

Conversion of Rapid-Transit Trains to One-Person Operation

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In recent years the federal government has pursued a policy of reducing its operating assistance to transit agencies. This policy has resulted in ever-increasing pressure on heavy-rail rapid-transit systems to develop more cost-effective operating procedures. One approach to improving cost-effectiveness is to reduce the rapid-transit train crew to a single operator. Although such reductions have taken place on a number of European systems, and all new U.S. systems have incorporated one-person operation, older U.S. systems continue to use two-person operation of multiple-unit trains. Battelle Columbus Division in conjunction with the National Cooperative Transit Research and Development Program, recently conducted a study of one-person operation of multiple-unit trains for improving the cost-effectiveness of heavy-rail rapid-transit systems. On the basis of the study findings, it is judged that while there are many problems to be resolved, conversion of many of the six older U.S. rapid-transit systems with two-person operation of multiple-unit trains to one-person operation is technically feasible. Such conversion will generally follow an evolutionary process. That is, rather than systemwide conversion of all services and lines at one time, systems will most likely convert those services or lines that are most compatible to one-person operation first, followed by conversion of less compatible services or lines over time. The most compatible services include new lines, lines or services with new or rehabilitated cars or facilities, and off-peak service.

In 1969 the Lindenwood Line of the Port Authority Area Transit Corporation (PATCO) began operation under full automatic control, except for doors and public address announcements, with one-person operation of all trains. It was the first instance of one-person revenue operation of multiple-unit, heavy-rail rapid-transit trains in the United States. Since Lindenwood, five additional heavy-rail rapid-transit systems have gone into revenue service in the United States—all with one-person operation of trains. The systems are as follows:

- BART—Bay Area Rapid Transit District (San Francisco),
- WMATA—Washington Metropolitan Area Transit Authority (Washington, D.C.),
- MARTA—Metropolitan Atlanta Rapid Transit Authority (Atlanta),
- MDTA—Metropolitan Dade County Transportation Administration (Miami), and
- MTA—Mass Transit Administration of Maryland (Baltimore).

Thus, over the past 18 years, six new heavy-rail rapid-transit systems have begun operation in the United States. Every one

of these new systems has one-person operation of all trains. Further, this development is not limited to the United States; it has occurred worldwide. Although all new U.S. systems use one-person operation of trains, essentially all of the older, heavy-rail rapid-transit systems continue to require a second crew member onboard each multiple-unit train. These systems include:

- CTA—Chicago Transit Authority (Chicago),
- GCRTA—Greater Cleveland Regional Transit Authority (Cleveland),
- MBTA—Massachusetts Bay Transportation Authority (Boston),
- NYCTA—New York City Transit Authority (New York City),
- PATH—Port Authority Trans-Hudson Corporation (New York City), and
- SEPTA—Southeastern Pennsylvania Transportation Authority (Philadelphia).

Some of the older systems run single-car trains with one crew member onboard. Also, recently SEPTA began operation of two- and five-car trains with one-person crews. In the fall of 1983, SEPTA reopened its 1.9 mi Ridge Avenue spur to the Broad Street subway with one-person operation of the two-car trains operated on that spur. In September 1984, SEPTA converted the five-car trains operated on its Broad Street Express service from two- to one-person operations. SEPTA continues to operate all of its Broad Street local and Market-Frankford line trains with two-person train crews.

APPROACH

The principal effort of the Battelle-National Cooperative Transit Research and Development Program study involved visits to 16 heavy-rail rapid-transit systems in the United States and Europe to solicit their opinion and obtain information on the issues, problems, and solutions to problems associated with conversion of heavy-rail rapid-transit systems to one-person train operation. That work was supplemented by a review of the literature to identify definitive documents on the many topics of interest to the study. The following systems were visited:

1. The six older U.S. heavy-rail rapid-transit systems listed previously;
2. Four of the newer U.S. one-person operation systems, listed previously (i.e., BART, MARTA, PATCO, and WMATA.); and

3. Six European metro systems:

- BVG—Berliner Verkehrs-Betriebe (Berlin, West Germany);
- HHA—Hamburger Hochbahn A. G. (Hamburg, West Germany);
- LT—London Transport Executive (London, England);
- RATP—Régie Autonome des Transports Parisiens (Paris, France);
- SL—AB Storstockholms Lokaltrafik (Stockholm, Sweden); and
- VAL—Vehicule Light Automatic (Lille, France).

The first five European systems are heavy-rail rapid-transit systems that either have or are in the process of converting to one-person train operation. The Lille system, which began operation in May 1983, claims to be the first fully automated, unmanned transit system operating in an open urban environment.

FINDINGS

Management personnel at all of the U.S. and European heavy-rail rapid-transit systems visited that are presently operating one-person train crews on multiple-unit trains are happy with that mode of operation and have no desire to convert to two-person train operation. They are satisfied with the safety, security, and operational performance of their systems and stated that they have no major or limiting problems. With respect to the labor issue, all of the newer systems that began operation from the first day of service with one-person operation of multiple-unit trains encountered no major labor opposition to one-person operation. All of the older systems, except BVG in Berlin, that converted their entire system or only specific lines or services to one-person operation have encountered strong union opposition. To date, union opposition has sometimes delayed but never stopped conversion to one-person operation where it has been attempted. BVG in Berlin encountered little labor opposition at the time of its conversion because of a labor shortage in Germany (i.e., mid-1960s).

