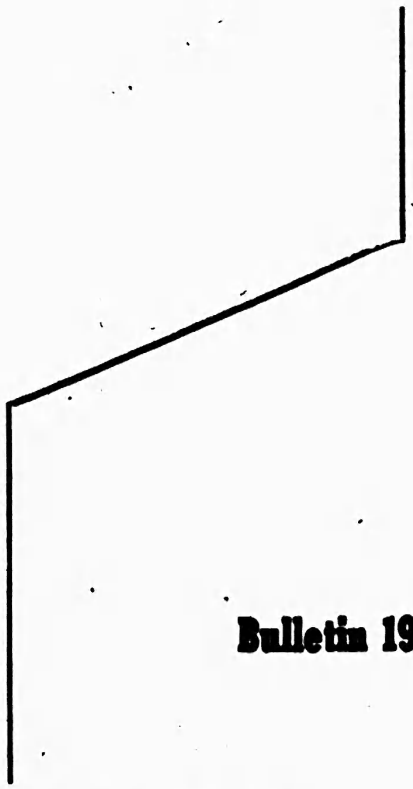

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Foreword

LOCAL SCHOOL-district officials are now participating in the largest school-building program in the history of the Nation. It seems likely that this program will continue for at least a decade and that these various local programs will involve the expenditure of more than $20 billion of school-district funds for new buildings.

By tradition and in practice there is a great degree of local autonomy in the planning and constructing of district school buildings. However, local superintendents who are required to provide leadership in various areas and who are subject to demands for various types of services often find it difficult to devote a substantial amount of time and attention to directing building programs. In most cases changing board membership also limits the experiences of board members in school-plant programs. School-plant programs of today are costly, and school officials seldom feel free to do much experimenting in school-plant construction at district expense. In general they want to avoid repeating the mistakes they see in some existing buildings and, insofar as possible, to avoid making other mistakes that might affect the building efficiency or durability.

The setting up of long-range school-plant programs, the establishing of school-building needs, the selection and purchase of sites, and the planning, financing, contracting, and constructing of new school buildings involve many activities and some complicated processes. A lack of knowledge of proper procedures or of the need for various actions at any stage of the program may prove costly in terms of money spent or in poor construction or inadequate services that may affect the future school programs.

Local School Construction Programs is designed as an outline to direct the attention of local officials to various features and steps meriting attention in planning and carrying out a school-plant construction program. Planning, administration, and construction practices and procedures may vary with buildings of different sizes or types of construction or with those erected

under different legal restrictions or climatic conditions. For many of the steps or procedures in school-plant programs there are no certain best methods or processes applicable for all buildings. Although not intended as final answers to specific problems on each building program, the suggestions and information outlined in this publication should provide general guidelines for planning the various steps in school building.

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Section I
Introduction

Unit 1
Developing School-Plant Programs

SCHOOL-BUILDING planning and construction programs involve many procedures and steps. Proper handling of these various steps facilitates the planning and construction programs and eliminates many difficulties that may otherwise arise. There was a time when some school buildings were erected as parts of community house-raising bees where simple design and construction patterns were planned and directed by local residents skilled in such work. As school-building programs became more extensive, as financing was handled on a community and/or State and community basis, and as certain State and other regulations were developed for the direction and control of school buildings, the planning and construction programs became more complex.

Many school boards have had limited experience in planning school plant programs and in constructing school buildings. Many of these school boards have not found it possible or convenient to employ planning and building directors who have had extensive experience and training. It is true that most school boards employ an architect who accepts certain designing, planning, and other construction obligations. However, he does not normally (and probably should not) accept responsibility for educational planning, site selection, financing programs, and many other problems that are a part of the obligations of the local officials. These local officials often wonder whether they have covered all of the essential points in planning and carrying out a school-construction program.

The following pages outline some of the problems and steps that merit

attention in most school-building programs. While the various steps have some sequential significance, they are not always equal in scope, nor do they appear in the same sequence in all school districts; consequently they are not listed here in one, two, three order. In these outline summaries it is not possible to cover every detail that will apply to each school-building program. In some programs the steps may be divided into patterns different from the ones outlined here. The intention is to provide a general list or outline of procedures without attempting to advise on each procedure involved or to provide specific solutions or answers to the many problems and questions that may arise in a particular program. In most instances procedure suggestions are offered rather than positive "do" or "don't" statements. However, certain procedures or steps that have been developed into generally accepted patterns may be discussed as recommendations. In other cases where a statement or principle seems axiomatic — such as the one in surveys that "tabular data should be explained"—it may be included as a positive statement.

In practice the various steps and procedures in a building program overlap in time. For instance, site selection, surveys, and educational planning may be separated into definite periods of time and sequence or may be intermingled in the procedures. Some of the procedures may vary from district to district or even in the same district in different years. For instance, a district may obtain capital outlay funds from moneys on hand; from a current regular or a special tax levy; from bond sales; or from State, county, or city grants. Some related procedure steps may be taken at different times during a program. For instance, some districts may first set up a financing plan and fit the program to the funds. Others may set up the proposed building program and then attempt to set up a financing plan. Even in the field of financing, the various steps or procedures may be taken at different times. The setting up of a financing plan may come early in the program. Voting bonds or special taxes may be done later in the program, and the bond sales may be made at one time or at different periods throughout the program. However, in this outline summary it seemed preferable to discuss all phases of the financing program as one general area even though the various steps or procedures may be taken at different times during the program.

Outline summaries of the various steps or procedures are presented as a general or comprehensive overview of school-building programs. However, some of the procedure details are applicable to a local building project. This study is developed as a general guideline in administering a school-construction program, but it is not designed to provide specific solutions for each of the various local building problems.

Section II

The Study and Planning Phases

AS IS indicated for the various steps in a school-plant program, the several phases also overlap. The following units indicate the general program-planning areas. The study and planning phases of a school-plant program may cover a long period of time and involve the interests and efforts of numerous people. These phases of the total school-plant program may include surveys of need; the adoption of a program pattern; and the development of educational, site, and design planning.

Unit 2

School-Plant Surveys

For many school communities the erection of new school plants is a major undertaking. It is good administrative practice to be sure that the total picture is available. Assumptions of need should be verified and supported by convincing data. Many local school officials, interested parents, and others wish to know how to evaluate the existing school plants and how to determine the need for new school-plant facilities in their communities.

The school survey provides one of the best means of evaluating the school-plant needs. When properly organized, the report of the school-plant survey provides an excellent means of informing the public on the local school-plant needs.

A major school-building program should include or be preceded by a study of the present and future school-plant needs and of the ability of the school district to finance plant improvements when they are necessary.

Many school officials maintain continuing surveys that provide data on probable future school enrollments, program changes, and anticipated school-plant needs. In other cases local administrators make or arrange for a survey, or at least assemble all available data to show the plant-improvement needs for a particular building project or a series of projects.

A. Board evaluation and approval of survey proposal and plan

Before the board of education approves or authorizes a proposed survey it may be desirable to obtain information concerning the need, the probable procedures to be followed, and the results that might be anticipated from a survey of school-plant needs. The persons providing such information may find it desirable to:

1. Describe the different kinds of school-plant surveys, such as
   a. Specific for building program
   b. General educational, including building needs as one element
2. Outline methods of making surveys, such as —
   a. Employing outside authority
   b. Using local staff
   c. Combining outside and local or with the outside authority providing consultative and perhaps evaluative services
3. Outline the purposes of the survey, general principles to be observed, organization, and costs of the survey

After the survey proposal has been reviewed by the board it may be desirable to have official board approval of the proposed survey.

The following suggested survey steps or procedures are not all-inclusive nor is it anticipated that all of these steps will be needed or applicable for all surveys. In some cases certain steps or factors should be developed fully while in other cases these steps may merit less attention.

B. Some of the types of school-plant surveys and the manner in which developed
   1. Some types
      a. Continuing
      b. Occasional or special for a particular building program
   2. The scope of the school-plant survey
      a. Statewide
      b. Limited to a district or area
   3. The building-survey coverage
      a. Part of a comprehensive educational survey
      b. Limited to building evaluations and needs
   4. Local surveys, direction and development
      a. Made by the State department of education
      b. Made as a self-survey by the local staff independently or with the State department of education or an outside specialist serving as a consultant
      c. Made by an outside survey staff

C. School population data as bases for estimating school-plant needs
   1. Census
      a. Enumeration trends over a period of years
      b. Pupil census by age levels, birth data
      c. Percentage of adults of child-bearing age

2. Enrollments
   a. Trends by years—public, nonpublic
   b. By grade levels, trends
   c. Enrollment persistency, for period of years
3. Socioeconomic factors in enrollment trends
   a. Industrial
   b. Housing
   c. Economic, as applied to local conditions
   d. Local trends
4. Transportation and traffic as factors in enrollments by buildings
   a. Traffic routes, barriers
   b. Transportation facilities, school and other
5. Pupil locations—current by areas
   a. Trends in housing developments
   b. Use various devices for portraying density
6. Future enrollment predictions
   a. By areas
   b. By grade levels

D. The educational program to be housed
1. The school, organization, policy
   a. Grade organization—K6-6, 8-4, etc.
   b. Policy on building sizes, enrollments
   c. Community and out-of-school use of school plants
2. Trends in the instruction program that may affect housing needs
   a. Subject offerings
   b. Class sizes
   c. Teaching methods
3. Number of teaching units
4. Classrooms needed
5. Special rooms needed
6. Other spaces and services

E. The existing plant
1. Building locations, with reference to
   a. Need, pupil locations
   b. Other buildings
   c. Accessibility
   d. Environment
2. Sites, sizes, availability of recreation areas
3. Building conditions, existing plant
   a. Age
   b. Safety
   c. Repair and upkeep
4. Building capacities
   a. Rooms available, capacities
   b. Loading
5. Plant adequacies for
   a. Program demands
   b. Pupil protection and services

F. A summary of plant needs
1. Total needs less capacities to be retained
2. Recommendations of needs

a. Set up in a series of attainable steps
b. Show recommended priorities—locations, types, etc.

G. Financing possibilities
1. Existing obligations
2. Financial capacity
a. Reserves
b. Tax levies
c. Bonding ability
3. Possible funds from outside sources
a. State
b. Federal
c. Other
4. Anticipated tax loads
a. Assessed valuations, trends
b. Legal taxing limits, and possibilities

H. Preparation of survey data for presentation
1. Organization
a. Separate into clearly defined sections or chapters
b. Separate survey, factual, and descriptive data from survey staff recommendations so that the board and other readers may evaluate separately
2. Scope and coverage
a. Limit the report to areas being considered or to those affecting this survey
b. Cover all essential facts but omit nonrelated or extraneous materials or comments
c. Organize proposals in some type of sequential steps, and provide suitable headings and/or other markings to facilitate assimilation. Insofar as possible tell the story in clearcut statements.
3. Presentation style
a. The basic survey facts should be presented. Valid reliable survey statements may be vital in building and sustaining public support.
b. If report is not too long, one volume may suffice. If the report is too voluminous for popular consumption, it may be desirable to issue a condensed supplementary report that sets forth essential data in a readable summary.
c. Tabular data should be explained.
d. Use of some graphic illustrations may help stress certain vital points.

Unit 3

Board Review and Acceptance of Survey

The board of education is usually the controlling organization in the school district and is the body which has authority to make official decisions on policy matters. The school-plant survey should be presented to the board of education for acceptance or rejection, before being presented to the public. The board members and the administrative staff should have

an opportunity to obtain an overview of the study and, insofar as they desire, to make a detailed analysis of the various recommendations. In reviewing the survey study the board of education may wish to follow a plan similar to the following.

A. In reviewing the survey report the board may find it desirable to:
   1. Obtain hasty overview of total study
   2. Analyze the various steps by sections
      a. View each part in perspective
      b. Compare recommendations with board evaluations of need
   3. Evaluate the various proposed steps of the program
      a. Determine whether the proposed steps are in keeping with community industrial and economic developments
      b. Determine whether proposed rate of progress is desirable and feasible
   4. Make an analysis of the individual building-project recommendations
      a. Note abandonments, demolitions, and major changes recommended
      b. Determine that proposed building plans correspond with board concept of the future school organization
      c. Determine whether proposed improvements are in keeping with area population trends

B. Board acceptance of the survey report

The board of education should allow ample time for a thorough study of the survey report. It probably is unwise for the board of education to accept or reject the report until each member of the board has had an opportunity to understand the general aims of the total survey report and of the various steps or changes recommended. After the board has made an analysis of the report it may then formally accept or reject, or it may modify the report before accepting. This does not mean that the board should modify the report as written by the survey staff but that the board might make other recommendations explaining that certain steps are not feasible at the time or that the board feels certain changes should be made more rapidly than proposed.

Unit 4

Board Adopts Policy, Initiates Program

After the board has accepted the survey report, either in whole or in part or with modifications, it should start proceedings to carry the survey recommendations into effect. The board members should realize that this is not solely a school board program, but that the board as an official body is representing the people of the school community in directing a public program of school-plant improvements. The board has an obligation to establish and announce a general policy, develop basic criteria, and to set up general procedural suggestions. These should serve as bases for public

information and support, staff direction in planning, and as general guides and limits on the types of programs and school plants to be developed.

A. A board policy statement, to announce and give direction to the proposed program, should be
   1. Formally adopted and made public
   2. General in nature, covering features or areas that may serve as goals or aims, such as
      a. Adequate plant facilities are essential to a modern school program
      b. Each child is entitled to a suitable environment in a safe school home
      c. Community has an obligation to provide adequate school housing.

In addition to policies the board should also set up a few basic criteria to serve as guides in planning. These might be termed principles or planning guides.

B. Planning principles may cover various areas such as:
   1. The school plants must provide a maximum degree of pupil safety and health protection
   2. Site sizes and arrangement should be ample for play and recreation areas and for present and future school needs
   3. School sites should be easily accessible to pupils (pedestrian or bus as per proposed plan)
   4. Community-use facilities should be included in the planning but should not have preference over pupil-use facilities
   5. The plant should be a sound investment, each part to have service or utility value, economical to operate and maintain
   6. Each unit or part of the plant should be carefully designed to provide the space, arrangement, and facilities needed for the activities to be carried on in it
   7. School plants should be adaptable to changing program and community needs

The board probably should avoid publishing detailed outlines of proposed procedures early in the program. However, the program may be delayed or started in the wrong direction unless some desirable guidance is given. The board should outline some general procedures similar to those suggested below.

C. Proposed program procedures set up by the board may serve several purposes.
   1. Instruct education staff to—
      a. Prepare outlines of proposed educational program changes
      b. Prepare detailed studies of facilities needed for each activity
      c. Require that these be incorporated into detailed educational specifications
   2. Invite the public to study the survey and the proposed program and to—
      a. Suggest means for providing information to the public
      b. Suggest areas of public participation
      c. Suggest ways to organize public study and support of program
   3. Request fiscal and legal staff to prepare data on—
      a. Cost studies, taxes, etc.
      b. Fund-raising limits, legal restrictions or requirements.

Unit 5

Informing the Public of the Proposed School-Plant Program

The public is entitled to information on the local school-plant needs and the proposed school-plant programs. A well-developed, long-range school plant planning program provides one of the best sources of public information on school-plant needs. This program is of little effect when hidden in the files, and may be implemented by a planned continuing public relations program. The leadership of the local school officials is often so planned and directed as to encourage the public to feel a personal interest in the future steps in the improvement programs for their schools. Even with a well-planned, long-range public relations program it is sometimes necessary for those in charge to provide specific information on needs and costs when construction-fund authorizations are to be voted and at various other times during the program. When long-range or continuing public relations programs have not been conducted, more intensive programs may be needed at the time funds are to be voted.

A. The school public relations program should include information on school buildings
   1. The schools belong to the public and the people are entitled to information about the schools
      a. Local citizens are interested in the school-plant programs
      b. Presentations of data on board-approved programs provide direction for public thinking and may limit dissipation of public interest and assistance on various proposals and in diverse directions
      c. An adequate public relations plan is essential to continued school board leadership in school-plant programs
   2. Good school-plant public relations programs are positive in nature and well supported
      a. A program worth developing is worth supporting
      b. Competition with other community enterprises for public support may be more acute when the school-plant programs are not well supported
   3. School officials cannot take it for granted that the people will support a program about which they know little
      a. Poorly planned programs or those not worthy of full support should not be presented
      b. Each program should be so planned and handled that the completion of each of the various steps marks another success in the total program

B. There are several types of school-plant public information programs
   1. Continuing
      a. It may be a part of a planned long-range program
      b. It may provide special information or summaries at the inception of or completion of certain steps in the program
   2. Short intensive programs for such steps as a bond vote
   3. Special programs—for authorizing special buildings or setting up approval for a long-range program.

Unit 6
Educational Planning for the School Plant

It is not feasible or desirable to outline here the importance of or all of the steps involved in educational or functional planning. Such planning involves a study of the various fields, of trends in teaching methods, curriculum developments and subject offerings, pupil grouping, class sizes, and school organization. It involves projecting the educational program into the future and anticipating the types of plant facilities that may be needed. In some schools such analyses and trend studies may have already been made by the educational staff. If not, they should be completed as partial bases for the plant facility recommendations. Such studies should be documented and made available as background data.

