

HUMAN SCALE FOR ELEMENTARY SCHOOLS

Submitted in partial fulfillment of the
requirements for the Degree of Master of
Architecture

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Dear Sir:

The following paper entitled "Human Scale for Elementary Schools" is respectfully submitted as a partial fulfillment of the requirements for the degree of Master of Architecture.

Sincerely,

/Mason S. Hicks

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INTRODUCTION:

The measure of a good school building is whether it fits the pupil; whether it benefits his health, his safety, his mental attitude toward learning; whether the character, interior spaces, and equipment are scaled to his physique; and whether the spaces and equipment are of sufficient size and number to enable proper instruction. It is for the pupil that educational systems are built, it is for him that teachers are trained, and it is for him that schools should be designed.

For too many years we have ignored the pupil. We have designed for him only indirectly. We have thought of space for teaching, of dollars for heating plants, of stairways and toilet seats made for the average 5'-9" American, of facades to impress ourselves and visiting dignitaries. It becomes a pathetic situation when one thinks of the number of schools in our country that have been built, and are being built today, which give little thought to the average American who is only 4'-4" tall.

Fortunately, our educators and architects have begun to think of him and for enough years that techniques in teaching, building, site planning and equipment design have rapidly changed. Research and invention have been carried far enough

that the pattern for the new school has been evolved. It remains only to be adapted to the different sites, different climatic conditions, and different teaching situations. It will be refined as these same researches and inventions are carried further. Any major future change will come only when the educational procedures undergo a revolution due to the introduction of new teaching aids.

The one realm of school design that seems to be the farthest behind is that which concerns human values. Not only does it seem to be the failing point of our school buildings, but of all our buildings; and moreover, of our whole society. Only physiological and psychological measures will show the way.

This paper, therefore, is slanted toward improving the school plant as is directed by the effects on the pupil of the artificial climate that must be created inside any enclosed space in a temperate zone.

This thesis is divided into four parts. One part consists of photographs of drawings for an elementary school in Marietta, Ohio. The three written parts are:

PART I Conditions that have a general application to elementary school design and have been accepted by most progressive educators as being necessary for a well planned school.

PART II Physiological and psychological effects of the different properties of a school, and the attempt to find methods of arriving at a school design that will improve the physical and mental health of the pupil.

PART III Conditions governing the design of an elementary school for Marietta, Ohio.

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PART I

GENERAL CONSIDERATIONS

This section is given over to a list of considerations that have been accepted by most progressive educators, city planners and school designers and have a general application to all elementary schools. The methods of achieving all, or any one, of these points are entirely local and must be decided by the School Board and its consultants for each individual school. Conditions concerning technical aspects such as sound, light, airconditioning and economy are discussed in Part II of this paper.

It is felt that detailed explanation of the following points is unnecessary; however, if a complete discussion on any one is desired, almost any of the publications that are listed in the bibliography can be consulted.

SITE:

1. The site should be centrally located in areas free from light obstructions, industrial air pollution, noise, and high intensity traffic arteries.
2. The site should be protected by community planning from future intrusions of business, industry, and traffic.
3. Community planning on future population changes and

direction of residential expansion should be used in the selection and most economical acquisition of sites.

4. The site should be considered as part of the city park and recreational facilities. The costs of land, equipment and upkeep should be shared by the ~~School~~ School Board and Park Commission.
5. A MINIMUM OF FIVE ACRES OF LAND IS NECESSARY FOR A MODERN ELEMENTARY SCHOOL. General rule is: five acres, plus one for every one hundred pupils.
6. Flexibility and expansion of site should be considered.
7. Walking distance for elementary school pupils should not exceed $3/4$ of a mile.
8. Walking paths to school should be considered from the standpoints of pupil safety and appropriateness of conditions along the path.
9. Off-street parking must be provided.
10. The topography and soil must be considered.
11. Steep terracing and high exposed retaining walls should be avoided.

12. Landscape and nature must become part of the school plant, especially on city sites.

13. Views should be considered.

Trends in Site Selection:

1. Ever increasing desire for land.
2. Increasing accent on group type play areas, decreasing use of individual or exhibition sport areas.
3. Decreasing insistence on "walking distance" as a criterion for site placement.
4. Increasing need for parking space.

BUILDING:

1. The school building should provide space and equipment for teaching according to the educational philosophies and the needs of the community. It should allow change as these philosophies and needs change.
2. The building should have after-school uses. It should provide space for community recreation and study, either supplementing the existing community facilities or actually

becoming the community center.

3. Spaces should have multiple uses wherever possible.
4. The building should add to the emotional growth and stability by being esthetically comfortable.
5. Its facilities should add to the physical comfort and well-being by having proper light, sound control, ventilation, etc.
6. It should present a friendly and inviting appearance to child and community, should not attempt to be monumental.
7. Orientation and layout should be dictated by the topography, climate, space functions, etc., should not be affected by ideas of "prestige".
8. Noisy and quiet elements should be zoned from each other.
9. The building should be planned for exterior and interior flexibility. However, with present-day materials, interior flexibility carried to an extreme sometimes results in planning and construction costs which render it unjustifiable.

Trends.

1. Use of lighter, demountable, high salvage value materials.
2. Planning for future use when school plant becomes obsolete as such.
3. Shorter amortization periods.

CLASSROOMS:

1. The classroom should possess the qualities listed under Building, page 6. Exception: Number 8 is not applicable to the classroom.
2. Special-use classrooms are advantageous, budget permitting their construction.
 - a. Art
 - b. Crafts, shop
 - c. Music
 - d. Drama
 - e. Science
 - f. Reading (library)
 - g. Home-making
 - h. Audio-visual

All are subject to combination; all are good "community use" rooms.

3. Classrooms should be on the ground floor for safety, to achieve affinity with outdoors, to open windows on the long views necessary for resting eyes. Moreover, stairs are dangerous, ramps expensive.
4. Contemporary educational philosophy demands SPACE within the classroom for:
 - a. vigorous informal activity, group and individual.
 - b. formal work, less space consuming, but often needed simultaneously with (a).
 - c. classroom library.
 - d. piano.
 - e. ample storage shelves, drawers, cabinets, etc., much of it movable to permit flexibility within the room.
 - f. tack-board.
 - g. outdoor clothing storage for the younger children.
 - h. facilities for toilet and personal hygiene training, especially for the younger children.
 - i. drinking fountains and sinks with hot and cold water.
 - j. growing plants, aquariums, and other projects.

35 square feet per pupil is recommended.

5. The classroom should provide facilities for radio-phonograph and movie projector, even if excellent audio-visual aids are present elsewhere in the school.
6. Some authorities believe that an intercommunications system with broadcasting facilities connecting all classrooms and principal's office is necessary. It is doubtful whether the use of such a system in an elementary school of small or medium enrollment would justify the expense.
7. Some provision for rest periods should be planned, especially in the lower grades.
8. Furniture should be scaled to its age group, should be easy for children to move, should be stackable to give clear floor space. For community use of the room, adult-sized furniture should be stored reasonably near, for easy substitution.
9. Floors should be resilient, long wearing, easy to clean, warm to touch, light in color, devoid of eye-catching designs.
10. Requirements for classroom heating, lighting and ventilation will be discussed in Part II.

Trends in Classroom Planning:

1. Closer affinity to the outdoors.
2. More excursions outside the classroom and outside the school grounds.
3. More controlled natural light.

GROUP SPACES

Playroom:

1. An enclosed play space is a necessary part of the elementary school plant.
2. Playrooms for elementary schools are distinguished from gymnasiums by dimensions, character, and amount of spectator space provided. If a gym is desired for community activity it may serve as playroom for the children.
3. Recommended playroom area is 25 square feet per pupil.
4. The playroom should have abundant natural light.
5. It should have direct access to playgrounds.

6. It should provide storage space for play equipment.
7. If the playroom is to be used as assembly area, student and/or community, a platform or stage and storage space for necessary furniture must be provided.
8. The playroom is a good community activity room.

Playground:

1. Recommended playground area is 250 square feet per pupil.
2. The playground should provide at least one large, level, open area, preferably grass covered, for running games.
3. Some paved play area should be provided. Such areas can be used effectively as parking space for after hours community activities.
4. A playshed is of value, especially where an indoor play space cannot be provided.
5. Standing equipment should include swings, sliding boards, sand boxes, jungle gyms, see-saws, wading pools, trees for climbing, benches for relaxing.
6. Play areas for kindergarten pupils should be separated

from other play areas, and should be in conjunction with their classrooms.

7. The playgrounds should be zoned from the quiet elements of the school.
8. Attempts should be made to reduce playground dust at its source by using grass and trees for filters, by keeping the grass planted, and by stabilizing the soil in grassless area.
9. Playgrounds should be placed so that the prevailing wind does not carry dust toward the building. Provisions should be made to reduce the amount of dirt carried into the school on the feet.
10. Convenient storage must be provided for athletic equipment and for implements necessary for playground maintenance.
11. If the community is to use the playground areas, proper facilities should be provided.

Auditoriums:

1. The auditorium has such a specialized use and such unique mechanical properties that it should not be compromised by attempting to give it a second use.

2. It should be a relatively narrow room.
3. It should not be so large as to make difficult the desired intimate relationship between audience and performer.
4. It should be windowless.
5. It should have a pitched floor.
6. It should have angled walls and ceiling.
7. It should have access into a lobby area.
8. It should have a stage and adequate space for scenery changes.
9. It should provide space for dressing.
10. It should provide space for orchestra, preferably not a pit.
11. It should provide ample storage space for scenery, costumes, instruments, etc.
12. For lighting, acoustic, heating and ventilating requirements, see Part II.

