Implementation of Modern Fleet Management Systems for Public Transportation – RGRTA Case Study

Background

From the open-air streetcars of the early 20th century to the double-decker and articulated transit buses of today’s cities, public transportation has become one of the most mature means of sustainable mobility. Many urban areas and their surrounding municipalities operate transit bus fleets (often through private contractors) to provide cost effective and needed transportation to residents. These systems also reduce traffic congestion and improve air quality by minimizing overall urban vehicle emissions. In Rochester, NY—the home of Rochester Institute of Technology’s Center for Sustainable Mobility (RIT CSM)—the Rochester-Genesee Regional Transit Authority (RGRTA) operates over 450 buses, serving the city of Rochester and 11 surrounding counties through 45 unique routes.¹ Throughout this service area, the RGRTA system handles a daily ridership of approximately 61,000 passengers, including many through its dedicated medically-accessible paratransit service.²

Customer Service Challenge

In 2007, RGRTA was in the process of developing their organization to improve both customer service and operational efficiency, goals that would enable them to better serve a greater number of transportation customers at lower costs. In this pursuit, they sought to integrate the management of transit services with a central command system and feedback from real-time customer experiences. While existing systems enabled communication between the RGRTA dispatch center and buses in service, these communications were reactive, limited by drivers’ ability to only respond to, rather than anticipate, changes or challenges that might affect customer service. As a result, RGRTA sought an integrated operations management system that could not only optimize scheduling, routing, and refueling according to real-time data updates, but could anticipate and proactively address obstacles in order to improve on-time service for customers. This vision was formally established as a broad initiative to identify and implement technology-based service improvement systems throughout all elements of operation, and was ultimately launched as the Technology Initiative for Driving Excellence (TIDE) program.³,⁴

As the first step in this program, RGRTA identified the need to improve its fleet management structure through Computer-Aided Dispatch and Automated Vehicle Location (CAD/AVL) and asset scheduling systems that would allow managers to know the location and status of all fleet vehicles from anywhere, at any time. Recognizing the necessity to define the unique needs of the RGRTA system in order to identify clear requirements for this technology solution, the CSM at RIT was selected to assist in a thorough evaluation of agency needs and potential technical solutions. Based on its knowledge in this area—and aided by its concurrently developing experience with fleet management solutions for the Office of Naval Research—the CSM at RIT identified commercially-available alternatives and evaluated each in the context of RGRTA’s unique requirements. RIT then assisted RGRTA in selecting a solution, and later contracting supported implementation of the system within existing IT infrastructures. When implemented, the resulting capabilities helped RGRTA to better optimize its transit service and operations.

strategies, recognizing patterns and supporting operational decision-making with information from both historical and real-time fleet data. Beyond improving operational efficiency and on-time service, this system also enabled RGRTA to connect user experience feedback with actual bus data to reveal future opportunities for improvement.

**Maintenance Management**

After transitioning from legacy systems to upgraded, advanced CAD/AVL capability, RGRTA achieved its desired operational improvements. Based on this success, the organization then sought to leverage its improved resource tracking and management capabilities to improve its maintenance performance. RGRTA’s maintenance resources, like those in many fleets, were effective, but in most cases reactive and lacked the infrastructure to communicate on a broader systems-level. By improving maintenance resource management as well, RGRTA recognized that it could reduce both the costs of maintenance as well as reduce downtime and the service disruptions it creates, ultimately benefitting the service as a whole.

In this pursuit, RGRTA again leveraged RIT’s expertise to investigate, evaluate, implement, and validate improved maintenance technologies and processes. This system leveraged the CAD/AVL structure capabilities, combined with health monitoring technologies, to communicate maintenance information such as the location of a bus and its potential maintenance issues. This visibility then allowed RGRTA to estimate the impact that required maintenance might have on operations and manage maintenance scheduling accordingly in order to minimize downtime. To support this, RGRTA and the CSM at RIT also explored electronic vehicle inspection reporting (EVIR) systems, equipping bus drivers to communicate customer satisfaction concerns related to bus equipment as well as anomalies that might signal an emerging failure. Fleet managers could then track this data through the maintenance management system and investigate reported problems proactively to minimize the likelihood of future problems—both reducing costs and mitigating impacts on customer service. Ultimately, RGRTA estimated that these technologies would reduce maintenance impacts effectively equivalent to one engine rebuild and transmission replacement every year; an operating cost savings of at least $30,000 annually.\(^5\)

