NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

AWARDS

A Project of the Office of Civil Defense
Department of Defense
Conducted by the American Institute of Architects



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Preface

The idea of a national design competition focused on the creation of dual-purpose shelter space in new school construction was conceived during discussions of the Construction Industry Advisory Committee of the Office of Civil Defense. The Committee, composed of representatives of the American Institute of Architects, the American Institute of Planners, the National Society of Professional Engineers, the Engineers Joint Council, the American Society of Civil Engineers, and the Associated General Contractors of America, recommended such a competition as a means of stimulating the design professions to devote their creative talent to the design and investigation of dual-purpose shelter space that would contribute needed educational facilities plus emergency protection from fallout gamma radiation in the event of nuclear attack.

In response to a request by the Department of Defense, the American Institute of Architects conducted the National School Fallout Shelter Design Competition as a public service under a nonprofit contract with the U. S. Government.

It is hoped that this presentation of the award-winning designs will contribute to general understanding of the nature of fallout shelter space, clarify design criteria, and stimulate improvement in school design and design for national defense.

A. Stanley McGaughan

Professional Adviser
Washington, D. C.
January 24, 1963

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NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Statement by Department of Defense

The Office of Civil Defense is conducting a program to provide fallout shelter for every American. To attain this protection, several avenues of approach are being used. One of these is encouragement and assistance for inclusion of fallout shelters in the design of school buildings. Since approximately one-quarter of the U. S. population attends school, all practical steps for the protection of our students must be taken.

The design concepts presented in this booklet show that fallout shielding for elementary schools can be achieved in varied and imaginative ways without sacrificing educational or aesthetic requirements. The concepts demonstrate that shielding can be unobtrusive - with the facilities conveying a feeling of openness, combined with natural lighting. It would be difficult for the layman to recognize these schools as shelters. The designs can be adapted to meet any particular requirements of local school boards or school administrators.

I am confident that the results of the competition will be manifold and far-reaching, and I congratulate the winners for their creative ability and their sound and ingenious solutions.

STEUART L. PITTMAN

Assistant Secretary of Defense
for Civil Defense

MR. PITTMAN

Statement by The American Institute of Architects

The results of the National School Fallout Shelter Competition amply justify the willingness of the American Institute of Architects to conduct the competition for the Office of Civil Defense. The Institute regards its sanctioned competitions as an excellent device for developing original approaches to new and different design problems of such national scope as this. The soundness of this concept has been admirably demonstrated by this competition in which teams of architects and engineers have displayed imagination, technical knowledge and aesthetically good taste in the winning designs.

HENRY L. WRIGHT, FAIA
President
The American Institute of Architects

MR. WRIGHT

The Story of The Competition

by A. Stanley McGaughan, AIA
Professional Adviser

Why Fallout Shelter in Schools

The program of the Office of Civil Defense is concentrated on the creation and provisioning of public fallout shelters throughout the United States. Both the effective utilization of shelter resources in existing buildings and the incorporation of shelter in new construction are vital to this program. Protection for school children is a primary concern. The elementary school, in particular, is a community facility with many characteristics appropriate to fallout protection requirements.

. . . Elementary schools are located in all residential neighborhoods and their locations are well known to the public.

. . . The neighborhood served by an elementary school is generally small. Thus, the ability of the local population to reach the shelter within a short warning period appears reasonably good.

. . . Schools are generally publicly owned and staffed by competent public employees trained in leadership. An administrative staff is already available for the facility.

. . . Schools are usually equipped with facilities for feeding and caring for large groups of people. Essential plumbing and other mechanical requirements are already met.

. . . Many new schools are being built, particularly in suburban areas, where the national fallout shelter survey, conducted by OCD, shows the fallout shelter potential in existing construction falls far short of accommodating the population.

Because of these factors, the design of an elementary school incorporating fallout shelter was selected for the competition.

The Writing of The Competition Program

Having selected the problem for the competition, it was then necessary to establish the basic objectives to be served and detailed design criteria to provide guidance to the competitors and a basis for judgment by the jury.

The objective and scope of the competition was defined in a Department of Defense statement which was incorporated in the program for the competition. (See complete copy of the program included in Appendix A.)

The shelter design criteria for the competition were those established by the Office of Civil Defense as minimal for radiation protection and shelter occupancy. Although these recommendations had all been previously published and were easily available, it was decided to include the specific applicable criteria in the program as a convenience for the competitors.

In deciding on the shelter design criteria the recommended minimum protection factor (PF) of 100 was carefully considered. Some of those concerned with establishing the specific criteria argued that a higher PF could be achieved with little effect on either material utilization or construction costs, and recommended a higher PF standard for the competition. However, as the basic objective was to stimulate advancement in the design of schools incorporating shelter as dual-purpose space, it was decided to hold the required PF value at the recommended minimum figure of 100, thus providing for greater flexibility and variety in the possible design solutions.

In recognition of the wide range of professional opinion on good school design and the variations in practice across the country, no attempt was made to establish detailed criteria for the education facility. The design problem was defined in the broadest terms. It was clearly indicated that attention should be focused on the design of a good school, fully meeting all functional, economic, and aesthetic requirements of a permanent educational facility, and incorporating fallout shelter space appropriate for its intended emergency use. The competitors were asked to design a school conforming to the best educational practices, suited to the prevailing climatic requirements for the selected site, accommodating a student population of 300 to 500, and providing community fallout shelter for at least twice the school population.

That this form of program was effective in bringing forth a variety of solutions is amply demonstrated by the award-winning designs published in this booklet.

Representatives of the American Institute of Architects and the National Society of Professional Engineers gave advice and assistance in writing the program. Finally, after review of the program, the competition was qualified as a Class A-II(b) competition under the Code of Architectural Competitions of

A. Stanley McGaughan, AIA
McGaughan & Johnson
Architects
Washington, D. C.

the American Institute of Architects and was approved by the Institute for participation by its members and by the National Society of Professional Engineers.

The Judgment

The jury for this competition was carefully selected to include leading school architects and outstanding engineers representing the specialized disciplines involved in design of schools and protective construction. Professionals both with and without experience in the design of fallout shelters were selected as a safeguard against creating specialized bias in the collective judgment of the group. To assure that educational requirements were fully considered, Mr. John L. Cameron, Chief, School Housing Section, Office of Education, Department of Health, Education and Welfare, was appointed as special adviser to the jury and was present throughout the period of the judgment.

Since the judging of this competition involved the evaluation of specific technical aspects of shelter design, a highly skilled team of shelter analysts was engaged to provide detailed technical advice to the jury. This group, selected from among the qualified instructors who have presented the OCD Fallout Shelter Analysis Courses to Architects and Engineers at schools throughout the country, was composed of the following:

CHARLES R. BISSEY, *Instructor in Mechanical Engineering*, University of Massachusetts

JOHN W. HILL, *Associate Professor of Architecture*, University of Kentucky

ALBERT KNOTT, *Director, Shelter Research and Study Program*, The Pennsylvania State University

DR. DONALD A. SAWYER, *Assistant Professor of Civil Engineering*, University of Florida

JAMES TING-SHUN WANG, *Assistant Professor of Engineering Mechanics*, Georgia Institute of Technology

WILLIS W. WERTZ, *Professor of Architecture*, Miami University (Ohio)

All designs designated by the jury for consideration for awards were evaluated by this analysis group. Final judgment was made by the jury with knowledge of the adequacy of the protection afforded and the shelter capacity for each design under consideration. The jury met at AIA Headquarters in Washington on the morning of November 5, 1962 and completed the judging on the evening of November 7, 1962. Public announcement of the awards was made by the Department of Defense on November 26, 1962.

Results of The Competition

The winning designs presented in this booklet include a wide variety of solutions. They contribute much to alleviate the fears expressed by some designers, that provision of fallout shelter in schools must lead to the creation of restrictive underground classrooms. Both above and belowground solutions are clearly possible. Even among the designs that utilized underground spaces, there is little to support the specter of the stifling environment of confinement predicted by some.

There are here vistas and a remarkable flexibility in the use of educational space even when the shelter is planned essentially as an underground installation. Many designs provide for natural light and ventilation even in the shelter areas by means of the skillful use of protective baffles. In some, the shelter space is incorporated in the educational facility with such subtlety that study is required to identify the protected areas.

The results clearly represent an important contribution by the design professions toward the advancement of dual-purpose shelter design in schools.

The Report of the Jury which follows provides general evaluation of the successful designs plus special comments by the Jury on each of the winning entries. The statement entitled Shelter Evaluation following the Jury Report was prepared by Mr. Albert Knott who directed the team of Shelter Analysts during the period of the competition judgment.

The specific comments by the Jury as well as comments of the Shelter Analysts are presented with each design.

Report of the

MR. BYRNE

MR. CAUDILL

MR. HAUF

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

In a statement prefacing the program, the Department of Defense discussed the objectives of the competition as follows:

"*The objectives of this competition are to serve the national interest by encouraging the creation of shelter designs which will: conserve materials, manpower and money; create fallout protection in the maximum area of the school; incorporate attractive features; and produce structures of aesthetic appeal.*"

In the opinion of the Jury, these objectives have been well and fully met.

Several hundred talented people throughout the country have given thoughtful consideration to the problems posed in the design of dual-purpose fallout shelters. The results of their efforts, particularly as expressed in the prize-winning designs, should have a positive impact upon attitudes toward shelter space. Much original thought is represented in these designs, and there are many ingenious solutions. A greater understanding of the concept of a fallout shelter, and what it is, should result from this competition, for here is evidence that it need not be a massive, enclosed box. Perhaps no *great* architecture has come from the competition, but certainly there is considerable good architecture. And certainly there is a major contribution to the understanding of and the techniques of design of fallout shelter space.

Jury

MR. SMITH
Chairman

MR. VISHER

The Jury

WILLIAM H. BYRNE
President
Byrne Associates, Inc.
New York, New York
President, American Society of
Mechanical Engineers '61, '62

WILLIAM W. CAUDILL, FAIA
Caudill, Rowlett & Scott
Architects-Planners-Engineers
Houston, Texas
Chairman, Department of Architecture,
Rice University

HAROLD D. HAUF, AIA
Vice President
Charles Luckman Associates
Planning, Architecture, Engineering
Los Angeles, California

LINN SMITH, FAIA
President, Linn Smith Associates, Inc.
Architects-Engineers
Birmingham, Michigan

PAUL S. VISHER
Formerly Deputy Assistant Secretary
of Defense for Civil Defense
Department of Defense
Washington, D. C.

In an overview of all the entries, it is interesting and significant that at least ten basic concepts for fallout shelter space were explored, some with variations:

1. The shelter as an interior *core*, shielded with a buffer of peripheral rooms and walls.
2. The shelter as a completely *underground* unit, either covered with earth or as a basement.
3. The shelter as a *windowless* building above ground, with a completely controlled environment.
4. The shelter built around a limited vista *court*, either as an underground or windowless building.
5. The shelter with a *movable protective enclosure* that closed glass areas.
6. The shelter with a combination of *overhangs and shields* to achieve openness, yet provide protection to glass areas.
7. The shelter in a multistory building located *several floors above the ground and several floors below the roof*, using several layers of standard floor and roof construction to shield against both ground direct and roof contributions.*
8. The shelter at *natural grade* with raised earth terraces and elevated floor surrounding the shelter to provide mass shielding against the ground direct contribution.
9. The shelter as a system of *baffle walls*, achieving great openness while shielding the protected area geometrically.
10. The shelter protected by *mechanical devices* which are closable when protection is required, such as hydraulically operated roof systems.

The Jury feels that there are at least four very important lessons to be learned from this competition.

1. Probably the most important lesson to architects and educators is the fact that shelter capability can be incorporated in a school with no interference whatever with the educational process. In many of these schools, it would be difficult, if not impossible, to know that fallout shelter is included.
2. Although the addition of fallout shelter capability to a school will increase its cost, there are many ways it can be done at a reasonable cost.
3. A team of talented and capable architects, engineers and shelter analysts can devise a dual use fallout shelter which will not adversely affect the aesthetics nor the function of a school.
4. The principles learned relative to schools are equally applicable to other building types.

* *For a definition of terms used in describing access of radiation see the section entitled Basic Concepts of Protection, p. 135.*

SHELTER EVALUATION

The inclusion of shelter in these schools shows skill and imagination. The shelters all satisfy the shelter design criteria established by the program and, in many cases, go well beyond in a true attempt to solve the problem with finesse and ingenuity. These schools are shelters. These schools clearly display the fact that architects and engineers have the ability and imagination needed to arrive at school shelter solutions.

The shelter design criteria stipulated by the program are characterized by an austerity justified by the expected short duration of shelter occupancy and assumed extreme emergency conditions. Some designers justifiably aimed their solutions at meeting the basic shelter requirements only, while others included amenities and shelter services, well beyond the minimum design criteria. To illustrate, kitchens, libraries, and health and nursing facilities are not considered mandatory for shelter and were not included in some of the school shelters presented here. Such facilities do however contribute much to shelter habitability and should be included wherever practicable. A number of the award-winning designs do provide shelters that are well equipped with all facilities and services to ease the job of shelter management. In other designs relatively minor adjustments in shielding could be made to bring these facilities into the shelter area.

In some instances minor changes in baffle locations or extent can improve the protection or increase the size of the shelter above the minimum requirements of the program. Also, the location of the shielding material could be studied further to develop better balance among the requirements of structure, radiation shielding, sound control, and heat loss. Such improvements and design refinements would normally accrue during the development of final designs and working drawings as any of these competition designs were carried forward to completion.


THE AWARDS

GRAND PRIZE

Ellery C. Green, AIA, *Architect*
Tucson, Arizona

Team Members

James A. Gresham, *Architect*
S. Wayne Williams
Dr. Howard P. Harrenstein, *Engineer (structural)*

Jury Comment:

This, in the opinion of the jury, is the outstanding entry in the competition. The objectives of the program are fulfilled with skill and imagination, resulting in a well-conceived elementary school with an unobtrusive fallout shelter capability.

This would be a pleasant and exciting school for its children. Based upon an accepted and commonly used educational philosophy, the spaces provided are adequate and well arranged. A feeling of openness and spaciousness has been created and the building is well scaled and aesthetically satisfying.

The fallout shelter aspects of this school are handled as skillfully as are its architectural and educational aspects. Most importantly, there is little, if any, interference or conflict with the normal functioning of the school. The protective requirements have been achieved simply and inconspicuously; in fact, it is not readily apparent that the building was designed as a shelter. The ground floor has, in effect, been depressed and opens onto a "patio" space—thus eliminating the major ground contribution to the designated shelter area. At the same time, the use of bridges over the depressed "patio" gives grade-level access to the second floor. As this is a two story concrete structure, the overhead protection accumulates by the weight of the roof and floor. Door openings are protected by use of the stair towers and toilets as baffles, allowing for daylight to filter through and for the movement of air. The lower level classrooms surrounding the shelter area have a good degree of protection and provide secondary shelter space which can be moved into as radiation deteriorates or after the "patio" area is washed clean.

The inclusion of fallout protection adds relatively little to the cost of this school. The use of

earth, illustrated in this scheme, is quite inexpensive. This type of building often is built as a concrete structure; using the cumulative weight of roof and floor for shielding adds little to the structure ordinarily required.

This is an excellent, well-conceived solution to the problem posed for the competition—a truly creative solution.

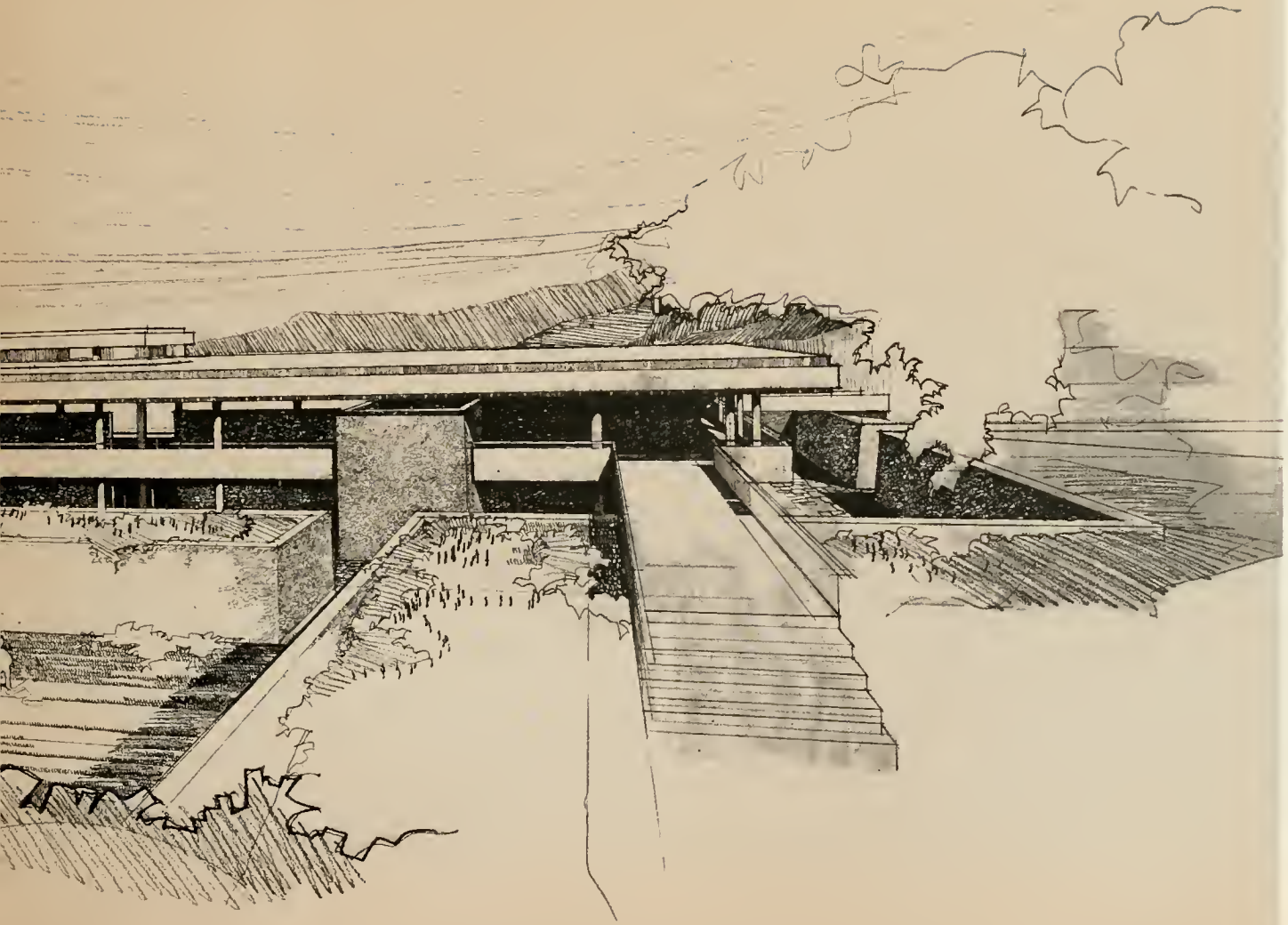
Analysts' Comment:

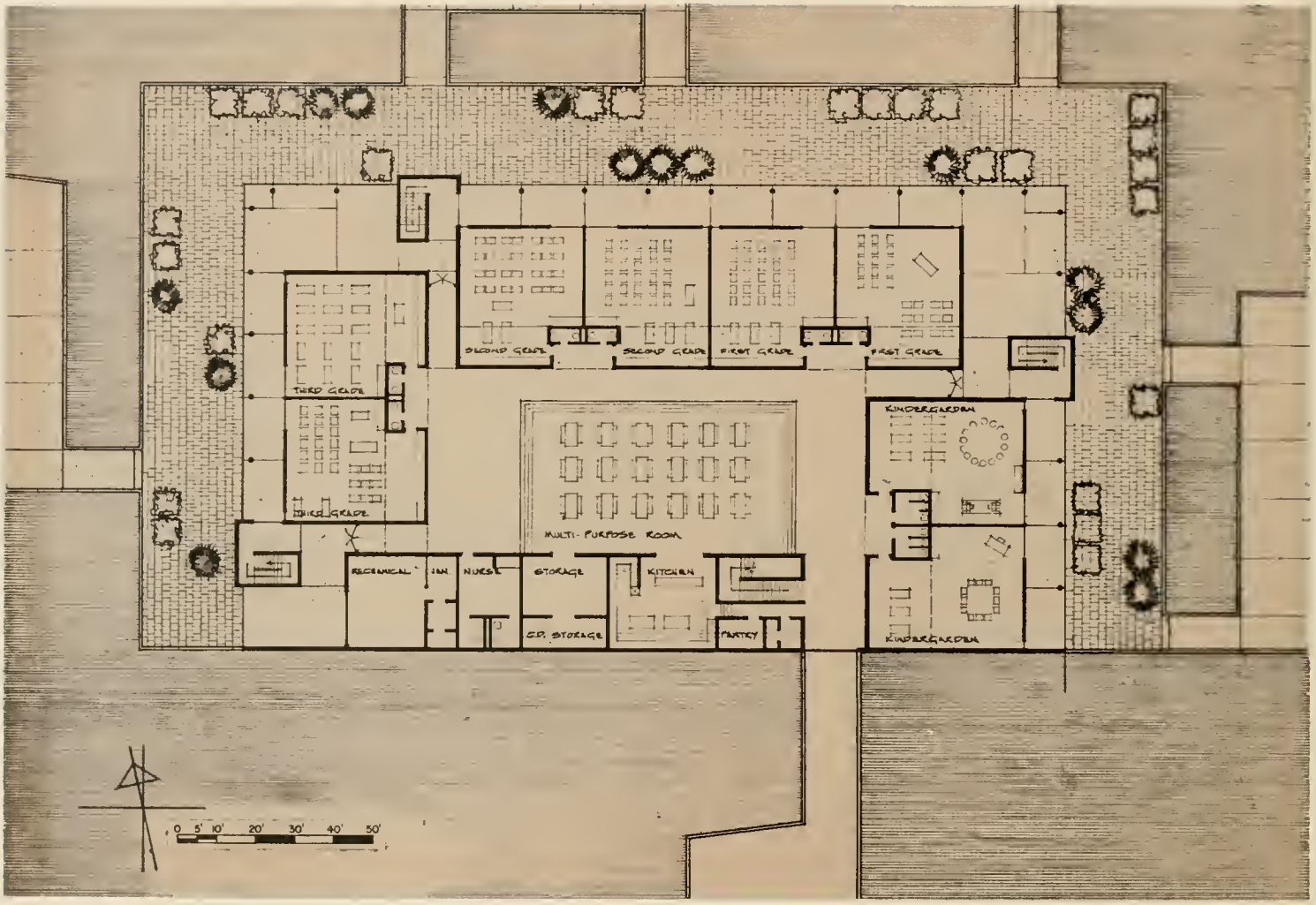
The shelter space is in the multipurpose room at the lower level. The occupants must be confined to this area during the early, highly radioactive period, but they may be moved into the adjacent classrooms when the radioactivity has sufficiently decayed. This modulation of shelter space allows an increase in shelter capacity not afforded by single-space shelters, and a saving in cost by reducing the required exterior wall thicknesses.

This shelter gains great protection from the judicious placement of earth. The major portion of ground contribution is eliminated. The use of the depressed floor area in the multipurpose room allows most of the "patio" contribution to pass over the heads of the occupants. The light, airy feeling achieved in this essentially belowground facility is a significant psychological advantage in shelter habitability.

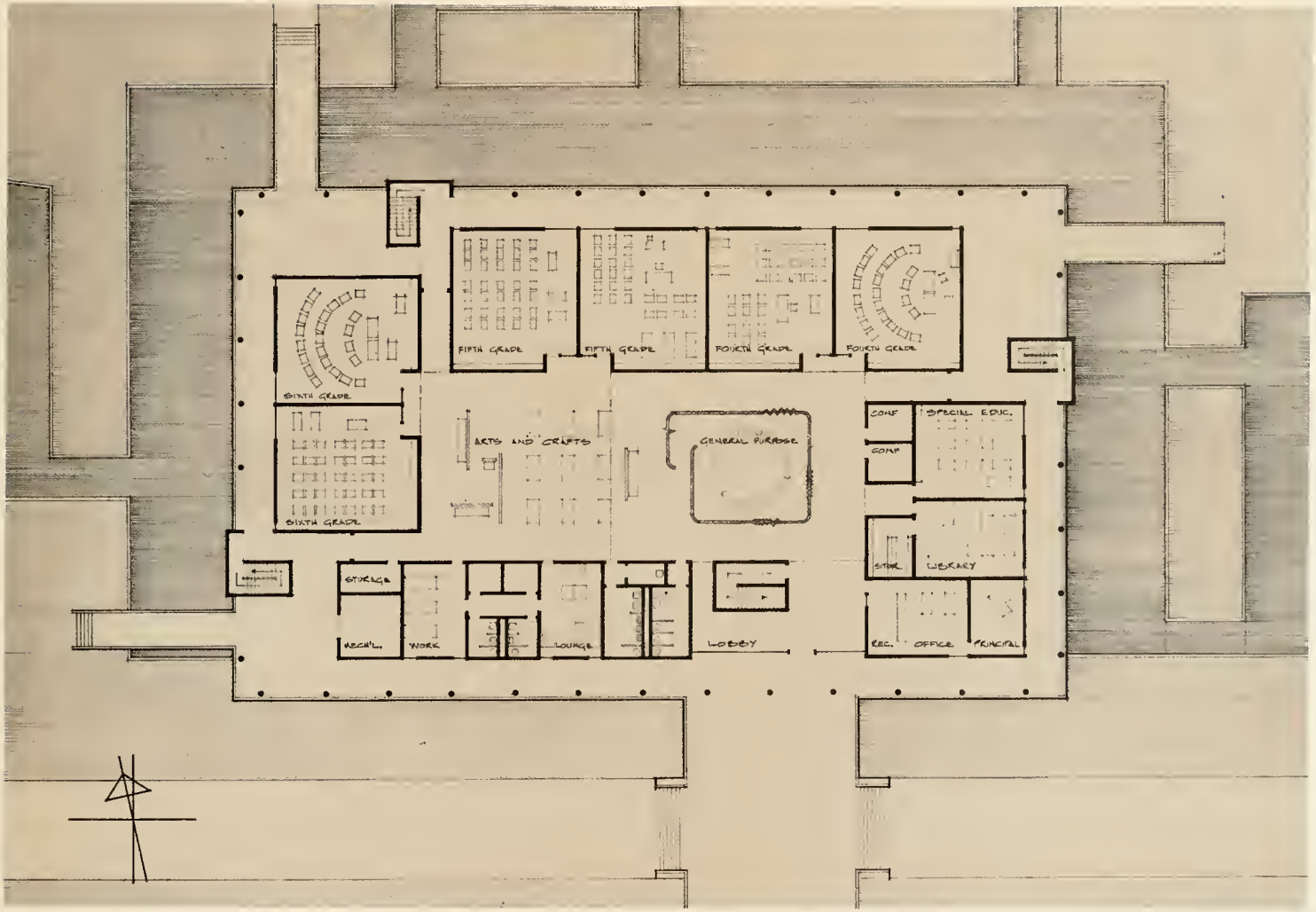
This solution displays a well-organized shelter facility incorporating the kitchen, medical room, storage and sanitary facilities within the major shelter area. Use of the classrooms will allow easy segregation of children from the aged and the sick from the healthy, and the separation of sleeping areas from recreational spaces—capabilities which should be incorporated in all good shelters.

Perspective Looking South

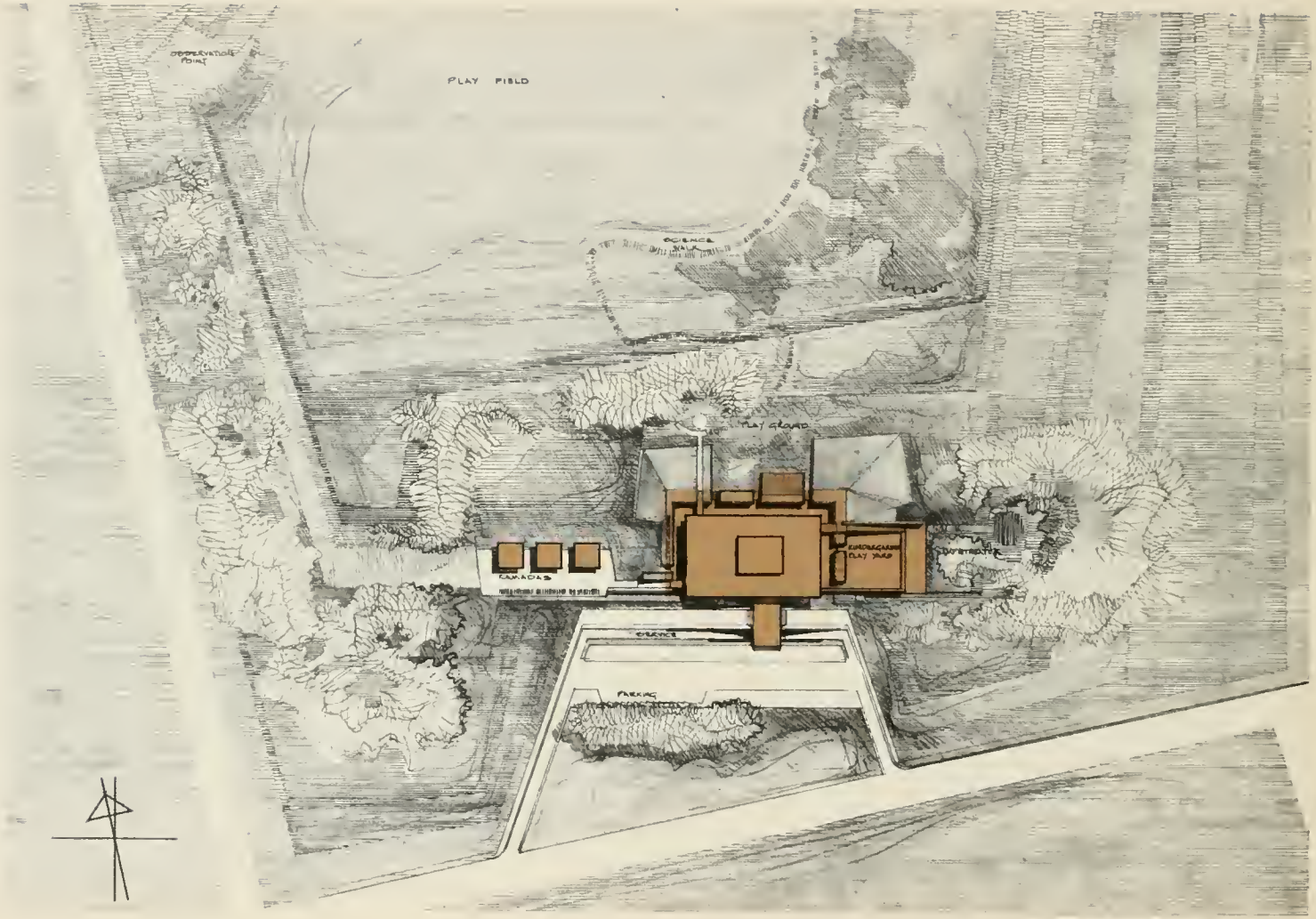




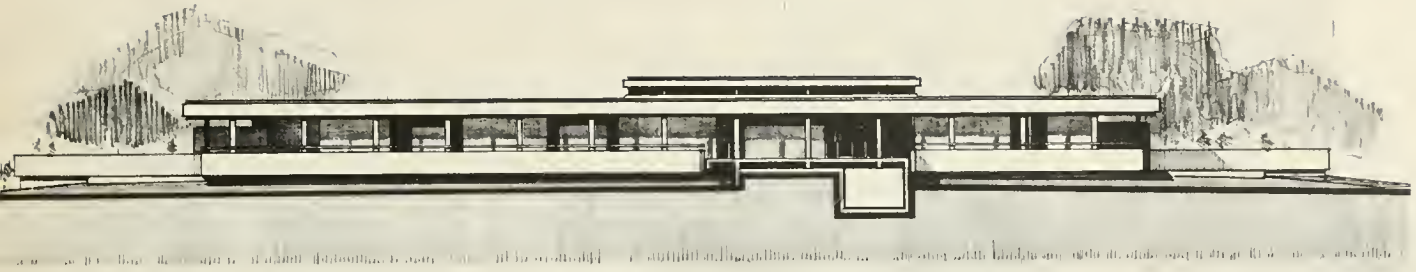
First Floor Plan



Second Floor Plan

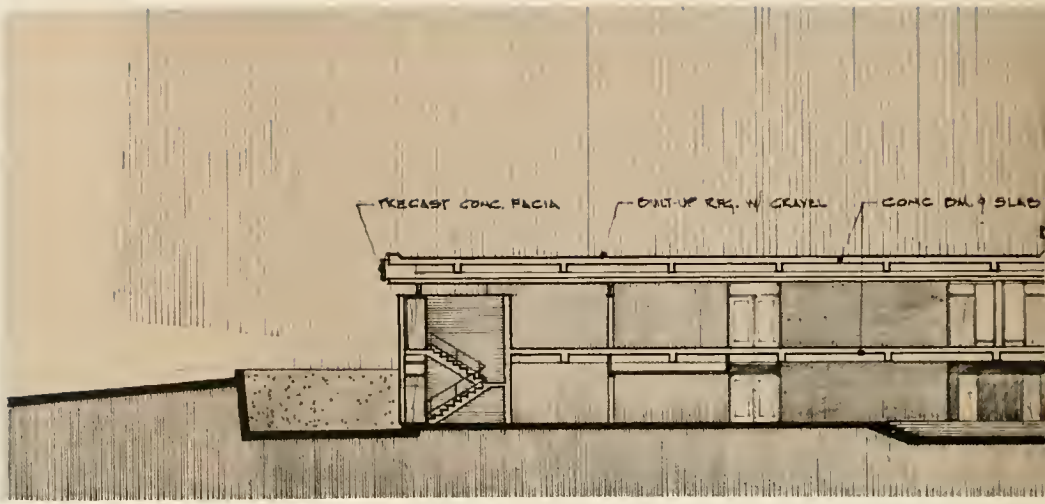

PLAY FIELD
SCIENCE WALK
Play Ground
CANADAS
KINDERGARTEN PLAY YARD
GRAVEL
PARKING

Plot Plan



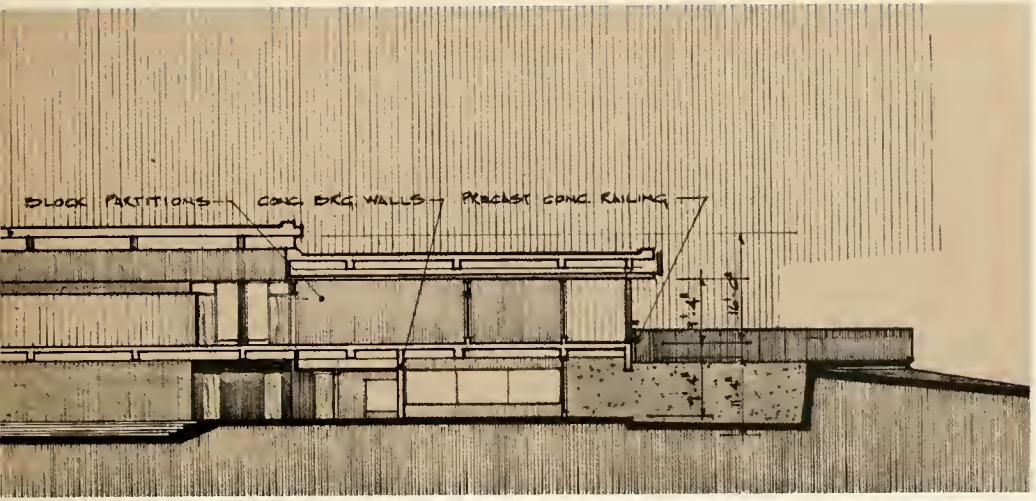
South Elevation

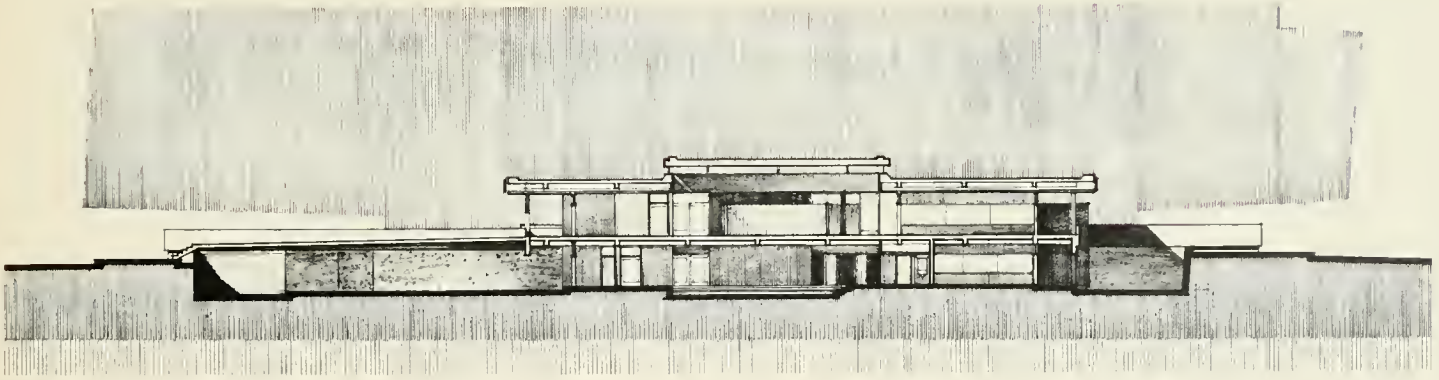
West Elevation



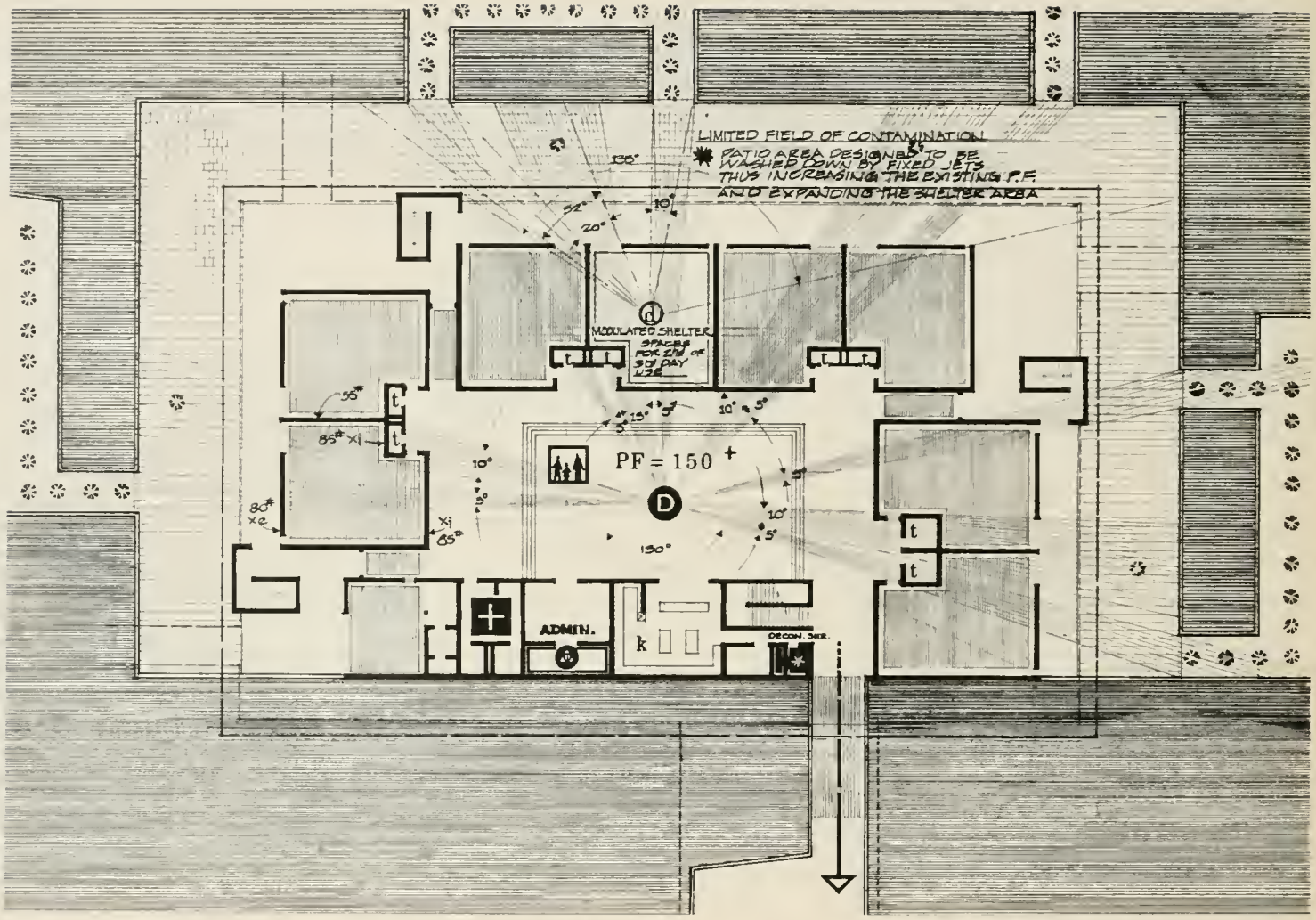
Section—Elevation Looking North

North Elevation

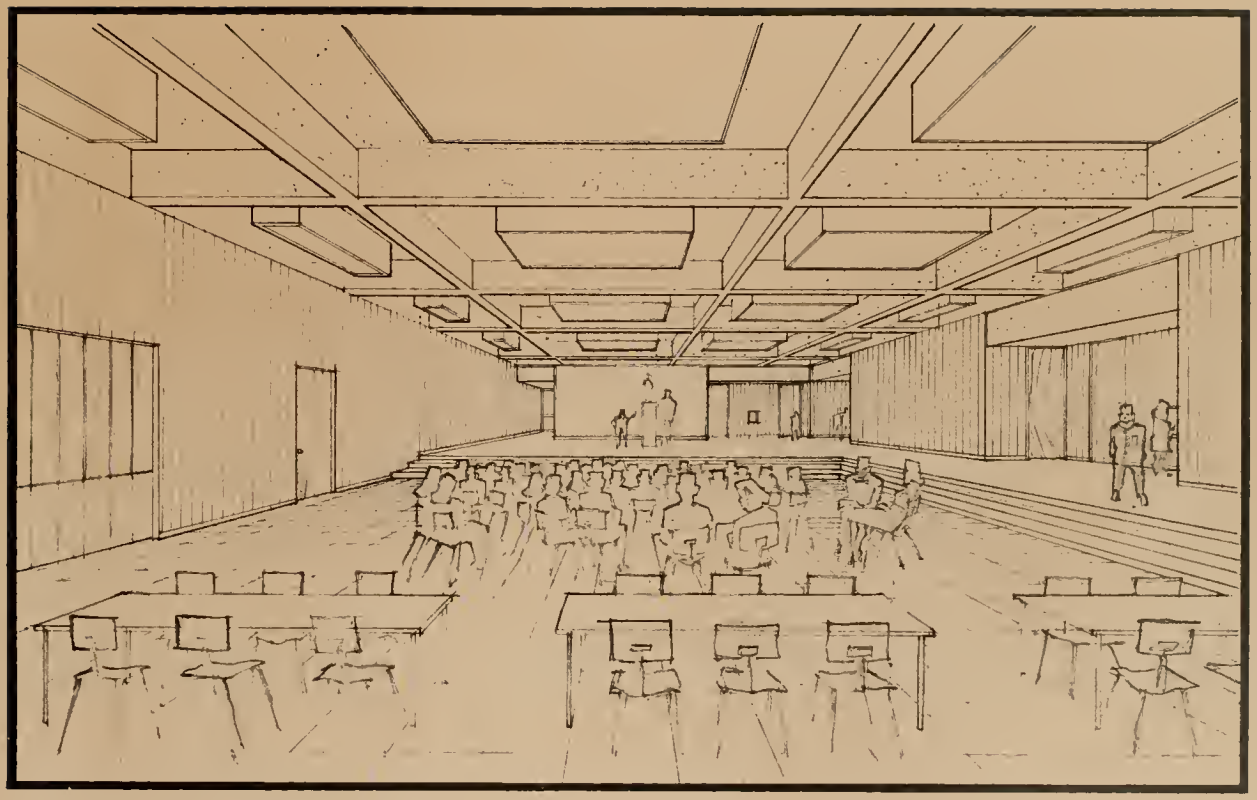




Section—Elevation Looking West



Shelter First Floor Plan



Perspective of Shelter Area

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 1

FIRST PRIZE

Sargent, Webster, Crenshaw & Folley
Architects Engineers Planners
Syracuse, New York

Team Members

Milo D. Folley, AIA, *Architect*
Arthur V. Serrano, *Engineer*
Harry der Boghosian

Jury Comment:

The most interesting and best developed of the many underground schemes submitted, this is a very pleasant, workable school. The classrooms, in flexible clusters of three rooms, are grouped around a large, open central court. As a result, each classroom, though actually underground, has a view to the outdoors and long, interesting vistas. A second smaller court in the service area, together with an abovegrade entrance unit, add to the open feeling of this almost completely earth-covered school.

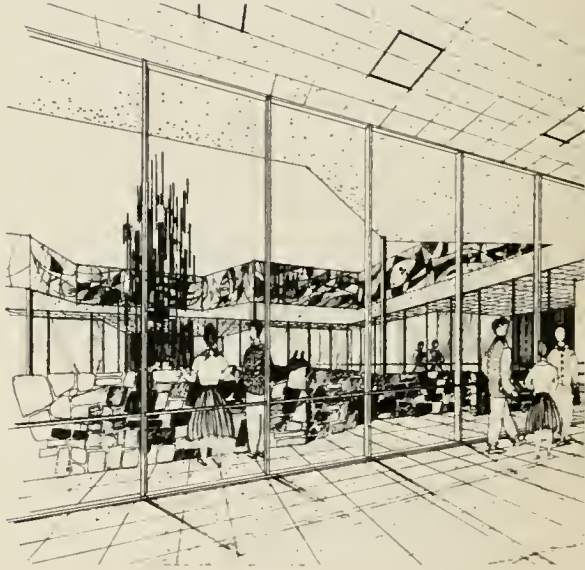
A relatively high percentage of the building is utilized as shelter area. The earth cover, of course, provides the primary protection while the depressed open court is well screened by overhangs and low screen walls. The mechanical and electrical systems are well thought out and well protected. However, some additional screening of the filter area should be provided to protect the shelter occupants from the radioactivity accumulated in the filter. The underground concept has the obvious "bonus" of some degree of blast and shock protection.

Analysts' Comment:

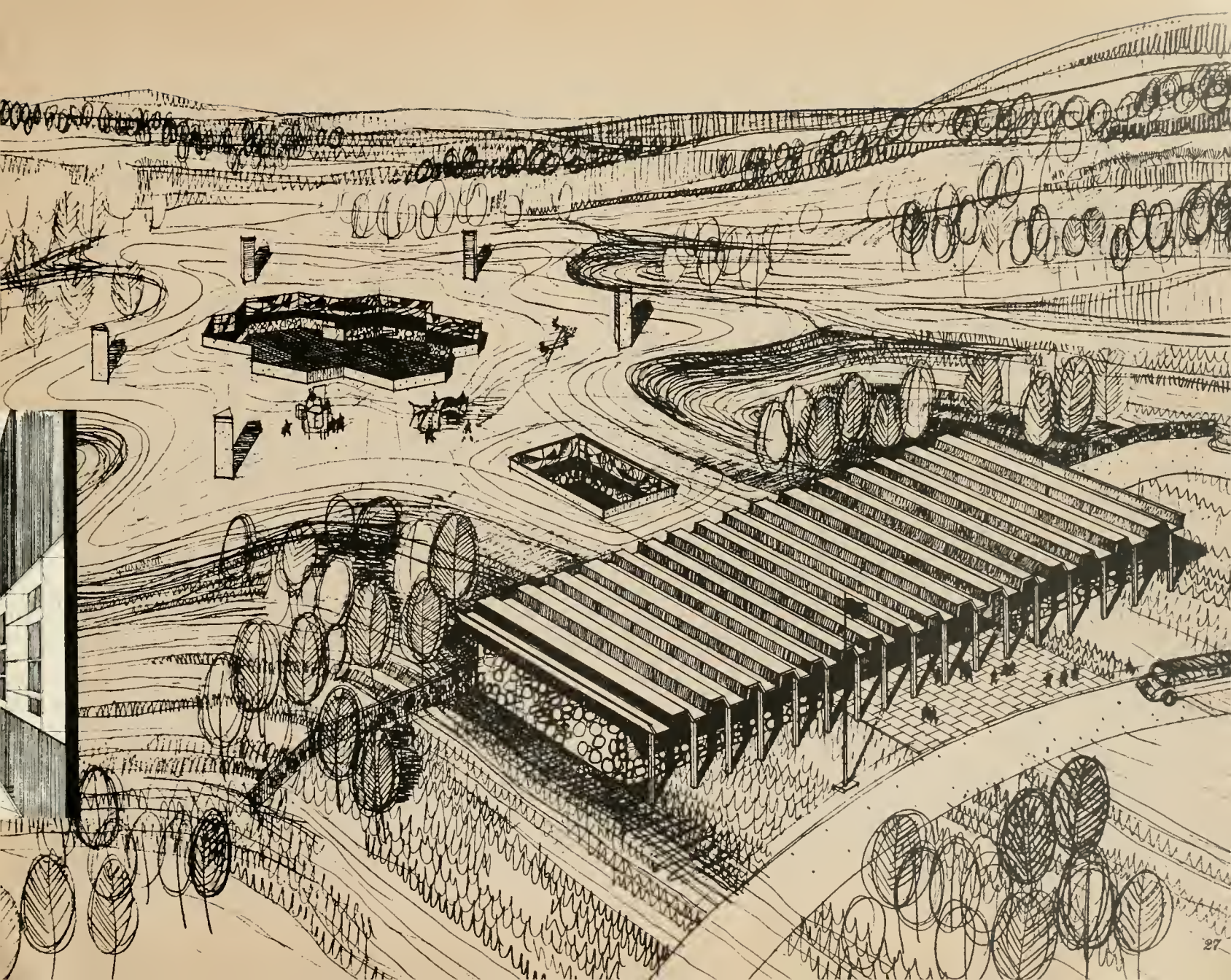
The use of a belowground, yet open, outdoor play court emphasizes a major consideration. Clearstory windows and overhead openness in fallout shelters are allowed by the fact that skyshine, coming through limited areas at or above head height, does not greatly decrease the radiation protection.