Dining room:

1. The dining room should be centrally located.
2. It should be a large cheerful room, full of natural light, treated to deaden sound, and be placed to provide a good view.
3. It is noisy and should be zoned from quiet areas.
4. The recommended dining area is 10 square feet (per pupil) times the maximum number of pupils to be fed during one eating shift.
5. The dining room should have direct access to the playgrounds.
6. If eating and cleaning schedules permit, the room can have many schoolhour uses, such as study hall, music room, or even library.
7. Provisions should be made for screening the serving area and kitchen from the dining area.
8. Regular-use furniture should be scaled; provision should be made for easy exchange to adult-scaled furniture for community use.

9. Tables should be small, preferably seating 4 to 6 children.
10. The dining room is an excellent community activity room.

Corridors:

1. Where enclosed corridors are necessary, they should be well lighted, preferably by natural light.
2. Successful uses of enclosed corridor space, other than passageway from one room to another should be devised. The extra uses being given most often and successfully are outdoor clothing storage and exhibition space.
3. Enclosed corridors should be treated to deaden sound.

Reception lobby:

1. The reception lobby should be pleasant and comfortable.
2. It should be adjacent with the main entrance and the administration area.
3. It should have some provision for the display of exhibits.

ADMINISTRATION:

1. The administration area should be centrally located.
2. It should be near the main entrance and opening from the reception lobby.
3. Its rooms should be friendly and inviting.
4. It requires space for:
 - a. vault
 - b. storage for records and equipment
 - c. information desk
 - d. secretarial work
 - e. staff offices
 - f. teachers' mail
 - g. teachers' lounge and work space
5. An area of 1 square foot per pupil is recommended.

Trends:

1. Increasing use of committee type administration.
2. Increasing use of psychiatric study and guidance of the child.

HEALTH FACILITIES:

1. The clinic should be centrally located.
2. It should provide space for:
 - a. waiting
 - b. examination room
 - c. isolation
 - d. toilet and sink
 - e. eye examination (20' clear space)
 - f. dental examination
 - g. storage of medical equipment and records.
 - h. desk
3. Clinic should be considered a community facility. Its maximum size and facilities will depend upon the amount of community use.
4. It should have outside access if it is to be a community health center.

SERVICES:

1. Mechanical equipment should be easy to operate and maintain.
2. It should be mechanically controlled whenever possible

provided break-down maintenance can be kept to a minimum.

3. Access to pipes and ducts should be provided whenever possible.

Janitorial:

1. Custodian's room should be adjacent to the heating plant.
2. The room requires space for:
 - a. desk
 - b. repair work
 - c. storage of indoor and outdoor tools and equipment.
 - d. locker
3. Conveniently located closets for cleaning equipment throughout the building should be provided.
4. An outside entrance is desirable.

Heating room:

1. The heating room should be adjacent to service drive.
2. It should allow provisions for boiler change.
3. It should have large window space.

4. It should not be subject to flooding.

Kitchen:

1. The kitchen requires a service entrance.
2. The kitchen should have maximum natural light.
3. Odors and excess heat must be removed.
4. Ample facilities must be provided for:
 - a. refrigeration
 - b. food storage
 - c. food cleaning and preparation
 - d. cooking
 - e. serving
 - f. cleaning and storage of dishes and utensils.
5. Locker and toilet space must be provided for kitchen personnel.

Toilets:

1. Individual toilets for each classroom are recommended.
2. Many educators believe there is no necessity for separate toilet rooms for the sexes, especially in the grades through the 4th.

3. Small toilets are recommended for lower grade children.
4. Normal size toilets are recommended wherever a gang-type toilet room is indicated.
5. Toilet rooms should be conveniently located throughout the school building.
6. Direct sunlight should be present whenever possible.
7. Proper ventilation is necessary.
8. All surfaces should be sanitary and easy to clean.

Showers Rooms and Lockers:

1. Shower rooms and lockers should be directly accessible from gymnasium or playroom and from play fields.
2. All surfaces should be sanitary and easy to clean.
3. Direct sunlight should be present.
4. Proper ventilation is very important.
5. Lockers should be scaled so that children do not have to climb or stretch to reach hangers.

PART II EFFECTS OF MECHANICAL ASPECTS ON THE PUPIL

The intent of Part II is to examine the lighting, heating, and ventilation standards with regard to the physiological knowledge upon which they are supposedly based. The researches prove disappointing from the standpoint of basic physiological data in all the three fields. The standards are almost entirely determined on the basis of subjective tests concerning "comfort". The slant of the studies should, however, give the architect or engineer who has a tendency to blindly follow given standards, a better insight of the human needs in the field.

The psychological effects that a building has on a child pose even more difficult questions. Mechanical aspects of a building affect the child's physical vitality and health, and are, therefore, great contributors or detriments to his mental well-being. These then are important tangibles for the architect to work with. The intangibles can at present be given only broad titles and depend on the designer's experience and skill for the degree of success in achieving the desired effects in a given building. They are:

1. The character of the building inside and out. Is it somber, cold and forbidding? Or is it warm, friendly and inviting?
2. The proportions of the individual planes, the total relation of plane to plane, and the relation of volume to volume.

3. The proportion of the enclosed spaces and the relation of space to space, of spaces in conjunction and space in sequence.
4. Materials, colors, and textures.
5. The craftsmanship of the building.
6. The balance of the structure.

Even in the break-down there is fallacy, as all of the last five points are necessary to the first, and as proportion in black and white is changed when color and texture are included in it. Regardless, all these things affect our mental attitude when we are in or near a building, whether or not we like to admit the effect. There will be no further attempt to evaluate the field of esthetics in this paper.

LIGHTING:

The purpose of this section of the paper is to explain the essentials of good lighting, state standards that seem appropriate, and to discuss briefly some of the problems and methods of achieving a good lighting environment.

There is fair indication that our eyes are not naturally adapted to close work, as it involves strain on the muscles that are responsible for the orientation of the eyeballs, and on the intrinsic muscles of the eye which constrict the pupil for proper sharpness of retinal image. Strain is also present when light is present in improper amounts and is improperly controlled for different seeing tasks. This

inherent strain plays an important role in total body fatigue. It is necessary that good lighting design reduce it as much as possible.

Lighting Essentials and Standards:

Generally, standards concerning amount of light have little support in the form of basic research on the radiant energy requirements of the human eye. The present standards are based on the mechanical properties of the eye and on subjective tests concerning fatigue rates on seeing tasks under different lighting conditions. These standards are open to a considerable amount of leeway due to personal opinion and have resulted in many different standards for the same seeing tasks.

The basic requirements for a room where close work is to be carried on are as follows:

1. Proper brightness ratio.

This is the most important and the essentially all inclusive requirement. Most standards on brightness ratio are based on a one-directional seating arrangement and are not satisfactory in the classroom of contemporary concept. The better standard would be to accept a 3 to 1 brightness ratio for the total room. This would have a decided effect on the remaining points.

2. Sufficient illumination level.

The minimum illumination level will be governed by the amount of light needed for the seeing task; the maximum will be that which is necessary to bring all of the brightnesses, window views included, within the ratio.

3. Proper distribution of light.

Proper distribution will be inherent if the 3 to 1 ratio is held.

4. Proper diffusion of light.

Proper diffusion will also be inherent, under the 3 to 1 ratio. The ratio implies that the sources themselves shall be either large and of low intensity, or shall be shielded from direct view.

5. Freedom from glare - direct glare and specular reflection. Direct glare will be abolished if the 3 to 1 ratio is held. Specular reflection will be reduced, but it must be further considered as its main cause is from highly reflective surfaces.

6. Facilities for resting the eye under strain-free conditions.

Such facilities indicate that a view out of the room is necessary. Photomurals have been suggested as a

substitute for windows, but it is felt that the static aspect of the mural would entirely nullify its function after the students' initial interest had been satisfied.

Though much work must be done on the design of lighting fixtures, material surfaces, and paints, requirements 1 - 5 can be met satisfactorily under completely artificial lighting conditions through the use of methods found in any lighting manual. The inclusion of windows, for eye rest and lighting economy, introduces brightnesses into the viewing field that are greatly in excess of those that are possible within the classroom itself. This is the biggest unsolved problem in classroom design.

Looking into the future, the possible solution might lie in the development of plastics or other materials from which the whole classroom could be constructed - diffusing plastics that would reduce the natural sunlight penetration about 60% without reducing the ultra-violet penetration, materials that have the proper reflection and insulation properties for both heat and sound. Such a structure would allow windows as large as the view dictates, and the only control would be to prevent direct sunlight from falling on highly reflective task surfaces. It is not too much to ask or expect that these researches should be carried out; nor should it be too much to ask that they be given a chance to prove themselves.

Methods of Attainment:

In using the present materials and methods of construction the 3 to 1 ratio is almost impossible to achieve. The methods of solution to the problem of good lighting are generalized as follows:

1. Bilateral windows to increase and distribute the natural illumination.
2. Controls in the form of diffusing panels, louvers, curtains, or overhangs to shield the classroom from direct sunlight during activity hours, and to shield the eye from direct view of the sky-vault or snow on the ground.
3. Evergreen screens planted at some distance from the openings to reduce snow glare.
4. Transitional, medium brightness panels or curtains between high brightness and low brightness views.
5. Small structural members and as little wall as possible in the same plane as the windows.

