Failsafing Operations in Small Urban and Rural Transit Systems

Joanne M. Sulek, Ph.D.
Mary R. Lind, Ph.D.
Co-Principal Investigators

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Urban Transit Institute
Transportation Institute
North Carolina Agricultural & Technical State University

B402 Craig Hall
1601 East Market Street
Greensboro, NC 27411
Telephone: (336) 334-7745 Fax: (336) 334-7093
Internet Home Page: http://www.ncat.edu/~traninst

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16. Abstract

Human error leads to transit service defects that can diminish customer satisfaction, compromise public safety, degrade productivity and stall ridership growth. Since small urban and rural transit systems often lack the resources larger systems enjoy, they cannot afford expensive technology or consultants to help them achieve error-free operations. Needed are low-cost, low-tech tools that managers of small systems can use to failsafe their operations. This research project developed one such tool *The Transit Manger's Guide to Failsafing Customer Service.* The methodology contained in this guide was developed in consultation with a manager of a small transit system who wished to mistake proof paratransit services provided by his system. The manager utilized the failsafe methodology to identify service problems, discover the causes of these problems, devise failsafe methods to prevent the problems and assess the effectiveness of individual failsafe methods.

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1. Executive Summary

Regardless of the size of a public transit system, mistakes are costly. Human error leads to service defects that can diminish customer satisfaction, compromise public safety, degrade productivity, and reduce ridership. Unlike their large urban counterparts, small urban and rural transit systems cannot afford expensive technology or external consultants to help them achieve error-free operations. Moreover, as the results from year one of this research effort have shown, new technology alone may fail to improve service quality in small transit systems (Sulek & Lind, 2003).

Managers of small urban and rural transit systems need inexpensive quality improvement techniques that are easy to understand, simple to implement, and target specific errors in service delivery. To meet this need, this research project developed a low-cost, low-tech methodology that managers can use to failsafe transit operations. The failsafe methodology will not only enable managers to identify and correct errors before they diminish service quality, but also can help them redesign specific elements of service delivery to reduce the likelihood of errors in the future.

The failsafe methodology developed in this project represents a hands-on six sigma tool for ensuring transit quality. Like the statistical process control (SPC) chart methods used by the principal investigators in year one of this project, failsafe techniques have played a role in industrial quality control for many years. While SPC charts involve statistical analysis of historical process data to assess process consistency, failsafe techniques emphasize service standards, worker empowerment, and information flows to prevent defects associated with customer error. Despite these differences, SPC charts and failsafe techniques constitute complementary, rather than competing approaches to transit quality. Used together, these two techniques provide an integrated systems approach to transit service quality.

This report is organized as follows. First, an overview of a systems approach to managing transit service quality will be given. Next, the research context and methodology are discussed. *The Transit Manager's Guide to Failsafing Customer Service* is presented

next. Finally, methods used to disseminate findings from this research project are delineated.

2. Transit Service Quality

Since mistakes can occur at any point in service delivery, a systems approach to transit service should guide any failsafe process. By modeling technology, systems, and people as the three main components of a transit system, this study adapted Chase and Bowen's (1991) framework for service delivery to transit services. In a transit context, the technology component involves vehicles, equipment, machinery, and software as well as facilities such as bus stops and bus stations. The systems component pertains to maintenance, inventory, routing, scheduling, planning, and performance tracking systems. The final component, people, includes both service providers, such as drivers and office personnel and transit customers such as riders, local government agencies, and local industries.

Both transit workers and customers contribute to errors in service delivery. For instance, drivers can make mistakes resulting in service problems that range from accidents or injury at one extreme to annoying or inconveniencing passengers at the other. Consequently, the failsafe process must address transit workers' technical job skills. Similarly, incidents in which a rider perceives a driver as rude, indifferent, or unable to provide needed information about transit service can have a detrimental effect on service quality (Jen & Hu, 2003). For most riders, transit employees represent the transit system; therefore, transit workers' interpersonal skills affect rider perceptions and must also be addressed by a failsafe process.

The failsafe process should also address the behaviors and attitudes of transit customers. In many services, a significant portion of customer complaints stem from mistakes made by the customers themselves. Chase and Stewart (1994) have identified three major sources of customer mistakes: 1) the failure to access the correct service or understand and anticipate the customer's role during the service encounter; 2) the failure to follow instructions, remember critical steps or communicate service needs during the service

transaction; and 3) the failure to alert management about service problems and offer suggestions once the service is complete. Since riders and other transit customers can make any of these mistakes, failsafe methods targeting customer participation skills and information access can be useful (Knuttson, 2003).

