Billing and Accounting by Use of a Computerized Data Reporting System: The Iowa Experience

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The allocation of costs and establishment of billing rates have become complex and time-consuming for transportation providers due to the variation of funding agency requirements and limitations of transit administrative processes. Many transit systems are developing management information systems to aid them in these efforts. A computer-based, comprehensive transit information system has been developed, tested, and implemented in 23 of Iowa's 33 transit properties. This system, known as the Uniform Data Management System (UDMS), is completely consistent with the Section 15 process established by the Urban Mass Transportation Act of 1964. UDMS is an integrated financial and nonfinancial system that is an accounting and management process first and a reporting system second. It is flexible enough to accommodate social service and local conditions. Due to the extent and variety of information available from UDMS, a wide range of cost-allocation and billing-rate variables are available. The selection and use of this information constitute a valuable, locally determined tool. UDMS information can play a vitally important role in the negotiation of service contracts. Transit managers need reliable service and financial data before, during, and after entering into contractual arrangements. Good information is the key to sound decision making and, ultimately, a better transportation system.

How does a transit manager know if he or she is fulfilling the mission of the transit system? How does the director of a transit funding agency know if the program objectives or contract conditions are being met? The answer to both questions is information.

Greater emphasis is now being placed on sound management and increased productivity. Arthur E. Teele, Jr., Urban Mass Transportation Administrator, recently said, "We think a hard-nosed business standard should be applied to transit management." It is essential that accurate and appropriate information be the basis for the decisions facing public transportation in the next five years. Equally important is the need to have the same information used by all parties involved. Common solutions can only be derived from a common recognition of conditions and trends.

However, in an attempt to gain various pieces of information from transit operators and planners, it became evident that several problems existed:

1. Wide variation in accounting systems and/or lack of various accounting practices,
2. Various definitions for the same terms,
3. Lack of a central source of data on any given operation,
4. Inability of decision makers to establish rational policies due to lack of information,
5. Difficulty in monitoring the progress of various operations, and
6. Inability to compare or tabulate transit data among various systems and operations with confidence.

To overcome the shortcomings resulting from inadequate information and use existing programs and resources to the maximum, several major concepts needed to be formulated. Foremost among these concepts was the overall structure. Fine-tuning small elements of the existing process would not cure the infirmity but only treat the symptoms.

The concept of Iowa's Uniform Data Management System (UDMS) is that single administrative transit agencies (in regional and urban areas), with the assistance and cooperation of transit providers and other appropriate sources, will compile the necessary data. These data would serve as a common basis used by all parties for all purposes: planning, programming, project development, grant application, bookkeeping, cost allocation, billing, fiscal accountability, program and service accountability, and system monitoring.

UDMS has several characteristics that, taken in combination, make the system unique.

1. Computer-based--A single, central computer is being used initially to minimize costs, allow for small computer advances and cost stabilization, and ensure uniformity of processing.
2. Section 15 (Urban Mass Transportation Act of 1964, as amended)--The process is being completely based on, and made compatible in all ways with, the national Section 15 definitions, procedures, and formats (1).
3. Expandable system--Iowa's system has been designed to accommodate and give detail for non-U.S. Department of Transportation (DOT) funding agencies and programs.
4. Flexible approaches--The system allows for the specific tailoring of UDMS to local structures and relationships. The basic chart of accounts and nonfinancial features are detailed for local conditions.
5. Low paper-handling process--Computer input can be keypunched directly from local source documentation (e.g., check copies and driver trip sheets).
6. Local management information system--UDMS is, first, a local accounting and management system, and, second, a reporting system.

AVAILABLE INFORMATION IN UDMS

The Iowa UDMS is basically three interrelated elements: (a) data items (financial and nonfinancial), (b) transit mode, and (c) geographic subarea or units (departments). These elements can be thought of as the length, height, and width of a "cube" (see Figure 1). Each side of the cube is broken down into small segments. Influencing this cube are the following: (a) accounting practices, (b) procedures and definitions, (c) the size and characteristics of the transit system, and (d) special information needs. Individual, small blocks of the cube can represent data as simple as one number or as complex as an extensive matrix.

