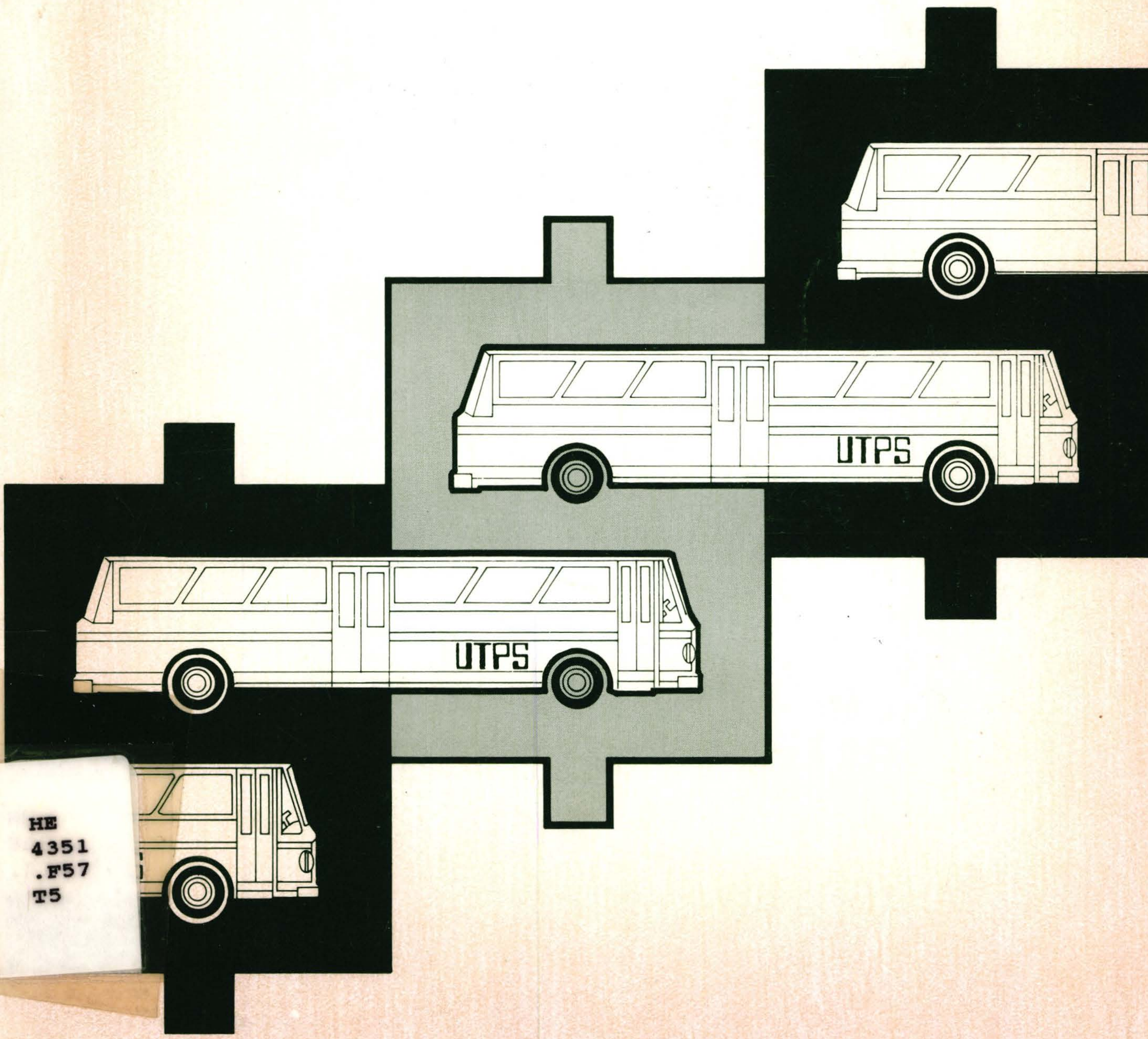
U.S. Department of Transportation

Urban Mass Transportation Administration

FINANCIAL FORECASTING TECHNIQUES IN THE TRANSIT INDUSTRY

A Summary of Current Practice



NOTICE

FINANCIAL FORECASTING TECHNIQUES IN THE TRANSIT INDUSTRY:

A SUMMARY OF CURRENT PRACTICE

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Prepared for

Office of Methods and Support
Urban Mass Transportation Administration
Washington DC 20590

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FOREWORD

The Urban Mass Transportation Administration is sponsoring the development and exchange of a wide range of computerized transit management aids. Any federally sponsored research will complement other development underway in the private sector. This effort has evolved under the general label "a transit operations planning system" which, conceptually, should be viewed as a collection of computer-based management support modules. The modules will support work of individual departments within a transit agency. Examples include operations analysis and planning, vehicle/driver scheduling, maintenance management, financial/budget analysis including capital asset and cash flow management.

Many transit agencies are already using computerized systems for such activities as payroll, accounting, maintenance and scheduling. The modules developed as part of this effort should complement or supplement many of these existing capabilities. Modular development should also allow adoption by transit properties of various sizes. Though the modules can be envisioned for any size of computer installation, initial development is emphasizing microcomputer implementations. These inexpensive systems offer many of the advantages of decentralized, departmentally oriented operations. However, these systems retain the potential to share an agency's data and information through a variety of communications interfaces. Thus, information produced through the modules may be brought together and organized as additional sources of management information. Technological breakthroughs continue to extend the computing power and data-handling capabilities of these desk-top systems. Very powerful systems are now within the financial reach of even the smallest transit properties, and these same systems can extend computing power to each appropriate organizational element in the larger properties.

This document is one of several which will provide background and summarize research conducted as part of the development process. The set of documents will provide information on concepts and proposed designs to encourage critique and feedback from the transit industry and other interested parties. New information and refinements in the overall concept will be reflected in the specification or operation of individual modules.

Comments and suggestions regarding the information and concepts discussed in this report are eagerly solicited, as well as recommendations for future development. Comments may be sent to either of the individuals whose addresses are listed below.

The authors of this document were George Anagnostopoulos, David Damm, Thomas Dooley, Walter Maling and Donald Ward of the Transportation Systems Center. Supervision of its production was the responsibility of Donald Ward. Granville Paules, Ronald T. Fisher, and Thomas Hillegass of the Urban Mass Transportation

Administration contributed important ideas and suggestions. Thanks are due to Donna D'Alessandro and Theresa McTague of TSC for their invaluable word processing capabilities.

The authors are extremely grateful to the individuals contacted at transit properties who were willing to spend time discussing their use of financial forecasting techniques. Because the information recorded in this report has not been verified, it should be considered preliminary. The authors apologize for any misinterpretations and welcome any information that provides clarification or additional detail.

Further information on this development effort and other related ones can be obtained from:

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TABLE OF CONTENTS

Financial Forecasting Techniques in the Transit Industry: A Summary of Current Practice

I. Introduction

The purpose of this study was to examine the procedures currently used by transit properties to forecast operating costs and revenues. Because of current economic conditions and diminishing Federal operating subsidies, there has been a growing need to investigate the implications of such actions as service reductions and fare increases. Past methods based largely on simple trend extrapolation do not produce sufficiently accurate forecasts with which to make sound decisions.

Discussions were held with individuals in the budget offices and, if necessary, in the operations, planning, and maintenance departments of twenty-six transit properties throughout the United States. Selection of these properties was based on previous discussions with transit operators conducted by TSC, a review of APTA's survey of management information systems (Ref. 3), and cognizance of properties judged to be using or developing innovative procedures. In addition, two firms, Peat, Marwick, Mitchell & Co. and Arthur Anderson, Inc., which are currently marketing financial planning software were contacted and several of their customers are included in this sample. Thus, while the sample of properties contacted is not necessarily representative of the industry as a whole, it does reflect the range of current financial forecasting practices.

Discussions with the operators attempted to examine both the annual budgeting process and longer range forecasting procedures, such as five-year planning. However, in only rare instances has a great deal of effort been devoted to planning beyond the one year horizon. Most operators cited too many unknowns and external factors as the reasons for not being able to perform credible long range planning. In addition, forecasting for capital expenditures was not explicitly addressed in this study; it will be the subject of a later effort.

Discussions focused on four specific operational areas: fare revenues, labor costs, maintenance costs and non-Federal subsidies. These areas are discussed in sections II through V. Section VI contains general observations and conclusions. Appendix A contains a table of summary information on the financial forecasting procedures in the four functional areas at each property. Appendix B contains the summaries of our discussions with each property.

II. Forecasting Revenues from Fares

A number of surveys of the transit industry have indicated that relatively little attention is paid to the methods used to forecast future ridership. Our recent discussions with operators confirmed this. Since projections of ridership are the central component in forecasts of fare-based revenues, this merits some concern. It does not appear to be as critical to be able to make accurate forecasts of the "base" conditions as it is to be capable of playing out, in advance, the likely consequences of various combinations of service levels and fares.

With a few exceptions, most properties still rely on the industry's rule of thumb, the "Simpson-Curtin" rule, to evaluate alternative futures. This rule embodies the belief that if fares are raised by 10 percent, then about 3.3 percent of all riders will leave the system. In the majority of cases, recent trends in aggregate, system-level ridership are extrapolated one or more years to provide a baseline. Using the industry's standard, variations in fares are employed to project deviations from this baseline. The baseline and the deviations are matched with assumptions about "average fares" which, when multiplied by projected ridership, produce estimates of fare-based revenues for future periods. For the most part, those responsible for predicting ridership temper their numbers with information on the local economy (e.g. level of unemployment), by making upward or downward adjustments as needed.

In several properties, aggregate elasticities (whether the Simpson-Curtin rule or numbers derived from local data) are used to squeeze a more detailed assessment of future revenues out of available data. Chapel Hill Transit separates out data by route and, although past trends are simply extrapolated, their forecasts are quite accurate because they make adjustments based on a thorough familiarity with each route. San Francisco MUNI has computed separate elasticities for "adult" and for "senior" categories and estimates two sets of numbers when projecting ridership and, hence, revenues. Milwaukee Transit has, on the basis of aggregate elasticities, created a matrix of expected ridership levels for a range of fare and service offerings. Since this approach has apparently been developed at the route level, it lends itself to the planning process well. It is not yet clear that its implied budgetary projections are on target.

In Washington, D.C. the transit authority collects a sample of data on board its vehicles regarding their passengers' origins and destinations and the fares they have paid. Based on the data collected, estimates are made about the proportional use of the system by riders from each of the associated jurisdictions. Although this procedure is primarily carried out to determine the distribution of financial obligation, it is also used to forecast revenues.

In several properties there have been valiant attempts to develop models at the aggregate level of the primary factors which correlate with a system's ridership. In Seattle, METRO planners have created a correlative model of a number of external factors such as employment levels and the price of gasoline to predict aggregate ridership under various assumptions. Once the number of riders has been determined for an assumed set of conditions, then forecasting the revenues is done similarly to most other properties in that gross "average fares" are assumed. In Atlanta, MARTA planners have developed a model of ridership for a single "average month." While there is still some question about the statistical validity of the model, it is clear that a sincere effort has been made to identify those variables which seem to explain why ridership levels vary from one time period to the next.

In general it is fair to state that estimates for fare-based revenues in most of the properties contacted are made manually using quite simple rules of thumb. There is evidence, however, that computer-supported methods, allowing greater flexibility in the selection and use of techniques, could relatively easily be adopted by those responsible for estimation. In Chapel Hill, the transit authority recently acquired a microcomputer system and is very interested in using its capability for analyzing options well in advance of the time when forecasts are needed in the budgetary process. In Los Angeles, planners are considering the development of a time series model of aggregate ridership. Presumably, extrapolations of prior trends could be made on the basis of systematically identified factors which seem to have influenced ridership levels, rather than merely using a linear relationship with time.

In most properties, there is a clear recognition that their approaches to estimating ridership and therefore revenues need reevaluation. In the current context of economic problems that are increasing the need to consider and implement cutbacks in service and fare increases (perhaps on a regular basis), past trends cannot simply be extrapolated. In short, the climate for more thoughtful and systematic forecasts of ridership and revenue is very favorable.

III. Forecasting Labor Costs

Our examination of labor cost forecasting focused on how these costs are determined for the budget year and beyond as a function of the level of service. Also considered were how the property forecasts the cost of work rule changes, the use of part-time labor and the size of the extra board. An attempt was made to determine the procedures used, the level of data or functional aggregation used in the procedures, the method of data capture, the methods used to manipulate the data and the level of integration between the financial forecasting process and other management procedures.

The procedures used to forecast labor costs are varied, the most basic of which involves using trends. The prior year's labor levels are used and the wage rates are updated to reflect the current contract provisions. The implicit assumption in this procedure is that the relationship between service provided and labor employed remains constant. This method was used primarily by properties requiring no expansion or contraction of service. Most properties have developed single factor unit cost models which relate service levels, usually expressed in aggregate terms such as total bus miles or bus hours or both, and total labor requirements, usually expressed in labor hours or the number of employees.

Properties such as WMATA in Washington, DC and the MTA in Houston are beginning to implement more sophisticated unit cost models of the type suggested by Peat, Marwick, Mitchell & Co. (4). These disaggregated unit cost models relate specific budget line items, possibly disaggregated by department or function, to some level of output such as vehicle miles or hours, productivity, wage rates, benefit packages, and overhead rates.

The productivity-unit cost models are system-level models developed from aggregate data. An example of this type of model is:

bus operating cost = bus platform hours x (payhours/platform hour) x average wage rate x average fringe benefit factor x average overhead factor.

These models are useful in forecasting if he past relationships hold for the future. They are easy to obtain from payroll data if that data is stored in a computer and capable of being easily and quickly manipulated. The models can also be useful in analyzing the different components of total labor cost.

Unit cost models have been extended in several ways. For example, MASSTRANS in Oklahoma City, OK and the Metro Regional Transit Agency in Akron, OH are planning to use a new feature of the TRANSPAC software called "Quick Plan" to develop unit cost estimates by route and time of day. This procedure involves estimating a model developed by Arthur Anderson, Inc. for London Transport (6) using the property's data. The model uses expense account data which has been allocated to direct and indirect costs by vehicle hour, vehicle mile, and peak vehicle resource categories. Then, samples of driver shift pay hour and vehicle hour data, differentiated by peak and base periods and representing the full range of staffing arrangements, are used to estimate the direct labor costs by time of day.

The PATH (New York) has developed work standards through industrial engineering techniques by which specific units of work are related to labor requirements. The Kansas City Transit Authority has developed unit costs for comparing full time and part time labor, as has Seattle Metro. The Santa Clara County (CA) Transit Authority has tried to separate fixed from variable costs. MARTA (Atlanta, GA) and the Tidewater Transportation District (Norfolk, VA) have developed "effective wage" rates which try to account for efficiencies which affect the type and duration of pay for drivers on a particular route. The "effective wage" rates are developed manually and are based more on a knowledge of the route and schedule than on quantitative methods. All of these properties are attempting to disaggregate historical data to understand costs in order to predict them.

The use of disaggregated unit cost models has the advantage of utilizing data currently captured by most payroll, operating statistics reporting and financial accounting systems. They provide insight into labor costs by relating output to input. One could apply these models with confidence to situations of changing levels of service, if no changes were contemplated in the dynamics of labor utilization, or if the effects of a change were all linear. For example, if report time was reduced by fifteen minutes, how would it affect the ratio of pay hours to platform hours? The level of disaggregation for unit costing can be the property, the department, the budget line item, the route, the bus or the trip. Since the financial forecasts must be made using data captured and processed for other purposes by other parts of the property, the degree of disaggregation available for developing unit cost models will be a function of the capability to manipulate (sort, aggregate, recombine) data already in place.

The most sophisticated procedures for estimating cost could be termed <u>labor simulation models</u>, which attempt to model how the labor is actually used. This approach is evident in NYCTA's (New York) labor negotiation scenarios and the work rule modeling in Seattle, SEPTA (Philadelphia), SCRTD (Los Angeles), and Sacramento. In New York, the cost of the management demands is being estimated by manually recutting schedules, estimating labor hours for each type of pay rate and determining the total costs. New York is doing the analysis manually because, with the exception of payroll, none of the information is computerized. In Seattle, a computer model was developed which takes the existing driver assignments, estimates of absence rates and guarantees, and the part time labor limitations and derives the overtime, extra board, and part time labor requirements. The labor requirements are used together with the wage rates and benefit packages to estimate labor costs for each type of operator. While the model was used in initial labor negotiation planning, its simulation of the extra board was not realistic and this part was later done manually.

