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A Study of the Potential Need, Location, and Cost of an Addition to St. Joseph-Ogden High School

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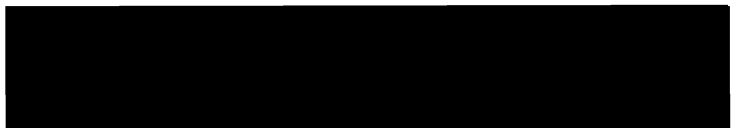
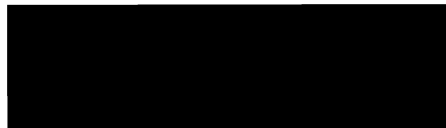
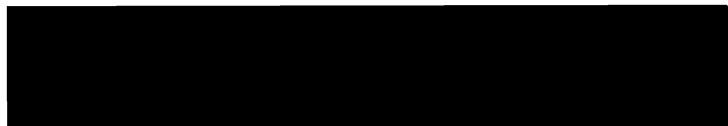
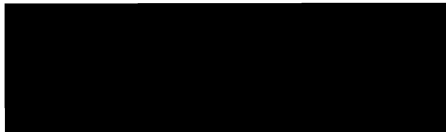
A Study of the Potential Need, Location, and Cost of an Addition to
St. Joseph-Ogden High School

BY
James M. Acklin

FIELD EXPERIENCE
SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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Abstract

This study was conducted to address the problem of the growing student population and potential overcrowding of St. Joseph-Ogden High School. It examined the extent of need, best location, and estimated cost of an addition to the high school. The extent of need was established by determining the assignable space percentage, the functional capacity, and the future enrollment of the high school. The best location was established by determining educational, classroom, and square footage needs and then determining what available property would satisfy those needs. The construction cost was established by multiplying the total square footage of the proposed addition by \$100 per square foot. Since the construction cost represents only 75% of the total project cost, the estimated total project cost was determined by dividing the construction cost by 0.75.

Based on the enrollment projection of 530 students by the 2001-02 school year, the St. Joseph-Ogden High School board and administration strongly need to consider building an addition to the high school. Further, strong consideration should be given to building an addition with six classrooms, each measuring 1,000 square feet in size. Of the three locations that would accommodate an addition of six classrooms, the site to the south of the 1976 addition was determined to be the best choice. Although the construction of an addition with six classrooms could cost as much as \$973,600, delaying a decision on building an addition could prove to be cost prohibitive as construction costs continue to rise. The employment of a professional architect and careful planning should help to control costs.

Although this study was limited to St. Joseph-Ogden High School, it is hoped that other school districts facing similar situations of overcrowding would find this study useful. The formulae and procedures used to establish the

extent of need, best location, and estimated cost of an addition to the high school should be applicable to personnel in other districts considering building additions to their schools. School boards and administrators of other districts should be able to make decisions concerning their own building projects using the information presented in this study.

Table of Contents

List of Tables	vi
Chapter 1: Overview of the Problem	1
Background	1
Problem	2
Objectives	4
Assumptions	4
Limitations	5
Definition of Terms	5
Uniqueness of the Study	7
Chapter 2: Review of Related Literature and Research	8
An Historical Perspective of Classroom Space	8
Determining the Capacity of Secondary Schools	10
Determining the Site for an Addition	13
Determining the Cost of an Addition	14
Summary of Literature Review	16
Chapter 3: Design of the Study	17
General Design	17
Objective 1: Determining the Extent of Need for an Addition	17
Objective 2: Determining the Best Location for an Addition	19
Objective 3: Determining the Estimated Cost of an Addition	21
Chapter 4: Results	22
Overview	22
Objective 1: The Extent of Need for an Addition	22
Objective 2: The Best Location for an Addition	25
Objective 3: The Estimated Cost of an Addition	28

Chapter 5: Summary, Conclusions, and Recommendations	29
Summary	29
Conclusions	30
Recommendations	34
References	36

List of Tables

Table 1: 1990 Projected Enrollments vs. Actual Enrollments	2
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Chapter 1

Overview of the Problem

Background

St. Joseph-Ogden High School District #305 had an enrollment of approximately 458 students in the 1996-97 school year. The high school is located in the village of St. Joseph, Illinois, but also serves the surrounding rural area. As well as being a rural community, St. Joseph is a bedroom community for professionals who work in Champaign or Urbana. In the researcher's opinion, the St. Joseph-Ogden school board and community have been extremely conservative in regard to decisions concerning expenditures. The only referendum ever proposed was defeated in the Spring of 1996.

Between 1981 and 1997, the population of the village of St. Joseph has increased from 1,900 to 2,592. This gain in population represents an increase of over 36%. During the last 10 years, there were over 500 new homes built in St. Joseph, representing an average of 50 new homes per year. The recent opening of two new subdivisions within the district's boundaries indicates that the trend of new home construction, and the corresponding population increase, will not level off any time in the near future (B. Hackler--St. Joseph mayor--personal communication, February 19, 1997). Further, according to Hackler (1997), a special census of St. Joseph done in 1995 indicated that there were 2.9 people per household living in the homes built since 1990, suggesting that many of the new homes have children living in them. More families with children moving into the village will have an impact on St. Joseph-Ogden High School.

From 1991-92 to the 1996-97 school years, the enrollment at St. Joseph-Ogden High School has increased by over 26% as indicated in Table 1. If enrollment continues to climb, it will likely be difficult to deliver the same

quality of education.

Table 1

1990 Projected Enrollments vs. Actual Enrollments

School Year	Enrollment		% Error ^a
	Projected	Actual	
1991-92	378	363	+4.0
1992-93	360	367	-1.9
1993-94	365	389	-6.6
1994-95	371	396	-6.7
1995-96	375	430	-14.7
1996-97	393	458	-16.5

^a+ indicates an overestimate, - indicates an underestimate.

Assuming a history of fiscal conservatism on the part of the board of education and community, it likely will not be an easy task to get approval for building an addition to the high school. In the researcher's opinion, the school board and district voters must be convinced of a real need for additional space before they are likely to authorize the use of taxpayer dollars to fund an addition to the high school.