All standards on light intensity are based on the seeing task involved, the contrast between print and paper, and the size of print. The standards are mechanically and subjectively

derived. They are first set for normal vision requirements, and then are arbitrarily increased to benefit sub-normal vision. It is obvious then that the standards allow great leeway in the exercise of opinion. The revealing commentary on the subject is found in the fact that recommended levels have risen steadily, in pace with improvements in lighting equipment and the decrease in the costs involved. Some of the different standards for the same area, the classroom, are as follows:

<u>Source</u>	<u>Foot Candles</u> ¹
<u>Architectural Forum</u> Oct. 1949	
90% max. possible performance	
Text	12
Notes	18
95% max. possible performance	
Text	28
Notes	40
American Illuminating Engineering Society	30
Wisconsin State Code	15+
New York Dept. of Education	20
United States Dept. of Ed. Bulletin No. 104	30
National Council, School Construction	20

In order to increase the performance of pupils from 90% of possible performance to 95%, 130% more light is required. The performance curve flattens out near the 95% point, and it becomes a very uneconomical practice to attempt to increase

¹Architectural Forum, Vol. 91, No. 4 (1949), p.148.

the performance above a certain level.

The standards are now under review by the Joint Committee of the American Public Health Association and the Illuminating Engineering Society. This body is attempting to bring the standards into line, and the general feeling seems to be that the engineers' standards are too high, being set for abnormal seeing conditions. However, until better research methods give us the proper lighting standards for human needs, it would seem wise to use the recommendations found in American Standard Practice for School Lighting.

Location	Minimum ² Footcandles
Classrooms - on desks and chalkboards ²	30
Study halls, lecture rooms, art rooms, offices, libraries, shops and laboratories	30
Classrooms for partially seeing pupils and those requiring lip reading - on desk and chalkboards ⁺ . .	50
Reception rooms, gymnasiums	20
Auditoriums (not for study) cafeterias, lockerrooms, washrooms, corridors with lockers, stairways	10
Open corridors and store rooms	5

+Where schools use chalkboards extensively for demonstration purposes, higher levels than those indicated are desirable.

²American Standard Practice for School Lighting, Illuminating Engineering Society (1948), p. 13.

In summary, the ideal lighting environment for close work areas requires; 1) a 3 to 1 brightness ratio for the total space, inside and outside; 2) as much natural but diffused light as is possible to achieve; 3) materials and seeing tasks that have specular reflection designed out of them; 4) a good view that is preferably a natural evergreen landscape. It need hardly be said that compromise is necessary.

ACOUSTICS:

Only extremely powerful noises can cause physical injury to the ear, and it does not appear that the organ itself is fatigued by bad hearing conditions. However, nervous tension and body strain, prevalent in rooms for listening and concentration, and caused by improper sound control, have a decided effect on vitality and disposition. Subjective tests concerning speech intelligibility and a great amount of research on the physics of sound are giving us the criteria, and the methods for proper sound control.

Sound is transmitted in two ways, disregarding electronic methods. It can be air-borne or it can be carried through materials and structures by vibration. It is normally reduced in either method of transmission. The reduction as sound is transmitted through materials and structures is dependent on the physical properties of the materials and on the way in which the construction is carried out.

The first part of this section on sound will be concerned with background noise; noise that masks a speaker's voice, noise that distracts a student from his studies. The second part will deal with the reinforcement and control of desired sound.

Background Noise:

One of the components of background noise inside buildings is that which penetrates from the outside. When high intensity noises are present near an outside wall it is expensive and often impossible to reduce the intensity to the desired level within the building, especially when the wall has openings for light and ventilation. It seems obvious that the first step in noise reduction in the classroom is through city planning and zoning; the second step is to attempt to reduce the offending noises at their source; and the third is to recognize that the noise level will vary over the site and that the classrooms should be located, other factors allowing, where the intensity is the weakest.

It is generally stated, that landscaping is of value in screening buildings from noise sources. It is probable, but it must be remembered that the plants must be closely and deeply planted, and be of thick evergreen foliage.

The second component of background noise in given rooms is that

which penetrates from other parts of the building. The three methods of control of air-borne noise are: 1) the separation of the noisy units from the quiet units and the use of intermediate units as sound buffers; 2) the use of sound absorptive materials in offending rooms to reduce the intensity of the penetrating noise; and 3) the use of non-porous materials as separating partitions. The use of all three methods in a given building is necessary, though the proportional importance of one over the other is almost entirely economic. It is generally considered that the first method is the least expensive, especially when the function of the plan dictates the same separation of spaces as is suggested by acoustic considerations. This is the case in most new school designs.

Thus danger points where air-borne noise is concerned are through ventilation ducts and open windows side by side in adjoining classrooms. The best solution for the first is absorptive lining in the ducts. The second requires either that the windows must be more than 15 feet apart or that a "baffle" of impervious material must be installed between and perpendicular to the window openings.

The sound that is transmitted through the structure by vibration must be controlled by construction details that break the paths of the vibration.

Reinforcement and Control of Desired Sound:

To provide good hearing conditions in any room demands that three other requirements, besides background noise control, be satisfied. These requirements are:

1. Adequate separation of successive sounds.
(Reverberation control).
2. Proper distribution of sound.
3. Sufficient loudness of sound.

The reverberation control consists of getting the proper "reverberation time" through the use of a correct amount of absorptive material. The reverberation time depends on the volume of the room. If too little material is used the room will be excessively reverberant and speech will be garbled. If too much is used it makes the room overly dead and makes it difficult for the teacher to speak.

The normal procedure of plastering absorptive materials over the whole ceiling has led to some very bad rooms, acoustically speaking. The correct method is to place some acoustic material on one surface of each parallel set of surfaces in the room. Most of the ceiling should be left "hard" to aid in the proper distribution of sound, and since the ceiling's opposite parallel surface is covered with very absorptive people.

Proper distribution of sound is aided by the method given above

but more complete measures are usually necessary. It is highly desirable that the walls and ceilings be non-parallel. Even slight non-parallelism is helpful in eliminating faulty distribution and unpleasant flutter echos. The third method in achieving proper distribution is to use incommensurate dimensions. Dimensioning according to the ratios given by the following formulas will give good results:

1. $1 \times \sqrt{2} \times \sqrt{4}$

2. $2 \times 3 \times 5$

The requirement of sufficient loudness is seldom a problem in the classroom, though it becomes the major point of acoustic interest in the larger rooms such as the auditorium or assembly.

In the assembly area every effort must be made to conserve sound energy and to direct the sound to the listeners. The shaping and modulation of the wall and ceiling surfaces is very important in giving a more uniform distribution of sound through out the room. The wall must be shaped and treated so that echos and flutter are avoided. The ceiling should be of hard material with possible peripheral areas of absorptive materials.

Sound engineers continually stress the points that the most inexpensive control of sound is at its source, and that corrective measures after a building is built are exceptionally expensive and can rarely accomplish good hearing conditions.

HEATING, VENTILATING AND AIR CLEANING:

It is more difficult to state the effects of climate on the mental attitude of the student than it is to state the effects of sound and light. The effects of extremes in heat or cold, air pollution and air velocity are fairly well known, but those effects that come in an enclosed space that is conditioned in any conventional manner show up as only subtle, or subconscious feelings. Most of the criteria have been based on subjective tests concerning these feelings and have resulted in standards that fall within what is now called the "comfort zone". It can be assumed that any feeling of discomfort, conscious or subconscious, will distract the student from his work.

The two interesting developments in the control of interior climate in recent years are concerned with the way in which the human body uses and affects the physical elements involved. First, it has been found that in order to be comfortable the body must liberate a certain amount of metabolic heat varying with the age of the person and the degree of physical activity. Second, the methods used by the body to accomplish this loss and the percent loss by each method under different conditions have been found. Also, researches on humidity have been enlightening, though the effects humidity has on the body are not completely understood at present. This knowledge allows us to state, with a fair degree of confidence, just what climatic conditioning should do for the occupants of given spaces.

The first part of this section concerns the objectives of climatic conditioning as established by physiological researches. The second part deals with the methods of attainment of these objectives.

Physiological Considerations and Objectives.

1. To allow the body to lose metabolic heat at a certain rate by a balance of radiation, convection, evaporation of perspiration, and breathing, depending on physical activity and the season of the year.
2. To remove objectionable odors.
3. To destroy and prevent the entrance of impurities that have injurious effects upon humans.

The four factors that control the methods of heat interchange between the body and its environment are; air temperature, mean radiant temperature, air movement, and relative humidity.

<u>Method of Heat Exchange</u>	<u>Controlling Physical Factors</u> ^s
Convection	Air temperature Air movement
Radiation	Mean radiant temperature
Evaporation	Air temperature Air movement Relative humidity

^sHeating and Ventilating Recommendations for New York State Schools, The University of the State of New York Press (1946), p.12.

The winter problem in heating is to prevent the body from losing too much heat and to maintain the balance between the losses. It has been found that under conditions where evaporation need not be depended upon the relative humidity has almost no effect on feelings of comfort. Thus, the heating problem in winter reduces to three physical factors: air temperature, mean radiant temperature, and air movement. If air movement is controlled as it should be to avoid drafts, the mean radiant temperature and air temperature will not differ more than 4 or 5 degrees. This fact has led to the conception of the "operative temperature scale" which is determined by the combined effect of the two temperatures and can be used as a design criterion for winter conditioning.

The following standards of attainment, in different spaces where different physical activities are expected, should be required.

