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ABSTRACT

This report identifies the longrun potential for savings available to Prince William County under an efficiently managed calendar of year round operations and specifies the areas in which these savings are most likely to occur. An analysis indicates that at the only secondary school in the County under the 45-15 plan, the overall 1971-72 per pupil cost of education was 9.6 percent lower than it would have been under a traditional 9-month calendar. The report provides a detailed breakdown of this reduction in cost. Results of the analysis lead to the conclusion that substantial savings are obtainable by districts which, like Prince William County, have management teams willing and able to make the necessary though sometimes difficult decisions involved in an innovative venture such as that of the 45-15 plan. (Author/JF)

45-15

AND THE COST OF EDUCATION

Prepared for:

Prince William County Public Schools
Prince William County, Virginia

SUMMARY

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This report is a condensation of the findings by Education Turnkey Systems, Inc. as presented to Prince William County Public Schools on October 11, 1972. The complete report (2 volumes) may be obtained by writing to the Prince William County School Board, P. O. Box 389, Manassas, Virginia, 22110.

EXECUTIVE SUMMARY

The program of year-round continuing education in the Dale City area of Prince William County has the potential for effecting substantial savings in the long-run per-pupil cost of education. Instituted in four schools on a pilot basis during the 1971-72 school year, the 45-15 year-round calendar promises to provide some relief from the pressures of the school system's bonded indebtedness ceiling.

The analysis indicates that at Godwin Middle School, the only secondary school under 45-15, the overall 71-72 per-pupil cost of education was 9.6% lower than it would have been under a traditional nine-month calendar. More than half (4.9%) of these savings came as the result of more intensive utilization of staff, teachers, aides, principals, counselors, librarians, and clerical support. Some of these savings (particularly those associated with teachers) may diminish somewhat in future years because of revised scheduling procedures. The remaining 4.7% savings came as the result of more intensive and efficient utilization of capital facilities (building and equipment). The largest portion (4.2%) of these long-run facility savings resulted from the ability of the Godwin (or any other) school building to house one-third more students under 45-15 than under a traditional calendar.

This report identifies the long-run potential for savings which is available to Prince William County under an efficiently managed calendar of year-round operations and specifies the areas in which these savings are most likely to occur. The report concludes that substantial savings are obtainable by districts which, like Prince William County, have management teams who are willing and able to make the necessary, though sometimes difficult, decisions involved in an innovative venture such as 45-15.

45-15 AND THE COST OF EDUCATION

PRINCE WILLIAM COUNTY, VIRGINIA

INTRODUCTION

Financing our public schools has become the greatest educational concern of the American populace. This contention is fully supported by the results of the 1971 Gallup public opinion poll on American education. Bond issues are failing at record rates and many districts are colliding with their bonded indebtedness ceilings. The inadequacy of the local property tax to support the educational needs of our children becomes more and more apparent as voters increasingly reject requests for higher tax rates.

Certain areas of the country are feeling this financial pinch in extremely graphic ways, especially those areas which have witnessed rapid growth in their school age population. In these areas, it is painfully apparent that the limited dollars available for education can produce only a limited amount of educational facilities, and rapid growth in the student population results in overcrowding of these facilities. Further, this growth may be so rapid that even unlimited educational resources could not possibly produce classrooms fast enough to meet these enormous demands. Thus, the issue of facility utilization is thrust to the forefront of discussions on educational economics.

Why Year-Round Schools?

The historical foundation for America's traditional September-June school calendar is a vestige of the nation's agrarian past. During the middle part of the 19th century, the major portion of the American populace lived on farms. These rural children often attended classes for only six months of the year. In the late 1800's, the Industrial Revolution caused a major shift in the nation's population makeup. City factories drew more and more workers away from the farm. Success became more dependent upon an individual's ability to read, write, and do arithmetic. State legislatures reacted to this concern by compromising between rural and urban needs. This resulted in a fairly standardized school calendar with a legal minimum of about 180 school days each year. The 180-day calendar has become a tradition that has existed in virtually the same form for over 50 years; it has been violated only in isolated instances.

The movement from farm to city and suburb has continued during the 20th century. Even the compromise 180-day/9 month school year has become outdated. Most schools are used by students six hours a day (one-fourth day) for about 180 days a year (one-half year); thus, a school building is normally used only about one-eighth of the time during a year. The American public should be concerned that the bond money they are asked to authorize purchases facilities that sit idle for about 88% of their useful lifetime. The seeming contradiction between overcrowded classrooms during the winter and idle buildings during the summer has distressed

many citizens. But tradition has always prevailed. During the past five years, however, strong interest has been expressed in the concept of year-round education. This interest has been inspired by force of necessity. The American public has ceased to ratify unquestioningly bond referenda and millage increases. It has demanded that educators show that they are using their resources in the best possible way. Accountability has become the word of the day.

This interest in year-round schooling has manifested itself in a number of implemented year-round programs, most of which fall into one of two categories: (1) those whose purpose is to provide students with a broader range of educational opportunities without prime concern for the expense involved and (2) those whose primary purpose is to get greater utilization from expensive facilities and thereby save school construction money.

Programs that fall in the first category are generally a logical extension of "summer school" as it has existed for many years. These new year-round programs, however, are intended to do more than merely allow slower students to catch up. Under such programs, schools are permitted to offer wider ranges of course options and faster students are able to pick up advanced work. Programs such as these may have a variety of exotic schedules. Fulton County, Georgia (including Atlanta) permits students to attend any three of the calendar's four academic quarters with the option of also attending the fourth, if the student so desires. At Champlain Valley Union High School in Hinesburg, Vermont, students are permitted to attend any four staggered nine-week "quarters" during the year. Optional programs of this nature are designed to provide enrichment and acceleration for students. Although these programs may yield somewhat more uniform annual facility utilization than traditional calendars, it is unlikely that the "capital account savings" derived from increased plant utilization will be sufficient to outweigh the increased operating costs inherent in such programs. Overall, programs of this type are likely to result in a higher per-pupil educational cost.

