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RELATIONSHIP OF COST TO THE GEOMETRY OF A BUILDING.

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DESCRIPTORS- *BUILDING DESIGN, *CONSTRUCTION COSTS, *SCHOOL DESIGN, ARCHITECTURE, BUILDINGS, DESIGN, SCHOOL BUILDINGS, SCHOOL CONSTRUCTION,

A SIMPLE BUILDING WITH A MINIMUM NUMBER OF INSIDE AND OUTSIDE CORNERS GIVES THE MAXIMUM AMOUNT OF QUALITY TEACHING SPACE FOR EACH BUILDING DOLLAR. THIS CONCLUSION IS BASED ON ONE ARCHITECTURAL FIRM'S COMPARISON OF TWO SIMILAR SCHOOLS, ONE OF WHICH HAD A MORE COMPLEX PLAN. A COMPARISON OF COSTS, AREAS, PERIMETERS, VOLUMES, NUMBER OF CORNERS, AND NUMBER OF ROOFS IS GIVEN. (JT)

RESEARCH REPORT 5

RELATIONSHIP OF COST TO THE GEOMETRY OF A BUILDING

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ANY individual with an interest in the subject of plane geometry is aware that a circle contains more area in relation to its perimeter than any other form. It is reasonable to assume that this knowledge can be applied to the plan of a building. This, however, cannot follow through to practical application, since the circular form imposes some technical difficulties in construction.

The square is the figure which, next to the circle, contains the maximum amount of area with relation to its perimeter. The square is very adaptable to methods of construction and the use of materials. We can then assume that a building erected on a square plan takes advantage of certain economies. It would not be feasible or right to arrive at the conclusion that all buildings should necessarily be built from a square plan, but wherever the building program permits, this square plan will offer many economical advantages.

A simple, rectangular building offers many of the advantages which are to be found in the erection of a square building. It may be more adaptable to some building programs than the square.

Complexity Increases Costs

Beyond the use of these simple forms, a certain complexity is in evidence which will proportionately increase the cost of a building. For example, a building plan which has more than four corners will increase the overall cost of the building.

Our foregoing statements actually amount to the fact that simplicity in itself is a basis for economy, but we wish to emphasize that such simplicity must result in usable space. The most simple building will not necessarily function as a place of learning unless de-

THE PROBLEM:

We are now living in an era of changing society and changing economy. Much has been written and said about the effects of the tremendous increase of school population on the limited space available for the purpose of instruction. The cry for more and more space is heard from all quarters. The availability of funds to provide this space is indeed limited. One of the principal problems that has faced school planners, educators and architects alike, is how to obtain the maximum amount of quality teaching space for each building dollar. One obvious method is to approach the problem through careful analysis of pure geometrical forms.