In particular, elderly riders may benefit from such failsafing efforts. The number of elderly citizens in the United States is expected to increase significantly as "baby boomers" age. Many of these older adults plan to maintain active lives and remain mobile. Yet, elderly drivers tend to experience high accident rates; moreover, even conservative projections indicate that by 2030, the number of fatalities in automobile accidents involving elderly drivers will be quadruple the 1996 level (Hildebrand, 2003). Public transit services that are easy for elderly riders to use may reduce the need for older adults to drive. Failsafe methods can help ensure that, in practice, public transit systems are truly accessible to older adults.

Since the failsafe process offers significant opportunities for improving transit performance, transit managers cannot afford to adopt a hit or miss approach to mistake proofing their operations. The following section describes a failsafe methodology that was used to mistake proof operations at a small urban transit system.

3. Research Context and Method

Cleveland County Public Transit, which serves the Shelby-Cleveland County area in western North Carolina, served as the research context for this study. Mr. Tom Crider, the Executive Director of Cleveland County Public Transit, was interested in failsafing operations to improve service not only to his riders but also to local agencies served by the system. Mr. Crider's top priority was to prevent service defects that might occur while riders were either using the system's paratransit service or trying to access it. Thus, the critical elements of interaction between transit workers and transit customers had to be addressed by the failsafe effort at this paratransit operation.

To organize the failsafe effort, the principal investigators developed a methodology that consisted of several key steps:

(1) The principal investigators, in conjunction with the transit manager, devised a flow chart of all the major stages that comprise a typical van ride.
(2) The service problems that had occurred at individual stages in the past were identified. Potential problems at individual stages were also listed.
(3) The causes of specific problems at individual stages were identified.
(4) The problem causes listed in Step 3 guided the transit manager and principal investigators as they devised failsafe solutions to service problems.
(5) Performance metrics based on actual operating data were selected.
(6) A customer survey was designed to assess paratransit service quality at this system.
(7) The manager assessed the effectiveness of specific failsafe techniques by analyzing survey results and monitoring the performance metrics that were selected in Step 5.

The failsafe methodology described above can be adapted to fit the failsafing needs of managers at other small urban and rural transit systems. To help these managers mistake-proof their operations, the principal investigators prepared *The Transit Manager's Guide to Failsafing Customer Service.* The principal investigators consulted frequently with the transit manager as they prepared the *Guide.* The final version of the *Guide* is given in the following section.

4. The Transit Manager's Guide to Failsafing Customer Service

4.1 Introduction

Every transit manager dreams of running an operation that is virtually error free. In practice, though, people make mistakes. However, it is possible to reduce the likelihood of human error during service delivery and to prevent small mistakes from growing into much larger ones. The purpose of this *Guide* to help transit managers failsafe rider services so that service defects caused by human error rarely occur. The failsafe process

described below can help a transit manager improve customer service without investing in advanced technology or expensive consultants.

4.2 Overview of the Failsafe Process

There are a few key steps the transit manager should follow to failsafe customer services.

Step #1: Develop a flow chart of the major stages involved in a typical bus or van ride. Such a chart should accomplish three important objectives: 1) trace the rider's participation in service delivery; 2) highlight critical back office tasks; and 3) identify all major points of interaction between transit employees and riders. It is important to meet all three objectives because service problems may stem from rider's mistakes, employees' errors or problematic interactions between transit workers and customers.

Step #2: Starting with the initial stage in the flow chart, list both actual problems that are occurring at each stage as well as potential problems that could cause a major defect in service safety, reliability, or customer satisfaction.

Step #3: For each stage, list the likely causes of each problem. If the problem cause does not seem apparent, the manager should investigate further by using follow-up phone calls with riders, reports from front-line personnel and/or analysis of performance data. The manager should be sure to differentiate human error from system-generated causes. System generated problems may result from unreliable technology, faulty operating procedures or other causes beyond the direct control of front line employees or transit customers.

Step #4: Review the problems listed in *Step #3* and design failsafe measures to address them. If a problem originated due to a customer's mistake, identify specific failsafe devices such as clearer signage or better route maps that can make it easier for the rider to effectively use the transit services. Similarly, if a problem results from worker error, the manager should identify the specific behavior that caused the problem. The manager should then devise simple failsafe devices so the driver or front office employee can

avoid making the same mistake in the future. If the problem stems from a systems error, the manager should try to redesign the procedure or upgrade the technology that generated the error.

Step #5: Implement the new failsafe devices and track the effect of their use. Meaningful service quality measures should be used to monitor the effectiveness of the failsafe techniques. For instance, the manager may wish to track the number of customer complaints over time or may monitor the number of late pickups by each driver.

