AN INTERPRETIVE STUDY OF FACTORS RELATED TO TRANSPORTATION COSTS IN THE SCHOOL DIVISIONS OF MANITOBA

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ABSTRACT

The purpose of this study was to determine the suitability of a selected set of factors as a measure of pupil transportation cost in school divisions in Manitoba. It was also necessary to give supplementary consideration to a comparison of contract with board-operated bus systems, and to study the general quality of the services being provided, relative to the operating cost of school transportation.

SOURCES OF DATA

The data for this study were obtained from (1) government reports, documents and records, (2) school division and district records, (3) questionnaires, (4) interviews, and (5) letters. The 1967 operational data were used rather than those of other years because of the changes that took place previously and the more limited scope of pupil transportation in the preceding period.

PROCEDURE

The following procedure was used.

1. Six density measures of pupil transportation operating costs were developed.
2. A weighting procedure was applied to such data as: the number of buses used, the bus mileage, the number of centralized schools, and the number of pupils transported daily.
3. The 1967 operational data were used to calculate the numerical values of the six selected factors.
4. The values of the six factors were treated by a step-wise multiple regression analysis to determine their relationship to the costs of pupil transportation.
5. A multiple regression equation was developed from the results of the statistical analysis.

6. The cost formula was appraised in terms of applicability to each school division included in the study.

7. "Contract" buses were compared with "board-operated" vehicles, respecting both costs and services.

8. The general quality of school transportation services was examined relative to the costs involved and the nature of services in various parts of Canada and the United States.

RESULTS

The four best predictors or measures of student transportation costs were found to be: (1) pupil-average distance; (2) the number of transported pupils per square mile of organized territory; (3) the assessed valuation per transported pupil, and (4) the bus mileage per square mile of organized area. The application of the cost equation based on these 4 factors showed that 12 out of the 10 divisions included in this part of the study would experience tax increases or decreases well below one mill while only 4 divisions would require increases ranging from 1.71 to 4.21 mills. The formula was found to be comparatively simple to apply yet sufficiently comprehensive in its measurement of influences upon costs to account for 85% of the variance between calculated and actual costs of pupil transportation in the 20 divisions.

The application of the cost formula indicated a need for investigation on the local level respecting such matters as management, economy and efficiency. This was substantiated by the fact that in 12 out of the 20 divisions the costs derived by means of the equation were below actual costs. It was further supported by the comparison of "contract" with "public-owned" buses, which revealed that despite an inferior quality of service the "contract" vehicles were significantly more expensive than "division-owned" systems.

The fact that the general quality of school transportation services was found to be inferior to that provided in many other areas, once again emphasized the need for efficient management as suggested by the application of the cost formula. It was revealed that the quality of service could be greatly improved even without extensive financial expenditure.

Both the cost of pupil transportation and the general quality of the services provided require continuous re-evaluation if the investments in school transportation are to serve the purpose of ensuring safety and maximizing the educational opportunities provided by the schools.

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CHAPTER I

THE PROBLEM, RELATED STUDIES AND METHOD OF PROCEDURE

Every school day in 1965 over 20,000 buses, bombardiers, and station wagons transported more than one million children in excess of 2.5 million miles to Canada's public schools. (Roberts, April, 1966, p. 34)[21] During 1967 in Manitoba more than 2300 vehicles operated daily to convey over 45,000 students to elementary and seconday schools. (Department of Education, Manitoba, 1967)[5] As the school centralization program advances, transportation assumes increasing significance in the education system of the province. It is important, therefore, that school transportation should be given careful study to ensure economy, efficiency and safety in the education of youth.

Statement of Purpose

The purpose of this study is to determine the suitability of a selected set of factors as a measure of pupil transportation costs in school divisions, consistent with an adequate standard of transportation service in Manitoba. The criteria used must be relatively independent of local board policy if the derived measurement formula is to be universally applicable. It will also be necessary to give supplementary consideration to a comparison of contract with board-operated bus systems, and to study the nature of the services being provided, relative to the cost of pupil transportation.

Transportation and the Principle of "Equalization"

The grants for transportation at the time of this study were based upon the government's "estimate" of need, with the "hope" that the cost of service in most areas would be adequately covered without additional local taxation. According to the Manitoba Royal Commission on Local Government Organization and Finance [13] (April, 1964, p. 112) these grants are inadequate because they produce equalization only among those areas which have a comparable unit-cost of transportation. In view of the discrepancies between divisions in the per pupil cost of transportation, considerable variation exists in the local mill-rate required to provide a satisfactory service. This points out the need for some technique to determine transportation costs. Such a measuring device should be adaptable to different conditions, and should permit a comparison of the cost in one division with that in another.

The principle of "equalization" has been widely accepted in the United States and Canada as the basis of a foundation educational program. Essentially this involves the establishment and acceptance of a foundation or minimal program which all local authorities will be able to offer. Localities are required to contribute to a central fund according to an established formula, with the provincial government contributing an amount equal to the difference between the cost of the foundation program as calculated, and the amount obtained from a uniform rate of local taxation.

During the 1920's the Educational Finance Inquiry Commission of New York outlined the basic elements of an equalization program. (Strayer and Haig, 1923, p. 173)[22] The plan called for the establishment of school systems which would give every child in each locality an equal opportunity within feasible limits. The necessary funds were to be raised by local and/or state taxation on the basis of an equalized tax burden calculated on the ability-to-pay principle. To insure effective use of public funds and equality of educational opportunity the commission recommended close supervision and control of the schools or their direct administration by the state department of education.

Johns and Morphet (1960, pp. 350)[11] have argued that any plan to equalize educational opportunities and costs must include pupil transportation in a foundation program, particularly in rural areas where centralization creates distances which make walking or independent transportation impractical. This poses a problem respecting the determination of transportation costs. Should they be calculated on a basis different from that used in determining other costs such as instruction, or should they be reckoned on a single measure of need to be used for all aspects of the foundation plan? Some studies, such as those by Mort, (1933)[16] support the use of a single measure for calculating all aspects of educational need. But unless carefully devised, such a single unit could needlessly retard centralization because allowances might not be enough to cover pupil transportation costs. On the other hand, such a unit might unduly accelerate the centralization process or even lead to over-centralization.

Studies generally confirm that transportation costs are different from instructional costs in that the latter are more closely related to teachers, pupils and number of classrooms, whereas the former depend upon such factors as pupil distance from school, pupil distribution within the district or division, the type of school organization being utilized, road conditions, and topography of the area. These observations support the view that transportation costs must be determined on the basis of a complex rather than a simple measure, and independent of criteria used to arrive at instructional needs.

An accurate technique for the computation of pupil transportation costs cannot be disassociated from the element of administrative control. The simplest way might be to establish a "provincially" operated and controlled transportation system, eliminating all local jurisdiction over costs. This may appear to be undemocratic and tend to deaden local interest and initiative. It may be possible, on the other hand, to accept locally incurred expenditures without question and reimburse school authorities out of the foundation program fund. Such a plan would tend to reward inefficient and uneconomical practices. Still another procedure might utilize standardized schedules of costs computed on the basis of factors largely beyond the control of local school authorities. The variables most frequently used under such a plan are related to distance, area, density and population distribution. They can be used to evolve cost equations which are universally applicable. Such a plan would provide a maximum of education opportunity, encourage the development and exercise of local leadership, and demand a senseof responsibility in the provision of transportation services.

The last of the alternatives discussed above has been employed in Alberta. When transportation costs were first accepted as a part of the foundation plan in 1961 the pupil transportation costs were calculated on the basis of a formula which used a modified "dwelling-to-school" distance factor. (Order-in-Council, 1961)[19] As this approach entailed extensive data respecting the place of pupil residence, it was modified in 1962. (Order-in-Council, 1962)[20] The new plan was based on a "density of population" factor; density being determined by dividing the number of acres in a district by the number of pupils who live beyond $1\frac{1}{2}$ miles from school. The number of acres per pupil was determined for each division or district. These were classified into 36 density groups after the following manner:

Density Group Number	Number of Acres per Transported Pupil	Cost per Transported Pupil
1	1-40	95.00
2	41-80	96.00
36	1401-1440	206.00

On the basis of the correlations between the number of acres per transported pupil and the per pupil transportation costs of the previous year for each of the 36 groups, an equation was devised for the computation of pupil transportation need. As indicated in the table above, the costs that were derived by the application of the formula to each density classification, ranged from $95.00 to $206.00 per transported pupil. To determine the transportation grant to a division the number of pupils in need of conveyance was multiplied by the amount per pupil applicable in the particular density group under which the division was classified.

Both 1961 and 1962 plans employed in Alberta indicate attempts to include pupil transportation costs in the foundation program. Both treated transportation as separate from instructional or other costs, and based the computations on some form of density factor rather than merely on actual expenditures.

In Manitoba, apparently no attempt has been made to calculate transportation costs according to any specified measurement formula. None of the regulations pertaining to pupil transportation, passed in either 1958 or 1967 nor the amendments of 1960 and 1966, set forth any plan for the measurement of need in order to provide equalization of grants, and thus guarantee an adequate standard of transportation services. (Manitoba Regulation, 58:67)[12] It is evident from this that some attempt must be made to determine a suitable set of factors to measure the needs and therefore the costs of pupil transportation, and to relate these costs to the services provided.

Related Studies and Formulae

The basic principles to be used for the treatment of the pupil transportation data have been derived from a number of related studies and practices. These reveal a strong trend toward the use of some density measures in determining pupil transportation costs as part of a foundation program. Computations generally have been based upon such factors as the number of pupils needing transportation; the area served; the distance traversed; the school organization; the topography; and the conditions of roads.

Mort, (1933)[16] in his New Jersey study employed three factors in determining pupil transportation need. These were the size of buses;

the distance travelled by the vehicles; and the number of students conveyed. He gave his strongest support to the use of the density of school population factors.

Burns, (1938)[2] in his research, followed the correlational techniques employed by Mort. He first found the relationship of the "density of total population" to the "percentage of pupils transported" and found a close correlation between the population density figure and transportation costs. Next he determined the relationship between the "density of school population" and pupil transportation costs, and concluded, on the basis of the close correlation, that the state government could thus effectively predict pupil transportation need.

Noble, (1940)[18] after investigating pupil transportation costs in Alabama, Oklahoma and Ohio, concluded that authorities in all three states made use of regression equations in which some density factor(s) constituted the basis for the computation. In Alabama the pupil transportation needs were equated to a multiple of the average daily per pupil transportation cost as determined for the counties with a specified population density and the aggregate attendance of all transported students. Oklahoma (Noble, p. 172)[18] authorities adopted the amount of transportation grant per day as the product of the average number of pupils conveyed daily and the amount per pupil per day as specified in a cost schedule. The Ohio plan (Noble, p. 175)[18] employed a regression equation for each district, using the number of pupils conveyed and the number of transported pupils per square mile as the principal factors. The cost figures thus derived were adjusted in terms of some cost accounting factors such as the salaries of bus drivers, depreciation, storage of vehicles, interest on capital cost liabilities and the purchase prices of vehicles.

In his studies on pupil transportation, Johns (1928)[9] agreed to some extent with the Ohio plan as outlined by Noble. Johns reasoned that all factors such as road conditions, types of roads, transportation distance, contract prices and even the cost of living were either negatively or positively related with the density of population. Thus population density could be regarded as a summation of the effects of the various factors on cost of pupil transportation, and could be used as an independent criteria for predicting such costs. Johns, therefore, evolved an equation which used the percentage of average daily attendance per square mile. Lambert, however, criticized the formula on the ground that inequities would result, expecially when applied to unevenly populated areas. Johns (1949)[10] later argued for state-aid based upon computations giving equitable and objective consideration to criteria beyond the control of local school boards.

McLure conducted a study in Illinois with the purpose of developing a measure of pupil transportation need. (Cornell and McLure, 1949, pp. 152-153)[3] He developed formulae based on a density measure of pupils per square mile and broken into segments. In the equation $X_1 = 0.7700 - 0.0567X_2$, the symbol X_1 was taken to represent the (estimated) per pupil transportation cost in dollars and X_2 to represent the number of rural pupils per square mile. In summary his formula took the following forms:-

1. For counties with an average of 6 or fewer rural pupils per square mile: $X_1 = 0.7700 - 0.0567X_2$

2. For counties with an average of more than 6 rural pupils per square mile but not more than 11: $X_1 = 0.5850 - 0.0262X_2$

3. For counties with an average of more than 11 rural pupils per square mile but not more than 22: $X_1 = 0.4100 - 0.0100X_2$

4. For counties with an average of more than 22 rural pupils per square mile: $X_1 = 0.3000 - 0.0050X_2$.

An analysis by the Illinois Education Association, (1956)[8] subsequent to McLure's study indicated that pupil transportation costs are primarily related to such factors as the size of the districts, the sparsity of population, and the total number of pupils to be transported. The investigators reported that as the number of pupils per square mile increased, the corresponding cost per pupil for transportation continued to drop until a rather stable figure was reached at a population density of four or five pupils per square mile. (p. 55)[8]

A study similar to that of McLure was undertaken in Michigan by Medlyn (1954)[15] who sought to determine the average cost of pupil transportation and to identify some controllable and uncontrollable factors which influence pupil transportation costs. His analysis led to several conclusions. The four major transportation cost components appeared to be gasoline, vehicle depreciation, drivers' salaries, and mechanics' salaries. The variation in annual per pupil cost from district to district was \$18.00 to \$156.00 and the variation in actual cost per pupil per mile was 0.18 to 0.99. The factors which tend to cause this difference in cost from one district to another were:

1. The relationship between the number of children per bus route and the cost per pupil;

2. the pupil capacity of vehicles and the cost per pupil;

3. the number of buses in the fleet and the cost of the operation per vehicle;

4. the mileage traveled by the fleet and the cost of operation of the fleet.