At SCRTD, ATE Management & Service Company has experimented with the HASTUS (7) model to determine how various work rules affect the run cut. This model is a linear programming model which minimizes cost subject to the schedule and the contract provisions. It approximates the schedule by putting relief points into half hour segments. The model is currently being validated against the existing schedule for one SCRTD division of 250 buses. Another example of the labor simulation process is the use of RUCUS (8) for examining alternative driver assignments at MUNI and at MTC in Minneapolis. To date, labor simulation models have been limited by the ability of properties either to capture and manipulate more disaggregate data or to extract the data needed from their existing information systems.

The attempt to develop a labor cost model based on work rules and driver categories and assignments seems to be the most promising financial forecasting procedure because it uses information directly from existing systems such as payroll, scheduling, and personnel. Work rule models (such as the one in Seattle and SCRTD and to some extent in NYCTA) involve first extracting data from the existing data base, such as payroll or schedule picks, and then manipulating that data to build a model of the process. The model is then used to examine alternatives. It is essential that the model be linked to the operational system in some way both to calibrate the model and to update it.

Based on our discussions, it appears that the ideal financial forecasting model would be fully integrated with the existing automated systems (e.g those for payroll, work order, or scheduling), be capable of manipulating the data in a variety of ways, and have access to disaggregate data. Most properties lack all or two of the above. Most properties have automated payroll and Section 15 reporting. Some have automated scheduling and vehicle maintenance. These automated systems were designed primarily for keeping track of things, not for understanding the relationships between them. Thus we find that a property may have a payroll system which allocates pay to forty accounts but does not know why the overtime expenditures are too high. Operations people may know why the overtime is high but do not know how much it costs or do not know the costs of alternative solutions. Often the data captured for finance and accounting (e.g. payroll) or personnel (e.g. job categories) may not be in a form which could be used by an operations department (e.g. scheduling) and vice versa (e.g. absences). The budget department, which puts the labor hour data together with the wage and fringe data, now must do this manually because two separate and incompatible sets of data exist.

Economic forces are clearly forcing properties to reduce their labor costs through contract changes or improved labor utilization. Tools which assist operators in analyzing the effects of work rule changes, part time drivers and service reductions on cost would be most welcome. Techniques such as disaggregate unit cost models which can be used to analyze the components of labor costs provide insight and are an excellent first step. Models or methods which can identify the true costs of service, such as route costs by time of day or alternative work rule arrangements, are needed.

IV. Forecasting Maintenance Costs

Because maintenance costs represent a significant portion of the operating budget, they are an important element in financial forecasting. The effectiveness of a maintenance system is a function of availability and dependability, that is, the degree to which an item is operable when needed and how long an item will continue to perform its specified function. System availability is a function of both reliability and maintainability, i.e., how often does an item break down and how long does it take to restore it to serviceable condition. Equipment utilization and fleet size are a function of availability and dependability. Maintenance, which influences these two parameters, can be performed in many ways, at many levels and with many costs. For example, a property faced with fewer maintenance dollars may decide not to pay any overtime, thereby increasing the time to repair and decreasing availability of equipment. A property may decide to eliminate the commonly used maximum operating time overhaul policy in favor of reliability centered maintenance (RCM), which is basically a policy of maintenance when needed (within certain constraints, such as safety). RCM has in some instances resulted in maintenance cost savings. It has become clear from our discussions with various properties that accurate evaluation of alternative maintenance policies is essential to reduce the number of buses in the inventory and increase the fleet utilization, while at the same time reducing maintenance costs.

In most of our sample, forecasting is done manually using a variety of techniques ranging from informal "back of the envelope" methods to analyses using infornmation from automated reporting systems. Trend analysis is the most commonly used technique for predicting maintenance costs. In their simplest form, predictions were made by simple unit cost models, e.g. dollars per vehicle-mile, based on a fixed schedule for maintenance. Adjustments were made to account for increases in the costs of labor, fuel and tires.

In more sophisticated analyses, costs from the current year and previous years as well as predictions of next year's labor costs are used. Inflation adjustments are also estimated for external factors and input into the analysis. Unit costs have been determined by the great majority of properties which relate level of service parameters to consumables. Several properties utilize a management information system (MIS) to derive more sophisticated disaggregate unit cost models that deal with individual buses and routes.

SEPTA aggregates its maintenance costs by depot. This level of aggregation has the potential disadvantage of not permitting determination of the costs associated with a specific fleet of buses. SEPTA uses a preventive maintenance (PM) program can compare the year's maintenance performance with that of prior years. SEMTA in Detroit uses a fixed formula of 2.2 buses per mechanic and 12 cents per mile plus inflation for parts to predict maintenance costs. MASSTRANS in Oklahoma City and Akron, Ohio are implementing the TRANSPAC maintenance module which will permit recording of the complete vehicle repair history. A complete history is necessary to determine failure history and the point of wearout when the failure rate is increasing. Use of aggregated maintenance cost data without a vehicle repair history does not permit the association of changes in maintenance costs with such factors as changes in wearout intervals, changes in labor rules, increases in the cost of parts, or the degree of effectiveness of maintenance management. Thus, a detailed individual vehicle history is necessary to determine causal relationships for the evaluation of alternatives and to make reasonable forecasts of maintenance costs. A western consortium of transit properties including Denver, Orange County, Sacramento, Santa Clara and Seattle is developing a Maintenance/Inventory System that is an integrated package dealing with operations, reporting, tracking, and planning functions at a disaggregated level. It is likely that such systems as TRANSPAC and the consortium design could be enhanced by features that would allow the determination of causal relationships.

The major uncertainties associated with predicting maintenance costs are both internal and external. The unit cost of labor associated with a change in the level of service is an internal factor that is a function of negotiated increases in the cost of labor. This varies from property to property depending on a number of factors such as whether the maintenance department is union or non-union, and the flexibility to change the work rules. The Flint MTA has perhaps the most unusual labor incentive program with 17 different repair skill categories that require successively less supervision and are tied to a pay scale. (Labor costs for the future period are generally derived as indicated in Section IV.) The cost of fuel, lubricants, tires, power, and parts are external factors influenced by the economy. No property reported a method of predicting these factors with any degree of accuracy.

Data capture is, in general, a manual process that is derived from work orders and time charts. This disaggregated data is entered into an MIS that is primarily an automated accounting and payroll system. Accounting and payroll departments process this data and generate statistical reports for operations staff. Reports are then aggregated (based on the individual bus) to the fleet type, budget line item, department, or property. The appropriate reporting level is then sent to the corresponding responsibility center. Some properties generate failure reports from work orders by bus and maintain this data in the MIS. However, no property has a good failure management system in which failure is recorded by type and fed back to the maintenance data base to determine the most appropriate action, e.g. improvement of parts, replacement of parts or inspection.

Preventive maintenance programs are being implemented in the great majority of properties. PM programs involve a higher frequency of maintenance actions such as inspections, lubrication, or early parts replacement to preclude catastrophic failure in service. The need to make parts available in a timely manner for this program has placed an undue burden on manual reordering and inventory control system. Thus, these properties are either trying to implement or are planning to implement automated inventory control systems. Furthermore, the cost of parts is apparently rising faster than inflation, resulting in a need to develop a method of making predictions of parts costs. (The average rise in the cost of parts has been about 25 percent with a range of 3 to 60 percent.)

The ideal maintenance control system would contain the following elements:

Management

1) Scheduled and Unscheduled Maintenance System (where scheduled is considered to be a PM system).

2) Inventory Control that keeps track of the inventory and reorders parts prior to the need.

3) Failure Monitoring System that accounts for malfunctions that result in both downtime and vehicles that are not fully operational.

Accounting

4) Work Order System that assigns maintenance new and available equipment.

5) Status and Tracking System.

6) Management Reporting System.

Planning

7) Planning System that predicts changes in maintenance costs given changes in the level of service or in maintenance management procedures.

V. Forecasting Non-Federal Governmental Subsidies

The planned reduction in Federal operating assistance beginning in FY83 and completed in FY86 will force greater reliance on state and local funding sources. Most transit authorities receive some state or local support out of general revenues or via a dedicated tax such as a sales tax, property tax or gasoline tax.

Transit operators typically forecast state and local support by extrapolating past trends. State agencies and metropolitan planning organizations are other sources of tax revenue forecasts used for planning purposes. Where dedicated taxes support capital bond issues, transit authorities usually hire outside consultants to forecast future tax receipts. In Atlanta, for example, MARTA hires a CPA firm to forecast sales tax revenues based on trends in historical sales and inflation and on projections in population and resident income. Both Houston and Denver hire outside consultants to forecast sales tax revenues. Houston's sales tax forecasts are based on retail trade employment and inflation forecasts. In Seattle, sales tax revenues are extrapolated from past trends, while taking into account inflation and the health of the regional economy as forecast by local economists. In Salt Lake City, sales tax revenues are estimated by the regional planning council and the state university.

In Los Angeles each year the Los Angeles County Transportation Commission forwards the county budget office's sales tax revenue forecast to SCRTD. Since this official projection tends to be overly conservative, SCRTD develops its own forecast by multiplying in the tax rate by the local retail sales forecast issued by the economics department of the Bank of America.

In New York City tax revenues are estimated by the State Department of Budget, Transport, and Finance. Budget planners at the New York City Transit Authority maintain close contact with the state budget people.

The Milwaukee Transit Authority's budget is tied into the overall county budget. This year the county mandated a five percent cut in transit service. State and local transit subsidy decisions are products of the political process; consequently, they are outside the transit agency's sphere of control and difficult to forecast. In Philadelphia, SEPTA's fiscal year ends July 1; however, Pennsylvania typically does not determine state transit subsidy levels until the following October. This forces the transit authority to implement budget and service level adjustments hurriedly.

Most transit authorities receive some state or local support out of general revenues or dedicated taxes. The need to develop better forecasts of revenues from state and local sources for long-range planning is widely recognized, but since financial assistance is heavily dependent upon political considerations, few have developed any in-house capability more sophisticated than simple extrapolation of recent trends. Transit operators typically rely on tax revenue forecasts prepared by metropolitan planning organizations or state agencies.

VI. Conclusions

The dominant problems in improving financial forecasting require solutions more fundamental than developing new quantitative models. The reason for this is that methods, data processing, and data collection procedures were designed for operating departments, not for financial forecasting. This points to two important observations: (1) financial planners and operating staff must work together, and (2) much of the data needed by both groups should come from the same source. In the properties described above, the most innovative work resulted from a close cooperation between the operations staff and the financial planning department. Additionally, operations, maintenance and other departments should be supported by many of the same sets of data. Whenever coordination does not exist, then the process breaks down.

We see financial forecasting as a process of integrating information internal to a transit property together with specific external information for the purpose of determining what resources will be required for a given level of service or, alternatively, what level of service can be provided with a given level of resources. To the degree practical, the more combinations of service levels, expected revenue, external variables and time frames which can be explicitly and accurately included in the process, the better the financial forecasting system. This may be equated with the ability to answer "what if" questions.

The formulation of an ideal financial forecasting system begins with the generation of "what if" questions and proceeds through the creation of information systems in the various departments. Each department, such as operating, maintenance, planning, finance and accounting has its own method of developing needed information, and generates the information by collecting data, organizing it and processing it using various automated and manual procedures. Procedures are applied to such tasks as scheduling, inventory and work order control, run picking, payroll generation and fare collection, each of which may or may not be automated. Data organization includes everything from file cabinets full of cards to sophisticated data base management systems. Data collection includes a variety of methods depending upon the kinds of information to be collected, the ability to process information, other related procedures considered important and the "what if" questions being asked.

In the area of financial forecasting, the ideal property has the following characteristics. Its staff knows what questions to ask and how to obtain the information it needs to answer them. The procedures to answer questions are efficient, yet account for the complex interrelationships among supply and demand variables. The data are collected and stored in such a way to minimize the cost to collect and maximize the number of ways each piece can be used, i.e. collect it once and use it many times. For example, time cards should be easy to fill out, it should be easy to store information on them, and the data should be useful to several departments.

It is against this paragon that we reviewed our sample. While economic realities are forcing many transit operators to do less with less, the changing economic climate has opened new opportunities to change old practices. In our discussions, we found many properties trying to move in some of the directions of the ideal financial forecasting system described above. (Examples are cited in Sections II through V of good questions, methods, processing, and data collection).

In most properties, data for quantitative models are not available, or available at only an aggregate level. This means that most financial forecasting is done in isolation or independently of other activities. If financial forecasting is important it must be made a part of the procedures for accounting, labor and equipment management and revenue management. This requires a rethinking of the entire process of how information flows within an organization.

We encountered a number of properties which are making significant progress in improving financial forecasting techniques. Much more can be learned by further study of these properties in such areas as:

(a) asking questions; properties dealing with major financial concerns such as substantial deficit, a new labor contract (New York, Sacramento) or major expansion (Houston, Portland) would be good candidates.

(b) developing procedures; properties which have attempted to "model" phenomena associated with ridership (MUNI), work rules (Seattle, Sacramento), disaggregate unit costs (WMATA), or maintenance management (western consortium) would be good candidates. The purpose of these investigations would be to identify how these models answered financial questions and how the data were derived or extracted from existing data bases.

(c) collecting data; all properties collect data. Many items are collected manually and then entered into some type of MIS for accounting and reporting. Often the data are collected and can be used for a single purpose only. Further study would determine if and how high quality data could be collected to meet multiple requirements.

(d) processing data; some properties have attempted to organize many of the items of data needed for financial forecasting in computer-accessible form. Seattle has a data base management system (RAMIS) while Akron and Oklahoma City have TRANSPAC file manipulation capabilities. NYCTA is in the process of developing a way to process the existing hard copy data. Investigation of these properties can provide information on how data can be organized or reorganized so as to serve many functions. This investigation can also examine the possibility of a single data base providing for all necessary functions.

(e) integrating procedures; it is clear that for most properties financial forecasting is accomplished through a collection of independent subsystems. To achieve a more systematic approach, greater depth of understanding of the operational functions and their interrelationships is needed. Investigation should include a determination of the most promising structures for effective forecasting procedures, and the development of appropriate performance measures for such an integrated system.

This analysis of current practice has identified the procedures currently in place for forecasting major costs and revenues. It has identified many innovative procedures and techniques which have been developed to deal with pressing economic problems. Many of the properties are asking questions which will lead to an improved understanding of cause and effect. In general, properties do not have financial analysis methods which cover the entire range of important issues noted above. An obstacle to progress is the lack of an integrated set of data to deal with the interrelationships between service levels, costs, and revenues.

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APPENDIX A

SUMMARY COMPARISON CHART

FINANCIAL FORECASTING TECHNIQUES IN TRANSIT PROPERTIES
(By Metropolitan Areas)

BUDGET ITEM

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Metro Regional Authority (Akron)	ridership forecasts made by metropolitan planning organization based on elasticity estimates and ridership surveys	dedicated property tax revenue is forecast by the county budget commission	labor cost estimates based on bus hour and inflation estimates (taken from DRI forecasts); RUCUS used for scheduling	function of service levels and inflation; new TRANSPAC software version will soon permit recording complete vehicle repair history	TRANSPAC property; RUCUS scheduling currently done on outside computer; plan to set RUCUS on in-house micro-computer; to get "Quick Plan" soft- (see Oklahoma TRANSPAC description)
CDTA (Albany, New York)	educated guess	annual projections based on State's estimates	assuming a number of labor hours, various wage rates used to compute expected costs	no projections	revenue cost side better than cost
MARTA (Atlanta)	<u>planning level</u> monthly ridership model (regression); f (miles, fare, gas price, days); revenue from fare & ridership <u>operations</u> <u>individual</u> route changes effect on ridership predicted using historical shrinkage & fare average	local subsidy of 1% of sales tax, forecast from population, per capita income, and expenditure pattern data	<u>planning level</u> rule of thumb for labor cost changes, no work rule analysis, regression on aggregate data with unit cost = f(miles) <u>operations</u> manual run cutting and analysis; cost savings for route changes estimated using "effective" labor rate and knowledge of route efficiencies	manual, based on parts inventory (not an on-line system)	simple but robust models for policy planning; manual route analysis (revenue and cost) budget adjustments; key managers aware of need for data processing

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Citran City Transit Services of Forth Worth	patronage and revenue module of MIS uses fare box data, RUCUS, & fuel consumption to yield patronage revenue by class; elasticities used to extrapolate historical trends	operating funds obtained from the city, no prediction of subsidies	payroll module gathers data and computes labor costs & benefits, manual projections revenue changes as trends	maintenance module reports fleet & vehicle performance; forecasts are extrapolations of unit costs	manual budget & financial forecasting based on past trends; inputs from automated sources
Metropolitan Transit Authority of Harris County (Houston)	no explicit forecasts made	sales tax revenues forecast as function of retail service employment levels; sales tax revenue forecast as a function of local CPI and growth in local economy	use model employing productivity measure (unit costs) to project bus transit operating costs	currently installing a vehicle maintenance system modelled after Chicago's SIMS	financial forecsting manual; use of VMS and unit-costing systems for management cost control
Kansas City Area Transit Authority (Missouri/Kansas)	judgemental process, supplemented by knowledge of elasticities for certain groups of riders; process in flux due to new fare structure	no projections	procedure developed to determine cost savings of proportions of part-timers; straight-line trends for full timers	informal straight-line projections	a number of areas of improvement

