Introduction
MARTA wishes to present this report for the 2015 APTA Rail Conference: Relationship Between Passenger Environment and Customer Satisfaction. In addition to reporting primary research findings and subsequent strategic recommendations, this report also documents activities leading to the development of the relationships between the two projects, survey instruments, and the strategic recommendations.

Background
The Metropolitan Atlanta Rapid Transit Authority (MARTA) is the ninth largest public transit system in the United States by annual ridership, carrying 129 million passengers during the 2014 fiscal year. MARTA has 38 rail stations and 92 bus routes in its’ service area. MARTA has 338 passenger cars and 554 buses. Vehicles are serviced at three rail yards and three bus garages.

Passenger Environment Survey
The Passenger Environment Survey (PES) was created by New York City Transit in 1983, with major revisions made in 1995 and 2000. MARTA began conducting PES in 2010, based upon the New York model. PES is an internal performance audit to bring to the attention of operations management system deficiencies and problems. It is a measure of what the passenger experiences in the vehicles and in the stations.

Customer Satisfaction Survey
MARTA has conducted a customer satisfaction survey, called the Quality of Service Survey, on an almost annual basis since 1995. The Quality of Service Survey is a comprehensive study that measures customer satisfaction and perceptions of MARTA’s bus, rail and mobility service. The Authority utilizes the data as a tracking instrument to examine changes in customer perception and satisfaction.

Report Organization
Key points of the entire research are found in the Executive Summary. It is intended, if desired, that this component of the report can function as a stand-alone document.

Project research goals are recapped in the Research Objectives section of this document.

The Research Methodology chapter provides details on the quantitative research conducted. Specifics of the research methodology, including sampling, scheduling, questionnaires and data validity are included.

All research findings are reviewed in the Detailed Findings section. Specific relationships between the two surveys are described.

The recommended strategies based on the research results are detailed in the Conclusions.
EXECUTIVE SUMMARY

MARTA’s Passenger Environment Survey (PES) is a quantitative and scientific approach to measuring passenger perception of MARTA’s services. The PES standards are consistent, well-defined, and clearly understood by operations personnel. Internally, PES functions as a performance audit for field operations management. Externally, PES serves as an objective, unbiased and analytical ‘scorecard’ measure of passenger experience.

Early AM Garage or End-of-Line Litter and Cleanliness scores are of particular interest to operations managers. While a clean bus or railcar might not stay very clean in service for very long, no excuses can be made for buses or cars leaving the garage or yard dirty.

OBJECTIVES

The primary focus of this paper is to show how measuring customer satisfaction and collecting service performance data on vehicles and stations can be synthesized together to show the strengths and weaknesses of the overall system’s performance. The key question is, how does the "voice of the customer" data compare with the "voice of the process" data? Customer expectations must be translated to, and linked with, performance measures for the agency.

For transit agencies, as in other service industries, increases in customer satisfaction translate into retaining choice riders, greater system usage, attracting new riders, and a more positive public image. The results of a customer satisfaction measurement program alone cannot be expected to drive transit agency service improvement plans unless the findings correlate with agency-based performance measures, i.e. that data which the agency collects on a regular basis to document service performance. Customer perspectives must also be validated and understood by frontline supervisors and management if corrective action plans are to translate into successful implementation.

The collection of data reflecting riders’ perceptions of transit service along with an ongoing program of transit performance data collection at the transit line, route and station level by different times of day can be used by a transit agency to:
• identify existing weaknesses of transit service as reflected in the responses provided by transit riders and in the performance measures being monitored
• set priorities for service improvements by focusing on the aspects of transit service that need to be addressed first and by identifying the service routes that will be affected the most
• design and implement the identified improvements in transit service, and determine the methods to communicate the improvements to the riding public.

FINDINGS

There appears to be a moderately strong relationship between the ratings from the performance audits and the results from the customer satisfaction survey. A strong relationship exists between the service attributes Exterior cleanliness of trains, Station telephones working and Trains displaying correct information from the customer satisfaction survey and their associated metrics from the ongoing performance audits over the past two years. But no relationship exists when it comes to the attributes Interior cleanliness of trains and Stations displaying correct information with the audit data.

METHODOLOGY

The methodology for each data collection effort will be presented separately. First, for the audits, then for the customer satisfaction survey.