Step #6: Remember that service improvement requires constant effort. The manager should routinely gather feedback from customers and transit employees and solicit suggestions for improvement. The transit manager should try to anticipate any new problems with service delivery that may emerge in the future and devise additional failsafe techniques to address these problems. It is especially important to plan new failsafe techniques when changes are made in operating procedures.

4.3 Getting Started: A Flow Chart of a Bus or Van Ride

The first step in failsafing a process involves charting all of the critical stages that it entails. For example, Figure 1 represents a flow chart for paratransit services provided by an actual transit system in western North Carolina. The flow chart depicts eight critical stages in this paratransit operation: (1) The rider's initial request for service, which is shown as the **Rider-Dispatcher Link** on the diagram; (2) Confirmation that the rider is eligible for services, which involves the **Department of Social Services (DSS)/Agency-Dispatcher Link**; (3) Ride scheduling, which involves the **Dispatcher-Scheduler** Link; (4) Manifest creation, which involves the **Scheduler-Driver Link**; (5) Rider pickup, which involves the **Driver-Rider Pickup Link**; (6) Transport of riders to their appointments, which is shown as the **Rider Transport Link**; (7) Rider pickup after their appointments, which involves the **Doctor's Office-Driver Link**; and (8) Transport of the riders back home, which is shown as the **Return Trip Link**.

The multiple links in Figure 1 indicate that there are many opportunities for a service error to occur in this paratransit operation. Since most of these service links involve rider interaction with either drivers or front office personnel, many of the failsafe techniques developed for this operation will aim at improving some aspect of passenger/worker interaction. The next section of this guide will refer to the flow chart shown in Figure 1 to identify specific service problems at this transit system.

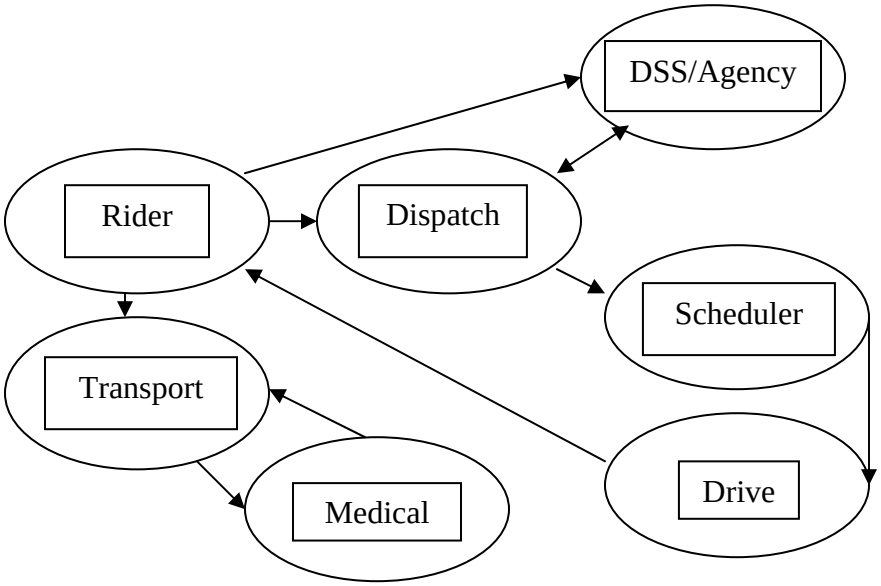

Figure 1

Process Flow Chart

4.4 Transit Problems and Their Causes

Once the manager has constructed a process flow chart, he or she can examine each critical link in transit service delivery. A close look at each link can help the manager determine the types of service problems that occur at each stage and may also make it easier to identify the causes of service errors.

At this paratransit system, a rider's phone call to the dispatcher represents the first link in service delivery. As Table 1 illustrates, a number of problems can occur at this initial stage. These include long wait times to schedule a ride, a lack of responsiveness to specific customer requests, and denial of service access.

Table 1

Rider/Dispatcher Link: Problems and Causes

Problems	Causes
Rider demands immediate pickup	Rider does not understand that 24-hour advance notice is required
	Rider has not been briefed by the agency
Rider is not eligible to use paratransit services	Rider may not be cleared to ride by the DSS/Agency
	Ride may be under suspension due to excessive no-shows
	Rider may be under suspension due to bad behavior on the van
Disabled riders request paratransit service when fixed route will meet their needs	Riders do not know how to access information about regular routes
	Rider does not have access to the transit system Internet site
	Rider cannot read the time table
	Rider does not understand route map
Initial request for services takes too long	Dispatcher in a high demand situation
	Dispatcher cannot pull up schedule on computer screen
	Rider does not know how to request service
	Rider does not have all the information (i.e., address) necessary to plan the transport
Passenger does not get pickup time requested	Requested pickup time is not available due to heavy demand
	Rider calls too late

Some of these problems are due to heavy demand on the system; for instance, a passenger may not get the pickup time requested because that time slot is already full. Similarly, a

rider may have to wait longer than he or she would like if the dispatcher were trying to schedule several customers at once. However, as Table 1 shows, riders generate some of the problems themselves. For example, if riders do not understand that a 24-hour advance notice is required, they may be upset that immediate pickup is not possible. Also, if riders are under suspension due to excessive no shows, they lose their eligibility to use paratransit services.

