Table 2. Example of fare program alternatives: fiscal integrity focus.

Item	Alternative A: Minimal			Alternative B: Selective			Alternative C: Major		
	Fare	Ridership Change	Revenue Change	Fare	Ridership Change	Revenue Change	Fare	Ridership Change	Revenue Change
Peak period adult ($)	+0.05			+0.15			+0.15		
Off-peak adult ($)	+0.05			+0.05			+0.10		
Zone fare ($)	Existing			Existing			+0.20		
Transfers ($)	Existing			+0.05			+0.10		
Express surcharge	+0.05			Existing			+0.10		
Student fares ($)	+0.05			Existing			+0.10		
Monthly pass discount (%)	Existing			5			0		

Note: This table is set up as a guide for transit property administrators. The ridership and revenue columns are left blank to show the items to be completed by administrators, so as to see how each fare alternative would alter both ridership and revenue.

point, the fare alternative that has the highest score should be reviewed to ensure that it satisfies the overall objectives. If it does not, then it may be changed by adding or deleting certain elements. If it does, it should be moved forward to implementation.

REFERENCES

1. Simpson and Curtin; University of Pennsylvania. Transit System Performance Evaluation and Service Change Manual. Pennsylvania Department of Transportation, Harrisburg, Feb. 1981.
2. J.F. Curtin. Effect of Fares on Transit Riding. HRB, Highway Research Record 213, 1968, pp. 8-20.
3. M.G. Ferreri. Transit Price Elasticities Revisited. ITE Transit Journal, Summer 1979.

Pennsylvania's Urban Operating-Assistance Grant Formula Methodology

JOHN DOCKENDORF

The Pennsylvania Department of Transportation (PennDOT) has provided state transit operating assistance since 1968. For many years, the Bureau of Mass Transit Systems, PennDOT, managed this activity as a discretionary grant program. However, due to the growth of the program and the increasing complexity of these grants, the Bureau determined that a better grant methodology was needed to ensure that state operating-assistance grants were adequate, equitable, and predictable. In FY 1976-1977, the Bureau began experimenting with a formula grant methodology that was based on financial need and system performance. After two years of experimentation and refinement, the Bureau developed a formula grant methodology that it believed achieved the objectives of predictability, equity, and adequacy. This concept was accepted by the state's transit industry as a reasonable and fair method to determine state operating-assistance grants, and efforts began in FY 1979-1980 to achieve passage of state transit legislation based on this grant methodology. This effort was successful and culminated in the passage of the Pennsylvania Urban Mass Transportation Law (Act 101) on July 10, 1980. The key elements of Act 101 and how they are applied to state operating-assistance grants are described. PennDOT believes this methodology has application for other transit funding programs and hopes other agencies can use the concepts in administering their transit programs.

Ever since the passage of Act 8 (Pennsylvania Urban Mass Transportation Assistance Law of 1967), Pennsylvania has participated in providing transit operating assistance to urban and nonurban transit systems. Originally, this program was administered by the Department of Community Affairs. However, in 1970 this function was transferred to the newly created Bureau of Mass Transit Systems when the Pennsylvania Department of Transportation (PennDOT) was established.

Act 8 authorized the state to fund up to two-thirds of operating losses, and localities were responsible for providing the remaining one-third match. With the introduction of the federal Section 5 operating-assistance program in 1974-1975 (Urban Mass Transportation Act of 1964, as amended), this policy was modified to authorize the state to fund up to two-thirds of the nonfederal share of operating deficits. State funds were allowed as matching funds for Section 5 grants.

This policy remained in effect until FY 1980-1981, when Act 101 (Pennsylvania Urban Mass Transportation Law) was passed. This legislation authorized PennDOT to provide a state subsidy of at least two-thirds, but not more than three-quarters, of its constrained deficit. The constrained deficit was defined as an amount equal to constrained operating cost reduced by assumed revenues and federal operating subsidies. These concepts are defined and discussed later in the paper.