In summary, UDMS output is the detailing of each of the small blocks of the cube. Thus, all combinations of the following are possible output:

1. Data items--Financial (assets, liabilities, capital, and expenses) and nonfinancial (facilities and equipment, employees, maintenance and fuel, safety, service, passengers, and time);
2. Mode--Motor bus, demand-responsive service (other modes are available but not used in Iowa); and
3. Department--Locally determined set of areas, subcontractors, or operations (when summed, they represent the entire system).

Figure 2 shows the maximum array of small information units (blocks) used in Iowa. Iowa City Transit has an elderly and handicapped service component as well as its regular fixed-route service (one department and two modes). Note the differ-

Figure 1. UDMS conceptual elements.

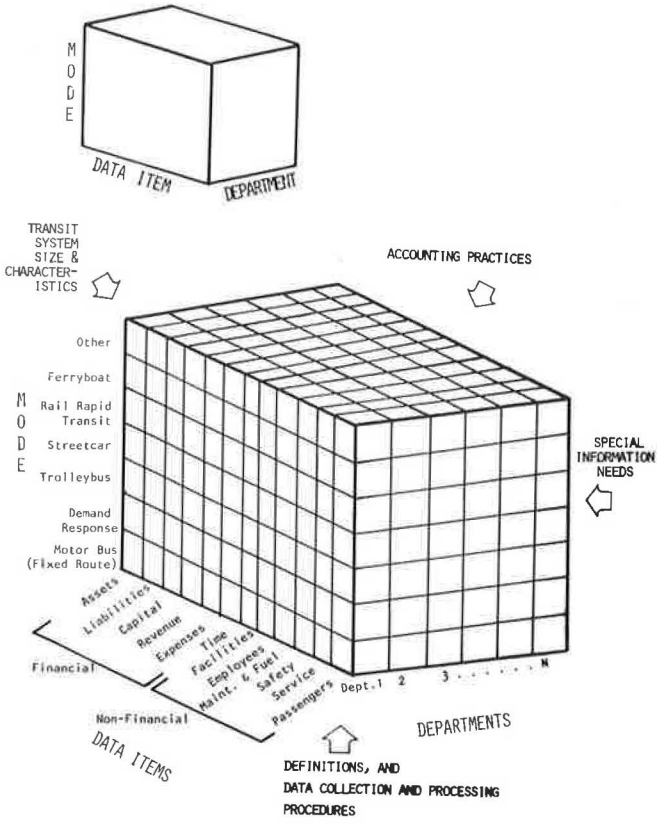
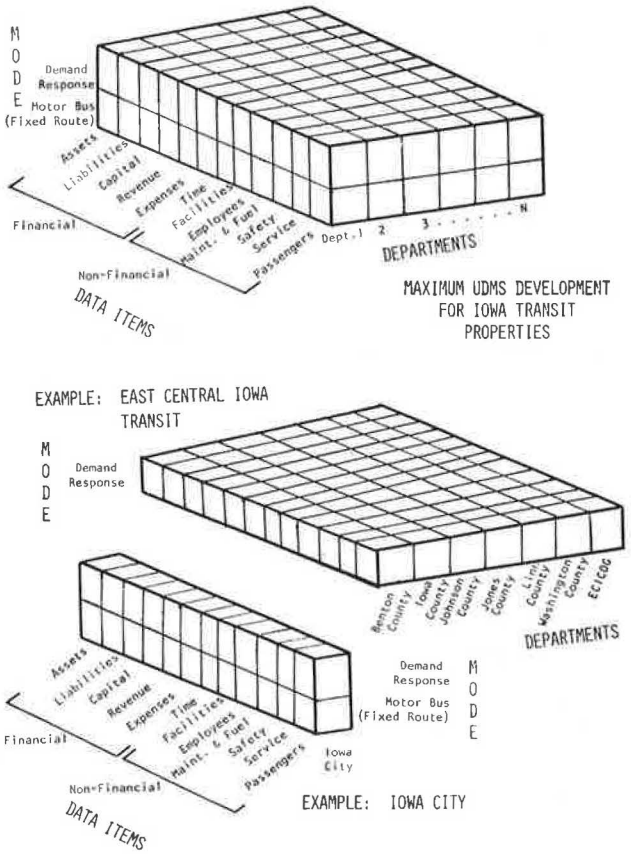