Problem

The enrollment of 458 students at St. Joseph-Ogden High School has surpassed the projected enrollment for the 1996-97 school year by eight students. As recently as 1991-92, St. Joseph-Ogden had only 363 students enrolled. The trend over the last five years has been steady growth. Further, although projected enrollments beyond the 1996-97 school year indicate a leveling off, there is evidence that those enrollment projections may be

underestimated. The enrollment projections made in November of 1990 for the past five school years have been underestimated by as much as 16% as indicated in Table 1.

By the 2000-01 school year, St. Joseph-Ogden High School is projected to have an enrollment of 454 students (M. McKenzie--building principal--personal communication, February 5, 1997). Although this enrollment projection does not seem to show support for continued growth, the enrollment projection made in 1990 for the 1996-97 school year was 393 students, while the actual enrollment for the 1996-97 school year was 458 students (M. McKenzie--building principal--personal communication, February 5, 1997). In other words, the original enrollment projection for the 1996-97 school year was in error by 16.5%. Assuming an error of 16.5% in the 1996 projection for the 2000-01 school year, the actual enrollment for 2000-01 would approach 529 students. This estimate may be conservative because a continued housing boom on the east side of St. Joseph could push enrollment higher.

Although the St. Joseph-Ogden High School building is designed to hold a maximum of 600 students, the upper limit figure is based on every available seat being filled in each classroom for each period, with as many as 30 students in some classrooms. Further, as classrooms are utilized for more sessions, it becomes increasingly difficult to schedule certain classes into the appropriate rooms. For example, science classes should be taught in classrooms designed with lab facilities, not simply in any room that is available during a given period.

An upper limit of 30 students in a classroom might be unrealistic. Many rooms are not designed to hold 30 students. Additionally, placing 30 students in certain classes may be unsafe (e.g., chemistry and industrial arts). Finally, since some classes will not have 30 students enrolled, others will need to have

more than 30 in order to meet the average. The situation of 30 or more students for some classrooms is not ideal (M. McKenzie--building principal--personal communication, October 24, 1996). A more realistic upper limit for St. Joseph-Ogden High School, based on 20 students per classroom, is about 500 students. With an average of just under 19 students per class, St. Joseph-Ogden High School is presently close to capacity (M. McKenzie--building principal--personal communication, February 5, 1997).

As the enrollment of St. Joseph-Ogden High School surpasses 500 students, it will become more difficult to deliver the same quality of education due to classes becoming larger and classroom space becoming scarce. The administration has tried to keep class counts under 26 students, but 27 classes surpassed that desired maximum the first semester and 33 the second semester for the 1996-97 school year. As the average class size begins to approach 30 students, students are not likely to get the same amount of individual attention from their teachers that took place in the past. Even with the hiring of additional staff--a costly venture--it is possible to fit only so many students into the classrooms currently available.

Objectives

The objectives are to:

1. Determine the extent of need for an addition to St. Joseph-Ogden High School.
2. Determine the best location for an addition to St. Joseph-Ogden High School.
3. Determine the estimated cost of an addition to St. Joseph-Ogden High School.

Assumptions

It was assumed that the St. Joseph-Ogden school board and community

are concerned about the quality of education that children receive. Further, it was assumed that an average class size of 25-30 students would have a negative impact on the instructional program at St. Joseph-Ogden High School. Finally, it was assumed that the school board and community, if convinced of a real need for additional space, would take steps to correct a problem they perceive as having a detrimental effect on the quality of education being delivered to their children.

Limitations

This study was limited to St. Joseph-Ogden High School. The ultimate goal of this project was to supply the St. Joseph-Ogden school board and community with the data necessary to make informed, objective decisions concerning the construction of an addition to the high school. It was hoped, though, that other school districts facing similar situations of overcrowding would find this study useful. Outside of the scope of this study was the development of a specific building plan in the event that an addition to St. Joseph-Ogden High School was deemed necessary. This study was limited to determining the extent of need for an addition, the best location for an addition, and estimated cost of an addition.

Definition of Terms

Terms germane to an understanding of this study are presented here.

Assignable Space

Assignable space is all of the space inside a school building except the area occupied by walls, hallways, lavatories, and service spaces. Assignable space does include locker rooms, storage areas off classrooms, offices, and other comparable areas.

Enrollment Projection

An enrollment projection is an estimate of future enrollment based on, in

the case of District #305, current enrollments at the feeder grade schools, past trends in the net gain of student transfers, and current trends in the development of new housing subdivisions.

Functional Capacity

Functional capacity is the building capacity figure derived from the program sensitive capacity approach.

Instructional Space

Instructional space is the space inside a school building where students are assigned or where instruction takes place. Instructional space does not include hallways, locker rooms, lavatories, storage areas, offices, or other comparable areas.

Maximum Student Containment

The maximum student containment approach for determining building capacity simply calculates the total number of students that can fit into the instructional spaces of a given school building.

Program Sensitive Capacity

The program sensitive capacity approach for determining building capacity involves consideration of average class size and scheduling efficiency, as well as total student capacity.

Scheduling Efficiency

The scheduling efficiency of a given school building is determined by multiplying the potential instructional spaces available by the number of periods per day and then dividing that product into the actual instructional spaces used throughout the day.

Square Feet Per Student

The square feet per student approach for determining building capacity utilizes a certain square footage value per student. An accepted range for

secondary schools is 110-145 square feet per student (Hawkins & Lilley, 1992, p. 5).

Total Seat Count

Total seat count is the procedure used in the maximum student containment approach; the maximum number of student spaces in each classroom is determined and those values are then totaled.

Total Student Capacity

The total student capacity represents the maximum number of students a school building could hold if every classroom was filled to capacity every period of the day.

Uniqueness of the Study

This study contributed to school board members and voters having information to make decisions concerning the alleviation of the potential overcrowding at St. Joseph-Ogden High School. In the researcher's opinion, relatively few members of the community are aware of the shortage of space at St. Joseph-Ogden High School.

Chapter 2

Review of Literature and Research

An Historical Perspective of Classroom Space

During the colonial period in the United States, a major function of education was to teach children to read in order for them to be able to study the Bible. As a result of this philosophy, churches often served as schoolhouses as well as sites for religious activities (Moore, 1991, p. A2). By the early 19th century, however, the role of education began to change. As a result of this changing role, schools began to disassociate themselves from churches, and one-room schoolhouses became commonplace. In these one-room schoolhouses, consideration of what constituted an optimal amount of space for each student apparently was not a priority. As Moore (1991) noted, "it was not unusual, in city schools, to have 500 students seated in a single 50 feet by 100 feet room" (p. A2).