Until the passage of Act 101, the Bureau determined operating-assistance grants in a discretionary manner by relying on rules of thumb, past state funding experience, and anticipated budgets. In the early years of the program, there were not a large number of program applicants, so it was possible to review projects on a line-item, as well as an overall, basis. The Bureau developed an extensive transit data-reporting system, which included an annual questionnaire, a detailed project application, and quarterly progress reports. Therefore, the staff had reasonably good knowledge of the participating transit systems, and the discretionary grant program worked fairly well for many years.

However, in the mid-1970s, the state operating-assistance program grew significantly, and it became increasingly more difficult to administer the program on a discretionary basis. Systems frequently did not understand how their grants were determined, oftentimes they did not permit the staff to take into account all relevant information in assessing financial need, and there was a growing perception that state transit grants were inequitable. Small systems believed the large systems received a disproportionate amount of state aid, while both of the state's two largest systems--Southeastern Pennsylvania Transit Authority (SEPTA) and Port Authority of Allegheny County (PAT)--thought the other was receiving a disproportionate amount of state aid.

Compounding this problem was the ever-widening gap between financial need and the overall state appropriation for transit operating assistance. Nationally, transit expenses increased an average of 11 percent annually from 1967 to 1975, while transit revenues only increased around 3 percent annually during this same period. This resulted in an average annual increase in transit deficits of more than 15 percent. Pennsylvania's transit industry experienced similar financial trends. At the same time, the statewide transit operating-assistance appropriation only increased at an average annual rate of 3 percent. From FY 1974-1975 through FY 1976-1977, the state transit appropriation was a constant $74.2 million. In the short run, this funding shortfall drained working capital accounts and required large increases in local subsidies over the levels required to match state grants. Gradually, this situation led to fare increases and service decreases. In the long run it was obvious that, unless this trend could be stopped, there would be a repeat of the cycle of higher fares, lower ridership, and reduced service that led to the collapse of most large transit systems in the 1960s and early 1970s, both statewide and nationally.

DEVELOPMENT OF FORMULA GRANT METHODOLOGY FOR DETERMINING STATE OPERATING ASSISTANCE

To overcome the problems of (a) inadequate overall transit funding, (b) uncertainty as to expected levels of individual system state transit funding, and (c) achievement of more equity in state transit funding, the Bureau began developing a formula grant methodology to distribute state transit operating assistance in FY 1976-1977. A comprehensive review was made of state and federal transit financial and operating trends as well as a study of probable future financial need and likely available state financial resources to meet transit needs. The outcome of this six-month in-house study was the development of a state transit formula methodology that was first used on an experimental basis in FY 1977-1978 for both the determination of individual state transit grants and for determining the required level of overall state transit assistance in FY 1978-1979. (The experimental methodology for FY 1977-1978 grants began after the statewide transit appropriation of $79 million was already established, so the procedures were limited to allocating the $79 million to individual participating transit authorities. A different methodology was tested in FY 1978-1979, which addressed not only the distribution of state funds but also the magnitude of the statewide transit appropriation.) This original formula methodology was refined and improved on for two years and ultimately became part of the state law with the passage of Act 101 in FY 1980-1981.

The calculation of state transit grants under Act 101 is divided into two parts: (a) the determination of financial need and (b) the assessment of transit system performance. The first part reflects a recognition that the primary justification for annual increases in state transit operating assistance is to cope with inflation. Therefore, 90 percent of the state's annual transit appropriation is earmarked to meet basic financial need. This part of the grant is known as the basic grant. [The 90 percent ratio is derived from the portion of the state grant dedicated to fund financial need (66.67 percent of the constrained nonfederal deficit) relative to the maximum possible state grant equal to 75 percent of the constrained nonfederal deficit. The 10 percent portion of the grant for financial need is based on the remaining 8.50 percent funding of the nonfederal constrained deficit relative to the maximum 75 percent state funding level.]

The remaining 10 percent of the state annual appropriation is earmarked to reward transit systems for improved performance. This element of the grant-determination methodology is needed to provide a financial incentive for transit systems to improve overall efficiency, effectiveness, and use that, in the long run, will reduce financial need.