Table 2 examines the DSS-Dispatcher link, which represents the next stage in this service process. Waiting is again a problem; the dispatcher may spend an excessive amount of time confirming that a rider is eligible for services. This problem arises when the dispatcher cannot quickly reach the DDS liaison or access a rider's records. Inaccurate information also constitutes a problem. Sometimes a dispatcher is unaware that a rider is no longer eligible for services. This happens if DSS fails to send rider information to the transit system in a timely manner or if the agency fails to provide accurate no-show data to DSS.

Table 2

DSS/Dispatcher Link: Problems and Causes

Problems	**Causes**
Takes too long to confirm that rider is on agency's approved list	DSS liaison not consistently accessible
	Too long to access rider records
Dispatcher list shows that a suspended rider is still eligible for service	DSS failure to record the no-show information
	DSS is late recording the no-show information
	Agency overlooks sending the no-show data to DSS

Inaccurate information is also a problem in the Dispatcher-Scheduler link, which is discussed in Table 3. In a high demand situation, a dispatcher may enter incorrect information for a rider. In addition, the scheduler may receive inaccurate information on return trip pickups and schedule pickups for the wrong time.

Table 3

Dispatcher/Scheduler Link: Problems and Causes

Problems	Causes
Dispatcher enters incorrect information regarding a rider	Attention overload due to high demand
Wrong time for return trip pickup is scheduled	Schedule does not have sufficient or accurate information on return trip pickups
Schedule looses accuracy	Uncontrollable conditions such as bad weather, accidents or vehicle breaks down

Table 4 delineates several causes of manifest inaccuracy, which can pose a significant problem at the Scheduler-Driver Link. Rider no-shows constitute part of the problem but drivers may also contribute to the problem if they do not find out if there are any late cancellations before starting their pickup routes. Technology problems, such as an unreliable voicemail system, can make it difficult to receive cancellation messages in a timely manner.

Table 4

Scheduler/Driver Link: Problems and Causes

Problems	Causes
Manifest is inaccurate	Rider no-shows
	Driver may fail to call in before starting the pickup route so unaware of late cancellations
	Voicemail communication system does not work so cannot leave message on need to cancel a ride
	Failure to enter cancellations in database
	Failure to enter passengers' special needs in database

In the Driver-Rider Pickup Link, both riders and drivers face such problems as late pickups, boarding mishaps, and physical barriers to boarding. As Table 5 illustrates, these problems stem from a variety of causes.

Riders can cause pickup delays if they are not ready to leave when the van arrives, if hearing impairment prevents them from hearing the driver blowing the horn or if they simply forget to cancel their ride appointments. On the other hand, there are a number of other causes of late pickups that are beyond the riders' control. These include heavy traffic, accidents, road construction, and adverse weather conditions. Schedule creep also contributes to late pickups.

Boarding mishaps can occur if riders who use wheelchairs rely on inadequate homemade ramps to help them board the van. Such ramps can easily collapse, injuring both the passenger and the driver. Without an adequate ramp, a driver may require a great deal of extra assistance with the passenger. In some cases, it may be impossible to get the rider on board safely, and the driver may have to refuse service to the passenger. A driver will also refuse service when parents try to bring children on board without approved safety seats.

Sometimes, a driver cannot get the van close enough to the rider's home for a pickup. A number of physical barriers can block safe assess to a rider's homes. For instance, fallen trees or tree limbs may obstruct driveways. The driveway itself may be too steep, too winding, or too long to travel over safe. The road surface may also contain deep ruts or be too muddy. Drivers may find that even if a driveway is fairly safe, there is no way to easily push a wheelchair across the passenger's yard to the van. A driver may need a great deal of extra help in conveying a rider in a wheelchair to the van if no sidewalks are available.

