A Report
on the

Public School Transportation Funding Allotment in North Carolina [Final Draft]

Management Partnership Services, Inc.
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May 23, 2006

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Mr. Derek Graham,
Section Chief
North Carolina, DPI
Dept. of Public Instruction,
301 North Wilmington Street
Raleigh, North Carolina 27601-2825

Dear Mr. Graham:

Management Partnership Services, Inc. is pleased to submit this report on the evaluation of the student transportation funding formula for the North Carolina State Board of Education. The report provides an overview of the present funding program and presents the results of our assessment of the present funding formula, followed by specific recommendations for improvement. The report also includes extensive analyses and supporting documentation in the Appendix section. We are confident that the conclusions and recommendations presented in this report will enable North Carolina to provide an equitable method of transportation funding for all of the local education agencies in the State, while continuing to achieve the desired levels of operational efficiency statewide.

We would like to thank the members of the Department of Public Instruction project team for their ongoing cooperation and assistance. In particular, we offer our thanks to you, and Kevin Harrison and Steve Beachum of the Transportation Services staff. Also, we wish to extend our appreciation to Phillip Price, Associate State Superintendent and Ben Matthews, Director of School Support Services Division, for their guidance and input throughout this project. Finally, we would like to express our appreciation to the school superintendents, transportation directors and other school professionals from across the State who participated in the regional meetings and responded to the survey last January.

We appreciate having been given the opportunity to assist the State Board of Education and the Department of Public Instruction in this endeavor. Please do not hesitate to contact us if we be of further assistance.

Sincerely,

Thomas W. Platt
President

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Executive Summary

Background

Management Partnership Services, Inc. (MPS), in partnership with TransTech Management, Inc. was contracted by the North Carolina State Board of Education (SBE) under Request for Proposals #40-Trans05 to study the pupil transportation funding formula which was put into place in 1990 that allocates funds to 115 city and county local education agencies (LEAs) across the State. The RFP directed that the consultant identify key issues faced by LEAs, particularly as they relate to inadequacies of the current funding formula, evaluate the extent to which the current incentives to minimize expenditures and to minimize the number of buses operated have been effective in achieving an efficient statewide transportation system, and to recommend an equitable funding process for transportation operations that maintains the appropriate incentives for efficiency.

Major Findings

The current formula has achieved desired result with respect to efficiency. The funding formula has led to a 27 to 28 percent decrease in both operating mileage and fleet size over the last 16 years. Moreover, the fleet is operating with 675 fewer buses in its fleet than the trend would have predicted had the current formula not been in place.

The site characteristics exert the appropriate influence on the adjustments to efficiency ratings. No bias was found in the site characteristics used to determine adjusted efficiency. However, the year-to-year variation in site characteristics selected has made it difficult for LEAs to anticipate future funding and to rationalize logistical strategies.

The current formula has permitted unintended increases to wealthier, efficient LEAs. This has resulted from the infusion of local funds by LEAs that can afford it. The effect of the rating buffer has been to perpetuate State funding of local dollar infusions, and to continue any advantage certain LEAs may have enjoyed as a result of a higher original base cost when the formula was first put into effect.

Efforts by LEAs to increase their budget rating may be resulting in service being traded for efficiency. Over the last seven years, the active bus fleet has grown by five (5) percent, while the average miles per bus have increased at more than twice that rate (13 percent). Case studies indicate a marked increase in ride times for some LEAs.

Treatment of non-traditional programs needs to be determined based on educational priorities. Existing regulations permit funding only for basic home-to-school transportation. However, a significant number of LEAs now utilize or wish to utilize non-traditional programs such as magnet schools, open enrollment, and other discretionary programs that require more resources per student, and thereby reduce efficiency.

Major Recommendations

As a result of our analysis, the following changes are recommended to the transportation funding process. These changes are intended to improve the equitable distribution of funding resulting from the formula, preserve the incentives towards efficiency, and to streamline and/ or simplify the administration of the formula.

Retain the basic funding mechanism. Our opinion is that the formula and allocation process has been very effective in influencing behavior on the part of LEAs and improving efficiency over the past 16 years. The formula is unavoidably complex, but achieving efficiency without sacrificing equitable treatment of the school systems is a complex problem that requires a complex solution.

Modify the funding calculation (Frontier Model). While the fundamental operation of the formula is sound and fair, improvements can be made to simplify the calculations and eliminate inequitable anomalies like the "alley problem" and provide for an improved adjustment process to account for site characteristics. Since it rests on a firm mathematical basis, the proposed Frontier Model is less awkward and is more mathematically defensible than the current "two-axis" model.

Standardize site characteristics. Using the same variables which tend to repeat in terms of statistical significance each year will both improve the predictability of the funding formula results for the LEAs and will stabilize and simplify the calculation. Site characteristics should be retested every 3-5 years to ensure that the changes in the topography and demographics throughout the State are properly reflected

Reduce the efficient frontier buffer. The 10 percent buffer that currently exists tends to perpetuate the funding discrepancies caused by differences in base and local funding amounts. A reduction in the buffer to approximately 5 percent will help to reduce these historical differences.

Continue to limit the level of local funding that is reimbursed by the State. We recommend that all allowable State and local expenditures be included in the calculation of the budget rating for an LEA but that only a portion of the LEA's local expenditures be included in the reimbursement calculation. This will ensure that efficiency ratings fairly incorporate all costs, while funding reimburses only those costs which are appropriate. Importantly, this change will also help to narrow the funding discrepancy between LEAs in the future that may have resulted from differences in the size of their original base expenditure levels.

Emphasize service delivery and safety. The most immediately effective way to accomplish this is to make key safety and service delivery statistics for each LEA publicly available through the DPI website and other statewide publications and communiqués to the school systems throughout the State. This would create some degree of pressure not to corrode service by exposing both efficiency and service delivery for each LEA.

Resolve funding issue for local programs based on State education goals. Ultimately, the decision on how to treat these programs for transportation funding purposes is a political and policy decision, and not a logistical one. The decision should be to retain the existing guidelines, if efficiency is the overarching objective of the funding process, or to change them, if supporting learning innovation is now paramount. Making that choice should ultimately be made based on the following criteria:

1) How the State now defines "basic education" compared to how this was defined in the past;

2) If that definition has changed, which programs are now considered to be explicitly or implicitly required by the State;

3) How the cost of educational programs for choice, magnet and other elective non-basic education programs are currently funded by the State; and

4) Of the programs defined as required by the State, which of these are funded through separate federal funding sources, either as part of the basic subsidy (Title I, IDEA) or discreetly for transportation requirements, such the Elementary and Secondary Education Act ("No Child Left Behind")

Upgrade DPI statistical and data tools. Current information technology should be upgraded to include a commercial statistical software package to simplify the process of creating and evaluating multiple regression models, incorporating database such as *Sequel Server* and browser-based software for improved data collection and management. Finally, the *Budget Rating Simulator* should be upgraded for use by DPI and LEAs in predicting funding amounts and the impact of the changes made to transportation systems.

I. Introduction

Study Objectives

The objective of this study was to evaluate whether the present transportation funding formula used by the State provides for the equitable distribution of appropriated funds among the 115 City and County LEAs in the State of North Carolina while supporting an efficient statewide student transportation system. Specifically, this study endeavors to describe the findings and make recommendations regarding the following:

- Does the formula promote the efficient use of transportation resources without degrading the quality of service delivery?
- Is the basic level of funding appropriate to the State mandates and the requirements of individual school districts given the current transportation environment?
- Does the current formula respond appropriately to changes in transportation requirements in recent years, such as the No Child Left Behind mandates, increased litigation for foundation funding for education, and more system-wide specialized educational programs?
- Do the present site characteristics in the Data Envelopment Analysis (DEA) model used in the funding formula adequately take into account significant factors that impact transportation and that are beyond the control of the school districts?
- Does the funding formula have adequate flexibility to adjust for anomalies, such as the "low base" effect, buffers for factors that cannot be accounted for within the base algorithm of the funding formula, and unusual contingencies such as significant unanticipated fuel price increases?
- Are adequate procedures and program safeguards in place to ensure equitable funding distribution to client school districts?

Report Structure

The report that follows is divided into three sections. Each section is designed to take the reader through a logical sequence of analysis that explores the issues pertinent to each area of review, and concluding with specific recommendations for improvement. Because the subject matter is complex, and to make the document as reader friendly as possible, the detailed analyses and technical summaries of simulations that were conducted are appended to the body of the report. Moreover, the focus of the report body is on the suggested actions to improve the funding, rather than engaging in an elaborate treatise on the theory, history, and functioning of the formula itself. The major sections of this report are structured around the following subject areas:

Issues and Concerns of Local Education Agencies

Improve the Effectiveness of the Formula

Improve the Formula Equity

Finally, it is important to note that one of the major areas of review, and perhaps the most important element of the report, namely how to handle transportation funding for magnet schools, open-enrollment, and other non-traditional programs which have increasingly appeared since the inception of the current formula 16 years ago is found at the end of Section IV. This was done because the logical sequence of our analyses attend to technical issues which, to the extent they are ultimately addressed by our recommendations, will mitigate the problems with, or at least simplify the decision on how to handle the funding for such programs.

Study Methodology

The technical approach to this study was consisted of the following key steps:

1) ***Gather input and identify issues from LEAs.*** This entailed the conduct of a survey to all of the LEAs in the State soliciting input at the transportation, business office and superintendents level. In addition, three regional meeting were held with invitations to all of the LEAs in the State to discuss the concerns and issues with the funding formula.

2) ***Quantify the costs and service characteristics of transportation.*** Base data was collected, tabulated and evaluated so that the logistical and cost characteristics of student transportation in North Carolina could be understood.

3) ***Evaluate the operation of the formula with respect of state goals and issues identified by LEAs.*** Numerous statistical, trend, and sensitivity analyses were conducted to test the validity and measure the scope of issues identified, whether from input received, or as a result of the assessment done by MPS.

4) ***Develop simulation scenarios.*** To test specific areas of the workings of the formula, such as the impact of local funding and the budget rating buffer, simulations were developed to statistically test specific aspects of the funding formula

5) ***Develop recommendations to retain, modify, or replace the current funding formula.*** Based on the results of the analyses and simulations, the concerns expressed by the LEAs, and the goals of the funding formula as the State currently identifies them, specific recommendations were made to improve the funding formula.

II. Issues and Concerns of Local Education Agencies

A key component in the analysis of the funding formula was to garner opinions and concerns on the part the local education agencies (LEAs) who must work with it. To collect this information, two methods were employed: (1) A survey was utilized to collect specific opinions about the formula, and (2) open group meetings were conducted at three regional locations with school systems across the State, using the survey data as a point of departure for the discussions,.

Results of LEA Surveys

Over 200 surveys were submitted with 91 percent (92 LEA's) responding with completed questions. The results of the survey can be seen in Appendix A. The table below gives the representation by position:

Table 1. Survey Respondents by Position

Position	No. Respondents	
Transportation Director	88	48%
Other Transportation Supervisor	4	2%
Business/Finance Officer	35	19%
Superintendent	25	14%
Associate / Assistant Superintendent	21	11%
Other	11	6%
	184	**100%**

Survey Structure

The main body of the survey consisted of 11 sets of paired questions (22 questions total) designed to explore specific areas of concern. Paired questions were used so as to validate the consistency of the responses. Five additional open-ended questions were included to allow the LEAs to provide more articulated responses. The scoring responses were based on the following:

Strongly Agree ....+2
Agree ....+1
Neutral 0
Disagree..-1
Strongly Disagree ....-2

The survey instrument was arranged according to six distinct characteristics of the current transportation funding formula, with the queries designed to evoke a response in each:

1) Understanding the objectives of the formula

2) Understanding the operation of the formula

3) The perceived equity of the formula

4) The adequacy of State funding

5) The influence of the formula on local education and transportation decisions

6) Opinions on whether the formula should be changed or replaced

Categorized Responses:

Despite a large number of participants, no distinct results could be identified from the average score for each question due the large standard deviation from the mean. Therefore, the survey analysis was grouped according to five categories shown below.

- Staff Position: Six (6) groups within category: Superintendent, Assistant/Associate Superintendent, Business Finance Officer, Transportation Director, Other Transportation Supervisor, Other (specify) - 184 responses;

- Staff Position (excluding "Other" categories): Same groupings as above but excludes two categories -"Other Transportation Supervisor" and "Other (specify)" categories due to low number of responses - 169 responses;

- Geography: Four (4) groups within category: Mountains, Piedmont, Inner Coastal Plains and Coastal (summarized by LEA) - 92 responses;

- Population: Three (3) groups within category: Metropolitan, Micropolitian and Noncore (summarized by LEA) - 92 responses; and

- LEA Size: Five (5) groups within category: Large, Medium Large, Medium, Medium Small and Small (based on number of buses operated and pupils in LEA - 92 responses;

In general, Mountain LEAs, Metropolitan LEAs, and Medium Small LEAs tended to give more favorable responses overall regarding the workings of the current formula, while Inner Coastal Plains LEAs and Micropolitan LEAs tended to give more unfavorable responses. Piedmont LEAs and Tidewater LEAs were more likely to feel that the formula was equitable and Piedmont LEAs were more likely to support the inclusion of local educational initiatives in the formula. Business/Finance Officers and Superintendents were more likely to report that the impact of educational decisions on the transportation budget was considered before implementing such decisions, although Transportation Directors were more likely to report the opposite. (Refer to *Appendix B* for LEA categories)

Table 2 lists the responses which had the strongest statistical correlation. Shaded areas indicate paired questions.

Table 2. Survey Responses with Highest Statistical Significance

Item	Statement	Factor	Finding
1	I believe the current formula should be replaced entirely.	Geography	Mountain LEAs less likely to Strongly Agree
12	I believe the current formula should not be changed.	Population	Metropolitan LEAs more likely to Strongly Agree or Agree; Micropolitan LEAs less likely to Strongly Agree or Agree
5	The current funding formula equitably allocates available state pupil transportation funds to my LEA.	Geography	Mountain LEAs less likely to Strongly Disagree; Piedmont LEAs more likely to Agree
		Size	Medium Small LEAs less likely to Disagree
16	The current funding formula does not equitably allocate available state pupil transportation funds.	Geography	Inner Coastal Plains LEAs more likely to Strongly Agree; Piedmont LEAs more likely to Disagree
		Population	Metropolitan LEAs more likely to Disagree; Micropolitan LEAs less likely to Disagree
7	With regard to the current funding formula objectives, I feel the current model treats my LEA fairly.	Geography	Tidewater LEAs more likely to Strongly Disagree; Piedmont LEAs more likely to Strongly Agree or Agree
10	My LEA considers the impact to our pupil transportation budget rating when making educational program decisions.	Position	Business/Finance Officers less likely to Strongly Disagree or Disagree; Transportation Directors less likely to Strongly Agree or Agree
21	My LEA does not consider the impact to our budget rating when making educational program decisions.	Position	Superintendents more likely to Disagree
23	The pupil transportation formula SHOULD address the cost of local educational initiatives that are not related to transportation efficiency or effectiveness.	Geography	Piedmont LEAs more likely to Strongly Agree

Results of Regional Meeting

Group meetings were conducted at three locations cross the State, Asheville (West), Greensboro (Central), and Smithfield (East) during the month of January 2006 to develop a dialogue with the LEAs and to give each participant the opportunity to comment on their concerns and expectations with respect to the funding formula, and with the adequacy of State transportation funding in general. Overall, the school administrators attending the meetings conveyed that they generally understood the basic workings of the formula. The key response summaries of those discussions are listed below:

- The funding formula is not equitable, particularly in that it provides more funding for larger LEAs that, by virtual of their size, have an inherent advantage in being able to operate their transportation programs more efficiently more easily than small systems.

- The need for change in the current formula is evidenced by the large differences in LEA reimbursements on a "per pupil" basis. This is particularly problematic in instances where adjacent LEAs with similar characteristics have large differences in funding.

- LEAs that started with a higher base cost and fleet size when the current funding formula was first put into place have continued to receive a higher reimbursement as a result.

- The formula structure allows the State to subsidize local funding, resulting in a perpetual advantage to "have" LEAs who can fund innovative local programs as result.

- The entire State budget allocation and distribution process does not provide adequate overall funding

- Some LEAs (particularly, the smallest and most rural) contend that they lack the ability to change operations sufficiently to improve their budget rating score. With limited options, these LEAs cannot implement basic means of improving efficiency, such as staggered school bell times. Accordingly, they have experienced declining scores over time as other LEAs have improved efficiency (moving the efficient frontier).

- The formula does not adequately adjust for the impact of key site characteristics.

- Budget ratings are commonly viewed as a "report card" on transportation operations. LEAs want more and better information on how they can improve efficiency scores and would like assistance or better tools in identifying how to improve the efficiency of their pupil transportation operations.

III. Improve the Effectiveness of the Formula

Using the concerns and views expressed by the LEAs as a point of departure, the formula was evaluated on the basis of how well it supports or creates incentives for the efficient use of transportation resources by the LEAs. However, our evaluative processes also took into account the fact that efficiency should not be pursued at the expense of reasonable levels of service delivery and safety. The combination of service delivery *and* efficiency defines effectiveness, and this is where our focus was placed in assessing the influence of the present student transportation funding process in North Carolina.

It is essential to recognize from the outset that this formula, like any formula designed to create an incentive for the economical use of inputs (resources) will always raise issues of fairness and equity. The overarching fact is that the State of North Carolina has notably improved the efficiency of the statewide student transportation system since the original funding formula was put in place in 1994. That does not obviate the fact that such an approach to funding will unavoidably reward the more cost-effective transportation programs and penalize those who use more resources than needed. The challenges which such a funding program imposes, and the inevitable issues of equity that will almost certainly arise, does not mean by default that the formula does not work and should be discarded or "watered down".

Retain the Basic Funding Mechanism

One of the key objectives stipulated for this study in the original Request for Proposals (RFP) was to determine the extent to which the present formula has been effective in promoting and providing incentives for the efficient use of transportation resources.

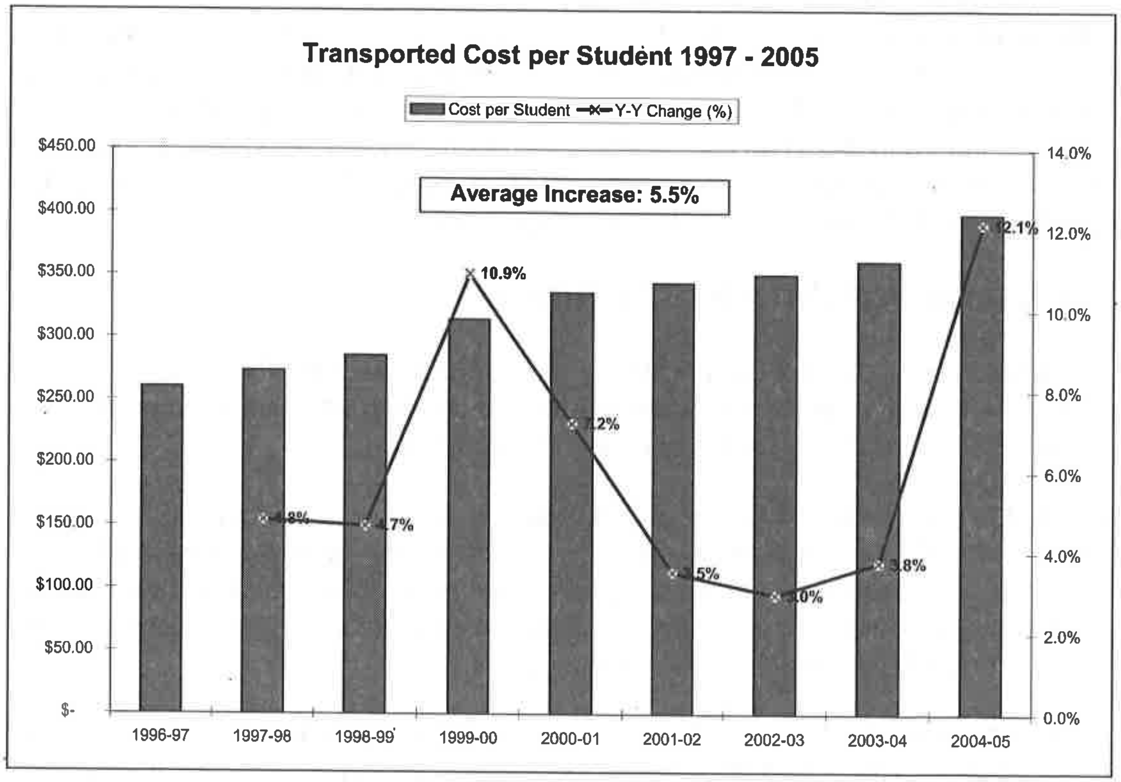
Our opinion is that the formula and allocation process has been very effective in influencing behavior on the part of LEAs. This has resulted in improved efficiency over the past 15 years, with resources being used more efficiently merely based on the announcement in 1990 that the formula would be out into place (See *Figure 2*). This has resulted in a very cost effective statewide student transportation system in the ensuing years.

Notwithstanding these clear positives, the funding process and mathematical calculations used are unavoidably complex. This is to a large extent inevitable when implementing a process with intrinsically divergent goals: encouraging maximum efficiency and providing the best (reasonable) level of service delivery. This has been accomplished by developing a formula for determining relative efficiency and that that recognizes that the LEAs across North Carolina operate under different conditions, called site characteristics. These site characteristics, over which the LEAs have no control, influence to a varying degree the amount of resources required to transport students. In other words, achieving efficiency without sacrificing equitable treatment of the school systems is a complex problem that requires a complex solution. There are simpler distribution mechanisms, but these cannot be implemented without obviating the objectives defined by the State in ensuring the economical use of its dollars and resources in transporting public school students in North Carolina.

Sufficiency

Sufficiency is the foundation criteria for this or any funding formula. It basically assumes that (a) The Legislature has appropriated sufficient funding according to the amounts determined by the formula and the budgeting process, and (b) School systems in the states have enough funds and buses with which to operate. In many ways, sufficiency can be the most difficult element to determine, since it is based on some amount that the LEAs *ought* to have – which is precisely the value that the formula calculations are designed to determine. In our estimation, the funds provided for transportation have been adequate. The chart below shows that the State has provided an average funding increase of 5.5 percent over the last nine years, while inflation over that same period has averaged approximately 2.8 percent[1]

Figure 1. Transportation Cost Trends



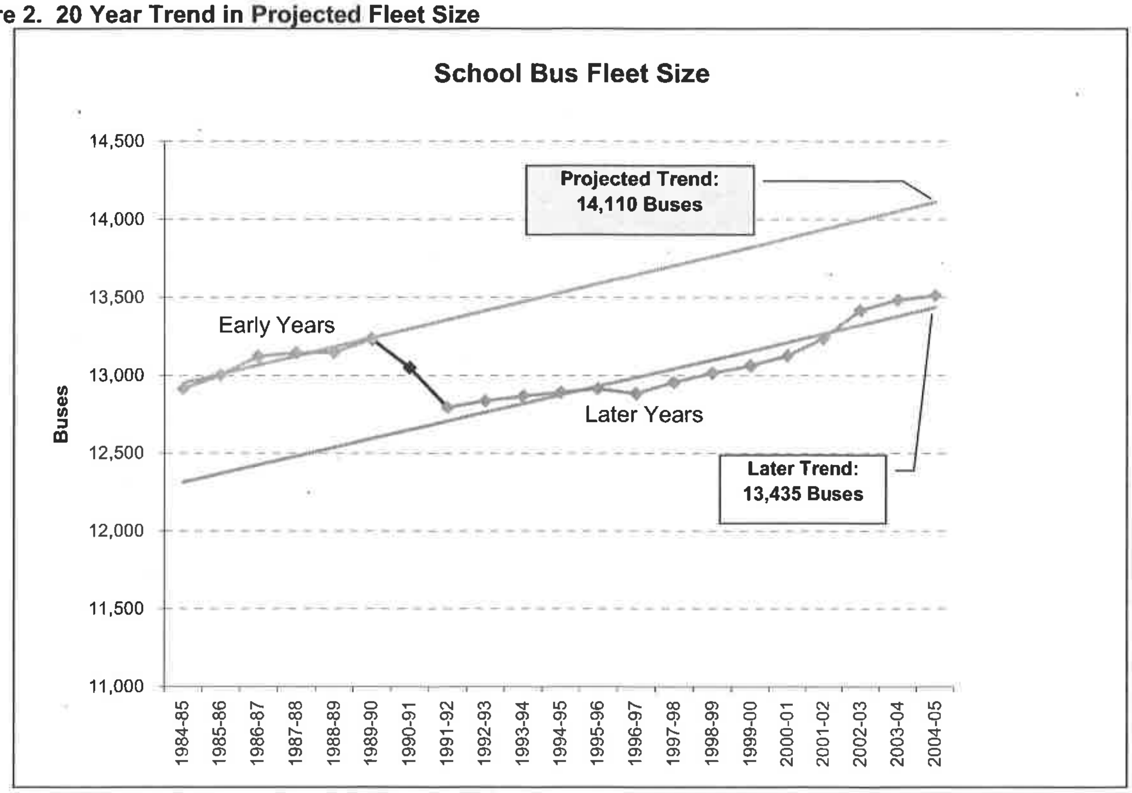
Efficiency

Throughout our evaluation of the funding process, there were a number of indices that clearly support the conclusion that the present funding formula has been successful in increasing efficiency. The most compelling of these were the results of our evaluation which showed that the size of the fleet and the mileage driven to transport the average student both have had clear downward trends since the inception of the original funding formula over a decade ago. The

[1] December to December Consumer Price Index for All Urban Consumers (CPI-U) calculated by U.S. Department of Labor, Bureau of Labor Statistics.

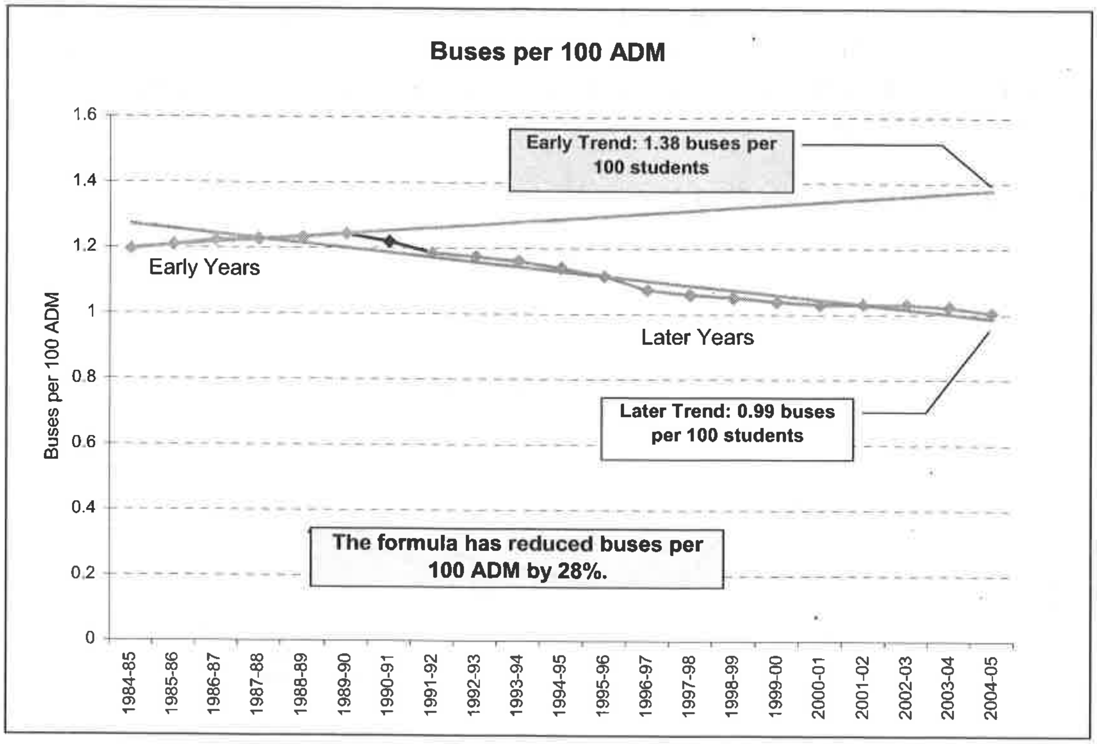
charts below show that mileage, when viewed as a proportion of average daily membership[2] (ADM), has decreased by 27 percent from its 20-year trend line, and the buses used have gone down by 28 percent. When the actual number of buses is projected using the same trend line, the result is that North Carolina has operated 675 fewer buses for the past 16 years when the formula was put into place.

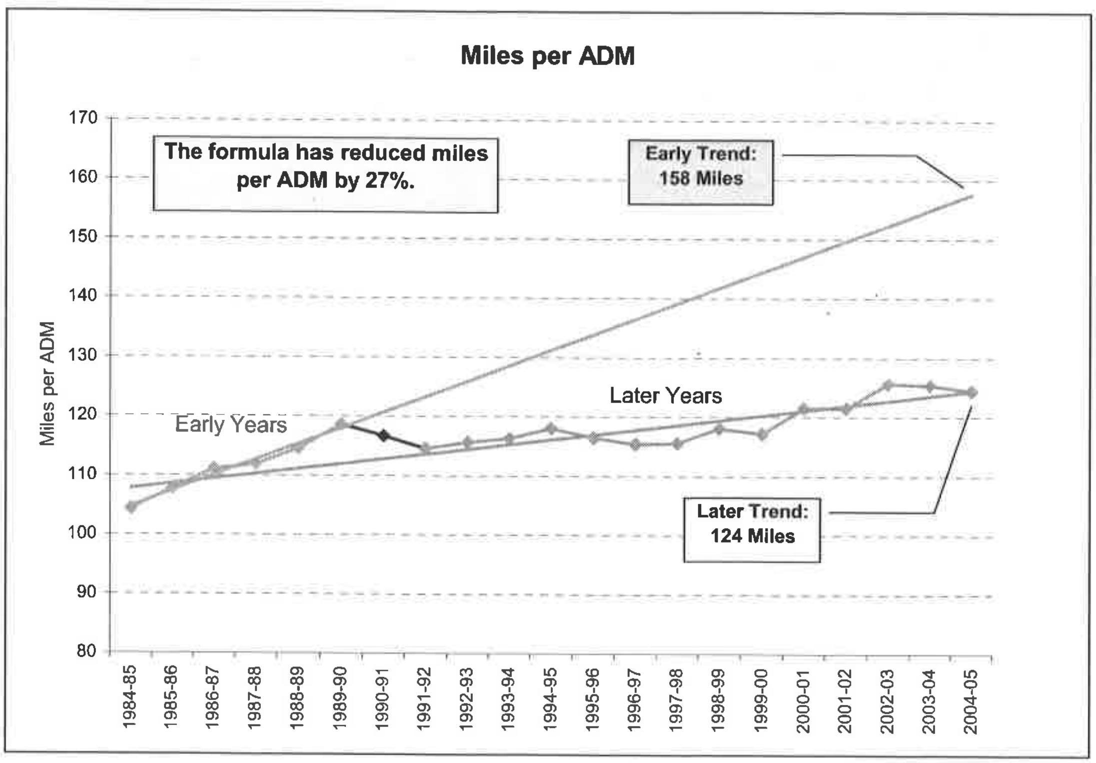
Figure 2. 20 Year Trend in Projected Fleet Size



[2] ADM used rather than transported students due to unreliability of student count figures prior to 1996.

Figure 3. Bus and Mileage Changes: 20 Year Trends

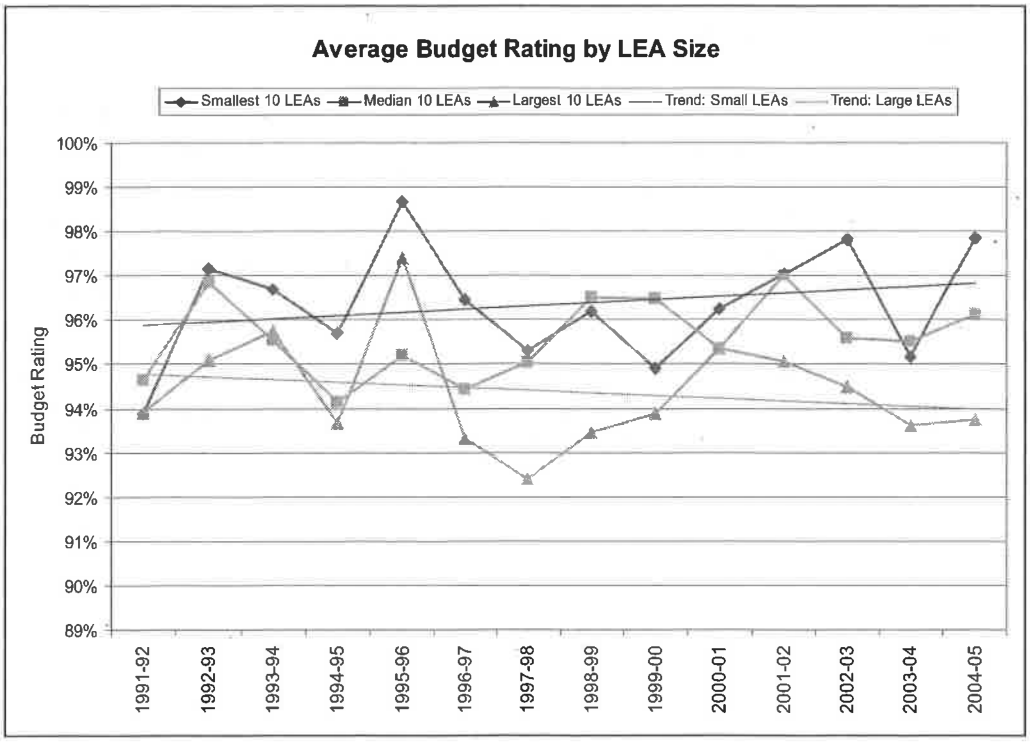




Equity

Our analysis of the formula led us to conclude that there are certain issues of equity resulting from mathematical anomalies with the calculation known as the "efficient frontier", as well as how local dollars are currently treated within the funding process. These will be explored in more detail in *Section IV* that follows. However, from the standpoint of inherent bias, we found no evidence that the funding formula provides a more favorable rating to larger operations over smaller ones or rural over suburban/urban areas (See *Appendices D - F*). For example, when grouped according to the ten largest, smallest and median sized school systems, the results of our evaluation indicated that there is no distinct advantage to any size LEA. If anything, smaller LEAs appear to be achieving a slightly more favorable budget rating than the larger ones (see *Figure 4*).

