Review of
Transportation Cost Component in the Essential Programs and Services Model

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Background

Beginning 2005-06, Maine implemented a new school funding formula entitled the Essential Programs and Services (EPS). The Essential Programs and Services model is based on two fundamental premises. First, there must be adequate resources in each of Maine's school administrative units and schools to achieve desired outcomes. Second, there must be equity in the distribution of these adequate resources among Maine's school administrative units. Equity means similar school administrative units should be treated similarly in the school funding formula, and dissimilar school administrative units should be treated dissimilarly.

Prior to 2005-06, Maine used an expenditure-reimbursement model for funding transportation costs. School administrative units annually submitted their transportation expenditure to the State, and the school administrative units were reimbursed for a portion of these expenditures based on an ability-to-pay formula.

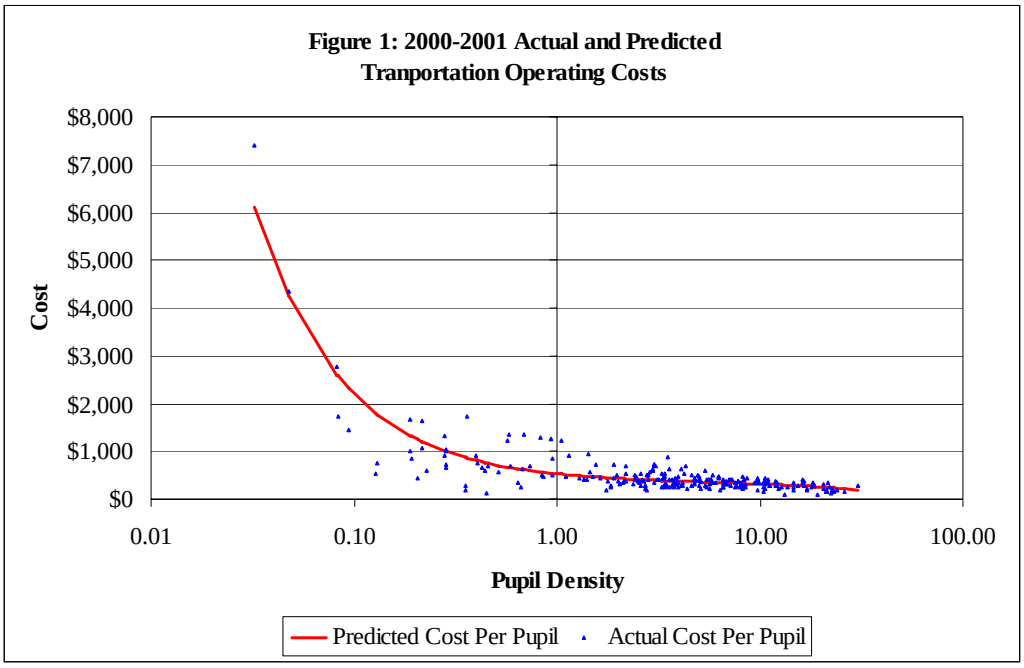
It might seem reasonable to expect that school administrative units with similar numbers of pupils, similar numbers of miles of road, similar numbers of miles traveled by school buses, etc., would report similar transportation operating expenditures. However, an analysis of historical data revealed wide variations in reported transportation expenditures, even among Maine school administrative units with apparently similar cost-relevant characteristics. A few examples are presented in Table 1 on the next page. As may be seen in the table, for example, school administrative units A1 and A2 have the same number of resident pupils (28 pupils) and similar miles of road (33-34 miles), but the transportation expenditures in school administrative unit A1 are more than 2½ times those in school administrative unit A2.

Table 1
Sample SAU Transportation Profiles

School Administrative Unit	Resident Pupils	Pupils Conveyed	Miles of Road (Class 1 - 5)	2000-01 Odometer Miles Traveled	2000-01 Cost Per Pupil
A1	28	26	33.57	18,900	$1,286
A2	28	23	32.95	10,890	$490
B1	48	41	45.96	14,500	$1,231
B2	44	44	39.41	14,814	$461
C1	152	106	62.67	36,776	$512
C2	175	151	68.89	37,258	$384
D1	173	185	49.05	35,875	$879
D2	177	106	47.08	35,639	$293
E1	337	352	170.70	87,104	$501
E2	339	379	183.19	78,499	$259

The differences in reported expenditures may be due to a combination of *controllable* (discretionary) and *uncontrollable* (non-discretionary) *cost drivers;* that is, cost factors *within the control of school administrative units* and cost factors *beyond school administrative unit control*. Controllable factors and the expenditures associated with them reflect local decisions, and consequently, in theory, the cost of these factors may be considered the responsibility of the local school administrative unit. However, uncontrollable factors should be the joint responsibility of the State and school administrative units. Accordingly, an analysis was undertaken of the relationship between key uncontrollable cost drivers and transportation expenditures. A variety of potential uncontrollable cost drivers were examined initially, but only two consistently surfaced in this analysis. The two key drivers were: (1) the number of resident pupils; and (2) the number of miles of road (class 1 – 5 roads). Using a statistical analysis procedure called multiple regression, the two uncontrollable cost drivers were found to be highly correlated with 2000-2001 expenditures, and consequently highly predictive of transportation costs. The correlation between the two variables, the number of resident pupils and miles of road, and transportation expenditures was 0.91 (a perfect relationship is 1.00).

