



## Education Logistics, Inc.

Innovative Technology.  
Demonstrated Savings.  
Proven Success.

**RESPONSE TO THE  
WEST VIRGINIA DEPARTMENT OF EDUCATION  
REQUEST FOR INFORMATION EDD377015  
SCHOOL BUS ROUTING SYSTEM**

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July 10, 2012

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**ATTACHMENTS: WEST VIRGINIA DEPARTMENT OF EDUCATION FORMS**



## INTRODUCTION

This white paper is submitted to the West Virginia Department of Education (WVDE) by Education Logistics, Inc. (EDULOG) in response to the WVDE's request for information for a school bus routing system. EDULOG understands that it is the intent of the WVDE to examine the feasibility of having every school district in the state use a student transportation management system in order to increase operational control and decrease costs, and this white paper will discuss the success school districts (including the only state administered system in the United States—that of North Carolina) have had with the EDULOG system. In this paper you will learn about the complete family of software products EDULOG offers for school transportation management, the advantages and benefits of having such a system, and how other entities have used the EDULOG system to reduce costs.

For questions about this white paper or to schedule a presentation, please contact Mr. Joe Hickey, EDULOG's sales manager for West Virginia. Mr. Hickey's office phone number is (406) 728-0893 extension 3116. Electronic messages may be sent to: [jhickey@EDULOG.com](mailto:jhickey@EDULOG.com). Facsimile messages may be sent to: (406) 728-8754. Our mailing and delivery address is: 3000 Palmer Street, Missoula, MT 59808.

## EDULOG OVERVIEW

### Our Beginnings

1977—First school bus routing and scheduling software system implemented by Dr. Hien Nguyen, Professor of Mathematics, University of Montana

1979—Company formed

1981—Company incorporated

- ◆ The company is privately owned and has never had any debt

### Our People

EDULOG senior management has an average of 19 years experience with the company

120 employees at corporate headquarters have an average of 7.75 years of experience

165 total employees worldwide

- ◆ EDULOG's engineering staff alone is larger than the total number of employees for any competitor
- ◆ EDULOG's implementation and support staff is larger than the total size of any competitor

### Our Clients

More than 1300 clients throughout North America and Europe

Total students for all districts exceeds 13 Million

Total transported students exceeds 6 million

Total buses (regular and special needs) exceeds 105 thousand

- ◆ 70 percent of the 100 largest school districts with routing software have EDULOG (New York City, Toronto, Chicago, Miami, Houston)
- ◆ Total statewide implementation of the EDULOG system in North Carolina— widely acknowledged to have the most efficient transportation system and most effective funding formulas of any state

### Our Clients' Cost Savings

Nearly \$18 million recently reported by clients through the use of the EDULOG system

- ◆ The Miami-Dade County Public Schools recently used the EDULOG system to remove 74 buses from service.
- ◆ The Toronto District School Board attributes \$20 million in savings over the years to the EDULOG software.
- ◆ The Toledo Public School and EDULOG produced a savings in the transportation budget of more than \$1.3 million this year.
- ◆ The Memphis City Schools used the EDULOG system to reduce its transportation expenses by \$8.2 million.

## Our Optimization Success

The Ontario Ministry of Education tested all of the leading routing and scheduling systems:

- ♦ The EDULOG system not only produced the best results in the least amount of time—in many cases it was the only system that could complete the assignment
- ♦ Much of the efficiency of the North Carolina districts is directly attributable to the power and flexibility of the EDULOG optimization software

## Our Customer Support

Even in the busiest times, first call resolution is completed within 30 minutes

The longest support hours in the industry: 6:00 a.m. to 8:00 p.m. Eastern time

Every new client is assigned a dedicated project manager.

- ♦ EDULOG's customer ACE department enhances EDULOG's support services through project management, client communication, and continuing education.

## Our History of Firsts

Geographic information system for school district transportation and boundary planning

Multi-user system allowing operators to perform the same function, at the same time, on multiple workstations

Total solution service approach with guaranteed results

Post-implementation consulting services

Transportation software system implemented under a statewide contract

System to connect separate transportation depots across a wide area network to a centralized database

Internet-based transportation applications

Ability to use maps from a variety of sources (ESRI, Navteq, MapQuest, etc.)

Computerized run, route, and stop location optimization

Optimization programs to simulate future transportation operations and boundary configurations and weigh the value of various alternatives

International users conference

Application service provider (ASP) software hosting

Integration of GPS technologies with routing software

Real time student and driver tracking integrated with routing and scheduling data

- ♦ EDULOG remains the only firm to provide recurring remote services for total system operations—the company as employee for a district

## Nothing Succeeds Like Success

Talk to our clients and compare their savings and satisfaction with clients of other firms.

## EDULOG THE COMPANY

Education Logistics, Inc. was established as a company in 1979—having evolved from a pilot project directed by Dr. Hien Nguyen, who holds a PhD in Mathematics from the Massachusetts Institute of Technology (MIT) and was professor of mathematics and operations research at the University of Montana in Missoula. In its development effort, Education Logistics has effectively balanced the usually conflicting objectives of providing powerful computer solutions while offering an extremely user-friendly approach to GIS-based pupil transportation management. This approach has made EDULOG the leading company in the field of student transportation management—particularly on the national scale in the public bid process, where our record in obtaining contracts has been outstanding.

Since 1979, EDULOG has been the most respected and popular choice for school district transportation and planning professionals. Why? Because of our unwavering commitment to providing quality technology and services at an affordable price. When Dr. Nguyen introduced the first GIS-based school bus routing and scheduling package in 1977, EDULOG changed the world of transportation management forever: we gave school districts for the first time the power to create optimized bus runs and schedules based on facts and supported by logic.

More than 30 years later, we're still leading the industry: our software has grown into true decision-support systems capable of meeting the most complex challenges. Now, with the integration of real-time GPS bus and student tracking into transportation management, EDULOG is setting new standards for power, flexibility, and ease-of-use.

**EDULOG continues to strengthen our ties to our long-term clients through the introduction of integrated GPS/AVL and student tracking technology, new web features, and enhancing consulting and support services. EDULOG's strength of experience is also on a personal level. Many EDULOG managers have been assisting school districts for more than 20 years, and the entire staff has nearly 700 years of experience with school district transportation operations.**

The integration of advanced technology with the human element forms EDULOG's core: no other firm has as broad a range of products (routing and scheduling, GPS, student tracking, electronic vehicle inspection, driver time and attendance tracking, web, GIS, planning, ASP, accounting, fleet maintenance, field trip management) or can offer total solution services that guarantee the client's success. This integration is scalable, flexible, and proven.

Often imitated, never equaled: that's another benchmark of EDULOG. We've seen competitors come and go while listening to them compare what they do to what we've already accomplished. While others try to catch up by copying original ideas, EDULOG is developing the newest, most powerful, and useful solutions (such as fully integrated bus and student tracking using GPS/GIS/wireless technology).

EDULOG's history of innovation includes the first:

- Geographic information system for school district transportation and boundary planning
- Multi-user system allowing operators to perform the same function, at the same time, on multiple workstations
- Total solution service approach with guaranteed results

## **EDULOG FACTS**

The Miami-Dade County Public Schools recently used the EDULOG system to remove 74 buses from service.

The Toronto District School Board attributes \$20 million in savings over the years to the EDULOG software.

EDULOG recently showed the Fulton County Schools of Georgia how to eliminate 10 special needs buses—while maintaining the current level of service.

The Toledo Public School and EDULOG produced a savings in the transportation budget of more than \$1.3 million this year.

The Memphis City Schools used the EDULOG system to reduce its transportation expenses by \$8.2 million in 2009.

The Carroll County School System of Georgia used the EDULOG system to reduce its fleet by 30 buses.

The Charlotte-Mecklenburg Schools of North Carolina saved \$495,000, parked 100 buses, and consolidated 11,000 stops thanks to the EDULOG system.

The Canyons School District of Utah reports more than \$200,000 in savings after the first year of using EDULOG software.

- Transportation software system implemented under a state wide contract (North Carolina)
- System to connect separate transportation depots across a wide area network to a centralized database
- Internet-based transportation applications
- Computerized run, route, and stop location optimization
- Optimization programs to simulate future transportation operations and boundary configurations and weigh the value of various alternatives
- Integration through ODBC and OLE links to other school district applications
- Application service provider (ASP) solution
- Integration of GPS technologies with routing software
- Transportation software approved by the Association of Educational Purchasing Agents and the National Joint Powers Alliance

## **WHAT IS AN INTEGRATED TRANSPORTATION MANAGEMENT SYSTEM?**

An integrated transportation management system (such as the EDULOG system) automates, records, and broadcasts all of the activities of a school district transportation department. In addition, such a system enhances and expands the capabilities of other school district operations such as enrollment/attendance, facilities planning, emergency response, public information, human resources/payroll, and state reporting by sharing system information such as: maps, student and driver information (assignments, times, locations), vehicle information (miles, times, activities, maintenance records), and school locations and capacities.

Therefore, an integrated transportation management system must be capable of performing all of these functions:

- Routing and scheduling buses
- Creating and maintaining student assignments and activities
- Recording vehicle activities
- Managing and reporting field trip and extracurricular activities
- Mapping the road network and student locations (even if the students have no conventional addresses)
- Recording and maintaining vehicle maintenance activities
- Administering parts inventory and maintenance requests, tasks, and needs
- Analyzing and recording expenditures
- Performing “what if” scenarios
- Electronically tracking vehicle inspections and noting defects
- Automatically recording student entrances/exits from buses with both time and location
- Determining when an emergency condition exists on a bus
- Recording and reporting on driver activity—including times, duties, and locations
- Reporting on the transportation of special needs students for Medicaid reimbursement

To meet these requirements, EDULOG offers an integrated family of software systems:

- Geocoding (for the maintenance of digital maps)
- Student System Interfaces (for the import and exchange of student information)
- Routing and Scheduling for buses and other vehicles
- Optimization (for bus stop locations, bus run sequencing, bus route coupling, and school bell times)
- Special Needs Routing and Scheduling
- Transacct (for financial management and accounting)
- Field Trip Management
- WebQuery for the broadcasting of transportation information to schools, parents, and the community
- WebSchoolAssistant for schools to access system information without having to be trained system operators
- WebReport for schools and non-transportation staff to create reports from the EDULOG system
- WebStudent for schools to create their own transportation assignments

- WebRouter for bus contractor use
- EduTracker (GPS/AVL for buses and other vehicles)
- Student Tracking (for the on-vehicle tracking of students)
- TripTracker (GPS/AVL tracking for out of district trips)
- Parent Portal (real-time notification system for parents of vehicle time and location information)
- EduRunBuilder (GPS data collection for routing and scheduling applications)
- SmartPhone GPS/AVL delivery from the system
- *eDTA* (electronic driver time and attendance tracking)
- EVIR (electronic vehicle inspection and reporting from Zonar Systems)
- Boundary Planning/Redistricting for geographic/demographic analysis and simulations
- Boundary Optimization for the creation of optimal school attendance boundaries
- Statistical Enrollment Projections

No other firm in the industry has such an extensive and powerful suite of applications to meet the needs of West Virginia school transportation operations.



## WHY HAVE AN INTEGRATED TRANSPORTATION MANAGEMENT SYSTEM?

It has been well documented that the use of routing and scheduling software (which is only one piece of an integrated K-12 transportation management system) will produce financial savings. Evidence of the financial benefit of routing and scheduling software in West Virginia was presented in a January 3, 2012 report prepared by Public Works LLC entitled "Education Efficiency Audit of West Virginia Primary and Secondary Education System."

On page 49 of the report, it was stated:

"Only nine counties in West Virginia use bus routing technology to plan school transportation routes; the majority of counties continue to plan routes manually. Yet, counties using bus routing technology are shown to have lower per student transportation costs.

"Six of 14 counties in high density areas use routing technology (Wood, Kanawha, Ohio, Berkeley, Hancock, and Cabell). Four of these six counties incur the lowest cost per pupil.

"Of the 15 sparsely populated counties in West Virginia, the two counties using route technology (Hardy and Randolph) have the second and third lowest per pupil costs.

"Among medium density counties, Mineral County is the only one using routing technology. Its expenses per mile are less than six of the other ten medium density counties."

The majority of the county school districts mentioned above use the EDULOG routing and scheduling software system.

Other reports from around the United States validate the financial efficiency that comes with EDULOG system use. For example:

- The Miami-Dade County Public Schools recently used the EDULOG system to remove 74 buses from service.
- The Toronto District School Board attributes \$20 million in savings over the years to the EDULOG software.
- EDULOG optimization was used to eliminate ten special needs buses at the Fulton County Schools of Georgia—while maintaining the current level of service.
- The Memphis City Schools used the EDULOG system to reduce its transportation expenses by \$8.2 million in 2009.
- The Carroll County School System of Georgia used the EDULOG system to reduce its fleet by 30 buses.
- The Charlotte-Mecklenburg Schools of North Carolina saved \$495,000, parked 100 buses, and consolidated 11,000 stops thanks to the EDULOG system.
- The Canyons School District of Utah reports more than \$200,000 in savings after the first year of using EDULOG software.



In a further section of this RFI response we will present case studies (including several from North Carolina) that further document financial success directly attributable to EDULOG system use.

The financial savings realized from implementing and using routing and scheduling software is primarily a result reducing the number of vehicles in service because of better route planning or reducing the number of miles driven, or a combination of the two. These result in less expenditures for fuel, replacement vehicles, labor (drivers, aides, mechanics), insurance, and non-fuel consumables (lubricants, tires, etc.).

There are, of course, other financial savings that can be realized by having an effective routing and scheduling system—especially labor and administrative costs related to transportation planning, maintenance and administration of the transportation plan, and reporting of statistics and the dissemination of information to the state, schools, and the community.

We will discuss the potential for these “off the road” savings further in this document, but we would also like to point that there are further benefits to having an integrated transportation management system (of which routing and scheduling is only one part) that go beyond dollars and cents. They include:

- Greater management control and mechanisms for change
- Increased situational awareness and student safety
- Improved service to the community

But let us return to the financial benefits of having a system.

## **FINANCIAL BENEFITS**

### **Optimization**

To some degree or another, all K-12 routing and scheduling systems can show on a digital map bus stop locations, student residences, schools, and the path that buses take to link the destinations together. Having this display capability is better than relying on colored pins and strings on a map, but it really doesn't address the issue of “how do I make my routes and schedules more efficient by reducing vehicles and miles while providing the same level of service?”

To answer that question, EDULOG developed in the 1970s powerful optimization algorithms that allows the software system quickly and efficiently analyze all possible combinations ride times, passenger loads, and route miles in a way that create the best solution based on factors determined by the client.

We then developed the application of route coupling optimization that links together bus runs so that one bus can serve multiple schools in the most efficient manner. That was followed by our introduction of bell time optimization that considers all possible school bell times and makes adjustments so that the least number of buses can be used to transport all students.

And it is through optimization that real “on the road” savings are produced—EDULOG optimization at the Toledo Public Schools of Ohio resulted in a fleet reduction from 143 to 102 buses, with a projected annual savings in transportation costs of \$1,394,000—based on the district's figure of \$34,000 in annual expenses

for each bus in service. But not all optimization processes are the same—either in their power or flexibility, or the amount of operator control that is provided to account for unique circumstances.

Fortunately, there are ways to evaluate optimization capabilities:

- Does the system provide sufficient feasibility in defining the actual requirements of the client? For example, when a system builds bus runs from scratch, can it consider different size vehicles, and can it limit bus runs by time and/or load? Can the user specify the desired number of vehicles to minimize the total fleet requirement?
- Another example is linking bus runs into full day schedules; can the system allow for individual arrival and departure time windows for each school and also each bus run? Can it consider road conditions or traffic congestion?
- What is the track record of the vendor with its optimization software? Has the system proved itself in the claimed capabilities? How has it done in agency administered tests against other systems?

The EDULOG optimization approach is based on a very solid mathematical background, and the algorithms are constantly being enhanced to increase performance in response time and the quality of solutions produced. And just as importantly, the whole procedure of building bus routes is extremely user-friendly, easy to train on and operate, and totally automatic.

### Savings from GPS/AVL

Global Positioning Systems (GPS) have existed for more than 20 years, but only recently have they been implemented in the student transportation industry. Initially, safety concerns spurred the decisions to equip school buses with GPS (knowing where a bus is and what it is doing at any given time is a significant security benefit). And although the safety benefits of GPS are vital, other advantages that GPS brings to a school district can recover the cost of the system and provide significant, continuing cost savings at a time when increasing efficiencies and reducing operating costs are more important than ever.

Based on the experiences of school districts that have implemented an EDULOG GPS solution, conclusions can be drawn about the potential results from installing such a system. The financial savings available as illustrated by this report can be quite startling. Often the return on investment (ROI) can be so significant that clients discover it's not a question of whether they can afford to have an EDULOG GPS solution—but rather how can they afford to be without one.

**Although the safety benefits of GPS are vital, other advantages that GPS brings to a school district can recover the cost of the system and provide significant, continuing cost savings at a time when increasing efficiencies and reducing operating costs are more important than ever.**

As the results below clearly show, there are multiple ways for school districts to permanently reduce its transportation costs by a significant margin through:

- Controlling Route Deviation
- Eliminating Unscheduled Stops
- Reducing Unnecessary Idling
- Tracking Driver Times and Activities

In the following examples of cost savings, we will use a hypothetical district with 30 buses.

### Reducing Route Deviation

\*\*\*Unplanned route deviations are a significant cost because they unnecessarily waste fuel, increase the total driving miles and the associated maintenance costs of buses, and are an unproductive use of driver payroll. Reducing the amount of route deviations will immediately reduce the district's costs. It is estimated that without any ability to actively monitor and confirm that its buses are following their planned routes, the typical school district has no less than a six percent deviation from its planned bus routes on an annual basis. An EDULOG GPS solution will allow the transportation department to identify and eliminate most route deviations by having the ability to compare real world GPS data with the planned route for that bus. Therefore, the following savings are available:

<b>Average Daily Mileage Per Bus</b>	<b>67</b>
<b>Assumed Deviation</b>	<b>5.40%</b>
<b>Extra Miles Driven Per Bus Per Day</b>	<b>3.62</b>
<b>Extra Gallons of Fuel Used Per Bus Per Day</b> (7 miles per gallon)	<b>0.52</b>
<b>Extra Fuel Cost Per Bus Per Day</b> (\$3.00 per gallon)	<b>\$1.55</b>
<b>180 school days</b>	<b>\$279.10</b>
<b>Total Buses in Fleet</b>	<b>30</b>
<b>Total Annual Savings</b>	<b>\$8,373</b>

Note: The above only considers the cost of fuel. It does not take into account wear and tear on a school bus, maintenance expenses, driver payroll, and other costly factors caused by driving unnecessary miles.

### Reducing Unscheduled Stops

It is well known that bus drivers do not always make the same stops as planned by the transportation department—drivers often ignore some planned stops and make a number of unscheduled stops. This isn't necessarily the result of drivers intentionally doing something they know is wrong, but the difference between what is planned to happen versus what actually happens in the real world can be a meaningful area for cost savings. Skipped and unscheduled bus stops can occur for a variety of reasons—for example:

- 1) Drivers may not report when a student stops riding the bus (they may not be motivated to do so because it would reduce their total route time). They don't make the stop for the phantom student, but rather drive past it, and the information never gets to the transportation department so that the planned schedule for that route can be altered. Transportation planners will continue to route the bus with the assumption that the stop is needed—thus reducing routing efficiency.
- 2) Drivers may be picking up some students at bus stops that the transportation department is unaware of, therefore making unscheduled stops (such as stopping directly in front of a student's home as a conven-

ience). The driver may not believe he/she is doing anything wrong if this unscheduled stop is along the route they are supposed to be driving. However, each time the bus comes to a stop and then must accelerate back to driving speed, there is an associated cost in increased fuel use. Unscheduled stops made willfully by drivers for other reasons are equally as expensive.

By implementing an EDULOG GPS solution, school districts will be able to quickly identify and remove most unscheduled bus stops. This will improve the quality of the planned data used for bus routing and scheduling and will effectively reduce payroll, idle time, total mileage, and fuel consumption. It has been estimated by other school districts that removing a single unscheduled daily bus stop will result in an annual savings of \$60 to \$70 per year. With an average unscheduled stop rate of five percent, the typical district would realize the following savings:

<b>Rate Unscheduled</b>	<b>5.00%</b>
<b>Average Unscheduled Stops Per Day Per Bus</b>	<b>3.05</b>
<b>Excess Annual Cost Per Bus</b> (\$60 per year per stop)	<b>\$183.00</b>
<b>Total Buses in Fleet</b>	<b>30</b>
<b>Total Annual Savings</b>	<b>\$5,490</b>

Note: The above only considers the cost of fuel saved by reducing unscheduled stops. It does not take into account wear and tear on a school bus, maintenance expenses, driver payroll, and other costly factors caused by unscheduled stops. It also does not consider the potential savings available from increasing routing efficiencies, as described above, which would be a benefit caused by having more accurate stop data for planning purposes.

### Reducing Engine Idling Time

Fuel is one of the greatest costs associated with pupil transportation. Therefore, any reduction in the amount of fuel used by the fleet will result in immediate savings. The results shown above from reducing route deviation and removing unscheduled bus stops specifically focus on reducing fuel expenses. However, simply reducing the amount of time that buses are stationary with their engines idling can provide a substantial return in savings.

A certain amount of engine idle time is to be expected for any school bus operation. Transportation departments can attempt to minimize fuel waste by setting a policy (for example, buses should never idle for more than ten minutes at a time). However, without a system that can actually track idle time, it is virtually impossible to enforce the policy. An EDULOG GPS solution monitors bus idle time, both historically (through reports) and also in real time. School districts could then effectively enforce an idle time policy: drivers would be aware that their idle time is being monitored and therefore would be less likely to violate the policy. And in extreme cases, dispatch can be immediately notified of gross violations in real time (a bus idling for 45 minutes), allowing them to contact the driver and tell him/her to turn off the engine.

The cost of unnecessary idle time is significant. The national average is  $\frac{1}{2}$  gallon of fuel used per one hour of idle time (Source: US, EPA). The ability of the transportation department to enforce an idle time policy using an EDULOG GPS solution will result in immediate cost savings. Based on the results at other school districts, it is reasonable to project that at least 14 minutes of idle time per bus per day can be eliminated.

<b>Minutes Reduced Idle Time Per Day Per Bus</b>	<b>14</b>
<b>Excess Gallons Of Fuel Per Day Per Bus</b>	<b>0.12</b>
(1/2 gallon per 1 hour idling)	
<b>Excess Fuel Cost Per Day Per Bus</b>	<b>\$0.35</b>
(\$3.00 per gallon)	
<b>180 School Days</b>	<b>\$63.00</b>
<b>Total Buses in Fleet</b>	<b>30</b>

**Total Annual Savings** **\$1,890**

Note: the above figures do not include the occasional gross violations (bus idling for 45 minutes or more) that occur.

### Reducing Driver Payroll

The other major recurring cost for a school district transportation department besides fuel is payroll, and the largest group of employees is bus drivers. Naturally, driver payroll costs are an inherent part of every operation, and unfairly scrutinizing or penalizing good drivers does not benefit the district or its drivers. However, protecting the transportation department from payroll abuse can substantially reduce excess payroll costs.

For example, it has been widely observed that drivers may “pad their hours” (perhaps inadvertently or unknowingly) by a small amount each day. Every excess minute counts—and quickly adds up—when considering the number of drivers and multiplying the effect over an entire year.

Existing payroll systems make it extremely difficult to reduce this type of payroll slippage—because any comparison of a driver’s logged hours with his/her planned hours must be done manually. As a result, there is no way to recover the estimated extra five to ten minutes that may be lost each day. An EDULOG GPS solution would allow the transportation department to fully integrate the driver payroll system with the scheduled hours for drivers. Through this integration, exception-based reports can document driver log-ins/logouts that exceed an acceptable time window (show the drivers that logged in more than 15 minutes early, or logged out 30 minutes late). Additionally, comparisons can be made to highlight non-productive time (drivers that spent more than 20 minutes on a pre-tip vehicle inspection), and also slack time (driver completed the pre-trip inspection but did not start the bus run until 27 minutes later).

With access to this invaluable information, management can have drivers modify their behavior and thus dramatically increase the productivity and efficiency of the operation.

Minutes of Wasted Time Reduced Per Driver Per Day	13
Average Hourly Driver Pay Rate	\$12.00
Excess Cost Per Driver Per Day	\$2.60
180 School Days	\$468.00
Total Drivers	30

<b>Total Annual Savings</b>	<b>\$14,040</b>
-----------------------------	-----------------

Note: Many school districts have reported a substantial savings of ten percent or more in driver payroll simply by announcing to drivers the introduction of GPS. Basic awareness that tracking will occur can lead to improved driver performance.

### Conclusion

EDULOG's GPS solutions offer a additional benefits that go far beyond financial return and cost savings. For example, it is difficult to assign a value to the safety and security of children. However, when purely focusing on cost and financial benefits, no other GPS solution can offer the continuing annual cost savings available from EDULOG—because no other system combines both actual GPS data and planned routing and scheduling data into a single system. As discussed in this text, a school district could immediately begin to realize cost savings starting in month one with an EDULOG GPS solution.

Reduced Route Deviation	\$8,373
Reduced Unscheduled Stops	\$5,490
Reduced Engine Idle Time	\$1,890
Reduced Driver Payroll	\$14,040

<b>Total Annual Savings Immediately Available</b>	<b>\$29,793</b>
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Compare the total annual savings with the cost of the system, and it becomes clear that you cannot afford not to have an EDULOG GPS system.



## **Administrative Efficiency**

Having student information (names, school of attendance, grade, residence address, special needs, etc.) in a routing and scheduling system is critical for the proper management of a transportation plan. But if all that information has to be entered manually, it creates a tremendous workload, and often leads to information not being updated or maintained. But a really well-designed transportation management system can automatically take information from a student information system and transfer the data correctly to routing and scheduling system—thus alleviating a tremendous amount of typing. EDULOG has interfaces with all the leading student information systems for this information transfer, and also interfaces with a number of legacy systems (after all, we've been doing this for more than 30 years).

