PUPIL TRANSPORTATION

STUDY REPORT

State Aids Section
Pupil Transportation Section
Minnesota Department of Education

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CONTENTS

EXECUTIVE SUMMARY

The 1980 Laws, Chapter 609, Article II, Section 6 require the Department of Education to report to the 1981 Legislature on proposed measures for economy and cost-effectiveness in school transportation and related services. Section 6, Subd. 1 specified that the report include:

1) A study of the existing administration of transportation services based on a sampling of districts of representative sizes and locations, and other data throughout the state.

2) Recommendations by the Department of Education concerning:

   a) measures by school districts to reduce fuel cost, conserve fuel and increase the overall efficiency of transportation and related services, and
   b) measures by the Department of Education to assist districts in reducing transportation costs.

3) Recommendations by the Department of Education concerning adjustments to the transportation aid formula.

Subdivision 2 directed that the Department of Education provide technical assistance to school districts which request it for developing computer assisted routing plans. Subdivision 3 authorized the Department to increase its staff complement by three employees for the purposes of Subdivisions 1 and 2. Subdivision 9 of the same article appropriated $150,000 for Fiscal Year 1981 to conduct the study and develop computer routing capability, but the appropriation was vetoed by the Governor in order to limit state expenditures.

Because Department management considered the study to be important, it was decided to proceed with a reduced study using existing Department resources and limited funds from the School Management Services Division. Since the available funding was limited, the computer routing portion of the study was postponed, and the study

effort was directed at preparing the report mandated in Subdivision 1 of Section 6.

Component I: The Administration of Pupil Transportation Services in Minnesota School Districts

The first component of the transportation study included 1) a detailed examination of transportation program administration in twelve sample school districts, and 2) statistical analysis of selected data for all districts in the state.

Review of Case Studies

Because of budget limitations, the study sample was limited to 12 school districts. The districts were selected in pairs, with the members of each pair having the following characteristics:

1) Similar pupil characteristics and geographic conditions as measured by the transportation aid formula;

2) Located in geographic proximity to one another;

3) Similar 1978-79 formula-predicted cost per pupil transported; and

4) Widely varying 1978-79 actual cost per pupil transported, with one member of the pair having actual cost greater than formula-predicted cost, and the other having actual cost less than formula-predicted cost.

Six pairs of districts were selected to provide a study sample of representative sizes and locations.

Given pairs of districts with similar characteristics, but widely varying actual costs, a major focus of the analysis was to determine what factors contributed to the differences in 1978-79 actual cost per pupil.

Findings based on the case studies include:

1) Cost differences between paired districts were found to be associated with variations in the quality and comprehensiveness

of services provided, unit prices paid for major budget items, and procedures used in cost reporting. (Due to budget constraints, a detailed analysis of bus routing efficiency in the sample districts was not undertaken).

2) Noon kindergarten and late activity transportation were more commonly provided in high cost districts than in low cost districts.

3) The high cost districts generally had fewer pupils per bus route, and shorter maximum riding times.

4) Salaries and fringe benefits were significantly higher in the high cost districts in four cases, and the high cost districts paid considerably higher gasoline prices in two cases.

5) High cost districts allocated administrative costs to the transportation fund more completely than low cost districts.

Analysis of Statewide Data

The factors accounting for cost differences between paired sample districts may also account for cost differences among other districts in the state. However, because of the small sample size and the procedures used in selecting sample districts, further study is needed to determine how well the findings apply to the entire state.

Findings based on analysis of statewide data include:

1) The provision of noon kindergarten transportation and/or late activity transportation did not significantly affect the status of school districts under the aid formula.

2) On the average, districts providing their own transportation service fared somewhat better under the aid formula than districts using private contractors. Differences in the impact of the aid formula on district-owned and contracted operations were less significant in the metropolitan region than in nonmetropolitan regions. Factors contributing to this situation are difficult to assess with existing data; however, a portion of this cost difference may have resulted from cost reporting differences. Additional study is needed to assess the impact of cost reporting differences between contracted and district-owned operations.

Component II: Recommended Measures for Economy, Fuel Savings, and Cost Effectiveness

In the second component of the study, recommendations were developed concerning measures by school districts to reduce fuel costs, conserve fuel, and increase the overall efficiency of transportation and related services. Recommendations were also made regarding measures by the Department of Education to assist districts in reducing transportation costs. The major recommendations which impact on and affect school districts and the Department of Education are:

1) The conversion of buses to diesel engines or to propane fuel.

2) An increased use of the bus reconditioning project at the Minnesota Correctional Facility-Stillwater.

3) A review, evaluation and restructuring of bus routing and scheduling.

These three major recommendations can result in substantial cost savings.

Component III: Analysis of the Pupil Transportation Aid Formula

The third component of the study reviewed the rationale, methodology and results of the transportation aid formula, and developed a set of recommended adjustments which could be implemented in the near future. Also, long-range funding options were discussed.

To address concerns cited in the study report, several recommendations are made toward improving the formula. These are:

1) To reduce the number of explanatory variables by removing most of the squared variables and by tightening up the statistical significance levels required for inclusion in the formula. This will result in a simpler model which provides both greater comparability of funding levels and stronger cost containment incentives. However, the resultant differences between the supported expenditure levels and historical cost levels will be increased for many districts.

2) To deal with these enlarged differences, a modification to the "softening" techniques is recommended. These include an adjustment to the base year predicted costs with relation to the base year actual costs. Also, the adjustment in the current year to state-supported expenditures with relation to actual current expenditures (the "softening" adjustment schedule) is retained, but diminished to improve the cost containment incentives.

The last section of the component contains a number of alternative long range funding options which may be considered. These include further simplification of the formula, introduction of a discretionary transportation levy, use of replacement cost in bus depreciation calculations, and consolidating the transportation and foundation aid programs so as to facilitate economic decision-making.

COMPONENT I

THE ADMINISTRATION OF PUPIL TRANSPORTATION SERVICES IN MINNESOTA SCHOOL DISTRICTS

The first major component of the transportation study, as specified in the Legislation, was to examine "the existing administration of pupil transportation services based on a sampling of school districts of representative sizes and locations, and other data throughout the state." (Laws 1980, Chapter 609, Article II, Section 6). The objective of this component was to obtain basic information on the administration of pupil transportation services which would be useful in developing recommendations concerning (1) measures by school districts to reduce fuel costs, conserve fuel, and increase transportation efficiency; (2) measures by the MDE to assist districts in this regard; and (3) adjustments to the transportation aid formula. Procedures used to accomplish this objective included detailed analysis of transportation program administration in twelve sample districts and statistical analysis of selected data for all districts in the state.

Review of Case Studies

Selection of Sample Districts

Because the sample size for the study was small, it was determined that a judgemental selection procedure would best serve the purposes and requirements of the study. The first step in the selection procedure was to identify pairs of districts in all parts of the state, with the members of each pair having the following characteristics:

(1) Similar pupil characteristics and geographic conditions as measured by the transportation aid formula;

(2) Located in geographic proximity to one another;

(3) Similar 1978-79 formula-predicted cost per pupil transported; and

(4) Widely varying 1978-79 actual cost per pupil transported, with one member of the pair having actual cost greater than formula-predicted cost, and the other having actual cost less than formula-predicted cost.

Based on these criteria, twenty-four pairs of districts were identified, including at least two pairs from each of the nine geographic regions used in computing transportation aid. Six pairs were selected from this pool to provide a study sample of representative sizes and locations. The location of each pair is illustrated in Figure 1.

Case #1 included two rural districts from the lakes region of northwestern Minnesota (Region 4/5). Two iron range districts (Region 3) were included in Case #2. The third case included two rural districts from west-central Minnesota (Region 6). Case #4 included two districts from the hilly Mississippi valley area of Region 10. Two rural districts from south-central Minnesota (Region 9) were included in Case #5. Finally, Case #6 included two suburban districts from the metropolitan region (Region 11).

Characteristics of Sample Districts

Selected characteristics of the sample districts, as measured for the transportation aid formula, are shown in Table 1. In each case study, district A was the higher cost district. While no two districts have identical characteristics, the districts paired for each case study were generally similar in location, size, and pupil characteristics. The districts included in Case #1, #3, and #5 were low in enrollment and density, with fewer than 600 pupils transported, and fewer than 5 transported pupils per square mile. Case #2 and #5 represented medium-enrollment, medium-density districts, with approximately 1,000 pupils transported and 6-16 transported pupils per square mile. Case 6 represented moderately large, high density suburban school districts, with more than 7,000 pupils transported, and more than 150 transported pupils per square mile. The proportion of pupils transported to nonpublic schools was below the state average in three cases, and above the state average in three cases. In two cases, the proportion of pupils transported in the handicapped category exceeded the state average. The districts included in the study used various modes of operation, including all district operations, all contract operations, and various mixtures of district and contract operations.

Figure 1
PUPIL TRANSPORTATION STUDY
LOCATION OF SAMPLE DISTRICTS

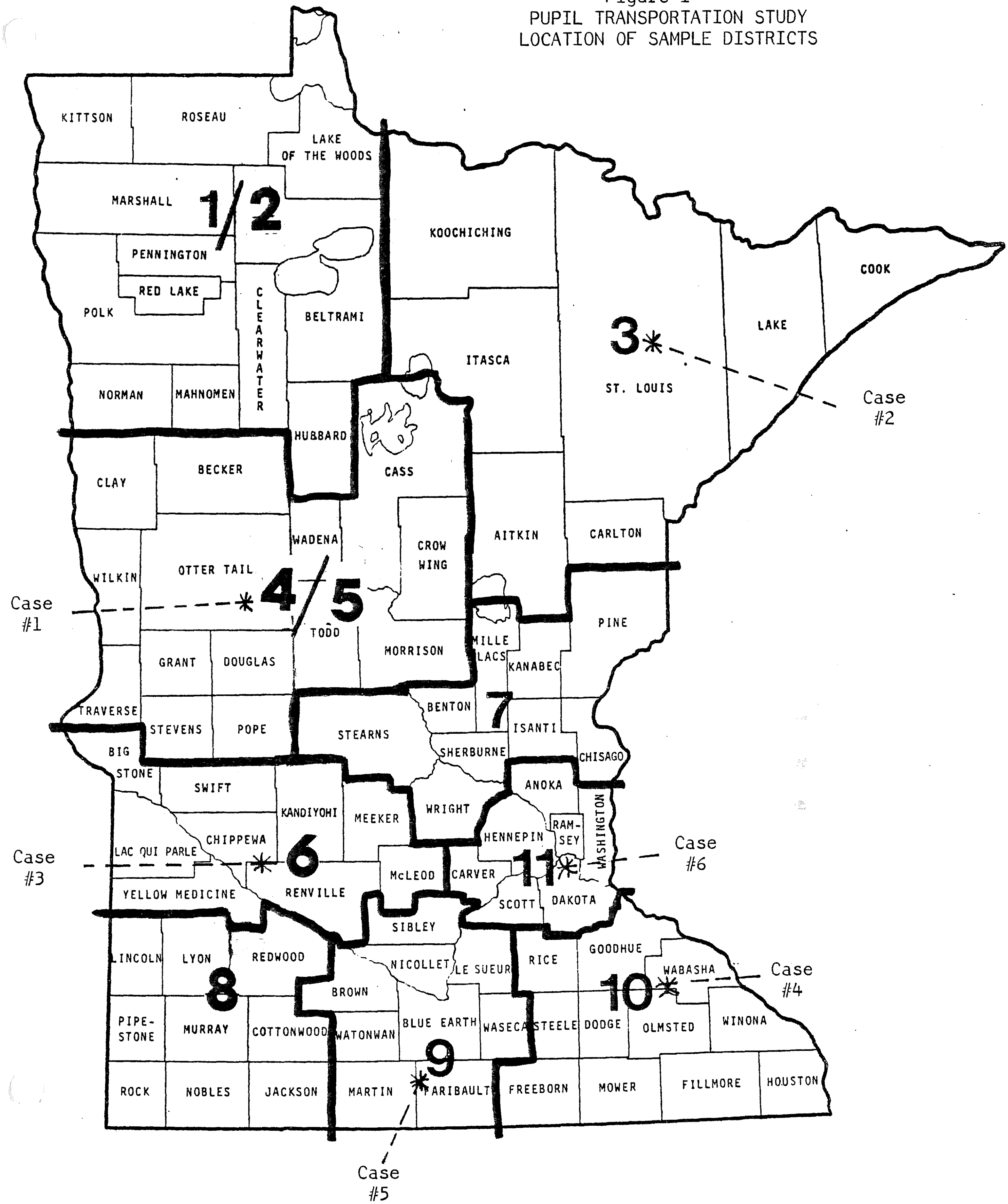


Table 1

Characteristics of Sample Districts, 1978-79

Six Case Studies (12 Districts)[a]

District	Region	Average Daily Membership	Regular FTE Pupils Transported	Square Miles	Density (Reg. FTE per Sq.Mi.)	Percent of Total FTE Nonpublic	Percent of Total FTE Handicapped	Mode of Operation
1A	4/5	435	357	85	4.2	.0	.0	District
1B	4/5	299	272	191	1.4	.0	.1	District
2A	3	1,528	922	56	16.5	.0	1.6	Mixed
2B	3	2,444	1,409	161	8.8	4.9	2.3	Mixed
3A	6E/6W	517	292	108	2.7	15.1	1.9	Contract
3B	6E/6W	381	306	99	3.1	18.6	.6	District
4A	10	1,433	1,099	99	11.1	15.4	1.0	Contract
4B	10	945	896	141	6.4	11.1	.3	Mixed
5A	9	606	511	119	4.3	2.7	.7	Mixed
5B	9	478	425	116	3.7	.0	.2	Mixed
6A	11	10,268	8,097	37	218.5	13.7	2.2	Mixed
6B	11	8,832	7,073	45	158.9	11.4	1.6	Mixed
State Average	---	1,842	1,538	194	24.0	5.3	1.1	------

[a]Each case study included two districts with similar characteristics and predicted costs, but considerably different actual costs. In each case study, district A was the higher cost district.

Cost Differences Between Paired Districts

Differences between paired districts in formula-predicted and actual 1978-79 cost per weighted FTE pupil transported are shown in Table 2. In each case, the difference in formula-predicted cost was small: the largest difference was $14 per WFTE pupil, and in five cases, the difference was $7 or less. Differences between paired districts in actual 1978-79 costs were much larger: the minimum difference was $26 per WFTE pupil, with differences exceeding $40 in five cases.

The third section of Table 2 shows the differences between paired districts in actual cost per WFTE pupil after adjusting for differences between the districts in the formula-predicted cost. In Case #1, for example, the actual cost per pupil was $70 higher in district A than in district B, while the formula-predicted cost was $7 higher in district A. Therefore, $7 of the difference was explained by the pupil and geographic factors included in the transportation formula, while the remaining $63 difference resulted from other factors. In the other cases, the difference in cost per WFTE pupil not explained by the factors in the transportation aid formula ranged from a low of $27 to a high of $126.

Given pairs of districts with similar characteristics, but widely varying actual costs, a major focus of the analysis was to determine what factors contributed to the differences in 1978-79 actual cost per pupil. Factors viewed as potential sources of actual cost differences between paired districts included the following:

(1) efficiency of transportation operation;

(2) quality of service provided;

(3) prices of major budget items (e.g. salary rates, gas prices);

(4) cost reporting procedures; and

(5) unique district characteristics not recognized in the transportation aid formula.

Table 2

Differences in Cost per Weighted FTE Pupil Transported, 1978-79

Six Case Studies (12 Districts) [a]

Description	Cost per Weighted FTE					
	Case #1	Case #2	Case #3	Case #4	Case #5	Case #6
I. Formula Predicted Cost per Pupil:						
A. District A	$197	$177	$221	$176	$194	$ 81
B. District B	190	163	221	171	191	82
C. Difference (A over B)	$ 7	$ 14	$ 0	$ 5	$ 3	$ (1)
II. Actual Cost per Pupil:						
A. District A	$249	$200	$258	$194	$272	$101
B. District B	179	146	207	152	143	75
C. Difference (A over B)	$ 70	$ 54	$ 51	$ 42	$129	$ 26
III. Actual Cost Difference (II.C.) Less Formula Predicted Cost Difference (I.C.)	$ 63	$ 40	$ 51	$ 37	$126	$ 27

[a]Each case study included two districts with similar characteristics and predicted costs, but considerably different actual costs. In each case study, district A was the higher cost district.

To determine which factors contributed to the differences in 1978-79 actual cost per pupil, detailed information was gathered concerning the administration of pupil transportation services in each sample district. First, basic information concerning the transportation program of each district was obtained from annual transportation and financial reports submitted to the Minnesota Department of Education. The data obtained from these reports were supplemented by site visits to each of the twelve sample districts. Each site visit lasted approximately one day, and included interviews with the district superintendent, business manager, transportation director, and other transportation personnel. The transportation facilities and equipment of the district were inspected, and a set of questionnaires was completed (see Appendix B, p. B-1). Information obtained from the questionnaires included a breakdown of district expenditures by detailed expenditure account, a description of district transportation policies and administrative procedures, and a summary of factors contributing to differences in 1978-79 actual cost per pupil transported.

Breakdown of Cost Differences by Expenditure Account

Table 3 provides a breakdown of differences between paired districts in actual cost per pupil transported by expenditure account. In the first case study, the transportation programs of both districts were totally district owned and operated. Bus driver salaries accounted for $10 of the $70 difference in actual cost per pupil between the two districts, while other salaries accounted for $34, fringe benefits for $12, and other operating cost for $30. Offsetting these differences, district B spent more per pupil on gasoline ($13) and bus depreciation ($3).

In Case #2, both districts operated mixed transportation systems. Examining the costs and pupils transported on district vehicles only, a difference of $80 per pupil was identified. Due to a smaller difference of $21 per pupil between the contract operations of the two districts, the overall difference in actual cost per pupil was $54. Bus driver salaries accounted for $50 of the $80 difference between the district

Table 3

Breakdown of Differences in Actual Cost per Weighted FTE Pupil Transported by Expenditure Account, 1978-79

Six Case Studies (12 Districts)[a]

Expenditure Account	Difference in Actual Cost per Weighted FTE (A over B)					
	Case #1	Case #2	Case #3[e]	Case #4[e]	Case #5	Case #6
Bus Driver Salaries	$ 10	$ 50	$---	$---	$ 85	$ 23
Other Salaries	34	(3)	---	---	(6)	3
Fringe Benefits	12	15	---	---	12	7
Gasoline	(13)	9	---	---	29	(2)
Other Operating Cost	30	7	---	---	42	2
Bus Depreciation	(3)	3	---	---	29	---
Total District Operations[b]	70	80	---	---	191	33
Total Contract Operations[c]	----	21	---	42	74	10
Grand Total Cost per Pupil[d]	$ 70	$ 54	$ 51	$ 42	$129	$ 26

[a]Each case study included two districts with similar characteristics and predicted costs, but considerably different actual costs. In each case study, district A was the higher cost district.

[b]Total authorized cost, excluding contract costs, divided by WFTE pupils transported on district vehicles, district A over district B.

[c]Authorized contract cost divided by WFTE pupils transported on contract vehicles, district A over district B.

[d]Total authorized cost di ided by total WFTE pupils, district A over district B.

[e]In case #3 and Case #4, ne or both districts did not provide transportation on district vehicles; therefore, cost comparisons were limited to contract operations in Case #4 and to total cost in Case #3.

operations, while fringe benefits ($15), gasoline ($), other operating cost ($7), and bus depreciation ($3) also contributed to this difference.

In the third case, district 3A was totally contracted while district 3B was totally district-owned; therefore, no cost comparisons by expenditure account were available. A similar situation limited cost comparisons by expenditure account in Case #4: district 4A was totally contracted while district 4B had a mixed operation. Therefore, comparisons for Case #4 were limited to contract operations, in which a $42 difference in cost per transported pupil was identified.

The $129 difference in actual cost per pupil between districts 5A and 5B consisted of a $191 difference in district operations and a $74 difference in contract operations. Bus driver salaries ($85), fringe benefits ($12), gasoline ($29), other operating cost ($42), and bus depreciation ($29) all contributed to the difference between the district operations. In the sixth case study, the overall cost difference of $26 resulted from a difference of $33 in district operations and $10 in contract operations. Bus driver salaries ($23) and fringe benefits ($7) accounted for most of the difference in district operations.

Breakdown of Cost Differences by Transportation Category

Table 4 provides a breakdown of differences between paired districts in 1978-79 actual cost per pupil by transportation category. In reviewing Table 4, it is important to keep in mind that per pupil cost differences for various transportation categories do not have a comparable impact on the overall per pupil cost differences between paired districts because different numbers of pupils were transported in each category. Since the number of pupils transported in the regular/public category was much greater than that in other categories, large per pupil cost differences in other categories generally had only a small effect on the overall cost per pupil differences.

In each case study, differences in the cost of regular transportation for public school pupils accounted for most of the overall cost difference. In Case #1, the per

Table 4

Differences in Actual Cost per Weighted FTE Pupil by Transportation Category, 1978-79

Six Case Studies (12 Districts)[a]

Transportation Category	Difference in Actual Cost per Weighted FTE Pupil (A over B)[d]					
	Case #1	Case #2	Case #3	Case #4	Case #5	Case #6
Regular:						
Public	$ 79	$ 79	$ 79	$ 37	$129	$ 27
Nonpublic	---	---[b]	(45)	39	---[c]	35
Total	$ 79	$ 79	$ 70	$ 37	$127	$ 32
Secondary Vocational	109	(188)	(134)	---	---[b]	(3)
Handicapped	---[b]	(54)	(20)	182	2	(8)
Other Misc.	---	---	---	63	---[b]	(22)
Total All Categories	$ 70	$ 54	$ 51	$ 42	$129	$ 26

[a]Each case study included two districts with similar characteristics and predicted costs, but considerably different actual costs. In each case study, district A was the higher cost district.

[b]Transportation category provided by district B but not district A.

[c]Transportation category provided by district A but not district B.

[d]Cost per pupil differences for various categories do not have comparable impact on total cost per pupil difference for all categories because different number of pupils were transported in each category. Because the number of pupils transported in the Regular/Public category is much greater than the number of pupils transported in other categories, large per pupil differences in other categories may have only a small effect on the total cost per pupil difference for all categories.

pupil cost of regular transportation for public school pupils was $79 higher in district A than in district B, while the overall cost per pupil difference was $70. Neither district provided regular/nonpublic transportation, while district A paid $109 more per pupil for secondary vocational transportation than district B. District B provided handicapped transportation at a cost of $410 per WFTE pupil, while district A did not provide this service.

In the second and third cases, the differences between paired districts in the regular/public category were greater than the overall differences in cost per pupil transported. The overall cost per pupil difference in Case #2 was $54. In the regular/public category, district A spent $79 more per pupil than district B, while district B spent $188 more per pupil for the transportation of secondary vocational pupils and $54 more per pupil for the transportation of handicapped pupils. A similar breakdown of cost differences by category was identified in the third case study: District A spent $79 more per pupil for regular/public transportation, but district B spent $45 more per pupil for regular/nonpublic transportation, $134 more per pupil for secondary vocational transportation, and $20 more per pupil for handicapped transportation. District A's high cost for regular/public transportation was partially offset by district B's high cost in other transportation categories, resulting in an overall cost difference of $51 per pupil.

In case #4, #5, and #6, the overall cost per pupil differences between paired district fell within $5 of the differences identified for the regular/public category. In Case #4, district A had a higher cost per pupil than district B in all transportation categories. Because the number of pupils transported in the handicapped and other categories was small, large per pupil differences in these categories resulted in an overall cost per pupil difference of $42, $5 greater than the difference for the regular/public category alone. In the fifth case, the overall difference in cost per pupil and that for the regular category were the same: $129. In Case #6, district A spent more per pupil than district B for regular/nonpublic transportation, but less for secondary vocational, handicapped, and other transportation. Given these offsetting factors, the cost per pupil difference for the regular/public category ~~was $27,~~ and the overall difference was $26.

<u>Factors Explaining Cost Differences Between Paired Districts</u>

Factors explaining the differences between paired districts in 1978-79 actual cost per weighted FTE pupil transported are summarized Table 5. In general, cost differences between paired districts were found to be associated with differences in the quality and comprehensiveness of services provided, the unit prices paid for major budget items, and the procedures used in cost and pupil reporting.

In case #2, #3, and #5, noon kindergarten transportation was provided in district A but not in district B. In these three cases, the provision of noon kindergarten transportation increased the overall cost per pupil transported in district A by an amount ranging from $8 to $20. In case #1, neither district provided noon kindergarten transportation. In case #4 and #6, noon kindergarten transportation was provided in both districts, but cost more per pupil in district A than in district B.

Late activity transportation was provided in district A but not district B in case #1, #4, and #5. Late activity transportation is transportation provided from school to home after students have participated in after school activities. In these three cases, the provision of late activity transportation increased the overall cost per pupil transported by approximately $8 to $10. In case #2, late activity transportation was provided in district B but not district A, resulting in an overall increase of $3 per pupil in district B. In case #3, neither district provided late activity transportation. In case #6, both districts provided this service, but the cost per pupil was higher in district A than district B.