<u>Type of Space</u>	<u>Design Operative</u> <u>Temperature</u>	<u>Corresponding Room</u> [*] <u>Air Temperature</u>
1. Sedentary activity- classroom, auditorium, offices, cafeterias, etc.70°	68° - 72° (30" above floor)
2. Moderate activity- corridors, stairways, shops, kitchen, etc.68°	66° - 70° (60" above floor)

^{*}Heating and Ventilating Recommendations for New York State Schools, pp. 16 - 17.

<u>Type of Space</u>	<u>Design Operative Temperature</u>	<u>Corresponding Room Air Temperature</u>
3. Vigorous activity- gymnasiums	65°	60°- 70° (60" above floor)
4. Special cases - lockers, shower rooms, etc.78°	76° - 80° (60" above floor)
Swimming pools83°	80 - 86° (60" above floor)

Overheating has a decided effect on the nasal mucosa and it is believed, places it in a more vulnerable state for germ attack when the mucosa is brought into contact with cold air. Also, excessively dry air in the winter classroom causes drying of the nasal and buccal mucosa. The health implications of this last point are not known and until further medical research proves the effects, it does not seem to indicate a real need for artificial humidification.

During the non-heating season and under more strenuous physical activity the skin temperature is raised and if the required heat loss cannot be accomplished by radiation and convection the sweat glands become stimulated. Cooling by evaporation of perspiration then becomes the major method of heat loss. Any one, or all, of the physical factors can be used to produce effects of comfort. This can be done by cooling the walls, cooling the air, or creating turbulence by added

air movement. The last is the most economical with the present mechanical equipment and has a marked cooling effect.

It has been found that odors have a decided detrimental effect on the appetite. Therefore removing them is as much a benefit to health as it is a benefit to comfort. Odor control in the classroom can be accomplished if a fresh air dilution of 10 cubic feet per minute per pupil is maintained. This amounts to 1 1/2 to 3 air changes per hour in the average classroom and will not cause uncomfortable drafts.

The science of air sanitation is a new and rapidly expanding field of research; so new in fact, that no standards for schools have been evolved. The methods of attaining sanitation in the classroom have not been perfected to the extent of real practicality.

The four methods that have been suggested so far, are:

1. Direct disinfection of the air.
2. Air change using disinfected air.
3. Filtration.
4. Air change using fresh air.

Filtration and air change using fresh air have proved impractical at present. The first because of the required filter resistance and the complexity of maintenance. The second, because it requires 60 to 120 fresh air changes per hour.

The first two methods use either a germicidal vapor or ultraviolet irradiation. In method number 2 the vapor or lamps are placed within the ventilating ducts and can accomplish a result that is equivalent to 20 to 30 fresh air changes an hour without exposing the occupants to the harmful effects of direct radiation. This method does not, however, kill the germs that are passed by human contact within the room.

Direct radiation within the room appears to be the most practical and economical procedure of the four. It requires that germicidal lamps that are shielded from radiating directly on the pupils be placed within the room at a height of 6 1/2 to 7 feet above the floor. To be really effective it requires also that ceiling heights be 12 feet or more. This method will provide an equivalent of 60+ fresh air changes per hour and will also destroy germs that are not air-borne.

It should be noted that to be at all effective germicidal measures must be carried out while the students are in the room.

Methods of Attainment of Proper Climatic Conditioning:

Translating these requirements into mechanical equipment presents a difficult problem as invention has only recently

turned from trying to get more and more heat out of given units to the more important concept of getting the right kind of heat according to human needs. There is much yet to be done in research on human needs, and more to be done on the methods of satisfying them.

The first point to be realized in the heating design for a classroom is that the heating problem comes very close to being a cooling problem even in the coldest part of the year. The average elementary pupil passes on to the air a sensible heat of approximately 170° BTU per hour. The real heating load comes in the morning before the students arrive and it is probable that no more heat will be necessary after the pupils have been in the room 2 hours. Transposing all the needs into generalized statements then:

1. The orientation of high pupil density rooms should be set to avoid added solar heat after the initial morning heating load is relieved.
2. Low pupil density spaces with large outside wall areas, such as gymnasiums, assembly areas, cafeterias, etc., should make use of insolation.
3. Shelter from high-velocity winter winds should be attempted, and exposure to prevailing summer winds should be effected.

4. Natural ventilation should be used wherever possible.
5. The sun should be considered a germ-killing agent, especially where artificial disinfection is not contemplated.
6. Walls, ceilings and floors should have maximum insulation value. Dehumidification and air cooling may be required.
7. Walls, floors and ceilings should have minimum heat capacity. Occupants should not be forced to lose heat by radiation to cold walls in cold weather, nor should the expense of heating the walls be incurred.
8. Odors should be removed; a minimum of 10 cubic feet of fresh air per minute per pupil is necessary.
9. Air change should be kept as low as possible to avoid drafts during the winter heating period.
10. Air turbulence should be used as the cooling agent in the summer, except where large, high occupancy rooms are to have a great amount of summer use.
11. Recirculated air should not be used unless disinfection is accomplished.

12. If the recirculation of air appears necessary, air disinfection should be provided within the room during the occupancy period if possible, or within ventilating ducts.

13. Dust should be controlled at its source.

14. Chemical hazards must be controlled at their source.

Some of the methods of satisfying these requirements with present conditioning systems are listed below in the order of their general preference:⁵

1. Direct heating by radiation with window air supply and gravity exhaust.
2. Direct heating with window air supply and duct exhaust with duct exhaust with central fans.
3. Direct heating with forced unit ventilator air supply and corridor gravity exhaust.
4. Forced warm air with central or zone fans.
5. Panel heating with window air supply and duct exhaust by gravity or central fans.

⁵Heating and Ventilating Recommendations for New York State Schools.
pp. 11-15.

It must be remembered that each room will present its own special requirements. This discussion has been aimed only at a basic understanding of human needs involved in interior climatic conditioning.

FURNITURE AND FLOORS:

The design of school furniture has received increasing attention in recent years, and the realization of excellent products, through use of new alloys and plastics, is at hand.

These are some desirable qualities in school furniture:

1. It should be stackable to allow a maximum of clear floor space.
2. It should be light in weight so that it can be moved by the pupils.
3. It must be sturdy and durable.
4. It should be finished to avoid specular reflection and yet be light in color to avoid contrasts and to assist in the illumination level of the room.
5. Work tables should be flexible enough to allow individual work on a slanted surface, and also allow the tables to be placed together to form a

large, flat surface for group work.

6. Furniture should be scaled to the users. It is suggested that three different sizes of chairs and tables be provided in each classroom.
7. Seating should be designed to promote good posture and health, and allow pupil to concentrate on the task at hand. The student should be able to:
 - a. rest his feet flat on the floor.
 - b. distribute his weight over the whole seat area.
 - c. have the back support only the hollow of the back.
 - d. have clearance between the front edge of the seat and the inside angle of the knees⁶.
8. Coat racks and storage should be designed for easy use.
9. Black boards and tack space should be designed for easy use by pupils and teachers.

The advent of radiant panel heating is allowing an increased use of floor areas for resting, games, and work.

⁶Lawrence B. Perkins and Walter D. Cocking, Schools (New York: Reinhold Publishing Corporation, 1949), p.184.

The floor should be light in color to avoid contrasts and assist the illumination level, of unobstrusive pattern, easy to clean, long-wearing, and must be resilient. It has been found that hard surface floors have many ill effects on the body, such as stiffness in the leg joints, leg and foot fatigue.

PART III

AN ELEMENTARY SCHOOL FOR MARIETTA, OHIO

This part of the paper is entirely concerned with the design considerations that are imposed on a school by given site, climatic, community and educational conditions. The school used here is one that was recommended by Prof. F. H. McKelvey of Ohio University, in his Survey of School Needs in Marietta, Ohio, for West Marietta and called in his report The New Harmar School. Most of the data on the community and selection of a site is from this report.

THE CITY:

Marietta is located in south-eastern Ohio, latitude $39^{\circ} 25'$, at the confluence of the Muskingum and Ohio rivers. The Ohio river is to the south while the Muskingum, on a NNW line, cuts the city into two parts. The city has been built on flat land, approximately 4 square miles in extent, and has an altitude of 616 feet MSL, which is about 49 feet above the normal level of the Ohio. Hills rise directly from this flat area and more or less confine the city to it. The river reaches a flood stage on the average of once every 2 years, and the highest recorded crest covered more than $3/4$ of the land upon which the city is built. Three of the present elementary school sites are below this high water level.

The surrounding land is quite hilly. The average height of the hills is around 900 feet above sea level, with a few rising a little above 1000 feet. The only flat and level land is on the flood-endangered flats and almost all the remainder has an average 10% to 40% slope.

Marietta was established as the first permanent village in the Northwest Territory in 1788. Almost the first thought of the early settlers was on the education of their children, and this high regard for learning has shown up in the establishment of the academy that is now Marietta College, the research and building program that was carried out for the Junior-Senior High School, and the thought and research that has gone into the present program for the elementary schools.

Prof. McKelvey shows an estimated 1950 population of 15,778, an estimated increase to 17,028 in 1960 and to 18,424 in 1970. He states however that this does not include possible gains from the increasing industrial use being made of the Ohio valley.

THE CLIMATE:

The climate is essentially of a continental type having a predominance of cold, dry, continental air during the winter months which is invaded and dominated by the warm, moist, gulf

air in the summer. The results are:

Winter

1. A comparatively even precipitation rate of about 3.2 in. per month with winter peaks in December and March.
2. Predominance of stratus type clouds with the sun obscured over 65% of the sunlight hours.
3. General stratus type precipitation.
4. Snow, though heavy, does not remain on the ground for long periods.
5. Prevailing winter winds are from the north-west.
6. Average mean temperature is 33° in January.