Year-round programs which fall in the second category, designed to achieve greater facility utilization, are usually conceived primarily as a means of saving construction and interest costs for school buildings, rather than to provide enrichment to students' academic schedules. This is not at all meant to imply that school systems which "go year-round" for the second reason, economy, are any less concerned about quality education than are those which do so for the first reason, enrichment. Indeed, the district which can save money without damaging the quality of education has freed resources to spend in other areas to substantially improve educational quality. Although implementation of programs such as these is necessarily accompanied by some curriculum reform, the intent is simply to make more uniform the utilization of capital facilities.

The 45-15 plan, originally developed at Valley View School District 96 in Lockport, Illinois, is the plan which Prince William County has modified and adapted for its own use and will be the subject of this report. This plan calls for each of four student groups to spend nine weeks (45 days) in school, four times a year, with three-week (15 days)

vacations between in-school sessions. This means that, at any one time, only three of the four student groups are in school. Consequently, only three-fourths of the building space which would be necessary to house the entire population under a traditional calendar is necessary to house the same number of students under the 45-15 calendar. Year-round operation of school facilities in this manner is attractive for a number of reasons:

--- Rapidly growing districts may relieve immediate problems of overcrowding, for each school building can comfortably serve one-third more pupils than it was originally designed to hold.

--- When it becomes necessary to build new schools under year-round operation, only three schools need be built for every four traditional term schools that would have been necessary.

--- School districts which are fairly stable in size may replace four outmoded facilities with three modern ones if they operate year round.

Further, year-round education will have impact on many of the costs in the operating budget as well. Teacher salaries, maintenance schedules, transportation activities, and administrative salaries are only a few of the other areas where the impact of year-round schools might be felt.

A myth which has surrounded the concept of year-round schools and the 45-15 plan, in particular, is the conviction that only very rapidly growing districts like Prince William County can realize construction savings from the plan. Regardless of the district's growth rate, building three schools instead of four for the same number of students is going to cost less money. There are two primary reasons, however, why rapidly growing school systems are more apt to participate in year-round schooling:

--- Large growth rates are usually associated with young families. Such families tend to have more school-age children than do older families in more stable communities. Therefore, since the student population is growing faster than the taxpaying population, revenues and bonding power simply cannot keep pace with the requirement for educational services. These systems, which cannot legally build enough schools, are forced to design ways by which existing facilities can be used to house a greater number of students.

--- Rapidly growing school districts are better able to adjust to the transition between traditional and year-round calendars. A stable-enrollment district which goes year round has the burden of divesting itself of 25% of its facilities. A rapidly growing system may not face this trauma since in only a few years it will probably "grow into" the excess facilities created by the changeover.

Nevertheless, year-round school construction economies are available to educational systems, of any growth rate, that have the initiative to search for them.

CONSIDERATIONS OF COST

Earlier studies on the costs of year-round education have had difficulty relating savings in future construction costs (which taxpayers cannot see or feel at this moment in time) to any anticipated increases in operating expenses which may result from year-round operations (and which can be felt immediately by the taxpayers). This difficulty is due in large part to the traditional budget reporting found nearly universally in American school systems. Under the traditional system for reporting district costs, the dollar figures most frequently quoted are the net current operating expenses. In nearly every school district this figure does not include any estimate of the cost of classroom and other building facilities. The dollars in "Instruction" accounts generally exclude any indications of the dollars allocated for the classroom area. When savings accrue in accounts not frequently quoted to the public, such as Debt Service, but increased costs appear in the familiar operating accounts, the result is taxpayer backlash over what appears to be increased expense for a program touted to be a money saver.

This report presents a comprehensive analysis of year-round school costs which is designed to determine the effectiveness of the 45-15 plan in reducing costs. This analysis includes considerations of the costs of staff, materials, and supplies, as well as of building and equipment facilities. The analysis estimates the long-run equilibrium costs of 45-15 as opposed to the traditional calendar. This means that the analysis will measure those cost differences between the two calendars which would be a part of a regular ongoing school operation. The long-range equilibrium aspects of the analysis assume that the district does not have facilities in excess of that necessary to service the selected student enrollment. In reality, this excess or slack in facilities will exist immediately after implementation of the year-round program. The degree to which this slack continues to be present depends upon the growht rate of the district and the speed with which the plan is implemented. In any event, it is most important that this facility slack not be allowed to pervade the philosophy of the school system. If the system becomes accustomed to using slack in an inefficient manner, the projected capital savings will never materialize. In order to assess the full economic potential of 45-15 the analysis will consider that the district has divested itself of excess facilities.

This report investigates the impact of 45-15 year-round education on the economic unit of the school system. Consideration is not given to costs which such a plan might impose on other sectors of the community. Society as a whole may incur costs and/or benefits as the result of 45-15. The lack of the usual "long, hot summer" vacation could result in less student unrest and destruction. The more uniform employability of students during the year might result in more equalized industrial production. On the other hand, the lack of a three-month stretch may make vacation employment less accessible to students. It may also impose a cost on

some families who might find difficulty in scheduling parents' vacations to coincide with their children's calendar. Further, this report does not consider costs to government agencies other than the school system. A new vacation structure might necessitate revised park planning for construction and operation. This could affect federal, state, and local governments. These and other similar aspects of year-round education are irrelevant as long as year-round schooling continues to exist as an occasional experiment which affects few people. When and if 45-15 becomes the standard school calendar, a study of these questions will become most important.

COMPARISON OF SCHOOLS

To assess adequately the cost impacts of Prince William County's 45-15 plan, it was determined that the analysis must represent a comparison between similar facilities operating traditionally and year round. To obtain sufficient precision to make the necessary comparisons, it was felt that these comparisons would have to be made between specific schools. These comparisons would then be generalized to other participating schools.