In four of the six cases, the maximum pupil riding time from home to school was significantly shorter in district A than in district B. In these cases, the maximum

Table 5

Factors Explaining Differences in Actual Cost per Weighted FTE Pupil Transported, 1978-79

Six Case Studies (Twelve Districts)[a]

Factor	Factors Which Help Explain Higher Cost per Pupil in District A					
	Case #1	Case #2	Case #3	Case #4	Case #5	Case #6
(1) Noon Kindergarten Transportation Provided in A but not B		X	X		X	
(2) Late Activity Transportation Provided in A but not B	X	(X)[b]		X	X	
(3) Shorter Maximum Riding Time in A	X	X	X	X		
(4) Fewer Pupils per Route in A	X	X	X	X	X	
(5) Higher Salaries & Fringe Benefits in A	X	X			X	X
(6) Higher Gasoline Cost per Gallon in A		X			X	
(7) More Sophisticated Communications System in A	X			X		
(8) Heated Bus Garage in A but not B	X					
(9) More School Sites in A					X	
(10) Over Reporting of Authorized Costs in A or underreporting of Authorized Costs in B	X	X	(X)[b]		X	
(11) Under Reporting of Authorized Pupils in A					X	

[a] Each case study included two districts with similar characteristics and predicted costs, but considerably different actual costs. In each case study, district A was the higher cost district.

[b] (X) indicates factor contrary to actual cost difference. In Case #2, late activity transportation was provided in B but not A. In Case #3, authorized cost was underreported in A not B.

riding time in district A ranged from 20 minutes to 60 minutes, while that in B ranged from 70 minutes to 90 minutes.

In five of the six cases, district A transported fewer pupils per regular bus route than district B. In three cases, the differences were relatively small: district B transported 3 more pupils per route in case #1, 4 more pupils per route in case #5, and 7 more pupils per route in case #2. In two cases, the differences were more pronounced: in case #4, district B transported 16 more pupils per route, and in case #3, district B transported 19 more pupils per route. The number of pupils per route and the maximum riding time relate to efficiency and service quality: in the majority of cases, district A carried out a policy of minimizing student riding time by reducing route length and number of pupils served on each route.

Higher salary rates and fringe benefits in district A than in district B accounted for a portion of the cost differences in four of the six cases. In case #2 and #6, district B made more extensive use of part-time drivers than district A. These part-time drivers were paid at a lower hourly rate than full-time drivers, and did not receive comparable fringe benefits. In district 6A, for example, the average salary cost per hour was $6.65 for full-time drivers, and $4.87 for part-time drivers. In case #5, the average hourly rate for bus drivers was approximately $2 per hour higher in district A than in district B, partially because the drivers in A were unionized and those in B were not, and partially because A had made a conscious effort to attract and retain well-qualified drivers by paying relatively high salaries.

The districts included in the sample reported widely varying gasoline cost per gallon, ranging from a low of 52.6¢ in district 2B to a high of 79.0¢ in district 5A. These differences resulted from variations in purchasing schedules during the year, use of bulk purchasing in some districts but not others, and price differences among base period suppliers. In case #2, district A paid 7.3¢ per gallon less than district B, partially because district A purchased gasoline in bulk deliveries of 8000 to 10,000 gallons, while district A did not. In case #5, district A paid 14.0¢ per gallon more than district B.

In case #1 and #4, district A employed more sophisticated and expensive communications systems than district B. District 1A rented mobile telephones for each bus at a cost of $12 per pupil transported, while district 1B used C.B. radios at a very low cost. Mobile telephones were viewed as necessary in district 1A for dealing with emergencies such as mechanical breakdowns in isolated areas or winter storms. In case #4, two-way radios were employed in district A, while no communications system was used in district B.

In case #1, district A rented a bus garage with heated storage and service areas, while drivers stored buses at home in district B. The heated bus garage increased the overall cost per pupil by $14 in district A, while amounts paid to bus drivers for home storage in district B accounted for $5 per pupil, a $9 difference. District A also employed a full-time foreman/mechanic at a cost of $27 per pupil, while district B contracted for its maintenance service at a substantially lower cost.

A difference in the number of school sites contributed to the cost difference in case #5: district A operated two elementary schools in different towns, while district B operated just one elementary school. The additional location made bus routing more difficult in district A, creating a need for additional route mileage, and reducing the number of pupils served per route.

Variation in cost reporting accounted for a portion of the cost differences in four cases. In case #1, district A reported administrative and clerical costs amounting to $8 per pupil, while district B did not report any administrative or clerical expenses. In case #2, district A did not report administrative and clerical expenses in the transportation fund, while district B did not report garage insurance. District B charged 75% of the salaries for driver/custodians to the transportation fund. While most of these drivers participated in noon runs as well as to-and-from school runs, the proportion of time may have been overestimated for some of the drivers.

In case #3, district A did not report administrative expenses, while district B did report these expenses. In case #5, district B appeared to under-allocate the cost of driver/custodians to the transportation fund.

In case #5, district A significantly underreported the number of eligible pupils transported. This underreporting of pupils increased the reported cost per pupil transported by approximately $ 28.

Analysis of Statewide Data

While the twelve sample districts included in the transportation study were representative of Minnesota school districts in size and geographic location, they were atypical in that the differences between predicted and actual 1978-79 cost per pupil transported greatly exceeded the state average. For the twelve sample districts, the median difference between predicted and actual cost was $20; for the state as a whole, the median difference was approximately $9.

Districts with unusually large differences between predicted and actual cost were selected for the study in order to analyze the factors contributing to the relatively large deficits or surpluses found in these districts. In the first section of this component, it was determined that the cost differences between pairs of sample districts resulted primarily from differences in the quality and efficiency of service provided and from differences in cost and pupil reporting practices. Noon kindergarten and late activity transportation was more commonly provided in high cost districts than low cost districts. High cost districts tend to transport fewer pupils per route, and provided for shorter maximum riding times. Higher unit rates were paid for labor and fuel inputs in the high cost destricts. Indirect transportation costs were also more fully reported in these districts.

The factors accounting for cost differences between the pairs of sample districts may be expected to account for cost differences among other districts in the state.

Because much of the data used in comparing sample districts was collected in site visits, only selected factors could be analyzed on a statewide basis. Factors for which statewide data were available included noon kindergarten transportation, late activity transportation, and mode of operation (district-owned or contracted).

Noon Kindergarten Transportation

During the past several years, the number of districts providing half-day daily kindergarten has gradually declined, and the number of districts providing full-day alternate day kindergarten has increased. In 1975-76, 306 districts provided half-day daily kindergarten, while 109 provided full-day alternate day kindergarten and 22 had other kindergarten schedules. By 1978-79, 266 districts provided half-day kindergarten while 144 provided full-day alternate day kindergarten. Statewide, 53 percent of all districts had 1978-79 predicted cost per pupil transported greater than actual cost, while 47 percent had predicted cost less than actual cost. Among districts providing noon kindergarten transportation, 50 percent had predicted cost greater than actual cost; among districts not providing this service, 58 percent had predicted cost greater than actual cost. While districts not providing noon kindergarten service fared slightly better on average than districts providing this service, districts with noon kindergarten transportation were not generally found to be "losers" under the aid formula.

Late Activity Transportation

In 1978-79, approximately half of all Minnesota school district provided late activity transportation service. Late activity service refers to transportation provided from school to home after students have participated in after school activities. Statewide, 53 percent of districts providing late activity transportation had predicted cost greater than actual cost; 53 percent of districts not providing this service also had predicted cost greater than actual cost.

Two factors may explain the difference between the case study findings and the statewide figures regarding late activity transportation. First, because this data item as reported on district annual transportation reports has not affected the aid calculations, tha accuracy of reporting may be suspect. Second, the transportation aid formula may adjust for the cost of late activity transportation more completely in some cases than others. Because the cost of late activity transporation is included in reported district cost and because the aid formula is based on a comparison of costs for similar districts within regions, the cost of late activity transportation will be reflected in the predicted cost where most districts in the region with similar characteristics provide this service. However, where late activity transportation service is not generally provided by similar districts within a region, districts providing this service may not have this additional cost reflected in their predicted cost.

Mode of Operation

Among the policy decisions made by local school boards concerning the administration of the pupil transportation program, the determination of mode of operation is probably the most significant. In 1978-79, 215 school districts used district-owned and operated equipment for all regular bus routes, while 119 districts contracted with private operators for all regular routes, and 102 used a combination of district and contract vehicles. Of the districts with mixed operations, 50 used district owned and operated equipment for a majority of regular routes, while 52 used contracted equipment for a majority of regular routes. On average, districts providing all or a majority of regular routes through private contractors were larger and more densely populated than districts providing all or a majority of regular routes with district equipment. Of the 265 districts providing a majority of routes with district equipment, the average ADM was 1210 and the average density was 13.2 pupils per square mile; of the 171 districts providing a majority of regular routes through private contractors, the average ADM was 2823 and the average density was 38.3 pupils per square mile. Because the districts relying primarily on contract operators were larger on average than those using district owned and operated equipment, the 39% of districts providing a majority of regular routes through private contractors accounted for 60% of all pupils transported statewide.

The utilization of private contractors varied among regions of the state. In the metropolitan region, 65% of the districts provided a majority of regular routes through private contractors; these districts accounted for 70% of all pupils transported. In all nonmetropolitan regions combined, 36% of the districts provided a majority of regular routes through private contractors, accounting for 52% of all pupils transported.

Statewide, 61% of all districts providing a majority of regular routes with district owned and operated equipment had a 1978-79 predicted cost greater than actual cost, while 41% of all districts providing a majority of regular routes through private contractors had a predicted cost greater than actual cost. On the average, districts with district owned and operated bus fleets had a predicted cost $2 higher than actual cost, while districts with contracted fleets had a predicted cost $3 lower than actual cost.

In the metropolitan area, differences in the impact of the aid formula on district owned operations and contracted operations were less substantial. Fifty-eight percent of district-owned operations had predicted cost greater than actual cost, and 46% of contract operations had predicted cost greater than actual cost. While slightly more than half of the districts with district-owned operations had predicted cost greater than actual cost, the average "loss" for districts with actual cost greater than predicted cost was greater than the average "gain" for districts with actual cost less than predicted cost. Overall, the average predicted cost for districts with district-owned operations was equal to the average actual cost. A similar situation was found to exist in districts with contracted operation. While slightly more than half of the contracted districts had predicted cost less than actual cost, the average "loss" for these districts was less than the average "gain" for districts with predicted cost greater than actual cost. Overall, the average predicted cost for districts with contracted operations was also equal to the average actual cost for these districts.

Within the metropolitan region, differences in position under the aid formula between district-owned and contracted operations do not appear to be significant. In other regions, the proportion of district-owned operations with predicted cost greater than actual cost was significantly higher than the proportion of contracted operations with predicted cost. greater than actual cost. In other words, in the nonmetropolitan regions a majority of the district operations are "gainers" under the aid formula, and a majority of contracted operations are "losers."

Factors contributing to this situation are difficult to assess with existing data. The transportation aid formula is designed to provide similar predicted costs per pupil transported for districts in a region having similar characteristics; the level of predicted cost reflects the average cost per pupil transported for similar districts. Apparently, the average 1978-79 reported cost per pupil transported in districts with contract operations is slightly higher than that in districts having similar characteristics but using district-owned and operated bus fleets. While the precise reasons for these cost differences connot be readily determined from existing data, cost differences between district and contract operations may result from actual cost differences or from variations in reporting of actual costs.

Cost reporting differences between contract and district operations are particularly evident in the area of facilities and equipment. The original cost of school bus garages and office facilities is included in transportation operating costs of contract operations but not district operations. In the case of contract operations, the expense incurred in purchasing facilities is accrued over a number of years and is taken into consideration in establishing a rate for contracted transportation services. This cost is then included in the authorized operating cost for districts with contract operations. In the case of district-owned operations, the original cost of facilities is included in the capital outlay fund and is not considered in determining the district's authorized operating cost. A similar descrepancy in cost reporting exists with regard to garage equipment, small transportation vehicles not eligible for bus depreciation, and equipment added to school buses after the buses are put into service. In each of these cases, the cost item is considered in determining the operating cost reported for contracted operations, but is excluded from the costs reported for district operations.

Due to rapidly escalating school bus prices, the bus depreciation component of the transportation aid formula may also underestimate bus replacement costs for districts operating their own fleets. The annual bus depreciation component of authorized operating cost is computed on a straight line basis at the rate of 12½ percent per year of the original cost of the district-owned bus fleet. This amount is included in the districts' authorized transportation cost, which is compared with the formula-predicted cost to determine the districts' aid entitlement. Of the total district aid entitlement, districts operating their own fleets must transfer annually to the appropriated fund balance account for bus purchases at least an amount equal to 12½ percent of the original cost of each bus until the cost of the bus is fully amortized.

Because of escalating school bus prices, the amount transferred into the bus purchase account for each vehicle over an eight year period is not sufficient to pay the full cost of a replacement bus. Therefore, districts purchasing new school buses are frequently required to supplement the amount available in the bus purchase account with a local school bus levy. During the past few years, the levy has ranged from about $5 million to $7 million statewide. In addition to financing the excess costs of eligible school buses, the school bus levy provides financing for small pupil transportation vehicles which are not eligible for bus depreciation aid, and for equipment added to school buses after they are placed in service.

In districts providing transportation service through private contractors, the full replacement cost of school buses must be included in the contract price in order for the bus contractor to remain in business over the long run. The cost of bus replacement is reflected in the contract price paid by school districts, and is included in the authorized operating cost of the districts for state aid purposes. Since these districts do not own school buses, they are not eligible for the school bus levy.

Cost reporting differences between contract and district operations may create certain inequities under the transportation aid formula. In general, the actual cost of district operations is underreported relative to that of contract operations in the area of facilities and equipment. To the extent that this underreporting lowers the regional average cost per pupil transported for districts with a given set of characteristics, the transportation aid formula will provide funding which is less than the actual cost of these districts.

If all districts in a region with a given set of characteristics are contracted, the aid formula will provide full funding for the actual average cost of these districts, including capital outlay and equipment costs which are reflected in contract prices. Approximately half will have predicted cost greater than actual cost, and half will have predicted cost less than actual cost. If all districts in a region with a given set of characteristics provide district-owned and operated transportation, the aid formula will provide full funding for the reported average costs, with half the districts having predicted cost greater than reported cost and half the districts having predicted cost less than reported cost. To the extent that the reported cost is less than the actual cost in the capital outlay and equipment areas, the aid formula will not fund the full actual cost, and the difference will be made up with the bus levy and with capital outlay funds.

If some districts in a region with a given set of characteristics provide transportation services through private contractors, and others provide these services through district operations, the aid formula will provide full funding for the average reported cost of these districts. If contract operations are approximately equal to district operations in efficiency and level of service, the costs reported by contract operations will be slightly higher than those reported by district operations, because the full cost of facilities and equipment for district operations not included in authorized transportation cost. Therefore, a majority of contract operations will have predicted cost less than reported cost, while a majority of district operations will have predicted cost greater than reported cost. While a majority of the district operations appear to be "gainers" under the aid formula, the total formula funding is less than the actual cost of transportation, including the nonreported facilities and equipment costs. Therefore, in this situation, the net effect of the cost reporting differences is to uniformly underfund both contract operations and district operations in relation to total actual transportation costs. The amount of the underfunding is equal to the amount by which the underreporting by district operations affects the regional average cost per pupil transported for all districts with a given set of characteristics.

The above analysis may be used to explain the differences observed in the impact of the aid formula on contracted and district-owned operations. In the metropolitan region, where a majority of all districts have contracted operations, the impact of cost reporting differences between contracted and district operations is very small. The regional average cost per pupil transported for districts with various sets of characteristics is determined primarily by the contracted districts, and any underreporting of actual costs by district operations does not significantly affect the regional cost comparisons. In the nonmetropolitan regions, where a majority of all districts provide transportation service using district owned and operated equipment, the impact of cost reporting differences may be larger. When contracted operations are compared with district owned operations, a higher proportion of district operations are "gainers," due at least in part to cost reporting differences.

In addition to affecting the determination of predicted costs for the second prior year, cost reporting differences between contracted and district operations also create potential problems with regard to the statutory cost escalator factor and softening adjustments provided in the formula. The statutory cost escalator factor is based on the projected increase in authorized costs between the base year and the current year. This increase includes the projected increase in bus depreciation amounts for district-owned operations and the projected increase in bus replacement costs for contracted districts.

If bus replacement costs are growing at a rate which exceeds the rate of growth in bus depreciation under the formula, the cost escalator may overestimate the rate of increase required by district operations, and underestimate the rate of increase required by contract operations. This situation will occur when the rate of increase in the cost of new buses over the two year period between the base year and the current year exceeds the average rate of increase in the cost of new buses over the preceeding eight years. On the other hand, if the rate of increase in the cost of new buses is declining, the statutory cost escalator may overestimate the rate of increase required by contract ~~district~~ operations. In the long run, these trends should offset each other, with no overall advantage for either contracted operations or district operations.

Finally, the difference in cost reporting affects the softening adjustments under the transportation aid formula. Because the full actual costs for contracted operations are included in the aid formula while those of district operations are not, contracted districts benefit more on the average from the softening adjustments than district-owned operations. The majority of contracted districts which appear to be "losers" under the qualify for softening adjustments which are added to their basic formula funding. These adjustments range from 20 to 75 percent of the cost which exceeds the basic formula amount. The majority of district operations, have their formula funding reduced because their reported costs fall below the basic formula funding level.

COMPONENT II

RECOMMENDED MEASURES FOR ECONOMY, FUEL SAVINGS, AND COST EFFECTIVENESS

The second major component of the study is to report on proposed measures for economy and cost effectiveness in school transportation. The legislation directed that the study report include recommendations on measures by districts to:

1. Reduce fuel costs
2. Conserve fuel
3. Increase the overall efficiency of transportation and related services.

Additionally, the legislation instructed that recommendations be made concerning measures by the S.D.E. which will assist districts in reducing their transportation costs. The recommendations which follow and the information to support them have for the most part come from professional journals, technical trade books and related resource papers and reference volumes. Such material has for many years urged school districts and bus operators to improve the quality of transportation programs through the various measures which will be recommended below. It was of special encouragement to find in the districts visited during the study that an impressive level of performance and a high degree of excellence in transportation is being delivered to Minnesota school students. Visits within the selected districts in the study indicated that serious efforts are being made to follow guidelines and directives which lead to operating good transportation programs.

Measures by Districts to Reduce Fuel Costs

The opportunities open to school districts for reducing the unit

cost of bus fuel are extremely limited. The cost of gasoline and diesel fuel has become one of the most expensive cost items in the transportation budget. While it is extremely urgent for districts to search out ways to reduce all cost items, there are but few measures available for reducing unit fuel costs, and those which do exist are not available to all districts.

Large capacity storage tanks may lead to a price advantage to those districts which buy fuel in quantities of 8000 to 10000 gallons. Even for that large quantity there is not always a significant price difference between truck load and pump price. Additionally there is the need to recognize that the cost of installation, maintenance and security of tank and pump equipment may far outweigh the relatively small price reduction.

It may be possible for school districts in some communities to lease underground storage from owners of closed service stations, but only where the cost savings justifies the added expense in order to gain the extra storage capacity. Such undergound tanks are occasionally available on farms where the need for storage no longer exists. For the small user the cost of acquiring large capacity storage is extremely high and carries with it a risk factor related to loss from either theft or leakage or defective tanks and equipment. Theft can be a particular problem where adequate security and protection is not available, the rule rather than the exception in most districts regardless of size.

An annual contract with a protected price or unit price pegged to cost at the local bulk plant may offer a method which small and medium sized districts can use in order to gain some cost reduction. Such an arrangement requires price protection for the bulk plant operator or dealer, which in times of rising prices is not always possible to obtain or guarantee. However, such arrangements carry the possibliity of accommodating both the district and the supplier in several ways. The district is assured of a fuel supply at a cost, though not firm nor predictable, which is fair to both parties to the contract. The supplier is reasonably assured the demand will exist through the school year and will be able to anticipate requirements. Additionally, the district is relieved of any concern for supply and the dealer need not be troubled with the prospect of competition or price cutting during the term of the contract.

Finally, it is possible in some situations and in some locations for school districts to shop for fuel at prices which are lower than those available from their regular suppliers. Gas and fuel oil are occasionally offered on what is referred to as the spot market. During such times it appears that fuel supplies can be obtained at prices below regular market or pump price. The practice of purchasing on the spot or open market may, however, carry some built-in problems for the district at later times when supplies are not plentiful. Since fuel allocations are determined on annual purchases made through one regular supplier, it is necessary to recognize that when supplies become scarce, previous spot purchases will not be included in the base allocation figures. In any event, it is apparent that numerous school districts are buying on the "open market" in anticipation that supply will not present a serious difficulty in the future.

Several observations coupled with words of caution are appropriate relative to considering obtaining fuel from sources other than a regular local supplier. In those cases where the school district is the largest volume customer of the local service station or bulk plant, a change to a supplier in a different community in order to gain a price advantage could work very adversely on the economic position of the local business establishment. There is the possibility in some communities that if school district purchases were discontinued or reduced in appreciable quantity, the supplier would be forced to cease operations. Such action, while giving the school district some small savings, would deprive the community of a service which might then be available only by driving several miles to obtain. Under such conditions the savings to the district would be offset to a greater extent by the inconvenience and added energy cost of driving or delivery to many other community members. Additionally, the school district which depends on the local service station for maintenance of its bus fleet and other vehicles has special reason to keep the local dealer operating and available.

With regard to the uncertain condition of the fuel allocation system and in view of the fact that there will always be the need to transport children to school, wisdom seems to suggest that some attention be directed to restructuring the allocation program. It would be wise to review the program prior to the time a critical shortage or related difficulty arises. Since, however, the program is the responsibility of the Federal Department of Energy, it is not possible to make a meaningful recommendation for alteration and change.

Summary of Recommended Measures by School Districts to Reduce Fuel Costs

It is recommended that school districts:

1. Consider the possiblity of installing or leasing large capacity fuel storage tanks. The districts should determine whether annual volume and usage justifies the expense and whether adequate maintenance and security can be provided.

2. Explore the opportunity to contract for a protected or guaranteed unit cost arrangement designed to reduce the impact of large price increases and fluctuations.

3. Investigate and be knowledgeable of the local fuel market to ensure that price offerings are the most favorable available.

Measures by Districts to Conserve Fuel and Increase Efficiency

Factors subject to school district control which substantially affect the quantity of fuel consumed may be grouped into four major categories:

1. Bus fleet management.
2. Maintenance, Driver Training and Fuel Control.
3. Transportation policy and administration.
4. Bus routing and scheduling.

Wise use and control within these categories can result in a reduction of both fuel consumption and costly maintenance, and also an increase in miles per gallon. In addition to close and careful containment of these major cost items there are transportation program support services which require constant attention. The expenses generated by routin maintenance, (including parts, repairs, overhauls, salaries and benefits for support personnel), along with garage rent and upkeep, insurance, equipment and depreciation all impact heavily on the total program. If a cost effective program is to be maintained, a daily control over direct and support expenses items is mandatory.

The reduction of fuel consumption can be effected in a number of ways through various parts of the transportation program. The district is in the position to exert the most influence on such programs, and increase efficiency while reducing costs.

Bus Fleet Management

First, the district can give consideration to adding diesel equipment when purchasing new buses. Even though initial cost is considerably higher than for gas powered engines, the increase in mileage and decrease in maintenance cost leads to a return of the extra expenditure in a relatively short period of time. Mileage of buses with gasoline engines ranges from 3 to 5 mpg, while diesel engines are reported to perform in the 9 to 11 mpg range. Savings also occur in diesel maintenance. Research reports indicate that gas powered equipment spends more time in routine maintenance than does diesel equipment. This is due in large part to the simplicity of diesel engines, their lack of a carburetor and spark plugs eliminating a lot of normal mechanical problems, their rugged construction and their ability to run almost indefinitely if properly maintained.

In addition to the purchase of new buses equipped with diesel engines, it is possible for districts installing new engines in existing equipment to convert to diesel power. New engines and conversion kits are now available along with technical assistance from dealers and from the school bus reconditioning program which operates at the State Correctional Facility at Stillwater.

There are disadvantages to diesels which should be recognized. There is extra cost in the purchase of diesel equipment whether for new buses or for diesel conversions. Separate storage for fuel is required. If the demand for diesel fuel accelerates, the cost will be certain to increase also, especially if a shortage develops. Mechanics working on diesel equipment require new and special training if proper maintenance levels are to be secured. Though not a major problem, diesels have been reported to be difficult to start in cold weather. This problem is a correctable with a regular electrical engine heater. It is true as well that diesel engines are noisier and tend to pollute differently than gas.

Propane powered school buses are not yet as numerous as those with diesel engines, however, the number which carry propane conversion units is growing and numerous districts are experimenting with this alternative fuel. Conversions can be made for costs well below those of diesel, between $1100 and $1500 per vehicle. Propane appears to give engines much of the same freedom from maintenance as do diesels because it is almost perfectly combusted, requiring no additives, and is nonpolluting. Fuel costs run approximately one-half that of regular gasoline. Mileage is only slightly less than that received from gasoline but fuel cost at 50% of gas coupled with low cost maintenance make conversion to propane an attractive possibility.

A number of districts have conducted pilot programs using propane with encouraging results. One district has already made plans to install more propane units because of their success with earlier conversions. There are extra costs, however, which need to be recognized. Payback is considerably longer than for diesel conversions; usually about twice as long. Installation of a propane unit includes additional weight of 200 pounds for the 20 gallon tank required to be mounted and secured on the vehicle. Finally, as with diesel fuel, propane cost has the possibility of large increases if useage expands and supply dwindles.

There is only small encouragement to be found in current experience for either alcohol or natural gas as a motor fuel. A local commercial vending organization is using natural gas to power a fleet of service and delivery vehicles in the Twin City area with good to excellent results, but the traveling range is small because of the size and weight of the supply tanks mounted underneath each vehicle. Only one school district in the nation is currently making a serious effort to properly test school buses on a natural gas program. In that case the use has been cost effective with natural gas unit cost at a level of about 1/4 to 1/3 that of gasoline. The fuel is clean, safe and dissipates very rapidly in the aid. Other benefits include longer engine life (due to the fuel being relatively free of corrosives), fewer oil changes, longer life for spark plugs, and easier cold weather starting (because natural gas is already in a vapor form). Conversion and storage costs, however, appear to be high at this early stage and the likelihood of sizeable increases in natural gas prices make considreration for this fuel a high risk venture on anything more than a pilot program.