Figure 2. UDMS elements in Iowa.



ences of the regional transit property, the East Central Iowa Transit System, with its one mode and seven departments (six counties and the central administrative function).

Financial Data Items

While department and mode designation is simple, the detailing of data items is complex. The financial items make up the chart of accounts (see Figure 3). In this case, the Section 15 definitions (1) are used. These can be summarized as follows:

Section 15 Object Class (chart of accounts)	Series Numbering
Assets	100s
Liabilities	200s
Capital	300s

Section 15 Object Class (chart of accounts)	Series Numbering
Assets	100s
Revenues (all operating income)	400s
Expenses (all operating expenses)	500s

Each individual item under the five basic object classes (shown above) is detailed down to two places to the right of the decimal point (e.g., revenue, 400s; passenger fares for transit service, 401; full adult fares, 401.01).

In this example, "full adult fares" (401.01) is just one part of "passenger fares" (401), which is similarly part of "revenue" (400s). In this system, great detail is available in each object class. Full reporting of detail, however, is usually reserved for "revenue" and "expense" object classes only. As a matter of fact, even more detail is required for the "expense" object class by the overlaying of function categories. The use of functions (only for the "expense" object class) merely sorts the total expenses in a different way. Therefore, if the object classes were displayed vertically and the functions horizontally, an expense matrix would form. This is, in fact, what happens. In Iowa, only four basic function categories are used (see Figure 4):

Section 15 Basic Function Category	Series Numbering
Vehicle operations	010
Vehicle maintenance	041
Nonvehicle maintenance	042
General administration	160

For very large transit systems, a greater expansion of the function categories is required by the Urban Mass Transportation Administration (UMTA). This produces an extensive matrix, which is too cumbersome for most small or rural operations.

In Iowa's UDMS chart of accounts, the following alterations have been made in order to accomplish two tasks--minimize coding and keypunching and enhancing data flow within UDMS by computer--while staying within the original Section 15 parameters:

1. Information needs to flow from subsidiary schedules (output) to the balance sheet, revenue detail, and expense schedule. To avoid inputting the same data two or more times, data are coded only once into subsidiary accounts for select accounts. The computer is programmed to then carry subsidiary account data into other schedules and records (parent accounts).

Figure 3. Section 15/UDMS general summary of chart of accounts.