Figure 4. Budget Ratings Analysis



Recommendation

Retain the basic funding formula. While clear issues of equity have been identified in the funding process, which are addressed in more detail in *Section IV* and appendices *I, J* and *O* of this report, our recommendation is to retain the basic funding formula in its current structure. We recommend this because the funding formula has been successful in its primary purpose: to reduce both the operating costs associated with pupil transportation and the number of school buses on the road in North Carolina. Moreover, trend analyses clearly show that the formula has created an environment in which maintaining an efficient operation is a major goal for each LEA, leading LEA managers to regularly search for ways to reduce costs and eliminate buses.

Emphasize Service Delivery & Safety

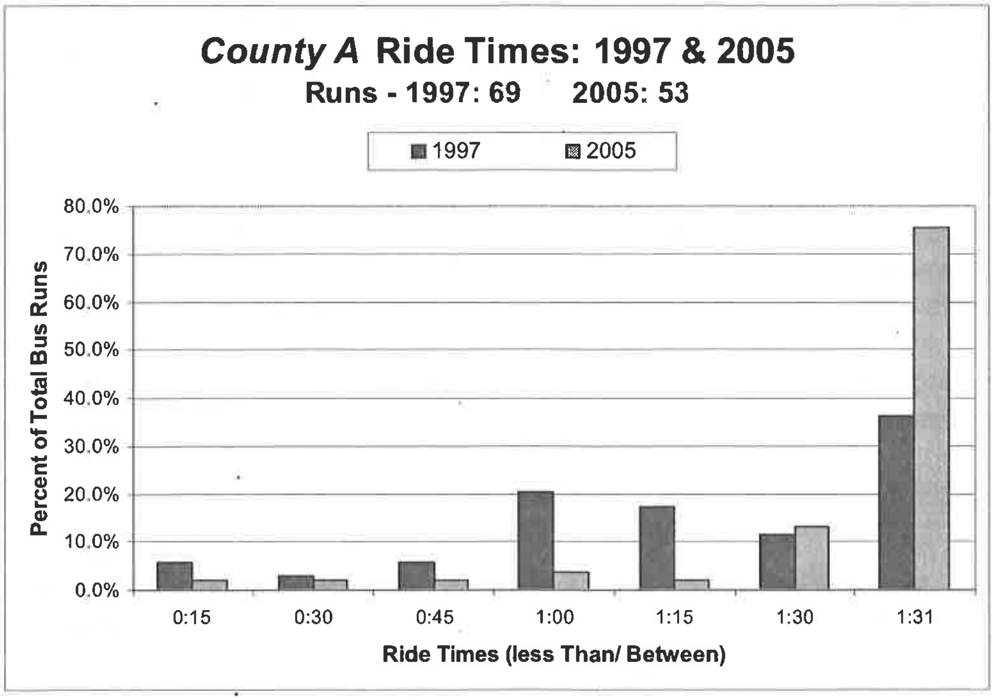
A concern expressed by the LEA transportation and school administrators was that the formula, while achieving its primary mandate of maintaining a consistent level of optimal efficiency in the transportation systems across the State, has done so at the expense of service and possibly safety. The position was expressed that the early opportunities for streamlining operations had largely been achieved; the "low-hanging fruit" had already been picked. Our evaluation at least partially validated these concerns.

Service Delivery

There is evidence that the school systems in the State may indeed be starting to trade service to achieve reductions in fleet resources or expenditures that will improve their budget rating. Since the length of a passenger's trip is a foundation indicator of service delivery, several school systems were selected that represented different sizes and geographic characteristics with which to compare differences in the duration of ride times between FY1996-97 and FY2004-05.

Figure 4 is an example of one of the actual counties that were selected for evaluation as a case study to see if there was evidence of service being traded off against cost. Three other examples can be seen in *Appendix G*. From *Figure 4* we can see that over the seven-year period observed, *County A* radically increased the percentage of bus runs operating for 90 minutes or more from 48 percent to 89 percent of its bus runs. At the same time, with the number of students being transported remaining essentially static, this LEA was able to reduce the number of buses it used by 19 percent, resulting in a budget rating improvement of 11 percent to achieve a 100 percent rating in FY2005. It should be noted however, that this was done by more than doubling the average passenger load. This, in turn, led to nearly an 80 percent jump in the average travel miles per bus, and a 36 percent increase in the average ride time of each bus.

Figure 5. Ride Time Trend - Sample Case Study



County A **Service Factor**	**1996-97**	**2004-05**	**Change**
Budget Rating	*89%*	*100%*	*11%*
Regular Students	2,154	2,139	-1%
Regular Buses	59	48	-19%
Regular Miles	614,919	840,712	37%
Average Ride Time	1:28	2:00	36%
Average Load	17	36	114%
Miles per Bus	8,912	15,862	78%
Miles per Student	285	393	38%

Keeping in mind that this is an actual school system in North Carolina, this demonstrates that the funding formula clearly influences the behavior of LEAs in attempting to utilize transportation resources as efficiently as possible. The concern is that an unintended consequence of that behavior may be that service levels are being degraded for some school systems. In the example above, *County A* was able to achieve a 100 percent budget rating with essentially the same number of students transported, by reducing its active fleet by almost 20 percent. However, this was achieved by increasing both the average miles and the average trip time by 36 to 38 percent.

When looked at on a state wide basis, there is further evidence that this may be taking place. During the same seven-year period, student enrollment has increased by 12 percent, and transported students by 5½ percent. The number of buses has increased slightly less than the number of transported students (5 percent), but the number of miles per bus has gone up by more than twice that rate at 13 percent. Notably, the ratio of students who use yellow bus transportation services to the total ADM has decreased by over six (6) percent. One reasonable interpretation of this is that as the LEAs try to squeeze more utility out of their fleets – resulting in longer rides – students are less inclined to use the bus service, with older students driving themselves, or parents providing transportation for younger students in their personal vehicle.

Safety

Safety should never be compromised, and there may be indications that the accident trend has worsened somewhat over the last six years. While the scope of this study did not include a comprehensive school bus operations safety analysis, a look at some annual accident data does give an indication that this is a concern calling for more in-depth review and continual monitoring, since the overall accident rate has increased by nearly 8 percent. Given these facts, it is necessary to properly interpret the statistics in *Table 3*.

Table 3. Comparison of Bus Accidents FY1998 – FY2004[3]

Accident	Year	1998	2004	Change	P-Value[4]
Type	**Miles (100 Millions)**	**1.413**	**1.655**	**+0.242 (+17.1%)**	
Fatal	Number	4	8	+4 (+100%)	0.1141
	Rate (per 100 Million Miles)	2.83	4.83	+2.00 (+70.7%)	
Injury	Number	329	325	-4 (-1.2%)	0.9848
	Rate (per 100 Million Miles)	232.8	196.4	-36.4 (-15.6%)	
Property	Number	528	754	+226 (+42.8%)	0.0002
Damage	Rate (per 100 Million Miles)	373.7	455.6	+81.9 (+21.9%)	
Total	**Number**	**861**	**1087**	**+226 (+20.8%)**	**0.0496**
	Rate (per 100 Million Miles)	**609.3**	**656.8**	**+47.5 (+7.8%)**	

Interpreting a limited assessment like this is important, since the statistics can be misleading. Therefore, some important details are needed to explain the conclusions. The P-value seen in the last column in *Table 3* that shows a value of less than 0.05 indicates that the observed increase in the corresponding accident rate is unlikely to be simply the result of random variation. Conversely, a P-value that exceeds 0.05 indicates that the observed increase is not inconsistent with the statement that the accident rate has either remained constant or decreased.

The P-value of 0.1141 for the fatal accident rate means that the observed 70.7% increase may well be simply the result of random variation. Specifically, we cannot conclude, on the basis of this data, that the underlying fatal accident rate has increased. This is because the number of fatal accidents is small and therefore a small change in the number of fatal accidents can result in a large change in the fatal accident rate.

[3] Source: School Bus Accidents for FY 1998 and FY 2004, North Carolina Department of Transportation, Division of Motor Vehicles, Traffic Records Section

[4] The P-values are for a one-tailed t-test that seeks evidence of an increase in the accident rate.

Similarly, the P-value of 0.9848 for the injury accident rate means that we are quite sure that the injury accident rate did not increase. In fact, the observed injury accident rate actually decreased by 15.6% and we can be quite sure (P-value = 0.0152, not shown) that the decrease in the injury accident rate is not the result of random variation.

The observed 21.9% increase in the property damage accident rate is certainly not explainable as random variation (P-value = 0.0002). However, there is concern that the definition of "property damage" may have changed between 1998 and 2004, which could explain some of the increase.

Finally, the P-value for the total accident rate is right on the cusp of statistical significance, suggesting that the 7.8% increase is may or may not be the result of random variation. Since the total number of accidents is dominated by the number of property damage accidents, it is prudent to conclude that the total accident rate, like the property damage accident rate, did indeed increase. However, the total accident rate is also heavily influenced by the property damage accident rate and therefore the caveat above applies to the total accident rate as well.

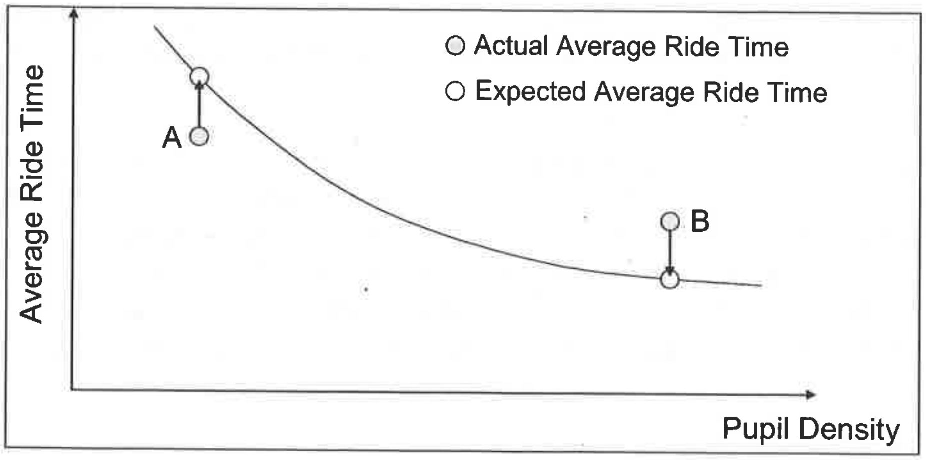
Recommendation

Publish key safety and service delivery statistics for each LEA. While it is in theory possible to incorporate safety and service level factors into the funding formula computation, it is inadvisable to do so because of the considerable complexity this would add to an already complex computation. However, it is important that service and safety be maintained or improved while striving for optimal efficiency. Our position is that the most immediately effective way to accomplish that is to make key safety and service delivery statistics for each LEA publicly available through the DPI website and other statewide publications and communiqués to the school systems throughout the State. This would create some degree of pressure not to corrode service by exposing both efficiency *and* service delivery for each LEA. Possible statistics that we would recommend including for public distribution include:

- Ride time distribution: average, shortest, longest;
- Earliest pickup time and latest (afternoon) drop-off times;
- Bus accidents per 100 million miles of operation;
- Driver traffic citations per 100 thousand miles of operation;
- Annual fatalities and injuries

To provide DPI with objective quantitative evaluations of the safety and service levels provided by each LEA, and to provide the LEAs with performance feedback in order to encourage improvement, we recommend that models be established, one for each service indicator, that adjust for site characteristics in a manner similar to that used by the funding formula. To do this would require a regression model with each indicator set as a dependent variable and the site characteristics as independent variables. Next, the expected level of performance for each LEA would be computed and compared with its actual level of performance. The difference would then be tested for statistical significance. The graph in *Figure 6* is an example of how this would work, using average ride time as the service indicator and assumes that pupil density is the only relevant site characteristic that affects average ride time (For illustration only, as we would expect several other site characteristics to influence average ride time).

Figure 6. Example: Expected Ride Times Adjusted for Density



In the preceding example, we can see that after the adjustments, LEA *A*, which has a longer average ride time than LEA *B*, is actually performing better than expected, while LEA *B* is expected to have a lower average ride time than at present. The regression model allows us to compare each LEA's service indicator to its expected level rather than to the service indicator of other LEAs that have different site characteristics.

Upgrade DPI Statistical and Data Tools

The final area which will improve the effectiveness of the formula concerns the administration of the funding process and formula calculations. While some of the recommended changes that follow will simplify the formula calculation, DPI has been laboring under data tools which are outdated and cumbersome to use. All of the calculations and regression steps are currently done in Microsoft *Excel*. The funding simulator, which is also *Excel*-based is no longer useful for the purpose of having individual LEAs (and DPI) perform if-then scenarios to project the rating impact of changes to expenditures or fleet resources.

Recommendations

To correct this situation, we recommend implementing the following improvements which will allow for faster analysis by DPI, improve internal and external reporting capabilities, and will support more efficient and effective auditing procedures:

- ***Implement a commercial statistical software package.*** Software packages such as *Statistix* greatly simplify the process of creating and evaluating multiple regression models and testing the results for statistical significance.

- ***Incorporate database web-based software for improved data collection and data management.*** An extensive amount of financial, demographic, and logistical data is currently maintained by DPI in *Microsoft Excel* format. While *Excel* is a powerful application and excellent for analytical purpose, it is not designed to be a repository of large databases. Commercial databases such as *Sequel Server* will allow data to be more easily retrieved and then imported into statistical applications or spreadsheets for more functional analyses. Also, much of the data currently captured in the TD2R, TDR, and TD1 reports from the LEAs could be HTML-based and captured through the DPI website. This would expedite data recovery and accuracy.

- ***Upgrade the Budget Rating Simulator***. The Budget Rating Simulator is designed to assist LEAs in their operational decision making and in choosing their fleet size by estimating the impact of such decisions on the LEA's budget rating. The LEAs would benefit greatly from an upgraded web-based Budget Rating Simulator that is easier to use and that takes advantage of current software capability. Moreover, should DPI implement any of the technical recommendations in this report, the Budget Rating Simulator will need modification to reflect these changes. In addition, LEAs would find the Budget Rating Simulator considerably more useful if it were available earlier in the school year. Currently, LEAs are making important decisions before the Budget Rating Simulator is released.

IV. Improve the Formula Equity

Because of the requirement to continue to create incentives for the efficient use of transportation resources, the basic funding mechanism is, in our opinion, the preferred approach to distribute transportation funding. At the same time, there were a number of inequities in the present funding process that need to be addressed. These include refining the formula calculation to eliminate the unfair benefit derived from the "alley problem," reducing the rating buffer and limiting local funding amounts in the funding process to ameliorate the impact of infusing local funds, and standardizing the core site characteristics to make the formula more stable and predictable. Finally, we explored the implications of including or excluding the costs and fleet resources needed to transport students to non-traditional educational programs.

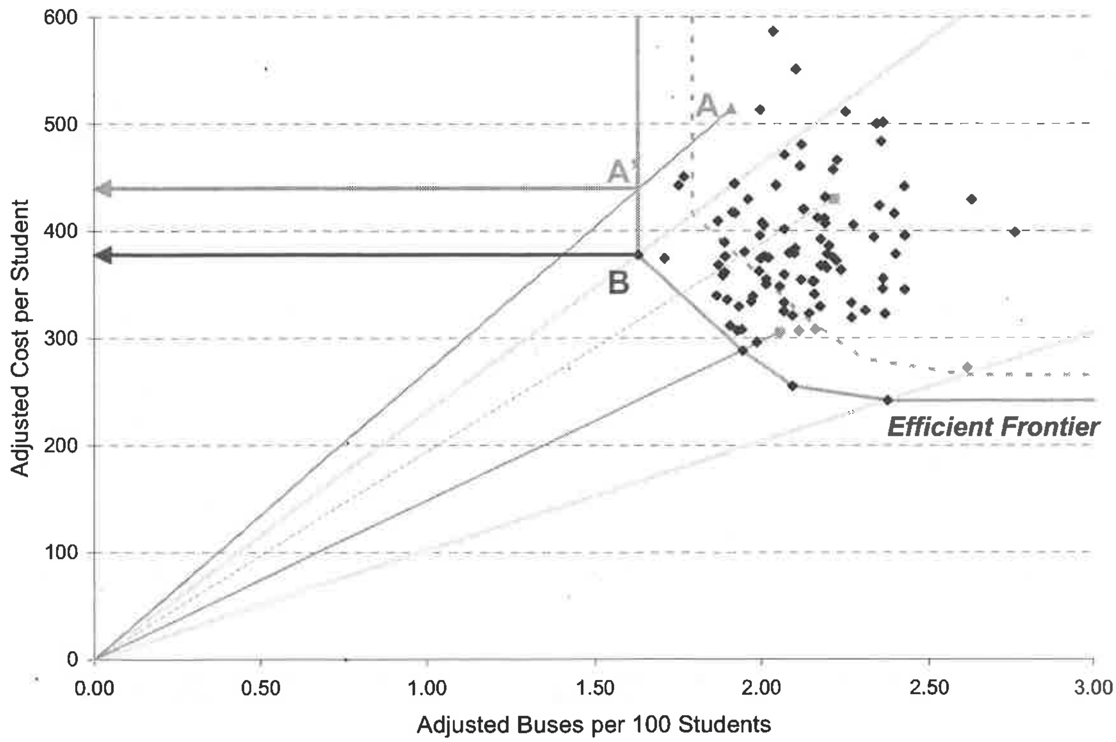
Modify the Funding Calculation

One of the key drawbacks of the current funding approach is its departure from the mathematics of frontier analysis as embodied in the technique known as Data Envelopment Analysis, or DEA. This modification was implemented to resolve the so-called "alley problem" in the existing formula whereby certain LEAs could increase their expenditures (while holding buses and students transported constant) without hurting their efficiency rating or their budget rating, thereby passing along the bulk, if not all, of those added expenses to the State.

When the formula was first developed in 1989-90, and later when it was reevaluated in 1996, the DEA literature was silent about how to resolve this issue. Since that time, techniques have been developed that resolves the "alley problem" within the mathematically sound DEA framework.

The "alley problem" is shown in *Figure 7*. It applies to all LEAs that lie above the "cone" defined by the origin, the LEA with the lowest (adjusted) cost per student, and the LEA with the lowest (adjusted) number of buses per 100 students. Consider LEA *A*, which lies above the cone but not on the frontier. The efficiency rating of LEA *A* is the ratio of the distance from the origin to point A' to the distance from the origin to point A, where point A' lies at the intersection of the efficient frontier and the radial line from the origin to point A. The original technique was to compute the budget rating for LEA *A* by adding the 10% buffer to this efficiency rating. The "alley problem" refers to the fact that LEA *A* can increase expenditures without adding students and maintain the same efficiency rating (and budget rating), thereby adding to its State reimbursement.

Figure 7. The "Alley Problem"



DPI attempted to work around the "alley problem" by using the so-called "two-axis" model. In the "two-axis" model, each LEA receives two efficiency ratings, one for expenditures (or cost) and one for buses. The cost rating for an LEA is defined as the ratio of the smallest cost per cost efficiency adjusted student (CEAS) to that of the LEA. Thus, if an LEA is spending $400 per CEAS and the smallest cost per CEAS in the State is $200, then the LEA has a cost rating of $200 divided by $400, or 0.50. Similarly, the bus rating for an LEA is defined as the ratio of the smallest number of buses per 100 bus efficiency adjusted students (BEAS) to that of the LEA. Thus, if an LEA is using 2.0 buses per 100 BEAS and the smallest number of buses per 100 BEAS in the State is 1.5, then the LEA has a bus rating of 1.5 divided by 2.0, or 0.75. The cost rating is then added to the bus rating and the sum is then divided by the average of a small number of the smallest sums in the State. The buffer is added to the result to obtain the LEA's budget rating.

While this approach eliminates the radial efficiency measurement, it does not entirely eliminate the "alley problem." Any LEA (not only those above the "cone") can increase its reimbursement by adding expenditures without adding students. The complexity of the "two-axis" model makes this difficult to see, but the idea is that, while the added expenditures will decrease the LEA's cost rating, it will have no effect on its bus rating and therefore its budget rating impact will be dampened. The LEA will then receive a smaller percentage of a larger total, which may well be a larger reimbursement. Thus, any LEA in the State can partially shift these additional expenditures to the State.

The solution to the "alley problem" is to return to the mathematically sound Frontier Model and, in the example in *Figure 7*, to reimburse LEA *A* at the same rate as LEA *B* is reimbursed. We refer to the process of moving from point A' to point B as "removing the slack," since the additional reimbursement per student associated with point A' relative to that at point B is called the "slack." Now, if LEA *A* were to increase its expenditures without adding students, its reimbursement per (adjusted) student would remain constant and LEA *A* would be required to absorb the additional cost.

Recommendation

Implement the proposed Frontier Model. A detailed description of the rationale and mechanics of the proposed Frontier Model is described in *Appendix I*. This model has several advantages over the current model. First, it places the funding formula on a more defensible mathematical basis, leaving it less vulnerable to dispute and misinterpretation. Second, the proposed *Frontier Model* eliminates the "alley problem" that prevented its implementation originally. Third, the proposed *Frontier Model* incorporates an improved adjustment process to account for site characteristics. Fourth, since it rests on a firm mathematical basis, the proposed model is conceptually easier to explain and easier to understand than the current "two-axis" model.

Reduce Buffer and Limit Eligibility of Local Expenditures

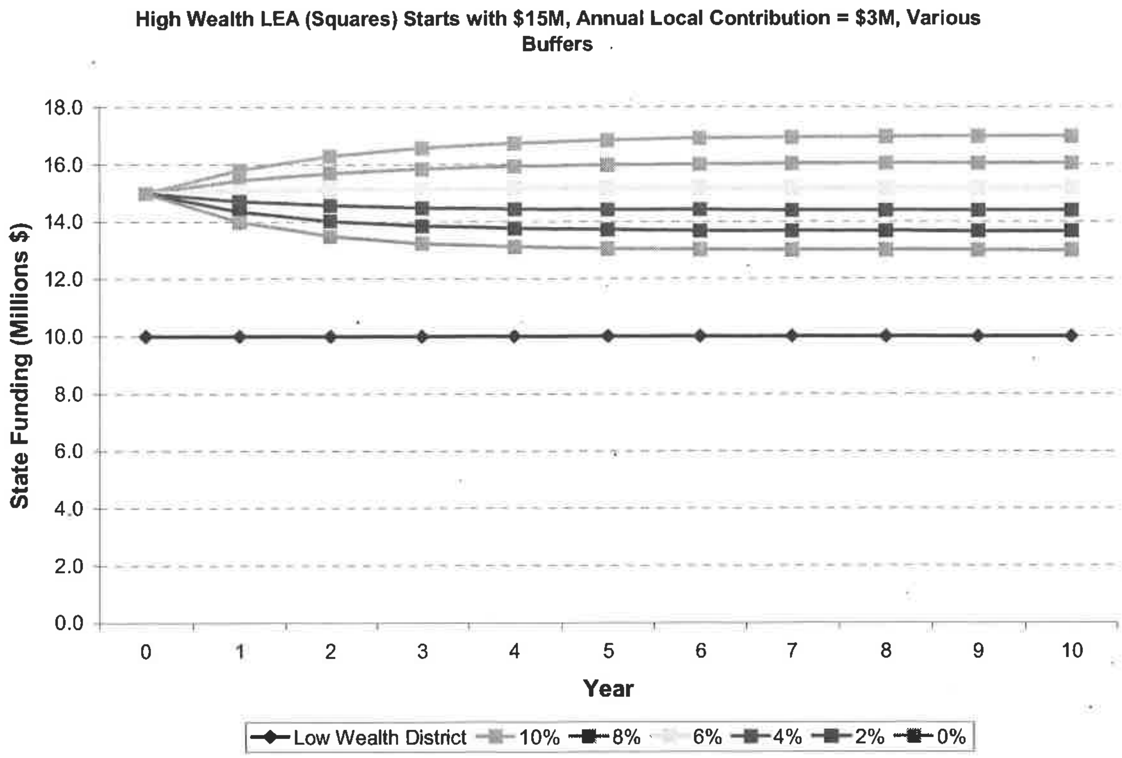
A concern that was clearly articulated by many of the school systems across the State was that an LEA can benefit under the current funding formula if its base funding (the level State funding prior to implementation of the current formula) was already higher than it 'should' have been. Related to that was the concern that under the current formula, a relatively efficient LEA can benefit by making local contributions to its student transportation operation that will be subsequently funded through State monies.

Modeling the Effects of Base Funding and Local Contributions

To answer these concerns, we conducted several statistical tests, and developed simulation models to answer the question of whether and under what circumstances, if any, an LEA may benefit from a relatively higher funding base, or from sustained or one-time local funding contributions. The conclusion from our simulations is that, indeed, LEAs can benefit from the infusion of local funds, and may continue to do so. This is explored comprehensively in *Appendix J*.

To illustrate, *Figure 8* below shows how the buffer affects the State funding for a hypothetical high-wealth LEA, that is, one that started off with $15 million in State funding and makes an annual local contribution of $3 million. The blue line represents a hypothetical low-wealth LEA that started off with $10 million and makes no local contributions. Both LEAs transport the same number of students, both use the same number of buses, and they have identical site characteristics. The low-wealth LEA is efficient with respect to both cost and buses. Calculations were done using the current funding formula.

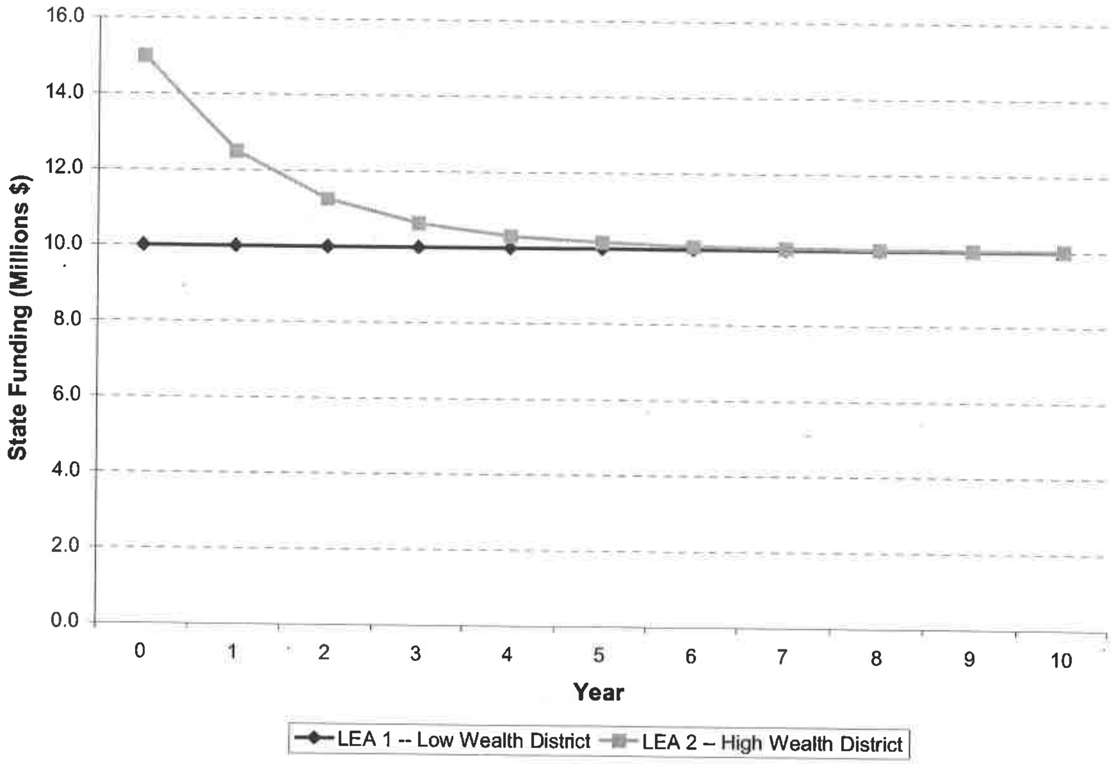
Figure 8. Impact of Different Buffers on Two Identical LEAs



A larger buffer makes the disparity between the two LEAs greater. However, *even if there were no buffer, the State funding for the high-wealth LEA would drop only to $13 million, not $10 million*, meaning that LEAs that began with a higher "set-point", or baseline cost, can maintain their original advantage, all other things being equal. The implication is that the buffer needs to be reduced from its current level of 10% to mitigate this disparity over time. The model also implies that significant limits will continue to be needed with respect to local contributions, as is currently done by DPI. (For further discussion on capping local costs, see *Appendix O*).

When we look at the same model with the buffers eliminated, and remove any State funding for local contributions (i.e., State funded costs only are factored into the model), this disparity created by the infusion of local funds is removed. In *Figure 9* below, if local dollars are excluded from the funding process, then both LEAs will eventually reach the same level of reimbursement by year six. While more equitable perhaps from the technical perspective of an efficiency formula, such a methodology ignores the fairness of whether or not to factor in the cost of non-traditional programs, such as magnet schools and open enrollment programs and the added fleet resource demands they impose.

Figure 9. Identical LEAs with No Local Funds Reimbursed



Conclusions on the Impact of Base Funding and Local Contributions

Our analysis indicates that, in the presence of a buffer, an LEA that uses its buses efficiently can "invest" local contributions, either one-time or sustained, to receive State funding in excess of the amount of the local contribution. The buffer also makes it possible for an LEA to benefit from a high level of base funding even in the absence of local contributions. Specifically, the analysis tells us that:

- In the presence of a buffer, it is possible for an LEA to remain inefficient and receive excess State funding, even in the absence of local contributions, if it started off at a higher base funding than it needed to be efficient. This is impossible without a buffer.
- In the presence of a buffer, a high-wealth LEA that has high bus efficiency can contribute local funds or make a one-time local contribution to its pupil transportation operation and receive a continual stream of additional State funding that exceeds the amount of its local contribution. In the absence of a buffer, the additional State funding will match the amount of the local contribution for LEAs.

- In the presence of a buffer, a high-wealth LEA that has low bus efficiency will also receive additional State funding if it makes local contributions but the increase will be less than the local contribution. However, in the absence of a buffer, State funding will not increase if a high-wealth LEA with low bus efficiency makes a local contribution.

- In the presence of sustained local contributions, the stabilized State funding level is the same regardless of the level of base funding.

- A one-time local contribution and sustained local contributions produce the same return on investment.

Recommendation

Reduce the efficient frontier buffer. The 10 percent buffer that currently exists was put into place to alleviate concerns that certain idiosyncratic site characteristics may not be included in the adjustment process either because they are not statistically significant or because inadequate data are available to properly estimate the effects of these site characteristics. Reduction of the buffer will require that other steps be taken to deal with these concerns. While there is no quantitative method that can be employed to compensate the possible funding discrepancies caused by differences in base funding that occurred many years ago, a reduction in the buffer will be an important step in reducing these historical differences. Since the site characteristics used in the formula statistically account for over 95 percent of the level of expenditures and use of fleet resources by the LEAs, we recommend reducing the buffer from the 10 percent to 5 percent.

Continue to limit the level of local funding that is reimbursed by the State. We recommend that <u>all</u> allowable State and local expenditures be included in the calculation of the budget rating for an LEA but that only a portion of the LEA's local expenditures be included in the reimbursement calculation. These local costs should be handled as follows:

- Continue to exclude cost elements in the TD1 report that are above the State provided increase or allowance (such as excess driver wage rate, local paid administrative and technician positions, etc.)

- Continue to adjust retirement and hospitalization benefits costs according to legislated cost increases

- Continue to make fuel price increase adjustments based on local fuel cost commodity indexes or rack (fuel terminal) price.

- Index other allowed LEA local operating and overhead costs to the Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (CPI-U).

- Index the increase in eligible costs to the percentage decrease or decrease in transported students. Require special review and audit for growth increases above 4 percent.

Thus, an LEA will be reimbursed for an amount equal to its budget ratings multiplied by the sum of its allowable State expenditures and the approved portion of its allowable local contribution, adjusted for inflation and growth.

Above these amounts that can be identified through inflation or growth, we recommend that the State cap the amount of local contributions that are reimbursable to some version of the larger of an appropriate dollar amount and an appropriate percentage of State funding (This is explained in detail in *Appendix O*). By including all allowable expenditures in the calculation of the budget rating, DPI can be sure that it is properly measuring the efficiency of each LEA, which is the original legislative mandate. Allowing a small portion of an LEA's additional local funding contributions to be counted toward reimbursement will allow these LEAs to make up, over time, for some of their historical shortfall, while preventing high-wealth LEAs from shifting excessive costs to the State.

Require full reporting of all local expenditures. Because the formula takes into account *all* dollar and fleet resources used in calculating the adjusted efficiency rating for each LEA, it is critical not to allow any local expenditures to be "shadowed" or not reported, which would give those LEAs able to afford it an unfair advantage. Concurrent with this recommendation is the need for DPI to incorporate comprehensive standard reporting and auditing procedures to enforce this requirement. Along with random audits, LEAs which show significant changes in expenditures should also be scheduled for comprehensive evaluations of their transportation expenditures.

Standardize Site Characteristics

Site characteristics are defined as those environmental (demographic, topographic) factors that influence an LEA's ability to operate efficiently but are beyond the control of LEA management. These play a pivotal role in the funding process. The incorporation of site characteristics into the formula calculation ensures that all LEAs are treated fairly, i.e., that no LEA receives more or less State funding than they deserve simply because they operate under relatively favorable or unfavorable conditions.

It is essential, therefore, that all relevant site characteristics appear in the model. In practice, including every possible site characteristic may be difficult or impossible for a number of reasons. First, it may not be recognized that a factor should be considered as a site characteristic. Second, adequate data for a potential site characteristic may not exist or may be very difficult to collect. Third, a potential site characteristic may have very small effects on cost efficiency and bus efficiency and therefore might not qualify statistically for inclusion in either model. Fourth, a potential site characteristic may be highly correlated with one or more other site characteristics and therefore may distort their coefficients if allowed into the calculation. Since no mathematical process can account for 100 percent of the possible environmental factors, the present funding formula has used a 10% buffer from its inception to account for the possibility of omitted site characteristics. However, as discussed in the preceding section, the buffer can create some undesirable effects.

Modeling the Effects of Site Characteristics on the Funding Formula

A concern that emerged consistently from the LEAs who participated in the survey and in the regional meetings was that the site characteristics used in the formula changed from year to year and that this impeded both the predictability and fairness of the funding result. To address this issue, we first need to understand fully how site characteristics affect an LEA's budget rating. Then we need to examine the magnitude of the effects of known site characteristics on budget ratings

Accordingly, several models were developed to test the impact of the site characteristics on the proposed Frontier Model using data from 2004-05 (See *Appendix K*). The first model involved a side-by-side comparison of two hypothetical LEAs that spend the same amount of money, use the same number of buses, and transport the same number of students but have different site characteristics. The first LEA was a mostly rural district while the other had site characteristics more like those of an urbanized area. This model illustrated clearly how these two LEAs would receive different State reimbursements because of their different site characteristics.