Generally the number of pupils per bus route mile was considered a better prediction of per pupil costs than the pupil density per square mile.

Am approach similar to those employed in the United States was used by Mowat (1953)[17] in his study of pupil transportation costs in Alberta. He used the operational cost figures of the preceding year as a basis for computation and obtained a correlation between a group of three factors and pupil transportation costs. The three factors: (1) group total days, (2) total pupil load, and (3) round trip mileage, were correlated with costs for each of four classifications of bus-load groupings, viz., 1-8, 9-19, 20-40 and over 40 pupil capacity. By using the multiple regression equation Mowat arrived at a pupil transportation need formula for each of the bus-load groupings. The equation for the 1-8 pupil capacity group was $C = 0.557N + 0.308P + 0.172M$, with N representing the group total days, P representing the total pupil load, and M representing the total round trip mileage. Mowat found that in 47 out of 49 divisions in Alberta the use of the derived formula for each of the groupings would keep the transportation cost burden to within 0.08% of a standard provincial levy of eleven mills. He concluded, therefore, that the use of such a formula was justified as a measure of pupil transportation costs incorporated in a foundation program. Conceivably, in areas of low assessment and high costs, the provincial grant might cover a substantial portion of the financial burden.

A more recent study analysing pupil transportation costs in Kansas has utilized a factor analysis technique to determine cluster relationship among a series of variables affecting transportation costs. Dodson (1966)[6] selected thirteen factors which, he concluded, would cover almost every phase of the school operation that might influence pupil transportation costs. These were: pupil population, school area, total assessed valuation, total adjusted valuation, valuation per pupil, general mill levy, transportation expenditure, number of pupils transported, number of pupils transported 2½ miles or more, operating costs, expenditure rate per pupil, transportation density, and transportation expenditures per pupil. Of these, only the "magnitude" factors were found to have a statistically significant relationship. Table I shows, in order of importance, the statistical relationship between transportation costs and each of the "magnitude" factors.

It should be noted regarding Dodson's analysis, that the factors that have the highest correlation with transportation costs do not necessarily constitute a set of criteria that together would yield the best formula for the computation of pupil transportation need. This is because the criteria largely measure the same thing as indicated by the high correlation of each factor with costs. Apparently, what is needed in Manitoba is an equation based upon a set of factors that measures the different components which together account for pupil transportation costs.

TABLE I

CORRELATIONS OF FACTORS WITH TRANSPORTATION COSTS

Factors	Correlation
District pupil population	0.7671
Total assessed valuation	.6560
Operating costs[a]	.6512
Number of pupils transported $2\frac{1}{2}$ miles or more	.6398
General mill levy[b]	.6286
Number of pupils transported	.6237
Transportation density[c]	.4834
Area[d]	0.1582

[a] Based on all school district expenditures less funds spent for capital outlay, debt service and transportation

[b] The tax levied by the school district to raise funds for operating the school budget's general expenses

[c] The number of pupils transported per square mile

[d] The geographical bounds of a school district

Most of the factors used in these research studies have been successfully employed by various governments in the United States and Canada. A review of some of the formulae in use may illustrate this. In Indiana the state support per pupil was arrived at by multiplying $20.00 by the sparsity factor and this again by the ability factor. (Barr, 1955)[1] In this formula the sparsity factor was defined as the ratio of the number of transported pupils to the round trip mileage of all bus routes. The "ability factor" was the ratio of the adjusted assessed valuation of the district to the number of resident pupils.

Arkansas authorities determined the allowance per pupil by dividing the average number of pupils transported daily by the total area of the district in square miles. (Eidson, 1952)[7] A depreciation allowance fund for buses was worked out on the basis of a ten year life of service for each vehicle. The average cost per child for each district was determined on the basis of the area density and the actual cost per child.

In Kentucky the amount of state aid was determined by the product of the pupil density and the daily cost per pupil. (Department of Education, Kentucky, 1958)[4] The density figure was obtained by dividing the number of transported pupils in average daily attendance by the number of square miles of area served. The daily cost per pupil was determined by dividing the total annual cost of transportation by the product of the average daily attendance of conveyed pupils and the number of days the school was open.

Another formula employed in calculating transportation costs is the one used in South Dakota (McIntyre and Combs, 1952)[14] where the sparsity factor was computed from the dwelling-to-school distances for each child and the number of pupils transported. To determine the nature of the dispersion from which a regression line could be obtained, the costs were plotted against the sparsity factor. This regression line was then used as a measure of transportation need.

As the cited literature illustrates, researchers recognize that both demographic and operational factors influence pupil transportation costs. The selection of criteria for use in cost computation has been limited, however, by the need for quantitative measurement because some factors are dependent on the practices and policies of local school boards and are subject to local manipulation. Consequently most researchers have agreed with Burns' contention (p.54)[2] that it is preferable to determine pupil transportation needs and therefôre costs, in terms of natural or constant (demographic) factors that cannot be modified by every whim or policy of a local school board. For the purposes of this study, essentially those variables that are relatively independent of local manipulation have been selected as a basis for a measure of pupil transportation need. This should make for both economy and efficiency. The basically non-demographic factors will be given supplementary consideration.

Transportation Cost Factors

In view of the studies and formulae considered above, those factors that have been most frequently used and have served most effectively in the measurement of pupil transportation cost, have been selected for the present study. These factors may be outlined as follows:

1. <u>Pupil-Average Distance</u>

The number of square miles in the division is divided by the number of centralized schools to get the average number of square miles per centralized school. The square root of this value yields the approximate distance over which pupils, on the average, are transported. This average distance times the weighted average of the number of pupils transported daily, provides the pupil-average distance for each division. This is basically an area-distance factor. Variations both in the number of pupils transported and in average distances, would be relatively independent of local board policy.

2. <u>Bus mileage per transported pupil</u>

The total daily mileage of all buses is divided by the total daily bus load. Both distance and density factors are involved here. This factor introduces an element of local board influence in so far as the number of bus miles could be changed. e.g. if gate service is provided.

3. <u>Number of transported pupils per square mile of organized district</u>

The weighted average of the number of conveyed pupils in each division is divided by the number of square miles of organized district. This is basically an area-density factor. The measure could <u>not</u> be changed appreciably by school board policy.

4. <u>Number of transported pupils per bus operated</u>

The weighted average of the number of transported pupils in each division is divided by the number of buses operated. This is not directly an area or distance factor. The factor used might cause local boards to operate buses to maximum feasible load and produce as much as possible an equalization of pupil travelling time per day.

5. Assessed valuation per transported pupil

The assessment for each division is divided by the weighted average of the number of transported pupils. This factor does not make use of area or distance, and is largely independent of local board policy.

6. Bus mileage per square mile of organized districts

The daily bus mileage is divided by the number of square miles of territory. This factor involves both distance and area. It is not easily modified by local policy in that the number of square miles remain fairly constant although the bus mileage might be varied somewhat by board policy.

Treatment of Data

A weighting procedure was employed when dealing with bus mileage, the number of bus routes, and the number of pupils transported daily. Weighting involves multiplying the totals for the Spring Term by six and for the Fall Term by four, adding these products and dividing the sum by ten to arrive at an overall monthly average.

Correlations between costs of pupil transportation and each of the values of the selected factors were calculated. This revealed which factor ranked highest as a predictor of transportation costs and which ranked lowest. These calculations indicated the necessity for using more than one factor in a formula for the basis of transportation cost prediction.

To determine which set or combination of factors would together form the best measure of transportation costs, it was necessary to perform two further calculations: first, to establish the inter-correlation among costs and the different factors (i.e. to work out an intercorrelation among the measures) and second, to use a step-wise multiple regression analysis. This second computational procedure involved selecting in rank-order sequence, the three or four best predictors or measures of student transportation costs, to be used with the first or best measure as determined by the simple correlation process. The second factor made up for the maximum criteria variance remaining after the first measure had been selected, and likewise the third after the first two had been chosen, and so on until all factors were selected in the order of their contribution toward accounting for a maximum of the remaining criteria variance. This procedure took into consideration the direct relationship between each factor and the cost, and also, the indirect relationships which prevailed among the various predictor factors.

The next step in the process was to calculate the costs of student transportation as applied to each division using the derived formula and comparing these computed costs with actual costs to appraise the effects of the application of the formula to each division. From this it was possible to determine the most appropriate set of factors to be used as a valid basis to measure pupil transportation cost in Manitoba. Consideration was also given to the nature of service rendered in relation to the calculated and actual costs of transportation.

Source of Data

The sources of the data for this transportation study were:

1. Department of Education Annual Reports, documents and records;
2. Department of Municipal Affairs Annual Reports, documents and records;
3. reports from the Departments of Education in other western provinces;
4. reports, monographs, etc., from Teachers' and Trustees' Associations in other provinces;
5. Manitoba Government Orders-in-Council;
6. Public School Acts and related regulations;
7. Manitoba Divisional Office records;
8. questionnaires sent to the divisional offices.

For the purpose of this study the 1967 operational data for both the Spring and Fall Terms were utilized, with annual figures arrived at on the basis of a weighted average. It was necessary to determine and compare the costs of "contract" with "board-operated" transportation for each division and to relate costs to the services provided. Determining the costs for each term and for the entire fiscal year permitted the use of financial reports from various government departments and made possible adjustments in data necessitated by the administrative changes in some of the school divisions.

For a number of reasons the 1967 rather than the 1966 operational data were the most appropriate figures to use respecting both costs and services of pupil transportation. During 1967 the new unitary division grant system came into effect, allowing the lesser of $175 per pupil or the actual per-pupil costs, to be paid to the twenty divisions that had established a single board to control both elementary and secondary education. These grants were retroactive to January 6, 1967. Eleven other divisions on a second referendum voted for unification during the year and the higher grant system became effective at the beginning of 1968. Eight rural divisions rejected a unification vote during 1967. In total, these nineteen divisions received transportation grants to the extent of $100 per pupil or enough to cover actual costs, whichever was the smaller amount, with grants payable to both the secondary and elementary school boards in the non-unitary divisions. The administrative structure within these divisions including the existing transportation systems, continued substantially unchanged during the year. This made possible a comparison of pupil transportation policies, costs, and services in one division with those in another.

The data used as a basis for selecting a suitable set of pupil transportation cost measurement factors were derived essentially from unitary divisions (1967), because:

1. the non-unitary divisions (1967), with few exceptions, transported secondary pupils;
2. school districts within the non-unitary divisions (1967) conveyed only elementary pupils in relatively small numbers;
3. it was possible to obtain information required to make adjustments in the data to accommodate any significant changes that occurred in these areas respecting such matters as the number of buses and the number of pupils transported; (most non-unitary divisions and school districts were unable to provide this kind of data)
4. the data from the predominantly urban unitary divisions could

> not be used due to the high population concentration, the high assessed valuation, the small acreage, and, in some cases, the relatively small number of pupils transported.

As a basis for comparing the cost of contract with board-owned bus systems, and for determining the nature of services provided, the data from 20 unitary divisions (1967), 2 non-unitary divisions (1967), and 28 consolidated school districts were utilized. The predominantly urban divisions, 18 non-unitary (1967) divisions and 11 consolidated school districts within the non-unitary divisions were not included in this study because:

1. the urbanized divisions furnished little basis for comparison with the predominantly rural areas;

2. information from the 18 non-unitary divisions (1967) and 11 consolidated school districts, was either seriously inaccurate or unavailable;

3. the unconsolidated school districts within the non-unitary system were not included because of the lack of centralization and a consequent absence of pupil transportation.

Supplementary Considerations

Since the method of school bus ownership and the general quality of services provided were issues of importance in the province, essentially inseparable from a consideration of pupil transportation costs, it was necessary to give supplementary consideration to these matters. In Chapter IV a comparison is made between "privately-owned" and "public-owned" bus systems. Chapter V deals with a study of the quality of pupil transportation services being provided.

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CHAPTER II

DATA, PROCEDURES, AND FINDINGS

The values of the six factors selected for this study are set forth in Table II. Correlations were derived between each factor and the actual cost of pupil transportation (criterion). Intercorrelations among the factors were then determined and the procedure previously described (see page 16, chapter I) was employed to establish the order in which combinations of factors may be used to yield the best prediction of pupil transportation costs.