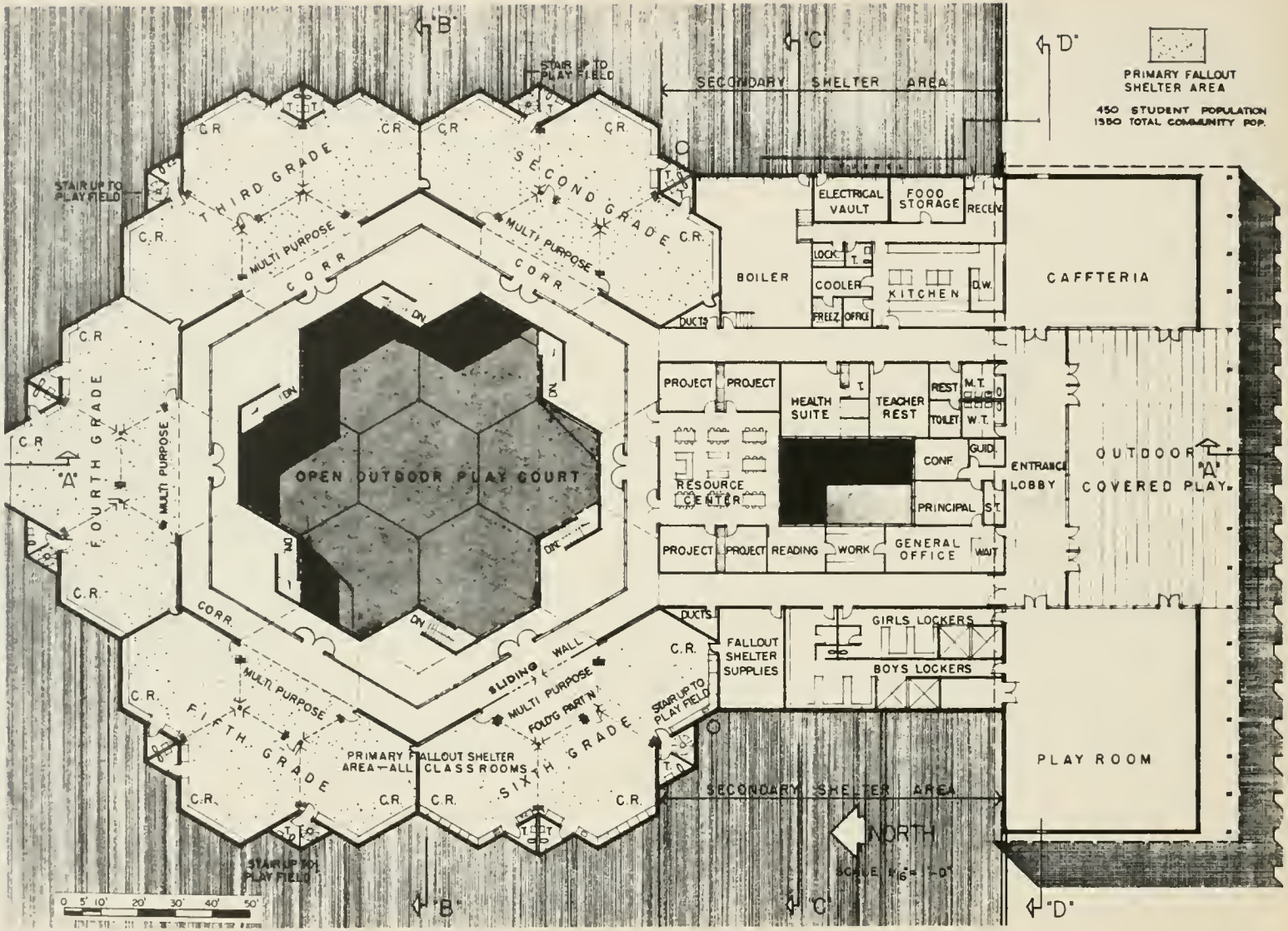
The overall atmosphere in this facility is one of openness and airiness. The classroom wing is an effective, well-thought-out shelter.

Aerial View



Interior View of Outdoor Court and Shelter Area

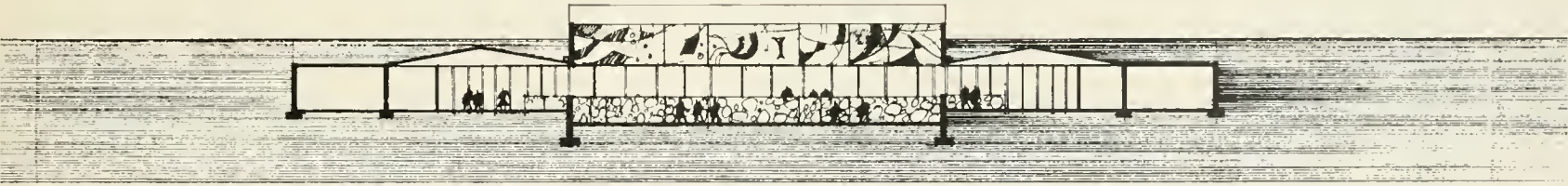




First Floor Plan

Section A A

South Elevation



Section B B

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 1

SECOND PRIZE

James S. Minges, *Engineer*
James S. Minges & Associates
Farmington, Connecticut

Team Members

Edward L. Pepin, *Architect*
William F. Hermann, Jr., *Architect*
Richard L. Howland, AIA, *Architect*
Richard D. Cosgrove, *Engineer (civil)*

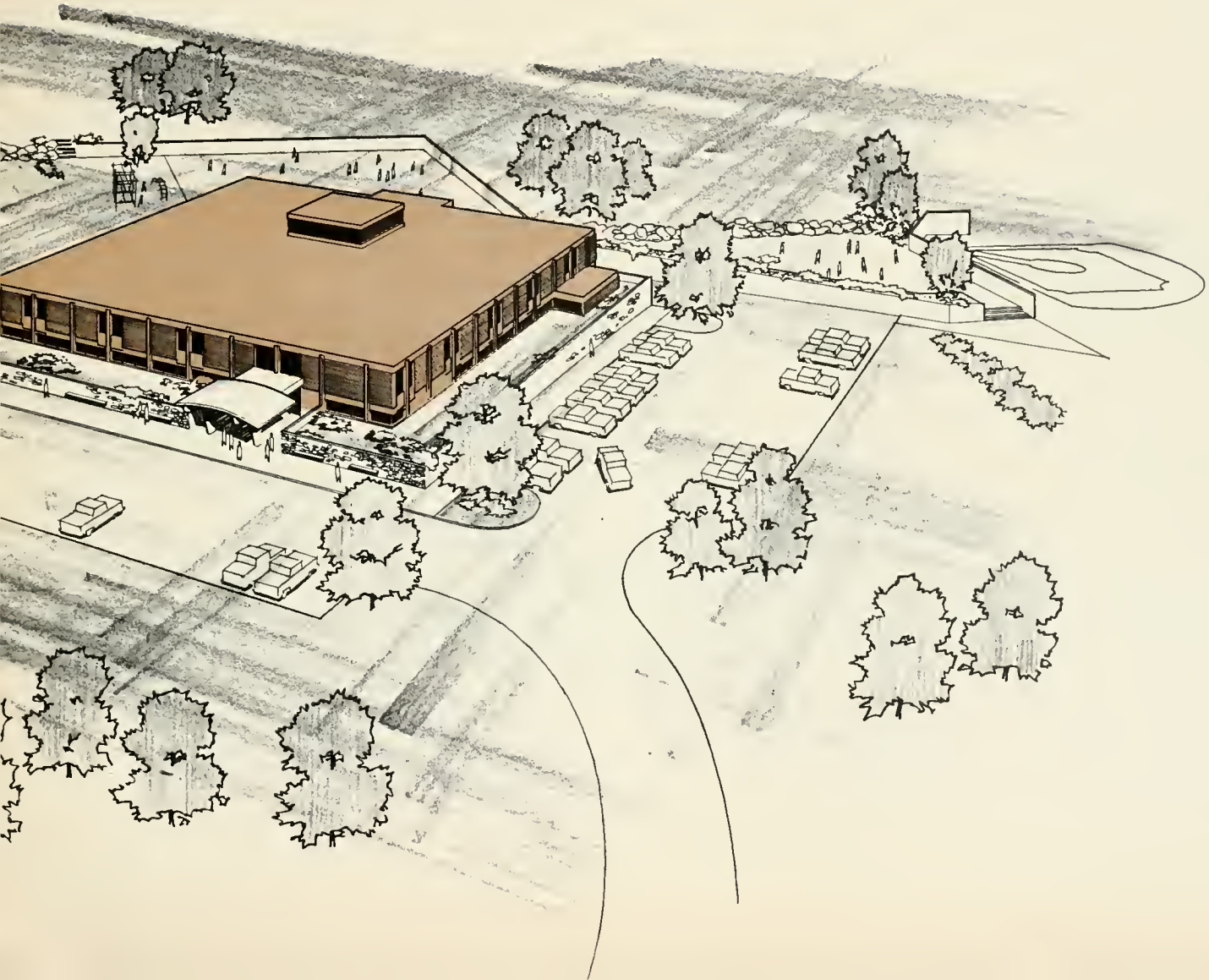
Jury Comment:

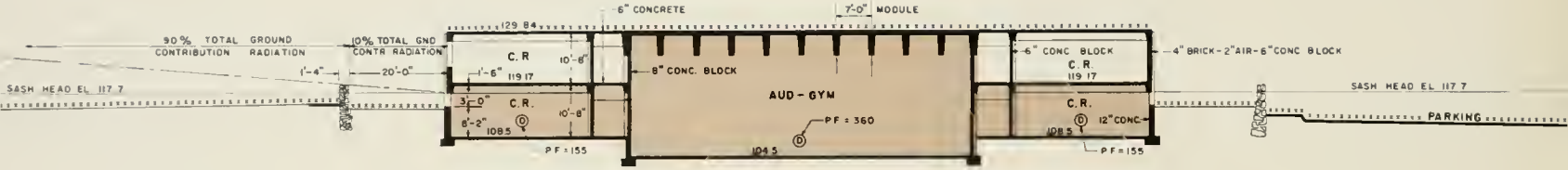
A simple, straightforward, basically traditional two-story school with a high proportion of shelter area, much of which has exterior windows. This inclusion of natural light and ventilation is made possible by adroit handling of a realistic and challenging site, with careful attention to minimizing radiation exposure by the manner in which the site is graded. Well-developed mechanical and electrical systems are included.

Analysts' Comment:

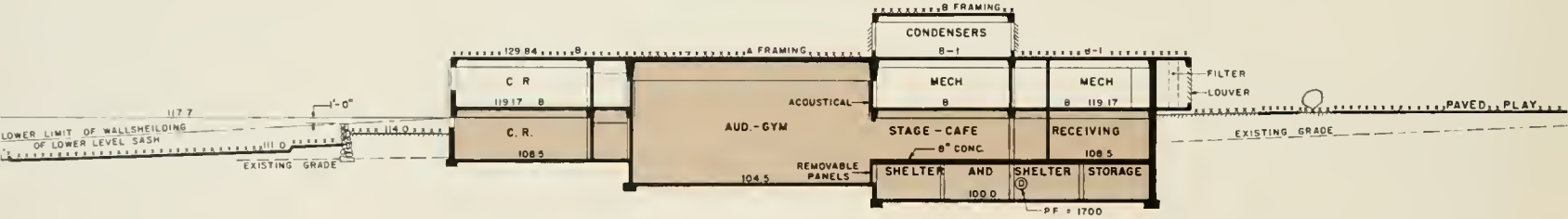
This is an excellent solution illustrating that the inclusion of the requirements for shelter in the standard criteria for school design need not unduly penalize the design. This building is a pleasant school. Through excellent control of the site, and placing the building partially below ground, the designer has produced good shelter by elimination of the ground direct contribution. The components normally found in schools which enhance the occupancy of shelter space are all included within the protected area. This is a well-studied and realistic school shelter.

Exterior Perspective

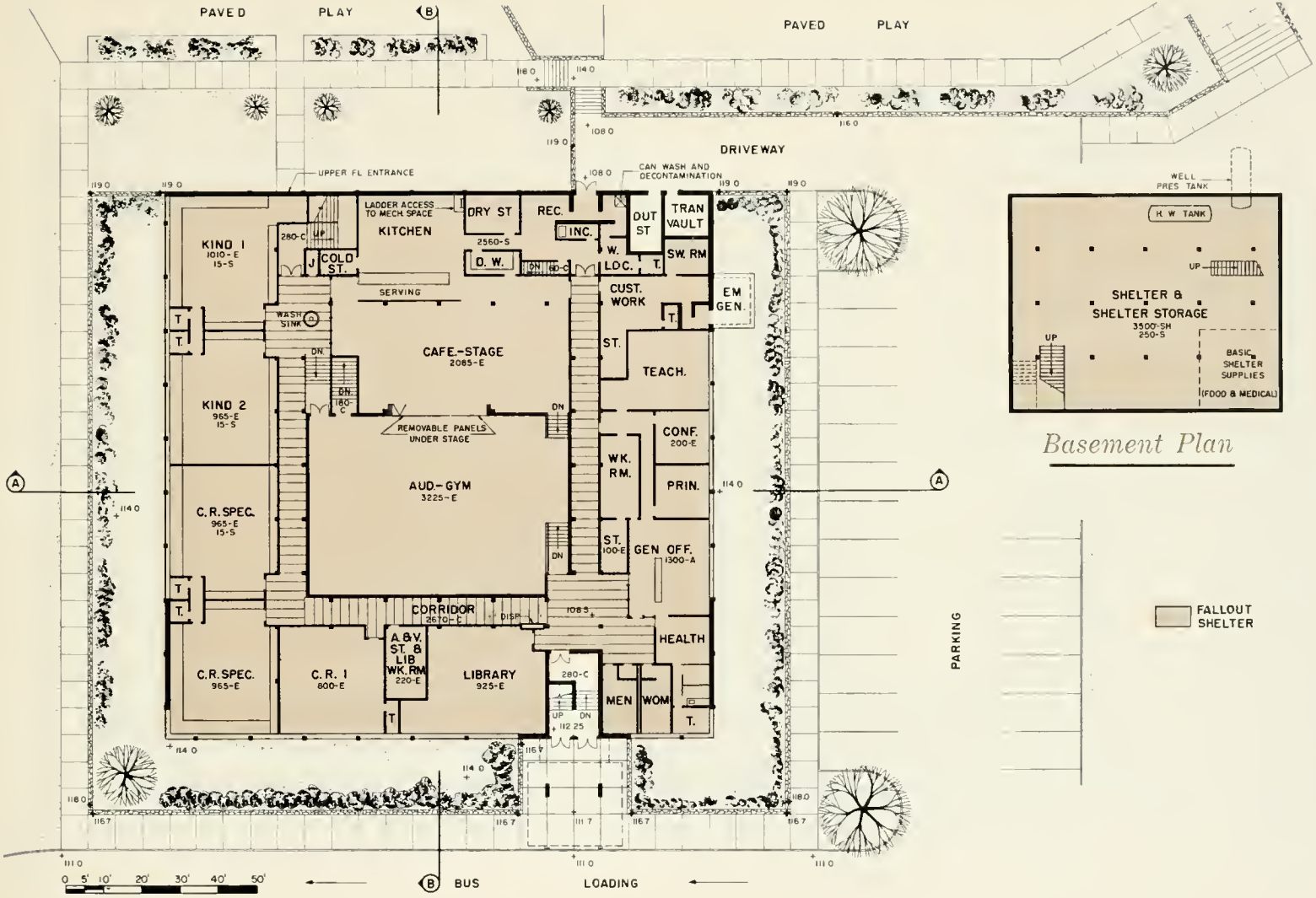




Section A A

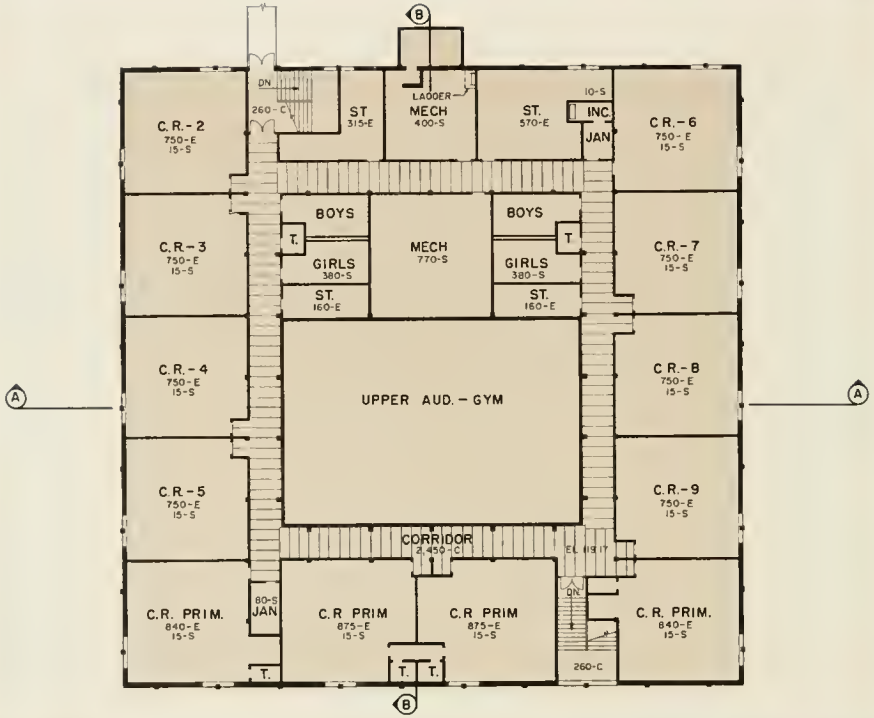


Section B B

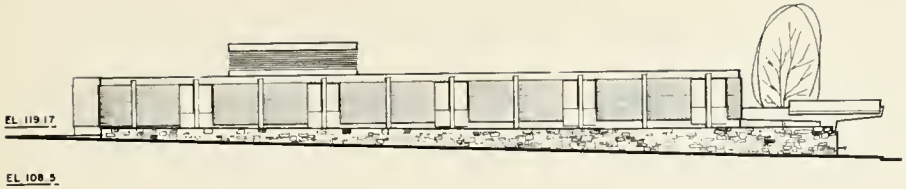


Basement Plan

Lower Floor Plan

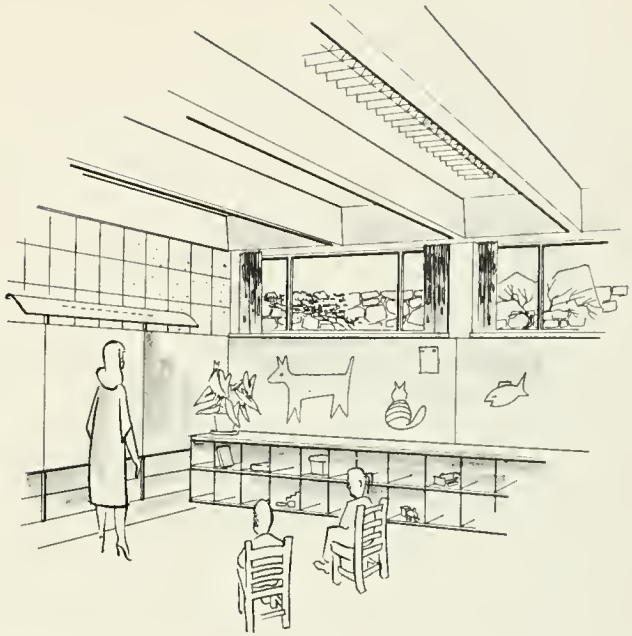


Upper Floor Plan

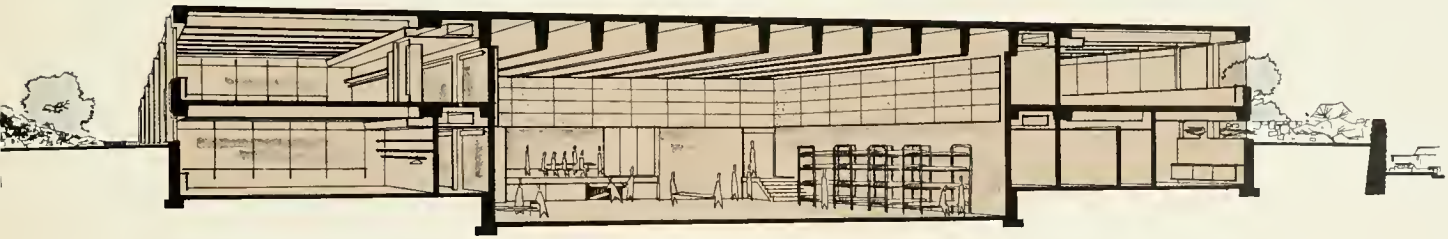


South Elevation

East Elevation



Typical Classroom



Interior Perspective

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 1

THIRD PRIZE

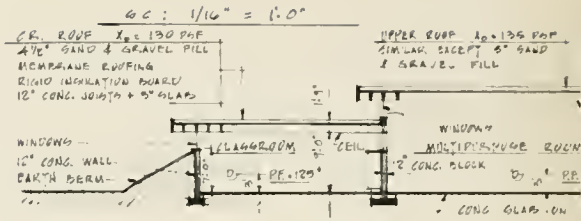
John Chornyak, *Architect and Engineer*
Greenfield, Massachusetts

Jury Comment:

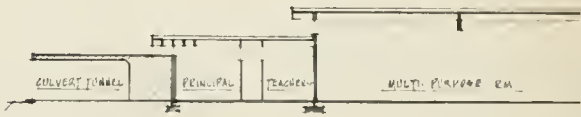
A compact one-story school—all of which is shelter area. Of particular interest is the use of an inexpensive earth berm to achieve exterior wall protection and the use of overhangs to provide protection for window areas.

Analysts' Comment:

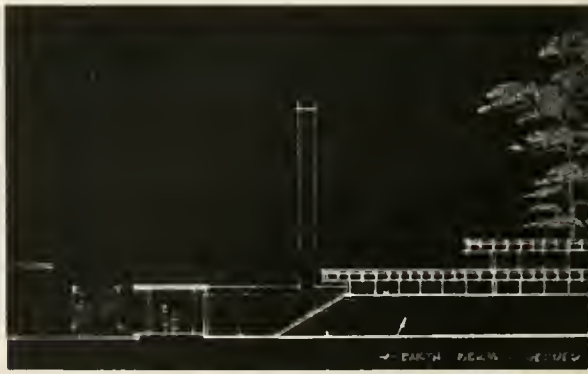
Shelter design criteria are fully met with economy of construction. However, the steel culvert tunnel entrances are considered unnecessarily crude. The use of screen walls at entrances and a more sculptured use of earth shielding as demonstrated in several of the award winning entries would improve this design.



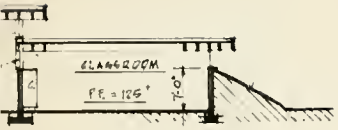
Transverse Section A A



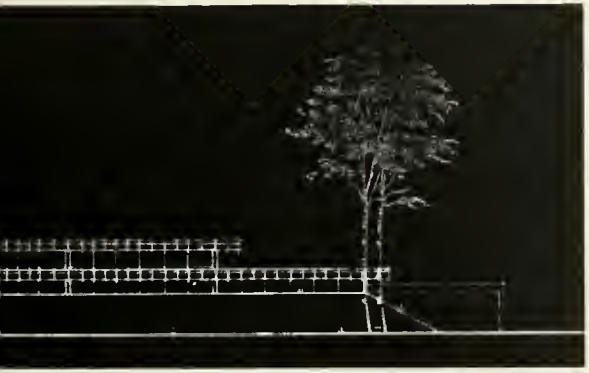
Longitudinal Section B B



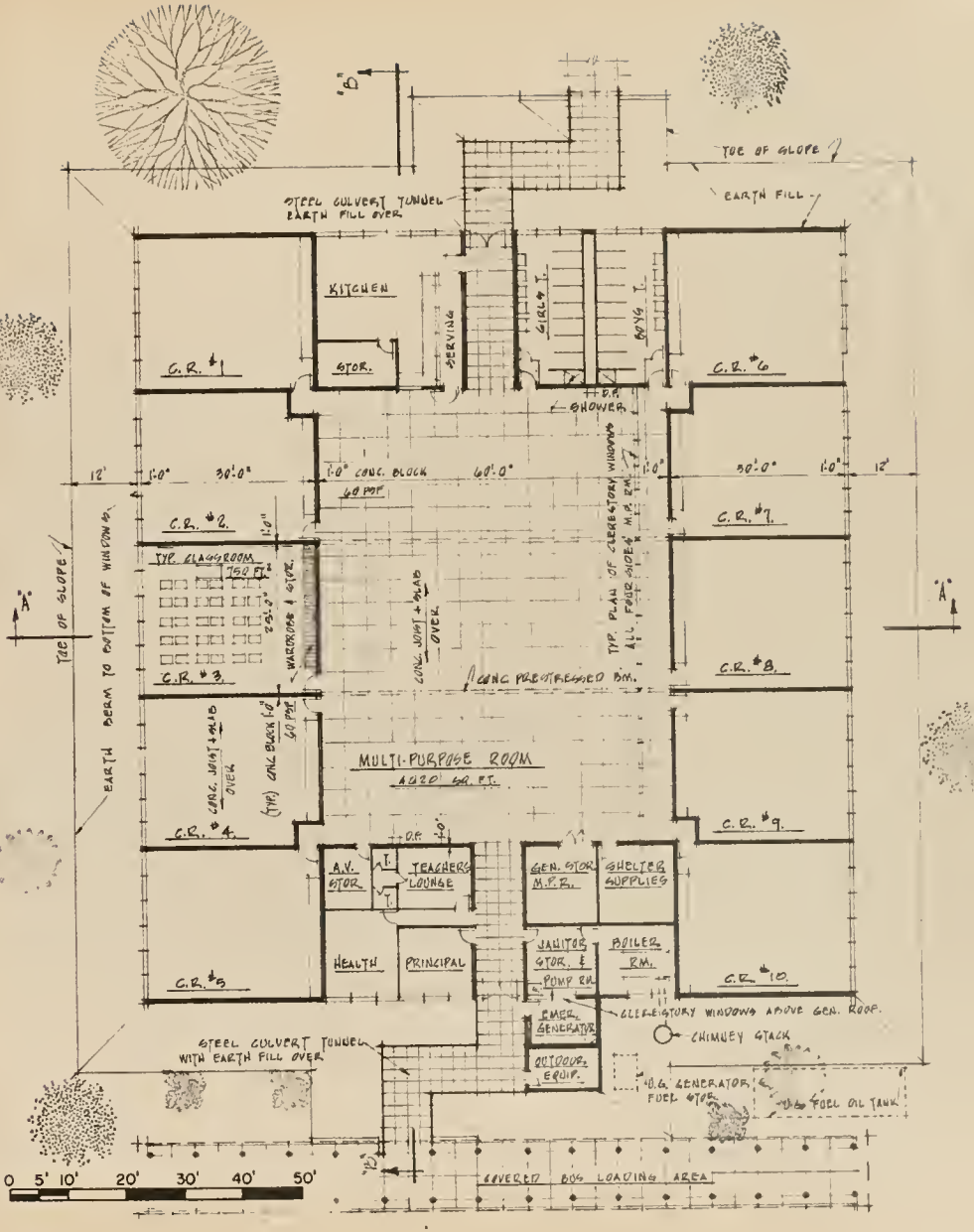
Right Side Elevation


CLASSROOM
F.F. = 125'
7'-0"


KITCHEN



Floor Plan


TOE OF SLOPE
STEEL CULVERT TUNNEL EARTH FILL OVER
EARTH FILL
KITCHEN
STOR.
SERVING
GIRLS T.
BOYS T.
C.R. #1
C.R. #6
SHOWER
12'
1'-0"
30'-0"
1'-0" CONC. BLOCK
60'-0"
60 PSF
C.R. #2
C.R. #7
TYP. CLASSROOM
750 FT²
WARDROBE & STOR.
CONC. JOIST & SLAB OVER
TYP. PLAN OF CLERESTORY WINDOWS
ALL FOUR SIDES
M.P. RM.
TOE OF SLOPE
EARTH BERM TO BOTTOM OF WINDOWS
C.R. #3
CONC PRESTRESSED BM.
C.R. #8
MULTI-PURPOSE ROOM
4020 SQ. FT.
CONC. JOIST & SLAB OVER
(TYP.) CMU BLOCK WALL
60 PSF
C.R. #4
C.R. #9
A.V. STOR.
TEACHERS LOUNGE
GEN. STOR M.P.R.
SHELTER SUPPLIES
HEALTH
PRINCIPAL
JANITOR STOR. & PUMP RM.
BOILER RM.
C.R. #5
C.R. #10
CLERESTORY WINDOWS ABOVE GEN. ROOF
CHIMNEY STACK
EMER. GENERATOR
OUTDOOR EQUIP.
STEEL CULVERT TUNNEL WITH EARTH FILL OVER
U.G. GENERATOR FUEL STOR.
U.G. FUEL OIL TANK
0 5' 10' 20' 30' 40' 50'
COVERED BUS LOADING AREA

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 2

FIRST PRIZE

Joseph Baker, AIA
Joseph Baker & Associates, *Architects*
Newark, Ohio

Team Members

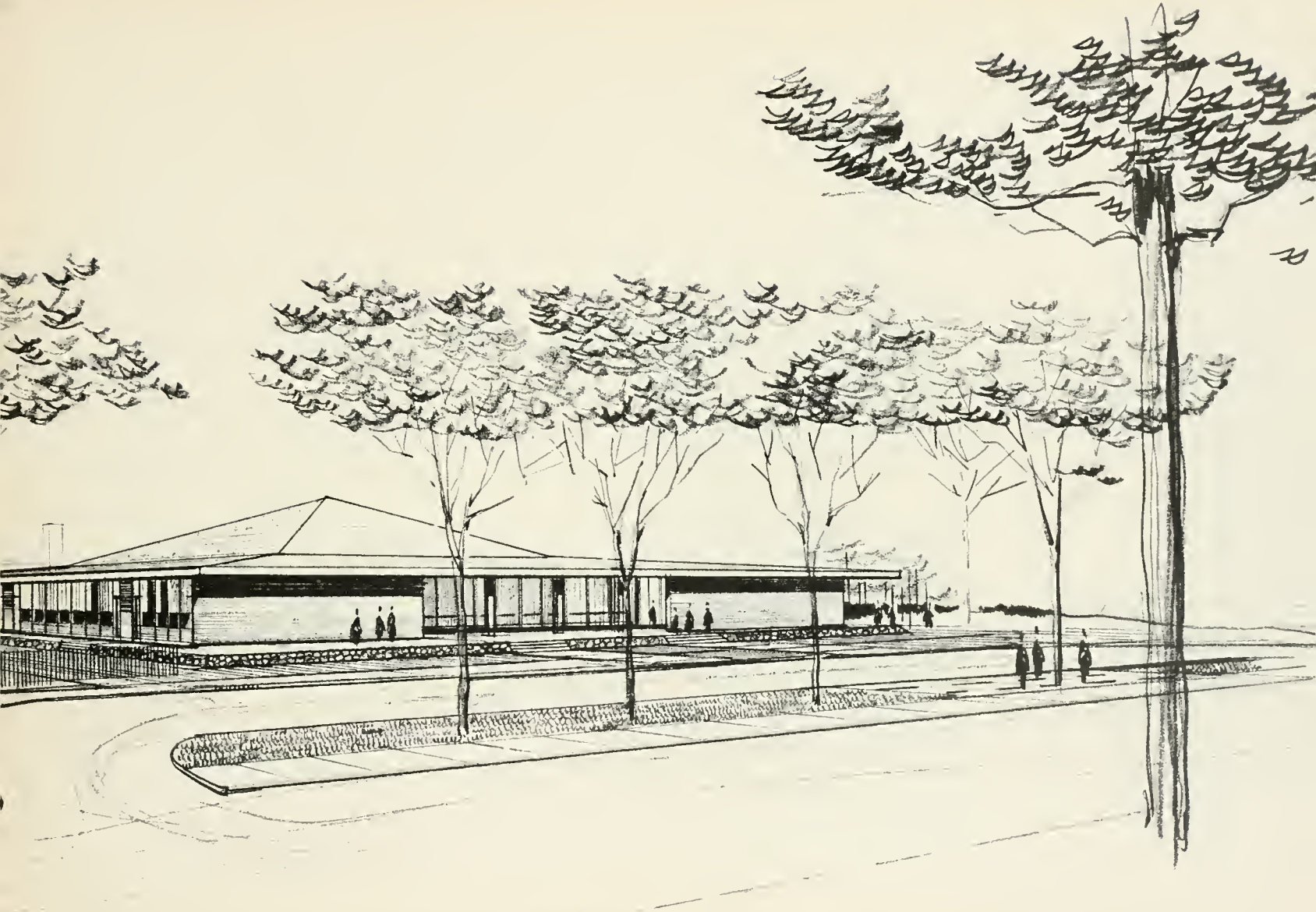
Donald Gunnerson, *Architect*
Robert Swank, *Architect*
Raymond Horstman, *Architect*
Jack Harden
Ralph J. Kramer, *Engineer (mechanical)*

Jury Comment:

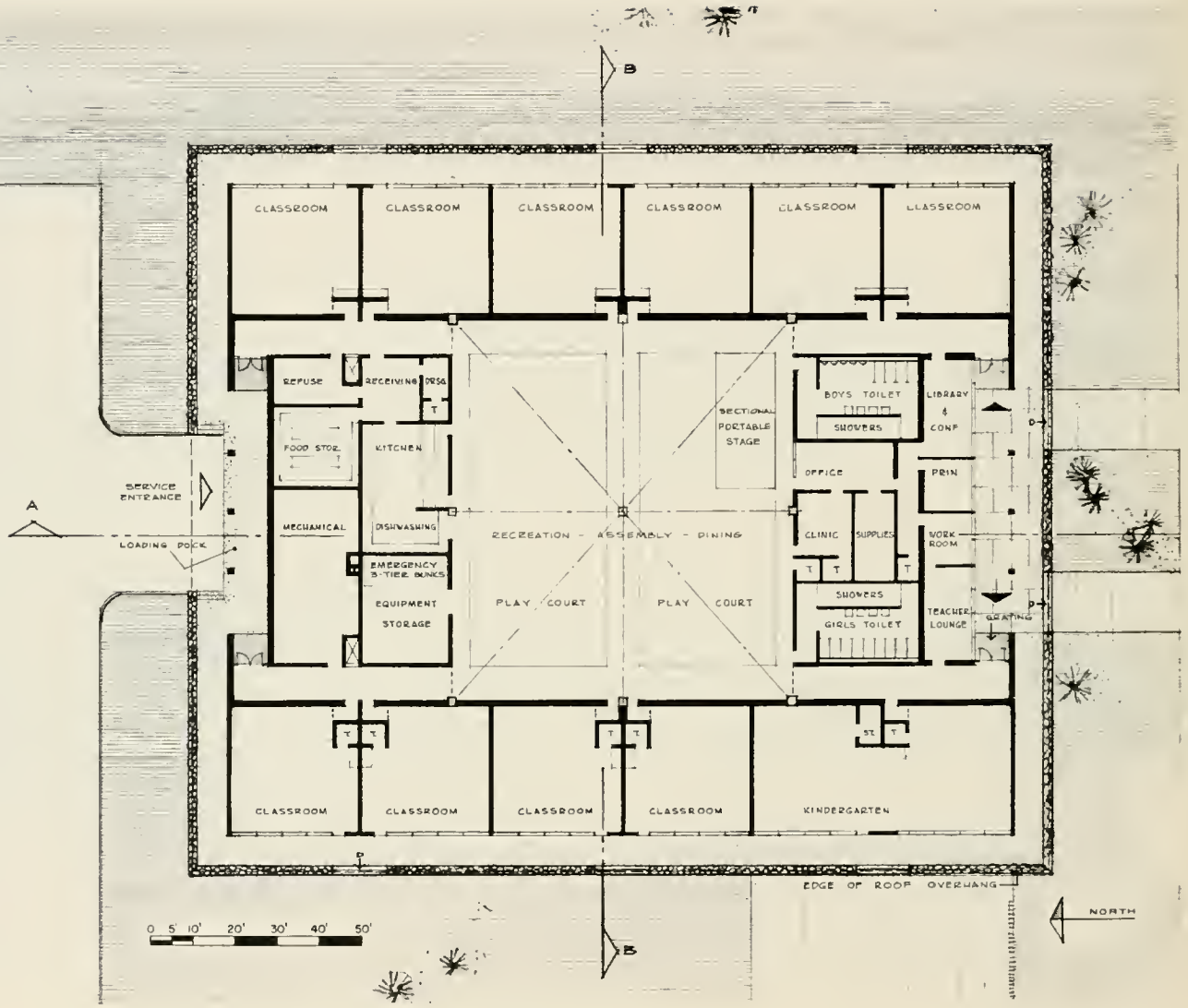
This is a delightful little school which would be an asset to any community. It has a delicate, refined quality which covers an extremely efficient shelter "core". The core provides a spacious, open activity-circulation area, together with all required services, for normal use. As a shelter area, it is well developed and well baffled with a protection factor well in excess of requirements. The heating and ventilating system is very simple and well handled.

Analysts' Comment:

The fallout radiation protection is achieved by the use of heavy concrete roof and walls. The protection factor in this building is well above 500 due to massive barriers provided. The thick walls are effective as a barrier to the ground direct contribution but could be reduced in weight from approximately waist height up without material reduction of the protection afforded.

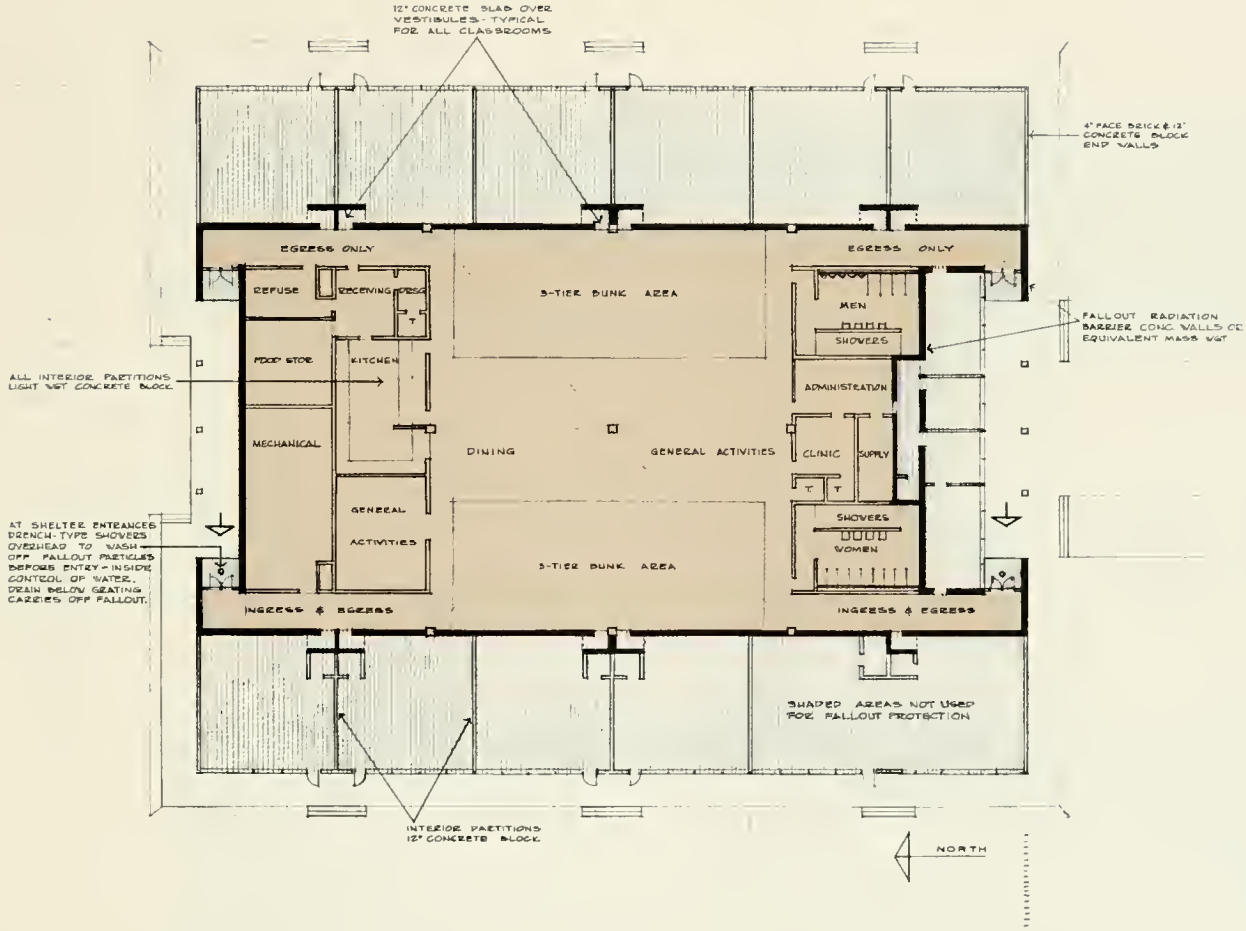


Exterior Perspective



Plan

Capacity 330/27,000 Sq. Ft.
School in Normal Use

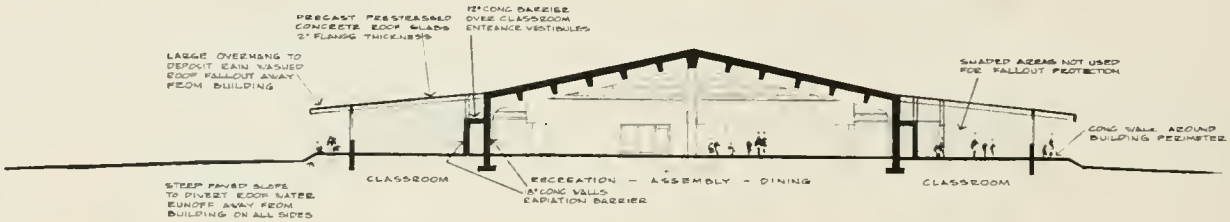


Plan

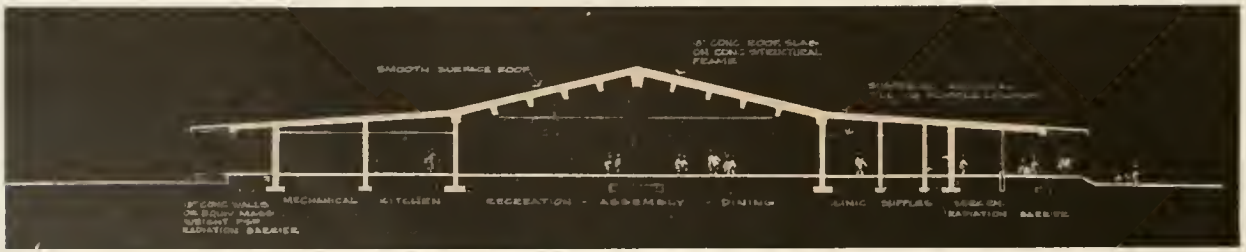
Capacity 660/12,500 Sq. Ft.
School in Emergency Use

West Elevation

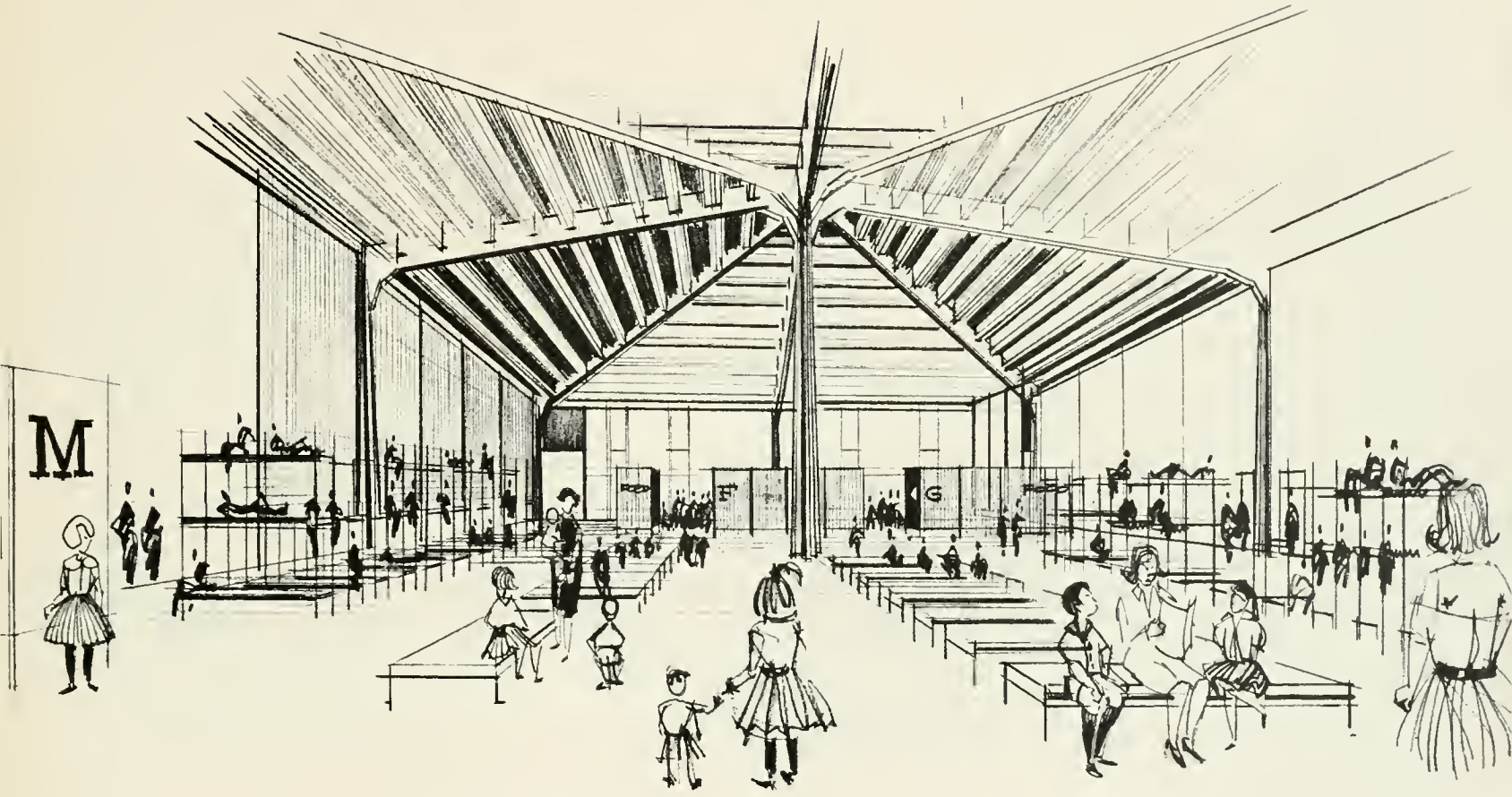
North Elevation



Section B B



Section A A



Interior View of Fallout Shelter

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 2

SECOND PRIZE

Harold R. Roe, *Architect*
Toledo, Ohio

Team Members

Dean L. Lashbrook, *Engineer (structural)*
Dennis J. Connelly, *Engineer (mechanical)*

Jury Comment:

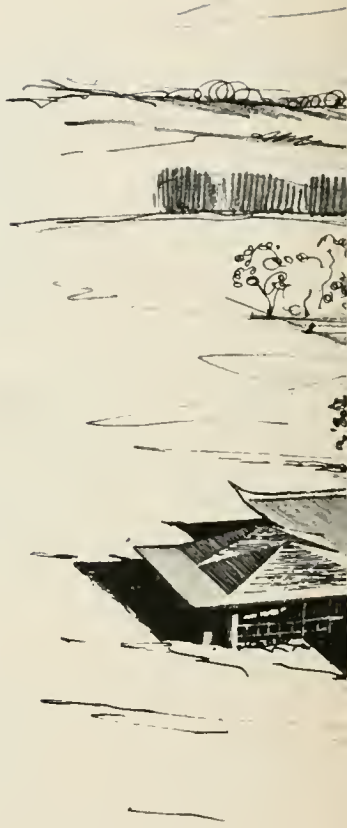
This is an extremely interesting treatment of an essentially windowless school. While most of the exterior is composed of massive sand-filled concrete walls, enough glass is judiciously used to create a feeling of openness. The classrooms—designated as teaching suites for flexibility and team teaching—are grouped around two open courts. These courts can be closed with "pivotable" concrete walls for fallout protection. This is a thoughtful, well-handled educational and shelter concept.

Analysts' Comment:

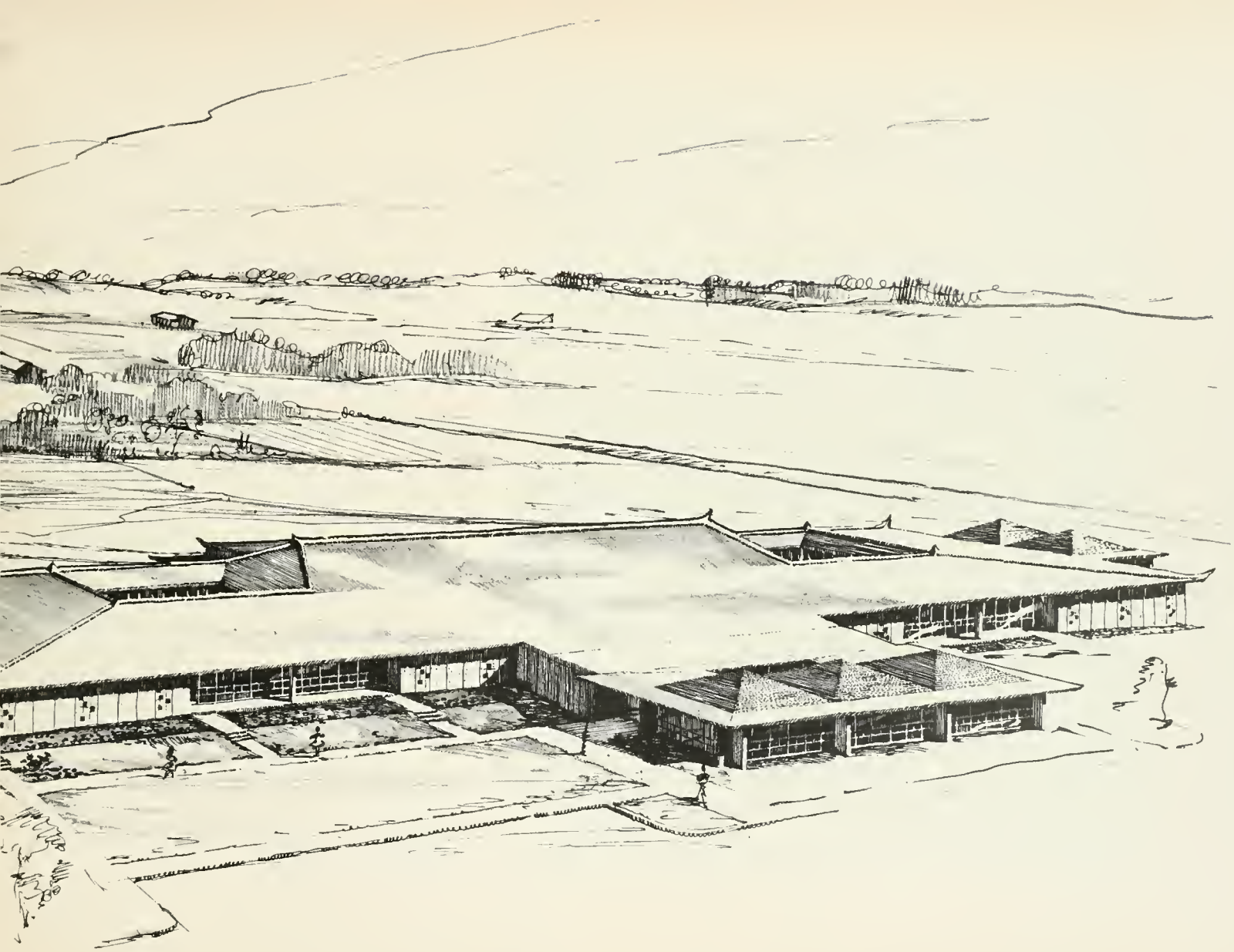
This solution shows good mastery of the overall problem of shelter. A large capacity is provided in a pleasant, open structure. When washed down, the interior courts will not only contribute to the habitability of the shelter by providing sunlight and natural ventilation, but can be occupied as exercise yards for controlled periods of time.

