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AUTHOR Paller, Alan; And Others
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ABSTRACT

This study was commissioned to investigate the special transportation problems in parent-choice school districts and to prepare a handbook to assist transportation supervisors in overcoming these problems. Intended for school districts that have alternative schools, open enrollment plans, magnet schools, or other kinds of parent and student choice programs, the handbook is a summary of the information gathered on transportation planning in both parent-choice and neighborhood-centered school districts. Elements of the traditional neighborhood-school-centered transportation system and those unique to the parent-choice transportation system are described. Methods are suggested for developing the information files and routing skills required to meet the needs of the new system. The characteristics of commercial services offering computerized transportation planning services are presented and compared. The concluding section presents "rules of thumb" and criteria for judging what levels of automation and what service might be most valuable for a specific district. (Author/MLF)

DESIGNING A TRANSPORTATION SYSTEM FOR A PARENT CHOICE SCHOOL DISTRICT: A TRANSPORTATION SUPERVISOR'S HANDBOOK

NOVEMBER, 1975

National Institute of Education
U.S. Department of Health, Education, and Welfare
Washington, D. C. 20208

Prepared by:

Alan Paller, Lynette Ferrara, Eileen Manley

Applied Urbanetics, Inc.
1701 "K" Street, N.W.
Washington, D. C. 20006

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FOREWORD

The National Institute of Education, in the course of overseeing the Alum Rock Education Voucher Program in San Jose, California, has become aware of the special transportation problems that confront school districts operating parent choice systems. With an eye toward assisting Alum Rock in managing its voucher program and recognizing that similar types of multiple option systems were gaining currency in school districts across the nation, NIE engaged Applied Urbanetics to conduct this study.

The monograph that you have before you is, we think, unique. For, in addition to providing guidance on the level of sophistication warranted for a transportation planning system, it contains what amounts to a consumers guide for selecting a commercial transportation planning service.

This second segment of the Applied Urbanetics report will soon go stale, but this as it should be as new products enter the marketplace. So while this report should have a shelf life of from 3 to 5 years, if in time local school districts evidence sufficient and widespread interest in information of this nature we would have good reason to commission a new review.

I hope this study will help school districts that have begun or are thinking of instituting alternative schools, open enrollment plans, magnet schools or other kinds of parent and student choice programs, and I would encourage all school districts who find this or similar publications of use to forward their critical views to the Institute.

Denis P. Doyle, Chief
School Finance & Organization

TABLE OF CONTENTS

Preface..... i

Introduction..... iii

Chapter I: The Information Needs of the Transportation Supervisor..... 1

Chapter II: Collection of the Fundamental Data..... 6

Chapter III: Fully Automated Transportation Systems..... 14

Chapter IV: Choosing the Best Approach for Your School District..... 33

Bibliography

Appendix: Examples of Report Formats

PREFACE

The Educational Voucher Program staff of the National Institute of Education recognizing that transportation planning was a problem both in Alum Rock, the first voucher demonstration site, and in local educational agencies assessing the feasibility of their own voucher programs, contracted with Applied Urbanetics, Inc., to investigate the special transportation problems in parent choice school districts and prepare a handbook to assist transportation supervisors in overcoming these problems.

Applied Urbanetics gathered information on the experiences of transporation supervisors in both parent choice and neighborhood centered school districts. Officials in Alum Rock (San Jose, California) provided much valuable information about their solutions to transportation problems in their voucher program. Special thanks go to John Williamson, Transportation Supervisor; Kathy McCoskey, Dispatcher; and David Bailey, Assistant to the Superintendent for their generous contribution of time and information.

This handbook is a summary of the information gathered on transportation planning in both parent choice and neighborhood centered school districts. Although the focus of the handbook is on parent choice districts, much of the information will also be valuable to planners in other districts. For example, this handbook contains the first published comparison of commercially-available computerized transportation planning services. The comparison will be valuable to any school district comtemplating the purchase of computerized transportation planning services.

Opinions presented in this handbook are those of the authors and should not be construed to represent the position of the National Institute of Education.

The neighborhood school system is the basic foundation of our public school system. The superintendent who wishes to introduce a parent choice system* in a district is faced with the challenge of devising a transportation system that makes non-neighborhood schools easily accessible, thereby expanding the number of educational alternatives for each family.

To make a parent choice plan work, the plan must have at least three components:

- the development of a set of clearly defined alternative educational programs which meet the educational needs of the district's children as perceived by their parents;
- a public information system to communicate the goals of the new system and to provide to parents the information and counseling they need in order to select an educational program for each of their children,** and
- a well-run school transportation system to demonstrate that children can be safely and efficiently transported to the school of their parents' choice.

This handbook has been developed to give guidance in an area which has not yet been explored: the design and implementation

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* Parent Choice System is used to designate a school district where parents have two or more schools to choose from for their children. Many systems regulate enrollment at a particular school through grandfather clauses which give preference to neighborhood residents or children with siblings enrolled in the school. On occasion, race or sex quotas are imposed. Commonly used terms for such systems include: voucher system, open enrollment, freedom of choice, optional assignment, and magnet schools.

** A vast amount of literature provides guidance in the development of a public information system. A bibliography appears at the end of Chapter IV. The Rand documents describing the Alum Rock Voucher experiment are a particularly rich resource. However, after one year of a major public information campaign, 62 per cent of Alum Rock parents indicated that they chose their child's school primarily because of its proximity to their home. (Weiler, D., et al. A Public School Voucher Demonstration: The First Year at Alum Rock. Santa Monica, California: Rand Corporation, June 1974, prepared for the National Institute of Education, Washington, D.C., p.125).

of a transportation system responsive to the special needs of the parent choice system. Topics to be covered include:

- Chapter I - The Information Needs of the Transportation Supervisor;
- Chapter II - Collection of Fundamental Data;
- Chapter III - Fully Automated Transportation Systems;
- Chapter IV - Choosing the Best Approach for Your School District.

Although the focus of this handbook is on the parent choice district, it also may serve as a guide to any district contemplating the purchase of a semi-automated or automated transportation planning system.

CHAPTER I: THE INFORMATION NEEDS OF THE TRANSPORTATION SUPERVISOR

The transportation supervisor in a parent choice system often finds his past experience provides little guidance in designing the effective, fluid system required for a parent choice system.

Two fundamental problems exist:

- Traditional routing methods are not readily adaptable to a system in which any child can go to any school.
- The fundamental data used as a basis for the "where and when" of transporting the children are not readily available.

This chapter outlines these problems by describing elements of the traditional neighborhood school centered transportation system and the parent choice transportation system. The remaining chapters suggest methods for developing the information files and routing skills required to meet the needs of the new system.

The Neighborhood School Centered Transportation System

Figure I illustrates a district with a typical neighborhood school centered transportation system. A school bus is routed up and down streets picking up children at selected contiguous collection points. In selecting the routes, the transportation supervisor has two objectives:

- to minimize the number of buses used and the miles travelled in order to save costs, and
- to ensure that transportation policies of the school board are met.

In a neighborhood school centered district, the routing problem can generally be reduced to a question of how to route a bus to pick up children at a number of bus stops and take them to a single school. All children within the same grade span, living in a defined area, are to be delivered to the same school. The transportation supervisor in this type of district needs to know:

- the location of each student with an indication of the school attended and grade;
- the location of each school, its grades and its attendance area boundaries;
- the capacities of the buses available for use;

NEIGHBORHOOD SCHOOL CENTERED TRANSPORTATION SYSTEM

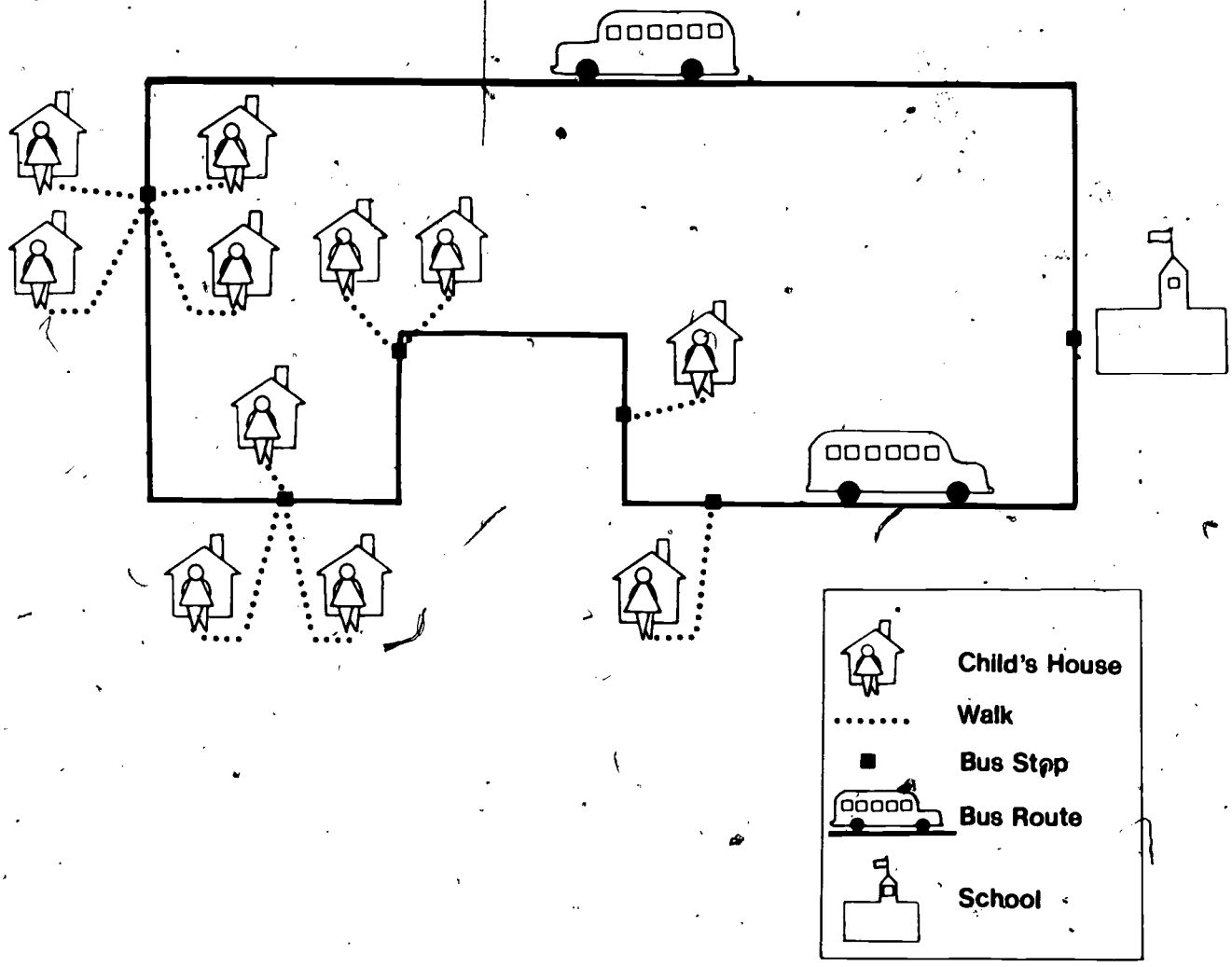

FIGURE 1

- the opening and closing times at each school and the school capacity and desire to supervise early arrivals and late departures;
- the roads forming the street network and their characteristics which affect passability.

Using these pieces of information, the transportation planner may proceed to determine:

- the bus stops to be used to pick up and drop off children, and
- the routes within each attendance area.

In the neighborhood school centered district, the routes for each school are generally independent of the routes for other schools. This feature differentiates this type of routing from its counterpart in a parent choice district.

The Parent Choice Transportation System

Figure II illustrates the typical transportation pattern in a parent choice district. Buses are routed through the district to pick up children at defined collection points and deliver them to the chosen schools.

The complicating element in the parent choice district is the possibility of a single bus stopping at a single school and dropping children off while picking up other children who will be later dropped off at other schools.

Thus, the parent choice transportation system may use one school as a collection point for children attending another school. Furthermore, the children picked up at a single collection point may be going to more than one school. In rare cases, children may even transfer from one bus to another at specified collection points.

The data required to design routes for the parent choice district are the same as those needed for the neighborhood school centered district. But the routing problem faced by the transportation planner is far more complex in the parent choice district because the routes may be required to serve:

- multiple schools, and
- multiple destinations from a single collection point.

Summarizing the Data Problem

Four categories of controlling information are required to design school bus routes:

- who - the names, locations and bus stops of the children to be transported;

Parent Choice Transportation System

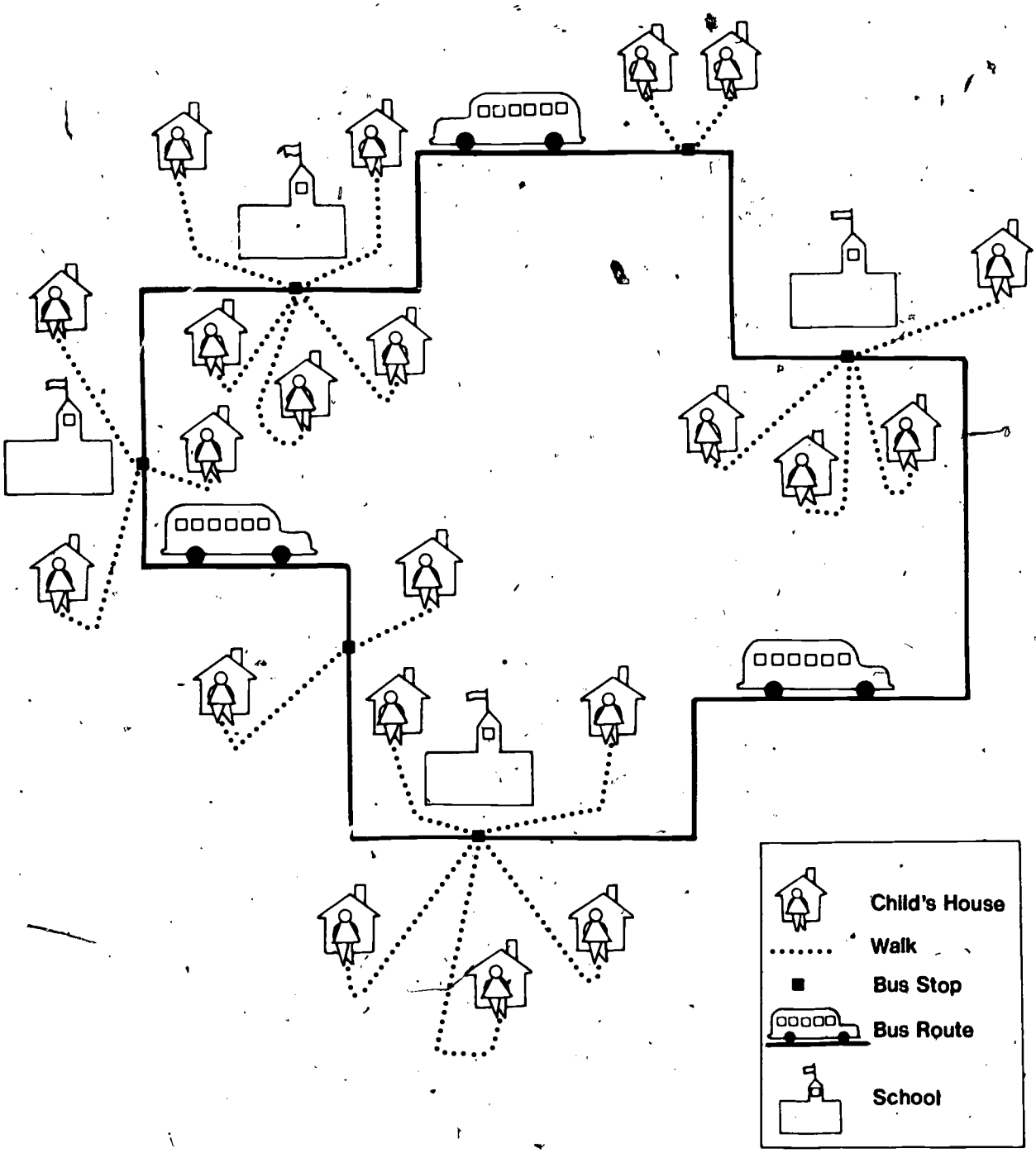

FIGURE 11

4

- has to go where - the location of the schools;
- when - bell times for each child's program;
- under what constraints - district transportation policy and fiscal capacity (e.g., funds available to buy and operate buses, the length of time children may remain on the bus or wait at the school, distances children may walk, safety rules on walking across streets, driving on hazardous routes and maximum number of children on a bus). These policies may vary for children of differing ages.