Both concepts were designed to overcome what were regarded as major shortcomings in the discretionary state operating-assistance grant program. The lack of parameters in defining financial need gave the perception that there were no limits on state transit aid. This blank-check perception was a serious deterrent to obtaining legislative approval for increases in the annual state operating-assistance appropriation.

In addition, the lack of any financial incentives to reward improved transit performance made the entire state grant a function of financial need. This had the effect of serving as a disincentive for improved transit productivity, as relatively inefficient transit systems generated higher operating assistance when compared with more efficient transit systems. Although the Act 101 transit aid methodology does not eliminate this outcome, it does at least moderate this counterproductive trend.

The determination of financial need is based on three important concepts. The first is the application of a maximum expense factor, which represents the percentage ceiling on the increase in transit operating expenses. The second concept is the use of a ratio of minimum revenue to expense, which represents the lowest allowable percentage of operating expenses that revenues are expected to cover for maximum state funding. This ratio served as a floor for operating revenue levels in a given year. The final concept is the constrained nonfederal operating deficit, which is the difference between the maximum allowable transit operating expenses based on the maximum expense factor and the minimum required transit operating revenue based on the ratio of minimum revenue to expense and after estimated federal funding has been deducted. The constrained nonfederal operating deficit is the bottom-line variable in determining state transit operating assistance.

Use of the constrained nonfederal operating deficit is only applied in cases where the projected deficit submitted by a transit authority exceeds the value of the constrained nonfederal operating deficit, as Act 101 stipulates that state reimbursement shall not exceed the difference between actual operating costs less actual revenues and federal subsidies for any fiscal year. For convenience, it will be assumed that the constrained nonfederal operating deficit is less than the projected nonfederal deficit in the remainder of this paper.

The maximum expense factor was devised to help ensure that financial need projected by transit systems is not excessive relative to inflation. It is

derived by calculating the percentage increase in aggregate transit operating expenses for the previous fiscal year versus aggregate transit operating expenses for the prior fiscal year. This percentage change is then multiplied by 1.15 to reflect anticipated inflation. For example, the percentage increase in aggregate transit operating expenses in FY 1980-1981 versus FY 1979-1980 was 10.94 percent. This 10.94 percent increase was multiplied by 1.15, and the result of 12.58 percent represented the maximum expense factor for FY 1981-1982.

After the maximum level of projected operating expenses is determined for each transit system, this value is multiplied by the ratio of minimum revenue to expense to determine the minimum required level of transit operating revenue.

The ratio of minimum revenue to expense was developed to help ensure that increases in transit revenue kept pace with increases in transit expenses over time. An underlying premise is that users should bear a reasonable share of financing constrained financial need through periodic fare increases that are commensurate with inflation.

Intially, it was found that the statewide average transit revenue/expense ratio in Pennsylvania was approximately 50 percent for urbanized transit systems in FY 1979-1980. A review of national and statewide financial trends indicated that this ratio had declined approximately 5 percent per year during the early and mid-1970s. This was due to annual increases in transit revenue of only 3 percent per year, while increases in transit expenses averaged 11 percent per year. It was clear that a continuation of this trend would result in transit financial need increasing beyond reasonable and realistic levels of available government transit assistance.

A compromise revenue/expense ratio policy was adopted that permitted a downward sliding scale of ratios of minimum revenue to expense over time. In effect, transit revenue is expected to increase at approximately one-half of the annual rate of the maximum expense factor. This compromise was made to avoid the likely outcome of annual fare increases. Instead, a policy of encouraging periodic (but not annual) fare increases was established. The long-run issue of how long the downward sliding scale of revenue/expense ratios could be permitted was deferred as there was an expectation that gasoline shortages and higher gasoline prices would ultimately result in an upsurge in both transit ridership and revenue that would ultimately level off, if not reverse, the past historical trend of the revenue/expense ratio.