Table 5

Driver/Rider Pickup Link: Problems and Causes

Problems	Causes
Driver is running behind schedule	Schedule creep
	Driver misjudged pickup time and travel time
	Rider provided the wrong pickup address
	Time of day
	Adverse weather conditions
	Delays in route – accidents, road construction, etc.
Driver must wait for rider	Rider does not understand that he/she must be ready prior to pickup time
Rider no show	Rider misunderstanding
	Rider forgets to cancel ride appointment
Rider has mishap while boarding	Physical barrier to safe boarding
Driver does not allow rider to board	Rider not able to board due to illness Parent brings along child without approved child seat
Driver needs help in getting rider safely on board	Inadequate, homemade ramps at passenger's home
	No ramp and no sidewalk – cannot push wheelchair from door to vehicle
Paratransit van cannot get near the house	Limbs obstructing driveway
	Ruts in driveway
	Fallen trees in driveway
	Driveway too long to drive down
	Driveway too steep
	Rider did not inform the dispatcher of barriers to boarding the vehicle
Passenger is not aware that van is waiting for him	Hearing impaired rider will not hear driver blowing the horn and did not inform the dispatcher about the impairment

Table 6, which deals with the Rider-Transport Link, considers the kinds of problems a passenger might experience during an actual ride. The worst problem occurs when the rider finds the trip unsafe. Reckless driving by the van operator can create this reaction as can disruptive behavior by other passengers. Vehicle malfunction can also give the impression that the ride is not a safe one. Even if a passenger considers a ride safe, he or

she may find it unpleasant. This can occur if the driver is rude or unhelpful to passengers or if the bus itself is dirty, too cold or too hot. The passenger may also believe that the service is too slow. While poor road conditions can make a trip seem longer, a driver's failure to stay on schedule can also delay a trip.

Table 6

Rider Transport Link: Problems and Causes

Problems	**Causes**
Rider finds trip unpleasant	Driver discourteous
	Vehicle radio music is too loud or annoying to the riders
	Bus dirty
	Driver not helpful
	Uncomfortable bus temperature
	Adverse road conditions
Rider thinks trip took too long	Traffic congestion
	Dispatcher over-schedules a route with too many passengers
Rider finds trip unsafe	Driver did not obey traffic laws
	Disruptive fellow passenger
	Van maintenance issues

Table 7, which involves the Doctor's Office-Driver Link, reveals some of the same problems found within previously discussed links (i.e., late pickups and difficulty boarding passengers) plus a new type of problem - leaving the rider stranded at the doctor's office. Failure to pickup a rider at the end of an appointment stems largely from poor communication between the doctor's office and the paratransit service.

There are several reasons why a driver may be late for a pickup. First, the scheduler may not have correctly estimated the length of the appointment. Second, a driver may have failed to note a schedule change. Third, the driver may not be available for pickup. Fourth, the rider may be late notifying the dispatcher about the pickup. Fifth, a rider may assume that the doctor’s office has called the dispatcher but personnel at the doctor’s office may think this task is not part of their job description and never call the dispatcher. Finally, late pickups may result from schedule creep.

Passenger boarding problems may also occur at this link. Lack of a curb break or an obstructed curb break can account for some of these problems. Other physical barriers can also contribute to boarding difficulties.

Table 7

Doctor's Office/Driver Link: Problems and Causes

Problems	**Causes**
Passenger stranded at doctor's office	Dispatcher not called that passenger ready for pickup
Passenger late being picked up	Schedule creep
	Passenger late notifying dispatcher
	Driver not immediately available for pickup
	Driver did not record on the manifest the schedule change that the dispatcher radioed to him/her
	Scheduler did not correctly estimate the length of the appointment
Difficulty loading passenger back on van	Barrier to efficient or safe loading
	Lack of curb break or curb break obstructed
	Passenger may be unable to help due to medical condition

Problems related to the Return Trip Link, discussed in Table 8, are similar to the problems delineated for the Rider Transport Link. While passengers can encounter virtually the same problems on this link as on the earlier one, the passengers are probably more tired on the return trip and thus more sensitive to any type of service error or inconvenience.

Table 8

Return Trip Link: Problems and Causes

Problems	Causes
Rider finds trip unpleasant	Driver discourteous
	Vehicle radio music is too loud or annoying to passengers
	Rider has a second appointment and the driver was not told.
	Bus dirty
	Driver not helpful
	Traffic congestion
	Uncomfortable bus temperature
Rider finds trip unsafe	Driver did not obey traffic laws
	Poor road conditions
	Disruptive fellow passenger
	Van maintenance issues

4.5 Problem Solutions

Once the transit manager has identified specific problems and their causes for each service link, he or she should then devise ways to reduce the chance of mistakes or other service errors. This may involve modifying the behavior of drivers or riders, improving access to information, and instituting new operating procedures.

Table 9, which lists solutions to Rider-Dispatcher Link problems, illustrates that riders' lack of knowledge is one of the primary causes of problems at this stage. Both the transit system and DSS can share the task of rider training. The transit system can use improved signage, newsletters, and brochures to help riders understand how to request service in advance or check on regular routes. The dispatcher can also remind riders that a 24-hour notice is needed to schedule a ride. Agencies and DSS employees must be trained so that they can help riders read and understand the no-show policy, service eligibility rules, timetables and route maps.

