Use of automatic passenger counters assessed for Central Florida's Lynx [January 1998]

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Use of automatic passenger counters assessed for Central Florida’s Lynx

Efficient and effective transit service delivery depends on accurate information collected about transit ridership and overall transit system operations. When provided with information about the transit system, performance of the system and of individual routes and route segments can be assessed by planning, scheduling, and management staff. Accurate and comprehensive ridership data will indicate areas of strength and weakness in transit operations and will support and justify necessary changes to service.

Historically, the data most appropriate for examining the performance of a transit system have been obtained from manually-derived passenger ride checks. Generally, these ride checks reveal peak passenger loads by bus stop and run times on a specified route and also show the demand for the service at the time, location, and direction of that demand. Frequency and running time decisions can be made to have the supply of service correspond precisely with the actual demand for that service. This will provide optimal economies to the transit system and, hopefully, improve the provision of transit service to the system’s customers.

An alternate solution for a transit system to meet its need for reliable, accurate, detailed, and current ridership data is through the use of Automated Passenger Counters (APCs). Unlike manual ride checks, an APC system provides a transit system with an automated method for collecting information about the number of passenger boardings and alightings at a variety of system levels, including route, route segment, or specific bus stops by time of day and by day of week.

Unlike the limited information available via manual ride checks, APCs allow the automatic collection of a host of additional information about operations, including maximum and minimum load points, boarding and alighting rates, vehicle dwell times, door cycles, distance traveled, and vehicle average speed.

Project Objective

At the request of the Central Florida Regional Transportation Authority (Lynx), the public transit provider serving the Greater Orlando area including Osceola, Orange, and Seminole counties, CUTR investigated APCs for possible implementation on its buses. To accomplish this objective, a number of tasks were completed:

- identifying Lynx’s passenger-level data needs;
• identifying different APC counting technologies;
• determining whether these technologies could meet Lynx’s data needs;
• determining the compatibility of the differing APCs with existing and projected Lynx scheduling hardware and software, Lynx’s bus stop inventory, and other databases;
• determining the accuracy of APCs on different bus types; and
• identifying other new technologies Lynx may incorporate into its system.

Based on the findings of these tasks, CUTR developed a Request for Proposals (RFP) for Lynx to use in procuring a number of APC systems for installation on a selection of its buses. After issuance of the RFP and all of the APC vendor proposals have been submitted, CUTR will review each of the proposals and assist Lynx in making a selection. Based on the findings from the project, it was learned that there are many aspects to consider when contemplating the implementation of APC systems by a transit system.

System Components

In general, APC system components can be divided into three categories: hardware, software, and transit agency staff. To collect ridership data such as load levels and their locations on a given route, a number of APC hardware components are required:

• counting sensors (such as treadle mats or I-R beams);
• an odometer sensor;
• an internal clock in the microprocessor to determine the time that the passenger activity occurred;
• a microprocessor to tabulate, accumulate, and store passenger activity data onboard the bus;
• manual or automatic data storage/retrieval devices;
• a power supply to convert primary bus voltage (usually 12 or 24 volts DC nominal) to the APC system;
• engine sensors to register engine dwell and idle times;
• wheelchair-lift sensors to register wheelchair lift activity (optional);
• door sensors to register door openings and closings; and
• either radio signposts or some type of Global Positioning System (GPS) technology (both optional) to improve the confidence in the location referencing of odometer readings.

APC Methods

The current state-of-the-art methods of APCs currently in use can be divided into several technologies:

• infra-red (I-R) beams (both passive and active);
• treadle mats;
• I-R optic sensors; and
- low ultrasonic frequency sensors.

The technology that utilizes I-R beams computes the total number of boardings and alightings by tabulating the number of times the beam(s) is "interrupted" by a passenger entering or exiting the bus. Generally, the I-R beams are placed at the waist height of passengers. Algorithms are specifically built into the APC’s proprietary software to take into account the under- and over-counting of passengers created by multiple passengers crossing the beam simultaneously and passengers exiting through the front door on a two-or-more-door bus. The other APC counting technologies are similar in operation but differ only in how the passenger’s presence is detected and counted.

APC systems currently in use at systems throughout North America have been customized a great deal to fit the particular data needs of these transit systems as well as the design problems related to the installation of an APC system on different types of buses.

**Transit Agency Survey Results**

In addition to investigating the different APC technologies, a brief 13-question survey was developed and sent to 41 transit agencies in the United States and Canada to determine if they have ever used or are currently using some type of APC technology, the type of technology employed, the vendor of the technology, uses for the ridership data once collected by the APC system, and the accuracy of the ridership data collected by the APC system, among other information.