The second model illustrated the effects of each site characteristic individually on a hypothetical LEA that was average with respect to expenditures, buses used, students transported, and all site characteristics. Each site characteristic was then individually analyzed by allowing it to vary across the range of observed values for that site characteristic while holding all other site characteristics (and all inputs and outputs) constant.

Conclusion on the Effects of Site Characteristics

The results of the second model can be seen in *Table 4*. The value in the column labeled "Max Impact" for a given site characteristic is the difference between the values in the columns labeled "Max" and "Min" in the same row. The value in the column labeled "Max" for a given site characteristic is the largest budget rating that the average LEA would achieve if the given site characteristic achieved its most favorable level while all other variables remained constant. Similarly, the value in the column labeled "Min" for a given site characteristic is the smallest budget rating that the average LEA would achieve if the given site characteristic achieved its least favorable level while all other variables remained constant. Thus, the "Max Impact" of a site characteristic is simply the largest possible change in the budget rating of an average LEA that can be created by that site characteristic.

As has been long believed, student density has the largest potential impact on both budget rating and bus rating, though not inordinately so since the four remaining site characteristics influence approximately 80 percent of the remaining formula results. Indeed, circuity has the second largest potential impact on budget rating. Distance to school has the third largest potential impact on budget rating.

Table 4. Key Site Characteristics

Site Characteristic	Budget Rating		
	Max Impact	Min	Max
Student Linear Density (based on DOT road miles)	**17.8%**	82.2%	100%
Circuity (3rd quartile)	**11.3%**	86.9%	98.2%
Student Distance to School (3rd quartile)	**9.1%**	85.5%	94.6%
Elevation	**7.0%**	87.6%	94.6%
EC Students (Pct. students using special buses)	**5.8%**	88.8%	94.6%

Recommendation

Standardize core site characteristics for formula computations. Our analysis revealed that the site characteristics listed in *Table 4* come into the regression calculation repeatedly from year to year. Using these same variables each year will both improve the predictability of the funding formula results for the LEAs and will stabilize and simplify the calculation. We suggest that the site characteristics should be retested every 3-5 years to ensure that the changes in the topography and demographics throughout the State are properly reflected.

Resolve Transportation Funding Issue for Local Programs

Perhaps the most important issue to many of the LEAs we spoke with is the issue of funding for local programs. Because the core workings of the formula and some of the issues of equity surrounding it needed to be explored first, this foremost issue was necessarily saved for last in our report. The most significant concern expressed by the LEAs was that the present funding formula does not take into account the changing demands on transportation which has resulted from an increase in the array of non-traditional programs, such as magnet schools and choice programs that many school systems are now transporting. Under the current funding formula, only transportation associated with basic home-to-school is considered, although existing magnet school programs were allowed in the formula from its inception, largely because of desegregation orders that were still in place at that time.

Table 5. Survey Responses: Transporting Non-Traditional Programs

	We do not offer this program for non-transportation reasons	We would like to offer this program but lack adequate transportation resources	We currently transport students in support of this program
No Child Left Behind	15%	3%	83%
Magnet Schools / Schools of Choice	62%	5%	34%
Cooperative Programs with Community College	34%	17%	49%
Before/after school tutoring / remediation	4%	10%	86%
Occupational Course of Study	8%	7%	85%
Locally funded Pre-K program	16%	6%	78%
Head Start	69%	3%	28%
Even Start	78%	3%	19%
Alternative Schools	6%	4%	90%
Following after-school extra-curricular programs	33%	12%	55%
Transportation of homeless children to/from prior school	28%	3%	69%
Extended School Year	56%	8%	36%
Summer School	9%	6%	85%
Learn and Earn	80%	9%	11%
Year Round Schools	73%	2%	25%
Smart Start / More at Four	16%	7%	77%
Other	48%	6%	45%

As can be seen in *Table 5*, there is a considerable amount of transportation currently being provided for magnet schools and other non-traditional programs. To the extent that the formula has established the efficient frontier based on the adjusted cost and use of resources for all of the LEAs in the State, this type of transportation has, over time, commingled with the more traditional forms of home-to-school busing. To that extent it is already being partially funded. Yet, as the table illustrates, there are a percentage of LEAs who wish to transport these programs, but cannot because of limited local funds.

The problem then revolves around how to treat such programs within the formula mechanism itself. To the extent that these enhanced and non-traditional education programs continue to be funded locally because they are considered a local choice, rather than a mandated program, the present funding formula and allocation process treats such programs appropriately. Traditionally, these programs have indeed been viewed to be a local choice, rather than a constraint over which transportation has no control. But, given that the decision to provide such programs is outside the jurisdiction of most transportation managers, it is a choice which has the effect of being a real constraint (i.e., site characteristic) from the perspective of transportation operators, with a very definite impact on resource requirements and costs.

Ultimately, the decision on how to treat magnet school and other non-traditional programs for transportation funding purposes is a political and policy decision, and not a logistical one. Basically, the decision should be to retain the existing guidelines, if efficiency is the overarching objective of the funding process, or to change them, if supporting learning innovation strategies is now paramount. Only the elected representatives in the Legislature and members of the State Board of Education can make this decision. Our specific direction on making that choice as it pertains to transportation is that the review/ decision process should incorporate the following criteria:

1) How the State now defines "basic education" compared to how this was defined in the past;

2) If that definition has changed, which programs are now considered to be explicitly or implicitly required by the State;

3) How the cost of educational programs for choice, magnet and other elective non-basic education programs are currently funded by the State; and

4) Of the programs defined as required by the State, which of these provide separate federal funding sources, either as part of the basic subsidy (Title I, IDEA) or discreetly for transportation requirements, such the Elementary and Secondary Education Act ("No Child Left Behind")

What follows is a summary of the decision factors and implications for the transportation funding process which need to be considered regarding whether or not to provide funding for non-basic education transportation.

Option A: Include in Funding Allocation

If other than traditional home-to-school programs are to be included, the first decision is: Which programs are considered to be part of the basic education requirement, and how much do they currently cost to transport for those LEAs that are now providing this service? The process we recommend involves initially funding the transportation costs outside of the formula, and then phasing it into the formula over a period of years.

Recommendations (If Option A)

Provide supplemental funding for low wealth LEAs who wish to provide transportation for approved non-basic programs. Where a financial hardship case can be quantified and supported by the LEA, the State should provide "seed" money for those LEAs that show a demonstrated inability to initially fund through local sources the non-traditional programs that the State considers to be required. This funding should be phased out over a period of time in decreasing increments, once the costs are later incorporated into the transportation funding formula.

Initially provide funding for transporting non-basic programs outside of the funding formula. We suggest this because it will be necessary to develop a history on the costs and fleet resources associated with transporting these programs before these can be factored into the formula calculation. This will require additional cost tracking and reporting tasks by the LEAs to specifically isolate these costs and resources.

Incorporate non-basic program transportation into the funding formula. Once the additional costs and required fleet resources associated with these programs are identified and a history established, the appropriate site characteristics needed to be identified and tested in the model. This will require the construction of multiple regression models and statistical sensitivity analyses. In addition, it will be essential to ensure that LEAs who choose to only provide traditional education programs are not inadvertently penalized by the changes made to the formula.

Option B: Exclude From Funding Allocation (Status Quo)

If the State decides to continue the policy of providing transportation funding only for those programs that are considered to be basic education under the current definition, then the *Frontier Model*, as recommended earlier in this section of the report will treat the cost of transporting those programs appropriately, given that these are now funded locally.

Recommendation (If Option B)

Implement the modifications to the funding formula (Frontier Model), as previously recommended. Contingent with this recommendation is that local dollar caps, standardized site characteristics, and a reduced budget rating buffer will also be implemented. Under this structure, only State and approved local costs will be considered in the budget rating and distribution process. At the same time, the modification to the formula should include adjustments to the influence of the present site characteristics used in the formula for those LEAs who already are transporting non-mandated educational programs, such as magnet schools and school of choice that are considered a local choice.

V. Appendix

Appendix A: Summary of Transportation Funding Formula Survey Responses

Summary of Responses

202	Unique surveys submitted
184	Surveys with questions completed
92	LEAs represented in responses

Responses by Position

Transportation Director	88
Other Transportation Supervisor	4
Business/Finance Officer	35
Superintendent	25
Associate / Assistant Superintendent	21
Other (please specify)	11

Scoring Method

Five potential responses for Question 1 – 24. The following were the numerical values assigned to these responses:

Strongly Agree .... *+2*
Agree.. *+1*
Neutral..*0*
Disagree.. *-1*
Strongly Disagree............................... *-2*

Statements 1- 24

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Average	Standard Deviation
1.)I believe the current formula should be replaced entirely.	3	56	50	45	30	0.2	1.1
2.)I understand the basics of how the current funding formula works.	4	26	25	123	6	0.6	0.9
3.)I understand how my transportation allotment is calculated.	5	33	37	106	3	0.4	0.9
4.)The State provides adequate overall funding for pupil transportation.	56	84	25	16	2	-1.0	0.9
5.)The current funding formula equitably allocates available state pupil transportation funds to my LEA.	35	71	38	39	0	-0.6	1.0
6.)I understand the current formula's objectives.	5	23	41	107	7	0.5	0.9

Appendix A: Summary of Transportation Funding Formula Survey Responses

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Average	Standard Deviation
7.)With regard to the current funding formula objectives I feel the current model treats my LEA fairly.	31	66	37	44	5	-0.4	1.1
8.)The current funding formula takes into account the important characteristics of my LEA.	24	95	37	26	1	-0.6	0.9
9.)My LEA considers the impact to our pupil transportation budget rating score when evaluating changes to our transportation system.	5	17	23	112	26	0.8	0.9
10.)My LEA considers the impact to our pupil transportation budget rating when making educational program decisions.	11	35	35	82	20	0.4	1.1
11.)I feel that the current formula accurately reflects the pupil transportation efficiency of my LEA.	22	57	48	52	4	-0.2	1.1
12.)I believe the current formula should not be changed.	43	73	49	16	2	-0.8	0.9
13.)I do not understand even the basics of how the current funding formula works.	21	106	36	16	4	-0.7	0.9
14.)I do not understand how my transportation allotment is calculated.	13	107	28	31	4	-0.5	0.9
15.)The State does not provide adequate overall funding for pupil transportation.	1	16	23	101	42	0.9	0.9
16.)The current funding formula does not equitably allocate available state pupil transportation funds.	0	32	40	79	32	0.6	1.0
17.)I do not understand the objectives of the current funding formula.	11	103	40	25	4	-0.5	0.9
18.)My LEA does not receive a fair share of pupil transportation monies.	2	34	51	67	29	0.5	1.0
19.)The existing funding formula does not adequately adjust for the important characteristics of my LEA.	2	27	28	91	35	0.7	1.0
20.)My LEA does not consider the impact to our budget rating scores in operating our transportation system.	23	107	27	19	7	-0.7	1.0
21.)My LEA does not consider the impact to our budget rating when making educational program decisions.	19	82	34	39	10	-0.3	1.1
22.)My LEA does not think the current model accurately measures transportation efficiency.	2	33	50	78	21	0.5	1.0

Appendix A: Summary of Transportation Funding Formula Survey Responses

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Average	Standard Deviation
23.)The pupil transportation funding formula SHOULD address the cost of local educational initiatives that are not related to transportation efficiency or effectiveness	6	25	26	93	34	0.7	1.0
24.)The pupil transportation funding formula DOES address the cost of local educational initiatives that are not related to transportation efficiency or effectiveness	29	94	44	15	2	-0.7	0.9
AVERAGE						**0.0**	**1.0**

Question 25: Please identify WHETHER and HOW your LEA provides transportation support for the following programs:

	We do not offer this program for non-transportation reasons	We would like to offer this program but lack adequate transportation resources	We currently transport students in support of this program	Response Total
No Child Left Behind	21	4	118	143
Magnet Schools / Schools of Choice	81	6	44	131
Cooperative Programs with Community College	46	23	67	136
Before/after school tutoring / remediation	6	15	127	148
Occupational Course of Study	12	10	124	146
Locally funded Pre-K program	22	8	108	138
Head Start	84	4	34	122
Even Start	93	3	23	119
Alternative Schools	10	6	138	154
Following after-school extra-curricular programs	43	16	73	132
Transportation of homeless children to/from prior school	38	4	94	136
Extended School Year	71	10	46	127
Summer School	14	10	135	159
Learn and Earn	93	10	13	116
Year Round Schools	89	2	31	122
Smart Start / More at Four	22	10	106	138
Other	15	2	14	31

Appendix A: Summary of Transportation Funding Formula Survey Responses

	My LEA does not offer these programs	We transport by "state" (yellow) buses	We transport with locally owned vehicles	Response Total
No Child Left Behind	16	90	7	113
Magnet Schools / Schools of Choice	64	33	2	99
Cooperative Programs with Community College	38	48	16	102
Before/after school tutoring / remediation	8	100	10	118
Occupational Course of Study	10	77	32	119
Locally funded Pre-K program	25	78	9	112
Head Start	65	18	11	94
Even Start	64	18	8	90
Alternative Schools	8	108	8	124
Following after-school extra-curricular programs	37	24	41	102
Transportation of homeless children to/from prior school	27	66	11	104
Extended School Year	62	35	2	99
Summer School	13	106	6	125
Learn and Earn	72	10	3	85
Year Round Schools	61	27	0	88
Smart Start / More at Four	18	76	19	113
Other	7	10	2	19
Total Respondents	168			

Appendix B: LEA Category Definitions

NAME	Students	Buses	Student Quartile	Bus Quartile	Size	Description	Population
ALAMANCE	9,205	154	4	3	Medium	Piedmont	Metropolitan
ALEXANDER	2,722	61	2	2	Medium/ Small	Piedmont	Metropolitan
ALLEGHANY	861	24	1	1	Small	Mountain	Noncore
ANSON	2,857	75	2	2	Medium/ Small	Piedmont	Metropolitan
ASHE	2,167	51	2	1	Medium/ Small	Mountain	Noncore
AVERY	1,174	33	1	1	Small	Mountain	Noncore
BEAUFORT	4,033	99	2	3	Medium	Coastal	Micropolitan
BERTIE	2,854	86	2	2	Medium/ Small	Inner Coastal Plain	Noncore
BLADEN	3,616	93	2	2	Medium/ Small	Inner Coastal Plain	Noncore
BRUNSWICK	5,677	142	3	3	Medium	Coastal	Metropolitan
BUNCOMBE	15,573	287	4	4	Medium/ Large	Mountain	Metropolitan
BURKE	6,519	109	3	3	Medium	Mountain	Metropolitan
CABARRUS	15,128	218	4	4	Medium/ Large	Piedmont	Metropolitan
CALDWELL	6,653	120	3	3	Medium	Mountain	Metropolitan
CAMDEN	882	22	1	1	Small	Coastal	Micropolitan
CARTERET	3,838	97	2	2	Medium/ Small	Coastal	Micropolitan
CASWELL	2,142	65	1	2	Medium/ Small	Piedmont	Noncore
CATAWBA	12,997	233	4	4	Medium/ Large	Piedmont	Metropolitan
CHATHAM	3,829	95	2	2	Medium/ Small	Piedmont	Metropolitan
CHEROKEE	1,656	46	1	1	Small	Mountain	Noncore
CHOWAN	1,621	44	1	1	Small	Inner Coastal Plain	Noncore
CLAY	852	19	1	1	Small	Mountain	Noncore
CLEVELAND	8,135	178	4	4	Medium	Piedmont	Micropolitan
COLUMBUS	6,298	158	3	3	Medium	Inner Coastal Plain	Noncore
CRAVEN	7,626	150	3	3	Medium	Coastal	Micropolitan
CUMBERLAND	25,872	485	4	4	Medium/ Large	Inner Coastal Plain	Metropolitan
CURRITUCK	2,253	55	2	2	Medium/ Small	Coastal	Metropolitan
DARE	1,692	44	1	1	Small	Coastal	Micropolitan
DAVIDSON	12,249	219	4	4	Medium/ Large	Piedmont	Micropolitan
DAVIE	3,275	64	2	2	Medium/ Small	Piedmont	Metropolitan
DUPLIN	5,135	120	3	3	Medium	Inner Coastal Plain	Noncore
DURHAM	16,419	266	4	4	Medium/ Large	Piedmont	Metropolitan
EDGECOMBE	4,166	107	2	3	Medium	Inner Coastal Plain	Metropolitan
FORSYTH	26,168	345	4	4	Large	Piedmont	Metropolitan
FRANKLIN	4,907	102	3	3	Medium	Piedmont	Metropolitan

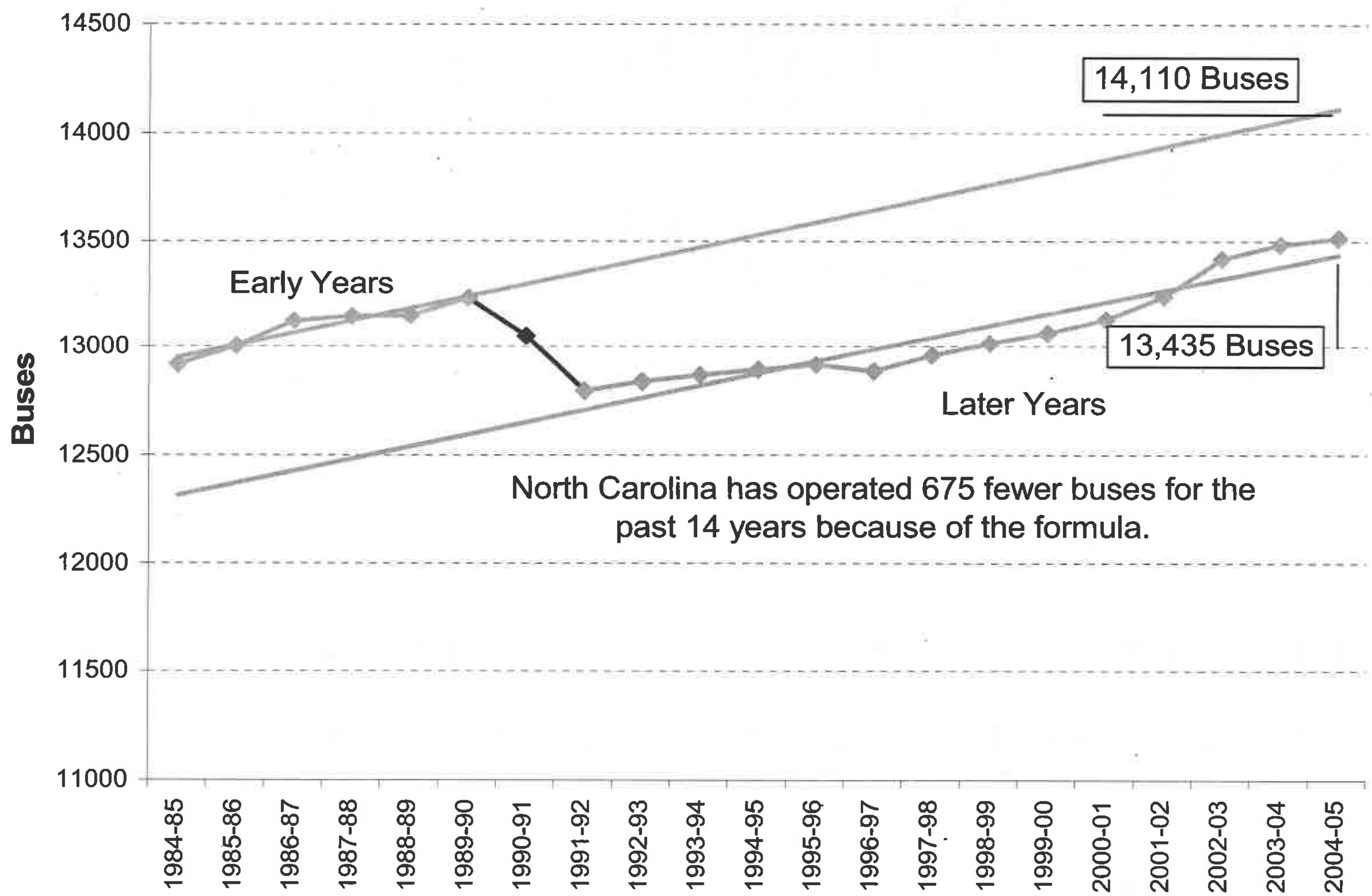
Appendix B: LEA Category Definitions

NAME	Students	Buses	Student Quartile	Bus Quartile	Size	Description	Population
GASTON	13,195	200	4	4	Medium/ Large	Piedmont	Metropolitan
GATES	1,315	35	1	1	Small	Inner Coastal Plain	Noncore
GRAHAM	818	21	1	1	Small	Mountain	Noncore
GRANVILLE	5,154	108	3	3	Medium	Piedmont	Noncore
GREENE	2,435	56	2	2	Medium/ Small	Inner Coastal Plain	Metropolitan
GUILFORD	38,256	613	4	4	Large	Piedmont	Metropolitan
HALIFAX	6,600	149	3	3	Medium	Inner Coastal Plain	Micropolitan
HARNETT	11,178	229	4	4	Medium/ Large	Inner Coastal Plain	Micropolitan
HAYWOOD	3,698	77	2	2	Medium/ Small	Mountain	Metropolitan
HENDERSON	5,218	103	3	3	Medium	Mountain	Metropolitan
HERTFORD	2,774	74	2	2	Medium/ Small	Inner Coastal Plain	Noncore
HOKE	4,616	75	3	2	Medium	Inner Coastal Plain	Metropolitan
HYDE	362	14	1	1	Small	Coastal	Noncore
IREDELL	12,988	209	4	4	Medium/ Large	Piedmont	Micropolitan
JACKSON	1,643	40	1	1	Small	Mountain	Noncore
JOHNSTON	13,682	317	4	4	Medium/ Large	Inner Coastal Plain	Metropolitan
JONES	1,087	30	1	1	Small	Coastal	Micropolitan
LEE	5,102	96	3	2	Medium	Piedmont	Micropolitan
LENOIR	6,874	147	3	3	Medium	Inner Coastal Plain	Micropolitan
LINCOLN	5,575	109	3	3	Medium	Piedmont	Micropolitan
MACON	2,046	52	1	1	Small	Mountain	Noncore
MADISON	1,973	51	1	1	Small	Mountain	Metropolitan
MARTIN	2,563	63	2	2	Medium/ Small	Inner Coastal Plain	Noncore
McDOWELL	2,983	70	2	2	Medium/ Small	Mountain	Noncore
MECKLENBURG	72,169	1,097	4	4	Large	Piedmont	Metropolitan
MITCHELL	1,838	36	1	1	Small	Mountain	Noncore
MONTGOMERY	2,795	60	2	2	Medium/ Small	Piedmont	Noncore
MOORE	5,619	134	3	3	Medium	Piedmont	Micropolitan
NASH	9,604	210	4	4	Medium	Inner Coastal Plain	Metropolitan
NEW HANOVER	11,220	184	4	4	Medium/ Large	Inner Coastal Plain	Metropolitan
NORTHAMPTON	2,363	63	2	2	Medium/ Small	Inner Coastal Plain	Micropolitan
ONSLOW	12,307	223	4	4	Medium/ Large	Inner Coastal Plain	Metropolitan
ORANGE	7,423	135	3	3	Medium	Piedmont	Metropolitan
PAMLICO	933	29	1	1	Small	Coastal	Micropolitan
PASQUOTANK	2,930	64	2	2	Medium/ Small	Inner Coastal Plain	Micropolitan

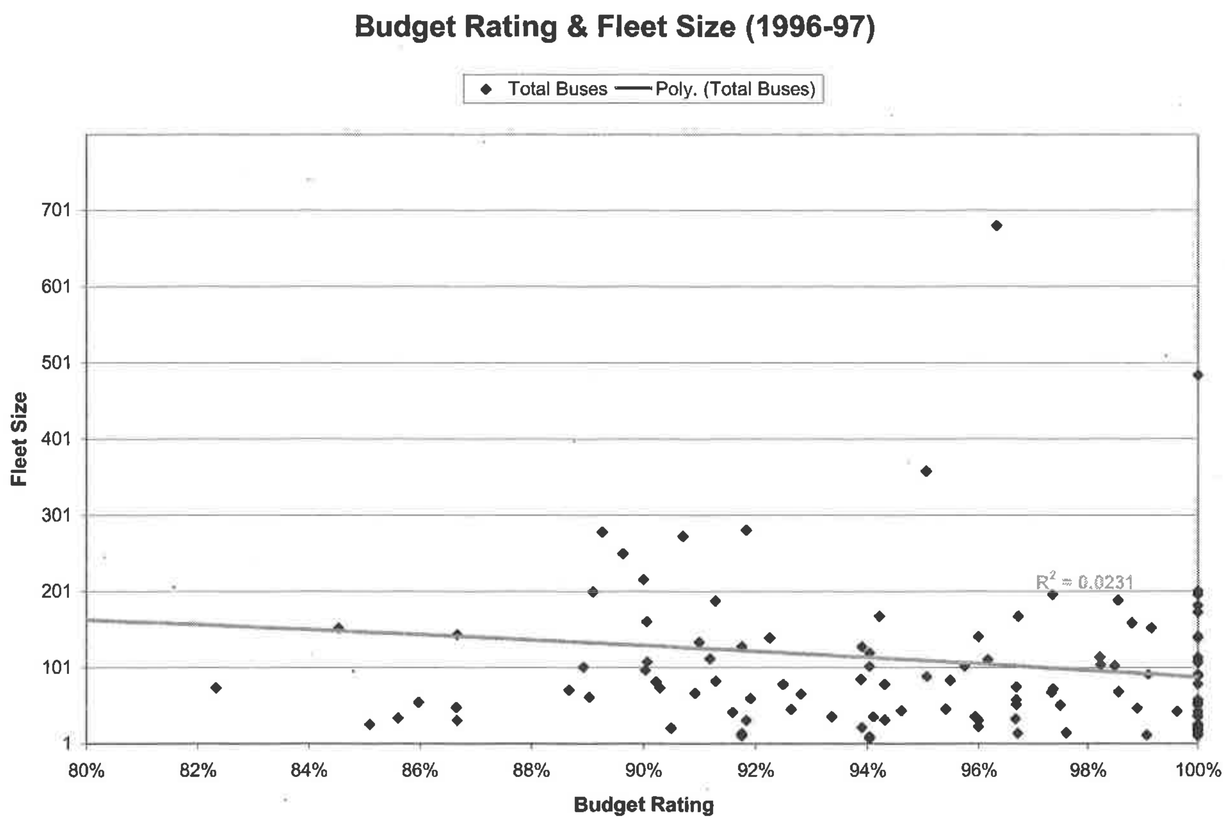
Appendix B: LEA Category Definitions

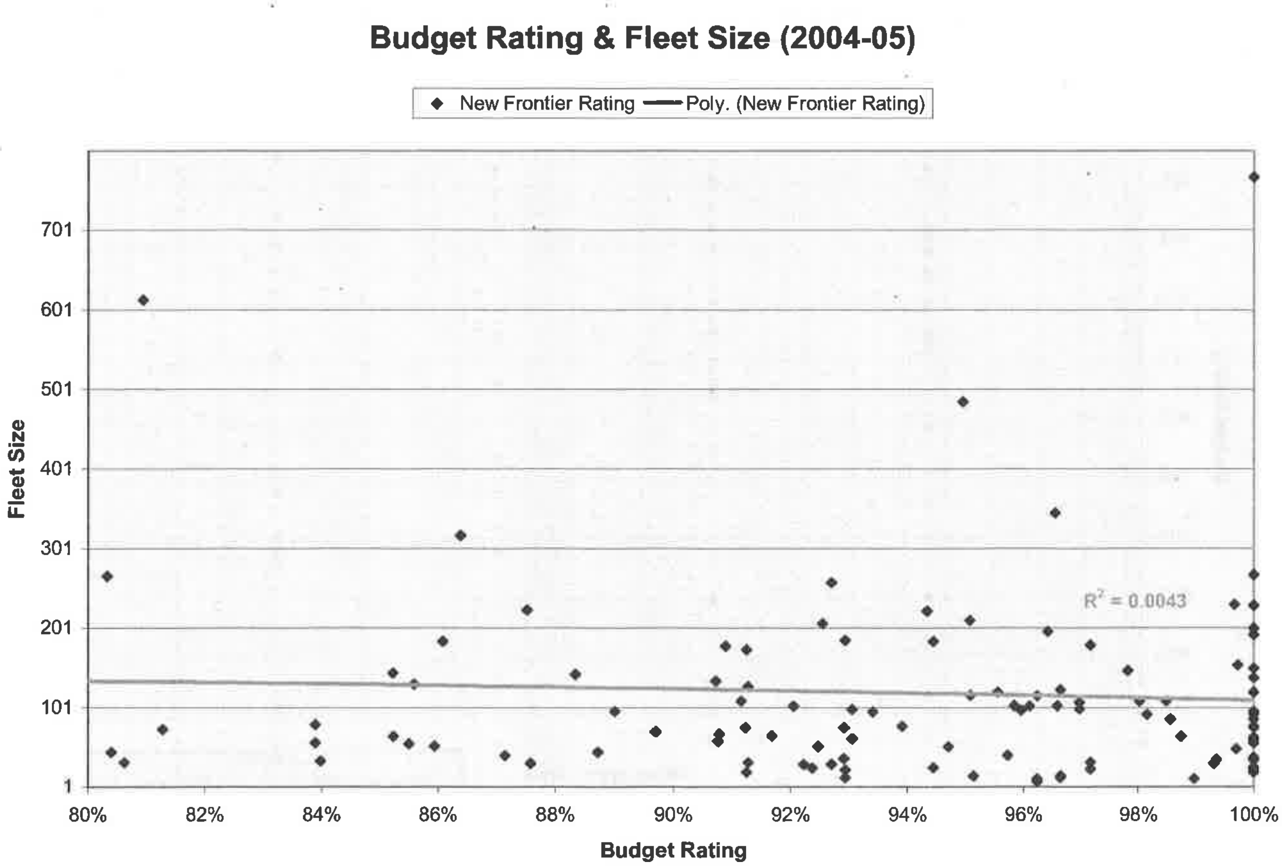
NAME	Students	Buses	Student Quartile	Bus Quartile	Size	Description	Population
PENDER	4,533	98	3	3	Medium	Coastal	Metropolitan
PERQUIMANS	913	30	1	1	Small	Coastal	Micropolitan
PERSON	3,370	77	2	2	Medium/ Small	Piedmont	Metropolitan
PITT	10,989	206	4	4	Medium/ Large	Inner Coastal Plain	Metropolitan
POLK	1,011	31	1	1	Small	Mountain	Noncore
RANDOLPH	9,714	192	4	4	Medium	Piedmont	Metropolitan
RICHMOND	5,327	92	3	2	Medium	Piedmont	Micropolitan
ROBESON	14,607	268	4	4	Medium/ Large	Inner Coastal Plain	Micropolitan
ROCKINGHAM	6,639	144	3	3	Medium	Piedmont	Metropolitan
ROWAN	10,933	196	4	4	Medium/ Large	Piedmont	Micropolitan
RUTHERFORD	5,382	116	3	3	Medium	Mountain	Micropolitan
SAMPSON	6,973	161	3	4	Medium	Inner Coastal Plain	Noncore
SCOTLAND	4,021	75	2	2	Medium/ Small	Inner Coastal Plain	Micropolitan
STANLY	4,647	103	3	3	Medium	Piedmont	Micropolitan
STOKES	4,293	96	2	2	Medium/ Small	Piedmont	Metropolitan
SURRY	6,393	132	3	3	Medium	Mountain	Micropolitan
SWAIN	1,131	22	1	1	Small	Mountain	Noncore
TRANSYLVANIA	1,673	41	1	1	Small	Mountain	Micropolitan
TYRRELL	373	11	1	1	Small	Coastal	Noncore
UNION	16,680	230	4	4	Medium/ Large	Piedmont	Metropolitan
VANCE	4,481	86	2	2	Medium/ Small	Piedmont	Micropolitan
WAKE	62,532	767	4	4	Large	Piedmont	Metropolitan
WARREN	2,289	58	2	2	Medium/ Small	Piedmont	Noncore
WASHINGTON	1,478	38	1	1	Small	Coastal	Noncore
WATAUGA	2,022	48	1	1	Small	Mountain	Micropolitan
WAYNE	10,152	223	4	4	Medium	Inner Coastal Plain	Metropolitan
WILKES	5,075	102	3	3	Medium	Mountain	Micropolitan
WILSON	5,684	130	3	3	Medium	Inner Coastal Plain	Micropolitan
YADKIN	2,837	67	2	2	Medium/ Small	Piedmont	Metropolitan
YANCEY	1,849	40	1	1	Small	Mountain	Noncore