The Factors used in Measuring Pupil Transportation Costs

The data were obtained from 20 divisions involving the transportation operations of 1967 only. The six factors used were:

1. Pupil-average distance
2. Bus mileage per transported pupil
3. Number of transported pupils per square mile of organized division
4. Number of transported pupils per bus operated
5. Assessed valuation per transported pupil
6. Bus mileage per square mile of organized division.

Treatment of the Data

The data were adjusted to apply to the calendar year by "weighting" them. Thus the figures for the June term were multiplied by 6 corresponding to the 6 months from January to June. The data for the December term were multiplied by 4 corresponding to the 4 months in this term. These products were then added and the sum

TABLE II

VALUES OF EACH OF THE SIX FACTORS FOR EACH DIVISION

Division (1)	Pupil-Average Distance Factor 1 (2)	Bus Mileage per Transported Pupil Factor 2 (3)	No. of Pupils Transported per sq. mile of Organized Area Factor 3 (4)	No. of Transported Pupils per Bus Factor 4 (5)	Balanced Assessment per Transported pupil Factor 5 (6)	Bus Mileage per sq. mile of Organized Area Factor 6 (7)	Operating Cost of Pupil Transportation Criterion-Cost (8)
A	2,550.465	0.6800	1.2300	42.750	$20,596.29	0.8355	$ 36,375.00
B	3,107.894	1.1545	2.0397	43.307	25,786.03	2.3548	40,034.36
C	3,784.142	1.7827	1.1840	35.600	33,105.42	2.1080	53,969.00
D	7,258.307	1.6559	0.5363	19.000	36,334.89	0.8879	86,408.96
E	4,404.761	0.8842	1.3513	29.833	12,666.53	1.1958	96,596.43
F	9,121.742	0.9623	1.3340	32.440	8,067.04	1.2345	112,166.61
G	3,697.903	1.2480	4.5935	32.989	11,204.97	5.7515	115,917.87
H	9,180.600	1.6815	1.4361	26.830	17,251.72	2.4140	124,716.91
I	8,335.230	1.6040	2.6756	39.000	38,401.90	4.2948	128,949.00
J	12,137.368	1.6145	1.2558	35.161	14,886.07	1.7304	134,234.37
K	7,340.534	1.7240	2.3563	30.640	20,785.20	4.0629	154,615.70
L	15,177.881	1.3578	1.8380	48.211	14,266.04	1.8850	158,300.00
M	12,535.590	2.1775	0.9184	24.800	5,201.12	2.0000	178,127.57
N	5,548.327	3.3470	1.3333	16.912	36,359.70	4.4548	187,969.00
O	9,101.096	1.5942	2.6220	42.210	8,545.85	4.1801	203,781.42
P	13,961.160	2.1810	1.2524	24.632	12,877.30	2.7407	205,850.00
Q	12,654.777	2.6267	0.8411	25.350	5,782.05	2.1806	221,428.00
R	16,731.074	2.6169	0.6871	26.967	5,755.01	1.8115	240,605.23
S	15,123.946	1.8439	1.6750	43.066	13,351.30	3.0890	241,556.20
T	18,877.512	1.8464	1.2805	23.778	10,041.34	2.4390	255,396.00

divided by 10 to obtain a weighted average for the calendar year. This "adjustment" was applied to the number of pupils conveyed, the number of centralized schools, the number of buses employed, and the daily bus mileage.

Description and Interpretation of Factors

Pupil-Average Distance

The number of square miles in each division was divided by the number of centralized schools to obtain the average number of square miles per centralized school. The square root of this value yielded the approximate distance over which pupils, on the average, were transported. This average distance was multiplied by the weighted average of the number of pupils conveyed daily, to provide the pupil-average distance for each division. The numerical values for this measure appear in Table II column (2), and vary from a low of 2,550.465 for Division A to a high of 18,877.512 for Division T. Such variation may be ascribed to the differences among the divisions in the number of students transported and the distances they were conveyed to centralized schools, both of which would be relatively independent of local board policy.

Bus Mileage per Transported Pupil

The total daily bus mileage in a division was divided by the total number of pupils transported daily by all buses in that division. The numerical values for this factor are listed in Table II, column (3), and vary from a low of 0.6800 for Division A to a high of 3.3470 for Division N. Thus, for every student conveyed in Division A a bus travelled an average of 0.6800 miles as compared to 3.3470 miles in Division N. Mileage figures might be modified by board policy respecting such matters as bus route patterns, "gate-service", employment of "division-owned" as opposed to "privately-owned" buses, the sizes of buses, and the use of feeder routes. Population movements would also affect the school bus mileage although this would be beyond school board control.

Number of Transported Pupils per square mile of Organized Area

The weighted average of the number of transported pupils in a school division was divided by the number of square miles in that division. The values as applicable to each unitary division are recorded in Table II, column (4), and indicate a low of 0.5363 transported pupils per square mile in Division D and a high of 4.5935 in Division G. This range reveals that the value of this factor is approximately 9 times as great in Division G as in D. This measure again is not subject to appreciable variation by the local school board because both population figures and size of the division are beyond the powers of the divisional school board.

Number of Transported Pupils per Bus Operated

The weighted average of the number of pupils conveyed in a division was divided by the weighted average of the number of buses operated in that division. Table II, column (5), indicates a low of 16.912 transported pupils per bus in Division N and a high of 48.211 in Division L. Some variations in this measure could be caused by school board policies on such matters as "gate-service" and partially occupied or overcrowded buses. This factor is largely governed, however, by the scatter of population.

Assessed Valuation per Transported Pupil

This factor does not employ either distance or area. The balanced assessment for a division was divided by the weighted average number of transported pupils in that area. These values appear in Table II, column (6) and show a low of $ 5,201.12 per transported pupil in Division M and a high of $38,401.90 per pupil in Division I. In the latter the assessed valuation per student was about 7 times as great as that in the former. Variations in the values of this measure would be influenced only slightly by changes in school organization, being largely independent of local school board policies.

Bus Mileage per square mile of Organized Area

The total daily bus mileage in a division was divided by the number of square miles in that division. As revealed in Table II, column (7), this measure of density ranged from a low of 0.8355 bus miles per square mile in Division A to a high of 5.0535 in Division G. Although bus mileage may be modified by board policy as described under Bus Mileage per Transported Pupil (p. 25), the number of square miles of organized district remain constant.

Statistical Treatment of the Six Density Factors

Coefficients of correlation between the cost of pupil transportation in the divisions and each of the values of the measurement factors were calculated. These correlations are summarized in Table III. Factor 1 correlated highest with the cost of pupil transportation and was therefore the best measure (predictor)* of pupil

*Factors used to measure pupil transportation costs may also be called predictors of pupil transportation costs.

TABLE III

SIMPLE CORRELATIONS BETWEEN COSTS OF PUPIL TRANSPORTATION AND COST MEASUREMENT FACTORS

Factor	Factor Number	Correlation with Cost	Correlation Squared
Pupil-Average Distance	1	+0.7940	0.6304
Bus Mileage per Transported Pupil	2	+0.5440	0.2959
Number of Transported Pupils per square mile of Organized Area . .	3	-0.0940	0.0088
Number of Transported Pupils per Bus Operated	4	-0.2840	0.0807
Assessed Valuation per Transported Pupil	5	-0.4800	0.2304
Bus Mileage per square mile of Organized Area	6	+0.2055	0.4223

transportation costs. Factor 2 placed second highest.

To determine the degree to which the various factors could be used to predict costs, the correlations of Table III were squared. This yielded 0.6304 for Factor 1 indicating that by itself it would account for approximately 63% of the operating costs of pupil transportation. It was deemed necessary, therefore, to use more than one factor in the final formula. To determine which additional "factors" would assist in increasing the percentage of influence upon the cost of pupil transportation, the inter-correlation among the factors was determined, the results of which are summarized in Table IV.

The complex relationships among the cost and measurement factors, summarized in Table IV, emphasized the need for further statistical procedures to select a second, third, or even a fourth factor to be employed collectively for cost prediction purposes.

The method of analysis used for determining the optimum relationship between the cost of pupil transportation (criterion) and the six factors (predictor variables) was that outlined by Wherry. (Garrett, 1965, pp. 426-443)[1] The procedure is essentially to

(1) select those factors which yield a maximum R (correlation) with the criterion (cost) and discard the rest;

(2) calculate the multiple correlation after the addition of each factor, stopping the process when the correlation no longer increases;

(3) compute a multiple regression equation from which the criterion (cost) can be predicted with the highest precision of which the given list of factors (predictors) is capable.

TABLE IV

INTER-CORRELATIONS AMONG COSTS AND SIX FACTORS

		Criterion	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Cost of Pupil Transportation	C	1.000	+0.794	+0.544	-0.094	-0.284	-0.480	+0.205
Pupil-Average Distance	1		1.000	+0.227	-0.346	-0.145	-0.534	-0.230
Bus Mileage per Transported Pupil	2			1.000	-0.137	-0.591	+0.140	+0.328
No. of Transported Pupils per sq. mile of Organized Area	3				1.000	+0.348	+0.046	+0.799
No. of Transported Pupils per Bus Operated	4					1.000	-0.035	-0.022
Assessed Valuation per Transported Pupil	5						1.000	+0.160
Bus Mileage per sq. mile of Organized Area	6							1.000

Illustration of the Method Used

Step 1

The correlation coefficients between each of the factors and the criterion which appear in Table IV were entered, with signs reversed, in V_1 row of Table V. The numbers heading the columns refer to the factors as tabulated previously. (see p. 23 and Table II, p. 24)

Step 2

The number 1.000 was entered in each column of the row Z, in Table VI, p. 33. Here again the numbers heading the columns refer to the predictors.

Step 3

The factor with the highest $\frac{V_1^2}{Z_1}$ quotient was selected as the first factor of the series. Table V, p. 32 and Table VI, p. 33 reveal this to be Factor 1, the Pupil-Average Distance. The calculation of this quotient is provided just below Table V, p. 32.

Step 4

The Wherry formula, $\overline{R}^2 = 1 - K^2 \left(\frac{N-1}{N-m}\right)$, was now applied. In this formula $\overline{R}$ is the multiple correlation coefficient. In Table VII, p. 34 column c, row 0, under K^2 the figure 1.0000 was entered. The N in column d represents the number of school divisions involved in the survey. The quotient $\frac{V_1^2}{Z_1}$ appears in column b, row 1.

$$\frac{V_1^2}{Z_1} = \frac{(-0.7940)^2}{1.000} = 0.6304$$

This amount 0.6304 was subtracted from 1.000 to yield 0.3696 as the entry in column c, under K^2. The quotient $\frac{(N - 1)}{(N - m)}$ is recorded in d, row 1.

TABLE V

CORRELATION WORK SHEET 1

	Factors					
	1	2	3	4	5	6
V_1	-0.7940	-0.5440	+0.0940	+0.2840	+0.4800	-0.2060
V_2		-0.3240	-0.1810	+0.1690	+0.0560	-0.3890
V_3		-0.1683	+0.1139	+0.1466	+0.0707	
V_4		-0.0496		+0.0306	+0.1276	
V_5		-0.0645		+0.0186		
V_6				-0.0101		

$$\frac{V_1^2}{Z_1} = \frac{(-0.7940)^2}{1.000} = \frac{0.6304}{1.000} = \underline{\underline{0.6304}}$$

$$\frac{V_2^2}{Z_2} = \frac{(-0.3890)^2}{0.9480} = \frac{0.1513}{0.9480} = \underline{\underline{0.1598}}$$

$$\frac{V_3^2}{Z_3} = \frac{(+0.1139)^2}{0.3339} = \underline{\underline{0.0388}}$$

$$\frac{V_4^2}{Z_4} = \frac{(+0.1276)^2}{0.6304} = \underline{\underline{0.0258}}$$

$$\frac{V_5^2}{Z_5} = \frac{(-0.0645)^2}{0.4254} = \underline{\underline{0.0097}}$$

$$\frac{V_6^2}{Z_6} = \frac{(-0.0101)^2}{0.4612} = \underline{\underline{0.0002}}$$

TABLE VI

CORRELATION WORK SHEET 2

	Factors					
	1	2	3	4	5	6
Z_1	1.000	1.000	1.000	1.000	1.000	1.000
Z_2		0.9484	0.8803	0.9790	0.7150	0.9471
Z_3		0.7958	0.3339	0.9465	0.7134	
Z_4		0.4339		0.6007	0.6304	
Z_5		0.4254		0.5452		
Z_6				0.4612		

TABLE VII

CORRELATION WORK SHEET 3

a	b	c	d	e	f	g	Factor Number
m	$\frac{Vm^2}{Zm}$	K^2	$\frac{N-1}{N-m}$	$\overline{K^2}$	$\overline{R^2}$	$\overline{R}$	
0		1.0000	(N=20)				
1	0.6304	0.3696	1.0000	0.3696	0.6304	0.7940	1
2	0.1598	0.2098	1.0556	0.2215	0.7785	0.8820	6
3	0.0388	0.1710	1.1177	0.1911	0.8089	0.8990	3
4	0.0258	0.1452	1.1875	0.1724	0.8280	0.9100	5
5	0.0097	0.1355	1.2667	0.1716	0.8280	0.9100	2
6	0.0022	0.1333	1.3572	0.1809	0.8191	0.905	4

Since (N - 1) = 19 and because m (the number of factors selected) here is 1, (N - m) also equals 19 and $\frac{(N - 1)}{(N - m)} = 1.000$. Next the product of columns c and d was entered in column e: (0.3696) x 1.000 = 0.3696. This amount was then subtracted from 1.000 to obtain $\overline{R^2} = 0.6304$ which was entered in column f, row 1. The square root of this column f entry is the correlation of Factor 1 with the criterion (cost) and is recorded in column g under $\overline{R}$.