The coordination of educational and building planning is often termed "functional planning," and functional planning is sometimes divided into two major parts. The first is "educational planning," including an analysis and a projection of the educational program to be housed, and the trends which might indicate a need for different housing in the future. The second phase of functional planning is the translation of these educational needs into space and facility requirements which are often summarized under the heading "educational specifications."

Educational Planning

Educational planning may be community or district-wide, or it may apply to one or more segments of a community program. Overall educational planning will, of course, be composed of many parts, and such planning should precede building planning. Survey data on population, program, growth, and other trends may provide estimates of current and anticipated needs and recommendations for plant improvements. Such data may serve as background for essential educational planning.

Educational planning for a community is one of the functions of the local educational staff members. These educators are specialists in their areas of work and are in an excellent position to analyze the educational needs of the pupils and to interpret enrollment trends. They should be able to advise on the effect of changes in the curriculum content and in teaching methods on building needs. They should also be able to advise on the current and the anticipated future trends in the educational program of the community. Such trends should be observed in planning a building to house the existing and proposed educational programs. The following suggestions are illustrative of the many factors that must be observed in functional planning.

Educational planning may be applied to the overall educational program or may be set up as studies for specific areas. There are many possible variations in the scope and nature of functional planning and in the local

organizational patterns for such studies. In some cases the study and planning committees have included professional and lay leaders and have been organized as continuing committees. In other cases short-term special committees have been used. Leadership in developing and in putting the proposed programs into effect seems important.

A. Some local educational program principles and patterns that may affect planning
   1. The philosophy back of the local education program
      a. Purpose, such as cultural, pre-vocational, civic, or a combination
      b. The nature of the educational program procedures such as placing stress on group or on individualized training
   2. The scope and organization of the school
      a. Scope
         (1) Grade levels covered—primary, elementary, secondary, or junior college
         (2) Specialized education such as vocational, or that for handicapped children
      b. Organization, including grade levels to be housed in each plant, such as:
         (1) K-6, 6-3-3
         (2) Special groupings

B. The educational program to be offered
   1. The scope and nature of the current curricular offerings
   2. Trends in each of these curricular offerings
   3. Teaching methods as they affect the program
   4. Current and anticipated class sizes
   5. Instructional program patterns that may create needs for various types of facilities
      a. Space for group library teaching
      b. Audiovisual centers vs. in-classroom audiovisual facilities
      c. Physical education gymnasium for common use or separate for each sex
      d. Other program facilities such as swimming pools

C. The community educational program
   1. Predetermined sizes of school centers for each type of school to be erected may affect such features as:
      a. Site locations and sizes
      b. Pupil travel distances and/or transportation methods
      c. Special services required—such as loading platforms, holding centers
   2. Planned community use of school plant
      a. Types of such use
         (1) Summer classes or recreation
         (2) Adult classes
         (3) Adult recreation
         (4) Group or community meetings
         (5) Community libraries
      b. Type and scope of the various plant facilities needed for such community use
   3. Special plant facilities needed for school-related services, such as:
      a. Lunchroom service
      b. Health clinic services
      c. Guidance clinics

D. Some recommended criteria or standards to be observed in "A" and "B" above. (These are not detailed educational specifications but are general guidelines for the preparation of educational specifications.)
   1. Size—limits or ranges—of various types of areas
   2. Special services, such as special heating and ventilation controls for auditoriums
   3. Some area grouping or segregation by activities
      a. Grouping of related activities
      b. Isolating noise-creating activities

It is anticipated that the educational staff will have studied the educational program and will have prepared recommendations for the projection of this educational program for the future. This educational program, including the curricular offerings and the anticipated trend in each of the subject-matter areas, should serve as a background for the next major step, which is the preparation of educational specifications.

Educational Specifications

Some school officials and committees have prepared and published general or overall standards or guides for planning school buildings. Such guides do not usually provide specific planning instructions for each building. Educational specifications are thought of as specific educational requirements for a certain building, section, or unit.

This is a phase of the functional planning for which the local administrative staff, teachers, custodians, and others must be responsible. It is a phase that should not be neglected or too long delayed. The educational specifications should be prepared for the plant or building and the various units before the architect is requested or authorized to prepare sketches of these units. The architect should not be expected to do the educational planning and is not in a position to design the finish and facilities desired in each room or space until the specific needs are outlined.

It is not desirable to provide here a complete analysis of educational specification planning. Conditions and procedures will vary. The steps and procedures outlined here are only suggestive.

The local school administrators should guide teachers and other staff members in their preparation of educational specifications. These administrators will also be responsible for developing working plans and suggesting working procedures.

A. Organization for the preparation of educational specifications
   1. A director or coordinator (may be principal or other administrator) should be selected. He may:
      a. Coordinate the work of committees
      b. Suggest source material
      c. Assist in selecting buildings to visit
      d. Guide teachers and committees in organizing materials
      e. Set time schedules

2. The director or leader should provide leadership to help project planning for the future
   a. Call for an analysis of the present program
   b. Request information on apparent trends in such areas as pupil grouping, class sizes, and teaching methods
   c. Ask that these be related to plant needs

B. Some functions of the various planning committees or individuals
   1. Project educational planning to apply to this building or unit
      a. Methods—teaching, pupil grouping, and other factors of building or space needs
      b. Offerings—regular or special, such as music
      c. Organization of school
   2. Translate these into plant facilities needed
      a. Space needed for each room, activity, etc.
      b. Room locations desired
      c. Finishes wanted in certain areas
      d. Storage facilities needed
      e. Special services such as in-the-room plumbing
      f. Spacing required for equipment
      g. Other features for complete unit or plant
   3. One general committee will need to outline such features as
      a. Lighting requirements
      b. Plumbing, fixtures, sizes, types
      c. Exits, number, type, control
      d. Parking, pupils, public
      e. Other

C. Samples of educational specification coverage
   1. Administrative suite
      a. Location
      b. Number of rooms, sizes
      c. Workroom, conference rooms
      d. Board rooms
      e. Waiting rooms
      f. Vault
      g. Exits
      h. Storage
      i. Other
   2. Library
      a. Location, size
      b. Acoustics
      c. Workroom
      d. Plan—open shelves, segregated book room
      e. Conference rooms
      f. Charging area
      g. Exits
      h. Record and catalog storage
      i. Lighting
      j. Equipment
      k. Other
   3. Shops, homemaking, commercial, cafeteria, etc.
      (Similar outlines)

4. Other areas
   a. Auditorium
   b. Classrooms
   c. Gymnasium
   d. Laboratories
   e. Shower and dressing rooms
   f. Other
5. Pupil traffic areas
   a. Stairs, corridors, exits
   b. Locations, number, dimensions, construction, safety
6. Services and service systems
   a. Heating, lighting, sanitary, and sound control
   b. Types, standards of services, controls, and types by areas

D. In coordinating the specifications, the director may find it necessary to
   1. Eliminate conflicts
   2. Give balance, reduce competition

E. Presentation of educational specifications and follow-through by the coordinator
   1. Administrator responsible—make first review
      a. Request more information, if needed
      b. If reduction necessary, refer to committee for revision
   2. Presenting to architect for consultation
      a. By the administrator or the director as his delegate
      b. Architect report on feasibility, within cost limits
      c. Essential revisions—refer back to production committees for selectivity
      d. Final decision by administrator but his decision reported back to committees
   3. Working with the architect in sketch studies
      a. Through the administrator or director
      b. Architect have access to advice from committees but recommendations to be submitted to the administrative director for decisions

Unit 7

School Plant Sites
Selection and Purchase

The school site is more than a building location. It is a part of the educational plant and serves as one of the tools of education. In many cases it becomes a community center for various interests and activities. It sometimes serves as a recreation center for youth and adults. The school site location, selection, and purchase are definite parts of the long-range planning which is essential for economical modern school-plant programs. The general location of school sites may have been determined by the school survey. However, it is the obligation of the local school officials to carry the site recommendations into effect. In many cases the school officials cannot afford to wait until needs are pressing before locating and purchasing sites. School sites should be located and obtained on the basis of the public good rather than according to the desires of individual property owners.

Selection and acquisition should parallel or precede major housing developments in the area, and definitely should precede area saturation with such developments. Site location and selection should be in keeping with the educational policies of the local officials, the proposed educational program, and the community population growth trends. Care should be exercised to avoid undesirable conflict or competition with some industrial developments. Site selection and purchase are often neglected and too long delayed by local officials. The importance of site selection is also often overlooked by State departments of education.

A. Some factors in site selection

Local conditions may play important parts in school-site selection. In many cases site selection and purchase are delayed until suitable sites are not available. Also in many cases local school officials fail to make projections of educational trends or to make estimates of area and local pupil-population growth as bases for advance selection and purchase of future school sites. Too often local officials are not aware of all of the factors involved or of the criteria that should be observed in selecting and purchasing school sites.

1. Educational policies to be followed
   a. School organization pattern
      (1) Neighborhood primary
      (2) K–6, 6–6, 6–3–3
      (3) Combined 12-year pattern
   b. Size of school—by types and enrollment
      (1) Immediate for school unit to be erected now
      (2) Optimum size
      (3) Ultimate and/or maximum programmed
2. Type of school to be housed on the site
   a. Primary
   b. Elementary
   c. Secondary
   d. Other
3. Planned or anticipated community use of school site and/or plant as a factor in site selection
   a. As a community center
   b. As a recreation area
   c. For summer play—pupils or adults
   d. For use in relation to park system
   e. For use as library center
4. School population to be housed
   a. Composition of population—age levels or other characteristics affecting school enrollment
   b. Population density—apparent saturation
   c. Business or industrial district encroachment
   d. Area population trends—determining direction and rate
      (1) Use of city maps
      (2) Use of planning board data
      (3) Use of utility service companies' projections
   e. Population predictions
5. Site accessibility and travel requirements
   a. Accessible to pupils and public

- b. Pupil travel—possibilities and requirements
  - (1) Public transportation facilities available
  - (2) Board operated buses
    - (a) Travel time required
    - (b) Travel distances
  - (3) Walking distances
    - (a) Elementary
    - (b) Secondary
  - (4) Measuring travel requirements
    - (a) Use of industrial route maps
    - (b) Distances—circles tangent, overlapping squares, or rectangles

6. Traffic facilities and problems
   - a. Available street or road traffic routes, and/or public transportation
   - b. Traffic problems
     - (1) Traffic congestion
     - (2) Barriers—hills, streams, etc.
     - (3) Hazards from busy lanes or crossings
     - (4) Railroad, arterial street, or highway traffic noises
     - (5) Hills to climb
7. Site environment
   - a. Pleasing
     - (1) In or near residential area—neighborhood
     - (2) Aesthetic possibilities
   - b. Problems
     - (1) Uncontrolled catering or commercial enterprises
     - (2) Factory noises or odors
     - (3) Air flight patterns
     - (4) Fire station traffic
8. Site availability, size, shape, cost
   - a. Availability of desirable site
   - b. Size ample
     - (1) For current and future programs
     - (2) For type of building to be erected
       - (a) Compact
       - (b) Sprawling
       - (c) Campus type
   - c. Shape—adapted to program needs
   - d. Cost
     - (1) Reasonable
     - (2) Within reach of district financing limits
9. Site characteristics
   - a. Contour—drain, not wash
   - b. Suitable location for building
   - c. Site maintenance problems limited
   - d. Soil—suitable for school needs
   - e. Good building footings available
   - f. Economical construction possible
10. Availability of certain essential services
    - a. Electric
    - b. Water
    - c. Sewage—or septic tank drainage
    - d. Gas
    - e. Fire protection

B. Some criteria for school sites

Many excellent criteria for school sites have been suggested but not all apply to any one particular district program. It may be desirable for the local school officials to adopt criteria suitable to their conditions and needs. The following are adaptations from various sets of criteria that have been prepared.

1. Ample size for present and future needs.
2. Adaptable to type of school to be operated, program to be offered, and plant to be erected.
3. Accessible to pupils and patrons.
4. Shape—rectangular, compact.
5. Away from noisy street, railroad, or street car lines.
6. Away from objectionable factory noises and odors.
7. Desirable locale, avoidance of undesirable environment.
8. Suitable soil, not too heavy, too light, or stony.
9. Enough slope for drainage, not inclined to wash, or too steep for playground use.
10. Accessible to public utilities, sewers, etc.
11. Within reasonable travel distance of the majority of the pupils served.
12. Adaptable to plot planning for building location, playgrounds, drive, and parking areas.
13. Landscaping possibilities for lawns, shrubbery, etc. (Aesthetic value as a factor in school and community pride.)
14. Room for program and building expansion.
15. Ample areas for playground, garages, shops, or other facilities needed in program.
16. Reasonable first, and upkeep, costs.

C. Purchasing school sites

School boards often wait until the need is pressing before purchasing school sites. There are various reasons for this delay. In some cases district funds are not available until bonds are voted. In other cases advance planning, site location, and site purchase may have been neglected. Failure to coordinate site selection and purchase with city or area planning and development often results in extra site costs and in some cases the most desirable sites are not available when local officials are ready to purchase. This is one of the areas of long-range planning meriting the attention of school officials.

1. Timing
   a. Early selection gives choice of areas
   b. Early purchase—in advance of need
      (1) Reduces inflation possibilities
      (2) Reduces pressures from agents wanting to sell, or others wanting to avoid sale
      (3) Provides site when needed, and facilitates long-range planning
2. Purchase procedures
   a. Accept as gift
   b. Negotiated deal—by board—or with realtor as agent
   c. Exercise right of eminent domain and condemn
      (1) Price by arbitration
      (2) Size and needs justified by program plans
   d. Precautions
      (1) Need absolute title—no reversion clause or rights reserved—except for other public services
      (2) Avoid serving self-interest of any school official—or in other way endanger contract

Unit 8

School Site Layout Planning, Landscaping

The school site provides the basis for planning a school-community center. For the pupils it can provide both a learning laboratory and an area for recreation and entertainment. The site will serve as a school-home center for many pupils and as a school and community meeting place for the neighborhood. Site-layout planning should be envisioned at the time of site selection and purchase. Coveniently planned as a school-community-work-play center, it can be attractive and can be made a source of school and community pride. A properly planned school site can be a beauty spot in the neighborhood. A well-developed and well-maintained school site furnishes for many of the patrons a showcase for the school. Many of them who have little direct contact with the schools can and do appreciate attractive environments. However, it must be remembered that attractive school yards don't just happen—they are the result of sound planning, care, and attention.

A. Importance of school-site planning

The many illustrations of small sites with buildings ill adapted to the site, crowded playgrounds, and the lack of attractiveness in some of the school sites give evidence of the need for more school-site planning. In most cases this planning should be done early in the program.

1. Early planning essential
   a. As a part of selection process
      (1) Determine general needs
      (2) Evaluate site adaptability to needs
   b. Fund allotments for site development and landscaping are essential
2. Site master-plan-layout planning
   a. Determine
      (1) Type of school
      (2) Probable ultimate enrollments
      (3) Types of buildings
      (4) Location and arrangements of buildings
   b. Make overall plot plan prior to designing and locating first building
   c. Provide contour maps
   d. Plan location of drives, walks, parking, play, and other areas
   e. Set up overall landscaping plan
   f. Keep master-layout of plot plan up to date

B. Some factors in site-layout planning

School officials often neglect advanced planning on school sites and complete the planning only as pressure demands. This often results in an improper balance of areas and a failure to make maximum desirable use of the school acreage.

1. Building location—The same general principles will apply for one or several buildings on a site. However, knowing the probable ultimate number facilitates planning.

a. Preferably on an eminence
b. Back from street or road sufficiently to present pleasing facade to the front view
c. Frontage for a landscaped beauty spot
d. Building location to allow for development of desirable play and activity areas

2. Playground layout planning
   a. Depend on type of school
   b. Preferably at sides and/or rear of building
   c. Separation of play areas
      (1) By age groups
      (2) By types of activities, such as
         (a) Open (running or throwing) game areas
         (b) Slides, teeters, swings
         (c) Quiet play areas for some types of recreation
   d. Use of hedge or other dividers
   e. Grouping activities to permit supervision
   f. Safety—avoiding
      (1) Ground ditches
      (2) Raised walks or open shoe scrapers
      (3) Thorny bushes
      (4) Dangerous fences
   g. Make use of terrain
   h. Dry surfaces—drainage possibilities
   i. Hard, all-weather, surfaces for part of playing area
3. Walks, drives
   a. Walks
      (1) Use of natural routes where feasible
      (2) Hard-surfaced
      (3) Separated from drives (limit vehicular and pedestrian traffic competition)
      (4) Planned to avoid steep ramps or dangerous short stairs
   b. Drives
      (1) Hard surfaces
      (2) Semicircle front drives avoided
      (3) Drives for service vehicles, patrons, or others not to cross main pupil traffic lanes to playground, or main pupil walks to street
      (4) Easy angle outlets from drives to streets
      (5) Shrubbery and trees not to mask drive entrances or exits
4. Parking and loading areas
   a. Ample, surfaced, car-parking areas for school service
   b. Night parking near community-use areas, lighted
   c. Bicycle parking—near building—not to block entrances
   d. Loading zones and platforms
      (1) For school bus or parent-transported pupils
      (2) Sheltered loading zones or platforms
      (3) Direct exits—without backing buses or crossing pupil traffic lines
5. Planning for service lines and areas
   a. Locate on plot plan
   b. Show sewer and water connections
   c. Limit open overhead wire service or posts on playground to a minimum
   d. When necessary, locate septic tank and disposal field installations

6. Planning for community-use areas
   a. Summer playground
   b. Night-use areas—various activities
   c. Toilet facilities available

C. Landscaping the school site

Landscaping is usually delayed until after the first buildings on the site are erected and in many cases the landscaping is neglected. Oftentimes failure to provide for landscaping means that funds are not available when ready to improve the sites. A well-planned landscape pattern may become an important factor in contributing to pupil and community pride and perhaps to pupil morale in the school.