During much of the 19th century, most school buildings in the United States were little more than shelters, with very little consideration given to how cramped, crude conditions might adversely affect student learning. In fact, many of the schoolhouses of this time period lacked such basic amenities as desks and lavatories (Moore, 1991, p. A3). Near the end of the 19th century, however, experimental schools that put a greater emphasis on the needs of students were developed. Schools such as the Cook County Normal School, the Horace Mann School, and the Laboratory School of John Dewey all developed systems that required more space for each student (Moore, 1991, p. A6).

During the early years of the 20th century, secondary schools began to evolve (Moore, 1991, p. A6). With the development of high schools came the need for more space. The need for additional space was due, in part, to an

increase in community use of school facilities (Moore, 1991, p. A6). More importantly, larger schools were necessary to support a growing curriculum during the 1930s and 1940s. As the curriculum and the school population burgeoned throughout the 1950s and 1960s, the need for larger school buildings increased dramatically.

Although the 1970s brought about spiraling inflation and the 1980s brought about plunging enrollments for public schools, there was still an increased need for space to house developing technology (Moore, 1991, p. A7). For example, a computer lab large enough to hold 25 computer stations not only needed to be larger than the average classroom, but its secondary uses were limited which lowered scheduling efficiency (Czerwinski, 1991, p. 19). As a result, school personnel had to become creative in their use of available space when adding space proved cost prohibitive. Also, architectural firms have been responsive to the need for added space in the face of rising costs, trying to design school buildings that make the most efficient use of space possible (R. Gruber--school architect--personal communication, November 26, 1996).

As American education finds itself on the threshold of the 21st century, the need for sound judgments in facility planning and design become even more critical. A continuing need for technology carries a corresponding need for more space. Further, as the children of the baby boomers continue to push school enrollments to record numbers, existing facilities will be stretched to their limits (Kantrowitz, 1996, p. 81). As new facilities or additions are built, the individuals responsible for planning instructional spaces will need to keep in mind the effects of the physical structure on human behavior and on learning (Moore, 1991, p. A7).

Determining the Capacity of Secondary Schools

As school buildings have become inadequate in size due to the needs of new programs and the students served, school officials and facility planners have had to make difficult decisions concerning the size of school buildings. In the past, decisions concerning the capacity of the school building have been based largely on tradition; however, there are different formulae that exist to determine the capacity of a school building. Determining the capacity of secondary schools may be more difficult than determining the capacity of elementary schools. The determination of the capacity of a typical elementary school simply involves multiplying the number of classrooms by average class size (Chambers, 1993, p. 37).

In determining the capacity of a secondary school, it is important to first “. . . decide if the capacity figure desired is the maximum number of students possible to be housed in the building, or a more functional number which can be reasonably used without serious harm to the instructional program” (Chambers, 1993, p. 38). Adding more students to a classroom or school building may be cost effective, but it can have a corresponding negative impact on learning. At some point, a decision must be made regarding the importance of cost containment versus what is best for the students. It is not an easy balance to achieve.

The three basic approaches used to determine secondary school capacity are (a) maximum student containment, (b) square feet per student, and (c) program sensitive capacity (Chambers, 1993, p. 38). Maximum student containment, or what architects refer to as total seat count, represents the total number of students that a building can hold. Maximum student containment is calculated by simply counting the number of available seats in each room that is available for instructional purposes. This number (total student capacity) is

not particularly useful in determining a realistic building capacity because it ignores the fact that it is extremely difficult to utilize every classroom every period of the school day (Chambers, 1993, p. 39).

The square feet per student approach can yield more significant data and is relatively easy to apply. Although there is not complete agreement in the research as to what the gross square footage per student should be, one recent study suggested a range of 110-145 square feet per student in the secondary school setting (Hawkins & Lilley, 1992, p. 5). There are two problems, however, with the application of the square feet per student approach. First, school building capacity figures are developed from past practice, not from educational research (Moore, 1991, p. 34). Secondly, this approach is based on national averages and does not take into account the unique needs of certain schools or the programs within those schools (Chambers, 1993, p. 38). For example, recommended space allocations for occupational education areas can range from 50 to 250 square feet per student (Storm, 1993, p. 13).

With the program sensitive capacity approach, average class size and scheduling efficiency are given consideration along with total student capacity. This approach, although arguably somewhat subjective in that it depends on judgments concerning optimal class size, can provide a more accurate estimate of the functional capacity of a school building. Further, “. . . careful control of the variables [can] lead to a capacity figure that is [both] realistic and functional” (Chambers, 1993, p. 38).

Establishing average class size, an essential element in determining functional capacity, can be more complex than might first appear. First, not all classrooms will hold the same number of students, due to either a difference in size or a difference in specific usage. Also, due to the complexities of

scheduling, the average class size variation is plus or minus five students (Chambers, 1993, p. 39). As a result, even though a given group of classrooms may be able to hold 30 students each, the scheduling must be done using a target of 25 students per class to keep from going over 30 students in some classes.

It could be argued that a more realistic average number of students per classroom is closer to 20 than 25. In fact, a recent study suggested that the capacity for senior high schools should indeed be based on 20 students per classroom (North Carolina Division of School Planning, 1988, p. 16). It should be noted that the variation from the average number of students per class is normally plus or minus five students. Therefore, if the average number of students per class is 25, some classes would have as many as 30 students in them. Classrooms below the recommended minimum size of 750 square feet for a high school classroom would not hold 30 students safely (DeChiara & Callender, 1990, p. 230).

Scheduling efficiency is determined by multiplying the potential instructional spaces available by the number of periods per day and then dividing that product into the actual instructional spaces used throughout the day. While secondary schools with enrollments of over 1,500 students can expect up to 90% scheduling efficiency, and those with enrollments between 500 and 1,000 students can expect 80% scheduling efficiency, secondary schools with enrollments of under 500 students can expect only 60-70% scheduling efficiency (DeChiara & Callender, 1990, p. 219). Although it may be possible to operate at a scheduling efficiency above the average, 100% scheduling efficiency is essentially impossible to attain for even the largest of secondary schools (Chambers, 1993, p. 39).