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Chapel Hill Transit (North Carolina)	extrapolation of past trends	straightline projections	straightline projections	annual projections for 4 types of costs	use of micro (Apple II+) planned to play out scenarios
Regional Transit District (Denver)	manual prediction of fares and revenues using highly aggregated data	outside consultant used to predict changes in revenue	manual trend analysis	manual analysis of maintenance using unit costs' past trends	manual financial & budgeting - will purchase Prime Informatics data base
SEMTA (Detroit region)	extrapolation of past trends; (expected ridership) * (average fare) = revenue	fixed % of "eligible expenses" which can be changed 2 years in advance; can only be predicted very roughly, annually	no models; adjustments made periodically in expectations based on known contract & local economy	fixed formulas: 2.2 buses per mechanic & 12¢/mile (+ inflation) for parts	many areas for which computer-aided methods would be of help
Flint Mass Transportation Authority (Flint, MI)	future ridership forecasts developed by look at historic ridership trends and the outlook for the local economy; bus driver records actual ridership manually	Michigan state transit aid is limited to 1/3 of operating expense filed with city and county, no forecasting of city and county transit aid which are financed out of general revenues	no COLA; incentive pay for good attendance and accident free driving	no COLA; incentives to do a job right the first time worker who needs less supervision get higher pay rates 17 different repair skill categories	unique incentive labor contract manual scheduling & financial forecasting MIS system primarily has accounting cost, control-orientation

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Southern California Rapid Transit District (SCRTD) (Los Angeles)	Simpson-Curtin rule; building monthly ridership model: f (fare, gas price, seasonal factors, variation in number of working days in each month)	sales tax revenue estimated as tax rate multiplied by the local retail sales forecast developed by the economics depart-ment of the Bank of America); the county auditor's office also prepares forecast	function of service level; HASTUS program employed to simulate the impacts of work rule changes	currently installing a vehicle mainten-ance system (VMS) similar to Chicago	financial forecasting manual; extensive manual ride checking program scheduling/ planning department; AVM demonstration ridership modeling ride checking scheduling/planning department; AVM demonstration
Milwaukee Transit Authority	ridership forecasts a function of fare elasticities & service levels (bus frequencies)	no attempt is made to forecast county subsidies which come out of general revenues	function of service levels and inflation estimates performed every 3000 miles	manual maintenance system	advanced ridership modeling
Metropolitan Transit Commission (Minneapolis/ St. Paul)	manual prediction by passenger type using historical data and registering fare box data	assume assessed value based on discussions with county and state	use COLA tied to consumer price index & assume inflation	manual predictions using key indica-tors & sampling based on discussion with cost center managers; have RUCUS	manual predictions using historical trends; in process of developing necessary MIS mod-ules; maintenance has highest priority with existing models

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Metropolitan Transit Authority (Nashville, TN)	Simpson-Curtin Rule	simple extrapolation of past subsidy levels	RUCUS used for scheduling; labor cost estimates based on inflation estimates and service levels	preventive maintenance performed as function of mileage; computerized vehicle system records fuel, tire and maintenance activities by bus	financial forecasting performed manually; major 5-year plan upgrade performed every second year
New York City Transit Authority (NYCTA) NY	adding 5¢ to fare equals $50 million in revenue; formulas for effect of service change on ridership	complicated subsidy from city and state general revenues, sales taxes, and miscellaneous income and profit taxes; forecasting by state legislature	review of work rule and schedule effects for current labor negotiations; manual simulation of alternative strategies plus payroll data base	model for labor requirements based on vehicle miles, inspection standards, and labor rules	financial plan with quarterly updates; 5-year forecast at aggregate level; current budget is manual, but computer-aided being developed; unit cost and labor simulation models in progress
PATH (New York City/ New Jersey)	constant fare for last twenty years; no models used	cross subsidy from Port Authority of New York and New Jersey	detailed work sampling to determine efficient standard staffing levels as a function of work to be done; train schedule optimization simulation; labor cost * manpower units for budget	inventory control and MIS from FRA work used for vehicle history	10-year manpower-based forecasts; industrial engineering analysis; cash management program; labor standards for all functions used for forecasting

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Tidewater (Norfolk, VA)	fare increases predicted by elasticities but working well; no model of trip rates and the inter-relationships of service	deficit allocated to jurisdictions based on in-service vehicle hours	labor costs = f(bus miles and hours) + "effective" wage rate	inventory control and vehicle history file; fleet mix change affects maintenance costs	MIS in place; "Datascan" provides file linkage by not fields for analysis; data collection good on payroll and inventory; analysis of current data disaggregated enough for planning
MASSTRANS (Oklahoma City, OK)	currently using trends to estimate fare revenue and impact of service changes.	no explicit forecasts	currently fore-casting using analysis of tabu-lated data through Transpac report generator; will be using Quick Plan route level bus cost model	maintains his-torical trends on recent fleet purchases by bus, repair type etc.	key features of Transpac are: integrated data capture/reporting, acct. & budget; use report generator to create own reports; Quick Plan for developing models for forecasting
SEPTA (Philadelphia)	simple elasti-cities	no explicit forecasts	financial forecasting model used to cost changes for negotia-tion	unit cost model for predictions;	manual forecasting system based on historical trends; great interest in predicting external factors

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Sacramento Regional Transit	manual ridership predictions based on their own feelings for economy & Simpson & Curtin Rule; no growth factor included for next 4 years;	no prediction made	developed new labor cost simulator & examined 125 items for labor negotiations	manual work order system	manual financial planning & budgeting; labor costs automated; examined 125 alternatives for labor negotiations; develop goals & objectives - test specific performance measurements
Utah Transit Authority (Salt Lake City)	predicted by trends; regression of historical data indicated that 52¢ is the max fare without revenue loss	sales tax predicted by regional planning commission and state univ.	assume labor costs same as last year since no change in vehicle miles routes, or wage rates	parts' usage and labor hours estimated from annual VMT; microcomputer-based inventory and work order system being prepared to predict costs	microcomputer tools show promise
San Diego Transit Corporation	use Simpson-Curtin Rule & historical trends	predictions are based on discussions with the state & periodic projections made by the state	inflation factors are entered into a detailed labor distribution model	unit costs used to predict maintenance costs	manual budgeting & forecasting; no automated means of making predictions - heuristic approach
MUNI (San Francisco)	elasticities from recent telephone survey used; since fares must be at least .33 of revenue, accuracy not stressed	sales tax tied to retail climate; "best guess" annually .	ad hoc basis, but some use of RUCUS to estimate expected labor hours	formulas tied into vehicle mileage & number of vehicles in service; vehicle history since '77	good climate for improving methods, especially microcomputer-based

PROPERTY (Metropolitan Area)	FARE REVENUES	NON-FEDERAL SUBSIDIES	LABOR COSTS	MAINTENANCE COSTS	SUMMARY
Santa Clara County (CA)Transit Authority	assume average "riders per hour" and "fare" and vary each	for local, past rates of real growth projected in a straightline; for state, simply assume a rate	only gross categories of overall costs predicted	only gross categories of overall costs predicted	way data is categorized and formatted may be a barrier to better forecasts
Seattle, WA METRO	project riders and and assume elasticities; (average fare & ridership)	extrapolation of past trends	model developed to analyze work rules	thorough system of cost accounting; vehicles' histories used with data on mileage & hours	high potential, though only slightly automated
WMATA (Washington, DC)	detailed models for allocation of revenue to jurisdictions; trip O-D and fare matrices used with resistance factors to predict change	local subsidies for 8 jurisdictions based on detailed revenue-cost allocations; allocation uses bus miles, bus hours, number of peak buses and costs related to those categories	unit cost * productivity * service is modeled for all budget line-items in process; pay rate * hours used now; manual cutting	computer system to track labor and material cost for each vehicle over time	unit cost model for prediction; emphasis on cost allocation rather than financial planning

APPENDIX B

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Transit Properties (By Metropolitan Area) Contacted

Metropolitan Area	Transit Property
Akron, OH	Metro Regional T.A.
Albany, NY	Capital City District T. A.
Atlanta, GA	MARTA
Chapel Hill, NC	Chapel Hill Transit
Denver, CO	Regional Transit District
Detroit, MI	Southeastern Michigan T.A.
Flint, MI	Mass Transportation A.
Fort Worth, TX	Citran
Houston, TX	Metro
Kansas City, MO/KS	K.C. Area T.A.
Los Angeles, Ca	SCRTD
Milwaukee, WI	Milwaukee T.A.
Minneapolis/St.Paul, MN	MTC
Nashville, TN	MTA
New York, NY	NYCTA
	Path
Norfolk, VA	Tidewater
Oklahoma City, OK	Masstrans
Philadelphia, PA	SEPTA
Sacramento, CA	Sacramento RTD
Salt Lake City, UT	Utah T.A.
San Diego, CA	S.D. Transit Corp.
San Francisco, CA	MUNI
Santa Clara County, CA	Santa Clara County T.D.
Seattle, WA	METRO
Washington, DC	WMATA

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Metro Regional Transit Authority

Contact: James R. Young, Asst. General Manager

Mailing Address: 416 Kenmore Boulevard
Akron, OH 44301

Telephone Number: 216-762-7267

Date Contacted: 26 Feb 82

Case Studier: Walter H. Maling

I. Overview

The Metro Regional Transit Authority's current five-year financial plan was prepared manually. The plan was required for a tax issue presented to local voters last fall. The Akron transit authority has been using TRANSPAC for one and a half years and is considering acquisition of the Quick Plan software as a financial planning aid. (The Oklahoma case study provides further details on Quick Plan's capabilities.)

II. Revenues From Fares

The Akron transit fare was increased 10¢ to 50¢ fare in February 1981. Service levels were cut 6% in March 1981. These changes led to a 12% drop in transit ridership. The metropolitan planning organization utilizes elasticity estimates and surveys of transit users to forecast ridership and revenue levels. The planning organization expects less than 5% annual increases in transit ridership over the next few years. No substantial increases in transit service levels are planned.

III. Non-Federal Governmental Revenue Sources

Effective January 1, 1982 for a 10-year period the Akron transit authority will receive 2 mills on property tax. In return transit fare increases will be limited to 5¢ yearly. The transit fare was increased to 55¢ in January 1982 with no ridership loss. The county budget commission estimates that property tax revenues increase 3.5% yearly. Properties are reappraised every 6 years. The Akron transit authority uses the tax revenue forecasts prepared by the county budget commision.

IV. Labor Costs

Inflation cost estimates are taken from Data Resources Inc. forecasts. Labor cost estimates are derived from bus hour and inflation estimates. RUCUS is used to schedule bus drivers.

V. Maintenance Costs

To date complete vehicle repair history data could not be maintained because of software limitations; however, upgraded TRANSPAC software will soon be installed to overcome this problem. Maintenance costs are forecast by extrapolating past trends.

VI. Summary

The Akron transit authority has been using the microcomputer based TRANSPAC system for the last one and a half years. Akron (and Phoenix) have hired Ken Roberts & Associates to convert the RUCUS 1 scheduling software from FORTRAN to BASIC so it will run on the 8-bit QANTEL microcomputers. Akron also plans to acquire the Quick Plan software to help forecast peak and off-peak bus service costs.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Capital City District Transportation Authority

Contact: Mr. Jack Reilly

Mailing Address: 110 Watervliet Avenue
Albany, NY 12206

Telephone Number: FTS 562-4411 (518-457-1283)

Date Contacted: 26 February 1982

Case Studier: D. Damm

I. Overview

Mr. Reilly's position is parallel to that of the comptroller, and as such, he plays a major role in the development of the numbers included in the budget and financial forecasts. Until now, the budget has been considered on a line-by-line basis with little effort expended to connect computations for any two or more items explicitly. In general, there appears to have been more success in analyzing and projecting costs than doing so with revenues. Regarding costs, Mr. Reilly has developed a program using VISICALC to compute costs for six cost-centers (and three main operating garages). Beyond a six month planning horizon, the budgetary process seems to be influenced strongly by anticipated capital grants. On the revenue side, there are three primary components: passenger-derived; subsidies; and "others," which make up roughly 1% of all revenues. There is no real use made of Section 15 data in this property's financial analyses. Mr. Reilly would very much like to create more integration of projections for service policies, fare structure and the budget.

II. Revenues From Fares

Currently, educated guesses are made about next year's ridership, and hence, future revenue. Given the current economic climate, it is assumed here that there will be a 1% decrease in ridership yearly. Ecosometrics study (of 1980) of service and fare elasticities may be used as a reference to judge the fare increases needed to compensate for losses in revenues.

III. Non-Federal Governmental Revenue Sources

The property in Albany receives a share of New York State's gross tax receipts, which derive from 1% of revenues from energy-related companies in New York State. Typically, the state informs transit properties seven months in advance about changes in the amounts they can expect from these receipts. [This year there happens to be a 20-30% increase in the offing. This is expected to cover the loss of Federal support.] Because this source of revenue is subject to forces which are not transparent to the property (and cannot really be), longer term annual projections for state-level sources are impossible.

IV. Labor Costs

A relatively straightforward procedure is used. A certain number of labor hours are assumed for each year, together with wage rates for straight-time and overtime. Two or three scenarios are played out under various assumptions about the wage rate for the coming contract year (October to September), and multiplied by the assumed number of labor hours. To the extent possible, fluctuations in the number of hours by seasons are taken into account (for example, in the summer, there is more overtime to pay because more drivers are on vacation).

V. Maintenance Costs

There is no vehicle history data and no method for projecting these costs into the future.

VI. Summary

Mr. Reilly has identified two areas of highest priority for improvements. First, it would be helpful to understand the relation of maintenance costs to changes in service levels (e.g. when the number of peak hour vehicles are reduced, the number of miles traveled decreases and clearly has a bearing on the frequency of maintenance). Second, it would be an asset to be able to determine the cost structure of the operation over the day. Currently, they cannot tell how much adding another peak hour vehicle will cost, or any other similar change for that matter.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Metropolitan Atlanta Rapid Transit Authority

Contact: Mr. Ken Gregor, AGM for Finance
Mr. John Bates, Manager of Marketing and Research
Mr. Michael York, Dir of Transit Engineering
Mr. Jim McDonald, Hammer, Siler, and George Associates

Mailing Address: 401 West Peachtree Street, NE
Atlanta, Georgia 30365

Telephone Number: Gregor: (404) 586-5065
Bates: (404) 586-5161
York (404) 586-5320
McDonald (404) 524-6441

Date Contacted: Gregor: 2 March 1982
Bates: 2 March 1982
York: 5 March 1982
McDonald: 5 March 1982

Case Studier: Tom Dooley

I. Overview

MARTA uses unit cost figures to develop the five year financial plan. For example historical data such as cost per station, cost per collector, propulsion power per vehicle mile, or mechanics per rail car are used to build up the estimates. Bus cost estimates are based on bus hours and bus mechanics (more detail from Mr. Bates is included in labor cost section). Economic forecasts are used to estimate COLA increases in the union contract. On the revenue side, the revenue from the 1% dedicated sales tax is estimated by outside consultants as required by the bond market. Federal operating subsidies are included and the remainder must come from the farebox. Mr. Gregor mentioned that MARTA built a simple budget model on the Apple II for analyzing "what if?" questions. He suggested that explicit and detailed models of the budget would not be helpful in the budget approval process.

MARTA currently has a $100 million operating budget, yet the key variables in the budget can be discussed quite simply and probably modeled that way as well.

Mr. York described the labor costing and fare revenue estimation process at the incremental level, that is, how much does each route save in cost and lose in revenue as service is reduced to meet budget constraints. The entire process is done manually and is extremely time consuming and tedious. His division within the transportation department has found it difficult to upgrade their data processing capability.

Mr. Bates has developed simple ridership and cost models which together with the subsidy predictions can be used to examine fare, service level, cost, and subsidy policy interrelationships.

II. Revenues From Fares

John Bates has developed a model for monthly ridership (presented at the January 1982 TRB meeting). The model is based on bus miles, average fare, gas prices, number of weekdays in the month and month type (December, July and August are low). The model was estimated with 120 months of data and predicted the 1980 ridership within 1%. The vehicle miles are derived from the schedules. The total fare revenue is just the product of ridership and average fare.

Ridership changes from fare increases or service reductions are developed on a route by route basis by Mr. York based on historical shrinkage factors (elasticities) and knowledge of the average fare (which is a function of pass and transfer usage).

III. Non-Federal Governmental Revenue Sources

MARTA receives a dedicated source of subsidy from the sales tax in the transit district. They receive 1%, of which half goes to operating expenses and half to capital expenses. This becomes the starting point in the budget.