For this analysis, two instructional models are constructed. The first will depict the costs of the resources consumed yearly, per pupil, for the students at the Godwin Middle School operating under the 45-15 plan. This model will use as a basis the actual operating characteristics of the current Godwin 45-15 plan. The second model will identify the costs of the resources which would be consumed yearly per pupil for the students at Godwin, if Godwin operated its same academic program on a traditional-term basis. This second model is a protrayal of a simulated program; such a simulation allows comparability of results to the greatest extent possible. A comparison of the costs of the 45-15 plan at Godwin to those of traditional plans at some other Prince William County middle schools would be confounded by the inputs of different facilities into each of the models. Only by hypothesizing a traditional-term program at Godwin can the true financial effect of the 45-15 plan be examined.

This report displays and discusses all areas where the corresponding cost factors for each model differ. Throughout the report indications are given of how the projected results of the analysis might come to pass in the future.

THE COST-ED MODEL

The analytical tool chosen for the financial analysis was specifically selected with the idea of avoiding some of the pitfalls of earlier analyses. This tool, known as the COST-ED Model, accomplishes this in a number of ways:

--- It relies on economic analysis; i.e., all resources are priced at their current replacement value. This avoids the problem of mixing current expenses with future savings and the attendant discounting complexities.

--- It employs the concept of resource consumption and not traditional budget categories of cost accounting. This allows all types of resources to be considered in a similar manner rather than having teachers' salaries in some operating fund and the costs of school buildings in some construction fund.

--- It displays graphically all the cost effects: both facility savings (if any) and operating costs and savings (if any). The format of presentation specifies exactly where these savings are produced or how these costs are incurred.

COST-ED analysis views the student's time in school as a series of activities, or functions, which either involve him directly or are necessary as a supportive service to his program. In each of these functions, the student consumes resources of a number of types: during instruction, for example, the time of a teacher, the classroom and its attendant furnishings, textbooks, and audiovisual materials. The nature of this type of analysis, particularly the detailed investigation of the consumption of building facilities, such as a modestly sized elementary school with a more extensive middle school, is difficult and of questionable analytical value.

The functional nature of the COST-ED methodology is similar to that of a Planning, Programming, and Budgeting System (PPBS). Figure 1 caricatures the manner in which COST-ED would combine staff, facilities (building areas and equipment), and materials costs into the functions to which they contribute. As in real life, the numbers of functions, staff, facilities, and materials used to educate the student are quite large. COST-ED serves to transform the complexity of these interactions into a convenient simplified picture suitable for decision making.

Educational costs, when presented in this manner, portray the overall nature of resource consumption. It must be remembered that this technique is different from the way in which traditional accounting practices treat these costs. Traditional accounting considers operating and capital funds as representing two different kinds of money; it does not recognize the interactions between the two. COST-ED presents information to the decision maker which shows these interactions and specifies the possible trade-offs between the two types of funds.

The first analytical section of this report describe the specific comparisons between the current Godwin/45-15 and the control Godwin/traditional term. Each cost area in which year-round schooling might have impact will be addressed individually. The nature and direction of the impacts will be discussed and suggestions will be made relative to projections of how these impacts might behave in the future.

The next analytical section of the report will address some of the "what if" aspects of the basic analysis. It is recognized that certain

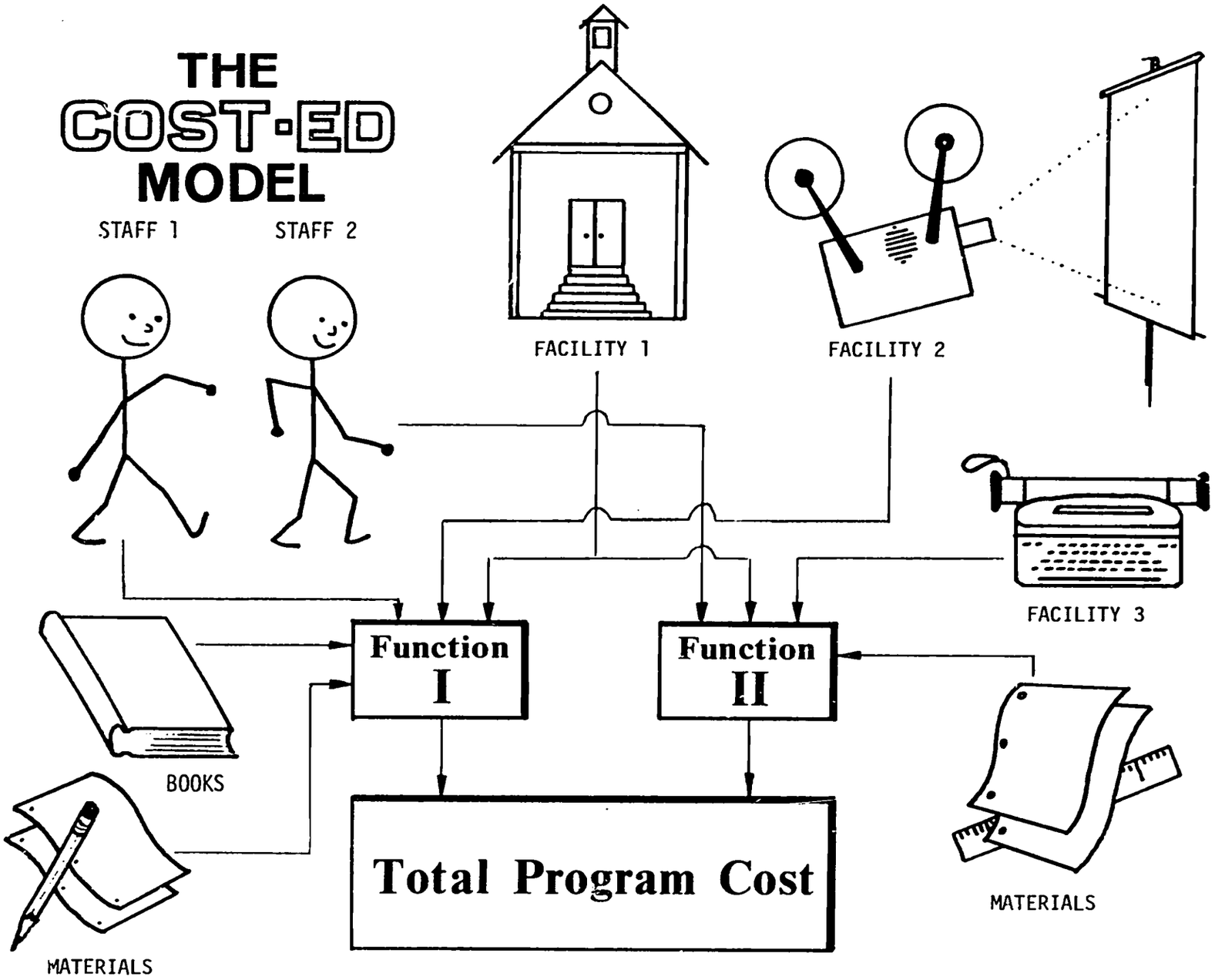
THE
COST-ED
MODEL
STAFF 1
STAFF 2
FACILITY 1
FACILITY 2
FACILITY 3
Function
I
Function
II
BOOKS
MATERIALS
MATERIALS
Total Program Cost