Appendix C: NC Bus Fleet Size: 20 Year trend

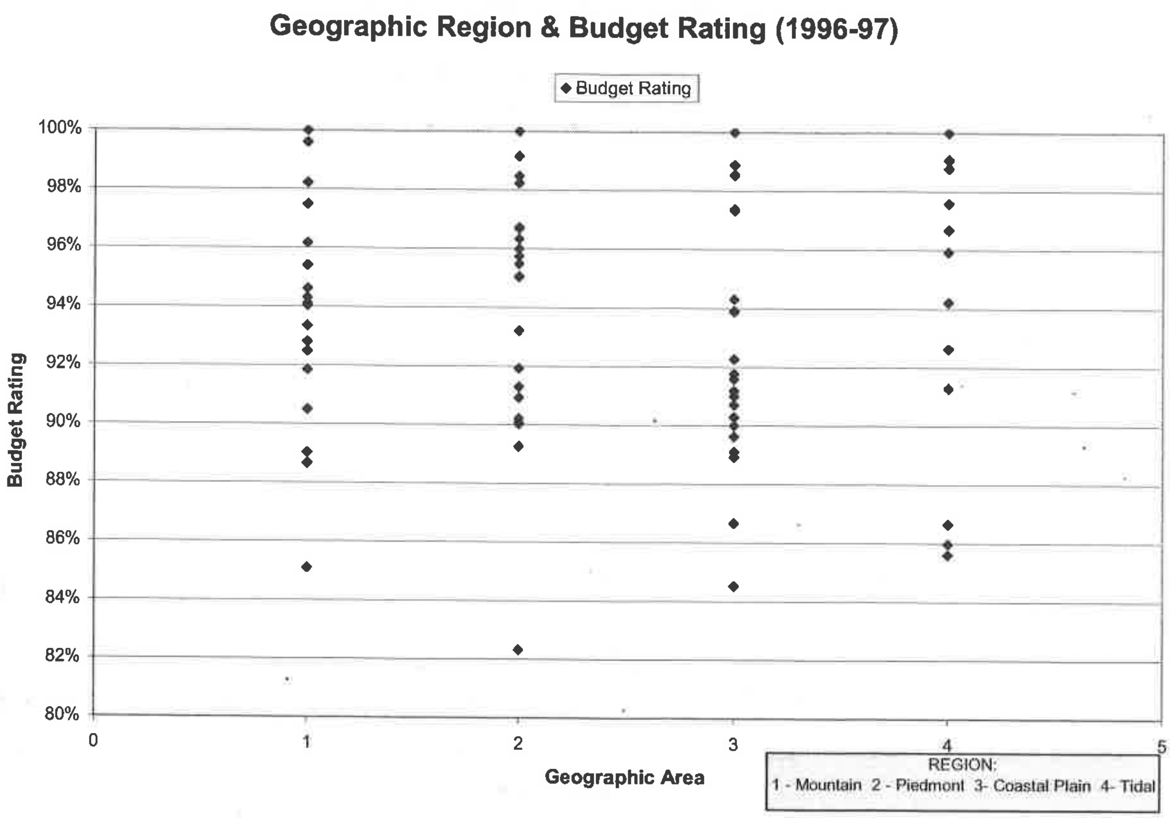


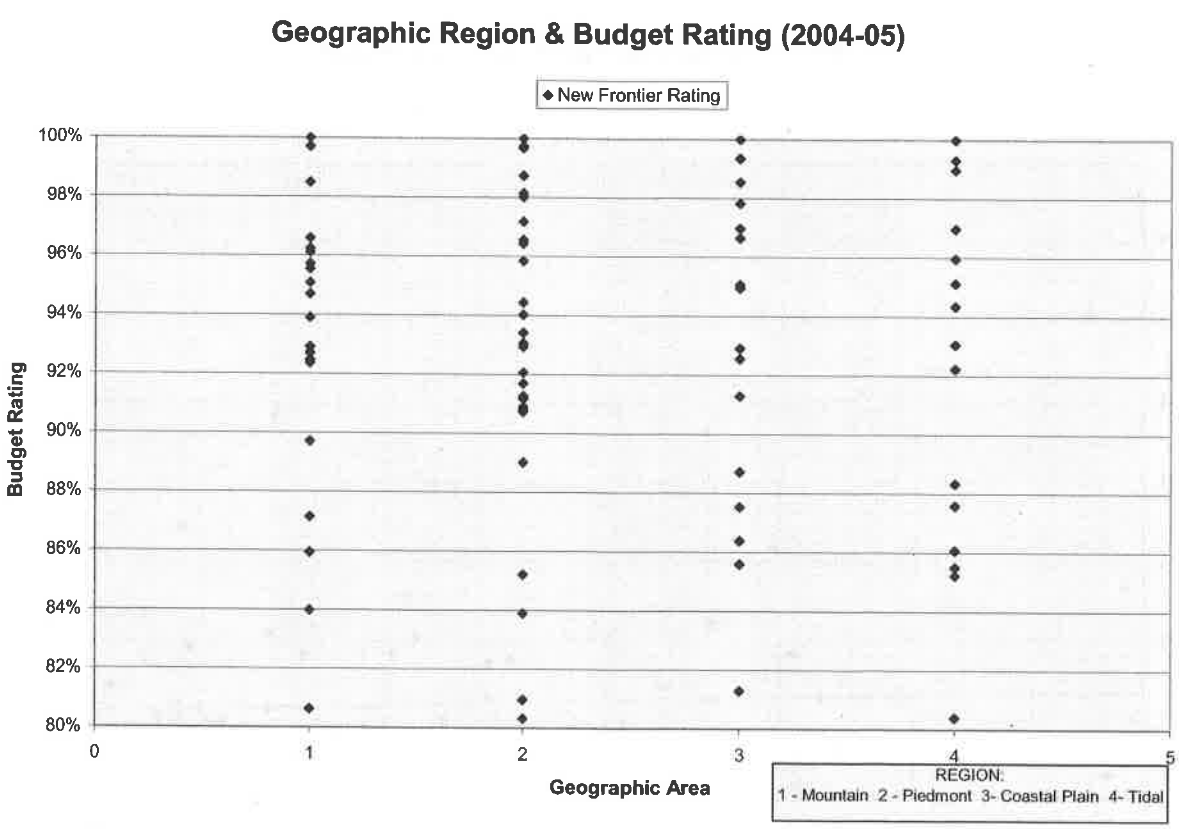
Appendix D: Fleet Size vs. Budget Rating





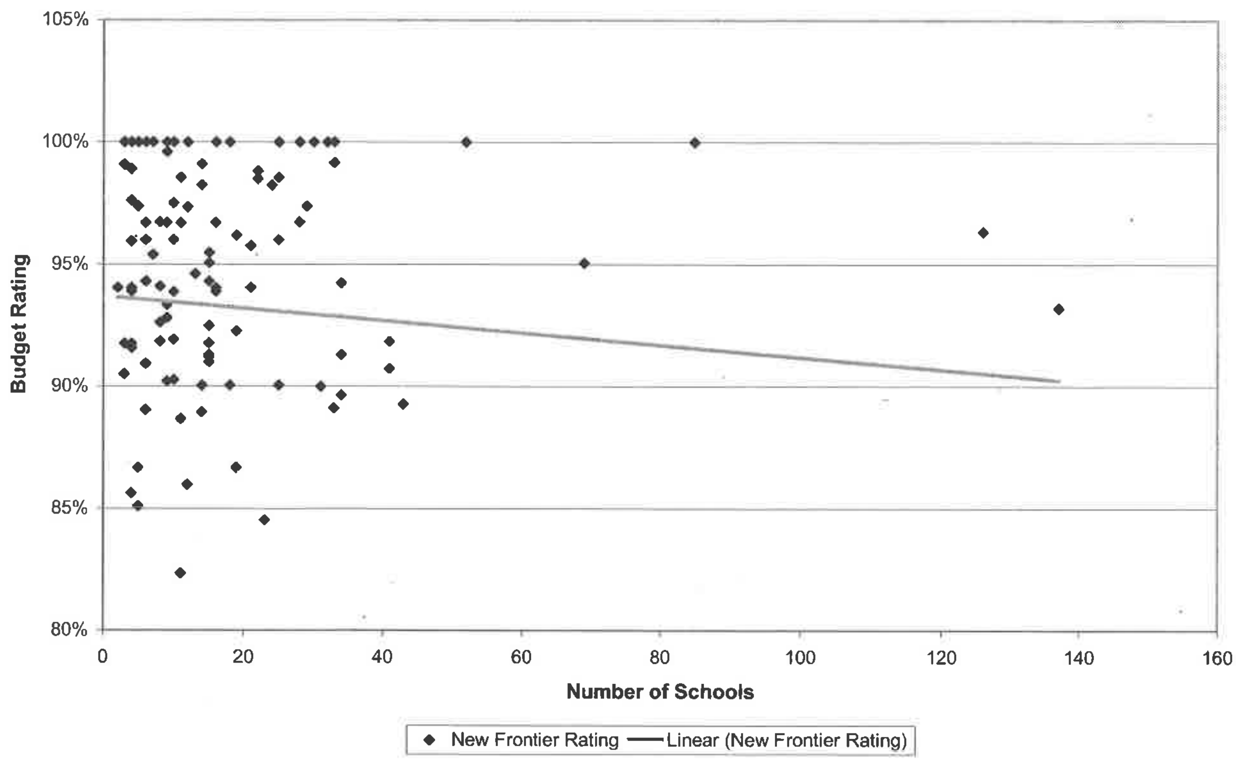
Appendix E: Geographic Region vs. Budget Rating



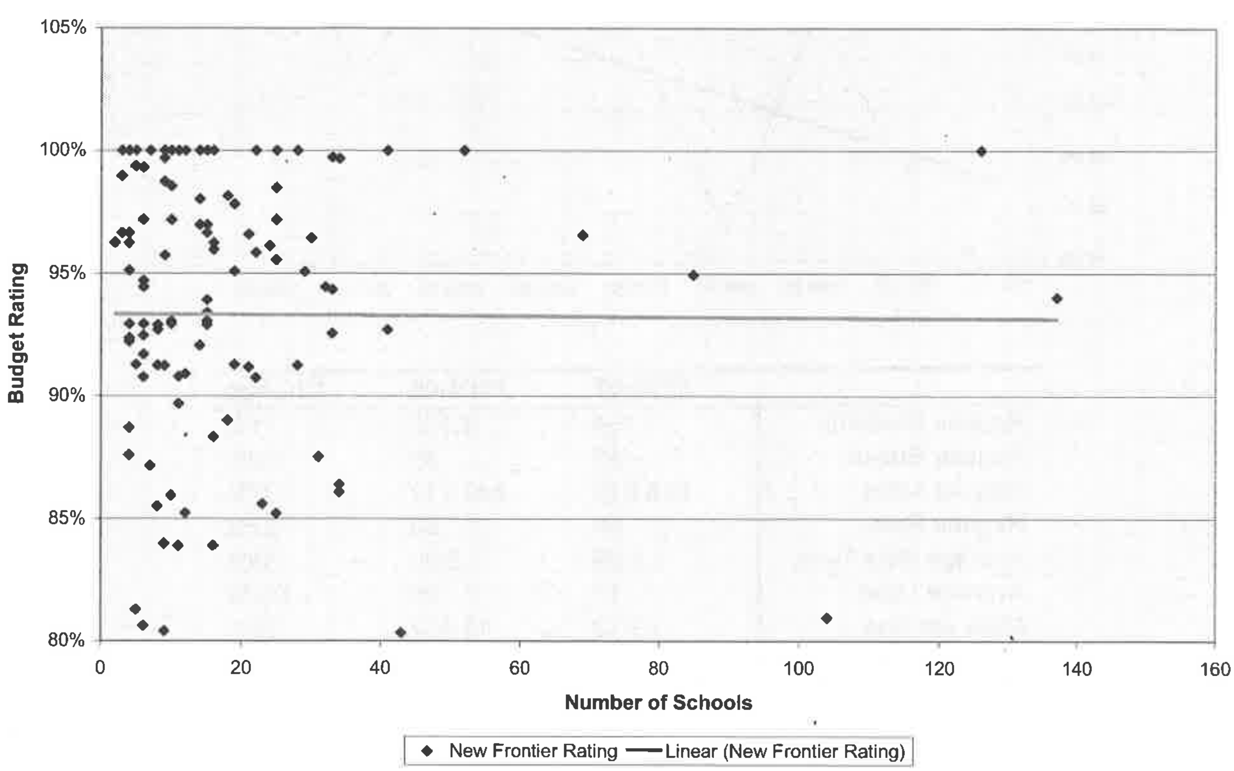


Appendix F: LEA Size (Number of Schools) vs. Budget Rating

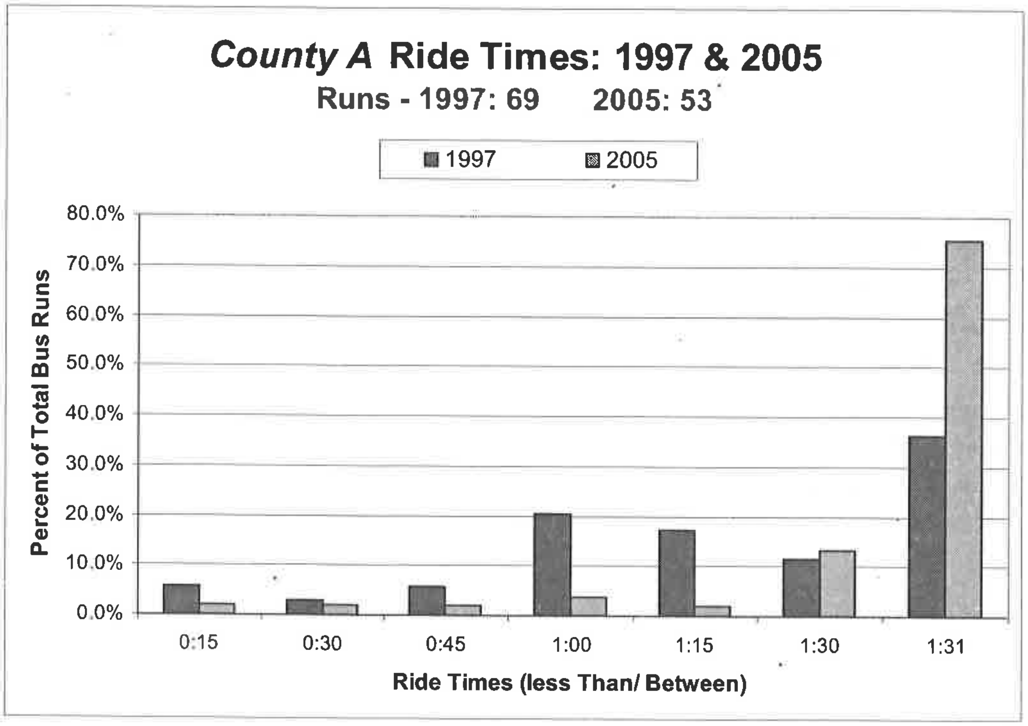
Number of Schools (per LEA) & Budget Rating (1996-97)

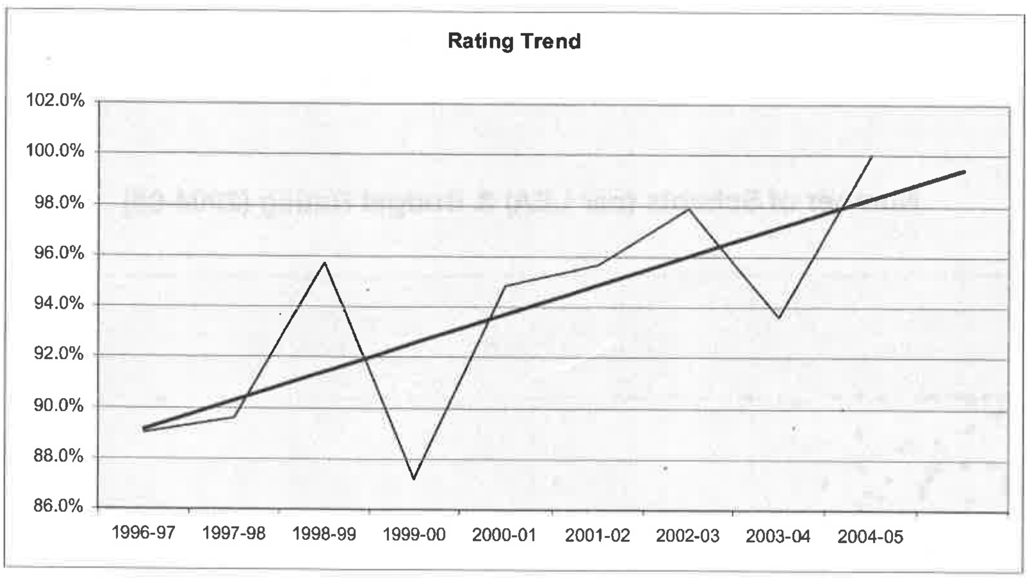


Number of Schools (per LEA) & Budget Rating (2004-05)



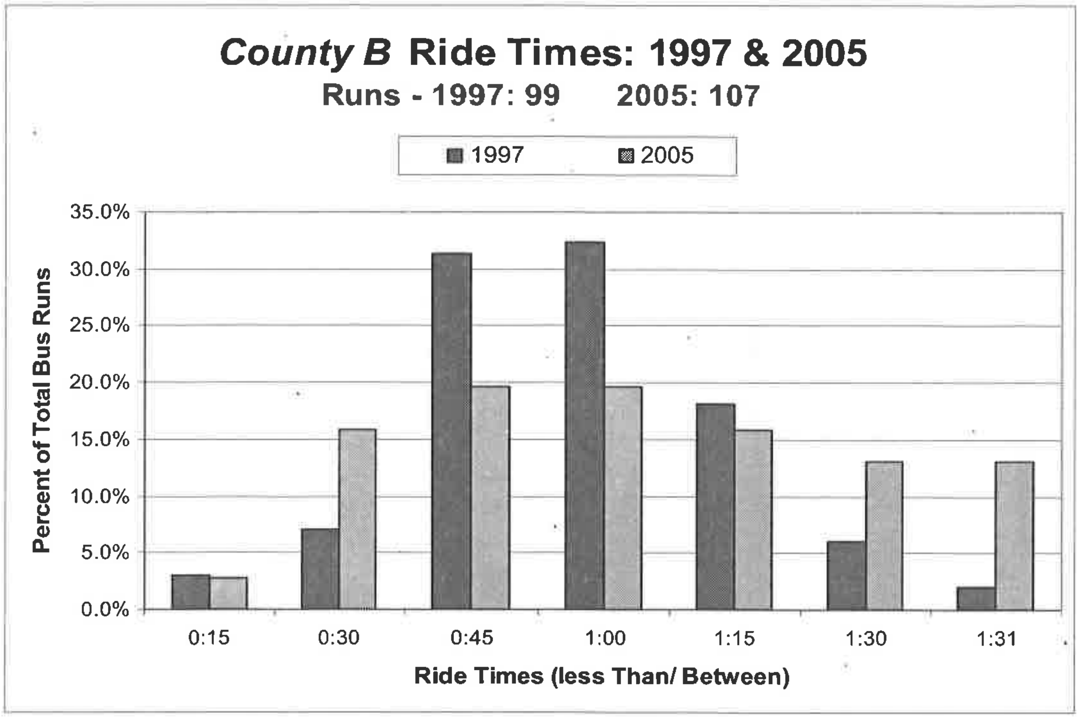
Appendix G: Case Study: Ride Time Comparison

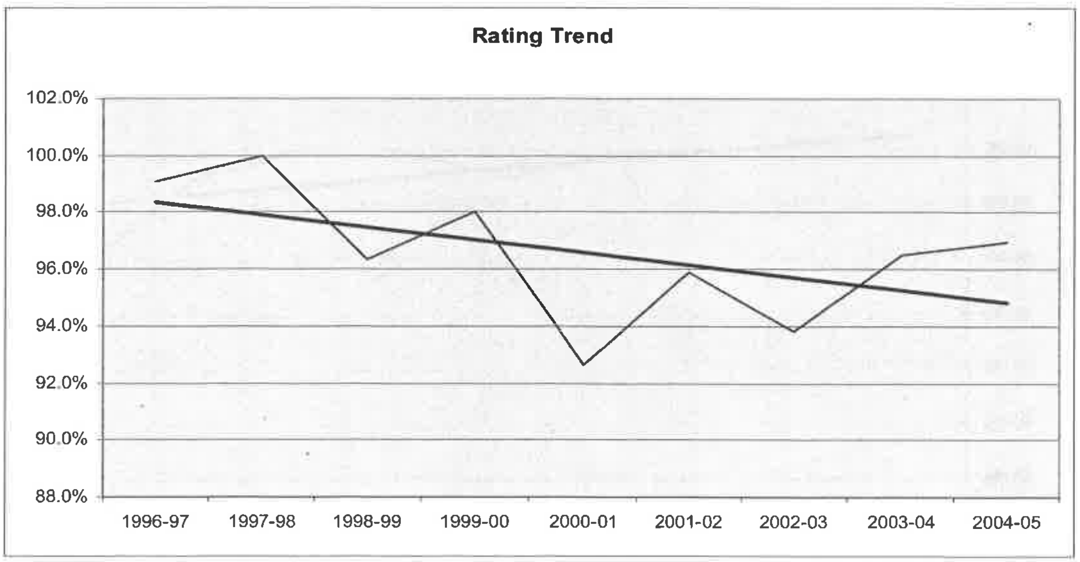




	1996-97	2004-05	Change
Regular Students	2,154	2,139	*-1%*
Regular Buses	59	48	*-19%*
Regular Miles	614,919	840,712	*37%*
Regular Runs	69	53	*-23%*
Average Ride Time	1:28	2:00	*36%*
Average Load	17	36	*114%*
Miles per Bus	8,912	15,862	*78%*
Miles per Student	285	393	*38%*

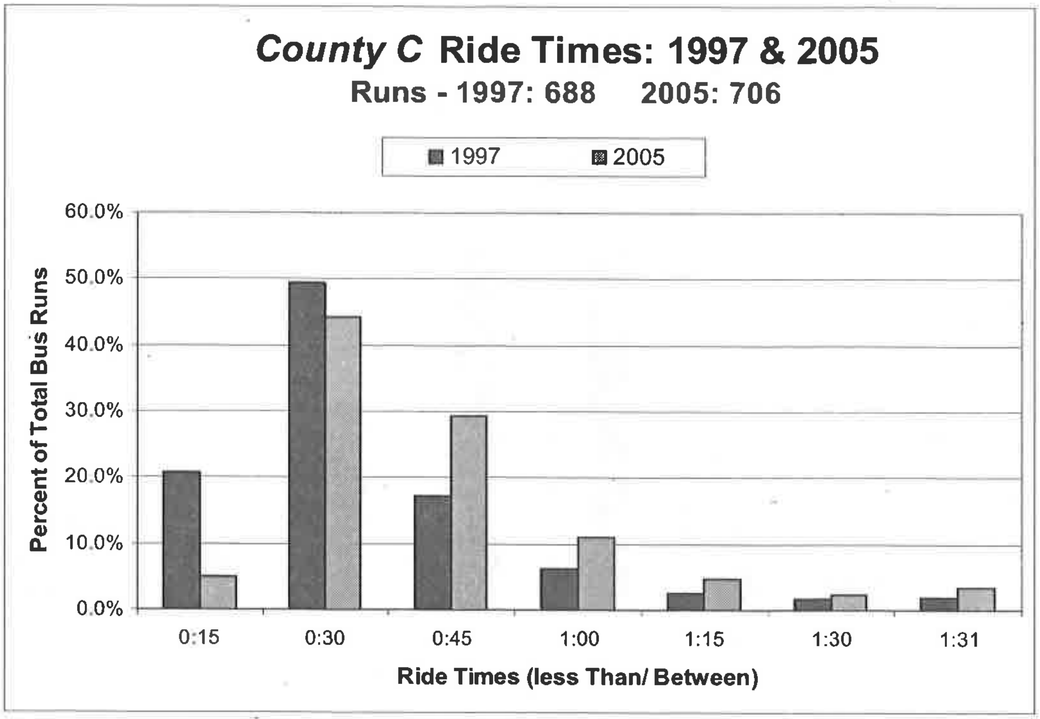
Appendix G: Case Study: Ride Time Comparison

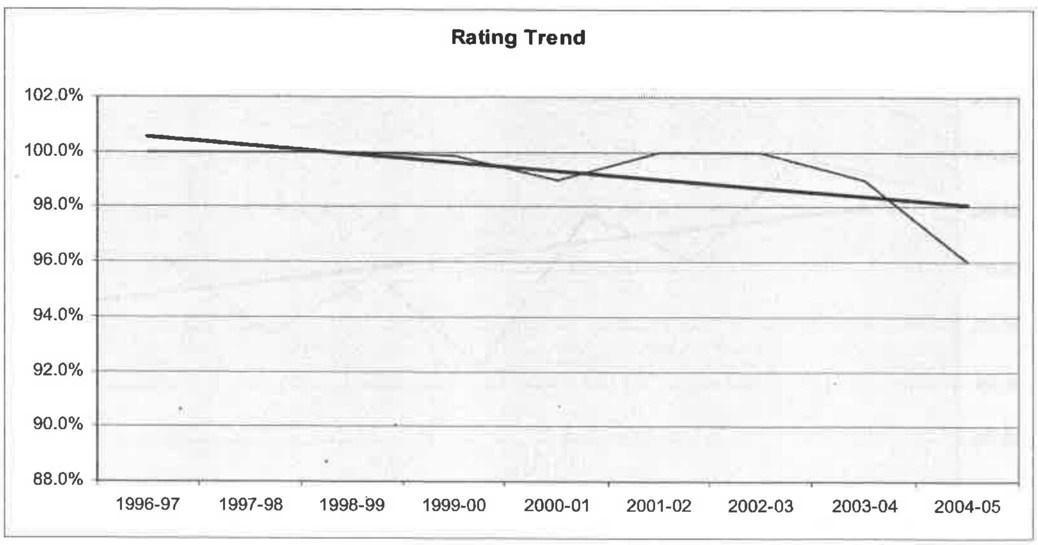




	1996-97	2004-05	Change
Regular Students	4,041	3,996	*-1%*
Regular Buses	89	95	*7%*
Regular Miles	961,916	1,108,994	*15%*
Regular Runs	99	107	*8%*
Average Ride Time	0:50	0:56	*12%*
Average Load	46	34	*-26%*
Miles per Bus	9,716	10,364	*7%*
Miles per Student	238	278	*17%*

Appendix G: Case Study: Ride Time Comparison





	1996-97	2004-05	Change
Regular Students	28,138	24,802	*-12%*
Regular Buses	432	421	-3%
Regular Miles	3,150,334	3,096,077	-2%
Regular Runs	688	706	3%
Average Ride Time	0:28	0:36	*29%*
Average Load	49	52	*6%*
Miles per Bus	4,579	4,385	*-4%*
Miles per Student	112	125	*11%*

Appendix H: Case Study: Cost v. Funding Amounts

			FY1997 Expenditures			FY 1997 Funding						
LEA NAME	Stu	Buses	Local	State	Total	Eligible Local Expenses	Eligible State Expenses	Total	Total Funds to be Allotted	Funding per Student	Actual Cost per Student	Budget Rating
ALAMANCE	8,965	153	$ 499,336	$ 1,748,444	$ 2,247,780	$ 249,061	$ 1,748,444	$ 1,997,505	$ 1,756,127	$ 196	$ 251	100%
ASHE	2,183	62	$ 187,200	$ 736,165	$ 923,365	$ 136,463	$ 736,165	$ 872,628	$ 711,646	$ 326	$ 423	89%
BEAUFORT	4,085	92	$ 28,973	$ 997,650	$ 1,026,623	$ 27,898	$ 997,650	$ 1,025,548	$ 971,146	$ 238	$ 251	99%
CATAWBA	7,594	141	$ 306,167	$ 1,572,902	$ 1,879,069	$ 167,969	$ 1,572,902	$ 1,740,871	$ 1,532,793	$ 202	$ 247	96%
CUMBERLAND	28,874	484	$ 191,853	$ 4,959,663	$ 5,151,516	$ 94,442	$ 4,959,663	$ 5,054,105	$ 4,843,673	$ 168	$ 178	100%
FORSYTH	23,438	359	$ 2,140,133	$ 6,826,348	$ 8,966,481	$ 947,825	$ 6,826,348	$ 7,774,173	$ 6,652,018	$ 284	$ 383	97%
WAKE	47,035	680	$ 5,268,337	$ 14,672,308	$ 19,940,645	$ 2,464,745	$ 14,672,308	$ 17,137,053	$ 14,361,836	$ 305	$ 424	100%

			FY2005 Expenditures			FY 2005 Funding						
LEA NAME	Stu	Buses	Local	State	Total	Eligible Local Expenses	Eligible State Expenses	Total	Total Funds to be Allotted	Funding per Student	Actual Cost per Student	
ALAMANCE	9,205	154	$ 221,926	$ 2,581,839	$ 2,803,765	$ 93,091	$ 2,581,839	$ 2,674,930	$ 2,636,452	$ 286	$ 305	100%
ASHE	2,167	51	$ 142,167	$ 1,300,965	$ 1,443,132	$ 89,316	$ 1,300,965	$ 1,390,281	$ 1,270,685	$ 586	$ 666	100%
BEAUFORT	4,033	99	$ 43,784	$ 1,442,402	$ 1,486,186	$ 7,365	$ 1,442,402	$ 1,449,767	$ 1,400,570	$ 347	$ 369	97%
CATAWBA	12,997	233	$ 67,842	$ 3,058,607	$ 3,126,449	$ 54,686	$ 3,058,607	$ 3,113,293	$ 3,012,182	$ 232	$ 241	97%
CUMBERLAND	25,872	485	$ 348,628	$ 8,677,640	$ 9,026,268	$ 215,380	$ 8,677,640	$ 8,893,020	$ 8,487,549	$ 328	$ 349	96%
FORSYTH	26,168	345	$ 1,012,890	$ 9,262,819	$ 10,275,708	$ 318,385	$ 9,262,819	$ 9,581,204	$ 9,082,436	$ 347	$ 393	95%
WAKE	62,532	767	$ 9,459,702	$ 31,868,642	$ 41,328,344	$ 919,300	$ 31,868,642	$ 32,787,943	$ 31,581,579	$ 505	$ 661	100%

Appendix I: Frontier Model for Student Transportation Funding

Background and Purpose

One of the key drawbacks of the current funding approach is its departure from the mathematics of frontier analysis as embodied in the technique known as Data Envelopment Analysis, or DEA. This modification was implemented to resolve the so-called "alley problem," in which certain LEAs could increase their expenditures (while holding buses and students transported constant) without hurting their efficiency rating or their budget rating, thereby passing along the bulk, if not all, of those added expenses to the State.

When it was first developed the formula in 1991-94, and later when reevaluated in 1997, the DEA literature was silent about how to resolve this issue. Since that time, A technique has been developed that resolves the "alley problem" within the mathematically sound DEA framework.

The purpose of this report is to describe the preferred approach and to illustrate the results using data from 2004-05. The proposed approach also uses a slightly different approach to adjust for site characteristics. The improved adjustment procedure was first published in 2002[1] and a second publication[2] is currently under review.

Overview of the Proposed Frontier Approach

The proposed approach consists of the steps outlined below. The next section will explain the adjustment process in greater detail and the following section will illustrate the results of applying this approach to data from 2004-05.

1. Build two regression models, one with cost as the dependent variable and one with buses used as the dependent variable. In each case, the independent variables are students transported and the appropriate site characteristics.

2. For each LEA, use the regression models to compute its expected cost and its expected number of buses used based on its students transported and its site characteristics.

3. Compute the *cost adjustment* and the *bus adjustment* for each LEA. The cost adjustment for an LEA equals the difference between (a) its expected cost *if it had average site characteristics*, minus (b) its expected cost *given its actual site characteristics*. These expected costs are easily derived from the regression model for cost. The cost adjustment will be positive for an LEA that operates under favorable conditions and negative for an LEA that operates under unfavorable

[1] "Firm-Specific Productive Efficiency Offsets in the Development of a Price Cap Formula," (with R. N. Norton and R. H. Silkman), *The Electricity Journal*, Vol. 15, No. 10, December 2002.

[2] "Adjusting for Site Characteristics in DEA: Leveling the Playing Field," (with R. N. Norton and R. H. Silkman), submitted to *International Transactions in Operational Research*, August 2005.

conditions. Compute the bus adjustment for each LEA in the same manner using the regression model for buses.

$$\text{Cost Adjustment} = (\text{Expected Cost} \mid \text{Average SCs}) - (\text{Expected Cost} \mid \text{Actual SCs})$$

$$\text{Bus Adjustment} = (\text{Expected Buses} \mid \text{Average SCs}) - (\text{Expected Buses} \mid \text{Actual SCs})$$

4. For each, LEA, compute its *adjusted cost* by adding its cost adjustment to its actual cost. Thus, if an LEA is operating under favorable conditions, then its adjusted cost will be greater than its actual cost. On the other hand, if an LEA is operating under unfavorable conditions, then its adjusted cost will be less than its actual cost. Compute the *adjusted buses* for each LEA in the same manner.

$$\text{Adjusted Cost} = (\text{Actual Cost}) + (\text{Cost Adjustment})$$

$$\text{Adjusted Buses} = (\text{Actual Buses}) + (\text{Bus Adjustment})$$

5. For each LEA, compute its adjusted cost per student and its adjusted buses per 100 students.

$$\text{Adjusted Cost per Student} = \frac{\text{Adjusted Cost}}{\text{Students Transported}}$$

$$\text{Adjusted Buses per 100 Students} = \frac{100 * \text{Adjusted Buses}}{\text{Students Transported}}$$

6. Construct the scatter plot and efficient frontier by plotting the LEAs using adjusted cost per student on the vertical, or *y*-, axis and adjusted buses per 100 students on the horizontal, or *x*-, axis.

7. For each LEA, compute its *target adjusted cost per student* and its *target adjusted buses per 100 students*. This is easily done with the help of commercially available software. To see this calculation graphically, connect the LEA to the origin and determine the point where this radial line intersects the efficient frontier. This point is called the *intersection point*. If the intersection point is not on either the vertical or horizontal portion of the efficient frontier, then it is the LEA's *target point*. If the intersection point is on the vertical portion of the efficient frontier, then move the point down until it reaches the point on the efficient frontier where the vertical portion begins. This point is the LEA's target point. If the intersection point is on the horizontal portion of the efficient frontier, then move the point left until it reaches the point on the efficient frontier where the horizontal portion begins. This point is the LEA's target point.

The LEA's *buffered target point* is the point whose coordinates are equal to the coordinates of the LEA's target point multiplied by (1 + buffer), where the buffer is expressed as a proportion (say 0.10 for a 10% buffer). The LEA's target adjusted cost per student and target adjusted buses per 100 students are the *y*-coordinate and *x*-coordinate, respectively, of the LEA's buffered target point.

$$\text{Target Adjusted Cost per Student} = (\text{y - coordinate of target point}) * (1 + \text{buffer})$$

$$\text{Target Adjusted Buses per 100 Students} = (\text{x - coordinate of target point}) * (1 + \text{buffer})$$

8. For each LEA, compute its *target adjusted cost* by multiplying its number of students transported by the smaller of its target adjusted cost per student and its actual adjusted cost per student. The rationale is that the State should not reimburse an LEA for costs that it did not incur simply because of the buffer. Compute its *target adjusted buses* by multiplying its number of students transported by the smaller of its target adjusted buses per 100 students and its actual adjusted buses per 100 students, and divide by 100.

$$\text{Target Adjusted Cost} = (\text{Students}) * \min(\text{Target Adj. Cost per Student}, \text{Actual Adj. Cost per Student})$$

$$\text{Target Adjusted Buses} = \frac{(\text{Students}) * \min(\text{Target Adj. Buses per 100 Students}, \text{Actual Adj. Buses per 100 Students})}{100}$$

9. For each LEA, compute its *cost allocation* by subtracting its cost adjustment from its target adjusted cost. Compute its *bus allocation* by subtracting its bus adjustment from its target adjusted buses.

$$\text{Cost Allocation} = (\text{Target Adjusted Cost}) - (\text{Cost Adjustment})$$

$$\text{Bus Allocation} = (\text{Target Adjusted Buses}) - (\text{Bus Adjustment})$$

10. Ensure that the funding percentage (the ratio of cost allocation to actual total cost) and the bus percentage (the ratio of bus allocation to actual buses used) are each uncorrelated with each of the site characteristics. This is easily accomplished by performing two stepwise regression analyses, one with each percentage as the dependent variable and with the potential site characteristics as the independent variables. None of the potential site characteristics should enter either model.