But having the student information in the system is just a start—transportation departments or school administrators then have to assign students to a bus stop and a bus route—again a time-consuming process. That's why EDULOG developed a process so that within three minutes of entering a student in a district's SIS, the EDULOG system automatically receives that information, determines transportation eligibility, assigns the student to the correct bus stop and run, and prints a bus pass.

## **Special Needs Transportation**

At many school districts, managing special needs transportation involves as much as 70 percent of the time spent on routing and scheduling activities. The task of managing special education transportation is made even more difficult by the large number of extensive changes made daily.

To alleviate the workload, the EDULOG system conducts all required special needs transportation functions, including special identification of handicapped students and their appropriate program, the ability to specify global or individual load times for special needs students, the generation of door-to-door pickup stops, the ability to group special needs students separately or have them be "mainstreamed" for routing purposes, and the ability to include medical information and/or a student's individualized transportation plan on the student census record.

## **Information Access**

The Internet has changed school district operations forever, and EDULOG was the first to leverage this change by creating tools to electronically broadcast transportation information throughout the school district and community.

We know that everyone wants instant access to real time information. With EDULOG web applications, West Virginia school districts can give parents, principals, secretaries, realtors, and contractors detailed information about bus runs, school boundaries, and student transportation assignments. By distributing information through the web, you decrease your workload and provide a valuable service to the community.

## **Field Trip Management**

Managing field trip and other extracurricular transportation activities is not only time-consuming, it is also prone to error with most manual approaches—errors that can cost money. Therefore, an integrated

transportation management system (such as EDULOG) should automate many of the management functions of field trip transportation. The system allows schools to request field trip transportation and allows administrators to approve or deny such requests. It also allows districts to:

- Automatically assign drivers and vehicles to trips
- Track driver and vehicle availability
- Store various types of information on requests, field trips, groups (schools who request field trip transportation), drivers, and vehicles
- Produce a variety of reports on your field trips
- Automatically calculate charges for trips using a variety of rate choices, then produce invoices to bill groups

### **Driver Time and Attendance**

Most employee time and attendance systems used by transportation departments simply record log-in/log-out times. But we believe (and many school transportation professionals agree) that much more can be done with a time and attendance system—especially one that is integrated with driver scheduling, vehicle activities, work types, and GPS/AVL.

What EDULOG provides is a system that is a true intelligent worker management system. EDULOG's *eDTA* (Electronic Driver Time and Attendance System) allows you to track and monitor bus driver hours electronically, providing an efficient alternative to traditional paper systems or manual time clocks. It saves time and money by:

- Tracking log-in and log-out times
- Recording vehicle inspection times
- Verifying that drivers are on the right bus/route
- Defining custom labor types and pay rates
- Eliminating wasted time
- Increasing efficiency and driver production
- Preventing driver abuse (padding hours)

### **Fleet Maintenance/Parts Inventory**

Significant operational savings can result from having an easy-to-use, fully integrated, vehicle specific database software system, for managing vehicles, parts inventory, work orders, and personnel. A complete case history can be kept for each vehicle that monitors operating costs, repairs, maintenance services, and fuel consumption.

As one example of the usefulness of such a system, the EDULOG system “manages” preventive maintenance. Schedules are evolved by treating a task as though it were regularly scheduled maintenance, letting the user assign it to an experimental timetable. The EDULOG system helps the district establish permanent timetables by allowing the director or manager to experiment with alternate preventive service schedules, and, over time, to tell if a change in maintenance and inspection work is yielding favorable results. Such changes can then be incorporated into the existing maintenance schedule permanently and the job is no longer guesswork.



Costs can also be controlled with the parts inventory feature as inventory problems like shortages and overstocks are recognized and dealt with. Cost savings are produced through several inventory control characteristics, including: an Economic Order Quantity (EOQ) model built into the system causing new orders to be generated for the inventory when a specified level of goods-on-hand is reached; a feature that inserts the number of a given part on order into the inventory automatically; and the maintenance of a complete and up-to-date vendor file.

### **Electronic Vehicle Inspection and Reporting**

Every school bus in West Virginia is currently equipped with Zonar Systems RFID tags for vehicle inspections. EDULOG can provide the hardware and software (the EVIR system) from Zonar Systems to allow every school district to perform its own daily inspections.

EVIR simplifies the entire pre- and post-trip inspection process. It is easy to use, captures powerful new fleet performance data and speeds vehicle repairs. EVIR is the only verified visual inspection system available. It complies with all DOT-mandated pre- and post-trip vehicle inspection regulations, as well as OSHA and MSHA equipment inspection requirements.

Zonar's EVIR system uses the innovative Tag Once, Inspect Regularly, Know Always approach to capture, transmit and record inspection, compliance and maintenance data. Required pre- and post-trip inspections are automated and verified using patented technology. Zonar has eliminated the errors, inefficiencies and risks inherent in all other approaches.

EVIR inspections create a new kind of safety mindset and deliver gains that benefit the entire fleet. It enables repair-before-failure strategies that lower operating costs and increase compliance. Because EVIR events are time and date stamped, a new kind of data gives fleets a totally new performance edge.

## **INCREASING MANAGEMENT CONTROL AND EFFICIENCY**

An integrated transportation management system (such as the EDULOG system) provides benefits at all three levels of transportation decision-making:

- Operational
- Tactical
- Strategic

At each level, savings can be achieved, and as the planning becomes more advance, the potential for savings grows larger.

As the levels advance, the time scope lengthens:

- days—operational
- months—tactical
- years—strategic

Also as the levels advance, the scope of the enterprise expands

- one school or one bus depot—operational
- the entire district's transportation plan—tactical
- the entire district (transportation and facilities and attendance boundaries)—strategic

This operational level of management involves day-to-day activities

- Making scheduling changes
- Keeping student and transportation information current and correct

Management at the operational level requires quick action, and often involves repetitive tasks. A system at this level needs to be easy to use and flexible, and should follow a work flow that fits the district's way of doing things.

Daily management at the operational level includes giving information to:

- Parents and students
- Schools
- Bus contractors or drivers
- Administrators

This information needs to be correct, and it needs to be produced quickly, especially when a new student is enrolled in the district.

One tremendous benefit of the EDULOG system is that you can put transportation information on the Internet so that parents can look up bus stop and time information for any address. In addition, this information can be made available throughout the district on an "intranet."

Operators must also maintain accurate data, which means keeping information up-to-date, and producing reports for:

- Schools
- Bus contractors or drivers
- Internal operations

A strong system at the operational level must be able to create both standard reports and "ad-hoc" or customized reports. When creating customized reports the operator must be able to:

- Sort or search on any and all items in the database
- Control the output
- Pass this information on to another system
- Save the report for later use and editing

Operational level actions usually don't require much administrative review, but a system must be flexible enough to let the operator consider all district policies.

However, it is of vital importance to the student and his/her parents that they get assigned transportation immediately.

Systems that cannot process student information downloads on a daily basis or that do not allow for the manual override of system assignments are not adequate for even the operational level.

At the tactical level of planning the EDULOG system offers an even greater savings potential:

- Efficiently planning for school year start-up
- Evaluating and comparing transportation policies
- Quickly and easily changing bus stop locations
- Creating optimized bus runs

Planning at the tactical level usually takes a few weeks to a few months, involves the higher levels of transportation management, and affects the entire district.

- If you can use the system to create state reports, you can save hours of overtime.
- If you can optimize runs and routes, you can save time on the road, mileage, and vehicles.
- If you can plan next year's schedule in two weeks instead of two months you might get to take a vacation.
- If your plan is accurate and valid, you won't have buses passing by students on the first day of school.

At the tactical level, a system must be able to:

- Evaluate transportation policies and bus stop locations
- Build bus runs and routes
- Prepare state reports

These are more complex issues than at the operational level—and require a more sophisticated solution.

At the strategic level EDULOG helps with long-term planning:

- Where is the district going?
- How are we going to get there?
- What can we do to increase efficiency, the level of service, or both?
- These are complex issues, and EDULOG can help solve a variety of “what if” problems

The strategic level often involves transportation in a working group with planning, facilities, educational administration, and looks into the future one or more years.

- To plan at the strategic level, you may need to use the system to:
- Forecast future enrollments and then use this information to project future bus requirements;
- Determine what would be the increase/decrease in transportation costs if you went from a three year to four year high school plan;

- Create a plan that will satisfy a court-ordered desegregation plan (or to provide supporting statistics to say that the plan has now been met);
- Find the best schedule of school start/end times that would be needed if you were required to reduce the bus fleet by 20 percent.

At the strategic level, policies are evaluated:

- What if the walk to stop or school distances were changed?
- What if school start/end times were altered?
- How will this affect transportation planning?
- What if a school were closed, or opened?

A system must be able to allow a district to:

- Create simulations,
- Save them,
- Analyze them
- And report on them

without affecting your current plan. In fact, you could be working on these strategic planning issues at the same time that someone else creating a new bus run to serve a newly-opened subdivision.

At the strategic level, you may need to analyze growth, decline, or shifts in enrollment

- What if schools change grade configuration?
- What if the attendance boundaries were changed?
- How will all of this affect the other schools and transportation planning?

Unless you have an EDULOG system that gives you integration between transportation and demographic analysis functions, it may prove impossible to perform these tasks with any sort of confidence or statistical validation.

## **SAFETY AND SECURITY**

Having a passenger roster with names and contact information is obviously valuable in an emergency or when a bus is overdue. In addition, the EDULOG system has been used as a GIS (geographic information system) tool for emergency notification and evacuation not related to transportation—tornadoes, chemical spills, etc. By quickly drawing a boundary at a set distance from the incident, the system was used to find the contact information for all who lived in the area.

With the EDULOG GPS/AVL system, when a driver or vehicle attendant pushes the emergency button on the vehicle, a signal is transmitted through the GPS device to the EDULOG base station server. All workstations currently monitoring the system will have a pop-up box displaying the emergency event, the vehicle number, and the vehicle location.

Because of the integration with routing and scheduling data for both time and place, EDULOG clients can quickly determine if there is an abnormal busing incident and take appropriate action. The delayed or stationary bus is highlighted on the system display, a dispatcher can radio the bus, report the position to authorities, and use the EDULOG system to get the names, phone numbers, and emergency contacts of all involved students.

Knowing where all the vehicles are, and what is happening out on the road, can also increase situational awareness and support effective decision-making when an accident or emergency occurs. These unplanned incidents can be handled better and quicker when a transportation department has an accurate picture of what is happening and are able to make decisions based on real-time information. This results in fewer delays, better use of resources, and better service to students and the community.

## INFORMATION TO THE COMMUNITY

With EDULOG's integrated web browser software, anyone with access to the Internet can look up transportation system information and have their school busing questions answered. Bus assignments, schedule changes, new transportation plans, all this can now be viewed using intuitive, easy-to-use software. School districts that make frequent transportation changes or that need to "broadcast" transportation system information throughout the community find this system to be exceptionally valuable.

The software is extremely useful for answering questions such as: what is the closest bus stop to any given address such as a student's house, when does the bus come in the morning and afternoon, how far is the bus stop from a house, and what is the bus number. In addition, the software shows a map a Internet users are familiar with, and the graphic display not only shows the selected address and the closest schools, but also allows the viewer to zoom, pan, and scroll the map. By clicking on the displayed address and then drawing a line to any point (such as a school), the distance along the actual street network is displayed. To produce a paper copy of the map, just click on the print button.

EDULOG's newest offering in its suite of GPS mobile application products is *Parent Portal*. This program allows parents or guardians to track the real-time locations of the vehicles used to transport their children. They can also examine the transportation times (both actual and planned) for the entire day. If the children are en-route to a location, *Parent Portal* provides the current location and the estimated time of arrival. You can display the run on a map to see the actual path of the vehicle up to that point, as well as the planned directions for the run and the location of the student's stop. As with all of our applications, *Parent Portal* has many safeguards built into the system to ensure that only authorized users have access to student information.

*Parent Portal* can also be used to send automated text messages to parents to notify them when a bus is expected to be late. This automatic notification capability is not just limited to regularly scheduled buses—it can also be used with any sort of extracurricular bus run such as a field trip or athletic event busing.

## **WHY AN EDULOG INTEGRATED TRANSPORTATION MANAGEMENT SYSTEM?**

A fully integrated transportation management system that is powerful enough to interact with everyone in the school district and community and that is also easy to use, with one consistent interface and database strategy was considered the unattainable holy grail of K-12 busing operators—until now. With the continued development and advancement of the EDULOG transportation management system, we have expanded the possibilities for information sharing and the leveraging of your technology investments while retaining the power, flexibility, and ease of use that have been our system's base since 1979. With the EDULOG approach, you get, if the appropriate software modules are installed:

- A single entry point for all common data:
  - ◆ Regular bus routing and scheduling
  - ◆ Special needs transportation
  - ◆ Field trips
  - ◆ Fleet maintenance
  - ◆ Route planning
  - ◆ Accounting
  - ◆ GPS tracking
  - ◆ Driver time and attendance tracking
  - ◆ Vehicle inspections
- Application connectivity and consistency (even from mobile devices)
- Easy to maintain data structures
- Centralized management and validation of users and access points
- A consistent look and feel for all software and processes
- Support and assistance from a single, proven company, specializing solely in K-12 transportation

Now there is no need to have a routing and scheduling system from one vendor, mapping software from a second, GPS/AVL equipment from a third, fleet maintenance software from a fourth, and a web portal for transportation information developed by in-house staff—it's all available from EDULOG today.

## **A REVOLUTIONARY PROGRESSION**

Computerized routing and scheduling systems have certainly made work easier for K-12 transportation departments, but even ten years ago, their use, and benefits, were limited primarily to within the school district's transportation department:

- Routes and schedules were created and tracked
- Drivers may have been given run sheets

- School staff may have been given bus rosters
- Reports were prepared for cost reimbursements

And if the department had a fleet maintenance/parts inventory system, there might have been some interaction between mechanics and maintenance supervisors.

But three far-reaching technology advances (the web, an enterprise database, and GPS/AVL) allow the EDULOG system to collect and manage information from a variety of sources, and send accurate and complete information out to:

- The district's business office
- Top-level district administrators
- Every school
- Principals and school staff
- Parents
- Students
- Bus drivers, mechanics, and aides
- State and Federal funding agencies
- Anyone connected to the Internet

With EDULOG's integrated platform, you can (some of this will require options not included in the proposed offering):

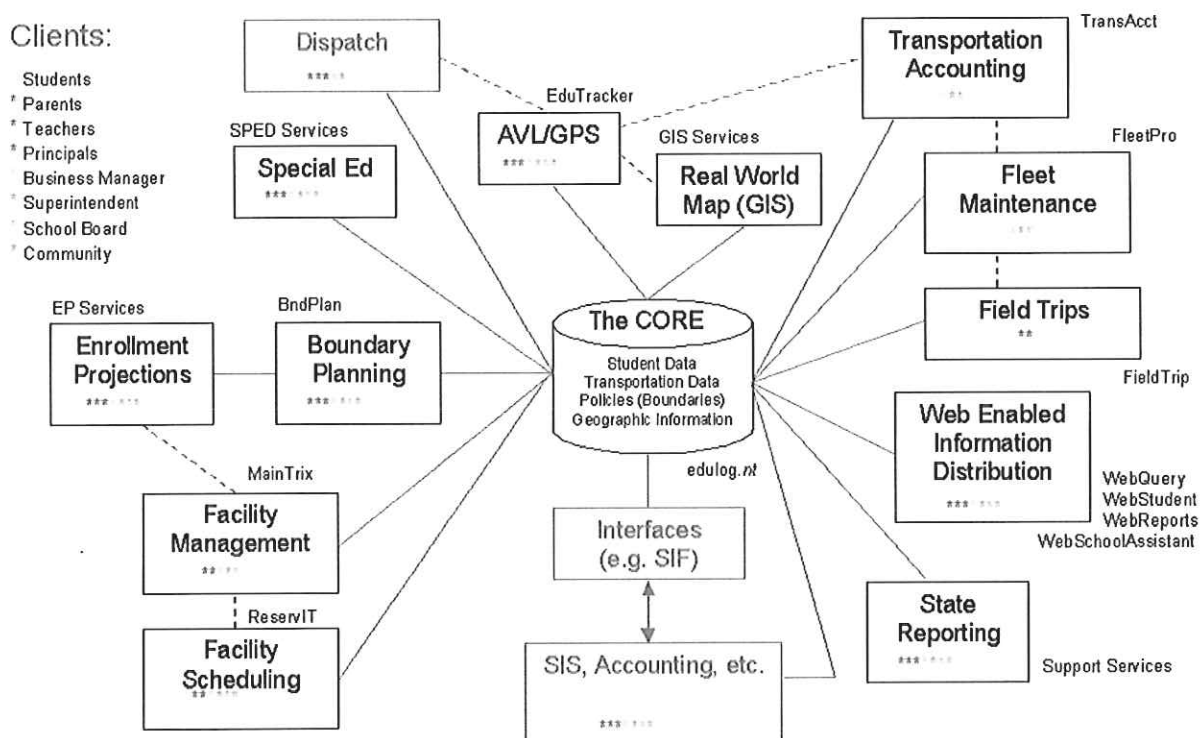
- Automatically notify parents if a bus will be late to a stop
- Track activity buses across the country
- Show the community next year's bus stops and schedules
- Meet fuel conservation goals by reducing bus idling
- Inform teachers when their field trip requests have been approved
- Determine in real time which buses are broken down or in trouble
- Automate driver time and attendance tracking and ensure compliance with all vehicle safety checks
- Comply with No Child Left Behind and Homeless Student requirements
- Send driver instructions to each bus
- Know exactly when and where students enter or leave a bus
- And, of course, conduct the usual routing and scheduling activities: assigning students to buses, optimizing for greater efficiency, printing maps and driver directions.

How is this accomplished? First, EDULOG has always been the leader in knowing what transportation departments manage and how they want to do it.



Then we developed modules that share information from a common data engine that can be accessed by a variety of interests. Data going in and out of the core updates all the affected applications.

## Information Distribution

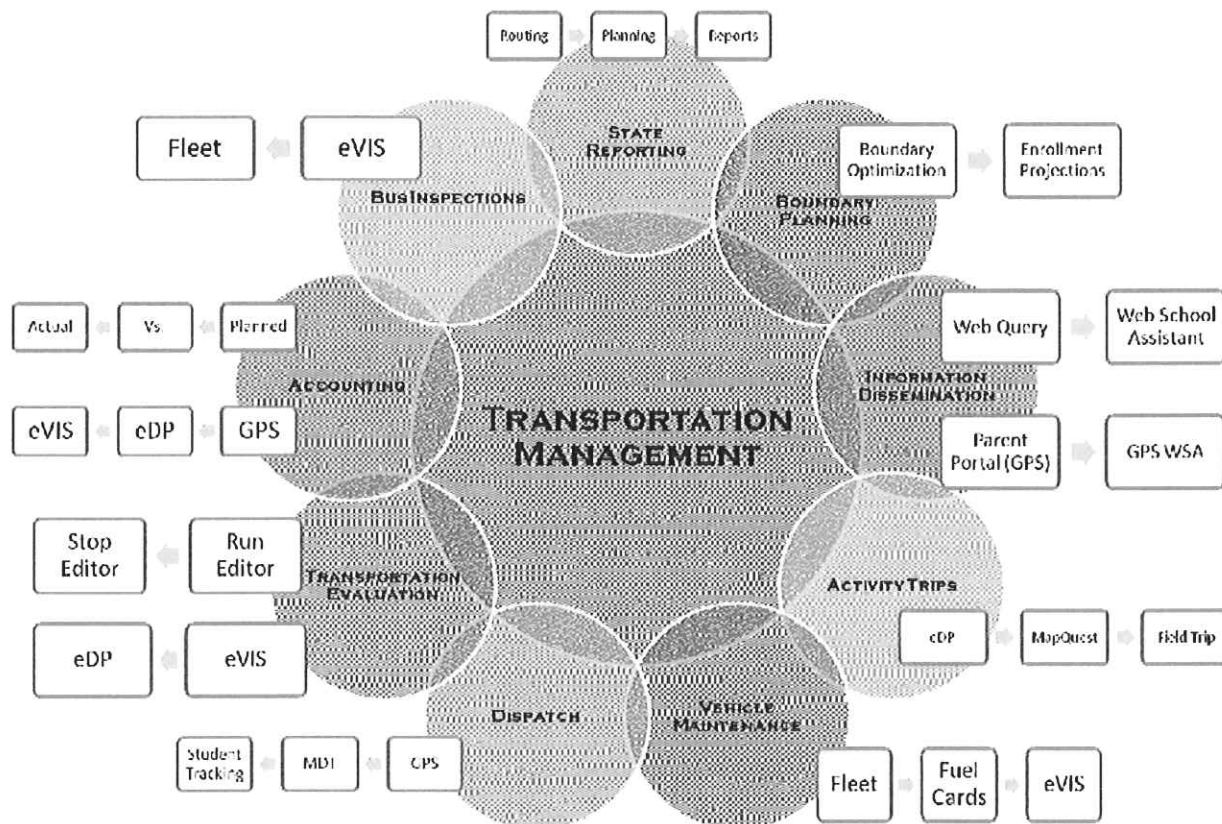


The result is a scalable solution that has no equal in terms of:

- Completeness
- Data cohesion
- Range of platforms (servers, workstations, laptops, web devices, PDAs, cell phones)
- Access and Security
- Upgrade potential to meet new requirements
- Experience backing the solution



From one vendor you can have:



## THE ADVANTAGES OF THE EDULOG APPROACH

**Single Point for Data Entry**—at many school districts, the current practice is to manually enter bus and/or student information into the routing and scheduling system, then do the same thing for the separate field trip, fleet maintenance, and GPS systems. Not only does this duplication of effort waste time, but it also commonly leads to errors and a lack of interoperability because each system may require data in a different format, the typist makes mistakes, etc.

But with the integrated EDULOG solution, one common entry (either manual or through automated data interfaces, including SIF) is all that is required for relevant information to be shared by all the modules. Data duplication is eliminated, changes are processed quicker and with more accuracy, and there's no need to jump from system to system—once information is entered, it's ready to use by all.

**Uniform User Interface**—because all of the EDULOG system relies on the same core, commands, prompts, help messages, and work flow is consistent throughout the enterprise. This not only reduces the need for specialized training in multiple platforms and applications, it also makes it easier for new or casual users to

get meaningful work done or to have their questions answered by the system. The burden on system administrators is also reduced—there are no databases to duplicate, patch fixes are quickly implemented throughout the system, and user administration is centralized.

**“Grow With Me” Scalability**—Start with one, two, or however many components and then add to additional areas to the system at your district’s pace. Any additional component will build on the combined value offered by integrating with the suite of products already in place. There is not necessarily any “right order” for which software product should be implemented first. Thus, the combined software portfolio is flexible—so a school district can start with the solutions that meet the most immediate needs and then consider the other components when the time is right.

**Plays Well With Other Applications**—As a result of the use of MS-SQL databases, software components having data useful to non-EDULOG applications can share this information to further leverage a district’s technology investment. A school district may already have made an investment in software developed by another company. Rather than having to reinvest in EDULOG’s software to address that area of your operation, the open nature of EDULOG’s applications and data allows the district to maximize value by using the third party application alongside the EDULOG system.

Additionally, while each of EDULOG’s applications include reporting capabilities, if a district has a current preference for a separate report writer, EDULOG’s MS-SQL database design and open architecture is ideal for this integration.

**The Largest Pool of Industry Experience**—EDULOG’s staff offers more than 812 years of combined experience in school bus operations, more than any other pupil transportation software provider. Thus, you can be confident not only in the ease of use and power of EDULOG’s software, but in the level of experience and quality of service that backs it up. People make software successful, and with EDULOG you have a partner you can trust.

**Single Vendor Accountability and Support**—we all know what can go wrong when multiple products from different vendors compete not only for network resources, but also for the valuable time of system administrators. Not to mention that changes to one product might ruin the interface to another, or that the task of administrating and implementing the entire enterprise system becomes the role of the district instead of one vendor. But with the EDULOG approach, you need only one contact point, one project management staff, one place to go to for answers and problem resolution.

## **A STATEWIDE TRANSPORTATION MANAGEMENT SYSTEM: THE NORTH CAROLINA MODEL**

The only statewide system similar to that contemplated by the WVDE is in operation throughout the state of North Carolina. The EDULOG system (known as TIMS—Transportation Information Management System in North Carolina) has been in place for more than 20 years in the state, and has gone through several major upgrades. Administered by the Pupil Transportation Group of the Institute of Transportation Research and Education (ITRE) at North Carolina State University, the TIMS program has resulted in North Carolina pupil transportation costs that are below the national average—and the total savings over the years has been in the millions of dollars.

EDULOG supported ITRE during the implementation and development of the TIMS systems, and continues to support ITRE staff (which number approximately ten who directly support school district use of the TIMS system). In addition, EDULOG directly supports and trains school districts using software applications not included in the TIMS program such as GPS/AVL, field trip management, driver time and attendance tracking, student passenger tracking, etc.

We suggest that the WVDE speak with ITRE to learn more about the advantages of their approach to statewide transportation system implementation and operation and how EDULOG has been fundamental to the success enjoyed by the state.

**To learn more about EDULOG and the North Carolina transportation management system and program, please contact:**

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Raleigh, NC 27699-6319  
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The following information about ITRE and TIMS is supplied by ITRE.

The mission of ITRE's Pupil Transportation Group is to apply transportation engineering principles and technology to the operation and management of multi-modal, safe and efficient transportation of school children. It is the only transportation research center in the country to focus on technical assistance and applied research for all modes of school-related travel. The key to the success of the Group has been its partnership with state and local education agencies, agencies, universities, national associations, and private industries.

The Group pioneered the development and training of the Transportation Information Management System (TIMS). In fact, North Carolina is still the only state in the nation with a statewide implementation of a computer-assisted school bus routing system.

A spin-off program, the Operations Research and Education Laboratory (OREd), uses a model of "Integrated Planning for School and Community" to enable school administrators to make school planning and decisions with scientific data enabling long-term plans on enrollment forecasting and land use for site location and redistricting.

With this impressive track record, the Pupil Transportation Group moves into the twenty-first century to provide a positive impact on the safety, operations, and long-term viability of school transportation in North Carolina as well as nationwide.

#### Transportation Information Management System (TIMS)

The Transportation Information Management System (TIMS) program provides support and consulting for the Computer Assisted Routing Program used in every secondary school system in North Carolina. It is a joint project of the North Carolina Department of Public Instruction (DPI), ITRE, and the Urban Institute at the University of North Carolina Charlotte (UNCC).