Determining the Site for an Addition

Site selection is an important concern for school administrators when considering building an addition to a school. The school site “. . . is an integral part of the school facility and one of the basic tools in the educational process” (Hawkins & Lilley, 1992, p. 7). When choosing a site for an addition, topography--the contours and grade elevations of the surrounding property--should be considered (DeChiara & Callender, 1990, p. 213). There should be no steep inclines on or near the property being considered for the addition (Hawkins & Lilley, 1992, p. 8). Further, the area being considered for an addition should have good soil and exhibit proper drainage (Moore, 1991, p. F5).

An additional concern involved in site selection is the aesthetic quality of the land being considered for an addition (Moore, 1991, p. F5). The site should be aesthetically pleasing to staff, students, and the general public. The building site is an important part of the total image of the school; a well landscaped building site can be an effective public relations tool (Hawkins & Lilley, 1992, p. 9). After the site has been selected and construction has begun, an attempt should be made to preserve existing vegetation, including all healthy trees (Moore, 1991, p. F11).

Another factor to consider in the selection of a site for an addition is the ultimate use of the classrooms that will be added. The location of additional classrooms is ultimately dependent on the anticipated uses of those classrooms. Regular classrooms, for example, should be located near the library and central area of the school, but away from music rooms and shop areas (Hawkins & Lilley, 1992, p. 35). However, it may not be possible to choose an ideal site if land use options are limited (Moore, 1991, p. F6). Ultimately, the site chosen for construction must be large enough to

accommodate the additional classrooms that are required.

The number of required additional classrooms can be determined easily if a building capacity figure has been agreed upon and the future enrollment has been estimated accurately (R. Gruber--school architect--personal communication, March 3, 1997). First, the present building capacity figure is subtracted from the projected enrollment to determine the number of students over the building capacity. Next, the desired number of students per class is multiplied by the scheduling efficiency to determine the functional class average. Finally, the number of students over the building capacity is divided by the functional class average to determine the number of required additional classrooms.

Once the number of required additional classrooms has been determined, the space required for the entire addition can be estimated. In order to determine the necessary square footage for the entire addition, both classroom size and hallway space must be taken into consideration. Although an accepted minimum size for high school classrooms is 750 square feet, a more desirable size is 900 square feet per classroom (R. Gruber--school architect--personal communication, March 3, 1997). Larger classrooms have become necessary because of an increasing trend for students to be engaged in small-group work (Hawkins & Lilley, 1992, p. 35). Finally, it should be noted that the size of the classroom is dependent on the use of the classroom (Hawkins & Lilley, 1992, p. 39).

Determining the Cost of an Addition

Once the additional space needs have been determined, it is possible to determine the cost of the building project. Since the the cost of labor and building material continually increases, long range forecasts of construction costs should be avoided (Moore, 1991, p. C11). The current average cost for

constructing a school building is \$100 per square foot, but this cost estimate is on the rise (R. Gruber--school architect--personal communication, March 3, 1997). Further, the actual cost of construction can be either above or below the average due to the specific needs of the district planning the building project. The accurate determination of the cost of an addition can be complex.

In estimating the cost of a building project, it should be noted that the cost of construction is only a portion of the total project cost. A building project budget should include costs for (a) construction, (b) site development, (c) fixed equipment, (d) architectural fees, and (e) contingencies (DeChiara & Callender, 1990, p. 212). Of the project cost, construction costs usually account for 75% or less of the total (R. Gruber--school architect--personal communication, March 3, 1997). In other words, "If there is a million dollars to spend, a million-dollar building cannot be built" (DeChiara & Callender, 1990, p. 212).

Although building projects can be quite costly, it is possible to control costs through careful planning. The use of a professional architect in planning building design is an expense that can save the school district money. A well-designed, compact addition can be cheaper to build initially by reducing costly exterior walls and eliminating unnecessary corridors (Moore, 1991, p. K8). Further, an addition that has been designed with energy conservation in mind will help reduce operation costs over its lifetime (Moore, 1991, p. K8). When planning a building project, consideration should be given to the total cost of the addition, which includes the expense of operations and maintenance, as well as the initial expense of the structure (Moore, 1991, p. K7).

School administrators should not attempt to control the cost of building projects by compromising the quality of construction and materials. Though steep, initial building costs are insignificant relative to the costs of operation

and maintenance over the lifetime of a building (Moore, 1991, p. K7). Cheaper design and materials may save a school district money initially, but they will usually end up costing the district more money in the future. It should be noted that “. . . the budget for the building and financing of the physical plant over its lifetime varies from [only] 5 to 15 percent of the cost of educating a child” (DeChiara & Callender, 1990, p. 210). High quality design and materials will ultimately save the district money.

Summary of Literature Review

As the role of education in the United States has changed since colonial times, there has been an increasing need for more space in schools. The continuing need for technology and increasing enrollments tax existing facilities to their limits. As facilities become unsuitable due to space constraints, school officials will have to make decisions concerning the inadequate capacities of their school buildings. To help school officials determine the extent of need for adding space to their facilities, there are various formulae that exist to determine the capacity of school buildings.

If it is determined that an addition must be built, then careful consideration must be given to determining the site for the addition. The choice of the school site partly determines the final cost of the building project. When determining the final cost of the addition, it should be noted that the total project budget includes expenses beyond construction costs. The final cost of the project will include additional expenses that represent at least 25% of the total. However, the added expense of professional fees should be viewed as a necessity; a well-designed building will save a school district money in operations and maintenance.

Chapter 3

Design of the Study

This study was qualitative in nature and developed a resource for the board and administration of St. Joseph-Ogden High School to use in determining the extent of need for an addition, the best location for an addition, and the estimated cost of an addition. It is hoped that other districts facing similar situations of overcrowding would be able to use this document when considering building additions to their schools. The format of this chapter explains the design for the completion of each of the three study objectives.

Objective 1: Determining the Extent of Need for an Addition

The extent of need for an addition to St. Joseph-Ogden High School was established by determining the assignable space percentage, the functional capacity, and the future enrollment of the high school. Factors that were considered in determining need are presented here.