Three of the six U.S. two-person operation systems visited (CTA, GCRTA, and SEPTA) are very interested in conversion to one-person operation of multiple-unit trains. SEPTA has already converted two special services on its Broad Street line to one-person operation. Management personnel at the other three (MBTA, NYCTA, and PATH) stated that they have no plans for conversion at this time.

System management and union personnel interviewed at the six U.S. two-person operation rapid-transit systems visited were asked their opinion as to the major issues or problems that must be resolved in converting from two- to one-person operation of multiple-unit trains. A single list of individual system responses was compiled. The issues or problems judged to be most important are listed first. The ranking takes into consideration the frequency of citation and relative priority placed on the issues or problems by the six systems in question, plus the overall judgment of the research team based on the findings of the total study. The ranked listing of issues and problems follows:

- Car side door safety;

- Labor union opposition;
- Fire prevention and control;
- Emergency evacuation between stations;
- Reduced train operational performance resulting from increased time to recover from equipment failures and increased station dwell time;
- Security, including perceived security;
- Communication among passengers on train and train operator and passengers on station platforms and central control;
- One less onboard crew member to provide passenger information and assistance and detect problems;
- Between-car and end-door safety;
- Onboard fare collection;
- Operator training;
- Incapacitation of train operator;
- Increased operator stress; and
- Loss of position to which to assign medically disqualified train operators.

In addition to the preceding issues and problems, there is some concern that new cars are still being delivered without provisions for future conversion to one-person operation. Also, while in most cases the reduced labor costs associated with one-person train operation should exceed the costs of conversion from two- to one-person operation, some systems are concerned that the costs of improving equipment reliability and upgrading facilities will in some cases offset such savings.

A detailed discussion of solutions successfully applied by existing one-person operation systems to each of the issues or problems listed previously is presented in *National Transit Research and Development Program Report 13: Conversion to One-Person Operation of Rapid-Transit Trains*.

CONCLUSIONS

On the basis of the findings of the study, it is concluded that

1. *Many systems have been successfully converted.* Many heavy-rail rapid-transit systems, including older systems, lines, or services, have been successfully converted from two- to one-person operation of multiple-unit trains. These include the European systems visited and the limited SEPTA services.

2. *Problems still exist.* It should not be inferred from Conclusion 1 that there are no problems associated with conversion of the older U.S. two-person operation systems to one-person operation. The systems, lines, or services converted to date generally have reliable rolling stock with full-width or convertible full-width operator cabs and provisions, such as mirrors or closed circuit television (CCTV), to assist the train operator in seeing the car side doors, particularly at curved station platforms. Although new one-person operation systems in the United States have demonstrated satisfactory door operation for trains up to 700 ft long (i.e., BART), these systems generally have straight, unobstructed station platforms. Many of the older U.S. two-person operation systems have less reliable rolling stock; antiquated facilities; curved, obstructed, and crowded station platforms; and more severe security problems, thus increasing the difficulty of conversion.

3. *Solutions are available to most problems.* Potential solutions to most of the problems at the older U.S. two-person operation systems have been successfully demonstrated at European or other U.S. one-person operation systems. These solutions are discussed in the final report.

4. *Conversion will follow an evolutionary process.* Conversion of many of the older U.S. heavy-rail rapid-transit systems with two-person operation of multiple-unit trains to one-person operation is technically feasible. Such conversion will generally follow an evolutionary process. That is, rather than systemwide conversion of all services and lines at one time, systems will most likely convert those services or lines, or both, that are most compatible to one-person operation first, followed by conversion of less compatible services or lines, or both, over time. The most compatible services include new lines, lines or services that have new or rehabilitated cars or facilities, or both, and off-peak service with shorter trains, fewer passengers, and longer headways. This process is presently being followed by SEPTA and London. The most likely exception is GCRTA, which operates a single heavy-rail line (Red Line) with all island platforms except one. GCRTA management plans to convert to all right-hand running in approximately 3 years. By that time, all of the older cars should be retired. All of the newer cars and cars on order have convertible full-width cabs with the operator's console on the left-hand or platform side of the cab for right-hand running. At that time, it should be rather straightforward to convert the total system to one-person train operation. On the other hand, NYCTA may never choose to convert its crush-loaded, 10-car, 600-ft-long, rush-hour trains to one-person operation.

5. *Transit employees will not be laid off.* Personnel and labor relations management people interviewed at all of the systems visited stated that train crew members displaced as a result of conversion to one-person train operation would either be used to improve service by running shorter, more frequent trains, assigned to other job classifications, or absorbed through normal attrition; they would not be laid off. An evolutionary process for conversion to one-person train operation will minimize the problems encountered with this approach.

6. *Eventual reduction in staff would be less than 14 percent.* The percentage of employees classified as train conductors varies from 9 to 14 percent at U.S. two-person operation rapid-transit systems. It is unlikely that any eventual reduction in staff as a result of conversion to one-person operation would be so large. Additional employees will most likely be required in the following areas:

- Security/police department;
- Maintenance;
- Ad hoc platform attendants (i.e., at busy stations during peak hours); and
- Supplemental crew members or wayside coverage persons at critical locations during peak commute hours.

7. *Economic assessment of each specific conversion is required.* Before proceeding with conversion of a specific system, line, or service to one-person operation, a comprehensive assessment of the economic worth of the conversion is required. For such an assessment, investment or capital costs include all of the costs required to convert that specific system, line, or service from two- to one-person operation. Likewise, the future savings (or losses) resulting from that investment include the sum of all the differences in operating and maintenance costs between the two- and one-person operation versions of the specific system, line, or service over its useful life. Detailed listings of the cost elements that must be considered in a site-specific economic analysis are presented in the final report.

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