These categories are identical for parent choice and neighborhood school districts. However, parent choice districts require more resources to develop and maintain this information because of the following factors whose impact is minimized in a neighborhood school district:

- changing school schedules;
- multiple schedules at a single school;
- frequent transfers of children between programs.

Many urban or fast-growing neighborhood school districts which are attempting to maximize the utilization of existing physical plant capacity while reducing class size have similar information problems. Such districts are increasingly turning to semi-automated or automated transportation systems to manage the complex flow of information required to make such a system work.

Presented in the following chapters are the common information processing elements of transportation planning for both neighborhood and parent choice districts. Specific features relevant to parent choice districts are highlighted and assessed. The chapters include:

- Chapter II: Collecting the Fundamental Data - presenting manual and semi-automated transportation planning techniques;
- Chapter III: Fully Automated Transportation Systems - presenting and comparing the characteristics of commercial services offering full automation;
- Chapter IV: Selecting the Best Approach - presenting "rules of thumb" and criteria for judging what levels of automation and what service might be most valuable for your district.

CHAPTER II: COLLECTION OF THE FUNDAMENTAL DATA

This chapter suggests methods of answering the basic questions:

"Who has to go where? When? Under what constraints?"

Two systems for translating the data into busing routes and child pick-up time rosters are discussed below:

- manual data collection and processing--where selection of routes, assignment of children and preparation of supporting materials, including schedules, bus tickets, pick-up rosters, are prepared manually, and
- semi-automated data collection and processing--where the computer is used to maintain student census files and prepare schedules, tickets, pick-up rosters. Route selection is accomplished manually.

These methods were derived from descriptions of transportation systems now used in parent choice districts, with particular emphasis on the Alum Rock voucher program. (Fully automated transportation systems are described in Chapter III.*)

Components of all Transportation Systems

A basic input into both a manual and semi-automated transportation system is the transportation policy of the district. This policy expresses constraints, including:

- the funds available to purchase, operate and maintain equipment;
- the distance a child can be expected to walk;
- the length of time a child can spend riding a bus or waiting in supervised play or study before or after school;
- the school-year schedule;
- each school program and grade bell times;
- the number of children of various ages who may ride a single bus.

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* A fully automated transportation system is similar to a semi-automated system except for the fact that the district street network is coded into the computer and the computer assists in selection of effective routes.

These district policies are usually decided by the school superintendent and board officials after consultation with school principals, parent advisory groups and district transportation staff. Care must be taken to reconcile demands for the short bus rides and flexible schedules with the resources of the transportation department.

A Manual System

The design and implementation of a manual system requires the following five tasks (shown schematically in Figure III):

- a manual search of each school's enrollment records to identify the home address, grade and program of each child eligible for transportation;
- manual identification of the pick-up points for each child;
- manual identification of the bell times for each child;
- preparation of school-by-school lists of eligible children, pick-up points and bell times;
- preparation of bus routes and child pick-up time rosters.

Moving from a Manual to a Semi-Automated System

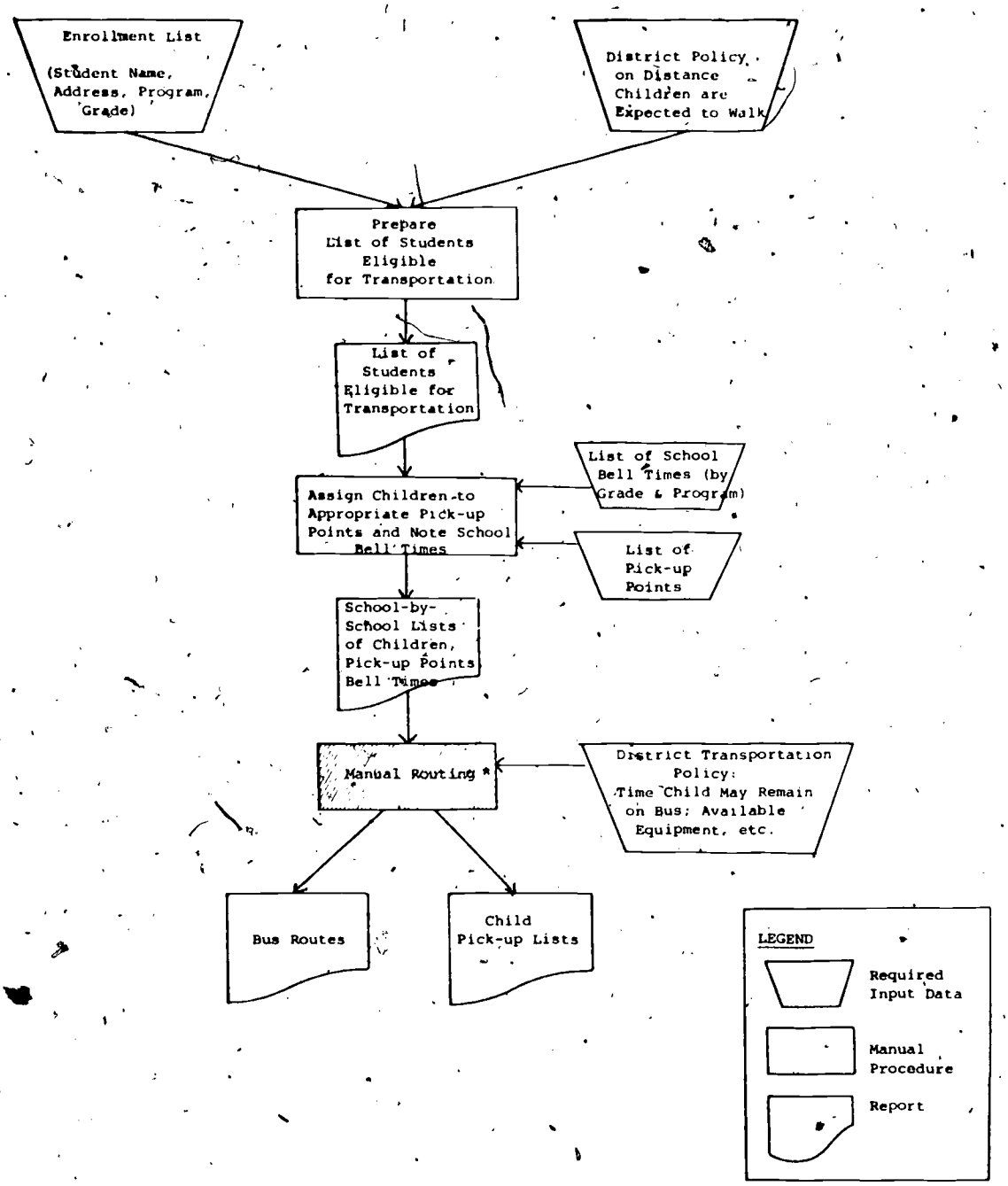
Transportation automation has been a by-product of the introduction of computers to other aspects of education administration such as budgeting, accounting, payroll and class scheduling. As districts learned to use computers, they built data files of the names and addresses of children. Simultaneously, growing numbers of students, changing enrollments and population mobility have caused headaches for transportation planners, especially when they were faced with the requirements to develop and revise routes and schedules in the two to three weeks at the start of school.

These factors -- the availability of computerized school censuses, the growth of student populations and the demand for rapid rerouting and rescheduling -- have forced many districts to turn to the computer as a clerical aid in maintaining lists and printing revised schedules.

The use of computers for these functions is called semi-automation.

FIGURE III

FLOW CHART OF MANUAL DATA COLLECTION AND PROCESSING SYSTEM



* Manual routing is represented by a shaded box as it is impossible to accurately describe how dispatchers use their intimate knowledge of equipment, driver personality, district roads, pick-up points and bell times to design optimal routes. Each dispatcher has his or her own individual set of decision rules.

A Semi-Automated System

The design and implementation of a semi-automated system requires the following 12 tasks:

- construction of a computerized school census file which contains the name, address, program and grade of each child (cards or tape);
- manual review of the file to identify each child eligible for busing;
- preparation of a revised school census file with a busing indicator (yes or no) attached to each child's record;*
- construction of an address range/bus pick-up point dictionary (list of addresses from which children are to walk to particular bus stops);
- translation of school program and grade bell times into computerized form (cards or tape);
- preparation of a program to merge revised school census file, bus pick-up dictionary and school bell times to prepare a school-by-school listing of child name, pick-up point and bell times (Separate listings should be prepared for pick-up and return.);
- manual preparation of bus routes and child pick-up rosters;
- conversion of routes to computerized form (cards or tape);
- preparation of a readily accessible computer file of bus routes and child pick-up rosters;
- collection of a list of required route or roster revisions;
- preparation of a computerized file of route or roster revisions;
- the design and implementation of a program to revise routes and child pick-up rosters.

A flow chart of the system is displayed in Figure IV.

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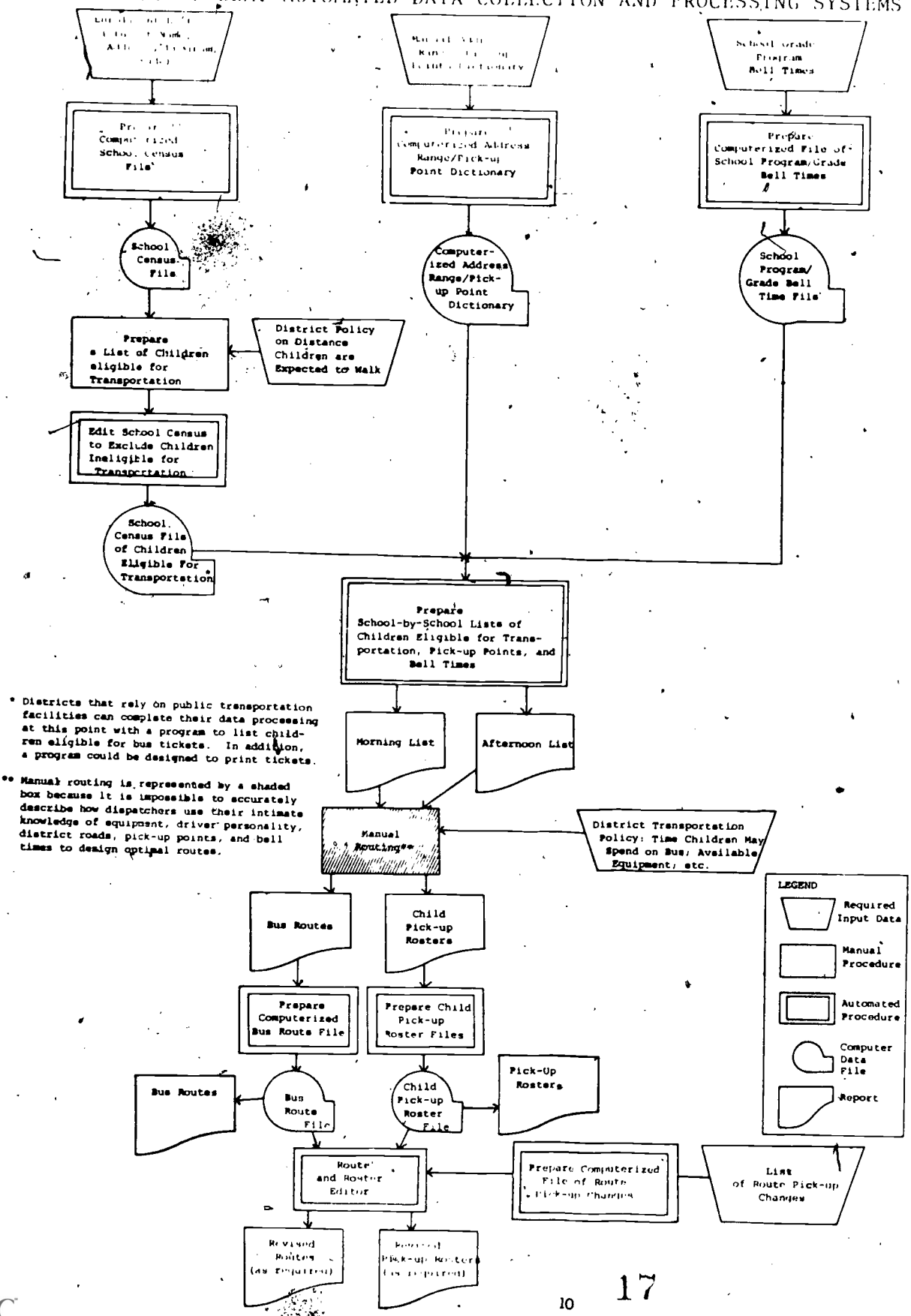
* Districts which rely on public transportation facilities can complete the processing at this point with a program to list children eligible for transportation passes. In addition, a program may be designed to print a pass for each eligible child.

FIGURE IV

FLOW CHART OF SEMI-AUTOMATED DATA COLLECTION AND PROCESSING SYSTEMS



* Districts that rely on public transportation facilities can complete their data processing at this point with a program to list children eligible for bus tickets. In addition, a program could be designed to print tickets.