The local subsidy from the sales tax is predicted by an outside firm. Mr. McDonald of the CPA firm of Hammer, Siler, and George, Associates discussed the prediction of sales tax revenue. The sales tax revenue projection is based on a projection of personal income for the MARTA region. SMSA per capita income and population statistics from the Survey of Current Business are used together with some state data. Assumptions are made on expenditure patterns and inflation rates. The sales tax revenue forecast is made once for the entire year by this firm. Mr. McDonald was not sure whether MARTA adjusted the forecast during the year.

IV. Labor Costs

Mr. Gregor stated that every 1 cent in the labor agreement cost MARTA $54,000 per year. He had estimated that the recent arbitrator's award would cost MARTA $20 million over three years. This was based on two 5 cent and two 10 cent steps plus a 12 to 16 cent quarterly COLA adjustment. Mr. Gregor also had rules of thumb for the cost of an extra holiday. MARTA's approach to labor cost modeling focused primarily on the wage rates rather than the work rules. Mr. Bates has developed a unit cost model in which unit cost is a function of the number of miles, i.e. cost per mile equals $1.57 plus .015 per million vehicle miles.

Mr. York analyzes the cost per route for the purpose of budgeting. As mentioned before, it is done manually. For each route Mr. York has developed an "effective cost" which takes into account the direct labor costs, overhead costs, fringe costs and scheduling efficiences (or inefficiencies). He knows the labor hours or operators, buses, and the variable cost as a function of mileage. Thus if the budget shortfall is 2.6 million; and the effective cost is $2./mile then 1.3 million miles of service must be cut. This figure is used to develop a first round of cuts for the public hearings. At the public hearings each route is discussed and voted on to determine a final set of cuts which Mr. York then costs out (miles saved, buses saved etc.) and estimates the passenger loss and revenue loss. This procedure requires an intimate knowledge of the individual routes and scheduling which at this time resides with Mr. York.

Mr. York mentioned that RUCUS II was on order for 1983.

V. Maintenance Costs

The only computerized part of the maintenance function is the parts inventory which is on a batch system maintained by the Finance department. In this application it is clearly not useful to the maintenance department. Additional discussions are planned with the maintenance department to determine their cost estimation procedures.

VI. Summary

MARTA does financial planning for a five year horizon. Some elementary models have been developed. These models are generally used for the budget year and beyond. The models are based on historical experience derived from the accounting system but are not tied directly into the accounting system.

The operations department manually analyzes the ridership, revenue, and cost changes on each route using a knowledge of the route structure.

MARTA has devoted most of its effort and information system resources to managing their $1 billion rail construction program. For example they developed an MIS for project control and warranty tracking. The bus operations managers seem to have some good ideas that have yet to be implemented due to this emphasis.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Chapel Hill Transit

Contact: Mr. Robert Godding

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Chapel Hill, NC 27514

Telephone Number: 919-929-1111

Date Contacted: 26 February 1982

Case Studier: D. Damm

I. Overview

Two products are generated in Chapel Hill for financial planning: an annual budget and a transit development plan which covers five years and is based on the budget's figures as a baseline. For both products, contracted services (such as shared rides) are separated out, leaving a remainder for costs and revenues to be broken down and analyzed. Primary costs are associated with salaries and wages, fuel and maintenance. Principal revenue sources encompass operating charges (pass sales and farebox), local and Federal operating assistance. Because this is a relatively small property (26 buses), only the Director's assistant and a tranportation planner from the City in addition to the Director himself participate actively in the process of generating the figures.

II. Revenues From Fares

Since there is a high frequency of use of passes (70%), riders tend to be sensitive more to the relative savings possible with passes versus cash than to changes in the fare as such. (A recent increase in fares resulted in almost no loss in ridership, but did lead to shifts from passes to cash.) Overall, transit users are most sensitive to alterations in the level of service provided and to changes in the relative costs of using an automobile (e.g. parking costs at the University of North Carolina). Past trends in ridership are extrapolated based on a thorough familiarity with the system and its ridership. Over the five year planning period, it is assumed that the current recovery ratio will not change as service is added.

III. Non-Federal Governmental Revenue Sources

There is no assistance provided from the State of North Carolina. The largest portion of revenues comes from local assistance. These include the 10 cents on $100 valuation ad valorem tax on Chapel Hill's residents, the local part of the State's intangibles tax and contributions from the University and from the adjacent town of Carrboro. None of these sources can be predicted by other than straightline extrapolations assuming identical proportional amounts.

IV. Labor Costs

Although some of Chapel Hill Transit's drivers belong to an ATU local, there is no collective bargaining conducted with the Town. [North Carolina is a "right to work" state.] As a result, there are few uncertainties with regard to labor costs and no incentives to make more than simple, straightline projections.

V. Maintenance Costs

While there is no general model of these costs, an attempt is made to break down items into four different categories, which are in turn detailed, but only for the next fiscal year. These categories are: 1. daily service costs (service attendants for every in-service vehicle); 2. preventive maintenance; 3. repairs and breakdowns (dependent on the age of vehicles, the complexity of repairs as well as the cost and availability of parts); and, 4. overhead (which pieces of equipment to use to perform service, for example, a welder or a dynamic tire balancer).

VI. Summary

In order to move away from straightline projections of costs and revenues, this property is in the process of putting its financial data (among others) into a form which can be manipulated within its new microcomputer system. The intent of this action is to create more time to examine changes in a host of variables and their implications for the budget and the projection of its line items over time. In the near term, levels of Federal assistance are the greatest source of uncertainty in Chapel Hill Transit's financial forecasting.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Regional Transportation District

Contact: John Picon, Deputy Executive Director of Finance

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Denver, Colorado 80222

Telephone Number: (303) 628-9000

Date Contacted: 25 Feb. 82

Case Studier: George Anagnostopoulos

I. Overview

Financial forecasting and budgeting at the RTD is a manual process that is conducted by the department heads. The principal document resulting from this exercise is the Transit Development Program (TDP), a five year capital and operating program of the Regional Transportation District (1982-1986). This document is updated annually and adopted by the RTD Board of Directors. The TDP is consistant with the regionally adopted Year 2000 Public Transportation Plan. The TDP is used to prepare the annual RTD budget, and it is the basis for the five year Transportation Improvement Program (TIP) which is brought up to date annually by the Metropolitan Planning Organization (MPO). The TIP includes both highway and transit projects.

Plans have been made to purchase a data base management system (DBMS) from Prime Informatics. This will be implemented on their second Prime machine which is due in another eight months. This will be used for accounting, processing ridership information, and for maintenance. At that time the two service agencies and the NCR 8430 will be phased out.

II. Revenues From Fares

A manual process is used to predict revenues from fares. Elasticities are considered in this determination. The principal input are ridership counts obtained from driver sheets which are filled out for each route. Currently all data is aggregated. At this time the RTD can not match revenues with routes. However, statistical sampling is used to correlate this information.

Their operations analysts examine routes for productivity. Operations assigns traffic checkers to obtain a better estimate of ridership count and headway of the lowest productive quartile.

III. Non-Federal Governmental Revenue Sources

The sources of revenue are from a sales tax, Federal grants for capital, operating and technical assistance, proceeds from Sales Tax Revenue Bonds, Series 1977, transit operating revenues, and accrued funds. An outside consultant is used to make predictions of changes in these revenue sources. These predictions have in general been conservative. The results are examined and modified by the RTD's analysts.

IV. Labor Costs

Labor costs are examined manually by their operations analysts with inputs from their DBMS. Simplified trend analysis is used to forecast labor costs. A variety of alternatives is examined for labor negotiations. These include the examination of issues such as part-time drivers.

V. Maintenance Costs

Maintenance costs are compiled manually with some inputs from the data base. Predictions of maintenance costs are made using simple trend analysis of unit costs. The RTD is a member of the Western Transit Maintenance Consortium and is contributing to the development of a maintenance and inventory system that wll be implemented on a minicomputer. An inventory control model exists which is partly operational in-house and outside at a service agency.

VI. Summary

The principal means of forecasting operating costs and revenues is manual trend analysis supplemented by judgment and local knowledge. The current emphasis is to automate the maintenance and inventory control system. It is intended to implement a DBMS that is common to the primary operating functions. Although there is a need to increase the level of automation to provide more time to examine alternatives, there is a sense of adequacy in forecasting with the present manual analytical techniques.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Southeastern Michigan Transportation Authority

Contact: Ms. Karen Jensen

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First National Bank Building
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Detroit, MI 48226

Telephone Number: 313-256-8689

Date Contacted: 3 March 1982

Case Studier: D. Damm

I. Overview

After receiving projections on ridership, scheduled bus runs and grant revenue, the Budget Section proceeds to develop its initial numbers for next year's document. Although there is some opportunity for review and comment on the numbers' reasonablness from other sections in the property, responsibility for preparing next year's proposed budget is not decentralized. The dominant component in the process of analyzing costs is information on the scheduled bus runs for the coming year. Once these figures are obtained, then most of the other numbers are derivable as they are based on either cost per mile or cost per hour. On the revenue side, the major factors are fare-related, Federal subsidies and state subsidies.

II. Revenues From Fares

Numbers provided by the Planning Department on expected ridership are multiplied by an assumed average fare to obtain the expected fare-based revenues. Within the Planning Department, ridership figures have been estimated by the following procedure. Five years ago the industry's standard rule of thumb (the "Simpson-Curtin Rule") together with judgement about the idiosyncrasies of the system were applied to come up with revised ridership figures for the next year. Estimates for each succeeding year were extrapolated from this initial exercise. Until now, this approach has been sufficient; however, as gasoline prices soften and the economy weakens, there is much less sanguinity about continuing to do this. The overarching concern is to have average fare at the point of meaning a recovery ratio of 30%.

III. Non-Federal Governmental Revenue Sources

The State of Michigan distributes (from property taxes) various amounts of money to highway and transit agencies throughout the state. SEMTA computes its "eligible expenses" each year and the state gives out an amount equal to 21% of these expenses, but only up to a predetermined limit. Typically, an exception to this limit is made for SEMTA, but requires an act of the state's legislature annually. The state usually lets SEMTA know two years in advance of any change in the percentage of eligible expenses to be distributed.

IV. Labor Costs

Contracts are negotiated in three year cycles. As a result, it is generally known what increases can be expected, based on what has been received before and what is in the existing contract. In addition, cost of living adjustments are made on a quarterly basis, and while projected for a year, are nonetheless revised as new information comes to light (e.g. given the very weak regional economy in the Detroit region, the cost of living is actually decreasing after several years of steady increses).

V. Maintenance Costs

To the extent that maintenance costs entail mechanics' time, the number of mechanics needed is computed by assuming that for every 2.2 buses, one mechanic will be needed. In regard to parts, there is an assumption of 12 cents per mile plus an inflation rate used to arrive at a final figure. An effort is underway to store all data related to maintenance in computer readable form so that histories of vehicles can be easily created and integrated into the process of estimating costs.

VI. Summary

There are many areas of possible improvement of methods of forecasting costs and revenues. If automation of data handling and data analysis were to be increased, the area of greatest potential for saving time and bettering the process would be drivers' costs. Many factors need to be accounted for and a large share of these change over time frequently enough to warrant recomputation regularly.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Flint Mass Transportation Authority

Contact: Robert J. Foy, Assistant GM and Director Operations

Mailing Address: 1401 South Dort Highway
Flint, MI 48503

Telephone Number: 313-767-6950

Date Contacted: 4 Mar 82

Case Studier: Walter H. Maling

I. Overview

The Flint Mass Transportation Authority (MTA) operates 77 peak period buses on its spoke-wheel route system. The 12 bus routes follow the main arteries out of town and run every half hour. Transit ridership is 4 to 5 million boardings annually. MTA's management information system collects Section 15 data.

Annually the transit authority develops a budget for the next fiscal year and updates a 5-year plan covering an additional 5 years. Resource requirements are developed for 7 individual cost control centers: administration, finance, purchasing, operations, maintenance, data management, and the general manager's office.

II. Revenues From Fares

The farebox generates approximately 27% of MTA's revenues. The bus drivers record passenger count data for each bus run on a card. This passenger count data by time of day is then entered manually into the computer. The latest 18 months of passenger counts is kept on disk. Future ridership estimates are developed by looking at the local economic climate and at historic ridership trends. No formal ridership model is employed. Revenue forecasts are based on ridership predictions and an estimate of the average fare.

III. Non-Federal Governmental Revenue Sources

Michigan limits state transit aid to a maximum of 1/3 of operating expenses. Eighteen months before the start of each fiscal year, the Flint Transit Authority must submit its state grant proposal request for operating assistance to the Michigan Department of Transportation. The transit authority budget always assumes that the state will pick up 1/3 of the authority's operating costs. The Transit Authority also submits an annual subsidy request to the city finance director and ultimately the city council. This year the financially strapped city provided no transit aid, so the transit authority for the first time appealed to the county for transit aid which was granted. The county transit aid covers between 1 and 2% of the budget. No formalized forecasts of city and county transit aid are prepared.

IV. Labor Costs

The Flint transit authority in 1980 negotiated an innovative, 4-year labor contract which rewards efficiency and good attendance. Bus driver's base pay is $7.65 per hour, but there are monthly, quarterly and annual incentives to reward good attendance and accident free driving. The inventive programs increase the hourly pay rate. Currently about 9% of a driver's pay is received through incentive pay features of the labor contract. Pay increases in future years are slanted towards the incentive pay clauses. The transit authority hopes to increase incentive pay to be 15% of total pay. The contract has no cost-of-living (COLA) provisions. Since the contract was implemented, the MTA has had a marked decrease in the number of accidents and the severity of accidents. The transit authority has reduced insurance costs by raising deductible limits and is now self-insured for workmen's compensation coverage.

V. Maintenance Costs

Incentive pay provisions also help hold down maintenance costs. There are 17 different repair skill categories. Workers in a skill category which need less supervision receive higher hourly pay rates. There are incentives to do a repair job right the first time. If a repair fails the maintenance worker who performed the job may be penalized by reassignment to a lower skill level. A computerized management information system records maintenance labor hours and material costs. The MIS system also generates a series of performance indicators including maintenance cost per mile, maintenance labor hours per mile and costs of repair parts per mile. Since there are no planned changes in service levels, and no COLA in in the 4-year labor contract, maintenance labor costs are reasonably predictable. Revenue forecasts are based on ridership predictions and an estimate of the average fare.

VI. Summary

MTA's management information system generates various performance indicators which can be used to measure the result's of efforts to increase efficiency.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: CITRAN - City Transit Services of Fort Worth

Contact: Jane Everett, Manager of Administration

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Fort Worth, Texas 76101

Telephone Number: (817) 870-6200

Date Contacted: 26 Feb. 82

Case Studier: George Anagnostopoulos

I. Overview

CITRAN is operated by McDonald Transit Associates for the City Council of Fort Worth. McDonald Transit Assoc. prepares the budget and all financial forecasts. A five year forecast is prepared consistent with UMTA guidelines. Financial forecasts have currently been prepared for the City Council through 1989. The Public Transportation Advisory Committee reviews budgets and forecasts and advises the City Council.

The method of budget and financial forecast preparation is manual. Budgets and forecasts are prepared by the Directors of Administration, Accounting, and Grants and Systems. Inputs from numerous automated sources are used to construct these forecasts. The FY83 Budget was prepared consistent with the following three assumptions: the same level of service, no fare increase, and only 50% of the revenues from the farebox.

PMM developed the CITRAN MIS in current use. It is based on PMM's Financial Accounting and Management Information System (FAMIS). FAMIS is a generalized system of financial management which is also able to integrate planning, programming and budgeting with the functions of reporting and performance measurement. The MIS contains three modules: patronage and revenue, maintenance, and payroll. All three modules interface with the accounting system in a way that permits automated production of internal, state, and UMTA financial reports.

A study of the CITRAN MIS was completed by Arthur Anderson & Co. in 1981. Ten prioritized recommendations were made:
1) Convert to the city's inventory control and accounting system (this system is currently operating in parallel with the manual system and is expected to be operational by mid 1983);
2) Implement an automated interface between the revenue and

patronage reporting module and the Duncan data collection system; 3) Acquire a report writer software package for ad hoc reporting; 4) Implement an automatic fuel monitoring system; 5) Enhance the current maintenance reporting module to include vehicle status information, additional road call and bad order information, unscheduled maintenance activity reports by operators and by bus; 6) Enhance payroll module by interfacing with RUCUS; 7) Implement the WANG SUPER payroll and personnel system which is being implemented by all other agencies of the city; 8) Incorporate attendance reporting in the SUPER personnel system; 9) Incorporate customer service (i.e., complaint and commendation data by operator) into the SUPER personnel system; and 10) Incorporate accident reporting data in the SUPER personnel system. These recommendations are currently in various states of implementation.