Alcohol as a fuel for buses has not received wide support, and considerably more research is needed before encouraging recommendations can be made. A number of school districts have expressed interest in participating in a demonstration project as reported to the 1981 Legislature. A copy of the report is attached as Appendix C.

One additional measure of importance available to school districts and bus contractors that can produce impressive results in efforts to reduce fuel consumption is the school bus reconditioning program at the Minnesota Correctional Facility at Stillwater. The program has been in operation for several years during which time 85 districts have used the service provided to rehabilitate and recondition school buses which would otherwise be traded or junked. The program is designed to extend useful life by three or more years thus reducing the need and cost for new equipment. Of special importance is a record increased gas mileage for vehicles reocnditioned at the Stillwater facility. The program is recognized as a cost saving by the districts because the reconditioning cost is returned to the district over a three year depreciation schedule through the transportation aid formula. Further, the program has become particularly attractive since an increasing number of buses can be accommodated at the facility.

Maintenance, Driver Training and Fuel Control

A preventive maintenance program combined with continuing driver training and education is essential to fuel consumption control and reduction. Drivers trained to recognize performance changes of their school bus are the most important element of every maintenance program. Individual drivers are expected to report all mechancial problems after each trip. They are expected to conduct daily inspections for safety, checking the working order of equipment and lights and making certain that braking systems and emergency exits properly. Weekly and monthly inspections include a more thorough check list and are designed to avoid costly breakdowns and serious safety hazards. Inspection schedules should require special monthly and annual inspections as well as the safety checks by the State Highway Patrol.

Basic maintenance requires that engines be tuned regularly and that plugs, points and timing be checked to assure a maximum fuel economy. It is necessary to maintain and clean pollution control equipment and to keep tires properly inflated. Standard maintenance manuals are available with each unit, from the State Department of Education and from professional associations.

Driver education and training helps to retain experienced drivers and a continuing program of re-education will result in fuel economy and good maintenance. Joint workshops for drivers and shop personnel provide the opportunity to exchange ideas for improved driving, vehicle maintenance and fuel economy.

Good driver incentive programs are important to improve economy.

Prominently posted charts which show the most efficient buses and drivers can provide both an incentive and encouragement to drivers for exert extra efforts to improve. Awards for excellent driving and economy records can result in even further improvements.

For fuel control and security there is a special need to place responsibility in one individual. Gas storage tanks need to be kept locked and in some cases tanks on vehicles should be equipped with special locking devices. One person should be responsible for fueling all vehicles and for maintenance records of fuel useage, mileage, oil changes, lubrication and routine maintenance and repairs.

In a fuel economy program drivers are the key to success. They should be expected to drive smoothly and avoid hard acceleration and heavy braking. They should shift gears when necessary and avoid lugging or overspeeding engines. Speeds should not be excessive; engine warm-up time, depending on weather and temperature conditions, should be kept to a minimum and long idling eliminated. Special efforts should be made to increase miles per gallon performance.

When considered individually, recommendations for maintenance, driver education and fuel economy do not appear impressive. Collectively, and when followed daily as part of an integrated preventive maintenance program, the results are very important. There is a wealth of material and information available to each district which can be used to develop a sound and thorough maintenance program. Professional transportation journals, references from local libraries, maintenance manuals furnished by vehicle manufacturers, and guidelines and instructions from the State Department of Education, all can assist the operation of a responsible maintenance program.

Transportation Policy and Administration

The district administration, in addition to supervising the operation of the transportation program, the bus fleet, drivers, maintenance, inservice education and the fuel economy program, has the responsibility for developing the guidelines and rules for pupil transportation and administering the board policy. A number of policy actions and measures that could reduce fuel consumption are available:

1. Curtail or reduce field trips and activity trips.
2. Change athletic schedules to reduce transportation costs by limiting competition with district schools and by scheduling more than one athletic event per trip.
3. Cooperate with neighboring districts on field trips and activity trips.
4. Use smaller buses when possible on long trips.
5. Use buses rather than large numbers of private vehicles both for long trips and local transportation when possible.
6. Consider transportation costs in making education decisions(e.g., school scheduling)

School district administrators should give consideration to formation of committees to help plan, evaluate and review transportation programs and activities. Such committees would be in a position to make recommendations to both the administration and the local school board.

There is need for a contingency plan for each district in the event of fuel shortages and emergencies. The administration in each district is responsible for developing such a plan and should have it available well in advance of the problem.

In the area of contract negotiations with transportation employees it might be helpful to have a data and information exchange among neighboring districts well in advance of the negotiation meetings.

For districts which contract for transportation services a similar kind of arrangement is encouraged.

Economies are possible in some districts through negotiation for both maintenance and repair service and/or facilities with local, county or state highway shops during slack time in those facilities.

For those districts contemplating new garage installations it is worth exploring the possibility of electric radiant heating in the concrete floor. Electric power is delivered at a lower rate during night time hours when the heat can be used to heat concrete floors. The concrete retains heat during the day time hours nad eliminates the need for power consumption during high cost daylight hours.

Bus Routing and Scheduling

Among the measures school districts can consider to reduce fuel consumption, bus routing and scheduling appears to hold the most potential for sizeable cost savings. It is an area where technical assistance and expert help from experienced transportation personnel can lead to a considerable cost reduction for nearly every school district in Minnesota. It is an area where impressive results have already been made in curtailing transportation costs. Most important, it can be accomplished at relatively small cost to each district and with a cost outlay which is usually recovered many times over during the first year of a reorganized routing and scheduling plan.

A considerable amount of work has already been completed in a number of Minnesota school districts, and interest in new routing plans is growing. Until recently there has been less reason to be seriously concerned about the cost of transportation since the prices of gasoline, oil maintenance, equipment, and even salaries were low. With the rapid increase in the petroleum price structure and the inflation those increases have encouraged, it has become apparent that responsible and dedicated effort is necessary if quality is to be retained in pupil transportation programs. Consequently, new ideas and plans in bus scheduling and routing have developed during the last several years and results have been very encouraging to a growing number of school districts. The plans which have developed are uncomplicated systems, all of which rely on a work outline using standard district maps, a student census or location program, assignment of permanent bus stops and pick-up stations, and route design and scheduling. Route design is accomplished in some cases with the assistance of a computer based program, but the work can often be done adequately through visual and manual procedures. The process is inexpensive and can be completed for the most part by existing district personnel.

While new routing and scheduling programs for some districts have shown cost reductions of over 20 percent in the first year, it is more reasonable to anticipate reductions of 10 to 12 percent. The development of good districts maps makes possible annual updating designed to increase cost savings and speed up efficiencies throughout the school year.

A new routing and scheduling plan aims to reduce mileage and trip time, to operate buses at capacity loads and to reduce the number of bus stops. To achieve these objectives it becomes necessary where possible to lengthen distance between pick-up points, consolidate loads and routes, avoid stops on hills, eliminate farm yard runs where safety is not a factor and use improved main roads where available. Also, special runs are consolidated with regular routes and appropriate locations for bus stroage are found in order to conserve miles, fuel and driver time. The very nature of such a plan causes alterations and changes in patterns which have existed for many years.

Changes and new programs almost always cause concerns for those who are affected. Long standing patterns which are altered can also change time schedules and family planning, even work schedules. However, when the need and expected economy is properly explained inconveniences which arise can be accommodated by most families.

Most serious may be the threat which economy programs often cause to those who depend on the pupil transportation for their incomes. Since the purpose of routing and scheduling is to streamline the process and to reduce cost, the result of success is the elimination of one or two or even several routes. This in turn eliminates driver positions and results in an extra bus or two for which there is no immediate need. For the district the unneeded buses can be sold or traded. For the bus contractor it may represent a loss of income, even if payroll and employee expense is also reduced. Contractor opposition in such situations is understandable.

The state might wish to consider making computer assisted or manual routing and scheduling mandatory to accomplish cost and fuel savings. This represents the one special area in which every school district has an interest and in which efficiencies can be effected at small expenses. Technical assistance is available from a number of sources including State Department of Education.

It should be noted that some very substantial cost savings have already been made in a growing number of districts in Minnesota. This is particularly true of several districts in the northwest part of the state where an average mileage reduction of 21,000 miles per district has been effected through the use of a computer program designed to reorganize bus routes. One large district alone accounted for an 80,000 mile reduction in the first year with a corresponding elimination of five routes and five buses. It is encouraging to know that the reduction in miles and bus routes was accomplished without increasing student ridership time or total driver time (See Appendix D).

In a number of districts consideration is being given to working with other districts on cooperative arrangements to reduce mileage and buses. The purpose is to make greater use of bus equipment between two or more districts, to conserve fuel and reduce maintenance costs. In addition, opportunities to develop combined routing and scheduling plans are being explored. Many small adjoining districts are able to consider combined bus routing by staggering schedules and starting times for elementary and secondary schools. In doing so it becomes possible in many cases to transport all secondary students from the two or more districts for the early starting time and then return for all the elementary sutdents on a second run and a later starting schedule. This arrangement makes it possible to reduce the number of buses and drivers while maintaining the same rider time and quality of service. Such a plan, in addition to reducing the size of the bus fleets, is also responsible for cost saving from reduced mileage, insurance, depreciation, maintenance, garage space and other related items.

Summary of Recommended Measures by School Districts to Conserve Fuel and Increase Efficiency

It is recommended that to conserve fuel school districts:

1. Consider possible advantages of diesel powered buses when purchasing new equipment.

2. Consider conversion to diesel engines when replacement is necessary and is cost effective.

3. Explore the possibility of converting to propane fuel in order to take advantage of reduced fuel cost.

4. Follow current research and advances in engineering and alternate fuels particularly those using alcohol and natural gas.

5. Take advantage of cost savings through the use of the bus reconditioning and rehabilitation program at the Minnesota Correctional Facility.

6. Give consideration to incentives and bonus awards for drivers for repair-free driving.

7. Secure and lock gasoline supply and closely control the fueling of vehicles.

8. Maintain full gas tanks to avoid unnescessary evaporation.

9. Consider limiting the number of students permitted to drive private cars to school.

10. Utilize buses to transport both students and staff to necessary activities to curtail use of private vehicles.

11. Instruct and encourage drivers to:

    a) Drive smoothly - avoiding heavy acceleration and hard braking.

    b) Shift gears when necessary to avoid lugging and over-speeding.

    c) Maintain optimum tire pressures.

    d) Reduce engine warm-up time. Keep idling time to less than two minutes.

    e) Avoid full throttle.

The following measures could serve to increase the efficiency of transportation services:

1. Monitor the use of vehicles by using trip recorders.

2. Use analyzing equipment to ensure oil and fuel economy.

3. Install modulated cooling system fans which operate only when required.

4. Reduce the number of field and activity trips.

5. Reduce distance of athletic trips and arrange schedules so that several teams are transported on same day or evening to the same destination.

6. Retain experienced drivers for as long as possible.

7. Train drivers and emphasize good driving techniques for fuel economy.

8. Train new drivers on dead-head runs to conserve fuel.

9. Follow and maintain an approved maintenance program with emphasis on preventive rather than repair work.

10. Provide garage space, protection and engine heating facilities.

11. Consider garage storage space at end of route to avoid dead heading.

12. Minimize tire wear by regular inspections of wheel alignment and bearings.

13. Schedule joint workshops for driver and shop personnel to improve maintenance operations.

14. When possible, make use of the reconditioning program for buses at the State Correctional Facility in Stillwater to avoid new bus purchases.

15. Maintain accurate and systematic records for each vehicle, covering maintenance, fuel consumption, oil changes, lubrications, tune-ups, repairs, tire and battery replacements and replacement parts.

With regard to Improved Bus Routing and Scheduling Methods, it is recommended that school districts:

1. Review and evaluate present routing and scheduling programs.

2. Seek technical assistance from qualified individuals and organizations, including the State Department of Education, in order to develop more cost effective transportation and routing programs.

3. Meet and confer with adjoining district personnel to explore ways that cooperative efforts could lead to more efficient and cost effective transportation programs.

4. Make every possible effort to reorganize routing and scheduling programs so as to maximize the use of equipment and bus capacity.

<u>Measures by the State Department of Education to Assist Districts in Reducing Transportation Costs</u>

In regard to measures by the State Department of Education which will assist districts in reducing their transportation costs, it is recommended that:

1. The Department should provide technical assistance to all school districts which need help with bus scheduling and routing.

2. The Department provide information to school districts on converting buses from gasoline to diesel or propane fuels.

3. The Department provide technical assistance in the development of adequate maintenance programs.

4. The Department, with assistance of E.C.S.U. staffs, survey all school districts to explore ways adjoining districts can enter cooperative arrangements to reduce costs through consolidation of transportation programs.

5. The Department maintain a resource list of individuals and organizations which are available to provide technical assistance in the areas of computerized and manual routing, maintenance management, engine and fuel conversions and transportation program control.

6. The Department maintain a resource file on alternative fuels and related items which will effect school transportation programs.

7. The Department provide assistance to school districts which have high costs for transporting special education students.

COMPONENT III

ANALYSIS OF THE PUPIL TRANSPORTATION AID FORMULA

The pupil transportation aid formula establishes the method by which school district transportation services will be financed. The process of determining the formula must include the resolution of many complex policy and technical issues. Six important policy issues that must be resolved are 1) the amount or proportion of state funding, 2) the amount of local discretion over programs and services, 3) the amount of local discretion over property tax levies, 4) the degree to which the state aid allocation will be adjusted to reflect variations in local conditions and service levels, 5) the degree to which district property tax levies will be fiscally equalized by the state, and 6) the degree to which incentives will be provided for local cost saving efforts.

It might be deemed desirable to have high levels in all these areas, but each of these areas conflicts with some of the others. For example, a major conflict exists between the level of state funding and the amount of incentive for local cost saving. If the state reimburses school districts for 100% of actual expenditures for aid-eligible transportation services, districts have no financial incentive to implement cost saving measures.

Once the basic policy of the state has been determined, a number of technical issues must be resolved in developing a state aid formula to effectively implement this policy. The manner in which these technical issues are resolved will substantially affect the equity or fairness of the state aid distribution among districts. A wide variety

of funding models are available for financing pupil transportation, and considerable differences exist among the states in specific funding provisions. (These provisions are reviewed in a paper attached as appendix A.)

The alternative funding models may be classified into two major groups based on the methodology used to determine variations in state supported revenues among districts. Formulas included in the first group are based on actual district expenditures: all factors affecting district cost are thus implicit included in the allocation of state aid, including conditions beyond the control of the district, local policy decisions regarding service levels, and managerial efficiency. The result is that districts with comparable local conditions receive varying state supported revenue per pupil transported, depending upon actual cost variations resulting from differences in service levels and efficiency.

In contrast to the first approach, formulas included in the second group attempt to provide comparable funding levels for districts with comparable local conditions through an adjusted average cost methodology. The goal of this approach is to adjust the aid allocation to reflect cost variations resulting from conditions beyond the control of the district, but to exclude cost variations resulting from differences in service levels and managerial efficiency. One difficulty in implementing this approach is the technical problem of identifying the costs of efficiently providing comparable service levels in districts with varying local conditions.

In addressing this problem, a conflict exists between simplicity and accurate measurement of necessary cost variations. The simpler the formula, the more likely that all factors significantly affecting costs will not be recognized. A complex formula, however, may not be more accurate than simple formula if the selected factors do not form a reasonable cost determination model.

The Development of Transportation Aid in Minnesota

Percentage Reimbursement Formula (Prior to 1974-75)

Prior to 1974-75, the pupil transportation aid formula provided state funding for 80% of district expenditures for authorized transportation, up to a specified maximum amount per pupil transported, with remaining costs financed out of the district's general fund or an unequalized local levy. The reimbursement limit was set at $60 per pupil from the mid-1950s through 1970-71, and at $80 per pupil from 1971-72 through 1973-74. By increasing the limit from $60 to $80, the percentage of total authorized costs paid by the state was raised from 66.8% in 1970-71 to 79.3% in 1971-72.

By 1974, a number of problems with the percentage of cost reimbursement method were widely recognized. Districts with costs exceeding $80 per pupil due to factors beyond local control (such as sparsity) were funded at a lower percentage of total cost than other districts. Districts with high costs and/or low EARC property valuations per pupil transported were required to exert greater local tax effort to maintain an adequate transportation program than districts with low cost and/or high EARC property valuations. Districts over the maximum per pupil expenditure had a financial incentive to hold down costs, while districts under the maximum had a much weaker incentive.

Base Cost Formula (1974-75 through 1978-79)

For the 1974-75 school year, the formula was changed to 100% financing of base year costs times an inflation factor. Separate calculations were made for each category of transportation service. The base year costs were equal to the actual district expenditures for aid-eligible transportation services for the second or third prior year. These costs were expressed on a per full time equivalent pupil (FTE) basis. The purpose of the inflation factor was to adjust for changes in the cost of delivering eligible transportation between the base year and the aid year. Under this formula, the 1974-75 transportation funding for each transportation category in each district was computed as 1) the district's 1972-73 actual cost per FTE times a 1.15 inflation factor or 2) the district's 1974-75 actual cost per FTE, whichever was less, multiplied by the district's 1974-75 FTE count. The total aid was calculated by deducting the proceeds of a one mill property tax levy from the total formula funding.

For example, if actual costs in 1972-73 were $100 per FTE pupil transported for regular transportation and $500 per FTE pupil transported in handicapped transportation, then the maximum costs for aid purposes in 1974-75 would be $115 and $575 respectively (with the 15% increase). The total formula funding would equal the district's actual 1974-75 cost per FTE in each category or the formula limit amount, whichever was less. This amount was multiplied by the number of FTE's in the category. For example, say the district's actual cost per FTE was $110 for regular transportation and $700 for handicapped transportation, and the district transported 100 regular pupils and 10 handicapped pupils. The total formula funding would equal (100 x $110 = $11,000) for the regular transportation and (10 x $545 = $5,450) for handicapped. This is the limit to which the state would fund expenditures in each category. Expenditures beyond this amount would be absorbed by the district's general fund.

The districts were expected to levy a one mill property tax for transportation purposes. The amount which this brought in per FTE was subtracted from the total formula funding to determine the state aid.

This formula remained in effect through 1978-79 with changes in the inflation factor and the base year. By the end of this period, it was felt that the formula 1) gave the districts too little incentive to seek cost savings in pupil transportation, and 2) was inequitable in that districts with similar conditions and transportation needs received widely varying funding levels as a function of differences in actual base year costs. The equity problem was partially due to changing costs between the base year and the aid year resulting from changing enrollments and building conditions, and partially due to variations in base year service levels and efficiency.

The incentive problem with the base cost formula resulted because any increases in a district's costs became part of the base year costs for a future aid calculation. If a district was able to hold its cost increase below the inflation factor, its base cost for two or three years in the future was decreased by the cost saving, reducing future cash flows. Since the districts were paid the lessor of inflated base cost and actual cost there was nothing gained by reducing costs. If a district's costs increased by more than the inflation factor in one year, the district would have to fund a transportation deficit from its cash balances or its general fund that year, but its base cost for future aid computations would be increased by the amount of the deficit. Thus, there could be an incentive for districts to realize anticipated cost increases as soon as possible and little incentive for the district to seek long run cost saving measures.

The equity problem with the base cost formula resulted because variations in base year costs among districts reflected differences in service levels and managerial efficiency as well as differences in cost necessitated by factors beyond district control. Districts with low base year costs because of historically low quality of service, high managerial efficiency, or simply a favorable contract with a private operator were essentially locked in at the low base level, and were frequently required to supplement transportation aids with general fund revenue in order to maintain adequate transportation services. This situation was particularly detrimental to districts attempting to move from historically low service levels to a level of service approaching the state norm. Districts with high base year costs fared better under the formula: service levels substantially exceeding the state norm could be maintained with no local contribution if these high levels had been established in the base figures. In this manner, the state aid formula fully funded the cost of service levels well above state or regional norms for some districts, while other districts with historically low service levels could not move up towards the state norm without a substantial local contribution.

The 1979-80 Formula

The incentive and equity problems with the base cost formula created widespread dissatisfaction by the 1978-79 school year. There was considerable interest in defining a formula which would 1) provide more comparable of funding for districts with similar conditions and 2) provide an incentive for districts to be cost efficient. A portion of the Federal funding allocated to Minnesota for school finance research under P.L. 93-380, Section 842 was used to analyze alternative approaches for funding pupil transportation. The 842 consultant worked in cooperation with Senate Research staff to develop a modified base cost formula, which was adopted by the 1979 Legislature and implemented during the 1979-80 year.

Rationale

The formula changes adopted by the 1979 Legislature were designed to shift the basic methodology for computing transportation aid from an actual district expenditure basis to an adjusted average cost basis. Rather than funding districts based on their actual expenditures for the second or third prior year, the revised methodology would fund districts based on regional average expenditures for the second prior year, adjusted for factors affecting transportation costs which are beyond district control.

The goals of this change were to improve the equity of the aid allocation and to provide strong incentives for district cost savings. These goals would be accomplished by providing similar funding amounts for districts with similar characteristics and different funding amounts for districts with different characteristics: the funding amount for a given district would approximately equal the average cost for districts in the region with similar characteristics. As a result of the average cost methodology, about half the districts in each region would have formula funding greater than actual cost, and half would have formula funding less than actual cost. Districts spending more than the regional average for comparable districts due to higher quality of service or managerial inefficiency would receive funding less than their actual cost. The state would pay a portion of the difference between the basic formula amount and the actual cost through a softening adjustment schedule, and the district would pay the remainder from local sources. Districts spending less than the regional average for comparable districts due to historically low quality of service or efficient management would receive funding greater than their actual cost. This additional funding could be used to improve the quality of service or transferred to the general fund.

Aid Calculation Procedures

The 1979-80 pupil transportation aid calculation process included two major steps. In the first step, depicted in Figure 1, the 1977-78 formula - predicted cost cost per FTE pupil transported was determined using multiple regression analysis. In the second major step, illustrated in Figure 2, the 1979-80 funding amount for each district was computed by comparing the predicted cost (adjusted for inflation) with the district's actual cost, and applying a set of softening adjustments.