The Revised Adjustment Process

The original adjustment process, which was created as part of the original funding process, was designed to work with an unaltered frontier model. It began by computing efficiency ratings from a standard frontier model based on the actual costs, buses, and students transported. It then built a regression model using the efficiency rating as the dependent variable and the site characteristics as the independent variables. This approach was modified when DPI altered the frontier model to compute separate cost ratings and bus ratings. The current approach builds two models, one using the cost rating as the dependent variable and one using the bus rating as the dependent variable.

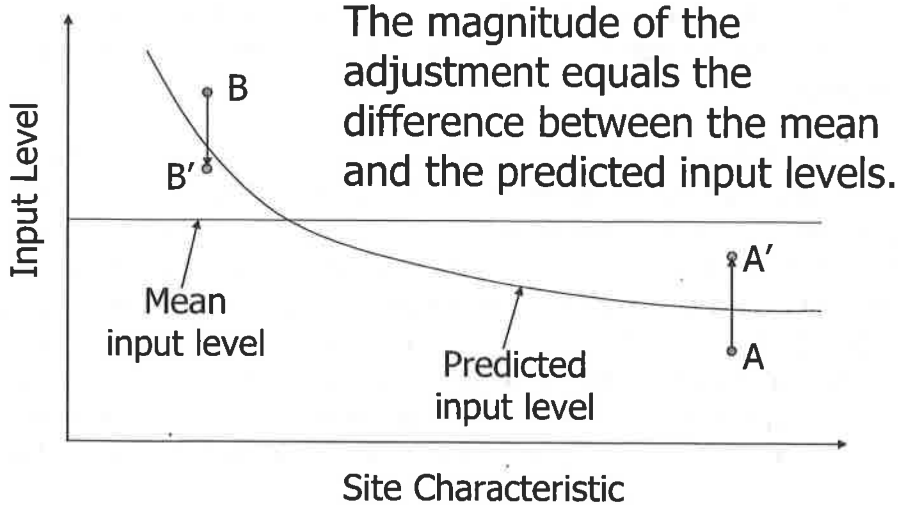
In subsequent DEA applications (with an unaltered frontier model), the proposed technique builds separate models for each input. This eliminates the need to compute efficiency ratings based on the actual data and preserves the ability of the site characteristics to affect the inputs (cost and buses) in different ways, which is present in the current approach.

The concept of the revised approach is essentially the same as that used in the current approach. The basic idea is to determine the extent to which an LEA spends more or less money, or uses more or fewer buses, as a result of its site characteristics. If an LEA operates under favorable conditions with respect to cost, then its cost is adjusted upward, whereas if it operates under unfavorable conditions with respect to cost, then its cost is adjusted downward. We apply the same approach to buses. Thus, for each LEA, its adjusted cost and its adjusted buses is computed. These values are then interpreted as the cost that the LEA *would have* incurred and the buses that it *would have* used if it transported as many students as it did but did so under average conditions.

Let's consider the cost adjustment; the bus adjustment works in the same fashion. We begin by constructing a regression model using cost as the independent variable and using students transported and the site characteristics as the independent variables. The model must be constructed carefully, transforming variables as necessary to account for nonlinear relationships, including only variables that are statistically significant, and ensuring that colinearity is kept to a minimum. The model must also pass the standard tests for normality of the residuals and constant variance of the residuals.

Once the regression model is completed, how much an LEA would be expected to spend can be computed by substituting its number of students transported and its various site characteristics into the regression model. How much this LEA would be expected to spend if its site characteristics were equal to the statewide averages can then be calculated. This is done by substituting the LEA's number of students transported and the statewide averages of the site characteristics into the regression model. The difference between these values (cost using statewide averages minus cost using actual site characteristics) is the cost adjustment necessary to align the LEA's cost with that of other LEAs after they too are appropriately adjusted.

The figure below illustrates the adjustment process. Suppose that the input is cost and the only site characteristic in the cost model is student density. The adjustment process, of course, works with multiple site characteristics but we illustrate it with only one so that we may show the graph in two dimensions. The curved line represents the regression model for cost. It reveals that we expect LEAs with higher student density to have lower cost for any given number of students transported[3]. The horizontal line represents the expected cost for an LEA with the same number of students transported but with site characteristics equal to the statewide averages. The difference between the height of the horizontal line minus the height of the curved line represents the cost adjustment required to account for the effects of site characteristics.



Consider LEA A, which has high student density. The height of the curve at its student density lies below the horizontal line, indicating that we expect LEA A to have a lower cost than it would if it had average student density. The distance between the horizontal line and the curve is the cost adjustment required for LEA A. The length of the arrow from A to A′ equals the cost adjustment so that the height of point A′ equals the adjusted cost for LEA A. We have adjusted LEA A's cost upward to account for its favorable student density. Notice that LEA A's actual cost (the height of point A) is less than its expected cost, indicating that LEA A is performing relatively well with respect to cost. After the adjustment, point A′ lies below the horizontal line by the same amount that point A lies below the regression model. Thus, LEA A's better-than-expected performance is preserved by the adjustment process.

Now consider LEA B, which transports the same number of students as does LEA A (so we can show them on the same graph). It has low student density and the regression model indicates that we expect it to have a higher cost than it would have if it had average student density. In this case, we adjust LEA B's cost downward to account for its unfavorable student density. Notice also that LEA B lies above the regression model, indicated that LEA B is performing relatively poorly with respect to cost. After the adjustment, point B′ lies above the horizontal line by the same amount that point B lies above the regression model. Thus, LEA B's worse-than-expected performance is preserved by the adjustment process.

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[3] Students transported is included in the model but not shown on the graph. The graph applies to LEAs with the same number of students transported. Equivalently, think of each LEA as having its own graph.

With multiple site characteristics, only one cost adjustment that takes into account the simultaneous effects of all the site characteristics is performed. Thus, the process is the same but it happens in a higher dimension. Also, the same approach for the bus adjustment is followed.

The resulting adjusted costs and adjusted buses are then used in the DEA model to construct the frontier and, ultimately, to determine the cost and bus allocations for each LEA. The next step is to test the effectiveness of the adjustment process by checking if the ratio of the cost allocation to the actual total cost (and the ratio of the bus allocation to the actual number of buses) is uncorrelated with the site characteristics. If a statistically significant correlation is discovered, the regression models need to be rebuilt to eliminate this correlation.

Using Data from 2004-05

The following illustrates the application of the proposed funding process using data from 2004-05 and compares the results with those obtained using the current funding process.

The following regression models were constructed for cost and buses:

Linear Regression of lnTotCost

Variable	Coefficient	Std Error	T	P	VIF
Constant	5.52167	0.29821	18.52	0.0000	
lnStudent	1.03432	0.03194	32.38	0.0000	4.2
Pupil_Den	-0.05027	0.01094	-4.60	0.0000	6.9
PupDenSq	0.01295	0.00187	6.91	0.0000	22.1
PupDenCub	-5.003E-04	1.019E-04	-4.91	0.0000	18.3
Circ3quar	0.22462	0.10207	2.20	0.0302	1.3

Cases Included	100	R Squared	0.9755	MSE	0.02423
Missing Cases	0	Adj R Sq	0.9718	SD	0.15564

Regression of lnBuses

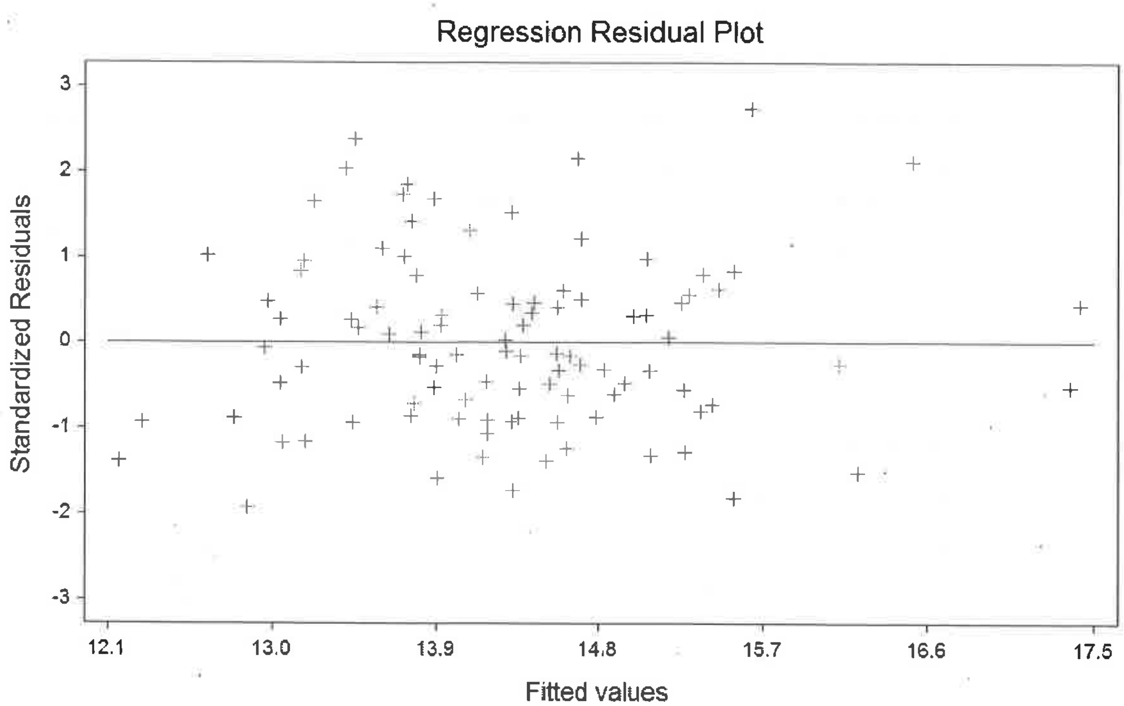
Variable	Coefficient	Std Error	T	P	VIF
Constant	-3.33297	0.14701	-22.67	0.0000	
lnStudent	0.96163	0.01786	53.86	0.0000	4.4
Pct_EC_St	2.03751	0.92432	2.20	0.0300	1.2
Elevation	-9.572E-05	1.740E-05	-5.50	0.0000	3.6
Elev_Sq	3.486E-08	9.452E-09	3.69	0.0004	3.2
Pupil_Den	-0.04934	0.00608	-8.11	0.0000	7.1
PupDenSq	0.00212	3.703E-04	5.73	0.0000	2.9
Dist3Quar	0.01502	0.00511	2.94	0.0042	2.0

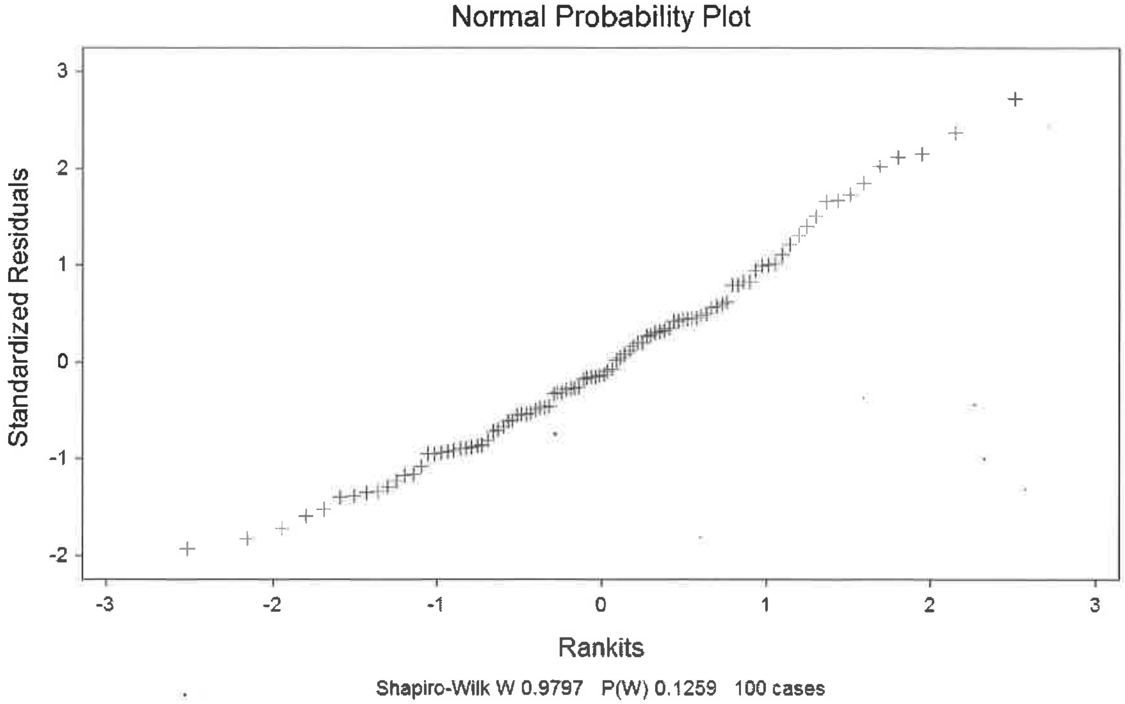
Cases Included	100	R Squared	0.9907	MSE	0.00723
Missing Cases	0	Adj R Sq	0.9893	SD	0.08503

In each model, the natural logarithm of the dependent variable (lnTotCost and lnBuses) and the natural logarithm of students transported (lnStudent) was used. The statistically significant variables in both models are pupil density (Pupil_Den) and (centered) pupil density squared (PupDenSq). (Centered) pupil density cubed (PupDenCub) and the third quartile of circuity (Circ3quar) also appear in the cost model. The proportion of students who are exceptional children (Pct_EC_St), elevation (Elevation), (centered) elevation squared (Elev_Sq), and the third quartile of distance to school (Dist3Quar) also appear in the bus model.

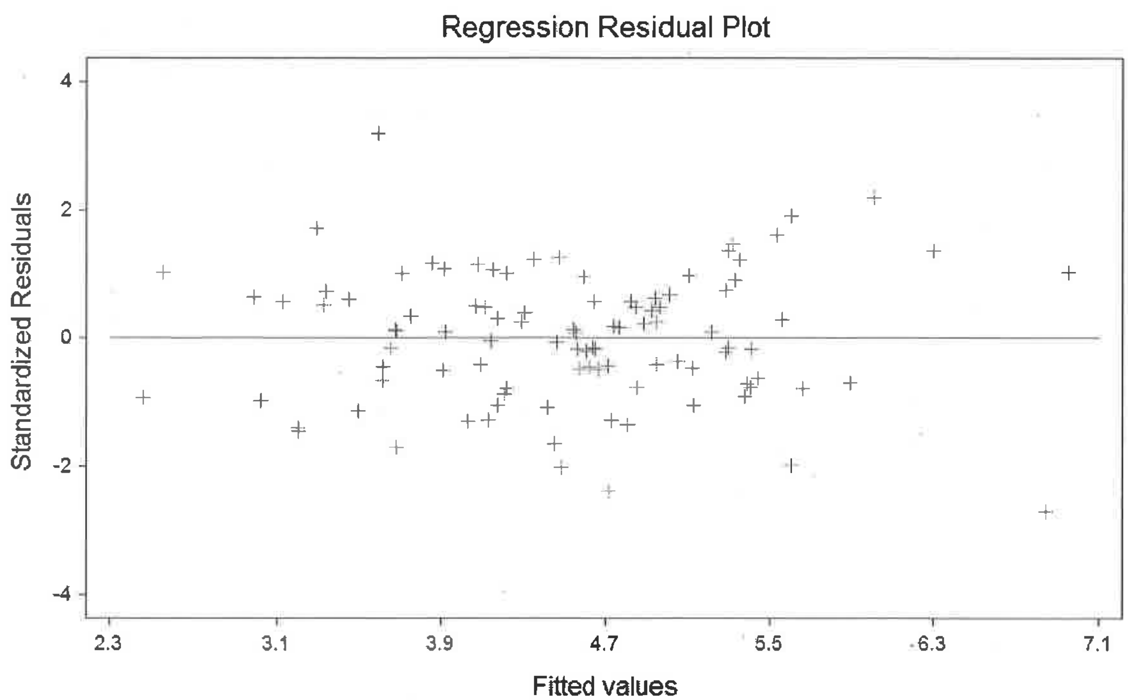
The R^2 values are very high (0.9755 in the cost model and 0.9907 in the bus model), indicating that there is virtually no unexplained variation in the dependent variables. The variance inflation factors (VIFs) are acceptable (< 10) in every case, indicating that colinearity is not a problem, except for the variables PupDenSq and PupDenCub in the cost model. However, such colinearity is expected when variables are computed from the same underlying data, student density in this case. As such, we are not concerned since the corresponding coefficients are highly statistically significant (as indicated by their very low P-values) and their coefficients all have reasonable signs.

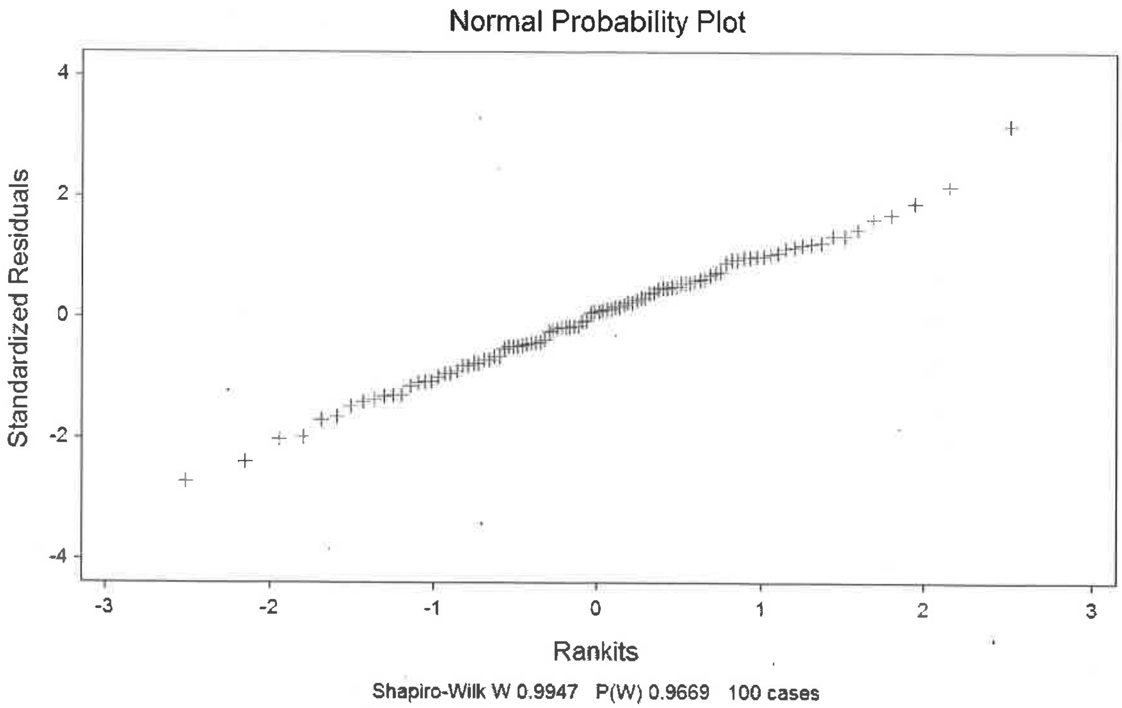
The graphs below show the residual plot and the probability plot for the cost model. Clearly, there is no evidence of any departures from the regression assumptions of normally distributed residuals, linearity (after transformations), or constant variance of the residuals.





The graphs below show the residual plot and the probability plot for the bus model. Once again, there is no evidence of any departures from the regression assumptions of normally distributed residuals, linearity (after transformations), or constant variance of the residuals.





1. We illustrate the rest of the steps using data for three LEAs: Ashe, Clay, and Buncombe. The table below shows the relevant data for these LEAs:

LEA	Actual Cost	Actual Buses	Students	Student Density	Pct. EC	Elevation	3 Quart Distance	3 Quart Circuity
Ashe	$1,390,281	51	2,167	2.62	1.28%	3,100	11.1	1.60
Clay	$314,880	19	852	3.34	1.41%	1,893	8.40	1.50
Buncombe	$5,725,527	287	15,573	9.34	2.31%	3,428	4.61	1.44
State Avg.				**6.28**	**2.05%**	**795**	**7.28**	**1.42**

The regression models produce the following expected costs and expected buses:

LEA	Actual Cost	Expected Cost	Actual Buses	Expected Buses
Ashe	$1,390,281	$1,079,310	51	56.5
Clay	$314,880	$360,493	19	20.6
Buncombe	$5,725,527	$5,209,750	287	254.4

Thus, Ashe is performing relatively poorly with respect to cost but relatively well with respect to buses. Clay is performing relatively well with respect to both cost and buses. Buncombe is performing relatively poorly with respect to both cost and buses.

2. The regression models produce the following expected costs and expected buses if these LEAs operated with average site characteristics. Also shown are the cost adjustments and the bus adjustments.

LEA	Expected Cost with Avg. SCs	Expected Cost with Actual SCs	Cost Adjustment	Expected Buses with Avg. SCs	Expected Buses with Actual SCs	Bus Adjustment
Ashe	$803,181	$1,079,310	−$276,129	46.9	56.5	−9.6
Clay	$305,830	$360,493	−$54,663	19.1	20.6	−1.5
Buncombe	$6,176,051	$5,209,750	$966,301	312.4	254.4	58.0

Thus, Ashe and Clay are operating under unfavorable conditions with respect to both cost and buses while Buncombe is operating under favorable conditions with respect to both cost and buses.

3. The adjusted cost and the adjusted buses for these three LEAs are:

LEA	Actual Cost	Cost Adjustment	Adjusted Cost	Actual Buses	Bus Adjustment	Adjusted Buses
Ashe	$1,390,281	−$276,129	$1,114,151	51	−9.6	41.4
Clay	$314,880	−$54,663	$260,218	19	−1.5	17.5
Buncombe	$5,725,527	$966,301	$6,691,828	287	58.0	345.0

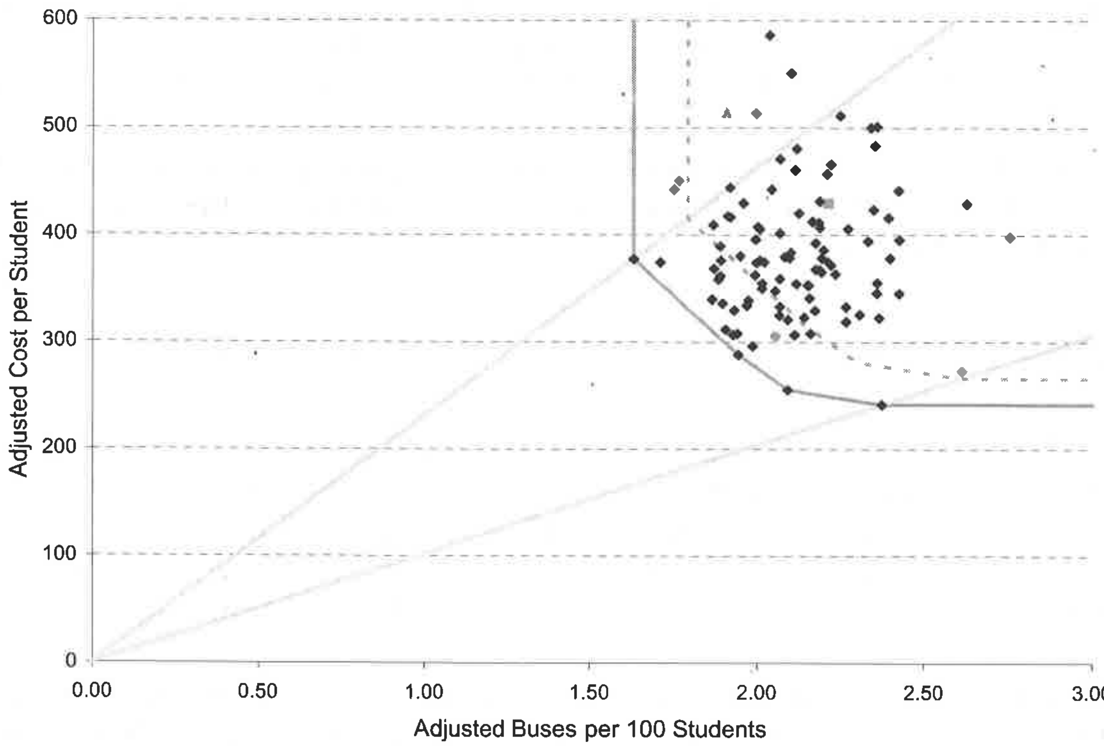
Because of their operating conditions, we "charge" Ashe and Clay with having spent less money and used fewer buses than they actually did and we "charge" Buncombe with having spent more money and used more buses than it actually did.

4. The adjusted cost per student and the adjusted buses per 100 students are:

LEA	Adjusted Cost	Students	Adjusted Cost per Student	Adjusted Buses	Adjusted Buses per 100 Students
Ashe	$1,114,151	2,167	$514.14	41.4	1.91
Clay	$260,218	852	$305.42	17.5	2.06
Buncombe	$6,691,828	15,573	$429.72	345.0	2.22

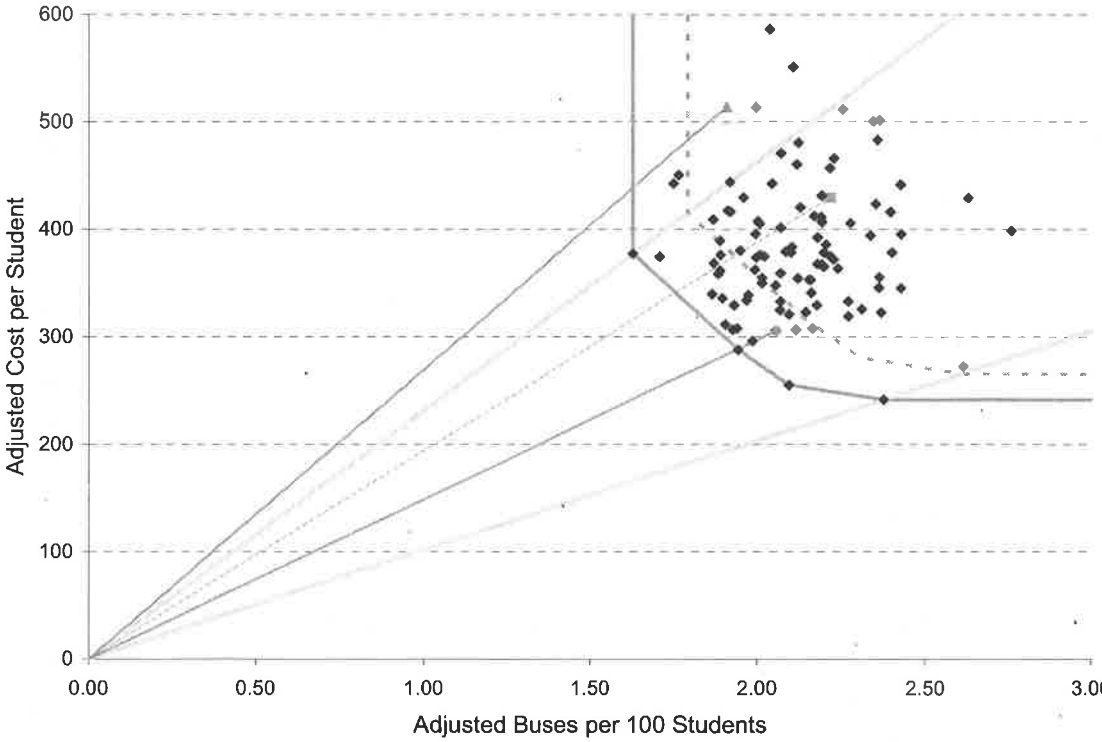
5. The scatter plot is shown below. The solid piecewise linear construct is the *efficient frontier*. LEAs that lie on the efficient frontier are 100% efficient. The dashed piecewise linear construct is the *buffered frontier* using a 10% buffer. LEAs that lie on the buffered frontier are 90% efficient. There are four LEAs on the efficient frontier. From upper left to lower right, they are Wake, Montgomery, Tyrrell, and Graham.

Note the two radial lines that emanate from the origin. One passes through Wake and the other passes through Graham. The region between these lines is called the *cone*. The region above the line that passes through Wake is called the *cost alley* and the region below the line that passes through Graham is called the *bus alley*. The three LEAs in the tables above are shown in red and with differently shaped markers. Ashe is the triangle in the "cost alley," Clay is the circle in the cone between the efficient frontier and the buffered frontier. Buncombe is the square in the cone above the buffered frontier.



6. The graph below shows the three radial lines that connect the three LEAs with the origin. For Clay and Buncombe, the target points are the intersections of their radial lines with the efficient frontier. For Ashe, because it lies in the cost alley, its target point is Wake. The table below shows the *x*-coordinates and the *y*-coordinates of the target points and, upon applying the 10% buffer, the target adjusted cost per student and the target adjusted buses per 100 students, which are the *x*-coordinates and the *y*-coordinates of the buffered target points.

LEA	*y*-coordinate of Target Point	Target Adjusted Cost per Student	*x*-coordinate of Target Point	Target Adjusted Buses per 100 Students
Ashe	\$377.39	\$415.13	1.63	1.79
Clay	\$288.65	\$317.51	1.94	2.14
Buncombe	\$341.11	\$375.22	1.76	1.93



7. The target adjusted cost and target adjusted buses are:

LEA	Target Adjusted Cost per Student	Actual Adjusted Cost per Student	Minimum	Students	Target Adjusted Cost
Ashe	$415.13	$514.14	$415.13	2,167	$899,583
Clay	$317.51	$305.42	$305.42	852	$260,218
Buncombe	$375.22	$429.72	$375.22	15,573	$5,843,165

LEA	Target Adjusted Buses per 100 Students	Actual Adjusted Buses per 100 Students	Minimum	Students	Target Adjusted Buses
Ashe	1.79	1.91	1.79	2,167	38.9
Clay	2.14	2.06	2.06	852	17.5
Buncombe	1.93	2.22	1.93	15,573	301.3

8. The cost allocations and bus allocations are:

LEA	Target Adjusted Cost	Cost Adjustment	Cost Allocation	Target Adjusted Buses	Bus Adjustment	Bus Allocation
Ashe	$899,583	−$276,129	$1,175,712	38.9	−9.6	49
Clay	$260,218	−$54,663	$314,880	17.5	−1.5	19
Buncombe	$5,843,165	$966,301	$4,876,864	301.3	58.0	244

9. The stepwise regression analyses reveal that none of the potential site characteristics entered either model, one using funding percentage as the dependent variable and one using bus percentage as the dependent variable. The stepwise model specification used 0.10 for the P-to-enter value. Thus, there is no evidence that either the cost allocation or the bus allocation is influenced in any way by the site characteristics.

   The table below summarizes the results for these three LEAs:

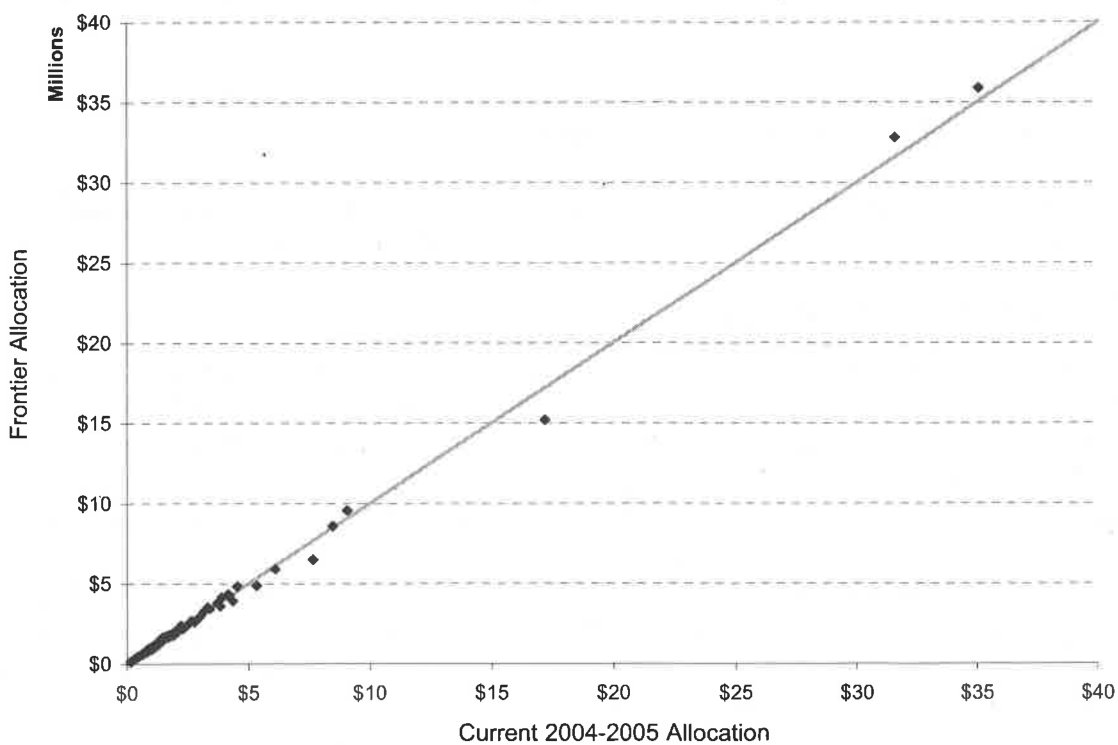
LEA	Actual Cost	Cost Allocation	Funding Percentage	Actual Buses	Bus Allocation	Bus Percentage
Ashe	$1,390,281	$1,175,712	84.6%	51	49	96.0%
Clay	$314,880	$314,880	100.0%	19	19	100.0%
Buncombe	$5,725,527	$4,876,864	85.2%	287	244	85.0%

We observe that Clay receives 100% of its cost and 100% of its buses. This is because Clay lies in the cone between the efficient frontier and the buffered frontier. We also observe that Buncombe's funding and bus percentages are almost equal. This is because Buncombe lies in the cone. Perhaps most interesting is Ashe, which lies in the cost alley. We see that it needs to lose only two buses (4.0% of its fleet) but that it must also reduce its costs by 15.4% to reach the buffered target point. The large difference in percentages occurs because Ashe is in the cost alley. Thus, not only must it move down and to the left to reach the buffered frontier but it must also move down to reach Wake's buffered target point. This illustrates how the alley problem is resolved using the proposed procedure.

The table below shows the 2004-05 cost allocations for the three LEAs using both the current formula and the proposed frontier formula. The graph that follows shows the cost allocations using both approaches and a diagonal line such that LEAs on the diagonal line would experience no change is funding. It is clear that there is no systematic difference between the cost allocations between the two approaches.