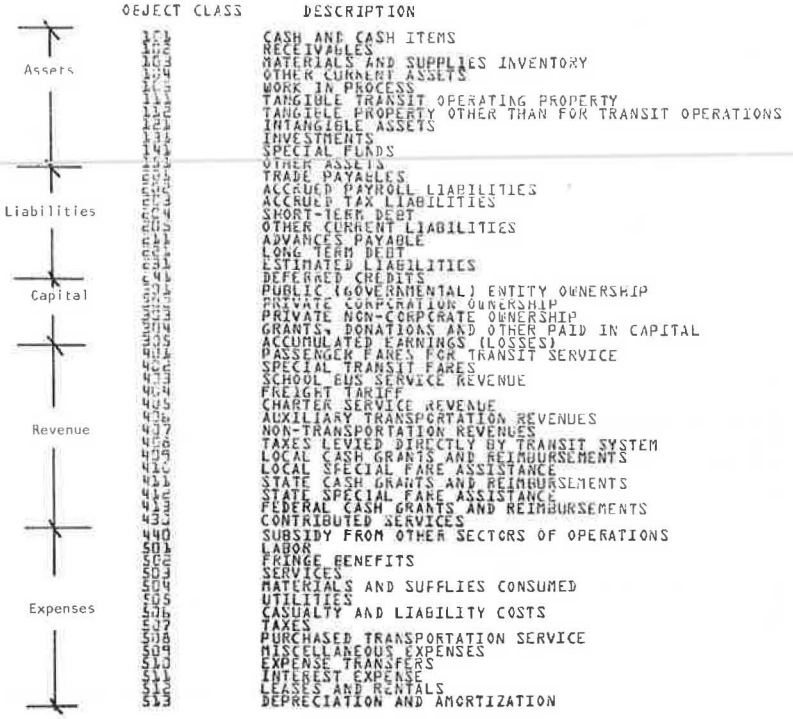


Figure 4. Section 15/UDMS expense matrix.

Object Classes	Functional Categories: Vehicle Operations 010	Vehicle Maintenance 041	Non-Vehicle Maintenance 042	General Administration 150	Total Expense for the Period
501. Labor					
01. Operator's salaries & wages					
02. Other salaries & wages					
502. Fringe benefits					
503. Services					
504. Materials and supplies consumed					
01. Fuel and lubricants					
02. Tires and tubes					
99. Other materials and supplies					
505. Utilities					
506. Casualty and liability costs					
507. Taxes					
508. Purchased transportation service					
509. Miscellaneous expense					
510. Expense transfers					
511. Interest expense					
512. Leases and rentals					
513. Depreciation and amortization					

2. Within the present Section 15 chart of accounts, unassigned numbers (accounts) exist. A variety of new accounts have been established to provide more specific and regular detail concerning a revenue source or common expense. For reporting purposes, these accounts are usually aggregated by the computer into "catch-all" accounts already established in Section 15 definitions (e.g., 504.99, other materials and supplies).

Figure 5 shows the linear distribution of account ranges across the entire chart of accounts. It also shows the flow of information from subsidiary schedules to primary schedules (i.e., from subsidiary accounts to parent accounts).

UDMS financial output (2) is as shown below:

1. Complete chart of accounts;
2. Balance sheet (Section 15 format);
3. Capital subsidiary schedule (Section 15 format);
4. Revenue detail schedule (Section 15 format);
5. Revenue subsidiary schedule (Section 15 format);
6. Expenses classified by function, single-mode system (Section 15 format);
7. Expense summary by function, multimode system (Section 15 format);
8. Expense summary by object class, multimode system (Section 15 format);
9. Direct, joint, and total expenses by object class and mode, by function, multimode system (Section 15 format);
10. Operators' wages subsidiary schedule (Section 15 format);
11. Fringe benefits subsidiary schedule (Section 15 format); and
12. General ledger.

The chart of accounts accomplishes the following:

1. Details each account that is available to the particular transit system, by number and description;
2. Identifies the account type: (a) balance sheet (asset, liability, or equity), (b) revenue, (c) expense, (d) capital assistance, (e) operating assistance, (f) operators' wages, or (g) fringe benefits; and

Figure 5. UDMS chart of accounts and financial data flow.