Two types of 1977-78 school district data were collected for the regression analysis program. To reflect district characteristics thought to affect the cost of pupil transportation, four data elements were collected for each district: square mile area, average daily membership, regular FTE pupils transported, and nonregular FTE pupils transported. These data elements were combined in various ways to create 28 factors to be used as independent or explanatory variables in the regression analysis program. The 28 variables included 7 basic factors listed in statute and 21 cross-products calculated by multiplying each basic factor by every other basic factor. The seven basic factors were: 1) the inverse of total FTE, 2) Regular FTE/ADM, 3) Regular FTE/square mile area (density), 4) the deviation of district density from the regional average, 5) ADM, 6) square mile area, and 7) Nonregular FTE. The basic factors were selected for the formula because of their presumed relationship with transportation costs, because they were readily available without requiring additional district reporting, and because

Figure 1

1979-80 Formula: Determination of Predicted Cost

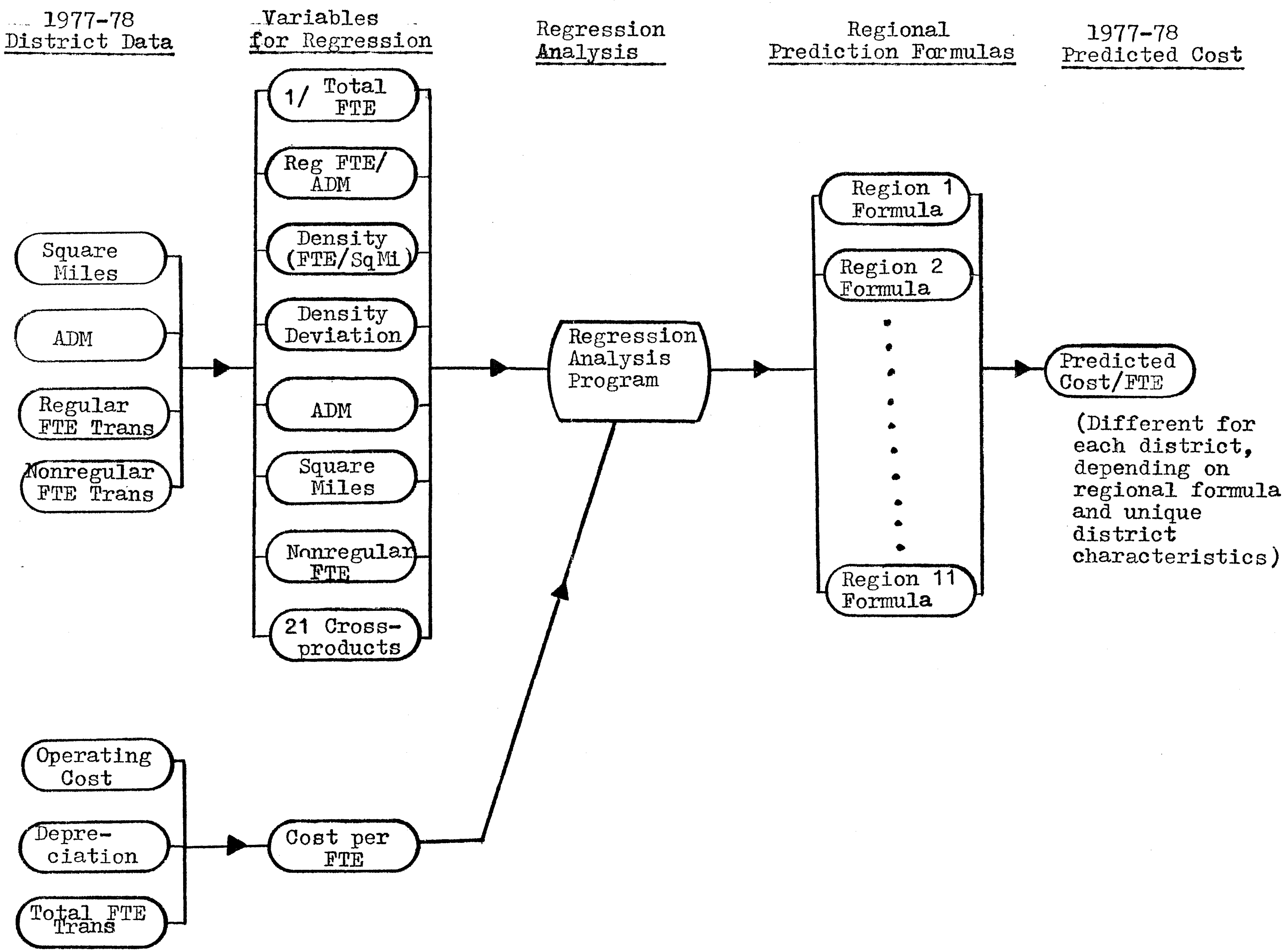
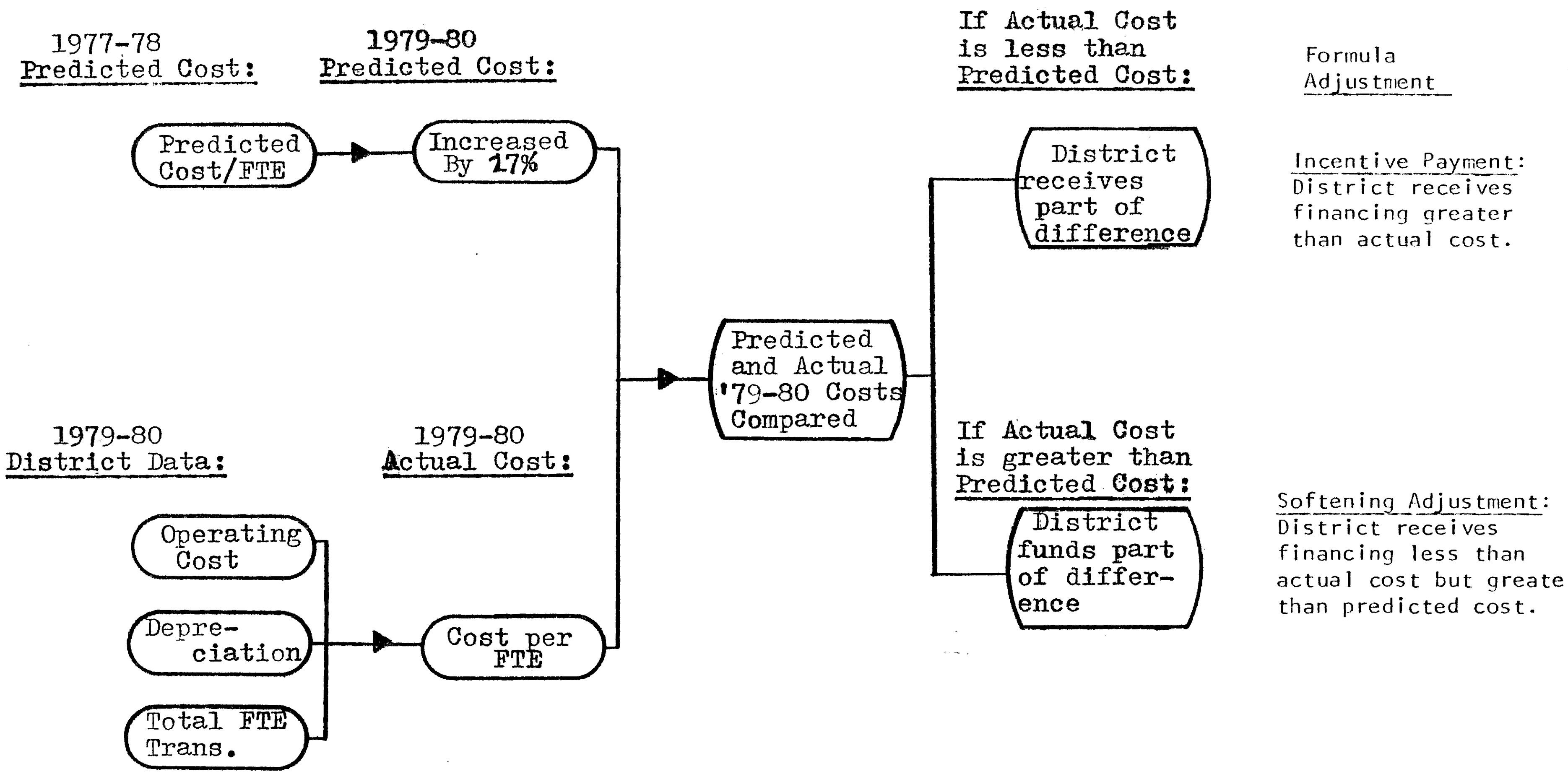


Figure 2

Comparison of Predicted Cost and Actual 1979-80 Cost



they were not subject to local determination. The 21 crossproducts and the coding of all variables in logarithm form were added after experimenting with several alternative equation forms in an attempt to maximize the proportion of variance accounted for (R^2 statistic).

The dependent or predicted variable for the regression analysis program, 1977-78 actual cost per FTE pupil transported, was calculated from three data elements as follows:

Cost/FTE = (Operating Cost + Depreciation)/Total FTE.

Bus depreciation, calculated on a straight line basis at 12½% of original cost per year, was included in the dependent variable in order to provide comparability between district-owned and contracted operations. Operating cost included the actual 1977-78 cost of all categories of aid-eligible transportation combined. One formula was used for all categories combined, rather than developing separate formulas for each service category, in order to simplify understanding and administration of the formula.

Multiple regression analysis is a statistical tool used to explain or predict the change in one variable due to the combined effects of two or more other variables. Because of the complex statistical procedures involved, it is generally completed through the use of a computer. In the transportation aid formula, the regression analysis program is used to predict differences among districts in transportation cost per FTE pupil, based on the relationship between district characteristics and actual cost per pupil transported. The regression analysis program was run separately for each region; districts were compared only with other districts located in the same development region.

The computer program used to build the regression formula for each region was "stepwise" in that the cost prediction formula for the region was built one step at a time. The first step was to select the single factor which was the best predictor of cost; this was the factor having the highest correlation with cost per FTE in the region. The second factor included in the cost prediction formula was the one which provided the best correlation or prediction in conjunction with the first characteristic. Additional factors were added one by one until none of the factors remaining out of the formula could meet the significance requirements set in running the regression procedure.

A single cost prediction formula was developed for each region: each factor entering the formula was given a weighting based on the direction and magnitude of its relationship with cost per FTE. Inserting the unique data elements for each district into the formula, a different predicted cost was determined for each district. Districts with similar characteristics were assigned similar predicted costs, while districts with differen characteristics were assigned different predicted costs.

The second major step in the aid calculation process was to determine the 1979-80 funding amount for each district based on a comparison of the district's inflated predicted cost and actual cost. This step is illustrated in Figure 2. First, the 1977-78 predicted cost was increased by a statutory escalator factor to adjust for cost increases between the base year and the aid year. This factor was set at 17 percent by the 1979 Legislature, and increased to 27 percent by the 1980 Legislature to adjust for rapidly-escalating gasoline prices.

Next, the districts' 1979-80 actual cost per FTE was calculated by summing the operating cost and bus depreciation amounts, then dividing by the total eligible FTE pupils transported. The actual and inflated predicted costs were then compared, and a softening or incentive adjustment was computed based on the difference. Districts with actual cost greater than inflated predicted cost received a softening adjustment: the funding amount provided was less than actual cost but greater than predicted cost. Under the softening adjustment schedule, the adjusted inflated predicted cost was equal to the inflated predicted cost per FTE, plus 10% of the first $10 difference between predicted and actual cost per FTE, plus 20% of the next $20 difference, with the difference between actual cost and adjusted inflated predicted cost per FTE not to exceed $20. Under the $20 cap, districts were guaranteed that the difference between actual costs and formula funding would not exceed $20 per FTE.

Districts with actual cost less than inflated predicted cost received an incentive payment: the funding amount provided was greater than actual cost but less than predicted cost. Formula funding was reduced by 10% of the first $10 per FTE difference between inflated predicted cost and actual cost, plus 20% of the next $20 difference, with the difference between actual cost and adjusted inflated predicted cost not to exceed $20. Under the $20 cap as applied to these districts, a district could not receive funding for more than $20 per FTE above its actual expenditure.

The districts' adjusted inflated predicted cost per FTE, determined through this process, was multiplied by the districts' total FTE pupils transported in all categories of aid-eligible service combined to determine the districts' total formula funding. The state aid entitlement for the district was computed by deducting the yield from a one mill levy on district 1977 EARC property valuation from the total formula funding. Districts operating their own buses were required to transfer to the bus purchase account an amount equal to 12½ percent of the original cost of the eligible bus fleet, plus 33 1/3 percent of eligible bus reconditioning expenses. In addition to state aid and the one mill levy, district revenue for pupil transportation included the proceeds of the school bus levy and the traffic hazards levy.

Analysis of Results

The 1979-80 formula was constructed during the 1979 Legislative Session under the constraints that the political process often places on aid formulas. The largest constraint on the analysts was to specify a model which both had some logical appeal and yet the results of which did not significantly reduce the supported funding for any districts. Another constraint was the limited time for development of the model. Despite these constraints, the 1979-80 formula significantly improved the comparability of funding for districts with similar conditions, and established strong incentives for district cost savings. Especially with the improvements passed by the 1980 Legislature, Minnesota became a leader in the use of cost incentive models for transportation funding. However, the results of the 1979-80 formula did not fully attain the objectives of the formula because of 1) technical problems in the design and implementation of the regression formulas, 2) incomplete adjustment for changes in the composition of district transportation programs between the base year and the aid year, and 3) underestimation of cost increases between the base year and the aid year. Most of these problems were subsequently dealt with by the 1980 Legislature.

The purpose of the regression formulas was to identify the costs of efficiently providing comparable transportation services in districts with widely varying local conditions. While the regression formulas did identify a portion of the necessary cost variations among districts resulting from varying local conditions, the accuracy of the formulas was reduced because 1) the 28 explanatory variables included in the formulas did not form a complete model for predicting transportation cost variations, 2) several regions did not contain enough districts to accurately assess cost variations resulting from differing local conditions, and 3) the statistical criteria used in the regression program permitted factors which were not significantly related to cost to enter the prediction formulas in order to maximize the proportion of variance accounted for (R^2 statistic).

If the predicted costs generated by the formula are to accurately reflect variations in the cost of efficiently providing comparable transportation services in districts with varying local conditions, the explanatory variables used in making the predictions must accurately reflect the factors underlying these cost variations. The explanatory variables should be chosen on the basis of a theoretical or logical relationship between them and the dependent variable, and together should form a realistic cost prediction model. If the regression model is to provide the basis for state aid distributions, it is also generally recommended that the explanatory variables be based on data which are 1) not subject to local control, 2) objective, 3) readily available on a periodic basis, and 4) easily audited. Finally, it is advantageous for explanation and understanding if the regression model is kept as simple as possible while retaining accuracy.

The data elements used in calculating the explanatory variables for the 1979-80 regression formula (square mile area, ADM, regular FTE and nonregular FTE) reflect the above considerations. They are logically related to transportation cost, largely beyond the control of local school districts, and are based on objective, readily available data.

They did not, however, represent all of the significant factors underlying transportation cost variations among districts. The variables not represented included certain factors beyond the control of the districts (e.g., proportion of students transported by non-regular service category, geographic conditions) and other factors subject to district control (e.g., quality and scope of service, managerial practices). The proportion of students transported in each nonregular service category and geographic conditions were excluded to simplify the model, with the idea that these factors did not make a substantial contribution to overall cost variations. Service levels and managerial data were excluded to provide incentives for cost savings.

Because a number of factors affecting cost were excluded from the regression model, fairly substantial differences would be expected between predicted and actual 1977-78 costs. However, because Minnesota districts have traditionally been reimbursed for pupil transportation on an actual cost basis, it was felt that the final formula would have to yield predicted costs which closely approximated actual costs in order to be acceptable to a majority of legislators. Therefore, additional analyses were completed in an effort to increase the proportion of variance accounted for. By coding each of the explanatory variables in natural logarithm form, and by adding the cross-products of each factor, the proportion of variance accounted for by the regression formulas was increased, and the average difference between predicted and actual costs was reduced. While the use of logarithms and crossproducts increased the proportion of variance accounted for, it also increased the complexity of the model, and did not reduce the difference between predicted and actual cost in a uniform manner for all districts.

A second problem with the application of multiple regression analysis in the 1979-80 formula was the small number of districts included in some regions. Minnesota's 436 school districts are grouped into 13 development regions. Separate regression formulas were run for each region. The number of districts per region ranges from 14 to 54; six regions (2, 5, 6E, 6W, 7E and 7W) have fewer than 30 districts.

It is technically possible to include 28 explanatory variables in a regression equation only if the number of districts included in the analysis is 30 or more. Because the number of districts was below 30 in six regions, the full set of explanatory varibles could not have been included even if all were significant predictors of cost. While the number of cases must be greater than the number of explanatory variables for the regression equation to be calculated, most authorities recommend that the number of cases be several times greater than the number of explanatory variables. The small number of districts in each regional regression formula, combined with the large number of explanatory variables, resulted in overestimation of the R^2 statistic and instability of the regression coefficients. Changes in the base data for a single school district could significantly affect the predicted costs for all districts in a region. The rate of increase in funding may not have been stable from year to year.

Third, the statistical procedures used in implementing the formula permitted factors not significantly related to cost to enter the prediction equations in order to maximize the R^2 statistic. The regional regression formulas were run using the regression component of the Statistical Package for the Social Sciences (SPSS). The SPSS package allows the user to set minimum standards for variables to enter the regression formula; if no standards are specified, the program uses minimal statistical criteria which permit most factors to enter the formula. These criteria (F to enter = 0.01, tolerance = 0.001, F to remove = 0.005) were used in the formula development and continued with the actual implementation of the formula. When these variables were added in the final steps of a regional regression run, the complexity of the formulas was increased, and the significance of the regression coefficients for factors already in the formulas was decreased.

Another problem, one that was not caused by the use of regression estimates, was the combining of transportation service categories in computing costs and aid. Under the previous base cost formula, costs and aid were calculated separately for each transportation service category (e.g., regular, handicapped, between schools). Under the 1979-80 formula, the categories were combined. This caused inequities in the aid calculations for districts with large changes in the proportion of pupils transported by service category between the base year and the aid year. Districts with growing incidence of pupils transported in high cost categories such as handicapped were underfunded, while districts with growing incidence of pupils transported in low cost categories such as between schools were overfunded. This situation resulted because the aid formula provided funding for the inflated predicted cost (based on the average cost for all categories combined) multiplied by the total FTE pupils transported. When pupils were added in a high cost category between the base year and the aid year, the level of funding was increased by the amount of the inflated predicted cost for each additional FTE pupil, while the cost was increased by a much larger amount. When pupils were added in a low cost category, the funding level was increased by the same amount, while growth in cost was much smaller. The softening adjustment schedule reduced this problem to a certain extent, but a significant distributional equity problem remained.

A third problem with the 1979-80 formula was the underestimation of cost increases between the base year and the aid year. This problem was not related to the use of regression estimates; it resulted entirely from underestimation of the rate of increase in district costs in preparing the transportation aid budget and appropriation. The 1979 Legislature set the 1979-80 cost escalator factor at 17% to reflect an assumed annual increase of 8% in cost per FTE pupil transported between the 1977-78 base year and the 1979-80 aid year. The 8% annual increase was based on a projected 15% annual increase in fuel cost and 7.5% annual increased in nonfuel operating cost. The assumed fuel price per gallon was \$.61, after deducting the 4¢ federal tax (which is not paid by school districts) and a factor for quantity discounts.

The 1980 Legislature increased the 1979-80 cost excalator from 17% to 27% to adjust for rapidly escalating fuel prices. The assumed fuel price per gallon was increased to \$1.03, after deducting the 4¢ federal tax and a 2¢ quantity discount factor. No adjustment was made in the nonfuel operating component of the budget. In actuality, nonfuel operating cost per FTE increased at a rate of 7.4% in 1978-79 and 14.7% in 1979-80, while the average fuel price per gallon for school districts was \$1.01. Overall, fuel costs were down \$1.2 million from the level assumed during the 1980 session. Nonfuel operating costs were up \$4.5 million, for a net increase in total cost of \$3.3 million. The softening adjustment schedule built into the 1979-80 formula funded about 40% of the cost increase, creating a $1,350,000 deficiency in the 1979-80 final payment appropriation and requiring a proration of 98.7 percent.

The average rate of increase in cost per FTE between 1977-78 and 1979-80 was 32 percent, or five percentage points higher than the 27 percent cost escalator. Because of this difference, 255 districts (58.4 percent) had aid entitlements less than actual cost, assuming that the deficiency is fully funded. One hundred-forty districts were at the $20 cap on the "loss" side, and 51 districts received incentive payments of $20 per FTE.

In addition to the technical problems described above, a year of experience with the 1979-80 formula revealed three other significant effects:

1) The formula placed more importance on district reporting of cost data. The formula for each region was based on the reports of all districts in the region. This put more pressure on the districts for uniform cost allocation and reporting since their reports affected all districts in the region by raising or lowering the regional average.

2) The new formula caused dissatisfaction in some districts because of difficulties in planning and budgeting for future years. Under the 1979-80 formula and the 1980-81 formula which succeeded it, district budgets depend on regional cost factors and regressions. School districts cannot calculate aid entitlements without relying on Department of Education figures.

3) The $20 cap on differences between actual cost and formula funding created a disincentive for efficiency in the affected districts. Because the difference between actual cost and formula funding was not

permitted to exceed $20, district costs in excess of the $20 level were fully reimbursed by the state. Given full state funding, the affected districts had no financial incentive to implement cost savings measures. Because the $20 cap was effective for only one year, an incentive was provided to increase expenditures for supplies and materials during 1979-80 in order to reduce necessary 1980-81 expenditures.

The 1980-81 Formula

Responding to problems identified by school districts and the Department of Education, the 1980 Legislature adopted several adjustments to the transportation aid formula. In addition to raising the cost escalator factors and appropriations for 1979-80 and 1980-81, substantial qualitative changes were made in the aid formula for 1980-81. The objective of these changes was to adjust the technical parameters of the formula to more fully accomplish the policy goals established by the 1979 Legislature: greater comparability of funding for districts with similar conditions, and stronger incentives for district cost savings. As in 1979, progress toward these goals was constrained by the assumption that the final formula must yield predicted costs which closely approximated actual costs in order to be implemented.

The fundamental problem with the 1979-80 formula was that the regression did not accurately model the determination of costs for efficiently providing comparable transportation services in districts with varying local conditions. Other problems included: 1) underestimation of cost increased between the base year and the aid year, 2) incomplete adjustment for changing composition of district transportation programs between the base year and the aid year, 3) low statistical significance requirements for factors to enter the regression formulas, 4) use of regional groupings too small to permit calculation of reliable regression estimates, 5) inaccurate cost and pupil reporting by some districts, 6) complex aid calculation procedures, and 7) cost savings disincentives created by the $20 cap.

Changes Adopted by the 1980 Legislature

To adjust for rapidly escalating gasoline prices, the cost escalator factors were raised from 17 percent for 1979-80 and 1980-81 to 27 percent for 1979-80 and 29 percent for 1980-81. These escalators reflected the estimated percentage increases in average cost per pupil transported between the base year (second prior year) and the aid year. To fund the higher escalators, the appropriations for 1979-80 and 1980-81, respectively, were increased by $4.2 million and $11.5 million.

Major changes adopted in the aid formula for 1980-81 and subsequent years included the following:

1) Several data elements were added to the regression analysis to better model efficient cost differences among districts.

2) To adjust for changes in the composition of district transportation programs between the base year and the aid year, service categories were made a part of the formula through the weighting of FTE pupil units by regional cost ratios for each service category.

3) Development regions with fewer than 35 districts were combined in order to improve the reliability, validity, and stability of the regression formulas.

4) The use of logarithms and crossproducts was deleted to reduce the complexity of the formula and to better model efficient cost differences among districts.

5) The softening schedule was adjusted and the $20 cap was deleted in order to strengthen cost savings incentives.

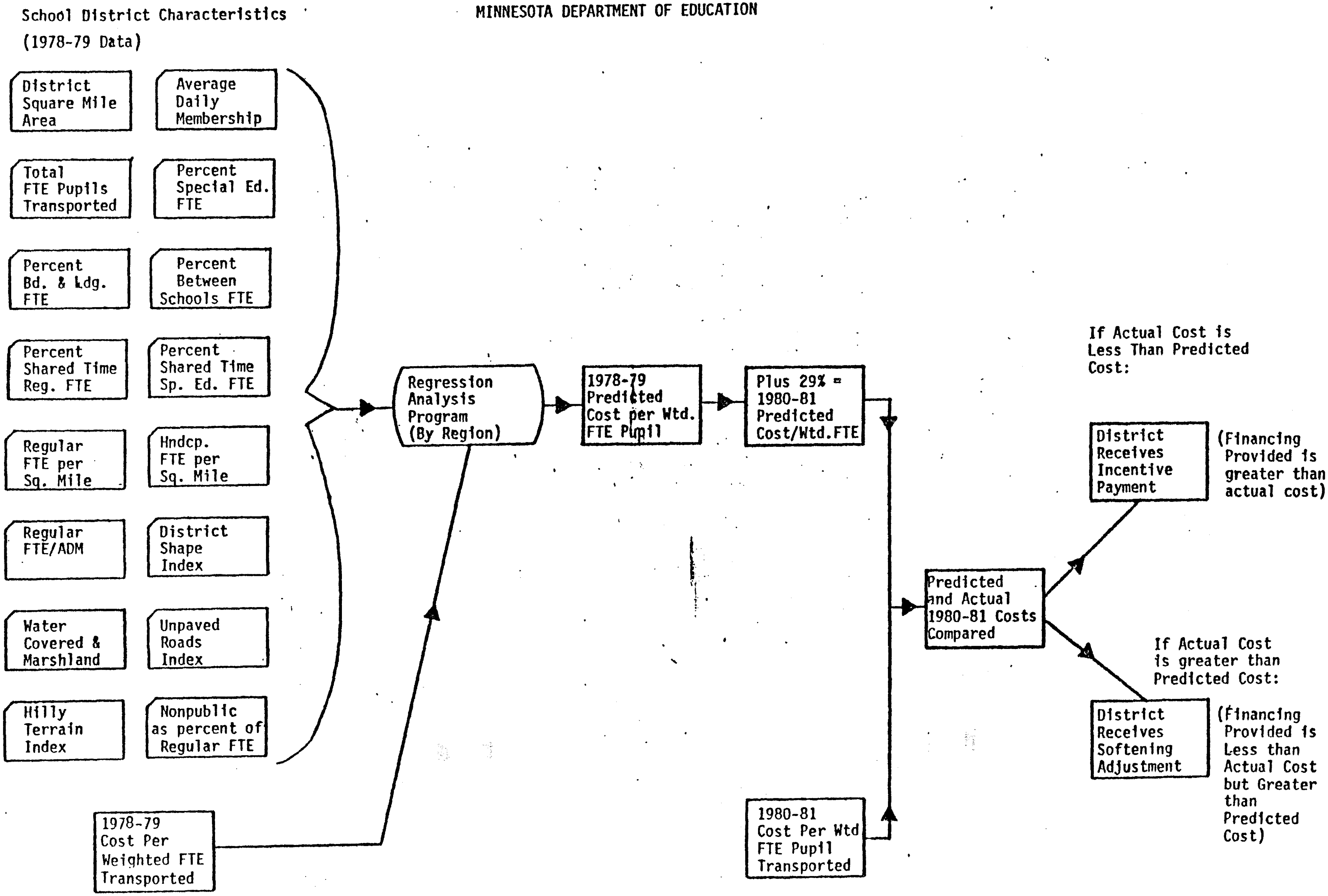
6) An excess handicapped transportation aid formula was adopted to provide additional state funding for districts with ADM below 2500 which have extremely high handicapped transportation costs.

7) Mobile units were added to the vehicles which qualify for the school bus levy and for depreciation computations under the transportation aid formula.

The new data elements for 1980-81 included seven factors to account for cost variations among categories of transportation service: percent of total FTE provided 1) special education transportation, 2) board and lodging, 3) between schools transportation, 4) shared-time regular transportation, and 5) secondary vocational center transportation; 6) percent of regular FTE transported to nonpublic schools; and 7) handicapped pupils transported per square mile. Four factors were added to adjust for cost variations resulting from geographic differences among districts: indexes for 1) district shape, 2) wetlands, 3) hilly terrain, and 4) road conditions.

Five of the seven basic variables included in the 1979-80 formula were added to these eleven factors to form a prediction model with 16 basic explanatory variables. The density deviation factor from the 1979-80 formula was deleted because it was highly correlated with the basic density factor. The nonregular FTE factor was deleted because data regarding specific categories of nonregular transportation had been added. The 21 crossproducts were deleted because they did not add new information to the model and only served to increase the R^2 statistic by permitting the regression program to capitalize on random correlations between different forms of the basic data elements and transportation costs for districts in a given region. The use of logarithms was deleted because their use in the 1979-80 formula was not based on any theoretical advantage over alternative coding procedures and because they increased the complexity of the model, making explanation and understanding of the formula more difficult. The 16 basic explanatory variables included in the 1980-81 formula are shown in the left column of Figure 3.