**Fuel & Fluid Monitoring**

With success in improving RGRTA’s quality of service through improved fleet operations and maintenance, the company recognized fleet-level management of fuel and fluid use and inventory as another significant opportunity to reduce operational costs. Beyond direct costs, fuel and fluid monitoring provides another source of data on the mechanical performance of buses. Like monitoring of bus maintenance parameters, tracking fuel use and engine fluid levels through a digital database allows trend monitoring to identify and target potential equipment problems. For example, increase in coolant consumption may highlight a pattern of lowering fluid levels indicative of a failing water pump; fleet managers can then address this issue before it causes a severe performance failure that disrupts customer service. In addition, fluid use data and analysis tools also allowed RGRTA to streamline and optimize fuel and fluid ordering, enabling them to meet operational demands while reducing the costs and inefficiency of excess inventory.

In this pursuit, RIT again managed the evaluation, implementation, and validation of these technologies. However, because EVIR, fuel/fluid monitoring, and fleet/facility maintenance technology solutions were each selected based on their individually optimal characteristics, these components—all part of the larger

TIDE modernization initiative—required some work to achieve total systems-level integration. To this end, RIT continued to work with RGRTA to develop an information architecture framework through which these constituent elements may communicate and work together, enabling centralized, all-inclusive systems management.

Beyond Optimization

With these systems, RGRTA is well equipped to optimize routing, scheduling, maintenance, and overall resource management across its expansive fleet. As a result of their implementation, the agency has realized efficiency improvements resulting in near 90-percent on-time service performance, exceeding their goals and setting new record highs in company history.\(^6\) In an annual review through 2016, the agency’s performance indicator assessment reflected further improvements in financial sustainability, customer satisfaction, and service quality up to 30-percent beyond targeted goals.\(^7\) As an ultimate result, these improvements increased ridership and allowed the company to maintain stable pricing—a fare of just one dollar—meeting the underlying goal of public transit to provide broad access to mobility services in an economically sustainable manner.\(^8\)

In a vision for continuous improvement, these technologies offer capabilities whose potential impacts in customer service and operational efficiency extend as well into broader economic and environmental sustainability. As on-board vehicle performance monitoring technologies allow operators to recognize and resolve maintenance issues before they create performance failures, resource managers are able to keep vehicles in peak operating condition, which ultimately minimizes the effects of maintenance issues on both customer service and the costs of operation. Beyond this, maintaining a healthy fleet that is free from severe failures extends vehicle life and mitigates the risk of in service interruptions. At a high-level, too, reducing maintenance intensity and lowering equipment replacement rates also lowers the material, energy, and emissions effects of public transportation as a whole.

Further, as increasing urbanization creates greater need, and technology improvements simultaneously improve the perceived quality of public transit services, more people will be encouraged to utilize these systems. This, in turn, may contribute to a reduced social dependence on less efficient modes of personal transportation via individual passenger vehicles. Then, as the financial and social viability of public transit continues to improve, the business case for transitioning to higher-efficiency and lower-emitting transportation platforms will similarly advance. Together, all of these benefits support both economic viability and environmental sustainability in the long-term.

Ultimately, a result of its relationship with the CSM, RGRTA was equipped with capabilities that supported significant improvements in the sustainability of their transit systems. Today, the company continues to work towards greater economic and environmental performance as both technological capabilities and customer demands continue to evolve. Likewise, in effort to develop and pursue the next generation of safe, accessible, and sustainable transportation systems, the CSM at RIT continues its efforts to explore new technologies, new system designs, and their place in a complex and dynamic society.

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\(^7\) RGRTA (2016). *Transit Organization Performance Scorecard 2015-2016*.