Summer

1. Showery type precipitation with a large number of thunderstorms (hail problem), giving a yearly precipitation peak of 4.2 inches in July.
2. Cumulus type clouds with the sun obscured approximately 40% of the sunlight hours.

3. Prevailing summer winds from the south-south-west.
4. Average mean temperature is 75° in July.

General

1. Possible extreme temperature range is 133° yearly.
2. Range from mean minimum (25°) to mean maximum (85°) is 60°.
3. Prevailing high-velocity wind is from the north-west.

THE PEOPLE:

The people of Marietta have, as already stated, shown an outstanding progressive interest in their educational system. There is evidence that they already understand and believe in the use of the schools as community centers. Of the 7 playgrounds which operate with paid leadership, 5 are on public school grounds. It seems a very short step to the use of the school buildings themselves as educational and recreational community centers.

THE SCHOOLS:

There are 9 public school buildings in Marietta, accomodating

2,774 students and 103 teachers during the 1948-49 school year. There is 1 Junior-Senior High School which enrolls 1364 students. The remaining 8 buildings are elementary schools. There is 1 parochial school in the city which enrolled 183 pupils in grades 1 to 12 in 1948-49.

Of the 8 elementary buildings it is found that 7 should be replaced as soon as possible and that the eighth requires interior work and more open land. The McLeary Guide for Evaluating School Buildings was used in order to get an unbiased rating of the schools. With a possible perfect score of 1000 in the evaluation and a score below 400 indicating buildings that are definitely unfit, inadequate, obsolete, or even dangerous, it was found that 3 of the 7 schools were so bad that they could not be scored at all, and that the 4 others scored less than 383 points.⁷ It was also pointed out that all of the schools have sites that are inadequate under the present standards.

Of the three schools that are affected by flood waters two can be moved to safe land and still serve their prescribed area without causing hardship to the pupils. The third seems destined to be designed as a "flood-proof" building.

Marietta appears to be in an excellent position to finance the new building program. It can be shown that under a present

⁷F. H. McKelvey, A Survey of Elementary School Building Needs, in Marietta, Ohio: (Center for Educational Service, 1949), p.30.

state statute the allowable debt for new construction of schools can be \$2,053,860.00 . It is concluded that the city can retire such a debt in a reasonable number of years.

WEST MARIETTA SCHOOLS:

Three schools serve the part of Marietta on the west side of the Muskingum River. Of the three, Fairview - 1 room, and Terberg - 2 rooms and outside toilets, are totally inadequate. The third, the present Harmar School - 13 rooms, is located at Fort Square and looks directly out over the junction of the 2 rivers. The site lacks the open area that is considered necessary and is subject to floods when the river crest is 39 feet and above. The building scored only 281 on the McLeary Guide, there is doubt as to its structural safety, and the fire protection in itself presents safety hazards. All persons concerned agree that a new building must be built; it is in the selection of a site that disagreement becomes evident.

The McKelvey report recommendations for immediate action that concern West Marietta are⁸:

1. The Terberg school should be sold.
2. The Fairview School and site should be sold but the attendance area continued on a limited basis.

⁸
F. H. McKelvey, op. cit., pp. 60,61,62.

3. A three-classroom unit with office and supply room, designed as the first part of a future larger school, should be constructed. The new unit should be located north-west of the present site of the Fairview School.
4. The use of the present Harmar School and site should be discontinued and a new school should be constructed on a site that is out of the flood area and is nearer to the center of the attendance area.

These recommendations are sound, and the size of the New Harmar School should be based on pupil population as it is affected by them.

THE NEW HARMAR SCHOOL:

Site Location:

The relatively low income of the West Marietta population dictates that the school site be located within reasonable walking distance for the pupil population. Only a small number of buses can be depended upon, and the people are not expected to transport their children to school. The only available site that fills this condition, is above flood level, and can be graded and leveled into an acceptable building site is located within the loop made by Barber Street and the Pearl Street Extension.

The McKelvey report suggests the lower, eastern part of this land as a possible site, but it was soon apparent that area, though accessible, was not adequate from the stand-points of size, shape, and sunlight.

The final decision was to use the western section that adjoins the Pearl Street Extension and includes the ridge of Bellevue Hill. (See page 55). This then is the alternate site as opposed to the re-use of the present site.

The points of argument concerning the two sites are:

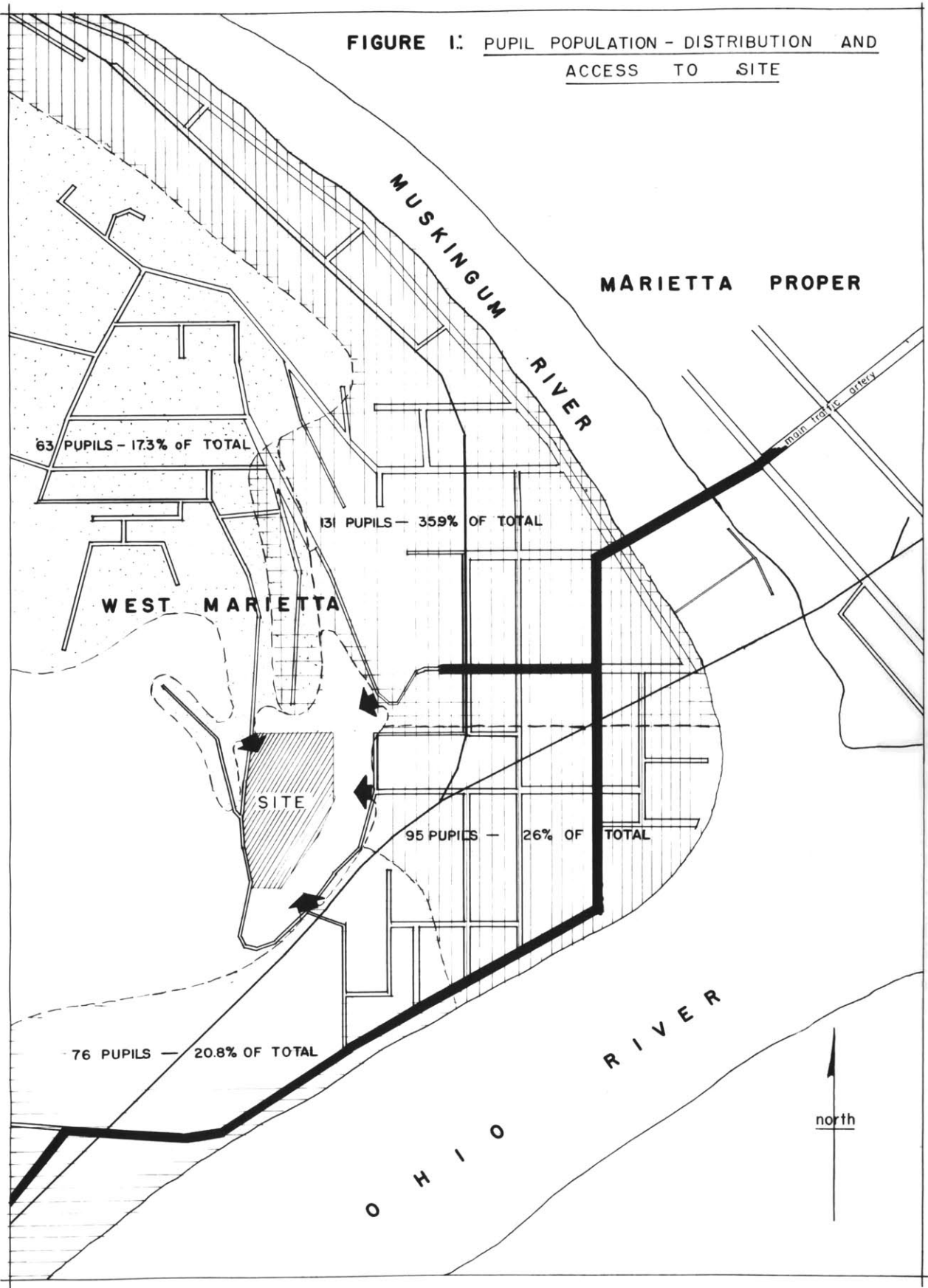
1. For the present site:

- a. A plot of 2 1/2 acres is already owned by the city.
- b. It can be expanded by the acquisition of 12 houses and a filling station to approximately 6 acres.
- c. It is located where pupil population is densest.
- d. It is easily accessible, whereas access to the alternate is difficult and expensive to develop.
- f. Site acquisition and development should be \$4,000. to \$8,000. cheaper than on the alternate. (Based on a rough, impartial estimate).

2. For the alternate site:

- a. A plot of 7 1/2 to 8 acres well above flood danger is available.

FIGURE 1: PUPIL POPULATION - DISTRIBUTION AND ACCESS TO SITE



- b. The grading and leveling would involve fewer problems than the proposed fill for the old site.
- c. The fill on the old site implies terracing comparable to that which is necessary here.
- d. It is nearer the center of the pupil area that is to be served.
- e. The estimated difference of cost of site acquisition and development will be quickly balanced in building construction costs when waterproof materials do not have to be used here.
- f. The school plan on this site will not be compromised so much by the topography as the plan on the lower site will be compromised by water control precautions.
- g. The hill top location can be a broadening experience to the children.
- h. The building can serve admirably as a flood relief station.