In 1986, DPI set in motion a plan to install a comprehensive computer-assisted school bus routing and scheduling system in all local educational agencies (LEAs) in North Carolina. This approach was completely unique in the field of computerized school bus routing.

ITRE worked with DPI throughout fall 1985 in the preparation of a project definition report, documenting "the state-of-the-art in computerized school bus routing and scheduling in North Carolina." This report led to a request for proposals (RFP) for system consultants to work with the DPI and ITRE in the preparation of a comprehensive system design. In 1986, the design was incorporated into another request-for-proposal (RFP) for software to become the heart of TIMS.

While no vendor could meet all of the extensive requirements of the RFP, DPI selected Education Logistics (Edulog) of Missoula, Montana, as the software vendor, with the stipulation that program enhancements would be made to bring the software into compliance with the TIMS system specifications.

Since September 1, 1992, as required by North Carolina legislative Bill 1128, all LEAs have implemented the Transportation Information Management System.

#### What do the schools have to say about the TIMS system?

"Under a manual system, I don't believe we would have been able to make the changes that we made in Lee County in the last five years. Time would not permit it." — Lee County (NC) School System

"We have reduced our fleet of buses by seven, our daily route hours by 47.1 per day, and mileage by 877.8 per day while transporting an increased number of students." — Onslow County (NC) School System

"Plots and reports have been used by and or generated for real estate companies, 911 planners, bond referendum committee members, teacher orientation and, of course, all schools." — Gaston County (NC) School System

"We were able to demonstrate the need for staggering school opening and closing times. We are using TIMS to redistrict over 60 percent of our students." — Randolph County (NC) School System

"By obtaining optimal routing through TIMS, we have reduced gas consumption and general maintenance of buses." — Alamance County (NC) School System

"Maps, stop lists, and bus runs were an impressive addition to open-houses in all schools prior to opening." — Forsyth County (NC) School System

"We reduced from 59 buses last year to 54 this year. We are transporting 2,262 children this year, compared to 2,240 last year." — Madison County (NC) School System

## **THE FOUNDATION FOR A SUCCESSFUL TRANSPORTATION MANAGEMENT SYSTEM**

To successfully implement and operate a K-12 transportation management system, certain elements (both human and data) must be in place. These elements, which could be considered the foundation of the system, are:

- Staffing
- Student Information
- Geographic Information
- Transportation Information
- School Information

### **STAFFING**

If the West Virginia Department of Education follows the model used in North Carolina for the student transportation management system, staff at the state level will be needed to:

- Administer the program
- Receive and record reports from the system
- Manage the possible hosting of the system for smaller districts
- Train district system operators
- Support district system operators
- Managing the interface between the WVEIS and the transportation management system
- Delivering system software upgrades to the district

To assist the WVDE, EDULOG could assign professional consultants/trainers/data specialists to the project on either a temporary or permanent basis. The assistance that EDULOG could provide would not only be the result of our experience with the North Carolina program and 1,300 school districts throughout North America, but would also include our expertise in project management. Tasks that the assigned EDULOG staff would manage or assist with could include:

- Data gathering (especially mapping information, but also student, transportation, and school data)
- Map creation and maintenance (including the editing of the street network, address ranges, adding new developments)
- Student residence address digitizing (placing on the system map student locations that don't use street addressing)
- Training WVDE staff in system use—and perhaps more importantly—training staff in how to train the district operators
- Performing optimization projects
- Serving as the first-line of support for the system—including GPS hardware and software
- Conducting enrollment projection and boundary realignment studies



- Implementing and managing the SIS (Student Information System)/EDULOG interface
- Installing on-vehicle GPS equipment
- Network administration
- Developing and administering system maintenance procedures

For those West Virginia school districts that may not have enough staff to properly operate and maintain a transportation management system, EDULOG could assist with our remote services model. More than 300 school districts today rely on EDULOG to essentially be the routing and scheduling staff for the district, and this process has worked very well for clients by reducing labor costs and reaping the benefits of having experienced professionals from EDULOG manage and operate the system on the district's behalf.

With this assistance model for smaller school districts (although we certainly also provide this remote service for larger districts), EDULOG would:

- Provide unlimited training (through the Internet) to district staff.
- Correct, enter, or edit any and all mapping information that the district can identify. For example, if it is discovered that an address range is incorrect, and the district provides the correct house numbers for that segment, EDULOG will edit the geocode and process a new map display. The same applies to street names, new housing developments, school locations, etc.
- Install new versions of the system as they become available.
- Provide unlimited access to support and implementation staff during normal business hours.
- Perform data backup and server administration—including keeping current on Windows updates and virus protection.
- Perform nightly preventative maintenance and periodic student uploads, address matching, eligibility checking, student assignments, geographic maintenance, etc.
- Maintain and modify custom reports created in the start up phase.

EDULOG could also perform student operations. This could include

- Uploading student information into the system
- Address matching student residences to the system map
- Calculating student transportation eligibility
- Assigning students to bus stops
- Performing student rollover (grade advancement in the system) based on district provided information

Extended student operations could include:

- Individual assignment of students not eligible for transportation based on information provided by the district
- Individual student matching based on information provided by the district
- Creating alternate pick up and drop off locations based on information provided by the district

Transportation operations that could be performed by EDULOG include:

- Creation/Relocation of stops at locations approved or requested by the district

- Assignment of new stops to runs approved or requested by the district
- Reordering stops on runs requested by the district
- Entering headcount loads on stops provided by the district
- Moving stops from one run to another at the request of the district
- Inputting actual stop times
- Creation of new runs approved or requested by the district
- Assignment of a run to route approved or requested by the district
- Swapping runs on routes approved or requested by the district
- Setting time at school for runs on routes

EDULOG is the only vendor of K-12 transportation management software that offers such extensive and comprehensive services to school districts, and we've been doing it for more than 12 years now.

### Other Possible Forms of Involvement

Because of constant interaction with our clients, EDULOG knows first hand what it takes to successfully manage school district busing operation. We've been with districts during the preparation of a new school year's transportation plan and those first hectic weeks when recently-enrolled students need busing right away. And we've also been there when new school boundaries require major changes to bus routes during the winter break, or when a bond measure fails and the number of buses in service needs to be drastically reduced to meet the shrinking budget.

Does the district need to create an entirely new transportation plan because of major changes in school attendance boundaries and policies? EDULOG has done that for school districts. Or does the district need to implement a new method to monitor contractor performance and costs? Once more, EDULOG has performed this service. EDULOG has the experience and knowledge to go beyond simple analysis and provide effective recommendations that result in verifiable and permanent improvements—in addition to the software tools that give districts what they need to affect positive change.

## STUDENT INFORMATION

The EDULOG student file contains basic information about each student in the district so that every student can be located in the geocode system, tested for school and/or transportation eligibility, assigned to bus stops if eligible, and recognized in tally functions throughout the pupil transportation system. A number of other fields may also be stored in the student file, allowing each district a customized file format that serves unique needs and concerns.

The student information would come from the WVEIS system through an automated interface to the EDULOG system, and information stored in the EDULOG system (such as student assignments to stops or the time a student arrives at school) would be passed back to the WVEIS system. EDULOG obviously has experience with this interface from our experience supporting several West Virginia school districts.

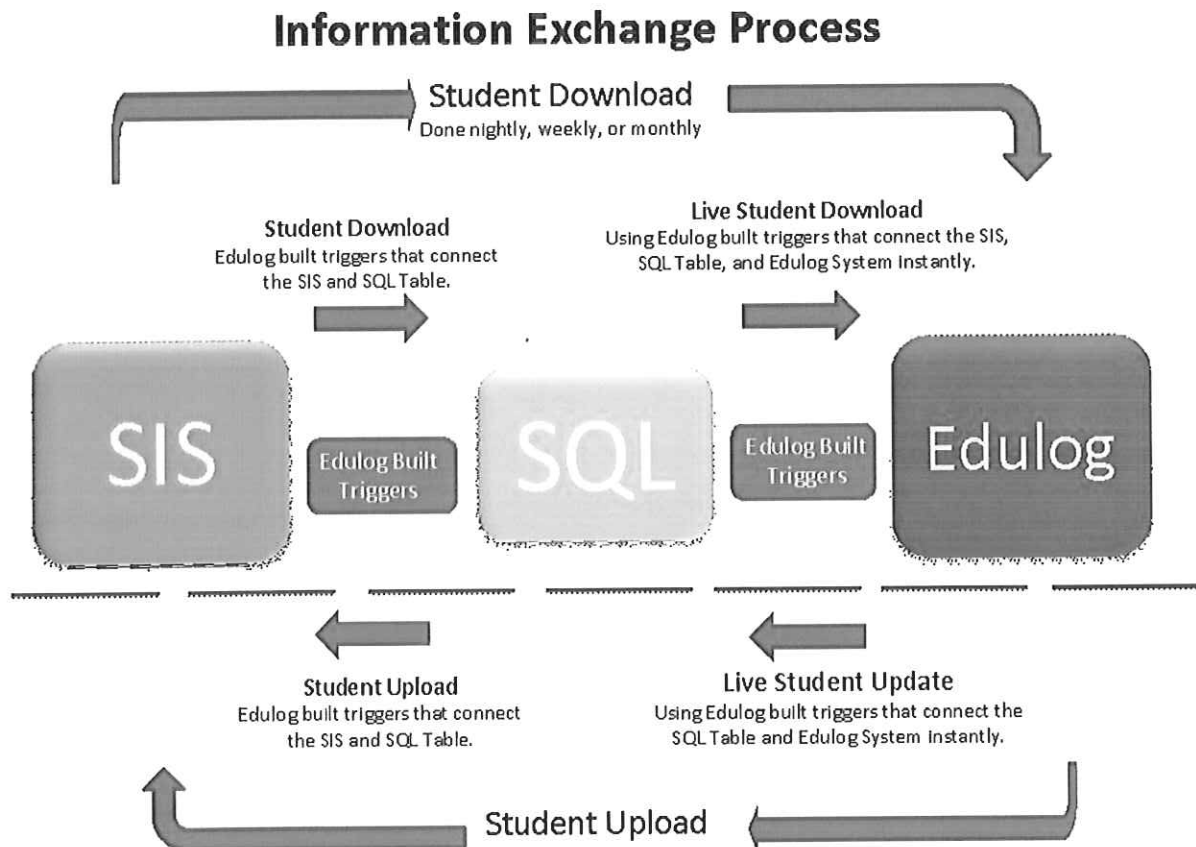


In addition to the required fields such as student name, address, grade, school of attendance, ID number, etc., the EDULOG student file may contain other fields, entirely at the discretion of the individual district. This auxiliary information can be read into the EDULOG student file from fields already maintained in the master database, or may be fields that transportation and/or planning personnel intend to enter and maintain manually. Any combination of these two types of fields is acceptable. Uses for these additional fields could include:

- Creating mailing label, letters, and notification cards
- Analyses using demographic variables such as ethnicity, gender, free/reduced lunch program eligibility, English as a second language (ESL)
- Tracking open enrollment policies and assignments
- Managing programs such as band, choir, after school activities, etc.

One unique and powerful advantage of the EDULOG system is our ability to automate student information processing all the way through to the transportation assignment stage. EDULOG has developed a process so that within three minutes of entering a student in the district's SIS, the EDULOG system automatically receives that information, determines transportation eligibility, assigns the student to the correct bus stop and run, and prints a bus pass. This is just one example of the power and integration capabilities that make EDULOG the number one choice of school transportation professionals.

The following illustration shows the information exchange that EDULOG has developed between the transportation management system and the SIS information.



The benefit of the EDULOG approach to this interface is that it totally automates one of the most time-consuming and error-prone processes of the transportation department: assigning students to a bus.

## **GEOGRAPHIC INFORMATION**

In order to identify and display schools and student residences, bus stops, vehicle travel paths, and school attendance boundaries, the system must have a digital map (also known as the geocode). To create a geocode that can support effective bus routes and boundary planning functions, additional information, called attributes, is included:

- street names
- separate address ranges for both sides of the street
- walk path restrictions
- restricted streets or areas for bus travel or student pedestrians (hazard conditions)
- one-way streets or any traveling restrictions by segment
- average travel speeds for each segment
- restricted turns (i.e., no left turn)
- transportation eligibility boundaries by grade level
- walk zones and school zone boundaries
- safety condition of a street by segment.

We've been in the mapping business longer than other K-12 transportation software vendor, and EDULOG has created solutions to every mapping problem yet encountered.

- Do the streets and roads have no names and or address ranges? Then we'll create them in conjunction with government agencies and the Post Office.
- Do the streets not have travel speeds? We can use GPS to gather bus travel speeds and then enter that information into the map.
- Are some streets and roads not suitable for school buses? We'll mark them on the map as no travel locations.
- Do student residences have no addressing other than rural route numbers or post office boxes? Then we'll digitize the locations to the map so they can be identified and including in the routing solution.
- Do steep roads mean that buses travel faster one way than the other? Our mapping software can take that into consideration.

- Are there streets that exist but don't appear on any map? EDULOG can draw them into the geocode from aerial photography—and even include the aerial view as a map layer for the system—see below for an example.



Many government agencies in West Virginia use mapping software from ESRI (ArcView, ArcInfo, ArcGIS, etc.). And over the years, EDULOG has learned that ESRI-formatted maps created for other agencies are often inadequate for school busing applications because:

- The street network connectivity was not complete;
- Underpasses and overpasses were not clearly defined;
- There were no turn restrictions or hazards;
- If there were speeds, they were posted speed limits, and not bus travel speeds, and they certainly didn't take time of day travel patterns into consideration.

Therefore, EDULOG has developed an intermediary geocoding engine that allows its clients to take information from the ESRI application (such as the wealth of overlays, the immediacy of segment updates as new construction is approved, the naming and addressing standardization with other agencies, etc.) and combine

this with accurate connectivity, turn restrictions, multiple speeds based on time of day, and penalties/restrictions based on vehicle type.

We know mapping and we know ESRI as well as any other K-12 software vendor. We've done our homework, evaluated why others have failed, and provide an ESRI solution that is different than anything else out there.

As a further example of EDULOG's experience and drive in mapping technology is the current work for a mapping enhancement that uses information gathered by GPS about stop light locations and associated average wait times. Our intent to use this data to create better system-derived run times as buses travel past these locations—or have the system avoid these locations if the stopping penalty is too great. This integration with stop light and stop sign logic further builds on EDULOG's mapping capabilities such as:

- Multiple travel speeds per segment based on time of day (to account for traffic congestion and different travel patterns in the morning compared to the afternoon)
- Travel speeds and turn and travel restrictions that vary according to vehicle type (big bus vs. small bus)
- Hazardous street differentiations (streets that students are not allowed to walk across or down to reach a bus stop location, streets that some buses can go down but not others, predator locations and constraints these place on bus stop locations, etc.).

Some portions of North Carolina are topographically and demographically vary similar to West Virginia (hilly, rural, limited road networks), and the EDULOG maps used by North Carolina districts are quite successful at locating students and routing buses. Or consider the case of the Wood County Schools of Parkersburg, WV, where EDULOG implemented a transportation management system using a newly-developed 911 map that created address ranges in places where none had existed before. In Wood County, as elsewhere across the United States, government agencies have been updating 911 addresses, associating a physical location or other geographic attributes so first responders have exact locations for emergencies that reported from 911 calls.

In many parts of West Virginia, particularly in Wood County and other rural areas, most people didn't have addresses associated with their phone numbers or physical locations. Essentially, the 911-based map gave everyone a numbered address. The U.S. Postal Service then notified residents and told them what their addresses were and the district then asked parents to update their addresses. The addresses were then entered into the district's student information system, the West Virginia Education Information System (WVEIS), and after some time collecting the proper addresses and placing them into WVEIS it was determined that all the addresses were verified against the EDULOG system geocode, and the data was updated in the EDULOG system. Now, there was a physical address associated with each student.

## TRANSPORTATION INFORMATION

Transportation information for a student transportation management system consists of what the bus is doing, both when and where. This information includes:

- The bus stop location
- The time at the bus stop

- The start and end point of a bus run
- The sequence that bus travels (a listing in chronological order of the bus stops visited)
- The bus route couplings (if a bus serves two or more runs in a morning or afternoon, what runs are they and what is the time gap between them)
- The students who are at each bus stop.

Typically, this information (for districts without routing and scheduling software) is contained in a database, Excel spreadsheet, or word processing document, and EDULOG uploads that information into the routing and scheduling system during the system implementation. But what if this information is incomplete, or is stored in the brain of a bus driver or transportation manager? Then EDULOG goes to work to gather that information.

For the Wood County Schools, three EDULOG-supplied Magellan handheld GPS units were used to gather busing data. Substitute bus drivers and substitute bus aides rode on the buses and recorded each stop on the run using GPS coordinates obtained by the Magellan units. Not only was stop data collected, but also the bus paths, transfer times, and associated times in between each stop—among other specifics—were recorded.

At the end of each day, the data from the Magellan units was sent to EDULOG. Using EDULOG's AutoRunBuilder software the professionals at EDULOG imported that data from the GPS units into the EDULOG routing and scheduling system. AutoRunBuilder made exchanging the data easy; it was automatically and electronically transferred and integrated with the routing and scheduling software.

If there is no student information for the bus stops, EDULOG can use GPS and RFID student identification technology to automatically create student rosters. In fact, EDULOG has a number of innovative and unique capabilities that use GPS to gather transportation information where none has existed before:

- AutoRunBuilder and EduRunBuilder to automatically create new runs in the routing and scheduling system from data captured by the GPS system
- RunEditor to modify EDULOG system runs based on actual GPS travel paths and stops
- RunDirectionEditor to change the turn by turn driver directions in the EDULOG routing and scheduling system based on the GPS record
- MapEditor (under development) to update the EDULOG system geocode from the GPS system

## SCHOOL INFORMATION

School information is the least complicated of the data elements required for effective computerized transportation management, but it is still necessary. The data elements are:

- The school's location (physical address)
- The school's configuration (which student grades are served by the school)
- The entry/exit points for buses
- The school hours for instruction

- The school hours for bus arrivals/departures
- And for planning purposes, the classroom sizes (number of students) by grade and how many classrooms there are

In cases where this information is not readily available, EDULOG can assist the data gather process by visiting the schools.



## **THE EDULOG ROUTING AND SCHEDULING SYSTEM**

Since its formation, EDULOG has specialized in developing software systems for school bus routing and geographic planning. Through the years it has refined its programs to satisfy requests from clients and meet new needs. The experience accumulated through the implementation of the software in school districts of varied characteristics allows EDULOG to provide a system with great versatility and flexibility. EDULOG's software can be adapted to rural, suburban, or urban areas and to school districts with complete or skeletal geocodes.

EDULOG's transportation/planning software is totally user-oriented. Fully menu-driven and self-prompting, the programs require no prior knowledge or use of computers. Such industry-standard features as windowing, pop-up menus, use of various colors and help messages, etc., are prevalent throughout the system to guide a user that may have little or no knowledge of the system. These features promote the system's quick and easy on-line review/update capability. The system's average response time (excluding sorting of reports or multiple field inquiries) is less than two seconds. Major data revisions—such as changing school boundary zones and transferring corresponding students to new zones—or any other major data addition or editing can be done in less than five minutes.

As a graphics-based system, EDULOG provides color screen displays and hard-copy plotting/printing capabilities on demand. A zoom feature is inherent in all graphic displays. Additionally, all information is accessible in a one-monitor-per-workstation environment.

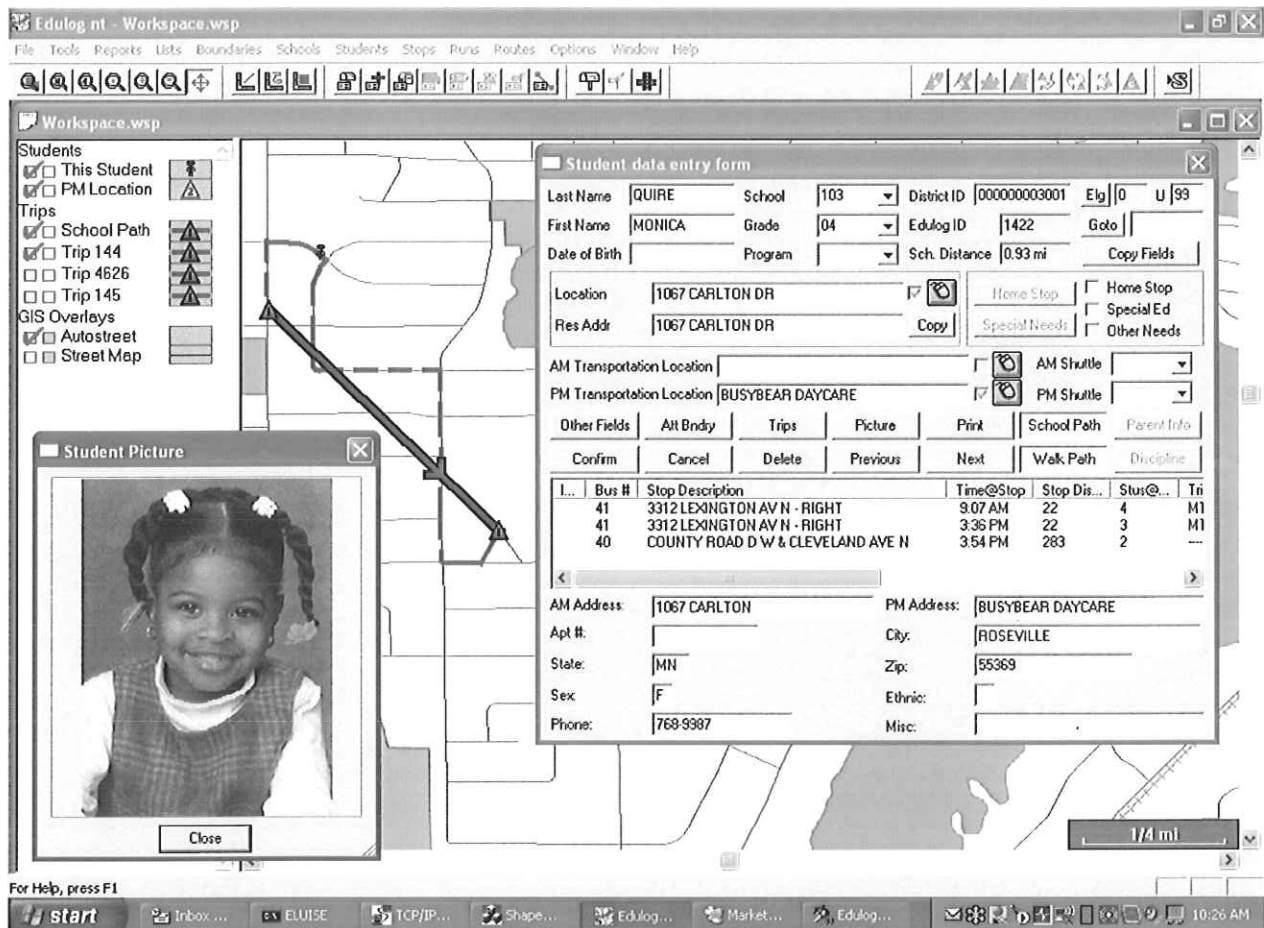
The following section, "Software Components," highlights some of the more complex planning management issues. The various software features will accurately reflect current and future transportation policies with capabilities to update or simulate any new parameters. These policies can be established by grade levels or programs.

## **SOFTWARE COMPONENTS**

### **Student Database Management**

The core of the EDULOG system is the student database management module, used by both the transportation and planning staffs. The EDULOG system uses the same student database for transportation and boundary planning functions—unlike many competing systems, there is no need to create and maintain separate databases. Partial updates to change student information and add or delete students are always possible with the EDULOG student database.





The initial database is created by downloading the relevant demographic information from the master student database. The EDULOG system allows the selection of a variety of data fields to be stored in the system's database. Once the key data fields are identified by the organization's staff working with the EDULOG project team, a procedure will be created and verified to automate the data loading tasks in the future. The system implementation team will design the procedure to load the data after it is downloaded to the system's disk drive.

The data entry tasks will be completed using this module. Some highlights of the system's data entry capabilities include:

- Batch and interactive data entry
- Extensive front-end editing functions to identify incorrect addresses, etc.
- Automatic assignment of school, bus stop, route, and other relevant information based on a student's address and grade
- Selective batch updates (for example, move all students up one grade)
- Immediate graphic location of student based on address
- Comprehensive report generation and data query
- selected, partial updates to student records without having to replace the entire database

One important distinction of the EDULOG system with major consequences for transportation eligibility determination, and stop assignment is that every student in the database has a unique record, and can easily be given an assignment different from every other student at the same address. The EDULOG system does not force every student living on the same address segment into a “rider group” for the purposes of determining transportation eligibility or stop assignment.

## Address Lookup Functions

Impressively quick and accurate random address lookup is a distinctive feature of the EDULOG system. Because the EDULOG map display allows for unlimited zooming and panning using the mouse, operators can move efficiently to the area and detail wanted. Any address can quickly be identified on the map by entering the information through the keyboard. Conversely, placing the cursor on the map and clicking the mouse will display the correct address in the text window. Features of the EDULOG address lookup facilities include:

- When the address and street name is entered, the cursor can automatically locate and highlight the actual location on the map display.
- Given a stated address, the programs display by name the exact attendance zone or zones containing the address.
- Graphic identification functions include the ability to identify via cursor placement a street segment’s name and address range on the right and left side of the street.
- Address identification functions include the ability to retrieve the exact street address number and street name for any cursor placement along the road network.
- Student address locations are displayed on the correct side of the street.