Figure 1

considerations might affect, perhaps greatly, the basic results of the analysis. These considerations include:

--- How would the results appear if the analysis had centered on the elementary schools rather than the middle school?

--- How could the analysis be extended to other schools within Prince William County not already operating on the 45-15 plan?

--- How may the Prince William educational decision makers obtain immediate feedback on the cost impacts of other program variations which might occur subsequent to the period of the analysis?

--- How may Prince William County educational administrators use the results of this analysis to simulate effects of proposed program revisions to determine their economic impact?

THE CHANGES AT GODWIN

The simple perception of a newly instituted 45-15 year-round school program is that fewer school buildings would be needed to house the same number of students and therefore, building costs, as represented by budgetary debt service accounts, would go down. Under 45-15, per-pupil education costs would go down because the same facility will serve many more students during its lifetime than it would operating on a traditional-term calendar. This simple perception of cost savings resulting from improved facility utilization tends to ignore many of the other aspects of school economics where 45-15 might have an impact. This report presents a picture of all of the predictable economic effects that institution of a 45-15 calendar has had on Godwin Middle School. The per-pupil cost information presented here represents the best possible estimate of the savings or extra costs which result because Godwin was operated on a 45-15 basis during the 71-72 school year rather than on a traditional term. Some of the cost differentials, however, will be the result of program changes caused by 45-15, but which are considered to be either not long-term economic effects or peculiar to the particular school (or even district) under consideration. It is also possible that some effects of 45-15 will not be seen immediately. These effects might take a number of years to develop and consequently, were not treated in predictive detail in this report. As much as possible, attention was given to these long-range eventualities.

The overall comparison between costs of the 45-15 program at Godwin and those of the corresponding simulated traditional-term program is shown in Table I. The costs of this year's 45-15 program is $1,033.60 per pupil; had Godwin been operated under a traditional-term program this year, the per-pupil cost would have been $1,143.06. The 45-15 plan resulted

in a savings of $109.46 per pupil this year, or about 9.6% compared to the traditional-term program. It should be kept in mind that these savings represent the total impact of 45-15, reflecting both the long-term effects (e.g., increased facility utilization) and the more immediate effects (e.g., lower teacher costs).

The right-hand column of Table I indicates the areas (resources) where these savings were garnered. Table II summarizes the overall nature of the cost savings made possible by this year's 45-15 calendar. The individual factors which have been considered in this investigation will be specified as either staff or facility effects. Those factors which relate to the comparison between the traditional and year-round calendars are discussed.

STAFF EFFECTS

Classroom Personnel: Teachers and aides who participated in the year-round project were given salary increases in proportion to increases in the length of their contracts: from a 193-day traditional-term contract to a 241-day year-round contract for teachers, and from a 184-day contract to a 241-day contract for aides. These represented 25% and 31% salary increases for teachers and aides, respectively. These classroom personnel, however, because of the 45-15 calendar, were able to teach 33 1/3% more classes. As indicated in Table II, these contract changes resulting from the year-round calendar brought about sizeable per-pupil cost reductions (3% of the total per-pupil cost). It should be pointed out that these savings in classroom personnel costs were made possible by the elimination of all non-teaching (in-service and preparation) days for these staff types. Savings of this type are permanent and long-term only to the extent that this elimination of non-teaching days is adopted as a long-range district policy.

Non-Classroom Personnel: Staff members which fall in this category are principals, assistant principals, counselors, librarians, and the clerical support staff (secretaries and clerks). These personnel were able to serve the one-third higher student enrollment with no additional people. All of these staff members not already on 12-month contracts were given 12-month contracts. This, however, accounted for only about 8% higher costs for these staff to serve 33 1/3% more students. The resultant savings of $20.96 (1.9% of total per-pupil cost) can be retained as long-run savings as long as people in this category are utilized in an efficient manner.