Thus, Pupil Density (i.e., the number of pupils per mile of road) is very predictive of transportation costs. Figure 1 displays visually this relationship between actual and predicted costs.



It is common knowledge that it costs more per pupil to operate a student transportation system in rural areas than in urban areas, because each student has farther to go to get to school. Pupil density provides a practical way to quantify this effect. Under a pupil density model, lower density areas, such as rural areas, have much higher predicted per-pupil costs than higher density areas, such as urban areas, as Figure 1 clearly shows.

To further test the viability of using a Pupil Density index in the EPS model, the same methodology was repeated using 2001-2002 transportation expenditures for purposes of examining the reliability and stability of the analysis method. Table 2 reports the relationships between actual expenditures and predicted costs for the two years examined.

The .905 correlation represents the 2000-2001 relationship between expenditures and predicted costs, and the .918 is the same type of relationship for 2001-2002. This evidence indicated that the model was very stable for the

Table 2: Correlations: Transportation Cost Per-Pupil: Actual v. Predicted

Year	Actual Per-Pupil Cost 00-01	Predicted Per-Pupil Cost 00-01	Actual Per-Pupil Cost 01-02	Predicted Per-Pupil Cost 01-02
Actual Per-Pupil Costs 2000-01	1			
Predicted Per-Pupil Cost 2000-01	.905	1		
Actual Per-Pupil Cost 2001-02	.873	.832	1	
Predicted Per-Pupil Cost 2001-02	.796	.913	.918	1

All correlations are significant at the 0.01 level.

analysis years. Based on this analysis, a pupil density model, along with some adjustments was incorporated into the EPS funding formula. Thus, beginning in 2005-06, SAU transportation cost allocations were determined based on these factors:

- A pupil density index (i.e., number of resident pupils and number of class 1-5 road miles within SAU).
- Per-pupil transportation cost allocation based on lower of reported transportation expenditures +10% or predicted per pupil costs +10%.
- Per-pupil transportation cost allocation may not be lower than 75% of established costs of most recent fiscal year (or less than 90% in the case of SADs and CSDs with 1,250 or more pupils).
- Adjustments for:
    1. Out-of-district special education transportation
    2. Vocation education transportation
    3. Transportation of homeless pupils
    4. Ferry costs
    5. Island SAU costs

In approving the transportation component of EPS, the Joint Committee on Education and Cultural Affairs of the Maine State Legislature formally requested a review of a particular aspect of the approved cost component. Specifically, the committee requested the following:

> *Review of the costs defined in Title 20-A, section 15681-A, subsection 3 as the costs pertain to school administrative districts or community school districts that have more than 1,250 resident pupils, in conjunction with other adjustments and funding increases provided by law to determine an appropriate level of funding for fiscal year 2006-07 in order for those districts to maintain their current level of transportation services.* (PL05, c. 12 (LD468), Sec. UU-11)

In addition, the committee informally requested that the Maine Education Policy Research Institute (MEPRI) review other features of the approved costs component. Based on these requests, MEPRI implemented a four phase review process. These four phases were:

1. The collection of additional transportation related information from SAUs.
2. An analysis of additional cost calculation models.
3. A review of the 10% adjustment to predicted and actual per pupil expenditures.
4. The identification of recommendations for any needed legislation.

Review

The first phase in the review was to develop a process for collecting additional information from SAUs regarding their school transportation systems and costs. An ad hoc advisory group was used in this development process. More specifically, several steps were taken in this process. These included the following:

- A meeting was held with a group of superintendents, transportation directors, and business managers.

- A second meeting was held with a sample of transportation contractors.
- Based on input from these meetings, a SAU transportation survey form was designed, revised and finalized.
- The transportation survey was distributed to all SAUs with deadline of February 10, 2006.
- The survey responses will be analyzed once a majority of the surveys have been returned by SAUs.

A copy of the transportation survey appears in Appendix A.

A second phase of the review entailed conducting analyses of alternative transportation cost calculation models to the basic Pupil Density model. One series of analyses involved examining the flat rate models; models used in some other states. Table 3 provides information on three such models.

Table 3

Flat Rate Transportation Cost Calculation Models
2003-04 Averages and Variation in Transportation Expenditures

	Average	Standard Deviation	Minimum	Maximum
Net Expenditures per *Resident Pupil*	$643	926	$53	$10,840
Gross Expenditure per *Pupil Conveyed*	$1,007	2,904	$171	$34,196
Gross Expenditure per *Mile Traveled*	$2.64	1.83	$.35	$20.84

As may be seen from the information in this table, using any one of these flat rate models would not correspond well with the actual variance in SAU transportation costs. For example, under a Net Expenditures per Resident Pupil model the flat rate would be equivalent to the statewide average of $643 per SAU resident pupil. However, the statewide range is $53 - $10,840. The same pattern holds true for the other two flat rate models. Consequently, it

was concluded that a flat rate model was not a viable alternative transportation cost calculation model.