LEA	Actual Cost	Current Cost Allocation	Funding Percentage	Frontier Cost Allocation	Funding Percentage
Ashe	$1,390,281	$1,270,685	91.4%	$1,175,712	84.6%
Clay	$314,880	$303,926	96.5%	$314,880	100.0%
Buncombe	$5,725,527	$5,347,631	93.4%	$4,876,864	85.2%

Of course, the funding formula is not designed to allocated buses, but it is interesting to note that the proposed approach provides such allocations should DPI decide to proceed in this direction. We may think of the bus allocations as a by-product of the funding process that comes with no additional computational effort. Such bus allocations would be logically consistent with the cost allocations and would provide DPI with a complete system of resource allocation for student transportation.



Appendix J: The Effects of Base Funding and Local Contributions on State Funding: A Two-LEA Model

Background and Purpose

A concern exists that an LEA can benefit under the current funding formula if its base funding (its State funding in the year prior to implementation of the current formula) was high. In addition, there is concern that an LEA can benefit under the current formula by making local contributions to its pupil transportation operation. The purpose of this analysis is to examine the impacts of these factors, both separately and together, on the LEA's State funding. Specifically, the analysis addresses the following questions:

1. Under what are the circumstances, if any, can an LEA benefit from high base funding?

2. Under what are the circumstances, if any, can an LEA benefit by making local contributions, either sustained or one-time?

The analysis will focus on the role of the 10% buffer, which is added to the LEA's combined efficiency score, and the efficiency with which the LEA uses buses.

The Funding Formula

In essence, the funding formula operates as follows. An LEA's expenditure efficiency is computed as the ratio of the smallest cost per pupil transported to the LEA's cost per pupil transported. An LEA's bus efficiency is computed as the ratio of the smallest number of buses used per pupil transported to the LEA's number of buses used per pupil transported. An LEA's combined efficiency is the average of its expenditure efficiency and its bus efficiency. An LEA's budget rating equals its combined efficiency plus the buffer (currently set at 10%), but not to exceed 100%. The LEA's State funding in the following year equals the product of its budget rating and its total expenditures in the current year, including local expenditures. There are many details regarding allowable expenditures, fuel cost adjustments, and other allocations, but this describes the key elements except for the adjustments for site characteristics.

Site characteristics are those factors that may influence an LEA's ability to operate efficiently and yet remain beyond the control of the LEA's management. The most important site characteristic is pupil density, defined as the ratio of the number of pupils transported to the number of highway miles in the LEA. Other site characteristics deal with the transportation of exceptional children, the terrain, the nature of the highway network, and so forth. The formula removes the effects of site characteristics so that the resulting budget ratings neither penalize nor reward an LEA on the basis of its site characteristics.

The present formula uses regression analysis to remove the effects of site characteristics. First, a model is built that uses the expenditure efficiency as the dependent variable and the site characteristics as the independent variables. The coefficients of the site characteristics tell us the effect of each site characteristic. The formula then rewards or penalizes LEA's by adjusting the number of pupils transported either up or down based on the overall effect of its site characteristics relative to the overall effect for a hypothetical LEA that has average site characteristics. LEAs that operate under generally unfavorable conditions have their number of pupils transported adjusted upward while LEAs that operate under generally favorable conditions have their number of pupils transported adjusted downward.

The formula then computes the LEA's budget rating using its adjusted number of pupils transported. To ensure that all the effects of site characteristics have been removed, the budget ratings are tested to ensure that they are uncorrelated with any of the site characteristics. This step guarantees that the budget ratings are equitable.

In this analysis, we assume that the two LEAs have identical site characteristics. Therefore, no adjustments are necessary and the budget ratings may be computed using the actual data.

A Two-LEA Model

To simplify the analysis, we will suppose that the State consists entirely of two LEAs that transport the same number of pupils (40,000) and that are absolutely identical with respect to all site characteristics. In other words, the two districts are clones except that LEA 1 is a low-wealth district and LEA 2 is a high-wealth district. Let's also assume that the LEAs remain perfectly static; there is no population growth or decline, no changes in the roadway system, no new educational programs, and so forth.

We also assume that LEA 1 is absolutely efficient in every year, that is, it has discovered the optimal operating strategy and that it could not possibly spend less money or operate fewer buses.

Scenarios

We consider five scenarios, as outlined in the table below. Each scenario is defined by the combination of base State funding received by LEA 2 and the manner in which LEA 2 makes local contributions. In all scenarios, we assume that LEA 1 received a base (Year 0) State funding of $10 million and that LEA 1 never makes local contributions. For LEA 2, its base State funding may be high ($15 million) or low ($10 million, the same as LEA 1). Its local contribution may be $0 in every year (the same as LEA 1), $3 million in every year, or $3 million in one year (chosen appropriately) and $0 in every other year.

Within each scenario, we consider all four combinations of number of buses used by LEA 2 and the presence or absence of the buffer. The number of buses used by LEA 2 may be high (750) or low (500, the same as LEA 1). The buffer may be 10% or 0%. We also assume that the current formula becomes effective in Year 1, starting with data from Year 0.

	LEA 2			
Scenario	Base Funding ($ Million)	Local Contribution ($ Million)	Buses Used	Buffer
A	$15	$0	750	10%
	$15	$0	750	0%
	$15	$0	500	10%
	$15	$0	500	0%
B	$15	$3/year	750	10%
	$15	$3/year	750	0%
	$15	$3/year	500	10%
	$15	$3/year	500	0%
C	$15	$3 one-time	750	10%
	$15	$3 one-time	750	0%
	$15	$3 one-time	500	10%
	$15	$3 one-time	500	0%
D	$10	$3/year	750	10%
	$10	$3/year	750	0%
	$10	$3/year	500	10%
	$10	$3/year	500	0%
E	$10	$3 one-time	750	10%
	$10	$3 one-time	750	0%
	$10	$3 one-time	500	10%
	$10	$3 one-time	500	0%

Scenario A: Higher Base Funding, No Local Contribution

Using data from Year 0, LEA 1 will have both its expenditure efficiency and its bus efficiency equal to 100% since it has the lower of the two costs per pupil transported and buses per 100 pupils transported. Thus, its budget rating will equal 100% and it will receive $10 million in State funding again in Year 1.

On the other hand, LEA 2 will have its expenditure efficiency and its bus efficiency equal to 66.7%, yielding a combined efficiency of 66.7% and a budget rating of 76.7% after the addition of the 10% buffer. Thus, LEA 2 will receive $11.5 million in State funding in Year 1 (76.7% of $15 million).

Thus, in Year 1, the new funding formula has maintained the State funding for the efficient LEA 1 and has reduced State funding for the inefficient LEA 2. However, because of the buffer, the inefficient LEA 2 still receives more State funding in Year 1 than does the efficient LEA 1.

Note that, if there were no buffer, then LEA 2 would have a budget rating of 66.7% and would receive $10 million in Year 1, the same amount as LEA 1 receives. Therefore, the buffer allows some excess State funding in Year 1 for LEA 2.

Now consider Year 2. Using Year 1 data, LEA 1 will remain efficient and will again receive $10 million in State funding in Year 2. However, LEA 2 will have its expenditure efficiency equal to 87.0% and its bus efficiency equal to 66.7%, assuming that LEA 2 has managed to reduce its expenditures without taking any buses off the road. Thus, LEA 2 will have a combined efficiency equal to 76.8% and a budget rating of 86.8%; it will receive $10 million in Year 2, the same amount as LEA 1 receives[1].

Figures 1a and 1b show the evolution of the LEAs over the first 10 years following the introduction of the new formula, assuming a 10% buffer.

Therefore, in Year 2, even with the 10% buffer, both LEAs will receive the same amount of State funding. In fact, from this point forward, both LEAs will continue to receive $10 million each year forever. However, LEA 2 is still not efficient, and it will never need to be efficient. Based on Year 2 data (and every year thereafter), its combined efficiency score is 93.3%. *With the 10% buffer, LEA 2 will receive the same amount of State funding as will LEA 1 even though LEA 2 uses 250 additional buses.*

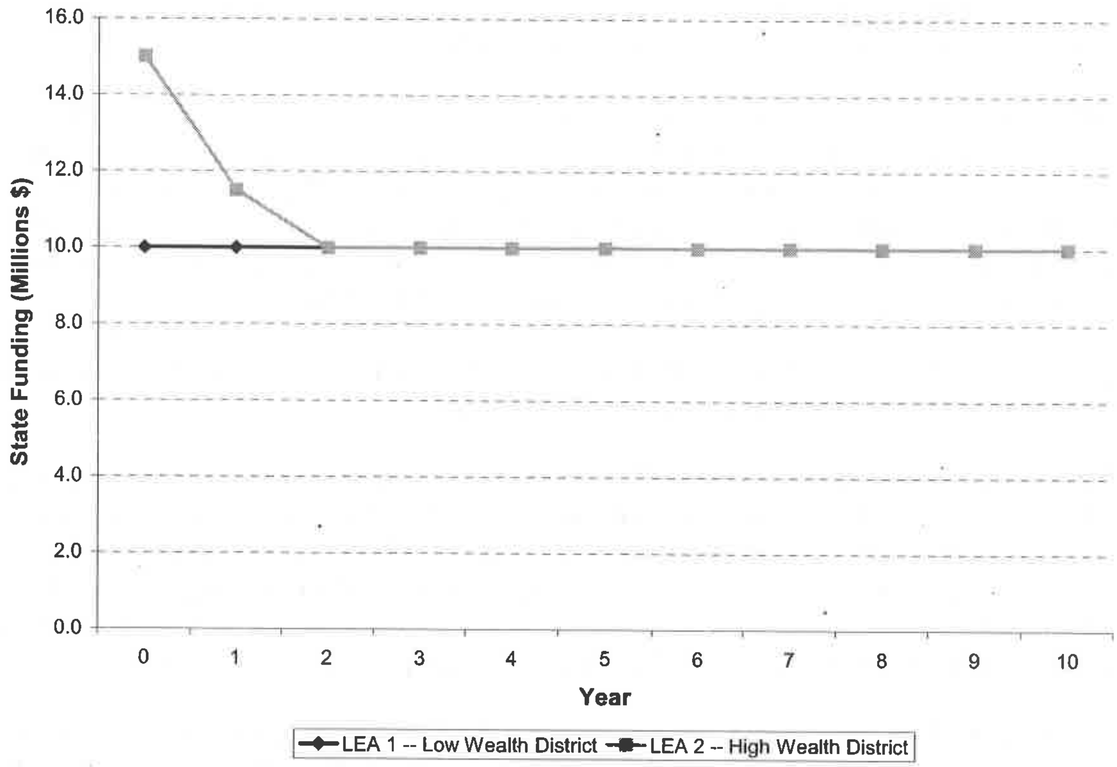
Now suppose that LEA 2 was initially using only 500 buses rather than 750 buses. Figures 2a and 2b show the evolution, assuming a 10% buffer. Now we find that LEA 2's State funding drops and its budget rating rises from 93.3% to 100% over the 10-year period, as intended. However, LEA 2's State funding drops only to $12.5 million and it will remain at that level in perpetuity. *Thus, LEA 2 will continue to receive $2.5 million per year more than LEA 1 receives even though LEA 1 is efficient and LEA 2 is not – LEA 2's combined efficiency will approach 90.0%.*

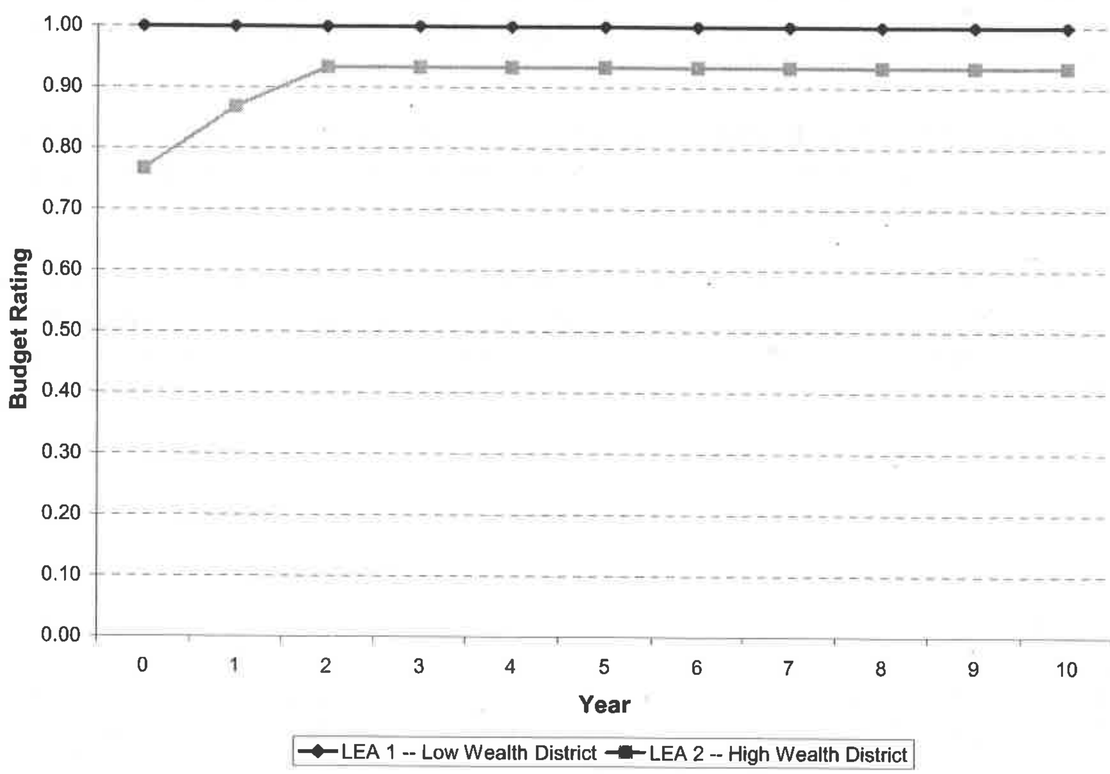
We note that this excess funding for LEA 2 is due entirely to the 10% buffer. If we were to eliminate the buffer, then LEA 2's State funding would drop to $10 million and its combined efficiency would rise to 100%.

Lesson 1: *In the presence of a buffer, it is possible for an LEA to remain inefficient and receive excess State funding, even in the absence of local contributions, if it started off at a higher base funding than it needed to be efficient. This is impossible without a buffer.*

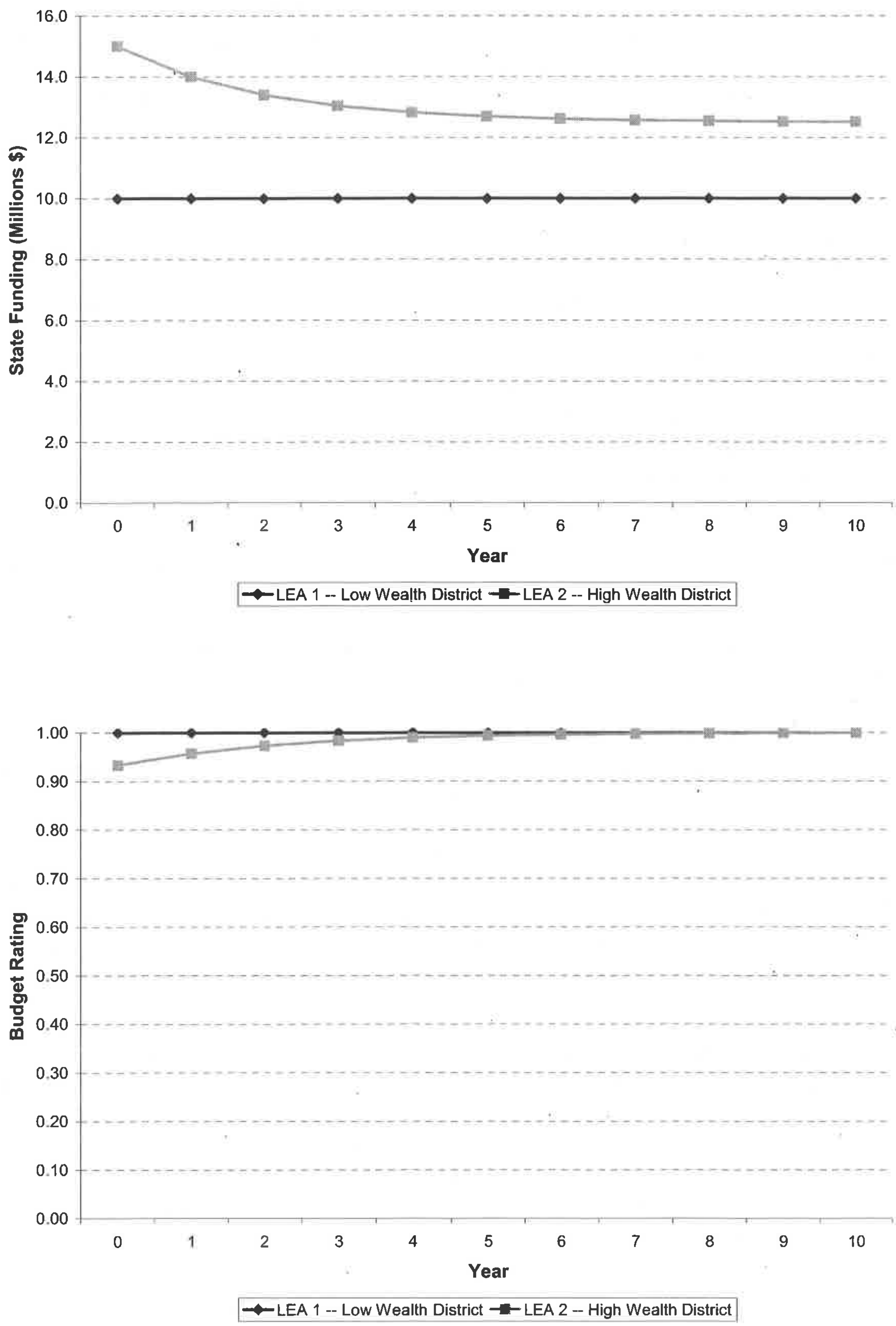
[1] Actually, the formula calls for $9.982 million. However, realistically, LEA 2 would need to remove some buses from the road to cut its expenditures. That would lead to an increase in its bus efficiency, and therefore a higher combined efficiency and a higher budget rating. Also, we are assuming that LEA 1 is absolutely efficient and that neither LEA could operate with less than $10 million or fewer than 500 buses.

Figures 1a and 1b: Scenario A with Low Bus Efficiency in LEA 2





Figures 2a and 2b: Scenario A with High Bus Efficiency in LEA 2



Scenario B: Higher Base Funding, Sustained Local Contribution

We consider now the situation in which LEA 2 makes a sustained annual local contribution of $3 million to its pupil transportation operation. Consider first the case in which LEA 2 is using 750 buses throughout the period. Figures 3a and 3b show the evolution.

LEA 2 becomes more efficient and its budget rating rises from 71.1% to 78.7%. However, the increase is muted by the local contribution, which adds to LEA 2's total expenditures and therefore decreases its expenditure efficiency. LEA 2's State funding drops from $15 million to $11.1 million by Year 6; however, this is $1.1 million per year more than LEA 2 would have received without the $3 million per year local contribution.

Thus, the local contribution allows LEA 2 to receive excess State funding beyond the $10 million that LEA 1 receives. However, LEA 2 certainly does not profit, since it is contributing $3 million per year to receive $1.1 million per year in additional State funding[2]. Therefore, while there may be many valid reasons to support LEA 2's decision to make local contributions to its pupil transportation operation, financial gain is not one of them.

Once again, the buffer plays a crucial role. In the absence of a buffer, LEA 2's State funding would drop to $10 million by Year 2 and remain there forever.

Suppose now that LEA 2 were initially using only 500 buses rather than 750 buses. Figures 4a and 4b show the evolution. Now we find that LEA 2's State funding rises from $15 million to $17 million while its budget rating falls from 87.8% to 85.0% by Year 8, contrary to the intentions of the formula. Thus, LEA 2 will make a $3 million local contribution each year and receive $17 million per year in State funding[3], as opposed to $12.5 million per year if it used 500 buses and made no local contribution.

In other words, *LEA 2's $3 million annual local contribution leads to $4.5 million annually in additional State funding.* In fact, that 1.5:1 ratio holds regardless of the amount of the local contribution. For example, if LEA 2 made a $6 million annual local contribution, its annual State funding would grow to $21.5 million or $9 million per year more than the $12.5 million per year it would receive if it used 500 buses and made no local contribution.

We note that this excess funding for LEA 2 is due partially, but not totally, to the 10% buffer. If we were to eliminate the buffer, then LEA 2's State funding would drop from $15 million to $13 million and its combined efficiency would rise from 77.8% to 81.2% by Year 6. Thus, LEA 2 would receive $3 million per year in additional annual State funding relative to the $10 million per year it would receive if it used 500 buses and made no local contribution. Its increase in State funding exactly matches its local contribution.

---

[2] Even in Years 1-5, when LEA 2 is receiving more than $11.1 million in State funding, the "investment" does not pay off. During that period, LEA 2 will have contributed $15 million and received an additional $8.5 million in State funding.

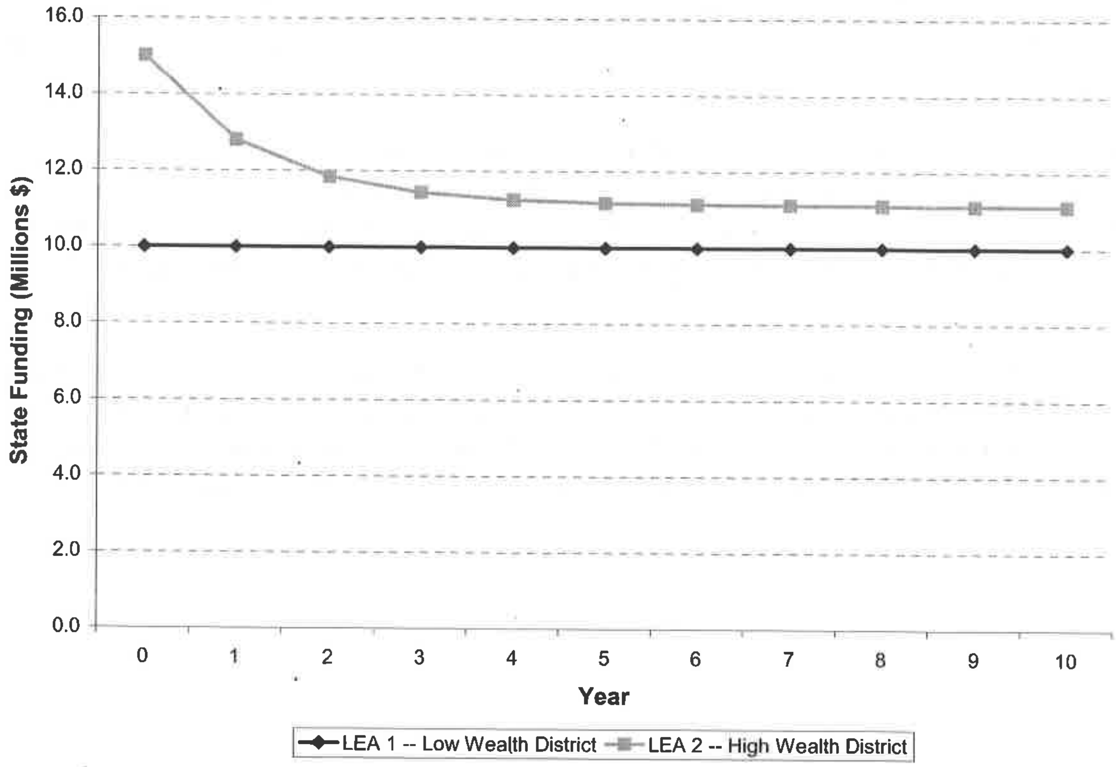
[3] By Year 8, LEA 2 is spending $20 million per year, twice that of LEA 1.

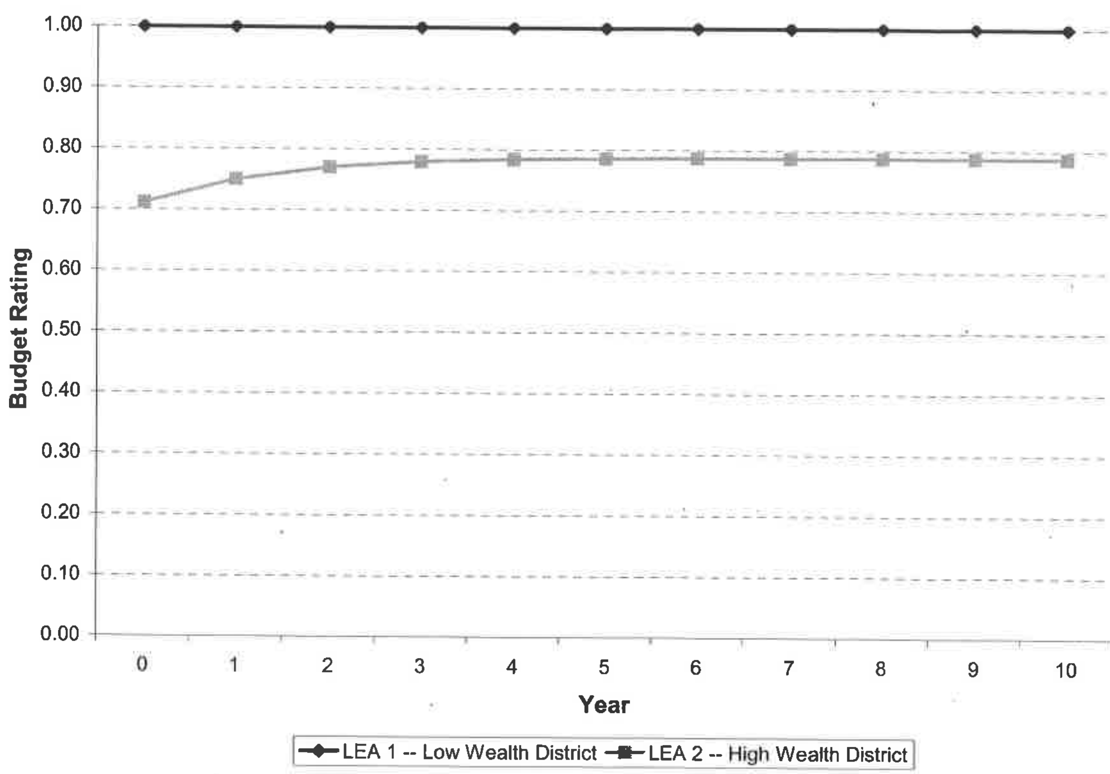
This remains true regardless of the size of the local contribution. *Therefore, in the absence of a buffer, the formula becomes a matching grant for LEAs that use buses efficiently: the LEA will receive additional State funding that exactly matches the LEA's local contribution.*

Lesson 2: *In the presence of a buffer, a high-wealth LEA that has high bus efficiency can contribute local funds to its pupil transportation operation and receive additional State funding that exceeds the amount of its local contribution. In the absence of a buffer, the additional State funding will match the amount of the local contribution for LEAs.*

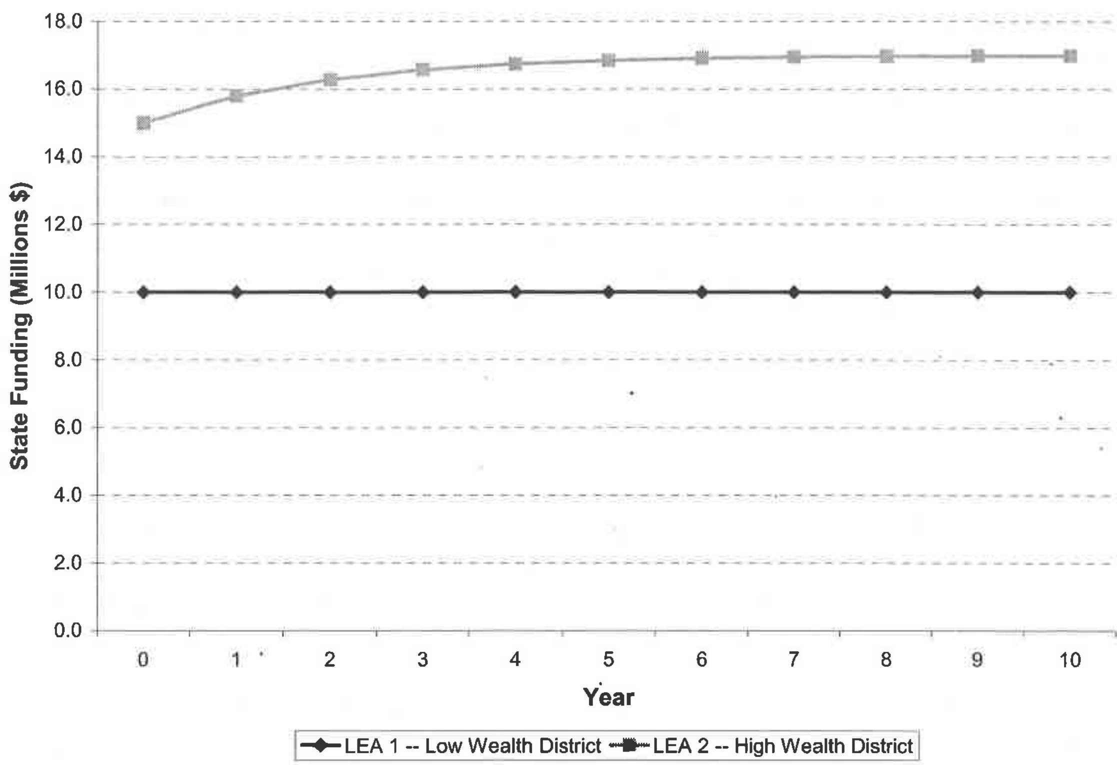
Lesson 3: *In the presence of a buffer, a high-wealth LEA that has low bus efficiency will also receive additional State funding if it makes local contributions but the increase will be less than the local contribution. However, in the absence of a buffer, State funding will not increase if a high-wealth LEA with low bus efficiency makes a local contribution.*

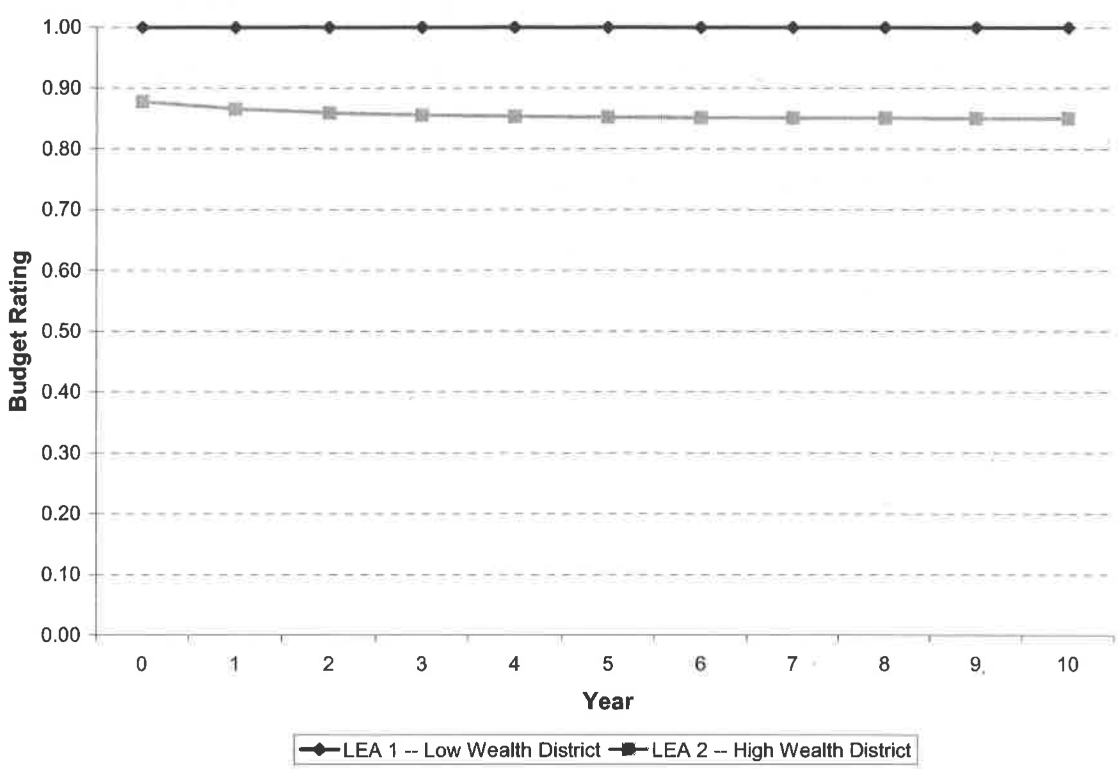
Figures 3a and 3b: Scenario B with Low Bus Efficiency in LEA 2





Figures 4a and 4b: Scenario B with High Bus Efficiency in LEA 2





Scenario C: Higher Base Funding, One-Time Local Contribution

Suppose that LEA 2 uses 750 buses and makes no local contributions until its State funding stabilizes. As we've seen, in the presence of a buffer, its State funding stabilizes at $10 million in Year 2. Suppose that LEA 2 then makes a one-time local contribution of $3 million in Year 3. Figures 5a and 5b show the evolution.

LEA 2's State funding increases from $10 million in Year 3 to $10.6 million in Year 4 but immediately returns to $10 million per year in Year 5. Thus, LEA 2's $3 million one-time "investment" has resulted in a return of only $0.6 million in additional State funding. Therefore, this is not a wise "investment" for LEA 2.

In the absence of a buffer, LEA 2 receives no additional State funding because its budget rating drops from 83.3% in Year 2 to 71.8% in Year 3 due to the additional expenditures.