Table I

PRINCE WILLIAM COUNTY

COMPARISON OF SECONDARY 45-15 WITH TRADITIONAL TERM

Dollars Per Pupil Annually

Resource	Traditional Term Cost	45-15 Cost	Net Saving
Teachers	$ 503.04	$ 469.20	$ 33.84
Aides	34.98	34.18	.80
Classrooms	150.41	121.57	28.84
Classroom Furnishings	32.55	27.80	4.75
Audiovisual Equipment	4.18	3.89	.29
Books and A-V Software	14.05	14.05	--
Gymnasium	51.71	41.83	9.88
Gymnasium Equipment	2.90	2.67	.23
Cafeteria	26.81	21.69	5.12
Cafeteria Equipment	1.54	1.38	.16
Counselors	33.46	29.07	4.39
Librarians	16.52	14.89	1.63
Library	12.90	10.41	2.49
Library Furnishings	3.22	2.84	.38
Offices	7.60	6.07	1.53
Office Furnishings	1.51	1.32	.19
Principal/Asst. Principals	44.27	35.08	9.19
Support Staff	31.40	25.65	5.75
Buses	7.57	7.57	--
Dist. Student Support Staff	2.05	2.05	--
Dist. Instruc. Support Staff	24.78	24.78	--
Dist. Administrative Staff	23.94	23.94	--
Districtwide Offices	6.77	6.77	--
Dist. Office Furnishings	3.74	3.74	--
Coaches	3.59	3.59	--
Misc. Supplies & Expenses	97.57	97.57	--
Total -	$1,143.06	$1,033.60	$109.46

Table II

PRINCE WILLIAM COUNTY

SUMMARY OF SECONDARY 45-15 COST SAVINGS

Dollars Per Pupil Annually

(Percent of Total Per-Pupil Traditional Term Annual Costs Shown in Parentheses)

STAFF:		
Instructional		
Teachers	$ 33.84 (3.0%)	
Aides	.80 (-%)	
Total Instructional		$ 34.64 (3.0%)
Support		
Counselors	$ 4.39 (0.4%)	
Librarians	1.63 (0.2%)	
Principal/Asst. Principals	9.19 (0.8%)	
Support (Clerical) Staff	5.75 (0.5%)	
Total Support		$ 20.96 (1.9%)
TOTAL STAFF -		$ 55.60 (4.9%)
FACILITY:		
School Building Areas		
Classrooms	$ 28.84 (2.5%)	
Gymnasium	9.88 (0.9%)	
Cafeteria	5.12 (0.5%)	
Library	2.49 (0.2%)	
Offices	1.53 (0.1%)	
Total School Building Areas		$ 47.86 (4.2%)
Furnishings and Equipment		
Classroom Furnishings	$ 4.75 (0.4%)	
Audiovisual Equipment	.29 (-%)	
Gymnasium Equipment	.23 (-%)	
Cafeteria Equipment	.16 (-%)	
Library Furnishings	.38 (0.1%)	
Office Furnishings	.19 (-%)	
Total Furnishings and Equipment -		$ 6.00 (0.5%)
TOTAL FACILITY -		$ 53.86 (4.7%)
TOTAL SAVINGS -		$109.46 (9.6%)

FACILITY EFFECTS

Building: The costs of providing a school building for students have four components: the actual construction costs (principal on bonds), financing costs (interest on the bonds), operations costs (utilities and custodial services), and maintenance costs (repair and upkeep of building and grounds). Economies in these building cost areas brought the largest component of the overall savings --- $47.86 (4.2% of total per-pupil cost). These savings came about because of per-pupil cost reductions in each of the four building cost categories: fewer buildings to build, fewer buildings to finance, fewer buildings to light and sweep, and fewer buildings to repair. These savings, some of which will appear in the operating budget and some of which will appear in capital accounts, are almost certainly of a long-term nature in a year-round program of this type.

Equipment: Relatively minor savings occurred in some areas of capital equipment as the result of the 45-15 calendar. This saving of $6.00 (.5% of total per-pupil cost) came about primarily because of more efficient utilization of classroom and library furniture and other furnishings.

VARIATIONS FROM CURRENT GODWIN PROGRAMS

For two important analytical purposes, a Prince William County administrator might wish to investigate the effects of variations from the specific baseline middle school analysis presented above. First, he might care to examine the impact of 45-15 on schools other than Godwin. Second, he might care to update or amend the models to account for program revisions or regular temporal changes. The reports produced in the COST-ED analysis are particularly suited for addressing these "What if...?" questions.

The same analytical technique may be applied to obtain answers to both questions which ask in effect, "What if things are different (either a different school or a different time) from the original analysis?" Using the original analysis as a baseline, an accurate approximation for such alternative programs may be obtained by identifying those key variables which have the greatest impact on the program's total cost and replacing those variables with the corresponding values for the proposed alternative program.

The COST-ED report known as the Economic Factor Ranking provides a detailed listing of all program variables over which an administrator might have direct control. These variables, or factors, are listed in order of their importance to total per-pupil cost. Figure 2 shows the first page of the Economic Factor Ranking for Prince William County's 45-15 program. As can be seen, the first-ranked, or most important, factor affecting the total cost is the student:teacher staff ratio in academic subjects ---