1. Timing of landscape planning
   a. Made a part of original plot layout
   b. Set up in a series of steps paralleling plot development
2. Some landscaping values and principles
   a. Values
      (1) Effect on community appreciation
      (2) Effect on pupil pride and morale
   b. Principles
      (1) Use—for beautification, masking—as area-division strips
      (2) Use of plantings adapted to local conditions—soil, climate, and use
      (3) Ease and economy of maintenance
3. Some landscaping practices
   a. Use of trees as borders or as shields—so located as to avoid cutting off light from building
   b. Use of plantings as borders of walks and drives
   c. Beauty spot at front
   d. Open lawn areas to facilitate mowing
   e. Banked masking shrubbery near building but not covering windows
   f. Judicious use of flower beds
   g. Avoiding use of thorny shrubs
   h. Adapting planting to contours

Unit 9

Architectural Services

Good building planning brings together the efforts of community and educational planners and building designers. As has been indicated, the educational planners set forth their needs in terms of spaces, finish, facilities, and services. The school officials establish the general type, scope, and location of the proposed project. Within the scope and type limitations established, the designers translate these needs and desires into building design or drawings and specifications. The local board of education should select with care the architects who will be responsible for planning a building to serve the community for the next 50 to 75 years. The architect and the designing staff play an important part in school-plant construction

programs. The architect may be employed on a fee basis for this one job; he may be a salaried employee responsible to the system; or he may be regularly retained by the board to do any desired construction planning on a fee basis. In each case the manner of selection may be different. Some of the design duties and obligations will be similar in each case, but some obligations and relationships may vary with the nature of the employment.

The experienced school board may give attention to various factors when employing a new architect. They may wish to know the size of his staff and whether he has his own heating or structural engineers, or whether these services are provided by other firms. They may want to know something of his relationships with materials and supply dealers, with contractors, and with previous employers or clients. In addition, the board will probably wish to give particular attention to the employing contract terms. The development of a school-building program may be a major enterprise for a community, and boards of education and school officials are not always familiar with some of the problems of designing and constructing school buildings. Hence, it may be important that the contract with the architect be clearly defined to indicate to the board members what services they are purchasing, their payment schedules, and their relationships with the designer, and with the contractor. Care in developing these early plans may help to avoid later misunderstandings on services rendered, costs, and authorities.

A. Architectural and design services

The term "architectural services" as used here applies to all design services. Some school boards prefer to center school design, and construction advisory and/or supervisory services in the project architect. Designing, structural, heating, sanitary, electric, and other engineers may work through, or usually for, the architect, either as members of his staff or on a fee basis. They are responsible to him and he is responsible to the board of education.

Board of education awareness of what services they want and may anticipate from the architect may affect their manner of selecting and employing such persons. The following are samples of service and of areas of relationships some boards anticipate in employing an architect.

1. Basic function
   a. Translates educational specifications into building design and specifications.
   b. Serves the employing board and its designated executive as a technical consultant on materials, design, construction, and costs.
   c. Is responsible for coordinating the work of the various designing engineers.
   d. Is the board's interpreter of plans and specifications, and is the technical adviser for the director of construction supervision, or is the supervisor of construction.
2. Relationships
   a. Is employed by the board as a technical adviser.
   b. Serves as a connecting link between the school officials and the building design, construction, and materials areas.

c. is responsible to the board or its designated executives.
d. In relationship with other employees, may provide and obtain consultative services through channels.

3. Some architectural functions or services
   a. Study educational specifications.
   b. Prepare preliminary sketches as needed and interpret to school officials.
   c. Advise on design patterns and materials.
   d. Advise on costs
   e. Prepare final drawings and specifications as directed
   f. Assist in letting contracts—bonding, etc.
   g. Prepare large-scale drawings—interpret to contractor
   h. Direct supervision of construction—extent may depend on whether board has own staff of supervising engineers
   j. Help check completed project
   k. Advise on State and local codes and regulations

B. Selecting and employing an architect

Many boards of education prefer to select architects on the basis of experience, reputation, and apparent ability to do well the job the board desires. Picture renderings, preconceived solutions for the board's building problems, or pressure salesmanship should not determine selection.

1. Basis of selection
   a. Previous training and experience
   b. Record of relationships with
      (1) Other boards
      (2) Contractors
      (3) People handling materials
      (4) Business world, including credit rating
   c. Record of willingness to cooperate
      (1) Completeness of design
      (2) Adaptation to State and local demands
   d. Ability to devote time to job
      (1) Other work competing for attention
      (2) Size of staff
   e. Location
      (1) Ability to see job as often as needed
      (2) Not subject to heavy travel costs
   f. The architect's design, engineering, and supervisory services in heating, sanitary, electric, structural, landscaping, and other special areas provided by
      (1) Regular staff of architect
      (2) Recognized engineers—engaged on a fee basis
      (3) Shopping—no regular service available
      (4) Materials suppliers

2. Time and method of employing architect services
   a. May be salaried staff members
      (1) Designing architects
      (2) Designing and/or supervisory engineers
   b. Retained firm—as district designer—on fee basis
   c. Employed as needed for specific job

d. Time of employment
   (1) May depend on local laws, bond funds available, etc.
   (2) May need to employ in time to have advice on sites
e. Employment procedures vary
   (1) A negotiated contract
   (2) Contract approval before requesting or accepting free services creating obligations

C. The board contract with the architect employed on a job basis should be specific. The contract terms should be clearly stated, nonequivocal, and should be fully understood by all concerned. The contract should be equally binding on both parties and so designed that it can be executed fairly. Provisions for arbitration may be of value. (In this connection a board is risking district money and future pupil welfare. The architect is risking professional reputation and standing. Care is essential.) Some features covered in contracting:

1. The term or time of the contract
   a. Starting time
   b. End, or length
2. Methods of terminating contract
3. Payment, commissions, fees, and/or services
   a. Rate of commission—basis for computing
      (1) Applicable to what contracts
      (2) Whether applicable to furniture and equipment costs
         (a) Contractor-purchased
         (b) Board-purchased
      (3) Applicable to other costs
   b. Determining responsibility for paying other costs
      (1) Clerk-of-works, or construction supervisor
      (2) Travel—and other costs of architect, if any
      (3) Preparation of site contour maps
      (4) Soil testing—footing load possibilities
4. Payments to architect—schedule
   a. Total rate—is it separated to show production and supervisory costs?
   b. First payment
      (1) Amount
      (2) When due
   c. Payments during construction—amounts and when due
   d. Method of making payments
   e. Contingent upon contract award and project completion, or as per agreement for services rendered regardless of whether project is continued
5. Supervision
   a. By architect
      (1) Constant
      (2) Occasional, or periodic
      (3) None
   b. By owner (board) supervisor or clerk-of-works
      (1) Paid by
         (a) Board
         (b) Architect
      (2) Takes directions from and reports to
         (a) Board
         (b) Architect

6. Ownership of blueprints, documents
7. Obligation of board
   a. To inform designer of funds available for contracts
   b. To limit scope and construction type demands to level agreed on with architect
   c. To limit postcontract changes that increase costs (beyond funds) without providing more funds
8. Obligations of the architect
   a. To produce drawings and specifications satisfactory to board
   b. To produce essential drawings for construction
   c. To accept responsibility for production and coordination of work of production engineers
   d. To produce plans within general price range established by board—or to advise that such production is not feasible
   e. To warn board of probable excess contingent costs
9. Board approval of plans required before advertising for bids
   a. Time allotment for review
   b. Approval by board action
   c. Approved plans—file set dated—and approval shown by signatures or an approval letter, or both—with all approved change orders similarly dated and signed
10. Payments for major plan changes, if any
11. Final authority
   a. Rests with
      (1) Board
      (2) Architect
      (3) Both jointly as per contract
   b. Arbitration procedure
   c. Obligation to comply—State and local codes
      (1) Board
      (2) Architect

Unit 10

Building Drawings and Specifications

Good school-building planning involves the efforts and study of many people. It includes a study of the needs and desires as outlined in the educational specifications. It also includes the work of translating these needs and desires into architectural design, space, and facilities. Because of the many steps involved it seemed best to separate this unit into three major parts—the first, the Study and Planning Phase; the second, the Development and Approval of Final Drawings and Specifications; and the third, the Preparation of Detailed Working Drawings.

Throughout these phases the architect plays a leading part. It is he who interprets space and facility needs as outlined by the educational staff and incorporates them into construction design. He studies site and environ-

ment possibilities, selects the best-fitted materials and design patterns, and attempts to develop an economical, functional, and attractive plant pattern within the funds made available.

In the planning and the development stages of preparing drawings and specifications the designing architect may need to confer frequently with school officials on layout patterns, materials, finishes, etc. To this end the coordinator mentioned under educational specifications may serve as a contact and advising agent between the architect and the staff or the board. He serves as an adviser and director for the architect. He also advises with his superior officers, and with the board when necessary to obtain official board action or approval.

Part I. The Study of Needs and the Preliminary Planning

The study of layout and facility needs and the development of preliminary sketches caring for these needs are important phases of architectural designing. Complete planning will involve a study of the educational specifications. It may also involve a study of program unit affinities, and the desired grouping of the various units into a whole. It usually involves numerous tryout sketches for best-fitted patterns, frequent interpretations and evaluations, and many conferences.

A. Information for and preliminary studies by and with the architect
   1. Some advance information for the architect may be provided in conferences or by documentary statements, and some which he may obtain by inspections and surveys of physical conditions
      a. Basic data on nature and scope of the proposed project
      b. Proposed schedule of starting work, completion, and occupancy
      c. Funds available for the project
      d. Site information—location, size, contour, soil conditions, load-bearing bases for footings, utility locations
      e. Special local ordinances or regulations that may restrict building designs or construction
   2. In early conferences the local coordinator or official in charge will discuss the educational and service needs and demands
      a. Review and analysis of the educational specifications, including space and facility requirements
         (1) Various units of instruction areas
         (2) Special units such as those for lunch, assembly, library, or physical education
         (3) Service and traffic areas
         (4) Service systems
         (5) Desired affinity groupings, or space and/or barrier isolation of activities
      b. The overall plant arrangement, access, design, etc.
      c. Plans for coordinating further educational planning with sketch development

(1) Coordinator in a liaison capacity
(2) Essential exchanges of ideas between instructor and designer, but with direction centered in the coordinator

d. The development of production time schedules

3. Architect prepare trial layout sketches
   a. Many tryout sketches of each unit often needed
   b. Various trial sketches discussed and evaluated by architect and educational adviser or coordinator
      (1) Coordinator handle desired clearance with staff members
      (2) May arrange conferences with interested groups
      (3) Coordinator authorized to make certain decisions
   c. Sketch development accompanied by some attention to unit locations, finish, storage, and special outlets or other facilities

B. Development and approval of preliminary drawings and specifications
   1. Architect presents preliminary drawings or sketches of total project
      a. Developed on basis of sketch studies
      b. In sufficient detail to present fair outline of proposed project
      c. Include sufficient specifications to describe materials, finishes, etc.
   2. Cost estimates—Early in the program the school officials will need to know whether the proposed project costs are to be within the limits set
      a. Architect may advise on costs—on basis of needs and desires
      b. Architect may advise on costs if plans are changed
         (1) In type of structure
         (2) Space
         (3) Other acceptable changes
      c. If cost estimates exceed funds allotted, board may
         (1) Change program—order new sketches
         (2) Provide more funds
         (3) Delay or drop proposed project
   3. Review and approval of preliminary plans
      a. Checking by coordinator—and other official and/or staff members as desired—comprehensive, cover whole project
         (1) Local officials need to have essential and desired information in many areas, such as
            (a) Sizes of units
            (b) Finishes
            (c) Arrangement
            (d) Spacing
            (e) Materials
         (2) The time to make changes
            (a) Ample time needed to study preliminary plans and discuss proposed changes
            (b) Positive action on questionable items or plans essential
            (c) Failure to make needed changes at this stage may result in
               (I) More costly changes later
               (II) Misunderstandings and discontent
      b. Obligations of the architect
         (1) To provide specific information—word or sketch of his intentions on such features as design, finish, etc.
         (2) Provide his clients information on what to expect
         (3) Explain—help avoid later complaint that "I did not know it

would be like that"—and perhaps reduce possible demands for free redrafting of plans

c. Coordinator and staff review should be complete and detailed. Some samples of coverage are:
   (1) Exits—number, type, location
   (2) Stairs—location, type
   (3) Toilets—location, shielding, finish, ventilation, types of fixtures, etc.
   (4) Heating—types
   (5) Storage—in-room, building
   (6) Classroom—arrangement, orientation, surfaces, ceiling height
   (7) Hardware—type, etc.

d. Coordinators and/or other officials who recommend board approval of drawings and specifications, or the withholding of such approval for certain changes or for a new architectural draft of the plans, should:
   (1) Make a formal recommendation, or report
   (2) Refuse to recommend until sure. They and the board should realize that regardless of who is responsible for misplanning, the next two or three generations of school pupils may have to live with the building finally erected.

e. Review and approval by other agencies having responsibility
   (1) Some of the agencies whose approval may be essential are:
      (a) State department of education
      (b) State health department
      (c) Local planning board
   (2) Responsibility for obtaining such approvals on the preliminary plans may depend on the type of approval. Some official, as the coordinator, may be assigned the responsibility.

4. Board action on approval of preliminary plans
   a. Formal action is generally desirable
   b. Approval may be explicit
   c. Approval may limit—on such bases as use of funds, types of materials, or construction

Part II. The Development and Approval of Final Drawings and Specifications

It is generally considered desirable to effect all desirable changes, or to the extent possible, before starting the final drawings and specifications. It is also desirable that the final drawings be specific and understandable.

A. Preparation of final drawings and specifications

The preparation of the final drawings and specifications is a technical task and the architect assumes the obligation of developing the approved preliminary plans into final drawings and specifications. He also normally assumes the obligation to provide the services, and to evaluate and coordinate the work of the various engineers in designing parts of the completed plans for which he is responsible. The architect also provides any needed plan interpretation for the designated school official or coordinator and advises with the coordinator and the designing engineers relative to patterns or changes desired.

1. Plan development
   a. Allow ample time—haste here may be wasteful

b. Plan development is a growth—resulting from the cooperative efforts of various interested persons

2. The architect
   a. Is responsible to the school board for design adequacy and efficiency. As a trained licensed designer he also carries a professional responsibility for safe and stable designing. In this capacity he usually:
      (1) Provides, or contracts for, essential structural, sanitary, heating, and engineering services
      (2) Coordinates the work of these various engineers
   b. Serves in a liaison capacity between the designated school official or officials and the designing specialists in ironing out difficulties and in obtaining economical plans embodying features acceptable to the school officials.
3. The school official or coordinator in charge
   a. Is responsible to the board for helping obtain plans embodying agreed-upon services and facilities
   b. Maintains close working relationships and has frequent conferences with the architect
   c. Keeps close watch on plan development, advises on arrangement, spacing, finishes, etc.
   d. Reports back to staff when essential on development or on proposed changes
   e. Reports—directly or through proper channels—to board of education as needed on plan development or on proposed changes
4. Plan-development practices
   a. Plans and specifications explicit, not depending on undefined terms such as good quality, or good workmanship
   b. Material descriptions, where feasible, rather than too much dependence on trade names
   c. Plans and specifications open, inviting competitive bidding on comparable bases
   d. Alternate proposals held to a reasonable minimum
   e. Specifications explicit on "plus or less" items and on unit price proposals
   f. Occasionally during plan development board decisions on proposals may be necessary. Board usually reserves the right to seek the advice of various specialists or authorities.

B. Final review and approval of completed drawings and specifications
1. Essential to allow ample time for study and required approvals
2. Review and approval service by other than local school officials
   a. Obligation of the architect or board to make copies of drawings and specifications available to any State and local agencies which have authority and duty of review and/or approval
   b. Any essential approvals of such State agencies as the department of education, department of health, and others obtained by those responsible for project
   c. Obligation of local officials, designers, or contractors to obtain necessary approvals of local agencies having approval authority such as local sanitary engineer, planning committees, electrical inspectors, etc.
3. Review of drawings and specifications by local school officials and board of education

a. Desirable to avoid rushing review procedures
b. Designated school official report to the board on acceptability, and adequacy of plans
c. May need inspection schedule covering such areas as room units, finishes, heating, lighting, and other services. (See Appendix C, *American School Buildings*. AASA Twenty-seventh Yearbook, 1949, p. 348-53 for one sample check list.) with explanatory notes and summaries for reviewers
d. Arrange for technical explanations needed by board and staff members
e. Limit review to what plans now show. If changes desired, repeat review after changes are made

4. Final approval by board and designated school official of final drawings and specifications
   a. Bid advertising withheld until plan approval is official
   b. Final approval by official board action
      (1) Should show on board minutes
      (2) Should be restricted to plans as then developed and such final approval withheld until plans and specifications are fully satisfactory
      (3) May be indicated by letter or by endorsement on designated set of plans—in either case show limitations of such approval
   c. Later change orders should also be subject to official review and approval

Part III. Preparation of Detailed Working Drawings

It is generally understood that the designers will prepare the complete working drawings needed by the contractors. Some of these may be included in the general working drawings. However, the designers normally assume an obligation to produce as needed by the contractors detailed sketches—often referred to as "shop drawings"—of specific construction items. These detailed drawings provide essential information for the contractor but are not generally needed as parts of the original drawings.