Unlike the maximum expense factor, where the lower of constrained expenses or projected expenses is used in calculating the constrained operating deficit, Act 101 only requires that transit revenue equal to the minimum level derived by applying the ratio of minimum revenue to expense to constrained expenses be used in calculating the constrained operating deficit. This concept is known as assumed revenue. Projected transit revenue in excess of the minimum level of required revenue may be used to partly offset projected transit expenses in excess of the maximum allowable expenses. This compromise was necessary to achieve the passage of Act 101. Table 1 summarizes the maximum expense factors and the ratio of minimum revenue to expense used to date.

After the maximum level of transit expenses and minimum level of transit revenue have been determined, the constrained operating deficit is determined by calculating the difference between these respective values. The projected level of federal Section 5 funding is then deducted to derive the appropriate constrained nonfederal deficit. Transit systems are ensured that they will receive 66.67 percent of the constrained nonfederal deficit based on financial need. This represents approximately 90 percent of the maximum authorized state funding level of 75 percent of the constrained nonfederal deficit.

The remaining 10 percent of potential state transit aid is based on improved transit performance. Again, the concept of bottom-line indicators is used. Four bottom-line ratios are used as determinants of improved system performance. They are as follows:

1. Improved ridership (revenue passengers) per vehicle hour,
2. Improved operating revenue per vehicle hour,
3. Reasonable operating expense per vehicle hour, and
4. Reasonable operating revenue/expense ratio.

These ratios were adopted as proxies of transit system performance, since the overall goal of most transit programs and policies is to maximize ridership and revenue per unit of service and to minimize operating expenses per unit of service. Virtually all improvements in efficiency, effectiveness, and/or use should positively affect one or more of these selected ratios. Vehicle hours were included in the first three ratios to reflect the amount of transit service provided. Thus, a demand and supply relation was established in the first two ratios and an efficiency relation developed in the third ratio. Vehicle hours, rather than vehicle miles, were used as a proxy of transit supply due to the relatively greater cost sensitivity of the former variable.

The actual determination of which of these four possible bonuses each urban transit system qualifies for (if any) is made by comparing these ratios between the previous and prior years. Lagging is necessary because budgeting rules require that transit appropriation projections be made approximately one year in advance. In addition, the Bureau wants to make sure that each bonus awarded is based on actual, rather than projected, data.

For the bonuses for improved ridership and improved operating revenue per vehicle hour, transit

Table 1. Summary of maximum expense factors and ratio of minimum revenue to expense requirements actually used for determining financial need.

Item	Percentage of Revenue Requirement by Fiscal Year							
	1977-1978	1978-1979	1979-1980	1980-1981[a]	1981-1982[a]	1982-1983	1983-1984	1984-1985
Maximum expense factor	–	8.13	9.80	12.58	12.58	9.78	NA	NA
Ratio of minimum revenue to expense requirement	–	45	46	48	48	46	44	42

[a]Percentages reflected the assumed revenue requirements as stipulated in Act 101. The duplicate values in FY 1980-1981 and FY 1981-1982 reflect the fact that sections of Act 101 became effective in the middle of FY 1980-1981 (January 1, 1981); therefore, these values were used for both fiscal years. Values prior to FY 1980-1981 were derived through pre-Act 101 methodology.

systems qualify if this ratio in the previous year equals or exceeds this ratio in the prior year. This amounts to an all-or-nothing approach, as the degree to which this ratio improved is not taken into account in determining the magnitude of this financial bonus.

The bonuses for reasonable operating expense per vehicle hour and reasonable operating revenue/expense ratio are handled by linking them to the financial need determinants. Systems qualify for the former award if their operating expense per vehicle hour in the previous year versus the prior year increased by less than the maximum expense factor. It is accepted that this ratio is likely to increase over time due to inflation. However, systems are expected to control this increase to levels below the actual rate of inflation if they expect to receive this financial award.

Similarly, it is expected that the operating revenue/expense ratio will decline over time. Therefore, to qualify for the bonus for the reasonable operating revenue/expense ratio, this ratio must decline in the previous year versus the prior year by less than the 2 percent annual decrease allowed for in Act 101.