Determining Assignable Space Percentage

The percentage of the total square footage that exists as assignable space for St. Joseph-Ogden High School was determined by using the following formula: $\text{total assignable space square footage} \div \text{total building square footage} \times 100$. The value for the total building square footage was gleaned from district documents, but the total assignable space square footage had to be determined by measuring each room in the building. Measuring each room also led to the awareness of how many classrooms are below the recommended minimum size of 750 square feet for a high school classroom.

Determining Functional Capacity

The functional capacity for St. Joseph-Ogden High School was determined by using the following formula: $\text{available instructional spaces} \times \text{average class size} \times \text{scheduling efficiency}$. The number of available

instructional spaces was determined by simply counting classrooms. The determination of average class size and scheduling efficiency are presented here.

Determining average class size. In order to determine a range for the functional capacity rather than just one value, two different class averages were used in the functional capacity formula: a maximum realistic average of 25 students per class and a more desirable average of 20 students per class. Further, the actual 1996-97 class averages were used for three departments due to the specific utilization of their instructional spaces. The special education department had an average of just over six students per class in three classrooms, while the physical education department had an average of 32 students per class in two gymnasiums. Finally, the music department (located in one band room) had 60 students in one period, and 38 students in another, but only two students in each of the other three periods; therefore, the class average used for the music department was 21 students in one classroom.

Determining scheduling efficiency. The scheduling efficiency for St. Joseph-Ogden High School was determined by the following formula: $\frac{\text{total number of periods available instructional spaces were used throughout the day}}{(\text{available instructional spaces} \times \text{number of instructional periods per day})} \times 100$.

Determining Future Enrollment

The future enrollment of St. Joseph-Ogden High School was determined by analyzing three sets of data. Data that were considered are presented here.

Analysis of transfer data. Students who transferred into or out of the district in the 1993-94, 1994-95, or 1995-96 school years were counted to determine the trend in the net gain or loss of students during the school year.

Analysis of enrollment data. Students who were enrolled in grades four through seven in the three feeder grade schools in the 1996-97 school year were counted to determine the projected enrollment for the 2001-02 school year. Next, the 1990 projected enrollment for the 1995-96 school year was compared to the actual enrollment for the 1995-96 school year and the percentage error was calculated. That percentage error was then multiplied by the projected enrollment for the 2001-02 school year to obtain an adjusted projected enrollment that considers continued growth of the district.

Analysis of community population data. For the village of St. Joseph, the population growth rate between 1981 and 1997 was calculated. Next, the average number of new homes built in St. Joseph each year during the last 10 years was determined. Finally, information concerning the number of people per household in homes built in St. Joseph since 1990 was studied.

St. Joseph was the focus of the community population study for two reasons. First, St. Joseph is the only community of the three district communities to show steady growth over the last 15 years. The populations of Ogden and Royal have remained relatively stable over the same period of time. Second, during the 1996-97 school year, St. Joseph Grade School had an enrollment of 700 students out of a total enrollment of 1,008 students in the three feeder grade schools, representing over 69% of the total grade school enrollment. Not only has more growth occurred in St. Joseph, but growth in that community affects a larger percentage of the total number of students.

Objective 2: Determining the Best Location for an Addition

The procedures for determining the best location for an addition to St. Joseph-Ogden High School were established by conferring with a local school architect. Factors that were considered are presented here.

Determining Additional Classroom Needs

The number of additional classrooms required was determined by the following formula: $\text{number of students over the functional capacity} \div (25 \text{ students/classroom} \times \text{scheduling efficiency})$. The number of students over the functional capacity was determined by subtracting the functional capacity from the projected enrollment for the 2001-02 school year.

Determining Additional Square Footage Needs

After determining the usage of the additional classrooms, the space required for the entire addition was determined by adding the total square footage of the desired classrooms to the square footage necessary for hallway space and exterior walls. The square footage necessary for the additional classrooms was obtained by calculating the average size of the six regular classrooms built as part of the most recent addition (1976) and multiplying that number by the number of additional classrooms required. The space required for a hallway was calculated by multiplying the width of the hallway in the 1976 addition by the length of the hallway required in the proposed addition. The square footage necessary for exterior walls was calculated by multiplying the wall thickness by the perimeter of the proposed addition.

Determining Available Property to Use

Determining the available property to use as a site for an addition was a matter of first determining where the proposed addition would fit on the current school property. From those available sites, the final site was determined by asking the following questions:

1. Which site offers proper drainage and is aesthetically pleasing?
2. Which site offers the greatest accessibility?
3. Which site requires the least amount of total square footage for the desired number of classrooms?

4. Which site offers an ease of integration of the addition into the existing structure?

5. Which site best allows the addition to match the surrounding architecture of the current building?

Objective 3: Determining the Estimated Cost of an Addition

Once the total square footage of the proposed addition was calculated, the construction cost was estimated by multiplying the total square footage by \$100 per square foot. However, it has been previously noted that the construction cost represents only 75% of the total project cost. Therefore, the total project cost was determined by dividing the construction cost by 0.75.

Chapter 4

Results

Overview

The first objective of this study was to determine the extent of need for an addition to St. Joseph-Ogden High School. Objective 1 was fulfilled by determining the assignable space percentage, the functional capacity, and the future enrollment of the high school. The second objective was to determine the best location for an addition to St. Joseph-Ogden High School. Objective 2 was fulfilled by determining additional classroom and square footage needs, and then determining what available property would satisfy those needs. The third objective was to determine the estimated cost of an addition to St. Joseph-Ogden High School. Objective 3 was fulfilled by multiplying the total square footage of the proposed addition by \$100 per square foot and dividing that product by 0.75 in order to determine the total project cost.

Results for Objective 1: The Extent of Need for an Addition

The results of this study show that St. Joseph-Ogden High School is running out of available space and will likely require additional classrooms by the 2001-02 school year. Factors that were considered in determining need are presented here.

Assignable Space Percentage

The percentage of the total square footage that exists as assignable space for St. Joseph-Ogden High School is 72.2%. This value was determined by dividing the total assignable space square footage by the total building square footage, then multiplying that figure by 100: $69,152.5 \text{ square feet} \div 95,832 \text{ square feet} \times 100 = 72.2\%$. Of the 29 classrooms in the building, 10 are below the recommended minimum size of 750 square feet for a high school classroom.