Walking paths to the sites are equally bad as a heavy traffic and a railroad pass through the center of the pupil area. (See page 55). Some consideration should be given to moving the highway to a riverside position.

This paper accepts the alternate site for the New Harmar School

Site Development:

The view from this site is breathtaking. The spectator is over 100 feet above the city proper, and the range of view out and over the surrounding landscape is more than 200° from SSW through east to due north. The most spectacular view is toward the east where the whole city is laid out below, and the Ohio River can be seen for 6 miles before it is obscured by the surrounding foothills.

The site is an exceedingly irregular one, having slopes up to 40% and an elevation change of 103 feet. The largest part of the site is to the east of Bellevue Hill and the average contour direction runs parallel to a SSE - NNW line. The first look at site conditions leaves little doubt that the building plan will be dominated by the topography.

The grading and leveling that is indicated is to cut off the ridge to a level of approximately 720 feet MSL and to use this earth on the south and east sides of the plot to build up another level at an altitude of approximately 707 feet. The cut would closely approximate the fill and the maximum level area would be obtained without attempting to cut to an excessive depth. The cut in this instance equals 15,060 cubic yards.

Such a procedure results in the following level spaces:

1. A rectangular area in the NW corner
of the plot (720' MSL) 53,600 sq.ft.
 2. An L-shaped area on the east and
south (707' MSL) 143,200 sq.ft.
- Total 196,800 sq.ft.
or 4.52 Acres

An estimate on the cost of such a project, taking into account the possibility of encountering rock (no borings were available) is given as \$36,850. This estimate includes excavation, clearing and grubbing, grading and leveling. The land is valued at \$1,050. per acre, or \$8,350. total. Therefore the acquisition and development costs total \$45,200.

Access:

Figure 1 on page 55 shows the relationship of the pupil population and the services to the site. The topography forces the approaches to be as indicated by the arrows. The diagram points up the necessity of an automobile and pedestrian approach from the east, and might indicate that the place to begin the 67 foot ascent to site level is at a point near the junction of Barber and Lord Streets. There is, however, a dead-end street off the Maple Street Extension that rises to a point 37 feet below the site level. An access from this point would assure a shorter road up to the site,

and a cleaner use of the school site itself. Also, the most accessible service entrance is up Maple Street. The fact that the access is to the extreme north side of the site should pose almost no problem, as the students from the extreme southwest will have to be transported by bus, regardless of the approach.

The access from the Maple Street Extension is, therefore, accepted. The road can cross over at the extreme north end of the site and join the Pearl Street Extension with a minimum of added costs and a maximum of utility.

Enrollment:

The table below gives the 1948-49 pupil statistics of the three schools that serve the pupil population of approximately 365 in West Marietta.

<u>School</u>	<u>Total Enrollment</u>	<u>Grades</u>	<u>No. of Classrooms</u> ⁹
Harmar	322	1-6	12
Fairview	30	1-2	1
Terberg	31	1-3	2

The following table shows the estimated elementary pupil population in West Marietta for the period from 1947 through 1961. The figures are obtained by multiplying the total Marietta elementary school population, as estimated by

⁹F. H. McKelvey, op. cit., p. 39.

Prof. McKelvey, by 26% which is the largest percentage of the total Marietta elementary school population that West Marietta has shown in the past 9 years.

Estimated Pupil Population in West Marietta,
1947 through 1961

<u>Year</u>	<u>No. of Pupils</u>
1947	370
1948	377
1949	369
1950	363
1951	363
1952	374
1953	401
1954	412
1955	423
1956	429
1957	433 Estimated peak
1958	417
1959	385
1960	360
1961	339

It is evident that during peak years 2 classrooms per grade will be inadequate, especially in grades 4 - 6, and that during slack years 3 classrooms per grade will be excessive. The logical solution then is to construct 12 regular classrooms at the New Harmar School, and to use the Fairview School, as a flexible plant to take care of the expected changes. The Fairview School would expand and contract depending on the need as shown by future and more accurate population studies.

If this plan is carried out, 3 regular and 3 temporary classrooms being constructed at Fairview, the number of pupils per

classroom will be as follows:

During Slack Years

Fairview

Grades 1 - 3 19+ pupils

Harmar

Grades 1 - 3 19+ pupils

Grades 4 - 6 29+ pupils

During Peak Years

Fairview

Grades 1 - 3 24+ pupils

Grades 4 - 6 (temporary) 24+ pupils

Harmar

Grades 1 - 3 24+ pupils

Grades 4 - 6 24+ pupils

Building:

While the enrollment totals indicate the number of classrooms that are needed, it is the type of educational program and community activity that indicates the space needs and extra areas which make up the total building.

The Marietta educators, though conservatively inclined, are well aware of the progressive movements in education, and approve them. However, due to the obsolescence of their present elementary schools, there has been little chance for them to practice new methods of educating the pupils. The desire for space and equipment is there. This desire translates into the following stated preferences:

1. Classrooms with plenty of space, movable furniture, work area including sinks and work benches, ample clothing storage, toilets close by each classroom, and good lighting conditions.
2. Facilities for instruction in music, arts, crafts, drama, science, etc.
3. Kindergarten and isolated play yard.
4. Library
5. Audio-visual facilities
6. Facilities for directed physical education.
7. Health education and examination facilities.
8. Assembly area.
9. Dining space for 1/2 enrollment.
10. Ample outdoor play areas.

Community use of the New Harmar School is somewhat restricted by the amount of funds that are available. Most of the spaces will have to be designed for child use, and any furniture

that the children will use for long periods of time will be child-scaled. This requires purchase and storage of special furniture for adult use. The playroom will not be large enough for organized exhibition games, etc. However, community use will be encouraged, and extensive use is expected to be made of the playground, dining facilities and adjoining playroom, health clinics, and certain of the specialized classrooms.

The allotment for the New Harmar School from the present bond drive has been set at \$520,000.

Estimated Costs of the School Plant:

Land costs	\$8,350.
Site development	36,850
Equipment	30,000
Planning fee	<u>29,000</u>
	\$104,200.
Allowable construction costs	<u>415,800</u>
Total	\$520,000.

Estimated area at \$13. sq. ft. 32,000 sq.ft.
Estimated cubage at \$.85 cu. ft. 490,000 cu.ft.

The consideration of the desires of the school board of Marietta District, the criteria listed in Parts I and II of this paper, and the results of the pupil population studies, leads to the following tentative program for the New Harmar School:

14 Classrooms

1. Grades 1 - 6
with work space and
individual class toilets

if possible 12 rooms 10,800 sq.ft.
2. Grades 4 - 6
Music room
Arts and crafts room . . 2 rooms 2,000 sq.ft.

Kindergarten 1 room 1,200 sq.ft.

Clinic

Office and reception
Examination and isolation . . 2 rooms 300 sq.ft.

Library 1 room 900 sq.ft.

Office and Lobby

Reception and secretary
Principal
Lobby 3 rooms 600 sq.ft.

Teachers' Lounge and Work Space . .1 room 200 sq.ft.

Dining and Kitchen 2 rooms 2000 sq.ft.

Heat and Janitor 1 room 400 sq.ft.

Playroom-Assembly

With stage 5000 sq.ft.

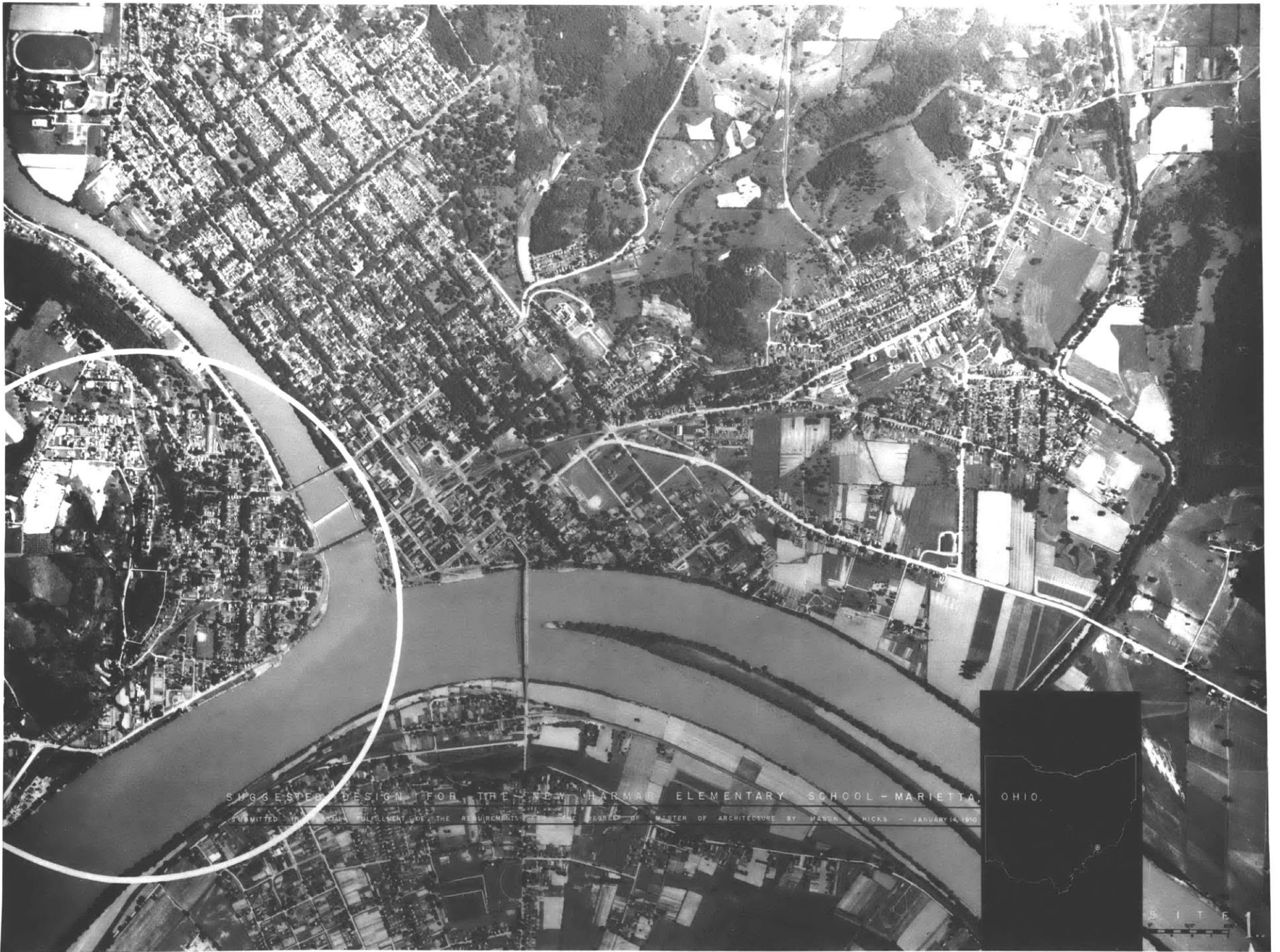
<u>Shower and Locker Rooms</u>	2 rooms	600 sq.ft.
<u>Storage Room</u>	1 room	<u>200 sq.ft.</u>
<u>Total</u> , not including corridors, service tunnels, covered areas, and gang toilets		24,200 sq.ft.