Step 5

For the selection of a second factor to be added to the first one a work sheet similar to Table VIII, p. 36 was utilized. Row a_1 was left blank. Row b_1 contains the correlations of Factor 1 (first selected factor) with each of the other factors as recorded in Table IV, page 30. In the column for Factor 1 the amount 1.000 was entered while in column -C the correlation of Factor 1 with the cost (criterion) was recorded. Its sign was reversed. Next the algebraic sum of the b_1 entries (-0.8220) was entered in the "Check Sum" column. Each b_1 entry was now multiplied by the negative reciprocal of the b_1 entry for Factor 1 and the products tabulated in the c_1 row. Since the negative reciprocal of Factor 1 was (-1.000), the items in the c_1 row are identical with those in row b_1 except that the signs are reversed.

The product of the b_1 entry in the criterion (-C) column of Table VIII by the c_1 entry for <u>each</u> of the six factors was added algebraically to <u>each</u> V_1 entry in Table V (page 32). The results of these calculations for each factor were recorded in the V_2 row of Table V, page 32. The formula for finding each V_2 entry is $V_2 = V_1 + b_1(\text{criterion}) \times c_1(\text{each factor})$. Thus for Factor 2, the V_2 item is: $V_2 = -0.5440 + (-0.7940) \times (-0.2270) = -0.3240$.

TABLE VIII

CORRELATION WORK SHEET 4

	1	2	3	4	5	6	Criterion (Cost) -C	Check Sum	Factor Number
a_1									
b_1	+1.0000	+0.2270	-0.3460	-0.1450	-0.5340	-0.2300	-0.7940	-0.8220	1
c_1	-1.0000	-0.2270	+0.3460	+0.1450	+0.5340	+0.2300	+0.7940	+0.8220	
a_2	-0.2300	+0.3280	+0.7990	-0.0220	+0.1600	+1.0000	-0.2055	+1.8292	6
b_2		+0.3802	+0.7194	-0.0554	+0.0365	+0.9471	-0.3881	+1.6401	
c_2		-0.4014	-0.7596	+0.0585	-0.0385	-1.0000	+0.4098	-1.7317	
a_3	-0.3460	-0.1374	+1.0000	+0.3480	+0.0459	+0.7992	+0.0940	+1.8028	3
b_3		-0.3476	+0.3339	+0.3398	-0.1665		+0.1140	+0.2734	
c_3		+1.0410	-1.0000	-1.0176	+0.4986		-0.3408	-0.8188	
a_4	-0.5340	+0.1402	+0.0459	-0.0350	+1.0000	+0.1597	+0.4800	+1.2568	5
b_4		+0.0735		+0.0591	+0.6304		+0.1276	-0.8906	
c_4		-0.1166		-0.0938	-1.0000		-0.2024	+1.4127	
a_5	+0.2270	+1.0000	-0.1374	-0.5910	+0.1402	+0.3283	-0.5440	+0.2431	2
b_5		+0.4254		-0.1890			-0.0645	+0.3398	
c_5		-1.0000		+0.4443			+0.1517	-0.7988	

The product of the b_1 and c_1 entries in Table VIII for each factor, were added algebraically to each factor in row Z_1 of Table VI, page 33, and recorded in the Z_2 row of the same table. The formula applied was $Z_2 = Z_1 + b_1$ (a given factor) x c_1 (the same factor). Thus for Factor 2, the $Z_2 = 1.0000 + (.227) \times (-.227)$ which equals +0.9484.

The factor (predictor) having the largest $\frac{V_2^2}{Z_2}$ quotient was selected as the second factor. The quantity $\frac{V_2^2}{Z_2}$ is a measure of the amount which the second factor contributes to the squared multiple correlation coefficient, $\overline{R}^2$. Table V, page 32 and Table VI, page 33, show that Factor 6 yielded the largest $\frac{V_2^2}{Z_2}$ quotient which was $\frac{(-0.389)^2}{(+0.947)} = (0.1598)$. This quantity was entered in column b, row 2 of Table VII, page 34. After subtracting the ratio $\frac{V_2^2}{Z_2}$ from the K^2 entry in column c, row 1, the difference was recorded in column c, row 2. The quotient $\frac{(N - 1)}{(N - m)}$ was found to be 1.0556, with $N = 20$ and m (number of factors chosen) equal to 2. This quotient was entered in column d, row 2. Next, the product of the c and d columns, (0.2215), was recorded in column e, row 2. The quantity was subtracted from 1.0000 to yield 0.7785 as the entry in column f, row 2. The square root of this last quantity, (0.7785), which was 0.8820, constituted the multiple coefficient $\overline{R}$ involving two factors, and was entered in column g, row 2.

By adding the $\overline{R}$ of Factor 1 to the $\overline{R}$ of Factor 6, the multiple R increased from 0.7940 to 0.8820. As this was a significant increase, it became necessary to proceed to add a third factor in the hope of further increasing the multiple $\bar{R}$. The procedure was essentially repetitious of that followed in determining the coefficients for Factor 1 and Factor 6, and the results have been summarized in Table V, page 32, Table VI, page 33, Table VII, page 34, and Table VIII, page 36.

It was found that the multiple correlation coefficient for Factors 1, 6, 3, and 5 was 0.910. With the selection of Factor 5 the process had reached the point where the addition of another factor would not increase the multiple $\bar{R}$. Consequently it was concluded that Factors 1, 6, 3, and 5 constituted a set which has the highest validity of any combination of factors chosen from our list of six. Table V, page 32, Table VI, page 33, Table VII, page 34, and Table VIII, page 36 were thus considered complete, (i.e. requiring no additional entries).

Step 6

In setting up a multiple regression equation for the 4 selected factors, the c entries for Factors 1, 6, 3, and 5 and for the criterion (cost), as shown in Table VIII, page 36, were summarized in Table IX.

TABLE IX

SUMMARY OF INTER-CORRELATIONS FOR THE FOUR SELECTED FACTORS

	Selected Factors				
	1	6	3	5	-C
c_1	-1.0000	+0.2300	+0.3460	+0.5340	+0.7940
c_2		-1.0000	-0.7600	-0.0390	+0.4100
c_3			-1.0000	+0.4990	-0.3410
c_4				-1.0000	-0.2020

When equated to zero, each row in Table IX is an equation defining the beta (β) weights.

For the 4 selected factors these equations were:

$$-1.0000\beta_1 + 0.2300\beta_6 + 0.3460\beta_3 + 0.5340\beta_5 + 0.7940 = 0$$

$$-1.0000\beta_6 - 0.7600\beta_3 - 0.0390\beta_5 + 0.4100 = 0$$

$$-1.0000\beta_3 + 0.4990\beta_5 - 0.3410 = 0$$

$$-1.0000\beta_5 - 0.2020 = 0$$

In solving these equations it was found that $\beta_1 = 0.7066$, $\beta_6 = 0.7536$, $\beta_3 = -0.4418$ and $\beta_5 = -0.2020$.

To write the regression equation in score form the β's were transformed into b's in the following manner:

$$b_1 = \frac{\sigma_c}{\sigma_1}\beta_1 \qquad b_6 = \frac{\sigma_c}{\sigma_6}\beta_6$$

$$b_3 = \frac{\sigma_c}{\sigma_3}\beta_3 \qquad b_5 = \frac{\sigma_c}{\sigma_5}\beta_5$$

The σ's are the SD's of the factor scores: σ_1 of Factor 1, etc. The regression equation in score form was found to be:

$$X_c - M_c = b_1(X_1 - M_1) + b_6(X_6 - M_6) + b_3(X_3 - M_3) + b_5(X_5 - M_5)$$

$$\overline{X}_c = b_1X_1 + b_6X_6 + b_3X_3 + b_5X_5 + K \text{ (constant)}.$$

When the values of the b's and means, as summarized in Table X, were substituted in the score form of the regression equation the following result was obtained:

$$\overline{X}_c = 9.6825\, X_1 + 38{,}273.7078\, X_6 - 32{,}778.0155\, X_3 - 1.26134\, X_5 + 28{,}889.601$$

TABLE X

SUMMARY OF VALUES FOR b's AND MEANS

Factor	b values	Means
1	+ 9.6825	9,531.5300
6	+38,273.7078	2.6896
3	-32,778.0155	1.6205
5	- 1.2613	17,563.2900
C		148,849.5500

Check on β weights and multiple R

The following formula (Garrett, p. 439)[1], in which R is expressed in terms of beta coefficients, was used to check the β weights. In the formula,

$$R^2_{c(1635)} = \beta_1 r_{c1} + \beta_6 r_{c6} + \beta_3 r_{c3} + \beta_5 r_{c5}$$

the c represents the criterion (cost), the r's are the correlations between (c) and Factors 1, 6, 3, and 5. By using the beta weights (see page 39) and the required correlations (see Table IV, page 30), the value of $R^2_{c(1635)}$ was obtained.

$$R^2_{c(1635)} = (0.7066)(0.7940) + (0.7536)(0.2055) + (-0.2020)(-0.4800) + (-0.4418)(-0.0940)$$

$$= 0.5610 + 0.1549 + 0.0970 + 0.0415$$

$$= 0.8544$$

Therefore:

$$R_{c(1635)} = 0.9243$$

From $R^2_{c(1635)}$ it is evident that Factors 1, 6, 5, and 3 as a selected set, accounted for 85% of the variance of the criterion (cost). These factors (1, 6, 3 and 5) contributed 56%, 15.5%, 9% and 4% respectively, to the criterion variance.

The R^2 which is 0.8544, as calculated above, is very nearly equal to $1 - K^2$, (Table VII, column c, row 4, page 34) which is 1 - 0.1452 or 0.8548. This checks very closely with the R^2 found above (0.8544) and therefore also shows the accuracy of the weights.

The multiple correlation coefficient of 0.9243 is slightly larger than $\bar{R}$ of 0.9100 (Table VII, column g, row 4, page 34) found between the criterion and the selected set of four factors. The calculated R was adjusted, therefore, in order to provide a closer estimate of the correlation in the population. From

$$\overline{R^2} = \frac{(N - 1)R^2 - (m - 1)}{(N - m)} = \frac{(19)(.8544) - 3}{16} = 0.8271$$

the $\overline{\overline{R}}$ was found to be 0.9095. This $\overline{\overline{R}}$ (i.e. 0.9095) is the corrected multiple correlation between the criterion (cost) and the selected set of four factors. Therefore the shrinkage in multiple R as found by the Wherry method (Garrett, pp. 423-446)[1] is small (0.9243 - 0.9095) = <u>0.0148</u>, and the multiple R used checks very closely with the multiple correlation as usually calculated.

Summary

The foregoing chapter has presented a description of the transportation cost measurement factors, the related data for each unitary division and their statistical treatment. By a multiple correlational analysis of the factors, the "average-pupil distance" (Factor 1) was found to be the best single predictor of pupil transportation costs, based on 1967 operational data. Three additional factors found to be useful were "the bus mileage per square mile of organized territory" (Factor 6), the "number of transported pupils per square mile of organized territory" (Factor 3), and the "assessed valuation per transported pupil" (Factor 5). These four measures were combined in a regression equation for predicting the cost of pupil transportation in the unitary divisions. A check on the β weights and multiple R verified the accuracy of the beta weights and revealed a close relationship of the $\overline{\overline{R}}$ to the multiple correlation coefficient as usually calculated.

References

[1] Garrett, Henry E, Statistics in Psychology and Education, New York, David McKay Company, Inc. 1965

CHAPTER III

APPRAISAL OF THE COST FORMULA

Application of the Equation to the Unitary School Divisions

The score form of the regression equation, which was found to be

$$\bar{X}_c = 9.6825X_1 + 38,273.7978X_6 - 32,778.0155X_3 - 1.2613X_5 + 28,889.601$$

was used to calculate the cost of pupil transportation for each unitary division. The results of these calculations are summarized in Table XI which also provides a comparison of the actual costs, calculated costs, grants, and maximum available grants for each unitary division.