Figure 2

LEVEL: MIDDLE SCHOOL
PROGRAM: 45-15/YEAR-ROUND

P R W M C O U N T Y , V A
COST-ED ECONOMIC FACTOR RANKING
EDUCATION TURNKEY SYSTEMS

DATE: 09/04/72

PAGE: 1

RANK OF 39	DATA GROUP	COST FACTOR	REFER.	COST FACTOR VALUE FOR CHANGE IN COST PER STUDENT YEAR: 1% SAVINGS	INITIAL VALUE	1% ADDL COST	COST IMPACT RELATION	RELATIVE POWER
1	ACADEMIC INSTRUC	STAFF RATIO	TEACHR	23.9543 :1	23.4250 :1	22.9186 :1	NEG ACC	100
2	TEACHER	ANNUAL SALARY		10929.8047 $	11178.0078 $	11422.2070 $	POS LIN	90
3	CLASSROOM	PEAK USE %		71.7432 %	75.0000 %	78.2567 %	POS LIN	46
4	CLASSROOM	RAW UNIT RQMTS		46.9626 UNIT	45.0980 UNIT	49.2333 UNIT	POS LIN	22
5	CLASSROOM	UNIT ACQ COST		19.0751 $	21.0300 $	22.9849 $	POS LIN	21
6	ACADEMIC INSTRUC	COMP FACTOR 1	TEACHR	0.3508	0.3889	0.4270	POS LIN	20
7	CLASSROOM	USEFUL LIFE		58.2483 YRS	50.0000 YRS	43.7984 YRS	NEG ACC	16
8	CLASSROOM	OP COST/UNIT-DAY		0.0046 $	0.0053 $	0.0060 $	POS LIN	15
9	CLASSROOM	OVERHEAD %		36.6495 %	44.4839 %	52.3184 %	POS LIN	11
10	CLASSROOM	BOND MATURITY		15.3664 YRS	20.0000 YRS	24.6336 YRS	POS LIN	9
11	GYMNASIUM	RAW UNIT RQMTS		12.0696 UNIT	16.2050 UNIT	20.3403 UNIT	POS LIN	8
12	CLASSROOM	INTEREST RATE		4.0643 %	5.5000 %	6.9357 %	POS LIN	8
13	INSCHL SUPRT SVC	STAFF RATIO	PR/AP	496.0586 :1	350.0000 :1	270.3933 :1	NEG ACC	8
14	CLASSROOM	MAINT COST/$-YR		0.0160 $	0.0220 $	0.0279 $	POS LIN	7
15	ACADEMIC INSTRUC	STAFF RATIO	AIDE	33.5816 :1	23.4250 :1	17.9858 :1	NEG ACC	7
16	PHYSICAL EDUCATN	STAFF RATIO	TEACHR	34.6312 :1	23.4250 :1	17.6985 :1	NEG ACC	7
17	PRIN/ASST PRIN	ANNUAL SALARY		11364.5547 $	16107.0000 $	20849.4453 $	POS LIN	7
18	INSTRUCTNL AIDE	ANNUAL SALARY		3755.4102 $	5383.5977 $	7011.7852 $	POS LIN	7
19	DSTWID ADMINISTN	OTHER HOUR COST	TOTALS	0.0153 $	0.0224 $	0.0296 $	POS LIN	6
20	INSCHL SUPRT SVC	STAFF RATIO	CONSLR	553.6074 :1	350.0000 :1	255.8949 :1	NEG ACC	6
21	STUDENT LUNCH	COMP FACTOR 1	TEACHR	0.0638	0.0929	0.1240	POS LIN	6
22	COUNSELOR	ANNUAL SALARY		8594.7109 $	13337.0000 $	18079.2891 $	POS LIN	6
23	INSCHL SUPRT SVC	STAFF RATIO	SSPSTF	1760.1367 :1	1050.0000 :1	748.1736 :1	NEG ACC	5
24	CLSRM FURNISHNGS	RAW UNIT RQMTS		110.4256 UNIT	175.8650 UNIT	241.3044 UNIT	POS LIN	5
25	DSTWID INST SUPP	STAFF RATIO	ISPSTF	54969.4883 :1	32080.0000 :1	22649.5391 :1	NEG ACC	5
26	DSTWID ADMINISTN	STAFF RATIO	AD-STF	56900.6484 :1	32322.0000 :1	22572.5430 :1	NEG ACC	5
27	ADVISORY PERIOD	STAFF RATIO	TEACHR	31.5692 :1	17.9050 :1	12.4981 :1	NEG ACC	5
28	INSCHL SUPRT STF	ANNUAL SALARY		20351.4258 $	34115.0000 $	47878.5742 $	POS LIN	5
29	DSTWD INS SUPSTF	ANNUAL SALARY		451400.0000 $	773475.0000 $	1095546.0000 $	POS LIN	5
30	CLSRM FURNISHNGS	USEFUL LIFE		12.6756 YRS	6.8000 YRS	4.6464 YRS	NEG ACC	5
31	STUDENT TRANSPRT	OTHER HOUR COST	TOTALS	0.1516 $	0.2635 $	0.3754 $	POS LIN	5
32	DSTWD ADMIN STF	ANNUAL SALARY		424427.6250 $	747163.0000 $	1069898.0000 $	POS LIN	5
33	CAFETERIA	RAW UNIT RQMTS		4.4383 UNIT	8.7670 UNIT	13.0957 UNIT	POS LIN	4
34	ACADEMIC INSTRUC	COMP FACTOR 1	AIDE	0.5836	1.3688	2.1540	POS LIN	3
35	INSCHL SUPRT SVC	STAFF RATIO	LIBRAN	1936.4124 :1	525.0000 :1	303.6768 :1	NEG ACC	3
36	LIBRARIAN	ANNUAL SALARY		3156.7344 $	10270.0000 $	17383.2656 $	POS LIN	3
37	ACADEMIC INSTRUC	OTHER HOUR COST	TOTALS	0.0041 $	0.0145 $	0.0249 $	POS LIN	3
38	ACADEMIC INSTRUC	IN-SV HOUR COST	TOTALS	0.0337 $	0.0141 $	0.0245 $	POS LIN	3
39	TEACHER	FRINGE RATE		0.7710 %	3.0410 %	5.3110 %	POS LIN	3
40	ACADEMIC INSTRUC	IMMED USE COST	CLSRM	0.0005 $	0.0034 $	0.0163 $	POS LIN	2
41	LIBRARY	RAW UNIT RQMTS		0.0219 UNIT	4.1570 UNIT	8.2921 UNIT	POS LIN	2
42	DSTWID INST SUPP	OTHER HOUR COST	TOTALS	LOW	0.0059 $	0.0131 $	POS LIN	2
43	STUDENT LUNCH	STAFF RATIO	TEACHR	HIGH	81.6530 :1	34.5139 :1	NEG ACC	2
44	CLSRM FURNISHNGS	MAINT COST/$-YR		LOW	0.0415 $	0.0936 $	POS LIN	2