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### U.S., Canadian, and European APC Vendors

#### U.S. Vendors

<table>
<thead>
<tr>
<th>Urban Transportation Associates (UTA)</th>
<th>700 East McMillan, Suite 302, Cincinnati, Ohio 45206</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(T) 513/961-0099, (F) 513/751-2821</td>
</tr>
</tbody>
</table>

#### Canadian Vendors

<table>
<thead>
<tr>
<th>Microtronix Vehicle Technologies (MVT)</th>
<th>200 Aberdeen Dr., London, Ontario N5V 4N2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(T) 519/659-9500, (F) 519/659-8500</td>
</tr>
<tr>
<td></td>
<td>E-mail <a href="mailto:mvt@microtronix.com">mvt@microtronix.com</a></td>
</tr>
<tr>
<td>Company</td>
<td>Address</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ILI Technologies, Inc.</td>
<td>830, 407 - 2nd St. SW, Calgary, Alberta T2P 2Y3</td>
</tr>
<tr>
<td>Wardrop Applied Systems, Inc.</td>
<td>600-6725 Airport Rd., Mississauga, Ontario L4V 1V2</td>
</tr>
<tr>
<td>Red Pine Instruments, LTD.</td>
<td>Rural Route 1, Denigh, Ontario K0H 1L0</td>
</tr>
<tr>
<td>TDE Transdata</td>
<td>807 De Bienville, Montreal, Quebec, Canada H2J 1T9</td>
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**European Vendors**

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone Numbers</th>
<th>Fax Numbers</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilax AG</td>
<td>Seepanorama, CH-8559 Fruthwilen, Lankwitzer Strasse 3, D-12209, Berlin, Germany</td>
<td>(T) (+41) 71 663 75 75, (F) (+41) 71 663 75 76</td>
<td></td>
<td><a href="mailto:dilax@paus.ch">dilax@paus.ch</a></td>
</tr>
<tr>
<td>INIT</td>
<td>Haid-und-Neu-Strasse 7-9, D-7500 Karlsruhe, Berlin, Germany</td>
<td>(T) 0-721-69-10-73-76, (F) 0-721-69-68-08</td>
<td></td>
<td><a href="mailto:postmaster@init-ka.de">postmaster@init-ka.de</a></td>
</tr>
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</table>
Surveys were returned by 25 transit systems, with 14 indicating that they currently use or have in the past used APC systems. Three of the transit systems indicated that they use(d) treadle mats, and the rest use either dual, multiple, or passive I-R beam technology.

It should be noted that discussions with staff at several of the responding transit systems uncovered the critical fact that an APC system’s counting technology (such as treadle mat or I-R beam) is not as critical to the quality of the passenger and system data collected as the APC system’s software. In addition, the transit system staff specifically noted that there is a nominal difference with regard to accuracy between the differing APC counting technologies (such as I-R beams and treadle mats).

Also, several transit system staff members felt that signpost technology works better in a highly urban environment, particularly in a metropolitan downtown setting with high-rise buildings, and that, overall, there is only a marginal difference between signpost and GPS technology for use in improving the confidence of an APC system’s odometer readings.

The majority of the transit systems responded that they use the data primarily to create, evaluate, and adjust schedules and run times and to plan and justify route changes. Other, less common uses of the APC-generated data are for the purpose of National Transit Database reporting requirements, monitoring driver performance, and determining the location of bus stops.

Approximately 93 percent of the transit systems with APC experience are satisfied with the system’s overall reliability, and about the same number are satisfied with the accuracy of their obtained passenger information; the vast majority noted that they are achieving accuracy levels of 90 percent and above regardless of the APC counting technology employed.

Finally, of the 14 transit systems that reported that they use(d) an APC system, 12 noted that they periodically verify the accuracy of the information collected by their APC systems via manual ridechecks, while the other two transit systems use a combination of manual ridechecks and GFI farebox-generated information.

Other Issues
Several other issues were uncovered during the project related to integrating APCs into a transit system.

1. For any APC system to perform maximally, it is critical that a transit agency have a very detailed bus stop inventory to allow for precise analysis of passenger activity at the bus stop and route segment levels.

2. Agency staff must be prepared to handle the voluminous amount of information gathered by the APC systems in comparison to the typically scant information obtained from manual ridechecks.

3. Agency staff should prepare a route sampling plan that specifies exactly how and when the APC-equipped buses will collect passenger data prior to APC system installation. This becomes especially important if the APC-equipped buses will be used to satisfy NTD reporting requirements or for the statistical validity of data collected for other reasons.

4. Consideration should be given to the environmental conditions in which a transit system operates prior to selecting an APC counting technology since rain, snow, salt, and extreme fluctuations in temperature may adversely affect the operation of the counting technology.

5. Consideration should be given to the fleet mix on which the APCs will be installed to make sure that routes requiring buses with smaller turning radii or buses with large seating capacities (articulated) are accommodated.

6. Consideration should be given to the portability of the APC systems between buses of varying types and the wiring of buses to accept APC systems.

7. It is critical that all staff embrace their system’s APC program to ensure that data will be properly used and that the APC units will be properly maintained.

"Given that demand for transit service in Central Florida outpaces local government’s capacity to fund it," says Lynx Project Specialist Darin Allan, "Lynx continues to seek new ways of maximizing service to our customers. CUTR’s efforts have been very helpful in identifying APC technology and developing the specifications that will ultimately translate into more effective service delivery."

For additional information, contact Research Associates Michael Baltes, or Joel Rey, (813) 974-3120.

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