The number of divisions, in which the calculated transportation costs were either in excess of or below the actual costs, is presented in Table XII, page 46.

As is apparent from Tables XI and XII, that calculated (formula) costs did not deviate excessively from the actual costs. This supports the use of a prediction equation based upon a selected set of pupil transportation cost factors. It is noteworthy that in 4 of the 5 divisions in which the actual costs were more than $20,000 in excess of calculated costs, predominantly or only contract buses were used. In all three divisions in which the actual costs ranged from $5,000 to $20,000 in excess of "formula" costs, from one third to three fourths of the buses were contract vehicles. Contrasted with this, it was found that all 8 divisions in which calculated costs exceeded actual costs, employed mainly or only division-owned buses.

The cost equation was derived from pupil transportation data

TABLE XI

COMPARISON OF ACTUAL COSTS, CALCULATED COSTS, ACTUAL GRANTS, AND MAXIMUM AVAILABLE GRANTS

Division	Cost of Pupil Transportation	Calculated Costs	Grants for Transportation	Maximum Available Grant*
A	$ 36,375.00	$ 8,976.91	$ 36,375,00	$ 59,850.00
B	40,034.36	49,559.43	40,034.36	98,525.00
C	53,969.00	65,969.00	53,969.00	93,450.00
D	76,408.96	64,931.79	76,408.96	106,400.00
E	96,596.43	58,445.84	96,596.43	125,300.00
F	112,166.61	110,888.17	112,166.61	181,650.00
G	115,917.87	120,244.60	115,917.87	178,850.00
H	124,716.91	141,059.79	124,716.91	192,500.00
I	128,949.00	137,932.03	128,949.00	190,750.00
J	134,234.37	152,555.98	134,234.37	190,750.00
K	154,615.70	151,803.48	154,615.70	235,900.00
L	158,300.00	169,479.11	158,300.00	244,650.00
M	178,127.57	190,062.35	178,127.57	190,925.00
N	187,969.00	163,889.85	163,800.00	163,800.00
O	203,781.42	180,325.91	203,781.42	280,700.00
P	205,850.00	201,907.55	205,850.00	243,250.00
Q	221.428.00	200,005.56	221,428.00	230,650.00
R	240,605.00	231,401.92	240,605.00	279,825.00
S	241,556.20	221,645.32	241,556.20	249,025.00
T	255,396.00	250,403.67	255,396.00	299,600.00

*Based on $175.00 per transported pupil in Unitary Divisions or the actual cost, whichever is the lesser

TABLE XII

THE NUMBER OF DIVISIONS IN WHICH ACTUAL COSTS DIFFER FROM CALCULATED COSTS BY THE SPECIFIED AMOUNTS

Calculated Costs are:	Number of Divisions
within $10,000 of actual costs;	8
within $20,000 of actual costs;	15
within $30,000 of actual costs;	19
up to $10,000 in excess of actual costs;	3
up to $10,000 below actual costs;	5
from $10,000 to $20,000 in excess of actual costs;	5
from $10,00 to $20,000 below actual costs;	2
from $20,000 to $30,000 in excess of actual costs;	0
from $20,000 to $30,000 below actual costs;	4
from $30,000 to $40,000 below actual costs.	1

of 1967 during which half the divisions under study used predominantly "contract" buses. Since these cost considerably more than "division-owned" systems (see Chapter V), the total operating costs were higher than they would have been if all buses had been board-operated. The cost formula, reflecting the impact of the "contract" buses, therefore yielded cost figures in excess of actual costs in those divisions that operated efficient and economical division-owned systems. There were, no doubt, other variables that contributed toward the fact that calculated costs were either above or below actual costs, but this study does not attempt to identify all of these. This would be an area for further investigation.

It can be assumed, however, that if all divisions operated their own bus systems, the cost prediction formula based upon such a uniform system of bus owndership, would yield (predicted) cost figures that deviate even less from the actual than those obtained by the equation in this study. It appears that the application of the derived formula should provide sufficient funds for operating an adequate pupil transportation system in the unitary divisions, and should serve to suggest areas where additional financial assistance might be required and where such assistance could be diminished.

The derived pupil transportation cost equation utilized Factor 1--"pupil-average distance", Factor 3--the number of transported pupils per square mile of organized territory, Factor 5--assessed valuation per transported pupil, and Factor 6--bus mileage per square mile of organized area. The first of these factors which accounted for 56% of the criterion (cost) variance, supports the principle of equalization in that both, the number of pupils transported and the distances they are conveyed, are relatively independent of local board policy. The same observation can be made regarding Factor 3 in so far as both population density and the size of the school division are beyond the powers of the local school board. The third factor used (i.e. Factor 5), also upholds the principle of equalization in that the assessed valuation per transported pupil can be influenced only slightly by changes in school organization. Factor 6 introduces an element of board influence in that bus mileage may be modified by local policy although the number of square miles of organized district would remain constant. Hopefully local officials would use personal initiative to modify bus route patterns, numbers and sizes of buses, etc. in such a way as to reduce mileage and still provide efficient service.

It is significant that in all but one division the maximum available grant based upon the number of pupils transported during 1967, was much greater than the actual operating costs or the actual grants received. This lends credence to the view expressed by authorities in several divisions, that the provincial pupil transportation grants are too generous.

Appraisal in Terms of Mill Rate

To further explore the effect of the use of the four factor regression equation on shareable pupil transportation costs in each unitary division, another calculation was undertaken. In view of the wide variation in balanced assessments it was deemed appropriate to express the differences between "calculated" (formula) and actual costs of pupil transportation as a mill rate on balanced assessment. This gave an indication of the additional tax effort beyond any grants based upon the formula costs, that would be required to provide the existing level of transportation service. It also indicated areas in which a saving could be effected without detrimental consequences upon existing services. The results of these calculations are summarized in Table XIII.

A positive value in column 4 of this table indicates that the calculated (formula) costs exceeded the actual, while a negative value reveals that actual costs were greater than those derived by application of the "cost equation". The former might indicate a reward for efficiency and enable the division to improve its services or to use the surplus for other educational purposes. The latter might show the need for an additional levy unless changes in local policies and services can be brought about to reduce costs to the level of the "calculated costs."

According to Table XIII, column 6, eight of the twenty divisions would experience rate decreases. Although these decreases would be small, being well below one mill in six of the eight divisions with rates of 1.13 and 2.1 in the other two divisions, grants based upon the "calculated" costs would give these areas a small revenue surplus.

In 12 of the 20 divisions the "actual" exceeded the "calculated" costs. With grants based upon the derived cost equation, 6 of the 12 divisions would experience rate increases well below one mill while

TABLE XIII

DIFFERENCE BETWEEN ACTUAL AND CALCULATED COSTS TRANSLATED INTO MILL RATES ON BALANCED ASSESSMENT

Division 1	Pupil Transportation Costs 2	Calculated Costs (Formula) 3	Difference between Calculated and Actual Costs 4 [a]	Balanced Assessments 5	Mill Rate on Balanced Assessment 6 [b]
A	$ 36,375.00	$ 8,976.91	-17,398.09	$ 7,043,930.00	+3.89
B	40,034.36	49,559.43	+ 9,525.07	14,517,535.00	-0.66
C	53,969.00	65,969.00	+12,000.00	17,678,296.00	-0.68
D	76,408.96	64,931.79	-12,477.17	22,491,613.00	+0.56
E	96,596.43	58,445.84	-38,150.59	9,069,240.00	+4.21
F	112,166.61	110,888.17	- 1,278.44	8,373,590.00	+0.15
G	115,917.87	120,244.60	+ 4,326.73	11,451,480.00	-0.38
H	124,716.91	141,059.79	+16,342.88	18,976,890.00	-0.86
I	128,949.00	137,932.03	+ 8,983.03	41,857,990.00	-0.22
J	134,234.37	152,555.98	+18,321.61	16,225,820.00	-1.13
K	154,615.70	151,803.48	- 2,812.22	28,018,490.00	+0.10
L	158,300.00	169,479.11	+11,179.11	19,943,930.00	-0.56
M	178,127.57	190,062.35	+11,934.78	5,674,430.00	-2.10
N	187,969.00	163,889.85	-23,238.72	34,032,680.00	+0.68
O	203,781.42	180,325.91	-23,455.51	13,707,540.00	+1.71
P	205,850.00	201,907.55	- 3,942.45	17,899,451.00	+0.22
Q	221,428.00	200,005.56	-21,422.44	7,620,750.00	+2.81
R	240,605.00	231,401.92	- 9,203.08	9,202,260.00	+1.00
S	241,556.20	221,645.32	-19,910.88	18,998,900.00	+1.00
T	255,396.00	250,403.67	- 4,993.33	17,190,770.00	+0.29

[a] A (-) in column 4 indicates that the "actual" exceed the "calculated" costs and a (+) shows the converse

[b] A (+) in column 6 indicates a possible need for additional tax levy (mill rate) to cover costs or the amount of cost reduction (expressed in mill rate) necessary to equate "actual" with "calculated" costs. A (-) reveals a possible reduction in tax levy or the amount of surplus expressed in mill rates

increases in the other 6 areas would range from 1 to 4.21 mills. Significant differences between actual and calculated costs might indicate the need for a local or divisional study of the transportation system to determine possibilities of increasing economy of operation by changing from "private" to "public" ownership of buses, by replanning bus routes, by changing the size of buses, and/or attending to other modifications of the bus system and its management.

Evaluation in Terms of Equalization Principles

The results of applying the pupil transportation cost equation to the 20 divisions included in this study show that the "formula technique" would

1. be consistent with the equalization principle;

2. indicate the amount of funds for each division on an objective yet realistic basis, giving consideration to the many variations within the province;

3. prevent the use of public funds to encourage inefficiency or uneconomical practices as exemplified in the large number of "contract" buses being used over which school boards cannot exercise effective control; (see Chapters IV and V)

4. promote local initiative, responsibility and leadership;

5. encourage centralization by eliminating small, ineffective, low enrolment schools;

6. provide for the formation of better local policies and practices wherever they are justified by special local conditions;

7. encourage long range planning of transportation services as opposed to short-sighted practices based on day to day expediency;

8. provide an equation adaptable to changing conditions from one school term to another whenever fresh data becomes available or as new conditions suggest modification.

Summary

A brief reference to prevailing concepts of "equalization" supported the view that pupil transportation services should be included as part of a foundation educational program but be treated as separate from instructional costs. The absence of a pupil transportation cost formula in Manitoba emphasized the need for a study designed to derive, if possible, a suitable cost equation that would support the idea of "equalization" and serve as an accurate "predictor" of school transportation operating costs.

The principles used for the treatment of pupil transportation data were derived from a number of related studies and practices. These indicated a strong emphasis on the use of some density measures in determining pupil transportation costs as part of a foundation program. Both research studies and formulae already in use revealed four classes of factors affecting pupil transportation costs. These were

1. the number of pupils transported;
2. the area served;
3. the policies of local school boards;
4. the topography of the region.

From these six measures of pupil transportation cost were developed. They were

1. pupil-average distance;
2. bus mileage per transported pupil;
3. number of transported pupils per square mile of district;
4. number of transported pupils per bus operated;
5. assessed valuation per transported pupil;
6. bus mileage per square mile of organized district.

These six factors had been most frequently used, had served most effectively in the measurement of transportation costs, and were those for which data were available either from the Department of Education or from divisional and district offices.

The six selected factors were described and the nature and organization of the data set forth. The statistical treatment of these data was outlined and illustrated. A weighting procedure was employed when dealing with the number of buses used, the bus mileage and the number of pupils transported daily. Correlations between costs of of pupil transportation and each of the values of the selected factors revealed pupil-average distance to be the best single predictor of costs. Calculation of the inter-correlations among cost and the different factors, and a subsequent multiple regression analysis indicated that the three best predictors or measures of student transportation costs, to be used with the first or best measure as determined by the simple correlation process were: (1) the number of transported pupils per square mile of organized territory; (2) the assessed valuation per transported pupil, and (3) the bus mileage per square mile of organized area. From these an equation was derived, based upon the most appropriate set of factors, to be used as a valid measure of pupil transportation cost in the unitary divisions of Manitoba.

The derived cost formula was then applied to the unitary divisions and the calculated costs were compared with actual costs. It was found that in 12 out of the 20 divisions, included in this study, the costs derived by means of the formula were below actual costs, suggesting the need for investigation on the local level respecting such matters as management, economy and efficiency. In 5 divisions the two costs were very nearly equal and in the remaining 3 areas the calculated costs were above the actual.

The differences between the two types of costs were also expressed in terms of mill rates on balanced assessments. The results showed that 12 divisions would experience tax increases or decreases well below 1 mill while only 4 would require increases ranging from 1.71 to 4.21 mills.

The relatively small differences between formula and actual costs, whether expressed directly in dollars or in terms of mill rates supported the use of the derived regression equation as an effective device for predicting pupil transportation costs without violating accepted equalization principles.