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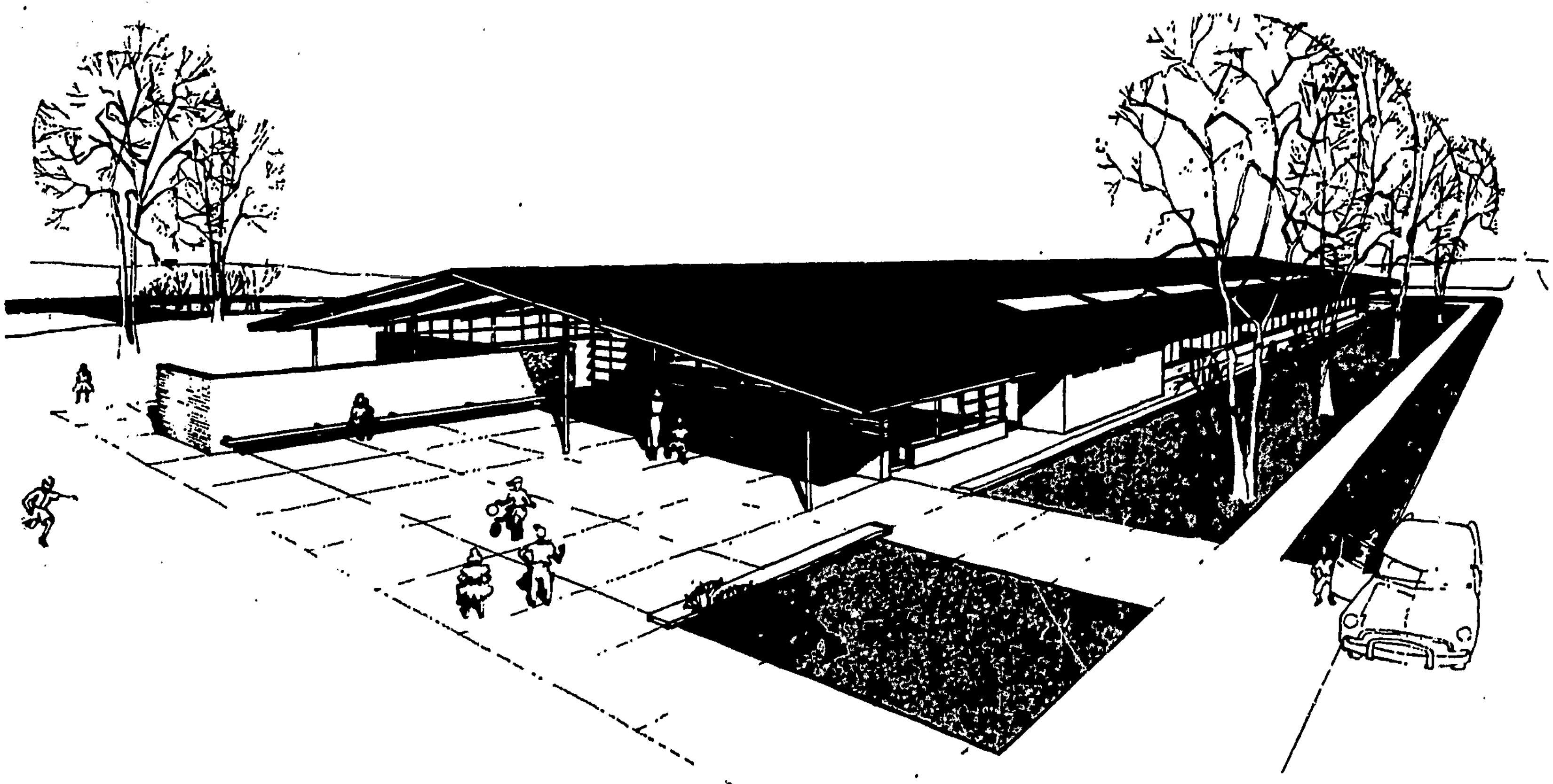


Roosevelt Elementary School in Miami, Oklahoma. The architects are Caudill, Rowlett, Scott and Associates. The total cost of this school was $165,003, with all interior areas located under one roof. There are 12 outside corners to the building and 8 inside corners. The perimeter of the building is 564 linear feet.

signed with this in mind. Our firm now has proof that a school may be designed for a particular educational program and at the same time be economical because of certain simple geometrical forms.

The Miami Schools

The Miami Schools in Oklahoma were custom designed for the educational program and have now been built and put into use. It is our desire to point out the study in geometry that made each school a reality. Because of different sites each school was designed differently, although both have the same facilities consisting of twelve classrooms, administration area and assembly-lunch area.

Certain factors were the same in both schools. These were:

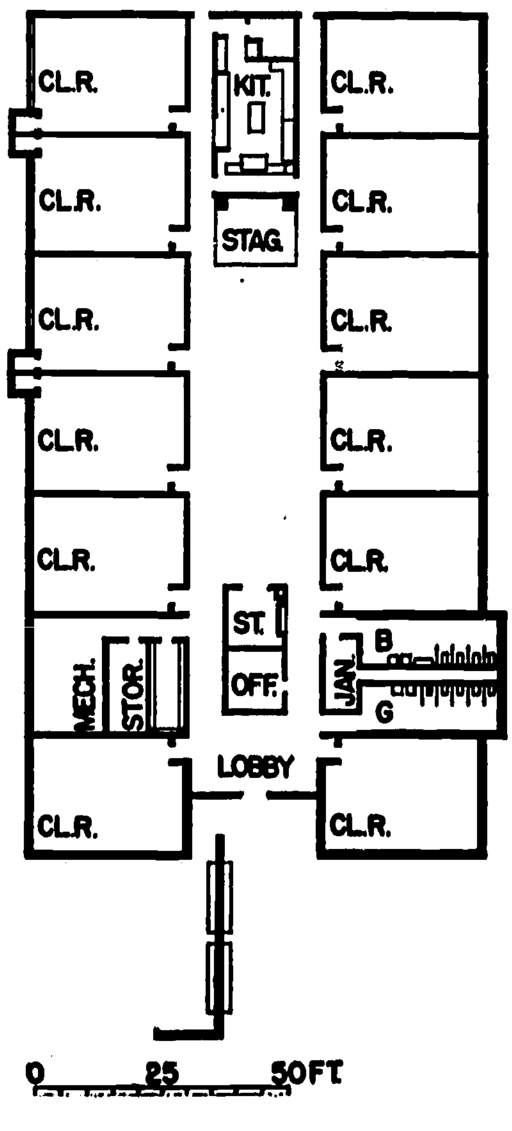
1. Bid letting date.
2. General contractor and sub-contractors.
3. Both sites are level.
4. Facilities.
5. Heating.
6. Lighting.
7. Materials.

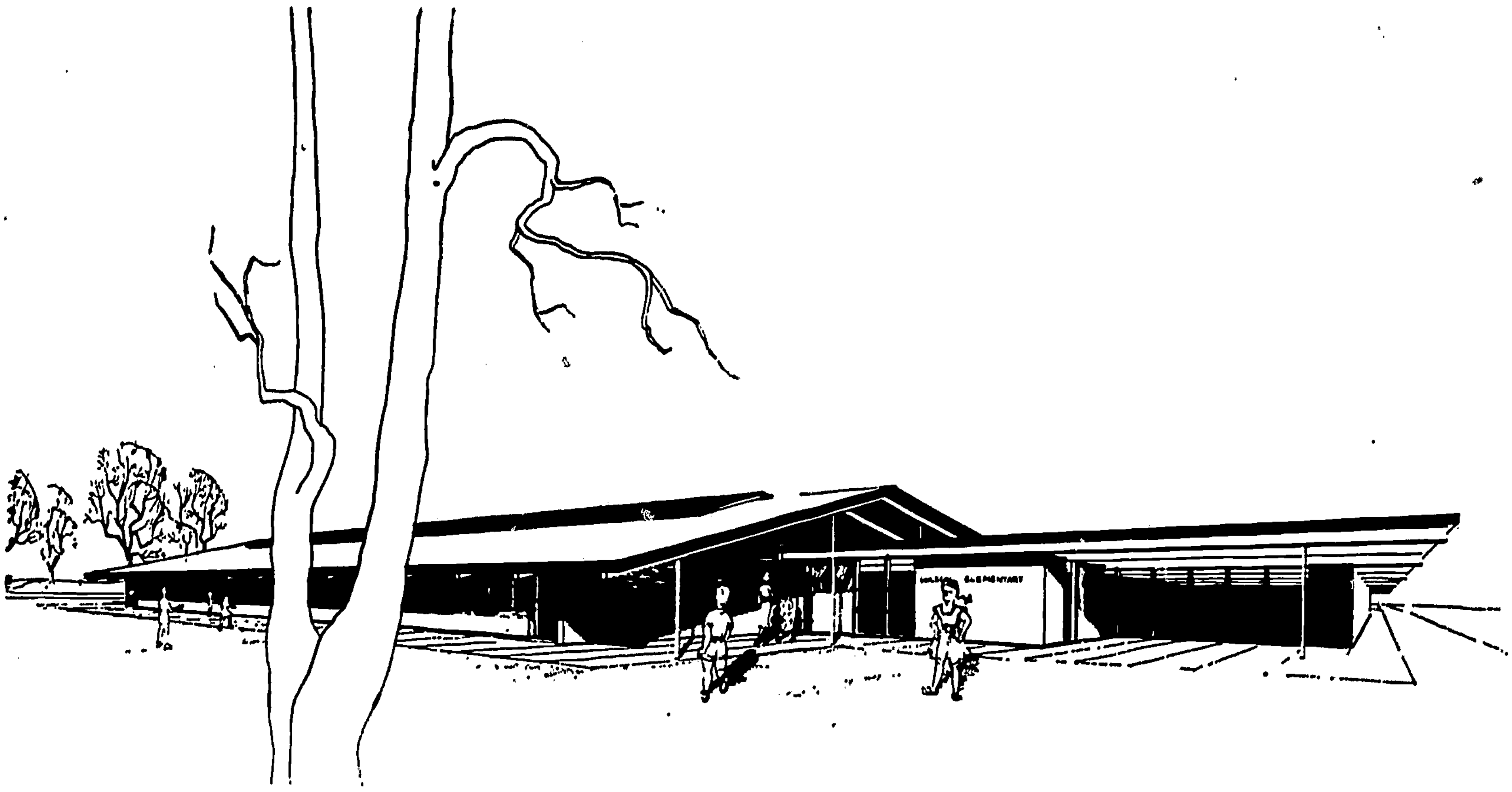
Geometrical differences were:

Roosevelt School

1. Area: 16,592 square feet.
2. Perimeter: 564 linear feet.
3. Volume: 176,274 cubic feet.
4. Outside corners: 12.
5. Inside corners: 8.
6. Interior area under *one* roof.

Roosevelt School





Wilson Elementary School in Miami, Oklahoma, Caudill, Rowlett, Scott and Associates, architects. The total cost of Wilson School is $180,120, and all interior areas are placed under three roofs. This building is more geometrically complex than Roosevelt School and has 19 outside corners and 15 inside corners. The perimeter of the building is 803 linear feet.

Wilson School

1. Area: 17,379 square feet.
2. Perimeter: 803 linear feet.
3. Volume: 163,799 cubic feet.
4. Outside corners: 19.
5. Inside corners: 15.
6. Interior area under *three* roofs.

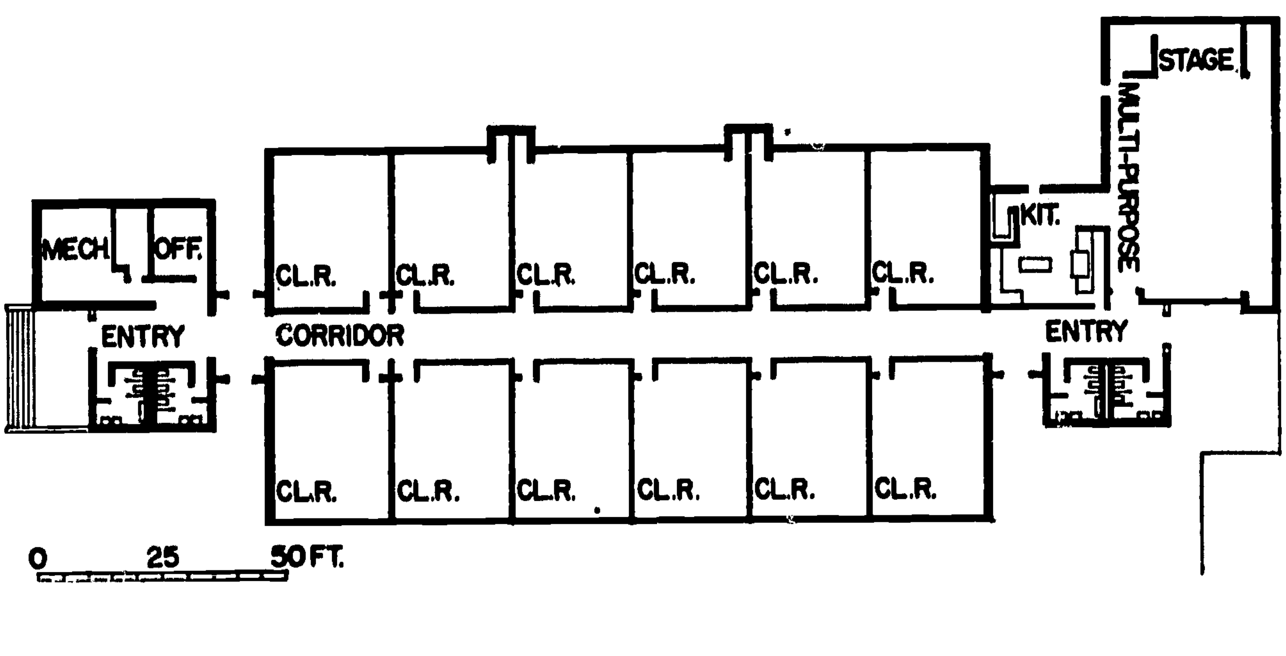