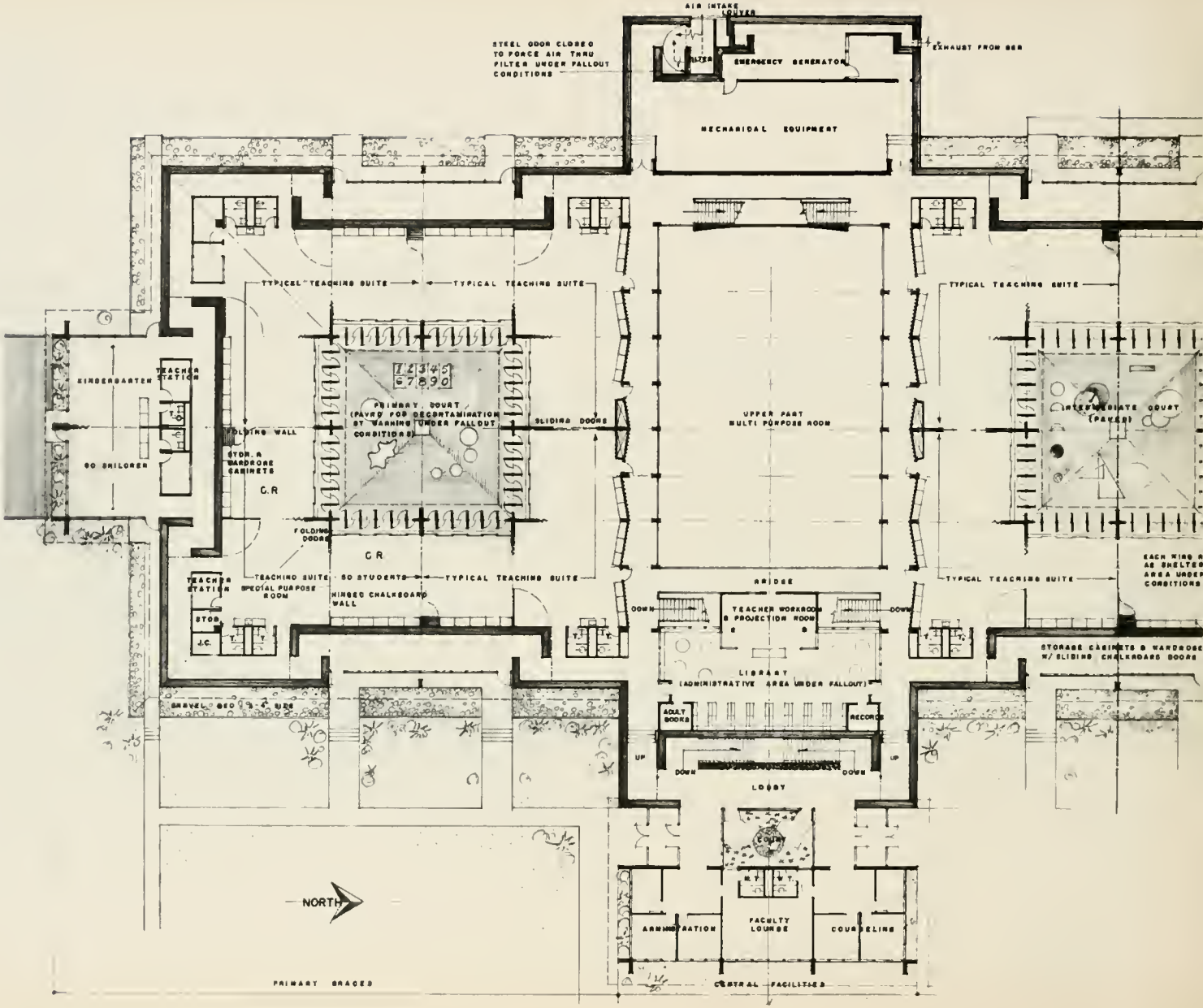
The dual use of the exterior walls as support for the roof as well as radiation shields emphasizes a major economy possible in well-planned shelter.

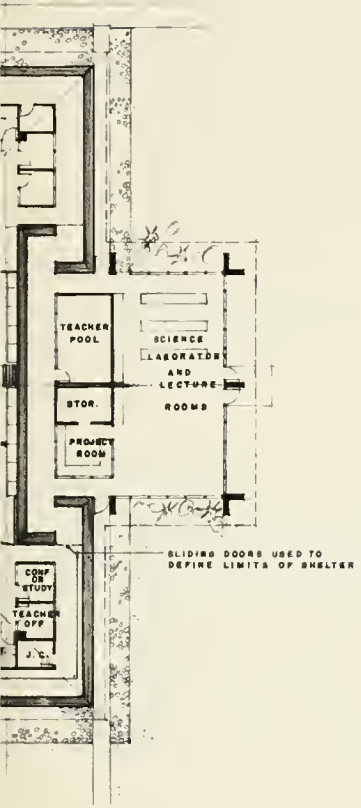
The air intake and essential shielding of the filter (where radioactive particles accumulate) have been well studied.



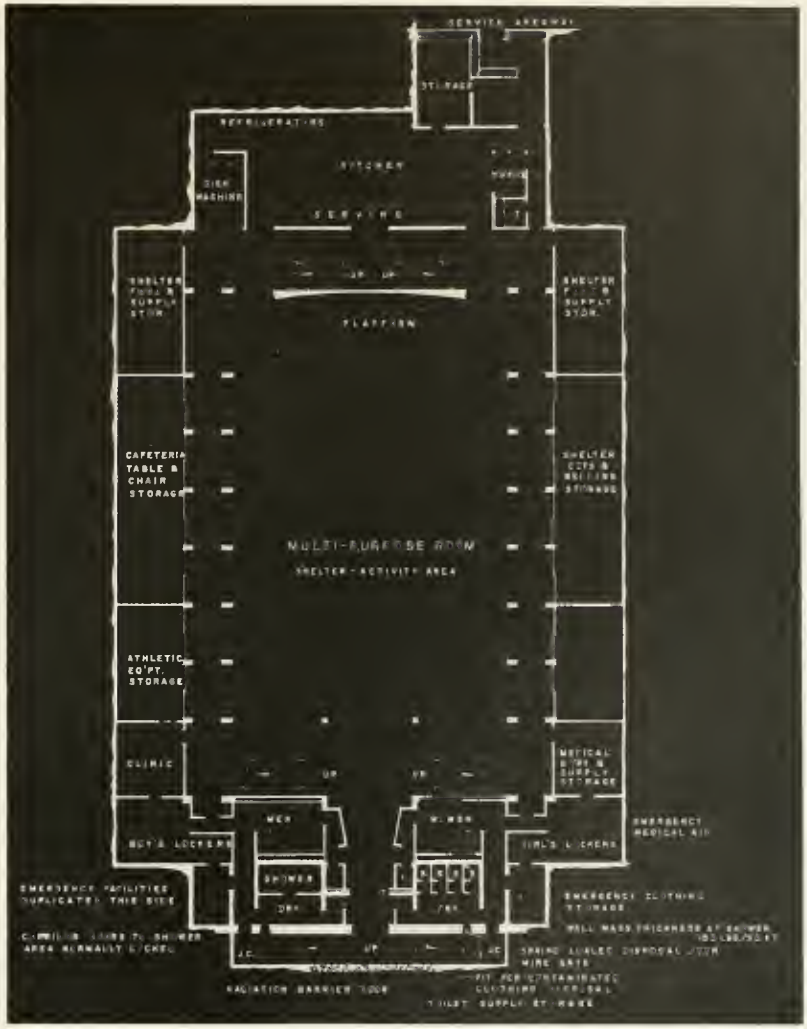
Exterior Perspective Looking Northwest



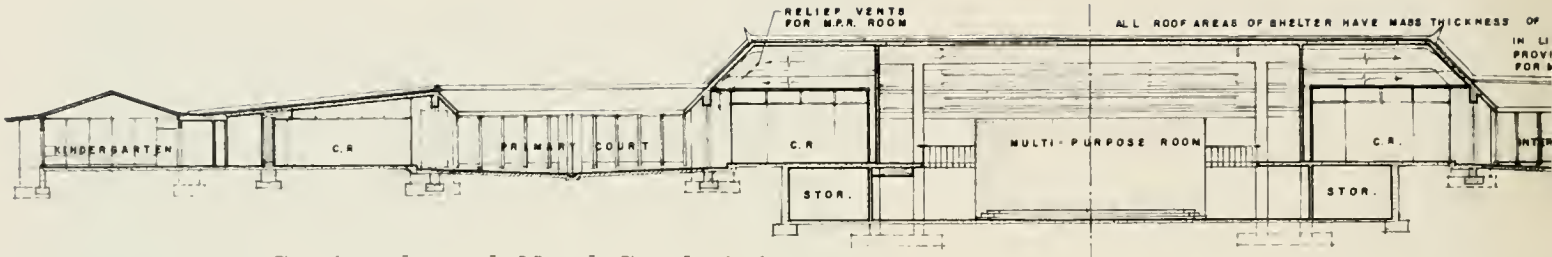

AIR INTAKE LOUVER
STEEL DOOR CLOSED TO FORCE AIR THRU FILTER UNDER FALLOUT CONDITIONS
FILTER
EMERGENCY GENERATOR
EXHAUST FROM GEN
MECHANICAL EQUIPMENT
TYPICAL TEACHING SUITE
TYPICAL TEACHING SUITE
TYPICAL TEACHING SUITE
KINDERGARTEN
TEACHER STATION
50 CHILDREN
FOLDING WALL
STOR. & WARDROBE CABINETS
C.R
PRIMARY COURT (PAVED FOR DECONTAMINATION BY WASHING UNDER FALLOUT CONDITIONS)
SLIDING DOORS
UPPER PART MULTI PURPOSE ROOM
INTERMEDIATE COURT (PAVED)
FOLDING DOORS
C.R
TEACHER STATION
TEACHING SUITE - 50 STUDENTS
SPECIAL PURPOSE ROOM
HINGED CHALKBOARD WALL
TYPICAL TEACHING SUITE
TYPICAL TEACHING SUITE
BRIDGE
STOR.
J.C.
DOWN
TEACHER WORKROOM & PROJECTION ROOM
DOWN
LIBRARY (ADMINISTRATIVE AREA UNDER FALLOUT)
STORAGE CABINETS & WARDROBES W/ SLIDING CHALKBOARD DOORS
GRAVEL BED 9" - 4" SIZE
ADULT BOOKS
RECORDS
UP
DOWN
DOWN
UP
LOBBY
COURT
NORTH
ADMINISTRATION
FACULTY LOUNGE
COUNSELING
PRIMARY GRADES
CENTRAL FACILITIES



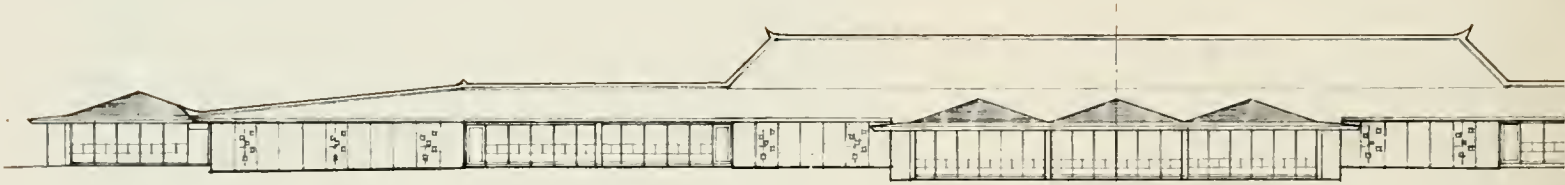
First Floor Plan



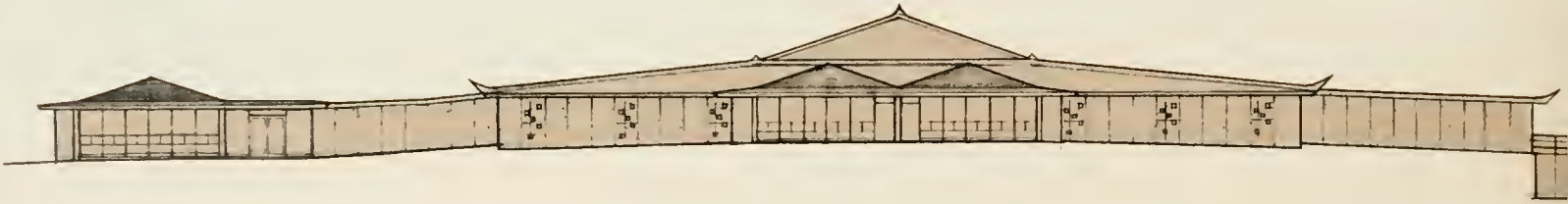
Lower Level Plan



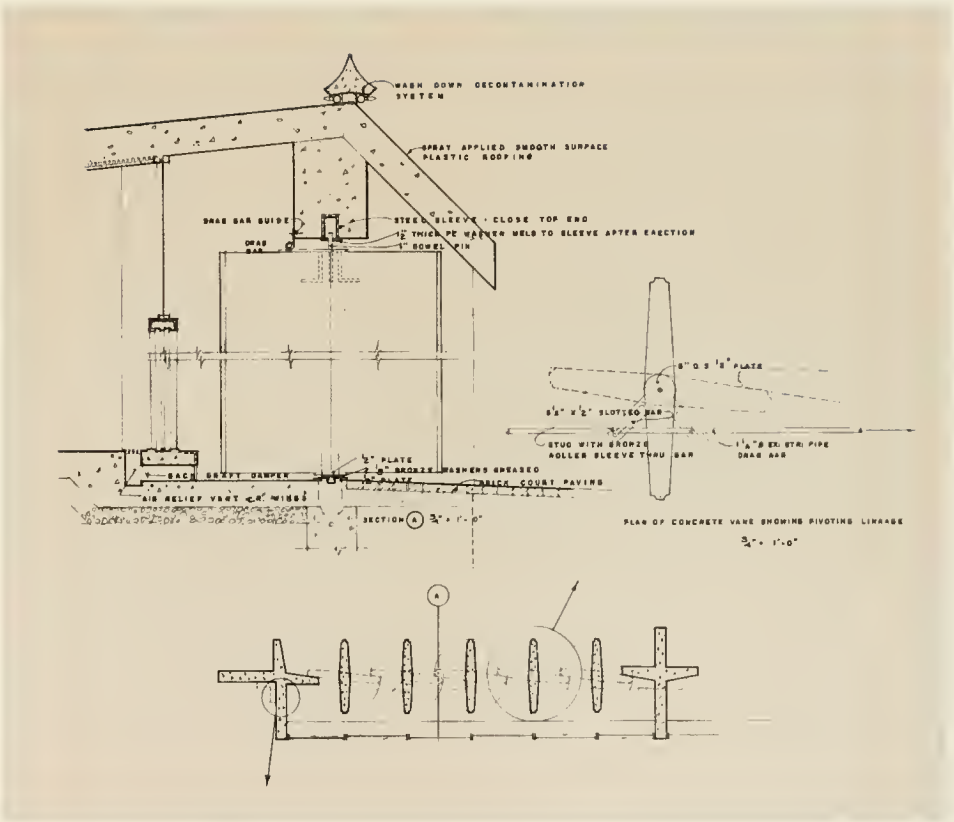
Section through North-South Axis



East Elevation



North Elevation



Detail Plan—Pivotable Concrete Vanes

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 2

THIRD PRIZE

William Crandall Suite, AIA, *Architect*
Washington, D. C.

Team Members

John Frank Dirks, Jr., AIA, *Architect*
Julian Smariga, *Engineer*

Jury Comment:

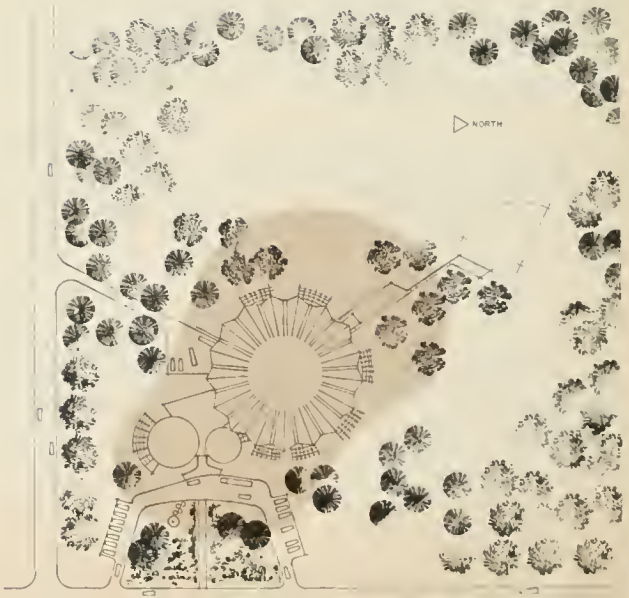
One of many circular schemes submitted, this school groups classrooms and services around a circular multipurpose room. A heavy roof, together with heavy walls and baffles make the multipurpose room the main shelter area. This is a simple handling of a difficult concept.

Analysts' Comment:

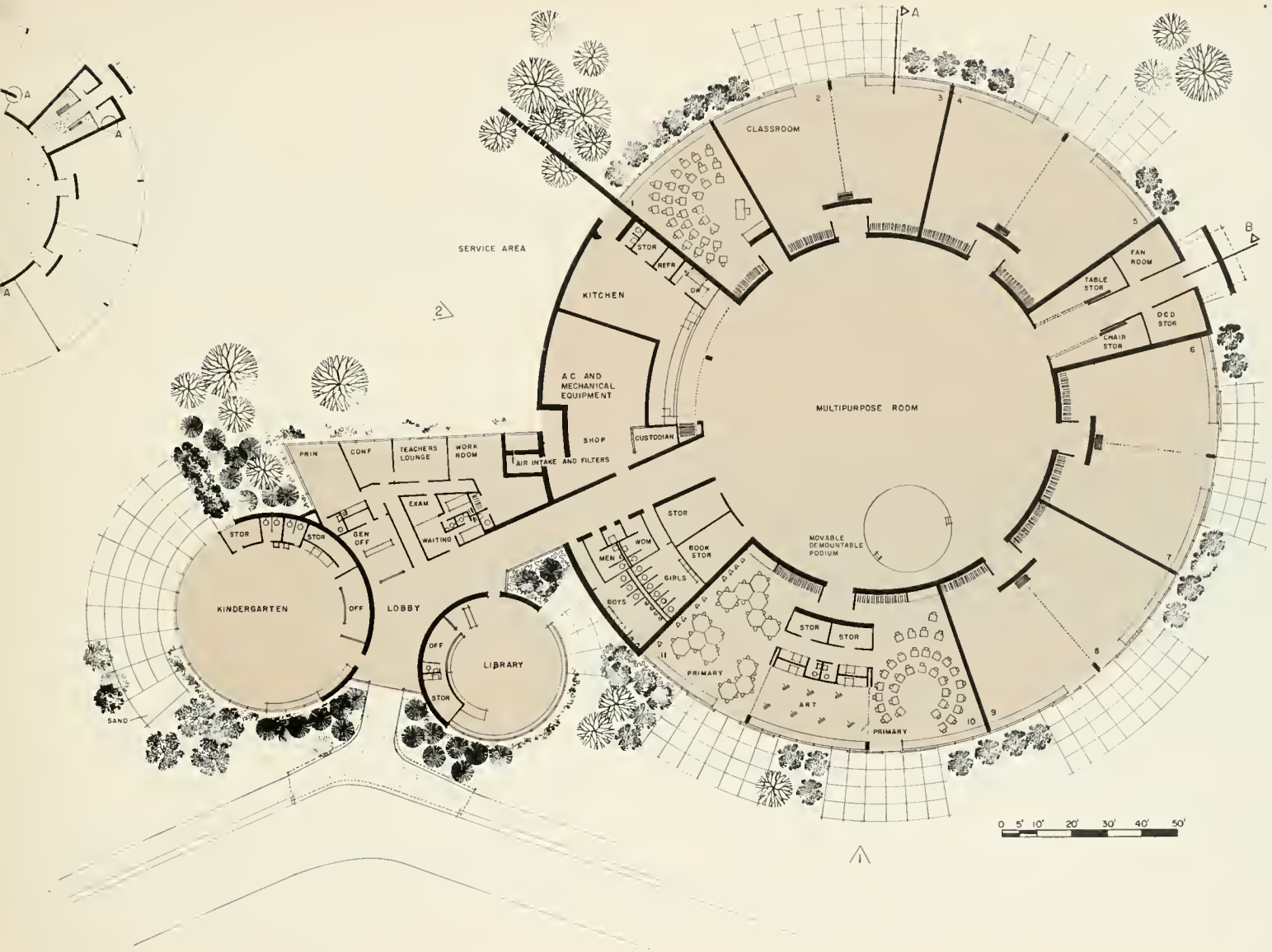
An interesting design. A slight extension of the baffle walls at the classroom entrances will improve the protection in the shelter space.

Shelter Plan

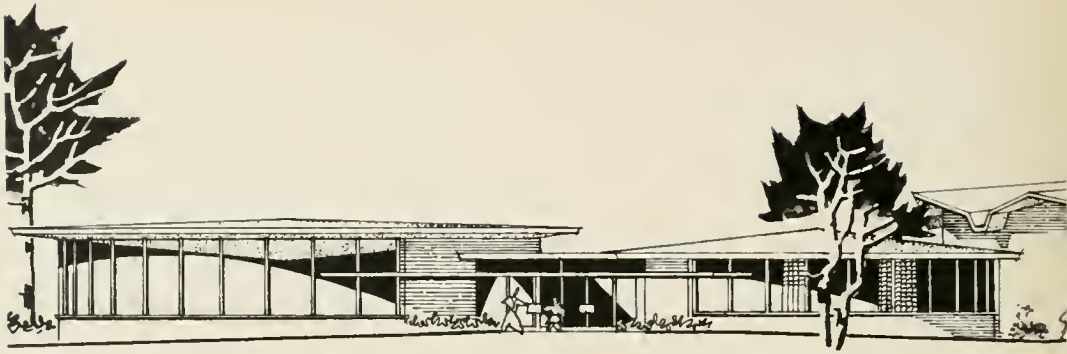
Stippling indicates protected area



Site Plan

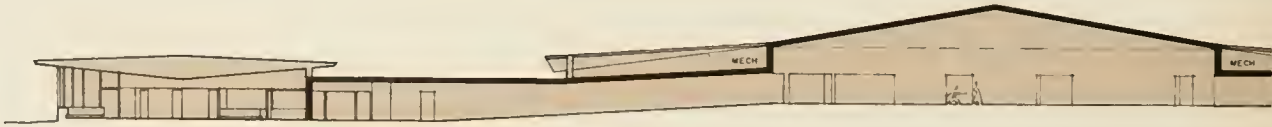

CLASSROOM
SERVICE AREA
KITCHEN
STOR
REFR
DW
A.C. AND MECHANICAL EQUIPMENT
SHOP
AIR INTAKE AND FILTERS
CUSTODIAN
MULTIPURPOSE ROOM
TABLE STOR
FAN ROOM
CHAIR STOR
OCD STOR
PRIN
CONF
TEACHERS LOUNGE
WORK ROOM
EXAM
WAITING
GEN OFF
STOR
STOR
KINDERGARTEN
OFF
LOBBY
OFF
LIBRARY
STOR
SAND
MEN
WOM
GIRLS
BOYS
STOR
BOOK STOR
MOVABLE DEMOUNTABLE PODIUM
STOR
STOR
PRIMARY
ART
PRIMARY
0 5' 10' 20' 30' 40' 50'

Floor Plan

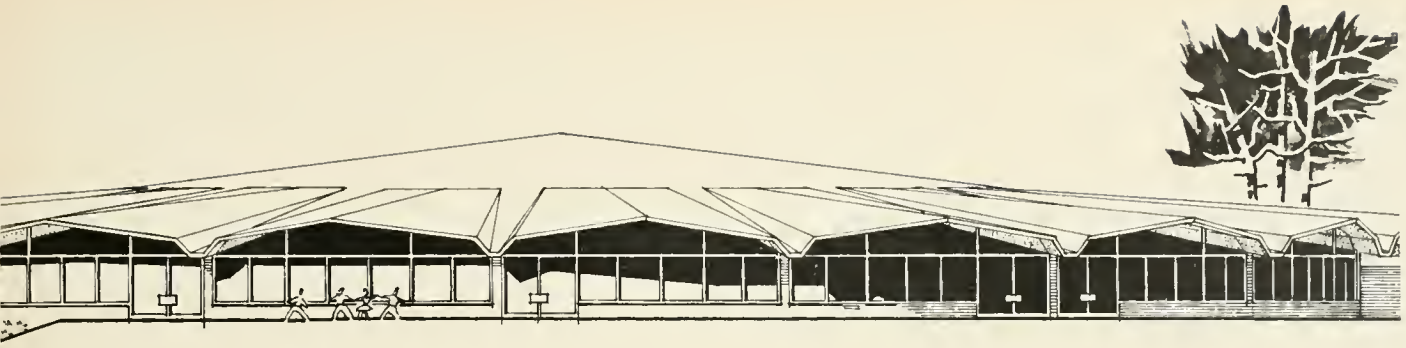


Elevation

Section A



Section B



Main Entrance

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 2

CERTIFICATE OF MERIT

Edgar T. Chatman-Royce, *Architect*
Hottinger, Smith, Chatman-Royce Associates
Architects & Engineers
Paoli, Pennsylvania

Team Members

Jacob Hottinger, *Architect*
Evan J. McCorkle, *Architect*
Garfield E. Smith, *Engineer*
Robert J. D'Alonzo
John F. Ray

Jury Comment:

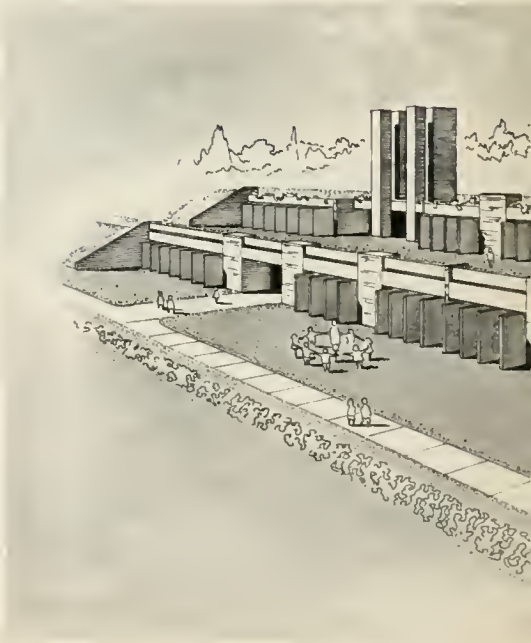
This single-loaded-corridor, two-story school is of particular interest because of its use of topography. It is built into the side of a hill, using earth on one side and the roof for protection. The open side can be closed with "pivotable" concrete walls.

Analysts' Comment:

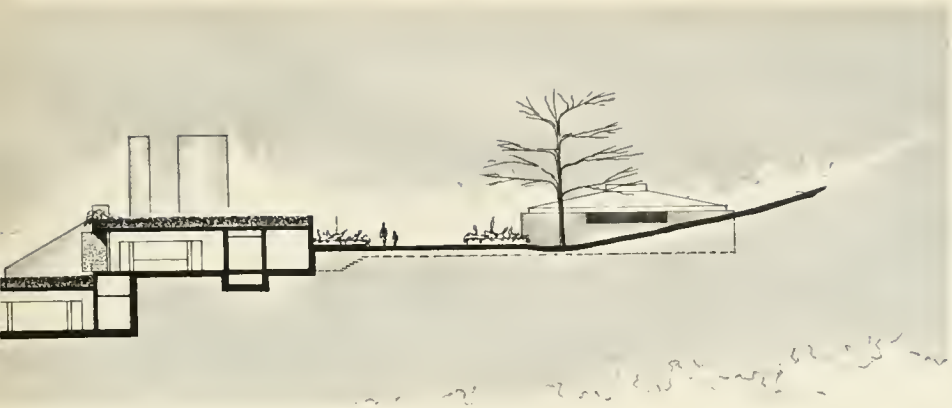
This solution is notable for its use of site planning to eliminate the major part of the ground direct contribution. The fields of radiation immediately adjacent to the classroom areas are limited in depth. The entire ground contribution is eliminated on three sides.

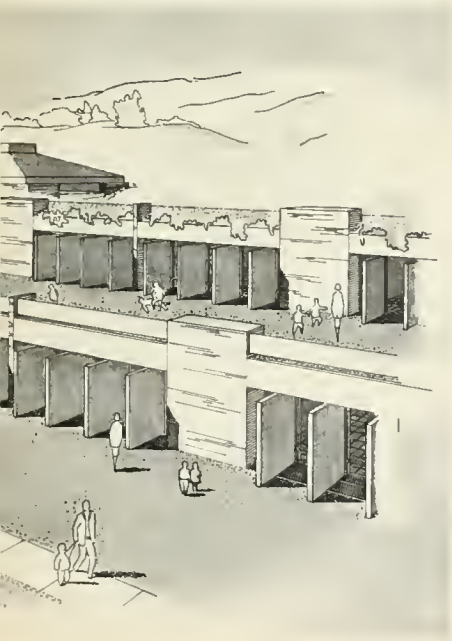
The use of the pivotable walls demonstrate an alternative method for shielding against both ground direct radiation and skyshine. Although a somewhat more expensive solution, the advantage of the movable shields lies in the ability to obtain open natural vistas and solar control during normal occupancy.

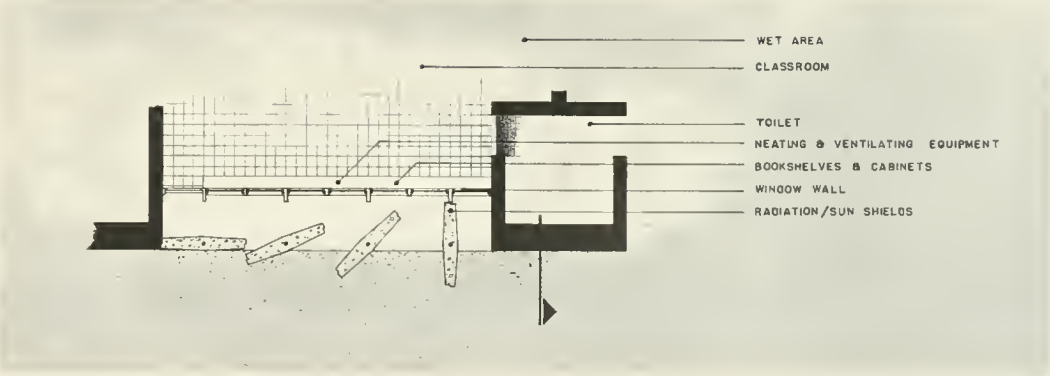
Elevation



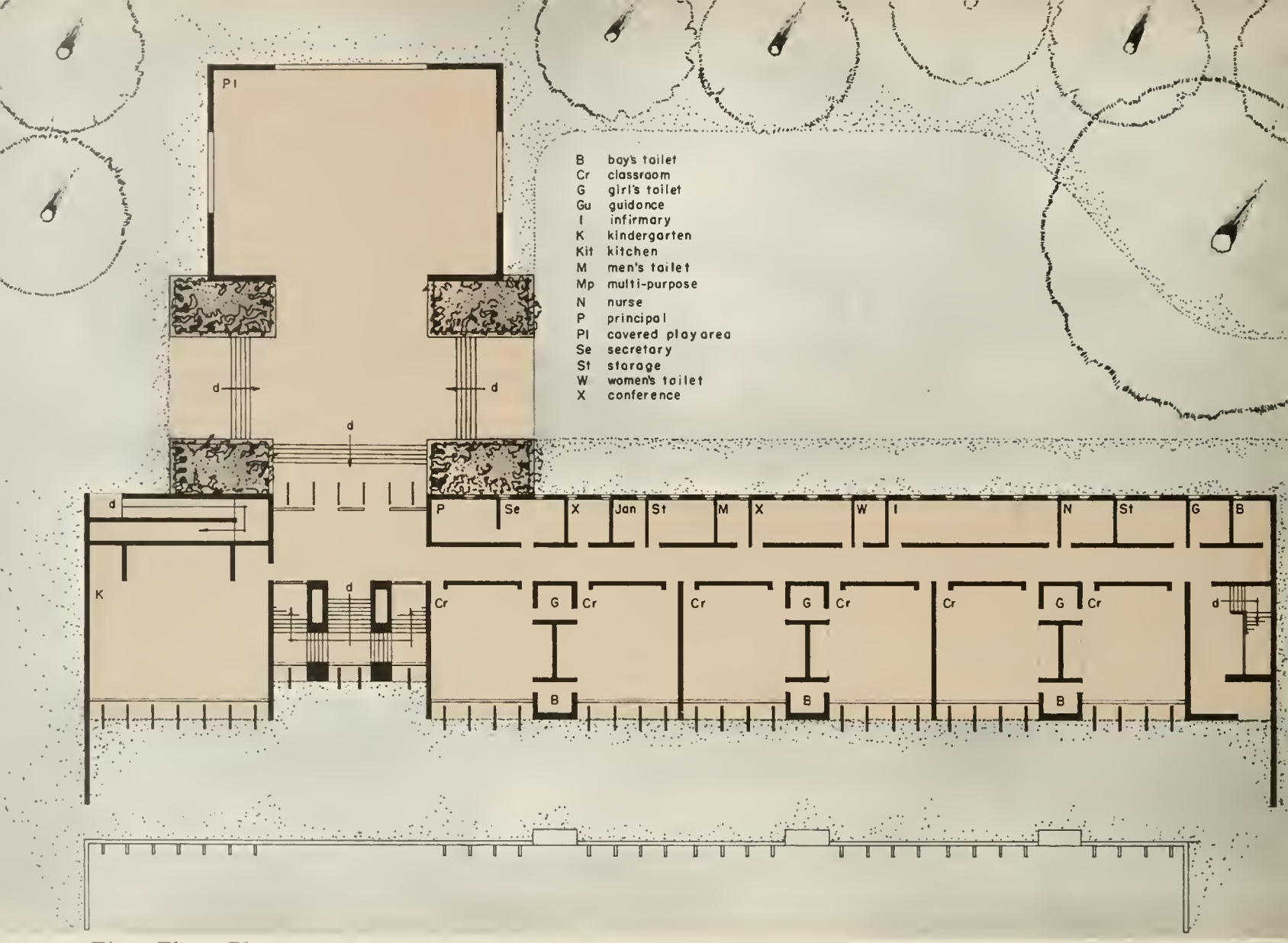
Perspective



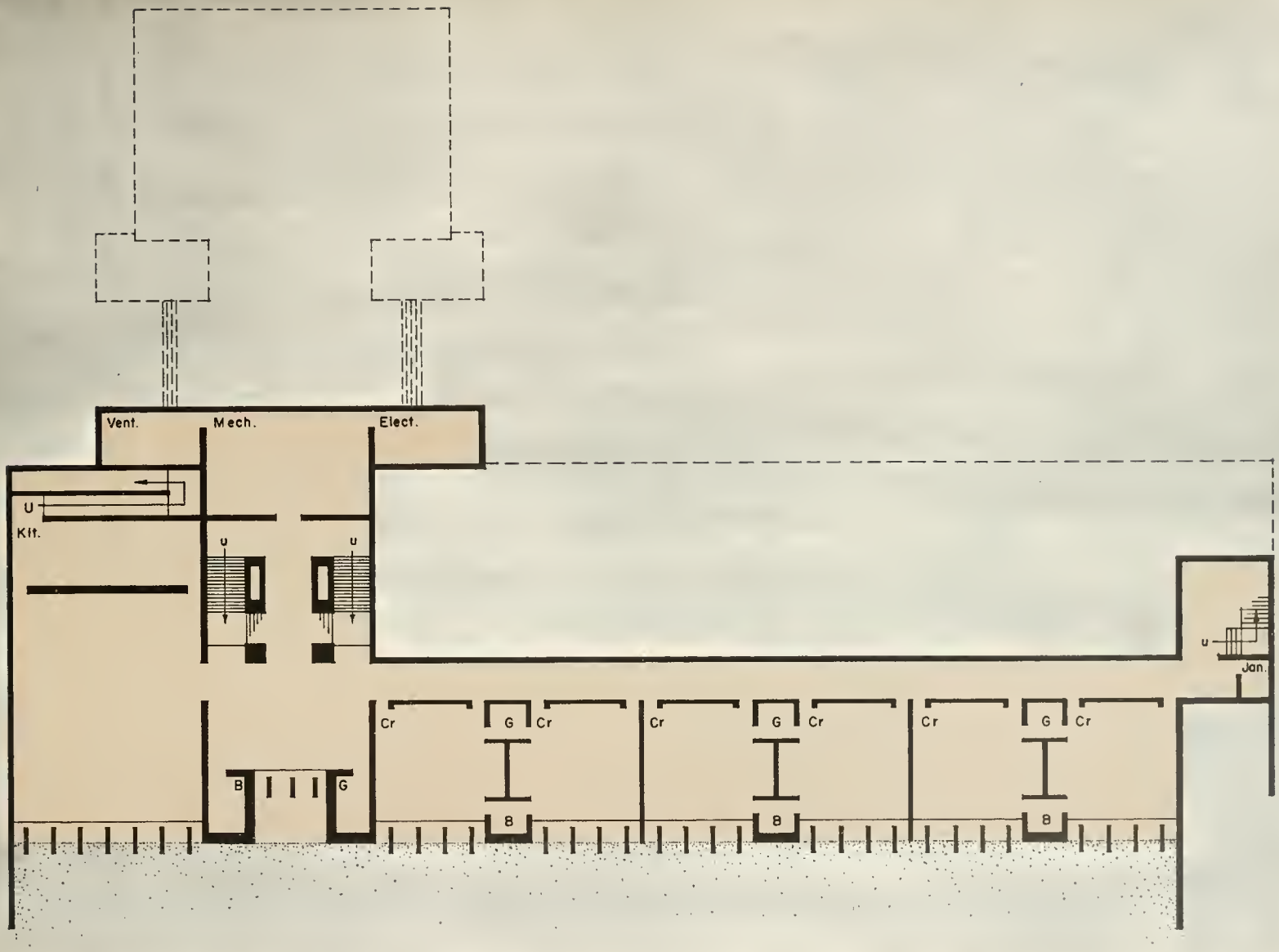




Typical Plan



First Floor Plan



Basement Plan

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 3

FIRST PRIZE

Francis E. Telesca, AIA, *Architect*
Miami, Florida

Team Members

Robert L. Dykes
Dignum Associates, *Engineers*

Jury Comment:

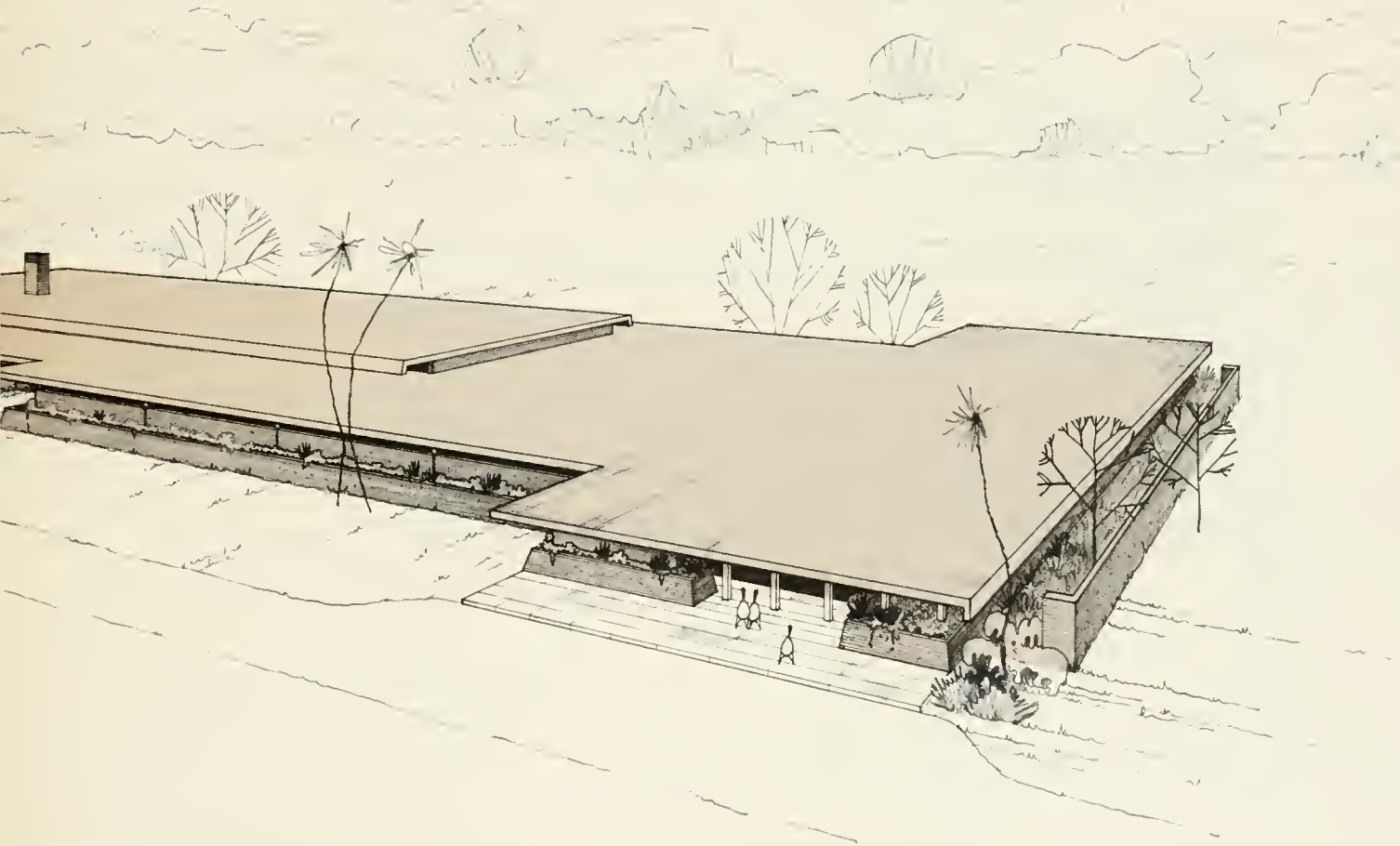
The fallout protection concept developed in this school is possibly the most intriguing of the competition. The entire building, which uses glass extensively, becomes shelter area. The intermediate classroom area combines high window sills with an exterior planter box and deep overhang, thus screening out both ground direct radiation and skyshine. The primary classrooms are similarly shielded by an exterior screen wall, a planter wall and a covered play area. Clearstory windows, lighting the central area of the building, are shielded by a deep overhang. The building is a very light, airy, open structure which always has a view to the outdoors. In addition to providing an efficient, high-capacity shelter, this scheme is not heavily dependent on mechanical ventilation and could serve well even if power were not available.

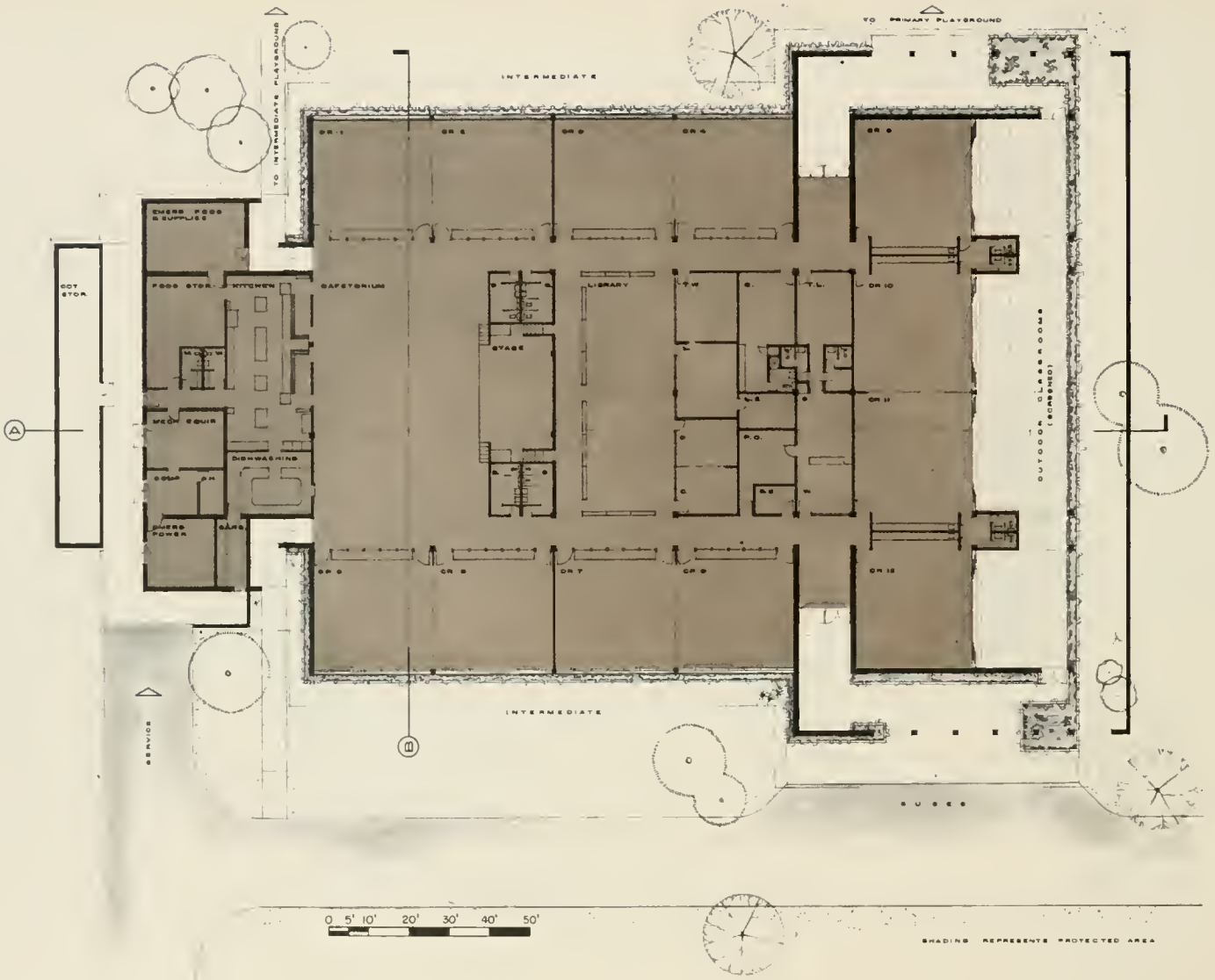
Analysts' Comment:

This simply arranged building can be quickly prepared for shelter use with a minimum of effort. The use of walls and planters in shielding the occupants from ground direct radiation displays unique understanding of the shielding problem. The designers have placed the shielding material where it is most effective, yet have maintained lightness and openness.

The free-standing wall screening the primary classrooms should be extended to the first column line to improve the shielding in this area.