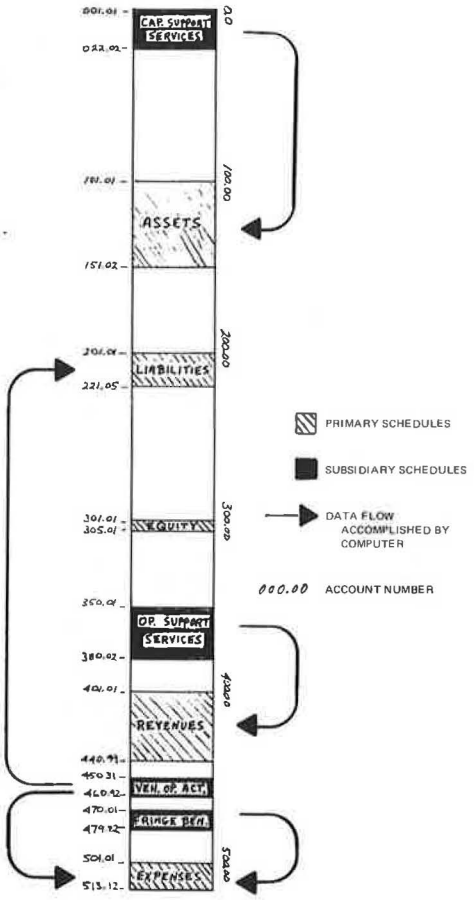
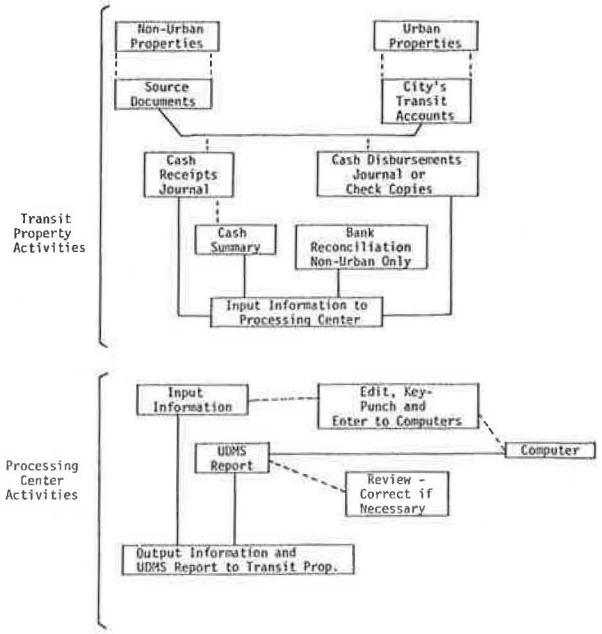


Figure 6. UDMS information input process.



3. Identifies the parent account associated with accounts reflected on the subsidiary schedule.

In addition, the chart of accounts is flexible in that it can be expanded when necessary for additional accounts and deletions can be made when accounts are no longer needed.

Each financial transaction is "coded" with six items: mode, department, function category, object class, dollar-and-cents amount, and description. For example, the coding for a gasoline purchase for revenue service vehicles (2) would be as follows:

Item	Coding
Mode	5
Department	1
Function	010
Object	504.01
Amount	$879.63
Description	Ajax Gas Company, July, gasoline

The methods and procedures of inputting data are not discussed in this paper due to space limitations but are shown in Figure 6.

Nonfinancial Data Items

On the nonfinancial side of the data items, one level of detail is usually all that is available, regardless of system size or complexity. However, variations are possible. But, as in the financial program, every attempt has been made to retain the integrity of the Section 15 forms and approach (3). The nonfinancial data available from the Section 15/UDMS process (4) are listed below:

1. Time periods;
2. Facilities and equipment--(a) Miles of roadway or track, (b) railway classifications, (c) bus roadway classifications, (d) revenue vehicle inventory classifications, and (e) number of passenger stations;
3. Employees--(a) Transit operating personnel classifications and (b) employee count classifications;
4. Maintenance performance and fuel consumption--(a) Road calls for mechanical failure and other reasons, (b) labor hours for inspection and maintenance of revenue vehicles, (c) fuel power consumption, and (d) number of light maintenance facilities;
5. Safety--(a) Collision and noncollision accident classifications and (b) injury and damage classifications;
6. Service supplied and vehicle utilization--(a) Average and total vehicles operated; (b) miles of revenue service, total service, and charter and school bus service; and (c) hours of revenue service, total service, and charter and school bus service; and
7. Passenger utilization--(a) Unlinked passenger trips, (b) passenger miles, and (c) average time per unlinked trip.