PERFORMANCE AUDITS

Because of PES’s audit functions, MARTA must ensure that the department collecting the data has no vested interest in survey results. Biases associated with using operating staff for data collection have been observed in many organizations. The Research & Analysis unit within MARTA’s Department of Planning provides a neutral data collection workforce, a group of eight specially trained surveyors. The PES team is supervised by two quality assurance specialists.
Sampling – Performance Audits
Statistically valid measurements require even and representative samples. Biases due to sampling must be minimized, to ensure validity. At the same time, sample size must be minimized for cost reasons.
• Surveys are evenly distributed throughout the week for those surveys where weekly checks are done at each location.
• For the rail survey conducted along the rail line, assigned lines and directions are evenly distributed each month.
• For surveys done during the service day, samples are evenly distributed during each three hour time period (6-9 am, 9am-12pm, 12-3 pm, 3-6pm)
The number of buses checked at each garage is in proportion to the number of buses assigned to each garage.

Table 1 shows all PES audits currently measured by MARTA, assigned time periods, and the observation quota required to reach design levels of statistical significance. The reliability column shows the margin of error for the data collected.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Time of Day</th>
<th>Avg. Sample Size</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>Before Service</td>
<td>1,500</td>
<td>+/- 2.5%</td>
</tr>
<tr>
<td>Bus</td>
<td>Midday</td>
<td>1,650</td>
<td>+/- 2.7%</td>
</tr>
<tr>
<td>Bus</td>
<td>During Service</td>
<td>2,000</td>
<td>+/- 2.2%</td>
</tr>
<tr>
<td>Rail</td>
<td>Before Service</td>
<td>875</td>
<td>+/- 3.3%</td>
</tr>
<tr>
<td>Rail</td>
<td>During Service-end of line</td>
<td>3,000</td>
<td>+/- 1.8%</td>
</tr>
<tr>
<td>Rail</td>
<td>During Service-along line</td>
<td>1,200</td>
<td>+/- 2.0%</td>
</tr>
<tr>
<td>Mobility</td>
<td>Before Service</td>
<td>400</td>
<td>+/- 4.9%</td>
</tr>
<tr>
<td>Mobility</td>
<td>Midday</td>
<td>400</td>
<td>+/- 4.9%</td>
</tr>
</tbody>
</table>

Survey Instruments – Performance Audits
Metrics are grouped into surveys based on mode and time requirements for measurements. All forms except the lighting count include an examination for cleanliness of floors and litter. There are a total of 16 data collection instruments across all of the modes and the stations. There are a total of 168 unique metrics on these 16 instruments. Several of the metrics, particularly those pertaining to cleanliness and appearance, are measured both before and during service. There are also metrics pertaining to the station where the same item is measured at multiple locations within the station.

The PES survey design calls for any of three types of measures for each metric. The vast majority of metrics result in a ‘pass’ or ‘fail’ score for each observation. This is done to simplify the surveyors’ task of making correct and valid observations. For litter and dirt, a quantitative measure is impossible to collect. An ordinal ‘rating’ standard is used for these metrics. For those metrics pertaining to lighting in the station, lighting in the railcar, and number of doors not working, counts of those not working is collected. Also, surveyors are required to measure ambient temperature in the vehicles with a digital thermometer. The metrics measured during the audits in the vehicles and at the stations consist of the following:

Railcars, Buses, Mobility Vans
• amount of litter, dirt, spills
• interior, exterior graffiti
• foul/unpleasant odor
• presence of pests
• scratched, cracked windows
• condition of doors, seats
• signage inside and outside vehicle
• condition of stop request cord (Bus only)
• condition of safety belts, ramp/lift for wheelchairs (Bus & Mobility only)
• lighting
• ambient temperature
• drivers in proper uniform

Scheduling – Performance Audits
Each PES survey has a unique set of requirements and constraints. Even though constraints are well defined, flexibility in scheduling is substantial. Surveys done at the garages and before the service day must start at a pre-defined time, but the other audits done during the service day may start at different times.
Station

- litter, dirt, spills in station interior, bus bay, station exterior
- interior, exterior graffiti
- foul/unpleasant odor
- presence of pests
- lighting within stations
- condition of escalators and elevators
- presence and readability of system maps
- working electronic signage amount of graffiti
- condition of telephones
- condition of faregates, vending machines
- condition of restrooms
- working microphones at RideStore, Reduced Fare office, customer information booth
- cleanliness of customer service facilities

DATA VALIDITY PROCESS – PERFORMANCE AUDITS

When all data is entered for the month, first the sample quota fulfillment is checked. Next, database queries are used to check for unusual patterns of activity. The database is checked for garage-bus route consistency. The validation prevents misallocation of buses to garages from affecting garage-based scores. The analyst checks if ratings are substantiated by surveyor comments as each record is entered.