Table 9

Rider/Dispatcher Link: Causes and Solutions

Causes	Solutions
Rider does not understand that 24-hour advance notice is required	Signage, newsletter
	Agency should brief the rider on the requirement
	Dispatcher reminds rider that advance notice is required
Rider may not be cleared to ride by the DSS	Better communication of eligibility rules to riders
Rider may be under suspension due to excessive no-shows	Provide rider written notification
Riders do not know how to access information about regular routes	Signage, newsletter
Rider cannot read the timetable	DSS representative
Rider does not understand route map	DSS representative
Dispatcher in a high-demand situation	Easy access to next day schedule
Dispatcher cannot pull up schedule on computer screen	Better scheduling software
Rider does not know how to request service	DSS representative
Requested pickup time is not available due to heavy demand or pickup point is in a rural location	More vehicles and drivers
	More efficient scheduling

Inaccurate or insufficient information can affect the DSS-Dispatcher Link, which is discussed in Table 10. The manager of this transit system addressed the problem of excessive waits to confirm rider eligibility for paratransit services by arranging for the DSS representative to work part of each day at the transit system office. Proximity of the DSS representative usually helped the dispatcher and scheduler to quickly resolve rider eligibility questions. However, in some cases, local agencies failed to provide timely no-show information to DSS. The transit manager addressed this problem by personally phoning in no-shows to DSS on a daily basis.

Table 10

DSS and Dispatcher Link: Causes and Solutions

Causes	Solutions
DSS liaison not consistently available	In house DSS liaison
	Use electronic media (voicemail/email)
Too long to access rider records	Electronic record of all appointments
DSS failure to record the no-show information	Better DSS technology
DSS is late recording the no-show information	Better DSS technology
Agency overlooks sending the no-show data to DSS	Transit manager phones in no-shows on a daily basis

Inaccurate information also caused problems in the Dispatcher-Scheduler Link. Table 11 indicates that better knowledge of appointment duration can reduce the possibility that wrong return pickup times are scheduled. At this transit agency, the scheduler learned how each local doctor's office operated and was able to estimate pickup times within a 30-minute margin of error.

Table 11

Dispatcher and Scheduler Link: Causes and Solutions

Causes	Solutions
Attention overload due to high demand	Easy access to next day schedule
	Additional secretary to answer and direct all phone calls
Schedule does not have sufficient or accurate information on return trip pickups	Better knowledge of duration of appointments
Uncontrollable conditions such as bad weather or accidents	Dispatcher calls doctor's office to see if rider can be late for the appointment

Inaccurate information also contributes to problems at the Scheduler-Driver Link. Table 12 indicates that better control over no-shows may help improve manifest accuracy. The manager of this transit system addressed the no-show problem by closely tracking no-show occurrences and by supporting the no-show policies used by the agencies served by

this transit system. Typically, one no-show results in a warning to the rider; two no-shows result in a 3-day suspension of riding privileges, and three no-shows result in a one-month suspension.

Manifest accuracy would also improve if drivers were aware of late cancellations. At this transit system, if a driver fails to call in before starting the pickup, the radio dispatcher radios late cancellations to the driver.

Table 12

Scheduler/Driver Link: Causes and Solutions

Causes	Solutions
Rider no-shows	Track and report no-shows to the agencies daily
	Support agency no-show policy
Driver may fail to call in before starting the pickup route so unaware of late cancellations	If driver does not radio the dispatcher, then dispatcher radios the driver
	Establish a call-in-line for each driver
Voicemail system does not work so can not leave message on need to cancel a ride	Two incoming telephone lines with separate voicemail systems.
	New telephone system

As Table 13 shows, the chief causes of late pickups and boarding problems on the Driver/Rider Pickup Link stem from schedule creep, adverse road and/or weather conditions, rider mistakes, and physical barriers to boarding. At this transit system, reduction of the number of no-shows helped to diminish schedule creep. In the event of adverse travel conditions, the dispatcher at this system may either call the doctor's office to try to reschedule the rider for a later appointment or may call the rider to cancel the pickup if the roads are unsafe. The dispatcher also helps prevent some of the riders' mistakes by asking them to be ready one hour early for pickups on long routes or by reminding a parent to bring along an approved child's seat if his or her child will be traveling in the van.

The Department of Social Services and individual agencies can also help to educate parents about the importance of approved safety seats when riders' children ride in the van and can explain how to obtain these seats free of charge from the local fire department. The fire department currently trains parents in the correct use of the safety seats. The Department of Social Services can further decrease rider error by educating riders about the need to cancel pickups if his/her plans change.