Limitations and Recommendations

Despite the apparent applicability of the derived pupil transportation cost equation there was evident a need for continuing research in the field of school transportation costs. More data on pupil transportation operations should be made available by school divisions and districts. The use of several factors or measures of density such as pupil-district-distance and bus route patterns, employed in transportation studies in other areas, was initially contemplated but not used because of insufficient data. More information is needed on

1. bus mileage, e.g. feeder lines, extra-curricula trips, etc.;
2. the types of roads;
3. natural barriers;
4. the extent of uninhabited areas through which buses travel;
5. the extent of isolated pockets of settlement.

Some areas in which research could profitably be carried on are:

1. the nature and degree of administrative control in the school divisions;

2. the relationship of the type of bus route and the type of vehicle to variations in mean unit costs;

3. the relationship of vehicle capacity and percentage of utilized capacity to variations in mean unit costs;

4. the effect of route pattern upon the mean unit cost;

5. the cost of insurance, licences and interest charges as related to mean unit costs;

6. the cost of "gate-service" and feeder routes as part of the overall transportation cost;

7. the relationship of topography and road conditions to transportation costs.

Supplementary Considerations

Since the costs of pupil transportation are really inseparable from such aspects as the type of bus ownership, and the general quality of the services provided, these matters will be considered in subsequent chapters.

SUPPLEMENT--PART I

CHAPTER IV

A COMPARISON OF THE COSTS OF PUBLIC-OWNED AND CONTRACT BUS SYSTEMS

It appeared, during the course of this investigation, that the per-pupil transportation cost was higher for privately owned buses than for those owned by the public. As more than half the divisions under study used only or predominantly contract vehicles, a comparison of the "private" operating costs and the nature of their services with those of division owned systems became necessary. The significance of this was emphasized by the need for economy and efficiency as indicated by the application of the cost equation. The subsequent sections, therefore, present a statistical examination of the two types of school transportation systems, but the treatment is somewhat less objective than that followed in deriving the cost formula because of the nature of the factors involved.

Related Studies

Research has shown that the cost per transported pupil is higher for private or contract than for division-owned buses. A study made of Central School Districts of New York State shows that the mean-cost per pupil was $29.38 for public-owned buses and $43.39 per pupil for contract bus systems. The mean cost per mile was $0.3025 for the public-owned buses while the corresponding figure for contracted vehicles was $0.4588. (University of the State of New York)[6] A similar investigation in Ontario revealed that the mean unit cost* for privately-owned school buses was 2.04 cents compared to 0.95 cents for

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* The mean unit cost was the cost of transporting one pupil one mile

board-owned vehicles. School-board ownership appeared to enjoy a definite financial advantage over other types of ownership. (Brehaut, 1953-54)[2]

In 1926, Greene conducted a comparative study of school transportation costs in both sparsely populated districts and more heavily populated areas of Colorado. (Greene, 1926)[4] He discovered that the operating cost of public-owned bus systems in densely populated areas was $0.175 per mile as compared to $0.259 per mile for privately-owned systems. Operating a contract bus system in the more sparsely populated areas cost 17% more than operating a public-owned system.

Beck made a study of 20 districts in Illinois, 10 of which employed contract buses and the others owned their vehicles. He found that contract buses cost $93.49 per pupil compared to $60.58 per pupil for public-owned systems. (Beck, 1952)[1] Similar studies were conducted by Waterman in Wyoming (1949)[7] and Ercolini in Oregon (1953)[3]. Waterman reported that in 1948 the mean operating cost per pupil for contract bus systems was 18% higher than that for district-owned systems. This was so despite the fact that all equipment costs for that year were included as transportation costs for that year only and were not depreciated over a number of years. According to the Ercolini study in 1953, the mean per pupil costs for school districts which operated public-owned bus systems was $50.00 while the mean cost to the districts which operated contract bus systems was $58.00 per pupil.

In the studies cited above three commonly accepted criteria were used to make cost comparisons of public-owned and privately-owned bus systems. These criteria were:

1. annual cost per pupil

2. annual cost per bus mile

3. annual cost per bus seat (i.e. mean cost per bus divided by the average number of pupils per bus transported).

Each of these criteria can also be utilized in comparing the costs of division or district-owned with privately-owned bus systems in Manitoba.

Comparison of Contract with Public-owned Bus Systems in Manitoba

Number of divisions and districts included in this survey

Of the 48 school divisions in Manitoba 8 provided little or no pupil transportation in 1967 and these were all unitary. Out of the 21 other unitary divisions (1967) 5 utilized only or mainly contract buses, 8 used predominantly or only division-owned vehicles, and 8 employed both contract and division-owned systems. The comparison of contract with board-owned buses, as presented in this study, involved 22 divisions and 28 consolidated districts as they operated in 1967. Eight school divisions provided little or no pupil transportation, consequently had no data to report, 18 divisions and 11 consolidated districts failed to report the needed information with accuracy or in sufficient detail to make possible its use for comparative purposes.

Comparison of overall costs and pupil capacity

From TableXIV it can be seen that in the 50 divisions and consolidated districts that reported the required data, contract buses transported only 34.17% of the pupils but traveled 46.19% of the total distance, at 49.72% of the overall operating costs of pupil transportation.

TABLE XIV

A "NUMBER" AND "PERCENTAGE" COMPARISON OF PUBLIC-OWNED WITH CONTRACT BUSES

	Public-Owned Bus Routes	Contract Bus Routes
Number of Buses	355	415
Per Cent of Buses	46.10%	53.90%
Number of Pupils Transported Daily . .	18,159	9,428
Per Cent of Pupils	65.83%	34.17%
Total Miles Driven Daily	15,214	12,274
Per Cent of Miles	53.81%	46.19%
Total Cost	$1,317,560.00	$1,313,120.00
Per Cent of Cost	50.27%	49.72%

Annual cost per school bus

Since the operating cost of a bus depends to a great extent upon its seating capacity, this factor was given consideration. The average operating costs per contract bus were $3164.14 was compared with $3711.43 for public-owned buses. (see Table XV) Two reasons for the mean operating cost per board-owned bus being higher than that for contract buses seem apparent from Tables XIV and XV which show that

1. the mean pupil capacity of public-owned vehicles is more than twice that of contract buses, and

2. the average number of miles traveled per day by a board-operated vehicle was 42.86 compared to 30.54 miles per day for contract buses.

TABLE XV

A "MEAN" COMPARISON OF PUBLIC-OWNED WITH CONTRACT BUSES

	Public-Owned Buses	Contract Buses
Mean cost per bus	$3,711.43	$3,164.14
Mean cost per bus seat	86.60	103.60
Mean cost per pupil	72.56	138.75
Mean cost per mile	0.433	0.535
Mean cost per pupil per mile	$ 0.0000238	$ 0.0000567
Mean bus capacity (Number of pupils)	51.16	22.72
Average number of miles per bus per day	42.86	30.54

Annual Cost per Bus Seat

The mean annual cost per school bus seat for public-owned buses was $86.60 compared with $103.60 per seat for contract bus systems. (see Table XV) The cost for private bus systems was 19.63% higher than that of public-owned.

Annual Cost per Pupil

As Table XV, page 60, reveals, the average annual cost per pupil is almost twice as high for contract as it is for public-owned buses. The mean cost per pupil for contracted transportation was $138.75 or 91.22% higher than that for public-owned. Based on this cost-per-pupil comparison alone, all other factors being equal, the divisions and districts involved in this part of the survey could have reduced their 1967 pupil transportation operating expenditures by 47.70% of the cost of bus contracts or by $626,458.24.

It is interesting to note the wide range in per pupil costs for both types of transportation as illustrated in Table XVI. This indicates the extent of the variations that prevailed among the different divisions and districts.

TABLE XVI

ANNUAL COST PER PUPIL

	Public-Owned Bus Systems	Contract Bus Systems
High	$201.52	$324.98
Mean	72.56	138.75
Low	16.39	73.14

Cost per Mile

The comparison of contract with public-owned bus systems on the basis of cost-per-mile appeared significant since both the cost of operating the vehicles and the distance traveled by the school buses are primary determinants of the unit cost for pupil transportation systems. As Table XVII indicates, the mean cost-per-mile for contract buses was 43.3 cents, compared with 53.5 cents per mile for public-owned. Considering only this comparison contract buses were 23.56% more costly to operate than public-owned buses. On the basis of this cost-per-mile factor, and barring all others, the school divisions and districts included in this study could have saved $250,411.98 in 1967 by operating only board-owned buses.

TABLE XVII

COST PER MILE

	Public-Owned Bus Systems	Contract Bus Systems
High	$1.250	$1.690
Mean	0.433	0.535
Low	0.100	0.200

Cost per Pupil per Mile

The use of the cost-per-pupil-per-mile factor is significant since a cost-per-pupil which appears to be unduly high may be quite reasonable when the distance factor is also considered. This was particularly noticeable in divisions and districts employing both contract and public-owned vehicles.

According to Table XVIII the mean cost-per-pupil-per-mile (annual) was $0.00005671 for contract as compared to $0.0000238 for public-owned buses. On the basis of this unit of measurement the operating costs of contract vehicles was 138.23% higher than that of buses owned by the public.

TABLE XVIII

COST PER PUPIL PER MILE

	Public-Owned Bus Systems	Contract Bus Systems
High	$0.00013181	$0.00012022
Mean	0.00002381	0.00005671
Low	0.00000069	0.00000184

Using the cost-per-pupil-per-mile as a unit of measurement and assuming the equality of all other factors, the divisions and districts included in this study might have saved $761,388.78 in the operating costs of transportation by utilizing board operated in place of contract systems. This figure was derived by reducing the total operating cost of contract buses in the divisions and districts by 57.98%.

It may be impractical in some cases to eliminate entirely the use of contract vehicles. Furthermore, many factors make it difficult to bring about the full amount of the reduction in operating costs suggested above. The foregoing comparisons do show, however, that contract systems are substantially less economical than public or board owned.

Types of Roads

It is reasonable to assume that the type of roads upon which the transportation vehicles must travel could have definite influence upon transportation costs, Since statistics on the number of miles traveled by buses on paved, gravel or dirt roads, was not available, it was not possible to make specific comparisons. It is noteworthy, however, that in 50 divisions and districts which forwarded information on contract and public-owned buses the operating costs of privately owned were substantially higher than those of the board operated systems under very similar road conditions that existed in these predominantly rural communities

Cost of Administration and Supervision

School boards must pay for time and effort consumed in administration and supervision of their bus systems. In most of the divisions and districts under study, these supervisory duties were carried out by employees who performed various other duties. Remuneration for time spent in services connected with pupil transportation was not recorded as a transportation expense. Should these have been included, the costs of the public-owned systems would have been somewhat greater than that indicated above, but proportionately less great than contract vehicles.

Return on Investment

Anyone who contracts to provide pupil transportation hopes to realize a financial return which will cover all costs, including depreciation, and will yield a profit on his investment. This is taken into consideration by the contractor and therefore adds to the cost of transportation services as compared to the cost of the same services rendered by a public bus system where profits need not be realized nor made up with public funds, and where such factors as depreciation on equipment are covered by capital investment grants.

Quality of Services

A significant factor in the cost of pupil transportation is the quality of the services rendered. Some areas have suggested that the higher cost of the privately owned buses can be justified on the basis of greater efficiency and more effective service than that provided by the public owned systems.

It should be noted, however, that the mean pupil capacity of privately owned buses was 22.72 (Table XV, page 60) with a large number of vehicles in the 6-10 passenger range and many of them traveling long distances on the same stretch of road. The consequence of this was comparatively more drivers, a high upkeep expenditure, and a loss in economy of size. In many instances one larger bus could have been used to do efficiently and economically what six or seven smaller vehicles were engaged to do. A school board, however, cannot easily bring about fully efficient routes where pupil transportation has been contracted out to private concerns, and especially where owners of station wagons, bombardiers and small buses engaged to convey the children have expended considerable investment for this equipment.

It is further evident from the comparisons presented in Table XIX, that the services provided by contract buses were generally inferior in nature to those rendered by board operated vehicles. The suggestion, therefore, that the higher costs of privately owned buses is justified by the superior nature of their services does not appear to be substantiated.