The final design of the New Harmar School, Marietta, Ohio, is based on this program, and is guided by the tenets of contemporary school planning as set forth in this paper.

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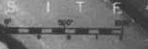
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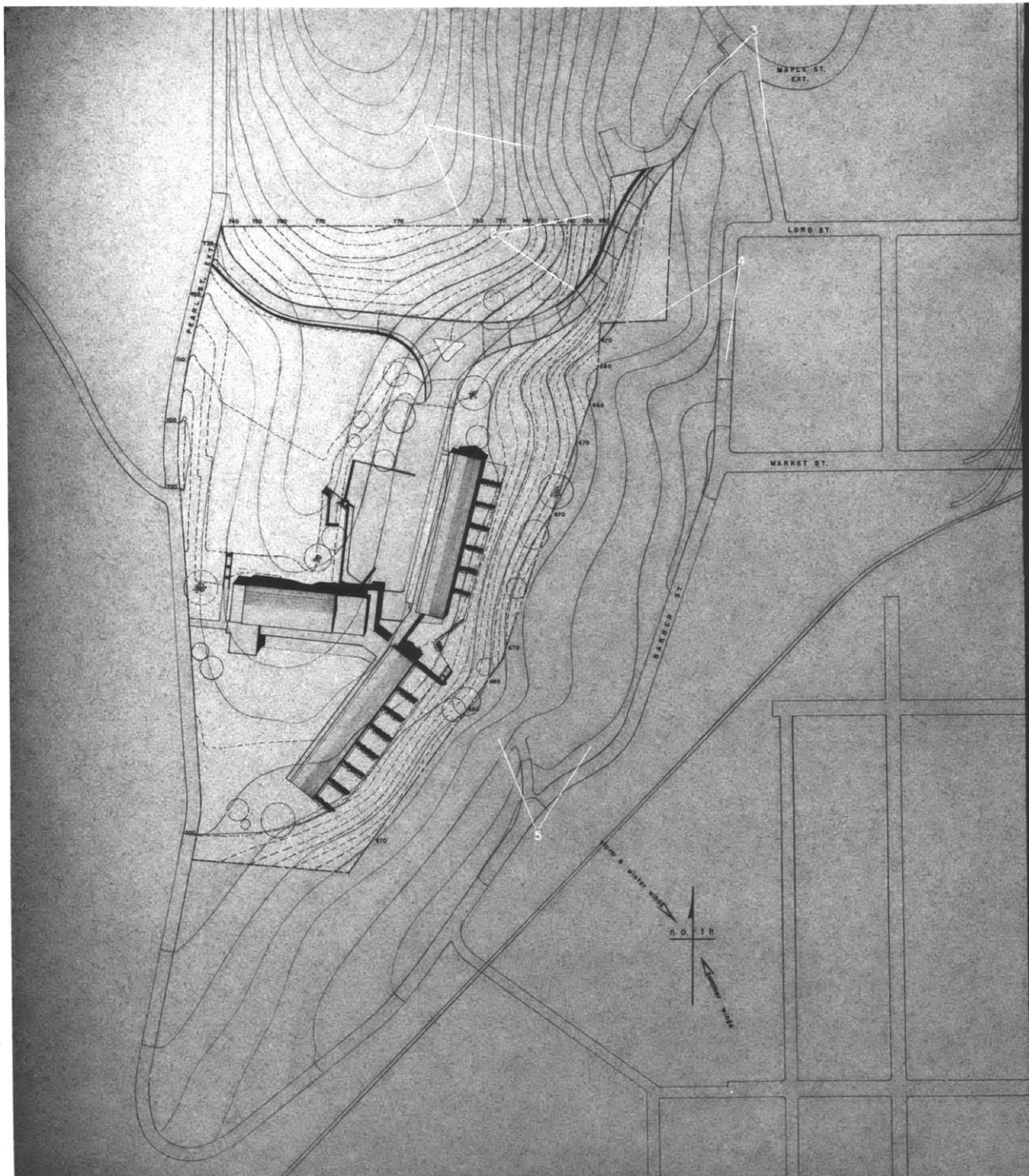
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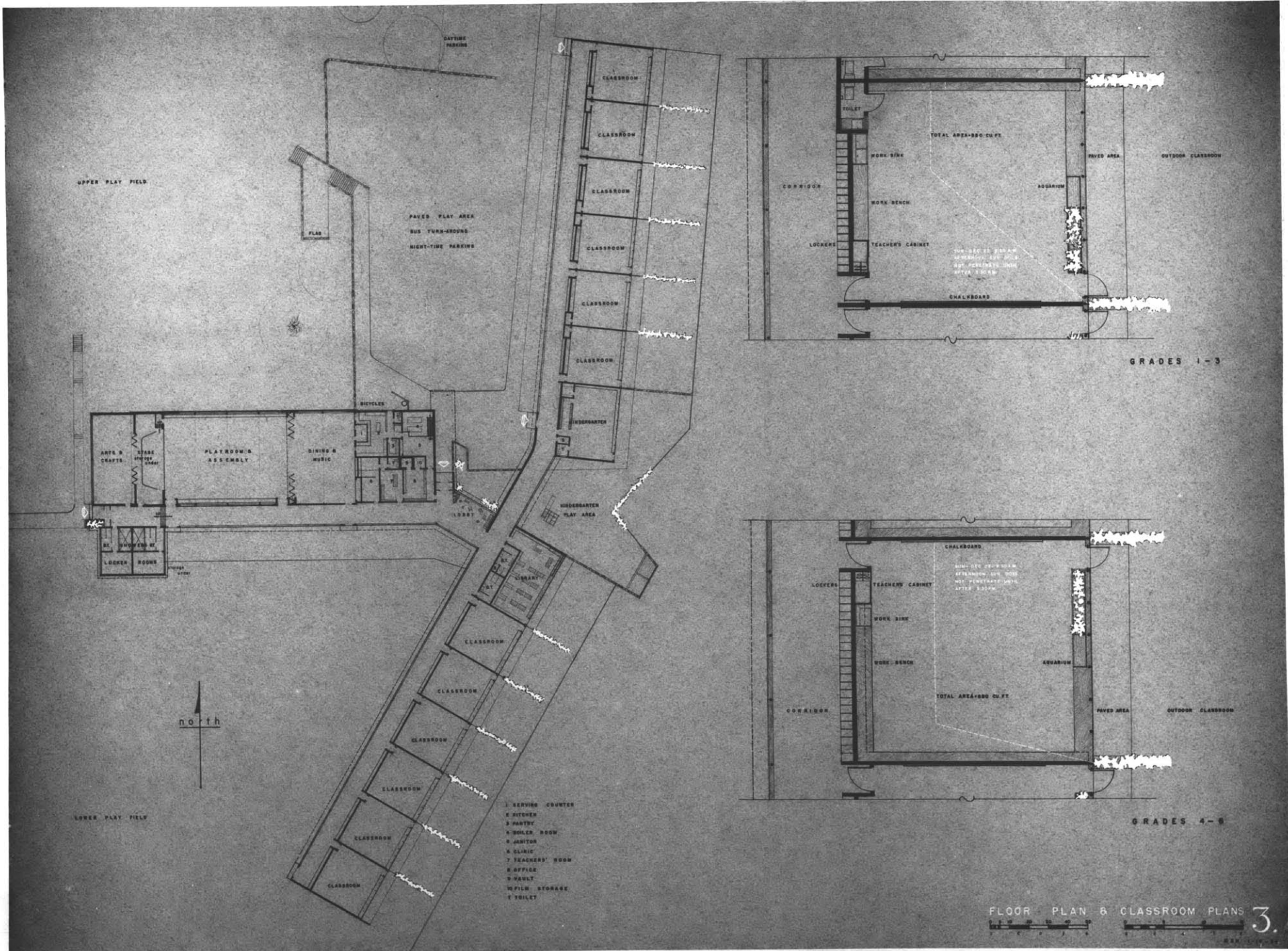


SUGGESTED DESIGN FOR THE NEW HARMAR ELEMENTARY SCHOOL - MARIETTA, OHIO.