Perspective

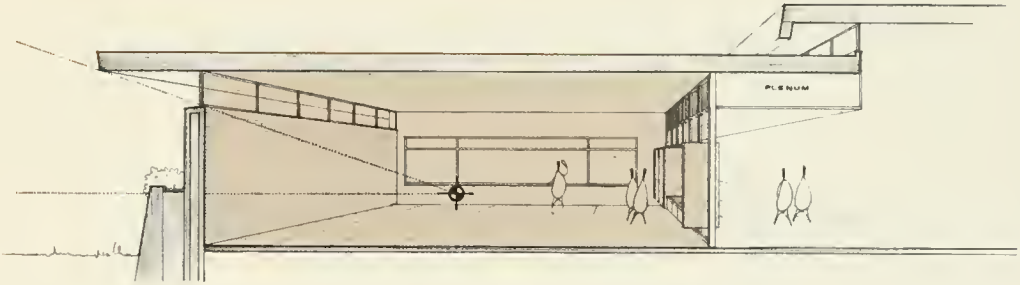



TO INTERMEDIATE PLAYGROUND
TO PRIMARY PLAYGROUND
INTERMEDIATE
CR. 1
CR. 2
CR. 3
CR. 4
CR. 5
CR. 6
CR. 7
CR. 8
CR. 9
CR. 10
CR. 11
CR. 12
EMERG. FOOD & SUPPLIES
FOOD STOR.
KITCHEN
CAFETORIUM
STAGE
LIBRARY
T.V.
T.L.
P.O.
MECH. EQUIP.
DISHWASHING
EMERG. POWER
COT STOR.
OUTDOOR CLASSROOMS (SCARCE!)
PRIMARY
SERVICE
INTERMEDIATE
0 5' 10' 20' 30' 40' 50'
SHADING REPRESENTS PROTECTED AREA

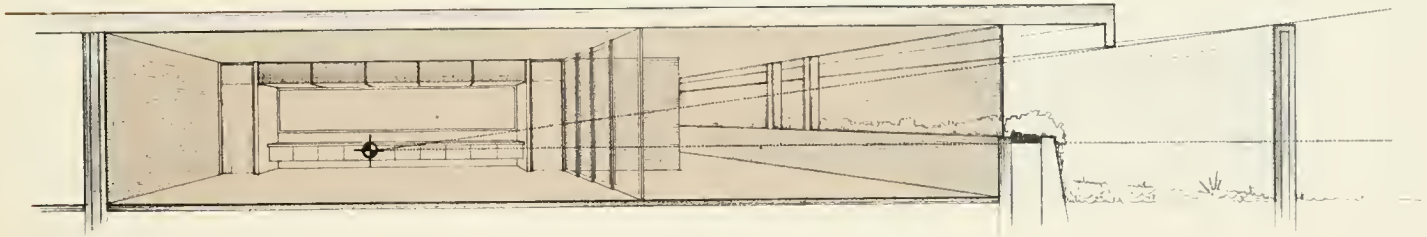
Floor Plan

Section B

South Elevation



Section — Intermediate Classroom



Section — Primary Classroom

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 3

SECOND PRIZE

Ronald E. Ginn, *Architect*
Gainesville, Florida

Team Member
Richard O. Newman, *Engineer*

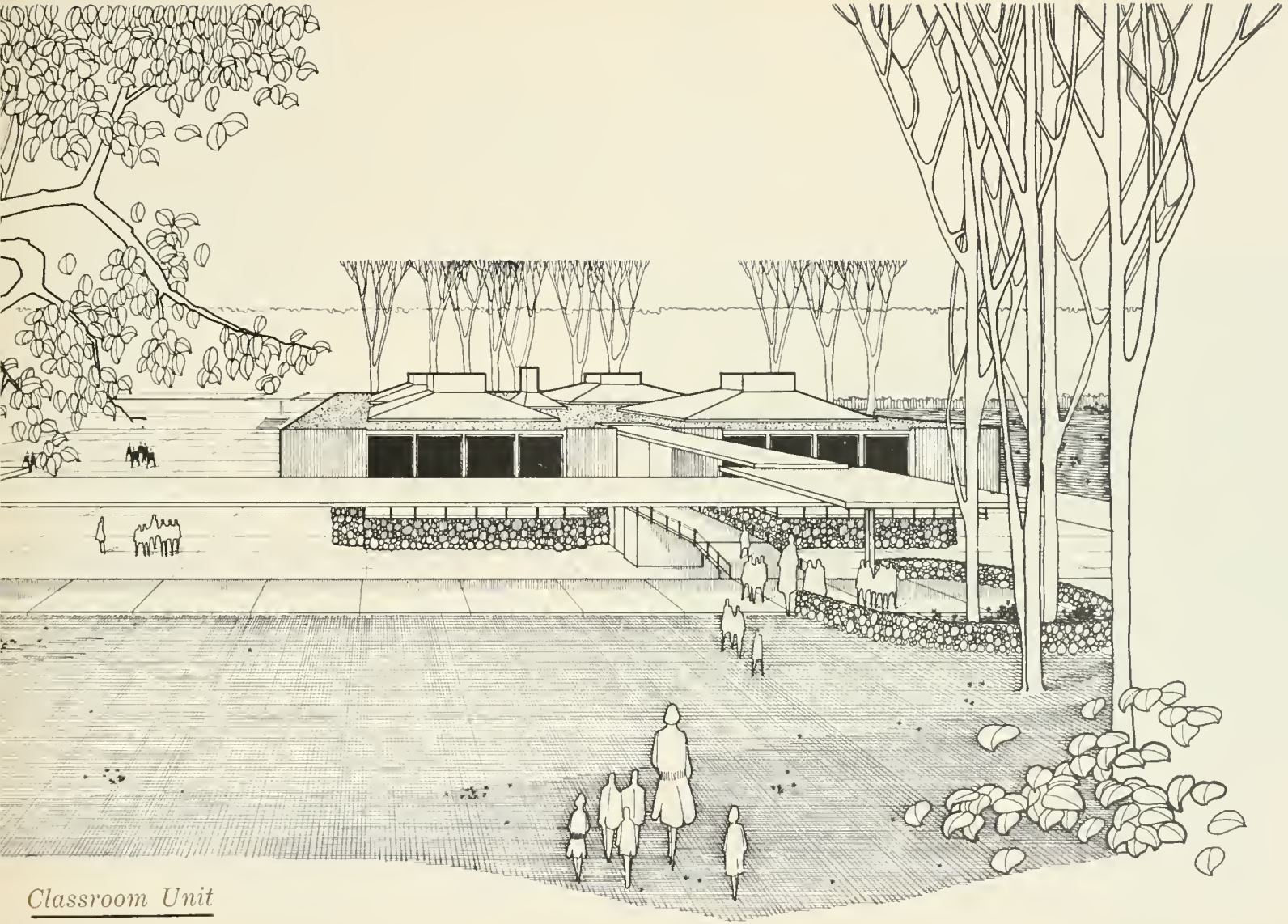
Jury Comment:

This is an interesting "cluster" concept, in which a depressed "patio" level is utilized as shelter area. The cumulative weight of roof and floor, together with the earth banks of the depressed areas, are utilized in providing the required protection. While nicely handled architecturally, some question exists as to the adequacy of communication between the separate shelter areas.

Analysts' Comment:

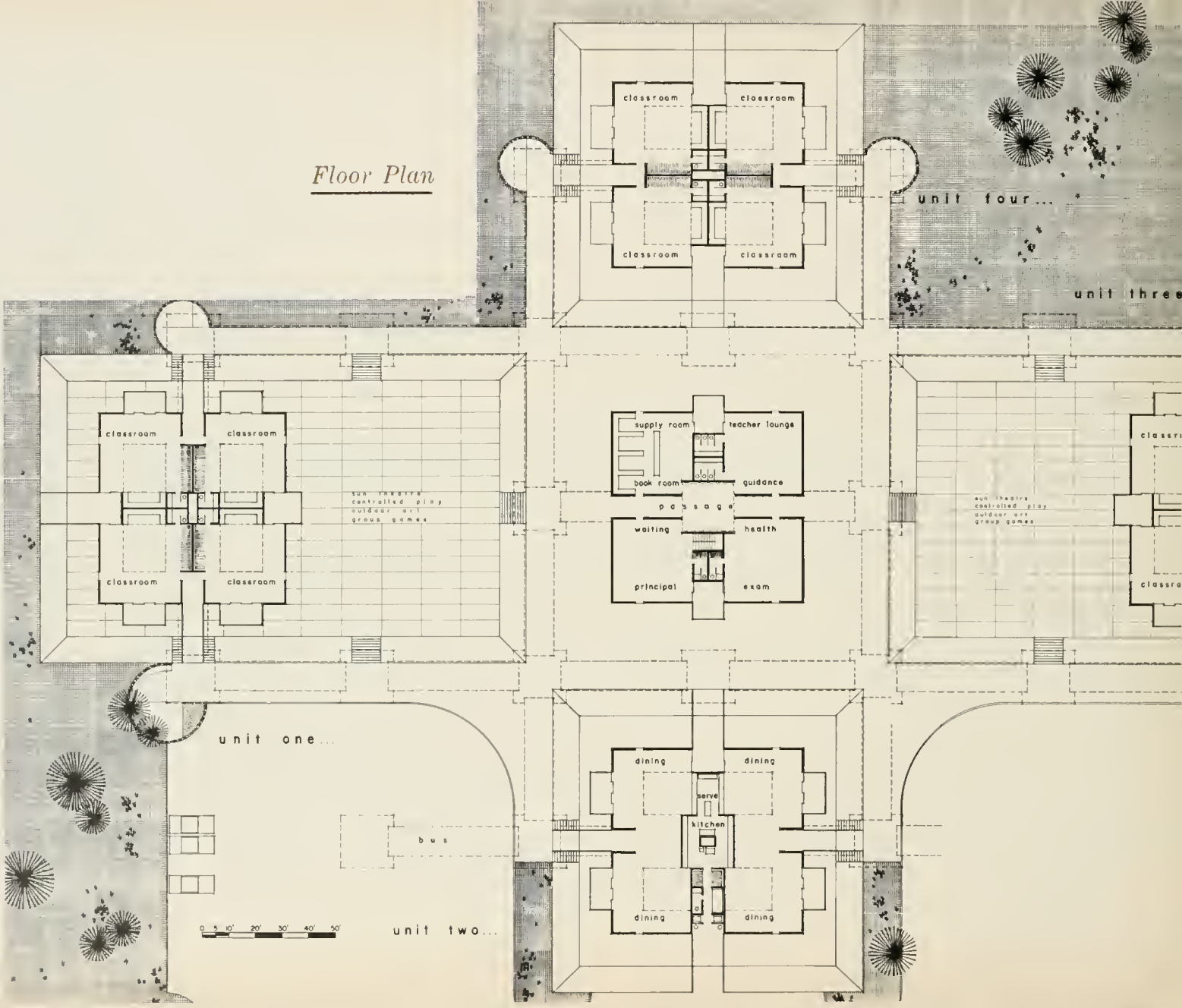
The use of mechanical equipment tunnels to provide circulation between shelter spaces is suggested. Access to toilet areas and circulation between levels could be further studied.

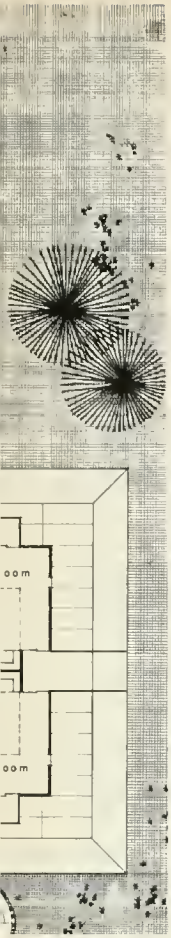
The simple ventilation concept is noteworthy. The use of normal structural floor and roof slabs over the shelter area provides sufficient mass weight for radiation protection with economy of construction.

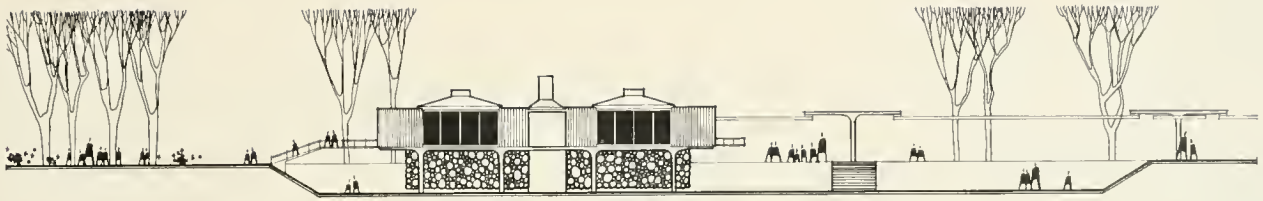


Classroom Unit

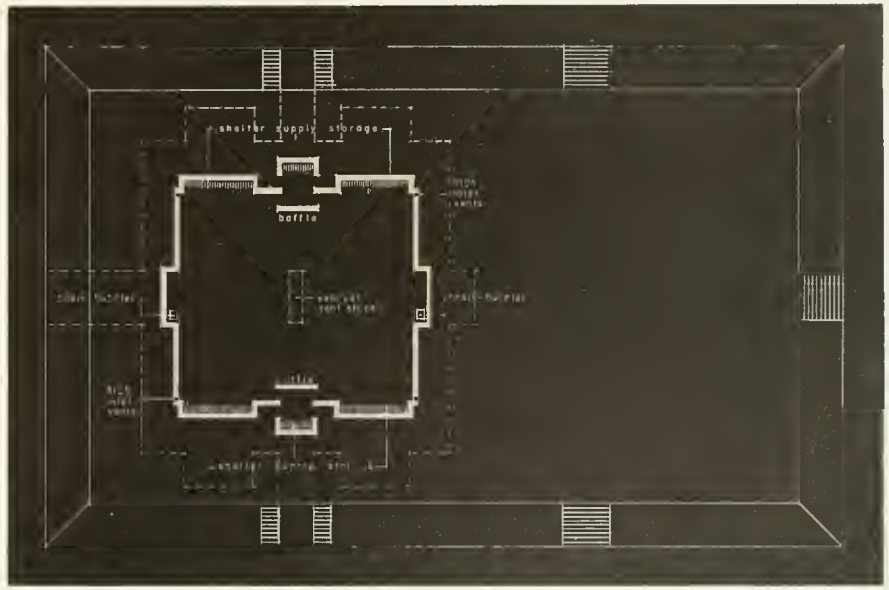
Floor Plan


classroom
classroom
classroom
classroom
unit four...
unit three
classroom
classroom
classroom
classroom
sun theatre
controlled play
outdoor art
group games
supply room
teacher lounge
book room
guidance
passage
waiting
health
principal
exam
sun theatre
controlled play
outdoor art
group games
unit one...
bus
dining
dining
serve
kitchen
dining
dining
0 5 10' 20' 30' 40' 50'
unit two...

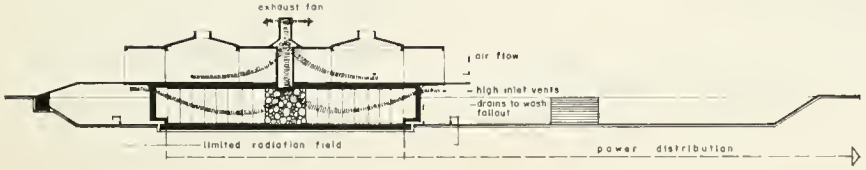




Classroom Unit through Lower Court . . . South



Unit 1 Multi-use Space . . . Typical



Mechanical Equipment Distribution . . . Section

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 3

THIRD PRIZE

Kirk R. Craig, AIA
Craig and Gaulden, *Architects*
Greenville, South Carolina

Team Member
G. H. Giebner, AIA, *Architect and Engineer*

Jury Comment:

A strong, dramatic statement, this school is of particular interest because of its large instructional area with no "classrooms" and its method of indirect daylighting and natural ventilation.

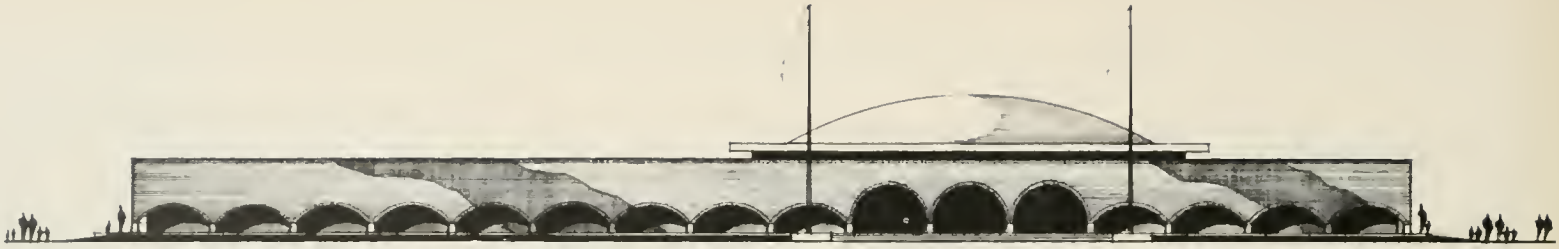
Analysts' Comment:

This design presents an interesting and useful example of the use of masonry as a material for shielding, and suggests an area for further investigation and research.

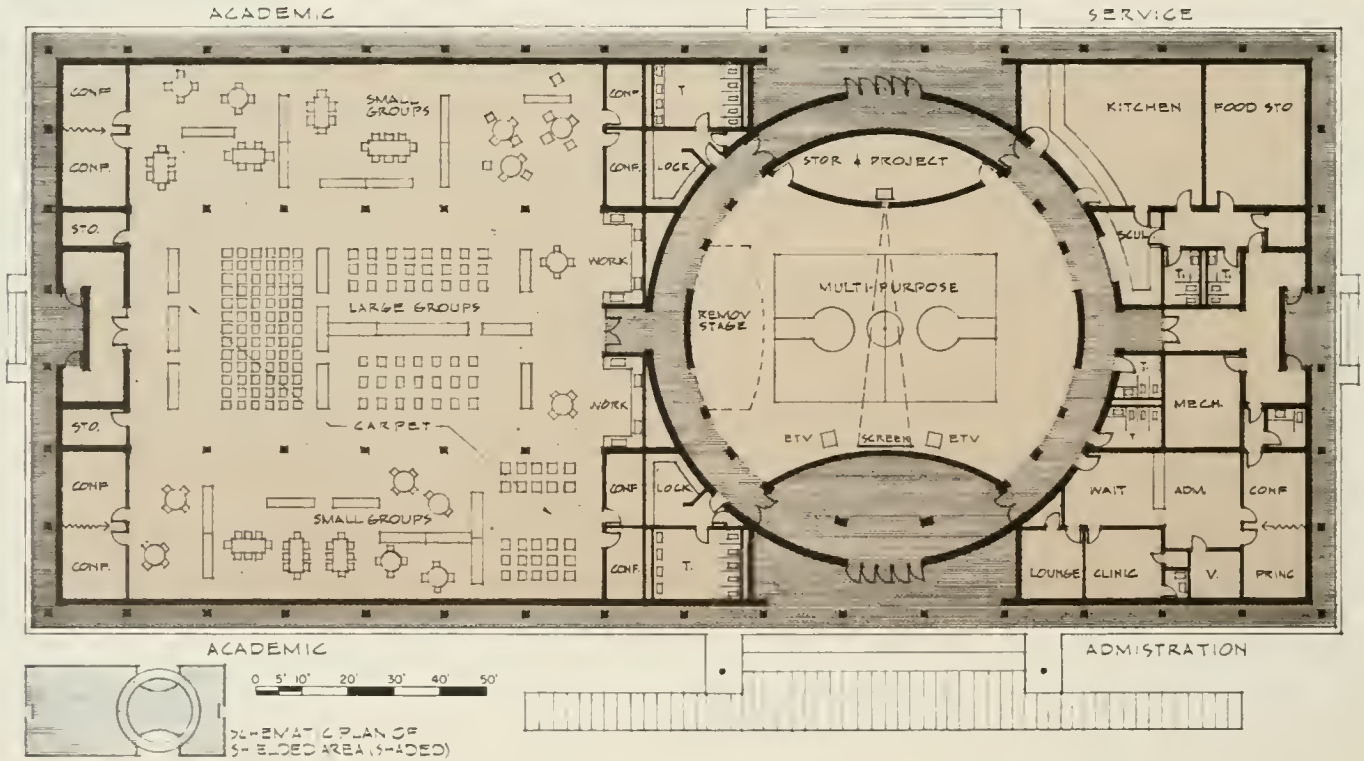
The creation of shelter which not only physically provides protection, but visually appears to do so, is a psychological plus factor in shelter habitability.

The use of earth within the roof construction as illustrated by the detailed section on the drawing involves an unnecessarily complex construction procedure.

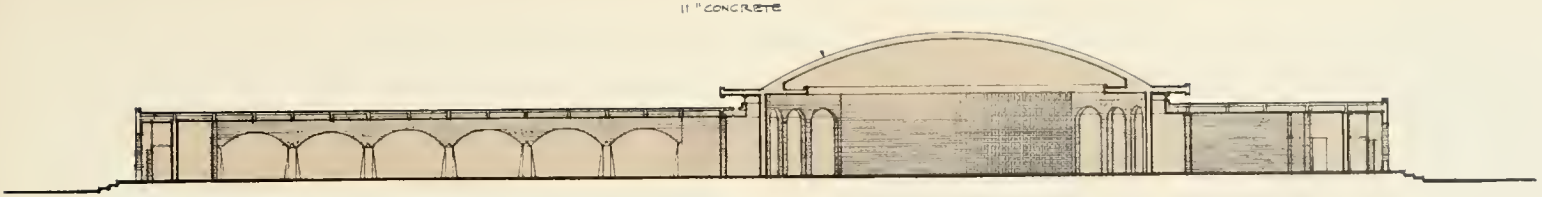
Perspective



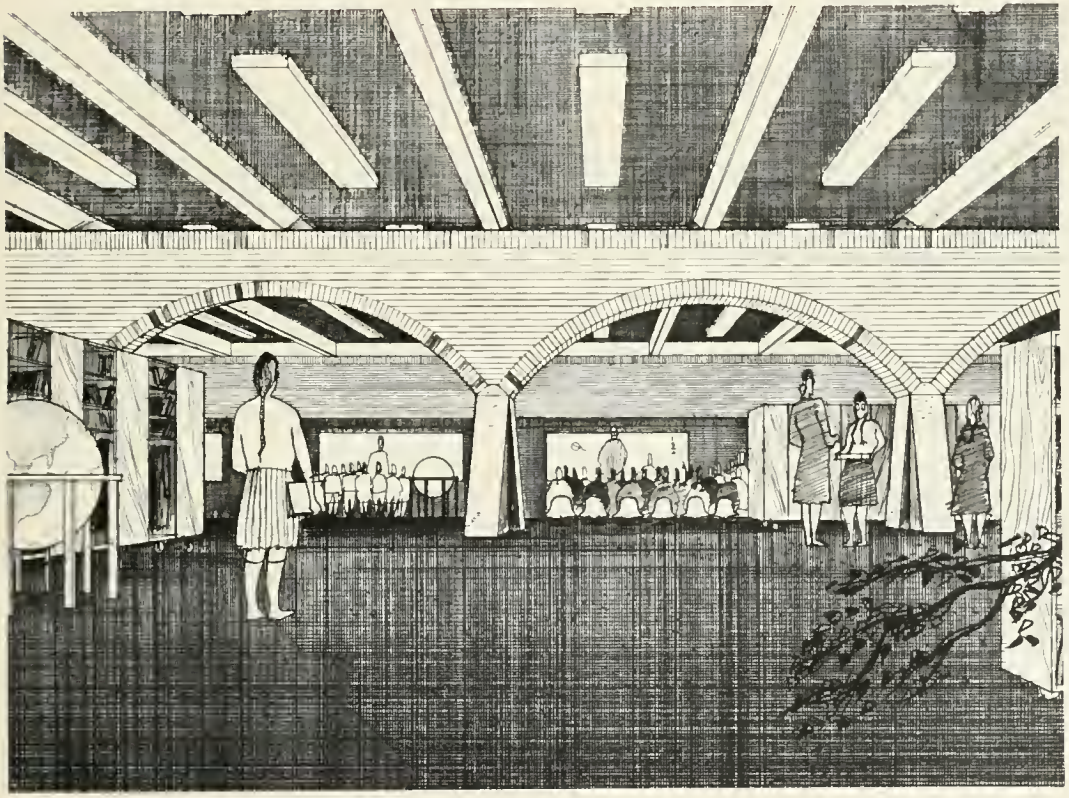
Front Elevation



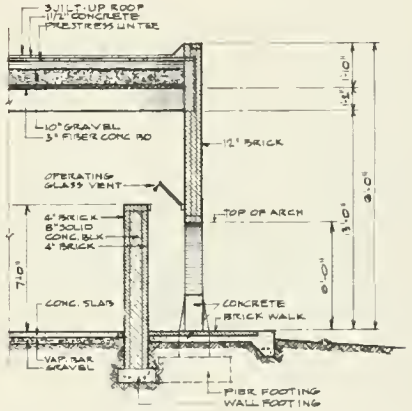
Floor Plan



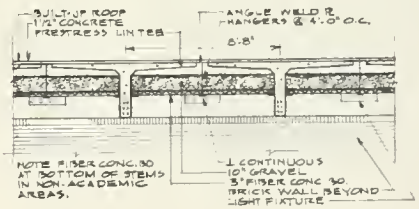
Longitudinal Section



Interior Perspective



Wall Construction Section



Typical Roof Section

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 3

CERTIFICATE OF MERIT

Charles E. Rogers, *Architect*
Mobile, Alabama

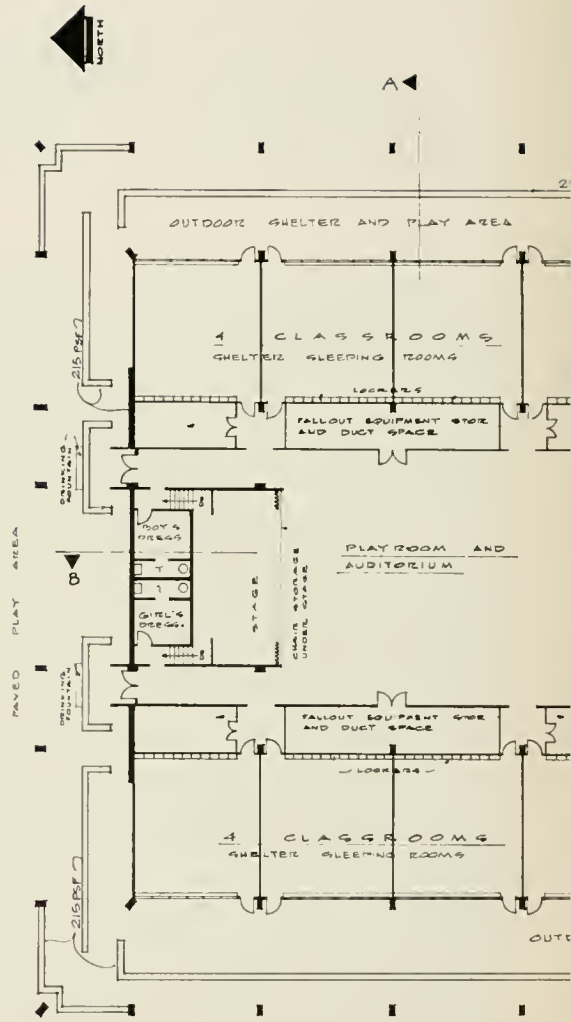
Team Member
Marvin C. Hill, Jr., *Architect*

Jury Comment:

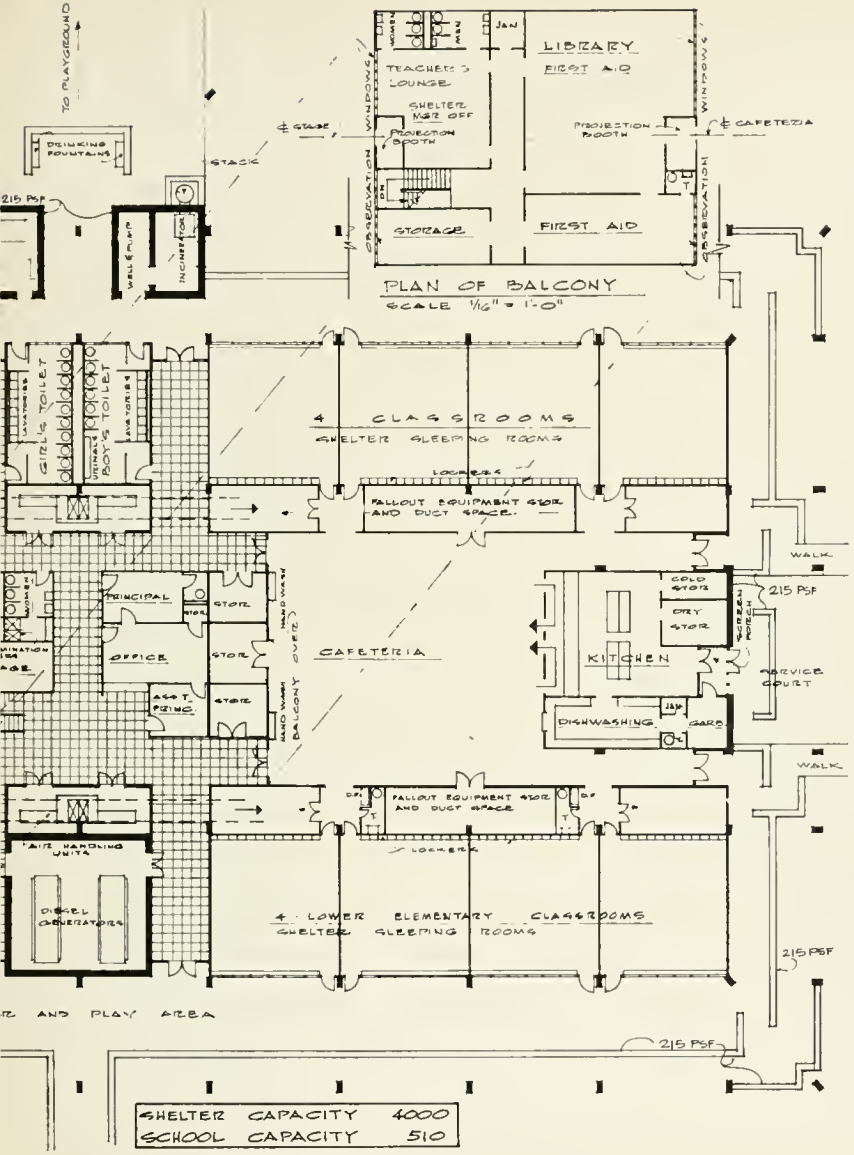
This school has a unique system of baffle walls and overhangs which provide natural light and ventilation, and a high utilization as shelter area.

Analysts' Comment:

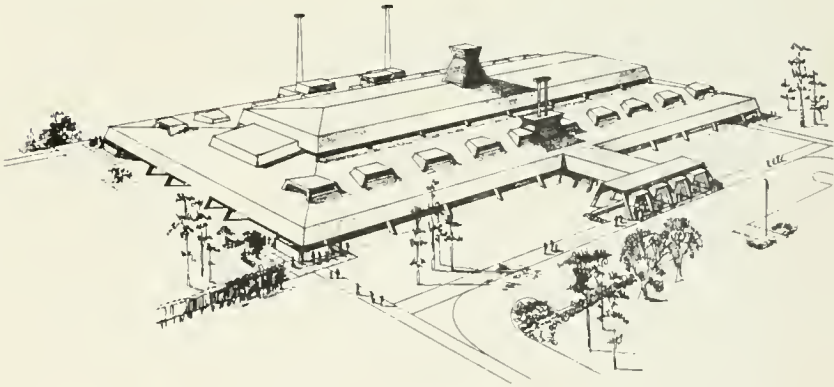
The school has a protection factor considerably higher than the minimum required value, assuming that no fallout will drift in around the exterior walls. However, massive shielding is needed to obtain protection in this aboveground construction.



Floor Plan



Section A



Perspective from Northwest

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 4

FIRST PRIZE

Brian Crumlish, *Architect*
Urbana, Illinois

Team Members

John T. Hanley, *Instructor, Dept. of Civil Eng., University of Illinois*
Carl R. Nelson, Jr., *Architect*

Jury Comment:

This is a very interesting concept in which an abovegrade school is combined with an underground shelter area, all on the same level. As a school, it is extremely simple and well organized and would be a pleasant building with nice spaces. The exterior is somewhat massive and imposing; however, it is very much in character with the underground concept and provides a high degree of openness for the instructional spaces.

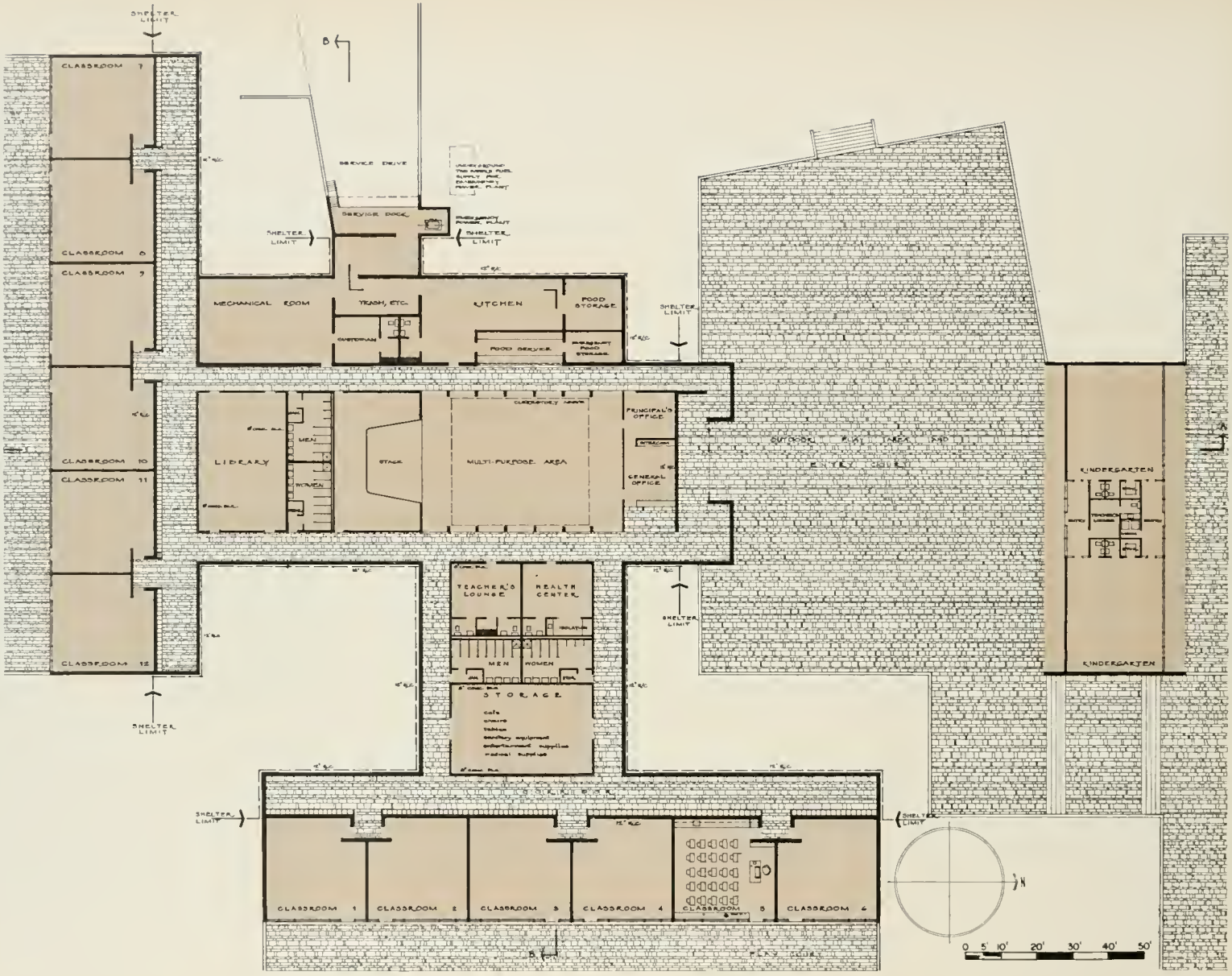
The building is equally well organized as a shelter. The classroom wings are used as well-baffled buffers on two sides, with the entire service area being protected by an earth cover. The multipurpose area has a high, well-screened clearstory which provides natural light and ventilation in a portion of the shelter area. Overall, a very nice scheme.

Analysts' Comment:

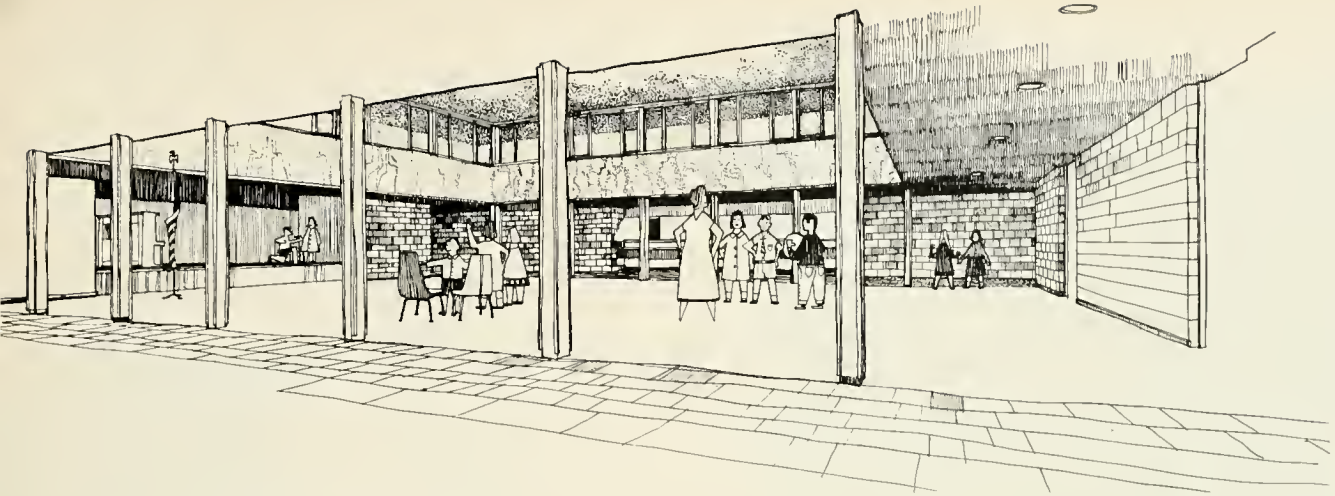
The sculptured earth provides a very effective wall shield against ground direct and skyshine contributions. The two-foot earth cover over the roof provides excellent protection. The shelter area adjacent to the classrooms is well shielded through the use of bearing walls and baffles at the classroom entrances. The use of baffles at the main entrance and the service dock is unusually well handled.

The basic design concept includes use of all conventional service areas—toilets, kitchen, and health center—within the protected area. Provision for ventilation during emergency conditions is effective.

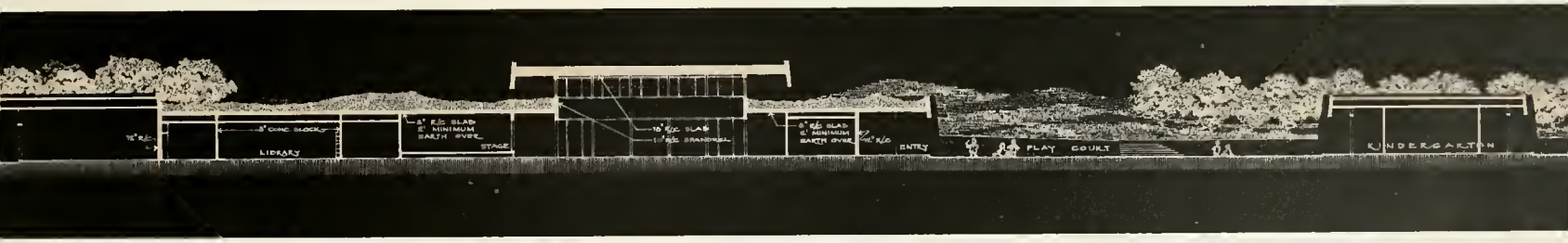
Perspective
Looking Southwest


SHELTER LIMIT
CLASSROOM 7
CLASSROOM 8
CLASSROOM 9
CLASSROOM 10
CLASSROOM 11
CLASSROOM 12
SERVICE DRIVE
SERVICE DOCK
MECHANICAL ROOM
TRASH, ETC.
JANITOR
KITCHEN
FOOD STORAGE
FOOD SERVICE
LIBRARY
MEN
WOMEN
STAGE
MULTI-PURPOSE AREA
PRINCIPAL'S OFFICE
GENERAL OFFICE
OUTDOOR PLAY AREA
KINDERGARTEN
TEACHER'S LOUNGE
HEALTH CENTER
ISOLATION
STORAGE
CLASSROOM 1
CLASSROOM 2
CLASSROOM 3
CLASSROOM 4
CLASSROOM 5
CLASSROOM 6
PLAY YARD
N
0 5' 10' 20' 30' 40' 50'

Floor Plan



Multipurpose Area



Section A A

North Elevation

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 4

SECOND PRIZE

Charles William Brubaker, AIA, *Architect*
Winnetka, Illinois

Team Members

Edgard C. Colin, *Engineer (structural)*
Hem C. Gupta, *Engineer (mechanical & electrical)*
John F. Janiga
James Allyn Stewart, *Architect*

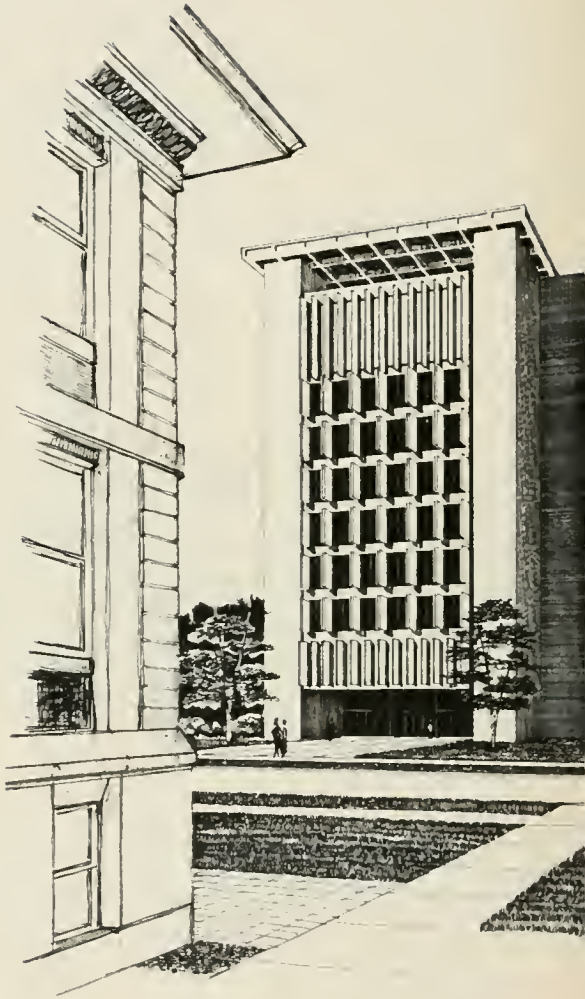
Jury Comment:

This nine-story urban school was the only entry which approached this type of problem. The building, on a small site in a congested area, has been handled very well and provides most of the amenities of a one-story school. The instructional spaces provide a high degree of flexibility for a challenging educational program.

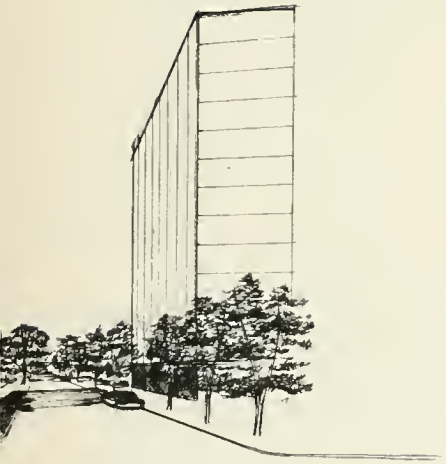
Six floors of the building, three through eight, are utilized as shelter area, making use of the cumulative roof and floor weights in achieving the required protection. An interesting scheme involving a double set of concrete shutters, which serve as sun screens when open, is used to accomplish the necessary exterior wall mass. It should be noted that, in a multistory building such as this, the wall mass required for shielding will be a function of rooftop contamination from adjoining buildings and that protective shutters may not always be required.

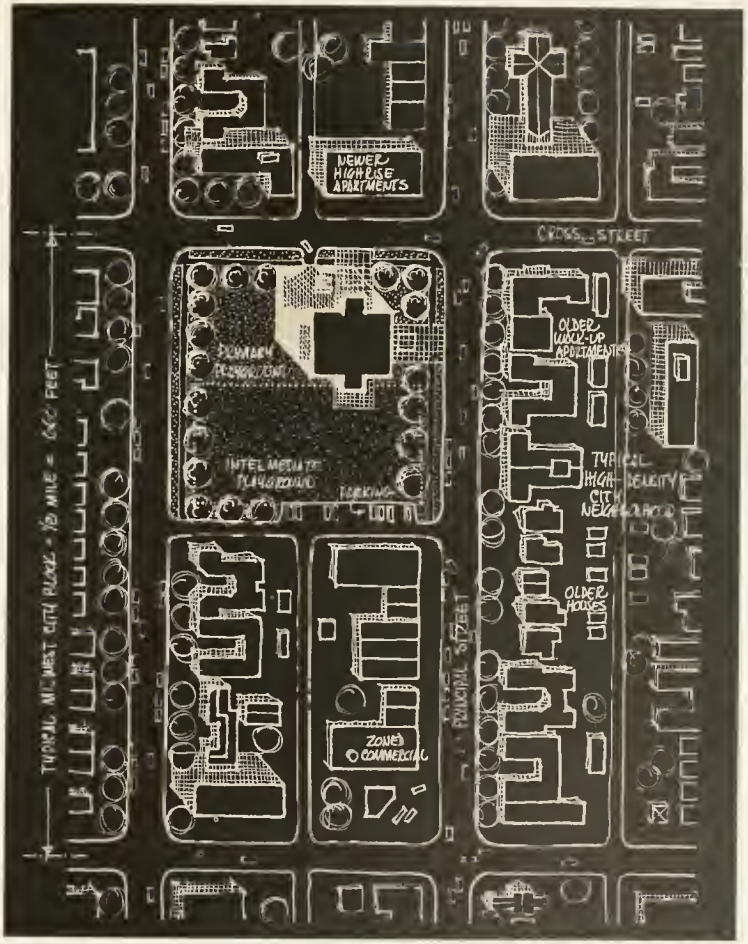
Analysts' Comment:

The double set of concrete shutters provides adequate protection against ground direct radiation and skyshine on floors three through eight. The design intent includes a gradual opening of shutters as fallout decays. In multistory buildings of this type, protection factors of the order of 100 or more can be achieved even without the use of shutters. To accomplish this would require further study of windowsill heights.