II. Revenues From Fares

Fare box data from the Duncan Electronic fare boxes describing the number of passengers by fare type for each line and driver are input into the patronage and revenue module. Vehicle and operator assignments from the RUCUS scheduling program are also input to each line. These basic inputs are combined with fuel consumption statistics to yield management reports describing patronage and revenue by fare class for each line and date. Weekly, monthly, and annual statistics are generated and compared with prior periods to determine changes in ridership. This data is combined with transit schedule information resulting in performance statistics such as ridership per vehicle-mile and revenue per vehicle-mile by line by day.

A fare change forecasting model developed by the Council of Government is also used by CITRAN to determine ridership changes and the point of diminishing returns. Simple elasticities are used to extrapolate historical trends.

III. Non-Federal Governmental Revenue Sources

The operating funds are obtained directly from the City Council. As a result CITRAN is not involved in predicting state or Federal subsidies.

IV. Labor Costs

Data from the patronage and revenue module and the maintenance module are used in the payroll module to compute the labor cost distribution and fringe benefits. This data is transmitted to a separate gross-to-net payroll system that prepares payroll checks, and to the accounting system. The payroll module generates reports on the functional distribution of employee gross pay and fringe benefits as required by Section 15, reports on overtime accrued and pension vesting requirements.

Manual projections of labor costs are based on historical trends.

V. Maintenance Costs

The maintenance module reports the fleet and individual vehicle performance in terms of mileage, fuel and oil consumption rates, and availability. It also reports the number and type of scheduled and unscheduled maintenance actions. A history of maintenance and servicing activities is maintained for each vehicle by date and mileage. In addition, it schedules maintenance for the coming week.

Inventory control is currently a manual operation, but will soon be automated by the introduction of City of Fort Worth's automated inventory control system.

The forecast of maintenance costs is performed manually by extrapolating unit cost indicators based on past trends.

VI. Summary

CITRAN has achieved a reasonably high level of automation and is currently in the process of implementing ten prioritized recommendations for improvement of their MIS. However, the budgeting and financial forecasting are manual analytic techniques that use past trends based on inputs from the MIS. More realistic budget projections are desired and it is perceived that automation of financial forecasting would be beneficial.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Metropolitan Transit Authority of Harris County

Contact: Marty Reiner, Chief of Capital Budgeting

Mailing Address: P.O. Box 61429
Houston, TX 77208

Telephone Number: 713-225-1151

Date Contacted: 26 Feb 82

Case Studier: Walter H. Maling

I. Overview

Like Los Angeles, Houston's ongoing guideway planning analysis is focused on the rail option. A draft environmental impact statement has been completed. The manually prepared 1987 5-year plan emphasizes transit service planning althouth it does include financial forecasts. An internal working paper on capital budgeting through the year 2000 is in a constant state of flux. Houston plans to buy between 100 and 130 buses annually through the year 2000.

II. Revenues From Fares

Houston does not worry about transit fare increases inducing ridership losses. The latent transit demand is so high that the transit authority is barely carrying more than captive riders. Revenues are forecast by multiplying the forecasted ridership by the average transit fare. Ridership forecasts are based on planned bus hours of service assuming a constant ridership per service hour. Houston also looks at historic growth rates in ridership.

III. Non-Federal Governmental Revenue Sources

The Houston transit receives the revenues from a 1¢ sales tax on sales within Harris county and those portions of neighboring counties where transit service is provided. In FY82 this tax is expected to raise between $161 million and $175 million. Houston hires outside consultants to forecast sales tax revenues. The finance division of the transit authority conservatively estimates that the transit tax revenue will show 1.5% real growth annually over the next 5 years. Sales tax revenue projections are pegged to retail trade employment levels. Chase Econometrics has developed retail trade employment forecasts for the Houston area. Chase in conjunction with PMM has developed a local CPI forecast through the year 1996. This local CPI inflation forecast gets revised periodically and is currently undergoing review. CPI forecasts impact labor cost forecasts since the union contract inlcudes a COLA clause. The transit authority's internal capital programming forecasting currently assumes the sales tax revenue will show 4% real growth annually through 1987, 3% real growth annually from 1988 through 1990, and 2% real growth annually from 1919 through the year 2000.

IV. Labor Costs

PMM has developed a model which uses productivity measures to project bus and rail transit operating expenditures. The PMM model, which is described in Transportation Research Record 797, has been used to evaluate regional transportation plans in the Houston Transitway Alternatives Analysis. Short term, labor costs per hour are forecast to increase roughly 10% annually. These forecasts are based on inflation forecasts prepared by outside consultants.

V. Maintenance Costs

Houston has prepared a Management Information System Plan which is currently being implemented (Contact: Gunter Liebel 713-225-1151 x 630). The vehicle management system is modelled after the Chicago VMS system. Maintenance costs are forecast as a function of bus hours of service.

VI. Summary

Houston is implementing a computerized vehicle management system and intends to switch from manual scheduling to computerized RUCUS scheduling by Fall 1982. Houston is very receptive to the use of computerized financial forecasting tools to help manage the transit authority's rapid expansion of service.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Kansas City Area Transportation Authority

Contact: Ms. Fern Cole (Director of Finance);
Mr. John Dobies (Director of Systems Development and Planning)

Mailing Address: 1350 East 17th Street
Kansas City, MO 64108

Telephone Number: 816-471-6600 (Cole, X222; Dobies, X233)

Date Contacted: 2 March 1982 (Cole); 5 March 1982 (Dobies)

Case Studier: D. Damm

I. Overview

This property seems to be typical in terms of its sophistication of methods of financial forecasting and its awareness of procedures other than what they are currently using. There are the standard yearly and quinquennial projections made for the usual categories of cost and revenue items. Beyond five years, projections are made for capital budgets, i.e. acquisition of buses or facilities.

II. Revenues From Fares

The Planning Department has established elasticities which it feels represent several of it primary categories of riders (e.g. non-peak discount, suburban/peak). These numbers are used as adjuncts in a larger judgemental process which governs ridership (and therefore revenue) projections. Until the past year, they tried to project growth over five years by relying on an extrapolation of historical trends, adjusted for external factors such as gasoline shortage or the price of gasoline. In the last year, ridership has stabilized and service has been reduced, resulting in flatter projections. There has been some attempt to automate the analyses associated with these forecasts, but this was stymied when the system's fare structure was fully revamped (from a flat fare to a graduated five zonal system). Using whatever projections of annual ridership are available by route, revenues are computed by multiplying an average fare for each of the routes, adjusted for any obvious changes in service.

III. Non-Federal Governmental Revenue Sources

There is no state-level assistance provided for this property. From the 10 associated municipalities in Kansas and Missouri, 1/2 cent of sales taxes is provided to the property. This is considered an external source which cannot be predicted beyond one year.

IV. Labor Costs

Within the last year, approval was obtained for the use of part-time labor. After reviewing the literature and discussing the issue with other transit properties, the Planning Department devised a method for costing out various proportions of part-time/full time labor. Two major components in these calculations merit mention. First, the reduction in the number of pay hours resulting from the use of part-timers is computed because such workers are only paid for "platform" time, are not eligible for spread time penalties and are not paid for allowances. Second, the wage rate and benefit rate are reduced for part-timers as they are eligible only for "statutory" benefits. Using the results of these two computations, the cost savings can be determined.

For full-time workers, there is simply a projection of past years' trends, which are assumed to be fairly stable. These workers' costs are a function of the ratio of the number of hours paid over the number of platform hours actually worked. In the recent past, this ratio has been 123% and is seen to be a function of the kind of services provided (e.g. expressed by the peak to base ratio).

V. Maintenance Costs

The procedures used for these costs are quite informal; there is simply a straightline projection asjusted for inflation. Although there is access to SIMS, it is not in-house and its reports are generally slow to be generated and do not reflect very current information.

VI. Summary

Many items in the financial forecasting system warrant improvement. The two areas of greatest urgency seem to be: 1. estimation of ridership, especially incorporating a better understanding of the relationship of revenues and ridership to external factors; and 2. the effects of a change in level of service on the costs of maintenance, particularly by age and type of bus.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Southern California Rapid Transit District (SCRTD)

Contact: Joe Scatchard, Controller/Treasurer/Auditor

Mailing Address: 425 South Main Street
Los Angeles, CA 90013

Telephone Number: 213-972-6581

Date Contacted: 26 Feb 82

Case Studier: Walter H. Maling

I. Overview

Since UMTA requires submission of a 5-year plan, SCRTD annually prepares one. However, preparation of the next year's budget receives the most emphasis. Development of the 5-year plan involves a lot of assumptions about ridership, labor costs, and state and Federal funding levels. The planning process is not computerized.

II. Revenues From Fares

SCRTD is developing a monthly transit ridership model which explains transit demand as a function of the level of transit service, real gasoline and transit prices, seasonality factors, and variations in the number of working days in a month. Currently SCRTD assumes that a fare increase would reduce ridership by 1/3 to 1/2 of the percentage increase in fares. Last year SCRTD raised the cash fare from 65 to 85 cents and ridership fell 9%. SCRTD also offers monthly transit passes. This makes fare revenue estimation more difficult.

III. Non-Federal Governmental Revenue Sources

SCRTD receives revenues from a 1/4¢ sales tax levied on sales within the county. Last fall voters approved the imposition of an additional 1/2¢ sales tax with the revenues to go (1) to cities for transportation use, (2) for rail guideway planning, and (3) for SCRTD to roll back transit fares to 50¢ and hold the fare at 50¢ for 3 years. Currently the 1/2¢ sales tax legislation is being challenged before the State Supreme Court on the grounds that it did not receive a 2/3 majority which the challengers claim is required under Proposition 13. Last fall 54% of the voters approved the 1/2¢ sales tax increase which only applies to sales within the county. The measure would generate $27Ø million annually.

In Los Angeles each year, the Los Angeles County Transportation Commission forwards the county budget office's sales tax revenue forecast to SCRTD. Since this official projection tends to be overly conservative, SCRTD develops its own forecast by multiplying in the tax rate by the local retail sales forecast issued by the economics department of the Bank of America.

IV. Labor Costs

Labor cost forecasts are a function of inflation rates (CPI) and projected transit service levels (bus hours). SCRTD has hired an outside contractor to simulate the impact of work rule changes (HASTUS program marketed by ATE).

V. Maintenance Costs

SCRTD is currently installing a vehicle maintenance system (VMS) similar to Chicago's system. Maintenance costs are function on inflation rates and project service levels.

VI. Summary

SCRTD is implementing a computerized vehicle maintenance system and has been utilizing computerized models to simulate the impact of work rule changes. Budgets and 5-year plans are prepared manually; however, SCRTD is not opposed to adoption of computerized financial forecasting tools to expedite the analysis of alternative budget scenarios.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Milwaukee Transit Authority

Contacts: Karl F. Abendroth, Finance Director
Samuel R. Seward, Senior Transit Planner
Ralph Malec, Shop Foreman

Mailing Address: 4212 West Highland Boulevard
Milwaukee, WI 53208

Telephone Number: 414-344-4550
414-937-3274 (Sam Seward)

Date Contacted: 26 Feb 82

Case Studier: Walter H. Maling

I. Overview

The annual budget for the Milwaukee County Transit system is developed manually. The transit authorities budget is tied into the overall county budget. This year the county mandated a 5% cut in service levels. The planning department has responsibility for all long-range planning. They have developed a prioritized 5-year plan which includes reorganization of the transit authority.

II. Revenue From Fares

Milwaukee increased transit fares last year and total ridership fell. Currently the adult fare is 75 cents and the student fare is 50 cents. Milwaukee employs a paper ticket system. Weekly passes good for 10 rides are available for $7. Weekly student passes are also available. There has been a shift toward more use of weekly passes. The planning department analyzes the cost and revenue impacts of service changes on a case by case basis. For example, the planning department would estimate both the revenues and the costs associated with implementation of new express bus services. Service cost estimates are derived from bus mile and bus hour estimates. Milwaukee has developed bus route lookup tables which relate headway increases (decreases) to bus ridership and revenue losses (gains). Revenue forecasts are based on ridership predictions and an estimate of the average fare.

Professor Alan Horowitz of the University of Wisonsin-Milwaukee has recently submitted a university research proposal to develop a transit ridership forecasting model which will focus on bus service characteristics.

III. Non-Federal Governmental Revenue Sources

The MTA forecasts future year costs by extrapolating historic trends. The transit authority budget is prepared manually and submitted to the county for approval. If the county mandates a lower subsidy level, then the MTA has to implement employee and service level cuts. The county transit subsidy comes out of general revenues and is determined by the county board.

The MTA does not attempt to forecast state or county subsidy levels.

Beginning in 1982 the state of Wisconsin is implementing a transit assistance formula which will pick up 30% of the operating expense budget of the Milwaukee County Transit System. State transit assistance is financed out of general revenues.

IV. Labor Costs

Labor cost estimates are derived from bus hour and inflation estimates. The union contract has a cost of living clause which increases the hourly wage.

V. Maintenance Costs

Preventive maintenance is performed at regular intervals based on bus mileage (currently every 3000 miles). Milwaukee parts inventory is currently maintained manually; however, Milwaukee plans to install a computerized vehicle maintenance system modelled after Chicago's system. Currently bus maintenance costs are projected from historic trends.

VI. Summary

Milwaukee is currently planning to implement a computerized vehicle management system. Computerized ridership models have been used to investigate the implications of service reductions. Currently, the transit authority manually prepares the annual budget which is tied into the county budget. Since the county transit subsidy is decided as part of the political process, it is difficult to forecast.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Metropolitan Transit Commission (MTC)

Contact: Gregory Andrews, Director of Finance

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160 East Kellogg Boulevard
St. Paul, Minnesota 55101

Telephone Number: (612) 221-0939

Date Contacted: 4 and 11 Mar 82

Case Studier: George Anagnostopoulos

I. Overview

The ATE Management & Service Co. Inc. provides upper level management for operation of the MTC. The Director of Finance is responsible for developing the budget. A long range plan going through mid 1985 and a bi-annual budget for 83-84 were prepared for the Commission. A set of assumptions are prepared based on historical data which include: subsidies from Federal, state, and property taxes; farebox revenues; levels of service in terms of units such as veh-miles, peak hour vehicles, total miles; and ridership. An estimate of revenues from fares is made to determine the level of service that can be supported. This level of service is given to the cost center managers along with the assumptions. A detailed budget is then prepared and negotiated with the Director of Finance. This negotiated budget is then presented to the Commission along with the assumptions. The process is conducted manually by three people in the budget section. The capability does not exist to exercise budget assumptions, although the flexibility to conduct "what if" analysis is greatly desired.

Currently, the payroll system is automated, but a new gross-to-net payroll system is being installed. The payroll system derives its input from a manual time roll system. The general ledger, accounts payable, fixed assets and revenues are also automated.

II. Revenues From Fares

The present method of revenue prediction is determined by passenger type from historical data and passenger counts made by registering fareboxes, driver counts, eight ride checkers, and off-bus load checkers. The actual ridership is adjusted on the basis of a consensus of the staff and the Commission. A number of revenue models are being examined. The most promising seems to be the Seattle model. However, no model has been discovered that makes satisfactory predictions.

III. Non-Federal Governmental Revenue Sources

Projections of state subsidies are arrived at by discussions with officials in the state government. The property tax subsidy is 2 mills times the assessed valuation in seven counties. Based on discussions with the county, an assumed assessed valuation of 11% was arrived at. This is not a detailed assessment. The state department of revenue was also crossreferenced.

IV. Labor Costs

Future labor costs are predicted by assuming inflationary increases. A cost of living increase which is tied to the consumer price index is in the labor contract.

V. Maintenance Costs

Predictions of maintenance costs are determined through discussions with the cost center manager. The increase in the number of man-hours, parts, and fuel are assumed. Unit cost indicators and sampling are then applied to make the predictions.

RUCUS is currently operational. An attempt is being made to implement RUCUS with the payroll. A shop control system and an inventory control system were in the process of development. A new maintenance manager has put both of these modifications on hold until a method is determined to link these two programs. Meanwhile, the manual shop control and inventory control systems are in use.

VI. Summary

The MTC is in the process of developing the necessary models of a MIS. Maintenance has the highest priority. There is interest in obtaining the capability and flexibility to examine alternative budget assumptions.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Metropolitan Transit Authority

Contacts: Eileen Healy, Director Operations Planning
Bob Brooks, Director of Marketing & Planning

Mailing Address: P.O. Box 100270
Nashville, NT 37210

Telephone Number: 615-242-1622

Date Contacted: 8 Mar 82

Case Studier: Walter H. Maling

I. Overview

Nashville has been an ATE-managed transit authority for the past 5 years. Over those 5 years administrative cost has between reduced from 26% to 8% of the operating budget. The Metropolitan Transit Authority currently does financial planning over a 5-year time horizon. A significant planning document is prepared every second year. Federal subsidies are expected to drop from 30% of Nashville's budget this year to under 12% next year.