By collecting information such as car or bus numbers, boarding station, an analyst can later establish whether the surveyor was actually present at the correct location. The bus or car numbers can be cross-checked with block register information independently recorded by operations personnel at the garage or rail yard. This is particularly critical when invariably a bad score causes operating departments to challenge the validity of one surveyor’s work. In addition, regular spot checks by the quality assurance team helps to maintain data quality.

Whenever a failing score is recorded, the surveyor records the reason on the form, and takes a picture of the item, when it is safe to do so. This demonstrates the surveyor understands PES standards and their correct application. The data is used to analyze the root causes of failing scores. The requirement to record specifics allows for post-facto auditing of surveyor activity.

METHODOLOGY - CUSTOMER SATISFACTION

During fiscal year 2014 (July 2013 through June 2014), research surveyors conducted 6,512 face-to-face interviews. A total of 5,175 patrons were surveyed on rail platforms at all MARTA rail stations and 1,337 patrons were surveyed onboard a random selection of fixed-route buses.

Sampling – Customer Satisfaction

Transit Research determined the target number of interviews based upon the minimum number of responses that would generate statistically reliable data on each rail line and from each bus division. This ensured the sample accurately reflected the patronage levels for both fixed-route bus and rail. Based upon a 95% confidence level, the estimated margin of error for the general rider data was +/-1.2% for a complete sample size of 6,512 responses.

Surveyors intercepted participants on rail station platforms and aboard buses at randomly selected times. At the stations, surveyors selected every third person who entered the platform to travel in a specified direction for a personal interview. On the buses, interviewers approached every third person that boarded a randomly selected block on the route.

Scheduling – Customer Satisfaction

Interviews were conducted on weekdays between 6:00 AM and 9:00 PM and on weekends between 9:00 AM and 9:00 PM. Rail assignments lasted three hours, while bus assignments consisted of one round trip. Each station and route is surveyed during both weekday peak periods, midday, evening and weekends.

Survey Instruments – Customer Satisfaction

Customers were asked to rate 42 MARTA performance attributes on a 1 to 10 scale, where 1 = “poor” and 10 = “excellent”. Riders who were surveyed on the rail system
were asked to rate 22 attributes specific to rail, while bus riders were presented with 18 attributes related to the bus system. In addition, all riders were asked to rate two attributes related to the system as a whole. Research & Analysis categorized these 42 attributes into the following categories: Cleanliness, Customer Service, Employee Performance, Mechanical Reliability, On-Time Performance and Safety.

The service attributes are listed below, according to service dimension. There are two separate survey instruments for both bus and rail. Three service dimensions appear on each form. The attributes that ask about rating items at a station are found on the appropriate rail survey instrument.

**Cleanliness**
- Clean elevators in stations
- Exterior cleanliness of buses/trains/stations
- Interior cleanliness of buses/trains/stations

**Customer Service**
- Availability of bus schedule information
- Buses/trains/stations displaying correct information
- MARTA keeps me informed of changes that affect my service

**Employee Performance**
- Announcements of train delays on trains/in stations
- Bus drivers board or discharge passengers properly
- Bus drivers operate the bus in a safe manner
- Courteous bus drivers
- Courteous station service personnel
- Knowledgeable employees
- Station service personnel are available to provide assistance
- Stop announcements made on buses/trains
- Understandable stop announcements made on buses/trains

**Mechanical Reliability**
- Condition of shelters, benches at bus stops
- Working elevators, escalators
- Frequency of delays caused by bus/train mechanical breakdowns or repairs
- Working telephones in stations
- Working condition of bus/train interior equipment

**On-Time Performance**
- Buses/trains arrive on-time
- Frequency of bus service on weekdays, weekends
- Frequency of train service on weekdays, weekends

**Safety**
- Controlling nuisance behaviors on buses/trains/in stations
- Personal safety while riding the bus/train
- Personal safety while waiting at bus stops/rail platforms

**DATA VALIDITY PROCESS – CUSTOMER SATISFACTION**

When all data is entered for the month, first the sample quota fulfillment is checked. The database is checked for garage-bus route consistency. The validation prevents misallocation of buses to garages from affecting garage-based scores. The analyst checks if ratings are substantiated by surveyor comments as each record is entered.