Figure 3

LEVEL: MIDDLE SCHOOL
PROGRAM: 45-15/YEAR-ROUND

P R W M C O U N T Y , V A
COST-ED SENSITIVITY ANALYSIS
EDUCATION TURNKEY SYSTEMS

DATE: 09/04/72

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COST FACTOR	KEYEP.	INITIAL VALUE	COST FACTOR CHANGE YIELDING 1% SAVINGS	COST FACTOR CHANGE YIELDING 1% ADDL COST	COST IMPACT RELATION	RANK OF 89	PERCENTAGE IMPACT ON COST PER STUDENT YEAR: COST FACTOR CHANGE -25%	-10%	-5%	+5%	+10%	+25%
STUDENT FLOW												
SCHOOL YEAR DAYS		180.0000 DAYS	-1.00%	1.00%	POS LIN		-25.0%	-10.0%	-5.0%	5.0%	10.0%	25.0%
ACADEMIC INSTRUC												
STAFF RATIO	TEACHR	23.4250 :1	2.26%	-2.16%	NEG ACC	1	15.1%	5.0%	2.4%	-2.2%	-4.1%	-9.1%
COMP FACTOR 1	TEACHR	0.3889	-9.80%	9.80%	POS LIN	6	-2.5%	-1.0%	-0.5%	0.5%	1.0%	2.5%
STAFF RATIO	AIDE	23.4250 :1	43.36%	-23.22%	NEG ACC	15	1.1%	0.4%	0.2%	-0.2%	-0.3%	-0.7%
COMP FACTOR 1	AIDE	1.3688	-57.36%	57.36%	POS LIN	34	-0.4%	-0.2%	-0.1%	0.1%	0.2%	0.4%
IMMED USE COST	CLSRM	0.0384 $	-94.01%	94.01%	POS LIN	40	-0.3%	-0.1%	-0.1%	0.1%	0.1%	0.3%
TOTAL USE COST	CLSRM	0.1150 $	-9.02%	9.02%	POS LIN		-2.8%	-1.1%	-0.6%	0.6%	1.1%	2.8%
TOTAL USE COST	FRNISH	0.0263 $	-39.47%	39.47%	POS LIN		-0.6%	-0.3%	-0.1%	0.1%	0.3%	0.6%
TOTAL USE COST	AV-EQP	0.0039 $	LOW	264.93%	POS LIN		-0.1%	-0.0%	-0.0%	0.0%	0.0%	0.1%
STAFF HOUR COST	TOTALS	0.4177 $	-2.48%	2.48%	POS LIN		-10.1%	-4.0%	-2.0%	2.0%	4.0%	10.1%
FACIL HOUR COST	TOTALS	0.1452 $	-7.14%	7.14%	POS LIN		-3.5%	-1.4%	-0.7%	0.7%	1.4%	3.5%
BK-AV HOUR COST	TOTALS	0.0141 $	-73.55%	73.55%	POS LIN	38	-0.3%	-0.1%	-0.1%	0.1%	0.1%	0.3%
OTHER HOUR COST	TOTALS	0.0145 $	-71.52%	71.52%	POS LIN	37	-0.3%	-0.1%	-0.1%	0.1%	0.1%	0.3%
TOTAL HOUR COST	TOTALS	0.5915 $	-1.75%	1.75%	POS LIN		-14.3%	-5.7%	-2.9%	2.9%	5.7%	14.3%
NET COST/STU-YR	TOTALS	589.5166 $	-1.75%	1.75%	POS LIN		-14.3%	-5.7%	-2.9%	2.9%	5.7%	14.3%
PHYSICAL EDUCATN												
STAFF RATIO	TEACHR	23.4250 :1	47.84%	-24.45%	NEG ACC	16	1.0%	0.3%	0.2%	-0.1%	-0.3%	-0.6%
TOTAL USE COST	GYM	0.2663 $	-36.12%	36.12%	POS LIN		-0.7%	-0.3%	-0.1%	0.1%	0.3%	0.7%
TOTAL USE COST	GYM-EQ	0.0178 $	LOW	540.55%	POS LIN		-0.0%	-0.0%	-0.0%	0.0%	0.0%	0.0%
STAFF HOUR COST	TOTALS	0.3834 $	-25.09%	25.09%	POS LIN		-1.0%	-0.4%	-0.2%	0.2%	0.4%	1.0%
FACIL HOUR COST	TOTALS	0.2840 $	-33.86%	33.86%	POS LIN		-0.7%	-0.3%	-0.1%	0.1%	0.3%	0.7%
OTHER HOUR COST	TOTALS	0.0033 $	LOW	HIGH	POS LIN	83	-0.0%	-0.0%	-0.0%	0.0%	0.0%	0.0%
TOTAL HOUR COST	TOTALS	0.6707 $	-14.34%	14.34%	POS LIN		-1.7%	-0.7%	-0.3%	0.3%	0.7%	1.7%
NET COST/STU-YR	TOTALS	72.3775 $	-14.34%	14.34%	POS LIN		-1.7%	-0.7%	-0.3%	0.3%	0.7%	1.7%
STUDENT LUNCH												
STAFF RATIO	TEACHR	81.6530 :1	HIGH	-57.73%	NEG ACC	43	0.2%	0.1%	0.0%	-0.0%	-0.1%	-0.1%
COMP FACTOR 1	TEACHR	0.0929	-33.42%	33.42%	POS LIN	21	-0.7%	-0.3%	-0.1%	0.1%	0.3%	0.7%
COMP FACTOR 1	AIDE	0.2274	LOW	345.21%	POS LIN	56	-0.1%	-0.0%	-0.0%	0.0%	0.0%	0.1%
TOTAL USE COST	CAFE	0.2407 $	-49.39%	48.39%	POS LIN		-0.5%	-0.2%	-0.1%	0.1%	0.2%	0.5%
TOTAL USE COST	CAF-EQ	0.0156 $	LOW	748.52%	POS LIN		-0.0%	-0.0%	-0.0%	0.0%	0.0%	0.0%
STAFF HOUR COST	TOTALS	0.1100 $	LOW	105.89%	POS LIN		-0.2%	-0.1%	-0.0%	0.0%	0.1%	0.2%
FACIL HOUR COST	TOTALS	0.2563 $	-45.45%	45.45%	POS LIN		-0.6%	-0.2%	-0.1%	0.1%	0.2%	0.6%
OTHER HOUR COST	TOTALS	0.0913 $	LOW	127.58%	POS LIN	45	-0.2%	-0.1%	-0.0%	0.0%	0.1%	0.2%
TOTAL HOUR COST	TOTALS	0.4576 $	-25.46%	25.46%	POS LIN		-1.0%	-0.4%	-0.2%	0.2%	0.4%	1.0%