Comparison of Costs

Geometrical differences affected the actual construction cost of each school to the extent that Wilson School cost approximately 9 percent more than Roosevelt. The actual cost of Roosevelt School was $165,003.57 as compared with $180,120.09 for Wilson School. The average of all bids received indicated a savings of 14 percent.

Planned for Overall Economy

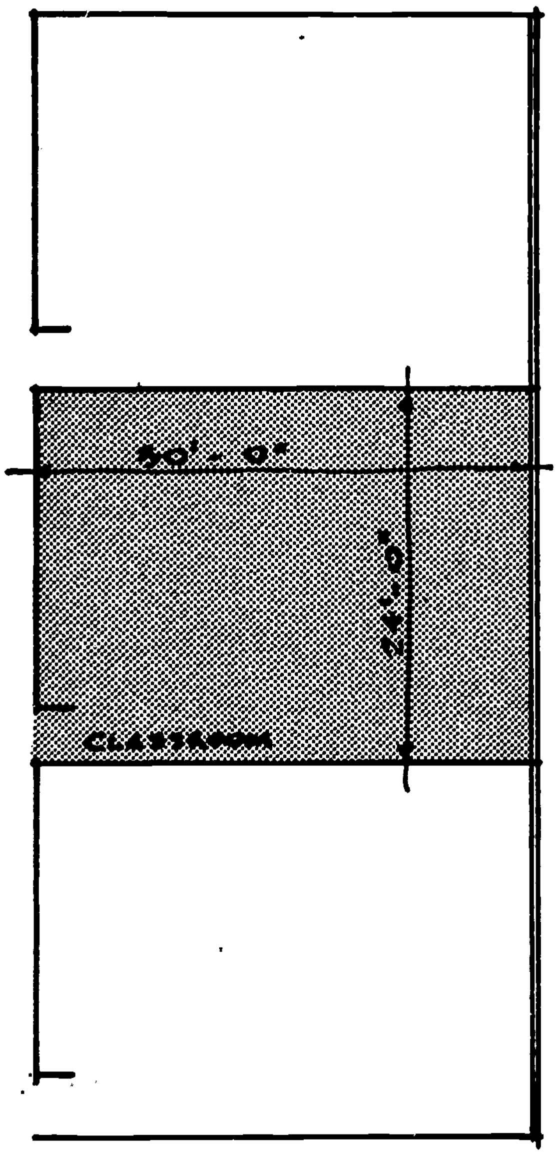
Although savings were realized in each school, we want to emphasize that both buildings consisted of planning designed for overall economy with features such as:

1. Minimum outside perimeter.
2. Simplified use of materials.
3. Repetitive structural bays.
4. Minimum wall heights.

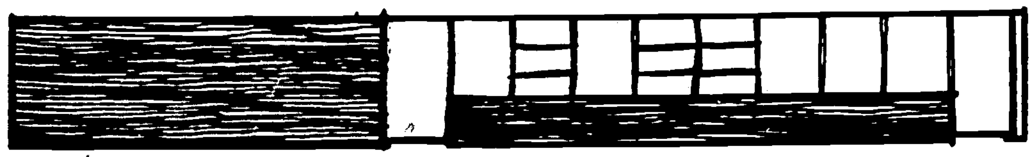


Wilson School

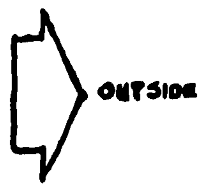
WAYS OF CUTTING COSTS:



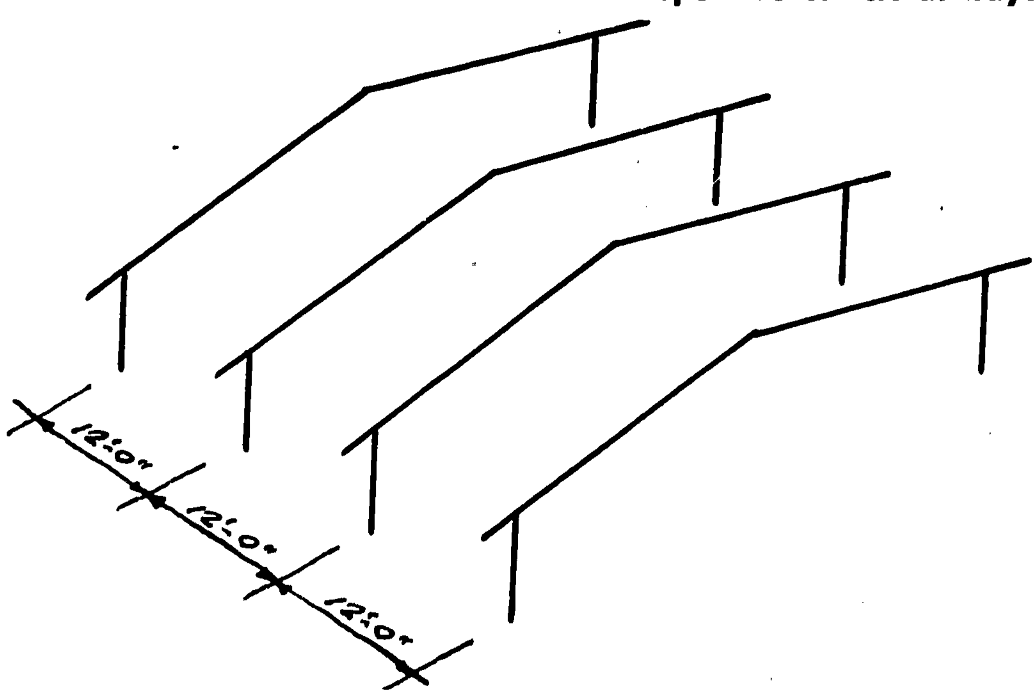
- Simplified use of materials



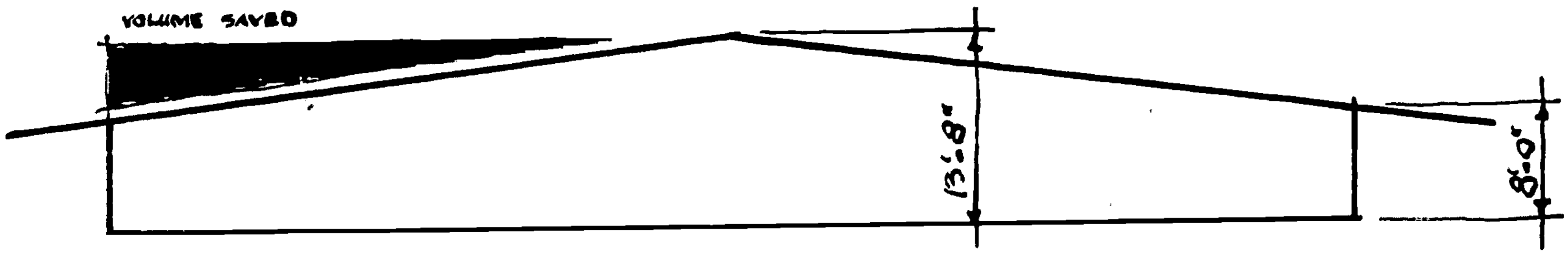
- Minimum outside perimeter



- Repetitive structural bays



- Minimum wall heights



CONCLUSION:

Our approach to the problem of planning and designing the Miami Schools was a direct result of careful analysis of geometrical forms. In both we attempted to plan simple and compact school buildings and, at the same time, make sure that the buildings were completely adequate for the educational programs; but conditions of the sites made one school more geometrically complex than the other. The results to date, construction-wise and educationally, have proven that the taxpayer got the most for his money in the simpler building. Geometrical considerations made this possible.