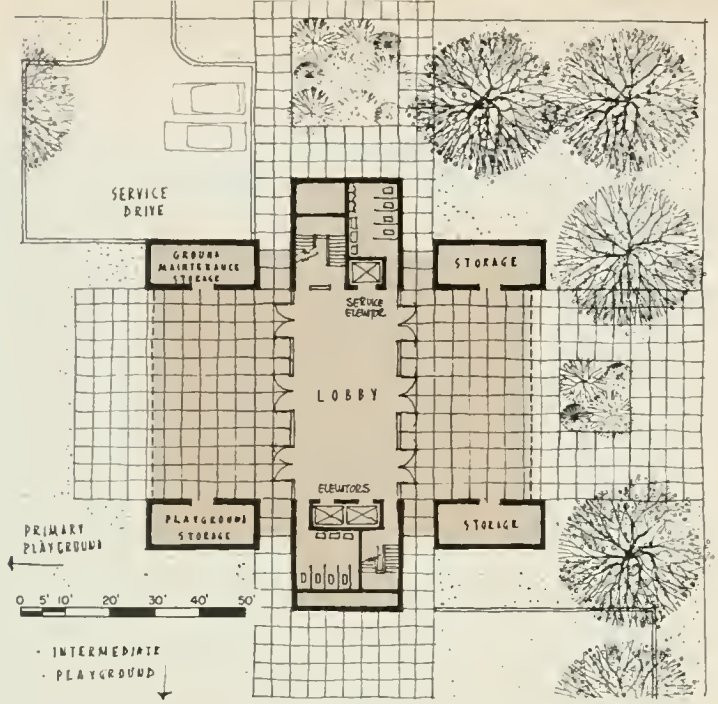


Perspective

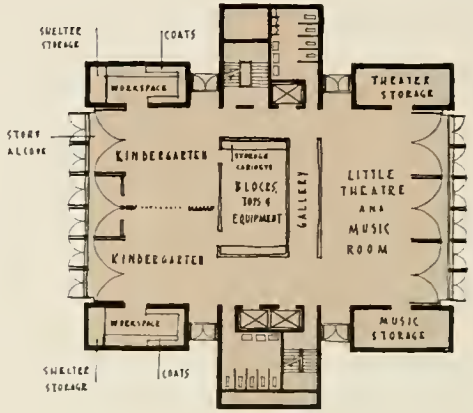



NEWER HIGH-RISE APARTMENTS
CROSS STREET
OLDER WALK-UP APARTMENTS
PRIMARY
INTERMEDIATE PLAYGROUND
PARKING
TYPICAL HIGH-DENSITY CITY NEIGHBORHOOD
OLDER HOUSES
ZONED COMMERCIAL
TYPICAL MIDWEST CITY BLOCK = ½ MILE = 2640 FEET

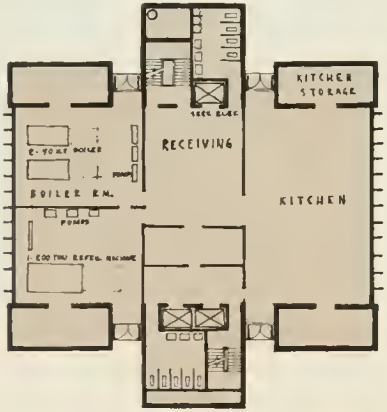
Plot Plan



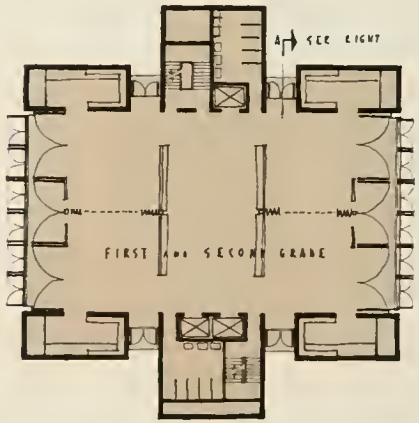
Ground Floor Plan



3rd Floor—Kindergarten

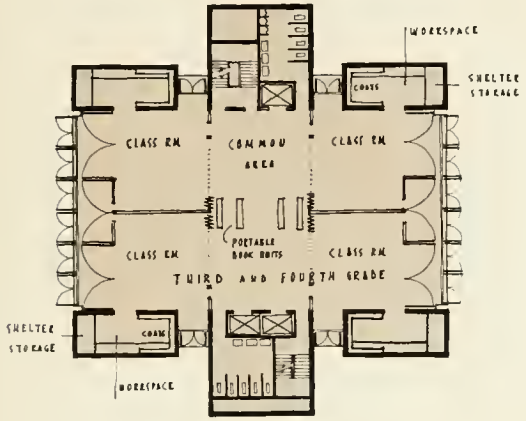


2nd Floor—Services

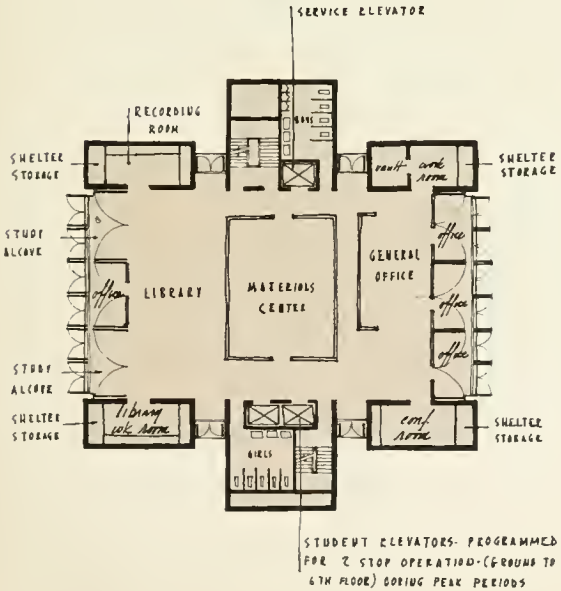


4th Floor—First and Second Grades

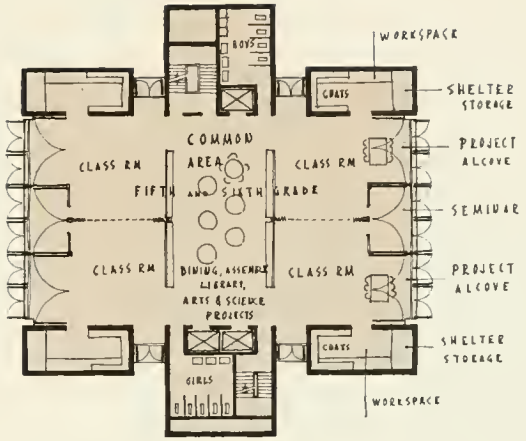
5th Floor—Third and Fourth Grades



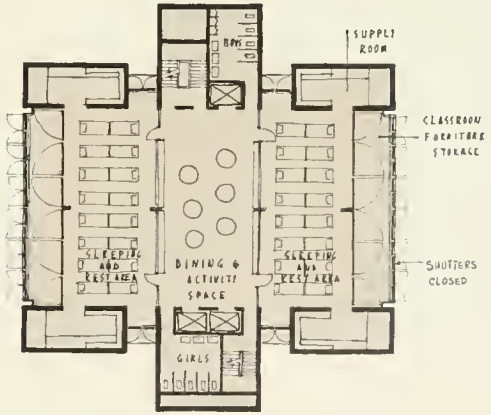
6th Floor—Library and Administration

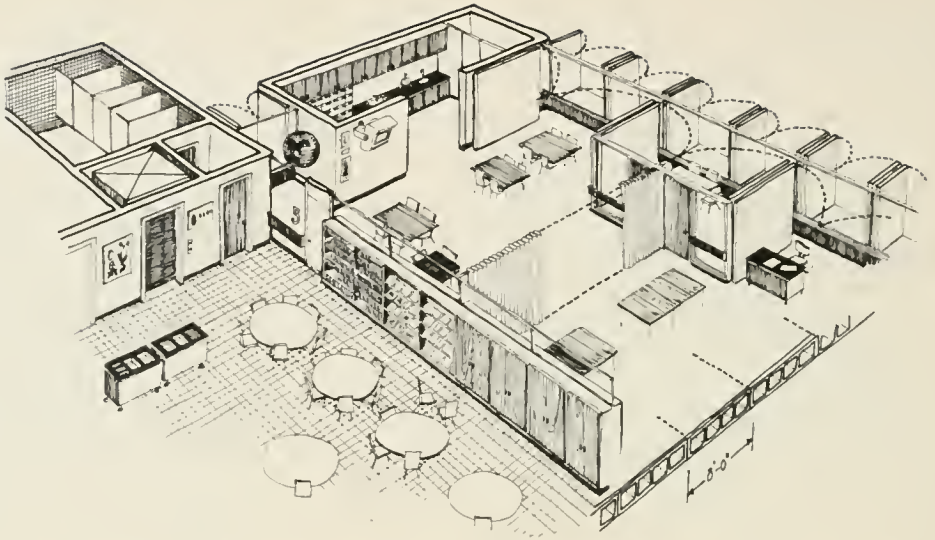


7th Floor—Fifth and Sixth Grades

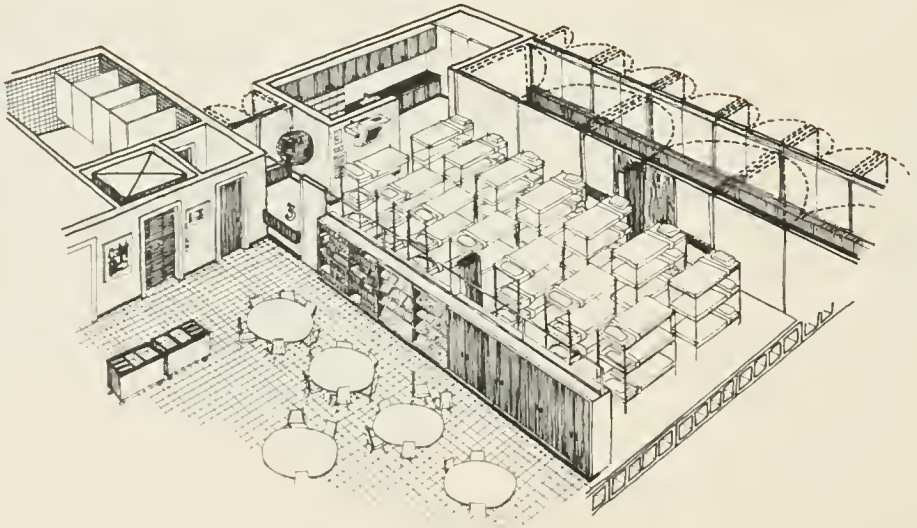


8th Floor—Seventh and Eighth Grades

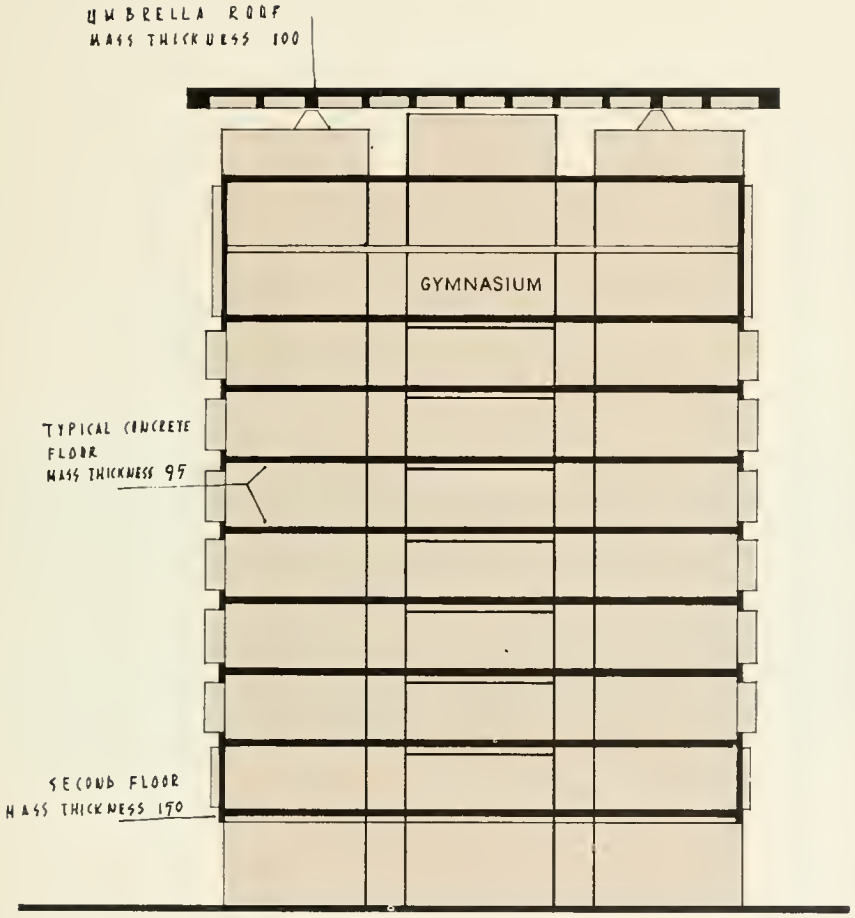




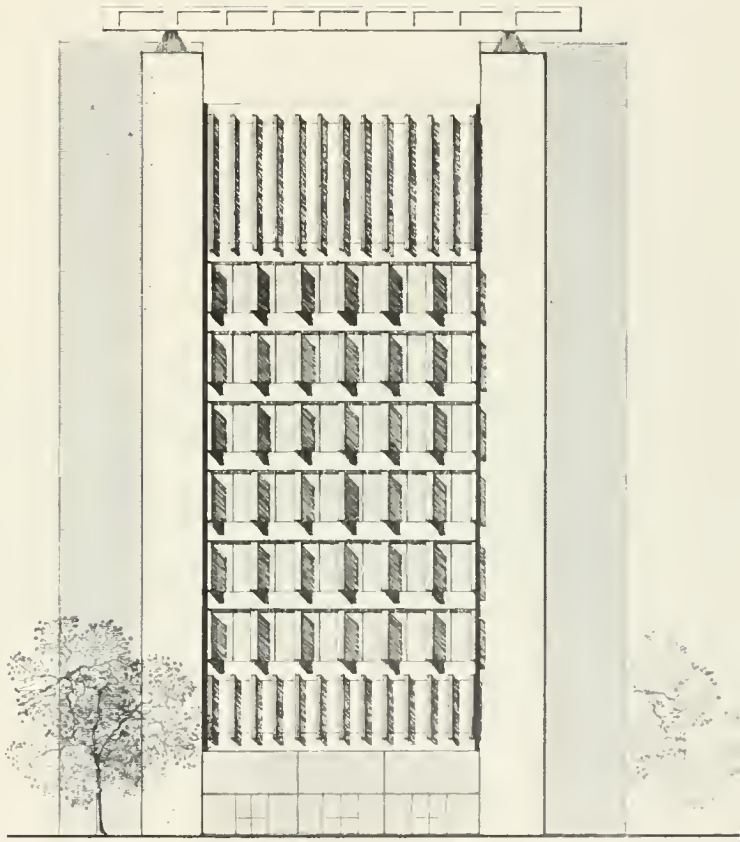
Typical Classroom and Common Area



Typical Classroom and Common Area in Use as a Shelter



Section



East Elevation

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 4

THIRD PRIZE

Frank A. Dyszewski, *Architect*
Warren, Michigan

Team Members

R. J. Tobin, AIA, *Architect*
M. Balderi
J. Renvez
J. J. Nagy, Jr., AIA, *Architect*
C. F. Fleckenstein

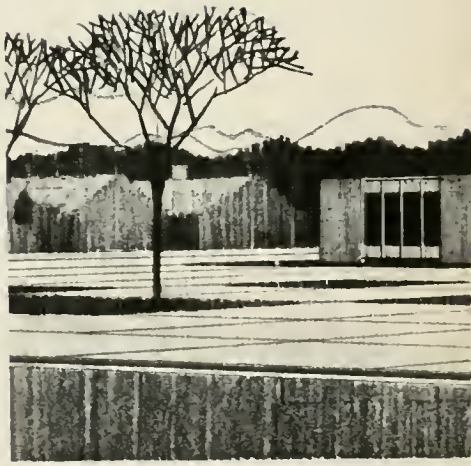
Jury Comment:

A simple core plan which uses a highly baffled multipurpose room as shelter area. Balconies on two sides of the room provide additional shelter area. The mechanical and electrical systems are well developed.

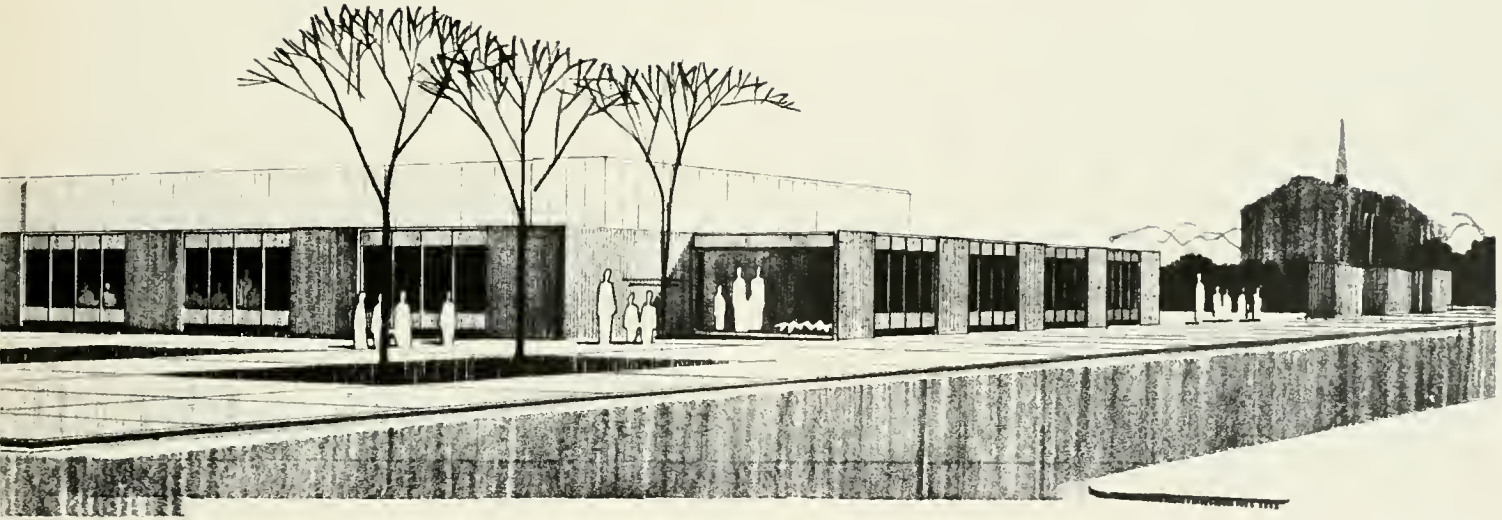
Analysts' Comment:

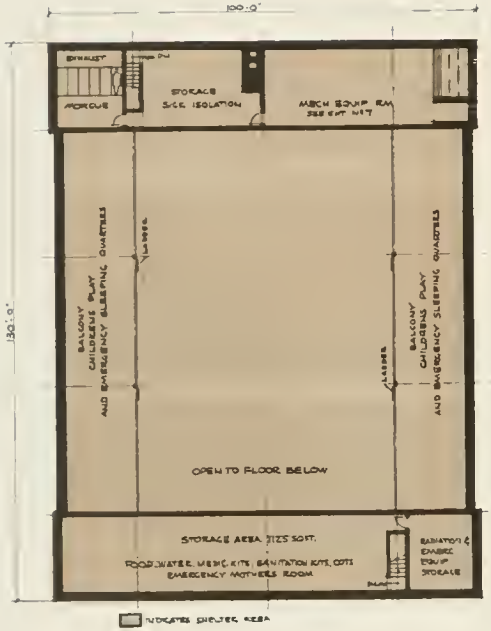
The interior core uses a massive wall thickness to provide the necessary shielding. A transfer of a portion of this wall weight to the partition at the classroom side of the corridor and improvement of the classroom door baffles will permit use of the corridor as shelter after radiation has begun to subside.

The filter in the mechanical room should be shielded to prevent excessive radiation exposure to persons servicing the equipment.

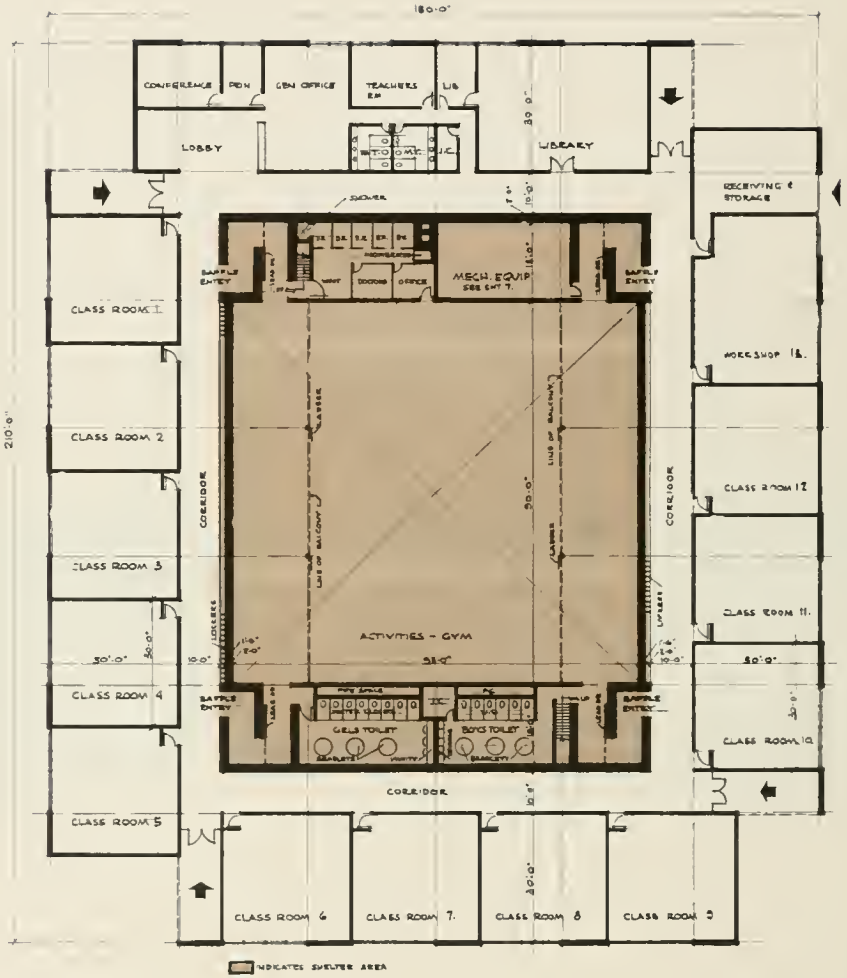


Perspective of Exterior

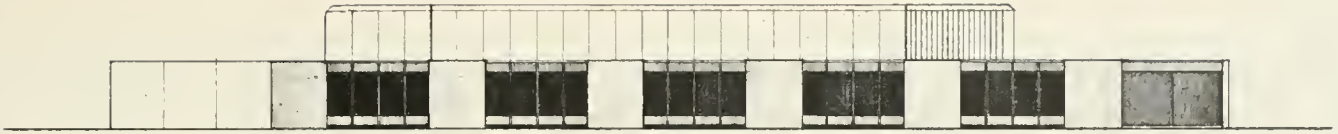




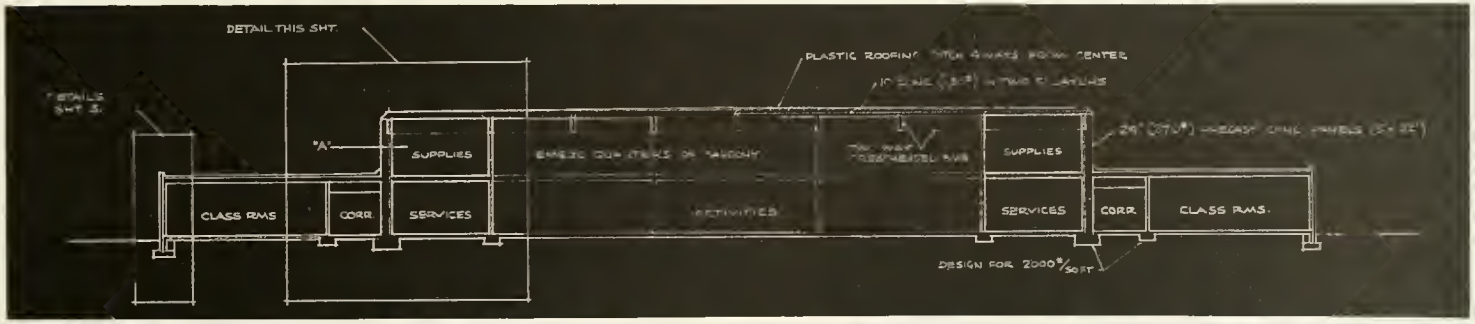
Plan of Second Level



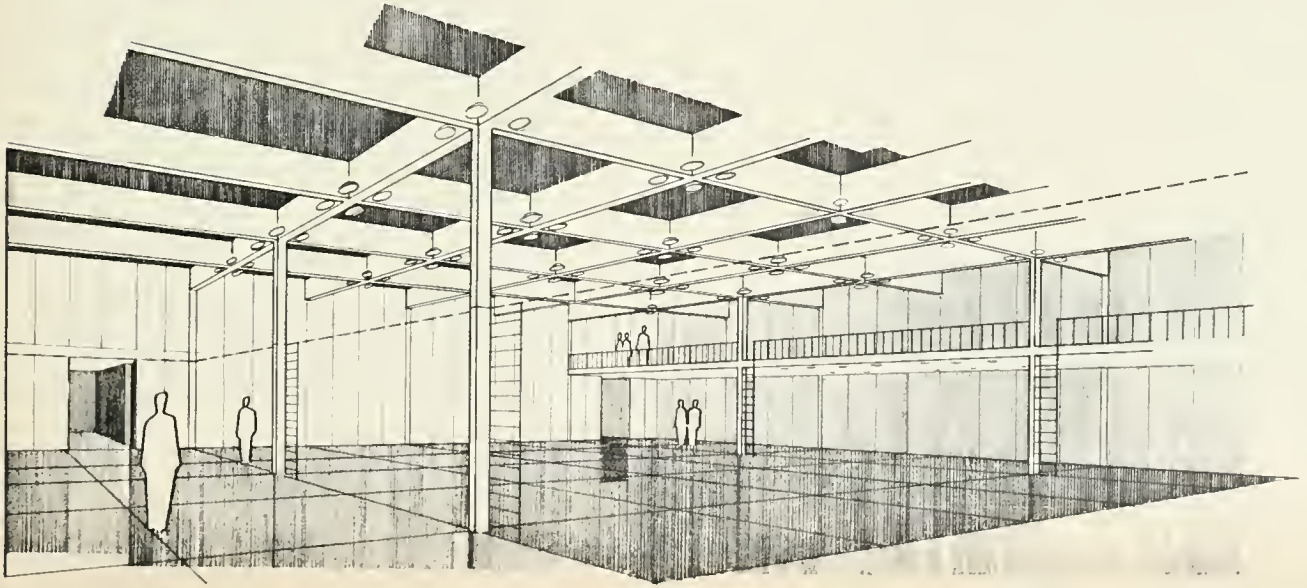
Plan of Main Level



East Elevation



Major Section



Perspective of Interior

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 4

CERTIFICATE OF MERIT

Ambrose M. Richardson, AIA
Richardson, Severns, Scheeler & Associates, *Architects*
Champaign, Illinois

Team Members

John E. Severns, AIA, *Architectural Engineer*
James A. Scheeler, AIA, *Architect*
Phillip J. Greene, *Architect*
Richard E. Spencer, AIA, *Architect*
C. J. Winters
R. J. Diedrich
R. T. Ruggles
P. Tan
E. B. Philippson

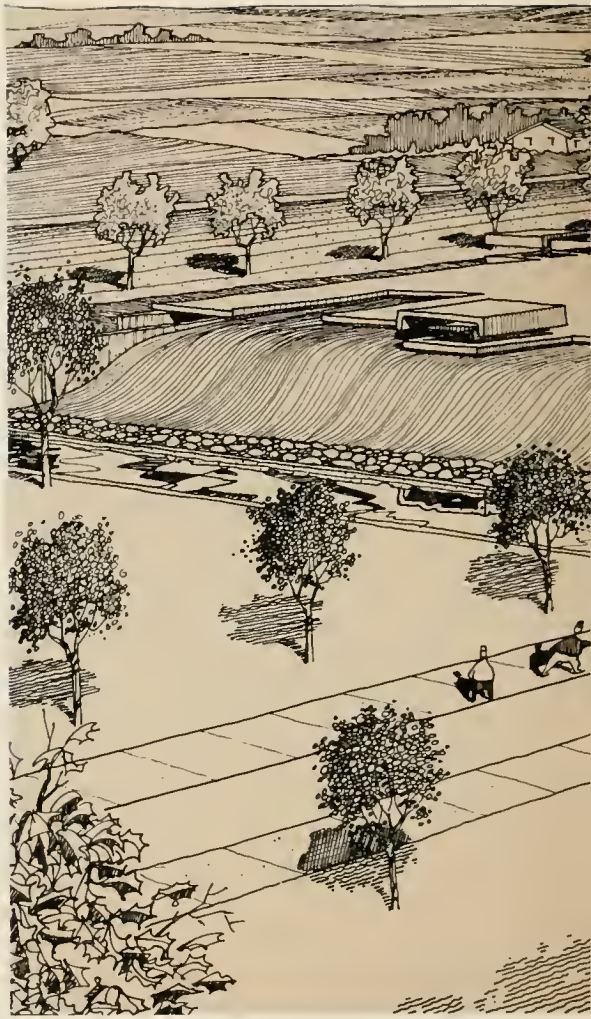
Jury Comment:

Two points of special interest are noted in this school. The first is the use of an inexpensive earth berm around the entire building. The second, and most interesting, is the use of hydraulically operated "lift-roofs" over the central court and ventilating shafts. Although some question as to the feasibility of this concept exists, this is the best developed scheme of this type submitted.

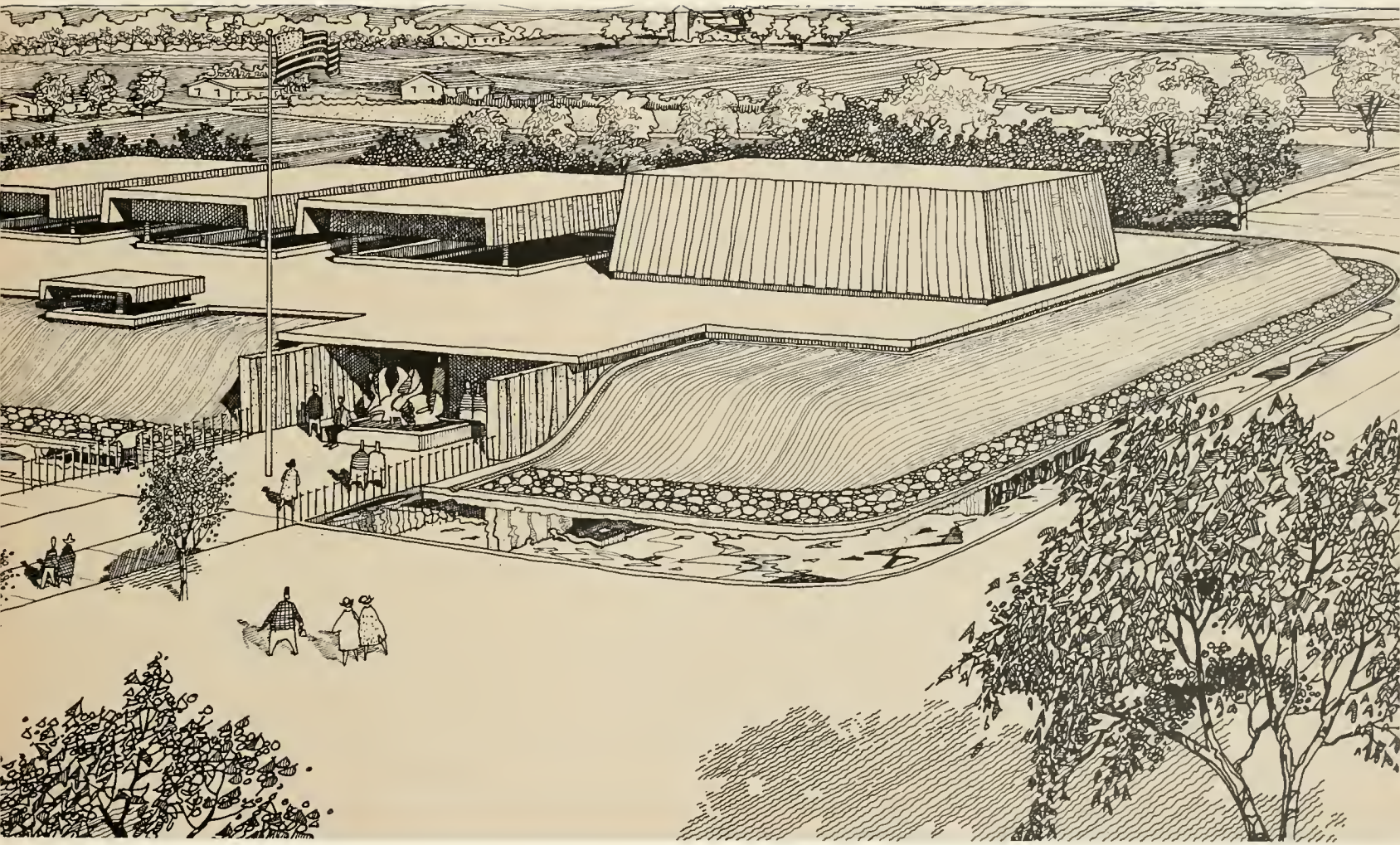
Analysts' Comment:

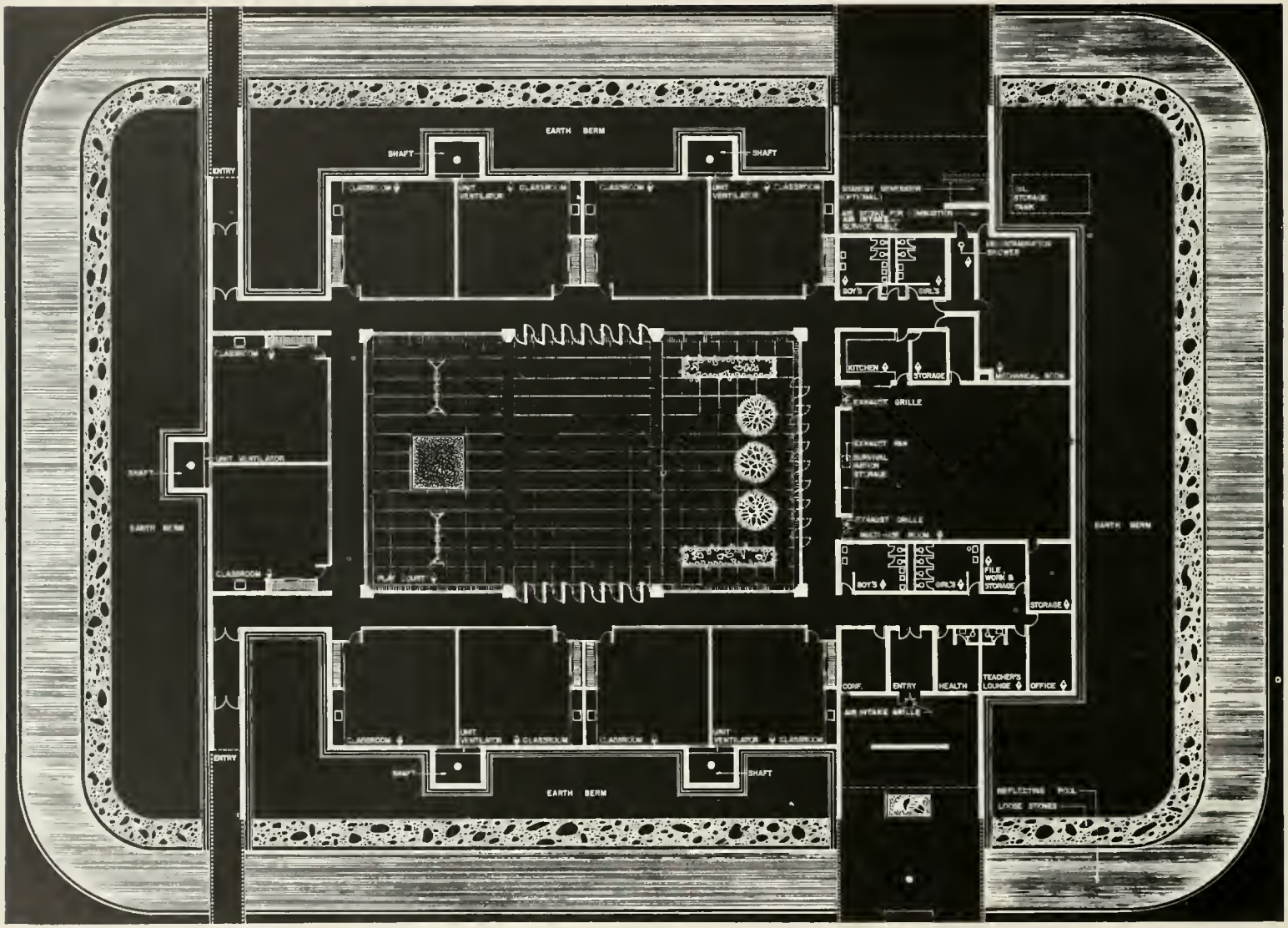
A fixed roof system, with judicious use of overhangs and clearstory windows as used in a number of the other entries, furnishes adequate protection from skyshine with greater economy than the hydraulically operated lift-roofs shown. The operable system does provide a view to the sky, natural ventilation and shade when in open position, and protection from the weather when closed.

The location of a window in the health room is questioned as it reduces the protection in this area.

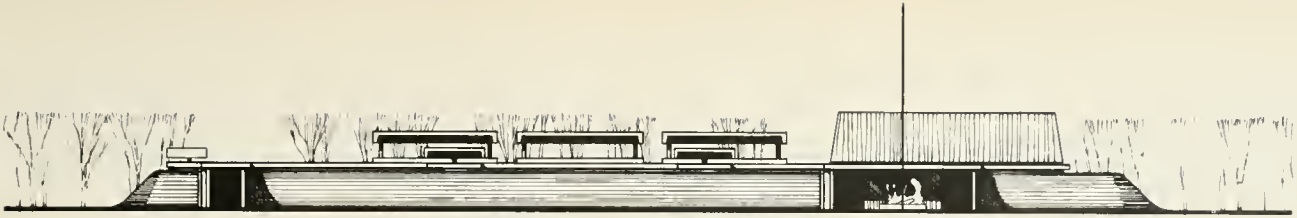


Perspective of Exterior

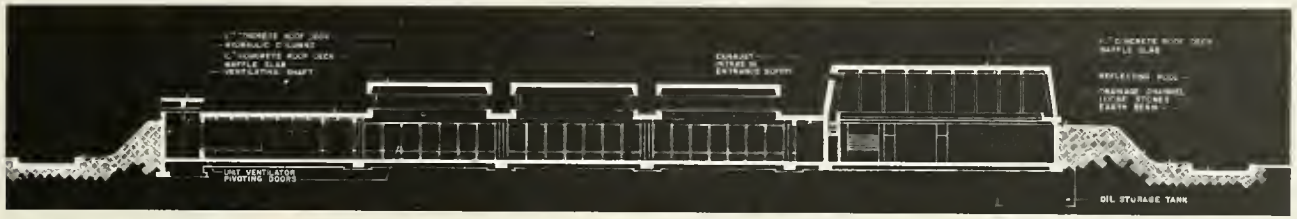



EARTH BERM
SHAFT
SHAFT
ENTRY
CLASSROOM
UNIT VENTILATOR
CLASSROOM
CLASSROOM
UNIT VENTILATOR
CLASSROOM
EMERGENCY GENERATOR (OPTIONAL)
AIR INTAKE FOR VENTILATION SERVICE TUNNEL
OIL STORAGE TANK
DECONTAMINATION SHOWER
BOY'S
GIRL'S
KITCHEN
STORAGE
MECHANICAL RM.
EXHAUST GRILLE
EXHAUST FAN
SURVIVAL RATION STORAGE
EXHAUST GRILLE
MULTI-USE ROOM
CLASSROOM
UNIT VENTILATOR
SHAFT
EARTH BERM
CLASSROOM
PLAY COURT
BOY'S
GIRL'S
FILE, WORK & STORAGE
STORAGE
EARTH BERM
CONF.
ENTRY
HEALTH
TEACHER'S LOUNGE
OFFICE
AIR INTAKE GRILLE
CLASSROOM
UNIT VENTILATOR
CLASSROOM
CLASSROOM
UNIT VENTILATOR
CLASSROOM
ENTRY
SHAFT
SHAFT
EARTH BERM
REFLECTING POOL
LOOSE STONES

Floor Plan

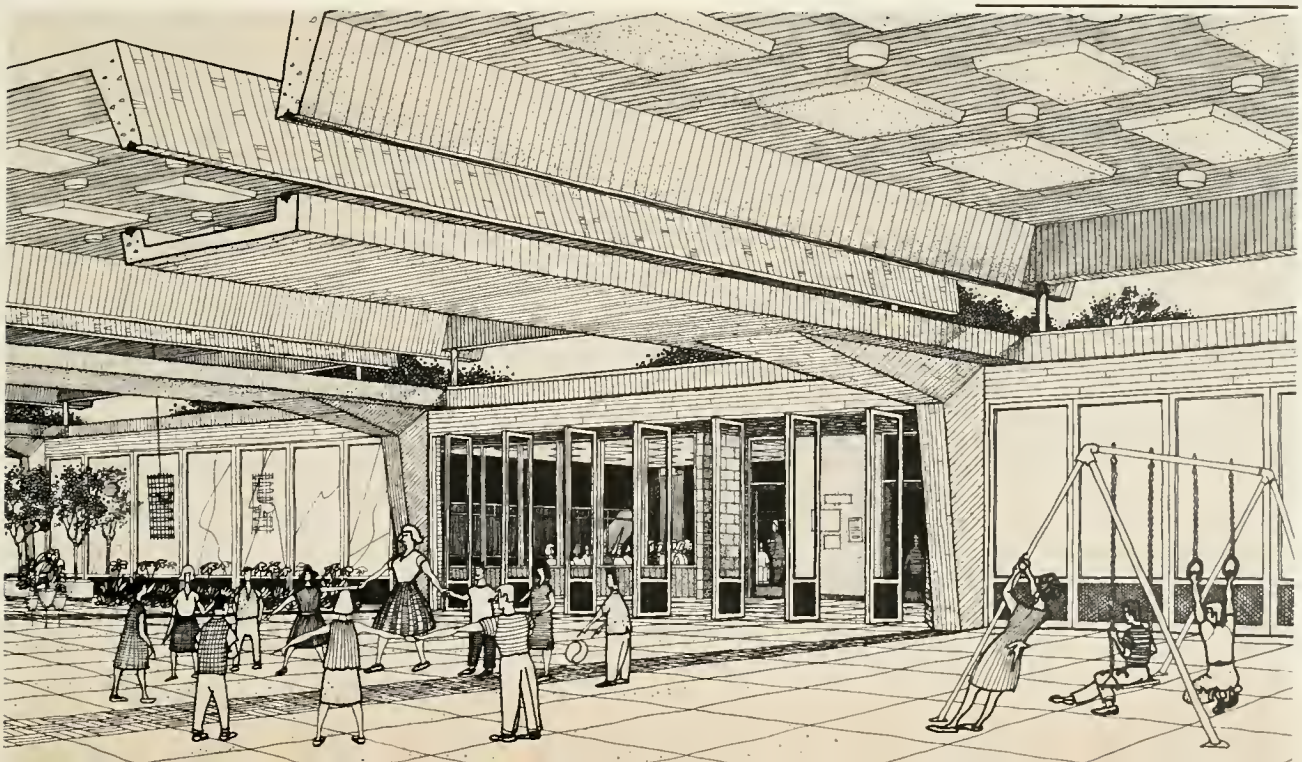


South Elevation



Longitudinal Section

View of Center Court



NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 5

FIRST PRIZE

Robert F. Coffee
Austin, Texas

Team Members

Rodney Ludwig, *Engineer*
Kelly R. McAdams, AIA, *Architect*

Jury Comment:

This is one of the most exciting and imaginative schemes submitted in the competition. Four highly developed "teaching units," located at the corners of the building, surround an open central multipurpose area and the service areas. A very simple, well-organized school plant is thus created, with exciting vistas and space relationships.

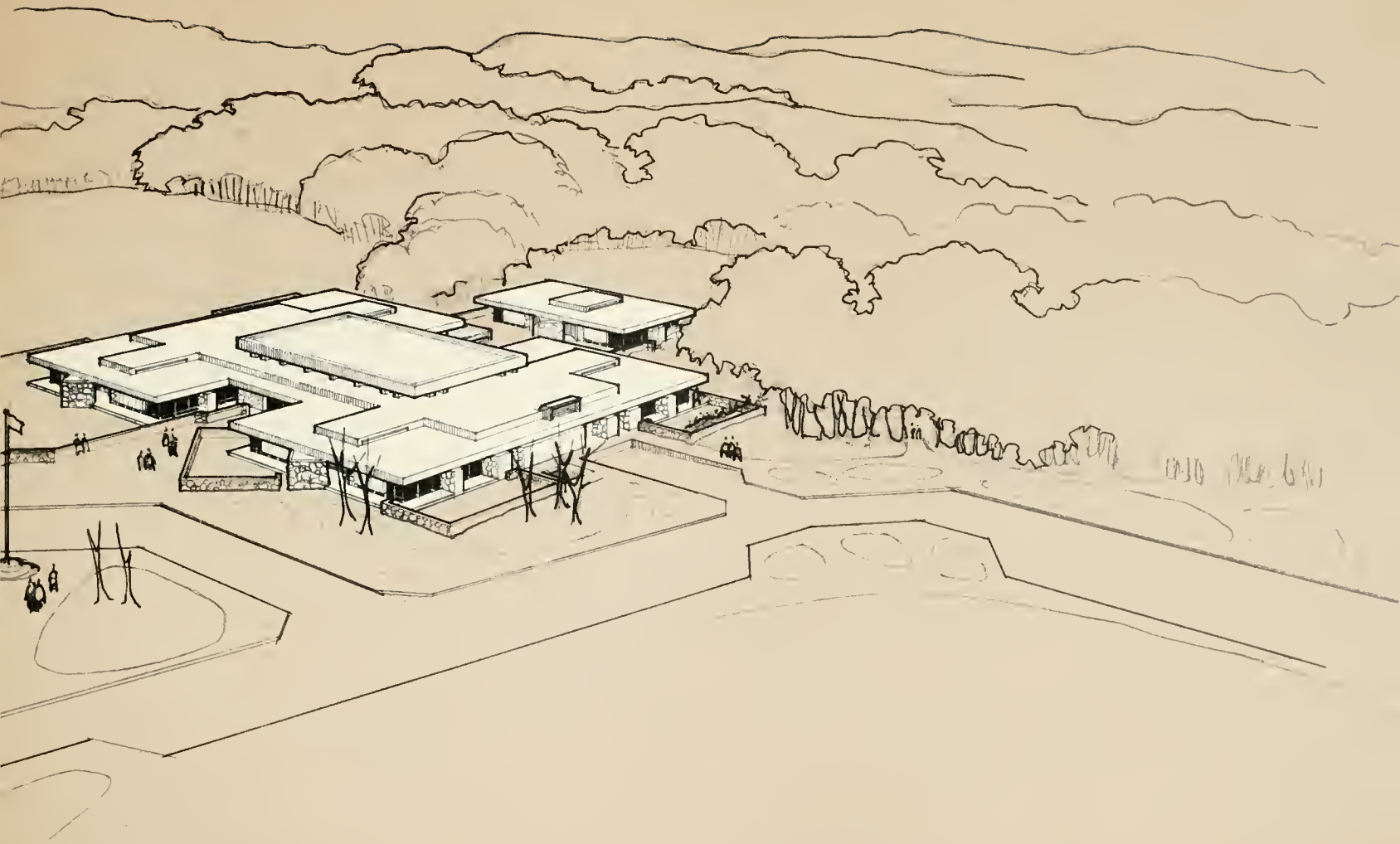
The creation of the protected area is, however, of even greater interest. Here is a completely open shelter area, with a clearstory above. The shielding required is obtained through the careful placement of heavy masonry piers, sections of ceiling high wall and low screen walls, and by depressing the floor of an overhang at the clearstory. This is truly an ingenious concept which totally eliminates any "closed-in" feeling, and at the same time provides excellent school and shelter facilities.

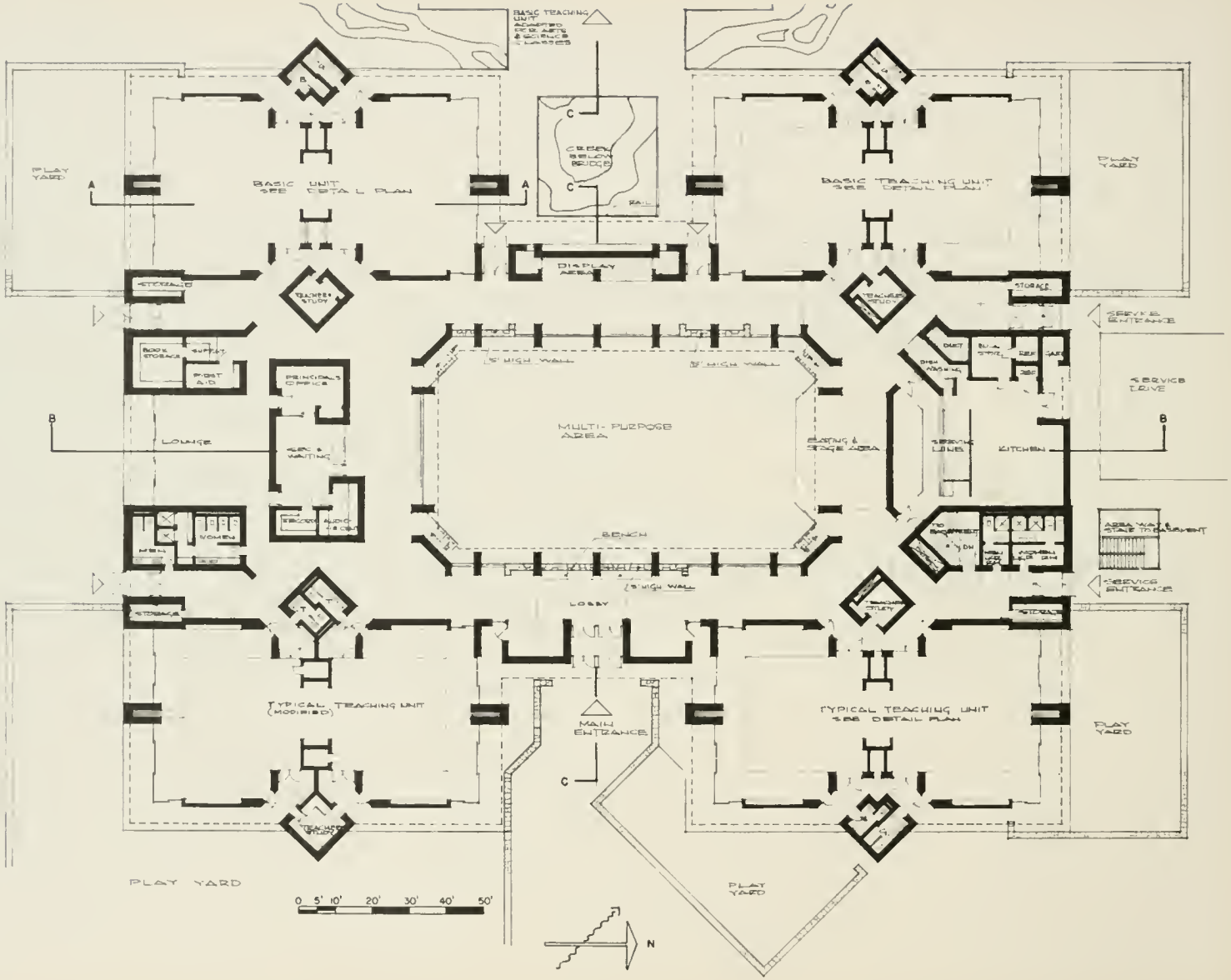
Analysts' Comment:

The location of masonry piers and integral wall shields has been well studied to provide protection against ground direct and skyshine contributions. The depressed floor in the multipurpose area provides further inherent protection from the ground direct contribution by placing the occupants below the path of direct radiation from the ground. The concrete roof over the multipurpose room has an overhang which protects against the skyshine contribution. Natural ventilation, controlled by operable louvers, further enhances the use of the shelter space during emergency conditions.

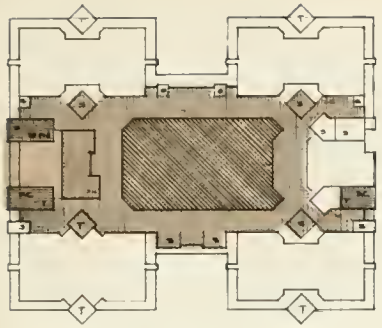
The shielding of the secondary shelter could be improved and the kitchen made an integral part of the shelter by some additional study of the baffles and roof systems.