One of the most important and unique features of UDMS and Section 15 is that certain passenger and trip data are collected by sampling instead of universal counts (4). Sampling procedures generated by UMTA for fixed-route operation and for demand-responsive services are used. By increasing the minimum sampling frequency recommended for the entire system, route data for fixed routes and client data for demand-responsive operations can be gathered.

DATA UTILIZATION

A key question that has been asked throughout the development of the UDMS program is, How much infor-

mation should be gathered? The UDMS program was designed to strike a balance between the type of information desired and the amount of and difficulty of gathering that information required to ensure validity. Certainly some of the best information is the hardest to gather and the most time-consuming. But what information should be gathered and at what cost in time and labor?

At each turn of the UDMS program, attempts have been made to justify data collection with data utilization. If a specific, demonstrable use for information could not be justified, it was not included. Alternatively, if some additional subdivision of information was seen as valuable and not excessively difficult to achieve, it was included. Section 15 requirements were contracted or expanded in light of maintaining that balance.

UDMS was not designed as a "jump-through-the-hoop," passive, external reporting system. It was principally designed as a dynamic internal management tool; therefore, the information gathered must be gathered seriously and used seriously. This requirement places an additional burden on transit operators, transit planners, and Iowa DOT district managers. The information generated must be used. The rewards of collecting and reporting the data elements are more efficient transit operations, better transit contracts, and better and more detailed information with which to articulate the needs of transit to policymakers.

Some of the uses of UDMS information will be revealed in the development of a performance audit system. However, the internal use of the information should start with the system implementation. To initiate this process of data utilization, internal uses of system data were developed on a system-by-system basis. For fixed-route, small urban systems, data utilization may be chiefly concerned with evaluation of routing and scheduling. For regional systems, depending on the amount of sampling available, a cost-allocation and billing procedure may be among the principal concerns.

As a prelude to discussing cost allocation and billing, a summary of the nonfinancial data set is given below. With the initiation of UDMS, a more detailed, consistently defined, uniformly gathered set of ridership information is generated. Iowa's UDMS reporting system contains the following elements:

1. A highly detailed uniform set of transit definitions (1);
2. Uniform, detailed procedures for acquiring and recording transit information (5,6);
3. Actual monthly passenger counts by client group;
4. Actual passenger-mile tabulations by month; and
5. Sample information that will render the following annually valid information: for demand-responsive systems, (a) total passenger minutes (by client group), (b) total capacity miles (by client group), (c) total seat miles (by client group), (d) average passenger trip distance (by client group), and (e) average passenger trip time (by client group); for fixed-route systems (by morning peak, midday, evening peak, night, and Saturday-Sunday service), (a) passengers boarded, (b) passengers on board, (c) bus trip distance, (d) passenger miles, (e) bus trip time, (f) passenger minutes, (g) capacity miles, (h) seat miles, (i) trips in sample, (j) total number of bus trips, (k) unlinked passengers per trip, (l) passenger miles per trip, (m) unlinked passenger trip time, and (n) unlinked passenger trips.

COST-ALLOCATION AND BILLING RATES

Obviously, the basis of a cost-allocation plan can be as different as the data and the combinations of data available. The more variables or subdivisions of variables (e.g., the same data variables such as passenger miles for two or more geographic areas or client groups), the more choices there will be to generate a cost-allocation plan and/or billing rate. The selection of variables or combinations of variables should be (a) developed based on appropriate measures for the service(s), (b) derived from available data, (c) based on definitions that are understood and agreed on, and (d) made part of the written contract between the parties involved.

The purpose of this paper is not to develop cost-allocation or billing-rate models. There are many others in the transit community who are working in this area. Table 1 summarizes some of this work

Table 1. Cost- allocation plan and billing-rate variables used by selected studies and agencies.