## GEOCODING SOFTWARE

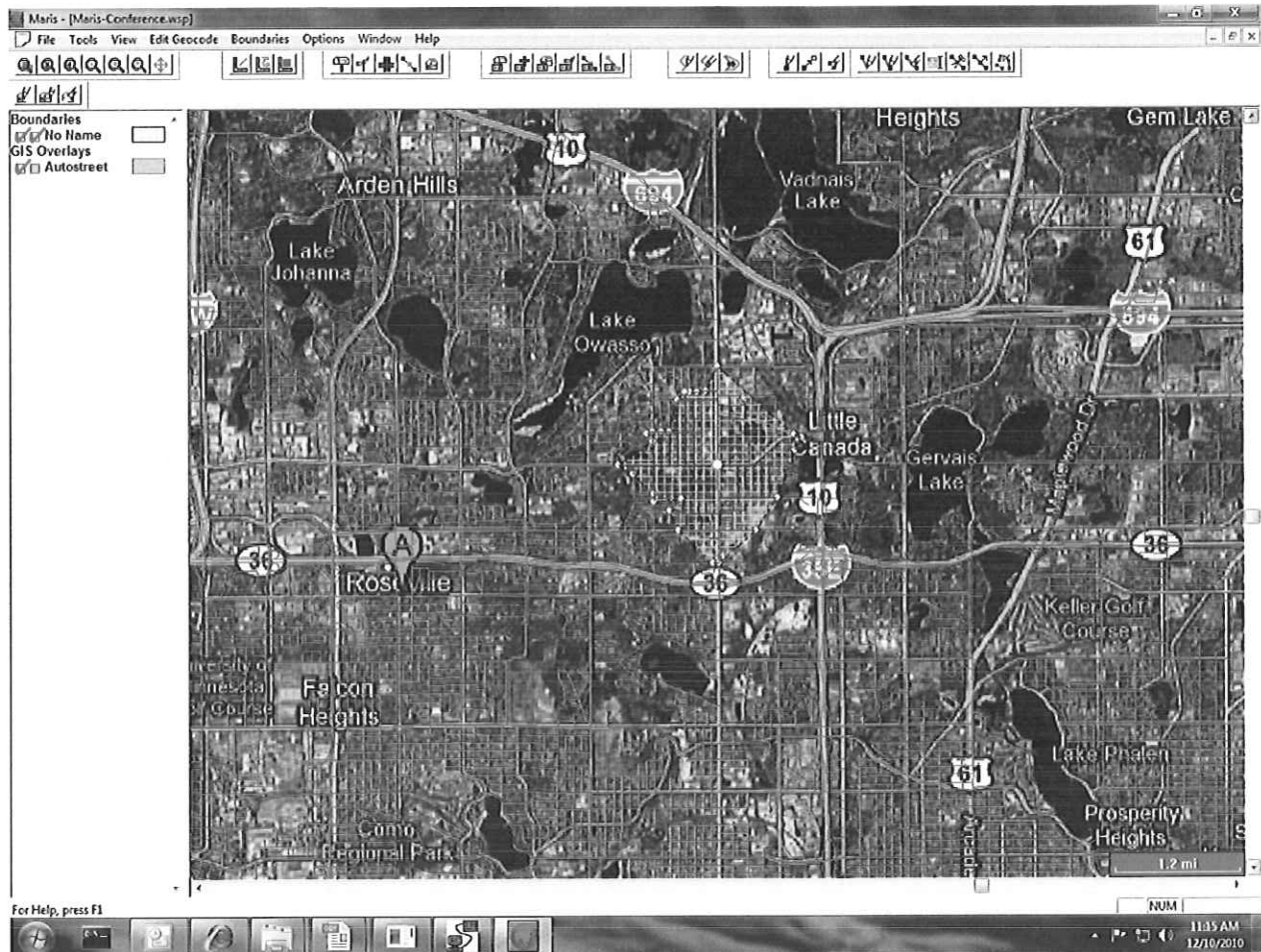
With EDULOG’s geocoding software, the school districts will have full control of its geographic data. New subdivisions, road construction and road changes can be added at any time to ensure accurate bus runs and schedules. Through interactive graphics, the user can add streets and cul-de-sacs as they come into use. Address matching of students who move into new subdivisions can be as accurate and current as possible. Because the graphics tools and programs are designed for ease-of-use, this specialized and complex task can now be accomplished safely and easily by current transportation/planning personnel.

## Street Attribute Coding

To create a geocode file that can support effective bus routes and boundary planning functions, additional information, called attributes, is included:

- street names
- separate address ranges for both sides of the street
- walk path restrictions
- restricted streets or areas for bus travel or student pedestrians (hazard conditions)
- one-way streets or any traveling restrictions by segment
- average travel speeds for each segment

- restricted turns (i.e., no left turn)
- transportation eligibility boundaries by grade level
- walk zones and school zone boundaries
- safety condition of a street by segment.



EDULOG's geocoding software includes a complete set of programs to effectively handle each of these data requirements. Depending on the type of data, entry is done with a digitizer, mouse, keyboard, or special search programs. Verification is performed by plotting special maps highlighting the particular information to be validated. For example, the following can be produced whenever needed: Speed maps for each velocity which make it easy to check linking continuity; plots showing one-way streets; or plots showing streets considered hazardous for student crossing.

## Geographic Data Maintenance

This activity is the fine-tuning part of the complete geocoding process. It corresponds to the on-going task of maintaining the geocode. These files remain dynamic and this feature is essential in guaranteeing that the map properly supports the transportation and geographic planning system.

One powerful advantage of the EDULOG geocoding system is the ability to fine tune the geocoding without altering the underlying map file. Using this feature it is possible to remove from stop and routing consideration: streets under repair, in construction zones, or unsafe for any reason; delete turns or entire streets because of noise, safety, or other consideration, etc. These changes can be made daily without risk of deleting addresses or inadvertently altering the actual street network.

The EDULOG system includes a complete set of menu-driven, user-friendly programs for maintaining the geocode. All the following information can be modified:

- street names and type (color coded)
- address ranges along streets (hundred block designations)
- one-way designation on segments
- modification for restricted turns
- bus traveling speed
- hazard conditions of segments
- availability of segment for student walking
- transportation eligibility boundaries by grade level
- walk zones and school zone boundaries
- total travel time
- total length of segment

"In recent years there have been dozens of software products that claim to offer solutions for all aspects of school business, especially in the area of school transportation. The EDULOG software actually delivers on that promise. Anoka-Hennepin Schools is the third largest school district in Minnesota with approximately 42,000 students. We have been using EDULOG for bus routing since 1993 and I can't imagine going through the growth, boundary area changes, bus fee areas, etc., without this system. The software creates an effective blend of student data and geographic data that is well designed and user-friendly. The support staff is accessible and wonderful to work with.

"Over the years, we have saved hundreds of thousands of dollars by developing more efficient bus routes with the EDULOG system, but more importantly, we have been able to better identify hazardous intersections and problem areas to make our bus routes safer for our students. In my opinion, this is the most advanced transportation software available and it is supported by a great staff."

Chuck Holden  
Director of Operations  
Anoka-Hennepin School District #11  
Coon Rapids, MN

These are the key tools used to ensure that the geocode is kept up-to-date to match the actual transportation environment. Depending on the needs of a particular client, the transportation or planning staff can use this module to develop the entire geocode and/or to use it regularly to update the existing file.

## PUPIL TRANSPORTATION SYSTEM

The purpose of the EDULOG routing and scheduling system is to give school organizations effective management tools to monitor the efficiency of bus routes and schedules and perform any required routing and scheduling tasks to maintain the highest level of efficiency.

The programs are on-line, interactive, and easy-to-use; no previous experience with computer applications or data processing is required. The screen displays are uncluttered and easy to read. Available functions are

displayed on the video screen and correspond to special keys on the keyboard. Functions can be selected by simply pressing a button on the mouse or keyboard. The menu approach used by all the programs ensures that the user can go easily from one screen to the next without referring to a directory or manual. The system helps the transportation staff perform the following tasks:

### **Student Functions**

- A. Adding new students to the system. A new schedule can be determined automatically if there is a current bus stop within the user-defined walking distance;
- B. Changing the data of a currently transported student (address, grade, school, etc.). All subsequent rescheduling can be performed automatically;
- C. Deleting a student from the system, and;
- D. Inspecting the current data and schedule of an individual student or a group of students, which may be specified by the user, so that only students meeting a user-defined set of criteria will be displayed and reported. This function has applications for many kinds of reporting for client use.

### **Bus Stop Functions**

- A. Adding a bus stop. The program will suggest the best location to insert the new bus stop on a run, and let the user simulate several alternatives before making the final decision;
- B. Reassigning a bus stop from its current run (the program will find the best alternative for reassignment);
- C. Deleting a bus stop from a run, and;
- D. Relocating a bus stop from its current location.

### **Bus Run Functions**

- A. Adding a bus run
- B. Changing a bus run
- C. Deleting a bus run
- D. Changing the pick-up or drop-off times at bus stops
- E. Changing travel times between two given stops on a run
- F. Resequencing bus stops on a run
- G. Automatically building new runs

### **Bus Route Functions**

- A. Adding a bus
- B. Changing the combination of runs served by a bus
- C. Adjusting arrival and departure times for a bus
- D. Deleting a bus



- E. Controlling the deadhead time between runs
- F. Modifying assignment of bus routes to buses

## System Maintenance Functions

In addition to the operational functions described above, the system also allows the client to perform software maintenance to incorporate new requirements or changes in its policies. Such changes are reflected in the client's transportation scheme. The client will at times decide to engage in some of these tasks:

- Updating students, addresses, and policies;
- Updating the geocode data;
- Changing transportation eligibility criteria;
- Changing school boundaries;
- Promoting students to their new grades at year end, and;
- Reassigning students to appropriate bus stops at year end.

## TRANSPORTATION ELIGIBILITY DETERMINATION

EDULOG has excelled in the area of eligibility determination by developing an extremely versatile and flexible approach to modeling school districts' varied transportation eligibility policies. Eligibility is processed either on-line during the update of student data or in a batch mode to process the entire student population.

All school districts have eligibility policies based on maximum walking distance to schools and all have innumerable exceptions to those policies because of hazard conditions, past practices, program exceptions and "grandfather" clauses. The EDULOG system allows users to automatically determine student eligibility conditions accurately for distance criteria and also for other special cases. EDULOG's approach is versatile enough to handle practically all possible eligibility criteria such as walking distance, hazard conditions, programs, and grade levels.

Eligible students are automatically assigned to the closest stop along safe walking pathways, with manual override always available during all the steps of the assignment process. Eligibility processing is flexible enough to allow client personnel to modify requirements to reflect changing organization policies.

The Des Moines Public School District has used Edulog since 1991. In 1994 Edulog was used to configure a three tier bell structure in a simulation area and then implemented those changes the following fall. We were able to reduce the fleet by almost 1/3. Since implementing Edulog we estimate our total savings to be \$500,000. This past year, 2009-2010, the Des Moines Public School District saved \$50,000 by using Edulog's run optimization module and we were able to eliminate two buses.

Sherry Bickett  
DMPS Transportation Route Manager

Eligibility for transportation is determined by the system according to current client transportation policies such as walking distance, hazard conditions, program and grade levels, travel times, bus load capacity, and safety constraints. Accurate computation of travel distances and times along the actual street network are determined without approximations such as "crow flight" or rectangular distances.

The software also allows the user to interactively override the system-determined eligibility for any student. Also, whenever a student's address is changed, or a student is added in the interactive program, the system automatically computes and displays the eligibility determination. The user may then approve or correct the presented data.

Reports are available to generate any eligibility information. These are part of the report-writer of the student census system so that the user can have access to the full power of generating reports of any desired format. Exception reports are also supported, such as listings of students who are eligible but not transported and/or students who are transported but not eligible.

## **ROUTE DRIVING DIRECTIONS**

This feature allows the system to automatically generate driving directions, such as left- and right-turn instructions with actual street names and times at each stop, to be included in the bus schedules given to drivers. As with all of EDULOG's software, this technical sophistication is accompanied by extreme ease-of-use for non-technical users.

Although the basic system offers all necessary standard reports with pick-up/drop-off points for students and times per route, this additional capability automatically calculates and defines travel directions for bus drivers. Automatic instructions include: directions to proceed along street segments; stop at a corner; pick up students listed by name; and where to make right and left turns. Student destinations, actual street names, and estimated time at stops and the final destination point are also provided in the automatic route driving directions.

## **MULTI-BUS TRANSFERS**

The EDULOG transfer system allows system users to create a special type of bus stop that can transfer students from one bus run to another bus run. Using the transfer system, the automatic bus run functions will pick up students and give the user the option of either taking students directly to school (or home) or taking them to a transfer stop location. The EDULOG transfer system is fully integrated with the text and graphic bus stop and bus run programs and the graphic student display program. As many as 99 transfer stop locations can be created for each school in the district. The EDULOG transfer system is fully controllable by grade level—users can set the program so that kindergarten students never transfer between buses and if any transfers are needed, routes will be created so that high school students are transferred first.

## **ATTENDANCE BOUNDARY DISPLAY SOFTWARE**

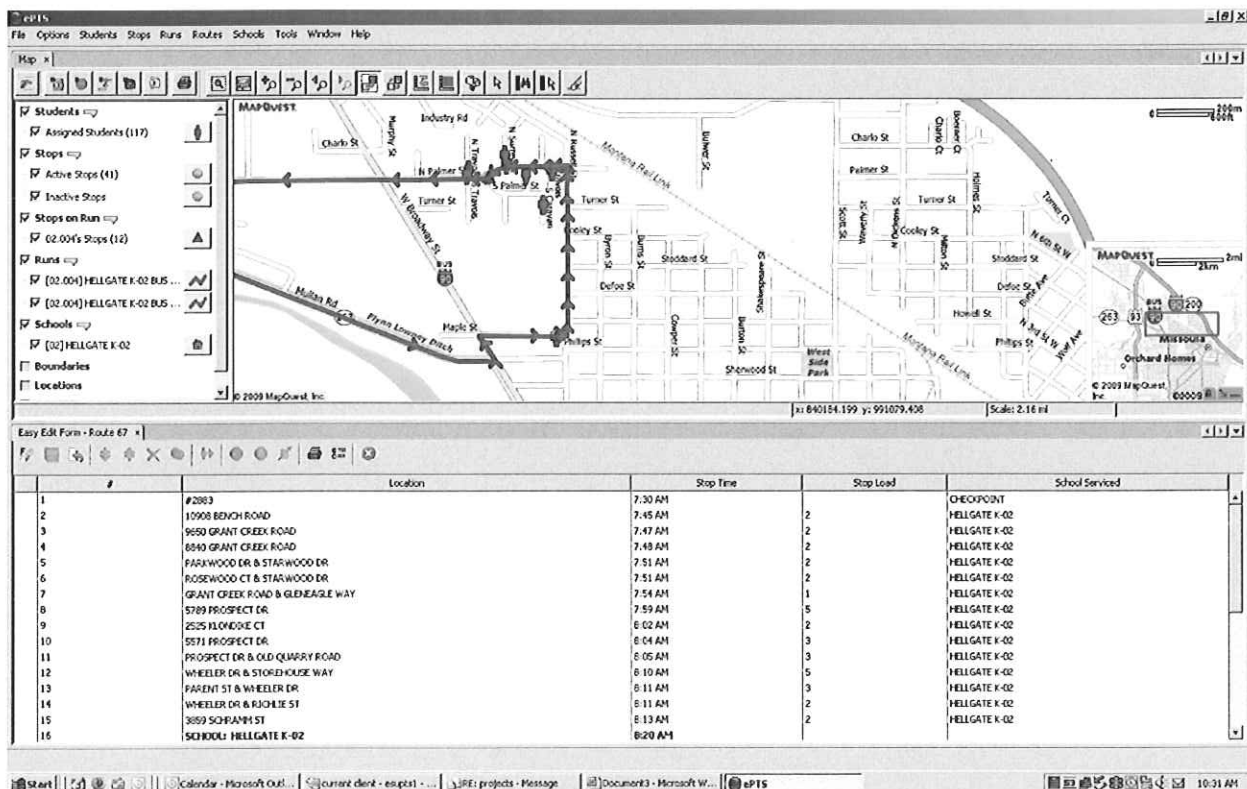
The attendance boundary display module can be used as a standalone system placed in every school to answer inquiries about school attendance zones and bus stop assignments. By typing in an address, the program will display the residence location on the digital map. Entering the grade (or special program) will show on the display screen the nearest applicable school, along with the distance from the school to the residence, the school phone number, bell times, principal's name, etc. In addition, the program can be used



to check current enrollment of the selected school, grade, and program for space availability. The nearest bus stops to the student's residence are also displayed, with addresses and pickup/dropoff times.

## EDULOGWEB INTERFACE SOFTWARE

Inspired by numerous client suggestions and comments, EDULOG's *EDULOGWeb* Interface introduces an easy-to-use method for stop, run, and route editing in just one Windows screen. *EDULOGWeb* Interface displays in both tabular and graphic form a current EDULOG system route with all associated runs, addresses, student headcounts, and times, and schools. Adding a run is as simple as filling in a Microsoft Excel cell: just put the cursor in the list, type in an address, and the system automatically performs an address match and places that address on the run. All associated information is then transparently updated—without ever having to leave the *EDULOGWeb* Interface display! The same process is used to assign a new student to a run or to change the rider load at an existing stop.



And for those who like to work with the run displayed on the map, adding a stop is as simple as clicking on any location and then dragging the run to that stop. Address matching, run sequencing, time and distance computation is all done automatically. And to make things even easier, *EDULOGWeb* Interface automatically creates run directions based on your changes. You're in charge all the way, and there's no need to toggle between screens or remember an exact sequence of events—thus making *EDULOGWeb* Interface ideal for new system operators or occasional users.

Because of the intuitive design of the interface and the powerful background processing that happens behind the screen, *EDULOGWeb* Interface can increase efficiency and productivity with very little effort on your part.

## **SPECIAL EDUCATION TRANSPORTATION CAPABILITIES**

Special education transportation is an especially demanding task for school transportation staff, and is generally run more or less independently from the regular transportation functions because most special education students require special buses, on-bus aides, and individualized door-to-door service. The large number of extensive changes made daily makes the task of managing special education transportation even more complex.

In the EDULOG system, special education routes can serve two or more schools, with student load fluctuations from stop to stop. As changes are made in the routes, the program ensures that the vehicle can still deliver students within school time limits and that the riding time does not exceed the limit for any student.

The EDULOG special education transportation module is interactive, on-line software designed to provide managerial control over all aspects of the special education transportation. With management support as a goal, the system allows for:

- Individual student needs and disabilities
- Maximum student riding time

This user-friendly system provides an effective way to store and retrieve all of the data about special education students, special education vehicles, and the routes and schedules used to transport students to schools and centers. The system also has remarkable versatility in controlling the daily management of re-routing and rescheduling required by the constant number of changes made wherever special education transportation is undertaken.

## **HAZARD ZONE AND SEXUAL PREDATOR DISPLAY SOFTWARE**

The purpose of the EDULOG hazard zones is to allow users the ability to visually track locations that may be hazardous to students and give warnings to system operators when creating or relocating a stop in the user-defined hazard zones. Examples of hazard zones may be an area around the home of sexual predator, a drug house, a mining location, a refinery, a bar, or an adult bookstore. The EDULOG system will allow stops to be created or relocated within the hazard distance, but the system will automatically warn the operator that stops may exist within the hazard. An associated report can be used which lists which stops are located within a hazard zone. Hazard zones are based on a user-defined rectangular distance from a given address.

## **TRANSPORTATION CAPABILITIES**

EDULOG has worked with school transportation operations of sizes ranging from 25 to 500,000 students, in urban, suburban or rural areas, serving a variety of programs requiring specialized services such as special education door-to-door, shuttles, and rural transfers.

We are confident that we have an excellent understanding of the needs and challenges of school bus routing management. Although each school district has its own special practices, there are many characteristics common to all pupil transportation operations, for example:

- The cyclical nature of the routing and scheduling activities: year start-up, intensive student update requests at the beginning of the year, tapering off after a couple of months; routine adds, changes and deletes during the rest of the school year, year-end rollover, summer program transportation.
- The sensitivity of the system to the accuracy of student and geographic data: *each* student must be accurately located, evaluated for eligibility, assigned to a pick-up location, etc. Any mistake can lead to a parent or school complaint.
- The intricacies of transportation policies. A typical case is the determination of eligibility, which is usually a factor of distance from school, age of the student, disability condition, if any; safety conditions and/or any number of individual exceptions based on medical conditions, historical or political considerations, etc.
- The importance of the geographic data. Not only is an accurate network necessary to correctly compute travel times, distances, and directions, but also detailed information concerning traffic restrictions (one-way, speed limits, etc.) and hazard conditions are essential in deciding eligibility and assignment to the appropriate bus stop.
- The complexity of the routing activities themselves. The mathematical model corresponding to a standard problem of grouping (clustering) stops into routes subject to capacity and riding time constraints is a well known unsolved problem in Operations Research for which no known solution method is available to guarantee the best (optimal) solution. Yet routes need to be produced that are the most efficient possible and which can also satisfy school district general policies.
- The immediacy of many of the demands on the transportation staff to respond to problems or to provide information. Most requests for action are made in a crisis mode and the response, either from a computer system or a manual approach, needs to be very quick.

These are some of the considerations that are essential to consider when designing an automated bus routing system. The EDULOG system has been tested through many challenging circumstances and requirements and has continuously evolved to include more capability and flexibility to address the very specific needs of its client market. The EDULOG system incorporates this experience by satisfying the following cardinal design considerations in functional requirements:

- high system performance in response time and computation capability—all data must be accessed in the shortest time so that user queries are addressed within an acceptable response level. The system must include extensive computational ability (mathematical algorithms) to help the user in all of the complex tasks of routing, scheduling and planning;
- extensive flexibility in design and features to accommodate current and also future needs.

and system requirements:

- ease of use of the programs, incorporating the newest technology and standards of user interface in order to allow non-technical users to derive the maximum use and benefits from the system;
- use of new software development and maintenance tools (DBMS, CASE) to simplify system maintenance requirements and enhance system flexibility at the level of file restructuring and customization;
- support of a variety of software/hardware platforms through the use of portable software codes.

In the area of functional requirements, EDULOG is confident that its current system can meet and exceed all of the WVDE's functional requirements. In particular, all the mathematical algorithms of automated routing, scheduling and stop selection and creation have been designed and continually enhanced with utmost attention given to performance and economy of computer memory resources.

## TRANSPORTATION OPTIMIZATION SOFTWARE

Optimization is a buzz word in the industry that has lost much of its original meaning. It is used by different vendors to mean different capabilities. Because optimization is extremely difficult to fully support, the differences in capabilities of various systems may be enormous, yet all vendors claim that they "have optimization." This is a particular area where the potential buyer has to be especially careful about vendors' claims. It is essential to evaluate the fundamental capabilities of a system, beyond the superficial level of cosmetics and flashy graphic displays. The task is not easy because most vendors will not reveal the internal working of their approaches, citing their proprietary nature. Fortunately, there are some ways for the discriminating buyer to evaluate these optimization systems:

- Does the system provide sufficient feasibility in defining the actual requirements of the client? For example, when a system builds bus runs from scratch, can it consider different size vehicles, can it limit bus runs by time and/or load? Can the user specify the desired number of vehicles to minimize the total fleet requirement?
- Another example is linking bus runs into full day schedules; can the system allow for individual arrival and departure time windows for each school and also each bus run? Can it consider road conditions or traffic congestion?
- What is the track record of the vendor with its optimization software? Has the system proved itself in the claimed capabilities? When was it released? Is it used by other school organizations with good results? How long has the software actually been in use by school districts?

User references are important to prove claims about all components of the system, but are essential in optimization because so much is unavailable or inaccessible to the buyer for direct scrutiny because of the proprietary or complex mathematical nature of the software.

### Optimization Software

Optimization in a transportation system consists of developing the most efficient a system of bus routes and schedules as possible within the guidelines of existing or potential transportation policies.

This optimization activity includes several stages of graphic review to consider all of the street network data along with student needs and transportation policies. The objective is to develop a set of routes and schedules with the minimum fleet requirement and travel distance while efficiently serving all eligible students. It is another major achievement of EDULOG's research and development effort that enables us to create an extremely effective route building scheme. EDULOG has consistently been acknowledged to be the only company capable of providing true global optimization in all three of the major routing functions: stop location, run building, and route coupling.

The routing and scheduling optimization software is the core of the EDULOG system. These programs were first created more than ten years ago and have been continually modified, refined, and enhanced through the years. EDULOG's optimization system has evolved through several generations of development so that the present system for personal computers has all of the effectiveness, flexibility, and versatility of the version available for larger computers.

The EDULOG approach is based on a very solid mathematical background, and the mathematical algorithms have been enhanced for increased performance in response time and the quality of solutions produced. More importantly, the whole procedure of building bus routes has been modified to be extremely user-friendly, easy to train on and operate, and totally automatic. The latest improvement has been the integration of interactive graphics with the optimization software so that solution review and adjustment can be done graphically.

The main functions of the optimization process (which can be operated interactively or in a batch mode) are:

- Run Building
- Route Coupling

### **Run Building Optimization**

The run building process can be executed for a given destination school or a selected group of schools. In the latter case, all bus runs produced by the system will have multiple service to the selected schools. The process can be further restricted to a specified group of bus stops, or a group of students. The run building procedure typically follows these steps:

- A. The operator defines the parameters for the optimization process including: the destination school (or group of schools) to be considered, the bus stops (or students) selected for routing, and the load and time factors for each run. These parameters are then stored in a file and can be retrieved if another run of the program is wanted.
- B. The run building programs are executed. The programs globally generate an optimal set of runs based on the pre-selected stops according to operator-specified time and load limits. Runs are created by sequencing stops for the most effective routing pattern while satisfying transportation policies.
- C. The resulting runs are available for transportation staff review through interactive graphics. Any of the standard reports available on the system such as passenger lists by bus stop, bus stop listing on runs, etc. can be generated to help in the evaluation.
- D. Computer plots are generated to further help the evaluation of the results.
- E. From the run review, it may be desirable to change some of the parameters defined in Step A, as well as perhaps change some service requirements and then repeat the process at Step B above. This process can be executed as many times as required until satisfactory runs are produced. Once a set of runs has been generated, stops may be added, deleted, moved to another run, or exchanged with other stops. The operator can "freeze" any run, group of runs, or part of a run and re-optimize the remaining stops according to the same or different time and load constraints. In this case, or in the case where only minor corrections are required, the on-line interactive programs can be called upon to perform the final fine-tuning of the runs for operation.

EDULOG was the first company to develop a system with the ability to automatically build multiple bus runs to a specific school or cluster of schools while using full vehicle capacity and minimizing time and distance



in travel. This capability has been honed by years of use, and the savings realized by our clients are well documented.