Aerial View



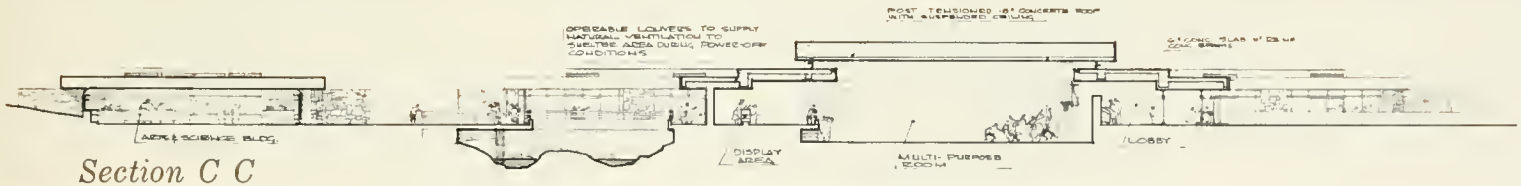

BASIC TEACHING UNIT ADAPTED FOR ARTS & SCIENCE CLASSES
CREEK BELOW BRIDGE
PLAY YARD
BASIC UNIT SEE DETAIL PLAN
BASIC TEACHING UNIT SEE DETAIL PLAN
PLAY YARD
DISPLAY AREA
STORAGE
TEACHER'S STUDY
SERVICE ENTRANCE
BOOK STORAGE
SUPPLY
FIRST AID
PRINCIPAL'S OFFICE
5' HIGH WALL
5' HIGH WALL
SERVICE DRIVE
LOUNGE
SEC. & WAITING
MULTI-PURPOSE AREA
SEATING & STAGE AREA
SERVICE LINES
KITCHEN
WOMEN
TELEVISION AUDIO & CONT.
BENCH
ADULT WASH & STAFF TOILET
5' HIGH WALL
SERVICE ENTRANCE
LOBBY
TYPICAL TEACHING UNIT (MODIFIED)
MAIN ENTRANCE
TYPICAL TEACHING UNIT SEE DETAIL PLAN
PLAY YARD
PLAY YARD
PLAY YARD
0 5' 10' 20' 30' 40' 50'
N

Floor Plan



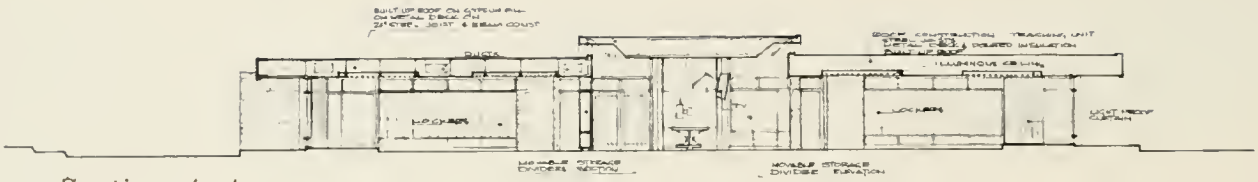
Shelter Area Schematic Plan

Section B B

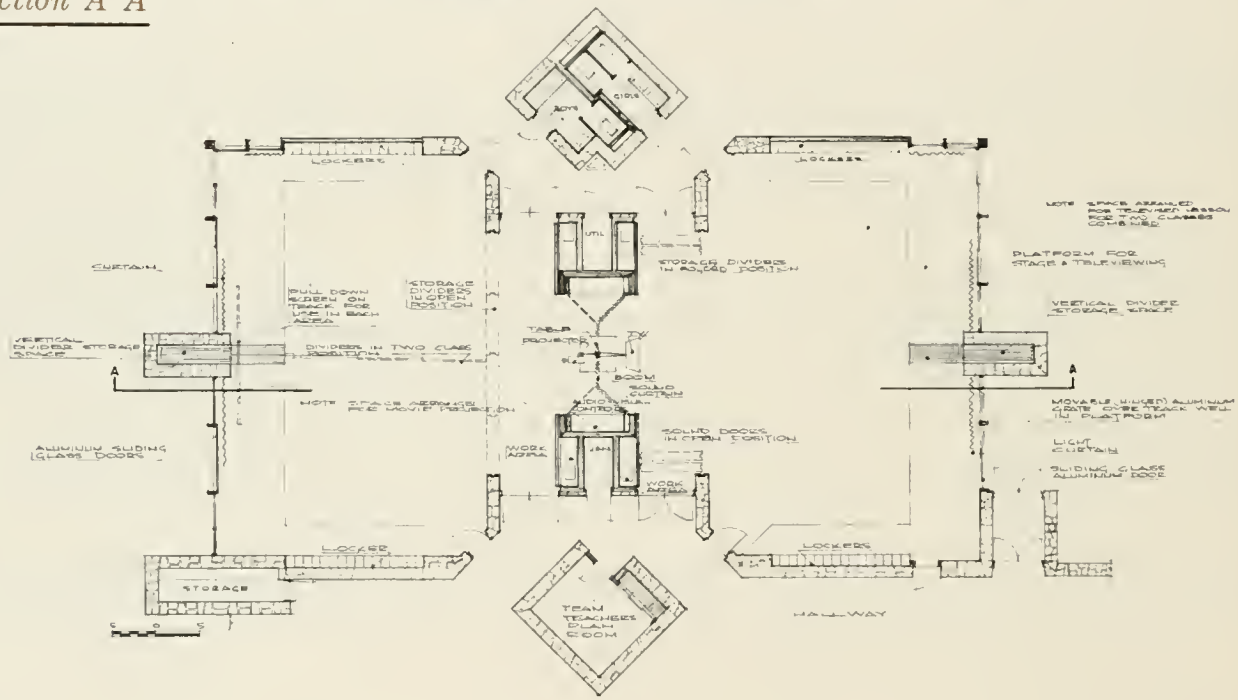


Section C C

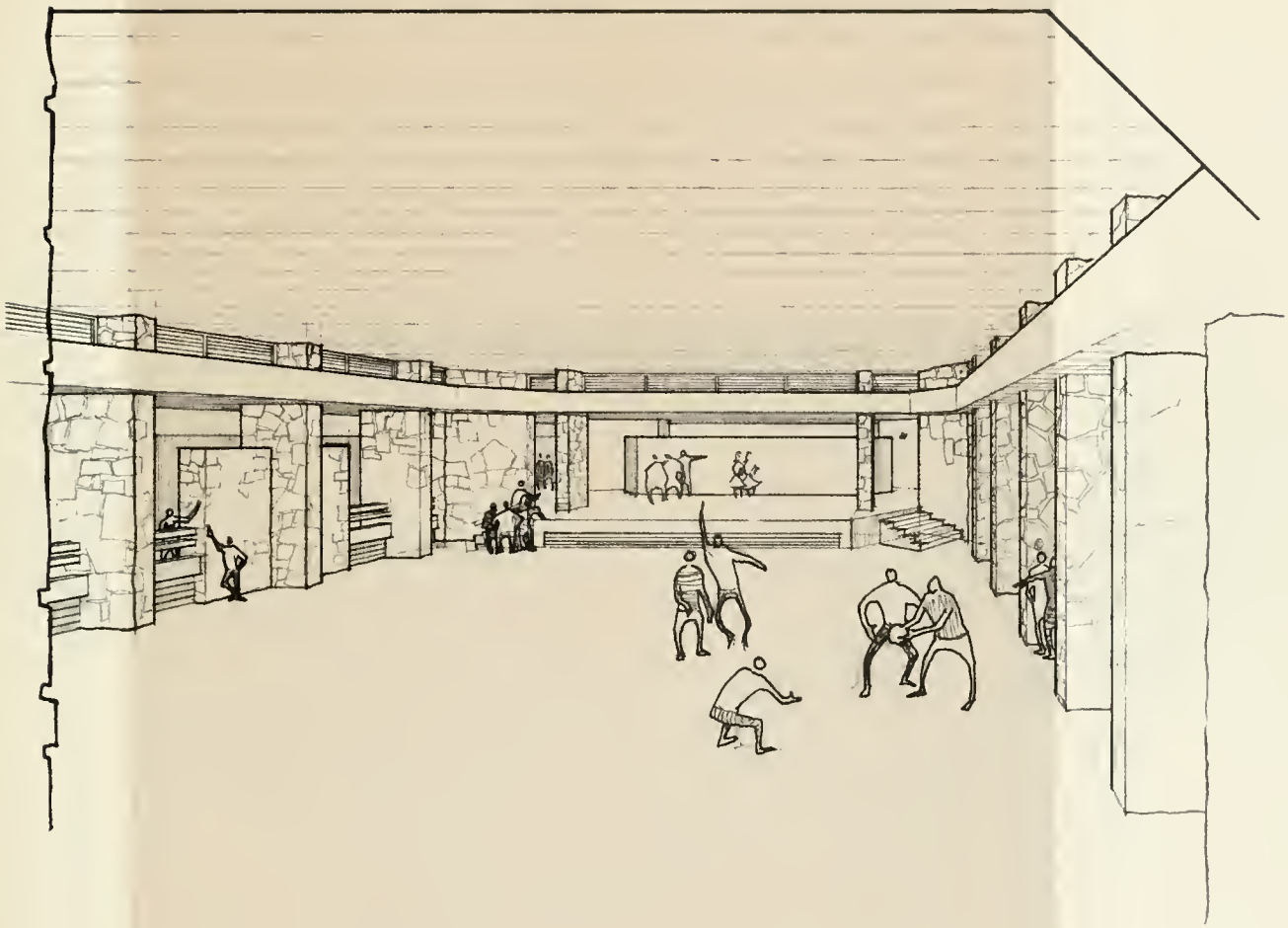
West Elevation



Section A A



Typical Teaching Unit Plan



Interior Perspective

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 5

SECOND PRIZE

E. Davis Wilcox, AIA
E. Davis Wilcox Associates, *Architects*
Tyler, Texas

Team Members

Cleon C. Bellomy, AIA, *Architect*
Demopulos and Ferguson, *Engineers (structural and civil)*
Gregerson and Gaynor, *Engineers (mechanical)*

Jury Comment:

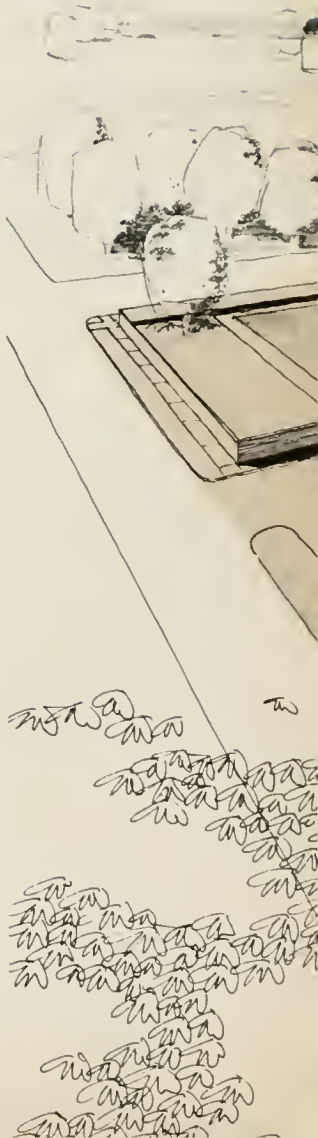
An interesting educational and shelter concept, this school is very nicely developed architecturally. The classrooms are circular areas with flexible divider panels and are grouped in spacious rectangular areas, providing a great variety of teaching spaces.

The shelter area is a large central court, with a skylight "cover" which must be left in place to provide protection. Light and ventilation are provided by a carefully devised system of horizontal baffles, using overhangs, low roofs and balconies. The scheme might have been improved by the use of shielded clearstory windows or skylight openings as included in several of the winning designs rather than relying on the placement of a cover.

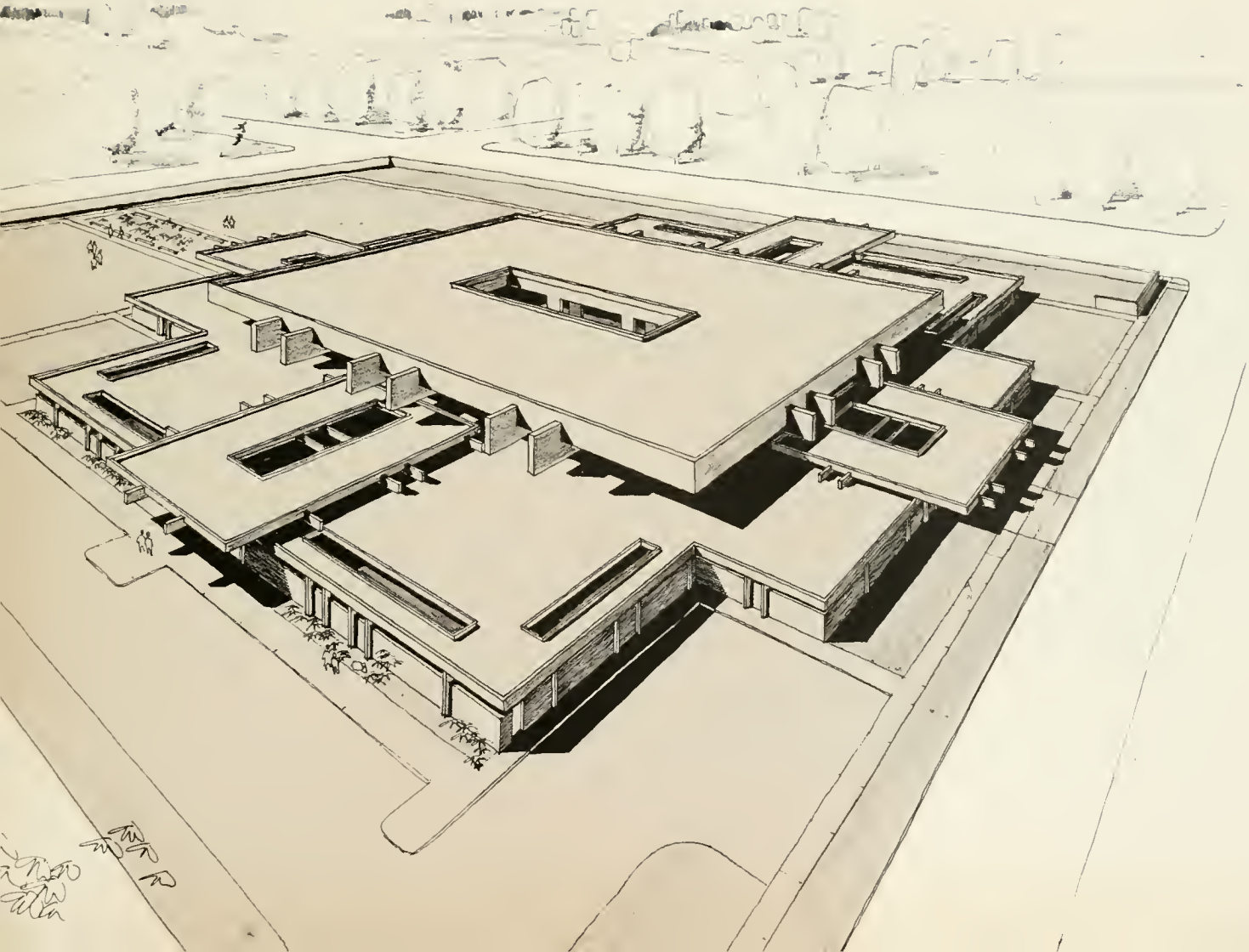
Analysts' Comment:

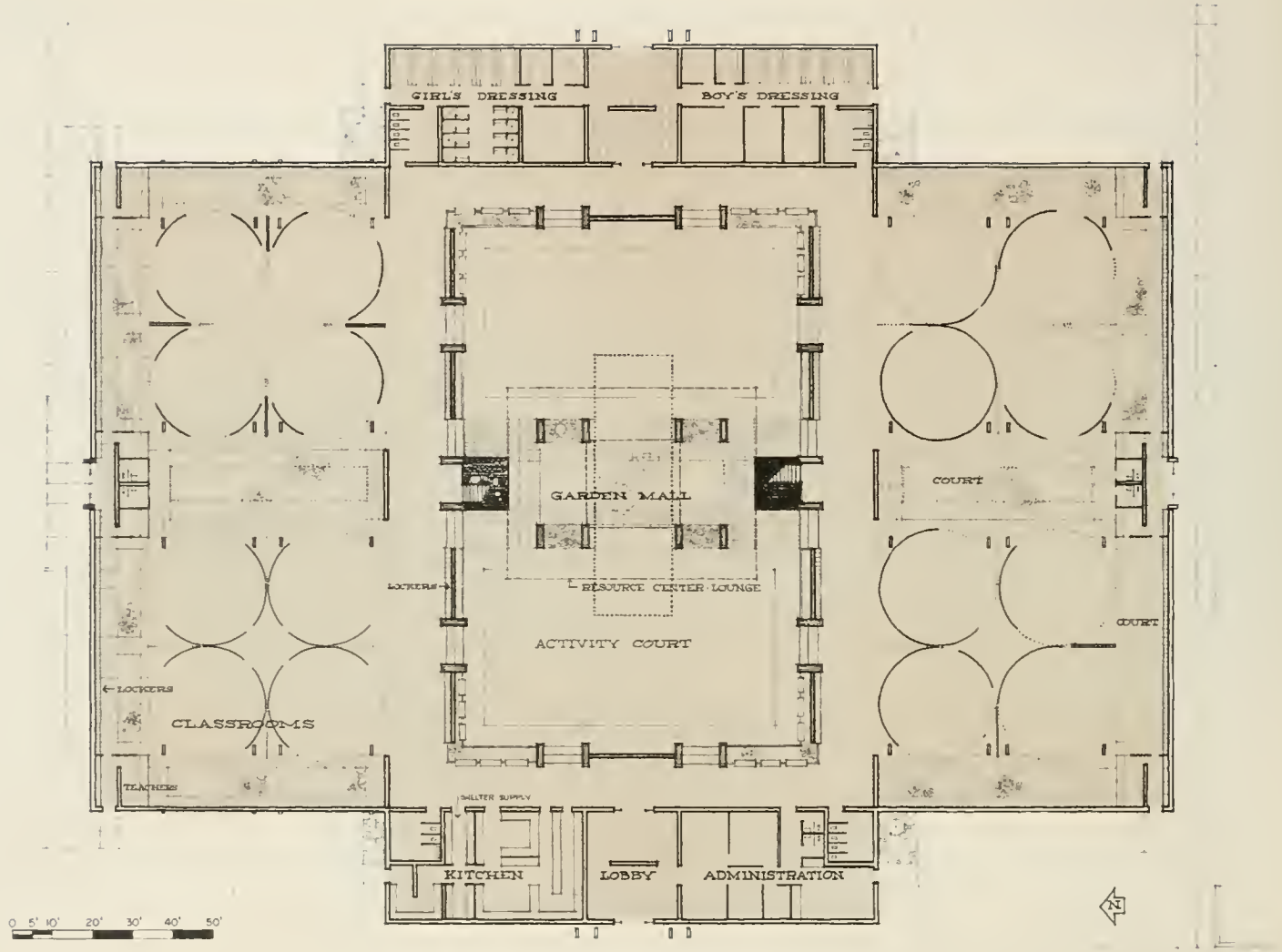
This solution makes ingenious use of dispersed baffles to obtain good shelter. It is felt that the closure of the skylight penalizes the current operation of the school.

The openness of this shelter is most commendable and constitutes a psychological plus factor. There is a management problem in that safe areas must be clearly marked so that occupants will not inadvertently wander into unprotected zones.

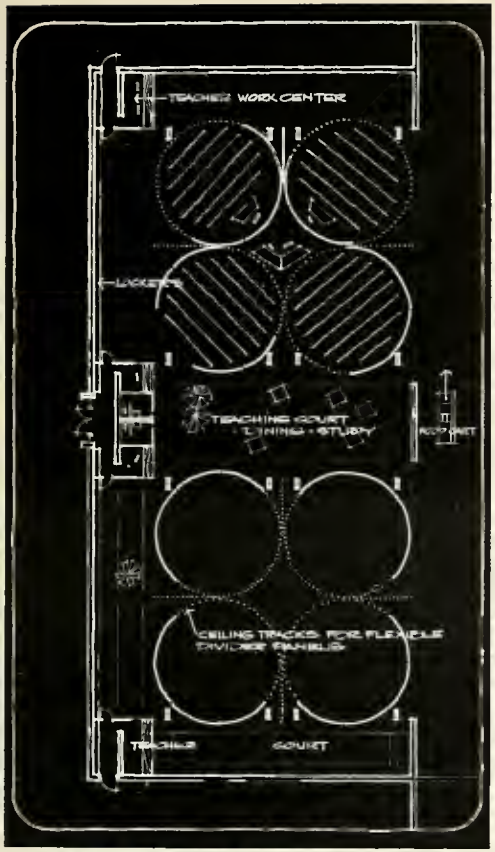


Exterior

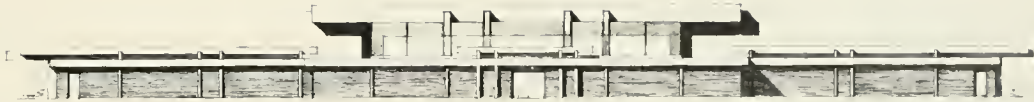



GIRL'S DRESSING
BOY'S DRESSING
GARDEN MALL
RESOURCE CENTER LOUNGE
ACTIVITY COURT
COURT
COURT
LOCKERS
LOCKERS
CLASSROOMS
TEACHERS
SHELTER SUPPLY
KITCHEN
LOBBY
ADMINISTRATION
0 5' 10' 20' 30' 40' 50'
N

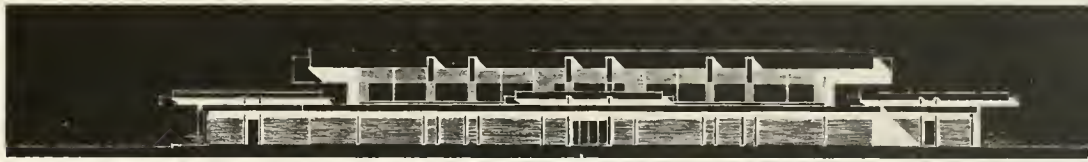
Floor Plan



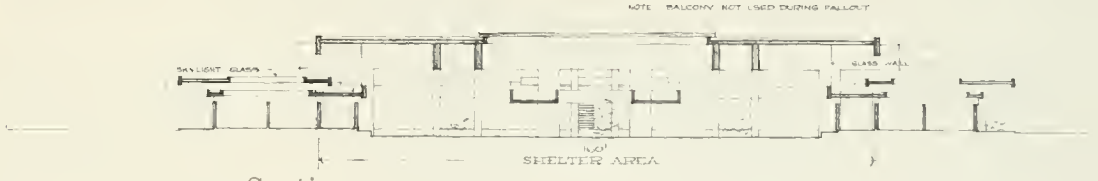
Typical Class Areas



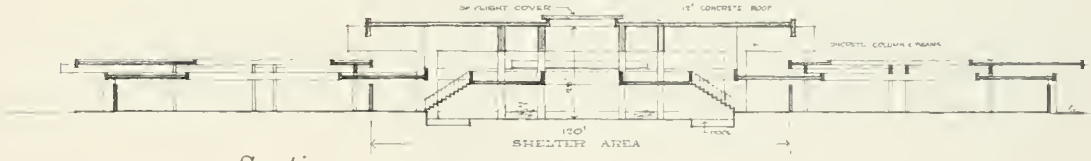
East-West Elevation



North—South Elevation



Section



Section

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 5

THIRD PRIZE

Arlyn A. Orr, *Asst. Prof. of Arch. and Arch. Eng.*
Oklahoma State University
Stillwater, Oklahoma

Team Members

Alec Notaras, *Assoc. Prof. of Arch., Oklahoma State University*
W. G. Chamberlain, AIA, *Architect*
Donn Wooldridge, *Inst. in Arch. Eng., Oklahoma State University*

Jury Comment:

This school is an orderly, nicely developed modular concept of a series of attached buildings of similar construction. A high shelter capacity is achieved through the use of massive exterior walls, "pivotable" shutters on slit windows, heavy roof construction and a good clearstory baffling.

Analysts' Comment:

A relatively simple exterior wall provides adequate protection against ground direct and skyshine contributions. The use of the 12-inch concrete slab over the classroom areas not only provides protection from the fallout on the roof but also serves to shield against skyshine that would normally enter through the clearstory. The arrangement of adjacent modular units provides for effective circulation throughout the various shelter functional areas.

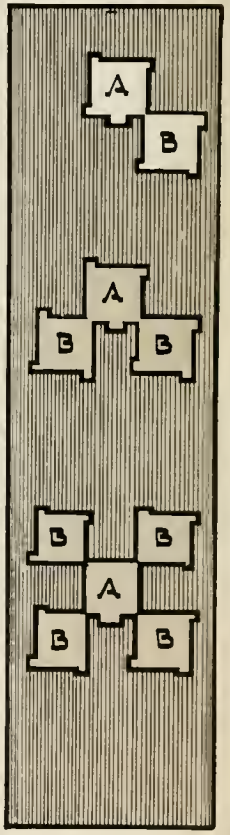
The protection factor in the corridors could be improved at the window locations by adding mass weight in the lower portion of the rotating panels as an additional barrier against the ground direct contribution.

Modular Expansion For Growing Communities

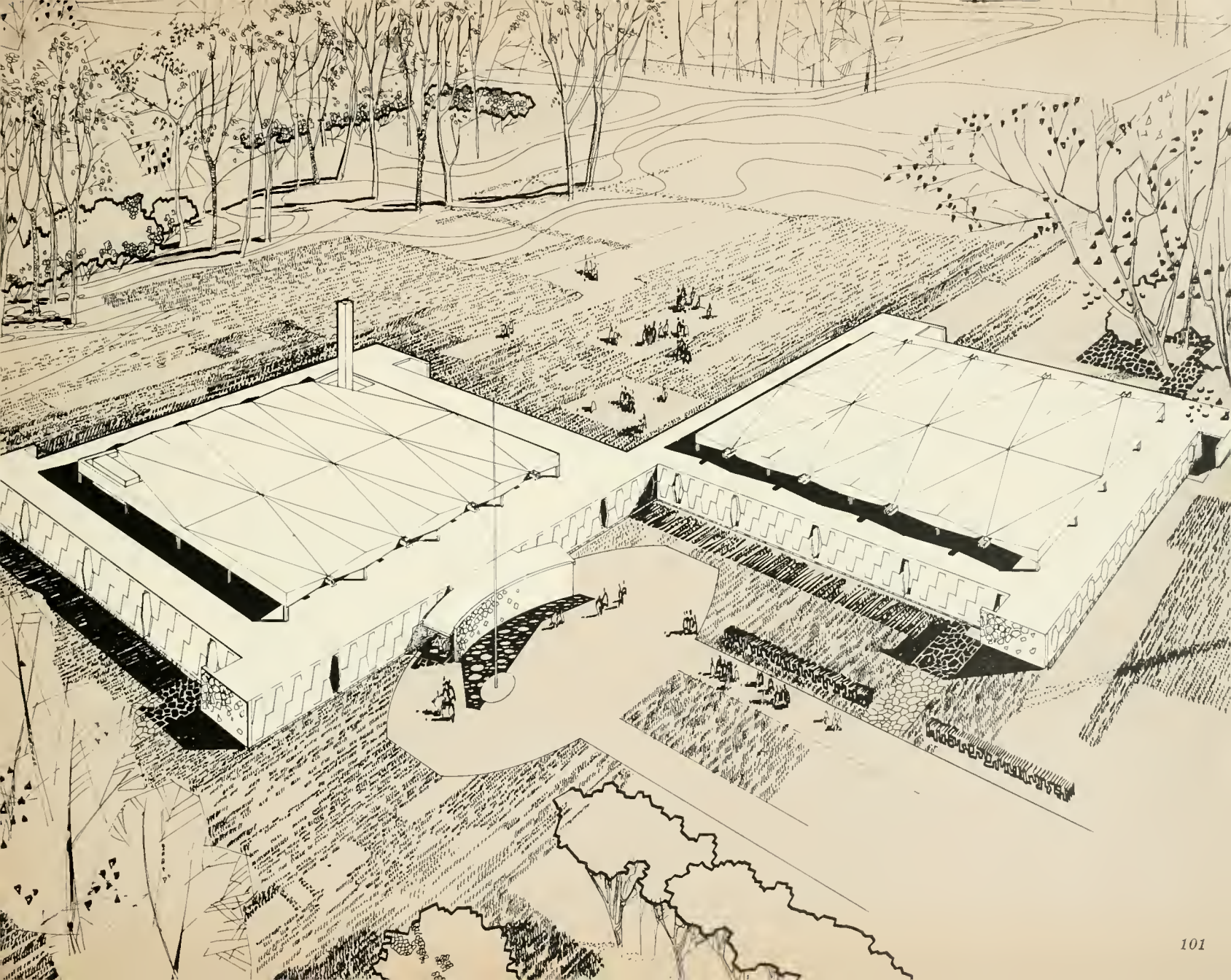
1. SCHOOL FOR 360 STUDENTS
   A Administration Unit 60 Students
   B 1 Cl. Room Unit 300 Students

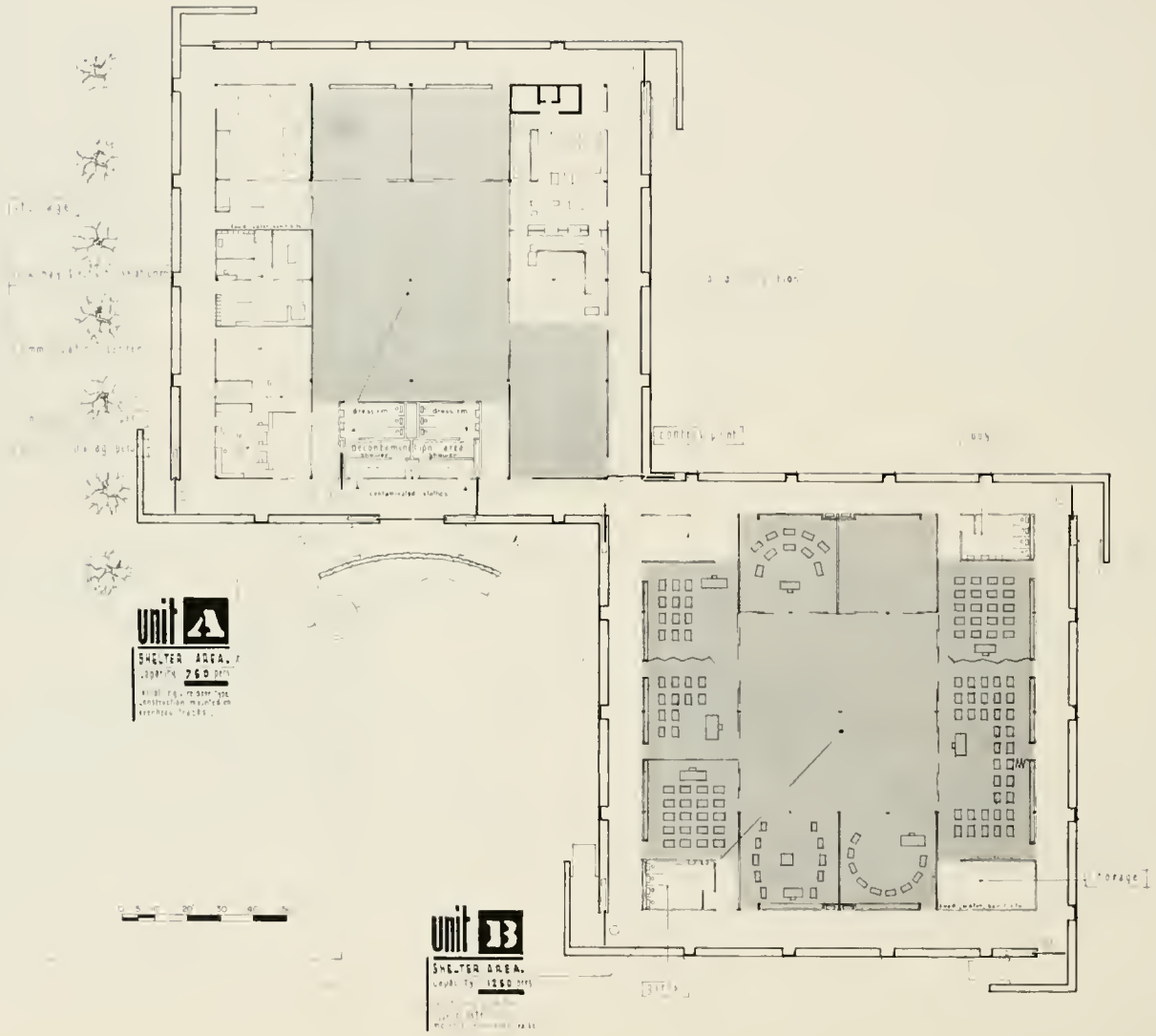
2. SCHOOL FOR 660 STUDENTS
   A Administration Unit 60 Students
   B 2 Cl. Room Units 600 Students

3. SCHOOL FOR 1260 STUDENTS
   A Administration Unit 60 Students
   (Expansion of Cafeteria in Multipurpose Room)
   B 4 Cl. Room Units 1200 Students

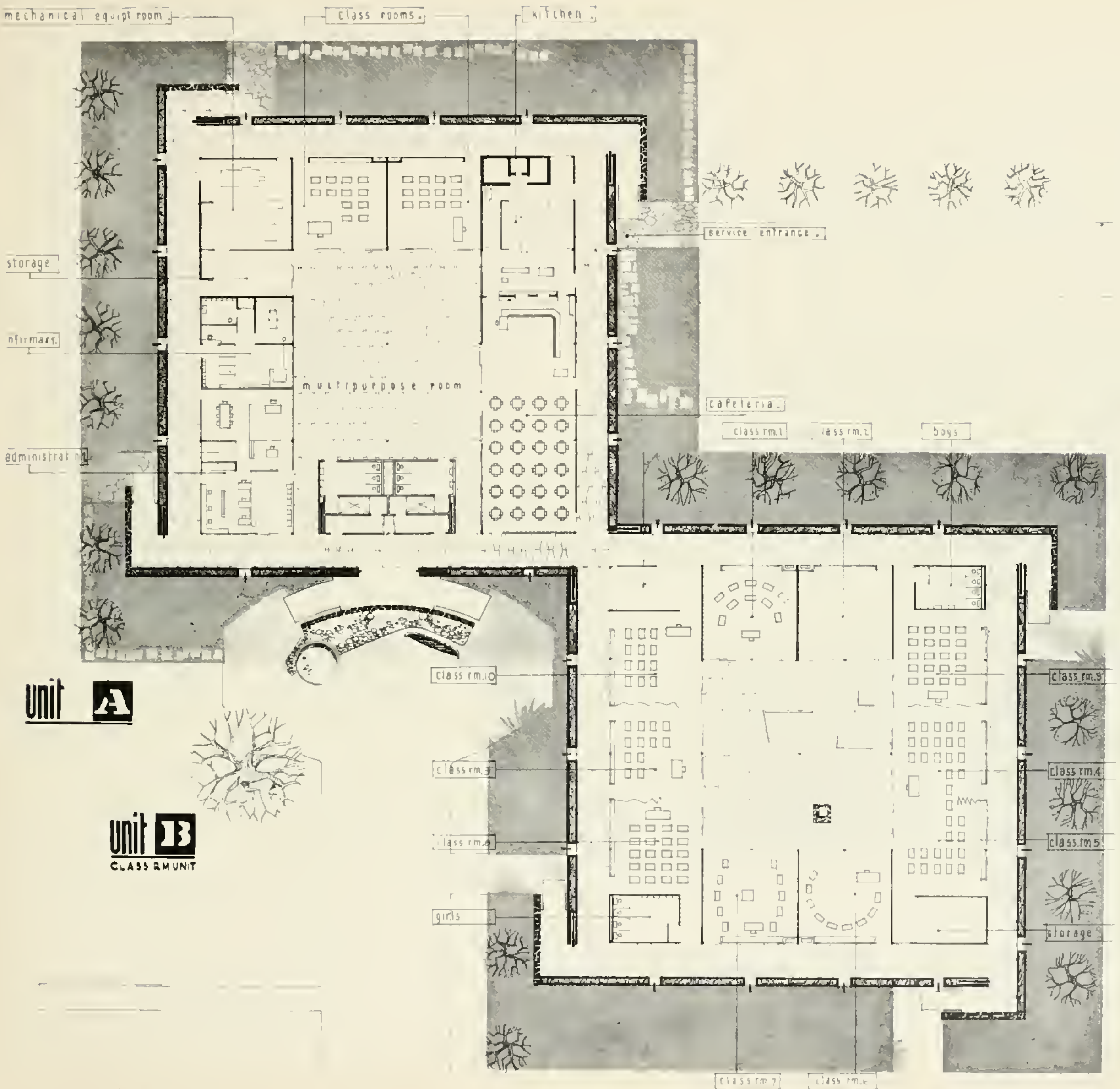


Bird's Eye View Perspective

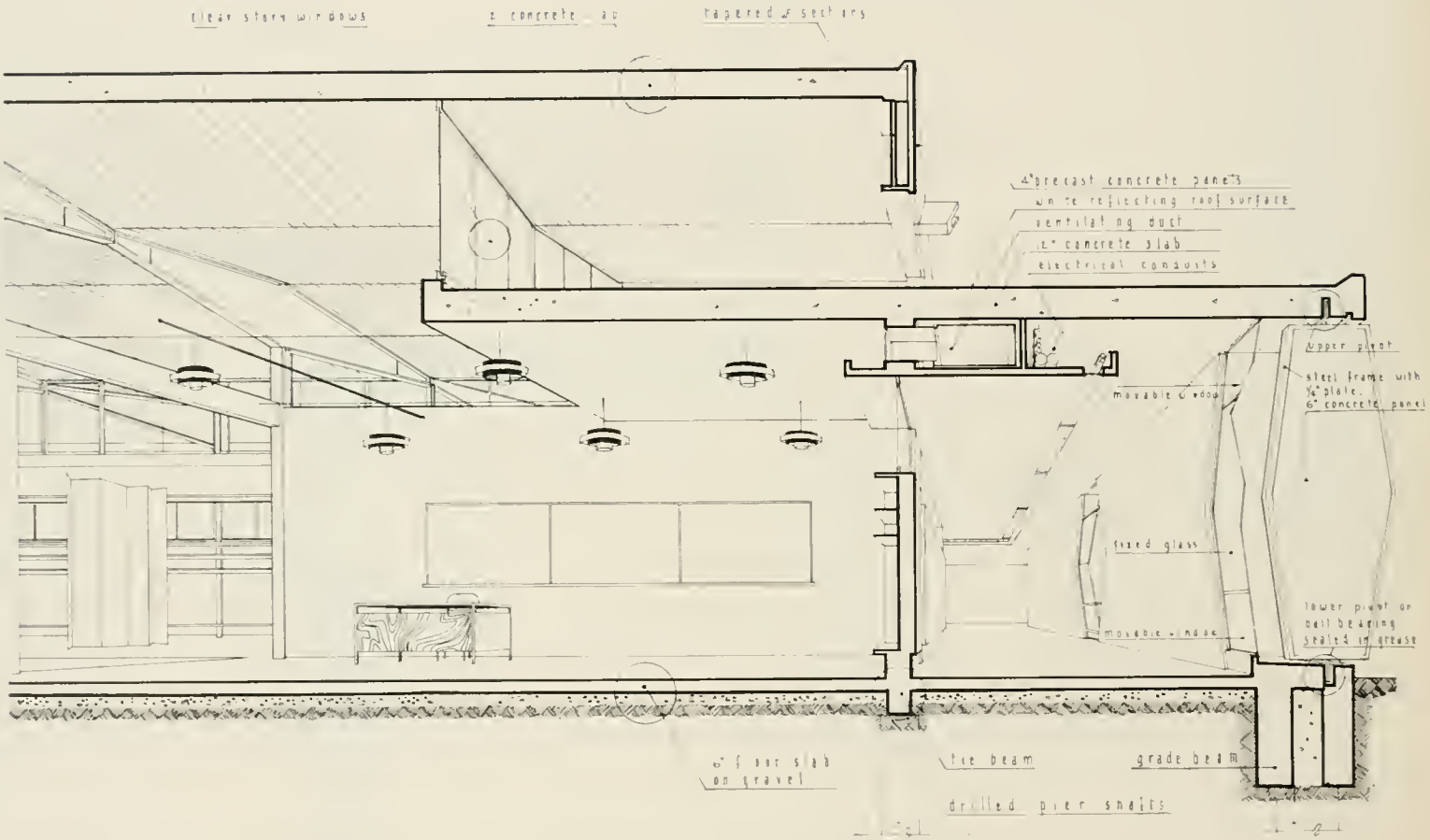




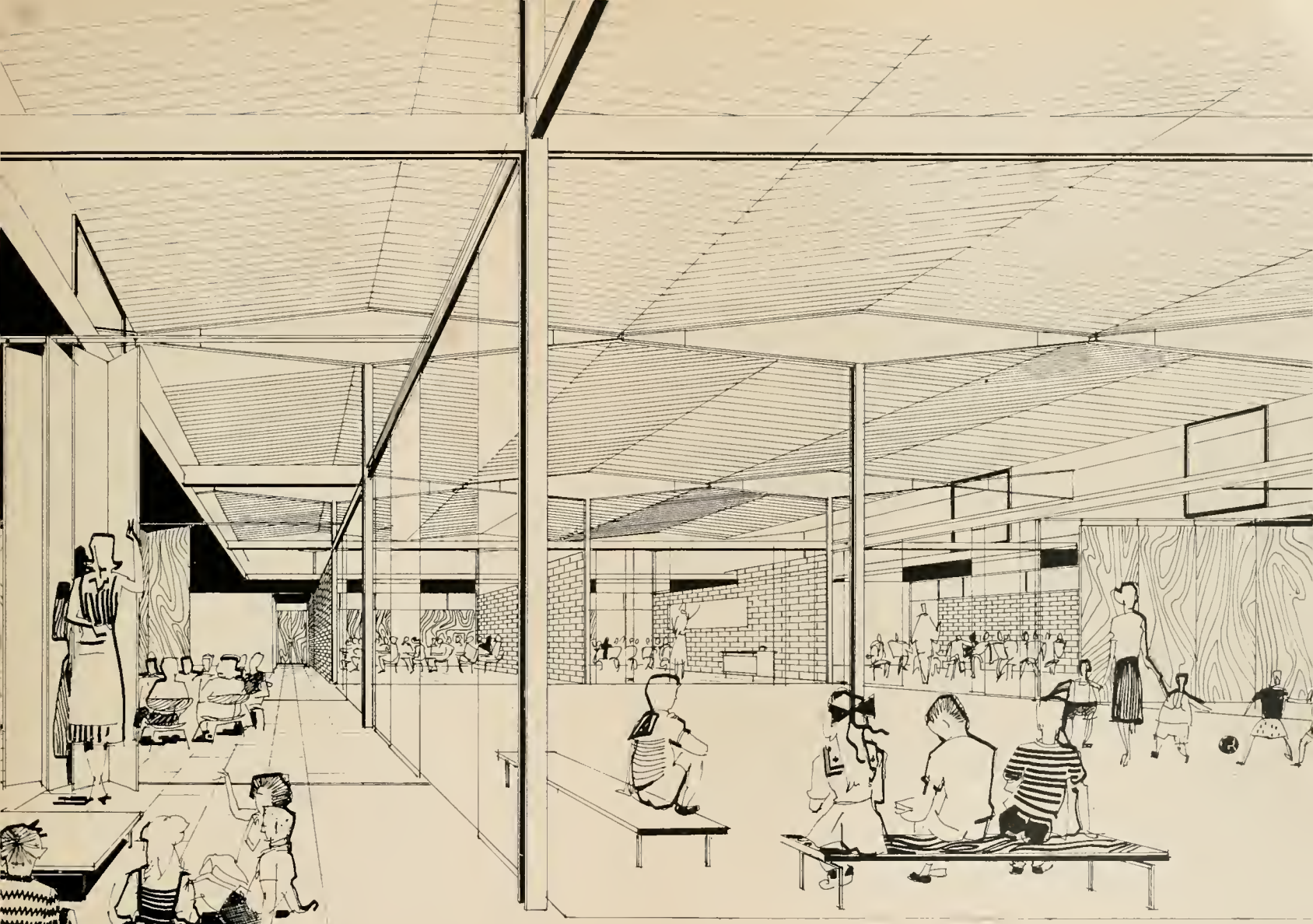
Floor Plan


mechanical equip't room
class rooms
kitchen
service entrance
storage
nfirmary
administrat
multipurpose room
cafeteria
class rm.1
lass rm.2
boys
class rm.10
class rm.9
class rm.3
class rm.4
lass rm.8
class rm.5
girls
storage
class rm 7
class rm.6
unit A
unit B
CLASS RM UNIT

Floor Plan


clear story windows
concrete cap
tapered rafters
4" precast concrete panels
white reflecting roof surface
ventilating duct
2" concrete slab
electrical conduits
upper pivot
steel frame with
¼" plate.
6" concrete panel
movable window
fixed glass
movable window
lower pivot on
ball bearing
sealed in grease
6" floor slab
on gravel
tie beam
grade beam
drilled pier shafts

Section



Interior Perspective of Multipurpose Room

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 5

CERTIFICATE OF MERIT

Elbert M. Wheeler, AIA
Wheeler & Wheeler, *Architects*
Enid, Oklahoma

Team Members

N. Glen Wheeler, AIA, *Architect and Engineer*
Richard W. Cramer

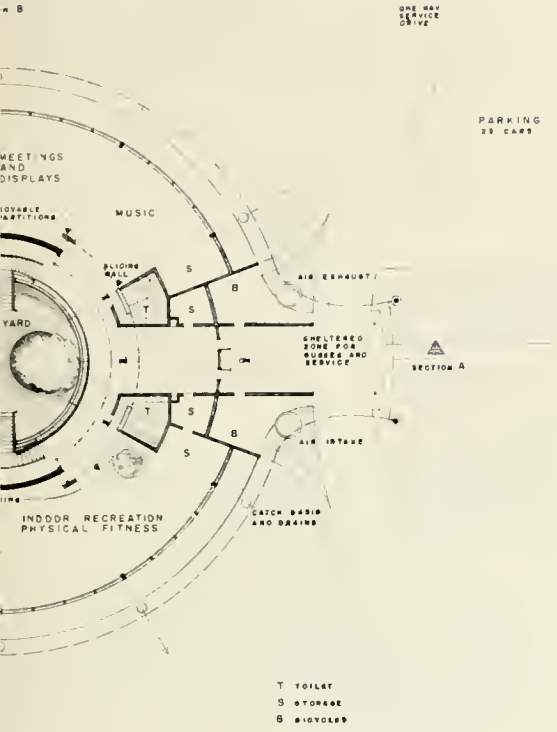
Jury Comment:

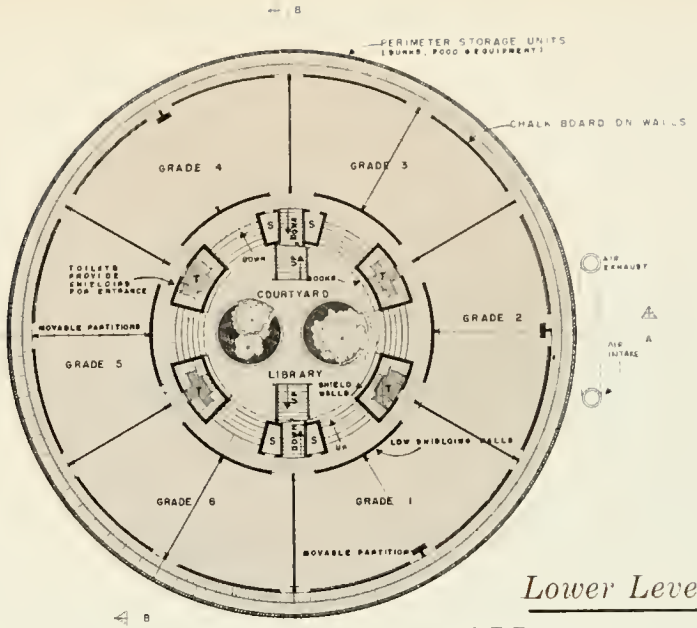
A well-thought-out concept of basement shelter space with a high degree of openness and good natural light achieved through use of a well-shielded skydome. Extensive, easily used secondary shelter space is provided and shelter storage space is well handled.

Analysts' Comment:

Protection against ground direct contribution is achieved simply, by means of the belowground arrangement of the shelter space. However, considerable airiness is retained through the use of the skydome. With washdown of the skydome, protection factors over 100 are achieved in the courtyard. A relatively large portion of the school area (perimeter) is devoted to sleeping spaces and storage.

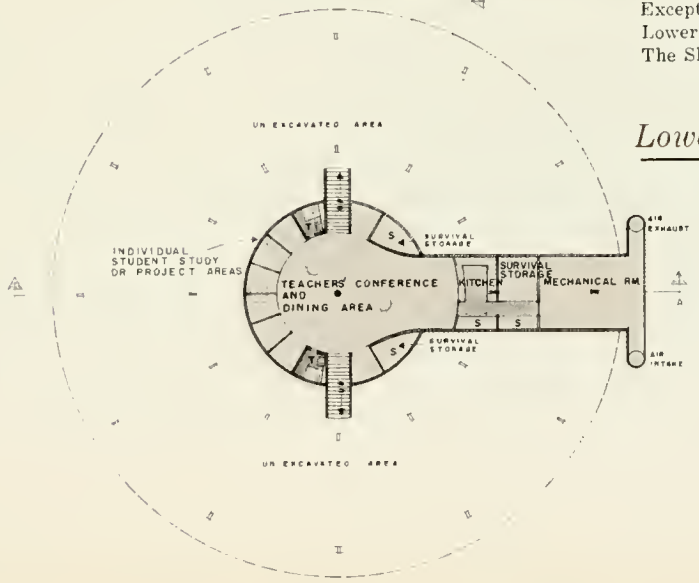
Ground Level Plan



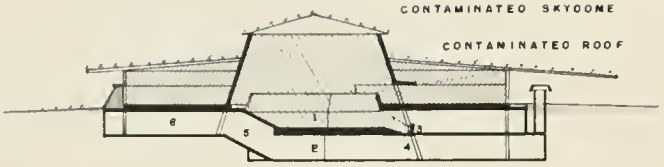


Lower Level 1

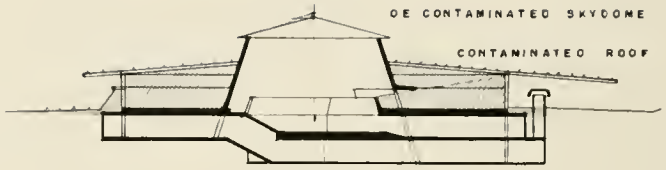
NOTE
Except for the Court Yard—Library Area Lower Levels 1 & 2 Are Considered To Be The Shelter Areas That Are Shielded.