SUBMITTED IN FULL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARCHITECTURE BY MARGO A. HICKS - JANUARY 14, 1990







UPPER PLAY FIELD

DAYTIME PARKING

FLAG

PAVED PLAY AREA
BUS TURN-AROUNDS
NIGHT-TIME PARKING

BICYCLES

ARTS & CRAFTS

STAGE

PLAYROOM & ASSEMBLY

DINING & MUSIC

LOBBY

UNDERBANQUET PLAY AREA

LOCKER ROOM

n o r t h

LOWER PLAY FIELD

- 1 SERVICE COUNTER
- 2 KITCHEN
- 3 PARTY
- 4 BOILER ROOM
- 5 JANITOR
- 6 CLERK
- 7 TEACHERS' ROOM
- 8 OFFICE
- 9 HALL
- 10 FILM STORAGE
- 11 TOILET

TOILET

TOTAL AREA-880 SQ. FT.

CORRIDOR

WORK DESK

WORK BENCH

LOCKERS

TEACHERS' CABINET

AQUARIUM

PAVED AREA

OUTDOOR CLASSROOM

CHALKBOARD

GRADES 1-3

CHALKBOARD

TOTAL AREA-880 SQ. FT.

LOCKERS

TEACHERS' CABINET

WORK DESK

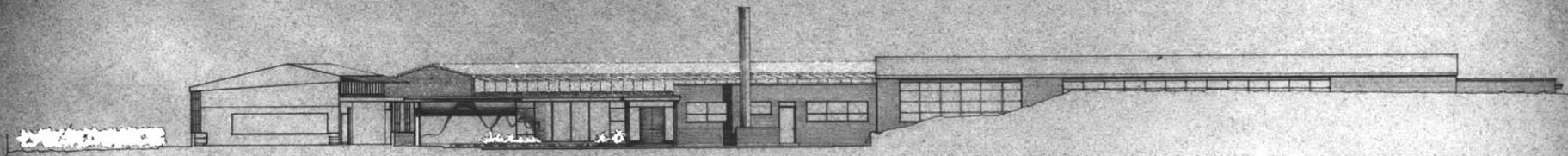
WORK BENCH

AQUARIUM

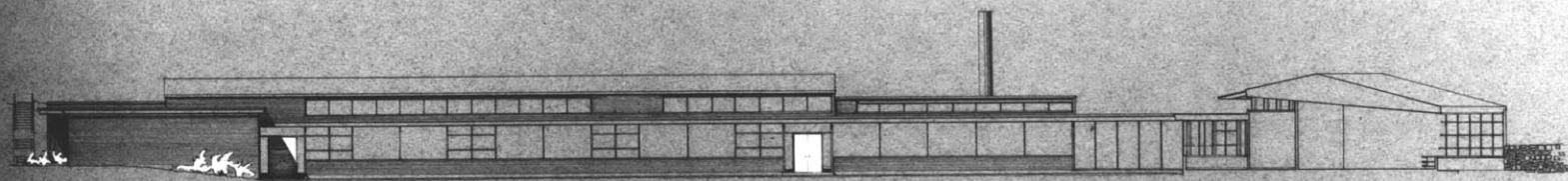
PAVED AREA

OUTDOOR CLASSROOM

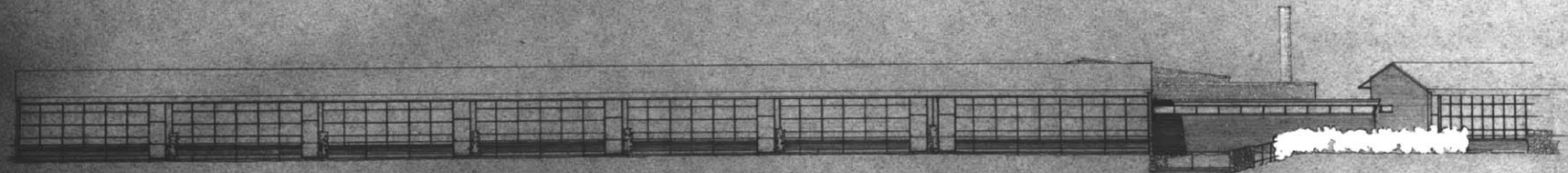
GRADES 4-9



NORTH



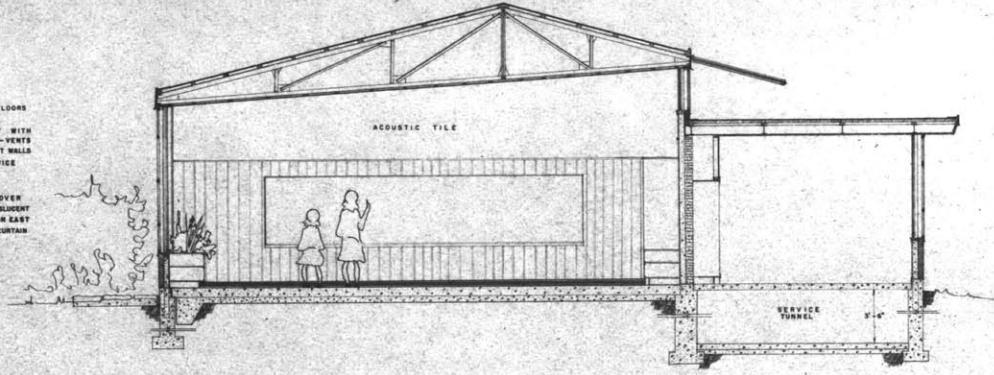
SOUTH



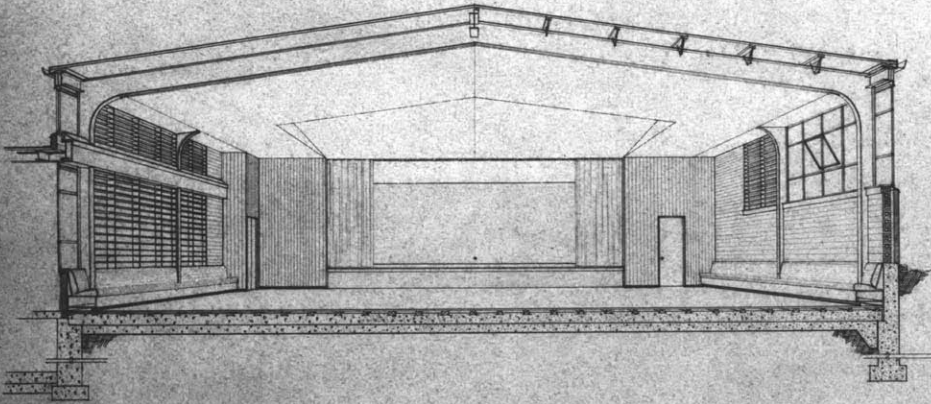
EAST



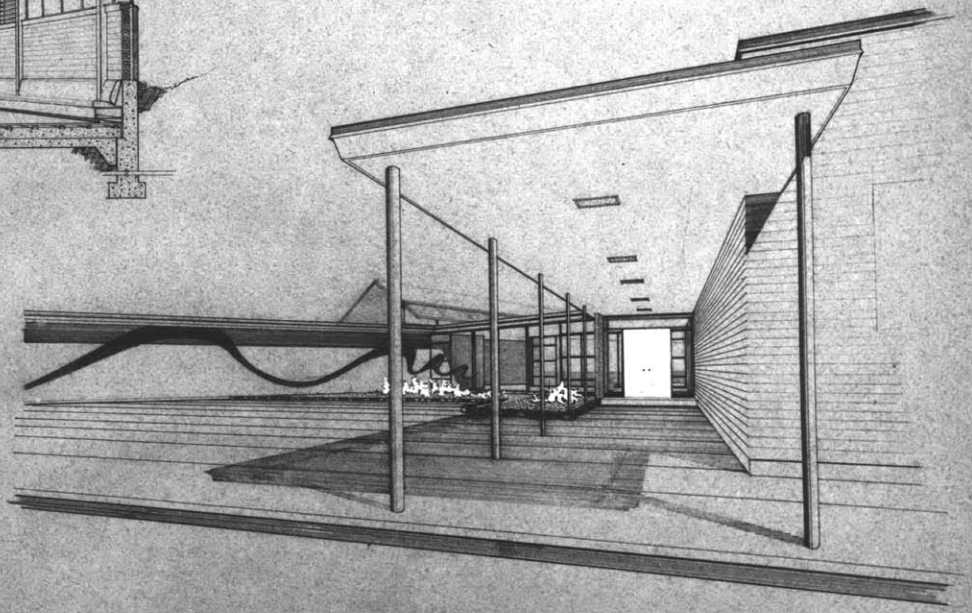
HEATING RADIANT PANEL FLOORS
 VENTILATION WINDOW AIR SUPPLY WITH FORCED EXHAUST - VENTS AT FLOOR ON WEST WALLS - DUCT IN SERVICE TUNNEL
 LIGHT CONTROL PLASTIC SHIMS OVER CLEARESTORY - TRANSLUCENT HANGING CURTAINS ON EAST WINDOWS - OPAQUE CURTAIN FOR SCREENING



CLASSROOM



PLAYROOM



NORTH ENTRANCE