II. Revenues From Fares

The farebox generates approximately 42% of Nashville's operating revenues. The transit authority assumes that a fare increase would reduce transit ridership by 1/3 of the percentage increase in fares. Revenue forecasts are based on ridership predictions and an estimate of the average fare. No new transit service is planned. In the past private contractors conducted attitudinal surveys before implementation of new transit service. MTA currently uses EZDATA to analyze ride check and point check data.

III. Non-Federal Governmental Revenue Sources

The Nashville transit authority receives 25 to 26% of its budget from local revenues financed by the general fund. No forecast of local assistance is prepared, since transit is heavily dependent on political considerations. The transit authority annually submits a subsidy request to the city and explains how various subsidy levels would impact fare and service levels. The transit authority forecasts state transit aid by extrapolating past trends. The state provides a relatively stable allocation of under 2% of the budget. A local option gasoline tax of 1¢ per gallon for transportation funding has been proposed in the state legislature. The measure has passed the House, but is currently under consideration in the Senate. The 1¢ local gasoline tax would raise $3 million in Davidson County.

IV. Labor Costs

Labor costs comprise 72% of Nashville's operating costs. The 3-year union contract has a COLA clause tied to the national CPI. Currently this cost of living clause increases the hourly wage rate by $1.74. Analysis of the impacts of changing work rules is performed manually by summer interns using historical cost data over a 3 month period. Labor cost forecasts are based on inflation forecasts and projected service levels.

V. Maintenance Costs

Preventive maintenance is performed at regular intervals based on bus mileage. A computerized vehicle maintenance system records fuel, tire and maintenance activities by bus. Besides maintenance performance reporting, roadcall reports are generated summarizing roadcalls by type of incident, bus number and bus operator. Maintenance cost forecasts are based on inflation forecasts and projected service levels (bus-miles).

VI. Summary

Nashville is an ATE-managed transit authority which is receptive to adoption of computerized transit management tools.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: New York City Transit Authority

Contact: Joanne Crowley, Budget Office
Harvey Poris, Budget Office
Richie Arthur, Budget and Planning Office

Mailing Address: Office of Planning and Budget
Room 1214
25 Chapel Street
Brooklyn, New York 11201

Telephone Number: Crowley and Poris 212-330-3602
Richie Arthur 212-330-4215

Date Contacted: Crowley, 2 March 1982
Poris, 11 March 1982
Arthur, 15 March 1982

Case Studier: Tom Dooley

I. Overview

I have just scratched the surface of this large organization. The financial plan is produced by the budget office. It is a summary of the budget. The budget is based on the cost to carry on operations next year at the same level of service and staffing as this year. The budget office then cranks in salary and inflation factors. Currently each department also provides expenditure reduction options which the budget office can exercise as the budget is being balanced. The plan is approved within the organization and then goes to the city for approval. The budget and financial plan are updated quarterly as actual costs are developed. Revenues come from fares and subsidies. Out of about $1.4 billion in revenue, $.88 billion comes from fares and $.36 billion comes from regular subsidy and $.16 billion is expected from subsidies passed July 1981. Most of the old subsidies are set at the same level as the previous year and the new ones are uncertain. Most of the subsidies are outside of the NYCTA's control and forecasts of these revenues are made by the state. The NYCTA's budget people did maintain close contact with the state budget people.

Mr. Poris indicated that a recent organization change had put planning and budgeting together and that an automated system was being developed. This system would provide better tools for financial forecasting.

Mr. Poris indicated that budget reviews are conducted quarterly. A five year forecast is made; however only aggregated figures are used together with gross assumptions. My impression was that the five year forecast was not really used in planning decisions.

II. Revenues From Fares

The TA has a rule of thumb. Each nickel of fare increase will generate $50 million in revenue. Ms. Crowley said that the EIS done for the July 1981 fare increase used elasticities based on previous ridership changes and tended to confirm the rule of thumb. The projections were within .2% of actual revenues. Operating revenues are tracked continuously and weekly reports are provided for control and compared to projected revenues.

Mr. Poris stated that formulas based on past experience existed for predicting the impact on cost and revenue of such actions as closing a rapid transit line with parallel surface service or closing a token booth.

III. Non-Federal Governmental Revenue Sources

Ms. Crowley explained the state and local subsidies received by the TA. These included:

(1) Triborough Bridge Authority surplus, this amounts to about $90 million a year. The number is received from the Comptroller's office and is not based on any service supplied figure.

(2) Federal operating assistance, this amounts to $105 million. The TA has little control over this number as NY share is capped.

(3) State operating assistance from the general revenue fund is $106.7 million. This amount has been the same since 1975.

(4) NY city matching grant of $76.7 million. This amount is based on ridership and vehicle miles so is relatively predictable.

(5) New tax package based on piggyback legislation and put into a new account for Mass Transit operating assistance includes:

- (a) 1/4% on sales tax for MTA region transit,
- (b) Corporate income tax on transmission and transportation companies through NY, i.e telephone and trucking,
- (c) Unitary tax on oil companies similar to California based on world wide profits of companies in NY state,
- (d) 3/4% on gross receipts of oil and gas sold in NY state,
- (e) NY city capital gains tax on real estate transfers over $1 million.

The taxes in (5) were estimated by the State Dept of Budget, Transportation, and Finance to yield $301 million in FY82 and $492 million in FY83 of which the TA would get $168 and $327 million respectively. The taxes based on sales and receipts seem to be predictable. The other tax yields are less certain.

IV. Labor Costs

Mr. Poris indicated that methods existed for determining the impact of eliminating various routes or changing them. The TA is currently in labor negotiations. Models or procedures existed for estimating the cost of changing various work rules.

Mr. Arthur stated that the NYCTA Budget and Planning office is simulating the impact of the current management demands (and will also simulate the labor demands) as part of the current contract negotiations. The simulation involves, among other things, recutting schedules, reviewing maintenance practices, estimating the hiring, progression, and attrition rates for various job categories and estimating labor hours by type (overtime, regular time, sick etc.) from the payroll tapes. These manual simulations together with the explanations of the methodology and assumptions run 550 pages. The analysis assumes constant level of service. The TA is moving toward an automated system for budgeting and forecasting.

V. Maintenance Costs

Mr. Poris explained that maintenance costs were predicted from vehicle miles of service and a knowledge of the current age and condition of the vehicles. Given this information and the required maintenance frequency for periodic inspection and the amount of labor hours required for each periodic inspection, the quota of men (adjusted for absences and overtime) could be predicted and then costed. Corrective maintenance requirements could be predicted from repair frequencies (mean distance to failure). Parts and outside contract work used the same vmt basis. The prediction of the quota of labor required was automated in the Maintenance of Way and Rail Car Maintenance departments. The Surface Division used a manual system.

VI. Summary

Although the NYCTA has not been analyzed in detail it seems that some progress is being made. Maintenance costs seem to be predictable based on service requirements although detailed analysis of the system needs to be done. Labor work rule analysis is underway. Automation of some forecasting functions is underway. The revenue estimation procedure is not refined, although we did not review the detailed EIS models for the last fare increase.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Port Authority Trans-Hudson Corporation

Contact: Terry Byrne, Budget Office
Bob Williams, Port Authority Industrial Engineering

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Telephone Number: Byrne (212)-466-7657
Williams (201)-963-7231

Date Contacted: Byrne, 1 March 1982
Williams, 9 March 1982

Case Studier: Tom Dooley

I. Overview

PATH is part of the Port Authority of NYNJ. As such it is slightly atypical. It operates only rail service. The case is illustrative of an efficient bureaucratic organization. PATH develops ten year forecasts. Each department submits budgets with the number of manpower units required by type and any changes expected due to changes in operations, facilities or technology over the ten year period. The number of manpower units for each function is established by the industrial engineering department of the Port Authority based on detailed studies. The planning horizon and the emphasis on investment planning is characteristic of rail operations. For example, Mr. Bryne cited the conversion of manual fare collection to automatic. The transportation department would show a decrease over time of thirty station attendants and an addition of four fare collectors, while the maintenance department would show an increase in six mechanics due to the sophistication of the equipment. These manpower units would be costed by the budget department. PATH produces a basic assumptions document which is a narrative supporting both the budget and the ten year plan. This narrative would identifiy any changes from the base or budget year and show expected labor or other cost escalations.

The Port Authority industrial engineering department is responsible for forecasting the operations and maintenance costs of all new investments. They can do this because they maintain and establish an existing base of knowledge on the current cost of operations. The PA central staff has provided several off line functions which greatly assisted Mr. Byrne. These included strategic planning, comptrollership, and industrial engineering. Mr. Byrne mentioned specific examples for this support including:

analysis of the decision to either rehabilitate an old maintenance facility or build a new one (see detailed discussion of maintenance and labor costs per Mr. Williams in the appropriate section), analysis of the tradeoff between silicon rectifier or rotary motors, train scheduling simulations, manpower analysis surveys, union vs. contracted cleaning labor for a new station and cash management programs. This kind of staff support would be the envy of most transit operators.

The PATH budget is prepared manually. The accounting system is automated and designed to provide continuous monitoring of actual vs. budgeted expenditures. For example, Mr. Byrne cited that January overtime figures were out of whack. He was able to follow up this discrepancy to a lower level of responsibility and determine the cause and remedy.

II. Revenues From Fares

The PATH fare is set by the governors of NY and NJ and has remained at 30 cents for the last twenty years. Fare revenue generates $15 million out of $72 million budget. NYCTA fares are in the 70 cent range. Pressure remains to keep fare low. Annual ridership is predicted using a growth rate trend.

III. Non-Federal Governmental Revenue Sources

The PATH subsidy is from other Port Authority operations such as bridges, the World Trade center, airports, seaports, etc. As such the pressure to control costs should be quite strong from internal sources.

IV. Labor Costs

Labor costs are estimated from manpower requirements. The cost of most fringe benefits are mandated such as railroad retirement and supplemental railroad benefits. Health insurance costs are determined by PA insurance department.

The industrial engineering department at the PA is responsible for establishing manpower standards for all PA operations and for estimating the operating and maintenance costs on all new investments based on these standards and the proposed improvements.

The industrial engineering department conducted a study of the train scheduling system several years ago (Referral: Jim Brown 201-963-7231). This study involved collecting data at all signal and platform points. Test schedules were simulated and the 3 minute headways were reduced to 90 seconds using staggered dispatching.

V. Maintenance Costs

Maintenance costs are handled the same way as labor costs by Mr. Byrne. The maintenance shop provides a good example of the PATH approach. Mr. Williams explained that efficiency studies of the existing maintenance shop had been conducted using industrial engineering techniques. Each operation had been analyzed and productivities established for each function. If problems were noticed, methods of doing the job or inventory procedures were improved. An attempt was made to optimize the current operation. Time standards for each function were established. A knowledge of the maintenance requirements of the fleet was established. Thus for a given number of vehicle miles the maintenance manhour requirements can be determined. Now the maintenance department is proposing a new facility. The industrial engineering group is analyzing the cost savings from the improved efficiencies forecast for the new facility. An economic analysis of the life cycle cost of the new facility is now possible.

VI. Summary

Despite PATH being a unique situation it was an interesting discussion. We need to obtain studies from Mr. Williams to examine in detail the types of analysis done and the types of standards established. PATH is typical of many properties in that the budget is manual, analysis is done off line from the accounting system, and control is more important than forecasting. Control is more important because many of the other factors are outside of the control of the local agency. PATH is unique in that standards have been established for most functions. Forecasting is easier once a baseline is established.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Tidewater Transportation District Commission

Contact: Lee Carlson, Manager of Budget, Finance and Data Processing

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Date Contacted: 3 March 1982

Case Studier: Tom Dooley

I. Overview

Tidewater is using parts of the system developed by PMM to do payroll, dispatching and maintenance management. Detailed data is captured for those functions. Costs are estimated using bus hours and miles and the effective wage rate. The effective wage rate is the base rate plus fringes and overtime approximations, etc. The revenues were much more difficult to predict and past experience has not been a good guide. Much of the computerized data is in a data base or data file which can be manipulated. Mr. Carlson used a program called DATASCAN which enabled him to link data files together by field specification. Mr. Carlson is doing most of the analytic work himself.

II. Revenues From Fares

Fare revenue has been difficult to predict. Fares have been increased three times recently. Each time the effect on revenue has been different. Mr. Carlson felt that since TTDC has little commuting traffic, many of the riders had decided not to make trips because of weather, the economy or the fare. One example of the difficulty of predicting ridership cited was the elimination of the 10 pm run on a bus route because few people used it, while many people boarded the 9 pm run. After the 10 pm run was eliminated few people used the 9 pm run.

III. Non-Federal Governmental Revenue Sources

There are five jurisdictions which contribute property tax based revenue to cover the transit deficit. The allocation of the deficit is done using in-service vehicle hours. Apparently there is also some state gas tax revenue which is used to support TTDC.

IV. Labor Costs

Mr. Carlson indicated that costs were easy to predict. Apparently TTDC does not have a high peak to base ratio so that scheduling of drivers is fairly straightforward. The existing payroll system enabled Mr. Carlson to generate very informative and detailed data on labor costs in a matter of minutes. The FY83 budget anticipates a freeze on wages. Since the number of operators had been cut from 296 to 230 in the last two years, a wage freeze was not expected to meet much resistance.

V. Maintenance Costs

An inventory system which enabled the mechanic to find the right part and which would calculate the optimal reordering point given parts usage was in the works. This system could be used to forecast parts usage if a vehicle history file were available. Mr. Carlson indicated that the ADB buses required more parts and more expensive parts than the older buses. Thus as the fleet mix changes the cost of maintenance changes.

VI. Summary

Tidewater seems to have a system which collects a lot of data for specific purposes, such as payroll (45 operator accounts), maintenance (300 accounts), dispatching and inventory. This data can be manipulated by the Budget director to estimate costs. Revenue estimation seems to involve factors beyond the control (and current knowledge) of the transit property. Mr. Carlson was aware that more disaggregate data was needed to manage his costs (maintenance costs depend on fleet mix) and revenues more effectively, yet he was limited by resource and manpower contraints.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Central Oklahoma Transportation and Parking Authority (MASSTRANS)

Contact: John Shugart

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Date Contacted: 24 February 1982

Case Studier: Tom Dooley

I. Overview

MASSTRANS just installed TRANSPAC, the Arthur Anderson/MTD Services software package, in October 1981. They bought most of the applications including the administration package, inventory control, vehicle maintenance control, Section 15 reports and payroll. They do not have the scheduler (see Akron report). They plan to implement another enhancement to TRANSPAC called Quick Plan within the next few weeks (see labor costs).

The budget is developed from the accounting system. The accounting system can generate Section 15 reports and is also tied into the city's accounting system. Each department makes up it own budget using general guidelines provided by Mr. Shugart for salary increases, fringes, fixed costs, etc. Forecasting is done primarily from trends. Eight departments include G & A, Operations (drivers), Operations Administration (schedules), Marketing, Planning, Maintenance, and two E & H services. MASSTRANS also runs several parking garages. Each department can query the system for their own account information.

They have 5 terminals, 2 printers, a 40 Megabyte disk. Mr. Shugart was very impressed with the TRANSPAC software. It works. He said the two most important capabilities were the report generator and the Quick Plan package. The report generator enabled him to link files together to either manipulate the data for analysis or more often to generate reports as needed. He said they could write programs to operate on the data files using Quick Basic but they had not yet written any programs because they had no programmers.

II. Revenues From Fares

MASSTRANS recently raised fares. They guesstimated that total revenue would increase. They were surprised that ridership continued to grow although at only 7% rather than the 15% of last year.

TRANSPAC enables MASSTRANS to process route level data on ridership by fare and fare type. They are planning to collect trip level information.

Currently drivers are collecting data on ridership which is correlated with the Section 15 samples and the ridership estimated using an average fare (from the farebox counts). Apparently all approaches were coming out with the same numbers.

III. Non-Federal Governmental Revenue Sources

MASSTRANS currently receives 27% of its revenue from the city council. No state money is received. The city money comes from general revenues not from a dedicated tax as he would like. Thus the property has no control over this source of funds.

IV. Labor Costs

Quick Plan has a bus route costing model in it based on the model developed by Arthur Anderson in London. Quick Plan uses the data from the accounting data base to estimate the coefficients for a regression model. The model will be sensitive to service levels and peak and offpeak costs. This would be a big improvement from the ad hoc procedure used recently to estimate the cost of doubling the midday service. The TRANSPAC software gives the manager an ability to <u>tabulate</u> data, which has already been captured, in a variety of ways. Thus the various types of labor costs can be determined, such as fringe benefits, pay categories, shift differentials, etc. Questions on cost distribution could be answered within ten minutes using the report generator.