FIGURE 3
1980-81 PUPIL TRANSPORTATION AID FORMULA
STATE AIDS SECTION
MINNESOTA DEPARTMENT OF EDUCATION



In addition to the 16 basic variables, the square of each explanatory variable was included in the regression analysis, bringing the total number of independent variables to 32. The square of the density factor was included based on considerable research which has indicated that the relationship between density and cost per pupil is curvilinear (see literature review included in paper attached as appendix A). The squares of the remaining 15 factors were included because it was felt that the relationships between these factors and cost per pupil could also be curvilinear, and because the R^2 statistic was significantly increased in several regions by including the squares.

The weighted FTE pupil count was used in place of an unweighted FTE count at two steps in the aid calculation:

1) Cost per weighted FTE pupil rather than cost per unweighted FTE pupil was the dependent variable in the regression formulas; therefore, the predicted cost computed for each district was a predicted cost per weighted FTE pupil rather than a predicted cost per unweighted FTE pupil.

2) The predicted cost per weighted FTE pupil, adjusted based on the statutory escalator and softening factors, was multiplied by the number of weighted FTE pupils transported in the district during the aid year to determine the district's formula funding.

To determine the number of weighted FTE pupils transported in a district, the district's FTE pupil count in each transportation category was multiplied by the appropriate pupil weighting factor for that category. The pupil weighting factor is equal to the ratio of the actual regional average cost per FTE in a particular transportation category to the actual regional average cost per FTE in the regular transportation category. The pupil weighting factors used in computing transportation aid are based on data for the second prior year; the pupil weighting factors for the 1980-81 aid calculations are based on 1978-79 transportation data.

A primary advantage of the weighted pupil approach is that districts experiencing a growing incidence of high-cost transporation (in categories such as Handicapped) between the regression year and the current year will receive increased funding which more fully reflects cost increases than under an unweighted approach. Similarly, districts with growing incidence of low-cost transportation in categories such as Shared-Time Regular or Between Schools will not be overfunded for additional pupils in these categories.

As illustrated in Figure 3, other aspects of the aid calculation process remained essentially the same as in 1979-80. One significant difference was the percentage factors included in the softening schedule. The changes provided additional softening for districts with inflated predicted costs falling within $20 of actual costs, but eliminated the $20 cap. The percentage adjustments in the state aid allocation, based on the difference between inflated predicted cost per weighted FTE (WFTE) and district actual cost per WFTE, are as follows:

20% of first $10 difference in cost per WFTE;
40% of next $10 difference in cost per WFTE;
60% of next $10 difference in cost per WFTE; and
75% of the difference in excess of $30.

Another change for 1980-81 was the addition of an excess handicapped transportation aid formula, designed to provide additional state aid for districts with extremely high cost handicapped transportation programs. To qualify for this aid, a district must meet the following criteria:

(a) Average daily membership must be 2,500 or less;

(b) The total authorized transportation expenditure must exceed the district's total formula funding amount; and

(c) The authorized expenditure per weighted FTE in the Handicapped and/or Board and Lodging transportation categories (excluding depreciation) must exceed 140% of the district's total formula funding amount per weighted FTE (excluding depreciation).

The excess handicapped transportation aid entitlement for qualifying districts is equal to the smaller of:

(a) 80 percent of the difference between:

(i) the authorized expenditure per weighted FTE in the Handicapped and/or Board and Lodging transportation categories (excluding depreciation) and

(ii) 140 percent of the district's total formula funding amount per weighted FTE (excluding depreciation); or

(b) the difference between the district's total authorized transportation expenditure and the district's total formula funding amount.

It is estimated that approximately 100 districts will qualify for this aid in 1980-81, with total aid amounting to approximately $350,000. Excess handicapped aid will be paid on a reimbursement basis, after the district annual transportation reports have been received and edited.

Analysis of Results

The adjustments made in the transportation aid formula by the 1980 Legislature corrected many of the problems inherent in the 1979-80 formula. The explanatory variables included in the regression formulas provided a more realistic cost determination model. The use of pupil weighting factors adjusted more fully for cost increases experienced by districts with growing incidence of high cost transportation categories such as handicapped. The reliability of the regression formulas was improved through the use of larger regional groupings. The elimination of logarithms and crossproducts reduced the complexity of the formula. The excess handicapped aid formula improved the position of districts which had been underfunded because of extremely high costs for transporting handicapped pupils. The elimination of the $20 cap strengthened cost savings incentives.

The results of the 1980-81 formula however, did not fully reflect the established policy goals because of a conflict between 1) full financing of actual costs and 2) full financing of the costs necessary for efficient provision of mandated service levels. The case studies reported in Component I of this report indicate that substantial cost differences exist among at least some Minnesota school districts because of differences in quality of service, cost reporting, and managerial efficiency. Because these factors were not included in the transportation aid formula, and because no formula could be expected to completely reflect the multitude of factors affecting costs, sizable differences would be expected between predicted and actual costs. However, because Minnesota school districts have traditionally been funded on an actual cost basis and because additional levy authority is not provided for high cost districts, a formula resulting in significantly different funding levels was viewed as being unacceptable.

To resolve this conflict, low statistical significance requirements were permitted for the inclusion of explanatory variables in the regression formula. This minimizes the differences between each district's predicted and actual base year costs (and therefore maximizes the R^2 statistic). Additionally, a set of softening adjustments was applied to the difference between the individual district's inflated predicted costs (from the formula) and actual aid year costs. This ensured that the amount of funding provided would not vary considerably from actual cost.

Comparison with Base Cost Formula

An improved perspective on the 1980-81 formula may be gained by comparing it with the old base cost formula using the policy issues listed at the beginning of this component. The two formulas are similar in several important respects, and different in others:

1) The amount and proportion of state funding under both formulas depends on the statutory cost escalator and the appropriation. Either formula could result in an average funding level approximating 100% of costs, or any other desired proportion. In Minnesota, both formulas have been funded at approximately 100% of costs, less the yield from a one mill levy on district EARC property valuation. In the short run, the present formula requires a slightly higher state appropriation to attain a given funding level because (a) the present formula provides funding greater than actual cost for some districts, and (b) a smaller proportion of districts are funded at a level below actual cost. In the long run, the present formula may require a smaller state appropriation if the cost savings incentives are effective in encouraging districts to reduce expenditures.

2) Both formulas allow local discretion over programs and services; however, the funding provided under the base cost formula reflects the individual district's historical scope and quality of service, while the funding provided under the new formula reflects the average for similar districts within the region. Therefore, districts providing services above and beyond the average for similar districts would be required to finance a portion of this expense locally under the new formula, while the old formula would fully fund this expense if the historical cost pattern of the district reflected it.

3) With the exception of the traffic hazards levy, neither formula provides local discretionary levies for pupil transportation operating costs, although referendum or discretionary levies to replace general funds transferred to the transportation fund are possible. Both formulas permit a local school bus levy to finance bus replacement costs exceeding the amount available in the appropriated fund balance account for bus purchases.

4) Base cost formulas implicitly reflect all factors affecting district historical cost in the state aid allocation, including conditions beyond district control, local policy decisions regarding service levels, and managerial efficiency. The present formula is intended to adjust the aid allocation to reflect cost variations resulting from conditions not subject to district control; variations in service levels and efficiency are adjusted for only to the extent that they are reflected in the regional average for similar districts. However, because of the adjustments made in the present formula to ensure that the formula funding does not vary greatly from a district's actual cost, a portion of the cost differences resulting from variations in service levels and managerial efficiency is paid by the state. This portion varies among districts due to the different percentage factors included in the softening adjustment schedule, and to the use of factors with low statistical significance in the regression formulas.

5) Both formulas fully equalize the one mill district transportation levy. The one mill levy is therefore equivalent to a statewide one mill property tax levy. Neither formula equalizes the school bus levy or the traffic hazards levy, although districts are eventually paid for the amounts levied. This permits districts with high property

valuation per pupil transported to obtain a current given funding level with a lower tax rate on EARC property valuation than would be necessary in a district with lower property valuation per pupil transported.

6) Finally, the present formula provides stronger incentives for local cost saving efforts than the base cost formula. The present formula encourages local cost savings in two ways. First, because the base year predicted costs reflect the average cost for similar districts in the region, districts spending more than this average because of high service levels or inefficient management are assigned predicted costs below their actual costs, and districts spending less are assigned predicted costs above their actual costs. Thus, a financial incentive is provided for high cost districts to examine their historical cost levels in relation to neighboring districts and to adjust their operations to reduce costs. The base cost formula, by paying each district based on its own historical cost level, did not encourage districts to compare the efficiency of their operations with neighboring districts. Instead, an incentive was provided to keep costs at a high level in order to increase the base cost for future aid calculations. Because of the adjustments built into the regression model to minimize the differences between predicted an actual cost, the incentive effects of the present formula are less than could be achieved, but are nonetheless considerably stronger than the cost savings incentives provided under the base cost formula.

The incentive adjustment payments made to low cost districts under the new formula also encourage districts to reduce costs where possible. Where actual costs are incurred below the inflated predicted costs, the districts are permitted to retain a portion of the cost savings. Also, incurring a lower cost will not directly reduce future state-supported cost levels for the district, for the determination of future predicted costs for the district is determined by the cost experiences of all the districts of the region. The base cost formula, on the other hand, paid districts the lesser of formula limited cost or actual cost; no financial incentive was provided for districts to reduce their costs below the formula limit. However, one area in which the new formula has somewhat reduced the incentives for cost savings is the softening adjustment provision for districts exceeding their inflated predicted cost. Under the old formula, districts paid 100 percent of costs in excess of the formula limit. Under the new formula, the percentage of excess cost paid by the districts ranges from 25 percent to 80 percent, with the state paying the balance. Disincentives are particularly strong for districts with actual cost more than $30 above inflated predicted cost: for each dollar of cost reduction, state aid is reduced by 75¢ and the district's deficit is reduced by only 25¢.

In designing a funding formula for a complex service such as pupil transportation, a major conflict exists between simplicity and accurate measurement of necessary cost variations. The base cost formula was simpler than the present formula, but did not accurately identify variations among districts in the cost of efficiently providing comparable levels of service, and did not provide strong incentives for district cost savings. However, because the present formula is based on regional comparisons, individual districts cannot determine their aid entitlements without information provided by the State Department of Education. Additionally, the aid calculations are not easily explainable because of the large number of variables and the complex statistical methods used in the formula.

Despite some remaining problems, the 1980-81 formula represents a significant improvement over both the base cost formula and the 1979-80 formula. The funding amounts provided to districts with similar conditions are more comparable, and the incentives for district cost savings are stronger. Resolving all of the issues in pupil transportation finance is a complex problem which would require extensive analysis. Some simple changes which could improve the present formula are discussed in the next section of this component. A number of broad, long range transportation finance issues are discussed in the concluding section of this component and in the paper attached as Appendix A.

Improving the Present Formula

While the present transportation aid formula provides greater comparability of funding among districts and stronger cost savings incentives than previous formulas, further progress could be made toward these goals without changing the basic structure of the formula. The major problem in designing a formula to achieve these goals has been the conflict between either the full funding of actual costs, or the full funding of only the costs necessary for efficient provision of mandated services. By giving precedence to the former, there has resulted the adoption of formula adjustments which have ensured that a district's formula funding would not differ significantly from its actual costs. The procedures used in effecting these adjustments (low statistical significance requirements for the admission of explanatory variables, inclusion of square factors in the regression analyses, and softening adjustments) have slowed progress toward improved comparability of funding between districts and stronger cost savings incentives, and have increased the complexity of aid formula calculations.

To address these problems, it is recommended that consideration be given to the following adjustments in the transportation aid formula:

1) Increase the level of statistical significance required for explanatory variables to enter the final regression formulas. Under the SPSS regression program, this may be accomplished by raising the minimum F statistic for variables to enter the formula from the default value of 0.01 to 1.00. Additionally, the minimum F statistic for variables to be deleted from the formula should be raised from the default value of 0.005 to 0.50, and the tolerance factor for variables to enter the formula should be raised from the default value of 0.001 to 0.10.

2) Eliminate the squares of all factors except density. This would reduce the number of explanatory variables in the regression model from 32 to 17. (The square of density should continue to be included because it has a consistently strong relationship with cost per pupil transported; the contribution of the remaining squares is less significant.)

By increasing the statistical significance requirements and eliminating the squares of all factors except density, the following changes would result in the regression formulas and base year predicted costs:

(a) The number of factors included in the final regression formulas for each region would be reduced considerably.

(b) Each of the remaining factors would have a significant independent impact on transportation costs.

(c) Because of the reduced number of factors and their increased significance and independence, the final regression formulas would provide a more concise and explainable cost determination model. By examining the weightings (regression coefficients) assigned to each factor, the impact of the factor on a district's predicted cost could be readily determined.

(d) Less leeway would be provided to the regression program to artificially increase the proportion of variance accounted for (R^2 statistic) by capitalizing on low correlations between the explanatory variables and cost per pupil transported. Therefore, the average difference between predicted and actual cost would increase, but the reliability and validity of the regression estimates would be improved. The differences between predicted and actual cost would more closely reflect the impact of variations in service levels and efficiency. The cost savings incentives of the formula would be strengthened.

3) If the resulting differences between predicted and actual base year costs are viewed as being too great for the districts to absorb with general fund transfers, the differences between predicted and actual base year costs should be softened to the extent necessary to obtain the desired balance between full funding of actual costs and incentives for cost savings. Two possible methods of base year softening are as follows:

(a) Compute the adjusted base year predicted cost as the average of the base year predicted cost from the regression formula and the base year actual cost.

(b) Alternatively, compute the adjusted base year predicted cost as the base year predicted cost from the regression formula plus:

- 100 percent of the first $10 difference between base year predicted cost and base year actual cost, and

- 50 percent of the remaining difference between base year predicted cost and base year actual cost.

The latter alternative would fund the district for its base year actual cost if the difference between predicted and actual costs was less than $10. This would recognize that there is a certain margin of error in the predicted costs, reflecting the fact that no formula will be able to recognize all of the multitude of factors beyond district control which may affect transportation costs. Districts with base year predicted costs more than $10 below base year actual cost would have adjusted base year predicted costs below base year actual costs, and would therefore continue to have a financial incentive for cost savings. Districts with base year predicted costs more than $10 above base year actual costs would have adjusted predicted costs above base year actual costs.

4) To reduce the disincentive effect of the aid year softening adjustment schedule, the maximum softening percentage paid by the state should be reduced. One alternative would be to eliminate the 75 percent step for districts with aid year actual costs exceeding aid year predicted costs by more than $30, and to continue (for example) the rate of state payment at 60 percent for any difference exceeding $20. A second alternative would be to pay a straight percentage of the difference between predicted and actual cost, irrespective of the amount of the difference.

The adoption of these four adjustments would significantly improve the equity and cost savings incentives of the transportation aid formula. The complexity of the formula would be reduced, and the aid calculations would be more understandable. Because these adjustments would not require a major structural change in the formula, they could be implemented during 1981-82. However, it is recognized the problems caused by changing the formula each year.

Further Long-Range Funding Options

In designing long-term solutions for the transportation aid problem, the Legislature and Executive may wish to examine a broader range of financing options. This may involve both a review of basic policy decisions and further analysis of technical procedures for implementing these decisions. As outlined in the beginning of this component, the basic policy issues in pupil transportation finance include 1) the amount or proportion of state funding, 2) the amount of local discretion over programs and services, 3) the amount of local discretion over property tax levies, 4) the degree to which the state aid allocation will be adjusted to reflect variations in local conditions and service levels, 5) the degree to which district property tax levies will be equalized by the state, and 6) the degree to which incentives will be provided for local cost savings efforts. A number of alternative funding models are available for implementing the decisions reached on these issues. In reviewing these models, it is evident that a conflict exists between simplicity and accurate measurement of necessary cost variations.

The present Minnesota transportation aid formula provides funding for each district which approximates 100 percent of actual cost for aid eligible transportation services. A uniform one mill levy on district EARC property valuation is deducted from the total funding level to determine the state aid for each district. Statewide in 1980-81, state aid accounted for 81 percent of total formula funding. Because of variation in district EARC property valuation per pupil transported, state aid as a percent of total formula funding ranged from 13 percent in Becker to more than 99 percent in Red Lake.

The allocation of state aid is based on an adjusted average cost methodology which employs multiple regression analysis to adjust for factors affecting cost which are beyond district control. The aid formula is one of the most complex in the nation (See Appendix A), but also one of the most accurate in adjusting for local conditions affecting cost. Considerable local discretion is permitted over programs and services, but little discretion is permitted in local tax levies. Therefore, districts 1) providing services above the norm for similar districts or 2) operating inefficiently, must finance a portion of the excess cost from accumulated fund balances or general operating revenues. Because of the adjusted average cost methodology and the limitation of local levies, the formula provides strong incentives for district cost saving efforts.

Two common criticisms of the present formula have been 1) the complexity of aid calculation procedures and 2) the requirement for some districts to finance transportation fund deficits with general fund revenues. The transportation aid formula could be adjusted to address these concerns, but not without reducing the equity of the aid distribution and/or the incentives for district cost savings.

The formula could be simplied by reducing the number of variables used to account for cost variations among districts and/or by using more widely understood statistical procedures. These changes would retain the goals of providing 1) comparable funding for districts with comparable local conditions and 2) strong cost savings incentives, but would place a higher priority on simplicity and a lower priority on accuracy than the present formula. (A return to the old base cost formula would simplify the aid calculations further, but would not address these goals because no comparisons would be made among districts.)

Rather than attempting to adjust for all factors beyond local control which affect cost, the formula could be designed to adjust for only the single most important factor--density--or for density plus two or three other factors with the most significant impact on cost. Regression analysis would be the most accurate statistical tool for implementing this approach. The regression formulas would be considerably simpler and easier to explain than the present formulas because of the smaller number of explanatory variables. If density was the only explanatory variable, the determination of predicted cost could be depicted with a simple chart or curve showing the predicted cost for each density level.

An alternative statistical technique would be to simply calculate the average cost per pupil transported for various subgroups of districts. If density was the only explanatory variable, the predicted cost for a district would equal the average cost for districts in the same density grouping. If more than one explanatory variable was used, the average cost would be calculated for districts with each specified combination of explanatory variables. This approach might be easier to explain than the regression methodology, but would tend to create larger differences between predicted and actual costs. Controversy could develop over the assignments of borders for the various groups, as districts with only slightly different conditions but located on different sides of a border could receive substantially different funding.

Irrespective of the statistical techniques used, a formula based on fewer explanatory factors would result in larger differences between predicted and actual costs than the present formula, increasing the transportation fund deficits of some districts and requiring larger general fund transfers. Two alternatives could be used to address this problem: 1) apply greater base year softening adjustments of the type suggested in the preceding section of this component, and/or 2) adjust the transportation levy authority of school districts.

At present, school district levy authority in the transportation fund is limited to the basic one mill levy, the school bus levy, and the traffic hazards levy. There is no authority for a discretionary transportation levy to permit districts to expand the scope or quality of transportation service beyond the norm for comparable districts. Because the aid formula provides funding for a uniform level of service through an adjusted average cost methodology, districts providing transportation service above and beyond the norm for comparable districts may incur deficits in the transportation fund, requiring a transfer from the general fund. To finance this transfer, the district may reduce the level of general educational services or increase the referendum or discretionary levies in the general fund.

To reduce the necessity of general fund transfers, discretionary levy authority could be provided in the transportation fund. A number of alternative procedures could be used to implement such a levy; two alternatives for an equalized discretionary transportation levy are discussed below.

1) One alternative would be to provide discretionary levy authority for the difference between the district's predicted and actual base year cost per pupil, multiplied by the number of pupils transported. The state could equalize this levy by guaranteeing a certain yield per WFTE pupil transported for each mill. For example, if the guarantee was set at the state average EARC property valuation per WFTE, a one mill levy would be guaranteed to bring in approximately $35 per WFTE.

2) A second alternative would be to provide a variable level transportation aid program, based on the ratio of base year actual cost to predicted cost. Under this alternative, the formula funding level for a district would reflect the district's actual cost per WFTE. The basic transportation levy would be set at one mill, multiplied by the ratio of district actual cost to formula predicted cost.

For example, a district with base year actual cost per WFTE 10 percent higher than predicted cost per FTE would levy 1.10 mills rather than 1 mill, and the formula funding level for the district would reflect the district's actual base year cost rather than the predicted cost.

Either of these alternatives would reduce the need for district general fund transfers to cover transportation fund deficits, but would reduce the cost savings incentives of the present formula. Under the first alternative, financing of costs in excess of the formula predicted level would remain essentially a local responsibility, with the state contributing only the amount necessary to equalize the yield of the levy up to some designated level. The second alternative would reflect a more basic policy change, with the state assuming primary responsibility for financing the expenditure level selected by the district. Cost savings incentives would be eroded more by the second alternative than by the first, because the state would pay a much higher percentage of the additional cost.

Other changes in the basic provisions for financing pupil transportation could also be considered in the long run. With a concentrated research effort, the regression formulas could be refined to develop an explanatory model of actual district costs. This model would include factors both outside an within the control of the districts. Once such an explanatory model is completed, factors within the control of the districts could be taken out, and the remaining coefficients used to estimate the aid entitlements. This would make clear what factors were adjusted for in the formula and what factors were excluded, thereby permitting better explanation of the differences between predicted and actual costs. Other changes might also come out of that research, including revisions of the regional groupings and pupil weighting factors used in the present formula.

Another area in which additional research is needed is the comparability of costs for district-owned and contracted operations. One possible formula adjustment to improve the comparability of cost data would be to compute depreciation on district-owned buses on a replacement cost basis. This could be accomplished by inflating the inventory values based on 1) the state average rate of increase in school bus prices, or 2) an appropriate U.S. Labor Department price index.

A more fundamental long-run analysis would involve a reexamination of the need for separate categorical funding of pupil transportation. Pupil transportation costs are an integral part of the overall resource use and cost decisions facing school administrators. They are as much a variable in the delivery of educational services as capital resources and teacher salaries. The presence of separate categorical funding for pupil transportation, particularly at a level approximating actual costs, creates incentives which may lead to overutilization of transportation services. On the other hand, wide variations among districts in the cost of providing necessary transportation services must be equalized by the state if the goals of equality of educational opportunity and statewide uniform property tax effort are to be achieved.

For long run, it might be worth studying the possibility of combining transportation aid with foundation aid, and permitting the districts to make decisions regarding the best allocation of resources based on individual district characteristics and problems. This could be done, for example, by incorporating further research on efficient transportation costs into a modified sparsity factor in the foundation program.

In concluding this review of pupil transportation funding, it should be stated that the aid formula has been evolving in the direction of fairness and incentives for cost control. Problems remain to be solved. Some timely evolutionary changes have been suggested in the previous section. In this section, some alternatives for the future have been identified as a guide to discussion and investigation. Department of Education staff are prepared to respond to questions regarding the transportation aid formula, and to conduct additional analyses of transportation funding alternatives.

APPENDIX A

STATE PUPIL TRANSPORTATION FINANCE PROGRAMS*

Pupil transportation is an essential element in all state educational systems. Transportation service plays an important role in assuring that educational opportunities are equally available to all children within a state. Because transportation need and local wealth vary widely among districts, state support is necessary if adequate transportation service is to be provided in all districts with a reasonable level of local effort.

The importance of pupil transportation in state educational systems has grown rapidly during the past half-century as the magnitude and cost of the service have increased. In 1929-30, 1.9 million pupils, or 7.4 percent of total enrollment, were transported in the United States at a cost of $54.8 million. Pupil transportation was significant primarily in consolidated rural schools, and the scope of service was essentially limited to transportation to and from school. The school district consolidation movement, the growth of secondary education, improvements in motor vehicles and road conditions, and the increased availability of state support contributed to the growth of pupil transportation during the following decades. By 1949-50, 6.9 million pupils, or 27.7 percent of total enrollment, were transported at a cost of $214.5 million.[1]

The magnitude and cost of pupil transportation have continued to increase during the past three decades. In 1969-70, 18.2 million pupils, or 43.4 percent of total average daily attendance (ADA), were transported at a cost of $1.2 billion. By 1978-79, the number of pupils transported had increased to 22.9 million, 58 percent of total ADA, while transportation costs reached $3.3 billion.[2] Factors accounting for the increases included the expansion of transportation service in urban and suburban areas, increased utilization of transportation for instructional purposes,

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the introduction of busing for desegregation, inflation, and rapidly escalating energy costs.

The growth of pupil transportation service and cost has been accompanied by a growing recognition of the need for equitable state support programs. Based on research findings and the results of experimentation by the states, a number of alternative transportation funding approaches have been developed and implemented. This paper reviews the pupil transportation finance research, examines the present status of transportation support in the states, and analyzes the alternative methods available to the states for financing pupil transportation.

Review of Research and Related Literature

Most pupil transportation finance research since the 1920s has been directed at the development of alternative methods for measuring school district transportation need. Related literature has dealt largely with the classification and evaluation of funding models based on these methods, and with the review of state pupil transportation finance programs.

Measuring Pupil Transportation Need

Early research in pupil transportation finance was stimulated during the 1920s and 1930s by the development of the state minimum foundation program. In 1923, Strayer and Haig[3] developed a conceptual model for such a program, but did not specify how it could be operationalized. Mort[4] established a procedure for defining the state minimum foundation program, and divided the costs of the program into two groups. Group one consisted of costs that are equal for all classrooms or teacher units throughout the state. Included in group two were the costs of special provisions, such as pupil transportation, which are not uniformly required in all communities. Mort's research focused primarily on the measurement of group one costs, and did not attempt "to arrive at a fundamental solution of the problem of measuring the educational need represented by transportation cost."[5] The actual pupil transportation expenditures of rural districts were taken as a proxy measure of transportation need, and a method was developed for relating transportation costs to group one costs based on density. In 1926, Mort[6] called for an index of transportation costs which could be utilized in the state minimum foundation program:

> There is need for the development of an adequate index for measuring the cost of transportation of pupils. In some communities transportation of pupils is necessary in order that the state's minimum program may be offered. The costs of such transportation are legitimate responsibilities of the state as a whole... Up to this time, however, no adequate index of transportation cost has been developed. States that are seriously attempting to assume the responsibility for a satisfactory minimum program are handicapped for the lack of such an index.