Systems qualify for an amount equal to 2 percent of the constrained nonfederal operating deficit for each of the ridership, revenue, and reasonable-expense bonuses. The bonus for ridership per vehicle hour is weighted slightly higher at 2.33 percent of the constrained nonfederal operating deficit. This higher weight is needed to cover the residual 0.33 percent between the basic grant level of 66.67 percent of the constrained nonfederal deficit and the maximum state authorized share of 75 percent of the constrained nonfederal deficit. (This residual assumes that the potential 6 percent of the constrained nonfederal deficit for the three other bonuses has been added to the 66.67 percent basic grant level, which results in funding of up to 72.67 percent of the constrained nonfederal deficit.)

After the financial need and bonus awards have been determined for each transit system, the individual grant amounts are totaled and an appropriate transit budget request is made based on this aggregate figure. Due to the need to do this one year in advance of the project year for which these funds will be used, it is essential that the budget information on projected expenses and revenue be highly accurate. Also, this approach requires lagging of bonus awards, as these bonuses need to be known at this time so they can be included in the budget.

The Pennsylvania General Assembly is then called on to approve the mass transit budget appropriation request based on these guidelines. Assuming both houses of the Assembly concur (House and Senate), the bill is sent to the Governor for signature and the budget becomes effective for the next fiscal year. In cases where the actual approved transit appropriation is less than the amount based on the Act 101 formula, the law requires that the state prorate each grant downward based on the constrained nonfederal deficit derived through the methodology outlined in this paper.

OVERALL ASSESSMENT OF ACT 101 FORMULA GRANT METHODOLOGY

PennDOT believes that the formula grant methodology has achieved most of the intended objectives. For example, there is evidence that the maximum expense factor and minimum assumed revenue requirement are constraining financial need. Also there is evidence that the performance bonuses are influencing revenue generation.

In addition, state transit operating assistance is more adequate than before. The average annual increase in transit operating-assistance appropriations has increased dramatically since the passage of Act 101. State transit aid is also more predictable. Most systems are able to estimate within 90-95 percent accuracy the magnitude of their final state grant 6-12 months in advance of their award. Finally, the methodology is more equitable. The Bureau maintains work sheets that document how each individual grant was calculated, so that systems may review them in order to verify the accuracy of the calculations and to confirm that their grant was determined in accordance with the law.

Basing state transit aid on the constrained nonfederal deficit is another advantage of the Act 101 formula grant methodology. It is a more direct and relevant measure of transit financial need than indirect measures such as population, population density, and variables such as ridership, vehicle miles, and peak vehicles. Also, the use of financial bonuses to reward systems for improved performance is helpful in providing an incentive to improve efficiency, effectiveness, and productivity. Use of this tool at least moderates the usual practice of basing government grants entirely on financial need. In addition, it offers the long-term potential of reducing the level of financial need as increases in ridership and revenue and improved cost control are achieved.

Naturally, the use of this formula grant methodology has some disadvantages. The Bureau of Public Transit Systems has less flexibility in modifying grants to reflect changing conditions, emergencies, and other unanticipated events. Also, the combination of requiring extremely accurate financial projections and considerable lagging in determining bonus awards makes the methodology less flexible than a discretionary grant program. Finally, the political compromises needed to achieve passage of Act 101, such as the application of assumed revenue in lieu of projected revenue and the requirement for across-the-board prorating when transit appropriation levels are less than the amounts needed to fully fund Act 101, make it less predictable and less constraining than was intended when the formula grant methodology was developed. However, the Bureau does not believe these disadvantages come close to outweighing the advantages of this grant methodology.

The major unknown relates to the impact of the elimination of federal Section 5 operating assistance on Act 101. At no time during the development of Act 101 was it anticipated that federal Section 5 funds would be terminated. Therefore, the cornerstone of financial need was the calculation of the nonfederal deficit. Without federal aid, both state and local shares of the constrained nonfederal deficit will increase dramatically. It remains to be seen if Pennsylvania and the local governments that sponsor the urbanized systems have sufficient financial resources to make up this lost federal transit aid. If not, amendments to Act 101 will probably be needed in order to cope with this potential shortfall in overall state and local transit operating assistance due to the elimination of federal transit aid.