TABLE XIX

COMPARISON OF THE NATURE OF CONTRACT WITH BOARD OWNED BUS SERVICES

	Contract Buses	Board Owned Buses
Percentage of bus systems characterized by each of the following:		
1. A routine bus safety check		
a) every 1000 to 2000 miles	24.00%	47.00%
b) as required by provincial regulations . .	55.00%	53.00%
c) not reported	21.00%	0 %
2. A bus cleaning		
a) Daily	35.00%	56.00%
b) Weekly	37.00%	44.00%
c) Irregularly	28.00%	0 %
3. A medical examination for bus drivers		
a) as a pre-requisite for employment	31.00%	62.00%
b) as an annual check while employed	4.70%	34.00%
4. A separately employed bus mechanic	0 %	18.75%
5. A supervisor of transportation	0 %	37.50%
6. A shop used only for bus maintenance	0 %	6.25%
7. A policy of safe driving awards	3.00%	25.00%
8. The use of student bus patrols to:		
a) help children at the bus doorstep	3.00%	18.75%
b) help children across the highway	18.75%	50.00%
9. A prearranged "plan of action" outlining what is to be done by the driver, the students, the principal, and the parents, in case of:		
a) a bus fire	9.38%	37.50%
b) a vehicle collision	12.50%	31.25%
c) breakdown of the bus on a road	18.75%	56.00%
d) a bus caught in a rain or snow storm . . .	25.00%	62.50%
e) unforeseen delays in bus arrivals or departures	21.95%	62.50%
f) bus transportation cancellations	37.50%	68.75%
10. Use of literature and meetings to inform the public on matters of pupil transportation	6.25%	25.00%

Summary

A review of related literature revealed that both research and experience support the use of board-owned pupil transportation systems. An examination of pupil transportation in 22 divisions and 28 consolidated districts in Manitoba indicated that on the basis of

1. annual cost per bus seat
2. annual cost per pupil
3. cost per mile
4. cost per pupil per mile,

the cost for contract buses was significantly higher than that for the public owned. Logically the difference in cost between the two types of pupil transportation could not be ascribed to the differences in kinds of roads because in many areas both contract and board-owned buses traversed the same or similar routes. It was evident that contract buses were usually not subject to effective school board management and control. Therefore, despite higher costs, the services rendered by contract buses were generally inferior to those provided by board owned systems.

Contract bus services thus appeared to be more expensive than board operated transportation. It may therefore be concluded that the application of the derived cost formula, as shown on page 39, would yield results that would deviate even less from the actual costs than did those in this present study, provided all or even most divisions resorted to the use of predominantly division-owned vehicles. Until such a conversion occurs, the derived equation would tend to provide some financial advantage to those divisions that operate efficient and economical public-owned systems. These savings could be utilized by them in improving other services. On the other hand, the areas that operate contract vehicles would thereby incur monetary pressures resulting from the excess of actual over formula costs. This might influence decisions toward the public ownership and consequently a closer quality control of pupil transportation.

This is not intended to suggest that all private vehicles should be eliminated from bus routes. In some instances, it might be both economical and more efficient to retain some of them, especially in small isolated pockets of population.

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SUPPLEMENT--PART II

CHAPTER V

PUPIL TRANSPORTATION SERVICES

As this study progressed it became evident that some consideration should be given to those aspects of pupil transportation which contribute to the quality of the services but cannot be measured effectively in financial terms. The purpose of the following sections, therefore, is to examine the general quality of pupil transportation services as noted in 31 divisions and 28 consolidated districts in Manitoba and, where possible, to related these to the operating costs. As in the preceding chapter, the treatment of data in this section is somewhat less objective than that used in deriving the cost equation, essentially because of the nature of the factors involved.

Description of Services

Bus Mechanic In many parts of Canada and the U.S.A., school boards have realized the advantages of board-operated shops for the maintenance and servicing of equipment. (School Progress, April, 1963, p. 44)[7] Although a few school boards in Manitoba either own or rent a shop for bus maintenance, the fact that only 15.15% of the divisions and districts involved in this study employ a bus mechanic suggests a need for development in this direction.

Supervisor of transportation Many school board officials in Manitoba agree that a large bus fleet demands special supervisory attention to ensure safe and economical operation.[16] Servicing of equipment, proper scheduling, driver recruitment and training, purchasing and routing, all require specialized attention. The fact that 20.54% or 12 of the 59 divisions and districts surveyed, employed a supervisor of transportation appears indicative of a trend toward the engagement of such an official.

Inquiries from several supervisors of transportation showed that the qualifications for such an official need to be carefully set forth. Lester C. Winder, director of transportation of the Normandy School District in St. Louis, Missouri attempted such an outline of qualifications. (School Progress, April, 1963, pp. 44-47)[7] The supervisor, he maintained, should:

1. be able to write specifications for the type of equipment which can do the job most efficiently and economically, giving due consideration to such matters as terrain, climate and density of population;

2. be able to establish the most efficient and economical bus routes and schedules;

3. be capable of setting up an efficient preventive maintenance program;

4. provide a driver training program;

5. know how to establish safety programs and acquaint the community with safety rules;

6. be able to keep all office records respecting students, driver equipment, mileage, all transportation costs, and submit related provincial reports;

7. be capable of working out a program of special services, such as educational field trips and athletic trips;

8. be knowledgeable in the concept of public relations;

9. accept responsibility for superintending all matters relating to student conduct pertaining to school buses and drivers.

Finding personnel to match such qualifications is difficult, but much has been done in various parts of Canada and the U.S.A. to improve services by providing in-service training courses, driver training clinics and workshops. One such course for bus supervisors and operators was sponsored by the Ontario Safety League in August 1963, and attended by school bus operators and supervisors from various parts of Canada. (School Progress, August 1963, p. 33)[4] Leading authorities from the United States and Canada were brought in to give instruction and guidance in practically every major aspect of the operation of pupil transportation systems.

By the close of the year (1967) apparently nothing had been done in the areas surveyed in Manitoba to provide in-service training for pupil transportation supervisors, and most of those employed had never received any specialized training for the job. School boards could make such courses available at relatively small expense. Well- qualified supervisors would be in a position to provide effective management that might result in a substantial saving of public funds, in efficient transportation service, and in the avoidance of serious accidents.

Mechanical safety inspections While driver competance is important it is evident that a capable driver cannot provide safe transportation if his vehicle is in poor mechanical condition. In 1967 many divisions and districts in Manitoba lacked a regular and systematic program of maintenance and inspection by well-qualified mechanics. Only 29% or 17 of the areas surveyed indicated the existence of a policy of mechanical safety inspections other than the semi-annual check-up required by provincial regulations. (Manitoba Regulation, 118/67)[14] In these same school areas only 10% or 6 school board either owned or rented a shop used exclusively for bus maintenance and repair. Although this would require additional expenditures for rentals, capital investment and salaries, developments in this direction are necessary if school divisions hope to render the type of efficient and safe pupil transportation now prevalent in many parts of Canada. (Katz)[12] (School Progress)[18] Polichek, supervisor of transportation at Quesnel, British Columbia has reported that every one of the buses under his control is given a regular monthly check, and detailed records are made of what is done and of all the defects that are found and rectified. Drivers are required to report on the state of the vehicle they have driven.

<u>Safe driving awards</u> A policy of safe driving awards has proven to be a valuable contribution toward top driver performance in many parts of the United States and Canada. In 1966 Elmer Polichek of Quesnel, British Columbia, was the recipient of the Ontario Safety League award for the third successive year. (School Progress)[18] During the same year he presented safe driving awards to eleven of his bus drivers. Each of them held a Class "A" chauffeur's licence, had at least 15 years' experience, and was a married man with children. In contrast to such an emphasis on safe driving awards only 13.5% or 8 of the 31 divisions and 28 consolidated districts surveyed in Manitoba offered some form of award as an incentive toward excellence of driving performance. This could be done with a very minimum of expenditure.

<u>Health of driver</u> Of vital importance to pupil safety is the physical condition of the bus driver. The state of Pennsylvania evolved a list of criteria now widely accepted in the United States and Canada. (Katz, p. 17)[12] (Rose, pp. 124-127)[17] This standard requires the driver to be tested annually for vision, hearing, muscular steadiness and strength,

reaction time, and freedom from physical ciditions which might cause him to faint. Psychological tests are also required to determine whether the driver is stable, self disciplined and patient. He should also be a person of healthful living habits. Compared with this, the standards required of school bus drivers in Manitoba appear inadequate. Only 42.80% or 25 of the divisions and consolidated districts surveyed required a medical examination of the driver before being hired, and 24.06% or 14 school boards demanded an annual examination. Here again is an aspect of pupil transportation service of vital importance to the children, that could be instituted at little or no extra cost to the division.

Automotive accessories The "extra" pieces of equipment that form part of a school bus system constitute a significant measure of the local emphasis on pupil safety and efficient service. Polichek of Quesnel (School Progress, p. 58)[18] has insisted that all larger vehicles should be equipped with very low rear axle gear ratios, air brakes, and tachnometers to assist in gear shifting at correct engine speeds. The Quesnel buses are also equipped with defroster fans, additional inside heating, special seating frames, defrosting rear mirrors, and windshield washers. In addition, all buses carry chains, shovels and sand, and are equipped with deep-tread tires throughout the year. There are, admittedly, a number of bus systems in Manitoba that meet the requirements of those in the system just described. Of all the bus systems surveyed, 54.00% were equipped with additional inside heating, 51.50% with windshielf washers, 6.61% with two-way communication devices, 29.10% carried chains, 55.40% carried shovels, and 17.57% carried sand. Although vehicles conveying children on paved roads near large urban centers may not require all the items listed above, the majority of the buses in the province, do need such equipment to enable them to meet eventualities with a maximum of safety for the pupils.

Plans to meet emergencies No matter how thoroughly trained the driver or how well equipped the buses, emergencies that place students in jeopardy can arise at most unexpected times. In many parts of Canada school boards have drawn up a "plan-of-action" outlining what is to be done by the driver, the students, the principal, and the parents when emergencies arise. (Nuttall, p. 40)[15] Despite general concurrence on the necessity of such a policy, many school boards included in this study have given little attention to the formulation of a "pre-arranged plan of action" This is evident from Table XX.

TABLE XX

NUMBER AND PERCENTAGE OF SCHOOL BOARDS PREPARED FOR ACTION IN CASE OF SPECIFIED EMERGENCIES

Emergency	Number of School Boards	Percentage of School Boards
1. A bus fire	12	20.03%
2. A vehicle collision	15	25.42
3. Breakdown of bus on a road	23	38.98
4. Bus caught in rain or snowstorm	27	46.76
5. Unforeseen delays of bus	26	44.07
6. Bus transportation cancellations	33	55.93

Boarding and leaving buses, crossing roads In 1965, the Ontario Transport Department reported a total of 184 accidents and 97 injuries involving school buses. Most of these occurred on the way home and resulted from improper bus evacuation and the careless crossing of highways.

The Ontario Transport Department has recommended that pupils should line up single file before boarding a bus, with the younger children at the front of the line. (Rose, p. 126)[17] Many areas in Ontario have followed government recommendations and now employ student bus patrols to assist young children at the bus door and to escort pupils across highways. Typical of the regulations prevalent in that province are those in effect in the Nassagaweya Township School Area. (Bornhold)[3] The school board there demands that

1. students file in lind, girls first, boys following, and enter the bus in an orderly way;
2. older students must be an example for younger pupils and assist them when alighting from the bus;
3. students must not be allowed to run in front of, or around the back of the bus; students must stand away from the bus and wait until the bus has pulled away, then they may proceed across the road after looking both ways for traffic;
4. each driver shall name two students to act as safety helpers.

The idea of appointing "safety helpers" has been rather fully developed in the Warwick Township School Area where John Beaton composed a set of rules and organized a bus safety patrol system. (Beaton)[2] He did this with the aid of the Handbook for Members of School Safety Patrol,[6] the tules developed by the Superior Coach Corporation, Lima, Ohio, and from his own experience. The system is apparently working very effectively.

Replies received from various divisions, districts and counties in different parts of Canada indicate that many areas have local regulations regarding such matters as bus patrols, loading of buses, evacuation of buses, conduct at bus stops, and crossing of roads by pupils. Generally these are very similar to those prevalent in the Nassagawa and Warwick

Townships noted above, and in some areas in Alberta. (Fadum)[9] (Hall)[10] (Hawkesworth)[11]

In Manitoba comparatively little has been done at the local level to formulate safety regulations such as those presently in effect in many parts of British Columbia, Alberta, and Ontario. At the time of this study only 8.47% or 5 of the 59 areas surveyed had instituted emergency bus evacuation drills. The practice of having pupils line up single file before boarding the bus had been adopted by only 22 or 37.29% of the school boards and the use of patrols was prevalent in 18 or 30.51% of the bus systems.

Pupil conduct on the bus A further subject of interest respecting pupil safety is student conduct while on the bus. Reavell, Safety Promotion Officer, Department of Transport, Ontario insists that safe driving is a full time job without the added responsibility of maintaining discipline. (Rose, p. 126)[17] The same department has recommended that pupils boarding a bus should be seated promptly and remain so until the bus has reached the desired destination. Pupils should refrain from loud and boisterous talking while on route. There should be no meddling with emergency doors or other equipment. Directions and instructions of the operator should be promptly obeyed. These stipulations are in accord with the recommendations made by the Alberta Department of Education in 1962 and since implemented by most divisions and counties in that province. (Department of Education, Alberta)[5]

Similar action has been taken in Wisconsin where schools have organized bus safety patrol systems. (Katz)[12] A two-man safety patrol is assigned to each bus. The patrolmen are senior students selected because of their maturity, intelligence and status in student activities. One of the patrolmen assists the children across highways while the other one insists that every pupil takes his assigned seat and conducts himself in an orderly manner while in transit. According to Wisconsin school officials, the student patrolmen have justified the confidence placed in them and have reduced disciplinary problems to a minimum.