Responding to the need specified by Mort, Burns[7] developed a transportation index in 1927. Burns based his index on two major concepts: (1) the transportation component of the state minimum foundation program for a given community should reflect the average level of transportation service and cost in communities with similar conditions, and (2) the factors used to measure transportation needs and costs should not be subject to local control. Reasoning that transportation need depends on the number of pupils transported and the average distance between home and school, Burns defined transportation need per pupil as the proportion of average daily attendance (ADA) transported, multiplied by the square root of the geographic area per school building.

Analyzing data for New Jersey counties, Burns found a curvilinear relationship between transportation need per pupil and school population density, where density was defined as average daily attendance per square mile. Regression equations of the form $Y=be^{ax}$ were developed to predict transportation need based on school population density. To determine the predicted transportation need for a county in dollars per pupil, the number of need units obtained from the regression equation was multiplied by the state average transportation cost per need unit.

Burns evaluated his transportation need index by examining the factors associated with variations between predicted and actual transportation need. It was found that "variability from the curve of transportation need, for places of like density, was caused by local policy with respect to type of school buildings and educational program".[8] Burns concluded that "the density of school population is a valid and reliable criterion by which the transportation need of a community may be predicted."[9]

Johns[10] reviewed the work of Burns and developed a refined procedure for measuring transportation need based on school population density. Like Burns, Johns sought to develop a measure of transportation need which would reflect the average service level and cost in communities with similar conditions, based on factors not subject to local control. Johns' chief criticism of the procedure developed by Burns was that it relied on area per school building as a weighting factor for measuring variations among communities in cost per pupil transported. Johns observed that a strong relationship between cost and area per school building had not been established, and noted that "it is unsafe to use any weighting factor for cost whose influence is not known."[11]

Johns divided the problem of measuring transportation need into two components. First, the community's need for transportation, in terms of number of students to be transported, was determined by analyzing the relationship between percent of ADA transported and school population density. Using regression analysis, equations of the form $Y = A/(X+K)$ were used to predict percent of ADA transported based on density. Second, the cost per pupil transported to be recognized in the state minimum program was determined using regression analysis, with actual cost per pupil transported as the dependent variable and density as the independent variable. The state-recognized transportation cost for each district was then determined by multiplying the predicted cost per pupil transported from the second step by the number of students to be transported from the first step. Analyzing data for five states, Johns concluded that "the density of school population is a valid, independent variable for the prediction of per pupil costs of transportation because the two variables are highly associated."[12]

The early pupil transportation studies of Burns and Johns measured pupil transportation need by estimating the proportion of students to be transported and determining an appropriate state-recognized cost for the transportation of these pupils. As walking distance requirements were established for determining state transportation aid eligibility, the number of pupils to be transported became a given, and pupil transportation finance studies focused more specifically on defining and measuring pupil transportation costs.

During the 1930s, alternative methods were developed for determining the transportation cost to be recognized in the state minimum foundation program. One alternative was to define transportation need based on cost per bus route rather than cost per pupil. Evans,[13] in a 1930 California study, used multiple regression analysis to predict the cost per bus route based on daily route mileage and seating capacity, and developed a table of predicted costs for bus routes having various combinations of mileage and seating capacity. Mort[14] applied the method developed by Evans in school finance studies in New Jersey and Maine. In the Maine study, separate equations were developed for routes on paved and unpaved roads.

Reusser[15] developed a similar approach in a 1934 Wyoming study. Observing that the number of children transported and route length were the two chief factors affecting the cost of transportation routes, Reusser calculated a pupil-mile measure by multiplying the number of pupils transported by route length. Regression equations were then developed for predicting the cost per route based on pupil-miles. The predicted costs for all routes in a district were summed to determine the state-recognized transportation cost for the district.

Evans and Reusser both considered the use of density in measuring transportation need, but found it unsuited to the conditions in their respective states. In California, Evans found that a density measure could be applied with favorable results in counties having a fairly uniform population distribution, but was inappropriate for counties having significant uninhabited areas. He commented that "in order to establish any definite relationship between density of population and the requirements in the way of transportation, it would be necessary to consider not the total areas of districts or counties under consideration, but that part of the area which is inhabited."[16] Reusser found little relationship between density and transportation need in Wyoming, concluding that "density of school population means little in Wyoming counties because of the vast regions which are unpopulated."[17] Johns addressed this problem in an Alabama study by deducting the area not served by transportation routes from the total area of the county.[18]

A second alternative method for determining the state-recognized pupil transportation cost for each district was to predict cost per pupil based on several independent variables. In a 1938 Ohio study, Hutchins and Holy[19] identified thirty factors affecting transportation cost, including fourteen beyond the control of local school boards and sixteen subject to local control. Of the fourteen factors not subject to local control, number of pupils transported, density (pupils per square mile), and road conditions were found to be the most significant in determining the cost of pupil transportation. A regression equation was developed to predict cost per pupil transported based on these three factors; the resulting predicted costs correlated .66 with actual costs.

To determine the impact of managerial factors on transportation costs, the sixteen factors subject to local control were correlated with the residuals from the regression equation. Managerial factors found to be significantly associated with the variations between predicted and actual cost per pupil included pupils transported per bus, average number of trips per bus, percent of bus capacity used, average number of bids per route, and percent of buses owned by the school district.

A third alternative, recommended by Lambert,[20] was the use of a detailed budget model. Under this method, the specific quantities of labor, materials, and equipment necessary to convey pupils in a district to and from school would be determined. The state-recognized pupil transportation cost would then be calculated by applying appropriate unit costs to the quantities of inputs required by the district. The unit costs would be developed through statewide cost analysis. Lambert contended that the budget model was preferable to formula-based funding methods because it provided for a comprehensive review of all factors affecting transportation costs, while the formula based methods could not. He was particularly critical of methods based on density alone, arguing that such methods oversimplify the problem, ignoring the impact of such factors as topography, climate, road conditions, population distribution, and the presence of uninhabited areas.

By the late 1930s, a substantial body of pupil transportation finance research was established. The three methods most commonly proposed for determining state-recognized pupil transportation costs were (1) determination of cost per pupil based on area density, or area density plus other factors not subject to local control, (2) determination of cost per bus route based on route length and bus size, and (3) the use of a detailed budget model.

Between 1940 and 1970, there were few published reports of pupil transportation finance research. Most of the studies conducted during this period were aimed at refining the methods developed during the 1920s and 1930s, and applying them in selected states. In 1949, Johns[21] reviewed the development of a refined method for predicting cost per pupil transported based on area density and road conditions. Barr,[22] in a 1955 study, reported on a formula utilized in Indiana for predicting transportation costs based on linear density. Linear density was defined as the number of pupils transported per mile of bus route.

During the 1970s, the school finance reform movement and rapidly escalating transportation costs combined to create a renewed interest in pupil transportation finance. Transportation analyses were included as a component of comprehensive school finance studies in several states. Responding to the problem of limited resource availability for education coupled with rising transportation costs, most of these analyses sought to develop transportation finance methods which would provide an equitable distribution of state aid among districts and a strong incentive for efficient operation.

National Education Finance Project (NEFP) studies conducted during the early 1970s included an analysis and assessment of pupil transportation finance methods in selected states. Farley, Alexander and Bowen[23] analyzed the Kentucky pupil transportation finance program in a 1973 NEFP study. It was recommended that the state recognized cost per pupil transported be determined based on the relationship between cost per pupil and net area density, using a regression equation of the form $Y = aX^b$. Net area density was defined as the number of pupils transported divided by the square mile area of the district served by school bus routes. In addition to the basic state allotment, a supplementary allotment was recommended for the cost of transporting exceptional children.

In a South Dakota study conducted by the NEFP, Frohreich[24] recommended that the relationship between cost per pupil transported and linear density be used to determine the formula adjusted cost per pupil transported, based on a regression equation of the form $Y = aX^b$. A weighting factor of 5.0 was suggested to provide supplemental financing for the transportation of exceptional children who could not be transported on regular transportation equipment.

Jordan and Alexander,[25] in a 1975 Indiana study, recommended the adoption of a similar linear density formula, with a weighting of 5.0 for severely handicapped children. Area density and district versus contract operation were considered for the formula but were rejected. It was observed that area density has the advantage of being fixed and not subject to local control, while linear density is dependent upon district routing decisions. Linear density, however, was preferred because it provides a more accurate measure of transportation need, particularly in districts with an uneven population distribution, natural barriers to transportation, or a necessity to provide bussing for desegregation. District versus contract operation was rejected in order to promote efficiency through the use of a uniform formula for all districts. It was emphasized that the formula should be recomputed annually to adjust for changing cost and density patterns.

During the late 1970s, a number of state school finance studies funded under P. L. 93-380, Section 842, included substantial transportation components. State-funded transportation research projects were also conducted in several states.

Frequently, these studies recommended the refinement or adoption of an area or linear density formula. In Arkansas, Alexander, Hale, et al.[26] concluded that the state area density formula should be adjusted annually using a curve of best fit between area density and cost per pupil transported to correct for changing cost-density relationships. It was also suggested that an adjustment factor be developed for the excess cost of transporting exceptional pupils, and that consideration be given to modifying the existing density measure by deleting areas not primarily served, or adopting a linear density measure. Stollar and Tanner[27] recommended that the Indiana linear density formula be refined to (1) reflect current cost-density relationships, (2) include a correction factor for inflation, (3) adjust for local wealth variations when aid reductions are necessary to match entitlements with appropriations, and (4) provide depreciation aid for district-owned vehicles.

An area density formula was recommended in a Maryland study conducted by Price Waterhouse & Company,[28] while researchers in Colorado,[29] Louisiana,[30] Tennessee,[31] Texas,[32] and West Virginia[33] recommended the adoption of linear density formulas. Alternative methods utilizing several independent variables were also analyzed in the West Virginia and Colorado studies. In West Virginia, Alexander et al.,[34] developed multiple regression equations for predicting cost per pupil transported based on thirteen factors reflecting area and linear density, road conditions, prevailing wage rates, dispersion of school buildings, and economies of scale. Linear density entered the equation first, accounting for 63 percent of the variance among districts in cost per pupil transported. A road conditions index entered the equation next, increasing the R^2 statistic to .66. The full thirteen variable prediction equation accounted for approximately 84 percent of the variance. As an alternative to the multiple regression approach, linear density alone was used to predict cost per pupil transported, based on a curvilinear equation of the form $Y = aX^b$. The alternative procedure was found to explain 66 percent of the variance in cost per pupil transported, and was recommended because it provided a reasonably high level of accuracy with a much simpler formula.

In Colorado, Gallay and Grady[35] used seventeen independent variables to predict cost per mile and cost per pupil transported. Included among the independent variables were area density, linear density, highway density, average teacher salary, income per pupil, number of pupils transported, total miles, number of conventional and small buses, and several geographic factors. The combination of linear density, highway density and average teacher salary was found to account for 70 percent of the variation in cost per mile. Linear density accounted for 84 percent of the variation in the cost per pupil, when both factors were expressed in logarithm form. It was concluded that cost per pupil transported is preferable to cost per mile as a unit of comparison, and that linear density is an appropriate independent variable for predicting variations among districts in cost per pupil transported. In a separate Colorado study, Bernd[36] recommended that state funding of pupil transportation be based on a line of best fit between cost per pupil transported and miles per pupil, the inverse of linear density.

Hennigan, Furno and Gaughan,[37] in a New York study, considered a predicted cost formula, but rejected it in favor of a two-tier aid ratio formula. Area density, number of pupils transported, and number of schools to which transportation was provided were used in a linear regression formula to predict district total pupil transportation cost. The predicted cost formula was not recommended because large deviations were produced between predicted and actual cost and because of the complex statistical procedures involved. In the first tier of the recommended formula, each district was provided with 95 percent of actual cost per pupil transported or 95 percent of the ninety dollars, whichever was less. The second tier provided for actual cost per pupil transported minus ninety dollars, multiplied by the following aid ratio: 1 - (.4 district wealth/state wealth). To adjust for cost variations among transportation categories, handicapped pupils were assigned a weighting factor of 6.0, and nonpublic pupils a factor of 2.0.

In an Illinois study, McKeown[38] developed a formula for predicting cost per pupil transported based on area density, linear density, mode of operation (district-owned, contractor-owned, or mixed), and district type (elementary, high school, or unit district). Eight dummy variables were used to control for mode of operation within district type, and eighteen additional dummy variables were used to account for mode of operation and district type within area density and linear density. The full 26 variable model was found to explain 56 percent of the variation in cost per pupil transported. Based on analysis of state average transportation costs for regular, special, and vocational education pupils, special education pupils and vocational education pupils were weighted, respectively, at 4.294 and 1.347.

Alternative Funding Models

Based on the findings of pupil transportation research and on the results of experimentation by the states, a wide variety of pupil transportation finance methods have been developed during the past half-century. Writers in the field of school finance have periodically classified these methods into major categories or funding models. Mort,[39] in a national school finance study conducted in 1933, identified five such models.

In the first model, transportation funding was based on a measure of transportation need such as the density approach developed by Burns and Johns. Objective measures of transportation workload, such as pupil miles, were used in the second model. In the third model, state authorities reviewed local transportation budgets to determine state-recognized costs. The fourth model was based on the actual expenditures of school districts, while the fifth model provided flat grants for pupil transportation.

Chase and Morphet[40] classified state transportation support methods based on provisions for equalizing fiscal capacity and on methods used to determine transportation need. Where transportation aid is provided within the basic state support program or as a special-purpose equalization grant, variations in local fiscal capacity are recognized in allocating state aid. Special-purpose flat grants do not adjust for variations in local fiscal capacity. Methods used to determine transportation need included (1) density formulas, (2) percentage reimbursement formulas, (3) approved budgets, and (4) allowable cost reimbursements based on standard unit costs.

Featherston and Culp[41] grouped state transportation aid formulas into four general categories. A flat grant per pupil transported was provided by states in the first category. Included in the second category were state provisions to reimburse districts for part or all of the cost of transportation, usually with certain limitations. The limitations could take the form of a percentage reimbursement, a ceiling on reimbursible unit costs, or a procedure for determining allowable costs. In the third category, approved transportation costs were determined based on the average unit costs for districts with similar characteristics, such as density of transported population. The fourth category included states in which approved transportation costs were calculated based on a formula composed of factors found to bear a relationship to variations in transportation costs, such as density, road conditions, number of buses, bus miles, and pupil miles.

State pupil transportation finance methods were classified by Stollar[42] into six basic funding models: (1) no state aid for transportation, (2) state flat grant per pupil transported, (3) full recognition of transportation cost variations beyond district control due to factors such as density and wage levels, (4) state ownership and operation of the transportation system, (5) state payment of the approved cost of transportation, and (6) state payment of a fixed percentage of actual costs.

Skloot[43] suggested that state funding formulas for pupil transportation may be divided into two basic groups. Formulas included in the first group are based on individual district experience, while those in the second group are based on fixed cost units or average costs. The experience-based model provides a reimbursement to districts for a portion of actual or approved costs; the level of funding is based on the workload and expenditures of the individual district. In the fixed unit cost model, districts with similar unit characteristics receive similar funding, irrespective of workload and expenditure variations due to differences in local policies and management practices. The experience-based model is attractive from a local perspective in that funding levels reflect actual costs; however, the fixed unit cost model is preferable from a state perspective because it provides an incentive for efficient operation and provides comparable funding for districts with comparable unit characteristics.

Criteria for Evaluating State Support Programs

Several criteria for evaluating state pupil transportation funding programs have been suggested in the school finance literature. In an early study, Mort[44] proposed two basic criteria. First, the funding method should be based on the cost of providing a transportation program of uniform quality throughout the state. Cost variations due merely to differences in local policy should not be recognized. Second, "the additional cost involved in transporting atypical children" should be fully recognized.[45]

Johns, in a 1949 study, concluded that no method of state support for pupil transportation is fully satisfactory unless it:

1. Provides adequate transportation services for all pupils who need it.
2. Encourages efficiency and discourages extravagance in local transportation management.
3. Is based on a completely objective formula, leaving nothing to the subjective judgement of state officials.
4. Is based on an equitable formula which takes into consideration all substantial variations in necessary transportation costs resulting from factors beyond the control of local boards.
5. Is part of a balanced comprehensive foundation program of education financed by an equitable taxing system.[46]

Featherston and Culp[47] recommended that the state pupil transportation support program: (1) take into account the factors which cause substantial variation in justifiable costs, such as density, road conditions, and prevailing wage levels; (2) be as simple as possible while retaining accuracy; (3) exclude factors subject to local manipulation, which may encourage inefficiency; (4) be based on past experience so as not to radically depart from established practice; (5) be as objective as possible; and (6) encourage efficiency in local transportation management. Similar criteria have been suggested by Stollar,[48] Bernd, Dickey and Jordan,[49] and Jordan and Hanes.[50]

Evolution of State Support Programs

While the history of pupil transportation in the United States is as long as that of the nation itself, state support for pupil transportation was not widely established until the 1920s. Prior to the mid-nineteenth century, the transportation of pupils was considered a parental responsibility, and no public funding was provided. With the advent of compulsory attendance legislation and the school consolidation movement, the need for public financing of pupil transportation became widely recognized. In 1869, Massachusetts became the first state to authorize the expenditure of public funds for this purpose.[51] By 1900, eighteen states had enacted pupil transportation laws, and by 1919 the transportation of pupils at public expense was authorized in all 48 states.[52]

Most of these early laws authorized local expenditures for pupil transportation, but did not provide state aid. Only four states provided aid for pupil transportation prior to 1910.[53] New Jersey and Wisconsin provided a flat amount per pupil transported, while Connecticut and Vermont based state aid allocations on a percentage of actual cost, not to exceed a certain amount per pupil. In other states, the financing of pupil transportation was generally regarded as a local matter.

With the development of the state minimum foundation program during the 1920s and 1930s, state participation in pupil transportation finance increased substantially. In 1933, Mort[54] reported that 32 states participated to some degree in funding pupil transportation. Fourteen states included approved transportation cost in the basic state school support program, eight states provided flat grants, and six states reimbursed a percentage of district expenditures. Delaware and North Carolina provided full state funding of transportation costs. Two states provided for the transportation of pupils from unorganized territory or districts unable to maintain schools to other districts.

In general, however, the level of state support was low, often requiring a substantial unequalized local contribution. Mort concluded that "less than one-third of the states are rated as having provisions for the transportation of pupils which are sufficiently adequate to guarantee educational opportunities to children not living within walking distance of school."[55]

After 1933, the number of states providing aid for pupil transportation and the level of state support gradually increased. The methods used to allocate transportation aid grew more refined and complex as the procedures developed through research were adopted in several states. By 1948, all but eight states provided aid for pupil transportation. Sixteen states distributed transportation aid as a component of the basic state support program, eighteen through special purpose flat grants, two through special purpose equalization grants, and four through some combination of these methods.[56]

Procedures used to determine the transportation aid allocation varied widely among the states. Eleven states reimbursed districts for a percentage of costs, eight states employed a density formula, and four states based aid allowances on approved budgets. Seventeen states provided allocations for a portion of authorized costs based on a variety of standards or limitations, such as a maximum amount per bus, per pupil or per mile, or a unit cost schedule for various budget items.[57]

In 1965, Featherston and Culp[58] reported that forty-four states provided aid for pupil transportation. Transportation aid was included in the basic support programs of twenty states, while twenty-two states funded pupil transportation through categorical aid programs, and two provided transportation funding in both basic support and categorical programs. Procedures used to determine the allocation of transportation aid among districts varied widely. Two states provided a flat grant per pupil transported, nine states reimbursed districts for a percentage of transportation costs, ten states provided funding for approved expenditures, and twenty-three states employed formulas composed of factors associated with variations in transportation costs. Most of the formulas were used to determine allowable cost per pupil transported. Density of transported population was a primary factor in the formulas of ten states, while mileage was a major factor in eleven state formulas. Road conditions were used in the aid calculation process in six states. In general, more than half of the funding for pupil transportation was obtained from local sources.

Jordan and Hanes,[59] in a 1978 survey, reviewed several aspects of state pupil transportation finance programs, including the level of state support in relation to total expenditures, travel distance eligibility requirements, and factors used in distributing state aid. The level of state support could not be identified for six states providing transportation funding as an element in the basic state support program. Of the remaining forty-four states, fourteen provided less than fifty percent of total transportation expenditures from state sources, fourteen provided between fifty and seventy percent, and sixteen provided more than seventy percent. This level of support reflected a significant increase in state funding of pupil transportation since the mid-1960s.

Statutory requirements specifying minimum travel distances from home to school as a precondition for state aid were found in thirty-one states. Twenty-four of these states specified a single minimum distance; one mile was used in five states, one and a half miles in eleven states, and two or more miles in eight states. In seven states, travel distance requirements for state aid eligibility varied by grade level, with longer distances required for secondary pupils than for elementary pupils.

Considerable differences were found among states in the factors used in distributing state transportation aid. Expenditure per pupil transported was used as a principal criterion in determining the aid allocation in eleven states, while seven based the state aid allocation primarily on a density measure, six utilized bus capacity, and two provided flat grants. In several states, a combination of factors was used;

the set of factors employed in nineteen states suggested that an efficiency or average cost concept was used in the allocation of funds.

State Pupil Transportation Finance Programs

At present, considerable diversity exists in state provisions for financing pupil transportation. State aid as a percentage of total transportation expenditure ranges from zero to one hundred. State support is provided for the transportation of nonpublic school pupils in approximately one-third of the states, predominantly in the northeast and midwest. A majority of the states have established minimum travel distances from home to school as a requirement for state aid eligibility, ranging from less than one mile to four miles. Factors used in allocating state aid among districts vary widely; some states base aid allocations on individual district expenditures, while others use detailed budget models, density formulas, or fixed unit cost formulas.

Detailed information concerning present state support programs was obtained for this study from a questionnaire submitted to each state department of education. Additional data regarding expenditures and state aids for pupil transportation were obtained from reports of the National Association of State Directors of Pupil Transportation and the U. S. Office of Education.

State Aid as a Percentage of Expenditures

In 1978-79, total public expenditures for pupil transportation in the United States amounted to $3,341 million.[60] Identifiable state aid for pupil transportation totaled $1,835 million, or approximately 55 percent of expenditures.[61] This figure underestimates the level of state support for pupil transportation in that transportation funding provided through basic state support programs was excluded for at least five states in which amounts specifically for transportation could not be identified. Adding estimated state transportation funding of $80 million for these states, the total level of state support for pupil transportation in

1978-79 was approximately $1,915 million, or 57 percent of total expenditures.

Among the states, the amount of state aid as a percentage of transportation expenditures varied substantially in 1978-79. New Hampshire was the only state providing no support for pupil transportation. In Hawaii and South Carolina, on the other hand, the pupil transportation systems were state owned and operated; actual expenditures were paid directly by the states with no local contribution. Of the remaining 47 states, seven provided state aid for less than forty percent of expenditures, eighteen for between forty and sixty percent, fifteen for between sixty and eighty percent, and seven for more than eighty percent. In twenty-three states, the local contribution to pupil transportation funding was equalized by the state, either by including the transportation entitlement within the basic state support program or through an equalized levy within the categorical transportation aid program. In the remaining states, local levies for pupil transportation were not equalized by the state.

Travel Distance Eligibility Requirements

Minimum travel distances from home to school have been established as a requirement for state aid eligibility in at least thirty-seven states. Twenty-eight of these states specified a uniform distance for all grade levels in 1980-81, while nine specified longer distances for secondary pupils than for elementary pupils. Of the states specifying a single distance for all pupils, seven set the minimum distance at one mile, eleven at one and a half miles, six at two miles, and four at greater than two miles. The longest distance requirements were found in the sparsely settled plains states: Kansas and South Dakota established a two and a half mile minimum, while Montana employed a three mile minimum, and Nebraska used a four mile minimum. Travel distance requirements were generally not applied to handicapped pupil transportation; several states also waived distance requirements where hazardous traffic conditions were present.

Factors Included in State Aid Formulas

In 1980-81, a variety of factors were used in state transportation aid programs to determine school district transportation need. Programs based primarily on actual or approved district expenditures were utilized in seventeen states, while seven employed detailed budget models, twelve used density formulas, and eleven employed fixed unit cost formulas.

Among the states using an actual or approved district expenditure approach, several different methods were used to limit or control the state portion of total costs. In nine states, the state share was limited to a fixed percentage of actual or approved expenditures. South Dakota provided funding for fifty percent of actual cost, not to exceed a certain amount per mile. In Oregon, school districts were reimbursed for sixty percent of approved costs for the second prior year. Wyoming included seventy-five percent of actual transportation costs in the state foundation program, while Michigan provided categorical funding for up to seventy-five percent of approved transportation costs. West Virginia provided funding for eighty percent of nonsalary operating costs, plus a flat amount per bus driver and a bus depreciation allowance. Idaho and Nevada included eighty-five percent of authorized transportation costs in the state foundation aid program. New Jersey supplied categorical funding for ninety percent of the cost of approved bus routes, while New York included ninety percent of approved transportation costs in the basic state support program.