Functional Capacity

The functional capacity for St. Joseph-Ogden High School is between 442 and 534 students. The lower figure was determined by multiplying 31 instructional spaces by the average class size of 19.5 students, and then multiplying that product by the 1996-97 scheduling efficiency of 73.3%. The higher figure was determined by multiplying 31 instructional spaces by the average class size of 23.5 students, and then multiplying that product by the 1996-97 scheduling efficiency of 73.3%. The determination of average class size and scheduling efficiency are presented here.

Average class size. The average class size figures used in the functional capacity formula were 19.5 and 23.5 students per class. The lower average was determined by dividing a total student capacity of 603 students by 31 instructional spaces. The total student capacity of 603 students was determined by multiplying 20 students per class by 25 regular classrooms (500 students), then adding 21 students for band, 64 students for physical education, and 18 students for special education. The higher average was determined by dividing a total student capacity of 728 students by 31 instructional spaces. The total student capacity of 728 students was determined by multiplying 25 students per class by 25 regular classrooms (625 students), then adding 21 students for band, 64 students for physical education, and 18 students for special education.

Scheduling efficiency. The scheduling efficiency for St. Joseph-Ogden High School for the 1996-97 school year was 73.3%. That value was determined by dividing the total number of periods the instructional spaces were used per day by the total number of instructional periods per day, then multiplying that figure by 100: $159 \div 217 \times 100 = 73.3\%$.

Future Enrollment

The projected enrollment for St. Joseph-Ogden High School for the 2001-02 school year is 462 students, based on the 1996-97 enrollment in grades four through seven in the three feeder grade schools. However, enrollment for the 2001-02 school year could reach 530 students or more, based on past enrollment projection error and continued growth of the village of St. Joseph. Data that were considered in the determination of future enrollment are presented here.

Analysis of transfer data. During the 1993-94 school year, 12 students transferred in and nine students transferred out, for a net gain of three students. During the 1994-95 school year, 17 students transferred in and 18 students transferred out, for a net loss of one student. During the 1995-96 school year, 12 students transferred in and 12 students transferred out, for a net gain or loss of zero students. Based on the three aforementioned school years, the effect of student transfers on the school population seems to be negligible.

Analysis of enrollment data. Based on the 1996-97 enrollment in grades four through seven in the three feeder grade schools, the projected 2001-02 enrollment for the high school is 462 students. The enrollment projection made in 1990 for the 1995-96 school year was 375 students, while the actual enrollment for the 1995-96 school year was 430 students. The original enrollment projection for the 1995-96 school year was in error by 14.7%. Assuming an error of 14.7% in the 1996 projection for the 2001-02 school year, the actual enrollment for 2001-02 would approach 530 students.

Analysis of community population data. The population of the village of St. Joseph increased from 1,900 to 2,592 between 1981 and 1997. This gain in population represents an increase of 36.4%, or an annual growth rate of about 2.3%. During the last 10 years, there were over 500 new homes built in

St. Joseph, an average of over 50 new homes per year. The recent opening of two new subdivisions within district boundaries indicates that the trend of new home construction will not level off any time in the near future. A 1995 census indicated that there were 2.9 people per household living in homes built since 1990, suggesting that many of the new homes have children living in them. Based on new home construction and the number of children per household, the village of St. Joseph may continue to add as many as 45 children per year to its population.

Results for Objective 2: The Best Location for an Addition

The best location for an addition to St. Joseph-Ogden High School was determined after conferring with a local school architect. An area on the south side of the school adjacent to the 1976 addition was determined to be the best location for an addition. Factors that were considered are presented here.

Additional Classroom Needs

There could be as many as four to six additional classrooms needed at St. Joseph-Ogden High School for the 2001-02 school year. This range was determined by first subtracting the lower end of the functional capacity range (442 students) from the adjusted projected enrollment for the 2001-02 school year (530 students) to find the number of students over the functional capacity (88 students). Next, the number of students over the functional capacity was divided by 18.3 students per classroom to determine the number of additional classrooms required: $88 \text{ students} \div 18.3 \text{ students/classroom} = 4.8 \text{ classrooms}$. The number of students per classroom was determined by multiplying 25 students per classroom by the scheduling efficiency of 73.3%.

Additional Square Footage Needs

The square footage needs for an addition with four to six classrooms are between 4,894 and 7,302 square feet. An interview of the administration at St.

Joseph-Ogden established that any additional classrooms built would be used by the math department. A math room should not require more than 1,000 square feet, 250 square feet over the suggested minimum for space.

The space required for the entire addition was determined by adding the total square footage of desired classrooms to the square footage necessary for hallway space and exterior walls. The average size of the six regular classrooms built as part of the 1976 addition is 1,000 square feet. Based on this average, the square footage necessary for four additional classrooms is 4,000 square feet, while the space required for six additional classrooms is 6,000 square feet.

The space required for a hallway was calculated by multiplying the width of the hallway of the 1976 addition by the length of the hallway required in the proposed addition. An addition with four classrooms would require approximately 697 square feet for hallway space: 12 feet of width x 58.1 feet of length. An addition with six classrooms would require approximately 1,046 square feet for hallway space: 12 feet of width x 87.2 feet of length.

The square footage necessary for exterior walls was calculated by multiplying the wall thickness by the perimeter of the proposed addition. An addition with four classrooms would require approximately 197 square feet for exterior wall space: 1 foot of thickness x 197 feet of length. An addition with six classrooms would require approximately 256 square feet for exterior wall space: 1 foot of thickness x 256 feet of length.

Available Property

Determining the available property to use as a site for an addition was a matter of first determining where the proposed addition would fit on the current school property. Including hallways and exterior walls, an addition of four classrooms requires about 4,900 square feet, with the approximate dimensions

of 60 feet by 82 feet. An addition of six classrooms requires about 7,300 square feet, with the approximate dimensions of 82 feet by 89 feet. The three locations that would accommodate an addition of four to six classrooms include an area on the south side of the school adjacent to the 1976 addition, an area on the west side of the school adjacent to the 1952 addition, and an area on the north side of the school adjacent to the large gymnasium. Factors considered in the determination of the final site are presented here.