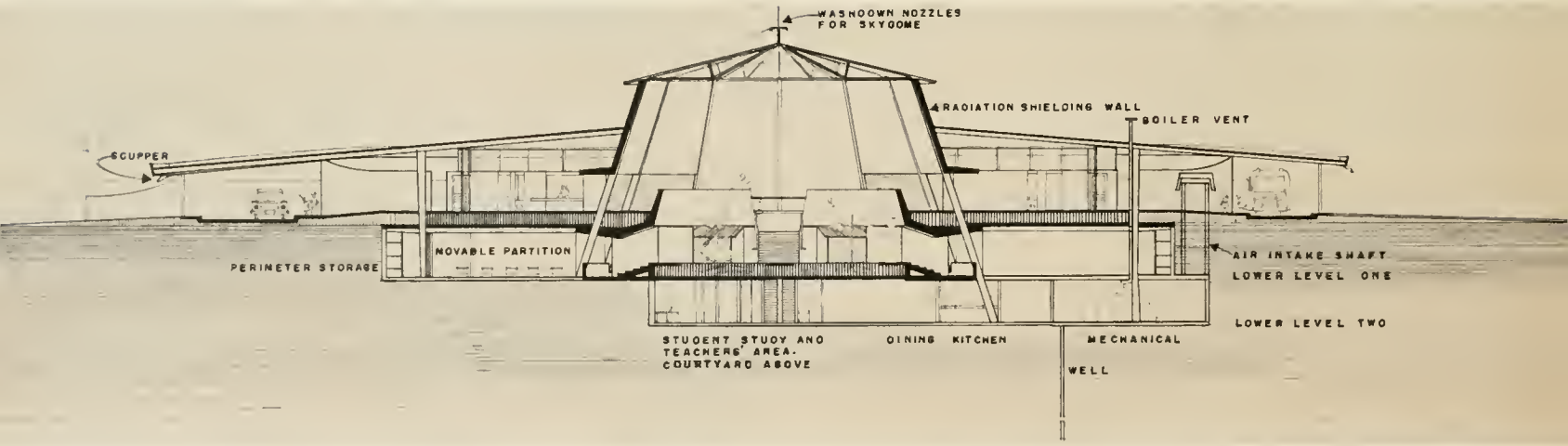
Lower Level 2



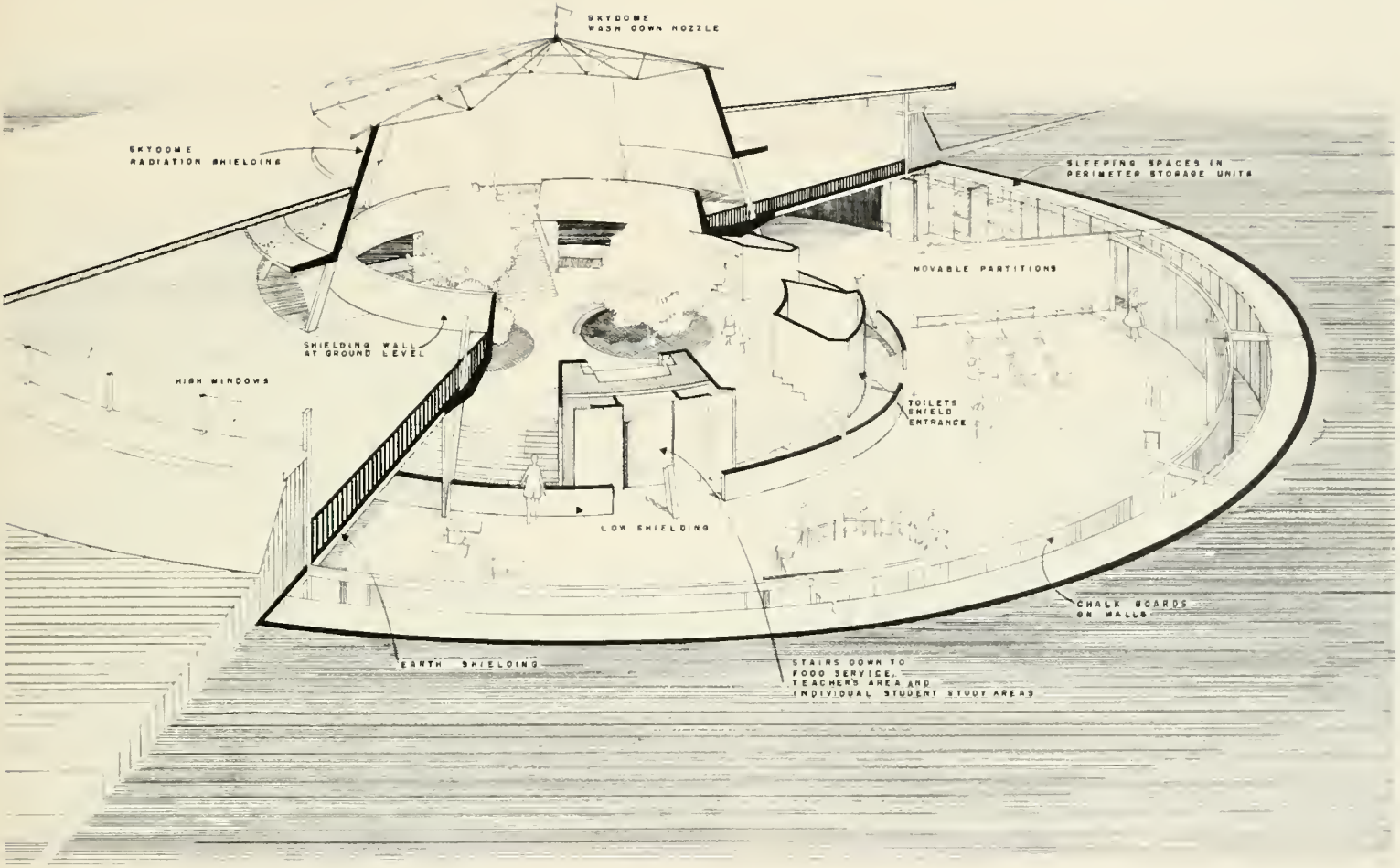
Shielding Diagram 1



Shielding Diagram 2



Section A



Interior Perspective of Shelter Area

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 5

CERTIFICATE OF MERIT

William G. Chamberlain, AIA, *Architect*
Stillwater, Oklahoma

Team Member
Arlyn A. Orr, *Asst. Prof. of Arch. and Arch. Eng., Oklahoma State University*

Jury Comment:

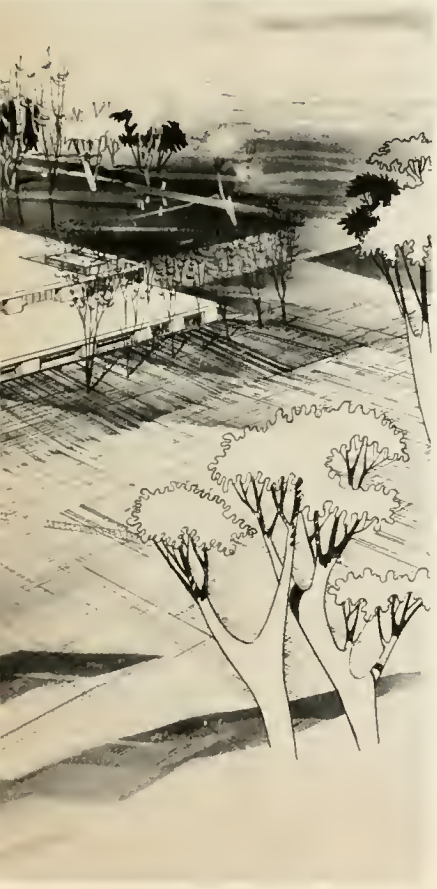
A simple, well-organized school notable particularly for its high shelter capacity achieved through the use of rolling concrete radiation barriers at the exterior.

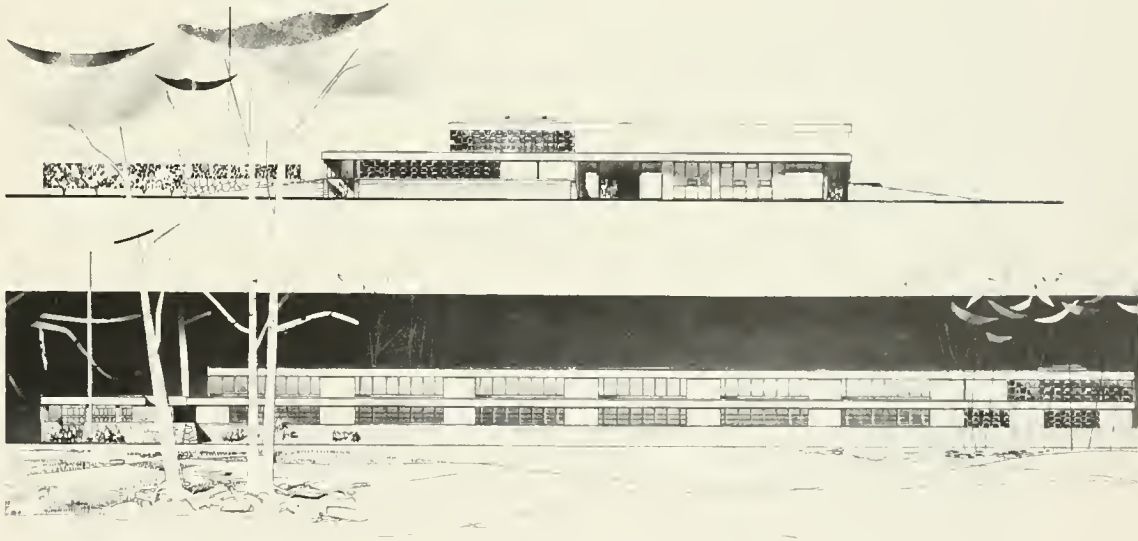
Analysts' Comment:

This solution shields effectively against the ground direct contribution by utilizing a sloping earth fill around most of the building perimeter. The heavy rolling concrete radiation barriers are most justifiable when used as a shielding against the ground direct contribution; i.e., where the sloping earth fill does not exist. From a shielding standpoint, the use of these rolling barriers for protection against skyshine, a relatively small contribution, offers a disproportionate amount of protection when compared with the roof shield.

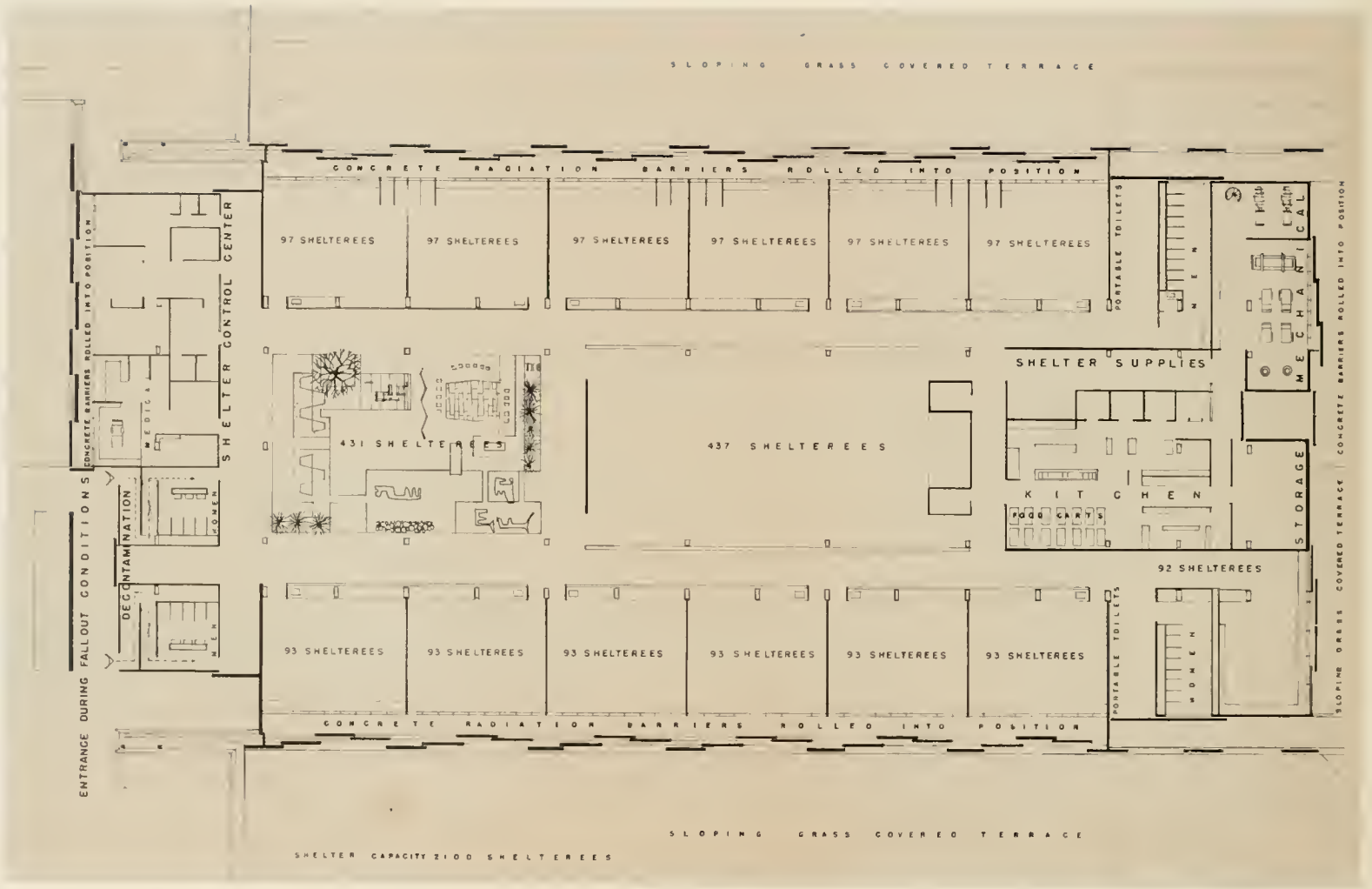
Exterior Perspective

East Elevation

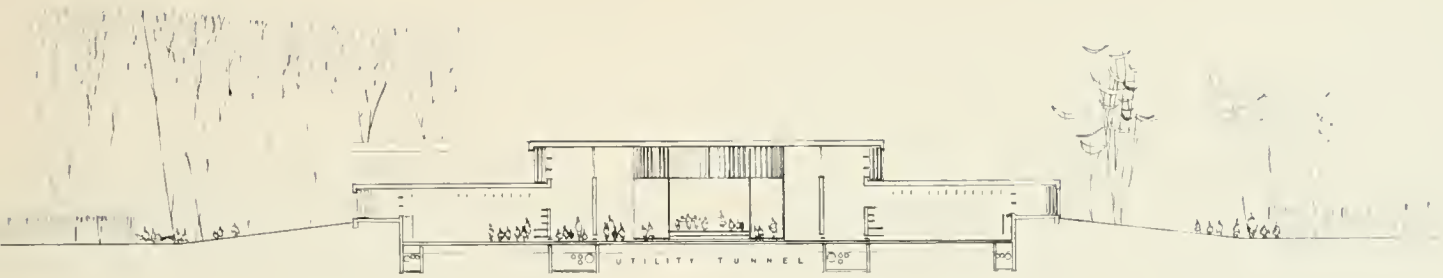




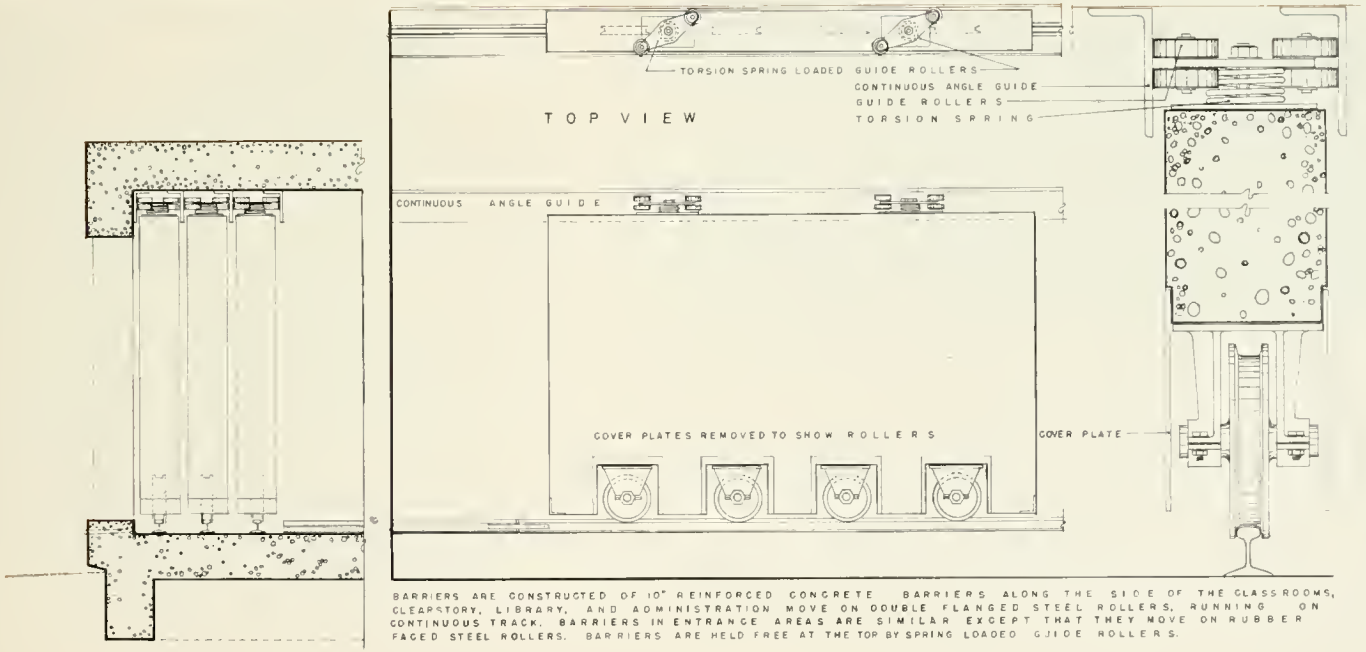
North Elevation



Shelter Plan



Cross Section



BARRIERS ARE CONSTRUCTED OF 10" REINFORCED CONCRETE. BARRIERS ALONG THE SIDE OF THE CLASSROOMS, CLEARSTORY, LIBRARY, AND ADMINISTRATION MOVE ON DOUBLE FLANGED STEEL ROLLERS, RUNNING ON CONTINUOUS TRACK. BARRIERS IN ENTRANCE AREAS ARE SIMILAR EXCEPT THAT THEY MOVE ON RUBBER FACED STEEL ROLLERS. BARRIERS ARE HELD FREE AT THE TOP BY SPRING LOADED GUIDE ROLLERS.

Movable Barrier Details

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 6

FIRST PRIZE

Neil Astle, *Architect*
Omaha, Nebraska

Team Member
Kenneth E. Nelson, AIA, *Architect and Engineer*

Jury Comment:

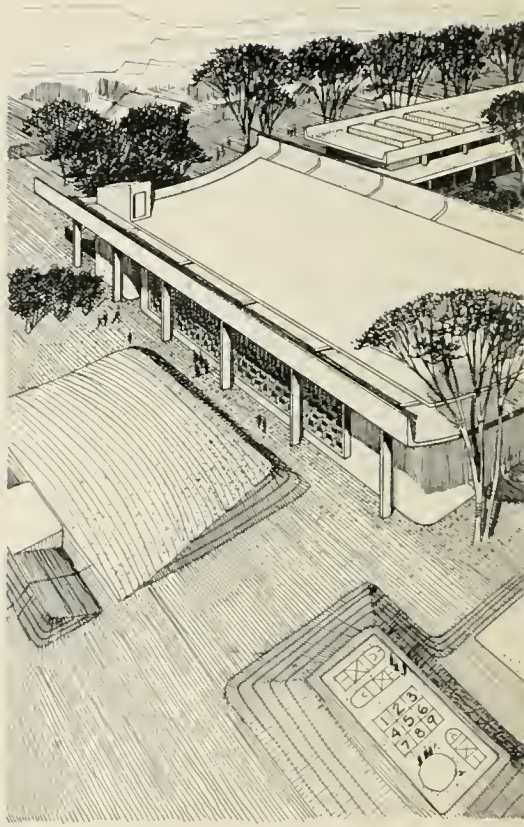
This school is a very interesting development of a multilevel, belowgrade, skylighted space. An ingenious and effective skylight covering a central at-grade court lights two levels of instructional space. A nice variety of individual spaces is provided in an arrangement which would work well educationally and provide a real spatial experience for the occupants of the building. The skylight detail, while perhaps requiring structural refinement, is particularly noteworthy as a major contribution to shelter techniques.

Analysts' Comment:

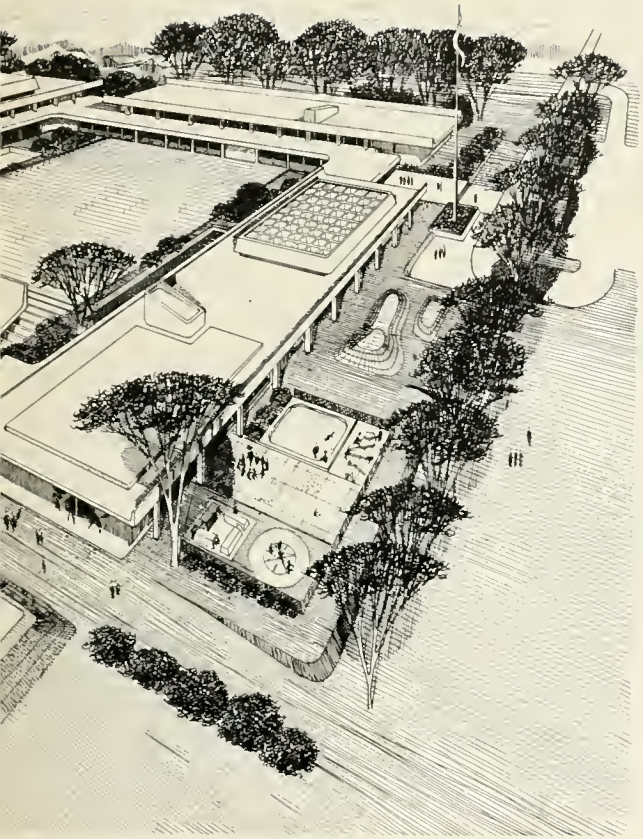
An excellent, imaginative solution to the psychological and sociological problems of shelter habitability. The shelter is conducive to good shelter management as the variety of spaces allows coexistence of diverse shelter functions.

A very high protection factor and high capacity are achieved. Although completely underground, the shelter is not dependent on mechanical ventilation and could be occupied during periods when electric power is not available.

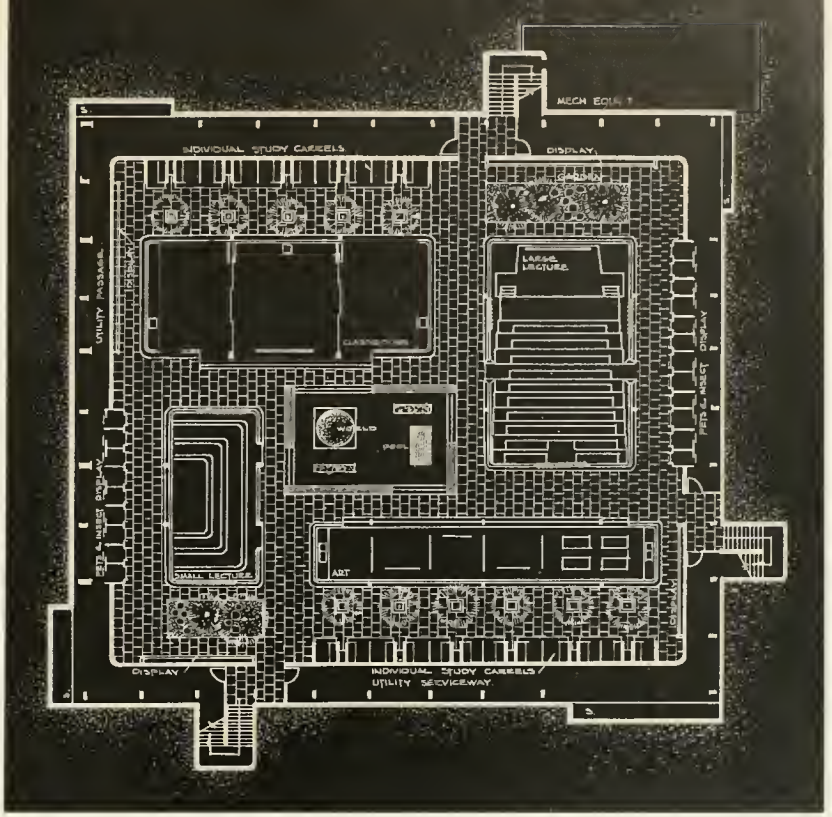
The use of gravel in the long-span roof troughs is questioned as it allows fallout particles to be trapped. A smooth topping or finish surface over the fill or the use of a relatively impervious material either structurally or as fill is suggested as an improvement in this design.



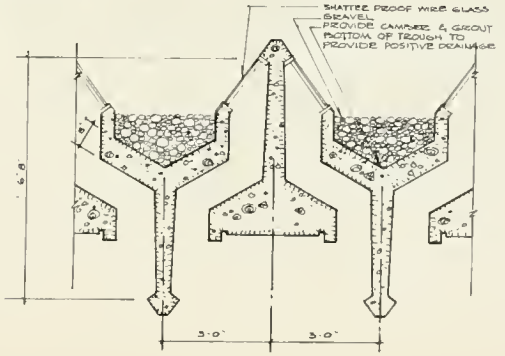
Exterior Perspective

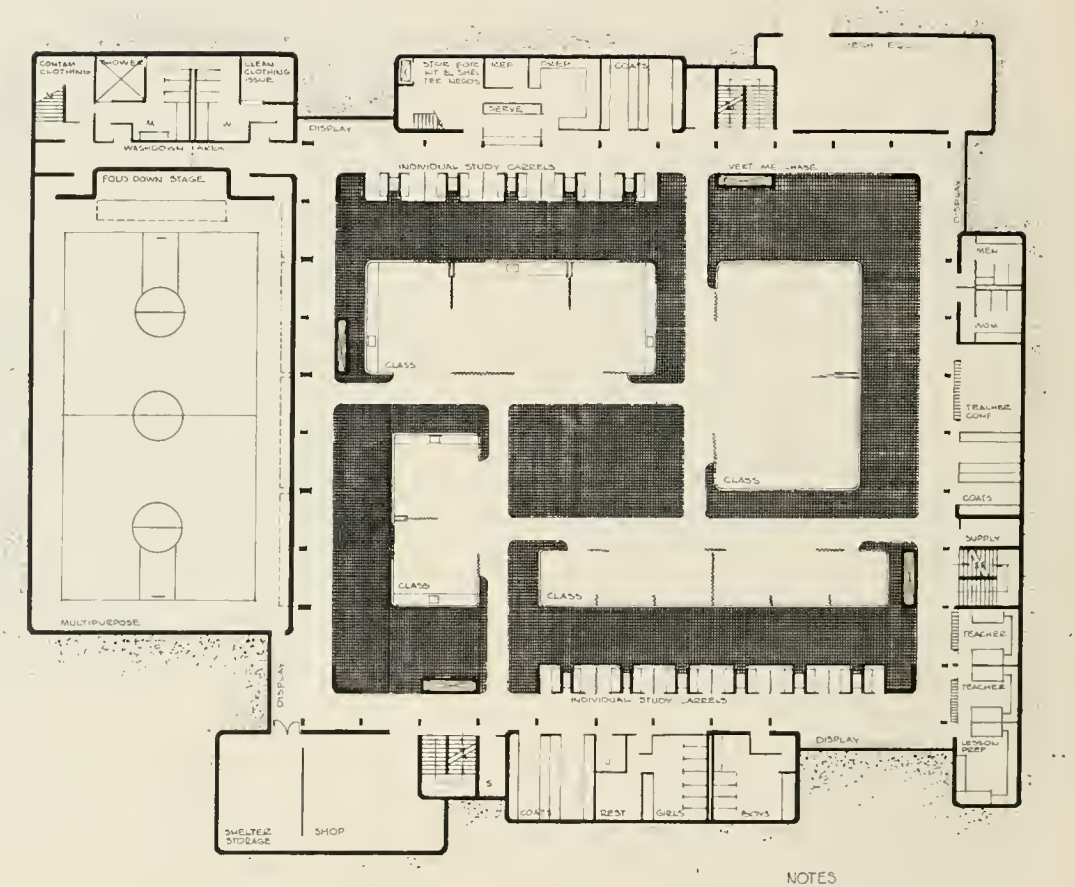


Skylight Detail



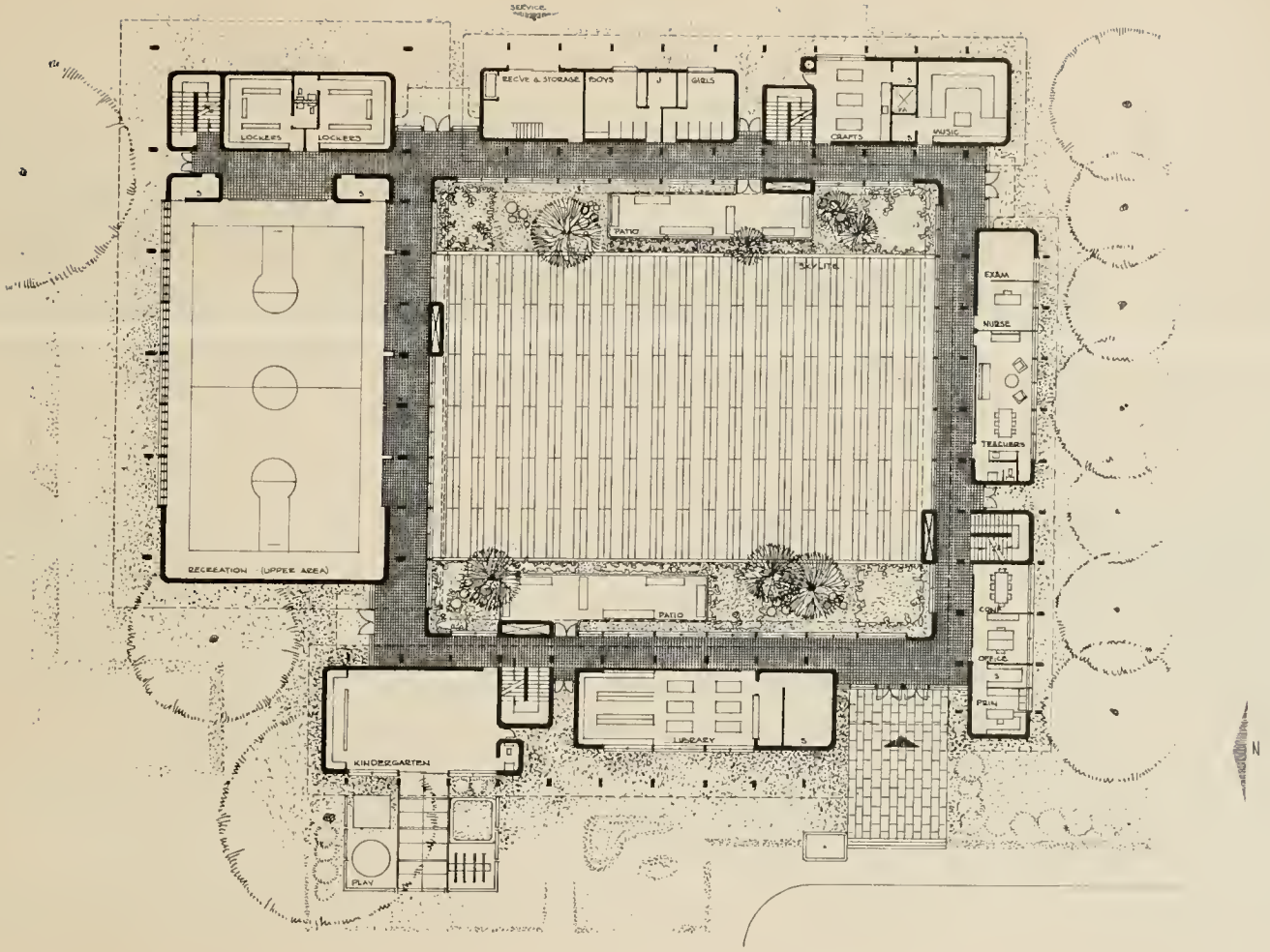
Floor Plan—Lower Level



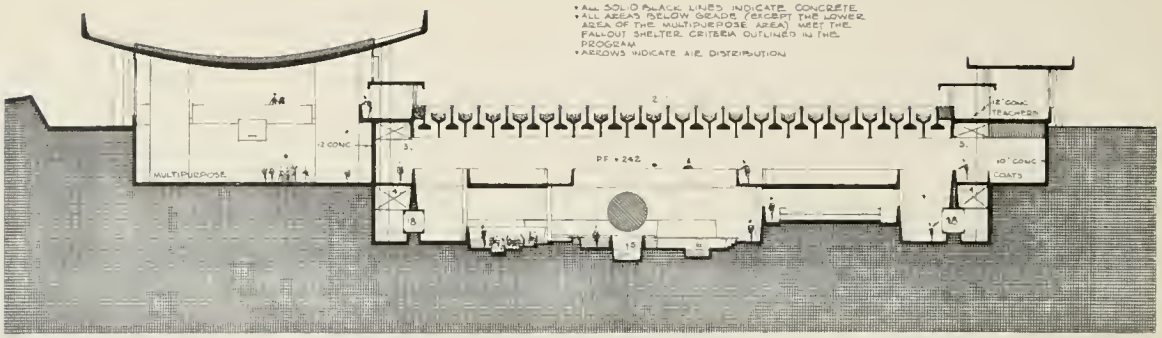


NOTES
- HATCHED AREA INDICATES OPEN AREA
- ALL AREAS SHOWN ON THIS PLAN MEET FALLOUT SHELTER CRITERIA EXCEPT FOR RECREATION PORTION OF THE MULTI-PURPOSE AREA

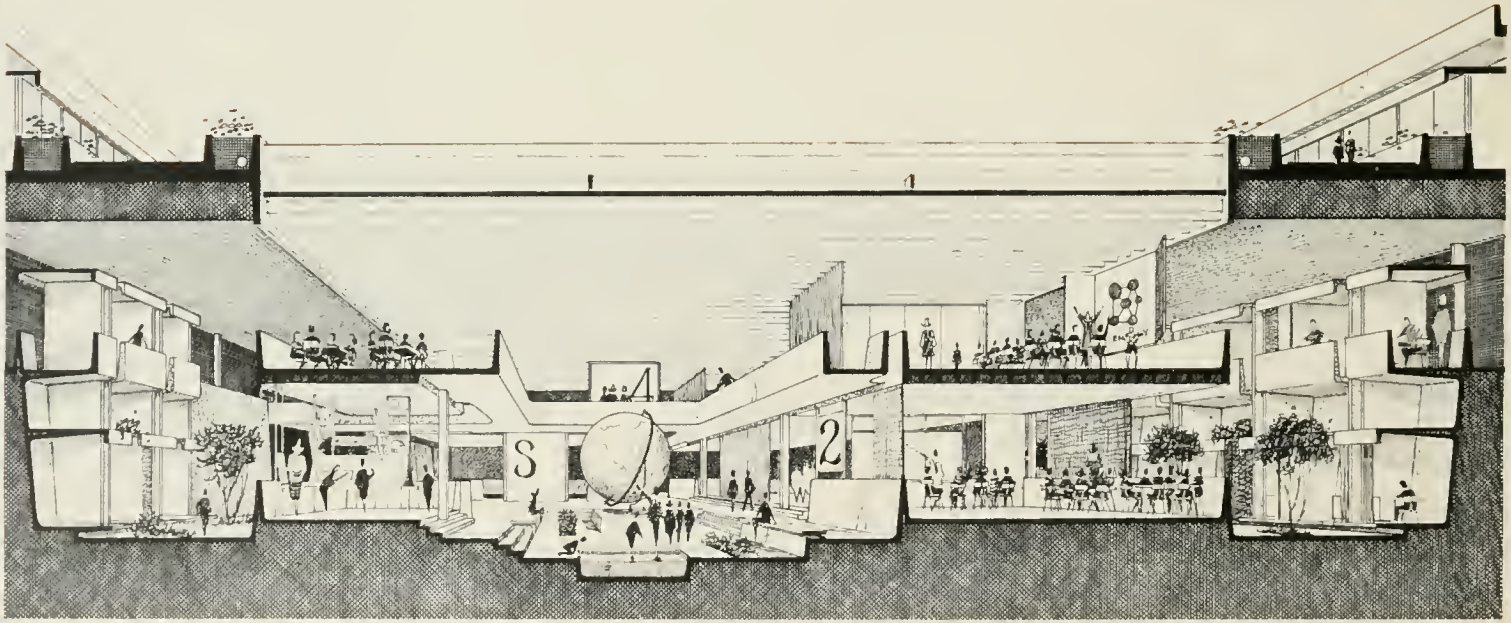
Floor Plan—Middle Level



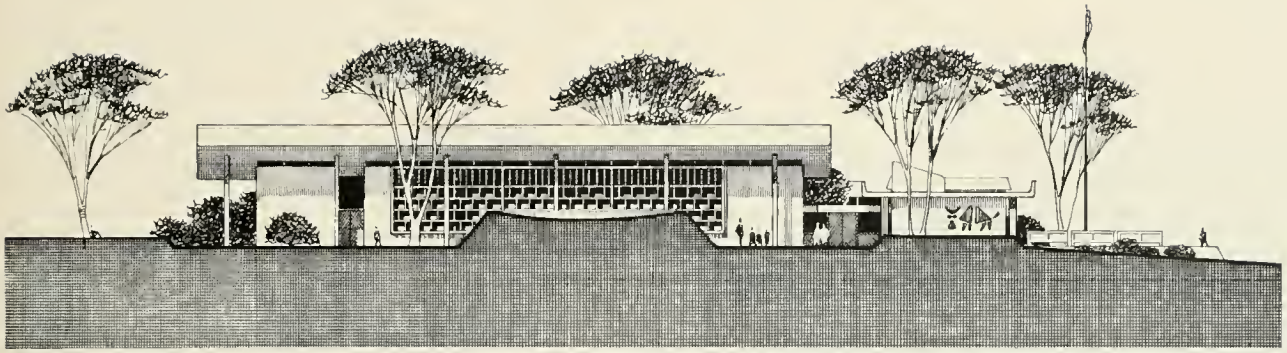
Floor Plan—Upper Level



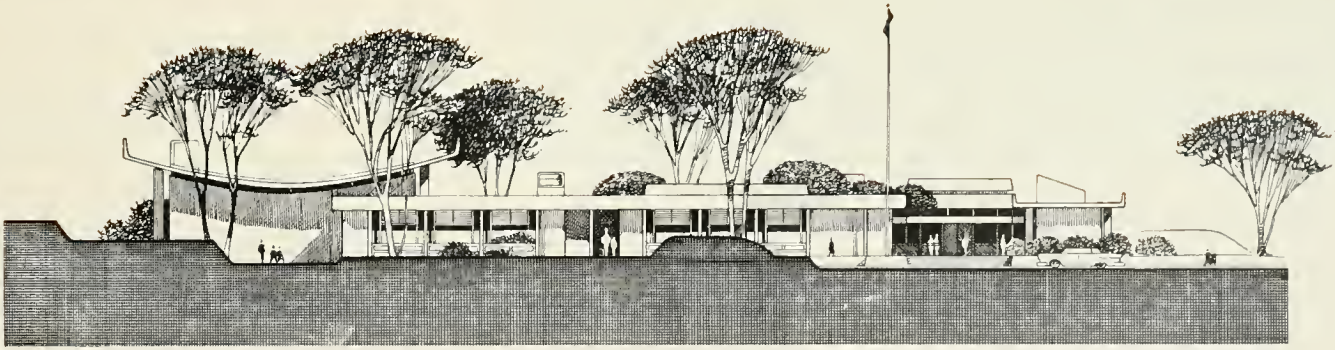
Section Looking East



Perspective of Academic (Shelter) Area



North Elevation



West Elevation

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 6

SECOND PRIZE

M. Dwight Brown, AIA
Marshall & Brown *Architects*
Kansas City, Missouri

Team Members

Ray B. Luhnow, Jr., *Engineer*
Robert F. Moore
Robert G. Westvold

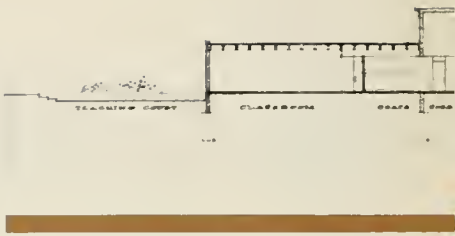
Jury Comment:

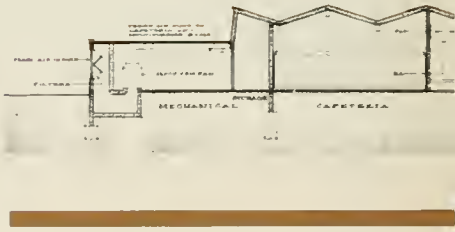
With this simple, neatly handled core shelter plan, the school and shelter both work well, and there is potential for a substantial increase in shelter capacity with only minor changes.

Analysts' Comment:

The core concept, that of providing protection from the ground contribution by surrounding the centrally located shelter with many walls, is well utilized in this design. The corridors running north to south could be utilized after the radiation partially subsides if the baffles at each end were extended.

If additional shielding is provided around the kitchen, mechanical room and nurses room, these areas can also be utilized for shelter.





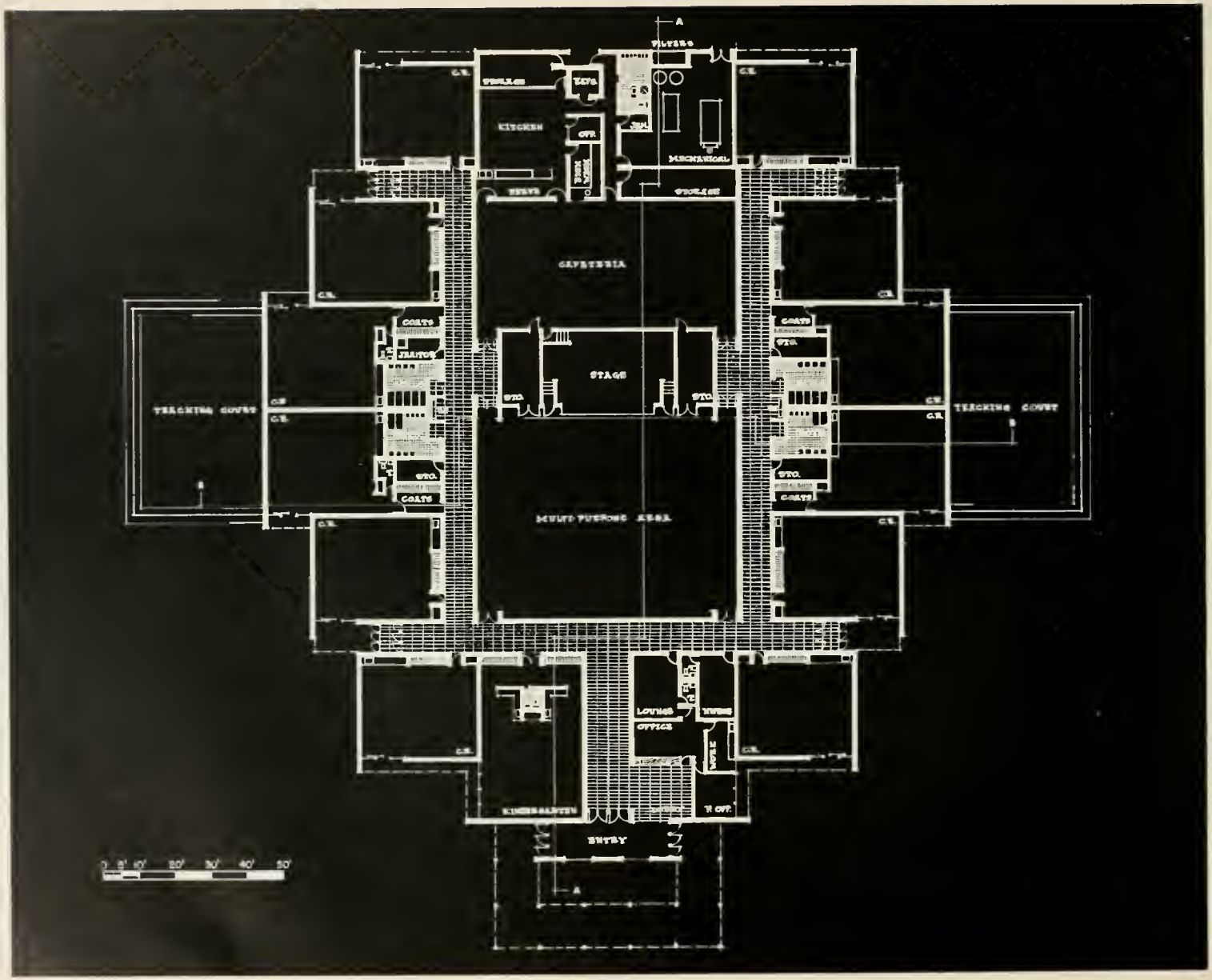
Section B B Looking West

Section A A Looking North

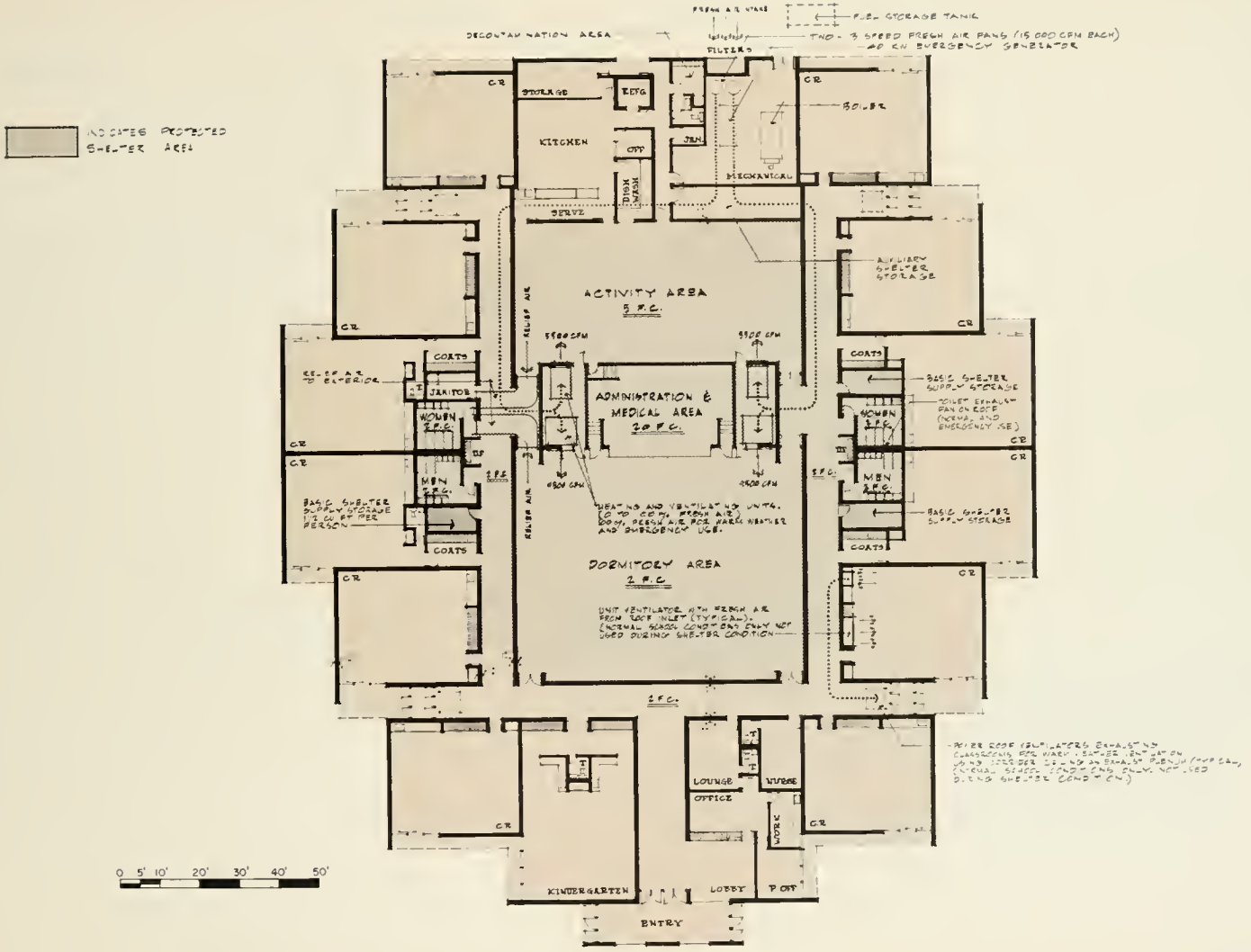
East Elevation

North Elevation

Northeast Perspective


KITCHEN
MECHANICAL
STORAGE
CAFETERIA
STAGE
TEACHING COURT
TEACHING COURT
MULTI-PURPOSE AREA
LOUNGE
OFFICES
KINDERGARTEN
ENTRY
0' 10' 20' 30' 40' 50'

Floor Plan



Shelter and Mechanical Plan

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 6

THIRD PRIZE

Thomas C. Porter, AIA, *Architect*
Des Moines, Iowa

Team Member
Robert S. Brierly, *Engineer*

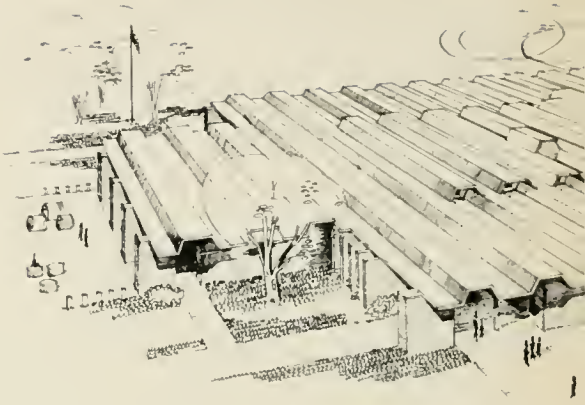
Jury Comment:

A well-organized effective core shelter scheme, with an open, clearstory-lighted commons area. A good percentage of the building serves as shelter, with adequate service facilities.

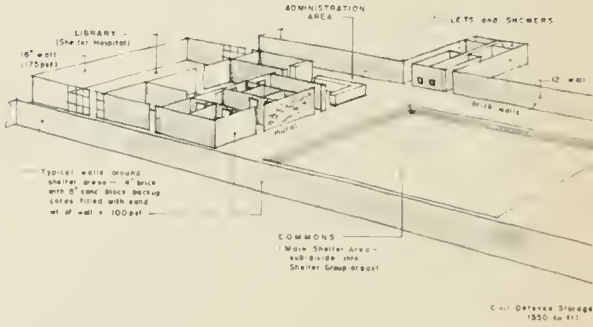
Analysts' Comment:

This solution includes an excellent example of the use of baffles at the west entrances. The placement of the series of pier baffles makes possible the use of glass in the library. This display of openness, enhancing the habitability of shelters, is a major contribution to the architecture of dual-purpose construction.

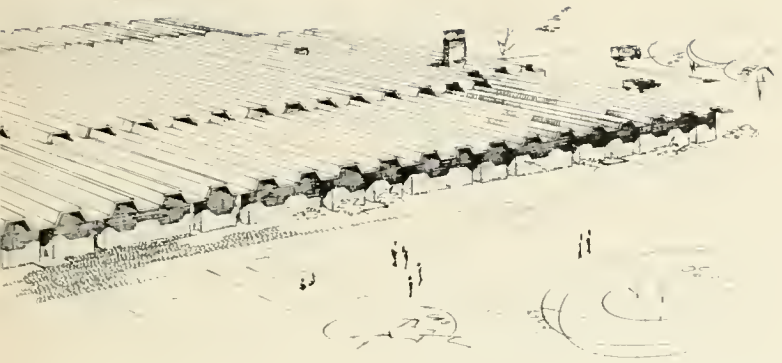
If additional shielding is provided at the loading dock, the kitchen area can be included as a functional part of the shelter. Protection in the library from the ground direct contribution can be considerably enhanced by placing a low wall at the west side of the kindergarten.