A. Usually cover special construction features, such as
   1. Certain mill work
   2. Truss or other support design
   3. Plumbing setting

B. A technical architectural production to serve as an explanation or illustration for the contractor

C. Board does not need to approve these detailed working drawings, but needs to understand the architect's obligations to provide and explain as necessary for the contractor.

Section III

Building Construction and Equipment

AFTER THE building is planned the construction forces have the task of developing the completed plant along the lines set up in the plans. This phase involves both construction and administration. The board of education, its supervisors, the architect, and the contractors accept most of the obligations for this phase of the program.

Unit 11

Construction Contractual Services

School construction contractual services often differ in several respects from private contracting services with which some of the school-board members may have become familiar. School boards are handling public money. They often have a limited construction budget to carry out a public vote authorization, which many boards consider equivalent to a mandate, to provide the school facilities needed. In handling public or school-district construction money the board may be subject to certain legal restrictions which do not always apply in private contracting. For instance, there may be less freedom in negotiating contractual provisions. In addition, legal restrictions may require that the board make fixed contracts for goods, buildings, or services to be delivered. This may limit the use of escalator clauses to meet price changes. Contracting for public construction may also call for more specific safeguarding of contract services through bonds and through payment schedules. The board of education is responsible for protecting the district's investment. The board has an obligation to provide the best facilities possible for the protection of the lives and health of the children and for the school program to be offered. The board serves as a trustee for the district's construction funds. The board probably will have an obligation to make prudential use of the district's construction moneys.

However, it may need to realize that the cheapest construction is not always the most economical. School-construction contracting involves many legal, financial, and other technical problems. Most boards of education find it desirable to have available competent technical advice in each of these areas.

In handling school-construction contractual services, the board will need to give attention to the necessary regulations in advertising for bids, to accepting and evaluating contractors' bids, and to the making of the necessary contracts for construction services.

Securing desirable bids is often a joint obligation of the school board officials and the architect. Local laws may define certain requirements relative to advertising for bids through local, trade, or other papers. However, such requirements do not normally restrict other published or oral announcements or advertising that might be expected to reach groups of desirable prospective bidders.

The timing of the advertising, the nature of the bid breakdowns, the starting and completion dates, restrictions on materials purchases, and payment schedules may become important factors in obtaining favorable firm bids. These factors are considered in the following outlines.

A. Advertising for bids
   1. An obligation of the board
      a. Based on advice of architect and attorney
      b. Not start advertising until board has formally approved drawings and specifications and has authorized advertising
   2. Timing the advertising
      a. Taking best possible advantage of seasonable and other contracting and materials market conditions
      b. Allowing ample time for
         (1) Dealers' estimates of materials, quantities, and costs
         (2) Contractors' estimates, arrangements with sub-bidders, bonding companies, etc.
      c. Giving consideration to seasonal construction limitations, and desirable completion dates
   3. Method of advertising
      a. Local papers
      b. Trade journals
      c. Letters and announcements
      d. Number of appearances of advertisements
   4. Notices to bidders
      a. Limited number, or open to all
      b. Include information on pertinent local restrictions on permits, storage, purchasing, etc.
      c. Notices specific on such features as conformity to specifications, earnest money, and inclusion of any required supplementary data
      d. Distribution of drawings and specifications to bidders
         (1) Number of copies available
         (2) Deposit copy at central point
         (3) Contractor's deposit, preferable to free or purchase
         (4) Ample time needed for bid preparation

B. Contractors' bids
   1. Time limit on receiving bids
   2. Bids sealed
   3. Limited to form and terms indicated in specifications
   4. Deposit of earnest money or bid bond
   5. Types of bids—The board and school officials should determine in advance the bidding and contracting pattern, and should evaluate the advantages and/or disadvantages of each of them on the proposed project. Bids may be:
      a. General construction—one prime contractor[1] bidding the total project
      b. Broken down into parts, with separate bidders or prime contractors for each. When broken down separate contracts are often for:
         (1) Heating and ventilating
         (2) Plumbing
         (3) Electrical
         and less frequently for:
         (4) Steel supply and erection
         (5) Excavating
         (6) Grading and/or landscaping
   6. Scope of breakdown of individual bids and the amount of supplementary information may vary with local demands and conditions. Bids may:
      a. Provide no breakdown
      b. Show tabulated unit prices
      c. Provide list of subcontractors, or of certain options used in estimates

C. Board acceptance and evaluation of bids
   1. Public announcement, closing of bid acceptance
   2. Opening, reading, and tabulating bids—public versus closed session
   3. Board evaluation of bids
      a. Executive session deliberation
         (1) The board and its executive staff, architect, and other desired officials or consultants
         (2) Immediately or delayed until after staff has analyzed bids and reported to board
      b. Acceptance or rejection of bidder's qualifying statements
      c. Alternates—defining selection basis and sequence
      d. Unit bid analysis, types, range (plus or minus) as possible factors in total contract
      e. Rejection of certain bids or bidders—establishing bases such as noncompliance or other supportable criteria
      f. Determining lowest and best bid
      g. Evaluation of backgrounds of competing low-bidding contractors; local experience, staff, time for this job, etc.
   4. Conference with low bidders covering such factors as:
      a. Previous experience
      b. Financing the job
      c. Contractors' ability to do job
         (1) Staff, equipment
         (2) Job supervision
         (3) time schedule
      d. Contractor licenses, current

[1] In this report a "prime contractor" is one making his contract directly with the board (owner) whether for the total job or a part, and a "sub-contractor" is one who makes a contract agreement with one of the prime contractors.

e. Familiarity with local and State laws and regulations
f. Local, special, or open market purchasing
g. Sub-bids and alternate materials used in bidding
h. Scheduling and coordinating pattern for work of prime contractors—when contracts are so awarded

5. Awarding the contract or contracts
   a. Formal action of the board pending bond approval
   b. Returning earnest money of other contractors

D. The contracts

Construction contract forms are available and boards of education may have adequate legal advice on the contractual service. However, as representatives of the people—handling public money—the boards usually wish to know that the construction contracts are complete and that they cover essential relationships and obligations. Some of the vital points covered may be such as:

1. The contract
   a. Designated scope—general, special, etc.
   b. Reference to plan and specification requirements as applicable to contract
2. The amount of contract
   a. Base contract
   b. Unit price—or change reference
3. Method and time of payment
   a. Payments on labor and materials in place, or labor in place and materials on grounds
   b. Percentages withheld
   c. Certification of approval—architect, clerk-of-works
4. Contractors' bonds—surety bonds—acceptable to the board
5. Timing
   a. Starting
   b. Completion
      (1) Penalties vs. premiums
      (2) Allowance for uncontrollable delays
6. Board options on alternate materials or equipment
7. Contractors' on-the-job supervision
8. Required cooperation between or among the contractors, and the prime contractor's responsibility for his subcontractors
9. Contract changes, termination procedures, arbitration
10. Board free from liens, contractors' debts, or obligations
11. Meeting State and local laws and regulations, taxes, workmen's compensation, and/or other specified obligations
12. Board and architect, or representatives to have access for inspection
13. Work change-order procedures—cost agreements
14. Work-rejection procedures
15. Unit-prices filed
16. Reports required
17. Final payment—surety obligations—and final release
18. Contractors' insurance—workmen's compensation, other liability
19. Property insurance—materials on ground, and materials and work in place—locate insurance obligation and indicate amounts
20. Obligation to leave job ready for use
21. Assignment controls

Unit 12

Supervision of Construction

The board of education in spending public money for new buildings has an obligation to assure prudential use of such funds. The board may employ a competent architect and require the construction contractor to provide a performance bond. These are measures of protection. However, the final obligation for providing the type of building facilities desired by the district rests with the board. In order to be assured that the district's interests are protected in the construction of the building, many school boards find it desirable to provide on-the-job supervision during construction.

It is anticipated that the contractor or contractors will have on-the-job construction superintendents or managers. They represent the contractor. The board's supervisor will serve as an official representative of the board. This board supervision is generally one of two types—technical and/or administrative. The technical involves plan interpretation and construction evaluation and may best be done by one who knows construction. In some cases the architect's contract requires that he provide constant supervision. In some cases the board provides the technical supervision. In either case the board has an interest in having such supervisory services. The administrative supervision is about what the name implies and includes record keeping and other similar activities.

Several titles such as supervisor of construction, superintendent of construction, or clerk-of-the-works are used to designate the board's representative. On some larger projcets it may be necessary to have one or more technical supervisors and also a clerk-of-the-works. These board supervisors represent the board and have authority only to the degree designated by the board. A supervisor employed by the architect is generally responsible directly to his employer and the employer to the board.

A. The board's supervisor or clerk-of-the-works

The following outline applies to the total area of board supervision of the construction program and does not provide separate descriptions of the qualifications and duties of various supervisors.

1. Qualifications needed in supervisory staff include such abilities as:
   a. A general knowledge of construction
   b. Ability to interpret drawings and specifications
   c. A general knowledge of materials
   d. Ability to deal with contractors
   e. A general knowledge of the administration and of the records of construction
   f. Ability to make decisions
2. Relationships
   a. Architect and his staff responsible for technical interpretations
   b. Supervisors employed by the board responsible to the board
      (1) Receive directions from board officials

(2) Not responsible to materials suppliers or contractors

3. Authority—that granted by the board—to represent and act within limits authorized by the board
4. Duties

The duties for each supervisor will vary with his obligations and type of work. For instance, on large projects one supervisor may be responsible for mechanical services, another for structural installations. The following comments refer only to general duties.

a. Obtain the type and quality of construction designated by approved drawings and specifications
b. Report on deviations, and in case of disagreement to stop work until approved by board or architect
c. Report on needed changes
d. Maintain continuing record
e. Make progress reports to the board and the architect
f. Serve with the architect as arbitrator between primary contractors
g. Maintain check on required materials or loading tests

B. Board control of construction

1. Scope
   a. Board has final authority within the limits of the current contract
   b. If the contract does not cover needs, renegotiation may be necessary
   c. If board requirements are not in agreement with local or State laws, arbitration or suit settlement may be necessary
2. How effected
   a. Limited to official actions of the board as a body
   b. No supervision by individual board member
3. Changes during construction
   a. All changes to be effected and documented by change orders
   b. Change orders initiated by the board or the contractor
   c. Have the approval of the architect
   d. Have a clear understanding in advance
      (1) Of effect on structure, on quality
      (2) Of costs, make use of unit prices submitted by the contractor and approved by the board and its agents
      (3) On use of arbitration procedures set up in specifications and/or contract, if agreements not reached on proposed changes

C. Payments for work done

1. On basis of reports and approval of architect and clerk-of-the-works or supervisor of construction
2. Amounts on bases outlined in contracts
3. Payments normally limited to prime[2] contractors

(The question of contract payments—or board obligations to any except prime contractors—brings up what sometimes becomes a troublesome point between the school board and dealers or subcontractors. Some hold that the district school board, as an official body representing the public, is authorised to spend school district money only for goods delivered or

[2] Ibid.

services rendered in response to a board approved order or contract. If this is true there is a question of the extent of the board's obligations, if any, for the payments for the materials delivered, or the service or work cost obligations of either the prime or the subcontractors. Some school officials recommend that board contracts with a prime contractor definitely limit the board's obligation to the amount specified in the contract.)

Unit 13

Planning, Selecting, and Purchasing Furniture and Equipment for the Building

As used here the terms "furniture and equipment"—or more generally the term equipment—may refer to such items as seats, desks, instruction machines, lockers, laboratory desks or tables, stage scenery, auditorium seating, audio-visual, physical education, play apparatus, and office chairs, but does not include such items as are a part of the heating, plumbing, and electric services which are generally considered a part of the building.

School furniture and equipment are essential tools of the educational program. The building and the faculty cannot contribute fully to the education of pupils without these tools for education and for living in the school home. Equipment and furniture planning should be done along with the building planning and funds should be allocated and reserved for such purposes.

With the modern furniture and equipment available, the architect is seldom called on to design such equipment, and in most cases the architect does not select or designate the furniture and equipment to be purchased. Also in many cases the furniture and equipment are selected and purchased by the school and are not included in the construction-contractors' bids. However, the architect and designing engineers may need to know something of the types of equipment that are to be purchased. They may need to know the dimensions of certain equipment and the connections needed in order to plan proper spacing and to locate such as electric, gas, water, and drain connections and outlets.

The furniture and equipment should be selected on the basis of need and its adaptation to the type of school program, the curriculum, teaching methods, and the size of the pupils. This selection should be as early as feasible so that dimension and spacing requirements may be available for the designer. Equipment may be of several types. We are concerned here primarily with the instruction and the building service equipment. Small handtools such as hatchets are not included here as equipment but larger portable tools such as drills or sanders, are considered as equipment. The term equipment as used here includes furniture.

A. Planning the equipment program
   1. An obligation of the school officials and the educational staff
   2. Procedures vary
      a. May use school-system stock lists and layout patterns
      b. May plan new layouts and equipment patterns for each unit or activity
      c. May depend on teacher requests for each room or unit of activity
   3. Budgeting for equipment
      a. Early planning essential to establishing equipment costs in capital-outlay budget
      b. Budgeting may be on:
         (1) A percentage of total construction-cost basis
         (2) A planned equipment schedule by types and quantities for the type of room or the activity to be served

B. Selecting the equipment
   1. Some of the bases of selection
      a. Type of school—primary, elementary, secondary
      b. Age and size of pupils
      c. Type of program in building
         (1) Range of subjects
         (2) Pupil grouping—numbers
      d. Teaching methods—expository, demonstrating, participating
      e. Adaptation to building—where used
      f. Finish, durability, adaptation to pupil use and comfort
      g. Costs
   2. Selection made early as a part of overall planning
      a. Permits locating outlets, connections, roughing in plumbing, and allocating in advance of construction
      b. Allows time for greater selectivity
      c. Helps fix budget allotment before funds are allotted elsewhere
   3. Selection procedure
      a. By architect
         (1) Use of detailed specifications or the use of catalog descriptions
         (2) Costs may include architect's commission on equipment costs
      b. By local officials
         (1) On basis of specifications prepared by local officials
         (*Note*—This is often recommended but many local officials find it difficult to prepare definitive specifications suitable for competitive bidding.)
         (2) From prepared local system schedules
         (3) On the basis of inspection and catalog descriptions, trade names, etc.
         (4) On a combination of these procedures using catalog descriptions but adding certain qualifying specifications

C. Purchasing schedules and procedures
   1. Scheduling
      a. Early buying fixes equipment costs in budget
      b. Early buying may facilitate delivery when needed
      c. Carefully selected seasonal buying may avoid peak-price periods
      d. Advance buying may permit more selectivity and avoid hasty buying in order to use building

2. Purchasing procedures
   a. Local dealer vs. regular supply houses for school equipment
      (1) Relative selectivity a factor
      (2) Adaptability of equipment to school needs, and financing patterns
   b. Methods
      (1) Competitive bidding
         (a) On specifications
         (b) On comparable terms such as on freight rates, terms
         (c) Use of "or equal" description
         (d) Methods of comparing costs
      (2) Direct from salesman or catalog without competitive bids
      (3) Purchases on basis of board plan as to quantity, quality, type, or on basis of sales appeal
   c. Purchasing controls or standards
      (1) Dealer sureties—on quality, etc.
      (2) Economies
         (a) Use of stock patterns
         (b) Standard patterns to facilitate replacement
      (3) Finish and color standards
      (4) Shipping—f.o.b. factory or warehouse, or laid down
      (5) Financing pattern
         (a) Cash—30 days
         (b) Deferred payment

D. Preparation of lists of equipment

Some schools prepare lists of equipment—by types of use—that may be available to teachers and others as a basis for planning. In some cases these lists refer to catalog numbers or equal. In other cases brief descriptions are given. If price ranges are quoted, budgeting of the equipment program is facilitated. The following items are taken from equipment lists that have been developed by some schools. These are illustrative and incomplete random samplings. In some cases the school lists show prices and descriptions, and/or catalog designations.

1. Some general items
   a. Window shades
   b. Chairs
   c. Lockers
   d. Display cases
2. Classrooms
   a. Seating
   b. Teachers' desks
   c. Cases (if not built in)
3. Science rooms
   a. Seating
   b. Demonstration desks
   c. Pupil workdesks
   d. Projection equipment
   e. Other, adapted to type of science
4. Homemaking
   a. Laboratory tables
   b. Stoves
   c. Storage (if not built in)
   d. Dining furniture

e. Homemaking—nursing-beds, etc.
f. Sewing machines
g. Mirrors
h. Cutting tables, etc.

5. Cafeteria
   a. Kitchen equipment—peelers, dishwashers, stoves, etc.
   b. Refrigerator
   c. Water cooler
   d. Dining room furniture
   e. Serving counters
   f. Mixing machines
6. Many other areas such as shops, art, mechanical drawing, commerce, visual education, music, library, gymnasium, dressing rooms, toilet rooms (dispensers) auditorium—stage, hall rooms, rest rooms, offices, kindergartens.