By collecting information such as car or bus numbers, boarding station, an analyst can later establish whether the surveyor was actually present at the correct location. The bus or car numbers can be cross-checked with block register information independently recorded by operations personnel at the garage or rail yard.

**RELATIONSHIP BETWEEN AUDITS & SURVEY**

The collection of transit performance data to support the monitoring, evaluation, and implementation of improvements in service presents a challenge to transit agencies. The data collection and analysis activities should be concentrated on those aspects of transit service that are both crucial to their operations and that more accurately reflect the needs and wants of customers and
potential customers. The objective of this analysis is to match customer attributes of the transit experience to its’ corresponding service performance indicators. The diagram on the next page shows how the service attributes from three of the dimensions in the customer satisfaction survey are related to the metrics measured on the performance audits. This is followed by Table 2, which is a comparative analysis that shows how the rail and station attributes performed according to the “voice of the customer” in terms of mean attribute rating. Then for the associated audit metrics, it shows how they performed according to the “voice of the process” in terms of average pass rate. Only the rail and station results are shown in this table. The relationship between the two will be explained in the Findings section of this paper.
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Attribute Means</th>
<th>Metric</th>
<th>Metric Pass Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FY13</td>
<td>FY14</td>
<td>Clear interior decal/signage</td>
</tr>
<tr>
<td>Interior cleanliness of trains</td>
<td>7.8</td>
<td>8.0</td>
<td>No Litter – During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Dirt – During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Interior Graffiti – During service</td>
</tr>
<tr>
<td>Interior cleanliness of stations</td>
<td>7.8</td>
<td>7.9</td>
<td>No Litter on Platform – During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Litter on Concourse-During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Litter in Bus Bay-During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Dirt on Platform – During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Dirt on Concourse-During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Dirt in Bus Bay-During service</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No Foul/Unpleasant odor-Platform</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No Foul/Unpleasant odor-Concourse</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Foul/Unpleasant odor-Bus Bay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Litter on Trackbed-During service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Litter-Stairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Graffiti-Platform</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Graffiti-Concourse</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Graffiti-Bus Bay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No Graffiti-Stair</td>
</tr>
<tr>
<td>Exterior cleanliness of trains</td>
<td>8.3</td>
<td>8.3</td>
<td>No Exterior Dirt</td>
</tr>
<tr>
<td>Elevators in good working condition</td>
<td>7.8</td>
<td>8.2</td>
<td>No Exterior Graffiti</td>
</tr>
<tr>
<td>Escalators in good working condition</td>
<td>7.7</td>
<td>8.2</td>
<td>Elevators Working</td>
</tr>
<tr>
<td>Station telephones working</td>
<td>7.7</td>
<td>8.0</td>
<td>Escalators Working</td>
</tr>
<tr>
<td>Working condition of train interior</td>
<td>7.6</td>
<td>7.8</td>
<td>Police Telephones Working</td>
</tr>
<tr>
<td>environment</td>
<td></td>
<td></td>
<td>Fire Telephones Working</td>
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<td></td>
<td></td>
<td></td>
<td>Customer Service Phones Working</td>
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<td></td>
<td></td>
<td></td>
<td>Schedule Info Phones Working</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No Broken Seats</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No Scratched Windows</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No Cracked Windows</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No Clouded Windows</td>
</tr>
<tr>
<td>Stations displaying correct information</td>
<td>7.8</td>
<td>7.9</td>
<td>Electronic Signs Working</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Percent of maps/signage present</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Maps readable on Platform</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maps readable on Concourse</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maps readable in Bus Bays</td>
</tr>
<tr>
<td>Trains displaying correct information</td>
<td>8.2</td>
<td>8.3</td>
<td>System Maps in Trains</td>
</tr>
</tbody>
</table>

Table 2
FINDINGS

Table 2 provides a link between the dimensions of transit service, the 46 attributes of service that were used in the transit rider survey and the list of performance measures from the audits. These linkages illustrate both the depth of the rider survey and the potential range of corresponding measures of performance. The PES audit metrics had an average passing rate from 93-95% during the past two years. While the average performance rating from the customer satisfaction survey ranged from 7.9-8.0 on a 10 point scale over the previous two years. These totals are cumulative for the fiscal year.