** Manual routing is represented by a shaded box because it is impossible to accurately describe how dispatchers use their intimate knowledge of equipment, driver personality, district roads, pick-up points, and bell times to design optimal routes.

A first step in the construction of this type of system is to coordinate the efforts of the district transportation and data processing staffs. Often, the transportation staff has had little or no experience with computerized information systems. Members of the staff need to be introduced to the many ways the computer can relieve them of tedious clerical chores of searching, sorting and listing data. Also, the data processing staff must be made aware of the information needs of the transportation staff. They may be able to identify existing school data files, such as school census or pick-up point dictionary, that can be adapted to the needs of the new transportation system.

Many districts have prepared such files as components of the traditional transportation system or as research or administrative tools. In the Alum Rock voucher program, coordination of the data processing and transportation staffs produced the semi-automated system described above using existing files. The manual system used the first year required six weeks of effort to locate eligible children. The computer programs necessary to integrate existing files and prepare the school-by-school listings of child pick-up points and bell times required less than one man week of effort. More importantly, the dispatcher was relieved of the tedious retyping of bus routes during the hectic first weeks of school. Her time was more productively focused on optimizing system effectiveness, efficiency and safety.

Special Problems that may Occur

The Alum Rock voucher program revealed a number of problems associated with parent choice. These included:

- massive late registrations which made pre-planned* bus routes obsolete;
- frequent school and program transfers which required development of a channel of communication between school and transportation staff;
- lowered transportation staff morale due to new job specifications and increased work load;
- conflict between demands for school schedule flexibility and the resources of the transportation department.

Late Registration

As many as 20 percent of the children in Alum Rock Voucher program may not register until the first day of class. This means that the transportation department will need the flexibility to cope with driver reports of unexpectedly heavy or light loads. Two primary methods for providing such flexibility are:

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* This is a problem peculiar to school districts such as Alum Rock that experience high rates of mobility.

- to equip buses with two-way radios so that they can be rerouted to pick up children appearing in unexpected places, and

- to prepare a readily accessible computer file of bus routes and child pick-up rosters so that tedious and time-consuming retyping of routes is done by the computer rather than by the dispatcher.

An Institutionalized Transfer System

Ten percent or more of the district's children may change school or programs during the year. To ensure that each transferred child is picked up on time by an appropriate bus, a system of communication is needed to inform the transportation system of each transfer. The need for such a system may seem self evident. However, the complexity of the information needs of the transportation system will be new to both school principals and parents accustomed to the yellow bus appearing with little or no effort on their part. Principals and parents should be told how to report transfers and why such reports are necessary.

Lowered Transportation Staff Morale

The transportation management staff is asked to learn new methods of collecting information and designing routes. For drivers, parent choice means the new responsibility of learning where each child msut be collected or discharged at each point in the route. Care should be taken to involve the transportation staff in the early stages of the system design so that there will be a clear understanding of the reasons for the system and an identity with its goals. School principals should be encouraged to share responsibility for ensuring that children get on and off the appropriate buses. Supervision should be provided for children arriving early or leaving several minutes after class is dismissed. Principals whose schools have never had "bused" children may feel such new responsibilities are unreasonable. An understanding of the complexity of the busing system will enable them to be more responsive to the needs of the new system.

Conflict between Demands for School Schedule Flexibility and the Resources of the Transportation Department

When assuming new responsibilities for program design, principals and teachers often choose program bell times without regard for the costs of transporting children to the same school at a variety of times. Sometimes such demands may be unrealistic. (One school in Alum Rock chose ten dismissal times, five minutes apart.) This type of problem is especially important if the school does not provide supervised study or play while waiting for a school bus. The district superintendent should try to

coordinate the planning of transportation department staff members and school officials so that schedules can be designed to preserve maximum flexibility (for example, uniform schedules may be designed for each building while schedules are staggered between buildings) without exceeding the district transportation budget or the capacity of the transportation department to provide service.

CHAPTER III: FULLY AUTOMATED TRANSPORTATION SYSTEMS

Fully automated systems are computer assisted transportation systems in which the computer is used to select effective routes in addition to serving as a clerical aide as it does in semi-automated systems.

A number of fully automated systems are available from commercial companies. These companies claim to offer a range of benefits including:

- increased pupil safety where potentially hazardous bus routes are identified and eliminated;
- reduced requirements for new buses despite growing enrollments;
- reduced mileage requirements for existing buses;
- reduced waiting time and time on buses for students;
- automatic preparation and updating of schedules, bus tickets, pick-up lists, and management reports.

In addition, each service provides computerized data files and programs which can be powerful management tools as well as being useful for research and planning.

Users' and Non-Users' Disagreement

District superintendents who attempted to assess the utility of such systems usually received contradictory reports. The reports fit into two categories:

- nearly unanimous agreement on the part of transportation managers who had never used a service that the services would be useless, and
- nearly unanimous agreement on the part of transportation managers in large and small districts who had used automated services that they received full value for the money and recommended it highly to their fellow transportation managers.

The apparent disagreement seems to stem from inadequacy of the historic title for these services: "school bus routing services." Actually, the services provide much more than routes and their value is most apparent in the computerized preparation of:

- detailed student census rosters;

- bus pick-up rosters for drivers;
- bus tickets for students;
- bus schedules for parents;
- total miles traveled for state reimbursement of transportation costs;
- master busing rosters for transportation managers.

These are the documents that help the transportation managers do their jobs and they are the products that the satisfied users point to as their "school bus routing system."

The transportation manager freed from these time-consuming clerical tasks becomes a true transportation planner evaluating a wide variety of alternative routing and schedule plans compiled by the computer. More time is available for the important tasks of driver training, design of safety programs and fleet management and maintenance.

The non-users, on the other hand, envision only the selection of routes as a product and naturally feel that the costs outweigh the benefits.

This chapter provides interested superintendents and transportation managers with a comparison of available authors' assessments combined with assessments by users of the services.

Criteria for Inclusion

Three criteria had to be met in order for a service to be included here:

- the service, or computer program, had to be fully documented and available for acquisition by interested school transportation managers;
- the service had to include the routing services, student lists and schedules and management reports;
- the service had to have been implemented in at least two districts prior to school opening in the fall of 1974.

Companies Offering Services .

The services which were found to meet these criteria included (in alphabetical order):

Boeing Computer Services Inc. Consulting Division 505 Baker Boulevard Seattle, Washington 98188	Mr. Granville E. McCormick 206-773-1141
Concord Research Corporation Information Systems Department 74 Loomis Street Bedford, Massachusetts 01730	Mr. Edward T. Bayliss 617-275-1565
Ecotran, Inc. 28749 Chagrin Boulevard Cleveland, Ohio 44122	Mr. John R. Thome 216-292-7070
Educational Coordinates Mathematica, Inc. P.O. Box 2392 Princeton, New Jersey 08540	Mr. David H. Lovell 609-799-2600
Educational Testing Service EISD Division Princeton, New Jersey 08540	Mr. Bruce L. Taylor 609-921-9000
LKB Administrative Systems, Inc. One Aerial Way Syosset, New York 11791	Mr. Lawrence B. Helft 516-938-0912

This list is not necessarily exhaustive. Other organizations may offer similar services.

The Comparison

The following pages present answers to six commonly asked questions about the workings and benefits of automated transportation information services:

- What services are actually provided by the contractor: (Alternatively, how much information must be collected by the district staff)?
- How much of the work is performed by computer and how much is manual?
- What types of routes can the system handle?
- Do they work in parent choice districts?
- What kinds of reports are provided to the district?
- What benefits and costs have been experienced by users of the service and in what kinds of districts have they been implemented?
- Does the district receive a fully documented system that can be operated by district personnel at reasonable cost?

An additional question, what criteria are used for determining the best routes, has the same answer in each case:

> Each of these services and programs determine the feasibility of reducing the number of buses used to serve the district consistent with district-imposed policy constraints and each may also consider through appropriate data input:
>
> - safety of bus stops and routes traveled;
> - total miles traveled;
> - maximum miles traveled;
> - total time on the bus;
> - capacity of bus.

What Services are Actually Provided by the Contractor?

The development of the typical automated transportation service includes the following tasks:

- preparation of computerized school census file;
- preparation of a computerized street network which identifies bus stops, school locations, distance and driving time between stops;

- design and development of a program to estimate the number of children at each bus stop;
- design and development of a program to establish bus routes (based on available bus and district transportation policy);
- route review and revision;
- preparation of final bus routes, schedules, child pick-up rosters and planning and analysis reports.

A flow chart of the automated system is shown in Figure V.

Although available systems appeared generally similar, the following differences were noted:

- the input data required of the district;
- the methodology used to prepare and verify computerized school networks;
- the degree of perparation in route design and verification required of district personnel.

Table I summarizes these differences. Please note that the major difference between systems appears to be the degree to which the systems attempt to conserve existing bus stops and schedules. However, since all systems search for effective, efficient bus routes within a district's specified constraints of child walking distance and school bell times, it is not certain that the described differences in routing techniques will lead to a measurable difference in the services provided to the district. A fully automated transportation system is an information system. In choosing a system, all aspects of the system, including the number and types of reports and information files created, must be evaluated as well as actual bus routes. The most important service the contractor offers is often the training of district personnel to use the new information system. Chapter IV offers more detailed guidelines for reviewing and selecting the service most appropriate for your district.

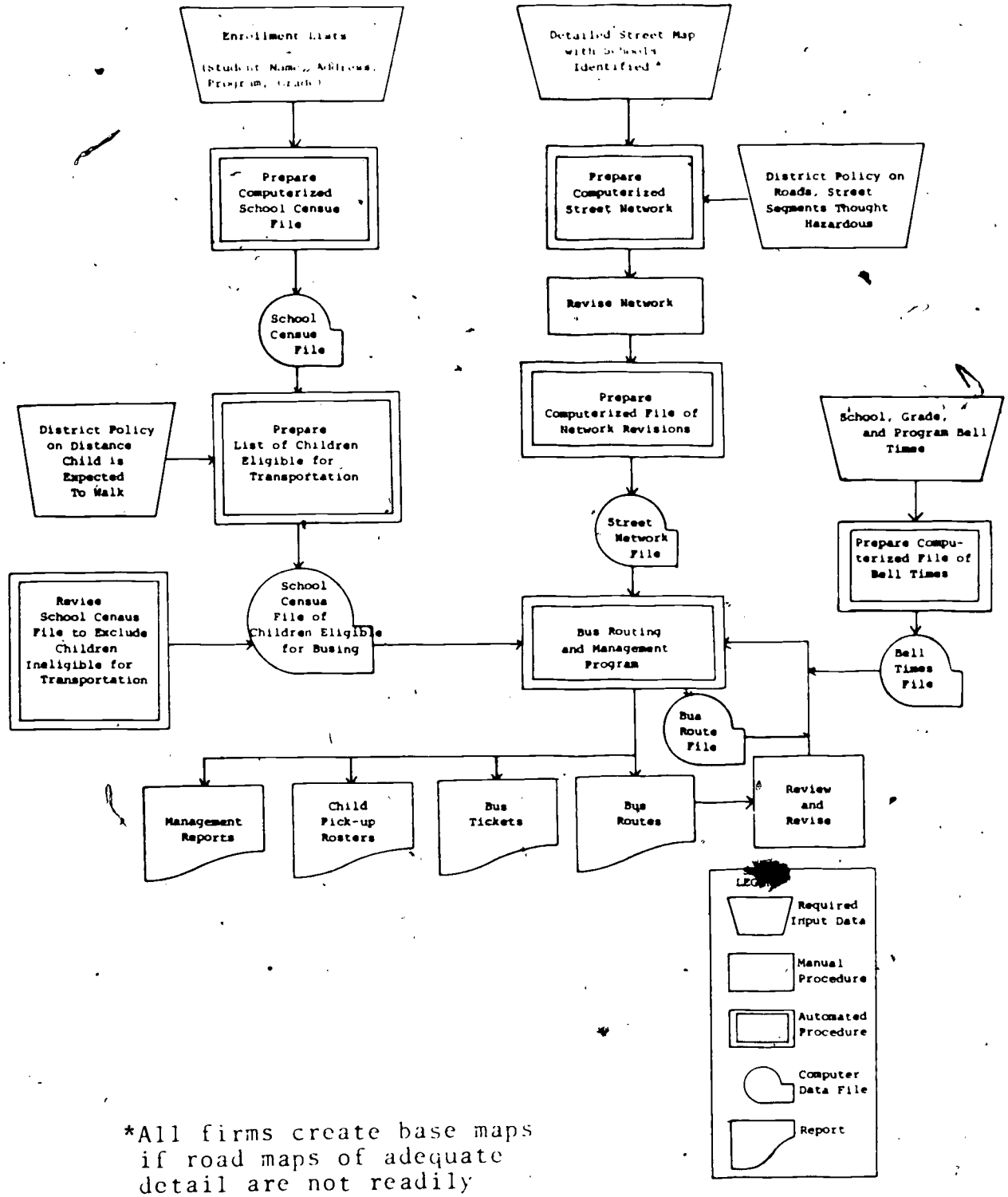
How Much of the Work is Performed by Computer and How Much is Manual?

The available systems reported that all aspects of routing were computerized including:

- address matching of children to pick-up points;
- selection of an initial starting point;

FIGURE V

FLOW CHART OF FULLY AUTOMATED SYSTEM



*All firms create base maps if road maps of adequate detail are not readily available.

TABLE I

Comparison of Available Automated Transportation Systems*

System	Input Data Required from the District	Methodology for Preparing and Verifying Computerized School Networks	Degree of Participation in Route Design and Verification Required of District Personnel
Boeing Computer Services	• school location and enrollment lists (including names and addresses of children); • school bell times by program and grade; • origin of bus fleet, number and capacity of buses; • description of current routes, including bus stops and counts of children at each stop in three separate days during school year; • district transportation policy constraints.	• A road map of the district is converted into computer readable form by a process called digitizing. For each road block segment, the distance, speed limit and direction (if one way street) are noted. Road segments known to be safety hazards are coded to ensure bus routes do not include these areas. • Previously used routes and bus stops are converted to computer readable form. • Methodology used to verify the network was not ascertained by our survey, however, bus routes are carefully reviewed with district personnel to correct any errors which might result from errors in network specifications.	• District personnel are asked to identify hazardous road segments and to outline existing routes and bus stops. • After initial network construction, preliminary bus routes are reviewed with district transportation staff. • Routes are adjusted as required.

* Material for this Table was gathered through a telephone survey (confirmed in writing) of corporate representatives listed on page 16.