Unit 14
Inspection and Approval of Completed Project

The board of education, serving as representatives of the people, uses district funds in providing school-housing facilities. The board awards construction contracts on the basis of approved drawings and specifications. The construction supervisors are expected to watch the work and to report on conformity to or deviations from the design and specifications. Even with these precautions the obligation for final approval of the completed project rests with the board of education. The board is responsible for protecting district moneys, and for providing adequate buildings for program needs and for pupil protection. Most boards of education find it desirable to make or to have made, detailed inspections of the building before accepting the building and approving final settlements with the contractors. In some cases board members help make the inspection, usually with the architect and the board's building supervisor and/or other school officials. In some cases the State building supervisor assists. These inspections should be thorough and detailed. They should cover the whole building insofar as possible.

Inspection, approval, and acceptance plans vary. In some places State inspection and approval are required. In some cases construction contracts call for the retention of a designated percentage of the contract price until after final acceptance. In addition, contract surety documents (usually referred to as contractors' bonds) may provide materials and workmanship guarantees for a designated period of time. However, these guarantees are usually considered separate and apart from, and do not usually affect the completion inspection, approval, and acceptance of a building project.

A. Completion
   1. The contractor or contractors may notify the board, its supervisor, or the architect that the building is ready for inspection

2. The architect and the supervisor may make a preliminary inspection and advise the contractor of incomplete or unsatisfactory items
3. The contractor may complete or correct these items before requesting final inspection

B. Official inspection
   1. Participating
      a. Board of education—or designated representative
      b. Architect—and perhaps engineers
      c. Project supervisor
      d. In some cases State department of education and/or other authorized building supervisor or inspector
      e. Contractors often accompany the inspectors
   2. Timing the inspections
      a. It is generally considered desirable to delay inspections until the building project, or segment thereof, is completed, but to make them while the contractors' staffs are still available to make needed corrections or completions
      b. The timing of any essential State inspection may be made more difficult because of travel distance
   3. Method
      a. Make a thorough inspection, covering details in various areas. In case of question refer back to drawings and specifications and architect's interpretations
      b. Make list of questionable or unsatisfactory items
      c. If changes are needed and feasible, give contractor time to make changes or completions
      d. If changes are not practical, determine whether to approve without correction, and if so the necessary changes in compensation
      e. After changes are made or completions accomplished, reinspect as a basis for final approval.

C. Acceptance

Formal acceptance involving the payments to and the release of the contractor from certain obligations is usually delayed until all requirements are met. In other words formal acceptance is not conditional but is delayed until it may be complete and final (subject, of course, to the usual guarantee-bond stipulations). Acceptance procedures vary and the following comments relate to some common problems and procedures.

1. Timing—delay acceptance until project is satisfactorily completed.
2. Scope
   a. Acceptance covers whole project—but board deals only with prime contractor
   b. Prime contractor and his surety responsible for materials and workmanship supplied by dealers and subcontractors
3. Nature of acceptance
   a. Formal acceptance—of completed project
   b. Partial precompletion use—by agreement—need not constitute final acceptance
   c. Certain retained contract payments are usually released as soon as the project is accepted
4. Guarantees
   a. Board get copies of all guarantees and continuing bonds

b. Acceptance need not affect such guarantees

5. Liens and other stipulations

a. Many school boards—as governmental bodies—deal only with the prime contractor, and

(1) Do not recognize any other claims for such materials or labor costs

(2) Expect performance bonds to cover and satisfy all claims and demands

b. Some boards may recognize modified lien claims. If so, withholding payments to cover them may—in effect—cause the board to serve in the capacity of a prime contractor.

D. Reporting to the public

The development of a new school building is usually an enterprise in which the public has much interest. In most cases such new construction is financed largely from local taxes. Often the new project is one unit of a total community long-range program of improving education. In some cases construction fund-raising programs have generated promotional campaigns in which much was said about our community schools and our school buildings.

Many boards find it desirable to make periodic and/or occasional reports to the people of the community on the progress of their program of school-plant improvements. The completion of a new building, representing one step in this program, provides an opportunity that school boards often use to take stock, review community accomplishments to date, and take a new look at future plans for the school-plant program.

1. Reporting to the people

a. Types of reports

(1) Annual, periodic, or special reports outline progress of the school-plant program

(2) Special plant-program reports at the time of completion of a project or unit may be timely and effective. These are often designed to show

(a) A review of the long-range program

(b) Projects completed and to come

(c) Financial status

b. Reports on individual projects at completion often show such items as

(1) History

(2) Costs

(3) Size

(4) Planned utilization

(5) Special features or information of interest

2. Presentation of completed project to the public

Showing the new building to the people provides for the public a chance to share in the satisfactions of having completed another step in their total school-plant program. It provides for the board and school officials opportunity to review accomplishments and to project some future steps in the program.

a. Types of presentation such as

(1) Open house

(2) Dedication exercises,

b. Procedures should be

(1) Well planned—for wide participation

(2) Used as a means of maintaining school-community understanding.

Section IV
The Financing Phase

THE FINANCING phase involves some early planning and cannot be completely separated from the other phases. However, the total financing program may extend over a period of two or three decades and may involve some legal and other problems not common to the other phases. The financing phase may have close relationships to economic conditions, to the local form of municipal control, and to the various State regulations or limitations.

Unit 15
Financing School-Plant Programs

It is generally desirable to develop long-range programs for capital-outlay financing along with or to supplement the long-range school-plant programs. School capital outlay financing programs may present many problems. Some of these are local problems and some have both local and State significance. These may involve the relationships of capital-outlay funds to other funds; types of State support; priority claims; earmarking, or a sharing of the current tax income; or may apply to such features as fund availability; district credit; or the protection of reserves. It is not feasible to provide here a detailed discussion of the principles, problems, and procedures in capital-outlay financing.

However, it seems desirable to outline a few of the basic principles and to point out some of the problems which may merit consideration by local officials in developing and carrying out a capital-outlay financing program for their schools.

Long-range school capital-outlay financing programs help create a public

awareness of future needs and may help reduce the competition between the school capital-outlay and other community programs financed from local taxes.

Capital-outlay financing programs should provide the essential funds—"when needed" for new construction or other capital improvements.

The financing program may need to be so developed that the tax load may be distributed over a period of years.

Debt obligations serving as a source of capital-outlay funds should be limited to a reasonable term of years consistent with sound financing. Continuing long-term obligations may be costly and may not leave free-bonding capacity for future use.

Capital-outlay and/or debt-service funds should be safeguarded and local accountability should be definite.

There are various plans for financing school-capital expenditures. Authorizations, limitations, and methods may vary from State to State. In some instances there are different types of authorization for the various districts in a State. In addition, variations in local district financing abilities contribute to the development of different types of capital-outlay financing plans. The following paragraphs outline some basic plans and will point out a few of the problems involved but will not provide a detailed analysis of any of the many capital-outlay financing plans.

In most cases capital-outlay funds are needed in substantial amounts at specified times to finance new construction projects. In some large or city school districts it may be possible to provide the construction funds needed from special or regular current tax levies. This is not always true in large districts and is seldom true in the smaller districts. In many, if not most, cases school districts attempt to distribute the taxes for capital-outlay funds over a period of years either by building up advance reserve funds for construction or by borrowing and paying through debt-service taxes. Under either plan there may be some earmarking or priority claim established for building and/or debt-service tax levies. Regardless of the method used such taxes should be considered in their relationship to the total school (and/or community) taxes so that the taxpayer will not be confused by competing tax demands.

Programs of financing school-plant construction may be divided into several parts, and each is sometimes thought of as one of the steps in a local school-building program. These steps may not be the same for all school districts or all types of financing programs, and the sequence of steps may not always be the same. The parts or steps to be considered in the following outlines are: estimating the funds needed; setting up a financing program, including the budgeting of building project expenses; voting school-financing bonds; sale of bonds; and setting up bond-payment and debt-service schedules. In addition some detailed optional amortization schedules are provided in Unit 16. Some of the general principles will be applicable to

all school-plant financing programs. However, many details of the different steps will vary with local conditions, State restrictions, local resources, and other factors. Each local program should be developed after considering the various factors involved.

Part I. Estimating the Funds Needed

School district capital-outlay programs may become major community enterprises. Local citizens may want, and are entitled to, information on the school-plant needs and the probable costs of the proposed current and anticipated future school-construction programs. Boards of education and other local school officials may need to provide information on the costs of various types of local construction, and some estimates of the factors or elements of such costs, and information on the comparison of local costs with those in other communities. Board information releases in these areas may facilitate public approval of capital-outlay financing programs.

A. Some factors in school-plant costs
   1. General factors
      a. Construction cost levels (as measured by construction cost indices)
      b. Size of project
      c. Type of construction
      d. Refinements and special features included
   2. Some local conditions affecting costs
      a. Local wage scales
      b. Local materials available
      c. Site conditions
      d. Haulage
      e. Availability of water, sewer, and other service lines

B. Estimating costs: Various measures, none of them very reliable, are used to make rough estimates
   1. Cubic foot costs—covering only the enclosed spaces with the enclosing walls and using a height measure from average roof height to about 1 foot below lowest floor level at each point
   2. Square-foot measures—covering at each floor level only the areas within the outer surfaces of the enclosing exterior walls, and omitting estimated costs for areas not so included
   3. Per pupil—optimum capacity
   4. Per classroom
   5. By analogy—or comparing with similar buildings erected under comparable conditions and on which cost units are known
   6. Use of construction-cost indices, by applying index number adjustment to known cost levels of a previous period

As indicated, the type of construction and many other factors increase the difficulty of advance cost estimating. However, after the preliminary drawings and specifications are completed and it has been determined what types of materials will be used, and the amounts and types of labor needed, it will be possible to make cost estimates having greater validity.

C. Cautions in estimating costs

Local officials should be careful to include all costs in projecting the cost estimates of a project or a program. The cost indices trend may provide some basis for projecting construction costs. However, there are costs—other than construction—that usually must be financed from the same bond or tax-levy source. If nearly all of the available funds are consumed in paying construction costs, such areas as equipping, landscaping, and other essential needs may be neglected. There are no reliable estimates of cost divisions that are applicable to all projects. Cost distributions will vary locally depending on the type of construction, site costs, the amount of new equipment needed, and other factors.

Some school officials estimate project construction expenditures as percentages of the total capital-outlay costs. The ranges shown below are averages and do not represent absolute limits, nor do they necessarily apply to any particular project or locality.

1. Construction contracts range from about 67 to 78 percent of total capital-outlay costs—including general construction, from 51 to 60 percent; heating and ventilating, 7 to 12 percent; plumbing, 4 to 5 percent; electric, 4 to 8 percent; each of total project costs.
2. Costs other than for construction range from about 22 to 33 percent of the total—including such items as sites, from 3 to 9 percent; equipment, 7 to 13 percent; engineering, architectural, and supervisory costs, 5 to 9 percent; administration, 1 to 4 percent; each of the total or capital-outlay costs of the project.

Part II. Setting up a Financing Program

The types of financing programs to be followed may depend on many factors. Some of them are the State laws on bonding, on reserves, and on related obligations; the size of the immediate project and of the anticipated future program; and local financial conditions and financing customs.

It seems essential that the local school officials develop and adopt—or if necessary recommend to the public for adoption—a logical long-range financing program. This program should include all anticipated capital-outlay funds from all sources such as taxes, bonds, sale of property, State and/or Federal aids if any, and others such as transfers. The program should show the district's assessed valuation projections and provide some indication of anticipated capital-outlay building and/or debt-service tax levies. The long-range financing program should show anticipated expenditures for capital improvements and for debt service.

A. Methods of financing plant-improvement programs

The following outline lists several financing plans but without evaluation. It is possible that a district may intermingle the various plans combining reserve funds, current tax income, some bond money, and other such as State-aid funds for one project or for a program.

1. Pay-as-you-go policy
   a. Building up capital-outlay fund reserves
   b. Voting special building-tax levies
   c. Building each year from regular current tax funds

2. On a credit or borrowing basis
   a. Short-term bonds
      (1) Sometimes authorized without public vote
      (2) May be for 2 or 3 years, usually not over 10
   b. Long-term bonds—terms 15-40 years with 20 or 25 as the median
      (1) Serial—either, amortizing with equal total payments, or equal principal payments and reducing interest payments
      (2) Sinking fund bonds—pay principal at end of fixed periods—with or without callable features
   c. Combinations of the methods listed above
3. Selecting a financing procedure to be followed. Each method has some advantages or disadvantages as applied to local situations. (See later tables pages 51–78 for some cost comparisons.)
   a. Pay-as-you-go plans are less costly in total dollars, but
      (1) Large reserves are not always easily protected
      (2) Annual collections large enough for major construction often insufficient
      (3) Repeated annual collections not assured if dependent on annual public vote, or the approval of some outside board
   b. Short-term bonds
      (1) Heavy immediate cost
      (2) Release future bonding capacity sooner
   c. Long-term sinking-fund bonds
      (1) Costly
      (2) Involve protecting sinking-fund reserves
   d. Long-term serials—favored by many districts
      (1) Annual principal payments constant, interest payments decrease
      (2) Amortizing—equal total payments—principal payments increase, interest payments decrease
   e. Bond terms—up to 35 or more years in some States
      (1) For short term, 6-10 years generally favored
      (2) For long term, 20 years generally favored

B. Budgeting of building-project expenses

Some mention has been made of possible divisions of capital-improvement expenses. It is usually desirable to budget such expenses. Satisfying all desires may prove costly, and the budgeting plan may help hold such costs in balance. The following outline does not assign budget percentages to the various areas, but lists some of the expenditure areas that should be considered in budgeting capital expenditures.

1. Need. School boards should consider all possible costs in advance planning. Failure to do so may result in fund shortage or in failure to obtain some items desired.
2. Preliminary expenses
   a. Legal, engineering, professional
   b. Survey—if paid from this fund
   c. Costs of elections, advertising
   d. Bond registration
3. Site costs
   a. Purchase
   b. Surveys, grading, landscaping, walks, etc.
   c. Parking areas

4. Construction costs
   a. Contract advertising and other costs
   b. The various contracts
   c. Architectural, engineering, supervision
   d. Builders' risk insurance—or insurance during construction
5. Furniture—equipment
6. Miscellaneous costs
   a. Incidentals and contingencies
   b. Public relations, and information
   c. Travel
   d. Legal costs
   e. Permits

Part III. Voting School Bonds

Currently a substantial part of the costs of public elementary and secondary school construction is financed from local funds. As indicated in a previous section, there are several possible ways to obtain the local funds needed for capital-outlay purposes. The use of local regular or special tax levies to obtain capital-outlay funds differs little from current procedures with other taxes and will not be discussed here.

However, a majority of the school districts depend on using district obligation bonds to obtain a part or all of the funds needed for school-plant construction. There may be many possible complications in voting and caring for bond issues, and it is anticipated that the boards of education will seek adequate legal advice. The comments and suggestions in this section are not developed to provide answers to legal questions. They should serve to provide some general information on the principles and on some of the problems in bonding and to call attention to some steps or procedures that may merit the attention of officials developing a bonding program.

Legal restrictions differ in the various States and in some cases among the different districts within a State. This is not the place to attempt to define school bonding customs. However, it seems proper to discuss briefly some basic principles or problems.

School bonds are normally voted or issued to be sold, and sales are not limited to the State of origin. Distant bond buyers may not know about the local district intent and financial integrity and must depend more on compliance with legal bonding restrictions and bond stability as factors in bond attractiveness as investments. Bond prices and interest rates may be affected by State authorization for, and district use of priority claim on, or the earmarking of taxes for debt service payments.

In some States bonds—at least in limited amounts—may be issued by local boards of education without a specific public vote. In other States all school-bond issues must be authorized by a vote of the people. Such

factors as the eligibility of voters and of the percentages of votes required for approval will vary from State to State. Likewise the regulations and rules governing the calling of bond elections, the manner of holding elections, and the vote certifications will vary. Local school officials will want to be assured that they have fully complied with the laws or rules applying in their State and to their district.

District bonding limits may be established by State laws for specific types of districts, or may in some cases vary with the vote cast or the district's financial ability. In some cases the district limit may be established by the amount of debt-service tax that can be levied. In other cases the limit may apply to the total for all bonds of the municipality. In still other cases the State may set no limit, and in such cases voter willingness and/or market salability may be the limiting factors.

The following outline lists some of the areas, activities, and problems boards may need to consider in preparing a district bond program.

A. Some basic information
   1. Assessed valuation applicable
   2. Total bonding capacity
   3. Outstanding debt
   4. Free bonding capacity
   5. School debts vs. other municipal debts—relationship if any

B. Board action
   1. Minutes of appropriate board meetings
   2. Call for election
   3. Notices of election
   4. Ballot—types, wording
   5. Handling—where held, judges, etc.
   6. Official report of election

C. Attorneys' reports—covering such areas as:
   1. Certifications of authority
   2. Certifications of legality of all actions
   3. Nonlitigation certification
   4. Board resolutions for issuing bonds
   5. Bond attorney's approval of bonds

D. Registration record and approval if required
   1. State officials
   2. City or other officials

E. Types of bonds. There are various types of bonds. Some of the common types are:
   1. Fixed term
      a. For total issue—typical for sinking-fund bonds
      b. Separately for each bond—adapted to amortizing schedules
   2. Callable—with or without callable time limits

Part IV. Sale of Bonds

In some States school officials may contract for bond sales, pending vote, before they are approved by a public vote. In some cases bond sales may be negotiated, and in other cases the bonds must be sold at public auction. It is not feasible to recommend here any sales procedures. It does seem desirable to list some of the steps, procedures, and problems local officials may need to consider in selling school bonds.