V. Maintenance Costs

Historical records are being maintained on a recent bus purchase through the TRANSPAC maintenance module. The system accumulates maintenance data off the work orders which specify parts and labor on all maintenance actions as well as the condition of the vehicle or part at the time of maintenance. These data can be aggregated by month, year to date, and vehicle life. This data can be pulled out and analyzed to determine cost as a function of bus life.

VI. Summary

Mr. Shugart was very enthusiastic about TRANSPAC's capabilities. He did not feel constrained by any prepackaged software. The level of software support and the bug free installation impressed him about this particular vendor. He had thought about his forecasting needs, especially on bus costs and felt that Quick Plan would do the job. The integration of forecasting tools with the accounting data base and the provision of file manipulation tools seemed especially appealing to this manager. Mr. Shugart will be presenting information on his system at the 1982 APTA Western Conference.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Southeastern Pennsylvania Transportation Authority (SEPTA)

Contact: George W. Miller, Controller and Treasurer

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Philadelphia, Pennsylvania 19107

Telephone Number: (215) 456-400

Date Contacted: 1 Mar 82

Case Studier: George Anagnostopoulos

I. Overview

Financial forecasting is performed annually for a three year period. The first of these is used for the budget. The process is initiated with the specification of objectives for that year which are set by the Deputy General Manager and by the department heads. That is, these objectives would be emphasized for that year of operation. For example, quality of service may be emphasized, and no bus would be allowed to leave the garage if a single component had malfunctioned, or if a bus were not washed every day and graffiti entirely removed. The financial forecast is made manually by the Controller with the help of systems analysts.

SEPTA is composed of five divisions: Operating, Planning and Construction, Railroad, Financial, and Administration. It serves five counties and the city of Philadelphia. This makes the funding and subsidy issues complex.

The accounting process which supports the budget development is manual. The general ledger system as well as the reporting system (including Section 15 data) is automated. Accounts payable is semi-automated. The inventory control system is manual. In general, the accounting system is consistent with the organization. That is, the system is not well automated and as such a great deal of work is needed to automate the system.

II. Revenue From Fares

The Revenue Model is used to make predictions of revenue subject to alternative fare assumptions. The model makes reasonable predictions using simple elasticities and the influences of fare, given a constant economy. However, it does not predict with any accuracy the influences on revenue of external factors such as the closing of a roadway or a factory.

III. Non-Federal Governmental Revenue Sources

The state subsidy is based on a funding formula. For FY82 the state provided funding for 73% of the deficit after the Federal subsidy was considered. The remaining 27% was provided by the local communities. The state and local subsidies are in reality arrived at through the political process.

The fiscal year starts on 1 July. However, the state will not decide on the subsidy until the following October. This keeps SEPTA guessing. For example, in the Governor's budget message, a 10% increase in the mass transit subsidy was suggested. Two months prior, this was indicated to be 22%.

SEPTA has not found a relationship between funding and any other parameter. In general, when the funding subsidies are finally decided and they are less than the budget SEPTA reallocates the funding and adjusts the level of service.

IV. Labor Costs

The Financial Forecasting Model deals only with labor costs. The model is used to cost alternatives for negotiations. For example, the impact on funding of changes in pension benefits was examined. Currently scheduling and dispatch are determined manually, but with some computer assistance. SEPTA is trying to implement RUCUS in such a manner so that it can be linked to the Financial Forecasting model.

V. Maintenance Costs

The SEPTA maintenance system is structured into a central depot and five district depots. The district depots are responsible for lower level maintenance and the central depot is responsible for all other, or higher level maintenance. The inventory control system at all levels is manual. An effort is under way to implement an automated inventory control system by FY83.

Maintenance data is currently aggregated by depot. Cost centers are built into the budget by district. Stock issues are made by depot. As such, SEPTA is unable to relate changes of the vehicle fleet to changes in material. That is, the material consuption for a given fleet is not known. Furthermore, changes in material consuption resulting from the introduction of a preventive maintenance program are also not known. An automated preventive maintenance program is being introduced for the new LRV's in conjunction with the inventory control system. SEPTA intends to expand this system in the future.

Predictions of maintenance costs are made through manual analysis of unit costs. Increases in costs of external factors such as oil, tires, and parts are based on historical trends.

VI. Summary

SEPTA forecasting is characterized by a manual process. As such, much time is spent in compiling data and computing a budget. There is substantial interest in the availability of financial forecasting tools. It is thought that the finance and accounting side of the house should play a limited role in developing the budget, rather; the operations side should do the budget planning. Obtaining better estimates of external factors is particularly important. This is considered to be particularly difficult, especially in trying to predict the influence of policy changes over the short run.

The need for a maintenance control system that can maintain individual vehicle performance is recognized. This development is given a high priority.

CASE STUDIES OF FINANCIAL FORECASTING

Property: Sacramento Regional Transit District (RT)

Contact: Bill Strong

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Sacramento, California 95810

Telephone Number: (916) 444-7591

Date Contacted: 25 Feb 82

Case Investigator: George Anagnostopoulos

I. Overview

Financial forecasting at the RT is a bottoms up manual process that uses information from a MIS. Although a financial planning model exists, it is not used since it does not include all important factors and as a result does not make sufficiently accurate predictions. A five year Transit Development Plan (TDA) is generated annually, but the RT does not have much confidence in projections beyond two years.

The forecasting and budgeting process is initiated with a broad set of goals and objectives provided by the Board of Directors and the General Manager. For example, make the service more efficient with no expansion. This is translated into a budget by the Director of Planning, Budgeting, and Administration. A document packet is prepared for each of 18 responsibility centers. The directors of each department form specific program and operating goals, determine the associated costs, and justify each line item within the budget constraints. These are iteratively reviewed internally and finally reviewed with the Board.

Sacramento's MIS is called the Performance Indicator Reporting System (PIRS). Some 40 performance indicators were developed including income and expense per hour and mile, subsidy and farebox recovery analysis, passengers, and driver attendance and cancellations. For each indicator, a responsibility center, or area of operations, was identified in which information on a particular performance indicator could be captured and reported to the individuals held responsible for seeing that area of activity performed on a daily basis. The distribution and frequency of report generation on an annual, quarterly, monthly, weekly, or daily basis was determined. An analysis of this information explaining trends and deviations from expected trends is also provided.

Section 15 reporting requirements were a contributing factor to installation of PIRS. The RT's Management System Plan called for the development of a new financial management information system. Installation of financial performance indicators in PIRS enabled the RT to meet both the Secton 15 financial reporting requirements and the internal reporting requirements related to the general ledger planning and accounting, payroll, personnel and labor distribution, budget development, and operator timekeeping.

PIRS, however, was not well organized and integrated. Currently the RT is building a program to aggregate payroll and integrate the budget with payroll.

II. Revenue From Fares

The RT is currently investigating route restructuring. They are considering a major revamping of 60% of the routes in the northeast area. A ridership statistics model was used to investigate this restructuring. In estimating revenue the SRTD uses the Simpson & Curtin rule but with adjustments for economic conditions. A revised ridership estimate has been prepared for the next 5 years. The estimate is reduced substantially from previous estimates. It is based on the last seven months of actual farebox revenues, automatic farebox data, ridechecks, and corner counts. No growth factor has been included for the next four years. This is a result of a 15% reduction in ridership from last year.

The Board, in an unprecedented move, has adopted a five year fare structure. This has been done in conjunction with the five year Transit Development Plan which will be completed in June. At that time the board will vote to adopt a budget for the next five years. An attempt is being made to develop the Transit Development Plan into a management tool. This is an expansion of PIRS which provided reports of operations, but does not provide marketing and administration functions.

III. Non-Federal Governmental Subsidies

The Transit Development Act money provided by the state accounts for 25-30% of the budget. Substantial cuts in Section 5 monies has resulted in a 16 million dollar shortfall. This means that there will be an increase in fares and an accompanying reduction in service to meet the budget constraint. No predictions of subsidies are made.

IV. Labor Costs

RT has developed a new labor cost model that is integrated with the budget and payroll. It determines the labor costs based on the known hours of service by each type and pay category broken down to a detailed level. The model has the ability to consider such elements as absenteeism, sick days and holidays. It has been used to examine work rule changes for labor negotiations. (An examination has been made of 125 items.) To insure that labor forecasts do not influence labor negotiations, a straight line forecast is included in the TDP five-year budget. A contingency fund is set up to account for salary increases. It is planned to integrate RUCUS with the labor cost model to provide the capability to input changes in the level of service. In addition, a new benefits plan and an affirmative action plan is being developed.

V. Maintenance Costs

The maintenance costs are currently predicted manually using a unit cost model with inputs from a manual work order system, and a manual inventory control system, and PIRS. Some vehicle history data is currently maintained. Each bus undergoes maintenance on a fixed three and six thousand mile cycle.

The prediction of increases in the cost of external factors is difficult and of particular concern. For example, the cost of parts has been increasing annually at an average rate of 20 to 25 percent, and for the 30 most frequently used parts from 3 to 60 percent.

Sacramento is a member of the Western Transit Maintenance Consortium which is developing a Maintenance/Inventory System. However, there is a need to do something as an interim measure. The inventory control and the maintenance management system is burdensome.

The Maintenance/Inventory System is being designed to provide timely information for maintenance and inventory control. It consists of seven major functions: Preventive maintenance, work order, inventory management, status tracking, failure monitoring, planning, and management reporting. These functions are integrated to provide monitoring, control, and reporting.

VI. Summary

A well organized bottoms up manual trend analysis is used to develop financial forecasts. A MIS is used to derive input data. A labor cost model was developed and used to examine some 125 items for recent labor negotiations. The model will be integrated with RUCUS to provide the ability to simulate labor costs. The maintenance and inventory control systems are manual and use extensive resources. Because of this, an interim solution to the Maintenance/Inventory System being developed by the Western Consortium is being sought.

This property is keenly interested in the development of automated financial forecasting tools that would facilitate this process.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Utah Transit Authority

Contact: Charles Preston

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Salt Lake City, UT 84111

Telephone Number: 8Ø5-262-5626

Date Contacted: 5 March 1982

Case Studier: Tom Dooley

I. Overview

A five year budget is developed. The budget is developed based on miles of service. Vehicle miles are used by the maintenance department to estimate parts, and preventive and corrective maintenance time. Vehicle miles are used by the operations department to estimate the number of operators. A large MIS was not approved by the Board; however, recent evidence suggests that RUCUS and a microcomputer based maintenance system will be implemented.

II. Revenues From Fares

Revenues are predicted using last year's figures. Mr. Preston thinks a fare increase beyond the current 5Ø cent fare would cause a loss in revenue. This was determined from direct surveys (how much would you pay for this ride?) and regression analysis of historical data. Given the same amount of service, he predicts a loss of ridership for this year.

III. Non-Federal Governmental Revenue Sources

UTA currently receives 1/4 cent of the state sales tax revenue. Estimates of this revenue are done by the regional planning council and the state university. Mr. Preston believes that a larger tax is needed to offset the loss in Federal operating assistance. The UTA will be going to the legislature to get its approval to have a referendum on the issue.

IV. Labor Costs

Mr. Preston stated that labor cost estimation was not a problem. UTA was running the same routes as last year and a recent labor contract was signed with no raises. RUCUS would be used to improve efficiency. The labor contract also allowed a 16 hour spread and a large extra board of part time labor which could be used in the peak.

V. Maintenance Costs

Mr. Preston is the director of maintenance. The maintenance department is applying for an UMTA grant for two TRS-80's, a disk, 5 terminals and a data base management system. They have currently developed a system using a standard statistical package and a service bureau which can be converted to the micro at a large cost saving. They have 50 "New Look" buses on which they are keeping maintenance history data. Work orders on each bus are recorded. This can be used to develop trends. As a matter of fact, they hope to use the new system to show the maintenance problems with their AMG 1976 buses which they are trying to replace. The TRS-80 sytem will be menu driven. They currently have an inventory system they developed using American Trucking Association codes. Mr. Preston said that the hardest part of the budget to estimate was the cost for parts which seemed to be escalating at 30-50% a year.

VI. Summary

Since service levels are not changing rapidly at this property, operator costs are easy to predict. Fare elasticities have been estimated. In maintenance, control of cost rather then estimation is important. A microcomputer system is being set up to manage inventory and vehicle history data. Similarly, the emphasis in operations (via RUCUS and the labor contract) seems to be on cost control procedures rather than estimation.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: San Diego Transit Corp.

Contact: R.H. Yagua, Director of Finance and Administration

Dan Ikenberg

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Telephone Number: (714) 238-0100

Date Contacted: 3 and 12 Feb. 82

Case Studier: George Anagnostopoulos

I. Overview

The process of financial forecasting is basically a manual process with some inputs from automated modules. Budgeting is performed annually. A set of assumptions including items such as level of service, fare structure, and vehicle-miles was determined. The principal constraint was to hold the level of service constant. The utility commission was contacted to obtain its estimate of the cost increase of power. A projection of the interest rate of inflation was obtained from local banks. An estimate was made of the UMTA and state support based on discussion with state and Federal officials. This support breaks down into approximately 20% Federal, and 30% state. A preliminary run through the budget was made manually to find the bottom line. This included inflationary increases. An updated schedule was obtained from RUCUS by an outside bureau. A budget package is then prepared for each department manager. They in turn prepare a detailed budget within the inflation constraints. Each manager then negotiates a budget with the Director of Finance and Administration. The General Manager and the Director of Finance and Administration decide on the final fare structure.

All work sheets including assumptions are reviewed by the Board and staff prior to submission to the City Council and the Department of Financial Management. A careful review is made by each agency with particular emphasis on assumptions.

San Diego has implemented a data base management system that supports the general ledger, accounts payable, payroll, personnel, labor distribution, and fare revenue models.

II. Revenues From Fares

Revenue prediction is considered to be an art not a science. The process is initiated with 0.3 elasticity to determine if this assumption is valid. Although a fare revenue model exists, it is not sufficiently accurate, and is therefore not used other than for a preliminary indication. Historical data is used to predict changes on an aggregate basis.

III. Non-Federal Governmental Revenue Sources

The primary source of predictions is periodic projections and discussion with the state. The state subsidy is based on a sales tax. A local share of $200,000 was provided to subsidize senior saver passes. The latter is based more on political considerations. Out of a budget of $35M this is too small to give it much attention.

IV. Labor Costs

A labor distribution model which is linked to the data base accumulates hours by pay code, sick leave, holidays, etc. This is detailed down to the level of even separating instructor and student hours. Inflation factors are input into the model and labor assumptions are examined. Apparently this labor cost accounting system provides an adequate prediction of labor costs. However, a more automated budget procedure is desirable.

V. Maintenance Costs

A computerized inventory control system that is an automated version of the manual CARDEX system has been implemented. This development effort was completely internal. This system shows the present inventory and which parts are critical, i.e. which parts are in short supply and must be reordered. The inventory control system does not predict the future cost of parts.

The maintenance management system is manual. Unit costs are used to predict changes in maintenance costs.

VI. Summary

Financial forecasting is characterized as a manual process with inputs from automated modules of an MIS. Predictions of revenue and maintenance costs need to be performed significantly better. External factors are not considered to be amenable to accurate prediction over the short run. However, a model that could provide assistance in examining sensitivities would be a significant advance.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Municipal Railway of San Francisco (MUNI)

Contact: Mr. Bruce Bernhard

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Telephone Number: 415-558-5346

Date Contacted: 4 March 1982

Case Studier: D. Damm

I. Overview

Projections are made for both one and five years. MUNI is part of the Public Utilities Commission(PUC) within the city and county government and as such, submits a proposed budget for the coming fiscal year each January to the PUC; this is followed by the Mayor's review and then the local government's Board of Supervisors review. Approval is generally obtained in August (a month after the new fiscal year has begun). The dominant actors in the process of generating the proposed budget change each year, though there now seems to be a standard procedure within MUNI. For FY 81-82, each of the 63 budget units in MUNI were asked to prepare estimates for their particular budgets. These estimates were then used to aggregate to larger organizational units and provided a basis for negotiation. For FY 82-83, each of the 63 units were requested to identify any changes in the prior year's numbers, which were in turn analyzed in the Budget Department and presented to the General Director.

Projections for five years are necessary to meet the Metropolitan Transportation Commission's (MTC's) requirement and these are updated annually. There are five steps in this process. First, changes in the number of vehicle hours of service which are anticipated are identified in the previous plan and then second, used to estimate the changes in percentages of each division's costs. Third, the costs from each division are aggregated and an overall projection of costs made. Fourth, projections of known sources of revenue are computed. Finally, costs and revenues are compared to project the overall deficit.