TABLE I (Continued)

System	Input Data Required from the District	Methodology for Preparing and Verifying Computerized School Networks	Degree of Participation in Route Design and Verification Required of District Personnel
Concord Research Corporation	• school location and enrollment lists (including names and addresses of children); • origin of bus fleet, number and capacity of buses; • district transportation policy constraints. • The district may supply a list of bus stops and school schedules. However, the Concord system is designed to identify optimal stops and schedules within district policy constraints.	• A road map of the district is converted into computer readable form by a process called digitizing. For each road block segment, the distance, speed limit and direction (if one way street) are noted. Road segments known to be safety hazards are coded to ensure bus routes do not include these areas. • Previously used bus stops are converted into computer readable form if the district wishes to conserve existing stops.	• District personnel are asked to identify hazardous road segments and to outline existing routes and bus stops. • After initial network construction, preliminary bus routes are reviewed with district transportation staff. • Routes are adjusted as required.
Ecotran, Inc.	• school location and enrollment lists (including names and addresses of children).	• The road map of the district is converted into computer readable form by a process called digitizing. For each road block segment, the distance, speed limit and direction (if one way street) are noted. Road segments known to be safety hazards	• District personnel are asked to identify hazardous road segments • After initial network construction, preliminary bus routes are reviewed with district transportation staff.

TABLE I (Continued)

System	Input Data Required from the District	Methodology for Preparing and Verifying Computerized School Networks	Degree of Participation in Route Design and Verification Required of District Personnel
Ecotran, Inc. (continued)	• origin of bus fleet, number and capacity of buses; • detailed road map of district (Ecotran will prepare map if none is available.); • district transportation policy constraints.	are coded to ensure bus routes do not include these areas. The computerized network is verified by comparing a computer drawn plot of the network with the original input road map. • Travel times, direction and speed limits of network are verified by on-site sample of driving conditions in the district.	• Routes are adjusted as required. • Comprehensive training sessions are held to acquaint staff with format and content of system reports.
Educational Coordinates	• school location and enrollment lists (including names and addresses of children); • origin of bus fleet, number and capacity of buses; • district transportation policy constraints; • a detailed road map of district (Educational Coordinates will prepare map if none is available.).	• The road map of the district is converted into computer readable form by a process called digitizing. For each road block segment, the distance, speed limit and direction (if one way street) are noted. Road segments known to be safety hazards are coded to ensure bus routes do not include these areas. • The computerized network is verified by comparing a computer drawn plot of the network with the	• District personnel are asked to identify hazardous road segments. • After initial network construction, routes are reviewed with district transportation staff. • Routes are adjusted as required. • Comprehensive training sessions are held to acquaint staff with format and contents of system reports.

TABLE I (Continued)

System	Input Data Required from the District	Methodology for Preparing and Verifying Computerized School Networks	Degree of Participation in Route Design and Verification Required of District Personnel
Educational Coordinates (continued)	• The district may supply a list of bus stops and schedules. However, • the Educational Coordinates system is designed to identify optimal stops and schedules within district policy constraints.	original input road map.	
Educational Testing Service (ETS)	• school location and enrollment (including names and addresses of children); • origin of bus fleet, number and capacity of buses; • a list of current school bus stops; • district transportation policy constraints.	• A road map of the district is converted into computer readable form by a process called digitizing. For each road block segment, the distance, speed limit and direction (if one way street) are noted. Road segments known to be safety hazards are coded to ensure bus routes do not include these areas. • Previously used bus stops are converted to computer readable form. • Methodology used to verify the network was not ascertained by our survey, however, both the input map (noting driving time and conditions of road segments)	• District personnel are asked to work with Educational Testing Service to construct road map used as input into computer system, e.g., they review driving time, road conditions and safety hazards. • After initial network construction, preliminary bus routes are reviewed with district transportation staff. At this time, bus stops or school schedule changes may be suggested which will increase safety, efficiency or economy of the busing system.

TABLE I (Continued)

System	Input Data Required from the District	Methodology for Preparing and Verifying Computerized School Networks	Degree of Participation in Route Design and Verification Required of District Personnel
ETS (continued)		and bus routes are carefully reviewed with district personnel to correct any errors which might result from errors in network specifications.	• Routes are adjusted as required.
LKB Administrative Systems. Inc.	• school location and enrollment lists (including names and addresses of children); • origin of bus fleet, number and capacity of buses; • location of existing bus stops; • district transportation policy constraints.	• A district road map is prepared by aerial photography. • The road map of the district is converted into computer readable form by a process called digitizing. For each road segment, the district, speed limit and direction (if one way street) are noted. Road segments known to be safety hazards are coded to ensure bus routes do not include these areas. • Methodology used to verify network was not ascertained in our survey.	• The LKB system is designed to minimize work load of district transportation staff. The nature and extent of effort required by district personnel was not ascertained in survey.

- selection of alternate routes;
- estimation of the number of buses needed;
- selection of the "best routes";
- preparation of bus schedules, bus tickets and child pick-up rosters.

If school census files and transportation networks do not exist, they must first be manually compiled, then translated into machine-readable form.

The transportation network is compiled (by the Contractor) by numbering each block face and school on a map and then preparing a computer file containing the bus stops, schools, possible routes among contiguous bus stops and probable travel time along these routes.

What Types of Routing and Scheduling Can the Fully Automated Transportation Services Handle? Do They Work in Parent Choice Districts?

All available services claim experience in a variety of routing and scheduling choices, including:

- single school routes;
- routes with transfers;
- multiple trips with single buses;
- schedules serving schools with multiple bell times;
- routes originating at locations other than schools.

However, parent choice districts pose a unique problem: serving multiple schools on a single bus trip. This requirement arises because some buses may pass one or more schools on the way to their ultimate destination. For efficiency, these buses need to serve the schools they pass if they have the capacity.

None of the available services has demonstrated experience in providing full automated services for multi-school/single trip routing.* This type of routing appears to be possible by computer, but more probably it would be accomplished by a

---

* Nor was any district found which had used a computer algorithm to solve the multi-school/single trip problem.

manual method (using a shuttle pattern, possibly like that shown in Figure II of Chapter I) as it was in the Alum Rock Voucher experiment.

This multi-school/single trip requirement makes the application of fully-automated routing more difficult in parent choice districts. In general, however, the number of children in a parent choice district who do not attend neighborhood schools is small relative to the number of children who do attend their neighborhood school. Thus, the decision to use full automation should be based on the value of full automation (over semi-automation) for routing the children attending neighborhood schools.

The routes manually designed to serve children who do not attend their neighborhood schools can be integrated with computer-generated routes for the other children and fed into the computer. The integration is accomplished by preparing a file of students, bus stops and schedules in the same format as the computer-generated file and then merging the two files. The computer can then prepare comprehensive routing and management information. Alternatively, student routings can be split into multiple segments, with the segments serving as input to the system.

Transportation managers who undertake a development like that described above should recognize that they are entering uncharted territory and should, therefore, allocate extra time and money to solve unanticipated problems.

What Kinds of Reports are Provided to the District?*

Each contractor offers a variety of reports at four levels: district, school, school bus route and pupil.

District Level Reports

District level reports are designed to provide the transportation manager with an overview of fleet utilization including:

- alphabetic lisings of bus stops;
- school census lists;
- alphabetized lists of children bused, including bus stop, pick-up time, school and school program;
- alphabetized lists of children walking to school, including addresses and school programs;

---

* Sample reports are found in the Appendix. However, the number and format of system reports varies not only by contractor but also by the level of effort desired by a district.

- summaries of fleet utilization, including miles traveled, time spent, numbers of children carried;
- reports evaluating alternative routing and scheduling patterns.

School Level Reports

These reports are designed to give school administrative personnel an overview of transportation systems serving their school. These include:

- alphabetized lists of bus stops;
- narrative descriptions of bus routes, including bus stops, times and pupil load at each stop;
- alphabetized lists of children bused, including bus stops and pick-up times;
- alphabetized lists of children walking to school.

School Bus Reports

These reports are designed to give each bus driver comprehensive descriptions of each route. They include narrative descriptions of routes specifying bus stop, driving time and numbers and names of children to be picked up at each stop.

Pupil Reports

These reports are designed to inform parents and pupils of the assigned bus stops and pick-up times. Often, bus tickets are prepared for each child.

Additional Reports

In addition to standard narrative reports, Ecotran and Educational Coordinates provide computer plotted maps of bus routes.

What Benefits and Costs Have Been Experienced by Users of the Service and in What Kinds of Districts has the Service Been Implemented?

This section lists the results of a survey of users who worked with each system during the past five years. The list of districts surveyed were obtained from two sources:

- each service was asked to provide the names and addresses of two or more clients, and
- each client was asked to provide the names of other known system clients.

TABLE II

CLIENT SURVEY RESULTS

Service	Client	Benefit	No. of Students Bused	Cost*
Boeing	North Shore School District 9816 N.E. 183rd St. Bothell, Washington 98011	• savings in time, money and number of buses; 1971 yielded savings of 3 buses ($8,000 each) or about $24,000; • used to predict patterns for upcoming year.	7,800	about $14,000 (1971) (approximately $1.79 per child).
Concord	Norwalk Board of Education 102 Main St. Norwalk, Connecticut 06852	• most transportation for least cost (1973-1974); yielded savings of 7 buses ($8,600 each) or about $60,200; • data files were useful for obtaining other information, i.e., district/street index file.	5,500	about $15,300 (approximately $2.78 per child). This district compiles new information for updating and then sends it to Concord. The cost is $1 per student. This year (1974-1975) will cost about $6,000.
Ecotran	Jackson Local School District 7355 Mudbrook St. Massillon, Ohio 44646	• increased efficiency of operation; • savings in capital outlay and in operating costs;	5,500	$26,000 for a 2-year package (approximately $4.73 per child).

* Cost information is only approximate because changes in district personnel or the reporting format of district accounting systems often do not allow retrieval of more precise cost information. Also note that failure to contract for an updating service does not necessarily mean dissatisfaction with vendor services. Many slow growing districts reuse school census and route files for several years without a major update.

TABLE II (Continued)

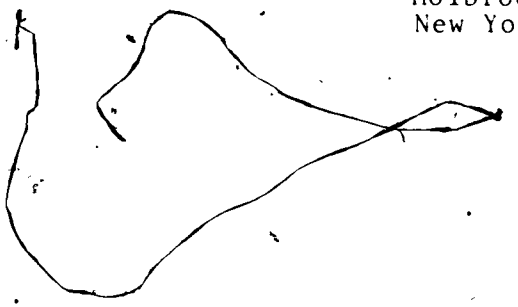
Service	Client	Benefit	No. of Students Bused	Cost
Ecotran	Plain Local School District. 901 44th St., N.W. Canton, Ohio 44709	• savings in time, money and number of buses; 1972 yielded savings of 5 buses ($9,000 each) or about $45,000; • increased safety; • data files are used for obtaining other information, i.e., class schedules, mailing lists, census verification, etc.	12,000	about $20,000 per year since 1972 (approximately $1.67 per child).
Ecotran	Wilton Board of Education Wilton Center Wilton, Connecticut 06897	• increased efficiency and safety; money was not their primary goal; • data files used to foresee problems and to correct them.	4,500	did not know the cost for the system itself but updating (1974) cost $10,000. (approximately $2.21 per child).
Educational Coordinates	Acalanes Unified School District 3210 Stanley Blvd. LaFayette, California 94549	• savings in time and money, increased efficiency; yielded savings of 1 bus; • this district received only a list of stops; next year they hope to receive route directions also; • a digitized map was created which has been most useful; • consolidated four districts into one to create a common transportation system.	6,100	about $15,000 (1973) for the system itself (approximately $2.46 per child). About $15,155 for the updating (1974). The updating cost was based on a $1.75 fee for a rider and $ .30 for a walker.

TABLE II (Continued)

Service	Client	Benefit	No. of Students Bused	Cost
Educational Testing Service (ETS)	Freehold Regional Board of Education 70 Schanck Road Freehold, New Jersey 07228	• savings in money and greater efficiency ; • data files presented information in easy-to-follow format and, as a result, found to be quite useful .	7,200	$10,900 for the system itself (approximately $1.51 per child). $4,100 for the updating.
ETS	Jackson Board of Education R.D. 4 P.O. Box 56 Coventry, New York 08527	• savings in time, money and number of buses ; • estimated savings at between $13,000 and $15,000 ; • plans to use data files for other purposes but do not at the present time .	8,300	$10,900 for the system itself (approximately $1.36 per child). $4,300 for the updating.
ETS	Montgomery Township Board of Education P.O. Box 147B Skillman, New Jersey 08558	• savings in time, money and accuracy ; • estimated savings at 10-15% of the transportation budget ; • foresees use of data files in other areas, but not done as yet .	1,800	$5,600 for the system itself (approximately 3.11 per child). $2,200 for the updating.
LKB	Middle County School District Central Administration Building 43rd St. Centereach, New York 11720	• safety and economy enabled savings of about 20 buses ($10,000 each) or $200,000 ; • aid in foreseeing future transportation problems ; • identified classroom and school overloads ; • defined attendance areas .	12,000	about $17,000 (1969) for the system itself (approximately $1.42 per child). $26,000 for the updating (1974).

TABLE II (Continued)

Service	Client	Benefit	No. of Students Bused	Cost
LKB	Sachem School District 245 Union Ave. Holbrook, New York 11741	• savings in time, money and number of buses; (1972) yielded savings of 15 buses ; • enabled district to clearly define who should and should not ride buses .	14,500	information not available .



CHAPTER IV: CHOOSING THE BEST APPROACH FOR YOUR SCHOOL DISTRICT

Three basic decisions must be faced by a school district evaluating alternatives for transportation planning:

- The district must decide whether a manual, semi-automated or automated system is most appropriate.
- If automation is appropriate, the district must decide whether to use district facilities or to use an outside service.
- If the district chooses to use an outside service, it must choose the best such service for its needs.

This chapter presents rough guidelines for making each of these decisions. The guidelines are based on a combination of suggestions from both school district personnel and spokesmen for companies providing fully automated services. The guidelines are presented with the hope that they will be tested and improved upon through future experience so that later editions of this handbook can be more precise.

Manual, Semi-Automation, or Automation

The score card below will help determine what degree of automation is appropriate for your school district.

District Busing Scorecard

Manual vs. Automated

1. Number of children to be bused: Score 0 for 0 to 1000, 1 for 1001 to 3000, 2 for 3001 or above.	
2. Number of pick-up points: Score 0 for 0 to 40, 1 for 41 to 80, 2 for 81 or more.	
3. Availability of updated school census: Score 0 for none, 1 for available but needing update, 2 for available, ready to use.	
TOTAL	

A district with a total of 0 to 3 dictates a manual system.

A district with a total score of 4 or more should lead to an evaluation of automation.

If a decision to automate is made, a second decision between semi- and full-automation is required.

Semi-Automation vs. Automation

Full automation costs (which include computerized route generation costs) are higher than semi-automation costs because of the tedious requirement of developing a computerized file of all street segments with distances and travel times. Therefore, full automation should be attempted only when large savings may be realized.

Full automation appears to be most valuable in districts where many routes are possible among the selected bus stops. Thus, if there is a complicated grid of streets, automation may provide significant savings. Full automation cannot be expected to provide such savings in districts where most stops are along a small number of main streets.