A. Sale procedures
   1. Time of sale
      a. Before voting
      b. After bond approval
   2. Type of sale
      a. Private or negotiated
      b. Public
         (1) Advertisement
         (2) Procedure for bidding
         (3) Earnest money, if any

B. Sale conditions
   1. Interest rate—fixed or as a factor in bids
   2. Price—fixed—with premium—variable—or competitive with bidders
   3. Dates of delivery
   4. Payment schedules, dates, place
   5. Sale of whole issue or part
   6. Payments for bonds—method of delivery

C. Protecting funds obtained from bond sales
   1. Board liability—or obligation
   2. Surety—on deposits
   3. Escrow—assets
   4. Investing—types of assets permissible
   5. Other

Part V. Setting Bond-Payment and Debt-Service Schedules

There are several types of school bonds in common use. The sinking-fund bond may defer all principal payments to a final maturity date. Tax incomes for bond redemption may be placed in a sinking fund to be available at the time the bonds mature. The preservation or protection of large reserve funds sometimes creates problems. Investing or lending such funds brings some income but may increase the protection difficulties.

Serial bonds now seem more popular than the sinking-fund bonds. One type of serial bond amortizes by maintaining a constant total annual payment increasing the payments on the principal as the interest payments decrease. A second type of serial bond program calls for fixed annual payments on the principal but with constantly decreasing interest payments. Initial

payments are slightly larger than with total equal payments but the total costs are slightly less. In either case bonds are so written that some bonds mature each year.

In setting up a bond payment schedule the school board may wish to consider such factors as other existing bonded obligations and their maturity dates, the probability of other bond issues in the future, district tax-paying ability, and local desires. In some cases boards wish to defer payments on the principal until other debts are retired, and in other cases they wish to pay off the bonds rapidly to release bonding capacity for future issues. The following comments do not include recommendations for any particular method of setting up debt-service payment schedules. The illustrations do show the differences in annual and total costs for the various plans of debt payments.

A. Setting up a payment schedule
   1. Determine the type of bond desired
   2. Determine term of bonds—10, 15, 20, ...years
   3. Set up payment schedule
   4. Project estimates of property assessments or other bases for debt-service funds
   5. Estimate tax levies required

B. Estimating bond retirement and interest rates

The samples and illustrations shown in tables 1–30 provide bases for estimating costs for the total bonded debt, for various periods of time, and at various interest rates for sinking-fund bonds, serial with equal annual principal payments, and serial with equal total but increasing annual principal payments.

A retirement schedule for sinking-fund bonds is shown in table 1. Some school officials have considered longer term bonding. Brief summaries on this and succeeding pages will show some of the costs for each 40- and 50-year bonds at certain interest rates. If 40- or 50-year *sinking fund bonds* are issued, the debt-service costs would be less per year but the totals would be more as shown in table 1. A majority of the school long-term capital-outlay obligations are now in the form of serial bonds. One of the types of serial bonds provides for equal annual payments on the principal and decreasing interest and total payments until the bonds are retired.

Table 2 shows retirement schedule for equal annual principal payment types of bonds. These estimates are based on $1,000 bonds at different interest rates, and for different periods of years.

Some school boards like this equal annual principal payment type of serial bonds. Total costs are slightly less, and the heavier early payments on the principal release bonding capacity for later use if needed. A schedule of this type may need to be adjusted if the new bond program must be coordinated with existing obligations and bond-retirement programs.

Table 1.—*Sinking-Fund Bonds*
Interest paid annually, sinking funds collected annually but principal payment deferred to one maturity date
Costs per $1,000 bond

Bond, by length of term	Cost of bonds at interest rate of —					
	1 percent	2 percent	3 percent	4 percent	5 percent	6 percent
1	2	3	4	5	6	7
10-year:						
Total interest cost	$100.00	$200.00	$300.00	$400.00	$500.00	$600.00
Total principal and interest	1,100.00	1,200.00	1,300.00	1,400.00	1,500.00	1,600.00
Average per year	110.00	120.00	130.00	140.00	150.00	160.00
15-year:						
Total interest cost	150.00	300.00	450.00	600.00	750.00	900.00
Total principal and interest	1,150.00	1,300.00	1,450.00	1,600.00	1,750.00	1,900.00
Average per year	76.67	86.67	96.67	106.67	116.67	126.67
20-year:						
Total interest cost	200.00	400.00	600.00	800.00	1,000.00	1,200.00
Total principal and interest	1,200.00	1,400.00	1,600.00	1,800.00	2,000.00	2,200.00
Average per year	60.00	70.00	80.00	90.00	100.00	110.00
30-year:						
Total interest cost	300.00	600.00	900.00	1,200.00	1,500.00	1,800.00
Total principal and interest	1,300.00	1,600.00	1,900.00	2,200.00	2,500.00	2,800.00
Average per year	43.33	53.33	63.33	73.33	83.33	93.33
40-year:						
Total principal and interest	———	1,800.00	———	2,600.00	———	3,400.00
Average per year	———	45.00	———	65.00	———	85.00
50-year:						
Total principal and interest	———	2,000.00	———	3,000.00	———	4,000.00
Average per year	———	40.00	———	60.00	———	80.00

Note: District protection of sinking-fund reserves may be a problem. Investing or bonding such reserves may bring some income, but may also increase the loss hazard.

Table 2.—*Serial Bonds*

Equal annual principal payments, interest, and total annual payments decrease as the unpaid principal decreases

Costs per $1,000 bond

Bond, by length of term	Costs at interest rate of —					
	1 percent	2 percent	3 percent	4 percent	5 percent	6 percent
1	2	3	4	5	6	7
10-year:						
Total interest to pay	$55.00	$110.00	$165.00	$220.00	$275.00	———
Total principal and interest to pay	1,055.00	1,110.00	1,165.00	1,220.00	1,275.00	———
Average annual payment	105.50	111.00	116.50	122.00	126.50	———
Maximum annual payment	110.00	120.00	130.00	140.00	150.00	———
Minimum annual payment	101.00	102.00	103.00	104.00	105.00	———
15-year:						
Total interest to pay	80.00	160.00	240.00	320.00	400.00	———
Total principal and interest to pay	1,080.00	1,160.00	1,240.00	1,320.00	1,400.00	———
Average annual payment	72.00	77.33	82.67	88.00	93.33	———
Maximum annual payment	76.67	86.67	96.67	106.67	116.67	———
Minimum annual payment	67.34	68.00	68.67	69.33	70.00	———
20-year:						
Total interest to pay	105.00	210.00	315.00	420.00	525.00	———
Total principal and interest to pay	1,105.00	1,210.00	1315.00	1,420.00	1,525.00	———
Average annual payment	55.25	60.50	65.75	71.00	76.25	———
Maximum annual payment	60.00	70.00	80.00	90.00	100.00	———
Minimum annual payment	50.50	51.00	51.50	52.00	52.50	———
30-year:						
Total interest to pay	155.00	310.00	465.00	620.00	775.00	———
Total principal and interest to pay	1,155.00	1,310.00	1,465.00	1,620.00	1,775.00	———
Average annual payment	38.50	43.33	48.83	54.00	59.16	———
Maximum annual payment	43.33	53.33	63.33	73.33	83.33	———
Minimum annual payment	33.67	34.00	34.33	34.67	35.00	———

Table 2.—*Serial Bonds*—Continued

40-year:						
Total principal and interest	———	1,410.00	———	1,820.00	———	2,230.00
Average per year	———	35.25	———	45.50	———	55.75
50-year:						
Total principal and interest	———	1,510.00	———	2,220.00	———	2,530.00
Average per year	———	30.20	———	40.40	———	50.60

A second type of serial bond program, in use by many school districts, provides for approximately equal total annual payments on principal and interest with the principal payments increasing as the interest payments decrease. This is probably the most common type of school bond, and since the computation tables are somewhat involved, some specific information on computation procedures will be provided in the following paragraphs and sample amortization tables will be provided in Unit 16.

A formula[1] for estimating amortization schedules may be derived from formulas showing annuities whose value at compound interest totals 1. The following tabulation, table 3, shows the amortization schedule indices, the average rate per $1,000 bonds, and the totals for various interest rates and for different periods of years.

However, school boards often prefer to use a simple amortization factor set as a fixed number of whole dollars per year. Table 4 shows the amortizing costs, using the next whole dollar above the minimum as the amortizing factor.

If the 40- and 50-year bond costs are computed on the basis of annual payments per thousand of the next whole dollar—above the applicable indices—then the totals would be slightly different from those shown in table 3 on the preceding page.

The use of the whole dollar (next above the minimum) factor has some advantages. It is easily handled. It aids in providing small reserves in the bond-retirement fund, and this is often needed for small bond issues, since bonds are often issued for even amounts of about $1,000 each. It also helps provide a small cushion for use if tax collections lag. Under

[1] Dyer, W. B. and Gilmore, Robert O. *Mathematics of Business and Finance* (including computations by F. C. Kent and M. E. Kent). New York, McGraw-Hill Book Company, 1948.

this whole dollar plan the payment for the last year may be small. This is probable if the next formula amortizing factor is 50 cents or more below the whole dollar used in computing costs. In such cases the total costs may be slightly less than when computed on the exact formula basis.

School officials often seek information on the effect and cost of an amortizing schedule on their proposed bond programs. Table 5 shows the payment and retirement schedule for a bond issue of $500,000 for 20 years at 3 percent. (Complete schedules for different interest rates and different terms of years are shown in Unit 16.)

Table 3.—*Amortizing Schedule*
Indices of amortization factors, average annual and total costs per $1,000

Schedule	10 years	15 years	20 years	30 years	40 years	50 years
1	2	3	4	5	6	7
1 Percent						
Index	0.1055820	0.0721237	0.0554153	0.0387481	———	———
Average per year	[1]$105.58	$72.12	$55.42	$38.75	———	———
Total—all years	[1]$1,055.80	$1,081.80	$1,108.40	$1,162.50	———	———
2 Percent						
Index	0.1118265	0.0778254	0.0611567	0.0446499	0.0365574	0.0318232
Average per year	$111.83	$77.83	$61.16	$44.65	$36.56	$31.82
Total—all years	$1,118.30	$1,167.45	$1,223.20	$1,339.50	$1,582.40	$1,591.16
3 Percent						
Index	0.1172305	0.0837665	0.0672157	0.0510192	———	———
Average per year	$117.23	$83.77	$67.22	$51.02	———	———
Total—all years	$1,172.30	$1,256.55	$1,344.40	$1,530.60	———	———
4 Percent						
Index	0.1232909	0.0899411	0.0735817	0.0578300	0.0505234	0.0465502
Average per year	$123.29	$89.94	$73.58	$57.83	$50.52	$46.55
Total—all years	$1,232.90	$1,349.10	$1,471.60	$1,734.90	$2,021.80	$2,327.51
5 Percent						
Index	0.1295045	0.0963422	0.0802425	0.0650514	———	———
Average per year	$129.50	$96.34	$80.24	$65.05	———	———
Total—all years	$1,295.00	$1,445.10	$1,604.80	$1,951.50	———	———
6 Percent						
Index	0.1358679	0.1029627	0.0871845	0.0726489	0.0664615	0.0634442
Average per year	$135.87	$102.96	$87.18	$72.65	$66.46	$63.44
Total—all years	$1,358.70	$1,544.40	$1,743.60	$2,176.50	$2,658.40	$3,172.21

[1] *Note.* — Averages are rounded to the nearest whole cent. Costs are slightly more than when computed on the basis of the next whole dollar as an amortizing factor.

Table 4.—*Serial Bonds*

Amortized with *equal annual total payments,*

Costs per $1,000 bond computed at next whole dollar above the index

[As interest payments decrease, principal payments increase]

Bond, by length of term	Costs at interest rate of —				
	1 percent	2 percent	3 percent	4 percent	5 percent
1	2	3	4	5	6
10-year:					
Total interest to pay	$55.62	$112.62	$171.16	$231.48	$293.76
Total interest and principal	1,055.62	1,112.62	1,171.16	1,231.48	1,293.76
Annual payment schedule used	[1]106.00	112.00	118.00	124.00	130.00
Average annual cost	105.56	111.26	117.12	123.15	129.38
15-year:					
Total interest to pay	80.89	166.97	255.65	348.83	440.78
Total interest and principal	1,080.89	1,166.97	1,255.65	1,348.83	1,440.78
Annual payment schedule used	73.00	78.00	84.00	90.00	97.00
Average annual cost	72.06	77.80	83.71	89.92	96.05
20-year:					
Total interest to pay	107.14	219.50	338.94	467.54	594.93
Total interest and principal	1,107.14	1,219.50	1,338.94	1,467.54	1,594.93
Annual payment schedule used	56.00	62.00	68.00	74.00	81.00
Average annual cost	55.36	60.98	66.95	73.38	79.75
30-year:					
Total interest to pay	161.26	335.78	513.36	730.40	917.05
Total interest and principal	1,161.26	1,335.78	1,513.36	1,730.40	1,917.05
Annual payment schedule used	39.00	45.00	52.00	58.00	66.00
Average annual cost	38.71	44.52	50.44	57.68	63.90

[1] *Note.* — Payment schedule used — next whole dollar above minimum required to amortize. Average annual costs shown here are slightly less than required annual amortizing payments, since larger payments (next dollar) are cumulative and leave smaller last year payment. For instance, the required amount to amortize a 20-year 2 percent bond is $61.16 per year, but when the even dollar ($62.00) annual payment is used the average annual cost is only $60.98.

The estimates shown in table 5 are based on full collection of the estimated $34,000 debt-service income each year. If full collections are not assured a reduction in the early payments on the principal would leave larger reserves in the annual debt-service fund balances.

This schedule would apply only for a bond issue set up for immediate amortization as shown. If existing obligations justify deferred principal payments, other schedules may need to be developed.

Table 5.—*Serial Bonds*

Equal total annual payments for a bond issue of $500,000 20 years, at 3 percent, set up in $1,000 bond units. Planned debt-service payments $34,000 or $68 per $1,000 of original issue

Years	Total bonds out	Interest to pay	Payment on principal	Total to pay	Balance in debt service fund	Balance of bonds outstanding
1	2	3	4	5	6	7
1	$500,000	$15,000	$19,000	$34,000	----------	$481,000
2	481,000	14,430	19,000	33,430	$570	462,000
3	462,000	13,860	20,000	33,860	710	442,000
4	442,000	13,260	21,000	34,260	450	421,000
5	421,000	12,630	21,000	33,630	820	400,000
6	400,000	12,000	22,000	34,000	820	378,000
7	378,000	11,340	23,000	34,340	480	355,000
8	355,000	10,650	23,000	33,650	830	332,000
9	332,000	9,960	24,000	33,960	870	308,000
10	308,000	9,240	25,000	34,240	630	283,000
11	283,000	8,490	26,000	34,490	140	257,000
12	257,000	7,710	26,000	33,710	430	231,000
13	231,000	6,930	27,000	33,930	500	204,000
14	204,000	6,120	28,000	34,120	380	176,000
15	176,000	5,280	29,000	34,280	100	147,000
16	147,000	4,410	29,000	33,410	690	118,000
17	118,000	3,540	31,000	34,540	150	87,000
18	87,000	2,610	31,000	33,610	540	56,000
19	56,000	1,680	32,000	33,680	860	24,000
20	24,000	720	24,000	24,720	10,140	----------
	----------	$169,860	$500,000	$669,860	----------	----------

Comparative Costs

Table 6 shows a comparison of the total costs for each $1,000 bond, various interest rates, and for different periods of years.

In table 6 the rounded or next whole dollar plan for the equal total annual payment plan was used. This table shows that the sinking-fund plan is the most costly; the equal total payment is next; and the equal principal and decreasing interest plan is least costly. The difference is in the interest, which may be nearly twice as much under the sinking-fund plan.

Table 6.—*Comparative Total Interest and Principal* Costs per $1,000 Bond at Various Interest Rates and for Different Periods of Years

Bond, by length of term	Costs at interest rate of —				
	1 percent	2 percent	3 percent	4 percent	5 percent
1	2	3	4	5	6
10 years					
Sinking fund	$1,100.00	$1,200.00	$1,300.00	$1,400.00	$1,500.00
Serial-equal principal, variable interest payment	1,055.00	1,110.00	1,165.00	1,220.00	1,275.00
Serial-equal total principal and interest[1] payment	1,055.62	1,112.62	1,171.16	1,231.48	1,293.76
15 years					
Sinking fund	1,150.00	1,300.00	1,450.00	1,600.00	1,750.00
Serial-equal principal, variable interest payment	1,080.00	1,160.00	1,240.00	1,320.00	1,400.00
Serial-equal total principal and interest[1] payment	1,080.89	1,166.97	1,255.65	1,348.83	1,440.78
20 years					
Sinking fund	1,200.00	1,400.00	1,600.00	1,800.00	2,000.00
Serial-equal principal, variable interest payment	1,105.00	1,210.00	1,315.00	1,420.00	1,525.00
Serial-equal total principal and interest[1] payment	1,107.14	1,219.50	1,338.94	1,467.54	1,594.93
30 years					
Sinking fund	1,300.00	1,600.00	1,900.00	2,200.00	2,500.00
Serial-equal principal, variable interest payment	1,155.00	1,310.00	1,465.00	1,620.00	1,775.00
Serial-equal total principal and interest[1] payment	1,161.26	1,335.78	1,513.36	1,730.40	1,917.05

[1] Total costs for equal total annual payments — principal and interest — are, as computed for the Unit 16 illustrations, on the basis of the next whole dollar above the minimum. Total costs are slightly less than those shown in Table 3, and the difference is greater or less as the amount of the next whole dollar varies from the minimum as derived from the index.