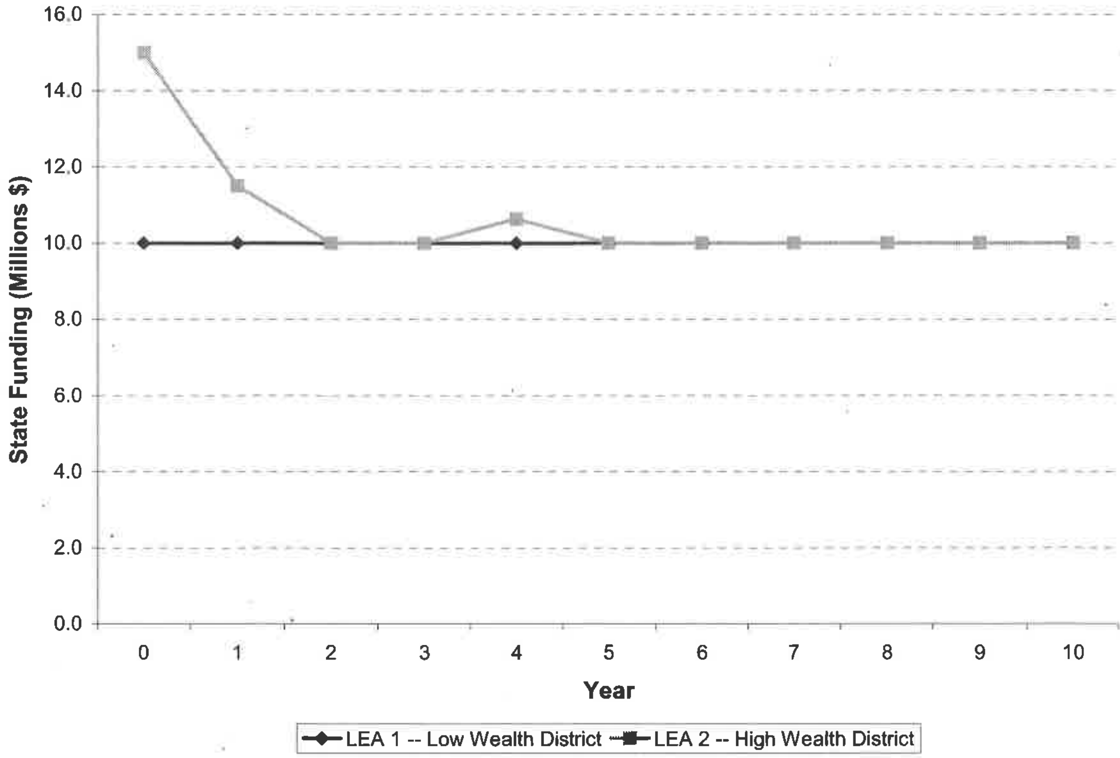
Suppose now that LEA 2 uses only 500 buses. In the presence of a buffer, LEA 2's State funding stabilizes at $12.5 million in Year 8. Suppose that LEA 2 makes its one-time local contribution of $3 in Year 9. Figures 6a and 6b show the evolution over the first 20 years.

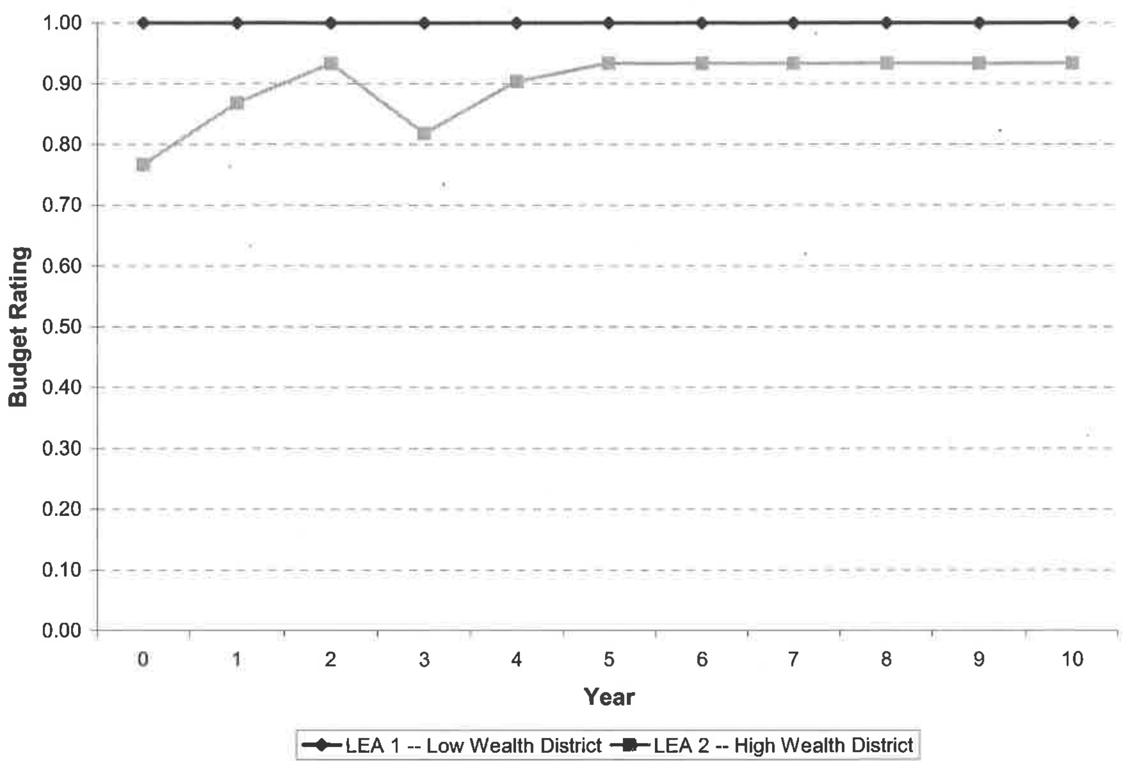
LEA 2's State funding rises to $14.3 million in Year 10 and then declines slowly back to $12.5 million in Year 18. During this 8-year period from Year 10 through Year 17, LEA 2 has received a total of $4.5 million in additional State funding in return for its $3 million local contribution. Once again, the ratio of 1.5:1 pertains regardless of the size of the one-time local contribution. A one-time local contribution of $6 million in Year 9, for example, would have returned a total of $9 million in additional State funding by Year 19.

In the absence of a buffer, LEA 2's State funding would rise from $10 million in Year 9 to $11.5 million in Year 10 and then decline to $10 million by Year 15. During this period, LEA 2 would have received exactly $3 million in additional State funding. Thus, the State would have matched the local contribution.

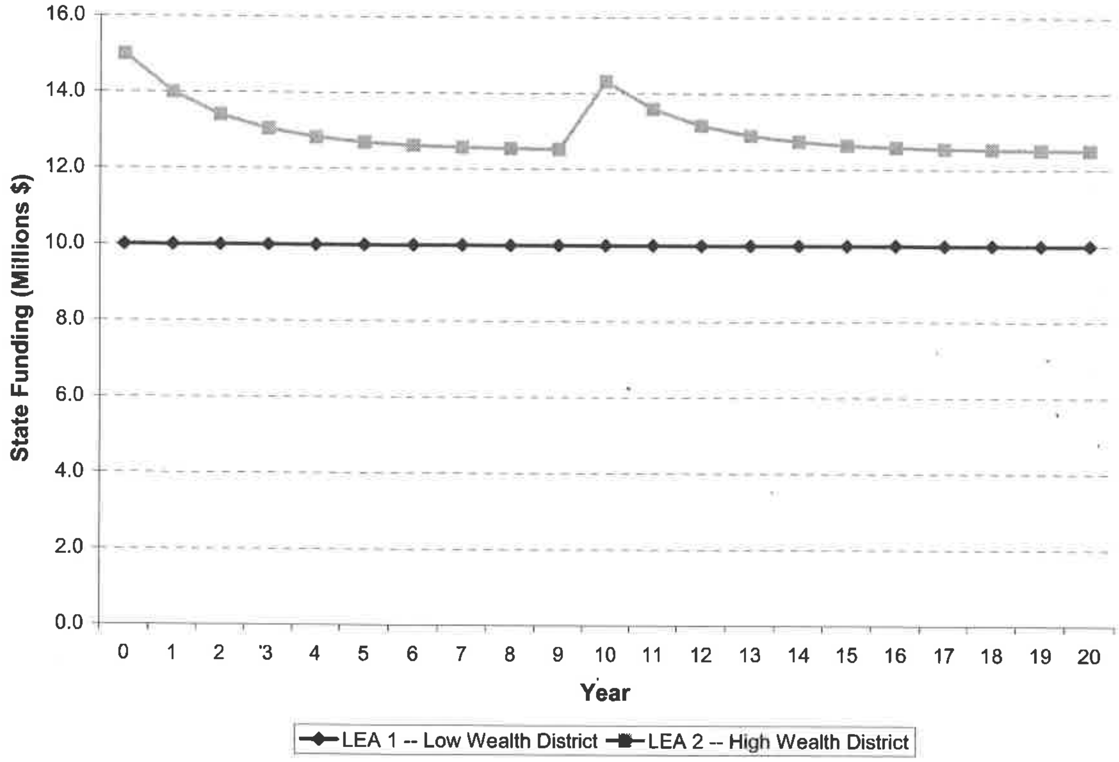
Lesson 4: *A one-time local contribution and sustained local contributions produce the same return on investment (see Lessons 2 and 3).*

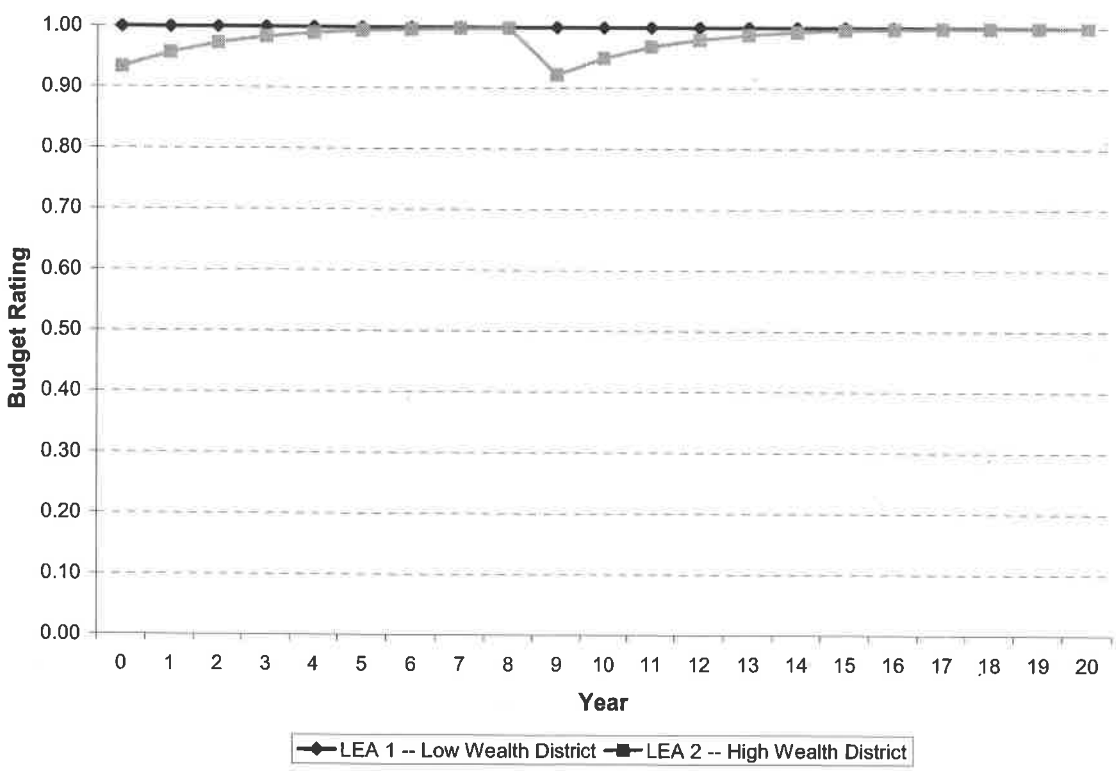
Figures 5a and 5b: Scenario C with Low Bus Efficiency in LEA 2





Figures 6a and 6b: Scenario C with High Bus Efficiency in LEA 2





Scenario D: Same Base Funding, Sustained Local Contribution

Suppose that LEA 2's base State funding in Year 0 was $10 million, equal to that of LEA 1. Suppose also that LEA 2 supplemented its State funding with a $3 million local contribution in Year 0 and every year thereafter. Consider first the case in which LEA 2 uses 750 buses. Figures 7a and 7b show the evolution.

The addition of the local contribution reduces LEA 2's budget rating from 81.8% in Year 0 to 78.8% by Year 4. However, LEA 2's State funding increases during this period from $10 million in Year 0 to $11.1 million in Year 4, and it remains at that level thereafter. *The stabilized budget rating and State funding for LEA 2 is identical under this scenario as it is under Scenario B.*

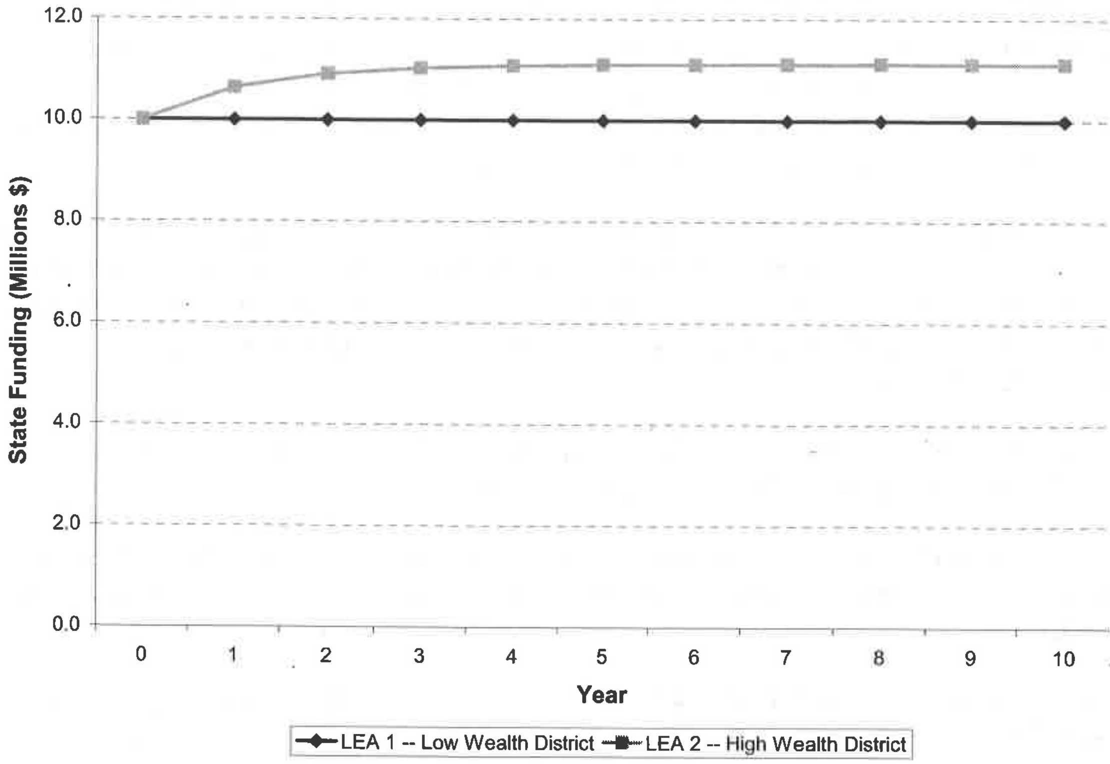
In the absence of a buffer, LEA 2's budget rating will remain constant at 0.718 and its State funding will remain at $10 million, *identical to Scenario B.*

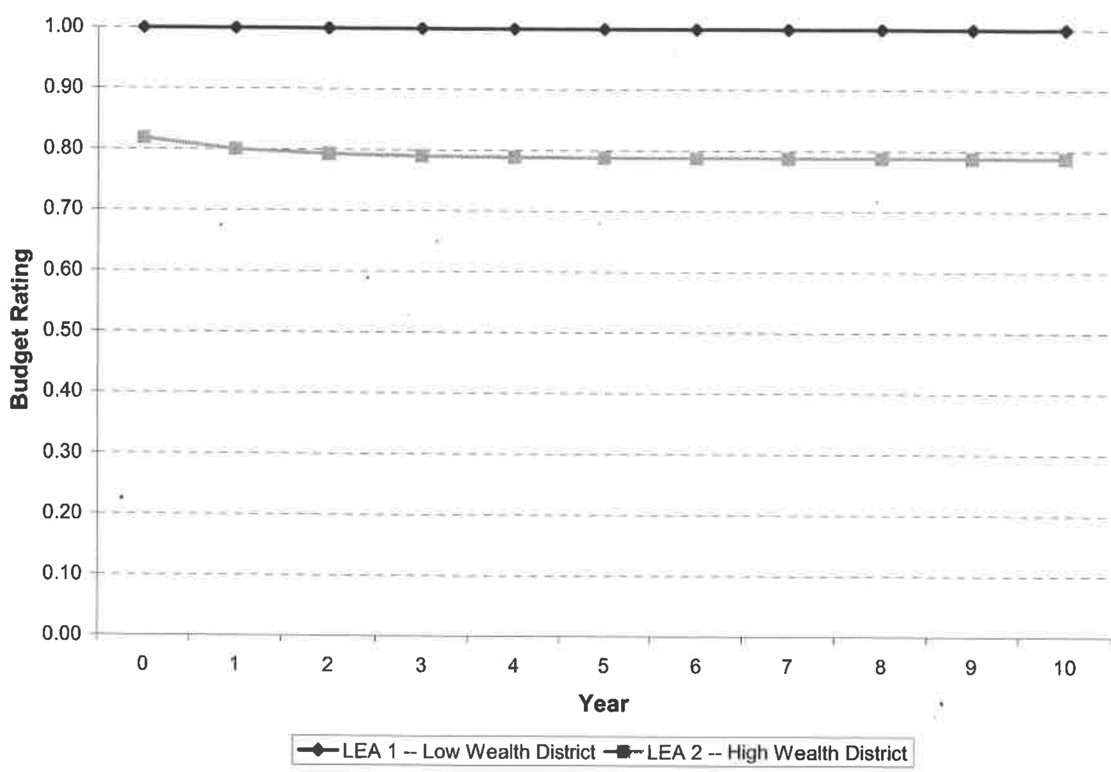
Suppose now that LEA 2 used only 500 buses in Year 0 and thereafter. *Then, as in Scenario B, LEA 2's State funding will rise to $17 million per year by Year 10 and remain at that level.*

In the absence of a buffer, LEA 2's State funding will rise to $13 million, *again matching that of Scenario B.*

Lesson 5: *In the presence of sustained local contributions, the stabilized State funding level is the same regardless of the level of base funding.*

Figures 7a and 7b: Scenario D with Low Bus Efficiency in LEA 2





Scenario E: Same Base Funding, One-Time Local Contribution

Once again, suppose that LEA 2's base State funding in Year 0 was $10 million and that LEA 2 then makes a one-time local contribution of $3 million in Year 3. Suppose that LEA 2 uses 750 buses. Figures 8a and 8b show the evolution.

As in Scenario C, LEA 2's State funding increases from $10 million in Year 3 to $10.6 million in Year 4 but immediately returns to $10 million per year in Year 5; LEA 2's local contribution has not paid dividends.

In the absence of a buffer, as in Scenario C, LEA 2 receives no additional State funding.

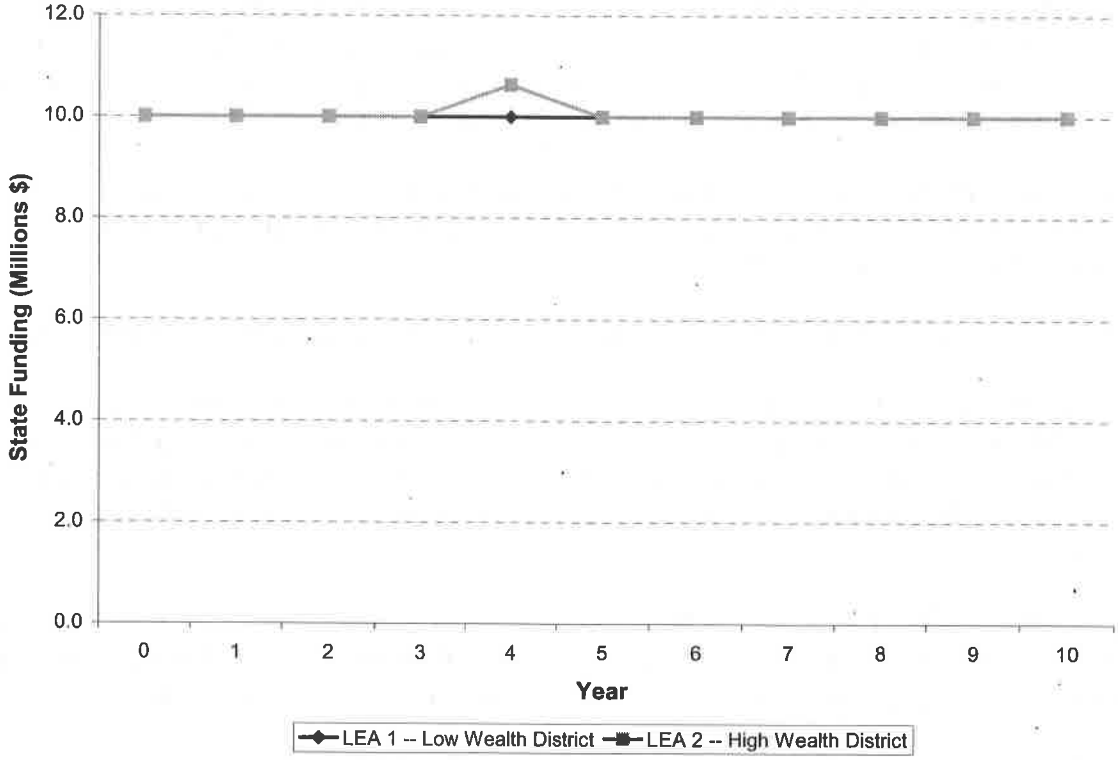
Suppose now that LEA 2 uses 500 buses. Figures 9a and 9b show the evolution. LEA 2's State funding rises to $12.8 million in Year 4 and then slowly drops to $12.5 million by Year 8 and then remains at that level forever. Thus, as in Scenario C, LEA 2 stabilizes at $12.5 million in State funding even though its combined efficiency is only 90.0%.

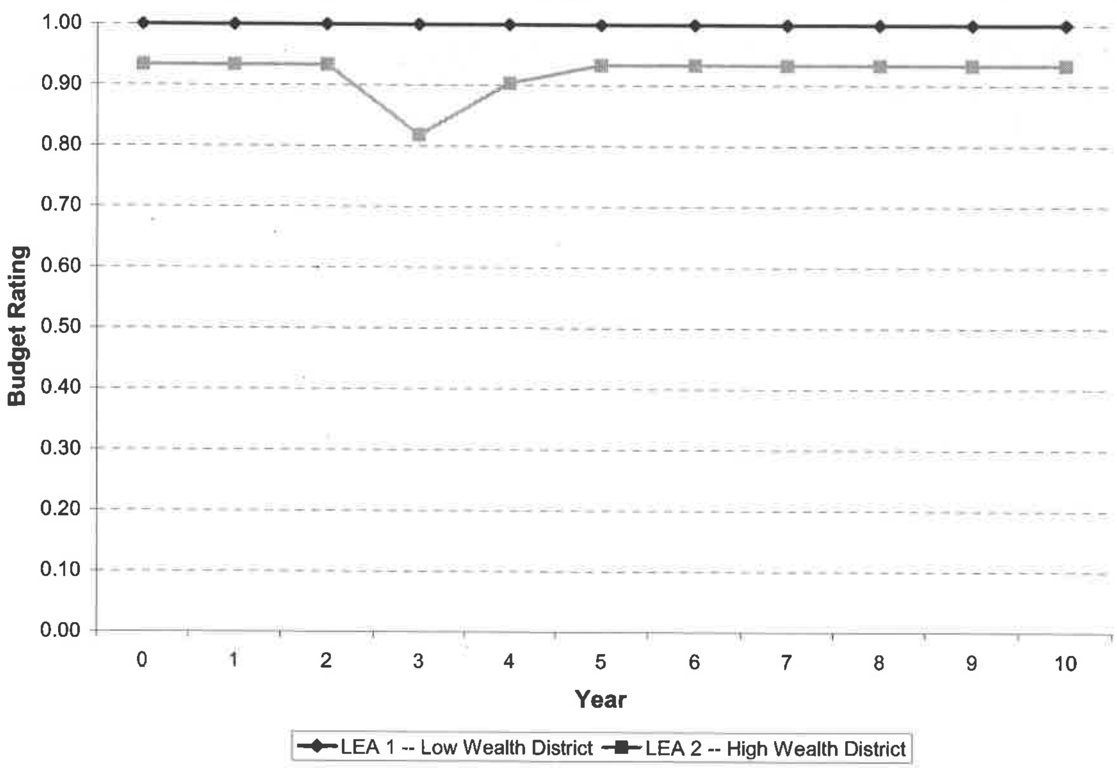
This means that LEA 2 can make a one-time local contribution of $3 million and its annual State funding will jump immediately from $10 million to $12.8 million and then stabilize at $12.5 million, producing an infinite stream of excess State funding.

In the absence of a buffer, as in Scenario C, LEA 2's State funding would rise from $10 million in Year 3 to $11.5 million in Year 4 and then decline to $10 million by Year 9. Again, during this period, LEA 2 would have received exactly $3 million in additional State funding and the State would have matched the local contribution.

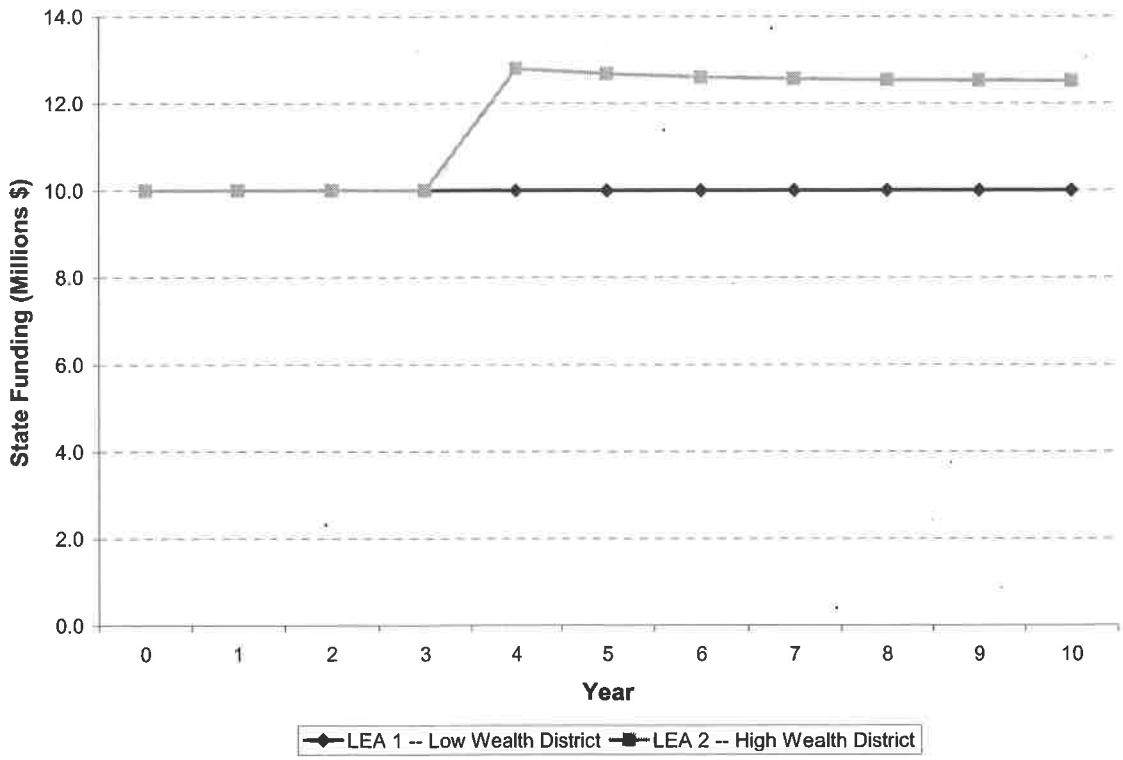
Lesson 6: *In the presence of a buffer, an efficient LEA can make a one-time local contribution and receive an infinite stream of excess State funding, even if base funding levels are equal.*

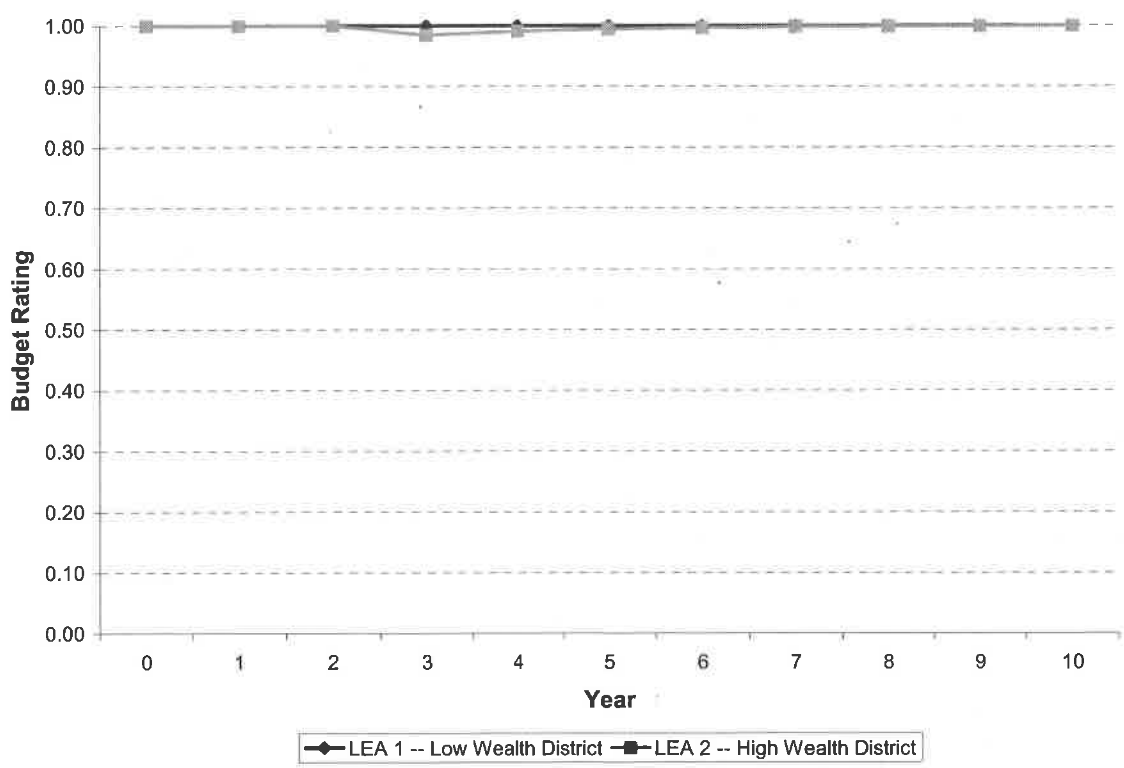
Figures 8a and 8b: Scenario E with Low Bus Efficiency in LEA 2





Figures 9a and 9b: Scenario E with High Bus Efficiency in LEA 2





Summary of Results

The table below summarizes the results of the analysis:

			LEA 2			
Scenario	Base Funding ($ Million)	Local Contribution ($ Million)	Buses Used	Buffer	Stable State Funding ($ million)	Combined Efficiency
A	$15	$0	750	10%	$10	83.3%
	$15	$0	750	0%	$10	83.3%
	$15	$0	500	10%	$12.5	90.0%
	$15	$0	500	0%	$10	100%
B	$15	$3/year	750	10%	$11.1	68.7%
	$15	$3/year	750	0%	$10	71.8%
	$15	$3/year	500	10%	$17	75.0%
	$15	$3/year	500	0%	$13	81.2%
C	$15	$3 one-time	750	10%	$10	83.3%
	$15	$3 one-time	750	0%	$10	83.3%
	$15	$3 one-time	500	10%	$12.5	90.0%
	$15	$3 one-time	500	0%	$10	100%
D	$10	$3/year	750	10%	$11.1	68.8%
	$10	$3/year	750	0%	$10	71.8%
	$10	$3/year	500	10%	$17	75.0%
	$10	$3/year	500	0%	$13	81.3%
E	$10	$3 one-time	750	10%	$10	83.3%
	$10	$3 one-time	750	0%	$10	83.3%
	$10	$3 one-time	500	10%	$12.5	90.0%
	$10	$3 one-time	500	0%	$10	100%

The lessons learned are:

Lesson 1: *In the presence of a buffer, it is possible for an LEA to remain inefficient and receive excess State funding, even in the absence of local contributions, if it started off at a higher base funding than it needed to be efficient. This is impossible without a buffer.*

Lesson 2: *In the presence of a buffer, a high-wealth LEA that has high bus efficiency can contribute local funds to its pupil transportation operation and receive additional State funding that exceeds the amount of its local contribution. In the absence of a* *buffer, the additional State funding will match the amount of the local contribution for LEAs.*

Lesson 3: *In the presence of a buffer, a high-wealth LEA that has low bus efficiency will also receive additional State funding if it makes local contributions but the increase will be less than the local contribution. However, in the absence of a buffer, State funding will not increase if a high-wealth LEA with low bus efficiency makes a local contribution.*

Lesson 4: *A one-time local contribution and sustained local contributions produce the same return on investment (see Lessons 2 and 3).*

Lesson 5: *In the presence of sustained local contributions, the stabilized State funding level is the same regardless of the level of base funding.*

Lesson 6: *In the presence of a buffer, an efficient LEA can make a one-time local contribution and receive an infinite stream of excess State funding, even if base funding levels are equal.*

Clearly, in the presence of a buffer, an LEA that uses its buses efficiently can use local contributions, either one-time or sustained, to receive State funding in excess of the amount of the local contribution. In other words, the buffer makes it possible for an LEA to "invest" local money and receive a large "rate of return" regardless of the LEA's base funding. The buffer also makes it possible for an LEA to benefit from a high level of base funding even in the absence of local contributions.

There is no mathematical way to eliminate or correct the problems caused by differences in base funding that occurred many years ago. That is because to do so would require having knowledge of what the costs "should" have been; the very that the formula was designed to determine over time. However, this analysis strongly suggests that the formula should be modified to reduce the current 10% buffer, since doing so will allow the formula to minimize or correct the discrepancies brought by on by the base amount issue. The buffer exists to alleviate concerns that certain idiosyncratic site characteristics are not included in the adjustment process because they are not statistically significant.

Appendix K: The Effects of Site Characteristics on Budget Rating

Background and Purpose

Site characteristics, defined as factors that may influence an LEA's ability to operate efficiently but are beyond the control of LEA management, play an important role in the funding process. The incorporation of site characteristics ensures that all LEAs are treated fairly, i.e., that no LEA receives more or less State funding than they deserve simply because they operate under relatively favorable or unfavorable conditions.

It is essential, therefore, that all relevant site characteristics appear in the model. In practice, this may be difficult or impossible for a number of reasons. First, we may not recognize that a factor should be considered as a site characteristic. Second, adequate data for a potential site characteristic may not exist or may be very difficult to collect. Third, a potential site characteristic may have very small effects on cost efficiency and bus efficiency and therefore might not qualify statistically for inclusion in either model. Fourth, a potential site characteristic may be highly correlated with one or more other site characteristics and therefore may distort their coefficients if allowed into the models.