An aid to the decision would be to calculate the ratio of the projected cost of the automated routing portion of the service, including developing the network and operating the automatic routing programs* (This includes the cost of district personnel who support the project.), divided by the total cost of pupil transportation.

Since savings in the range of five to 15 percent have been realized by many districts that have used automated systems, a ratio of .05 would mean that the cost of the service would be returned in one year. A ratio of .10 would mean the cost of the service would be returned in one to two years. Thus, the district policy on required pay-back periods may be used to make a decision on semi- versus full-automation.

Choosing Between Using District Computer Service or Purchasing Outside Services for a Semi-Automated System

The single most important factor in deciding whether to use in-house or outside services for a semi-automated system is the existing resources of the in-house facility.

A good semi-automated system, as described in Chapter II, requires:

- an accurate, computerized student census;
- accurate, computerized rosters of children to be bused;

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* If providers of automated routing services will not provide semi-automation, then the entire cost of their fully-automated service should be used in this formula.

- accurate, computerized locations of bus stops;
- a competent, willing and hard working systems analyst/programmer available for at least six weeks, or on-going support from a systems analyst throughout the year.*

It is the last element, the systems analyst, that should help decide the in-house versus outside services question. If the systems analyst is available and will not be pulled off the project, then an in-house development may be appropriate. If not, then the development should be contracted outside.

Choosing Between Using District Computer Service or Purchasing Outside Services for a Fully-Automated System

The in-house versus outside decision in full automation is more difficult than in semi automation.

In general, outside services provide more comprehensive, integrated services than can an in-house effort. This is true because of the large amount of software development that has been performed by the outside firms for previous contracts.

Integration means building the routing programs and the other programs that comprise the semi-automated system so that they all use common files. This is difficult when a district purchases or leases a routing program (like VSPX from IBM) and tries to integrate it with the other programs.

Price competition in outside services for full automation is keen, so the district often pays only for the use of the programs and not for their development. The use cost contains only a prorated share of development costs. Thus, it is generally true that outside services are more cost effective than in-house services for full automation.

Criteria for Selecting the "Best" Outside Service

Transportation managers may find that answers to the following questions will be especially effective in selecting a firm to provide automated busing services:

---

* If the computerized census, rosters and locations of bus stops are not available, they will have to be developed during the routing process. Costs and benefits of such files should be included in an analysis of the feasibility of automated routing.

- How many districts has the proposed project manager previously managed and what percentage of his/her time is guaranteed to this project? How much time will he/she spend at the site?
- What information must the district transportation manager provide? By when?
- What penalties will the company agree to for late delivery?
- What is the total cost for the first year? For updates?
- What specific products are included in that price?
- Are examples of report formats available for inspection?
- How many copies are provided and how much do additional copies cost?
- How close and how available are the firm's staff members for assistance in correcting problems or in rerunning the program when parents change their selection in an open enrollment situation?
- How much technical assistance is provided to instruct district transportation staff in the use of new summary reports and route information?
- Does the package include a system that can be updated by the district staff?

Written answers to these questions should be asked of each firm proposing to offer services.

Neither cost nor excessive previous experience should outweigh availability of staff and speed of updating in a parent choice district. Parents are apt to change their minds and their flexibility must not be unduly constrained by the busing system.

When a firm is selected to provide the service, the district can help guarantee success if it will invest a substantial amount of both the transportation manager's and the superintendent's time in learning what the service will and will not do. Only a working partnership between the district and the outside firm can guarantee a successful contract.

Estimating Savings

Both contractors and user districts surveyed estimated that automated routing systems reduce overall transportation costs by five to 15 percent after the first year of automation. However, generalized estimates of savings must be viewed with caution because they reflect a variety of levels of contractor effort in training of district personnel, building of input data files and a variety of output formats. Reliable system costs and proposed savings for an individual district are best determined by competitive bidding procedures which ask all available firms to respond to the questions listed on page 36.

The unique nature of parent choice systems may inflate costs more than expected, but the potential for savings may be greater because the transportation network will undoubtedly be more complex.

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APPENDIX

TABLE OF CONTENTS

	PAGE
Fleet Utilization Summary	A-1
Bus Stop List	A-4
Narrative Description of Bus Route	A-7
Bus Route Summary: Stops, Times and Load	A-10
School Bus Route Summary	A-18
Pupil Level Reports	A-20

Note: Identity of individuals listed in tables has been intentionally obscured.

FLEET UTILIZATION SUMMARY

FLEET UTILIZATION SUMMARY

VEHICLE TYPE	SEATING CAPACITY	MAXIMUM VEHICLE TIME		NO. OF VEHICLES	NO. OF TRIPS	RUN NO.	LOAD	MILES	TRAVEL TIME		RUN TIME		NO. OF STOPS
		HOURS	MINUTES						HOURS	MINUTES	HOURS	MINUTES	
1	60	0	35	24	20								
						1	49	3.7	0	10	0	17	3
						2	37	2.9	0	8	0	13	2
						3	42	5.1	0	14	0	20	2
						4	41	2.2	0	6	0	11	3
						5	58	4.0	0	11	0	18	3
						6	59	3.7	0	10	0	18	1
						7	60	2.2	0	6	0	14	1
						8	58	5.5	0	15	0	22	4
						9	59	2.2	0	6	0	13	2
						10	60	5.5	0	15	0	24	4
						11	51	1.5	0	4	0	11	1
						12	53	2.2	0	6	0	13	2
						13	55	5.1	0	14	0	22	2
						14	59	5.9	0	16	0	24	3
						15	55	7.3	0	20	0	27	2
						16	56	8.1	0	22	0	29	2
						17	39	3.7	0	10	0	15	1
						18	56	6.6	0	18	0	25	3
						19	56	4.4	0	12	0	19	3
						20	54	2.9	0	8	0	16	3
TOTAL							1057	84.7	3	51	6	11	47

WILTON PUBLIC SCHOOLS

BUS SCHEDULES - 1972

Capacity	← 66 →														*						← 72 →													20	20	8	
Bus Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	41	42	43	Totals
High School:																																				
Route No.	21	23	18	13	5	4	9	17	22			16	8	7		12	10	19	20	14	6	1	8	27	3	15	11						26	25	24	27
Load	57	62	61	60	51	57	53	57	63			61	55	53		59	62	60	62	64	44	57	55	57	55	64	62						19	19	4	1433
Elementary: Driscoll-Miller																																				
Route No.	58			63	64	62	68			59	55				51	67	66		53	61						60	69	57	56	54	52		65	70		20
Load	64			33	38	46	62			52	57				66	60	63		55	62						59	60	70	58	54	60		18	20		1057
Post Elementary:																																				
Route No.														74							76	73	72	75	71							77			78	9
Load														39							56	60	66	59	56							61			8	413
																																		79		
																																		8		
Middle:																																				
Route No.	34			46		28			29		31				44		45		30	36	39	38		40		35	41	42	32	33	43	37	47	48	49	22
Load	61			41		33			44		59				53		53		63	60	64	68		69		58	56	47	77	59	51	63	18	16	7	1120
Comstock (A.M.)																																				
Route No.		84	82		89		93	83		86		85	90	94		81		87					92		91								88	80	15
Load		23	32		38		35	38		25		26	19	26		29		54					33		36								14	6	434
Total Routes	3	2	2	3	3	3	3	2	2	2	2	2	2	3	2	3	3	2	3	3	3	3	3	3	3	3	3	2	2	2	2	2	3	4	5	53
Total Load	182	85	93	134	127	136	150	95	107	77	116	87	74	118	119	148	178	114	180	186	164	185	154	185	147	181	178	117	135	113	111	124	55	69	33	4457

A-2

50

BUS SCHEDULE SHOWING ROUTE
EXECUTED BY BUS

Ecotran, Inc.

FIGURE I.G. 5

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

DAILY FLEET SUMMARY STATISTICS REPORT

CABSTOWN HIGH SCHOOL (AM SCHEDULE)

ROUTE ID	PUPIL LOADS	START TIMES	END TIMES	ROUTE TIMES	LIVE MILES	AVG SPD
H025	48	8.20	8.40	20	4.08	12.2
H026	51	8.17	8.38	21	3.70	10.6
H027	54	8.27	8.38	11	2.48	13.5
H028	60	8.21	8.40	19	10.11	32.0
H029	58	8.25	8.40	15	2.25	09.0
H030	49	8.28	8.36	18	6.45	21.5
H031	60	8.14	8.35	21	8.21	23.5
H032	58	8.23	8.40	17	8.09	28.6
HC33	55	8.14	8.35	21	8.01	22.9
H034	55	8.14	8.37	23	7.75	20.2
H035	57	8.13	8.37	24	9.61	24.0
HC36	40	8.18	8.38	20	6.48	19.4
HC37	52	8.14	8.35	21	5.25	15.0
H038	48	8.31	8.40	09	2.76	18.4
	2058			722	238.42	

38 ROUTES FOR THIS SCHOOL
2058 PUPILS CARRIED
722 MINS OF LIVE LOAD TIME
238.42 LIVE LOAD MILES TRAVELLED
55 PUPILS PER BUS (AVG)

BUS STOP LIST

PTAS RUN 81 -*BELLEFONTE AREA SCHOOL DISTRICT*-

-*** PTAS SYSTEM USING THE OPTION OF BUS STOPS ***-

-*BELLEFONTE ELEMENTARY*-

-SORTED BUS STOPS BY STREET NAME-

BUS STOP DESCRIPTION			BUS STOP NUMBER	BUS STOP SIDE OF STREET
*AIRPORT RD	GC	PARK	5359	
*AIRPORT RD	RA		5360	
*AIRPORT RD	MC	)S	5361	
*ARMAGAST RD	CC		1231	
*BENNER PIKE	FR	RESH	1177	
*BENNER PIKE	WI	(EXXON	2049	
*BISHOP ST	IR		5261	
*BLANCHARD ST EXT	BC	HOUSE	2213	
*BLANCHARD ST EXT	YC	SE	2075	
*BLANCHARD ST	LO		5362	
*CENTER ST	DE		5369	
*CENTER ST	GA		5271	
*CENTER ST	RC		5272	
*CENTER ST	YO		5368	
*CENTER ST	BE		5151	
*DAWSON AVE	JE	TNESS CH	5365	
*HIGH ST	TO		5367	
*HUBLERSBURG ROG RD	WE		4258	
*HUBLERSBURG ROG RD	MA	I-80	3156	
*JACKSONVILLE RD	SI		2031	
*JACKSONVILLE RD	BI	INE CENTER	2032	
*JACKSONVILLE RD	NO	ITT	2034	
*JACKSONVILLE RD	SM	CE HOUSE)	2199	
*JACKSONVILLE RD	SC	LANE	2198	
*JACKSONVILLE RD	AU		3041	
*JACKSONVILLE RD	FI	ER	3086	
*JACKSONVILLE RD	TI		3080	
*JACKSONVILLE RD	PE		3077	
*JACKSONVILLE RD	WE	E	3052	
*JACKSONVILLE RD	CO		3050	
*JACKSONVILLE RD	RE		3188	
*JACKSONVILLE RD	GE	E	3184	
*JACKSONVILLE RD	GE	M	3183	
*LYONSTOWN RD	MO		2026	
*LYONSTOWN RD	JA	S	2025	
*LYONSTOWN RD	GE	NS	2024	
*LYONSTOWN RD	DE		2023	
*LYONSTOWN RD	LO		2022	
*MC ALLISTER ST	BI	TMENTS	5144	
*MINGOVILLE RD	MI	POST OFC	4111	
*OLD RD	LA	R	4050	
*OLD RD	SA	CHURCH	4266	
*OLD RD	[illegible]		4064	
*OLD RD	SH		4065	
*OLD RD	GL		4073	

CITY SCHOOL DISTRICT — STREET INDEX — FEBRUARY 20TH 1973

CODE	STREET NAME	ADDRESSES FROM	ADDRESSES TO	SPEED LIMIT	CLASS CODES ELEM.	MID. S.	HIGH	NON-PUB.
133	DONEGAL	3575	3610	25	2	2	2	2
134	DOROTHY	2518	2825	25	2	2	2	2
135	DROSSEL	6500	6601	25	4	4	4	4
136	DRUMCLIFF	4804	4861	25	2	2	2	2
137	DUNCANNON	2050	2331	25	2	2	2	2
138	DUNKEITH	1800	2930	25	2	2	2	2
139	DUNKEITH WOODS	4910	4965	25	4	4	4	4
140	EAST CENTER	5270	5600	30	2	2	2	2
141	EAST HILL	600	1638	30	2	2	2	2
142	EASTERN	3210	3245	25	2	2	2	2
143	EASTON NE	705	4004	30	1	2	2	1
144	EASTON NW	1000	2250	30	2	2	2	2
145	EASTWOOD	800	1111	25	2	2	2	2
					5	2	2	2
					2	2	2	2
					2	2	2	2
					4	4	4	4
					2	2	2	2
151	EDGEFIELD	3500	4317	25	5	2	2	2
152	EDGEFIELD	4500	4700	25	3	3	3	3
153	EDGEFIELD	4900	5200	25	3	3	3	3
154	EDGEHILL	3700	3754	25	5	4	4	4

54

STREET INDEX
BUS POLICIES BY STREET

LEGEND
1 - STUDENT MAY NOT CROSS STREET
2 - STUDENT MAY CROSS STREET
3 - DEAD END STREET
4 - STUDENT WALKS TO STOP
5 - STUDENT NOT TRANSPORTED
6 - SMALL CAPACITY VECHICE
7 - NO BUS TRAVEL

FIGURE I.G. 1

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

ALPHABETIC STOP DESCRIPTION REPORT

CABSTOWN, U.S.A.