Unit 16
Bond Payment Amortization Schedules

The following tabulations show sample amortization plans for $1,000 bonds for 1-, 2-, 3-, 4-, 5-, and 6-percent interest rates and for terms of 10, 15, 20, and 30 years. In each case the annual payment rate or schedule is set at the next whole dollar above the minimum required for such bond retirement. Under this plan the last payment will be less than the schedule —the amount of difference will depend on the excess of the even-dollar schedule over the minimum required. (These tabulations do not provide

for carryover district balances each year to compensate for any lag in tax collections. It is anticipated that local boards will provide any such balances needed through adjustments of the debt-service tax levies.

Tables 7 through 30 show the bond amortization schedules and costs at various rates of interest for certain term bonds under the total equal annual payment amortization plan.

Table 7.—*Bond Amortizing Schedule*
10-year bonds, interest *1* percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$10.00	$96.00	$106.00	$904.00
2	904.00	9.04	96.96	106.00	807.04
3	807.04	8.07	97.93	106.00	709.11
4	709.11	7.09	98.91	106.00	610.20
5	610.20	6.10	99.90	106.00	510.30
6	510.30	5.10	100.90	106.00	409.40
7	409.40	4.09	101.91	106.00	307.49
8	307.49	3.07	102.93	106.00	204.56
9	204.56	2.05	103.95	106.00	100.61
10	100.61	1.01	100.61	101.62	.....
Total	.....	55.62	1,000.00	1,055.62	.....

Table 8.—*Bond Amortizing Schedule*
10-year bonds, interest *2* percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$20.00	$92.00	$112.00	$908.00
2	908.00	18.16	93.84	112.00	814.16
3	814.16	16.28	95.72	112.00	718.44
4	718.44	14.37	97.63	112.00	620.81
5	620.81	12.42	99.58	112.00	521.23
6	521.23	10.42	101.58	112.00	419.65
7	419.65	8.39	103.61	112.00	316.04
8	316.04	6.32	105.68	112.00	210.36
9	210.36	4.21	107.79	112.00	102.57
10	102.57	2.05	102.57	104.62	.....
Total	.....	112.62	1,000.00	1,112.62	.....

Table 9.—*Bond Amortising Schedule*
10-year bonds, interest 3 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$30.00	$88.00	$118.00	$912.00
2	912.00	27.36	90.64	118.00	821.36
3	821.36	24.64	93.36	118.00	728.00
4	728.00	21.84	96.16	118.00	631.84
5	631.84	18.95	99.05	118.00	532.79
6	532.79	15.98	102.02	118.00	430.77
7	430.77	12.92	105.08	118.00	325.69
8	325.69	9.77	108.23	118.00	217.46
9	217.46	6.52	111.48	118.00	105.98
10	105.98	3.18	105.98	109.16	.....
Total	.....	171.16	1,000.00	1,171.16	.....

Table 10.—*Bond Amortising Schedule*
10-year bonds, interest 4 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$40.00	$84.00	$124.00	$916.00
2	916.00	36.64	87.36	124.00	828.64
3	828.64	33.15	90.85	124.00	737.79
4	737.79	29.51	94.49	124.00	643.30
5	643.30	25.73	98.27	124.00	545.03
6	545.03	21.80	102.20	124.00	442.83
7	442.83	17.71	106.29	124.00	336.54
8	336.54	13.46	110.54	124.00	226.00
9	226.00	9.04	114.96	124.00	111.04
10	111.04	4.24	111.04	115.48	.....
Total	.....	231.48	1,000.00	1,231.48	.....

Table 11.—*Bond Amortising Schedule*
10-year bonds, interest 5 percent

[The amortising schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$50.00	$80.00	$130.00	$920.00
2	920.00	46.00	84.00	130.00	836.00
3	836.00	41.80	88.20	130.00	747.80
4	747.80	37.39	92.61	130.00	655.19
5	655.19	32.76	97.24	130.00	557.95
6	557.95	27.90	102.10	130.00	455.85
7	455.85	22.79	107.21	130.00	348.64
8	348.64	17.43	112.57	130.00	236.07
9	236.07	11.80	118.20	130.00	117.87
10	117.87	5.89	117.87	123.76	.....
Total	.....	293.76	1,000.00	1,293.76	.....

Table 12.—*Bond Amortising Schedule*
10-year bonds, interest 6 percent

[The amortising schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$60.00	$76.00	$136.00	$924.00
2	924.00	55.44	80.56	136.00	843.44
3	843.44	50.61	85.39	136.00	758.05
4	758.05	45.48	90.52	136.00	667.53
5	667.53	40.05	95.95	136.00	571.58
6	571.58	34.29	101.71	136.00	469.87
7	469.87	28.19	107.81	136.00	362.06
8	362.06	21.72	114.28	136.00	247.78
9	247.78	14.87	121.13	136.00	126.65
10	126.65	7.59	126.65	134.24	.....
Total	.....	358.24	1,000.00	1,358.24	.....

Table 13.—*Bond Amortising Schedule*
15-year bonds, interest *1* percent

[The amortising schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$10.00	$63.00	$73.00	$937.00
2	937.00	9.37	63.63	73.00	873.37
3	873.37	8.73	64.27	73.00	809.10
4	809.10	8.09	64.91	73.00	744.19
5	744.19	7.44	65.56	73.00	678.63
6	678.63	6.79	66.21	73.00	612.42
7	612.42	6.12	66.88	73.00	545.54
8	545.54	5.46	67.54	73.00	478.00
9	478.00	4.78	68.22	73.00	409.78
10	409.78	4.10	68.90	73.00	340.88
11	340.88	3.41	69.59	73.00	271.29
12	271.29	2.71	70.29	73.00	201.00
13	201.00	2.01	70.99	73.00	130.01
14	130.01	1.30	71.70	73.00	58.31
15	58.31	.58	58.31	58.89	.....
Total	.....	80.89	1,000.00	1,080.89	.....

Table 14.—*Bond Amortizing Schedule*
15-year bonds, interest 2 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$20.00	$58.00	$78.00	$942.00
2	942.00	18.84	59.16	78.00	882.84
3	882.84	17.66	60.34	78.00	822.50
4	822.50	16.45	61.55	78.00	760.95
5	760.95	15.22	62.78	78.00	698.17
6	698.17	13.96	64.04	78.00	634.13
7	634.13	12.68	65.32	78.00	568.81
8	568.81	11.38	66.62	78.00	502.19
9	502.19	10.04	67.96	78.00	434.23
10	434.23	8.68	69.32	78.00	364.91
11	364.91	7.30	70.70	78.00	294.21
12	294.21	5.88	72.12	78.00	222.09
13	222.09	4.44	73.56	78.00	148.53
14	148.53	2.97	75.03	78.00	73.50
15	73.50	1.47	73.50	74.97	.....
Total	.....	166.97	1,000.00	1,166.97	.....

Table 15.—*Bond Amortizing Schedule*
15-year bonds, interest 3 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$30.00	$54.00	$84.00	$946.00
2	946.00	28.38	55.62	84.00	890.38
3	890.38	26.71	57.29	84.00	833.09
4	833.09	24.99	59.01	84.00	774.08
5	774.08	23.22	60.78	84.00	713.30
6	713.30	21.40	62.60	84.00	650.70
7	650.70	19.52	64.48	84.00	586.22
8	586.22	17.59	66.41	84.00	519.81
9	519.81	15.59	68.41	84.00	451.40
10	451.40	13.54	70.46	84.00	380.94
11	380.94	11.43	72.57	84.00	308.37
12	308.37	9.25	74.75	84.00	233.62
13	233.62	7.01	76.99	84.00	156.63
14	156.63	4.70	79.30	84.00	77.33
15	77.33	2.32	77.33	79.65	.....
Total	.....	255.65	1,000.00	1,255.65	.....

Table 16.—*Bond Amortizing Schedule*
15-year bonds, interest 4 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$40.00	$50.00	$90.00	$950.00
2	950.00	38.00	52.00	90.00	898.00
3	898.00	35.92	54.08	90.00	843.92
4	843.92	33.76	56.24	90.00	787.68
5	787.68	31.51	58.49	90.00	729.19
6	729.19	29.17	60.83	90.00	668.36
7	668.36	26.73	63.27	90.00	605.09
8	605.09	24.20	65.80	90.00	539.29
9	539.29	21.57	68.43	90.00	470.86
10	470.86	18.83	71.17	90.00	399.69
11	399.69	15.99	74.01	90.00	325.68
12	325.68	13.03	76.97	90.00	248.71
13	248.71	9.95	80.05	90.00	168.66
14	168.66	6.75	83.25	90.00	85.41
15	85.41	3.42	85.41	88.83	.....
Total	.....	348.83	1,000.00	1,348.83	.....

Table 17.—*Bond Amortizing Schedule*
15-year bonds, interest 5 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$50.00	$47.00	$97.00	$953.00
2	953.00	47.65	49.35	97.00	903.65
3	903.65	45.18	51.82	97.00	851.83
4	851.83	42.59	54.41	97.00	797.42
5	797.42	39.87	57.13	97.00	740.29
6	740.29	37.01	59.99	97.00	680.30
7	680.30	34.01	62.99	97.00	617.31
8	617.31	30.87	66.13	97.00	551.18
9	551.18	27.56	69.44	97.00	481.74
10	481.74	24.09	72.91	97.00	408.83
11	408.83	20.44	76.56	97.00	332.27
12	332.27	16.61	80.39	97.00	251.88
13	251.88	12.59	84.41	97.00	167.47
14	167.47	8.37	88.63	97.00	78.84
15	78.84	3.94	78.84	82.78	.....
Total	.....	440.78	1,000.00	1,440.78	.....

Table 18.—*Bond Amortising Schedule*
15-year bonds, interest 6 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$60.00	$43.00	$103.00	$957.00
2	957.00	57.42	45.58	103.00	911.42
3	911.42	54.68	48.32	103.00	863.10
4	863.10	51.79	51.21	103.00	811.89
5	811.89	48.71	54.29	103.00	757.60
6	757.60	45.46	57.54	103.00	700.06
7	700.06	42.00	61.00	103.00	639.06
8	639.06	38.34	64.66	103.00	574.40
9	574.40	34.46	68.54	103.00	505.86
10	505.86	30.35	72.65	103.00	433.21
11	433.21	26.00	77.00	103.00	356.21
12	356.21	21.38	81.62	103.00	274.59
13	274.59	16.48	86.52	103.00	188.07
14	188.07	11.29	91.71	103.00	96.36
15	96.36	5.79	96.36	102.15	———
Total	———	544.15	1,000.00	1,544.15	———

Table 19.—*Bond Amortising Schedule*
20-year bonds, interest *1* percent

[The amortising schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$10.00	$46.00	$56.00	$954.00
2	954.00	9.54	46.46	56.00	907.54
3	907.54	9.08	46.92	56.00	860.62
4	860.62	8.61	47.39	56.00	813.23
5	813.23	8.13	47.87	56.00	765.36
6	765.36	7.65	48.35	56.00	717.01
7	717.01	7.17	48.83	56.00	668.18
8	668.18	6.68	49.32	56.00	618.86
9	618.86	6.19	49.81	56.00	569.05
10	569.05	5.69	50.31	56.00	518.74
11	518.74	5.19	50.81	56.00	467.93
12	467.93	4.68	51.32	56.00	416.61
13	416.61	4.17	51.83	56.00	364.78
14	364.78	3.65	52.35	56.00	312.43
15	312.43	3.12	52.88	56.00	259.55
16	259.55	2.60	53.40	56.00	206.15
17	206.15	2.06	53.94	56.00	152.21
18	152.21	1.52	54.48	56.00	97.73
19	97.73	.98	55.02	56.00	42.71
20	42.71	.43	42.71	43.14	.....
Total	.....	107.14	1,000.00	1,107.14	.....

Table 20.—*Bond Amortizing Schedule*
20-year bonds, interest 2 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$20.00	$42.00	$62.00	$958.00
2	958.00	19.16	42.84	62.00	915.16
3	915.16	18.30	43.70	62.00	871.46
4	871.46	17.43	44.57	62.00	826.89
5	826.89	16.54	45.46	62.00	781.43
6	781.43	15.63	46.37	62.00	735.06
7	735.06	14.70	47.30	62.00	687.76
8	687.76	13.76	48.24	62.00	639.52
9	639.52	12.79	49.21	62.00	590.31
10	590.31	11.81	50.19	62.00	540.12
11	540.12	10.80	51.20	62.00	488.92
12	488.92	9.78	52.22	62.00	436.70
13	436.70	8.73	53.27	62.00	383.43
14	383.43	7.67	54.33	62.00	329.10
15	329.10	6.58	55.42	62.00	273.68
16	273.68	5.47	56.53	62.00	217.15
17	217.15	4.34	57.66	62.00	159.49
18	159.49	3.19	58.81	62.00	100.68
19	100.68	2.01	59.99	62.00	40.69
20	40.69	.81	40.69	41.50	———
Total	———	219.50	1,000.00	1,219.50	———

Table 21.—*Bond Amortizing Schedule*
20-year bonds, interest 3 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$30.00	$38.00	$68.00	$962.00
2	962.00	28.86	39.14	68.00	922.86
3	922.86	27.69	40.31	68.00	882.55
4	882.55	26.48	41.52	68.00	841.03
5	841.03	25.23	42.77	68.00	798.26
6	798.26	23.95	44.05	68.00	754.21
7	754.21	22.63	45.37	68.00	708.84
8	708.84	21.26	46.74	68.00	662.10
9	662.10	19.86	48.14	68.00	613.96
10	613.96	18.42	49.58	68.00	564.38
11	564.38	16.93	51.07	68.00	513.31
12	513.31	15.40	52.60	68.00	460.71
13	460.71	13.82	54.18	68.00	406.53
14	406.53	12.20	55.80	68.00	350.73
15	350.73	10.52	57.48	68.00	293.25
16	293.25	8.80	59.20	68.00	234.05
17	234.05	7.02	60.98	68.00	173.07
18	173.07	5.19	62.81	68.00	110.26
19	110.26	3.31	64.69	68.00	45.57
20	45.57	1.37	45.57	46.94	———
Total	———	338.94	1,000.00	1,338.94	———

Table 22.—*Bond Amortizing Schedule*
20-year bonds, interest 4 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$40.00	$34.00	$74.00	$966.00
2	966.00	38.64	35.36	74.00	930.64
3	930.64	37.23	36.77	74.00	893.87
4	893.87	35.75	38.25	74.00	855.62
5	855.62	34.22	39.78	74.00	815.84
6	815.84	32.63	41.37	74.00	774.47
7	774.47	30.98	43.02	74.00	731.45
8	731.45	29.26	44.74	74.00	686.71
9	686.71	27.47	46.53	74.00	640.18
10	640.18	25.61	48.39	74.00	591.79
11	591.79	23.67	50.33	74.00	541.46
12	541.46	21.66	52.34	74.00	489.12
13	489.12	19.56	54.44	74.00	434.68
14	434.68	17.39	56.61	74.00	378.07
15	378.07	15.12	58.88	74.00	319.19
16	319.19	12.77	61.23	74.00	257.96
17	257.96	10.32	63.68	74.00	194.28
18	194.28	7.77	66.23	74.00	128.05
19	128.05	5.12	68.88	74.00	59.17
20	59.17	2.37	59.17	61.54	.....
Total	.....	467.54	1,000.00	1,467.54	.....