A second series of analyses were undertaken to calculate the empirical relationship between various models and SAU transportation expenditures. These relationships are reported in Table 2 on the next page. Recalling that a correlation of 1.00 would in this case represent a complete correspondence between the model and expenditures. As may be seen from the table, the pupil density model still remains the strongest model (r=.928). The Odometer Miles Model also was strong (r=.903), so a third model combining the two strongest

Model	Description	Correlation
1. Odometer Miles Model	The gross cost per pupil conveyed for each SAU is predicted by the odometer miles traveled per pupil conveyed by each SAU.	.903
2. Cost Per Mile Traveled	The gross cost per odometer mile traveled for each SAU is predicted by the odometer miles traveled per pupil conveyed by the SAU.	.704
3. Pupil Density Model	The net cost per resident pupil for each SAU is predicted by the pupil density per mile of class 1 through class 5 road in the SAU.	.928
4. Combined Pupil Density and Odometer Miles Models	The average of the Pupil Density Model and the Odometer Miles Model.	.905

models was calculated. This combined model (models 1 and 3 above) also yields a strong correspondence (r=.905) between the model and SAU expenditures.

A review of the two models, the Pupil Density Model (3) and the Combined Model (4) revealed some strengths and weaknesses of each. These were:

1. **Pupil density model (100%)**

   Strengths:

   - Based on strong relationship between density and costs.

- Develops unique predicted costs for each SAU.

Weaknesses:

- Does not model all SAUs equally well.

2. Pupil density model (50%) + Miles traveled per pupil conveyed (50%)

Strengths:

- Maintains strong relationship of per pupil density model.
- Provides for non-density related factors (dead-end road runs, midday runs, summer school runs, etc.).
- Develops unique predicted costs for each SAU.

Weakness:

- May support some controllable inefficiencies.
- May not model some high density SAUs.

Based on these series of analyses and review of the models an attempt was made to apply the two models to the most recently available information on SAU transportation expenditures. More specifically, the following procedures were implemented:

A. Both models were applied to all SAUs.
    1. If predicted per pupil cost was less than the actual per pupil expenditures, 10% was added to the predicted per pupil cost.
    2. If the actual per pupil expenditure was less than the predicted cost, 5% was added to actual per pupil expenditures.
    3. Adjustment costs (including mileage to multiple vocational sites) were added to the results.
B. Whichever model was most beneficial to each individual SAU was selected.

Procedure A.1. was the same procedure currently in place in the 2005-06 EPS transportation cost calculations. Procedure A.2. was similar to 2005-06 EPS calculations, except additional allocations to per pupil expenditures were

limited to 5%. This was done in response to concerns by some education committee members that allocations be closer to actual expenditure in those cases where expenditures were lower than predicted cost in the models. Procedure A.3. added a modification to one of the original adjustments to recognize those cases where SAUs may be transporting pupils to and from more than one vocational site.

The results of applying Procedures A and B are reported in Table 4. An analysis of those SAUs which were included in A.2.a and B.2.a was completed to determine if any other adjustment was appropriate. All but a few SAUs were within 10% of expenditures.

Table 4

Application of Transportation Cost Models

Results of Applying Density and Density plus Miles Traveled Models to SAUs (Comparison to 2005-06 Cost Model Allocations)
A. Increase in Total Allocation (n=130)
1. Allocation greater than expenditure (n=44)
a. Increase in number of pupils (n=24)
2. Expenditure greater than allocation (n=86)
a. Decrease in number of pupils (n=57)
B. Decrease in Total Allocation (n=146)
1. Allocation greater than expenditures (n=81)
2. Expenditure greater than allocation (n=65)
a. Decrease in number of pupils (n=61)

It was concluded that the new allocation models were appropriate for use in 2006-07, and appropriate until more information becomes available from SAUs. Accordingly, for 2006-07 the following was recommended:

1. Apply Density (D) Model or Density (50%) Odometer (50%) (DO) Model to each SAU depending on whichever model is more beneficial to SAU relative to most recent transportation expenditures.
2. Limit transportation cost allocation to no less than 90% of transportation expenditures for most recent year.
3. Incorporate modified vocational education adjustment into regulation.
4. Analyze additional information for SAUs and recommend any additional adjustments for 2007-08 if necessary.
    - Any recommended adjustment applicable only to SAUs submitting empirically based survey information.
5. Explore implementing new transportation systems in small number of pilot sites (e.g., routing software, regional models, etc.).

The 2006-07 EPS transportation cost calculation model will be reviewed once sufficient surveys are returned from SAUs, and if any additional revisions are needed, they will be recommended to the 123rd Maine State Legislative session.