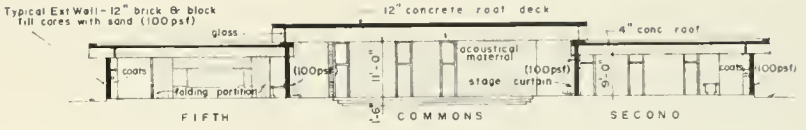


Perspective View Looking Northeast

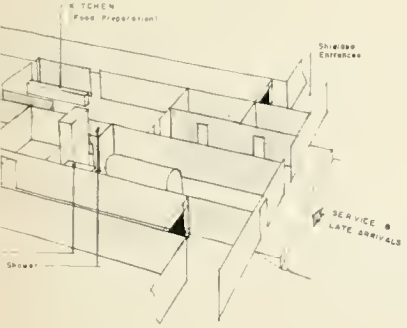


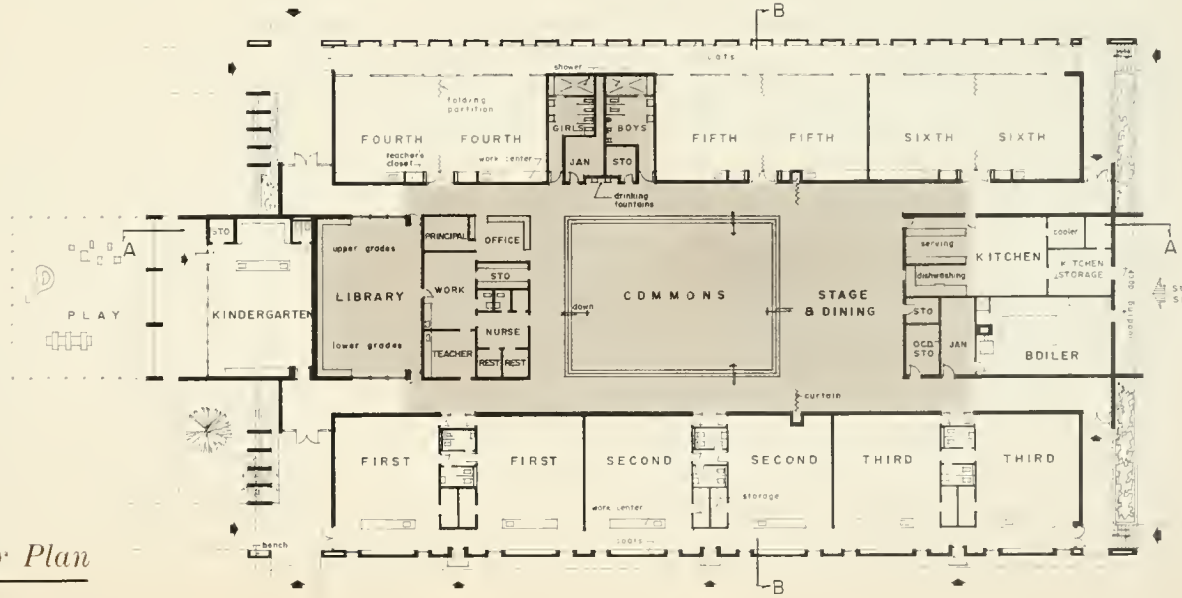
School—Shelter Functions





Section B B





Floor Plan

NOTE: *The First Prize winner for Region 7 was awarded the Grand Prize.*

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 7

SECOND PRIZE

Albert M. Dreyfuss, AIA
Dreyfuss and Blackford, *Architects & Planners*
Sacramento, California

Team Members

Leonard D. Blackford, AIA, *Architect*
Robert M. McLaughlin, *Engineer (structural)*
Frank L. Veninga
Merle D. Gilliland
Donald J. Davison
Theodore A. Werner
William H. Richards, *Engineer (civil)*
Laurence C. Evans
Daniel Yoshpe, *Engineer (mechanical)*
Mario Ajello, *Engineer (electrical)*

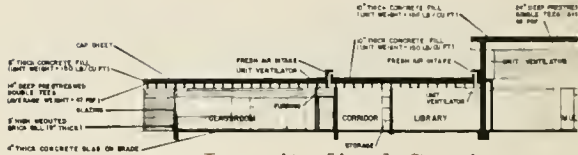
Jury Comment:

A simple, straightforward school with an extensive, well-baffled core shelter area. The planning for the conversion of educational spaces to alternative emergency uses is most noteworthy.

Analysts' Comment:

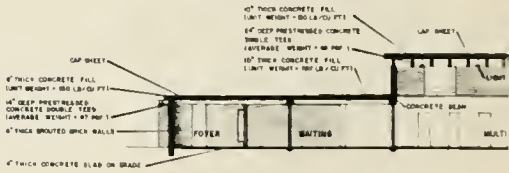
Effective use of the three-foot-high sill in the classroom provides protection against the ground direct contribution to the shelter area. A relatively open multi-use room is protected through judicious use of material and placement of classroom corridor walls, as well as through the use of stub walls at the classroom interior entrances. Shelter functional areas and mechanical systems have been particularly well studied.

North Elevation

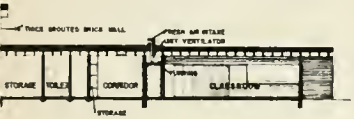


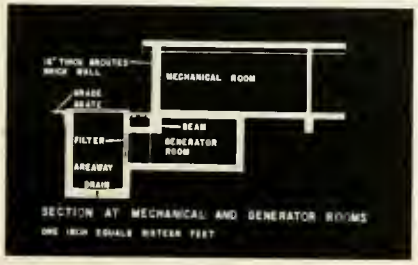
Longitudinal Section

West Elevation

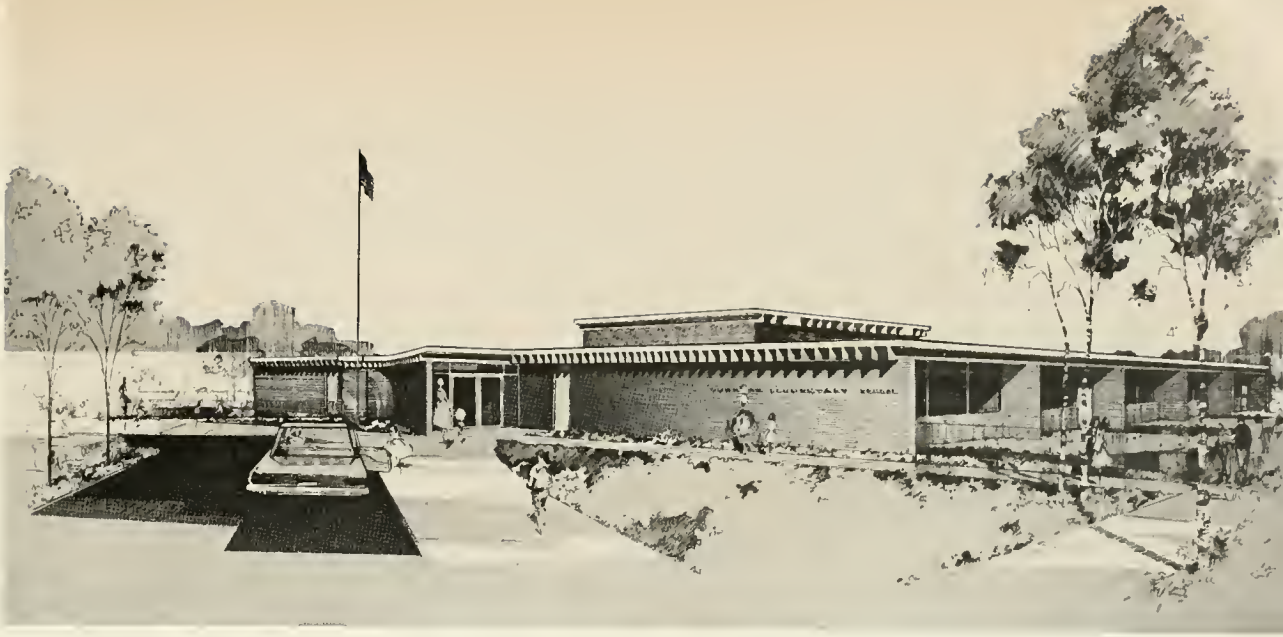


Transverse Section



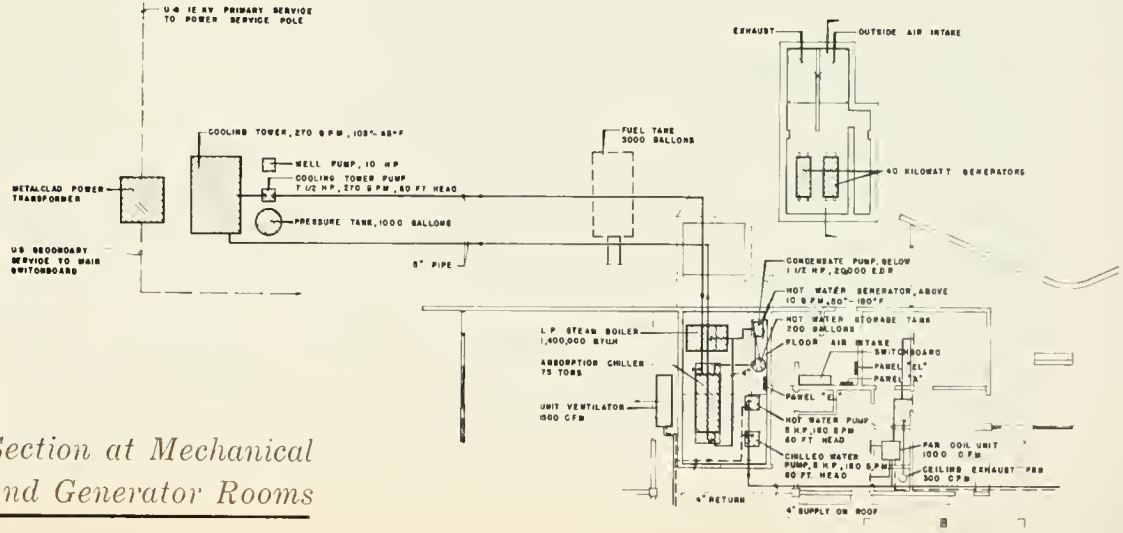


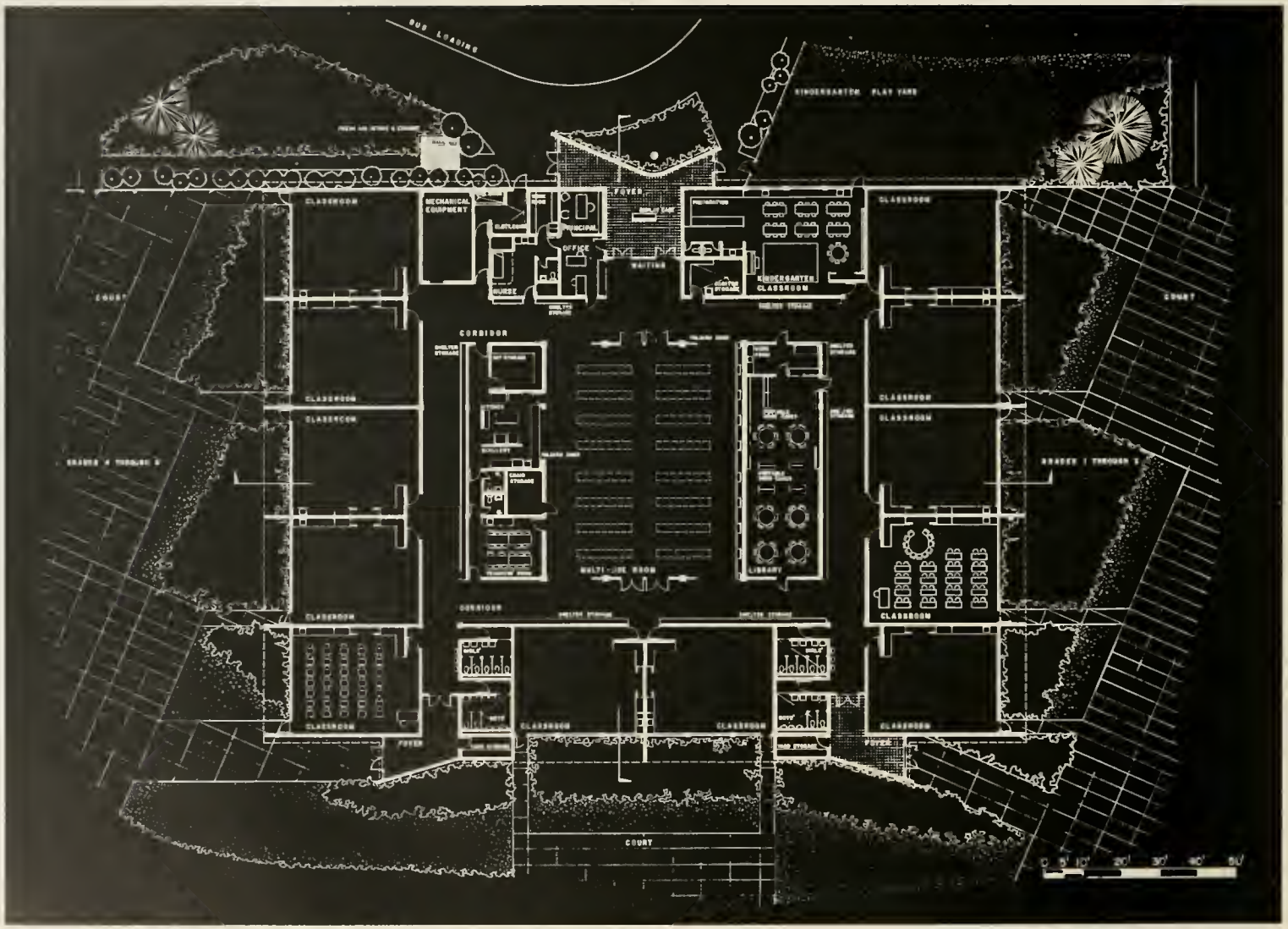
Section at Mechanical and Generator Rooms



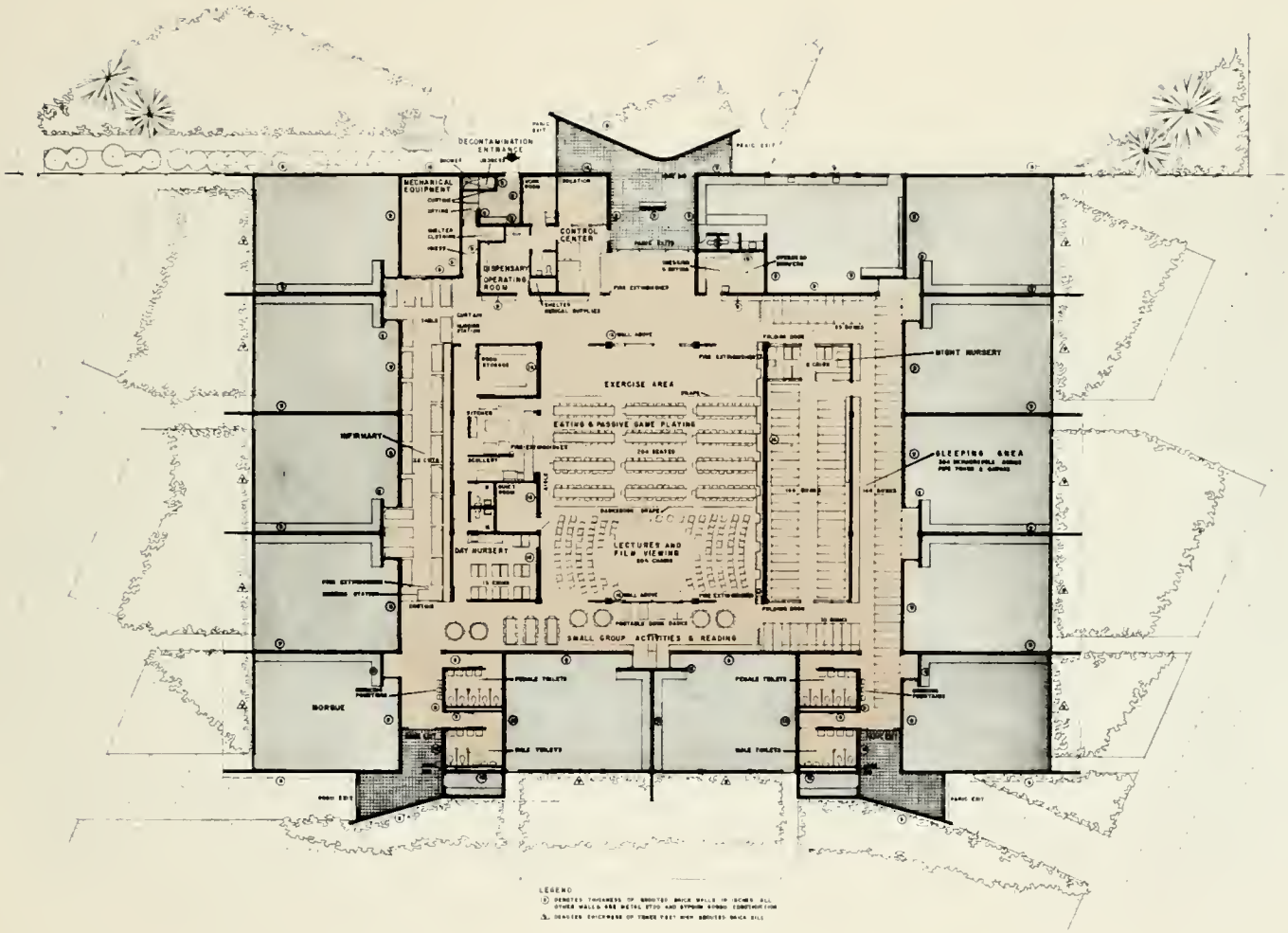
Exterior Perspective

Detail of Mechanical and Electrical Plan




BUS LOADING
KINDERGARTEN PLAY YARD
MECHANICAL EQUIPMENT
FOYER
PRINCIPAL
OFFICE
WAITING
NURSE
KINDERGARTEN CLASSROOM
CLASSROOM
COURT
CORRIDOR
MULTI-USE ROOM
LIBRARY
GRADES 1 THROUGH 3
0 5' 10' 20' 30' 40' 50'

Floor Plan



Shelter Floor Plan

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

Region 7

THIRD PRIZE

Wilsey, Ham & Blair *Architects*
Millbrae, California

Team Members

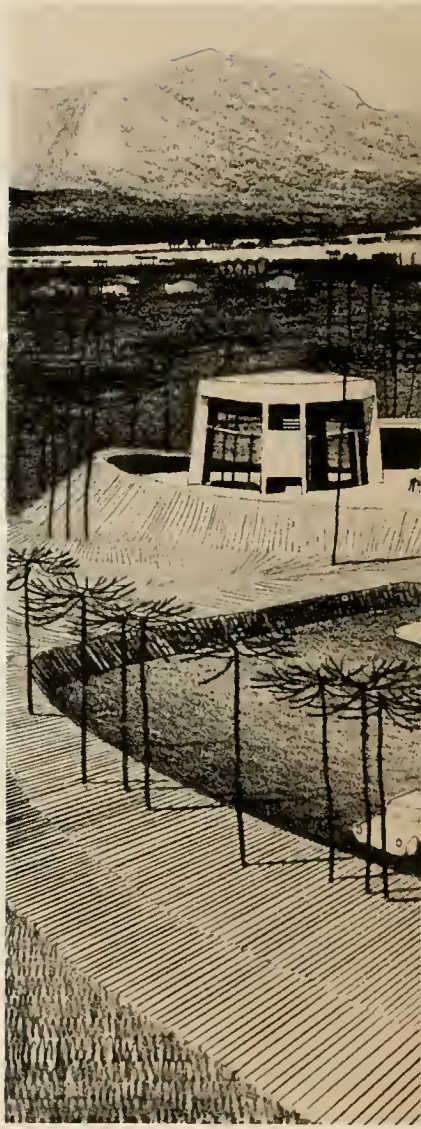
Gilman G. Hoskins, AIA, *Architect*
Joseph J. McGraw, *Architect*
Eugene C. Lewis, Jr.
Donald W. McGlashon, *Engineer (civil)*
William Gropp, *Engineer (mechanical)*
Remo Piers, *Engineer (structural)*
William T. Cannady
William Wilson
Dr. John D. Andes

Jury Comment:

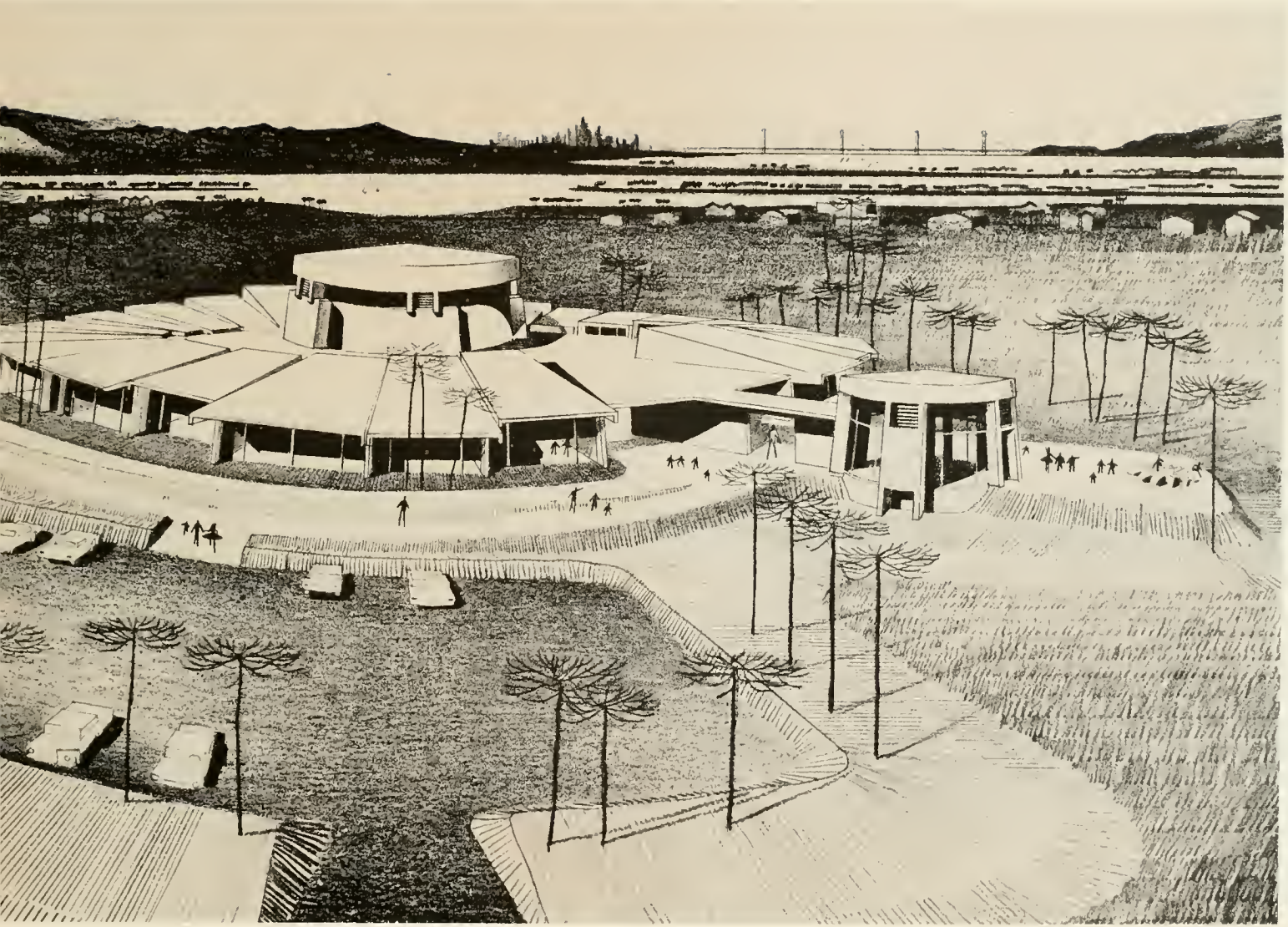
This is the most interesting and imaginative of the many circular schools submitted. The handling of roof lines and placement of exterior walls is done in a manner which creates a variety of classroom spaces and an interesting building. The core shelter area is well baffled and allows for the filtering in of natural light. The detailing and shielding of the mechanical ventilating system is particularly well done.

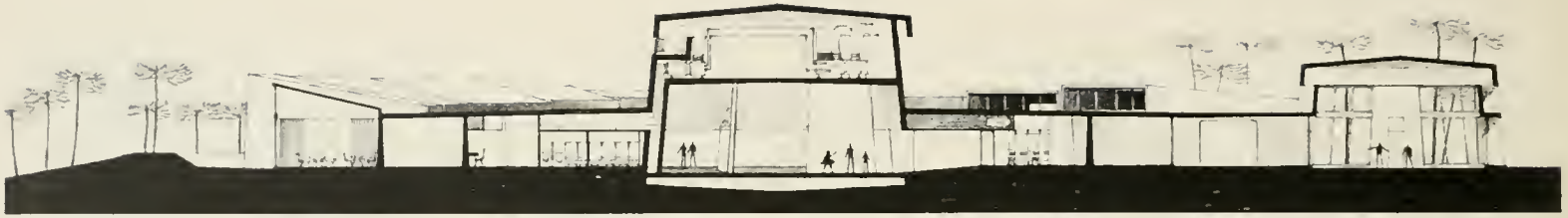
Analysts' Comment:

Judicious use of baffles and shields provides protection against ground direct and skyshine contributions. The double overhead masses in the central area provide good protection against the roof contribution. Deliberate contouring of the site offers very effective and inexpensive shielding from ground direct contribution.

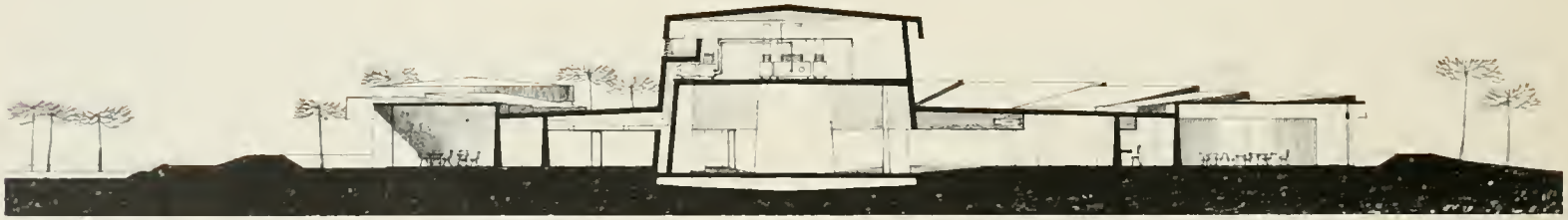


Exterior Perspective



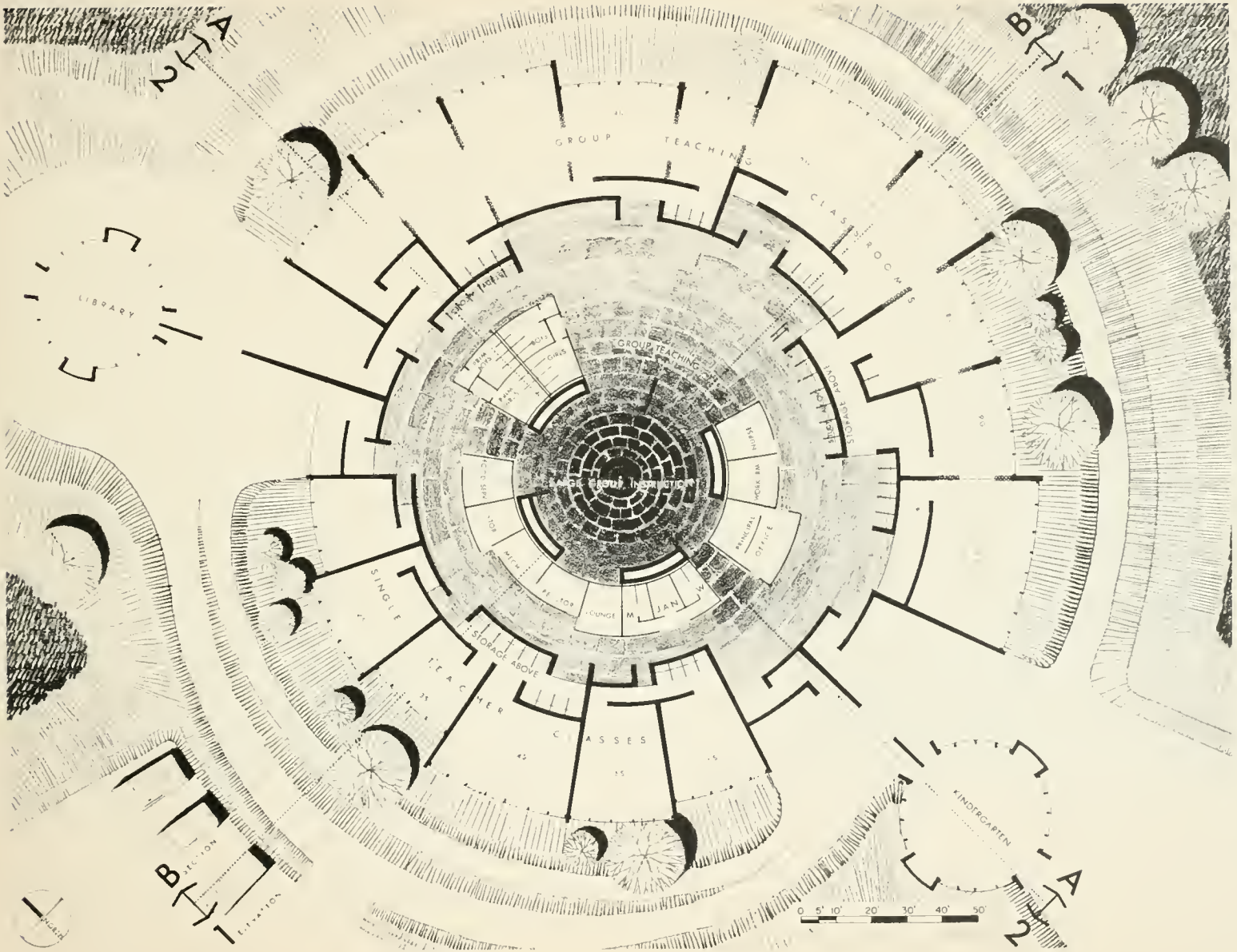


Section A



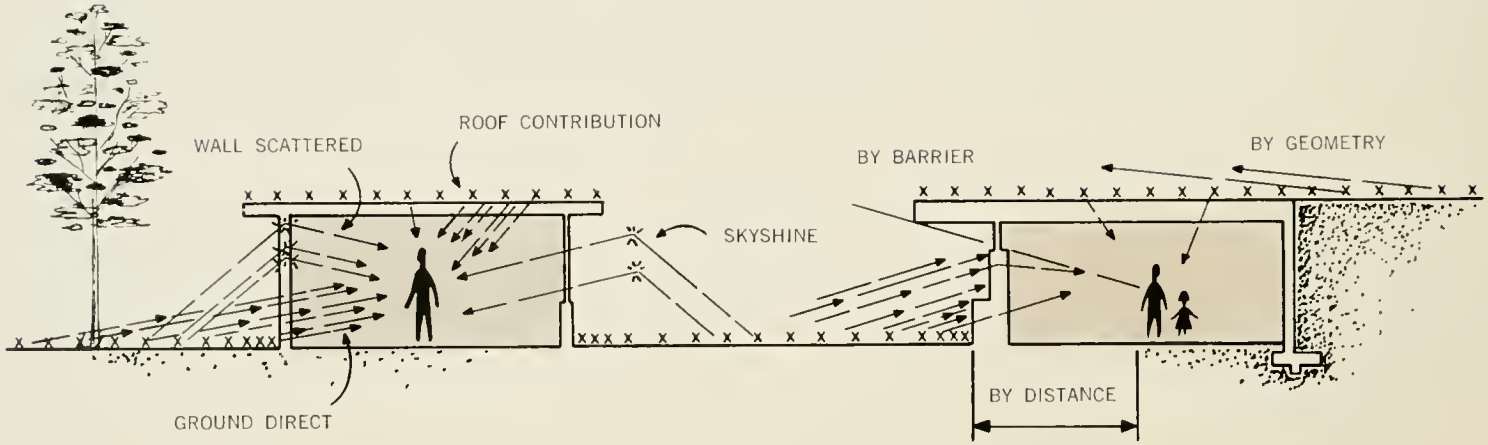
Section B

Elevation


GROUP TEACHING CLASSROOMS
LIBRARY
GROUP TEACHING
STORAGE ABOVE
SINGLE TEACHER CLASSES
STORAGE ABOVE
KINDERGARTEN
0 5' 10' 20' 30' 40' 50'

School Plan

REGION 8. *In the judgment of the jury, none of the entries from Region 8 fulfills the objectives and requirements of the program. Therefore, no prizes are awarded for this region.*



ACCESS OF RADIATION

FIG. 1

CONTROL OF EXPOSURE

FIG. 2

BASIC CONCEPTS OF PROTECTION

by **Albert W. Knott** *and* **Gifford H. Albright**

Many terms used in the design of shelters are becoming commonplace. It is commonly known that nuclear explosions create fallout, that fallout consists of radioactive dust, sand, or ash, and that it is deposited on roof surfaces, ledges, canopies, and on the ground. Fallout drifts through the air just as dust particles do. Thus roofs and surrounding ground surfaces are the major locations where radioactive particles settle.

Lesser known are the effects of nuclear radiation and the manner in which it can gain access to shelters. For this reason the following definitions describing access of radiation are given:

Roof contribution: Radiation coming from fallout on the roof, and entering the shelter through the roof material.

Ground direct contribution: Rays coming from the ground directly into the shelter without interacting with the intervening wall barriers.

Wall-scattered contribution: Rays coming from the ground into the shelter after interacting with particles of material in the wall barrier.

Skyshine contribution: Rays entering the shelter after interacting with air particles or foreign matter suspended in the air.

(All of the contributions cited above are illustrated in Figure 1.)

Figure 2 shows the three basic ways in which protection from radiation can be obtained. These ways are: (1) Geometry, design so that shelter occupant is out of the direct path of radiation, (2) barrier, placing a heavy shield between radiation and the shelter occupants, and (3) distance, getting away from the source of radiation. In areas where basements can be built, geometry is normally the least expensive of the three. Figure 2 shows that roof and ground direct contributions are potentially the most dangerous, and always require special attention.

Shelter design has many characteristics other than radiation shielding which require the trained minds of architects and engineers. These include, to mention only a few, psychological and sociological aspects, food, clothing, sanitation, and medical care. To design a facility to be used once, quickly and successfully in an emergency, yet to operate normally in a radically different way requires imagination, intelligence, and experience.

The shelter problem requires great study. As a school transforms a child into a productive citizen, so must a shelter safeguard a frightened, possibly sick or injured person so that he can continue to be a productive citizen capable of rebuilding a severely crippled nation. All matters conducive to the protection of occupants should be considered in the design of shelters. This will require great imagination, understanding, care, and competence on the part of architects, engineers, their clients, and the people of this Nation.

Appendixes

a. The Competition Program

b. Memorandum to Registrants

NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

NOTE: the following is a reprint of the competition program as it was issued to competitors during June of 1962.

The Department of Defense has contracted with the American Institute of Architects to conduct in its behalf a competition for design of an elementary school incorporating fallout shelter. The aims of the competition are expressed in the following statement prepared by the Department of Defense.

objective and scope

The Nation has embarked on a long range program of identifying present fallout shelter capacity and providing shelter in new and existing structures.

There is a need to conduct shelter design studies, refine present criteria, develop new concepts, and develop designs which will serve specific needs in various climates and provide dual purpose usage.

A nation-wide shelter design competition will stimulate development of new concepts, encourage attendance at educational courses for professional development, and contribute to providing a broad base of qualified Architects and Engineers for future shelter design requirements.

The objectives of this competition are to serve the national interest by encouraging the creation of shelter designs which will: conserve materials, manpower and money; create fallout protection in the maximum area of the school; incorporate attractive features; and produce structures of aesthetic appeal.

The awards are offered to develop and promote ingenuity, originality, economy and advancement in the field of dual purpose fallout shelter design for elementary school shelters. The plans developed will provide general suggestive guidance to the many school planners and designers throughout the U.S.

$55,000 in prizes!

awards

The following prizes will be awarded:

	Total Prizes
1 Grand Prize @ $15,000	$15,000
7 Regional First Prizes @ $4,000	28,000
8 Regional Second Prizes @ $1,000	8,000
8 Regional Third Prizes @ $500	4,000
Total Cash Prizes	$55,000

Judgment will first be conducted on a Regional basis and first, second and third place winners established for each of the eight Civil Defense Regions. The national Grand prize of $15,000 will be awarded to one of the eight submissions placing first in regional competition. Regional first prize awards of $4,000 will be made to each of seven remaining first place winners.

In addition, up to 50 Certificates of Merit will be awarded. Winners will be announced within 15 days of the judging and cash prizes paid shortly thereafter.

ownership

All entries shall become the property of the Office of Civil Defense, Department of Defense, provided however, that entries not awarded monetary prizes will be used only for publicity or educational purposes. The contestants concerned will be identified in connection with reproduction by the Government of any entry. Credit will be given to all members of the design team, with the registrant being listed first.

jury

The Jury consists of:

WILLIAM H. BYRNE
President
Byrne Associates, Inc.
New York, New York
President
American Society of
Mechanical Engineers
'61, '62

WILLIAM W. CAUDILL
FAIA
Caudill, Rowlett & Scott
Architects Planners
Engineers
Houston, Texas
Chairman
Department of Architecture
Rice University

HAROLD D. HAUF, AIA
Vice President
Charles Luckman
Associates
Planning, Architecture
Engineering
Los Angeles, California

LINN SMITH, FAIA
President
Linn Smith
Associates, Inc.
Architects Engineers
Birmingham, Michigan

PAUL S. VISHER
Deputy Assistant Secretary
of Defense for Civil Defense
Department of Defense
Washington, D.C.

PROFESSIONAL ADVISER
A. Stanley McGaughan, AIA
McGaughan & Johnson
Architects
Washington, D.C.

One person from the United States Office of Education will be designated to serve as technical adviser to the Jury.

The Jury shall have full and final power in the selection of all entries for awards. All entrants

in this competition agree that they will make no claim against the Jury, any members thereof, the Professional Adviser, the American Institute of Architects or the Government on account of anything that may be done or omitted to be done, except in connection with the non-delivery of monetary prizes as awarded.

A. Stanley McGaughan, AIA, has been appointed as Professional Adviser and his address for this competition is 1735 New York Avenue, N.W., Washington 6, D.C.

examination of designs and awards

The Professional Adviser will examine the designs to ascertain whether they comply with the mandatory standards. At the time of judging those selected for consideration as winners will be carefully examined and computation made of the protection factor and shelter capacity to assure compliance with the design criteria stipulated in this program.

report of the jury

The Jury will make a report giving the order of selection and the pertinent reasons for their choice.

eligibility

The Competition is open to teams of registered architects and engineers licensed to practice in the United States and to similar teams composed of faculty members and graduates of architectural or engineering schools.

Collaborative participation by architects and engineers, working as design teams, is a requirement because of the scope of this competition.

Teams must be registered with the Professional Adviser in the name of an individual who shall be either a registered architect or engineer or a faculty member or graduate. Each registrant shall show on his registration form his valid license number with an architectural or engineering registration board in one of the states, the District of Columbia, Puerto Rico or the Panama Canal Zone, or shall show his affiliation with or degree from a qualified architectural or engineering school.

To be eligible to participate in this competition a faculty member must be affiliated with an architectural school which is a member of the Association of Collegiate Schools of Architecture (1961/62) or an engineering school having curricula currently accredited by the Engineers Council for Professional Development. An architectural or engineering graduate to be eligible to participate shall have received his baccalaureate degree in architecture or engineering from an architectural or engineering school which was at the time of his graduation qualified as indicated above.

Employees of Federal, state or local Offices of Civil Defense and their families and staff members of the American Institute of Architects and their families are not eligible to particiapte in this competition. The competition is open only to citizens of the United States.

communications (mandatory)

No communications will be allowed in view of the size of the competition. All contestants must rest on their own judgment of the problem as stated.

return of drawings

No drawings will be returned. It is suggested that competitors keep copies if they so desire.

completeness of drawings

Architectural, structural, mechanical and electrical design shall be shown in sufficient detail to permit easy determination of economic feasibility, protection factor and shelter capacity. Detailed working drawings are not required.

Outline specifications or narrative should be used to supplement the drawings.

The limits of designated shelter areas shall be clearly indicated. Materials shall be indicated and material thicknesses shall be given either by scale, dimension or note, wherever such thicknesses are significant in computing the protection factor.

required drawings (mandatory)

The following drawings are required:

1. A plot plan—Scale 1″ = 100′
2. All floor plans—1/16″ scale
3. At least two elevations—one front, one side—1/16″ scale
4. An exterior perspective—any suitable scale
5. An interior perspective of shelter area—any suitable scale
6. At least two sections showing structure, one each major direction—1/16″ scale
7. Other drawings as may be necessary to illustrate fallout protection, including mechanical and electrical features. For this purpose schematic sketches, amplified as necessary by written text, are preferred.

Drawings shall be on white translucent paper, measuring 17 inches vertically and 22 inches horizontally. A single border line may be used if desired. Drawings shall be in black and white suitable for reproduction. Drawings shall not be rolled but shall be kept flat to facilitate review and display.

Models will not be permitted.

Outline specifications or narrative or both, of not more than 1000 words, typewritten and double spaced, on one side only of plain 8½″ by 11″ pages may accompany the entry if desired.

anonymity of drawings (mandatory)

The drawings to be submitted shall bear no name or mark which could serve as identification, nor shall any competitor directly or indirectly reveal the identity of his design, or hold communication regarding the competition with the Department of Defense, the American Institute of Architects, the Jury or the Professional Adviser. It is understood that in submitting a design, each competitor thereby affirms that he has complied with the foregoing provisions in regard to anonymity, and agrees that any violation of them renders null and void any consideration in this competition.

With each set of drawings must be enclosed a plain, opaque, sealed envelope which shall bear no superscription or mark of any kind other than, O.C.D. Region 1 to 8 as the case may be, which number shall be the region of the Office of Civil Defense in which the registrant or one member of the design team lives, and for which the school is designed. The region number shall appear also on the first sheet of drawings in the upper right hand corner.

The following information shall be enclosed in the envelope:

1. Names, addresses and professional or school affiliation of the registrant and other members of the design team.
2. Name(s) of individual(s) to whom any award check is to be made payable and address to which check is to be mailed.

Entries and envelopes will be numbered upon receipt, with envelopes remaining unopened until after the judging when they will be opened in the presence of the Jury and a representative of the O.C.D.

delivery of drawings (mandatory)

Drawings shall be addressed to the Professional Adviser, National School Fallout Shelter Design Competition, P.O. Box 12068, Washington 5, D.C. All entries shall be sent by registered mail prior to 5 pm, 15 October 1962. Receipts shall be forwarded to Professional Adviser under separate cover as evidence of mailing.

schedule of dates

Announcement, 14 May 1962
Program Mailing Begins prior to 15 June 1962
Registration Ends, 15 July 1962
Competition Ends, 15 October 1962
Judging Complete, 15 November 1962
Awards Announced, 1 December 1962

SITE

Each team shall choose its own hypothetical site, which shall be within the O.C.D. region in which the registrant or team member resides. A short paragraph shall be included detailing hypothetical site conditions in relation to subsurface conditions; soil types encountered and water level. Topography of site and general climatic conditions shall be commented upon briefly. In judging the Jury shall consider the solution in respect to the particular site chosen.

PROBLEM

The problem is to design an elementary school for a student population of not less than 300 or more than 500, incorporating community fallout shelter having a capacity of not less and preferably more than 2 times the school population, and providing a protection factor of not less than 100.

The area or areas designated as fallout shelter shall be designed as dual purpose space serving normal functions in the educational plant and providing protection from fallout gamma radiation during emergency periods.

Submissions will be judged on the quality of the total design, on excellency of the school design, on suitability and adequacy of the fallout shelter and on originality and ingenuity in the design of dual-purpose space.

The provision of auditoriums, gymnasiums and multi-purpose rooms planned for shelter use is left to the discretion of the competitor.

Economy of construction including considerations of maintenance and operating costs is considered essential. A building of quality construction but without features or materials that would be considered lavish is desired. For this reason and because of the need for determining the protection factor, materials must be indicated.

Design criteria for determination of the protection factor and shelter occupancy standards are as supplied by the Office of Civil Defense of the Department of Defense as stated in the following section.

SHELTER DESIGN CRITERIA

1. radiation shielding

A. A fallout shelter is a structure, room or space which protects its occupants from fallout gamma radiation and provides a protection factor (PF) of at least 100. This factor is used to express the relation between the amount of fallout gamma radiation that would be received by an unprotected person compared to the amount he would receive in the shelter. An unprotected person would receive 100 times more radiation than a person inside a shelter with a PF of 100.

B. **Computations**—Shall be made by the methods established in OCD publications—"Guide for Architects and Engineers" or "Design and Review of Structures for Protection from Fallout Gamma Radiation." These will be furnished to all registrants.

C. In the calculation of the protection factor, the radiation dose contribution to the shelter occupants coming from the entranceways, ventilation ducts or other openings in the shelter's barriers shall be considered.

D. Entranceways shall be properly designed to prevent the infiltration of fallout particles and to reduce the fallout gamma radiation hazard through the use of principles of geometry and/or barrier shielding.

2. space

A. **Floor Area**—At least 10 square feet of usable shelter area per person.

B. **Volume**—When mechanical ventilation is provided:

(1) For aboveground areas, at least 65 cubic feet of net space per person shall be provided for at least 50 percent of the occupants and at least 40 cubic feet of net space for the remainder.

(2) For belowground areas, at least 65 cubic feet of space per person shall be provided for all occupants.

C. **Volume**—When mechanical ventilation is not provided:

(1) For aboveground areas, at least 65 cubic feet of space per person shall be provided. However, the volume of the surrounding or adjacent areas of the building may be considered in determining the volume requirements.

(2) For belowground areas, 500 cubic feet of net space per person shall be provided (See 3B).

3. ventilation considerations

A. If the shelter capacity is based on minimum space requirements, then mechanical ventilation shall supply at least 3 cubic feet of fresh air per minute per person.

B. When mechanical ventilation is limited or not available, the following table can be used for determining the relation of space requirements to ventilation:

Rate of air change (minutes) /1	Volume of space required per person
	Cu. Ft. /2
1,000	500
600	450
400	400
200	300
100	200
60	150
35	100
22	65

/1 Computed at the ratio: $\frac{\text{Net volume of space (cu. ft.)}}{\text{Fresh air supply (cfm)}}$

/2 Shelter capacity or occupancy time may be limited by the volume of the room and not by its area. This is particularly true if mechanical ventilation is inadequate. For rough estimate, each basement shelter occupant should be allowed at least 500 cu. ft., if no mechanical ventilation is available. This would permit shelter occupancy for about a day before conditions may become intolerable. In many cases, however, interior stairwells, shafts, and ducts would create enough natural ventilation to extend staytime markedly.

C. If filters or plenum chambers or other areas where radioactive particles can accumulate are in or adjacent to a shelter area, they shall be properly shielded.

4. egress

At least one unit of access and egress width should be provided for every 200 people (a unit width is 22 inches, the space required for free travel of one aisle of persons). In no case shall the width be less than 24"; nor shall there be less than two widely separated means of egress from each building.

5. services

A. General

Provisions will be made for the storage of basic shelter supplies by allotting one and one-half cubic feet per person. Community shelters meeting Federal Criteria are now being stocked with:

(1) Water Containers—enough to provide each person with 14 quarts of water.
(2) Food—Enough special biscuits or wafers to provide 10,000 calories per person.
(3) Medical care kits.
(4) Sanitation Kits which include toilet tissue, sanitary napkins, waterless hand cleaner, toilet seat and commode chemicals. Empty water containers convert to commodes.
(5) Radiation detection instruments.

B. Alternative Assumptions

(1) Water Supply—A suitable well or water storage tank may be provided in lieu of water stored in separate disposable containers if proper assumptions are made regarding power availability and alternative sanitary provisions.

(2) Sanitation—Provisions shall be made for the collection and disposal of garbage, trash, and human waste in such a way as to preclude the creation of unsanitary conditions.

(3) Electrical—Fallout shelters normally need not be supplied by emergency power if it can reasonably be assumed that power supplies and transmission lines have been sufficiently protected, or when multiple power sources provide reasonable assurances of continuity of service under fallout conditions.

Power shall be adequate to operate at least the following systems:

Required ventilation demand
Required lighting (unless battery-operated lights are provided).
Emergency water supply (when well is provided).
Emergency sewage ejection (when provided).
Emergency lighting minimum levels are:
Sleeping areas—2-foot candles
Activity areas (floor level)—5-foot candles
Administrative and medical areas (desk level)—20-foot candles.

If the design assumptions indicate a requirement for an emergency engine generator set, it shall be separately vented and heat-isolated from the shelter. In this case special consideration should be given in locating engine generator sets and fuel tanks to minimize hazards from exhaust gases and fires.

Emergency power provisions require the storage and maintenance of a minimum 14-day fuel supply.

O.C.D. REGIONS

1—Me., N.H., Vt., Mass., Conn., R.I., N.Y., N.J., P.R.

2—Pa., Ohio, Ky., Va., W. Va., Md., Del., D.C.

3—Tenn., N.C., S.C., Ga., Ala., Miss., Fla.

4—Minn., Wis., Mich., Ill., Ind.

5—N.M., Okla., Tex., Ark., La.

6—N.D., S.D., Wyo., Neb., Colo., Kan., Iowa, Mo.

7—Calif., Nev., Utah, Ariz., Hawaii

8—Wash., Mont., Oreg., Id., Alas.

Note: For purposes of this competition only the Panama Canal Zone will be considered as part of Region 5.

MEMORANDUM TO REGISTRANTS

July 16, 1962

To: All Registrants in the
NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION

From: A. Stanley McGaughan
Professional Adviser

We are enclosing the following listed reference material for your use:

1. "Guide for Architects and Engineers," published by the Department of Defense, Office of Civil Defense, Washington 25, D. C.

2. "Design and Review of Structures for Protection from Fallout Gamma Radiation," published by the Department of Defense, Office of Civil Defense, Washington 25, D. C.

3. Excerpts from "Environmental Engineering in Protective Shelters," published by the National Academy of Sciences, National Research Council, Washington 25, D. C.

4. Regional Directory of Architects and Engineers Qualified in Fallout Shelter Analysis, for the particular OCD Region in which you reside, published by the Department of Defense, Office of Civil Defense, Washington 25, D. C.*

5. Listing of Civil Defense Regional Offices and the States which they serve, issued by the Department of Defense, Office of Civil Defense, Washington 25, D. C.

** Complete listings of all architects and engineers who have successfully completed the OCD course in Fallout Shelter Analysis are available through the Office of Civil Defense, Washington 25, D. C., and from Regional and State Civil Defense offices.*

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NATIONAL SCHOOL FALLOUT SHELTER DESIGN COMPETITION