As distinct from costs, there are a number of special categories of revenues which bear enumeration, and are grouped into the classes of external and internal. Comprising "external" are: Section 5 support, 1/2 cent sales tax allocated to MUNI annually from MTC, and an allocation from the State of California from the general 6% sales tax (see section III below). In the "internal" category fall: 10% of the County's general fund (which derives from taxes on property, gross receipts, payrolls and hotels) and farebox collections.

II. Revenues From Fares

Projections are based on elasticities derived from a large-scale telephone survey of households in 1980. Separate elasticities were computed for "adults" and for "seniors" to predict the losses in ridership with the doubling of fares and the resulting revenues which could be expected. The same elasticities were employed again in 1982 to estimate the revenues anticipated after fares are raised 20% in April. In general, these kinds of predictions are felt to be adequate because most riders are perceived as transit-dependent. It would appear that fares may need to be raised in two year cycles, because the State of California mandates that recovery ratios of 33% be maintained if transit properties want to receive their share of the 1/2 cent sales tax revenues. For five year projections of farebox revenues, adjustments are made for changes in the real prices of alternative modes.

III. Non-Federal Governmental Revenue Sources

One quarter of the 6 cents in sales tax the State of California collects within each county is returned to the counties for use in meeting transit-related expenses (though non-transit transportation expenses are also eligible after certain tests have been met). Projections of this source, which is allocated through MTC, are very difficult to make beyond one year.

IV. Labor Costs

This is currently done on an "ad-hoc" basis. Each year the head of the Analysis Unit in the Budget Section (Mr. Bernhard now) sits in on a committee to cost out various labor-related proposals. Changes in the wage rates are straightforward to analyze, but most other contract provisions require a more roundabout procedure. For example, the amount of overtime and number of part-time laborers needed are approached by making indirect use of the RUCUS package. At this time, RUCUS cannot handle the analysis of both part-time and full time labor simultaneously; as a result, modifications and adjustments are necessary before the actual estimate of effect can be produced.

V. Maintenance Costs

For the annual projections, there are formulas for the three primary factors of equipment, maintenance and labor which were developed by the Urban Transportation Development Corporation of Toronto, Canada in 1977. These formulas set standards for various procedures and establish labor inputs for each category so that forecasts can be made. Two factors dominate the annual forecasts: vehicle mileage and the number of vehicles in service by mode (5 in all). For the quinquennial projections, gross estimates are developed by interviewing the managers of the various maintenance operations about their estimates of how many categories will vary with changes in the level of service provided and by how much. MUNI began to develop a history of all vehicles in its system in 1977 and expects to make increased use of this history since it is stored in computer-accessible form.

VI. Summary

Over the last few years many organizational changes have occurred in MUNI; for example, the analytical and budgetary functions were consolidated into a single office and new staff were hired. The current trend is therefore one of streamlining and innovating where feasible; the climate is quite ripe for improved methods of financial forecasting. In addition, several departments in MUNI make regular use of micro-computers. The two areas of highest priority in the analysis of the budget at MUNI are: automating projections of needs for the vehicle operator budget and computing formulas so that they could be extended to include costs of maintenance and supplies as well as supervision.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Santa Clara County Transportation Agency

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408-299-2362 (Bachman)

Date Contacted: 1 March 1982

Case Studier: D. Damm

I. Overview

There are two parallel tasks related to financial forecasting in this property: preparation of the annual budget and generation of a five year plan. Obviously, these two tasks are interrelated. A committee composed of representatives of the various operating divisions coordinates each task, conducted in an iterative fashion. In November of each year, estimates of service levels and capital needs are made based on last year's totals. Revisions are then undertaken with respect to more current information from whatever sources. Using a computer model, projections out to five years hence are made using different sets of assumptions. In any case, costs and revenues must be balanced at the end of the five year planning period. By February, an operating budget should be ready. Since transit operations constitute the bulk of the agency's revenues and expenses, Mr. Lightbody's group takes on much of the work associated with producing the numbers upon which the budget and five year projections are based. On the cost side there appear to be only a very limited number of data of any type. It is considered good if accurate cost data can be obtained for quite broad categories (such as "coach operations").

II. Revenues From Fares

These projections are adjusted annually, depending on new information. In general, service (as measured by hours and miles) is projected for a year. Ridership figures are obtained by assuming an average number of riders per hour and then multiplied by an assumed average fare. Scenarios are played out by varying the number of riders per hour and/or the average fare. Currently, elasticities are not used to make predictions about riders' reactions to changes in the fare. There is a good deal of interest in improving the method of predicting ridership and revenues.

III. Non-Federal Governmental Revenue Sources

At the local level, tax revenues channeled to this property are a function of retail sales. As a result, projections are made for the growth in aggregate taxable sales in the County. Rather than develop a detailed, complex model of all the factors which may influence future levels of sales, past rates of increase are simply projected on a straightline curve, both for one and for five year periods. Of course, variations in the rate of inflation are taken into account to produce projections of the real growth expected to occur. As a rule, estimates for future periods are made conservatively, such that revenues from local sales taxes are often underestimated, but are still accurate enough to make more complicated methods unnecessary. With respect to revenues from the State of California, numbers for future years are assumed rather than projected, because the dominant variables are political in nature and not subject to any quantitative analysis.

IV. Labor Costs

See section VI

V. Maintenance Costs

See section VI

VI. Summary

On the cost side, projections are made on extremely gross levels. Items are judged to be either fixed or variable, and if variable, allocated to the sub-categories of hours, miles or peak buses in service. It would seem that particulars of labor or maintenance costs are difficult to establish for projections. An additional constraint in making financial forecasts derives from the county's system of budgeting, which forces the people in transit operations to format the data they collect in ways which are not conducive to financial planning of detailed items.

The two areas of greatest need are as follows. First, it would be of considerable help if revenues could be projected from changes in the fare charged. Second, capability should be developed to predict the effects of variations in labor contracts and of the use of stand-in vehicles when breakdowns occur.

It should be noted that this agency is multi-modal and is embedded within the county's governmental structure. As a result, the needs of the transit section with respect to financial data do not always mesh with the requirements of the county government. Further automation and systematizing of this property's financial forecasting capabilities may be hampered less by the quality of the data or sophistication of the methods than the reporting requirements of its organization.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Seattle Metro

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Case Studier: D. Damm

I. Overview

Mr. Smith's Budget Division within the Financial Department of METRO prepares a document annually which represents their best estimates of what may be spent for the next fiscal year. Although the process by which this document is produced varies from year to year (depending on the politics of the situation), there are some regularities. The Budget Division begins with numbers from the current fiscal year and extrapolates and adjusts each according to the best information they have at hand about next year's conditions. "Targets" for each of METRO's organizational units are then generated based on predetermined formulas and sent to each division for review and comment. The final figures are, of course, subject to negotiation among the divisions. Major cost and revenue items within the budget are nonetheless easily identifiable. On the cost side, there are: fuel(diesel), unionized labor, non-unionized labor and "other." Inflation and changes in the costs of living are also factored into the cost side. With respect to revenue, there are: fares, other operating revenues, Section 5 subsidies, sales tax, motor vehicle excise tax, and a miscellaneous set. Seattle METRO also has made projections to 1990 for the purpose of understanding longer term costs and revenues associated with service expansion and capital developments. The process of making these projections is currently undergoing review. In general, financial forecasting is conducted manually.

II. Revenues From Fares

About one third of METRO's revenues accrue from the farebox (with most of the rest coming from a local sales tax and a share of the state's automobile excise tax). The basis for prediction of future fare-derived revenues is a mixture of assumptions about the number of riders and about the elasticities which will govern shifts in ridership when fares change. Elasticities are simply taken from "the literature." To begin with, the Planning Department's model for ridership is used, based on projected employment and prices for gasoline in the region. The projected ridership is simply multiplied by an assumed "average fare" to get projected revenues. Recently, projections have been made which reflect differentiation of ridership by type of fare paid, such that elasticities may be applied by type of rider (or "market segment") in order to get more precise estimates if increases in fares are anticipated. Revenues from fares can be projected into the future indefinitely since the Budget Division assumes that fares will roughly keep pace with inflation.

III. Non-Federal Governmental Revenue Sources

Of the four detailed budget-related items outlined here, this is clearly the one analyzed most informally. The automobile excise tax is, in effect, a refund to METRO of a state tax, dependent on the level of automobile sales in King County in a calendar year. It is 1% of the fair market value of all vehicles registered in King County. [There is also a state-level refund of utilities taxes, related to the number of customers served by sewers, the other part of METRO's responsibilities. This is of minor consequence.] Projections of state-level revenues are made by extrapolating from past trends, while taking into account inflation and the health of the regional economy (based on what local economists are saying).

IV. Labor Costs

This appears to be the area in which the most innovative and systematic analyses have been performed. Mr. Smith was the primary analyst developing predictions of costs with respect to different work rules and wage progressions. A task force was set up prior to the expiration of the local union's contract to evaluate alternative provisions. For example, it was proposed that the current method of run allocation be switched from "blocking" to "open-pick." A model was constructed to figure the number of full time drivers needed to run the number of pieces of work available; the remainder of jobs were allocated to part-time drivers. Costs were then figured by multiplying the wage rates times the number of hours, plus benefits. While single contract provisions have been analyzed thoroughly, there is still a need to develop procedures for extrapolating from particular work rules to the full system of labor costs.

V. Maintenance Costs

Seattle METRO has an excellent base of data with which to track these costs. Since the early 1970's it has kept a history of all vehicles in its system. Using ARMS (accounting resource management system), they record all costs of operating their business by noting down a unique project number for each vehicle and over time, using this number every time any maintenance is performed on the vehicle. At the same time, there are a large number of tasks which may be performed and each task is assigned a unique number to be recorded when maintenance work is done. Since the costs for labor and for parts is obviously also noted down, METRO staff can easily determine any variety of aggregate or disaggregate costs. For example, they can compute the number of brake jobs over a specified period of time or the mean time between repairs for a fleet of buses or the performance of a particular crew over time. In terms of the budget, the two primary factors of interest are "mileage on coaches" and "operating hours" per year; average costs for labor and for parts are calculated for each of the tasks which are usually performed. These costs, together with those for fuel and preventive maintenance and inspections comprise the totals used for the baseline and forecasts. It is noteworthy that attention is paid to the fact that maintenance costs vary by the mix of fleets (type of bus, manufacturer and model). For example, a growing proportion of METRO's fleet is composed of articulated buses whose operating costs are typically higher than standard buses.

Seattle METRO is part of a consortium of western U.S. transit properties which recently formed to pool their knowledge of maintenance.

VI. Summary

The procedures used in Seattle are only partially automated. Individual parts of the financial forecasting system are based on "models" which lend themselves partially to formal, computer-oriented methods. However, two reservations should be stated. First, the process in Seattle, as in most places, is subject to considerable qualitative, non-quantifiable negotiation. Second, there appears to be only limited capacity to link the forecasts made in various departments in meaningful ways, such that a computer-aided "system" could be developed. In spite of these reservations, there is surely good potential in this property for further systematizing of the way financial forecasts are generated.

CASE STUDIES OF FINANCIAL FORECASTING IN TRANSIT

Property: Washington Metropolitan Area Transit Authority (WMATA)

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Carl Green, Accounting Office
Gus Shindle, Budget Office

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Date Contacted: Benewitz 24 February 1982
Green 2 March 1982 and Shindle 2 March 1982

Case Studier: Tom Dooley

I. Overview

Mr. Benewitz stated that WMATA uses the PMM model developed as part of the "Alternatives Analysis" for the financial forecasting. This is the Holec model; Total cost= unit cost x productivity factor x number of units supplied x burden rates. Apparently WMATA is currently negotiating with PMM for a mechanized implementation of the model at a detailed (subaccount) level. This would replace their current manual approach. Benewitz said they estimated within $4 million out of a $300 million budget using this approach last year. The Holec model would probably require recalibration for significant service changes. Mr. Shindle pointed out that the ratio of payhours to platform hours changed from 1.33 to 1.18 at one garage after new rail service was initiated because the buses now all terminated their trips in the same spot. Mr. Benewitz stated that WMATA uses extensive feedback of actual expenditures versus the budget for management control.

Mr. Green provided a description of the link between the budget and the actual. Each cost center prepares its own budget based on the number of pay hours and the pay rate. The budget review process resolves differences. When the work is done the labor charges are captured on either driver manifests, time cards, or time sheets which go into the payroll system to enable people to be paid. The pay information is entered on the general ledger system to determine actual figures which are then automatically compared (monthly) to the budgeted figures. WMATA is currently implementing a new MIS system (from Management

Science America, Inc) for their general ledger, budget, obligations, and accounts payable. The accounts payable file is done manually at this time. The new MIS would also convert from batch to screen input. The current payroll system captures the driver information required by Section 15 (time by pay categories) which can be analyzed by the budget office. The current maintenance system captures only direct labor and parts charges off the vehicle work orders. Apparently the vehicle maintenance system serves the needs of maintenance but not accounting.

Mr. Shindle described the very elaborate models used by WMATA in allocating costs and revenue for the purpose of obtaining local subsidies. These models are not extensively used for prediction in that costs are fairly well understood in the static situation and revenue estimation is supported by an extensive knowledge of passenger origins and destinations and the fare between them.

II. Revenues From Fares

Mr. Shindle described how the revenue allocation program was used in revenue forecasting. The origin to destination fare and interchange matrices developed for revenue allocation are used together with elasticities (resistance factors) to predict ridership changes. Exogenous factors such as parking costs, modal alternatives and gas prices are not included.

III. Non-Federal Governmental Revenue Sources

WMATA receives subsidies from eight jurisdictions within the DC metropolitan area. The cost allocation models they have developed are worth mentioning because they have attempted to capture the cost and sales of service on a trip level basis, with the difference being the subsidy which amounts to 35-40% of total revenue. Rail deficits are paid as a function of each juridiction's proportion of ridership, population and population density and the number of stations. Bus costs are allocated as follows: total reported costs are determined to be a function of miles, hours, or peak buses and aggregated accordingly by the accounting system. Each bus trip is dedicated to one or more jurisdictions. The bus hours, miles and peak buses delivered to each jurisdiction are totaled and then the total costs are allocated based on each jurisdiction's proportion of service supplied. Since each jurisdiction can request more or less service whenever they want, WMATA has a series of computer programs to do this allocation over 16800 daily bus trips. While this is not a predictor of costs, the allocation model captures the marginal cost of peak service by including deadhead and layover time and peak buses in the amount of service provided. Fares are set by each jurisdiction. Since revenue cannot by counted for each trip, passengers are surveyed on board to create a passenger interchange table of on-offs and a fare matrix table (related to average fare since passengers are also asked how they paid). Revenue counts are monitored weekly, and any variance calls for a new survey. The difference between the allocated revenue and the allocated costs is the required jurisdictional subsidy.

IV. Labor Costs

Mr. Shindle stated that no specific programs existed for analyzing work rule provisions. Changes in contract provisions are added on a percentage basis and indices are used to project COLA changes. Run cutting is done manually. Overhead costs are averaged throughout the system even though it is known that differences exist. WMATA will be relying on the PMM models to predict labor costs. These models are good at isolating wage rates from service levels from productivity measures but they are predicting the future based on the past productivities. Changes in service structure or technology may not be explicitly captured.

V. Maintenance Costs

Mr. Green mentioned that a vehicle maintenance reporting system (VMRS) existed. A recent reorganization will create eight bus divisions which will operate as separate cost centers. These bus divisions will do light maintenance. Heavy bus maintenance shops will also exist. The VMRS captures only direct labor and parts charges. As such it creates a problem for accounting and for maintenance to accurately forecast their costs. Mr. Benewitz indicated that one of WMATA's problems was the lack of rate books from the manufactures. Rate books tell how long it should take to repair something and would provide a standard for the VMRS. A review of the maintenance system will be conducted in the near future.

VI. Summary

WMATA's situation highlights the need for an integrated system. While many of the aspects of a financial planning system are there, or will be there with the PMM implementation, they have not been linked together. The pressing problem of jurisdictional subsidy has resulted in a cost allocation scheme which provides valuable insight; the question is how can it "automatically" be used for forecasting? The WMATA experience also illustrated the need for a disaggregated model because they had several experiences when the structure of the system changed and the past aggregated measures or models needed to be revised. This need was identified by the good use of feedback between the actual and the budget, which is another important aspect in financial planning.

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16. Abstract

This report describes the results of discussions with approximately two dozen transit operators concerning the use of financial forecasting techniques for planning and budgeting. Four major budget categories were examined: fare revenues, labor costs, maintenance costs, and subsidies. Although several properties are developing improved and innovative forecasting procedures, in general there is great potential for increasing the efficiency and effectiveness of financial forecasting in the transit industry. A major issue is the improvement of coordination and cooperation among the departments of a property in the generation and use of data for forecasting purposes.

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