### **Route Coupling Optimization**

The route coupling software combines a specified group of bus runs into bus schedules with the objective of minimizing fleet requirements, travel distance, and wait times. The process can be conducted for any group of specified runs so that the least number of buses is used to transport all eligible students. Operation of the software is similar to the route scheduling process:

- A. The operator defines the parameters for the route coupling process: the group of runs involved, the particular restrictions on vehicle types and capacities, the time windows within which the runs can be at schools, etc. The parameters are stored in a file and can be retrieved and changed for another run of the process when needed.
- B. The route coupling is executed. The programs create coordinated bus schedules using the least number of vehicles while minimizing distances, deadhead travel, and wait times.
- C. Hard-copy reports are generated for review (or review can be carried out through interactive graphics). At this point additional simulations for school start/stop times and arrival/departure times can be performed to further minimize vehicle requirements.
- D. The review may lead to changing some of the run parameters and repeating the process at Step B above or, if the results are satisfactory or close to being so, the on-line interactive programs can be called upon to fine-tune the schedules.

We believe that the EDULOG route coupling optimization software has fully proven the value of automatically performing route coordination to maximize vehicle usage by scheduling multiple trips.

## **SIMULATION CAPABILITIES**

Because the system operators can access all software to construct bus routes and schedules and also update the geographic and street network information, there is no limit to the simulation activities that the district can conduct, as long as the parameters considered in the simulation process are the same as those supported in the run scheduling and coupling processes or the interactive maintenance programs.

The optimization programs are fully integrated and interactive with other EDULOG software modules. This allows the transportation optimization software to create what-if scenarios for simulated attendance boundary changes, school closings, opening of new schools, changes in school start/stop times, and changes in bus arrival/departure times to measure their effects on transportation.

Simulation activities are supported by both types of EDULOG software: the route maintenance system allows small scale route change simulation whereas the route global optimization system allows the client to simulate the complete network.

## REPORTING FUNCTIONS

EDULOG generated reports are of three types: standard reports used often and routinely, customized reports that are typically used only a few times a year, and user-defined reports. Standard reports include all student assignment and bus scheduling information, and are quickly produced with just a few keystrokes. Custom reports are easily created by non-programming staff; unlike many competing systems, there is no need to leave the EDULOG system to prepare custom reports.

Full capabilities for creating custom and ad hoc reports from the database are integrated into EDULOG software—giving EDULOG's report writer flexibility unsurpassed in the industry. Changes to the database structure are automatically incorporated into the report writer component—there is no need to alter the report structure when modifications are made to the database.

EDULOG's powerful Report-Writer includes complete sort priority options for individually designed special reports. For example, the system easily produces computer-generated routes and bus schedules with complete data for dispatching. The software will also automatically compute and display travel times and distances along actual streets. System operators may select students based on any combination of criteria stored in the student files, and then sort and format the information as desired. Statutory reports can be easily produced. For example, the Report-Writer feature can generate reports for the effective management of the transportation system, such as:

- Driver Schedules—stops to be executed by vehicles showing points of pick-up (defined in terms directly understandable by the driver), the names and number of students assigned to each stop, and the expected time of arrival.
- Route Census—listing of route schedules including the name, identification number, school, grade, and home telephone number for each student assigned to a stop. All student data fields are available for selection for this report.
- District Listings—alphabetic listing of enrolled (not just transported) students including bus route and stop information, and enrollment data such as the student's address, school, grade, telephone number, and birth date.
- Timeline Report—time chart representation of the schedule of each bus, showing schools served, destination, deadheads between runs, and start and ending times for each run.
- School Listings—alphabetic listing of students arranged by school, grade, telephone number, birth date, and transportation (bus route and stop) information.
- Notification Cards—individual mailing labels and/or student notification cards, suitable for mailing, with information regarding stop location, stop time, and route assignment. These reports are available for selection of students according to school, grade, program, or bus runs. In particular, the user can select students who are affected by a change in schedule (for example, when pick-up and return times are changed) or reside in a specific user-defined area and generate the required notification for these students.
- Driving Directions—directions showing right and/or left turns with specific street names.



- **Map File Reports**—various reports listing all street segments of the school district with address ranges, speed limits, traffic restrictions, etc.

The system can produce a graphic hard-copy or display screen plot of virtually any report generated in text form by the Report-Writer. A similar procedure is followed for sorting priority options and data field selections. Sample output graphics include:

- Computer-produced maps of the street network of the district with color coded speeds, street names, hundred block listings, user-defined hazard conditions, and one-way designations;
- Student distribution maps—the selection of students is user-defined with the same flexibility as in the report-writer;
- Bus stop maps—a selection of bus stops defined by the user to be represented over the street network;
- Bus run maps—a selection of bus runs defined by the user to be represented over the street network. At the option of the user, the actual street path used by the runs may be plotted.
- Capability to display several routes simultaneously;
- School attendance boundary maps;
- Student bus passes with student ID, name, grade, a.m. bus and stop numbers, and p.m. bus and stop numbers.

Reports can be formatted to provide any eligibility information desired—users can create reports of any desired format without leaving the system or having to learn arcane query languages. Exception reports are also supported, such as listings of students who are eligible but not transported and/or students who are transported but not eligible.

## THE EDULOG FIELD TRIP MANAGEMENT SYSTEM

EDULOG's field trip management system includes a web interface for schools to request field trips on-line—and also review the stages of the approval process.

The field trip module stores and reports trips by school, date, destination, requesting group, or trip category. The user can record a variety of items of information relating to each individual trip. Standard information can be included such as: grade levels and the number of students in the activity; originating school; destination; reason and date for the trip; when the trip was requested; and the proposed departure/return time.

Among its many versatile features, the field trip management module can automatically assign drivers to field trips scheduled for any particular day by taking into account such information as driver preferences, driver eligibility based on time left prior to overtime, type of vehicle, driver training required for the trip, and availability of vehicle based on use, repair, and mileage.

Field trip activity status reports can be prepared for a variety of needs to suit school administrators, trip requestors, drivers, and state auditors—and for reimbursement purposes.

To create a field trip, you submit a field trip request. A request is simply a form you fill out with the necessary field trip information, such as the origin, destination, the groups serviced by the trip (schools, typically), the number of passengers, the trip dates, and the times. When you submit the request, your transportation personnel evaluate the trip requirements and approve or deny the request. They can also assign drivers and vehicles, enter billing information, and so on. When they approve the request, the field trip management program automatically creates a field trip record for each requested trip. In fact, the only way to create a field trip record is to get a request approved.

The parameters that can be used for online field trip requests and approvals include trip type (for example, overnight or out-of-state), the number of students and adults, the start and end points, the funding source, the group type, the school or schools associated with the trip, the duration of the trip, the names of the requestor and approver, reason for denial of trip request, driver assignment, special needs or certifications, etc. The EDULOG field trip management software is definitely the most powerful and flexible in the industry.

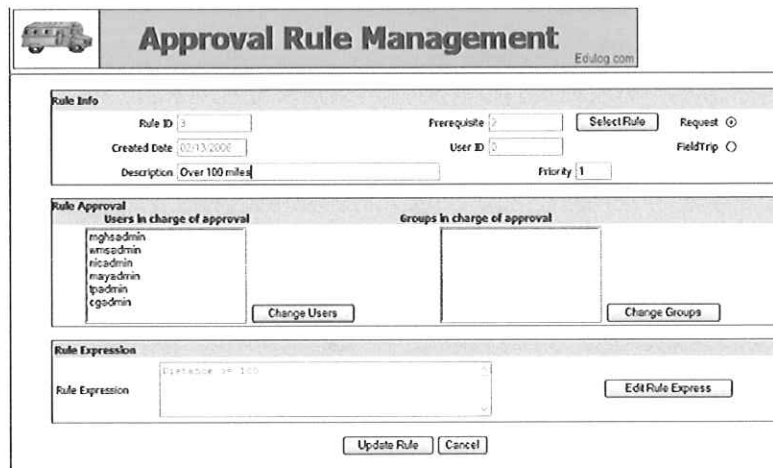
The screenshot displays the 'Request Information' form in the EDULOG system. The form is organized into several sections: 'Request Info' at the top with fields for Request ID (468), Request Date (03/02/2006), PO #, Request Status (Submitted), and a Comment field. Below this is a 'Recurring Trip' section with checkboxes for 'Recurring Trip' and 'Frequency'. The 'Groups Served' section contains a table with columns for Group Name, Department, Account N., and Split %, with one entry for 'Winnequah Middle' in the '6th Grade' department, account '12', and split '100'. Action buttons 'Add', 'Edit', 'Remove', and 'Common Destination' are provided. The 'Contact' section includes 'New Lead' and 'Contact Phone' (221-7676). The 'Trip Origin/Destination' section has fields for 'Origin' (Winnequah Middle School), 'Multi Destination' (checked), 'Distance' (10), 'Destination' (Princeton Club WEST), and 'Purpose' (Sport). The 'Trip Times' section includes 'Depart' (03/22/2006, 9:00 AM), 'Arrive' (MM/DD/YYYY, 8:00 AM), 'Leave' (MM/DD/YYYY, 8:00 AM), 'Return' (03/22/2006, 4:00 PM), 'Multi Day' (unchecked), 'Total Time' (6:00), 'Estimate Cost' (125.30), and 'Estimation Cost' (125.30). The 'Trip Passengers' section includes 'Adults' (2), 'Spec Needs' (unchecked), 'High School' (50), 'Elementary' (unchecked), and 'Total Passengers' (52). A 'Comments/Instructions' section contains the text 'We will need a trailer for transporting equipment.' At the bottom, a row of buttons includes 'New Request', 'Cancel Request', 'Requirements', 'Equal Bill', 'Submit Request', 'Approve Request', 'Next Request', 'Prev Request', 'Delete Request', 'Save Request', 'Close', and 'Deny Request'.

The system will notify authorized users by email when the status of a matching request or field trip changes. For requests, you can receive notifications for any or all of the following status changes:

- Saved to Canceled
- Saved to Submitted
- Submitted to Denied
- Submitted to Approved
- Denied to Submitted

For field trips, you can receive notifications for the following status changes:

- No Resource
- Pending to Canceled
- Active to Canceled
- Active to Scheduled
- Scheduled to Canceled
- Scheduled to Completed
- Completed to Billed



The screenshot shows the 'Approval Rule Management' interface. At the top, there is a header with a bus icon and the title 'Approval Rule Management' with the Edulog.com logo. Below this is the 'Rule Info' section, which includes fields for Rule ID (3), Created Date (02/13/2008), Description (Over 100 miles), Prerequisite (2), User ID (0), Priority (1), and buttons for 'Select Rule', 'Request', and 'Field Trip'. The 'Rule Approval' section is divided into two columns: 'Users in charge of approval' and 'Groups in charge of approval'. The 'Users' column lists mgtsadmin, wmsadmin, nicsadmin, mayadmin, tpadmin, and cgsadmin, with a 'Change Users' button. The 'Groups' column is empty with a 'Change Groups' button. The 'Rule Expression' section has a text area containing 'Distance > 100' and an 'Edit Rule Express' button. At the bottom, there are 'Update Rule' and 'Cancel' buttons.

## THE EDULOG GPS/AVL SYSTEM

There are several software systems designed for the K-12 transportation industry that can take data from on-vehicle GPS devices and then display the position of school buses on a digital map. But when it comes to achieving a true return on investment from a GPS system—and knowing the difference between what a bus is doing and what it should be doing—integration of the GPS software with a district's routing and scheduling system is of paramount importance. For example, consider the following situations:

- A standalone GPS software system may tell us that a bus is at 103 Main Street at 7:55 a.m. Is this bus early, late, or on time? Should this bus even be at this location at all? Without having the ability to automatically compare real-time GPS data with the planned data contained in the routing and scheduling system, there is no way that any of these questions can be answered.
- This same standalone GPS system may tell us that another bus has not moved from 121 Elm Street for five minutes. Is the bus in trouble? Should it be somewhere else? Is it supposed to be stopped for this long? Again, only through integration of GPS with routing and scheduling data could you know if something out of the ordinary is occurring.
- Or you might notice that another bus is traveling down the Center Avenue and seems to be making stops every few blocks for a minute or more. You think that the bus might be off route, but you can't tell for certain because you can't display the planned travel path on the digital map and compare it with what the bus is doing.

Obviously, simply tracking and recording vehicle locations, travel paths, and times is not enough to obtain any meaningful analysis of actual vs. planned activities, nor does it provide for a way to make improvements and increase efficiency because there is no mechanism for comparing what should happen with what does happen.

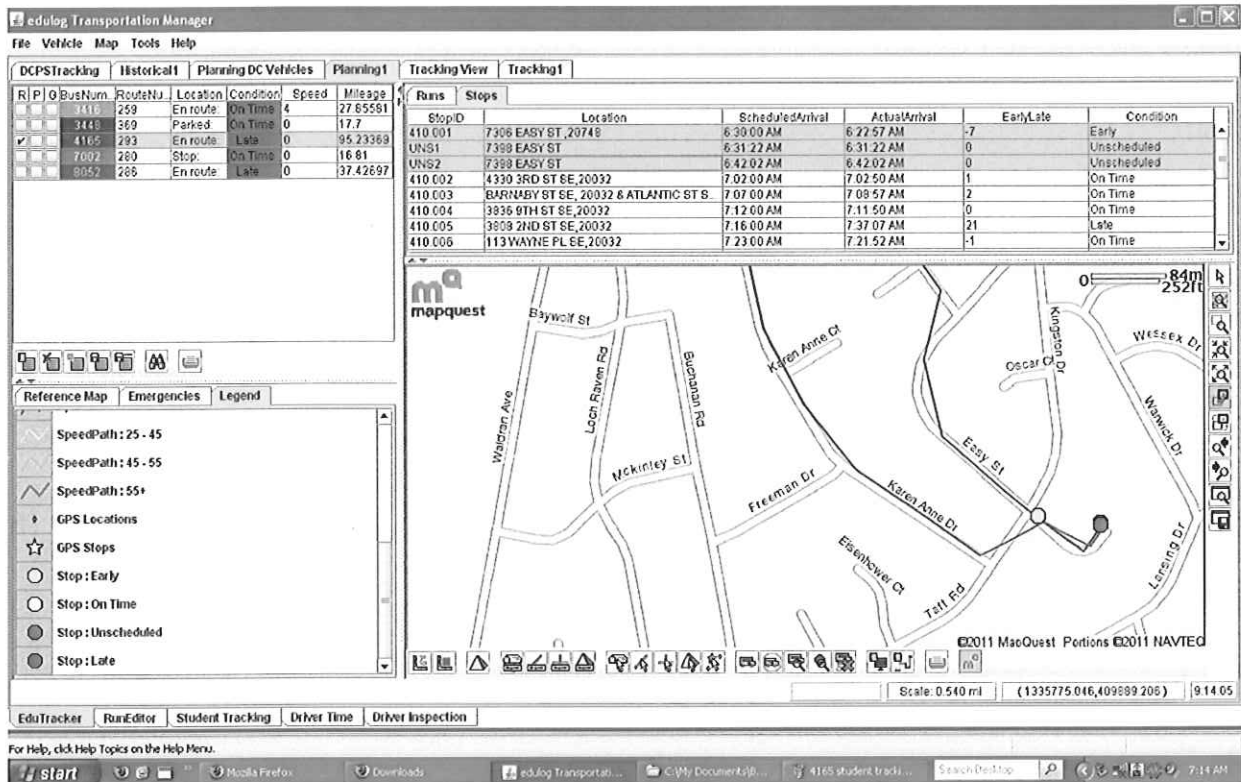
The EDULOG GPS/AVL tracking software has the following capabilities:

- The GPS data can be displayed for any group of vehicles, selected by the user as all buses serving one specific school, or buses serving a given geographic area or buses satisfying any user-defined criteria.
- For each vehicle, the software allows the user to select the types of events to be reported. These may consist of such events like bus stops, school stops, railroad crossings, garages, emergency events, excessive speed alerts, idle events, etc. Each has a specific symbol selectable by the user, for color and shape.
- The GPS data can be reported with a complete travel path for any time interval defined by the user. The color, line type and other graphic attributes are selectable by the user. The system can display the real-time path together with the planned path for the vehicle if it exists.
- Emergency events are tracked according to different levels of severity. At the most severe, the emergency event will alert the user by sound or clear visual cue, may require specific action before any other activity can resume, and may notify all on-line users whether they are tracking that vehicle or not. At the least severe, it may simply be logged to a file for later analysis. The level of severity is district-defined. The types of emergency events are also be district-defined.
- GPS location reporting is scheduled at a user-defined interval, for example 10 seconds for a yellow bus and five minutes for a field trip bus on a long trip. However, event-based data that are triggered by specific sensor readings or exception computations are transmitted immediately as they occur.

- The EDULOG system allows for the comparison of the actual driving data to the planned data as available in the routing system.
- The EDULOG system allows for the real time display of vehicle performance (early, late, on time). The comparisons are based on the use of the data available in the routing management system. Exception situations (as defined by the user, for example late status) are automatically brought to the user's attention, both in text table form (listing of bus operational data) and graphic mode (color coded icons immediately identifiable regarding the vehicles on-time/early/late statuses).
- The EDULOG system has the ability to display actual versus planned route data. Any bus stop can be clearly viewed as on time, early or late, missed or unscheduled. According to the current status of the vehicle, all future bus stops are provided an estimated time of arrival adjusted according to the latest real-time GPS data received.
- The EDULOG system has the ability to display actual versus planned route data on the map. The user can display both actual real-time and planned travel paths on the same screen, with a user-defined selection of colors and symbols to clearly separate the two.
- The system allows the user to easily evaluate the location of any bus stop as computed by the routing system in relation to the actual location reported by the GPS system. At the user's decision, the planned data can be automatically corrected if the optional run editor software is implemented.
- The system allows the user to easily compare the time at any bus stop to the time computed by the routing system. The user can then decide on any editing possible to realign the planned times to the actual GPS times, and the system should perform these time corrections with minimum user data entry.

## **GPS AND ROUTING AND SCHEDULING INTEGRATION**

"Integration," in terms of GPS and routing and scheduling systems, has been used by vendors to mean almost anything—or nothing. EDULOG introduced the concept of GPS/Routing and Scheduling integration more than five years ago when we began delivering a solution that combined GPS information and planned data in one piece of software. At that time, only EDULOG was describing and offering such integration; our competitors either dismissed the value of integration or said that it couldn't be done. Since that time, as integration has been successfully implemented by EDULOG, these companies have had to deliberately skew the meaning of the word in order to accommodate what they are actually capable of delivering. As a result, what one company claims is integration is very different in value from another. Thus we believe it is important first define what integration really means.



The above screen display shows the actual times and route path for student pickups with comparative analysis to the planned times contained in the routing and scheduling software system.

## The Basics of Integration with Routing and Scheduling

Integration of a GPS/AVL system with the routing and scheduling system requires information exchange in three areas:

- The geocode (street segments, addresses, travel speeds, boundaries, point locations for students, bus stops, and schools)
- Student Information (assignment of students to buses, the locations of student residences and assigned bus stops)
- Transportation Information (bus identification, travel paths, times along a route).

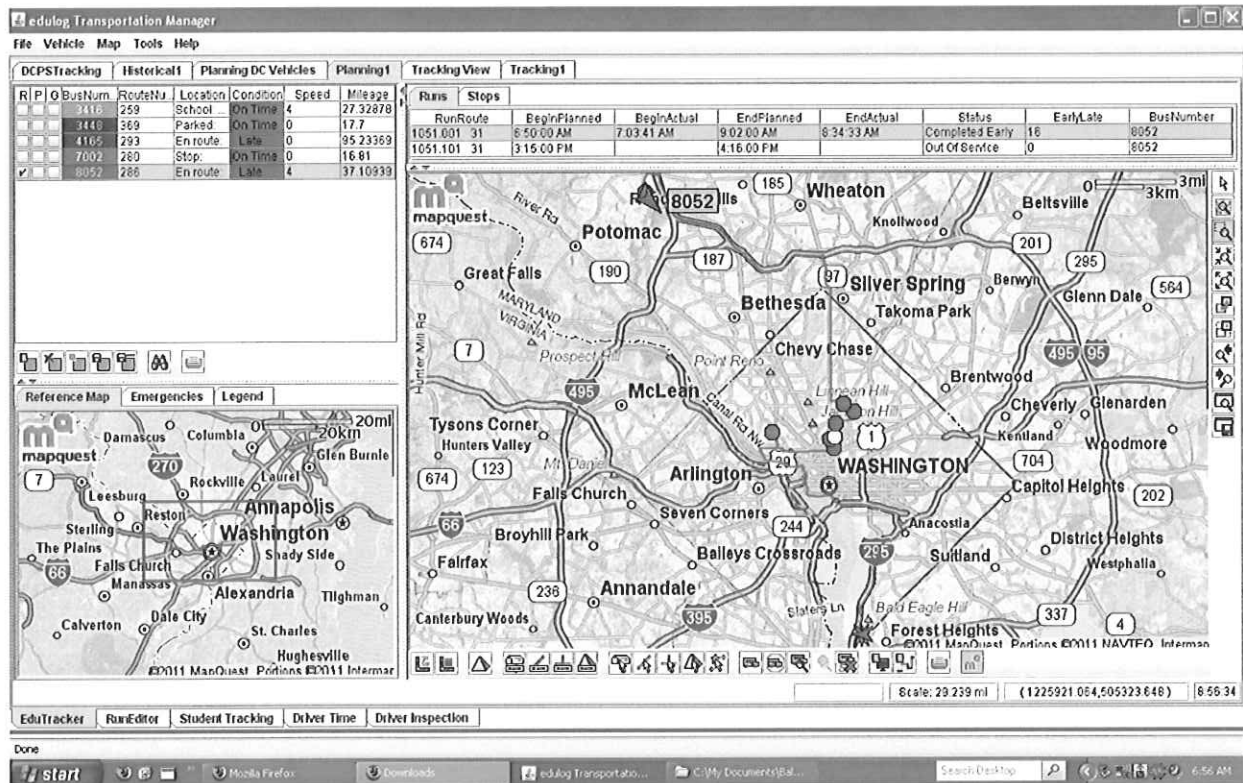
For each of these three data classes there is the potential for integration by importing data from the district's routing and scheduling system into the EDULOG GPS system in real time. Examples of this integration include:

- Student information from the routing and scheduling database is also available in the GPS system for student tracking
- Planned bus events such as the run sequence, start/intermediate/end times, assigned stops, and the travel path can be displayed by the GPS system and compared with what the GPS units are reporting.



## GPS/AVL SOFTWARE FUNCTIONS: EDULOG *EDUTRACKER*

EDULOG provides school districts with a cost-effective and powerful method of tracking bus locations at all times. With this innovative technology, not only can you have the exact location of any bus displayed on the EDULOG system map, but the time and location of each pick-up and drop-off can be recorded for route analysis, emergency notification, and accident reporting. Because of the EDULOG system interface capabilities, uses of the GPS interface are almost endless. For example, if a district has an automated calling system, it would be possible using the EDULOG GPS interface to determine when a bus is late and then call every parent along the route to inform them of the situation. Enhanced productivity, maximized fleet utilization, improved safety and security, and increased community service can all result from the EDULOG GPS inter-



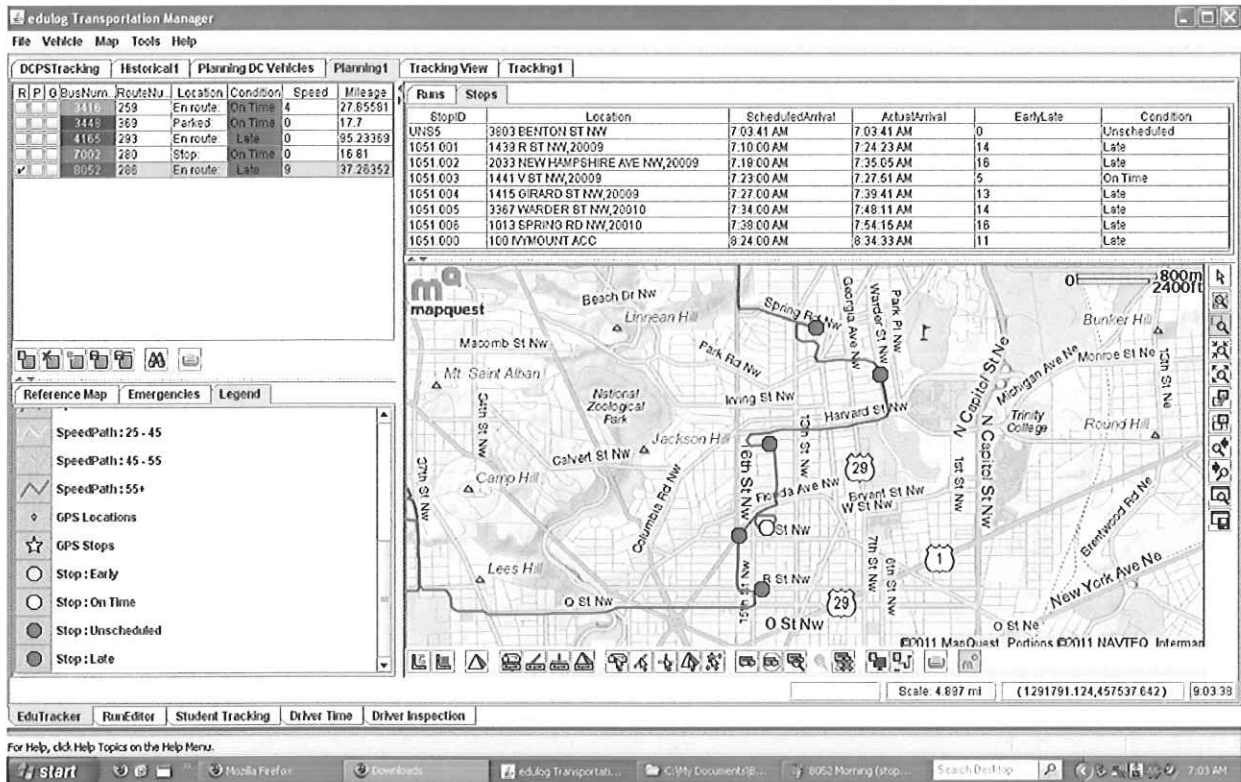
face.