Eight states determined the state share of pupil transportation expenditures by deducting a certain amount from total actual or approved costs. In Maine, 100 percent of transportation costs for the second prior year were included in the state foundation program. Massachusetts provided a categorical reimbursement for 100 percent of authorized costs less five dollars per pupil in average daily membership. In Illinois, districts were reimbursed for the cost of transporting eligible pupils less a qualifying amount, or sixteen dollars per eligible pupil, whichever was greater. Pennsylvania provided funding for approved costs less a qualifying amount, with the approved cost equal to the lesser of actual cost for authorized transportation or a formula providing standard unit rates for various cost components. In California, state aid was provided for approved prior year expenses less a qualifying amount; approved expenses were limited to statewide median expense per bus day, plus twenty-five percent, based on sixteen bus classifications reflecting bus capacity and hours of operation.

In Connecticut, Rhode Island, and Vermont, state funding for pupil transportation was provided through percentage equalizing or guaranteed tax base formulas. By including transportation expenditures in the state's basic percentage equalizing formula, Rhode Island and Vermont provided funding for a percentage of transportation cost varying inversely with district wealth per pupil. In Connecticut, a categorical guaranteed tax base program was used to reimburse districts for between twenty and sixty percent of transportation cost, depending on local wealth.

Seven states provided full state funding for approved pupil transportation services through detailed budget models: Alaska, Delaware, Georgia, Louisiana, Maryland, New Mexico, and North Carolina. In this method, transportation need is defined in terms of the quantities of labor, materials, and equipment necessary to provide appropriate transportation service in each district. Generally, state administrators closely monitor the level of inputs requested by the districts to assure that a transportation program of uniform quality is maintained throughout the state. After defining the transportation program for each district, the state funding level is calculated by applying standard unit costs to the approved quantity of inputs. District costs which exceed the approved state funding level are paid with local funds. Budgetary models used in selected states are described below.

In Delaware, separate reimbursement formulas were used for districts providing transportation service by contract and by district operation. For contracted districts, formula components included a return of capital allowance, a fixed cost allowance, an attendant wage rate and a layover rate. The return of capital allowance provided a certain amount per vehicle, based on seating capacity and model year. The fixed cost allowance provided for the cost of wages, supervision, profit, and operation for a standard thirty-mile minimum route: a variable amount was provided based on bus capacity and geographic region. In addition to the basic fixed cost allowance, additional allowances were provided for each mile in excess of thirty and for midday routes. The attendant wage rate and the layover rate were computed on an hourly basis. Buses for district-operated transportation systems were provided by the state. Operating costs were reimbursed through a fixed cost allowance, an attendant wage rate, and a layover rate similar to but slightly lower than that provided for contracted districts. The standard rates for both district and contract operations were adjusted for inflation based on the private transportation subsection of the Consumer Price Index for the Philadelphia region.

The Georgia transportation funding model included five line items. First, a uniform amount was allocated per bus driver for all districts. Second, a standard allowance was provided per vehicle for bus insurance. Third, a bus replacement allowance was calculated based on the prior year average cost by bus size. Fourth, an operating expense allowance was determined using the average cost per mile by size of bus within four geographic regions of the state. Finally, an adjustment was made for increased fuel costs.

In Louisiana, the transportation aid allocation included a fixed amount per bus driver plus a bus operation allowance based on bus length and route mileage. The level of funding for bus driver salaries was based on a state minimum salary schedule. For each bus length, the bus operation allowance provided a certain rate per mile for the first six daily route miles, with reduced rates for additional mileage.

The Maryland transportation aid formula consisted of a series of allowances for various transportation budget categories. For each approved route vehicle, a replacement allotment was provided which varied with vehicle capacity and year placed in service. Additional allotments were provided for approved spare vehicles and for the cost of special equipment such as lift gates. An allowance for driver and aide salaries was computed based on a fixed hourly rate plus fifteen percent for fringe benefits. Salary allowances for uncertified drivers and aides were fifteen percent lower than those for certified drivers and aides. For operation and maintenance costs, a per-mile allowance was provided which varied with vehicle capacity; miles travelled on unpaved roads were doubled for funding purposes. Based on the number of pupils transported, each district was allowed a certain number of administrative personnel at specified salary rates. Additional allowances were made for other budget items, including administrative travel, training costs, driver physical examinations, and bus inspections.

In New Mexico, an allowance was computed for each vehicle which included amounts for bus depreciation, operation and maintenance, contractor profit, fuel, driver's salary and employee benefits. A certain amount was allowed for bus depreciation on each contractor-owned vehicle, depending on vehicle size and model year. For district-owned buses, a capital outlay allowance was made. Funding for operation and maintenance and for fuel was determined using a rate per mile which varied based on vehicle size and road conditions. Special adjustments to the rate per mile were made for routes with frequent stops, heavy grades, and altitudes over 6,000 feet. For contractor-owned vehicles, a profit on operational revenue was calculated at ten percent of the operation and maintenance allowance. Bus drivers salaries were funded at a base amount depending on total daily reimbursable miles, plus an increment for driver training institute attendance. Employee benefits were calculated at sixteen percent of authorized salaries.

Twelve states allocated 1980-81 transportation aid among districts based on an area or linear density formula. Area density formulas were used to determine the transportation aid allocation in six states: Alabama, Arkansas, Kansas, Kentucky, Mississippi, and Oklahoma. Additionally, area density was one of several factors included in the Minnesota transportation aid formula. Area density is calculated by dividing the number of pupils transported by the square mile area of the district. In Kentucky and Oklahoma, the area density measure was adjusted by deleting areas not primarily served; these are areas located more than a certain distance from an approved bus route.

Under the area density approach, an allowable cost per transported pupil is determined based on analysis of the relationship between density and cost. Procedures used to establish the allowable cost include (1) use of a curve of best fit between density and cost per transported pupil based on regression analysis, and (2) calculation of an average cost per pupil transported within specified density groupings. After the allowable cost is established, the transportation funding for a district is calculated by multiplying the allowable cost per pupil by the number of pupils transported. In some states, a district may receive funding greater than its actual cost by keeping its cost below the allowable level; in other states, the level of funding for a district is limited to actual cost.

In Minnesota, transportation aid was allocated among districts through a complex formula in which cost per weighted pupil transported was predicted based on area density, average daily membership, certain geographic factors such as terrain, road conditions, and regional location, and proportion of students transported in regular, vocational, and special education categories. Weighting factors were assigned to the pupil count for each transportation category based on the average cost per pupil transported in that category in relation to the average cost per pupil transported in the regular category.

Using multiple regression analysis, a predicted cost per weighted pupil transported was determined for each district for the second prior year. The predicted cost was increased by an inflationary cost escalator to establish the allowable cost per weighted pupil for the current year. The allowable cost was then compared with the district's actual cost, and a state aid adjustment was made for a portion of the difference. If the district's actual cost was greater than the allowable cost, the state allocation was increased by twenty percent the first ten dollar difference per pupil, forty percent the next ten dollar difference, sixty percent of the next ten dollar difference and seventy-five percent of the difference exceeding thirty dollars per pupil; the remaining excess cost was paid by the district. If the district's actual cost was less than the allowable cost, the state aid allocation was reduced under a similar schedule, and the district retained a portion of the difference as an incentive for efficient operation.

Five states employed linear density formulas in allocating transportation aid: Florida, Indiana, Missouri, Texas, and Utah. Linear density is calculated by dividing the number of pupils transported by the number of bus route miles. In Florida, Indiana, and Utah, linear density formulas were used to determine the allowable cost per transported pupil. Reflecting the inverse relationship between linear density and cost per pupil, the allowable cost per pupil increases as linear density decreases. In Texas, the allowable cost per bus mile was determined based on the average cost for districts within seven linear density groupings.

In Missouri, the inverse of linear density, bus miles per pupil, was used in adjusting the allowable cost per pupil-mile for each district. Based on simple curvilinear regression analysis, cost per pupil-mile was predicted from miles per pupil using an equation of the form $Y= ax^b$. A percentage variance factor based on the standard error was calculated to allow for error in the regression equation. If the actual district cost per pupil-mile was less than the predicted cost plus the variance factor, the state aid allocation for the district was equal to eighty percent of eligible cost. If the actual cost per pupil-mile was greater than the predicted cost plus the variance factor, the state aid allowance was reduced from the eighty percent level: a one percent reduction in the state reimbursement percentage was made for each percent that the actual cost exceeded the predicted cost plus the variance factor. For example, if the variance factor was four percent, and the district cost per pupil mile was six percent greater than the predicted cost, the state reimbursement percentage was reduced to seventy-eight percent, a two percent reduction. The maximum reduction in the state reimbursement percentage under this provision was five percent; a minimum reimbursement rate of seventy-five percent was guaranteed.

In eleven states, pupil transportation aid was allocated through formulas providing a flat rate per unit of transportation need, where need was defined in terms of pupils, miles, and/or buses. In Arizona, the transportation support level was equal to the lesser of a flat amount per transported pupil or per approved route mile, adjusted for district enrollment size. Colorado provided a fixed rate per bus mile, plus twenty-five percent of district operating cost in excess of this rate. Iowa did not categorically fund pupil transportation, but included the state average transportation cost per pupil in the basic state support program. In Montana, a certain amount per mile was allocated for each bus, depending on bus capacity. The Nebraska foundation program included a weighting factor of 1.25 for pupils residing more than four miles from school; this was equivalent to a flat amount per transported pupil. North Dakota provided a flat amount per pupil plus a flat amount per mile. In Ohio, a flat amount was provided per pupil or per mile, whichever was greater; different rates were specified for district, contractor, and public carrier operations. The Tennessee formula allocated sixty percent of the transportation appropriation based on number of pupils transported and 40 percent based on district square mile area. In Virginia, forty percent of the transportation allocation was distributed based on pupils transported, forty percent on mileage, and twenty percent on number of buses in daily use. Factors used in the Washington transportation aid formula included number of bus miles, number of logged hours, and a recognized rate of pay for school bus drivers. Wisconsin provided a variable amount per transported pupil, depending on the distance from home to school; transportation costs not reimbursed through this formula were included in the basic state support formula.

Financing Special Education Transportation

Considerable variation may also be found in provisions for state support of special education transportation. More than half of the states fund special education transportation through the basic state transportation formula, without special adjustments except the deletion of minimum distance requirements for state aid eligibility. This approach is commonly used in states employing an actual or approved district expenditure formula or a detailed budget model. Where a certain percentage of actual or approved costs are reimbursed, the reported costs generally include special education transportation costs. Where a detailed budget model is employed, the allocations for vehicles, personnel, and miles usually include the inputs necessary for transporting special education students.

Alternatively, several states make identifiable allocations for special education transportation by (1) providing an adjustment for this service within the transportation aid program, (2) specifying a separate calculation procedure within the transportation aid program, and/or (3) funding special education transportation through the state special education aid formula. In Kentucky, transportation funding for handicapped pupils is provided through the basic transportation formula by applying a weighting of 5.0 to the count of handicapped pupils transported. Minnesota employs a similar weighted pupil approach, and also provides a supplemental allocation for a percentage of excess special education transportation costs. Several states which fund regular transportation through an average cost formula provide funding for special education transportation through a separate calculation based on approved or actual district cost. For example, Kansas combines a density formula for regular transportation with an eighty percent reimbursement formula for special education transportation. In other states, the special education aid formula includes a component for the transportation of handicapped pupils. Wisconsin, for example, pays seventy percent of special education transportation costs through the state handicapped aid formula. In addition to state and local funding, federal P. L. 94-142 funds are used for special education transportation finance in some nineteen states.[62]

Analysis of Alternative Transportation Finance Programs

Because transportation need and local wealth vary widely among districts, state support is necessary to facilitate the provision of adequate pupil transportation services in all districts with reasonable local effort. State programs for financing pupil transportation have two basic elements: the measurement of needs and costs, and the determination of state and local contributions to overall funding. Four major approaches are employed by the states for measuring district transportation need: expenditure reimbursement formulas, detailed budget models, density formulas, and fixed unit cost formulas. After establishing the state-recognized transportation need for each district, state aid may be allocated on a fiscally equalized or unequalized basis. The strengths and weaknesses of alternative transportation funding programs may be analyzed using four general evaluative criteria: (1) recognition of necessary cost variations, (2) use of simple, objective calculation procedures, (3) promotion of efficiency, and (4) adequacy of funding.

Recognition of necessary cost variations is a basic criterion for evaluating state pupil transportation finance programs. The cost of pupil transportation varies considerably among districts, due partially to social, economic, and geographic factors which are beyond district control, and partially to district policies and procedures which affect transportation program quality and efficiency. To ensure that adequate financing is provided for each district, the state funding method should adjust for significant cost variations resulting from factors beyond district control. These factors include topography, road conditions, dispersion of population, prevailing wage rates, enrollment size, incidence of special and vocational education pupils, and density of transported population.

Alternative transportation funding methods differ substantially with regard to procedures for recognizing necessary cost variations. Expenditure reimbursement formulas based on actual costs shift the task of defining transportation need and necessary costs from the state to the local district. The state reimburses all costs at the same rate; no distinction is made between cost differences due to factors beyond district control, and cost differences resulting from district policies and procedures. While this method is appealing from a district perspective, it may result in an inefficient and inequitable funding distribution from the viewpoint of the state. Limited state dollars for pupil transportation are not allocated among districts based on the cost of providing a transportation program of uniform quality throughout the state . Instead, districts which have high costs due to unusually high quality of service or to inefficient operations receive a disproportionate share of available funding at the expense of districts with a lower quality of service or more efficient operations. To address this problem, several states using an expenditure reimbursement method base aid allocations on approved costs rather than actual costs. Through the cost approval process, reimbursable costs for various expenditure components are limited to a state-specified level.

In contrast to the expenditure reimbursement method, the detailed budget model establishes the responsibility for determining necessary costs of pupil transportation at the state level. Transportation need is defined in terms of the quantities of labor, materials, and equipment necessary for the provision of adequate transportation in each district. State officials actively monitor and approve input quantities requested by each district to ensure that transportation services of uniform quality are provided throughout the state. Necessary costs are calculated by applying standard rates to the approved input levels. To the extent that the inputs included in the budget model and the rates applied to approved input levels reflect the actual cost experience of the districts, the detailed budget model provides a thorough method for determining necessary cost variations among districts.

Density formulas provide recognition of necessary cost variations through the application of an average cost concept. Density is generally regarded as the principal factor not subject to local control which affects transportation costs. In states using this funding method, state-recognized costs for each district reflect the average cost for districts with similar density. Within a particular state, the validity of this approach depends on the strength and stability of the relationship between density and unit cost. Where density and cost are closely related, a formula based on density alone will provide an accurate measure of necessary cost variations. Where other factors not subject to district control have a significant independent impact on transportation costs, additional variables may be included in the average cost formula.

Fixed unit cost formulas vary widely in the degree to which necessary cost variations are recognized. Formulas providing a flat amount per transported pupil fail to recognize cost variations resulting from density of transported population, road conditions, prevailing wage rates, incidence of special education pupils, and other factors beyond school district control. Since density is generally the most significant factor contributing to variations in cost per transported pupil, such formulas tend to underfund districts in sparsely populated areas. Where a flat amount is provided per mile, cost variations due to road conditions, frequency of stops, traffic congestion, and vehicle size are not accounted for, placing an undue burden on urban districts. In general, fixed unit cost formulas based on a single factor do not adequately measure district transportation need, and provide an unnecessary bonus to districts with low unit costs at the expense of districts with high unit costs. Formulas utilizing multiple criteria, such as a flat amount per pupil or per mile, eliminate some of the major inequities inherent in the formulas based on a single factor, but may still provide only a rough measure of transportation need. In most cases, fixed unit cost formulas result in larger differences between formula funding and actual transportation cost than the three major alternatives.

A second criterion is that the procedures for calculating state aid should be as simple and objective as possible while retaining accuracy. Simplicity and objectivity facilitate district planning and budgeting by enabling local administrators to make fairly accurate calculations of state aid entitlements. Administrative costs are lowered at the state and local levels as requirements for detailed record keeping are reduced, extensive statistical analyses are avoided, and audit procedures are simplified. Additionally, simplicity and objectivity enhance the understanding and acceptance of the funding method by state and local policy makers.

Simplicity and objectivity, while important, should not take precedence over accurate measurement of district transportation needs. Unfortunately, the goals of simplicity and accuracy may conflict: the simpler the formula, the greater the likelihood that some of the factors contributing to necessary cost variations will not be adequately recognized. Fixed unit cost formulas based on single factor and expenditure reimbursement formulas based on actual costs are probably the simplest methods employed by the states for financing pupil transportation, but are also the least accurate in measuring necessary cost variations. Fixed unit cost formulas based on multiple criteria may provide greater accuracy, but require additional calculations, more detailed record keeping, and more extensive audits.

Where a close relationship exists between density and unit costs, density formulas combine moderately simple calculation procedures with reasonably accurate measurement of necessary cost variations. The data necessary for density formulas are readily available and easily audited. Complex statistical procedures are required at the state level, but the aid calculations may be completed quickly and inexpensively through the use of computers. While the administrative costs of density formulas are quite low, the use of an average cost concept based on complex statistical procedures may hinder understanding and acceptance of the funding method. Particularly where formula-generated costs are recomputed annually, district administrators may have difficulty in projecting state aid entitlements. Average cost formulas using more than one factor may permit more accurate recognition of necessary cost variations, but are more complex and less understandable than formulas using density alone.

Detailed budget models and expenditure reimbursement formulas based on approved costs are generally more complex than other funding methods. Due to the large volume of data included in the aid calculations, the costs of record keeping, reporting, and auditing are increased at both the state and local levels. To monitor and approve district programs and funding requests, a state bureaucracy of considerable size may be necessary. Formula adjustments to correct for inflation and changing cost patterns may require changes in several budget categories, rather than one overall rate. Subjective judgements of state officials regarding required services and reimbursement rates may conflict with local preferences, creating difficulties in planning and budgeting, and reducing local understanding and acceptance of the funding method.

Third, the state pupil transportation support program should promote efficiency in local transportation operations. State approval and monitoring of local programs is the most direct method of promoting efficiency. The effectiveness of this approach depends upon the availability and expertise of state administrators working cooperatively with local transportation managers to establish and maintain efficient transportation operations. As an alternative to direct state supervision, efficiency may be promoted by including incentives for efficient operation in the state aid formula. Two types of incentives have been widely suggested: (1) the use of average unit costs in calculating state aid, and (2) cost sharing between the state and school districts. When efficiency is promoted through the use of incentives, information and assistance should be available from the state department to assist districts in developing more efficient operations. To avoid disincentives for efficiency, factors subject to local manipulation should be excluded from the funding formula, or closely monitored to minimize potential abuses.

Detailed budget models promote efficiency through state approval and monitoring of district transportation programs and by applying standard unit costs to approved inputs of labor, materials and equipment. Expenditure reimbursement formulas based on approved costs also promote efficiency to a certain extent through the program approval process and by limiting reimbursable costs for various expenditure categories. Expenditure reimbursement programs based on actual costs do little to promote efficiency and may provide an incentive for inefficient program operation. The cost sharing feature of programs reimbursing districts for a percentage of costs may provide some incentive for efficiency; however, since the majority of costs are paid by the state, cost increases are paid primarily from state sources, while cost savings reduce the local contribution only slightly.

Density formulas provide an incentive for efficiency by allocating state aid based on average unit costs adjusted for density. If the actual cost is less than the formula predicted cost, the district receives funding greater than actual cost as a bonus for efficient operation. If the actual cost is greater than the formula predicted cost, the district must provide the balance of funding from local sources. Since funding is based on average costs, district administrators are encouraged to compare their transportation operations with similar districts to identify possible cost savings. Districts with cost varying substantially from the norm are clearly identified, and may be analyzed to determine what factors have contributed to unusually high or low unit costs.

Fixed unit cost formulas provide efficiency incentives by allowing a flat rate per unit of service and by requiring a substantial local contribution. Given a flat rate of state support per pupil or per mile, districts are encouraged to keep unit costs down so as to minimize the local contribution. Fixed unit cost formulas based on factors beyond district control establish a stronger efficiency incentive than formulas based on factors subject to district control. For example, a formula providing a flat amount per pupil will provide a stronger incentive for efficient bus routing and scheduling than a formula providing a flat amount per mile. Where funding is based on factors subject to district control, state monitoring may be necessary to minimize potential disincentives.

Funding adequacy is the fourth and final criterion for evaluating pupil transportation finance programs. No program of state support is fully satisfactory unless it supplies sufficient funding to enable each district, with reasonable local effort, to provide safe and timely transportation for all pupils needing the service. Funding adequacy requires that the state support program be comprehensive, fully funded, and fiscally equalized. State funding should be provided for all categories of authorized service, such as regular, vocational, and special education transportation. All legitimate costs of the transportation program should be recognized in the formula, including capital outlay as well as operating expenses. State appropriations for pupil transportation, in combination with a reasonable local contribution, should fully fund transportation costs. Adjustment factors should be included for inflation and escalating energy costs to ensure that the intended level of state support is maintained. Finally, any local contribution required to support the state-recognized program should be fiscally equalized to provide an equitable distribution of local tax effort.

Policy Issues

In conclusion, at least four basic policy issues must be resolved in designing a state pupil transportation finance program. First, what transportation services will be funded, and for whom? Will the state program be limited to transportation to and from school, or will it include transportation for instructional purposes during the day? Will transportation services for vocational and special education pupils be funded through the basic transportation finance formula or through a separate mechanism? Will minimum travel distances from home to school be established as a requirement for state aid eligibility? If travel distance eligibility requirements are used, will a uniform distance be specified for all grades, or will longer distances be specified for secondary pupils than for elementary pupils? What exceptions to minimum distance eligibility requirements will be provided for hazardous traffic conditions or other special circumstances? Will the state program be limited to public school pupils, or will nonpublic school pupils to be included?

Second, how will the cost of pupil transportation be shared by the state and local school districts? What proportion of pupil transportation revenue will be provided from state sources and what proportion from local sources? How will the level of state support be adjusted for inflation and rising energy costs? Will state support be provided for operating costs only, or will bus depreciation be included in the state program? Will state funds be allocated on a flat grant basis or an equalized basis?

Third, how will necessary unit cost variations be recognized? Will greater emphasis be placed on accuracy or simplicity in the measurement of needs and costs? Will the funding method be based on individual district experience or on average unit costs? Will an expenditure reimbursement formula, a detailed budget model, a density formula, a fixed unit cost formula, or some combination of these approaches be employed?

Finally, will the state program be designed to promote efficiency in school district transportation operations? If so, will efficiency be promoted through state approval and monitoring of programs, average cost funding formulas, costs sharing between the state and school districts, or some combination of these methods? If an average cost formula is used, will districts with actual unit costs below formula predicted costs be permitted to retain all or part of the difference as an incentive for efficient operation?

In addressing these questions, state policy makers should strive for solutions which will ensure that adequate transportation services are provided in all districts with reasonable local tax effort.

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APPENDIX B

PUPIL TRANSPORTATION STUDY QUESTIONNAIRE

Name of School
or Administrative Unit: ______________________________

Analysis made by: ______________________ Date: ______________

DIRECTIONS: On this and the following pages are a number of items which represent certain specific practices which make up a pupil transportation program. If a particular item represents a regular practice of the program, encircle **Yes.** If the item is not a regular practice, encircle **No.**

EXAMPLE:

The school provides transportation service for pupils. .... Yes No

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ADMINISTRATION AND MANAGEMENT

School Board Policy

The board of education has adopted specific policies regarding the pupil transportation program. .... **Yes No**

The transportation policies of the board of education are in written form. .... **Yes No**

The board of education policies include a definition of what is considered a reasonable walking distance for children. .... **Yes No**

The board of education makes an exception in the walking distance requirement for children living on heavily traveled highways. .... **Yes No**

Transportation is furnished to all physically handicapped children regardless of the distance involved. **Yes No**

The board of education has adopted a specific and detailed policy regarding the use of buses for instructional or other non-route trips. .... **Yes No**
(Non-route trip — Any trip made by a school bus for a purpose other than transporting children over a regularly scheduled route.)

Transportation is provided when necessary for pupils who participate in school activities during non-school hours. .... **Yes No**

The board of education has adopted a set of operating rules for bus drivers. .... **Yes No**

All policies and board of education decisions which affect the pupil transportation program are a matter of school board record. .... **Yes No**

Safety Education

The school has a definite program for teaching children to become safe bus passengers. .... **Yes No**

The education program for bus safety includes:

Classroom instruction .... Yes No

Assembly programs .... Yes No

Demonstration and practice on the bus .... Yes No

Emergency drills on the bus .... Yes No

Bus drivers assist teachers in the instruction of bus safety. .... Yes No

Pupils have an opportunity to participate in the planning and development of safety rules and the bus safety program. .... Yes No

There is a definite training program for members of the pupil patrol .... Yes No
(Do not mark this item if a pupil patrol or drivers' assistants are not used.)

Purchasing

The board of education has adopted a long-range plan for purchasing and replacing buses, i.e., replacements are anticipated and provisions made. .... Yes No

When possible, purchases of new buses are made at times other than during the summer months. .... Yes No

Vehicles are purchased only after requesting bids .... Yes No

When purchases are made by bids, a written set of specifications describing the kind of equipment desired is supplied in advance. .... Yes No

Contracting

The school district provides all of the transportation of pupils with publicly owned equipment and is required to contract for none. .... Yes No
(If Yes, the rest of the items in this section on contracting should be marked No.)