Drainage and aesthetics. All three sites offer good drainage, but the site to the south of the school is perhaps the best choice aesthetically. The site to the south is well landscaped, surrounded by grass and trees. Although seven mature trees would have to be removed to utilize this site, the construction project should not have an undue negative impact on surrounding vegetation. The sites to the west and to the north are in the middle of parking lots; building in either of these locations would have the additional negative impact of reducing available parking, which is an existing problem.

Accessibility. All three sites are accessible from the outside in that they are adjacent to parts of the building that exit at ground level. Additions at any of the sites would not require steps or ramps to be built in order to reach the inside. However, the site to the south might offer the greatest accessibility from the inside in that an addition built there could be reached from an extension of the existing hallway of the 1976 addition. Additions built at the sites to the west or to the north would probably have to be entered from the inside by going through the large gymnasium.

Efficiency. A square-shaped addition usually requires the least amount of square footage for the desired number of classrooms. The site that would lend itself best to an 82 feet by 89 feet addition for six classrooms is the site to the south. The sites to the west and to the north would likely require a more

rectangular shape for an addition.

Current building design. The site that has an adjacent building structure that would be the easiest to add on to is probably the site to the south. The new addition could be built at the end of the 1976 addition by extending the length of the building the desired number of feet. The new hallway would line up with the old hallway, eliminating the need for excess hallway space. The sites to the west and to the north would both require more hallway space than the site to the south.

Further, it should be relatively easy to match the design of the proposed addition to the surrounding architecture of the 1976 addition. The width, height, and roof line of the proposed addition should be easy to match to the width, height, and roof line of the end of the 1976 addition. The sites to the west and to the north both have adjacent building structure with different widths than the proposed addition. The heights and roof lines of the buildings at those sites would also make it difficult to match the design of an addition to the surrounding architecture.

Results for Objective 3: The Estimated Cost of an Addition

The final cost of the proposed addition should be between \$652,500 and \$973,600, depending on whether an addition with four classrooms or an addition with six classrooms is built. The construction cost was estimated by multiplying the total square footage by \$100 dollars per square foot. The final project cost of each proposal was determined by dividing the construction cost by 0.75, since the construction cost represents only 75% of the total project cost.

Chapter 5

Summary, Conclusions, and Recommendations

Summary

As the enrollment of St. Joseph-Ogden High School continues to grow, it will become more difficult to deliver the same quality of education due to classes becoming larger and classroom space becoming scarce. As the average class size begins to approach 30 students, students are not likely to get the same amount of individual attention from their teachers that has taken place in the past. Even with the hiring of additional staff, only so many students will fit into the classrooms currently available. The board and administration at St. Joseph-Ogden must be ready to deal with the potential lack of classroom space at their high school.

The objectives of this study were to:

1. Determine the extent of need for an addition to St. Joseph-Ogden High School.
2. Determine the best location for an addition to St. Joseph-Ogden High School.
3. Determine the estimated cost of an addition to St. Joseph-Ogden High School.

Objective 1 was accomplished by determining the assignable space percentage, the functional capacity, and the future enrollment of the high school. St. Joseph-Ogden has an assignable space percentage of 72.2%, while the state recommended minimum for assignable space is 65%. For St. Joseph-Ogden, the functional capacity is between 442 and 534 students. The higher functional capacity figure assumed an average class size of 23.5 students, while the lower functional capacity value assumed a more desirable average class size of 19.5 students. The enrollment at the high school could

reach 530 students or more by the 2001-02 school year, based on past enrollment projection error and continued growth of the village of St. Joseph.

Objective 2 was accomplished by determining additional classroom and square footage needs, and then determining what available property would satisfy those needs. By the 2001-02 school year, St. Joseph-Ogden could require as many as six additional classrooms to house its burgeoning student population. The total square footage needs of an addition with six classrooms are approximately 7,300 square feet, including hallway and exterior wall space. Of the locations that would accommodate an addition of 7,300 square feet, the best choice is the site on the south side of the school adjacent to the 1976 addition.

Objective 3 was accomplished by multiplying the total square footage of the proposed addition by a construction cost of \$100 dollars per square foot. However, since the construction cost represents only 75% of the total project cost, the construction cost was then divided by 0.75 in order to achieve an accurate estimate of the total project cost. The total project cost of an addition with six classrooms will be approximately \$973,600.

Conclusions

Objective 1: The Extent of Need for an Addition

The results of this study show that St. Joseph-Ogden High School is running out of available classroom space and will likely require additional classrooms by the 2001-02 school year. Factors that were considered in determining need are presented here.

Assignable space percentage. The percentage of the total square footage that exists as assignable space for St. Joseph-Ogden High School is 72.2%. Currently, the state recommends a minimum of 65% as the value for the assignable space percentage, while school architects try to design school

buildings with assignable space that consists of 70% of the total square footage (R. Gruber--school architect--personal communication, November 26, 1996). It could be argued, therefore, that almost all of the space that could be utilized as instructional space at St. Joseph-Ogden High School is being utilized. Further, 10 of the 29 classrooms in the building are below the recommended minimum size of 750 square feet for a high school classroom. Adding more students would be difficult in over a third of the available classrooms.

Functional capacity. The functional capacity for St. Joseph-Ogden High School is between 442 and 534 students. The lower value assumes an average class size of 19.5 students and a scheduling efficiency of 73.3%. The higher value assumes an average class size of 23.5 students and a scheduling efficiency of 73.3%. As previously discussed, 100% scheduling efficiency is essentially impossible to attain for even the largest of secondary schools. In fact, with a scheduling efficiency of over 73%, St. Joseph-Ogden is just past the higher end of the range for schools with enrollments under 500. Compared to other secondary schools its size, St. Joseph-Ogden is making efficient use of its available space.

A higher average class size yields a higher functional capacity, but not without problems. As discussed previously, adding more students to a classroom or school building may be cost effective, but it can have a corresponding negative impact on learning. Although cost containment should always be given strong consideration by school boards and administrators, the ultimate decision concerning the number of students per classroom must be based on what is best for the students. If the lower of the average class size values is used to determine functional capacity, then St. Joseph-Ogden High School was slightly above its functional capacity for the 1996-97 school year.