the class size. The second most important factor is the average annual salary of the teachers in the school. By utilizing this Economic Factor Ranking, it is possible to identify those key factors which will give a valid approximation of the cost of the alternative program. Perhaps using only the 25 highest ranked factors will be sufficient. Once these key factors are identified, their impact on total costs can be determined from the COST-ED Sensitivity Analysis shown in Figure 3. Using the first-ranked factor, student:teacher ratio, as an example, the Sensitivity Analysis shows that the existing program has an average student:teacher ratio of 23.425. The far-right portion of Figure 3 indicates the nature of the relationship between this factor and total cost. For example, a 5% decrease (-5% change) in the factor (staff ratio) will result in a 2.4% increase in total cost. Conversely, a 10% increase (+10% change) will result in a 4.1% lower total cost. By interpolating from this Sensitivity Analysis, it is a simple matter for an administrator to assess the impact of virtually any program variation. This technique was used in Prince William County to estimate the average per-pupil cost of the elementary school 45-15 programs. This technique can be used by Prince William County next year to get updated information on how their program's costs have changed in a year's time.

The COST-ED Economic Factor Ranking and Sensitivity Analysis can be used not only to investigate real program variations, but also to simulate the cost impact of proposed program changes. For example, Figure 2, the Economic Factor Ranking, shows for each factor ways by which 1% of the total per-pupil cost can be saved or can be overexpended. The first-ranked factor, student:teacher ratio, is 23.425 in the existing program. If it were increased to 23.954, about a half student average increase in class size, the total per-pupil cost would decrease by 1%. On the other hand, if class size were to be decreased to 22.919 students, the total per-pupil cost would rise by 1%. Interesting simulation equal-cost trade-offs are possible using this technique. For example, by increasing class size by about a half student (to 23.954), 1% of the total per-pupil cost is saved. This 1% is then freed to be spent in other program areas. The 38th-ranked factor, for example, shows that in the existing program about 1.41¢ is spent on books and audiovisual software for each hour a student is in class. If the 1% per-pupil cost savings were allocated to this factor, it would be possible to increase expenditures for books and audiovisual software to 2.45¢ per student-hour, nearly a 75% increase in learning materials in exchange for an average class size about one-half student larger. Almost endless numbers of these trade-offs can be envisioned using these COST-ED reports.

SUMMARY OF THE 45-15 ECONOMIC ANALYSIS

The pilot 45-15 program at Godwin Middle School this year cost 9.6% less than the same program operated on a traditional-term basis. In the long run, this savings may erode somewhat because of expected salary increases to reflect increased student loads. The results at Godwin are the best estimate of the potential savings from 45-15 operation districtwide since the per-pupil costs of the middle school program are most nearly equal to districtwide all-grade average per-pupil costs.

It is not being said that if the district were to adopt the 45-15 plan in all its schools that next year's budget will be smaller than this year's.

Prince William County is a rapidly growing district, and growing districts have growing budgets. More students next year will mean more teachers, and even under 45-15 this growth in student population will eventually mean more buildings. The significant economic impact of 45-15 is that whatever the total budget is next year or in years hence, it will be smaller under 45-15 than it would have been under traditional-term operation.

The total district school budget is still likely to grow under 45-15 as the district grows, but the rate of growth will be suppressed by 45-15. The frequency of purchasing new school facilities will be lower under 45-15; the attendant hiring of the staff necessary to serve these buildings will also be less frequent under 45-15.

It should also be noted that the district could decide, independently of the 45-15 plan, to spend more on education. The district could opt for an expensive policy of program enrichment, could upgrade many personnel positions both in the schools and in the administration, or could do any of a number of other things which would increase the cost of all educational programs in the system generally. It should not be construed at some future date that because the cost per student has risen over that discussed here, that 45-15 has not saved any money. All of the above mentioned factors could be at work by that future time to create a higher general level of expenditure for education. In any case, whatever the prevailing fiscal policy as it relates to the educational program in Prince William County, the current program at any time in the future would cost less under a well-planned 45-15 operation than a similar program run on a traditional-term basis.

Of course, these conclusions do assume that the county does not inefficiently utilize any facility slack generated by a widespread move to 45-15. If such slack is viewed as just some more available resources, then it is possible that no savings from 45-15 will exist in the future. If, for instance, excess capacity is created for the school buses because of a sudden change to serving only three-fourths of the current daily attendees, and this slack were viewed simply as a way of making shorter bus rides, creating more stops, allowing more less-than-filled runs to persist, then whatever slack might have existed at the changeover to 45-15 would have been dissipated by the time the district's enrollment had increased to the point where this slack could be efficiently utilized.

In summary, 45-15 as it appeared in Prince William County this year has significant potential for savings. This report has indicated that while much of these savings were in school construction funds and interest on construction bonds, a large portion of these savings would actually be seen in the operating funds of the district. Future actions could erode part of these savings especially those related to school-based instructional and support personnel. Inefficient management of facility slack created by a districtwide move to 45-15 could further erode some of the facility savings. But the 45-15 plan does have the potential for producing long-run savings in educational costs. Educators, who must recognize the importance of school finance, cannot afford to ignore it.