Agency or Study	Indirect Cost Determination	Allowed/ Unallowed Cost Sharing	Service Type	Population	Property Valuation	Clients	Vehicle Miles	Vehicle Hours	Passenger Trips	Passenger Miles	Trip Length (zonal system)	Person Hours
U.S. Department of Health, Education, and Welfare (Health and Human Services) Publication OASC-10 (7)	X											
Ecosometrics, Inc. (8)	X	X	X				X	X	X			
LIFTS, Linn County, Iowa	X						X					X
Eastern Task Force on Aging (9)										X		
Mount Grace Regional Transportation Program Corporation (9)							X					
Regional Transportation Program, Inc. (9)										X		
DAST (9)											X	
Cape Cod Regional Transit Authority (9)									X	X		
University of Massachusetts[a] (9,10)			X	X	X	X	X	X	X	X		
Santee Wateree Regional Transportation Authority, South Carolina			X				X			X	X	
Gobel (11)	X	X								X		

[a]Study uses different applications of variables for different situations.

and key features of the cost-allocation methods.

With regard to one of these models, Iowa has examined concepts laid out in a report by Knapp of Ecosometrics, Inc., on coordinated transportation systems (8). Ecosometrics procedures are based on disaggregating passenger trips by client groups. UDMS goes one step further by providing sample data on trip efficiencies by client group. Ecosometrics did not go to this length because it argued that it is too "difficult to keep passenger hours of service (and miles of service) when a system mixes clients." Although this is certainly true when one records such information on a daily basis, this level of detail can be provided by using a sampling technique. Because use of the sampling approach is infrequent and random, it is not perceived as an excessive responsibility for a transit operation.

The key feature lost in the Ecosometrics method (8) is the relative system impact of each trip. Different client groups and different passenger types generate different trip times and miles. For example, within most coordinated systems, demand-responsive trips for the elderly are longer and take more time than Head Start trips. Only sampling can determine that approximate impact at a reasonable cost.

In the UDMS program, sample information is designed to identify transportation utilization characteristics by client group. It is expected that client groups will be defined by the transit property as preidentified client categories (e.g., elderly and handicapped). But it is also designed to use contract categories (e.g., sheltered workshops and congregate meal sites).

By gathering ridership information by client group, specific unit costs can be developed. These unit costs can be translated into cost-allocation or billing plans.

The basis for Iowa's system is that, with extensive, consistently defined, uniformly gathered information across a number of variables (as detailed previously), a wide variety of cost-allocation and billing-rate procedures are possible. The data gathered by using the sampling process are as good as, and sometimes better than, "universally counted" records (i.e., every data element in the set is counted). This is done at relatively low cost, with fewer personnel, and often results in higher driver morale than other methods (due to a lighter data-gathering burden).

The Iowa DOT has not mandated and will not mandate a single-process allocation plan or billing method because this is believed to be a locally determined prerogative of the client funding agency. However, the Iowa DOT is working toward getting client funding agencies to accept UDMS methods as being sufficiently accurate, documentable, and accountable. An effort is also being made to get local, state, and federal funding agencies to select billing and cost-allocation variables currently available through UDMS as the basis for contractual arrangements with transit agencies. This will result in a more stable, long-lived management information system (i.e., UDMS). Thus, the Iowa UDMS is attempting to balance the structure of a single information system with the data needs and desires of various agencies. The flexibility of UDMS enables one to make select changes while maintaining the system integrity.

In summary, UDMS offers a wide combination of variables in establishing cost-allocation plans and/or billing rates. The Iowa DOT will encourage local agencies to determine the variables to be used. In addition, work with state and federal funding agencies will stabilize the information system used by all while minimizing costs within accountability parameters.

UDMS AND CONTRACT NEGOTIATIONS

The reimbursement rate or funding level made part of a transit service agreement should not be a foregone conclusion based on management information. Transit systems need to negotiate the highest rates possible for services provided. The total transit system service and financial capabilities must also be continually reexamined.

Negotiating the highest possible rate for transit service is a concept that is significantly different from the general consensus nationally. However, transit agencies should no more give away service than physical assets.