Future enrollment. The enrollment for St. Joseph-Ogden High School for the 2001-02 school year should be between 462 and 530 students. The lower projection is based on the 1996-97 enrollment in grades four through seven in the three feeder grade schools. The higher projection is based on past enrollment projection error and continued growth of the village of St. Joseph. With a functional capacity of 442 students, the St. Joseph-Ogden High School building may be pushed beyond its limits by the 2001-02 school year. The lower enrollment projection is 20 students above the lower end of the functional capacity range, while the higher--and arguably conservative--enrollment projection is almost 90 students above the lower end of the functional capacity range.

Objective 2: The Best Location for an Addition

An area on the south side of St. Joseph-Ogden High School adjacent to the 1976 addition was determined to be the best location for a new addition. Factors that were considered are presented here.

Additional classroom needs. In order to house an increasing number of students, the board and administration at St. Joseph-Ogden will need to consider adding as many as six classrooms to the high school by the 2001-02 school year. Assuming that the functional capacity of the high school will be exceeded by 88 students by the 2001-02 school year, there will be a need for nearly five additional classrooms by that time. Since the enrollment projection of 530 students for the 2001-02 school year may be an underestimate, an addition with five classrooms may prove to be inadequate. An addition with six classrooms would have a cost efficient square shape and could house as many as 110 extra students, assuming a class average of 25 students per classroom and a scheduling efficiency of 73.3%.

Additional square footage needs. The square footage needs for an

addition with six classrooms are 7,302 square feet. This total includes 6,000 square feet for classrooms, 1,046 square feet for hallway space, and 256 square feet for exterior wall space. As previously discussed, an accepted minimum size for high school classrooms is 750 square feet, but a more desirable size is 900 square feet per classroom (R. Gruber--school architect--personal communication, March 3, 1997). Further, the average size of the six regular classrooms built as part of the 1976 addition is 1,000 square feet. Over 20 years later, the need for larger classrooms is even greater, based on the increasing use of technology and the increasing trend for students to be engaged in small-group work.

Available property. The three locations that would accommodate an addition of six classrooms include an area on the south side of the school adjacent to the 1976 addition, an area on the west side of the school adjacent to the 1952 addition, and an area on the north side of the school adjacent to the large gymnasium. The site to the south offers several advantages. It is the best choice aesthetically, being surrounded by grass and trees. Further, the site to the south offers the greatest accessibility and would require the least amount of total square footage for the desired number of classrooms. Finally, the site to the south has a building structure that would be the easiest to add on to, both in terms of ease of integration and ease of matching surrounding architecture.

Objective 3: The Estimated Cost of an Addition

An addition with six classrooms to St. Joseph-Ogden High School should cost approximately \$973,600. As discussed previously, it is possible to control the great expense of a building project through careful planning. A well-designed addition can be less expensive to build initially and less expensive to operate and maintain over its lifetime. The use of a professional

architect in planning building design is an expense that can ultimately save the school district money.

Recommendations

Based on the enrollment projection of 530 students--nearly 90 students over the functional capacity--by the 2001-02 school year, the St. Joseph-Ogden High School board and administration need to consider building an addition to their high school. Although it is possible to continue to add students to classrooms and surpass the functional capacity, this can have a corresponding negative impact on learning. As previously discussed, a decision must be made regarding the importance of cost containment versus what is best for the students.

If an addition is to be built at St. Joseph-Ogden, strong consideration should be given to an addition with six classrooms. An addition with only five classrooms may prove to be inadequate, since the enrollment projection of 530 students by the 2001-02 school year may be underestimated. An addition with six classrooms could house as many as 110 extra students, assuming a class average of 25 students per classroom and a scheduling efficiency of 73.3%. Further, an addition with six classrooms would have a cost efficient square shape and should not prove to be much more expensive to build than an addition with five classrooms.

When building an addition, strong consideration should also be given to including classrooms that measure at least 1,000 square feet in size. Although an accepted minimum size for high school classrooms is 750 square feet, the average size of the six regular classrooms built as part of the 1976 addition to St. Joseph-Ogden High School is 1,000 square feet. As previously stated, the current need for larger classrooms is even greater than it was 20 years ago, based on the increasing use of technology and the increasing trend for

students to be engaged in small-group work.

Of the three locations that would accommodate an addition of six classrooms to St. Joseph-Ogden High School, the site to the south offers several advantages. Not only is that site the best choice aesthetically, but it offers the greatest accessibility and requires the least amount of total square footage for the desired number of classrooms. Further, the site to the south has a building structure that would be the easiest to add on to, both in terms of ease of integration and ease of matching surrounding architecture.

Although the construction of an addition will be costly, the cost of a school building over its lifetime is only 5 to 15% of the total cost of educating a child (DeChiara & Callender, 1990, p. 210). Further, construction costs will continue to rise. Delaying a decision on building an addition could prove to be cost prohibitive. As stated previously, it is possible to control costs through careful planning. Since a well-designed addition can be less expensive to build initially, as well as less expensive to operate and maintain, a professional architect should be employed.

References

Chambers, B. K. (1993). Program sensitive school capacities. Journal of School Business Management, 5 (4), 37-41.

Czerwinski, W. P. (1991). Developing a multipurpose high school student computer room. The Computing Teacher, 18 (8), 19-22.

DeChiara, J., & Callender, J. H. (1990). Timesaver standards for building types. New York: McGraw Hill Publishing.

Hawkins, H. L. & Lilley, H. E. (1992). Guide for school facility appraisal. Columbus, OH: Council of Educational Facility Planners, International. (ERIC Document Reproduction Service No. ED 344 337)

Kantrowitz, B. (1996, September 16). Standing room only. Newsweek, 128, 81.

Moore, D. P. (1991). Guide for planning educational facilities. Columbus, OH: Council of Educational Facility Planners, International. (ERIC Document Reproduction Service No. ED 344 336)

North Carolina Division of School Planning. (1988). Cleveland County: a special report. Raleigh, NC: North Carolina State Department of Public Instruction, Raleigh Division of School Planning. (ERIC Document Reproduction Service No. ED 303 293)

Storm, G. (1993). Planning laboratory design. Tech Directions, 52 (8), 11-14.