To interpret Table 2, first compare the mean attribute rating for a given year to the overall mean for the customer satisfaction survey. If it is above the mean, then customers have rated that MARTA is performing the service attribute favorably well. Next, compare the average pass rate for the metric to the overall average pass rate for the mode of interest. If it is above the mean, then MARTA is performing at an excellent level, and would achieve target performance levels if looked at from a KPI perspective. If both the customer satisfaction data and all the metrics from the performance audit data are performing above their averages, then a positive relationship exists between PES and customer satisfaction data. On the other hand, if the range of pass rates for the metrics is very high, with some above the overall mean and others below the overall mean by a considerable amount, then there is no relationship between the customer satisfaction data and the PES audit data for that attribute.

Based on these results, there appears to be a moderately strong relationship between the ratings from the performance audits and the results from the customer satisfaction survey. A strong relationship exists between the service attributes Exterior cleanliness of trains, Station telephones working and Trains displaying correct information from the customer satisfaction survey and their associated metrics from the ongoing performance audits over the past two years. But no relationship exists when it comes to the attributes Interior cleanliness of trains and Stations displaying correct information with the audit data. When this occurs, further investigation should take place when it comes to those metrics that do not allow a relationship to exist. Since the attribute statements on the customer satisfaction survey are worded in a general way, knowing which metrics are associated with that attribute in the audit enables one to attempt to deduce what factors within the definition of the attribute go into the customers’ rating. It also shows what procedures are done best and what needs improvement when it comes to preparing vehicles for service, because the before service audits are of greatest interest to operations maintenance supervisors. They want to know if the vehicles are being put into service in a perfectly clean state.

Among the initiatives that MARTA actively pursued during FY14 was to upgrade the elevators and escalators at all stations. Also, MARTA began the process of replacing electronic signage in stations that alert customers as to when the next train will arrive. Towards the end of FY14, service frequencies were shortened from 15 minutes to 10 minutes during peak hours and 12 minutes during midday. This has a much greater impact on customer satisfaction, which should be fully realized during FY15. A secondary effect of making this fundamental change is greater attention paid to those items that are very important to the overall transit experience and drive satisfaction. Thus, the relationships between the two data collection projects could become stronger.

The best means of determining the strength of the relationship is to further analyze the data from both data collection efforts geographically to see what, if any, relationships exist. One caveat in doing this analysis that should be pointed out is that the audits are point-in-time measurements, but the customer satisfaction survey measures overall perceptions from the customer’s riding experience. In short, the capacity to establish linkages between customer satisfaction, and operational results should be the central strategy of a transit agency’s customer satisfaction measurement process.
CONCLUSIONS

The general environment through which passengers travel on transit has a great deal to do with their level of satisfaction. However, it is difficult to develop a consistent and objective approach to measuring the quality of the passenger environment.

Based on these results, a strong relationship exists between the service attributes Exterior cleanliness of trains, Station telephones working and Trains displaying correct information from the customer satisfaction survey and their associated metrics from the PES audits over the past two years.

The ability to make the linkage between riders’ perceptions and measures of transit performance is instrumental in providing transit management with the means of evaluating potential service improvements aimed at enhancing rider satisfaction and transit ridership. Such an evaluation can be supported by an ongoing data collection effort that captures differences by rail line, route, or time of day and focuses on a comprehensive list of transit performance indicators.

As a result, the ongoing analysis of the transit performance measures can be used to:

- provide transit management with a systemwide overview of transit operations for different modes
- monitor changes in transit service over time to identify deteriorating conditions or to highlight service improvements in response to initiatives by operations
- identify the variation in level of service by collecting data specific to a service area or time of day for the service attributes of interest
- facilitate the development of marketing and communication strategies to inform current customers and potential customers of the most important service features.

MARTA found that passenger environment surveys are the most optimal way for transit agencies to understand their system from the customers' perspective. There can be difficulties in establishing and monitoring the data collection effort. Also, many of the measures are subjective and qualitative, which also adds to the challenges. It enables the agency to show the quality of services that are provided to customers.

REFERENCES