There are funding or client agencies that are bound to purchase services based on their cost. In these cases, the total, true cost of service provision should be used. If the purchasing agency claims that it can supply its own service at a lower rate, a comparison should be made between the transit system rate and the purchasing agency rate. It is extremely important that comparison be made on the basis of "apples to apples". In other words, the total, true costs for both agencies must be used for identical service. If the purchasing agency claims that its personnel are available for transportation purposes "already paid for", those costs still must be made part of the comparison.

The rate, then, is not a question of the actual cost to the transit system but rather what the rate would be if the funding or client agency supplied the service themselves or purchased the transit service elsewhere. If this rate (based on a true, total cost comparison) is lower than the total cost rate of the transit system, then the transit system needs to analyze its own operations and finances. The institution of a cost containment program or service analysis may be in order.

The data from UDMS play an important part in the entire negotiation process. Definitions and billing-rate components are clearly laid out. Indisputable data from the transit system are readily available. The transit system knows the limits of its negotiation levels: cost and service.

Negotiating the highest possible rates should enable the transit system to establish flexible service levels, initiate true general public operation, and generate a capital sinking fund. A healthier transit system means higher levels of service and better economies of scale for everyone.

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Use of Unrestricted Federal Funds of the Section 18 Program

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South Carolina's use of the Federal Highway Administration Section 18 program provision that allows the use of unrestricted federal funds as local match is analyzed. Answers are provided to the following three questions: Can a definition of unrestricted federal funds or a list of preapproved federal funding sources be provided? What are the mechanics of using the unrestricted federal funds for matching purposes? How can the match maximums be calculated? Two case studies that include a complete range of use of unrestricted federal funds are discussed.

In the past decades, many separate federal programs have been established to meet the transportation needs of social service programs and programs that serve the general public. Such programs either required local funds as match against the federal contribution or, in a few cases, required no local match. Match requirements were usually established to ensure local commitments for the program and to help share the program cost between the federal and local governments.

With Congress' approval of the Small Urban and Rural Public Transportation Program (Title III, Section 18, of the Surface Transportation Assistance Act of 1978), a new approach was legislated. This approach allowed the use of other federal funds to partly account for the local match requirements. This new flexibility in developing the local match for federal grants, known as the unrestricted federal share provision, recognized the limited matching resources at the small urban and rural level and has greatly aided one of the program's main goals: coordination of human service and general public transportation delivery at the local level.

The extent to which other federal funds are used to match the Section 18 funding is left in great degree to the state administering agency. Many states have interpreted the unrestricted federal share provisions rigidly whereas others have allowed great latitude. This difference among states is principally due to the nature of each state's existing program in small urban and rural areas. If a state has a tradition of public transportation services in nonurbanized areas, local financial resources are most probably available to match the Section 18 funds and there is not quite the urgency to start a large number of new programs. The initiation of new programs requires a large initial investment and therefore more local match. In 1978, states like South Carolina had very few public transportation systems in nonurban areas and were therefore looking for the greatest flexibility possible to produce the local match for federal funds. Another major factor is the availability of state funds to assist counties, municipalities, or authorities in developing local match. Consequently, some states with a state public transportation subsidy program found it unnecessary to look for unique approaches to use the unrestricted federal funds provision.

This paper examines efforts in South Carolina to make the most efficient use of the Federal Highway Administration (FHWA) Section 18 program provision (Chapter I, 23 CFR §825.9b) that allows the use of unrestricted federal funds. The provision reads, "Half of the local share for both capital and operating expenses must be provided in cash, from sources other than federal funds or revenues from the other operation of the system. The other half of the local share may be made up of unrestricted funds from other Federal programs." In practice, this provision has been applied to administrative expenses as well.

The above reference to "efficient use", when viewed from the local perspective, means minimizing local cash need or stretching available local cash as far as possible. Ironically, and contrary to popular belief, making efficient use of local cash resources also makes efficient use of federal funds; therefore, all parties are benefiting.

To reduce any possible confusion that may have resulted from reading other related federal publications, the terms "soft match" and "nonrestricted federal funds" are synonymous with "unrestricted federal funds".

The three major questions that had to be answered