The above screen display shows the actual travel path and stop locations for a completed morning run with actual compared to planned times (obtained from the routing and scheduling system) displayed.

The combination of appropriate GPS equipment and our *EduTracker* software lets you go far beyond just locating a bus. Because EDULOG *EduTracker* is connected both to a feature-rich map and data from routing and scheduling software, you can quickly and easily find out not only where the bus is, but also where it has been and where it is scheduled to be. For example, you can display a single bus run or all of the bus runs serving a particular school, and the system will show on the detailed map where each bus is at the current time, the bus stops that have already been visited, and those awaiting service. *EduTracker* also tells you the scheduled time of the bus or buses at the stop, the estimated time of arrival, and the actual time of arrival.



If a bus missed a stop, you will know instantly by looking along the travel path on the map. If a bus has missed a defined deadline, the map display will be highlighted to warn the system operator.



The above screen illustration shows the actual travel path of a bus with stop information, including on-time and late information (as compared to the planned data in the EDULOG routing and scheduling system) and cumulative mileage.

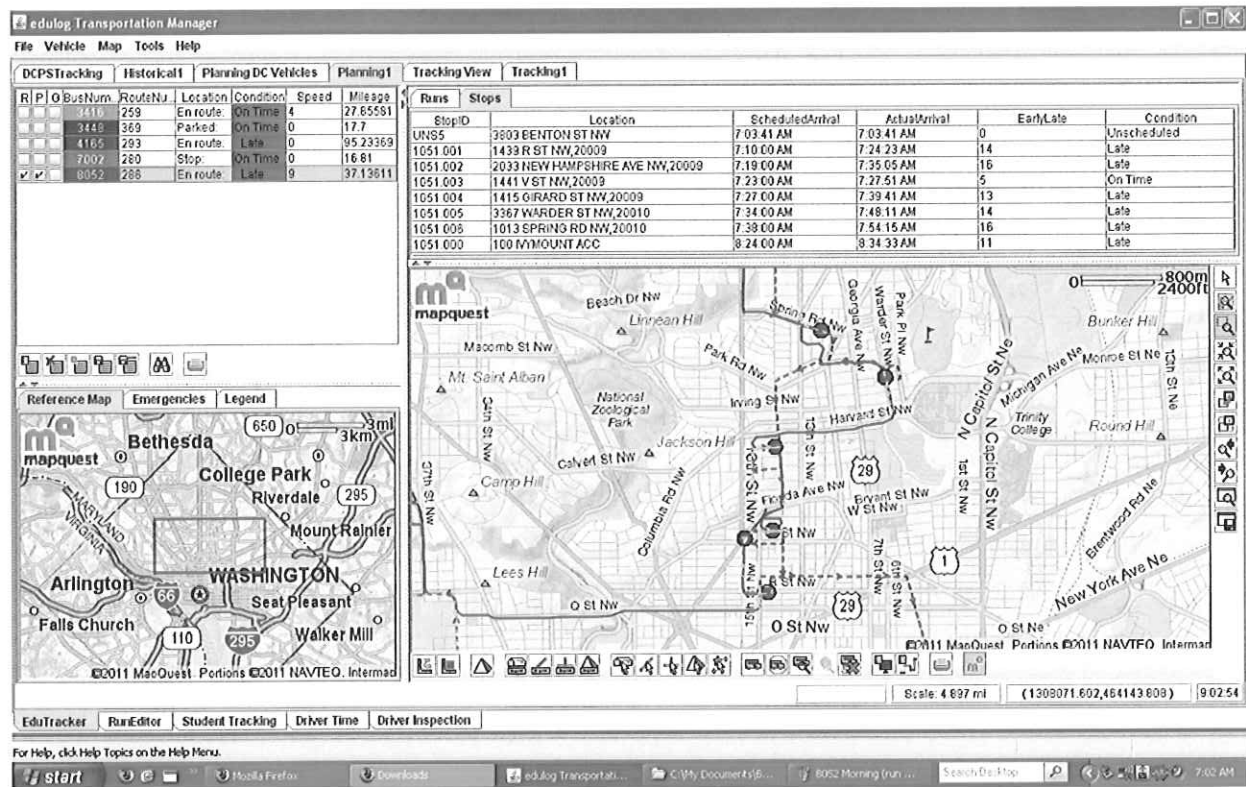
With this access to present, future, and past information for both time and place, EDULOG clients can quickly determine if there is an abnormal busing incident and take appropriate action. The delayed or stationary bus is highlighted on the system display, a dispatcher can radio the bus, report the position to authorities, and use the EDULOG system to get the names, phone numbers, and emergency contacts of all involved students. Having timely and accurate information during a serious incident can immeasurably improve performance, safety, and peace of mind.

But the *EduTracker* system is much more than just an emergency tool—it can be used to actually improve routing and scheduling efficiency. If a bus is consistently late on a run, the *EduTracker* will store this information for review and analysis. Using the included reporting functions, you can then determine the cause of the problem and make adjustments in the district's routing and scheduling data. If it is taking too long to load all the assigned students at that stop, then a routing adjustment may need to be made and some stops assigned to another bus run. If a bus is taking too much time between stops, then a different street may need to be used. Conversely, if a bus is taking less time than expected to complete a run, you can use the routing and scheduling system to assign more stops to that run—thus equalizing the load and maximizing fleet potential with verifiable statistics. Total time, total mileage, idle time—all this and more is available for preparing state

reports, cost calculations, performance reviews, and contract negotiations. With this information, you have the control and facts to make informed and fair decisions.

The EDULOG *EduTracker* system gives you:

- **Ease-of-use:** access is through the web from any Java equipped computer. At home, at work, on the move, the information you need is just a few clicks away.
- **Security:** you'll always know where your buses are, but this information is only for authorized users you allow. Further system security includes limiting views to only certain schools or only certain functions.



The above screen illustration shows details of a morning bus run with stop information of actual versus planned times.

- **Flexibility:** The map display lets you zoom in for detail, pan for the wider picture, show all or selected buses, and make on-the-fly distance measurements. With EDULOG's *EduTracker*, you see as much or as little as you need, without clutter or distractions.
- **Knowledge:** Now you can track, store, and report on real times and real miles, for an entire fleet during the whole year, or just one bus one day. With this information you can justify expenditures, calculate savings, and track efficiencies.
- **Integration:** because of EDULOG's open system design, information collected by *EduTracker* can be interfaced with alarm systems, student databases, financial software, maintenance schedulers, etc.

Data entry duplication is eliminated, information is spread throughout the district, and your technology investment is leveraged for greatest return.

## OTHER CAPABILITIES

The EDULOG *EduTracker* AVL/GPS system can calculate loaded and unloaded travel miles, and validate reports for busing reimbursement from state and federal agencies. When the optional student tracking software and hardware are added, the EDULOG *EduTracker* AVL/GPS system also has the ability to automatically track and record student ridership information in real time and both display this information and archive it for reporting and reimbursement purposes. This ridership information includes: student name and ID number, time and location upon entering the vehicle, time and location upon exiting the vehicle, and total ride time for any particular day.

The system operator has the ability to control the following attributes of the graphic display module of the EDULOG GPS/AVL system:

- Map Refreshing: The user has the ability to specify the timed intervals of data changing the system map.
- Vehicle Display: The user has the ability to specify which vehicles and the number of vehicles visually displayed within the application and/or on the map.

The EDULOG system displays vehicle location reports in real-time, for all vehicles, including the following:

- Ability to display groups of vehicles on the screen
- Stored standard groupings such as:
  - Buses running ten or more minutes late (or some other user-defined period) if comparative analysis information is available from the routing and scheduling system
  - Buses running early if comparative analysis information is available from the routing and scheduling system
  - Buses in “Emergency” mode (driver pressed the Emergency button)
- User-defined groupings such as:
  - Buses for a particular school
  - Buses in a particular geographic area
- Ability to color-code or otherwise graphically identify a certain bus or group of buses
- Buses running early turn one color, buses running late turn another color, parked buses are another color.
- Vehicle icons generate information boxes on mouse-over with:
  - Vehicle ID number.
  - Speed and travel direction of vehicle
  - Time of last GPS update
- Run number and run description, if vehicle is assigned to a run at the time
- Vehicle route number, if vehicle is assigned to a route at the time

- Calculated time ahead of or behind schedule, if applicable and if comparative analysis information is available from the routing and scheduling software

EDULOG GPS/AVL system reports provide the following data:

- Vehicle number
- Driver name and number
- Bus Route (if applicable)
- Bus Run (if applicable)
- Time and Date
- Vehicle position
- Vehicle position on street grid
- Vehicle speed and direction

The EDULOG GPS/AVL system also provides ready access to standard and user-defined reports such as:

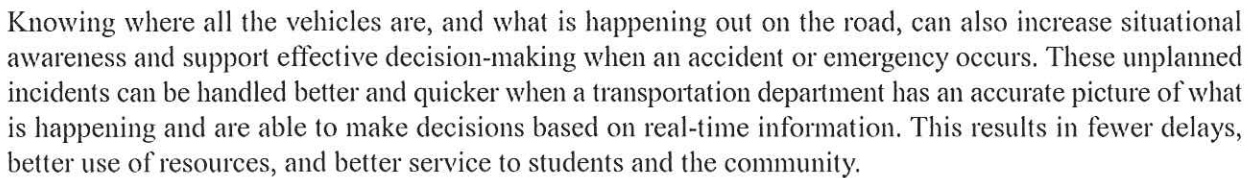
- GPS history for a particular vehicle over a user-defined time period
- All bus departures or arrivals from a particular school for a particular date range
- Mileage statistics for buses
- Mileage statistics for routes or runs

## ALERTS

In the EDULOG system, alerts are classified as events that send a message to the system operator. Emergency events are tracked according to different levels of severity. At the most severe, the emergency event will alert the system operator at the base station by sound or clear visual cue, may require specific action before any other activity can resume, and may be notified to all on-line users whether they are tracking that vehicle or not. At the least severe, it may simply be logged to a file for later analysis. The level of severity is district-defined. The types of emergency events are also district-defined. All alerts include the time, date, and exact location of the bus with bus number.

When a driver or vehicle attendant pushes the emergency button on the vehicle, a signal is transmitted through the GPS device to the EDULOG base station server. All workstations currently monitoring the system will have a pop-up box displaying the emergency event, the vehicle number, and the vehicle location. These emergency events are also stored in the system for later recall and analysis.

Below is a screen display showing an emergency condition.



- Buses running ten or more minutes late (or some other user-defined period)
- Buses running early
- Buses in “Emergency” mode (driver pressed the Emergency button)
- Buses exceeding user-defined speeds
- Buses idling for a more than a user-defined period

- Missed stops (stops on routes that were not visited by the bus assigned to the route or run over a period of time or on a single day)
- Late or early stops (stops visited on the route, but within parameters for deviation from scheduled time)
- Late or early arrival at school stop based upon scheduled time



## STUDENT RIDERSHIP TRACKING SYSTEM

File Help

**Student Search Options**

By Name:  Go

By List:

By School:  Go

By Field:  Go

Select a student

Edulog	Last Name	First Name	Sch.	Gr.
583	TORRES	RYAN	107	05
554	TORRES-TOLEN	BRANDON	107	05
784	TORRES	PEDRO	044	08
799	TORRES	GUADALUPE	044	08
918	TORRES	CHRIS	044	08
1155	TORRES	FERNANDA	044	05
1157	TORRES	INDALECIA	044	05
1269	TORRES	EVERARDO	044	07

Go to Page:

View: ☒ Tag Info ☒ Ridership History

**Student Tag Info**

Tag ID	District ID	Tag Type	Effective Date	End Date	Comments
00000020A899B	000000591123		11/19/2010	06/20/2011	

Add Edit

**Ridership History**

Start Date: 05/27/2011 End Date: 07/30/2011 Search

Last Name	First Name	Date	Planned Vehicle	Planned Time	Planned RunID	Planned StopID	Actual Vehicle	Actual Time	Actual Run ID	Actual Stop ID	Exception
TORRES-T.	BRANDON	05/27/2011	263321	07:09:00 AM	107:006	107:007	263321	07:09:40 AM	107:006	107:007	Planned
TORRES-T.	BRANDON	05/27/2011	263321	07:45:00 AM	107:006	107:007	263321	07:47:21 AM	107:006	107:004	Unscheduled
TORRES-T.	BRANDON	05/27/2011	263321	11:40:00 AM	107:106	107:007	263321	11:53:20 AM	107:106	UNSD160	Wrong Stop
TORRES-T.	BRANDON	05/27/2011	263321	07:45:00 AM	107:006	107:007	263321	08:03:50 AM	107:006	107:004	Unscheduled
TORRES-T.	BRANDON	05/27/2011	263321	11:40:00 AM	107:106	107:007	263321	12:04:00 PM	107:106	UNSD161	Wrong Stop
TORRES-T.	BRANDON	05/27/2011	263321	11:30:00 AM	107:106	107:007	263321	12:40:28 PM	107:106	UNSD162	Wrong Stop
TORRES-T.	BRANDON	05/28/2011	263321	07:45:00 AM	107:006	107:007	263321	07:48:28 AM	107:006	UNSD163	Wrong Stop
TORRES-T.	BRANDON	05/28/2011	263321	11:32:10 AM	107:006	107:007	263321	11:32:10 AM	107:006	UNSD164	Wrong Stop
TORRES-T.	BRANDON	05/29/2011	263321	07:45:00 AM	107:006	107:007	263321	07:45:00 AM	107:006	UNSD165	Wrong Stop
TORRES-T.	BRANDON	05/29/2011	263321	11:40:00 AM	107:106	107:007	263321	11:40:00 AM	107:106	UNSD166	Wrong Stop
TORRES-T.	BRANDON	05/29/2011	263321	07:45:00 AM	107:006	107:007	263321	07:45:00 AM	107:006	UNSD167	Wrong Stop
TORRES-T.	BRANDON	05/29/2011	263321	11:40:00 AM	107:106	107:007	263321	11:40:00 AM	107:106	UNSD168	Wrong Stop
TORRES-T.	BRANDON	05/29/2011	263321	07:45:00 AM	107:006	107:007	263321	07:45:00 AM	107:006	UNSD169	Wrong Stop
TORRES-T.	BRANDON	05/29/2011	263321	11:40:00 AM	107:106	107:007	263321	11:40:00 AM	107:106	UNSD170	Wrong Stop
TORRES-T.	BRANDON	05/30/2011	263321	07:09:00 AM	107:006	107:007	263321	07:09:23 AM	107:006	107:007	Planned
TORRES-T.	BRANDON	05/30/2011	263321	07:45:00 AM	107:006	107:007	263321	07:45:51 AM	107:006	107:006	Planned
TORRES-T.	BRANDON	05/30/2011	263321	11:30:00 AM	107:106	107:007	263321	11:28:57 AM	107:106	107:006	Planned
TORRES-T.	BRANDON	05/31/2011	263321	11:40:00 AM	107:106	107:007	263321	11:51:34 AM	107:106	UNSD172	Wrong Stop
TORRES-T.	BRANDON	07/01/2011	263321	07:05:23 AM	107:006	107:007	263321	07:05:23 AM	107:006	107:007	Unscheduled
TORRES-T.	BRANDON	07/01/2011	263321	07:45:00 AM	107:006	107:007	263321	07:45:00 AM	107:006	107:006	Unscheduled

Edulog Tracker RunDirEditor RunEditor RouteEditor Student Tracking UnitManagement Driver Time Driver Inspection

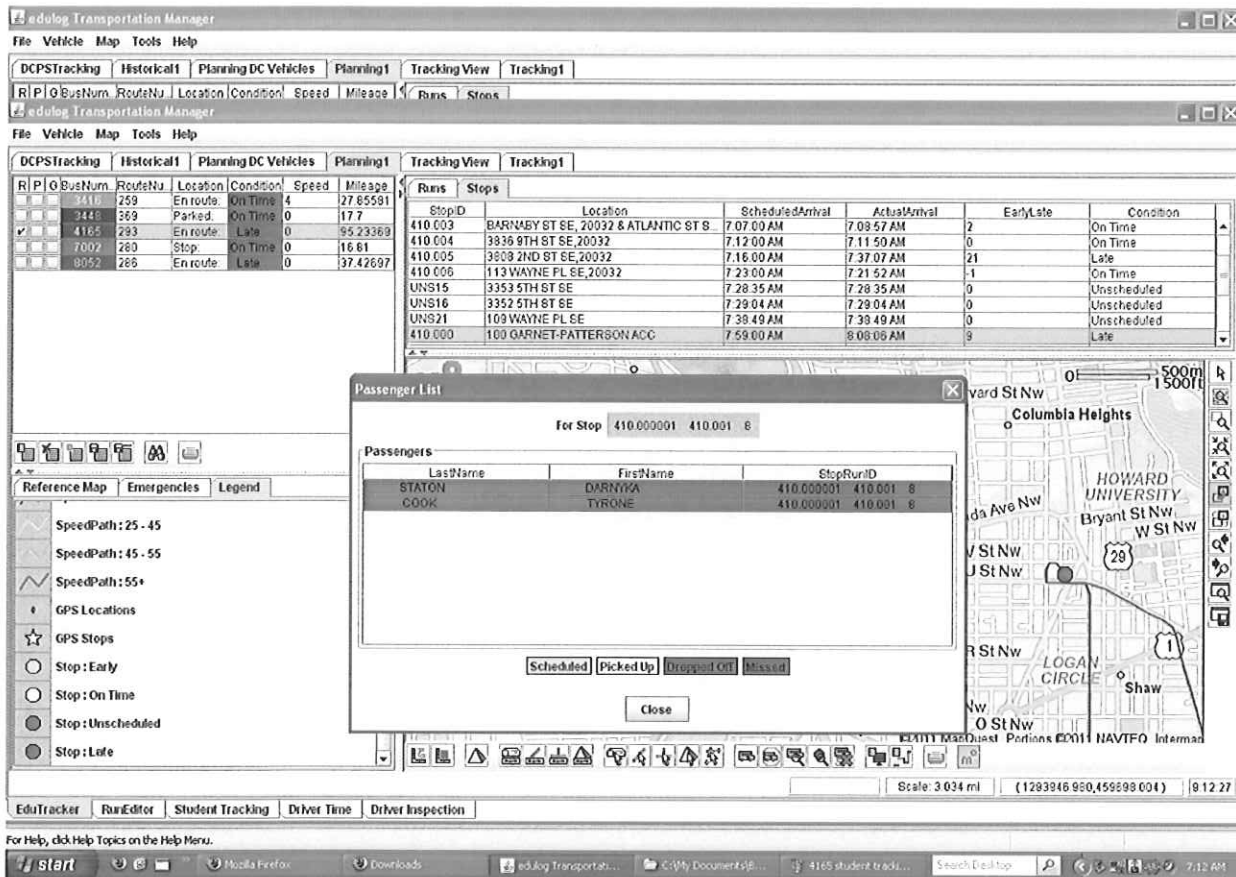
The above screen illustration from the system at an EDULOG client district shows the actual records of one student during a selected time periods. Note that the system tracks when and where the student entered and exited a bus, the actual bus number, and the comparison between actual and planned times.

Looking beyond routing and scheduling integration, perhaps what is more important to focus on is the integration with the routing system as it relates to students. As demonstrated recently for a major urban school district, EDULOG successfully reported on student tracking far beyond what any other vendor can offer. For instance, it's very easy to demonstrate which student got on the bus: you simply swipe a card. EDULOG went much further in its demonstration by providing data that showed children that did not ride the bus as scheduled, loaded and unloaded at the wrong stop and/or wrong bus, rode the bus as a non-rider and much more.

No topic related to school bus GPS/AVL has received more attention in recent years than student tracking. The motivations for automatic student tracking range from: increasing student safety and security; improving the efficiency of special needs routing; meeting state/federal reporting requirements; and securing Medicaid reimbursement.



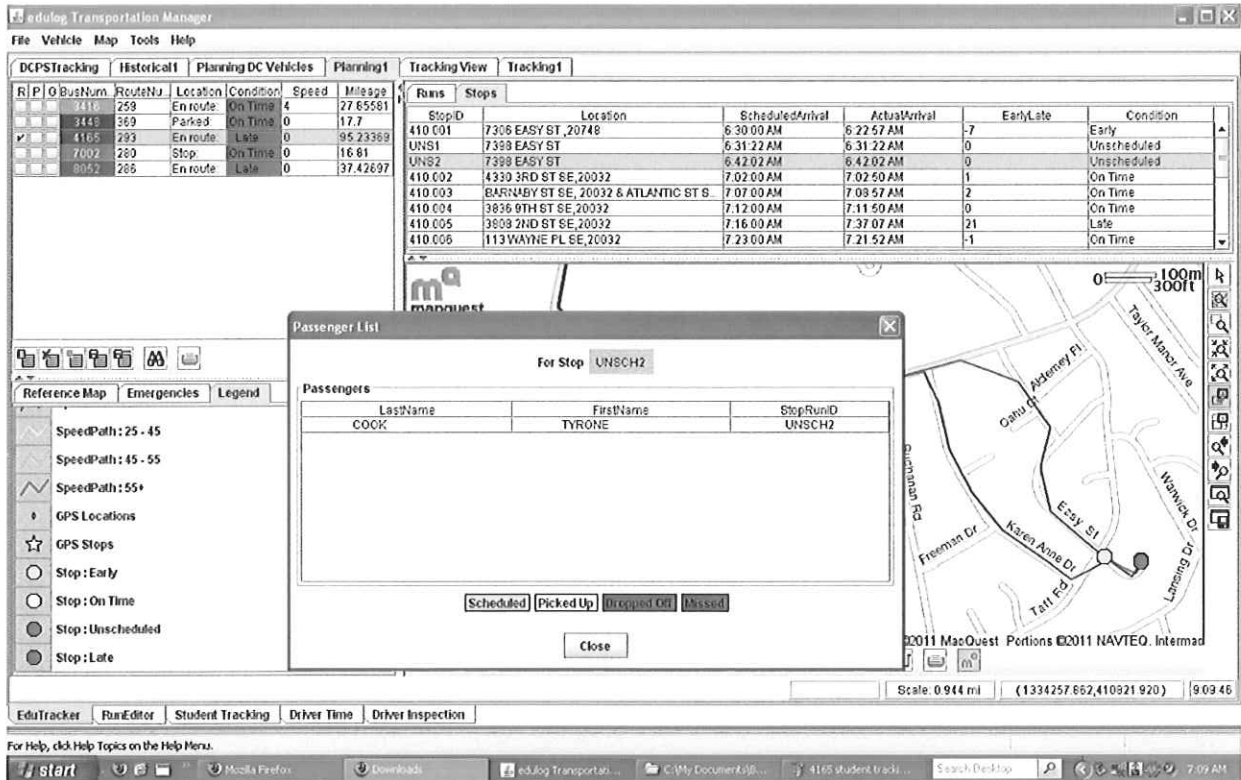
The options for student tracking technology are as diverse as the motivations to implement them. Hardware products include RFID, swipe cards, bar coding, mobile data terminals (MDT), biometrics, and more. The only clear conclusion is that there is no perfect answer to student tracking. Every option has advantages and disadvantages that clients must consider when making an informed decision.



The above screen illustration shows the actual travel path of the bus and the identification of a student who has been confirmed as boarding the bus. Also note that actual versus planned information (the planned information is taken from the routing and scheduling software) is displayed regarding on-time performance.

In keeping with the “one size does not fit all” philosophy, EDULOG’s approach to student tracking has been to design its GPS solutions to offer clients the ability to select from the complete range of student tracking options. For many clients, a combination of student tracking technologies will provide the best fit.

But being a true solution provider means going far beyond simply selling a variety of hardware options. There needs to be accountability and responsibility for the operational success of the overall system—which is directly affected by the selected technology. Therefore, EDULOG works with each individual client to understand and define the unique requirements and expectations for the student tracking system. Only then can meaningful, objective recommendations be made, and subsequent operational experiences be evaluated with the client.



The above screen illustration shows that two students were dropped off at their school, and that according to the planned information taken from the routing and scheduling system, the bus was nine minutes late.

## Student Tracking Hardware

While a variety of student tracking options are available, many clients have selected the following technologies.

**Radio Frequency Identification (RFID)**—Widely used in other industries, RFID technology offers clients an effective way to accurately identify students as they board and exit the bus. The type, size, and costs vary based on the range or proximity required by the client for both the RFID reader and the student credential being scanned. The smaller the range, the less passive the system is—thus requiring physical participation from each student to ensure a successful scan. EDULOG works with clients to adapt the installation of this equipment to fit with the models of school buses in a client's fleet.

**Mobile Data Terminals (MDT)**—Through the integration of the student tracking system with planned routing data, student information can be sent out to each bus and displayed on an MDT for the driver to interact with. This can be especially effective for special needs student tracking: the driver can simply push a button to indicate whether or not a child was picked up—and if not, select from a list of reasons why. Beyond student tracking, the MDT offers the additional features of being able to provide run directions, traffic alerts, and more to the driver—all especially helpful for frequently changing bus runs and/or substitute drivers.

## Student Tracking Software

As with GPS/AVL, the value of a student tracking system can be exponentially increased when it is integrated with planned routing data. Rather than simply tracking which students board and exit the bus, clients can compare this information to a list of students assigned to a given bus stop. Not only can dispatch know when a child has exited at an unassigned stop, the driver will know when someone boards the bus who isn't supposed to.

As a true dispatch tool, *EduTracker* allows operators to better manage phone calls from parents and determine with detailed accuracy where their child is located, if/when they were picked up or dropped off, and exactly what time this occurred. Ultimately this allows operators to “manage by exception,” rather than being flooded with data that represents business as usual. This unique design makes a wide range of features possible. For example, comparative reports can be generated to show:

- The list of students that rode the wrong bus that day.
- The list of students that got off at the wrong stop that day.

By leveraging the ability of real time student tracking data, comparative analysis can be automatically performed by the *EduTracker* software dynamically. As school buses drive their planned routes the software can monitor exceptions and immediately notify operators of events that require their attention (through pop-ups, color and/or flashing text, icons, etc.)

Dispatchers also have the ability to utilize the system to drill down, looking at a specific school bus (or individual bus stop) to observe the real time status of which assigned students are: a) waiting for the bus, b) have been picked up and are onboard, c) have been dropped off, and d) were missed at a bus stop.