The transit manager regularly addresses the problem of physical barriers to boarding. If low tree branches obstruct access to a rider's driveway, either the transit manager or the operations manager will go to inspect the problem. Usually, they ask the city utility service to clear away the overhanging tree limbs. In this transit system, volunteers from the local churches and senior center volunteers help to fix ruts in riders' driveways or clear away fallen trees from driveways. Volunteers also build safe ramps for riders who need them but cannot afford to purchase one.

As mentioned earlier, safe ramps are essential to boarding safety; a driver may refuse to board a rider if the ramp seems unsound. If a rider's yard is inaccessible, the driver can call the local EMS, the operations manager or the transit manager for immediate help with the passenger.

Table 13

Driver/Rider Pickup Link: Causes and Solutions

Causes	**Solutions**
Schedule creep	Minimize no-shows
	Monitor drivers' driving times
Time of day	Add extra van
	Choose different routes
Adverse weather conditions	Dispatcher calls rider to cancel pickup if roads are dangerous
	Post notice on local radio, TV, and cable TV stations
Delays in route – accidents, road construction, etc.	Dispatcher calls doctor's office to see if rider can be late for appointment
Rider does not understand that he/she must be ready prior to pickup time	DSS representative
	Reminder cards for riders
	Dispatcher gives the rider a window on pickup time when he or she calls for a ride
	Dispatcher reminder
Rider misunderstanding	DSS/Agency representative
Rider forget to cancel ride appointment	DSS/Agency representative
Physical barrier to safe boarding	Volunteer agencies
	City or county services
Parent brings along child without approved child seat	Signage, newsletter, driver intervention, local radio, and TV spots
Inadequate, homemade ramps at passenger's home	Volunteer groups
No ramp available	Volunteer groups
No sidewalk so driver cannot push wheel chair from door to vehicle	Help from EMS, operations manager, transit manager, another driver or neighbors
Limbs obstructing driveway	Volunteer groups, city, county or state agencies
Ruts in driveway	Volunteer groups, family members
Fallen trees in driveway	Volunteer groups, family members
Driveway too long to drive down	DSS/Agencies
Driveway too steep	DSS/Agencies
Hearing impaired rider will not hear driver blowing the horn	Rider instructed to watch for the van and driver goes to the front door or window

Problem causes and solutions at the Rider Transport Link are summarized in Table 14. The manager at this transit system tries to prevent driver mistakes during this stage through various training programs. These programs not only teach drivers correct procedures for ensuring passenger safety, but also stresses driver helpfulness and sensitivity to riders' needs. The manager also requires drivers to complete incident reports when anything out of the ordinary occurs during a trip. Unusual occurrences may involve problems with the vehicle, passengers, access to boarding or accidents. The transit manager reads and personally follows-up on all incident reports.

Table 14

Rider Transport Link: Causes and Solutions

Causes	Solutions
Driver discourteous	Training, dashboard reminder, discipline
Bus dirty	Maintenance, driver training, discipline
Driver not helpful	Training, dashboard reminder, discipline
Traffic congestion	Schedule more trips during non-peak hours
Uncomfortable bus temperature	Maintenance
Driver did not obey traffic laws	Training, discipline
Disruptive passengers	Incident reports
	Driver intervention, intervention by the transit manager or DSS/Agencies
Accidents	Incident reports, police reports, training
Equipment failure	Incident report
	Maintenance

Table 15 shows that there are a number of causes of late pickups from the doctor's office. First, the dispatcher may be unaware that the passenger has not been picked up. While riders at this transit system are told to call the dispatcher when their appointments are over, they sometimes fail to do so. To help solve this problem, the dispatcher checks riders' names off a list as they are picked up from the doctor's office. The dispatcher can see at a glance which passengers still need a ride. If a rider is late phoning the transit office after an appointment, the dispatcher will try to work in the next available van for the pickup. A second cause of late pickups involves a driver failing to record a schedule change after the dispatcher has radioed it in. A simple dashboard reminder can help to

prevent this from happening. A third cause of late pickups is schedule creep. As discussed earlier, the transit manager focused on reducing the number of no-shows to minimize schedule creep. A final cause of late pickups dealt with incorrect information about appointment duration. As mentioned earlier, the scheduler at this transit system gained a good working knowledge of each doctor's office and how long appointments typically last at each office.

Physical barriers to boarding also cause problems at this link. Lack of curb breaks and obstructed curb breaks represent common barriers at this stage. Drivers note such problems in incident reports so that the transit manager can work to resolve the problem.