That comparable action has not been taken in Manitoba appears evident from the fact that only 3 of the 59 school boards contacted indicated the use of student patrols or a supervisor of pupil conduct while vehicles are in motion. Only one of the divisions utilized a student council representative to help the driver maintain suitable student behavior. Of all the areas contacted, 31 or 52.54% reported a seating plan for students and only 7 or 11.86% attempted to have boys and girls seated separately on a bus. In many instances the driver did not know the names of the pupils and frequently he did not know how many pupils were on board.

Communication with the public Apparently very little is being done by school boards in Manitoba to inform the parents on matters of pupil transportation and the associated problems of safety, pupil conduct, and conditions required for effective service. Approximately 19% or 11 of the 59 school boards made an attempt to communicate with parents through literature and/or public meetings on matters of pupil transportation.

Summary

In retrospect, it appears that some of the changes in pupil transportation services suggested by the survey would entail additional expenditures. More specifically these would be:

1. employment of well-qualified transportation supervisors, bus drivers, and mechanics;

2. acquisition of additional equipment such as spare buses, communication systems and other necessary automotive accessories;

3. divisional ownership of shops for bus maintenance and repair.

Logically the savings resulting from good management and control, efficient use of equipment, and the prolonged life of vehicles would more than cover the additional cost of employing expert personnel and of operating division-owned garages. In addition to greater economy resulting from the adoption of the practices outlined above, students would enjoy greater safety and more acceptable transportation service.

It should be noted, also, that effective management would improve the general quality of pupil transportation by attending to those aspects which do not necessarily involve additional expenditures. Some of these might be:

1. more frequent and thorough vehicle safety inspections

2. a policy of safe driving awards

3. more emphasis on the health and personal characteristics of bus drivers

4. school board policies respecting
   a) a pre-arranged plan-of-action to meet emergencies
   b) pupil boarding and leaving of buses
   c) pupil conduct on buses
   d) the use of bus patrols
   e) emergency training for pupils and drivers

5. a means of educating the public on all aspects of pupil transportation.

Recommended Areas for Further Research Study

Further investigations might be conducted in such areas as:

1. Safety measures and pupil behavior in Manitoba's school transportation systems.

2. Methods of selection and the qualifications of school bus drivers in existing school bus systems.

3. The amount of pupil transportation involved in extra-curricular activities.

4. Methods of transportation management and control.

5. The extent to which bus capacity is utilized.

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CHAPTER VI

CONCLUSION

The absence of a school transportation cost equation in Manitoba emphasized the need for a study to derive, if possible, a suitable formula that would serve as a valid predictor of the operating costs of pupil conveyance. On the basis of research studies, existing practices, and availability of data, six "measures" of pupil transportation cost were developed. They were:

Factor 1 Pupil-average distance

Factor 2 Bus mileage per transported pupil

Factor 3 Number of transported pupils per square mile of organized district

Factor 4 Number of transported pupils per bus operated

Factor 5 Assessed valuation per transported pupil

Factor 6 Bus mileage per square mile of organized district

Correlations between the cost of pupil transportation and each of the values of the six selected measures showed that Factor 1 was the best single predictor of operating costs. Calculation of the intercorrelations among cost (criterion) and the different factors, and a subsequent multiple regression analysis indicated that the three best measures of the cost of conveyance, to be used with Factor 1 were Factors 3, 5, and 6. From these a pupil transportation cost formula was derived.

This derived equation was used to calculate the pupil transportation costs for each of the 20 divisions included in this study. A comparison of "actual" with these "calculated" or "formula" costs, whether expressed in dollars or in terms of mill rates, indicated that the regression equation was an effective device for predicting school transportation operating costs.

Although this study very definitely supports the use of the regression equation technique, it is not intended that the particular "cost formula" derived in this investigation should be applied to circumstances and areas not covered by the 1967 data and the 20 divisions from which these were obtained. To accomodate change a regression analysis should be made each year and the equation accordingly modified to maintain its effectiveness as a predictor of the operating costs of pupil conveyance. Subsequent experience with the cost formula method may necessitate the use of factors other than those utilized in this study, particularly when further data on school transportation become available and the conditions in the unitary divisions are more stabilized.

The application of the cost equation revealed a need for economy and efficiency in matters respecting pupil transportation. Factors other than the density measures used as a basis for the cost formula, affect school transportation expenditures and the quality of the services provided. Some of these, therefore, were given particular consideration.

Reference to research studies in Canada and the United States, and accounts of existing practices revealed that board-operated pupil transportation systems are more economical and efficient than private buses. This was substantiated by responses from 22 divisions and 28 consolidated districts in Manitoba. A comparison of the two types of bus systems on the basis of (1) annual cost per bus seat, (2) annual cost per pupil, (3) cost per mile, and (4) cost per pupil per mile, showed that the cost to the division of contract buses was substantially higher than that of public-owned systems. It was also found that contract vehicles were not subject to effective school board management and control, with the result that despite higher costs the services provided by them were inferior to those rendered by board-owned systems.

Responses from 32 divisions and 28 consolidated districts and a comparison of the pupil transportation services in these areas with those existing in other parts of Canada, emphasized the need for effective management. Some of the aspects of school transportation which should receive attention were found to be: (1) safety inspections, (2) safe driving awards, (3) health and personal characteristics of bus drivers, (4) driver training, (5) school board policies on emergencies, (6) boarding and unloading of buses, (7) pupil conduct, (8) use of bus patrols, and (9) communication with the public on matters of pupil transportation. In each of these areas of concern very little financial expenditure would be required to improve the quality of service.

Such matters as (1) ownership or rental of shops, (2) employment of a supervisor of pupil transportation, (3) employment of qualified mechanics, and (4) acquisition of automotive accessories and "spare" buses, would involve additional expenditures, including both capital and operation costs. Good management and better bus servicing, however, would lengthen the life of the vehicle, improve the quality of pupil transportation, and enhance the safety of students. The acquisition of "extra" equipment might be justified if its use would reduce the wear on the bus and minimize the possibility of accidents.

Both the determination of the cost of pupil conveyance and the general quality of the transportation services require careful attention if the investments in school transportation are to serve the purpose of ensuring safety and maximizing the educational opportunities provided by the schools.

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CORRESPONDENCE AND INTERVIEWS

Questionnaires

Correspondence with Secretary-Treasurers of School Divisions and Districts.

The author visited the School Divisions, observing bus systems and interviewing Secretary Treasurers.

APPENDIX A

PUPIL TRANSPORTATION ANALYSIS

Dear Sir:

I have undertaken a project in connection with a study at the University of Manitoba to examine pupil transportation services on the basis of costs and present government grants.

We trust that the results will be helpful in your efforts to provide the best possible transportation service, and are pleased to inform you that this study has the endorsation of the Supervisor of Transportation for the Department of Education, and the Central Office of the Manitoba Association of School Trustees.

Information from the project will be supplied to the Central Office of MAST who will make it available to its members. Would you please complete the attached questionnaire and return it in the enclosed, self-addressed envelope at your earliest convenience.

Opinions and any information you supply will be kept anonymous, all names being held in confidence. Your frank replies will, therefore, be appreciated. I thank you for your cooperation in this venture.

Yours truly,

(Mr.) Aron Sawatzky

Pupil Transportation Survey

Date ________________ 19_____

Name of School Division ____ Number _________

Address ____

Name of Secretary Treasurer ____

Note: All answers will be held in confidence, and the names of persons or divisions will not be associated with the data in this study.

I

1. Please provide the information as indicated below.

		Number of Elementary Pupils Transported	Number of Secondary Pupils Transported	Total Number of Pupils Transported	Total Operating Costs of Pupil Transportation	Bus Mileage Total for all Routes
January to June 1967	Division owned buses					
	Contracted buses *					
September to December 1967	Division owned buses					
	Contracted buses *					

* Privately owned buses used to convey pupils for the district or division.

2. Number of elementary schools in district or division with:

(a) One classroom .... __________

(b) Two classrooms .... __________

(c) Three classrooms .... __________

(d) Four or more classrooms .... __________

3. What are your major problems and concerns regarding pupil transportation? (Use reverse side of this page if necessary).

....

....

....

....

....

II Please supply the answer for <u>both</u> Division owned and Contracted buses.

		Division-owned buses	Contracted buses
1.	The approximate average distance from a student's home (yard) to the bus line is	....	....
2.	The approximate number of miles that buses travel before receiving a routine safety check-up (not overhaul or maintenance)	....	....
3.	If the board has a policy on speed limits, what is the speed limit on:		
	(a) Paved roads	....	....
	(b) Gravel roads	....	....
	(c) Dirt roads	....	....

III Please check (✓) Yes or No for <u>both</u> Division owned and Contracted buses, for each of the following questions.

		Division-owned buses		Contracted buses	
		YES	NO	YES	NO
1.	Are bus interiors cleaned (swept, vacuumed, washed, etc.)				
	(a) Daily.	.....	.....	.....	.....
	(b) Weekly	.....	.....	.....	.....
2.	Are buses required to have				
	(a) Additional inside heating	.....	.....	.....	.....
	(b) Windshield washers	.....	.....	.....	.....
	(c) Chains	.....	.....	.....	.....
	(d) Shovels	.....	.....	.....	.....
	(e) Sand	.....	.....	.....	.....
	(f) Two-way communication devices . . .	.....	.....	.....	.....
3.	Are bus drivers required to have a medical examination				
	(a) Before being hired	.....	.....	.....	.....
	(b) Once per year thereafter	.....	.....	.....	.....

IV Please check (✓) YES or NO in answer to each of the following questions

	YES	NO
1. Does the division employ a bus mechanic?	....	....
2. Does the division employ a supervisor of transportation?	....	....
3. Does the division own a shop for bus maintenance	....	....
4. Does the division have a policy of safe driving awards?	....	....
5. Does the driver conduct emergency bus evacuation drills?	....	....
6. Do students line up single file before boarding the bus?	....	....
7. Do you make use of student bus patrols to		
(a) Help children at the bus doorstep	....	....
(b) Help children across the highway	....	....
8. Does the division have a pre-arranged "plan of action", outlining what is to be done by the driver, the students, the principal, and the parents, in case of		
(a) a bus fire	....	....
(b) a vehicle collision	....	....
(c) breakdown of the bus on a road	....	....
(d) a bus caught in a rain or snow storm	....	....
(e) unforeseen delays in bus arrivals or departure	....	....
(f) bus transportation cancellations	....	....
9. Are boys and girls seated separately on the bus	....	....
10. Are students assigned to special seats on the bus	....	....
11. Is someone, other than the driver, appointed to supervise pupil conduct on the bus	....	....
12. Does a student council representative assist the driver in maintaining suitable student behavior on the bus	....	....
13. Is the bus driver directly responsible to the principal for the safety and conduct of all pupils in his care? (For example: Does the driver report any misconduct or disciplinary action <u>directly</u> to the principal?)	....	....
14. Are meetings held to inform the public on matters of pupil transportation	....	....

APPENDIX B

MAJOR PROBLEMS OR CONCERNS REGARDING PUPIL TRANSPORTATION

The following outline is a summary of the problems or areas of concern respecting pupil transportation as expressed by the 32 divisions and 28 consolidated districts included in this survey. The problem areas are listed in descending order of importance based on their frequency of occurrence on the questionnaires.

1. Scheduling bus routes
   a) Timing arrivals and departures
   b) Satisfying demands for "gate-service"
   c) Transporting kindergarten children
   d) Controlling travelling time
   e) Transporting pupils residing in isolated settlements

2. Obtaining and maintaining roads
   a) Keeping roads passable
   b) Securing good roads for <u>all</u> bus routes
   c) Maintaining feeder lines to main roads

3. Implementing safety practices
   a) Enforcing driving regulations
   b) Training drivers
   c) Controlling traffic while pupils are boarding or leaving buses
   d) Upgrading minimum safety regulations
   e) Obtaining information on school bus safety

4. Making effective use of government grants
   a) Introducing economy and efficiency when grants are inadequate
   b) Avoiding inefficiency and extravagance as a result of grants that are too generous

5. Repairing and maintaining buses
   a) Instituting a "preventative-maintenance" program
   b) Obtaining information on maintenance costs in different divisions

6. Establishing and maintaining good public relations
   a) Informing the public on all aspects of pupil transportation
   b) Establishing effective discipline on the buses
   c) Granting bus contracts
   d) Maintaining control over privately operated bus systems

7. Obtaining bus drivers
   a) Hiring drivers who reside relatively close to their bus routes
   b) Locating well-qualified and experienced drivers who can work on a part-time basis
   c) Securing driver-mechanic combinations