The ability to perform two-way communication between the GPS/AVL/routing software and the GPS unit on the school bus in real time allows the EDULOG network to be extended to include the buses themselves. This important feature offers flexible options for future expansion such that comparative analysis of actual vs. planned student data can be performed onboard the bus itself at each stop and then communicated to the driver.

Beyond daily operations, further routing efficiencies can occur because the system gives you a better understanding of exactly how many students are actually riding the bus compared to the total number eligible for transportation.

## School System Management

In order for student tracking to work, clients need much more than student tracking hardware and software—they need a cohesive management system. Many clients underestimate the resources needed to successfully maintain and operate a student tracking system—especially when individual credentials are assigned to students. Questions such as: Who will assign cards to students? Where will this occur? What happens when a card is lost? How will all of this integrate with the existing student database?

Fortunately, EDULOG has developed software tools within *EduTracker* to help clients manage these challenges. Card assignments are as simple as scanning an ID and then the system instantly connects this card

number to both the transportation assignment for that student and the student record within the client's student information system.

## THE EDULOG DRIVER TIME AND ATTENDANCE TRACKING SYSTEM

Most time and attendance systems for school district transportation staff are based on a time-clock at a fixed site which records log-in/log-out information. The EDULOG *eDTA* (electronic driver time and attendance) system can certainly be used that way, but to expand on that capability, EDULOG offers a system that is a true intelligent worker management system. When a school district transportation department employee logs in or out, the system will know:

- Who the worker is and all his/her information (emergency contacts, permanent/temporary status, license number, etc.)
- What that day's work assignment is
- The employee's planned schedule (including breaks)
- If they are early or late
- What job classification the worker has
- If they are at the right bus
- Where they are and where they've been (if the system is integrated with GPS/AVL)
- The employee's pay rate, type, and schedule
- The employee's certifications, skills, and training
- The accounting codes associated with the employee
- If the employee has performed all necessary pre- and post-trip bus inspections (if optional software is implemented)

All of this tracked, managed, stored, and reported upon in an easy-to-use, flexible, and powerful web-based EDULOG system.

What is fundamentally different, and profoundly revolutionary, about EDULOG's approach to time and attendance tracking are:

- The EDULOG system is the only one on the market that can actually compare transportation department staff actual activities (driving a regular bus, driving a field trip, making inspections, etc.) with planned activities and schedules, because only the EDULOG system has an interface with a transportation management system. With a simple log-in, log-out system, you'll know that a driver reported to work at 7:05 a.m., but you won't know, as you would with the EDULOG system, that the driver clocked in at 7:05, took three minutes longer than scheduled to perform the pre-trip inspection, started the bus five minutes late, and arrived at school two minutes late. Only the EDULOG system provides this level of detail and ability to analyze, improve, and/or correct employee performance.
- The EDULOG system is mobile—the recording device goes with the employee. Not only is the device right at the worksite, it also allows for tracking, recording, and reporting when the employee is working but is not at a fixed transportation site—as would be the case on a long extracurricular trip.
- The EDULOG system can be tied to GPS/AVL. Most transportation professionals recognize that the future of school bus management requires GPS/AVL to be integrated fully into all operational aspects, and EDULOG has designed its time and attendance tracking system from the start to take advantage of the time/location/activity data that GPS/AVL provides (such as moving vs. idling, engine on/off, loaded vs. unloaded travel, etc.)

With more than 30 years of experience in the school transportation industry, EDULOG is very familiar with all aspects of how a transportation department operates and its management roles and challenges. And during the last decade, we heard from more and more districts that traditional timekeeping systems could not meet the requirements of a school transportation department. As we listened to districts' experiences, we realized that there are two fundamental flaws in the standard, fixed-point timekeeping process:

- The time clock or other device is in a fixed location, but the people the device is supposed to track are moving all around the district—or many miles away in the case of field or athletic trips. Therefore, the district either had to pay the time it took for drivers, attendants and mechanics to move to and from the time clock and the start and end locations of that day's work, or the district had to rely on paper reports from drivers—and then enter this information manually into the timekeeping software.
- A traditional timekeeping system can record start and end times to the degree of accuracy of the clock, but after that, it cannot record what the person is doing—especially when that person is driving a school bus. For example if a bus driver is supposed to be at work at 7:00 a.m., and that same driver would like to have a cup of coffee before starting the bus run, most likely he or she would clock in at 7:00, then turn on the coffee pot and wait for the brew to be completed. But with the EDULOG system, the driver might think twice about starting the coffee after, as opposed to before, clocking in, because the system will know that at 7:15 the pre-trip inspection needs to be completed and the driver has to record when he/she performed this task.

To address the issue of mobility, EDULOG decided that the system must be based on inexpensive, reliable, and portable technology—namely a cell phone. Compared to traditional timekeeping devices, the benefits of a cell phone are tremendous:

- It can go wherever the driver goes, or it can be placed in a lock-box in a vehicle;
- It works even when or where there is no electricity;
- It can be moved from vehicle to vehicle, employee to employee, or place to place with no interruption in system service;
- It's a multipurpose device that can also be used for communication, GPS, and vehicle inspection;
- It keeps perfect time;
- It has menus and a keypad so that advanced functions and capabilities can be used such as instructions, visual confirmations, and messaging;
- It transmits information to the server instantaneously;
- It can be easily upgraded (with new or enhanced software applications) or replaced
- The cell carriers are almost giving them away with their data plans.

Another option offered by EDULOG that solves the mobility problem and introduces not only a firm link to GPS/AVL but also provides the opportunity to track and record vehicle inspections with the Zonar Systems EVIR system (Electronic Vehicle Inspection and Reporting). EVIR simplifies the entire pre- and post-trip inspection process. It is easy to use, captures powerful new fleet performance data and speeds vehicle repairs. EVIR is the only verified visual inspection system available and it complies with all DOT-mandated pre- and post-trip vehicle inspection regulations, as well as OSHA and MSHA equipment inspection requirements.

The next piece of the solution was to integrate what actually is happening with what is supposed to happen. To do this, EDULOG decided it was crucial to have the time and attendance information be compared against



planned activities—start and end of pre- and post-trip inspections, start and end times of loaded runs and also unloaded driving time; breaks, actual times on field trips and athletic events. In addition, we recognized the important of having more information available that what can be captured by a traditional timekeeping system: is the driver with the usually assigned bus, or is this a substitution? Does the driver's actual time on a run correspond to the expected time (taken from the routing and scheduling system databases)? Is the driver behind schedule and needs help?

Also, there is an immediacy with the EDULOG approach that is missing from traditional timekeeping systems—in which the data is usually examined only at the end of each pay period. With the EDULOG system, you can know immediately when an activity has started and ended, and if a person is following the schedule or not—allowing corrective action to be taken in a timely manner, instead of perhaps weeks after the action.

## THE DRIVER TIME AND ATTENDANCE WINDOW

The following is an example of the EDULOG *eDTA* main window with driver information.

**Employees**

Last Name	First Name	Employee ID	Current Status	Job Class
ADAMS	SHAMILLE	000009	Not Active	Sub-Driver
ALCON	TAMMY	091892	Not Active	Sub-Driver
ALLEN	KENNETH	027208	Not Active	Driver
ALSTON	LORENZO	003122	Not Active	Driver
ANDERS	NICHOLAS	006675	Not Active	Sub-Driver
ANDERSON	DAVID	047194	Not Active	Driver
ANDERSON	DELPHINE	071037	Not Active	Sub-Driver
APPLE	MARILYNN	009603	Not Active	Driver
AREVALO	MANUEL	088295	Not Active	Driver
ASHLEY	EUGENE	008904	Not Active	Driver
BACON	ANITA	004556	Not Active	Driver
BAGGERLY	PATRICIA	000822	Not Active	Driver
BAGGERLY	PATRICIA	00000822	Not Active	Driver
BAGGERLY	PATRICIA	822	Not Active	Driver
BAKER	MICKIE	4167	Not Active	Driver
BAKER	MICKIE	000004167	Not Active	Driver

**Personal Info**

Last Name: ADAMS First Name: SHAMILLE Middle Init: H  
Employee ID: 000009 Job Description: BUS SUB  
Department: Transportation Work Group: 101  
Job Class: Sub-Driver Status: Active  
Work Phone: (113)113-1113 Home Phone: (223) 223-2223  
Email: a@yahoo.com District: 123 Group: 2  
Temp. Emp. ID: ☐  
Notes: a

**Driver Info**

License No: 123456789 State: California Expiration: 1/1/2012  
License Classification: Driver Classification:  
Fuel Card: Driver District ID: 000009 Cellboard: ☐  
Restrictions:

**Employee Search**

Job Class: All Status: Active  
By Name: From: To: Go  
By Employee ID: From: To: Go

**Route Served**

Route ID	Bus Number	Description	Frequency	Active	From Date	To Date
3	3		MTWUF--	yes	01/03/2012	01/02/1...

Add Edit Re...

EduTracker RunEditor Student Tracking Unit Management Driver Time Schedule Utilities

The window is divided into two main sections. The Employees table on the left lists the loaded employees. Functions for loading and modifying employee records appear beneath the table.

If you select an employee from the table, information on that record appears in the fields on the right side of the window. Those fields include personnel and driver information, as well as a list of the routes serviced by the driver.

## THE EDULOG BOUNDARY PLANNING/REDISTRICTING SYSTEM

This software module allows planners to analyze alternative attendance boundary scenarios using the data maintained by the student database management module. Planners can use the boundary planning module to analyze current or future students in system-generated alternative attendance boundaries. Staff can also simulate user-defined boundary scenarios and determine the effect of the reassignment of students to other and/or new schools.

The system has a report generating capability, which produces student counts by school, grade and any other relevant information within any area specified by the user. Student counts are tallied for the correct side of the street if the area under analysis is bordered by the center line of the street. Both sides of the street can also be assigned to the area being tallied. The tally area can be generated interactively using a mouse, bit-pad (digitizer), or the key pad. The user can use sophisticated polygon operations to interactively create the area. For example, the tally area can be defined as that area that is in two boundaries (polygon intersection) or as that area that is in one area but not in the other area (polygon difference).

The programs can provide custom report formats that tally students by user-specified geographic areas and provide statistical summaries by name, school, grade, sex, social and economic status, race, or any other user-specified student attribute stored in the EDULOG database. The system can produce mailing labels and form letters for students located in a user defined geographic area.

User intervention is supported during all phases of the boundary planning process. System users have final control of the results and can use their own judgement to make general and/or detailed boundary adjustments. Special considerations such as community interest, PTA membership, and other political realities can be included to maintain neighborhood consistency.

The complete graphics-based approach allows for the interactive graphic modification of data, such as boundary modification, *while identifying addresses or students by location from the graphics display screen*. This display also shows a multiple number of students per address location.

The boundary planning module offers the following capabilities:

- Simulates user-defined attendance boundary scenarios and determines the effect of the reassignment of students to other and/or new schools.
- Evaluates the effect of school closings, openings, or assignments.
- Evaluates the effect on school space utilization as a result of any changes indicated above.
- Allows for an indefinite number (limited only by disk space) of temporary retrievable boundary simulations.
- Analyzes any combination of the student data characteristics by census tract, school attendance area, user defined area, and block or nine digit zip code such that:
  - Social and economic analysis can be conducted on the student population.
  - Changes in the distribution of student populations can be studied.
  - Enrollment projections and trends can be developed.
- Produces a directory listing by district and school to be attended by children from given addresses.

- Generates school attendance boundary maps with user selected and defined annotations.
- Catalogues and saves for recall an unlimited number (limited only by disk space) of user-defined boundary areas.
- Loads and displays simultaneously any and all boundaries chosen from the main menu.
- Any number of boundaries simultaneously displayed graphically can be modified from the same screen.
- Boundary modification includes the ability to move any segment or point, delete, or insert any new point on any part of all displayed boundary perimeters.
- Any particular displayed boundary can be chosen to be hidden from the screen while other boundaries remain displayed.
- Graphic identification functions include ability to identify via cursor placement a street segment's name and address range on the right and left side of the street.
- Address identification functions include the ability to retrieve the exact street address number and street name for any cursor placement along the road network.
- When the address and street name is entered, the cursor can automatically locate and highlight the actual location (in the graphics mode).
- Given a stated address, the programs display by name the exact attendance zone or zones that contain the address.
- Student address locations are displayed on the correct side of the street.
- The system is capable of identifying and printing a report that identifies students who attend a school but live outside of the school attendance area. This report can also include a listing all student attributes including their reason for transfer.
- Plots in a hard-copy format any or all boundaries selected from the screen with boundary perimeter points clearly identified.
- Automatically creates and saves a new boundary from the difference of two overlapping boundaries.
- Automatically creates and saves a new boundary only for the intersected portion of two overlapping boundaries.
- Automatically creates and saves a new boundary from the union of adjacent boundaries.
- Is able to delete or rename any or all displayed boundaries through a drop-down menu function.
- Has the capability to generate mailing labels and/or notification cards for students located in a user defined geographic area.

The system includes a versatile report-writer that allows production of hard-copy reports for analysis of data. It provides the user with the ability to edit, sort and display numerical tallies and text information of data.

## **BOUNDARY OPTIMIZATION SOFTWARE**

The Boundary Optimization module will determine the optimal boundary configuration based on a set of district defined parameters. The Boundary Planning module, described above, efficiently manipulates attendance boundaries to quickly determine the impacts of the adjustments. With that module the boundary lines are defined by the operator and input into the system. In contrast, the Boundary Optimization module automatically determines the location of the boundary lines based on weighted user-defined criteria such as school enrollment, capacity, ethnic balance, special programs, or any other criteria available in the database.

The approach developed by EDULOG in order to arrive at optimal boundaries is to represent the boundary planning problem as a mathematical model. The function of this model is to translate the real-world requirements of an equitable distribution of students, student needs for special programs, assignments of students to the closest facility whenever possible, building capacities, etc. into a set of mathematical equations under a standard format.

The programs used in this module are unique from the viewpoint that all schools are considered simultaneously in a global approach for the process of automatically loading students to schools. The loading covers all geographic areas under consideration and does not leave residual areas unassigned unless the schools are loaded with capacity constraints below the available student population in the specific geographic area. This global optimization approach builds boundaries for all schools or for a selected subset of schools and not merely for one school at a time. The mathematical algorithms consider the shortest travel path, producing boundaries that are as compact as possible without leaving unassigned areas in the final solution. At the same time the solution satisfies constraints on school load and acceptable balance for pre-defined subcategories.

The software requires a pre-defined set of neighborhood planning units. These planning units can be a single city block or aggregate city blocks that correspond to demographically homogeneous neighborhoods. The operator controls the size and shape of the planning units.

The boundary optimization process allows at least fifteen subcategories or student characteristics to be considered, in decreasing order of importance for the boundary definition process. Because there are various stages of refinement and manual override options, the order of selection of subcategories can be changed between different phases of the optimization procedure. The process of changing the assignment of a neighborhood planning unit from one school to another, whether done manually or by program will automatically adjust the enrollment tabulated for each affected school.

Highlights of the boundary optimization software include:

- This is the most familiar and natural method used in assigning areas to schools;
- Offers improved control for compactness so that generated boundaries look reasonable;
- Provides fast processing for loading initial student data and for performing the optimization process;
- The user defines the planning units. This adds a degree of control in interacting and influencing the automated process;
- Planning units can be easily pre-assigned to schools with a manual override feature during the automated optimization procedure.

EDULOG's boundary optimization software is particularly designed to allow the simulation of new facilities planning. It offers the tools to determine the optimal location and capacity of proposed new school facilities to meet expected enrollment demands. A planner can create a new school location by simply pointing graphically to the selected location and then entering the characteristics for that school such as total capacity, grade levels, subcategories, etc. Likewise, current or existing facilities can be temporarily deleted from this simulation exercise. This approach offers the greatest flexibility in simulating alternatives for opening and closing schools. The process also takes into account the particular combination of characteristics chosen by the planner, such as a pre-defined ethnic ratio. Because EDULOG's programs are based on a computerized street file, any pre-defined barriers or hazard conditions, such as rivers or railroad crossings, are taken into consideration during the boundary creation process.



## **EDULOG'S MOBILE APPLICATIONS PARTNERSHIPS**

For the mobile (on-vehicle) software applications, EDULOG has partnered with a number of the leading hardware vendors to offer the broadest choice for GPS/AVL, student passenger tracking, driver time and attendance tracking, and electronic vehicle inspection and reporting. For just GPS/AVL alone, EDULOG offers systems based on: cell phones (with or without mounting lock boxes), dedicated black boxes from CalAmp and Zonar Systems, and a radio-based system using Motorola MOTOTRBO GPS-enabled radios (the latter is currently being implemented for the Wood County Schools of WV).

It is not our intent in this white paper to describe all of the partnerships and hardware combinations, but because every school bus in West Virginia is current equipped with RFID tags for the Zonar System EVIR (electronic vehicle inspection and reporting) system, we believe it would be helpful for the WVDE to learn more about our partnership with Zonar.

## **SIMPLY BRILLIANT, SIMPLY AFFORDABLE: THE BEST OF ALL WORLDS WITH ZONAR/EDULOG SOLUTIONS**

Now there is no need to accept anything but the best when it comes to school bus GPS/AVL tracking. With the Zonar/EDULOG team, school districts can enjoy the best software, the best hardware, the best support and service, and an unbeatable combination of value and capability. No other firm in the industry has the experience and success with school district transportation operations as EDULOG: more of the top 100 school district fleets rely on EDULOG than all other software vendors combined. And in field of GPS/AVL, student tracking, and vehicle inspection hardware, Zonar is the undisputed leader in features, value—and above all—reliability. It's hard to argue with success, and Zonar's 99% customer retention rate (and 150,000 installed units) is proof indeed of the success enjoyed by its customers.

Zonar and EDULOG are both passionate about the application of technology to K-12 bus operations, and both firms are committed to enhancing their partnership to provide even better and more efficient solutions in the future. For example, the companies have plans to develop combined solutions for mobile data terminal messaging and a parent facing portal for student tracking. The unequalled synergy of the combined capabilities of Zonar and EDULOG ensure that customers receive the best of both worlds—hardware and software. EDULOG offers the only proven solution that fully integrates GPS and routing data—while Zonar has vast experience implementing and supporting more than 150,000 GPS units.

This partnership provides school districts with a reliable solution that simplifies information gathering, reduces the workload, and replaces labor-intensive practices with easy-to-use electronic solutions for monitoring vehicle and workforce activities so that school districts can keep track of buses and students in real-time. It simply makes no sense to go anywhere other than EDULOG and Zonar—the two best and most experience firms in the market, with proven records of increasing efficiency, improving a district's service to the community, and greatly reducing expenditures.

## ABOUT ZONAR

**Meet the leaders in electronic inspections.** Experiencing first-hand how the transportation industry was underserved by electronic solutions, Zonar Systems' founding team formulated an idea that revolutionized mandatory pre- and post-trip inspections for commercial and private fleets. The electronic vehicle inspection report (EVIR™) concept evolved into a comprehensive fleet management solution that enables pupil transportation fleets to more effectively inspect, track, and manage their operations.

A solution that simplifies workload and improves processes by eliminating paperwork is one of the driving forces behind Zonar Systems. By replacing manual processes with simple-to-use electronic methods, Zonar has made it easier to improve regulatory compliance, workforce productivity, and safety. Their pupil transportation experience has given them the knowledge to provide, implement, and maintain a superior system to meet the detailed needs of school districts.

**The innovator of student tracking.** Zonar is also differentiated in the pupil transportation market with their patented RFID student tracking solution ZPass™. This system gained national recognition in 2010 as the system of choice for school districts across North America, then winning the Edison Best New Product Award in the Innovative Services for Health, Wellness, and Safety category in 2011.

Zonar is the only GPS supplier in the pupil transportation space with a proven track record of supporting rollouts to bus fleets in excess of 15,000 vehicles and is the provider of choice for First Student, the largest pupil transportation fleet in the United States.

**The company that keeps 99% of its clients.** Over the years, Zonar has listened to their customers and given them what they wanted: superb, reliable performance without costly and little-used features that are not vital to operations. They focused on cost, performance and delivery of those features that customers defined as having the most relevance to their operations. The result is an easy-to-install, easy-to-operate system with lightning-quick reports that drill into issues that the customer defines as important to their operation.

Their strategic direction has them pointing their significant engineering resources directly at the school bus routing space by combining their high-definition GPS with their electronic inspection system and ZPass RFID student tracking solution.



## WHEN LEADERS UNITE, CUSTOMERS WIN



Two powerful market leaders, Zonar Systems and Edulog, join forces to revolutionize pupil transportation with the most extensive offerings of integrated products and services. Proven market leaders in their respective areas:

- Zonar Systems has more GPS and telematics units deployed than any other company in pupil transportation.
- Edulog offers the only proven solution that fully integrates GPS and routing data.

Zonar Systems and Edulog have finally teamed up to bring you the best of both worlds.

## One-Stop Shopping for Pupil Transportation

- GPS-based Routing and Scheduling
- Boundary Planning and Enrollment Projections
- Field Trip Scheduling, Fleet Maintenance (Parts, Inventory, Work Orders, etc.)
- Consulting - Proven History Of Generating Massive Savings Through Routing Efficiency
- Driver Time And Attendance
- ZPass™ - Student Tracking Integration with Planned Data
- EVIR® - Verified Visual Inspection System for Pre- and Post-Trip Inspections
- Comprehensive Fleet Management Solution for Pupil Transportation



INSPECT • TRACK • KNOW

Zonar Systems provides electronic fleet inspection, tracking and operations solutions to a full range of public and private fleets. Zonar's unique Inspect, Track, Know approach enables fleets to realize unprecedented gains in operational efficiencies, cost savings and environmental impact. To experience the benefits of having the right fleet management partner, please visit [www.zonarsystems.com](http://www.zonarsystems.com), call 877.843.3847 or email [info@zonarsystems.com](mailto:info@zonarsystems.com)



EDULOG is recognized as the industry leader of Pupil Transportation solutions since 1978 with an estimated 150,000+ school buses routed by its clients each day. EDULOG uniquely combines its powerful software with ongoing consulting services from the industry's largest source of such expertise. For more information about EDULOG, call 866.340.3986 or email [bswendse@edulog.com](mailto:bswendse@edulog.com).

## **EXAMPLES OF COST SAVINGS RESULTING FROM EDULOG SYSTEM USE**

### **SEVERAL SCHOOL DISTRICTS IN NORTH CAROLINA**

#### **Education Logistics (EDULOG) Announces Significant Cost Savings Attributed to Software Use at North Carolina School Districts**

**Missoula, MT – October 14, 2009** Education Logistics, Inc. (EDULOG) announced today the results of a number of cost saving initiatives recently conducted using the TIMS (Transportation Information Management System) software that EDULOG developed for the transportation operations of every school district in North Carolina. Districts both large and small throughout the state have documented financial savings and improved service directly attributable to the capabilities of the TIMS/EDULOG software.

"Every North Carolina district has been using TIMS since 1992, and our situation is unique in that we have one routing and scheduling software system used by everybody in the state," says Derek Graham, section chief, transportation services for the North Carolina Department of Public Instruction. "The TIMS software, which is EDULOG.nt, is obviously quite capable at managing daily operations and state reporting functions, but where it really shines is in producing valid efficiencies and cost savings when they're needed."

According to the North Carolina Department of Public Instruction, "the state budget for school transportation is down \$15 million and LEA transportation departments are feeling the pinch. Many have implemented new efficiency measures to cut cost while serving the same population of students. The Transportation Information Management System provides a powerful planning tool to ensure the viability of new strategies."

"EDULOG's optimization functions have always been the best in the industry at producing verifiable, valid cost savings while maintaining or even increasing the level of service," explains Mike Darling, EDULOG president. "And these recent results from North Carolina prove once again that the EDULOG system is not only a powerful management tool, but also the most effective software for answering school district transportation operations' biggest questions: how do we cut costs, and then how do we implement the plan?"

The following case studies are taken from documents prepared by the North Carolina Department of Public Information.

#### **Currituck County Schools: Reduced three buses; longest rides shortened by nearly an hour**

By using TIMS to observe the results of staggered bell times between schools, bus runs were paired up, therefore maximizing efficiency of each school bus by gaining additional runs without

involving more buses. This process is known as EDULOG bell time optimization and route coupling optimization.

The result was a reduction in ride time for all students in the target area to reasonable levels. Previously, some students rode for as long as two hours and 16 minutes. With the changes suggested by the system, the longest ride time will be one hour and 23 minutes. The number of students with long ride times went from 309 to 72 and most of those were actually in the 65 minute range.

By making several runs shorter, and reusing a single bus for an additional school run, the total number of buses needed to transport students in the target area is reduced from 20 to 17.

"This has worked out better than we thought it would," says Gary Cox, transportation director. "The staggering of bell time allows us to reduce most of the ride times of our students to less than an hour where it was as much as two, and in the outer areas reducing their ride times, that were as much a two plus hours, to less than 90 minutes. As a bonus, we were able to park two buses saving the county about \$170,000 in new bus purchases and reallocate a third to service our early college program. Overall, a big success for the Currituck County Schools."

The Currituck County Schools has a total enrollment of approximately 3,650 students. According to Census Bureau statistics, Currituck County is the 72nd fastest growing county in the US.

### **Charlotte-Mecklenburg Schools: Parked 100 buses, Consolidated 11,000 stops**

In July of 2008, Charlotte-Mecklenburg Schools (CMS) transportation staff partnered with University of North Carolina Charlotte TIMS staff to review current neighborhood bus stop placement and develop a template using landmarks in TIMS to create common neighborhood bus stops across the district in an effort to reduce the number of stops, buses, and miles.

Using ArcGIS and TIMS geographic data, maps were created using a Charlotte Chamber of Commerce study on quality of life. CMS staff used these maps as they visited each of the neighborhoods and recorded common bus stop locations. These maps were then used by UNCC TIMS staff to create landmarks in TIMS and a template of stops to be used by any school serving the neighborhood.

Two layers of landmark locations were created to address the difference in walking distances to stops for elementary students (.20 mile) and secondary students (.40 mile). Bus stops and runs were then created over the summer by CMS transportation staff using the template. Route optimization was used to pair the runs together.

Through this effort, the district has been able to trim about 100 buses from the fleet, reduce the number of daily bus runs from 5,652 to 5,292, and eliminate 11,000 miles of school bus travel each day. Assuming fuel costs of \$2.00 per gallon and a consumption rate of 8 MPG, the reduction in miles by itself represents a \$2,750 savings every day.