When it is necessary for the board of education to authorize a parent to transport children to school (or as a "feeder" line to a bus route), a written contract is made between the board and the parent. .... Yes No

Transportation contractors are required to give a bond for the faithful fulfillment of the terms of the contract. .... Yes No

The board of education prescribes the minimum amount of insurance to be carried by the contractor as a condition of the contract. .... Yes No

Contracted equipment is inspected at regular intervals by competent inspectors. .... Yes No

The garage or mechanic authorized to inspect contracted vehicles is designated by the board of education as a condition of the contract. .... Yes No

Reports of the inspections of contracted equipment are required by the board of education as a condition of the contract. .... Yes No

Transportation Records

A separate transportation accounting system is kept subsidiary to the general account. .... Yes No

A cost analysis for the operation of each individual bus is made periodically. .... Yes No

Records show the following information for each bus in the fleet:

Original cost and date of purchase of the bus. .... Yes No

Total miles operated to date. .... Yes No

Miles operated per day on assigned route. .... Yes No

Number of pupils transported on assigned route. .... Yes No

Cost of gasoline, oil and grease. .... Yes No

Cost of repairs. .... Yes No

Specific information on school bus accidents. .... Yes No
(If there have never been any accidents, answer **Yes.**)

Monthly reports indicate the operating costs of each vehicle. .... Yes No
(These reports would include such information as miles traveled, gasoline consumption, oil consumption, maintenance costs, and repair costs.)

A record is kept of the dates worked and wages paid to substitute drivers. .... Yes No

Records are kept for the use of buses for instructional and other non-route trips .... Yes No

Records for instructional and other non-route trips include:

The number of miles traveled on each trip. .... Yes No

Cost of gasoline, oil, and other operating expenses. .... Yes No

Cost of drivers' wages for diving on non-route trips. .... Yes No

Transportation records show the following costs:

The cost of all transportation and garage insurance. .... Yes No

The depreciation of vehicles. .... Yes No

Rents paid for garage or bus storage. .... Yes No
(If renting space is unnecessary, do not mark this item.)

Operating expenses of the bus garage. (fuel, electricity, water). .... Yes No

Repair parts and supplies are carried on an inventory account and charged off to each individual bus only as used. .... Yes No

Routing

An up-to-date spot map of the transportation area in a scale large enough to be functional is kept. ...... Yes No

The spot map shows the following information:

Location of all roads. .... Yes No

Type of all roads. (hard surfaced, gravel, etc.) .... Yes No

Distances between major intersections. .... Yes No

Location of all operating school buildings. .... Yes No

Location of all pupils to be transported. .... Yes No

Location of these pupils in a manner which clearly indicates which are kindergarten, elementary school, and secondary school pupils. .... Yes No

Exact route of each bus. .... Yes No

Weight capacity of all bridges .... Yes No

Location and nature of major route hazards .... Yes No

All points where buses will stop to pick up and discharge pupils are determined in planning routes ...... Yes No

Bus stops are designated so that they are not on steep grades, blind curves, or near the creast of a hill .... Yes No

Children are picked up and discharged only at designated stops .... Yes No

A definite time schedule showing the time the bus can be expected at each stop is established for each trip .... Yes No

Enter here the distance from school within which transportation is not generally provided for pupils.... ________

(Answer all the following questions. Each should be answered Yes or No)

Is the distance ¾ of one mile or less? .... Yes No

Is the distance 1 mile or less? .... Yes No

Is the distance 1½ miles or less? .... Yes No

Is the distance more than 1½ miles? .... Yes No

Enter here the maximum distance that children are expected to walk to reach a bus pick-up point .... ________

NOTE: The following two sets of items are an attempt to determine the time children spend riding the bus to school and the total length of their school day, i.e., the length of time between when they leave home in the morning and return in the afternoon. If buses serve more than one school on separate school schedules, indicate only for a single group of children or the average for all groups served by the transportation program.

Enter here the time for the beginning of the school's morning session.......... ________

Enter here the approximate average time that the buses make the first pupil pick-up in the morning ...... ________

Enter here the elapsed time between the first pupil pick-up and the beginning of the school's morning session........ ______

Enter here the approximate average time of the last pupil delivery........ ______

Enter here the elapsed time between the first pupil pick-up and the last pupil delivery........ ______

When routing of buses has been determined, a detailed report describing the routes is made to the board of education .... Yes No

Officials responsible for the construction and maintenance of roads are given a copy of the bus routes and schedules........ Yes No

The size of the bus assigned to each route is in every instance appropriate (in terms of capacity) for the number of pupils transported........ Yes No

Traffic patterns for approaching, parking on, and leaving school grounds are established........ Yes No

Traffic patterns make it unnecessary for a bus to be driven backwards on the school grounds........ Yes No

Vehicles are parked on school grounds for loading before school is dismissed........ Yes No
*(When this kind of procedure is not possible, do not mark this item.)

Designated teachers are present in the bus loading area to assist and supervise loading........ Yes No

Procedures

There is a direct and easy way for drivers to report disciplinary problems immediately after the trip in which such problem occurred........ Yes No

There is a definite and clearly understood procedure for handling requests for the use of buses for instructional trips and other non-route uses........ Yes No

Requests for the use of buses for instructional or other non-route trips are submitted for approval in writing........ Yes No

A thorough inventory of supplies and repair parts is made at least twice each school year........ Yes No

Parents and Pupils

Parents are informed of policies regarding the transportation program........ Yes No

A copy of the time schedule for the bus is sent to each home affected prior to the opening of school.... Yes No

Changes which are made in the time schedule of any bus are delayed until notice has been given to all parties concerned. (except in emergencies) .... Yes No

Rules and regulations for pupil conduct and pupil responsibility are specific and well understood........ Yes No

Rules for pupils are sent to the home of each child to be transported........ Yes No

Children are expected to be at the road waiting for the bus........ Yes No

The local policy of having buses wait for children at pupil stops is definite and well understood by the driver, the pupils, and the public .... Yes No

Children who must cross the road after alighting from a bus are required to cross in front of the bus and then only after receiving a signal from the driver........ Yes No

The privilege of riding on the bus is denied any child who proves to be a chronic disciplinary problem until arrangements are made either by the child or by the child and his parents with the school administrator .... Yes No

It is the policy of the transportation program that no child should be put off the bus for any reason except at his designated stop unless special instructions have been given by the school administrator .... Yes No

DRIVER

Conditions of Employment

The bus driver is regarded by the board of education and the entire staff as an important school employee .... Yes No

When drivers are hired, they are given a written contract .... Yes No

Rules and regulations regarding their duties and responsibilities are given to drivers in written form or in a drivers' handbook .... Yes No

The board of education has adopted a salary schedule for drivers and other transportation personnel... Yes No

Salaries paid to bus drivers are high enough to insure competent drivers .... Yes No

Drivers are given a maximum of security for continous employment as long as a reasonable quality of service is rendered .... Yes No

Driver Qualifications

When new drivers are employed, previous driving experience is investigated to assure that it has been safe and satisfactory .... Yes No

Consideration is given to maturity and character of every individual before he is employed as a driver. Yes No

Drivers are required to hold a state chauffeur's license or a special school bus driver's license .... Yes No

Every driver is required to have a physical examination by a registered doctor before employment. (Examination should include all aspects of health and physical fitness which have a bearing on suitability as a bus driver.) .... Yes No

Every driver is required to have a physical examination at least annually after employment .... Yes No

The board of education has established a minimum and a maximum age range for employment as a driver .... Yes No

Substitute drivers are expected to meet the same general requirements as regular drivers .... Yes No

Substitute drivers are expected to meet the same physical examination requirements as regular drivers Yes No

Training

There is a definite program for training bus drivers .... Yes No
(If No, the rest of the items in this section on training should be marked No.)

The training program for drivers includes both classroom instruction and demonstration and practice with the vehicle .... Yes No

The training program includes:

Explanation of the driver's responsibilities for the bus. .... Yes No

Explanation of the responsibility of a bus driver's job and the liability of drivers. .... Yes No

Responsibilities of drivers for administrative routines and reports. .... Yes No

Driving skills and practice .... Yes No

Correct procedures for loading and unloading children at pupil stops. .... Yes No

Correct procedure for handling disciplinary problems. .... Yes No

Psychophysical tests (breadth of vision; judging distance; reaction time) so that each driver is made aware of any limitations. .... Yes No

Operation and Supervision

The supervisor of the transportation program has had specific training or experience which qualifies him as a supervisor. .... Yes No

There is close contact between the person responsible for supervising the transportation program and the bus drivers and maintenance personnel on all transportation problems. .... Yes No

Conferences with drivers and discussions of problems are held at regular intervals. .... Yes No

Buses are inspected regularly for cleanliness. .... Yes No

Drivers operate their buses consistently on schedule. .... Yes No

Drivers are always clean and neat. .... Yes No

Drivers know what to do and what not to do in an emergency. .... Yes No

VEHICLE

All vehicles used for transporting children meet the minimum standards for construction of school buses adopted by the National Conference on School Transportation. .... Yes No

Large vehicles (50 passenger capacity or over) are equipped with air or vacuum actuated power or assistor type brakes. .... Yes No

Every school bus is equipped with:

Flashing stop lamps, front and rear. .... Yes No

Flashing turn-signal units. .... Yes No

An exterior "non-glare" rear-view mirror on both the left and right side of the bus. .... Yes No

A set of warning flags and flares in good condition. .... Yes No

MAINTENANCE

Policy and Procedures

School officials emphasize and make all necessary provisions for carrying out a preventive maintenance program. .... Yes No

Maintenance and repair work is done in a school operated garage.......... Yes No

Mechanics are trained for preventive maintenance. .... Yes No

There is an easy and direct way for drivers to report apparent failure or unsatisfactory performance of the bus. .... Yes No

The driver of the bus is responsible for daily maintenance checks for his own bus — tires, gas, oil, radiator. .... Yes No

The driver is responsible for the cleanliness of the bus — inside and out. .... Yes No

A spare bus is available and can easily be assigned to a bus route in case of need. .... Yes No

Inspection and Repair

Every bus is inspected regularly by a mechanic for detecting mechanical defects. .... Yes No

All inspections are guided by a check sheet to insure against over-looked items. .... Yes No

Immediate repairs are made where defects are found. .... Yes No

Station wagons and passenger cars used to transport pupils either regularly or for special trips are inspected frequently. .... Yes No
(If none are used, do not mark this item.)

State inspectors make thorough periodic inspections of all school buses.......... Yes No

Inspectors have the authority to keep vehicles out of service if deemed unsafe. .... Yes No

Maintenance Records

A record or written report is made of all maintenance and repair work. .... Yes No

Maintenance records show specifically maintenance costs directly resulting from accidents. .... Yes No

The mechanic makes a written record of maintenance and repair work done for each bus. .... Yes No

All materials or parts used on each bus are shown on the record of the particular bus. .... Yes No

Labor in excess of one hour is shown on the record of the particular bus. .... Yes No

Records of mechanic's inspections become a part of the record for each bus. .... Yes No

Garage

Garage or other shelter is provided to keep buses out of the weather when not in use. .... Yes No

The bus garage is heated when this is necessary and desirable. .... Yes No
(If a heated garage is not necessary, do not mark this item.)

If the bus garage has a separate heating plant, it is an automatically controlled unit. .... Yes No
(If a heated garage is not necessary, do not mark this item.)

The bus garage is equipped with a telephone. .... Yes No

Walls, partitions, and roof of bus garage are made of fire-resistive materials.......... Yes No

Minnesota Department of Education
Pupil Transportation Study

September 16, 1980

Supplemental Questionnaire: Pupil Transportation Cost Data

1. Please list 1978-79 Actual Expenditures for pupil transportation by gray manual account code below:

3-510.1	Salaries of Pupil Transportation Directors and Supervisors	$________	
3-510.2	Salaries of Bus Drivers	________	
3-510.3	Salaries of Mechanics and Other Garage Employees	________	
3-510.4	Salaries of Clerks and Other Pupil Transportation Employees	________	
3-510	Salaries for Pupil Transportation		$________
3-520.1	Transportation Contracts with Public Carriers	________	
3-520.2	Transportation Contracts with Private Operators	________	
3-520	Contracted Services and Public Carriers		$________
3-540	Pupil Transportation Insurance		$________
3-550	Board and Lodging in Lieu of Transportation		$________
3-560.1	Gasoline for Pupil Transportation Vehicles	________	
3-560.2	Vehicle Maintenance	________	
3-560.3	Garage Operation	________	
3-560.8	Rent for Pupil Transportation	________	
3-560.9	Miscellaneous Expense for Pupil Transportation Operation and Maintenance	________	
3-560	Other Expenses for Pupil Transportation Operation		$________
3-570	Snow Removal for Transportation		$________
3-580.1	School Bus Driver Training	________	
3-580.2	Pupil Transportation Safety Education Program	________	
3-580.3	Training of Other Pupil Transportation Personnel	________	
3-580	In-Service Training		$________

3-585	Transportation Chargebacks (Credit-Contra Expenditure)		$______
3-590	Interdistrict Pupil Transportation Reimbursement Expenditure		$______
3-810.3	District Contributions to PERA	______	
3-810.4	District Contribution to Social Security	______	
3-810	School District Contributions to Employee Retirement		$______
3-820.22	Group Hospitalization, Health, Accident	______	
3-820.23	Group Life and Income Protection	______	
3-820.24	Retired Employee Insurance	______	
3-820.28	Other Employee Insurance	______	
3-820.2	Employee Insurance		$______
3-820.34	Worker's Compensation		$______
3-840.1	Interest on Orders Not Paid For Want of Funds	______	
3-840.2	Interest on Certificates of Indebtedness	______	
3-840.4	Interest on Installment Purchase of Buses	______	
3-840.5	Interest on Interfund Borrowing	______	
3-840	Interest on Current Loans		$______
3-841	Interest on Capital Leases		$______
3-850	Abatements and Other Fixed Charges		$______
3-855	Variances on Prior Year's Encumbrances		$______
3-870	Severance or Seperation Pay		$______
3-1230	Equipment		$______
3-1230.51	Eligible Pupil Transportation Vehicles	______	
3-1230.53	Transportation Garage Equipment	______	
3-1230.54	Two-Way Communication Systems	______	
3-1230.55	Non-Eligible Pupil Transportation Vehicles	______	
3-1230.58	Miscellaneous Equipment	______	
3-1230.5	Equipment for Pupil Transportation		$______

3-1240	Principal on Capital Leases	______	
3-1410.1	For Special Education	______	
3-1410.2	For Secondary Vocational Education	______	
3-1410.3	For Other Eligible Education Services	______	
3-1410	Interdistrict Expenditures to Minnesota School Districts		$______
3-1420.1	For Special Education	______	
3-1420.2	For Secondary Vocational Education	______	
3-1420.3	For Other Eligible Education Services	______	
3-1420	Interdistrict Expenditures to Out-of-State School Districts		$______

2. Describe the procedure used in allocating indirect costs to the transportation fund (e.g., administrative salaries and fringe benefits, supplies, heat, etc.)

3. Describe the procedure used to determine each of the subtractions from gross cost reported on lines 3-19, Sec. D of the 1978-79 Annual Transportation Report (form F28-3)

9/16/80

Additional Data Items for
Transportation Study Supplemental Questionnaire

1. Copy of School Board Policies Relating to Pupil Transportation.
2. Description of transportation insurance coverage.
3. If noon kindergarten transp. is provided, how many pupils are transported at what cost?
4. If late activity transportation is provided, how many pupils are transported at what cost?
5. What replacement schedule is used for buses?
6. What procedures are used in purchasing supplies and equipment?
7. Copy of up-to-date spot map of the transportation area showing routes-regular and other, # of riders per route, location of bus stops, etc.
8. Schedule of school opening and closing times-both public and non-public where transportation is provided.
9. Maximum riding time on bus by route; waiting time at school for classes to start after being dropped off by route.
10. Salary rates paid to school bus drivers, mechanics?
11. Are transportation employees full-time or part-time--other jobs with district?
12. Annual mileage, MPG, type of fuel used by school bus?
13. Use of spare buses.
14. How many buses does the district have that are greater than eight years old? How are they used?
15. Who is responsible for route development?
16. If contracted, what data is available regarding the specific terms of the contract; also what wage rates are paid by the contractor, what are his other expenses?

February 11, 1981

APPENDIX C

Legislative Report

School Bus Alcohol Fuel Demonstration

This report is being submitted pursuant to Chapter 609, Article II, Section 5, laws of 1980, which required Department of Education to conduct a demonstration project and report on the use of alcohol as a fuel for school buses. Funds in the amount of $30,000 were appropriated for the project, however, budget recissions reduced this amount to $28,414.

On July 1, 1980 information regarding the availability of the program was sent to all school districts. The following eleven (11) districts expressed an interest in participating in the project:

	District Name & No.	Date Received
1)	Barrett #262	5/23/80
2)	Halstad #524	5/23/80
3)	Dassel-Cokato #466	5/30/80
4)	Benson #777	6/27/80
5)	Belgrade #736	6/27/80
6)	East Chain #453	6/30/80
7)	Campbell-Tintah #852	7/01/80
8)	Goodridge #561	7/07/80
9)	Roseau #682	7/11/80
10)	Villard #615	7/18/80
11)	Staples #793	8/26/80

On September 26, 1980 application forms were mailed to the interested districts.

Nine (9) districts did not submit application forms. Reasons given for not participating included:

February 11, 1981

APPENDIX C

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On September 26, 1980 application forms were mailed to the interested districts.

Nine (9) districts did not submit application forms. Reasons given for not participating included:

- no source of fuel
- dependability of supply
- price of fuel
- cost of conversion would exceed grant allowance
- no availability of conversion kits
- questions of reliability
- quality (low proof rating) of fuel
- interested in gasohol but not straight alcohol conversion
- propane or diesel are better alternative fuels than alcohol

Only two (2) completed application forms were submitted to the Department of Education. The two participating districts have been allocated grants and they are: Belgrade #736 in the amount of $1,570.00 and Staples #793 for $1,430.00.

Neither of the participating districts submitted a written report because neither had used an alcohol-fueled bus on a regular basis before November 15, 1980. Belgrade is experiencing problems with operation and reliability of their converted unit. Staples, because of late application, has not completed conversion work.

Based on the limited sample above, an accurate determination of the practicality of alcohol as a fuel is not possible at this time.

Recommendation

Escalating fuel prices make fuel conservation practices and alternative power source exploration necessary. Technology needs to be developed and personnel need to be trained to make reliable alcohol conversions. It is suggested that the Vocational-Technical Institute system is best equipped to provide this technology.

FEB 18 1981

BELGRADE PUBLIC SCHOOLS

Independent School District 738
Stearns and Kandiyohi Counties
Belgrade, Minnesota 56312
Phone 254-8212

DUANE R. SWENSEN, Superintendent

February 12, 1981

Mr. Gerald Pavek
Transportation Director
MN State Department of
Education
Capitol Square Building
550 Cedar Street
St. Paul, MN 55101

Dear Mr. Pavek:

Please excuse me for the delay in getting this letter to you, but from the onset I should explain that we still do not have much information on the alcohol bus experiment to give you much detail.

We actually started to work on this last October in finding sources for alcohol and the party that we came upon was not in production at that time. When he was in production, we did receive 168 proof alcohol. It was made from corn and we paid $1.03 a gallon plus transportation for it. Our source has used it in a John Deere tractor, a 1941 International tractor and in a Fiat automobile with quite a bit of success. The main secret being in getting the alcohol pre-heated. We obtained a storage unit for the alcohol at a cost of $619.40 and an additional tank for a bus on order as of this date yet.

Instead of using the 1979 Ford school bus, as on our application, we decided to try it out on a 1967 International 6 cylinder 308 engine. This was a 60-passenger capacity bus.

My transportation director wrote the following:

> Without any adjustments to the engine, I used 168 proof alcohol and could not start the engine with the alcohol. I had to use gas to start the engine. After I started the engine, I switched to alcohol. The engine would run at a fast idle but it would not run at a slow idle. It would run on the road at speeds from 15 m.p.h. and if I slowed down to stop the engine would stop. After

OVER

Mr. Gerald Pavek
Page 2
February 12, 1981

the engine was warm, 170°, it would start on alcohol. The consumption of alcohol was about three times more than gas and the power of the engine was less. With adjustments to the engine such as the timing and carburator and using alcohol, the engine still would not idle and would not start on alcohol when it was cold. After the engine was warm it would start on alcohol. Over the road engine performance was very bad. Mixing alcohol and gas to the engine would cause it to run somewhat better. I had no way of measuring the amount of alcohol and gas that was mixed. With the adjustment of the carburator and timing, consumption of alcohol was three to four miles per gallon.

To operate an engine on alcohol, there should be two carburators mounted on the intake manifold, one for alcohol and one for gas to be controlled by the driver from the dash and the alcohol should be pre-heated in some way before getting to the carburator. The engine used should be of high compression and that could run at nothing less than 195° temperature.

Our head mechanic is still working on advancing the engine. We are concerned with any possible danger we may encounter in pre-heating alcohol when having students on a school bus. However, the alcohol when put into a cup burns without apparent explosive qualities (of which I am no expert).

We will continue to experiment with this bus on making some modifications before we will try it on another vehicle, such as our 1978 Ford.

Obviously with this poor mileage and the cost of production of alcohol these tests would not prove to be profitable for anyone concerned. However, it has, as of yet, not had a fair chance to work out.

I might add that in our gifted school program, some of our students have been working on energy sources and this is an interesting experiment for them to observe and see the practical approach to using alcohol.

We have also thought of adding isopentane of 5 to 10% as we have heard that this might help in carburation of ethanol.

Sincerely yours,

Duane R. Swensen
Superintendent of Schools

bjt

APPENDIX D

APR 2 1981

Detroit Lakes Public Schools

DETROIT LAKES, MINNESOTA 56501
PHONE 218-847-9271

DENT
NDEEN,
NAGER

NELIA LORENTZEN, CHAIRPERSON
HAROLD TRIEBENBACH, CLERK
DUANE ERICKSON, DIRECTOR
HERMAN HULIN, DIRECTOR
DELMOURE HULTGREN, DIRECTOR
GEORGE JERNBERG, DIRECTOR

March 31, 1981

. Gerald Pavek, Director
JPIL TRANSPORTATION SECTION
oom 912, Capitol Square Building
550 Cedar Street
St. Paul, Minnesota 55101

Dear Mr. Pavek:

The purpose of this letter is to review and confirm some of the information we discussed in your office regarding changes in our bus routing and related efforts to reduce transportation expense.

Initially we attempted to analyze our transportation services with our two private carriers and the two routes serviced by the district to seek ways to economize and improve our transportation services. This effort was followed by a completely revised district transportation policy adopted by the Board of Education. We then sought ways to save route miles and in general, reduce the expense (which was far in excess of reimbursements) of our entire transportation services. We did make some strides in reducing expense and improved our communication and coordination with the private contractors and district transportation services.

We still felt much more needed to be accomplished to better analyze our routing and related transportation concerns in a district comprising 324 square miles and approximately 160 lakes, with many year-around lake homes on the various lakes throughout the district.

Although several efforts were made to improve our transportation system, our costs were still exceeding the State Formula Allowances under the new transportation formula. This required annual transfers in excess of $100,000 from the General Fund. In the fall of 1979, the Board of Education acted to engage Dr. Rudolph Wagner of the N.D.S.U. Civil Engineering Department with the BRAM Computer Assisted Transportation Analysis. The process required a complete analysis by district and private contracted transportation personnel of our entire district, including roads, order of pickup, loaded miles, duplicated miles, and a host of other considerations. The development of the maps, detailing all the roads and the locations of all students for the computer programming in itself was of significant value. Many questions and many suggestions were made through the process of preparing all the data for the computer. Once the data was compiled and put into the program, many other questions were raised, answers were obtained, and generally were taken into consideration in the recommendations of Dr. Wagner.

In the spring of 1980, we received the "preliminary" and later the "revised" final analysis of our transportation system detailing Dr. Wagner's recommendations for implementation. The options were reviewed by the Board, administration, and transportation contractors. The recommendations were selectively considered in relationship to the acceptability and reasonableness for implementation and most cost effective.

- MORE -

Prior to BRAM study, we had 40 bus routes, of which 38 were contracted by two independent local contractors. Because of our comprehensive effort to reduce transportation expense without increasing rider time, time of pickup, and other limitations, we were able to eliminate five bus routes over the past three years with the cooperation of the private contractors. Although it would be unfair to say the five routes were dropped as a direct result of the BRAM computer analysis, it is fair to state that the analysis was an integral part, presenting an objective analysis, by a third party, for the decisions to modify the day-to-day routing configurations and subsequent reduction of route mileage and savings of transportation expense.

Dr. Wagner calculated that a reduction of 63,625 route miles per year could be eliminated if all the recommendations were implemented, including the change from half-day every-day kindergarten to full-day alternate-day kindergarten. FDAD kindergarten was implemented for two-thirds of the school year in 1980-81 with a lot of parental objection. We have not estimated an exact number of miles saved for the current year at this time, but anticipate, when total mileage is compared to two years ago, we will have reduced some 80,000 miles in our transportation network. We do intend to analyze the total route mileage this year as compared to the prior years when all transportation totals are available and when comparisons can best be made. We have enhanced our transportation system, saved many thousands of miles, and have made our transportation system more efficient and economical through the efforts enumerated. Although we have implemented several cost effective measures and reduced expenses, we just can't seem to catch up with the inflationary increases and stay within the new formula allowances.

In summary, we are very pleased with the outcomes and the value of the computer analysis for the improvement of our transportation system and services. I would strongly recommend any district with 10 or more bus routes to consider a computer analysis. Moreover, it is extremely beneficial to have an "expert" third party to study and present an objective analysis and recommendation for the local district's consideration of it's transportation services. The preparation of the computer data in itself, is a most worthwhile effort for any school district of any size to aid in the analysis and self-evaluation of transportation routing configurations.

The added help of each bus driver being challenged to "beat the computer" continues to be helpful as drivers seek ways to eliminate route mileage on a day-to-day basis by creating driver awareness and sensitivity of the relationship between route miles and unnecessary expense. The total savings is difficult to estimate, but at a cost of approximately $1.50 per mile per bus, it is a significant factor, whether or not it's reflected in the negotiated transportation contract.

If I can be of further help, please feel free to call upon me or our district Business Manager, Richard Lundeen.

Sincerely,

Robert R. Ness
Superintendent of Schools

RRN/cs

cc: Board of Education
Dick Lundeen