Consequently, the funding formula has always incorporated a 10% buffer to account for the possibility of omitted site characteristics. The buffer is added to the efficiency rating of each LEA to produce the LEA's budget rating, with the sum not allowed to exceed 100%. The 10% buffer means that an LEA whose efficiency rating is 90% or higher will receive 100% State funding. The inclusion of the buffer was instrumental in convincing people that the process was fair, even generous, to LEAs that might argue for the inclusion of some idiosyncratic local factor as a site characteristic.

However, we have seen that the buffer can create some undesirable effects. For example, we found that, in the presence of a buffer, it is possible for an LEA to remain inefficient and receive excess State funding, even in the absence of local contributions, if it started off at a higher base funding than it needed to be efficient. This is impossible without a buffer. In addition, the buffer may permit an LEA to make a one-time investment of local funds and receive additional State funding in perpetuity without having to reduce its expenditures. Thus, it is prudent to consider whether the buffer should be either eliminated entirely or significantly reduced.

To address this issue, we first need to understand fully how site characteristics affect an LEA's budget rating. This is explained in Appendix I. Then we need to examine the magnitude of the effects of known site characteristics on budget ratings, since these will be a guide as to the size of the buffer required to cover for any other factors that may be omitted from the process.

Site Characteristics

The five site characteristics in the full frontier model are:

- **Pupil Density Using DOT Road Miles** (along with centered pupil density squared and centered pupil density cubed)
- **Proportion of Pupils Transported who are Exceptional Children**
- **Elevation** (along with centered elevation squared)
- **Third Quartile of Distance to School**
- **Third Quartile of Circuity of the Road Network**

The table below shows the regression coefficients in the models for (the natural logarithm of) cost and (the natural logarithm of) buses used. Note that (the natural logarithm of) the number of students transported appears in both models even though this is not a site characteristic. Its inclusion is necessary to ensure that the models are properly specified.

	Coefficients	
	ln(TotCost) Model	ln(Buses) Model
Intercept	5.52167	−3.33297
ln(Students Transported)	1.03432	0.96163
Pupil Density Using DOT Road Miles	−0.05027	−0.04934
Centered Pupil Density Squared	0.01295	0.00212
Centered Pupil Density Cubed	−0.0005003	
Third Quartile of Circuity of Road Network	0.22462	
Proportion of Pupils who are Exceptional Children		2.03751
Elevation		−0.00009572
Centered Elevation Squared		0.00000003486
Third Quartile of Distance to School		0.01502

Analysis of Individual Site Characteristics

To examine the effects of each site characteristic on budget rating, we consider an LEA that is average with respect to expenditures, buses used, students transported, and all site characteristics. The table below shows the data for this LEA.

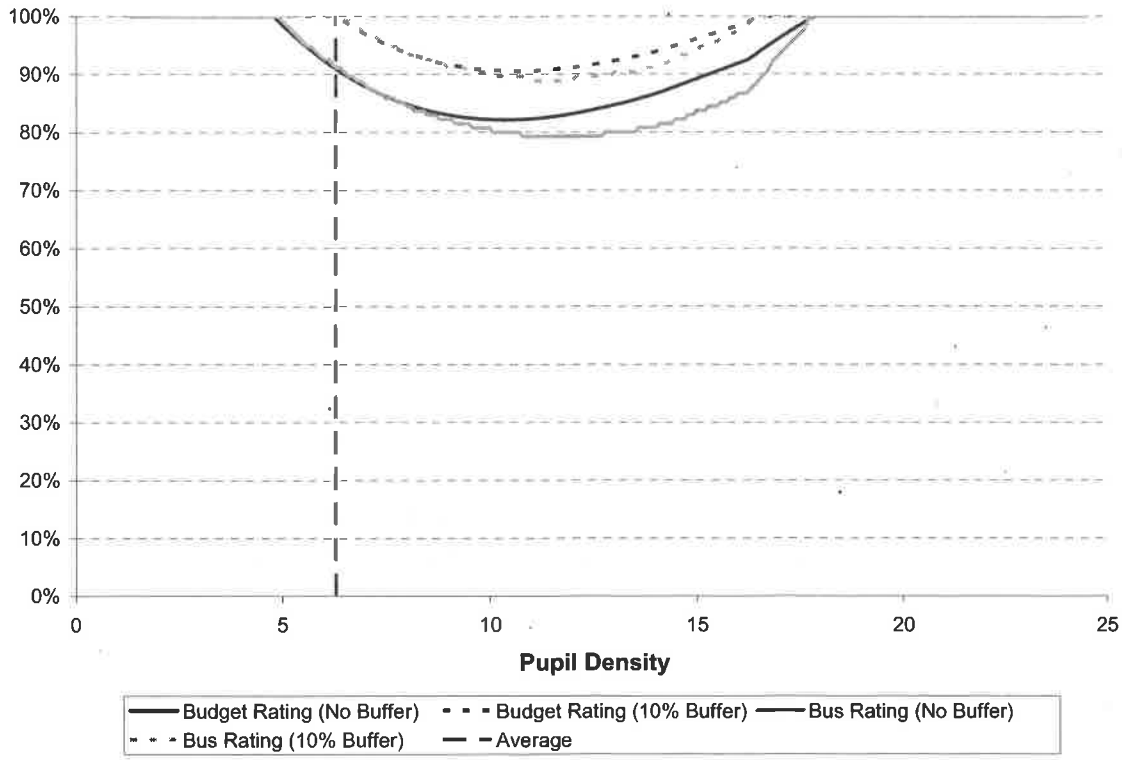
Inputs and Outputs	Average LEA
Cost	$2,914,341
Buses	135
Students	7304
Cost per Student	$399
Buses per 100 Students	1.85
Site Characteristics	
Pupil Density Using DOT Road Miles	6.28
Third Quartile of Circuity of Road Network	1.42
Proportion of Pupils who are Exceptional Children	0.0205
Elevation	795
Third Quartile of Distance to School	7.28

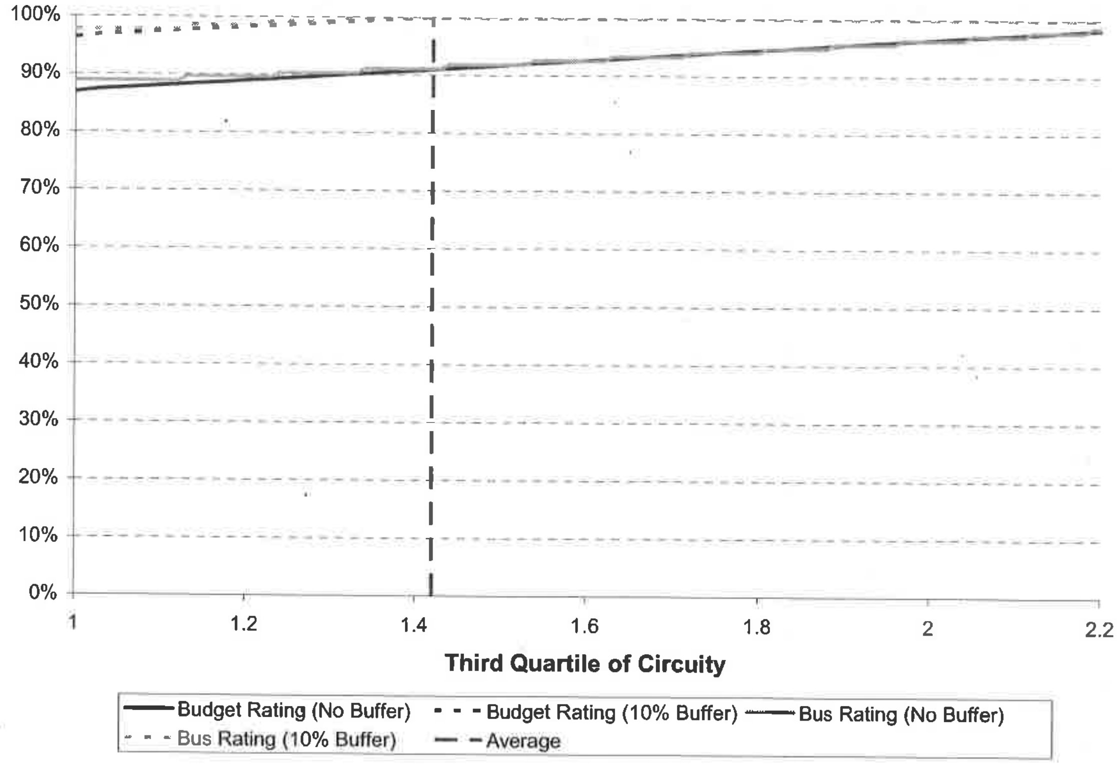
The next table shows the Frontier Model analysis for this LEA using no buffer and using a 10% buffer.

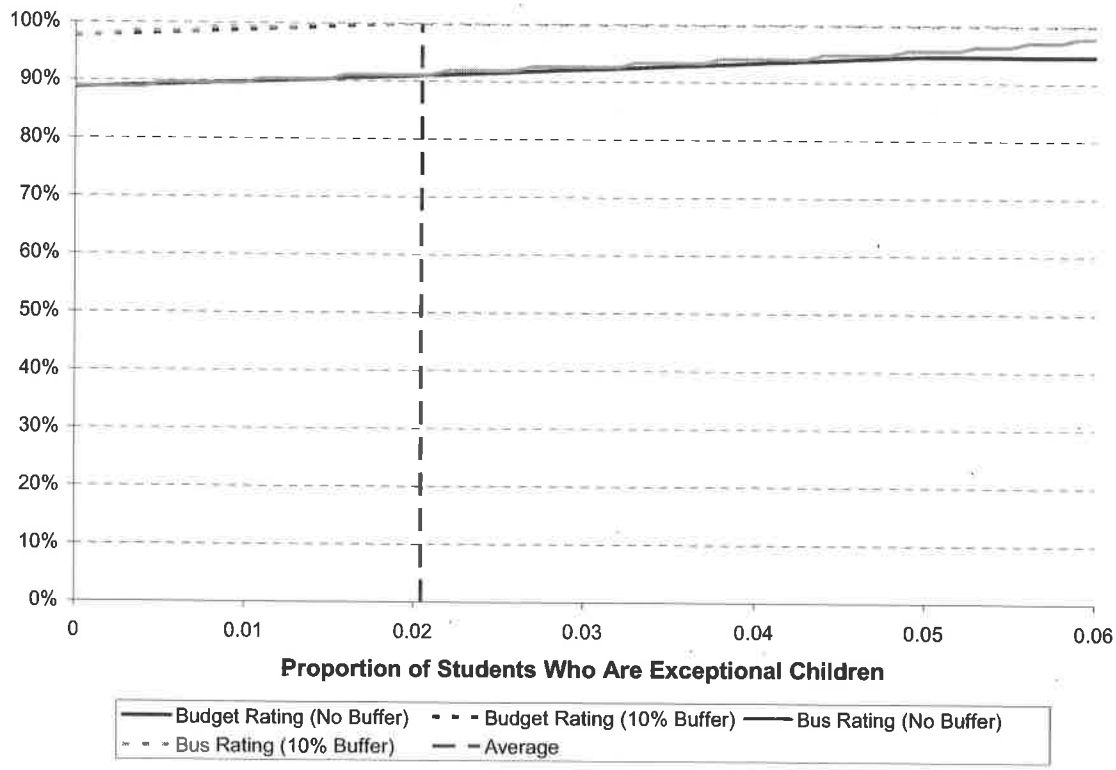
Frontier Model Analysis		
Buffer	10%	0%
Expected Cost	$2,486,039	$2,486,039
Expected Cost with Average SCs	$2,486,039	$2,486,039
Cost Adjustment	$0	$0
Adjusted Cost	$2,914,341	$2,914,341
Adjusted Cost per Student	$399.01	$399.01
Target Adjusted Cost per Student	$399.34	$363.04
Target Adjusted Cost	$2,914,341	$2,651,639
Cost Allocation	$2,914,341	$2,651,639
Budget Rating	**100.0%**	**91.0%**
Expected Buses	146.5	146.5
Expected Buses with Average SCs	146.5	146.5
Bus Adjustment	0	0
Adjusted Buses	135	135
Adjusted Buses per 100 Students	1.848	1.848
Target Adjusted Buses per 100 Students	1.850	1.682
Target Adjusted Buses	135	123
Bus Allocation	135	123
Bus Rating	**100.0%**	**91.1%**

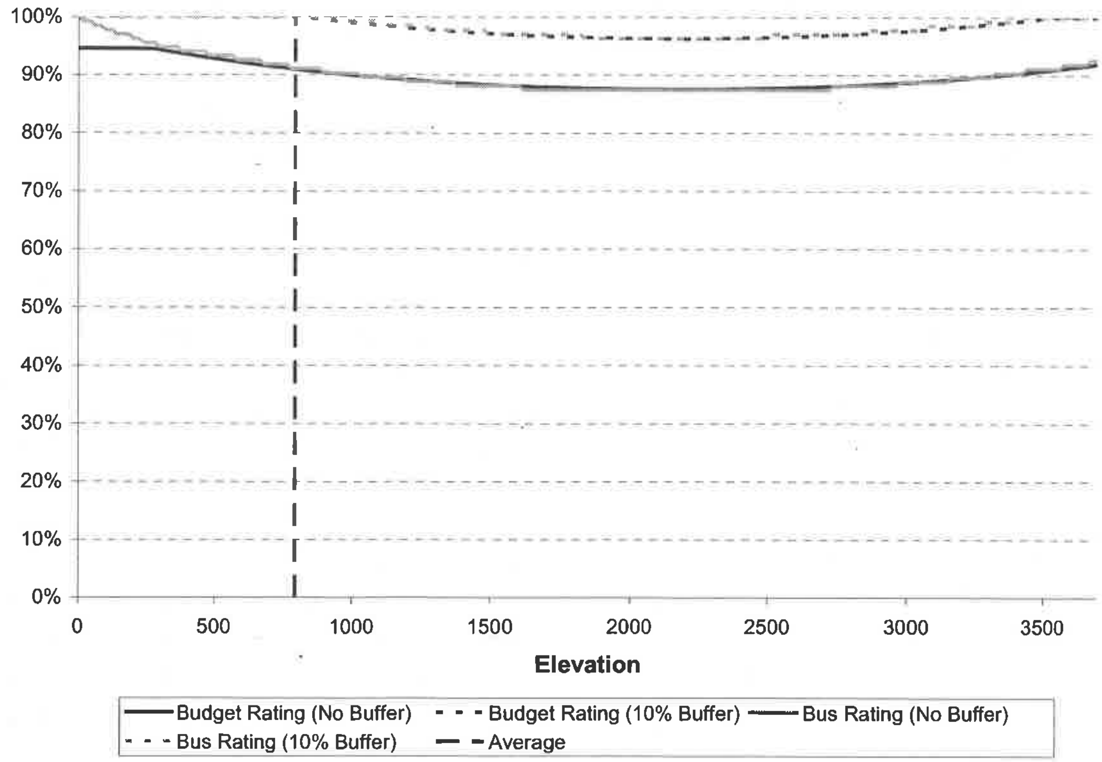
Next, we analyze each site characteristic in turn by allowing it to vary across the range of observed values for that site characteristic while holding all other site characteristics (and all inputs and outputs) constant. The graphs below show the results. Each graph shows the budget rating and the bus rating that the average LEA would have, with the

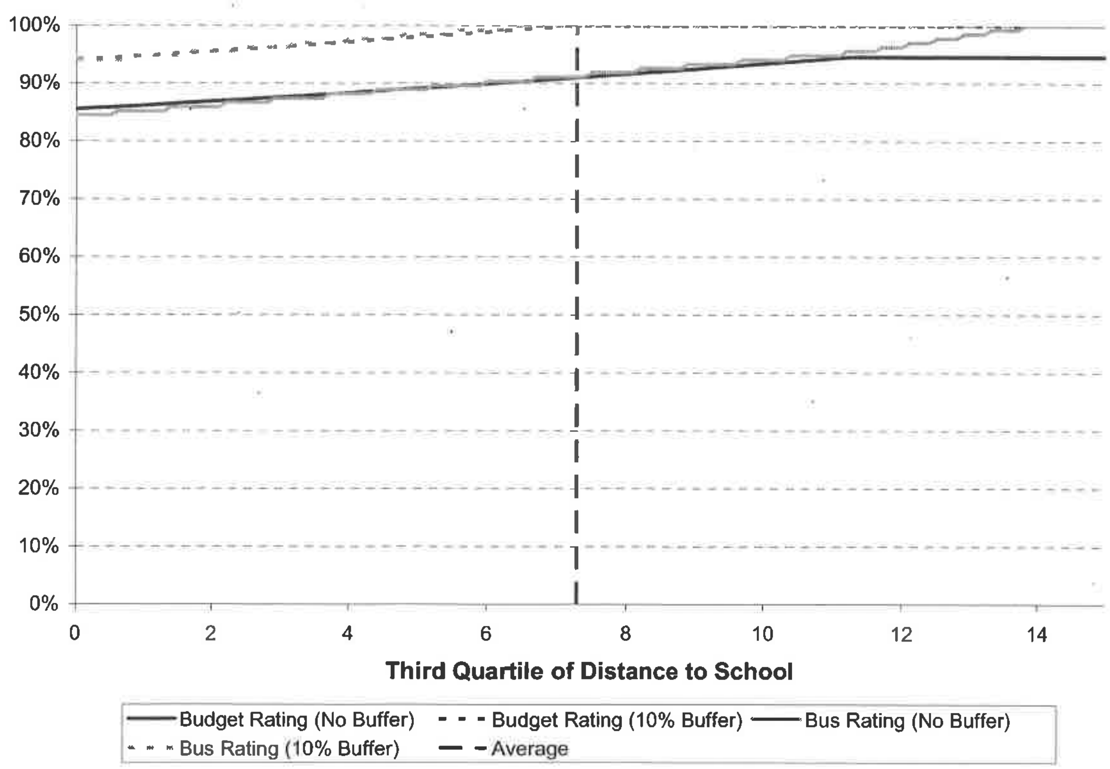
10% buffer and with no buffer, if the given site characteristic were to take on a different value with all other variables held constant. The vertical line in each graph indicates the statewide average value for the site characteristic.




100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
1.2
1.4
1.6
1.8
2
2.2
Third Quartile of Circuity
Budget Rating (No Buffer)
Budget Rating (10% Buffer)
Bus Rating (No Buffer)
Bus Rating (10% Buffer)
Average


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.01
0.02
0.03
0.04
0.05
0.06
Proportion of Students Who Are Exceptional Children
Budget Rating (No Buffer)
Budget Rating (10% Buffer)
Bus Rating (No Buffer)
Bus Rating (10% Buffer)
Average





We can examine these graphs to determine the maximum impact that each site characteristic can have on the budget rating (and on the bus rating) of an average LEA using no buffer. We do this by computing the difference between the highest and lowest budget rating (and the difference between the highest and lowest bus rating) for this LEA as the site characteristic ranges over its observed set of values. The table below shows the results of this analysis, with the site characteristics sorted according to decreasing maximum potential impact on budget rating.

	Budget Rating			Bus Rating		
Site Characteristic	**Max Impact**	Min	Max	**Max Impact**	Min	Max
Pupil Density Using DOT Road Miles	**17.8%**	82.2%	100%	**20.7%**	79.3%	100%
Third Quartile of Circuity	**11.3%**	86.9%	98.2%	**9.6%**	88.9%	98.5%
Third Quartile of Distance to School	**9.1%**	85.5%	94.6%	**15.6%**	84.4%	100%
Elevation	**7.0%**	87.6%	94.6%	**12.6%**	87.4%	100%
Proportion of Pupils who are Exceptional Children	**5.8%**	88.8%	94.6%	**8.9%**	88.9%	97.8%

Pupil density has the largest potential impact on both budget rating and bus rating, as we have long believed. Circuity has the second largest potential impact on budget rating. Distance to school has the third largest potential impact on budget rating and the second largest potential impact on bus rating. Elevation and the proportion of pupils who are exceptional children have greater potential impacts on bus rating than on budget rating.

Appendix L: Transportation Allotment Policy

TRANSPORTATION OF PUPILS[1]

State Allotment Formulas Effective July 1, 2004 Allotment Policy Manual FY 2004-05 104

PROGRAM REPORT CODE: 056

UNIFORM CHART OF ACCOUNTS CODE: 6XXX-056-XXX

TYPE: Dollars

TERM: July 1 - June 30

PURPOSE: Provides funding for all transportation related expenses for "yellow bus" use for eligible school age (K-12) students for travel to and from school and between schools. Examples of these expenses are contract transportation, transportation personnel (other than Director, Supervisor, and Coordinator), bus drivers' salaries, benefits, fuel, and other costs as defined in the Uniform Chart of Accounts.

ELIGIBILITY: Each LEA is entitled to funding.

FORMULA:

1. Allotted based on a "budget rating" funding formula using the following factors: pupils transported; total eligible operating expenditures (local and state funds); number of buses operated.

2. The initial allotment shall consist of a portion of the projected final allotment.

3. The initial allotment will be adjusted within available funds by December 1. This adjustment is derived from establishing a final budget rating calculated annually from the three key factors outlined in #1 above.

SPECIAL PROVISIONS:

1. Funds can be transferred into or out of this category by submitting an ABC transfer form. Transfers will impact efficiency ratings.

2. These funds may not supplant other state, federal and local programs use of the "yellow bus" that serve the instructional purpose of the school, such as Pre-K, Smart Start, Head Start, Remediation Programs, Summer School, NC State Fair, Special Olympics, NC Symphony and other instructional field trips. When allotted state transportation funds are used to provide transportation services for these programs, the responsible program must reimburse this fund.

[1] Source: 2004-2005 Allotment Policy Manual, State Board of Education, Department of Public Instruction, Financial and Business Services, Division of School Business. January 31, 2005

Appendix M: Statewide Statistics FY1997 - 2005

BASE DATA	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	
Total Costs	$ 180,142,631	$ 188,790,783	$ 197,596,362	$ 219,180,329	$ 234,988,485	$ 243,261,935	$ 250,444,455	$ 259,865,693	$ 291,434,058	
Active buses	12,884	12,957	13,014	13,062	13,127	13,236	13,416	13,484	13,513	
Transported Students	692,331	690,291	692,254	696,802	699,615	707,312	714,975	719,601	730,388	
Enrolled Students	1,200,810	1,222,493	1,238,973	1,258,607	1,274,326	1,284,866	1,301,975	1,319,857	1,345,469	
Miles	138,568,034	141,322,010	146,283,032	147,460,816	154,944,392	156,095,823	163,621,922	165,547,407	167,436,709	
Cost Metrics	**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	
Cost per Student	$ 260.20	$ 273.49	$ 285.44	$ 314.55	$ 335.88	$ 343.92	$ 350.28	$ 361.12	$ 399.01	
Cost per Bus	$ 13,982	$ 14,571	$ 15,183	$ 16,780	$ 17,901	$ 18,379	$ 18,668	$ 19,272	$ 21,567	
Cost per mile	$ 1.300	$ 1.336	$ 1.351	$ 1.486	$ 1.517	$ 1.558	$ 1.531	$ 1.570	$ 1.741	
Buses per 100 students	1.86	1.88	1.88	1.87	1.88	1.87	1.88	1.87	1.85	
Miles per bus	10,755.0	10,907.0	11,240.4	11,289.3	11,803.5	11,793.3	12,196.0	12,277.3	12,390.8	
Pct. Transported Students	58%	56%	56%	55%	55%	55%	55%	55%	54%	
Y-YChange (%)	**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**Overall**
Total Costs		4.8%	4.7%	10.9%	7.2%	3.5%	3.0%	3.8%	12.1%	61.8%
Active buses		0.6%	0.4%	0.4%	0.5%	0.8%	1.4%	0.5%	0.2%	4.9%
Transported Students		-0.3%	0.3%	0.7%	0.4%	1.1%	1.1%	0.6%	1.5%	5.5%
Enrolled Students		1.8%	1.3%	1.6%	1.2%	0.8%	1.3%	1.4%	1.9%	12.0%
Miles		2.0%	3.5%	0.8%	5.1%	0.7%	4.8%	1.2%	1.1%	20.8%
Buses per 100 students		0.9%	0.2%	-0.3%	0.1%	-0.3%	0.3%	-0.1%	-0.6%	-0.6%
Miles per bus		1.4%	3.1%	0.4%	4.6%	-0.1%	3.4%	0.7%	0.9%	13.2%
Pct. Transported Students		-2.1%	-1.0%	-0.9%	-0.8%	0.3%	-0.2%	-0.7%	-0.4%	-6.2%

Appendix O: Funding Cap Analysis

Background and Purpose

Previous analyses have demonstrated that local contributions by LEAs can effectively shift costs to the State in future years. This allows wealthier districts to fund various transportation activities with local money in a given year and then have some or all of those costs paid for by the State in subsequent years. Over time, this practice can add considerably to the State's burden and create significant educational disparities between high-wealth and low-wealth LEAs who cannot afford significant local contributions.

One way to address this issue is to limit the amount of local money that is eligible for reimbursement. While all local contributions should be included in the computation of the LEA's budget rating, the question remains as to how to limit the extent to which local contributions are reimbursable.

The purpose of this analysis is to arrive at a reasonable policy for capping local contributions. The choice of policy must reduce the shifting of costs from LEAs to the State while allowing LEAs that have been historically underfunded the opportunity to recover.

The Core Underlying Decision

Underlying the choice of method for capping local contributions is the decision by the State regarding its willingness to fund pupil transportation beyond the usual morning and afternoon trips to and from school. We suspect that much of the local contributions are for the purpose of supporting these other transportation operations.

Alternative 1: If the State decides to support such operations with State funds, then it should allow all local contributions for those purposes to be reimbursable. In that case, such transportation would be treated no differently than the basic to and from school trips.

Alternative 2: If the State decides not to support such operations with State funds, then it should not allow local contributions for those purposes to be reimbursable. In that case, such transportation would be viewed as the responsibility of the LEA.

We believe that the State would be best served by a version of the first alternative in which transportation funding is reimbursable if and only if the educational program that it supports is reimbursable. This would present a consistent policy to the LEAs that will allow them to implement such programs without the need to provide local money for the necessary transportation. This would be especially critical to the low-wealth LEAs for whom such local money is very difficult to find.

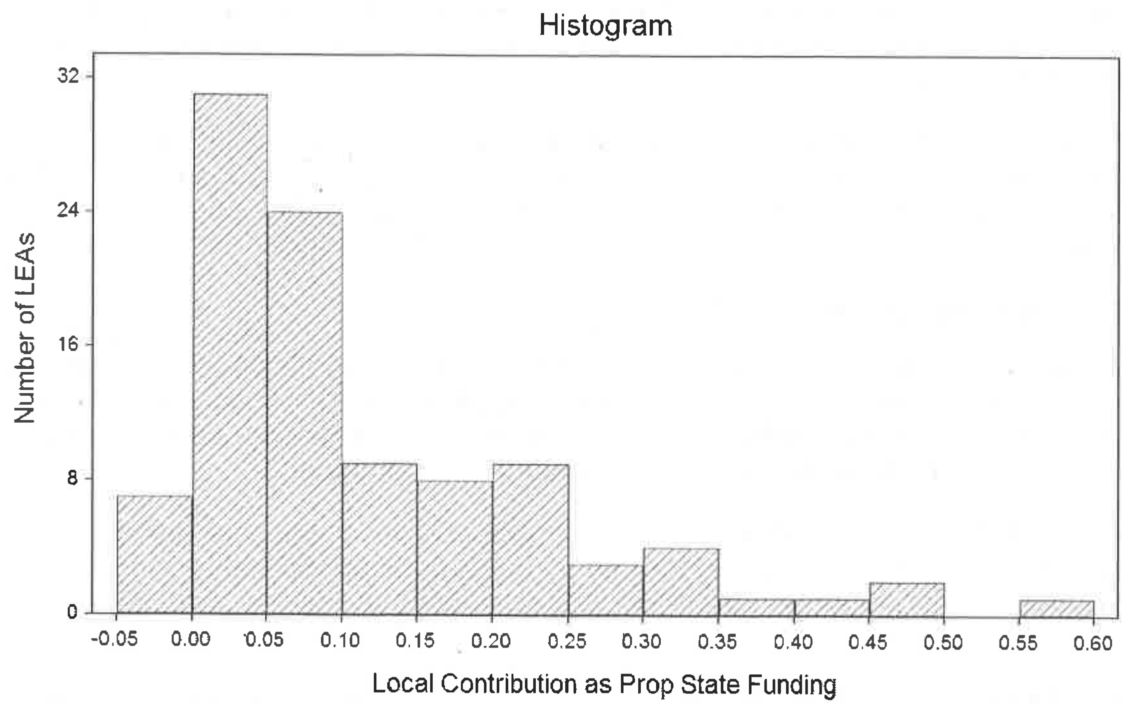
However, we also recognize that such a policy would increase the cost to the State. Moreover, it would still require low-wealth LEAs to fund the transportation in the first year. This will lead to inequities across LEAs to the extent that low-wealth LEAs are unable to provide first-year funding. While it may be possible to implement a program in which the

State provides "seed money" to qualifying low-wealth LEAs, we also understand the inherent difficulties in designing such a program.

To limit the cost increases that the State would incur, we believe that a reasonable approach is to limit the amount of local funding that is reimbursable. This would prevent high-wealth LEAs from shifting large cost burdens to the State.

Local Contributions and State Funding

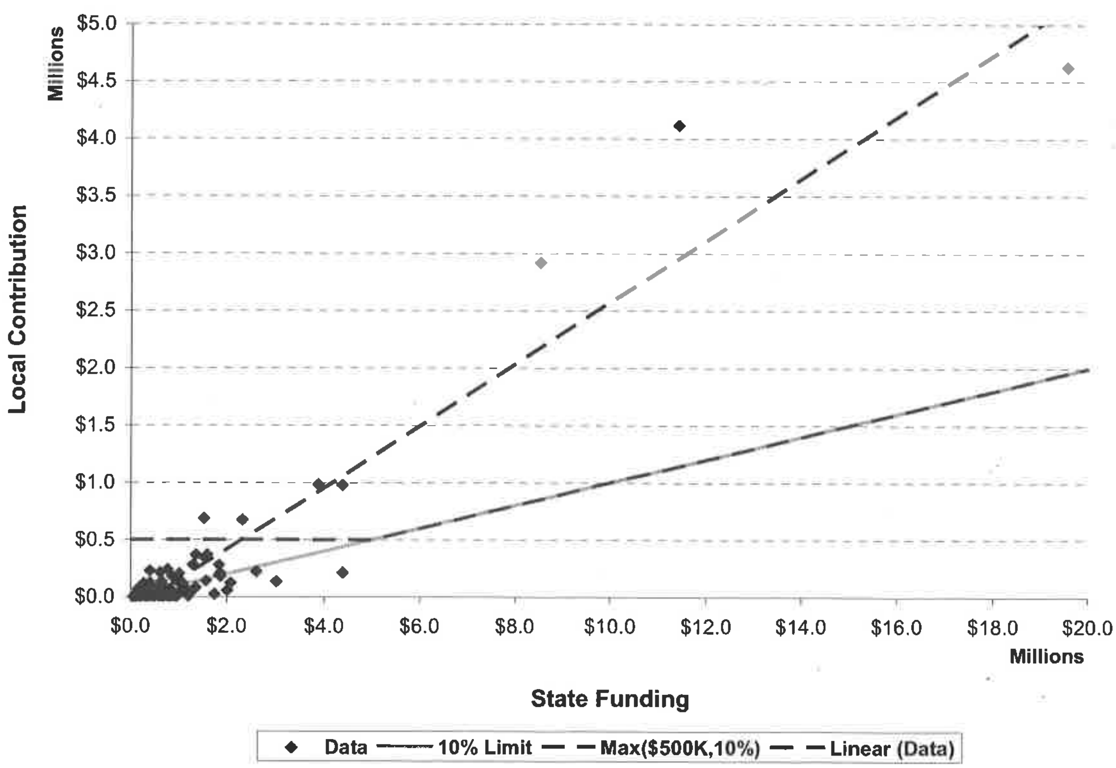
To determine how to control cost shifting, we examine the histogram below, which shows the current levels of local contributions as a proportion of State funding. The bar at the far left indicates that 7 of the 100 LEAs make no local contribution. The frequency table that follows shows the number of LEAs in each interval. As the table shows, 62 of the 100 LEAs contribute less than 10% of their State funds.



Frequency Distribution of Local Contribution as Prop of State Funding

Low	High	Freq	Percent	Cumulative Freq	Cumulative Percent
-0.05	0.00	7	7.0	7	7.0
0.00	0.05	31	31.0	38	38.0
0.05	0.10	24	24.0	62	62.0
0.10	0.15	9	9.0	71	71.0
0.15	0.20	8	8.0	79	79.0
0.20	0.25	9	9.0	88	88.0
0.25	0.30	3	3.0	91	91.0
0.30	0.35	4	4.0	95	95.0
0.35	0.40	1	1.0	96	96.0
0.40	0.45	1	1.0	97	97.0
0.45	0.50	2	2.0	99	99.0
0.50	0.55	0	0.0	99	99.0
0.55	0.60	1	1.0	100	100.0
Total		100	100.0		

Next, we consider the graph below that plots State funding on the horizontal axis and local contribution on the vertical axis. The dashed line called "Linear (Data)" is the regression line for this data. It shows clearly that local contributions tend to rise quickly with State funding. The pink line corresponds to local contributions equal to 10% of State funding. Any of the 38 LEAs above the pink line would be affected by a policy that limits local contributions to 10% of State funding. Many of these would be smaller districts that received less than $2 million in State funds in 2004-05. We consider this feature undesirable since some of these LEAs are likely to be low-wealth LEAs and local contributions can help a low-wealth LEA recover from historical underfunding.



We can eliminate this undesirable feature by setting the cap on local contribution that is reimbursable to the larger of $500,000 and 10% of State funding, as indicated by the dashed teal line. This would allow all but one of the under-$2 million LEAs to continue to have their local contributions reimbursable and it would affect only 7 LEAs. However, these are precisely the 7 LEAs that make the largest local contribution and therefore shift the greatest cost burden to the State.

Other variations on this approach are certainly possible. Setting the cap at the larger of $1,000,000 and 10% of State funding would shift the horizontal portion of the teal line up to the $1,000,000 line and reduce the impact to only the 3 LEAs that make the largest local contributions. Alternatively, the State could set the cap at the larger of $500,000 and 20% of State funding.

Conclusion

We recommend that the State cap the amount of local contributions that are reimbursable to some version of the larger of an appropriate dollar amount and an appropriate percentage of State funding. This analysis suggests that using $500,000 and 10% would be reasonable but other choices may be found to be preferable.