The Charlotte-Mecklenburg Schools is the largest school district in North Carolina, with more than 133,000 students. It also has one of the largest pupil transportation operations in North America.



### **Pender County Schools: Eliminated three buses; introduced GIS-based decision making**

Pender County Schools updated the TIMS map from county GIS data. After optimization with the new GIS map in place, Pender County Schools was able to reduce its fleet by three buses, eliminate 950 daily miles of travel, and realize savings of approximately \$386,000 this school year.

County government geographic information system (GIS) data are now widely available in nearly every county of North Carolina—which was not the case when the TIMS map was initially created. Nearly all school districts have converted their TIMS system to a GIS-based map. After the initial update of a TIMS map based on GIS data, the school district's map can easily be updated from time to time using software supplied by EDULOG.

Time was of the essence for Pender County Schools to produce accurate and efficient bus routes. Not only was a GIS map conversion needed, but they needed a turn-key TIMS dataset with all students, routes, streets, speeds, addressing, etc optimized and ready for operation). The TIMS staff acquired the county GIS data and began the conversion process in April. After only a month of data collection, conversion, and optimizing, a new TIMS system based on county GIS data was implemented in Pender County.

Ricky Carter, transportation director for Pender County Schools, has no regrets. "Switching over to GIS has been a positive for Pender County Transportation. The new GIS data is more accurate in every aspect, saving us lots of time and making our route times and mileage more accurate. We would do it all over again!"

The Pender County Schools serves coast communities in the southeastern portion of the state. Total enrollment of the district is approximately 8,250.

### **Henderson County Schools: Reduction of one bus and 1,200 miles for just one elementary school**

The Henderson County Schools transportation office began using run optimization at the end of the 2008-2009 school year in an effort to develop more efficient bus runs and routes for 2009-2010.

TIMS staff decreased the Sugarloaf Elementary School bus fleet from four buses to three. Last year, four buses each performed two AM runs and two PM runs daily. By analyzing student transportation data through run optimization, Henderson County Schools determined that the same number of students and geography could be served by just three buses, each performing two AM runs and two PM runs.

In addition to reducing the Sugarloaf bus fleet by 25%, the number of daily miles has been reduced from 171.4 miles last year to 164.6 miles for 2009-2010. Likewise, the total minutes of driving time decreased from 568 minutes to 510 minutes per day. These daily savings calculate to reductions of 1,229.4 miles and 174 hours of driving time over the course of the 180 day school year.

Student service, for the most part, is unaffected by these changes. While the average ride time increased from 36 minutes to 39 minutes, the average for students with the longest rides has been reduced from 59 minutes last year to 51 minutes this year.



Henderson County is located in the Blue Ridge Mountains, and the district has a total enrollment of more than 13,000 students.

### **Cabarrus County Schools: Reduction of 53 buses and average ride times**

The Cabarrus County Schools (NC) transportation office used TIMS software during the summer to explore reducing the district bus fleet. A new transportation plan has since been adopted and is being implemented for the 2009-2010 school year. By experimenting with a three-tiered, staggered bell time structure using run optimization, TIMS staff determined the entire bus fleet could be reduced by nearly one-quarter and still have the capability to serve the same geography and number of students. Last year, Cabarrus County Schools operated 963 distinct bus runs using 233 buses, for an average of 4.1 runs each day per bus (two AM runs, two PM runs).

Using the TIMS/EDULOG system, many of the longer runs were reworked and shortened to accommodate the new three-tier bell time structure. After analyzing school transportation data in TIMS, Cabarrus County Schools reduced the entire bus fleet to 180 buses and increased the number of distinct runs to 1,048 for the 2009-2010 school year, thereby increasing the average number of runs per bus to 5.8 each day (three AM runs, three PM runs).

By increasing the number of daily runs for each bus, Cabarrus County Schools has reduced the entire fleet by 53 buses (22.7%) and expects an average increase of 30 miles per day (39%) for each bus. The successful staggering of bell times and pairing of runs and routes also reduced student ride time. The average total ride time decreased three minutes each day per student, while the longest ride times decreased an average of 12 minutes per student.

Cabarrus County Schools transportation director George Douglas tipped his hat to the Board of Education for seizing this opportunity and following through on the detailed transportation plans developed by Doris Dry and the Cabarrus County Schools TIMS staff.

Cabarrus County Schools educates more than 22,300 students in Carolina's Piedmont region.

### **Watauga County Schools: Savings of an estimated 84,042 miles and 828 hours of driving time**

The Watauga County Schools transportation office began examining the efficiency of bus routes in compliance with North Carolina guidelines regarding pupil transportation. Anticipating a reduction in transportation funding, transportation supervisor Toni Floyd reviewed the proximity of stops to one another as well as the amount of travel on side roads that occurred during the 2008-2009 school year.

Complying with North Carolina laws and policies, Watauga County Schools eliminated a substantial amount of travel on a number of side roads where, safety permitting, students are able to walk to and from home to a corner stop just off the main road. Additionally, several bus stops within close proximity were moved to a minimum distance of 0.2 miles from one another, where applicable, thus reducing the amount of unique stops made each day.

By analyzing potential bus loads in TIMS and using a clever system of transfers in accordance with staggered bell times, Floyd was able to reduce a number of buses from several schools, while significantly reducing daily mileage and driving hours across the county.

At one example school, Green Valley Elementary, the changes reduced the Green Valley bus fleet from six buses to five buses and eliminated 35.8 miles and 2.1 hours of driving time each day at this single school. These daily reductions calculate to 6,444 miles and 378 driving hours for the 180 day school year at Green Valley Elementary alone.

After implementing similar changes at all schools throughout Watauga County, preliminary estimates show daily reductions of 466.9 miles and 4.6 hours of driving time after eliminating unnecessary travel on side roads. These county-wide reductions have produced savings of an estimated 84,042 miles and 828 hours of driving time for the entire 2009-2010 school year.

Watauga County Schools serves 4,650 students in the High Country of North Carolina along the Tennessee border.

## **TOLEDO PUBLIC SCHOOLS, OH**

### **EDULOG Optimization Study Saves the Toledo Public Schools Nearly \$1.4 Million in Busing Costs; Reduces Fleet from 143 to 102 Buses**

**Missoula, MT – October 12, 2010** Education Logistics, Inc. (EDULOG) announced today that optimization services the company provided to the Toledo Public Schools (TPS) of Ohio has resulted in a fleet reduction from 143 to 102 buses, with a projected annual savings in transportation costs of \$1,394,000—based on the district's figure of \$34,000 in annual expenses for each bus in service. Working on-site with TPS transportation staff and using EDULOG's powerful transportation and bell time optimization software, an EDULOG consultant created a new busing plan that met all district and state requirements and reduced the required number of buses by nearly 30 percent.

The Toledo Public Schools is the fourth largest school district in Ohio, with approximately 30,000 students. The school district has been an EDULOG client since 1993, and in recent years has been working closely with EDULOG to increase the efficiency of its busing.

As with many other Ohio districts, the Toledo Public Schools has been forced to reduce its budget, and the transportation department was asked by the administration to decrease spending. In the spring of 2010, at the request of the district EDULOG conducted a study to determine the effect transportation policy changes would have on busing costs. The report provided by EDULOG indicated that it would be possible to reduce the number of buses in service by a significant amount.

Based on the results of this initial study, the district then contracted with EDULOG for a full-scale optimization project to create the most efficient routes and schedules for the 2010-2011 school year. The consultant assigned to the project quickly developed a busing plan that took into account all walk to school and walk to stop distance policies, hazardous or exempt areas for busing, school bell times, and the TPS's existing fleet composition. At every step in the process EDULOG explained

to the district what steps were being taken to increase efficiency and why, and the final plan was accepted by the TPS without reservations. The result of EDULOG's efforts was the elimination of almost 30 percent of the district's bus routes, and the gratitude of the Toledo Public Schools.

Payment to EDULOG for this project is based entirely on the number of vehicles that the optimization services removed from service—thus making this project entirely risk free to the Toledo Public Schools.

EDULOG has been providing transportation optimization services for more than 30 years, and the Toledo Public Schools example is only one of many where EDULOG has produced remarkable savings that are verifiable and sustainable. "As shown by the results at the TPS, EDULOG certainly has the skill, experience, and software expertise to create the most efficient, effective, and safe transportation plan," said Mike Darling, EDULOG's president. "EDULOG and the Toledo Public Schools have a long history of working together, and we're pleased that we were able to help them reduce their operating budget."

According to EDULOG, the company's consulting services group can work with any school district: those that operate their own fleet, those that contract busing, transportation departments that have routing and scheduling software, and ones that have no computerized management system. "Other consultants may have the ability to identify a problem or area of concern, but only EDULOG has the experience and knowledge to go beyond this analysis and provide effective recommendations that result in justifiable and permanent improvements, as well as the software tools that give districts a way to implement and manage these improvements," said Darling.

## **MEMPHIS CITY SCHOOLS, TN**

### **EDULOG Bus Routing Software Helps Memphis City Schools Eliminate \$8.2 Million In Annual Transportation Expenses**

**Missoula, MT – October 14, 2009** – Education Logistics, Inc. (EDULOG) announced today that its bus routing and scheduling software has allowed the Memphis City Schools (MCS) to successfully implement the district's plan to eliminate \$8.2 million from its annual transportation budget.

The Memphis City Schools is the largest school district in Tennessee, with more than 105,000 students attending a total of 209 schools. The district has been using EDULOG's routing software since 1998.

MCS contracts with First Student, Inc. for transportation services, and was able to eliminate 40 percent of its routes, reducing the fleet size from 496 to 331 buses, by removing hundreds of bus stops, assigning some special education students to schools closer to their homes, and enforcing the district's transportation eligibility policies. The results are an expected reduction of 36 percent of the district's \$23 million annual transportation budget.

"Tightening budgets required MCS to take a closer look at the number of routes and buses that First Student was running," stated William White, director of school choice and student accounting

for MCS. "This type of drastic reduction is never popular, but we knew the savings were there and transportation efficiency has become increasingly important."

MCS evaluated various ways to achieve its \$8.2 million goal, and made final policy decisions during the past summer. The district then used EDULOG's routing software to implement the new busing plan.

"Coming up with the general plan to reduce buses wasn't the hard part," continued White. "The implementation of changes this widespread was the real challenge. That's where EDULOG really made the difference."

In addition to the software, EDULOG provided full consulting services that included both on-site and remote assistance to ensure that the MCS could implement its plan. EDULOG staff also analyzed and predicted potential concerns so as to better prepare district staff for the realities of school start.

"We didn't want to take chances," added White. "So in addition to using the EDULOG software to implement the new routes, we asked if they could help us make sure it would work. They put a full time professional consultant on site for six straight weeks, and it made all the difference. Not only was EDULOG able to help us implement the changes, they provided us with a detailed report in the days leading up to school start that identified potential problems and allowed MCS to be better prepared to deal with the issues that occurred."

MCS provided First Student with the new routes, and the district started school on August 11. "After addressing some initial public concern, and making some minor adjustments, the system is running as designed," stated White.

"MCS is a valued, long time client," commented Mike Darling, president of EDULOG. "We are pleased to have been able to assist with such an ambitious project and that the company's software and services were successful in helping the district meet its goals."

## **CLAYTON COUNTY PUBLIC SCHOOLS, GA**

### **EDULOG Announces That The Clayton County Public Schools, GA Projects \$2 Million In Annual Cost Savings Using EDULOG's Electronic Driver Time and Attendance Tracking System**

**Missoula, MT – October 29, 2009** Education Logistics, Inc. (EDULOG) announced today that the Clayton County Public Schools (CCPS) of Georgia projects \$2 million in annual savings attributed to EDULOG's *eDTA* (Electronic Driver Time and Attendance) system. *eDTA* is a mobile application that uses cell phones to report and record bus driver work schedules in real time. *eDTA* is one of the newest components in EDULOG's suite of transportation management solutions for the K-12 school market.

The Clayton County Public Schools is the fifth largest school district in Georgia, with more than 52,000 students enrolled at 63 schools. Located just south of Atlanta, CCPS operates a fleet of 505 school buses.



"With the EDULOG time and attendance tracking system we've taken care of two of our district's goals: reducing payroll costs while keeping busing services the same; and ensuring that all labor records are fair and accurate in order to reduce lawsuits and claims against the district," says John Lyles, transportation director for the CCPS. "We had previously used paper time cards, and with those, a considerable amount of error is inevitable. And with 522 drivers and monitors being paid an average of \$19 per hour, 15 minutes here and there can quickly add up."

"EDULOG presented us with a very elegant and inexpensive solution: place cell phones on the buses where the drivers would use the keypad to enter their ID numbers, and the system would take care of the rest," Lyles notes. "That way there is no need for all the drivers to go to one place and punch into a time clock, there can be no fudging of the time, and there's no need to collect, store, and transcribe paper cards. That in itself saves time and money, and EDULOG's electronic system keeps accurate records down to the minute."

The installation of the equipment onto the district's fleet of 505 buses occurred in April, 2009. "I was impressed that the initial hardware installation only took five days," continues Lyles. "It was a very smooth process and the installers were willing to work around the clock to accommodate our operational schedule." In addition to the buses, five handsets were installed next to doors at various buildings such as the vehicle maintenance area and the main transportation office. The system was tested during the summer school session in June by a limited number of drivers, and then fully deployed for use by all drivers when CCPS started school on August 10.

"Another great benefit of the *eDTA* solution is that this payroll information is recorded in real time and is immediately available for review and analysis," explains EDULOG president Mike Darling. "Supervisors know immediately if a driver is late/early/on-time, and if a driver doesn't show up, dispatchers can be alerted and a substitute assigned to that bus. So not only is EDULOG *eDTA* a payroll reporting and recording asset, it also has a dispatch benefit which increases safety and service."

The Clayton County Public Schools estimates that the *eDTA* system could save the district as much as \$2 million per year in payroll costs, based on the results observed since the *eDTA* system was introduced in August, although Lyles adds that, "As a result of a variety of CCPS policies and service standards, the actual savings amount may vary." This savings results from paying drivers for their actual time behind the wheel compared to self-reported hours as was the previous practice. The CCPS pays all drivers for a minimum of five hours per day, but before the implementation of the *eDTA* system, it was impossible to gauge what was happening the rest of the day, and the district was paying overtime to many drivers who reported working more than eight hours in a day. The *eDTA* system at the CCPS includes alerts that notify management when a driver is reaching the overtime threshold, and also integration with field trip management so that driver assignments to extracurricular trips don't exceed the 40 hours per week limit.

"Part of the funding for this system came from the CCPS risk management fund," says Lyles. "Several other districts in the Atlanta area have been in disputes regarding bus driver pay, and it was decided that if we could reduce risk by having verifiable records of clock-in/clock-out, we could substantially reduce the chance for discrepancies that could later lead to financial settlements."

"In addition, our administrative payroll staff can now use the time that was previously spent reading time cards to instead actually analyze payroll trends and investigate the possibility of payroll

abuse," continues Lyles. "Before we had *eDTA*, we really had no way to systematically look at any of the information, and so we really couldn't tell what was going on with any certainty."

"The Clayton County Public Schools also uses EDULOG's routing and scheduling and real-time GPS/AVL systems," adds Darling. "The district therefore gains enormous value from the integration of each of these modules—*EduTracker* GPS/AVL makes the routing and scheduling system more accurate, *eDTA* reconciles differences between planned schedules in the routing software and actual work times, and the routing software forms the basis for comparative analysis in the *EduTracker* system. This synergy benefits dispatch, route planners, drivers, payroll administrators—and of course the students and parents of Clayton County.



## **ATTACHMENTS: WEST VIRGINIA DEPARTMENT OF EDUCATION FORMS**

## CERTIFICATION AND SIGNATURE PAGE

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By signing below, I certify that I have reviewed this Solicitation in its entirety; understand the requirements, terms and conditions, and other information contained herein; that I am submitting this bid or proposal for review and consideration; that I am authorized by the bidder to execute this bid or any documents related thereto on bidder's behalf; that I am authorized to bind the bidder in a contractual relationship; and that to the best of my knowledge, the bidder has properly registered with any State agency that may require registration.

Education Logistics, Inc.

(Company)

Jason Corbally, President



(Representative Name, Title)

Phone: 406-728-0893; Fax: 406-728-8754

(Contact Phone/Fax Number)

July 3, 2012

(Date)

STATE OF WEST VIRGINIA  
Purchasing Division**PURCHASING AFFIDAVIT**

**West Virginia Code §5A-3-10a states:** No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owed is an amount greater than one thousand dollars in the aggregate.

**DEFINITIONS:**

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

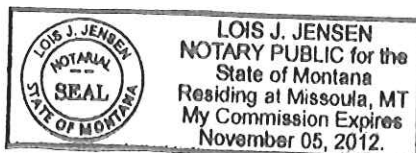
"Debtor" means any individual, corporation, partnership, association, limited liability company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceeds five percent of the total contract amount.

**EXCEPTION:** The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

Under penalty of law for false swearing (*West Virginia Code §61-5-3*), it is hereby certified that the vendor affirms and acknowledges the information in this affidavit and is in compliance with the requirements as stated.

**WITNESS THE FOLLOWING SIGNATURE**Vendor's Name: Education Logistics, Inc.Authorized Signature: [Signature] Date: July 3, 2012State of MontanaCounty of Missoula, to-wit:Taken, subscribed, and sworn to before me this 3rd day of July, 2012My Commission expires 11/05/2012, 2012

AFFIX SEAL HERE

NOTARY PUBLIC [Signature]



State of West Virginia  
Department of Administration  
Purchasing Division  
2019 Washington Street East  
Post Office Box 50130  
Charleston, WV 25305-0130

## Solicitation

NUMBER

EDD377015

PAGE

1

ADDRESS CORRESPONDENCE TO ATTENTION OF

CONNIE HILL  
304-558-2157

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**Edulog**  
3000 Palmer Street  
Missoula, MT 59808

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DEPARTMENT OF EDUCATION

BUILDING 6  
1900 KANAWHA BOULEVARD, EAST  
CHARLESTON, WV  
25305-0330

DATE PRINTED

06/12/2012

BID OPENING DATE:

07/12/2012

BID OPENING TIME

01:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
0001	1	JB	961-74	THE WEST VIRGINIA DEPARTMENT OF EDUCATION, OFFICE OF SCHOOL TRANSPORTATION IS SEEKING INFORMATION ON PROVIDING AN ANALYSIS OF WEST VIRGINIA'S SCHOOL BUS ROUTING SYSTEM, WITH THE GOAL OF IDENTIFYING REALIZABLE COST SAVINGS.		
				THIS IS A REQUEST FOR INFORMATION ONLY AND IS SOLEY USED FOR INFORMATION AND PLANNING PURPOSES. THIS REQUEST DOES NOT CONSTITUTE EITHER A REQUEST FOR PROPOSAL OR QUOTATIONS (RFP/RFQ) OR A PROMISE TO ISSUE A RFP OR RFQ IN THE FUTURE.		
				BID OPENING DATE: JULY 12, 2012 AT 1:30 PM		
				TRANSIT MANAGEMENT AND OPERATIONS		
				REQUEST FOR INFORMATION ON PROVIDING AN ANALYSIS OF WEST VIRGINIA'S SCHOOL BUS ROUTING SYSTEM WITH THE GOAL OF REALIZABLE COST SAVINGS.		
				SEE ATTACHED SPECIFICATIONS.		

SIGNATURE

TELEPHONE

406-728-0893

DATE

July 3, 2012

TITLE

President

FEIN

81-0389667

ADDRESS CHANGES TO BE NOTED ABOVE



State of West Virginia  
Department of Administration  
Purchasing Division  
2019 Washington Street East  
Post Office Box 50130  
Charleston, WV 25305-0130

## Solicitation

NUMBER

EDD377015

PAGE

2

ADDRESS CORRESPONDENCE TO ATTENTION OF:

CONNIE HILL  
304-558-2157

RFQ COPY

TYPE NAME/ADDRESS HERE

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DEPARTMENT OF EDUCATION

BUILDING 6  
1900 KANAWHA BOULEVARD, EAST  
CHARLESTON, WV  
25305-0330

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DATE PRINTED

06/12/2012

BID OPENING DATE:

07/12/2012

BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
	ATTACHED: INSTRUCTION TO VENDORS FORM TERMS & CONDITIONS SPECIFICATIONS SIGNATURE PAGE ADDENDUM ACKNOWLEDGEMENT FORM					
	***** THIS IS THE END OF RFQ EDD377015 ***** TOTAL:					

SIGNATURE

TELEPHONE

406-728-0893

DATE

July 3, 2012

TITLE President

FEIN

81 0280667



State of West Virginia  
Department of Administration  
Purchasing Division  
2019 Washington Street East  
Post Office Box 50130  
Charleston, WV 25305-0130

## Solicitation

NUMBER

EDD377015

PAGE

1

ADDRESS CORRESPONDENCE TO ATTENTION OF:

CONNIE HILL  
804-558-2157

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EDULOG  
3000 PALMER ST.  
MISSOULA, MT 59808

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DEPARTMENT OF EDUCATION

BUILDING 6  
1900 KANAWHA BOULEVARD, EAST  
CHARLESTON, WV  
25305-0330

DATE PRINTED

06/19/2012

BID OPENING DATE:

07/12/2012

BID OPENING TIME

LINE	QUANTITY	UOP	CAT. NO	ITEM NUMBER	UNIT PRICE	AMOUNT
ADDENDUM NO. 1						
ADDENDUM ISSUED TO CLARIFY REQUIRED DATES FOR THIS SOLICITATION:						
BID OPENING DATE: JULY 12, 2012						
QUESTION & ANSWER PERIOD: CLOSES AT 5PM JUNE 26, 2012						
APPROX. DATE QUESTIONS WILL BE ANSWERED: JUNE 28, 2012						
ADDENDUM ACKNOWLEDGEMENT IS ATTACHED AND SHOULD BE RETURNED WITH YOUR BID. FAILURE TO RETURN ACKNOWLEDGEMENT MAY RESULT IN DISQUALIFICATION OF YOUR BID.						
END OF ADDENDUM NO. 1						

SIGNATURE

TELEPHONE

406-728-0893

DATE

July 3, 2012

TITLE

President

FEIN

81-0389667

ADDRESS CHANGES TO BE NOTED ABOVE



**ADDENDUM ACKNOWLEDGEMENT FORM**  
**SOLICITATION NO.: EDD377015**

**Instructions:** Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

**Acknowledgment:** I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

**Addendum Numbers Received:**

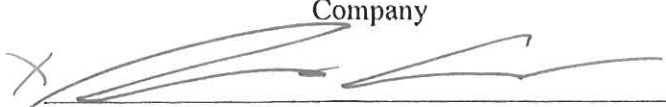
(Check the box next to each addendum received)

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6  |
| <input type="checkbox"/> Addendum No. 2            | <input type="checkbox"/> Addendum No. 7  |
| <input type="checkbox"/> Addendum No. 3            | <input type="checkbox"/> Addendum No. 8  |
| <input type="checkbox"/> Addendum No. 4            | <input type="checkbox"/> Addendum No. 9  |
| <input type="checkbox"/> Addendum No. 5            | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Education Logistics, Inc.

\_\_\_\_\_  
 Company

  
 \_\_\_\_\_  
 Authorized Signature

July 3, 2012

\_\_\_\_\_  
 Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.

**ADDENDUM ACKNOWLEDGEMENT FORM**  
**SOLICITATION NO.: EDD377015**

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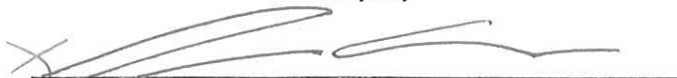
(Check the box next to each addendum received)

<input checked="" type="checkbox"/> Addendum No. 1	<input type="checkbox"/> Addendum No. 6
<input type="checkbox"/> Addendum No. 2	<input type="checkbox"/> Addendum No. 7
<input type="checkbox"/> Addendum No. 3	<input type="checkbox"/> Addendum No. 8
<input type="checkbox"/> Addendum No. 4	<input type="checkbox"/> Addendum No. 9
<input type="checkbox"/> Addendum No. 5	<input type="checkbox"/> Addendum No. 10

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Education Logistics, Inc. (Edulog)

Company

  
Authorized Signature

July 3, 2012

Date



State of West Virginia  
Department of Administration  
Purchasing Division  
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DEPARTMENT OF EDUCATION  
BUILDING 6  
1900 KANAWHA BOULEVARD, EAST  
CHARLESTON, WV  
25305-0330

DATE PRINTED

06/27/2012

BID OPENING DATE

07/12/2012

BID OPENING TIME 1:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
ADDENDUM NO. 02						
ADDENDUM ISSUED TO PROVIDE A RESPONSE TO THE QUESTION RECEIVED REGARDING COUNTIES DENSITY. SEE ATTACHED RESPONSE.						
AN ADDENDUM ACKNOWLEDGEMENT IS ATTACHED AND SHOULD BE RETURNED WITH YOUR BID. FAILURE TO RETURN WITH YOUR BID MAY RESULT IN DISQUALIFICATION OF YOUR BID.						
END OF ADDENDUM NO. 2						

SIGNATURE

TITLE President

FEIN 81-0389667

TELEPHONE

406-728-0893

DATE

July 10, 2012

ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO SOLICITATION, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

**ADDENDUM ACKNOWLEDGEMENT FORM**  
**SOLICITATION NO.: EDD377015**

**Instructions:** Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

**Acknowledgment:** I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

**Addendum Numbers Received:**

(Check the box next to each addendum received)

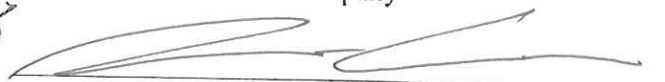
<input checked="" type="checkbox"/> Addendum No. 1	<input type="checkbox"/> Addendum No. 6
<input checked="" type="checkbox"/> Addendum No. 2	<input type="checkbox"/> Addendum No. 7
<input type="checkbox"/> Addendum No. 3	<input type="checkbox"/> Addendum No. 8
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Education Logistics, Inc.

Company

X



Authorized Signature

July 10, 2012

Date

**NOTE:** This addendum acknowledgment should be submitted with the bid to expedite document processing.

Revised 6/8/2012