STOP NUMBER	STOP DESCRIPTION	TURN TIME	PICKUP CODE	LOW GRADE	HIGH GRADE
824503	MAIN ST AT CHERRY ST		02		
824502	MAIN ST AT KNOWLES ST		02		
605003	MAIN ST AT MAPLE LA	030	02		
884502	MAIN ST AT MEADOW AVE		02	09	12
964501	MAIN ST AT STUMP RD	015	02		
824501	MAIN ST AT SYCAMORE LA		01	06	08
605002	MAIN ST AT		02		
605001	MAIN ST AT		01	00	00
865009	MAIN ST AT		01		
925001	MAIN ST AT		01		
964502	MAIN ST AT		01		
172008	MARTIN MILL RD AT BUTTERNUT LA		00		
242002	MARTIN MILL RD AT COUNTY LINE RD	045	00	00	05
124503	MARTIN MILL RD AT CREST DR		00		
240001	MARTIN MILL RD AT GLEN ECHO DR		00	09	12
242001	MARTIN MILL RD AT HEATHER LA		00		
124502	MARTIN MILL RD AT STRATHMANN ST		00		
124501	MARTIN MILL RD AT WINDING WAY		00	00	00
172009	MARTIN MILL RD AT		00		
378002	MUMFORD AVE AT GREGORY ST		00		
378001	MUMFORD AVE AT HILLSIDE DR		00		
432002	NAUBUC ST AT STREET RD		02	06	08
432001	NAUBUC ST AT		01	00	05
571008	NEWARC DR AT MIRANDA WAY		00	00	05

NARRATIVE DESCRIPTION OF BUS ROUTE

PRIVATE

TAS*** RUN M1 -*HANOVER PARK REGIONAL HIGH SCHOOL DISTRICT*- 08/24/73 TIME 0.00.08

-*** PTAS SYSTEM USING THE OPTION OF MODIFY ***-

-DESCRIPTION OF ROUTE NUMBER 2-
-*** SCHOOL BUS IDENTIFICATION W102 ***-

-*WHIPPANY PARK HIGH SCHOOL, DEPARTING CLASS 10*-
-****SCHOOL CLASSES DISMISSAL TIME IS 03:42:00PM*****-

LOAD AND START AT *WHIPPANY PARK HIGH SCHOOL -
- GO NORTH ON E FAIRCHILD PL TO WHIPPANY RD TURN RIGHT -
- GO EAST ON WHIPPANY RD TO PARSIPPANY RD TURN LEFT -
- GO NORTH ON PARSIPPANY RD TO MT PLEASANT AVE -
>STOP AND UNLOAD ON PARSIPPANY RD AT MT PLEASANT AVE -
- CONTINUE -
- GO NORTH ON PARSIPPANY RD TO REYNOLDS AVE -
>STOP AND UNLOAD ON PARSIPPANY RD AT REYNOLDS AVE -
- SHARP LEFT -
- GO NORTH ON PARSIPPANY RD -
>STOP AND UNLOAD ON *PARSIPPANY RD AT KITCHELL PL -
- CONTINUE -
- GO NORTH ON PARSIPPANY RD TO KEARNEY AVE -
>STOP AND UNLOAD ON PARSIPPANY RD AT KEARNEY AVE -
- TURN RIGHT -
- GO EAST ON KEARNEY AVE TO LIONEL PL -
>STOP AND UNLOAD ON KEARNEY AVE AT LIONEL PL -
- CONTINUE -
- GO EAST ON KEARNEY AVE TO JOSEPH ST -
>STOP AND UNLOAD ON KEARNEY AVE AT JOSEPH ST -
- TURN RIGHT -
- GO SOUTH ON JOSEPH ST TO REYNOLDS AVE TURN LEFT -
- GO NORTH ON REYNOLDS AVE TO HILLCREST RD -
>STOP AND UNLOAD ON REYNOLDS AVE AT HILLCREST RD -
- X X - X X -
- GO SOUTH ON REYNOLDS AVE TO JOSEPH ST -
>STOP AND UNLOAD ON REYNOLDS AVE AT JOSEPH ST -
- X X - X X -
- GO NORTH ON REYNOLDS AVE TO HOWELL ST TURN LEFT -
- GO WEST ON HOWELL ST TO NORTH POND RD TURN RIGHT -
- GO NORTH ON NORTH POND RD TO BUCKINGHAM RD -
>STOP AND UNLOAD ON NORTH POND RD AT BUCKINGHAM RD -
- CONTINUE -
- GO NORTH ON NORTH POND RD TO BEEMEADOW PKY -
>STOP AND UNLOAD ON NORTH POND RD AT BEEMEADOW PKY -
- TURN RIGHT -
- GO EAST ON BEEMEADOW PKY TO REYNOLDS AVE -
>STOP AND UNLOAD ON BEEMEADOW PKY AT REYNOLDS AVE -
- TURN RIGHT -
- GO SOUTH ON REYNOLDS AVE TO HILLCREST RD TURN LEFT -
- GO SOUTH ON HILLCREST RD TO LOUIS ST -
>STOP AND UNLOAD ON HILLCREST RD AT LOUIS ST -
- TURN RIGHT -
- GO SOUTH ON LOUIS ST TO BRANFORD RD CONTINUE -
- GO SOUTH ON BRANFORD RD TO SHERRY LA -
>STOP AND UNLOAD ON BRANFORD RD AT SHERRY LA -

PRIVATE

PTAS*** RUN M1 -*HANOVER PARK REGIONAL HIGH SCHOOL DISTRICT*- 08/24/73 TIME 0,00.10

-*** PTAS SYSTEM USING THE OPTION OF MODIFY ***-

- TURN LEFT -
- GO SOUTH ON SHERRY LA TO ADDIE LA -
>STOP AND UNLOAD ON SHERRY LA AT ADDIE LA -
- TURN RIGHT -
- GO SOUTH ON ADDIE LA TO HIGHLAND AVE TURN RIGHT -
- GO WEST ON HIGHLAND AVE TO REYNOLDS AVE -
>STOP AND UNLOAD ON HIGHLAND AVE AT REYNOLDS AVE -
- BEAR LEFT -
- GO WEST ON REYNOLDS AVE TO PARSIPPANY RD TURN RIGHT -
- GO WEST ON PARSIPPANY RD TO STATE HWY 10 BEAR LEFT -
- GO EAST ON STATE HWY 10 TO MT PLEASANT AVE CONTINUE -
>STOP AT *HANOVER PARK HIGH SCHOOL -

-END OF DESCRIPTION FOR ROUTE 2-

CRYSTAL SPRINGS ELEMENTARY

1972-73 Bus Schedule

A. M. ROUTES

T-5 Starts 8:39 Grannis Rd after 35th Ave before Bothell Way.

T-9 Starts 8:26 35th Pl after Jewell Rd to 35th Ave to S 180th St to Bothell Way before 228th St SE.

T-12 Starts 8:26 31st Ave at S 228th St to S 220th St to 35th Ave to S 212th St to 45th Ave to S 228th St to 31st Ave.

T-37 Starts 8:26, 39th Ave after Maltby Rd before S 228th St deadhead to 27th Ave (on S 228th St) to Bothell Way to S 240th St deadhead to S 228th St at 2nd Ave to 3rd Ave to S 227th St to 4th Ave to S 228th St to 9th Ave to S 223rd St.

T-47 Starts 8:16 Maltby Rd after Bothell Way to Jewell Rd to 43rd Ave turn around to S 196th St to 51st Ave to S 180th St before 35th Ave.

T-62 Starts 8:17 S 212th St after Woodinville-Snohomish Rd to Little Bear Creek Rd to turn around to S 212th St to 55th Ave to S 216th St to 57th Ave to S 218th St to 60th Ave turn around back to S 212th St to Maltby Rd to 43rd Ave to S 200th St turn around to 43rd Ave to S 204th St to Maltby Rd deadhead past Bothell Way to 208th St to 9th Ave before S 214th St.

T-67 Grades 1-3 only Starts 8:20 At S 208th St on Filbert Dr to Duchess Rd to Winesap Rd to Filbert Rd before Filbert Dr.

T-67 Grades 4-6 only Starts 8:30 At S 208th St on Filbert Dr to Duchess Rd to Winesap Rd to Filbert Rd before Filbert Dr.

T-68 Grades 1-3 only Starts 8:20 At 198th Pl SE on 10th Dr SE to Grimes Rd to Filbert Dr to Filbert Rd to S 208th St to 9th Ave.

T-68 Grades 4-6 only Starts 8:30 At 198th Pl SE on 10th Dr SE to Grimes Rd to Filbert Dr to Filbert Rd to S 208th St to 9th Ave.

BUS ROUTE SUMMARY:

STOPS, TIMES AND LOAD

PRIVATE

•••PTAS••• RUN M1 -•HANOVER PARK REGIONAL HIGH SCHOOL DISTRICT•- 08/24/73 TIME 0.00.11

-••• PTAS SYSTEM USING THE OPTION OF MODIFY •••-

-ROUTE NUMBER 2-
-••• SCHOOL BUS IDENTIFICATION W102 •••-

-•WHIPPANY PARK HIGH SCHOOL, DEPARTING CLASS 10•-
-••••SCHOOL CLASSES DISMISSAL TIME IS 03:42:00PM••••-

BUS STOP DESCRIPTION		BUS STOP NUMBER	BUS STOP PICK-UP TIME	NUMBER OF STUDENTS	MINIMUM MILES TO SCHOOL	BUS ROUTE MILES TO SCHOOL
•WHIPPANY PARK HIGH SCHOOL		3	3:52:00PM	0	0.00	0.00
PARSIPPANY RD	MT PLEASANT AVE	390	3:54:10PM	1	.92	.92
PARSIPPANY RD	REYNOLDS AVE	462	3:54:52PM	1	1.03	1.03
•PARSIPPANY RD	KITCHELL PL	456	3:55:44PM	3	1.20	1.20
PARSIPPANY RD	KEARNEY AVE	454	3:56:20PM	1	1.25	1.25
KEARNEY AVE	LIONEL PL	318	3:57:41PM	4	1.43	1.43
KEARNEY AVE	JOSEPH ST	314	3:59:00PM	3	1.56	1.61
REYNOLDS AVE	HILLCREST RD	280	4:00:13PM	1	1.61	1.84
REYNOLDS AVE	JOSEPH ST	480	4:01:04PM	1	1.47	1.98
NORTH POND RD	BUCKINGHAM RD	401	4:03:49PM	4	2.33	2.84
NORTH POND RD	BEEMEADOW PKY	48	4:04:51PM	2	2.33	2.96
BEEMEADOW PKY	REYNOLDS AVE	50	4:06:01PM	1	2.76	3.23
HILLCREST RD	LOUIS ST	282	4:08:07PM	1	1.63	3.81
BRANFORD RD	SHERRY LA	70	4:09:24PM	2	1.45	3.99
SHERRY LA	ADDIE LA	16	4:10:12PM	1	1.48	4.06
HIGHLAND AVE	REYNOLDS AVE	278	4:11:23PM	2	1.22	4.32
•HANOVER PARK HIGH SCHOOL		1	4:16:56PM	0	0.00	7.15

NUMBER OF STUDENTS	>	28 -
AIDED STUDENTS	>	0 -
UNAIDED STUDENTS	>	28 -
AIDED STUDENT MILES	>	0.0-
UNAIDED STUDENT MILES	>	44.8-
PERCENT OF STUDENT AIDED MILES	>	0.0-
PERCENT OF STUDENT UNAIDED MILES	>	100.0-
ROUTE LENGTH IN MILES	>	4.3-
ROUTE TRAVEL TIME IN MINUTES	>	19 -
ROUTE DEADHEAD LENGTH IN MILES	>	2.8-
ROUTE DEADHEAD TIME IN MINUTES	>	5 -
STUDENT TRAVEL MILES	>	66.2-
STUDENT AVERAGE TRAVEL MILES	>	2.4-
NUMBER OF STOPS	>	15 -
BUS CAPACITY	>	40 -

CONCORD RESEARCH CORP.

TRIP 44 T-34			
START	7:30		3 MIN.
KENMORE JR. 5	7:33	7:50	17 MIN.
			21 MIN.
CANYON PARK 5	8:11	8:25	14 MIN.
			8 MIN.
SHELTON VIEW 1	8:33	8:50	17 MIN.
RETURN		8:56	6 MIN.
			86 MIN.

TRIP 52 T-47			
START	7:31		8 MIN.
BOTHELL 14	7:39	8:05	26 MIN.
			11 MIN.
CRYSTAL SPRINGS 4	8:16	8:50	34 MIN.
RETURN		8:57	7 MIN.
			86 MIN.

TRIP 4 T-46			
START	7:16		9 MIN.
BOTHELL 3	7:25	8:05	40 MIN.
			6 MIN.
WESTHILL 6	8:11	8:35	24 MIN.
RETURN		8:41	6 MIN.
			85 MIN.

TRIP 55 T-42			
START	7:16		6 MIN.
BOTHELL 1	7:22	8:05	43 MIN.
			10 MIN.
WESTHILL 4	8:15	8:35	20 MIN.
RETURN		8:41	6 MIN.
			85 MIN.

TRIP 53 T-45			
START	7:37		4 MIN.
LEOTA 3	7:41	8:19	38 MIN.
			7 MIN.
WOODIN 3	8:26	8:55	29 MIN.
RETURN		9:02	7 MIN.
			85 MIN.

BOEING COMPUTER SERVICES

8/11/73 ROUTE 49 ---- ROUTE SUMMARY REPORT ----

HUDSON SCHOOL DISTRICT...HIGH SCHOOL BUS CODE = 15

STOP SEQ.	STOP NUMBER	STOP LOCATION OR DESCRIPTION	NUMBER OF STUDENTS	DEPARTURE FROM STOP	ELAPSED ROUTE RUNNING TIME
1	4163-4	6 W	4	7:03	0.4
2	4162-4	6 W	6	7:04	1.6
3	4161-4	6 W	1	7:04	2.2
4	4239-4	2 ENNA	1	7:05	2.8
5	4240-4	2 ENNA	1	7:05	3.2
6	4241-4	3 ENNA	6	7:06	4.3
7	15-0	C E & HALE	6	7:10	8.2
8	4186-4	6 NE	2	7:11	8.8
9	4151-4	6 NE	1	7:12	9.9
10	23-0	C FTSBORO & MEADOW FARM	11	7:15	12.8
11	4225-4	2 EETSBORO	1	7:15	13.1
12	4224-4	2 EETSBORO	1	7:16	13.7
13	41-0	C GREEN & DOUG	7	7:18	15.6
14	40-0	C OR & DOUG	3	7:19	16.5
15	4062-4	C & WINSOR	4	7:20	17.6
16	4061-4	C ND & WINSOR	4	7:21	18.6
17	4060-4	C GREEN & HARLAND	3	7:22	19.4
18	------	---- MAIN SCHOOL.....	0	7:28	25.4

TOTAL STOPS = 17. BUS CAPACITY = 66. TOTAL STUDENTS = 62. RUNNING TIME = 25.4

SUMMARY OF STOPS, TIME OF PICK UP AND STUDENTS BY ROUTE

ECOTRAN, INC.