Table 23.—*Bond Amortizing Schedule*
20-year bonds, interest 5 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$50.00	$31.00	$81.00	$969.00
2	969.00	48.45	32.55	81.00	936.45
3	936.45	46.82	34.18	81.00	902.27
4	902.27	45.11	35.89	81.00	866.38
5	866.38	43.32	37.68	81.00	828.70
6	828.70	41.43	39.57	81.00	789.13
7	789.13	39.46	41.54	81.00	747.59
8	747.59	37.38	43.62	81.00	703.97
9	703.97	35.20	45.80	81.00	658.17
10	658.17	32.91	48.09	81.00	610.08
11	610.08	30.50	50.50	81.00	559.58
12	559.58	27.98	53.02	81.00	506.56
13	506.56	25.33	55.67	81.00	450.89
14	450.89	22.54	58.46	81.00	392.43
15	392.43	19.62	61.38	81.00	331.05
16	331.05	16.55	64.45	81.00	266.60
17	266.60	13.33	67.67	81.00	198.93
18	198.93	9.95	71.05	81.00	127.88
19	127.88	6.39	74.61	81.00	53.27
20	53.27	2.66	53.27	55.93	———
Total	———	594.93	1,000.00	1,594.93	———

Table 24.—*Bond Amortizing Schedule*
20-year bonds, interest 6 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$60.00	$28.00	$88.00	$972.00
2	972.00	58.32	29.68	88.00	942.32
3	942.32	56.54	31.46	88.00	910.86
4	910.86	54.65	33.35	88.00	877.51
5	877.51	52.65	35.35	88.00	842.16
6	842.16	50.53	37.47	88.00	804.69
7	804.69	48.28	39.72	88.00	764.97
8	764.97	45.90	42.10	88.00	722.87
9	722.87	43.37	44.63	88.00	678.24
10	678.24	40.69	47.31	88.00	630.93
11	630.93	37.85	50.15	88.00	580.78
12	580.78	34.85	53.15	88.00	527.63
13	527.63	31.66	56.34	88.00	471.29
14	471.29	28.28	59.72	88.00	411.57
15	411.57	24.69	63.31	88.00	348.26
16	348.26	20.89	67.11	88.00	281.15
17	281.15	16.87	71.13	88.00	210.02
18	210.02	12.60	75.40	88.00	134.62
19	134.62	8.08	79.92	88.00	54.70
20	54.70	3.28	54.70	57.98	.....
Total	.....	729.98	1,000.00	1,729.98	.....

Table 25.—*Bond Amortising Schedule*
30-year bonds, interest *1* percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$10.00	$29.00	$39.00	$971.00
2	971.00	9.71	29.29	39.00	941.71
3	941.71	9.42	29.58	39.00	912.13
4	912.13	9.12	29.88	39.00	882.25
5	882.25	8.82	30.18	39.00	852.07
6	852.07	8.52	30.48	39.00	821.59
7	821.59	8.22	30.78	39.00	790.81
8	790.81	7.91	31.09	39.00	759.72
9	759.72	7.60	31.40	39.00	728.32
10	728.32	7.28	31.72	39.00	696.60
11	696.60	6.97	32.03	39.00	664.57
12	664.57	6.65	32.35	39.00	632.22
13	632.22	6.32	32.68	39.00	599.54
14	599.54	6.00	33.00	39.00	566.54
15	566.54	5.67	33.33	39.00	533.21
16	533.21	5.33	33.67	39.00	499.54
17	499.54	5.00	34.00	39.00	465.54
18	465.54	4.66	34.34	39.00	431.20
19	431.20	4.31	34.69	39.00	396.51
20	396.51	3.97	35.03	39.00	361.48
21	361.48	3.61	35.39	39.00	326.09
22	326.09	3.26	35.74	39.00	290.35
23	290.35	2.90	36.10	39.00	254.25
24	254.25	2.54	36.46	39.00	217.79
25	217.79	2.18	36.82	39.00	180.97
26	180.97	1.81	37.19	39.00	143.78
27	143.78	1.44	37.56	39.00	106.22
28	106.22	1.06	37.94	39.00	68.28
29	68.28	.68	38.32	39.00	29.96
30	29.96	.30	29.96	30.26	.....
Total	.....	161.26	1,000.00	1,161.26	.....

Table 26.—*Bond Amortizing Schedule*
30-year bonds, interest 2 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$20.00	$25.00	$45.00	$975.00
2	975.00	19.50	25.50	45.00	949.50
3	949.50	18.99	26.01	45.00	923.49
4	923.49	18.47	26.53	45.00	896.96
5	896.96	17.94	27.06	45.00	869.90
6	869.90	17.40	27.60	45.00	842.30
7	842.30	16.85	28.15	45.00	814.15
8	814.15	16.28	28.72	45.00	785.43
9	785.43	15.71	29.29	45.00	756.14
10	756.14	15.12	29.88	45.00	726.26
11	726.26	14.53	30.47	45.00	695.79
12	695.79	13.92	31.08	45.00	664.71
13	664.71	13.29	31.71	45.00	633.00
14	633.00	12.66	32.34	45.00	600.66
15	600.66	12.01	32.99	45.00	567.67
16	567.67	11.35	33.65	45.00	534.02
17	534.02	10.68	34.32	45.00	499.70
18	499.70	9.99	35.01	45.00	464.69
19	464.69	9.29	35.71	45.00	428.98
20	428.98	8.58	36.42	45.00	392.56
21	392.56	7.85	37.15	45.00	355.41
22	355.41	7.11	37.89	45.00	317.52
23	317.52	6.35	38.65	45.00	278.87
24	278.87	5.58	39.42	45.00	239.45
25	239.45	4.79	40.21	45.00	199.24
26	199.24	3.98	41.02	45.00	158.22
27	158.22	3.16	41.84	45.00	116.38
28	116.38	2.33	42.67	45.00	73.71
29	73.71	1.47	43.53	45.00	30.18
30	30.18	.60	30.18	30.78	.....
Total	.....	335.78	1,000.00	1,335.78	.....

Table 27.—*Bond Amortizing Schedule*
30-year bonds, interest 3 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$30.00	$22.00	$52.00	$978.00
2	978.00	29.34	22.66	52.00	955.34
3	955.34	28.66	23.34	52.00	932.00
4	932.00	27.96	24.04	52.00	907.96
5	907.96	27.24	24.76	52.00	883.20
6	883.20	26.50	25.50	52.00	857.70
7	857.70	25.73	26.27	52.00	831.43
8	831.43	24.94	27.06	52.00	804.37
9	804.37	24.13	27.87	52.00	776.50
10	776.50	23.30	28.70	52.00	747.80
11	747.80	22.43	29.57	52.00	718.23
12	718.23	21.55	30.45	52.00	687.78
13	687.78	20.63	31.37	52.00	656.41
14	656.41	19.69	32.31	52.00	624.10
15	624.10	18.72	33.28	52.00	590.82
16	590.82	17.72	34.28	52.00	556.54
17	556.54	16.70	35.30	52.00	521.24
18	521.24	15.64	36.36	52.00	484.88
19	484.88	14.55	37.45	52.00	447.43
20	447.43	13.42	38.58	52.00	408.85
21	408.85	12.27	39.73	52.00	369.12
22	369.12	11.07	40.93	52.00	328.19
23	328.19	9.85	42.15	52.00	286.04
24	286.04	8.58	43.42	52.00	242.62
25	242.62	7.28	44.72	52.00	197.90
26	197.90	5.94	46.06	52.00	151.84
27	151.84	4.56	47.44	52.00	104.40
28	104.40	3.13	48.87	52.00	55.53
29	55.53	1.67	50.33	52.00	5.20
30	5.20	.16	5.20	5.36	.....
Total	.....	513.36	1,000.00	1,513.36	.....

Table 28.—*Bond Amortising Schedule*
30-year bonds, interest 4 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$40.00	$18.00	$58.00	$982.00
2	982.00	39.28	18.72	58.00	963.28
3	963.28	38.53	19.47	58.00	943.81
4	943.81	37.75	20.25	58.00	923.56
5	923.56	36.94	21.06	58.00	902.50
6	902.50	36.10	21.90	58.00	880.60
7	880.60	35.22	22.78	58.00	857.82
8	857.82	34.31	23.69	58.00	834.13
9	834.13	33.36	24.64	58.00	809.49
10	809.49	32.38	25.62	58.00	783.87
11	783.87	31.35	26.65	58.00	757.22
12	757.22	30.29	27.71	58.00	729.51
13	729.51	29.18	28.82	58.00	700.69
14	700.69	28.03	29.97	58.00	670.72
15	670.72	26.83	31.17	58.00	639.55
16	639.55	25.58	32.42	58.00	607.13
17	607.13	24.28	33.72	58.00	573.41
18	573.41	22.94	35.06	58.00	538.35
19	538.35	21.53	36.47	58.00	501.88
20	501.88	20.07	37.93	58.00	463.95
21	463.95	18.56	39.44	58.00	424.51
22	424.51	16.98	41.02	58.00	383.49
23	383.49	15.34	42.66	58.00	340.83
24	340.83	13.63	44.37	58.00	296.46
25	296.46	11.86	46.14	58.00	250.32
26	250.32	10.01	47.99	58.00	202.33
27	202.33	8.09	49.91	58.00	152.42
28	152.42	6.10	51.90	58.00	100.52
29	100.52	4.02	53.98	58.00	46.54
30	46.54	1.86	46.54	48.40	.....
Total	.....	730.40	1,000.00	1,730.40	.....

Table 29.—*Bond Amortising Schedule*
30-year bonds, interest 5 percent

[The amortizing schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$50.00	$16.00	$66.00	$984.00
2	984.00	49.20	16.80	66.00	967.20
3	967.20	48.36	17.64	66.00	949.56
4	949.56	47.48	18.52	66.00	931.04
5	931.04	46.55	19.45	66.00	911.59
6	911.59	45.58	20.42	66.00	891.17
7	891.17	44.56	21.44	66.00	869.73
8	869.73	43.49	22.51	66.00	847.22
9	847.22	42.36	23.64	66.00	823.58
10	823.58	41.18	24.82	66.00	798.76
11	798.76	39.94	26.06	66.00	772.70
12	772.70	38.64	27.36	66.00	745.34
13	745.34	37.27	28.73	66.00	716.61
14	716.61	35.83	30.17	66.00	686.44
15	686.44	34.32	31.68	66.00	654.76
16	754.76	32.74	33.26	66.00	621.50
17	621.50	31.08	34.92	66.00	586.58
18	586.58	29.33	36.67	66.00	549.91
19	549.91	27.50	38.50	66.00	511.41
20	511.41	25.57	40.43	66.00	470.98
21	470.98	23.55	42.45	66.00	428.53
22	428.53	21.43	44.57	66.00	383.96
23	383.96	19.20	46.80	66.00	337.16
24	337.16	16.86	49.14	66.00	288.02
25	288.02	14.40	51.60	66.00	236.42
26	236.42	11.82	54.18	66.00	182.24
27	182.24	9.11	56.89	66.00	125.35
28	125.35	6.27	59.73	66.00	65.62
29	65.62	3.28	62.72	66.00	2.90
30	2.90	.15	2.90	3.05	.....
Total	.....	917.05	1,000.00	1,917.05	.....

Table 30.—*Bond Amortising Schedule*
30-year bonds, interest 6 percent

[The amortising schedule is based on equal total payments for each—except the last year, computed at the next whole dollar above the required minimum annual payment]

Years	Principal due	Interest to pay	Payment on principal	Total to pay	Balance due
1	2	3	4	5	6
1	$1,000.00	$60.00	$13.00	$73.00	$987.00
2	987.00	59.22	13.78	73.00	973.22
3	973.22	58.39	14.61	73.00	958.61
4	958.61	57.52	15.48	73.00	943.13
5	943.13	56.59	16.41	73.00	926.72
6	926.72	55.60	17.40	73.00	909.32
7	909.32	54.56	18.44	73.00	890.88
8	890.88	53.45	19.55	73.00	871.33
9	871.33	52.28	20.72	73.00	850.61
10	850.61	51.04	21.96	73.00	828.65
11	828.65	49.72	23.28	73.00	805.37
12	805.37	48.32	24.68	73.00	780.69
13	780.69	46.84	26.16	73.00	754.53
14	754.53	45.27	27.73	73.00	726.80
15	726.80	43.61	29.39	73.00	697.41
16	697.41	41.84	31.16	73.00	666.25
17	666.25	39.97	33.03	73.00	633.22
18	633.22	37.99	35.01	73.00	598.21
19	598.21	35.89	37.11	73.00	561.10
20	561.10	33.67	39.33	73.00	521.77
21	521.77	31.31	41.69	73.00	480.08
22	480.08	28.80	44.20	73.00	435.88
23	435.88	26.15	46.85	73.00	389.03
24	389.03	23.34	49.66	73.00	339.37
25	339.37	20.36	52.64	73.00	286.73
26	286.73	17.20	55.80	73.00	230.93
27	230.93	13.85	59.15	73.00	171.78
28	171.78	10.31	62.69	73.00	109.09
29	109.09	6.54	66.46	73.00	42.63
30	42.63	2.56	42.63	45.19	.....
Total	.....	1,162.19	1,000.00	2,162.19	.....

Section V.—Summary

Unit 17
Some Procedure Steps in a Local School Building Program

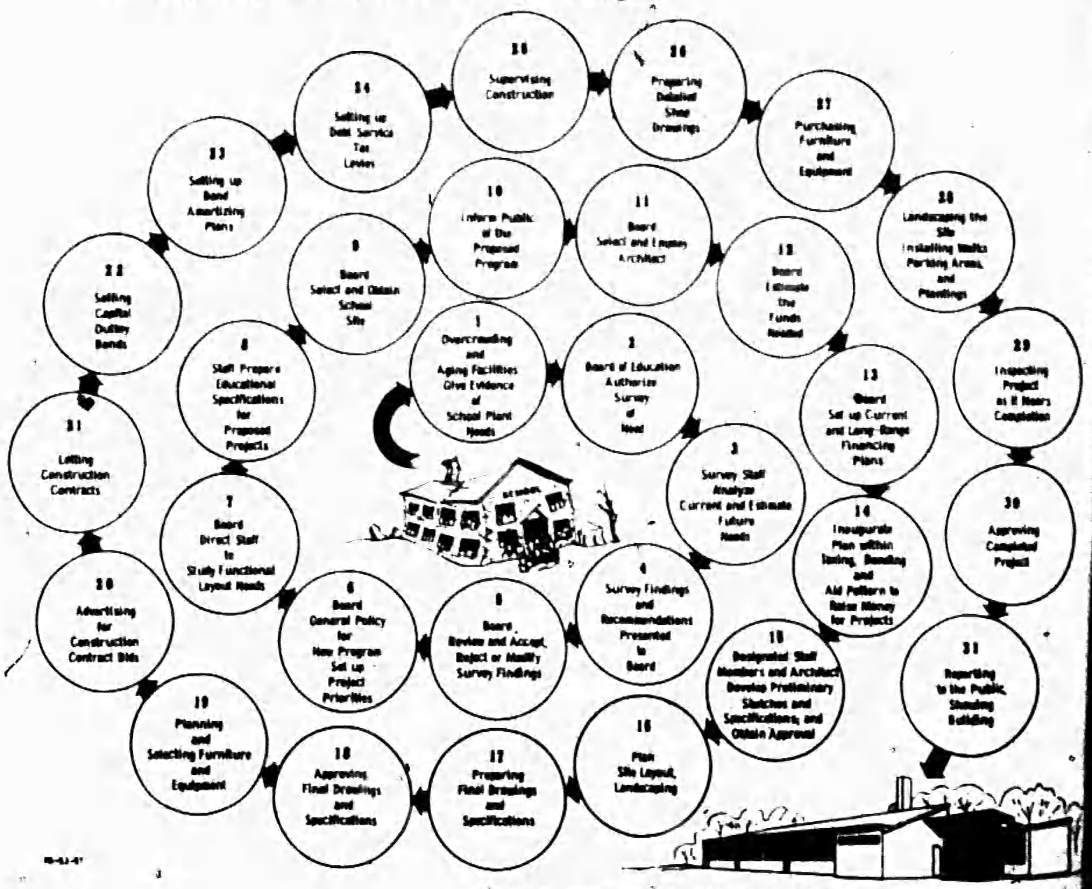
LOCAL SCHOOL building program procedures will vary in the different States and sometimes will vary with the different districts within a State. In some instances school boards will vote funds before making extensive planning efforts. In other cases they may complete their planning stage of the program to determine cost needs and then vote bonds. In some cases sites may be purchased years in advance and in other cases they may not be purchased until the need is imminent.

The following outline of the various steps in procedures for a building program is real in that each of the steps may apply in various school districts, and all of them may apply to some school districts. The sequence is hypothetical but could occur in the order listed. In this listing certain related steps are pulled apart because of the need for touching some of them early in the program even though they may be completed later. For instance, it is desirable to plan the equipment before the contractor locates his electrical and service outlets even though the actual purchase may be delayed until a later date.

The steps in procedure are as follows:

1. Overcrowding and aging facilities give evidence of school-plant needs.
2. Board of education authorize survey of need.
3. Survey staff analyze current—and estimate future needs.
4. Survey findings and recommendations presented to board.
5. Board review and accept, reject or modify survey findings.
6. Board general policy for new program set up project priorities.
7. Board direct staff to study functional layout needs.
8. Staff prepare educational specifications for proposed projects.
9. Board select and obtain school site.
10. Inform public of the proposed program.

11. Board select and employ architect.
12. Board estimate the funds needed.
13. Board set up current and long-range financing plans.
14. Inaugurate plan—within taxing, bonding, and aid pattern—to raise money for projects.
15. Designated staff members and architect develop preliminary sketches and specifications; and obtain approval.
16. Plan site layout, landscaping.
17. Preparing final drawings and specifications.
18. Approving final drawings and specifications.
19. Planning and selecting furniture and equipment.
20. Advertising for construction contract bids.
21. Letting construction contracts.
22. Selling capital outlay bonds.
23. Setting up bond amortizing plans.
24. Setting up debt-service tax levies.
25. Supervising construction.
26. Preparing detailed shop drawings.
27. Purchasing furniture and equipment.
28. Landscaping the site—installing walks, parking areas, and plantings.
29. Inspecting project as it nears completion.
30. Approving completed project..
31. Reporting to the public, showing building.



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