U.S. Department of Transportation

Urban Mass Transportation Administration

# RUCUS: Automated Vehicle and Scheduling System

It may not be widely known that public bus transportation service in the United States is traditionally rescheduled four times a year—for the fall, holiday season, spring, and summer periods. Furthermore, other changes in rider-ship patterns also require occasional rescheduling. Schedule making is a time-consuming and exacting process, requiring the services of experienced people who must spend vast amounts of time engaged in tedious, repetitious computations. After new schedules have been adopted, it is necessary to organize all of the scheduled trips operated by a transit system into daily driver assignments. This procedure is called run cutting. This procedure has been simplified by a recently developed computerized approach.

**Problem** During the 1960s, most transit agencies were faced with an ever-diminishing cadre of qualified schedulers to perform the intrinsically complex tasks of scheduling and run cutting. The average age of persons who were scheduling bus operations was 55 years; young people were not choosing bus scheduling as a career partly because of the long apprenticeship period, especially at agencies with complex transit systems. Research sponsored by the Urban Mass Transportation Administration (UMTA) Technical Assistance Program was therefore directed toward exploring means of automating the procedures. The Mitre Corporation, chosen by UMTA to develop an automated Run Cutting and Scheduling system (RUCUS), found that previous computerization efforts could be grouped into three categories: first, partial computer implementations that are generally unsatisfactory because they are difficult to integrate into an existing process; second, the combination of a transit industry that was not computer-oriented and analytical personnel who were not familiar with industry problems; third, and perhaps most important, use of computer equipment that was neither large enough nor fast enough to handle the large data base and complex algorithms required.

**Solution** The research agency began by preparing a comprehensive analysis of all of the steps involved in the scheduling and run-cutting process. This was followed by the development of a modular system that covered all phases of the scheduling department's activities, yet was suitable for staged implementation. The RUCUS software was tested against manual scheduling solutions in Akron, Baltimore, and San Diego. The driver assignment of trips produced by the automated system was found to save about 2 percent in driver pay hours over the manually produced schedules. After extensive testing, RUCUS software was developed to the point where it was placed in full operational use in mid-1975 at the Central New York Regional Transportation Authority in Syracuse.

**Application and Benefits** By 1979, 44 transit agencies in North America were using, testing, or actively investigating RUCUS computer software or derivatives of it. The 25 transit agencies using RUCUS or RUCUS-like software systems estimated annual savings of about $3.3 million, with savings in operating costs varying from 1 to 3 percent.

A study by the Metropolitan Transit Commission (MTC), St. Paul, Minnesota, documented specific savings in one case. The MTC cost-benefit analysis demonstrated the following advantages of RUCUS:

- Relieving the schedule maker of repetitive and error-prone tasks;
- Producing efficient and cost-effective runs; and
- Making a major contribution to the management information system data base.

The annual savings in operating costs averaged $184,000 over a 5-year period. For 1982, the costs for operating RUCUS were $515,000, whereas the estimated benefits were $988,000 for a net savings of $473,000. This led MTC to conclude in 1982 that "using projected cost/benefit figures, the RUCUS system will have paid for itself in mid-1983."

The scheduling of transit vehicles, the preparation of timetables, and the assignment of runs to drivers are all highly complex and time-consuming tasks that involve the use of a large amount of data. After RUCUS is installed and the data base is established, however, additional benefits accrue. Examples of these benefits are: (a) automated processing of passenger load counting data; (b) automated interface with phototypesetter for public timetables; (c) interface to a payroll system; and (d) scheduled mileage by vehicle for cost control.

Recent RUCUS-like developments from the consulting community have produced automated scheduling aids that operate on mini- and microcomputers. The original RUCUS development, sponsored by the Urban Mass Transportation Administration, has led to a new small industry in the consulting community with several companies offering RUCUS and RUCUS-like systems to the transit industry.

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