8/15/73 ---- ROUTE DETAIL REPORT ---- ROUTE NUMBER 71

PLAIN SCHOOL DISTRICT PLAIN CENTER ---1973/1974--- PREPARED BY ECOTRAN INC

STUDENT NAME	HOME ADDRESS	GRADE	HOME PHONE	SCHOOL NAME
***** STOP 1. 1510 MT PLEASANT NE		TIME... 7:18		STOP IDENT... 349-2
K ICTOR A	15 PLEASANT NE	5	4	PLAIN CENTER ELEMENTARY
S TEPHEN J	18 PLEASANT NE	3	4	PLAIN CENTER ELEMENTARY
***** STOP 2. 8101 KENT		TIME... 7:19		STOP IDENT... 587-2
H JAMES K	81 ENT	6	4	PLAIN CENTER ELEMENTARY
H ERRY L	81 ENT	2	4	PLAIN CENTER ELEMENTARY
M EILA K	81 ENT	5	4	PLAIN CENTER ELEMENTARY
M NORA D	81 ENT	1	4	PLAIN CENTER ELEMENTARY
***** STOP 3. 1260 MT PLEASANT NW		TIME... 7:21		STOP IDENT... 348-2
B FFERY E	12 T PLEASANT NW	6	4	PLAIN CENTER ELEMENTARY
***** STOP 4. 1440 MT PLEASANT NW		TIME... 7:22		STOP IDENT... 347-2
S DAVID P	14 T PLEASANT NW	5	4	PLAIN CENTER ELEMENTARY
S JOHN C	14 T PLEASANT NW	3	4	PLAIN CENTER ELEMENTARY
S HRISTINA A	14 T PLEASANT NW	2	4	PLAIN CENTER ELEMENTARY
	E	TIME... 7:23		STOP IDENT... 346-2
	19 T PLEASANT NW	3	4	PLAIN CENTER ELEMENTARY
	19 T PLEASANT NW	1	4	PLAIN CENTER ELEMENTARY
	79 UTTONSHOE	6	4	PLAIN CENTER ELEMENTARY
	18 T PLEASANT NW	5	4	PLAIN CENTER ELEMENTARY
		TIME... 7:25		STOP IDENT... 345-2
C DIANE L	78 UTTONSHOE	6	4	PLAIN CENTER ELEMENTARY
M N CHRISTOPHER	78 UTTONSHOE	4	4	PLAIN CENTER ELEMENTARY
M N DAVID B	78 UTTONSHOE	3	4	PLAIN CENTER ELEMENTARY
M N ROBIN R	78 UTTONSHOE	6	4	PLAIN CENTER ELEMENTARY
W EDWARD A	79 UTTONSHOE	5	4	PLAIN CENTER ELEMENTARY
***** STOP 7. 7900 ELMHURST		TIME... 7:28		STOP IDENT... 344-2
MC PAUL W	790 HURST	2	4	PLAIN CENTER ELEMENTARY
MC TIFFANY A	790 HURST	4	4	PLAIN CENTER ELEMENTARY

ROUTE LISTING
STOPS, ARRIVAL TIMES AND
STUDENTS SERVICED BY STOPS

8/11/73 ---- ROUTE DETAIL REPORT ---- ROUTE NUMBER 16

ORANGE SCHOOL DISTRICT...HIGH SCHOOL ---1973/1974--- PREPARED BY ECOTRAN INC

STUDENT NAME	HOME ADDRESS		GRADE	HOME PHONE	SCHOOL NAME
••••• STOP 1. 35450 CHAGRIN			TIME... 7:08		STOP IDENT...6486-4
D MELINDA S	355	MAGRIN	11	24 73	ORANGE HIGH
U DRA A	354	MAGRIN	12	24 89	ORANGE HIGH
P N SCOTT L	353.	MAGRIN	12	24 11	ORANGE HIGH
S CHERYL L	352.	MAGRIN	12	26 77	ORANGE HIGH
S MICHAEL D	352.	MAGRIN	9	24 51	ORANGE HIGH
••••• STOP 2. 38230 CHAGRIN			TIME... 7:11		STOP IDENT...7114-4
L ISABETH L	382	MAGRIN	10	24 82	ORANGE HIGH
L ARRY A	382	MAGRIN	12	24 82	ORANGE HIGH
••••• STOP 3. 38400 CHAGRIN			TIME... 7:11		STOP IDENT...6489-4
H CAROLYN	386	MAGRIN	12	24 30	ORANGE HIGH
H THOMAS R	386	MAGRIN	9	24 30	ORANGE HIGH
P ON CLAIRE A	384	MAGRIN	10	24 93	ORANGE HIGH
P ON CRAIG L	384	MAGRIN	9	24 93	ORANGE HIGH
••••• STOP 4. 4265 GILES			TIME... 7:16		STOP IDENT...6561-4
J OMAS	42	ILES	12	24 07	ORANGE HIGH
••••• STOP 5. 04355 GILES			TIME... 7:17		STOP IDENT...6542-4
	43	ILES	10	24 94	ORANGE HIGH
			TIME... 7:17		STOP IDENT...6541-4
	41	ILES	11	24 55	ORANGE HIGH
	41	ILES	9	24 55	UNIVERSITY UPPER
	41	ILES	9	24 77	ORANGE HIGH
	41	ILES	12	24 77	ORANGE HIGH
	41	ILES	11	24 77	ORANGE HIGH
••••• STOP 7. 4109 GILES			TIME... 7:18		STOP IDENT...6540-4
P ORY A	4	GILES	10	24 19	ORANGE HIGH
P GIL	4	GILES	9	24 19	ORANGE HIGH

ROUTE LISTING
STOPS, ARRIVAL TIMES AND
STUDENTS SERVICED BY STOPS

FIGURE I.G. 4

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

SCHOOL BUS ROUTE DESCRIPTION

CABSTOWN ELEMENTARY

ROUTE ID - E010

STOP NUMBER	STOP DESCRIPTION	CALL TIME	PUPIL LOADS	ROUTE MILES
824503	MAIN ST AT CHERRY ST	8.20	3	0.00
824502	MAIN ST AT KNOWLES ST	8.23	7	0.74
884502	MAIN ST AT MEADOW AVE	8.24	10	0.90
890099	SHELMIRE SCHOOL	8.26	24	1.37
124503	MARTIN MILL RD AT CREST DR	8.30	6	1.80
138001	CREST DR AT TULIP ST	8.32	3	2.25
142501	CREST DR AT STREET RD	8.35	8	3.18
	DESTINATION - CABSTOWN ELEM	8.40	61	5.53

TOTAL PUPILS CARRIED - 61
TOTAL LIVE MILES - 05.53
TOTAL ROUTE TIME - 20 MINS
AVERAGE VEHICLE SPEED - 16.6 MPH

DRIVING DIRECTIONS -

STOP AT MAIN ST AT CHERRY ST
PROCEED VIA MAIN ST
STOP AT MAIN ST AT KNOWLES ST
PROCEED VIA MAIN ST
STOP AT MAIN ST AT MEADOW AVE
PROCEED VIA MAIN ST
STOP AT SHELMIRE SCHOOL
PROCEED VIA MAIN ST
TURN LEFT AT MARTIN MILL RD
PROCEED VIA MARTIN MILL RD
STOP AT MARTIN MILL RD AT CREST DR
TURN RIGHT AT CREST DR
PROCEED VIA CREST DR
STOP AT CREST DR AT TULIP ST
PROCEED VIA CREST DR
STOP AT CREST DR AT STREET RD
TURN RIGHT AT STREET RD
PROCEED VIA STREET RD
STOP AT CABSTOWN ELEM

FIGURE I.G. 6

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

ROUTE COORDINATION REPORT

CABSTOWN, U.S.A.

BUS NUMBER - 268 A.M. SCHEDULE

STOP NUMBER	STOP DESCRIPTION	CALL TIME	PUPIL LOADS	ROUTE MILES	VEHICLE MILES
ROUTE ID - H001					
300650	CANYON RD AT SANDERS DR	7.18	46	0.00	02.81
300646	CORLISS DR AT	7.22	18	1.62	04.43
	DESTINATION - CABSTOWN SHS	7.29	64	4.25	7.06
ROUTE ID - J005					
100034	ORCARD RD AT GREAT VALLEY CIR	7.38	03	0.00	10.69
100033	ORCARD RD AT VALLEY RD	7.39	07	0.12	10.81
100032	ORCARD RD AT BROCKSIDE ST	7.43	08	0.95	11.64
100031	ORCARD RD AT	7.46	04	1.61	12.30
100030	ORCARD RD AT OAKWOOD DR	7.47	05	1.77	12.46
100011	OAKWOOD RD AT TARA RD	7.51	01	2.63	13.32
100045	TARA RD AT SOUTHWOOD DR	7.56	01	3.92	14.61
100072	TARA RD AT DAVIS DR	7.57	01	4.08	14.77
100044	TARA RD AT TARABROCK DR	8.00	24	4.24	14.93
	DESTINATION - CABSTOWN JHS	8.04	54	5.11	15.80
ROUTE ID - E006					
210049	RHEEM BLVD AT ZANDER DR	8.10	05	0.00	17.10
210050	RHEEM BLVD AT LIND CT	8.14	04	1.23	18.33
210047	RHEEM BLVD AT HALL DR	8.16	04	1.64	18.74
210048	RHEEM BLVD AT MORAGA ST	8.19	10	1.87	18.97
210036	GLORIETTA ST AT MEADOWVIEW ST	8.24	06	2.71	19.81
210037	GLORIETTA ST AT HOLLY RD	8.25	04	2.79	19.89
210061	GLORIETTA ST AT FLEETONE CT	8.36	02	5.16	22.26
210062	DONALD ST AT DOVER CT	8.39	11	5.31	22.41
210084	DONALD ST AT HALL DR	8.41	05	5.46	22.56
210063	HALL DR AT MORAGE WAY	8.42	01	5.61	22.71
	DESTINATION - CABSTOWN ELEM	8.47	52	7.29	24.39

TOTAL PUPILS CARRIED - 170
TOTAL LIVE LOAD MILES - 16.65
TOTAL DEADHEAD MILES - 9.89
TOTAL LIVE LOAD TIME - 74 MINS
TOTAL VEHICLE TRAVEL TIME - 105 MINS

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C A B S EDUCATIONAL COORDINATES OF SUNNYVALE, CA AND PRINCETON, NJ C A B S

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FIGURE I.G. 7

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

REPORT OF STUDENT CENSUS BY BUS ROUTE

CABSTOWN ELEMENTARY

ROUTE ID - J015

STOP NUMBER	CALL TIME	STOP DESCRIPTION	STUDENT NAME	STUDENT ADDRESS	
104001	8.21	TOLL HOUSE RD AT FITCH PL			
		B	WILLIAM T	12 F	PL
		C	, LAWRENCE B	175	HOUSE RD
		H	, THOMAS R	20 F	PL
		J	JOCELYN G	133	HOUSE RD
		M	, EDGAR R	120	HOUSE RD
		W	S, ALICE M	157	HOUSE RD
106001	8.24	TOLL HOUSE RD AT WESTERN WAY			
		A	CHARLOTTE E	284	HOUSE RD
		B	T, RALPH N	325	HOUSE RD
		D	, DANIEL R	2403	ERN WAY
		F	ON, ARTHUR C	370	HOUSE RD
		M	S, CANDICE B	2430	ERN WAY
		V	N, JANICE E	2515	ERN WAY
		W	SKI, WALTER C	433	HOUSE RD
112C01	8.28	WESTERN WAY AT HOPWOOD ST			
		E	, CHARLES W	801	OD ST
		C	T, CHARLES B	2730	ERN WAY
		C	DAN A	807	OD ST
		E	JAMES M	824	OD ST
		E	SKI, MARY JANE	847	OD ST
		C	, JO ELLEN	2800	ERN WAY
		I	ELIZABETH A	2630	ERN WAY
		K	K, STEPHEN F	870	OD ST
		M	EZ, JULIA S	2843	ERN WAY
		R	, REGINA T	882	OD ST
120001	8.30	WESTERN WAY AT COOPER ST			
		A	, BEVERLY R	3011	ERN WAY
		D	O, MONIKA	308	ERN WAY
		H	CLARA K	111	ER ST
		K	ER, LENORE S	310	ERN WAY
		M	JOHN F	115	ER ST
		O	O, JOSEPH O	311	ERN WAY
		S	, BERTRAM L	314	ERN WAY
		T	ROBERT G	316	ERN WAY

TOTAL PUPILS CARRIED - 31
TOTAL TRAVEL TIME - 15 MINS

SCHOOL BUS ROUTE SUMMARY

BOEING COMPUTER SERVICES

RUN DATE 30 NOV 72 SCHOOL BUS RUNS BY SCHOOL

DAKHURST ELEMENTARY (MORNING)

STOP	TIME	STUDENTS	ROUTE ID
WASHINGTON DR & 1ST ISLAND S OF 134TH AVE (BOYS ONLY)	7:11	54	
OAKHURST ELEMENTARY (MORNING)	7:20		
RUN TOTAL		54	5
12TH AVE & BAY PINE BLVD	7:04	11	
GULF BLVD & 8TH AVE	7:06	20	
GULF BLVD & S CANAL AVE	7:09	21	
GULF BLVD & 2ND AVE	7:10	7	
1ST ST E & 4TH AVE	7:11	2	
DAKHURST ELEMENTARY (MORNING)	7:10		
RUN TOTAL		61	36
BAY BLVD & 27TH AVE	6:50	7	
HARBOR DR & MAXWELL	6:50	11	
BAY BLVD & 23RD AVE	6:54	12	
BAY BLVD & 20TH AVE	6:55	13	
16TH AVE & KOLB PARK (SHUFFLE BOARD CT)	6:57	14	
GULF BLVD & 12TH AVE	6:59	6	
OAKHURST ELEMENTARY (MORNING)	7:20		
RUN TOTAL		63	158
WASHINGTON DR & JEFFERSON CIRCLE (GIRLS ONLY - NORTH END)	7:09	51	
OAKHURST ELEMENTARY (MORNING)	7:50		
RUN TOTAL		51	172
SCHOOL TOTAL		229	

BOEING COMPUTER SERVICES

[redacted] SCHOOL BUS SCHEDULES

DATE: 30 NOV 72

ROUTE 90

LEAVE AT 6:48 FROM DUNEDIN JUNIOR HIGH COMPOUND

STOP		TIME	STUDENTS
7TH ST & 9TH AVE	AT	7:00	2
7TH ST & 11TH PLACE	AT	7:02	27
LINCOLN HEIGHTS ELEM	AT	7:05	3
4TH ST N & ELM AVE	AT	7:06	8
DUNEDIN SENIOR HIGH	AT	7:20	40
HARBOR DR & MARSHALL	AT	7:36	8
BECKETT & GREENWOOD (GIRLS ONLY)	AT	7:38	15
SAN JOSE ELEMENTARY	AT	7:50	23
PASADENA AVE & ALT 19	AT	8:05	7
PASADENA AVE & REUNA VISTA	AT	8:06	8
PASADENA AVE & SAN JOSE	AT	8:07	0
SAN SALVADOR & SANTA ANNA DR	AT	8:09	11
SAN CHRISTOPHER & HIGHLAND	AT	8:10	13
FREDERICA LN & DAVIS DR	AT	8:12	16
DUNEDIN-HIGHLAND JUNIOR HIGH	AT	8:20	61