Table 15

Doctor's Office/Driver Link: Causes and Solutions

Causes	Solutions
Dispatcher not called that passenger ready for pickup	Dispatcher and driver instruct rider to call when appointment is over
	Dispatcher checklist
Schedule creep	Reduce no-shows
	Monitor driving times
Passenger late notifying dispatcher	Work in pickup if a van is available
Driver not immediately available for pickup	Work in pickup as van becomes available
Driver did not record on the manifest the schedule change that the dispatched radioed to him/her	Training, dashboard reminder
Scheduler did not estimate the length of the appointment correctly	Better information about duration of appointment
Barrier to efficient loading	Incident report
Lack of curb break or curb break obstructed	Incident report

Problem solutions on the Return Trip Link, which are listed in Table 16, are very similar to those on the Rider Transport Link. Since passengers are probably more tired at this point than they were earlier, the driver needs to be especially sensitive to riders' needs.

Extra courtesy and helpfulness at this stage can leave the rider with a more positive perception of the service they have received.

Table 16

Return Trip Link: Causes and Solutions

Causes	Solutions
Driver discourteous	Training, dashboard reminder, discipline
Bus dirty	Maintenance, driver training, discipline
Driver not helpful	Training, dashboard reminder, discipline
Traffic congestion	Schedule more trips during peak hours
	Select different routes
Uncomfortable bus temperature	Maintenance, driver training
Driver did not obey traffic laws	Training, discipline
Accidents	Incident report, police reports, training, discipline
Disruptive passengers	Incident report
	Driver intervention, intervention by the transit manager and DSS/Agency
Equipment failure	Incident report
	Preventive maintenance

4.6 Monitoring Service Quality

After a manager has chosen to implement new failsafe methods, he or she must determine their effectiveness. There is no way to determine if the new methods helped to improve service quality without devising adequate measures to monitor system performance. These measures must correspond to those aspects of transit service that the manager was trying to failsafe. For instance, at this transit system, the manager created a demand response form to capture data on assigned pickup times and actual pickup times for each rider. The data allowed the manager to monitor variances in pickup times and determine if the system was doing a better job in reducing wait times for passengers. Similarly, the manager collected data on the number of riders who were not ready when the van arrived for pickups; this type of data is useful for determining if passengers are complying with the rule to be ready in advance. Likewise, the manager collected data on the number of

suspensions by agency; this kind of data can be used to check which riders understand and comply with the eligibility rules.

4.7 Customer Feedback

Since quality improvement requires constant effort, the manager should routinely gather information on perceived service quality from transit customers and analyze their suggestions and complaints. At this transit system, the manager routinely administered a survey on needs and resources to agencies served by the system. This survey consisted of both scaled questions and open-ended questions. The scaled questions dealt with such issues as overall satisfaction with paratransit service, timely provision of service, dependability of service, professional skills of the drivers, interpersonal skills of the drivers and courteous and professional treatment by front office employees. The open-ended questions asked what the system could do to improve service to the agencies and their clients, what agencies considered the major shortfalls in current service, and what gaps existed in transporting clients to work. The manager at this system most recently administered the survey in fall 2004. Analysis of the comments revealed that not all clients were aware of the range of transit services provided by this system and that some customers simply did not understand how to use the system properly. For instance, one respondent did not realize that transport of patients on oxygen was already available while others felt that the system was not responsive to the timing of their scheduling requests. The manager decided that “refresher” training sessions for clients at participating agencies would be helpful. At such sessions, the trainer reviews the procedures for requesting service and also explains why certain rules were in place.

In addition to explaining how to use paratransit services, the trainer could also distribute wallet-sized cards listing the most important rules a rider must follow. Some attendees may benefit from having a handy “reminder card” to help them remember what to do to successfully access services. If the print is easy to read and the color of the cards is bright, riders may be more likely to keep them and refer to them.

5. Dissemination of Results

Technology transfer occurred throughout this project. Initial technology transfer occurred as the principal investigators worked with the transit manager in preparing the flow chart for a typical van ride, identifying service problems and their causes, and selecting survey items. Additional technology transfer took place as the principal investigators devised failsafe techniques in consultation with the transit manager of . Further technology transfer occurred when performance metrics were chosen. Broader technology transfer will occur when other managers of small urban and rural transit systems use the *Failsafe Guide* to help reduce service defects in their operations. In this instance, the *Guide* will not only provide each manager with a step-by-step method for mistake proofing operations, but will also help them to assess how well individual failsafe techniques worked in practice.

Results from this study will be presented at the Urban Transit Institute Research Showcase on March 23, 2005, at the School of Business and Economics at North Carolina Agricultural and Technical State University. As they have done in previous years, the principal investigators will disseminate their findings through the Newsletter of the North Carolina Public Transit Association (NCPTA) and will make the *Failsafe Guide* available to NCPTA members in an electronic format.

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