ROUTE SUMMARY - DISTANCE 27.0 MILES
TOTAL TIME 1 HOURS 31 MIN

PUPIL LEVEL REPORTS

ORANGE SCHOOL DISTRICT

STUDENT CENSUS DATA

RT. NUMB	STOP NUMB		STUDENT NAME	STREET ADDRESS	GUARDIAN SURNAME		HOME PHONE	BUS. PHONE	GR	SCHOOL ATTENDED
28	2	R	IZABETH ELLEN	30930	DENCE		8[illegible]061	53[illegible]00	3	31
50	9	R	ORGE W	29180	LL		2[illegible]350	69 00	8	20
36	6	R	RRI	29180	LL		2[illegible]350	24 50	5	30
4	4	R	TRICIA L	29180	LL		2[illegible]350	69 00	10	10
28	2	R	RGINIA C	30930	DENCE		8[illegible]061	53 00	1	31
17	13	R	ANDY J	3915	HIRE		2[illegible]589		11	10
7	8	R	LIE E	2550	HILL		4[illegible]046	83 63	10	10
45	12	R	DOUGLAS S	26	R CREEK	RT	8[illegible]20	94 00	7	20
15	14	R	GLENN M	26	R CREEK	RT	8[illegible]20	94 00	9	10
8	1	RI	SHEILA A	2811	ARD		9[illegible]341	66 00	9	10
49	9	RI	VID M	3323	RTON		8[illegible]290	29 61	8	20
49	9	RI	RCIE E	3323	RTON		4[illegible]261	29 61	6	20
34	10	RI	BERT A	3323	RTON		8[illegible]290	29 61	2	31
14	13	RI	DOUGLAS D	32890	REE	AL	8[illegible]197	99 00	11	10
34	3	RI	REGINA L	28299	WOODLAND		8[illegible]112	24 00	2	31
30	3	RI	DIRK	150	HOLLOW		2[illegible]181	68 13	4	30
30	3	RI	MARK R	150	HOLLOW		2[illegible]181	68 13	1	31
30	3	RI	MARY JO	150	HOLLOW		2[illegible]181	68 13	5	30
33	17	RI	R RUSSELL D	27600	RD	ER	8[illegible]53	24 00	1	31
23	9	RI	NN E	30850			8[illegible]32	44 80	8	20
44	4	RI	ANE E	29942	GBROOK		8[illegible]80	62 13	6	20
46	9	RI	AREN L	30850			8[illegible]32	44 20	7	20
15	8	RI	ICHARD K	30850			8[illegible]32	44 80	10	10

ALPHABETICAL LISTING OF STUDENTS

SHOWING BUS ROUTE AND STOP

ECOTRAN, INC.

ORANGE SCHOOL DISTRICT

STUDENT CENSUS DATA

SCHOOL CODE 30 GRADE 4

RT. NUMB	STOP NUMB	STUDENT NAME	STREET ADDRESS	GUARDIAN SURNAME	HOME PHONE	BUS. PHONE
31	10	K RI J	284 DALE	K	[illegible]	[illegible]
25	16	K KERI LYNN	314 ER	K	[illegible]	[illegible]
36	15	K GREGORY J	2 NCREST		[illegible]	[illegible]
34	1	K HRISTINE	311 IT	K	[illegible]	[illegible]
33	1	K DANIEL F	34 LAND	K G	[illegible]	[illegible]
28	10	K ROBERT P	278 RAVE	K	[illegible]	[illegible]
26	7	L Y JOHN	ERBERRY	L Y	[illegible]	[illegible]
31	6	L 1	288 MOUNT	L	[illegible]	[illegible]
33	21	L HERMAN L	37 NG PARK	L	[illegible]	[illegible]
30	17	L ARION	41 ER	L	[illegible]	[illegible]
28	14	L TTHEW E	27 RAVE	L	[illegible]	[illegible]
31	9	L DGE MARTHA	294 DALE	L DGE	[illegible]	[illegible]
29	20	L NNY	35 ING HILLS	L	[illegible]	[illegible]
23	3	L ISA A	51 NARD	L	[illegible]	[illegible]
34	10	M HEIDI A	32 ERTON	M	[illegible]	[illegible]
26	7	M CHAEL	HSPUR	M	[illegible]	[illegible]
30	4	M TER D	00 KSON	M	[illegible]	[illegible]
34	18	M ELLEY A	333 TH WOODLAND	M	[illegible]	[illegible]
27	17	M DERICK	336 RMOUNT	M	[illegible]	[illegible]
36	7	M L T W	51 PER	M ELL	[illegible]	[illegible]
24	13	M BARB	296 RMOUNT	M NG	[illegible]	[illegible]
25	15	M TEPHEN J	28 MOUTH	M	[illegible]	[illegible]
35	12	M KARA T	282 COURT	M	[illegible]	[illegible]

ALPHABETICAL CENSUS ARRANGED
BY SCHOOL AND GRADE SHOWING
BUS ROUTE AND STOP

ORANGE SCHOOL DISTRICT

STUDENT CENSUS DATA

RT. NUMB	STOP NUMB	STUDENT NAME	STREET ADDRESS	GUARDIAN SURNAME	HOME PHONE	BUS. PHONE	GR	SCHOOL ATTENDED
18	1	C ITA L	344 \	(	E 0		12	10
18	1	M EIL L	345 \	ICK	E 5	E 7	12	10
18	2	D TY KATHLEEN R	341 LAND	TY	2 9		12	10
18	2	D TY SUZANNE E	341 LAND	TY		2 9	9	10
18	2	K JOEL M	340 LAND		E 8	E 8	11	10
18	2	N GELA M	340 LAND		2 9	2 6	12	10
18	2	N THONY T	340 LAND		2 9	2 6	10	10
18	2	O NDRE M	342 LAND		E 4	4 0	12	10
18	2	O ABRINA	342 LAND		E 4	4 0	11	10
18	3	F R TARRY L	344 INIA	R	E 4	E 3	10	10
18	3	R MICHAEL D	340 INIA		E 3	E 0	9	10
18	4	G ROBIN E	345 URNE		E 3	E 6	11	10
18	5	K ELA M	342 INARD		E 7	E 3	10	10
18	6	F FRANK J	328 ARD	\	E 2	E 3	12	10
18	6	F LORI	328 A	\	E 2	E 3	10	10
18	7	B STEVE H	2805 1 1 D		E 2		11	10
18	8	B CAROL J	2815 1 1 D		E 7	E 7	10	10
18	8	B ELYNN	2815 1 1 D		E 7		12	10
18	8	G ROBERT G	2835 1 1 D	AN	E 6	E 0	12	10
18	8	T LAUREANN	2850 1 1 D	I	E 4	E 4	9	10
18	9	B ERLY A	2870 1 1 D		E 8	E 0	10	10
18	9	B DENNIS S	2880 1 1 D	D	E 6	E 6	9	10
18	9	B LORI A	2880 1 1 D	D	E 6	E 6	10	10
18	9	S OBERT A	2875 1 1 D		E 6	E 0	12	10
18	10	G G GABRIELA L	350 DA	AG	E 7	7 0	10	10

LISTING OF CENSUS DATA FOR STUDENTS SERVICED ON A GIVEN ROUTE ARRANGED BY STOP

(10-10) TO THE PARENTS OF - DIANE M HUDSON, OHIO 44236	STUDENT.. DIANE M SCHOOL....HUDSON HIGH SCHOOL STOP LOCATION... CRN S MAIN & NANTUCKET TIME... 7:22, ROUTE... 36, BUS... 20
(10-10) TO THE PARENTS OF - BECKY J HUDSON, OHIO 44236	STUDENT.. BECKY J SCHOOL....HUDSON HIGH SCHOOL STOP LOCATION... CRN STONE & HALE TIME... 7:10, ROUTE... 49, BUS... 8
(10-10) TO THE PARENTS OF - PARTICIA L HUDSON, OHIO 44236	STUDENT.. PARTICIA L SCHOOL....HUDSON HIGH SCHOOL STOP LOCATION... 215 S MAIN TIME... 7:23, ROUTE... 50, BUS... 21
(10-10) TO THE PARENTS OF - DAVID B HUDSON, OHIO 44236	STUDENT.. DAVID B SCHOOL....HUDSON HIGH SCHOOL STOP LOCATION... 669 BARLOW RD TIME... 7:08, ROUTE... 36, BUS... 20
(10-10) TO THE PARENTS OF - PAUL F HUDSON, OHIO 44236	STUDENT.. PAUL F SCHOOL....HUDSON HIGH SCHOOL STOP LOCATION... 8021 VALLEY VIEW TIME... 7:08, ROUTE... 40, BUS... 19
(10-10) TO THE PARENTS OF - MARK R HUDSON, OHIO 44236	STUDENT.. MARK R SCHOOL....HUDSON HIGH SCHOOL STOP LOCATION... 640 STREETSBORO TIME... 7:16, ROUTE... 35, BUS... 17

ECOTRAN, INC.

FIGURE I.G. 8

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

REPORT OF STUDENT CENSUS BY SCHOOL

CABSTOWN HIGH SCHOOL

ID NUMBER	STUDENT NAME	STUDENT ADDRESS		SEX	YR GD	SS CD	DIST H-SC	DIST H-TP	BUS NUMB
004829 T	EDWARD L	140	NG WAY	M	76		02.4	0.53	180
004830 T	WILLIAM L	140	NG WAY	M	76		02.4	0.53	180
004831 T	ELEANOR A	MEAD	LD RD APT A102	F	76		02.5	0.00	080
004832 T	JAMES M	MEAD	LD RD APT A140	M	76		02.5	0.00	080
004833 T	ROBERT D	MEAD	LD RD APT B201	M	76		02.5	0.00	080
004834 T	LAURA N	MEAD	LD RD APT B360	F	76		02.5	0.00	080
004835 T	, ROBERT R	MEAD	LD RD APT F083	M	76		02.5	0.00	080
004836 T	MOLLIE H	488	RD	F	76		02.6	0.80	006
004837 T	, BARBARA M	7975	ERSON ST	F	76		02.2	0.23	006
004838 T	DAVID H	861	IC AVE	M	76		03.1	0.19	079
004839 T	, CHERYL M	48 0	DR	F	76		03.4	0.28	049
004840 T	, LYNE H	7569	VIEW TERR	F	76		05.6	0.55	201
004841 T	, ADA K	1157	RIC AVE	F	76		04.6	0.21	079
004842 T	, RICHARD G	14 C	DR	M	76		03.2	0.12	049
004843 T	L, STEPHEN J	964	IC AVE	M	76		03.4	0.18	079
004844 T	, GAY T	3628	N PL	F	76		06.8	0.43	035
004845 T	NORMAN R	4992	Y PL	M	76		05.7	0.31	035
004846 U	N, DONNA J	235	HIP LINE RD	F	76		08.1	0.00	151
004847 U	HERBERT L	1008	IT PL	M	76		09.4	0.18	151
004848 U	OOD, JACOB C	1810	TON ST	M	76		02.0	0.31	108
004849 U	CLARA K	2051	RGREEN ST	F	76		07.3	0.25	064
004850 U	, HAROLD D	4327	GREEN ST	M	76		04.3	0.66	024
004851 U	KENNETH H	66	T	M	76		05.4	0.41	024
004852 U	CAROL B	757	ST	F	76		08.7	0.51	027

FIGURE I.G. 9

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

REPORT OF WALKING STUDENTS BY SCHOOL

CABSTOWN HIGH SCHOOL

ID NUMBER	STUDENT NAME	STUDENT ADDRESS		CTY COD	S X	SCH COD	SS CD	YR GR	DIST H-SC
025111	KI NORMAN A	4	EES AVE	086	M	041		75	1.47
025112	KI AVID A	34	DEN LA	086	M	041		75	0.13
025113	KI JODIE W	20	CH AVE	086	F	041		75	0.48
025114	KI RUBERT L	11	ER DR	086	M	041		75	1.31
025115	K ILLIAM O	46	ON RD	086	M	041		75	0.90
025116	K NNA B	12	TE ST	086	F	041		75	0.67
025117	L EN, INGA K	22	LA	086	F	041		75	0.71
025118	L HAROLD B	13	NSWICK ST	086	M	041		75	0.20
025119	L IOLET	27	ONSHIRE ST	086	F	041		75	0.23
025120	L ARK W	27	NTON ST	086	M	041		75	1.01
025121	L , RENNEE B	10	SHIRE DR	086	F	041		75	0.48
025122	L Y, HELENE M	31	DMAN AVE	086	F	041		75	0.17
025123	L THERESA V	88	S CT	086	F	041		75	0.76
025124	L EWIS B	81	NKLIN ST	086	M	041		75	0.51
025125	L , LOIS A	11	TE ST	086	F	041		75	0.73
025126	L , GERALD C	17	RCH AVE	086	M	041		75	0.22
025127	L ROGER D	10	TT ST	086	M	041		75	0.41
025128	L , NEVA T	57	NTON ST	086	F	041		75	1.18
025129	L ORE, SHARON M	2	STON DR	086	F	041		75	1.27
025130	L IN, WALTER C	28	ANT ST	086	M	041		75	0.78
025131	L ARTHUR J	98	TSHIRE DR	086	M	041		75	0.42
025132	L SANDRA T	10	AKE DR	086	F	041		75	0.51
025133	L AUL W	11	DWDEN LA	086	M	041		75	0.77
025134	L T, BRYAN G	20	MES CT	086	M	041		75	0.98

FIGURE I.G. 10

DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

SCHOOL BUS INFORMATION PASS

CABSTOWN, U.S.A.

TO THE PARENTS OF
THOMAS C
11[illegible]
CABSTOWN, NJ 08540

ASSIGNED SCHOOL - CABSTOWN SR HIGH
BUS STOP - GOATHILL RD AT CASEY CIR
BUS ARRIVAL TIME - 7.49
BUS NUMBER - 104

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C A B S EDUCATIONAL COORDINATES OF SUNNYVALE, CA AND PRINCETON, NJ C A B S

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DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

SCHOOL BUS INFORMATION PASS

CABSTOWN, U.S.A.

TO THE PARENTS OF
ANNETTE R
23[illegible]
CABSTOWN, NJ 08540

ASSIGNED SCHOOL - CABSTOWN SR HIGH
BUS STOP - PATTON DR AT HEATHER LA
BUS ARRIVAL TIME - 7.46
BUS NUMBER - 030

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C A B S EDUCATIONAL COORDINATES OF SUNNYVALE, CA AND PRINCETON, NJ C A B S

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DATE 10/25/74 COMPUTER ASSISTED BUS SCHEDULING

SCHOOL BUS INFORMATION PASS

CABSTOWN, U.S.A.

TO THE PARENTS OF
LEONARD K
1[illegible]
CABSTOWN, NJ 08540

ASSIGNED SCHOOL - CABSTOWN SR HIGH
BUS STOP - NEW ST AT HARBER RD
BUS ARRIVAL TIME - 7.41
BUS NUMBER - 064

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C A B S EDUCATIONAL COORDINATES OF SUNNYVALE, CA AND PRINCETON, NJ C A B S

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GPO 898-084