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16. Abstract

In recent years, the policy and regulatory environment for intercity passenger rail in the United States has shifted dramatically, sparking a renewed interest in intercity passenger rail among policymakers, planners, and the general public. As the nation expands its passenger rail network, a better understanding of the mobility provided by short- to medium-distance corridors is desired. This study examined the *Heartland Flyer*, a 206-mile intercity passenger rail route between Oklahoma City, Oklahoma, and Fort Worth, Texas. Researchers analyzed responses to an on-board survey, distributed to passengers in April and July of 2009, to identify who was using the service and how the service impacted regional mobility. The key measure used to identify the mobility impacts was the passengers' self-reported alternatives for travel if the *Heartland Flyer* were discontinued. This study also identifies the economic impact of the rail service, measured through total spending on certain items (and the associated sales tax revenue). The findings of this study can be used in a variety of potential applications for all levels of passenger rail planning, including statewide rail planning, corridor-specific studies, and station-area planning, both in the southwestern United States and in other regions.

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Measuring the Benefits of Intercity Passenger Rail: A Study of the *Heartland Flyer* Corridor

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ABSTRACT

In recent years, the policy and regulatory environment for intercity passenger rail in the United States has shifted dramatically, sparking a renewed interest in intercity passenger rail among policymakers, planners, and the general public. As the nation expands its passenger rail network, a better understanding of the mobility provided by short- to medium-distance corridors is desired. This study examined the *Heartland Flyer*, a 206-mile intercity passenger rail route between Oklahoma City, Oklahoma, and Fort Worth, Texas. Researchers analyzed responses to an on-board survey, distributed to passengers in April and July of 2009, to identify who was using the service and how the service impacted regional mobility. The key measure used to identify the mobility impacts was the passengers' self-reported alternatives for travel if the *Heartland Flyer* were discontinued. This study also identifies the economic impact of the rail service, measured through total spending on certain items (and the associated sales tax revenue). The findings of this study can be used in a variety of potential applications for all levels of passenger rail planning, including statewide rail planning, corridor-specific studies, and station-area planning, both in the southwestern United States and in other regions.

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EXECUTIVE SUMMARY

INTRODUCTION

In its December 2007 *Transportation for Tomorrow* report, the National Surface Transportation Policy and Revenue Study Commission identified the need for a "fast and reliable" intercity passenger rail network as a key component of America's mobility future, citing increased congestion in existing highway and air transportation networks as well as the energy efficiency of rail passenger transport in support of its recommendation. The Commission further recommended that enhancements or additions to the nation's passenger rail network should focus primarily on intercity corridors between 100 and 500 miles in length. In these corridors, intercity rail can be a reasonably competitive alternative to highway or air travel on a travel time basis. By diverting some short- to medium-distance trips from highway or air modes, passenger rail can play a critical role in relieving congestion on major intercity corridors (*1*).

In September 2008, the Texas Transportation Institute initiated this research study, funded by the Southwest Region University Transportation Center, with the primary objective to examine the impacts of intercity passenger rail on regional mobility. Since the study's inception, the rail policy and planning climate in the United States has shifted dramatically. In October 2008, the *Passenger Rail Investment and Improvement Act of 2008* (PRIIA) established new paradigms for the government's role in the provision of intercity passenger rail (*2*). In April 2009, the Federal Railroad Administration released its *Vision for High-Speed Rail in America*, which outlined the use of $8 billion of funds from the *American Recovery and Reinvestment Act of 2009* (ARRA) to stimulate job growth by investing in passenger rail infrastructure (*3*). In January 2010, the distribution of the ARRA funding for intercity passenger rail was announced, with 31 states receiving funds (*4*). Collectively, these events have sparked a renewed interest for intercity passenger rail among policymakers, planners, and the public.

As the nation moves forward with the development of a more robust intercity passenger rail network, the burden falls upon policymakers to ensure that states utilize the significant investment of public resources necessary to build such a system in the most efficient manner possible. Given that the future of passenger rail in the United States appears to be primarily in

short- to medium-distance intercity corridors between 100 and 500 miles in length, a detailed understanding of the regional mobility provided by these corridors is critical to the nation's goals for expanding its passenger rail system. Understanding passenger rail's role in supporting regional and intercity mobility is important for rail planners, who are tasked with developing investment and service strategies for existing or proposed passenger rail service; and also for policymakers, who are responsible for the efficient use of public resources for improving mobility. Arguably, the southwest region of the United States has lagged behind other regions of the country in the development of intercity passenger rail corridors. Consequently, the primary objective of this study was to gain a greater understanding of the mobility implications of providing passenger rail service in a short- to medium-distance (100 to 500 mile) intercity travel corridor with an emphasis on the southwestern United States. The passage of PRIIA and its emphasis on the benefits associated with public investment in intercity passenger rail provided a secondary objective for this study, which was to develop a detailed methodology for the use of an on-board passenger survey to measure the impacts of intercity passenger rail. The need to develop a robust methodology was strengthened by the provisions of ARRA, which emphasized accountability and transparency in the use of ARRA funds, including funds for improving intercity passenger rail. As a result, this research study is both relevant and timely above and beyond the original motivation of studying passenger rail's impact on mobility in short- to medium-distance intercity corridors.

LITERATURE REVIEW

Intercity Passenger Rail in the United States

In the United States, the National Railroad Passenger Corporation, better known as Amtrak, operates intercity passenger rail services. Amtrak's nationwide passenger rail system includes more than 21,000 miles of routes with 500 destinations in 46 states. The Amtrak system route structure is divided into three components: the Northeast Corridor spine, state-supported and other short-distance corridors, and long-distance routes (*5*). The primary concern of this study was Amtrak's state-supported routes and how these routes impact mobility in the intercity corridors they serve. These are routes where states or groups of states have entered into a contractual agreement with Amtrak to provide financial support for the operation of passenger

rail service along intercity corridors. The policy basis for state-supported passenger rail service was established in Amtrak's founding legislation, the *Rail Passenger Service Act of 1970*, which outlined the cost-sharing structure between Amtrak and partner states (*6*). As of September 2009, 14 states contracted with Amtrak to operate 19 intercity passenger rail routes. Total ridership on state-supported routes for the 12-month period ending September 2009 was 10,277,003 passengers, or about 38 percent of the total Amtrak ridership over that time period (*7*). Current figures show that contracts for state-supported service account for more than $164 million in revenue to Amtrak annually, with the largest such contract being the State of California, valued at $74 million (*8*). Funding sources used by the states to support passenger rail include general revenue funds, federally designated grants, gasoline tax, vehicle registration, or specialty license plate revenues (*9*).

Past Studies of State-Supported Rail Corridors

The literature review element of this study included a comprehensive review of past studies of state-supported passenger rail corridors. Researchers identified a total of 41 past on-board surveys of passengers on state-supported intercity passenger rail routes in 10 of the 14 states currently supporting service. Collectively, these studies offered valuable insight on the current state of the practice for on-board surveys of state-supported intercity passenger rail corridors. Of the 41 studies identified in the literature review, slightly less than half (19) were sponsored by state departments of transportation (DOT). The remaining studies were sponsored by Amtrak, the rail corridor's administrative authority, metropolitan planning organizations, or a University Transportation Center. Of the 19 studies sponsored by a state DOT, 13 were undertaken within the department's administrative unit assigned to passenger rail while the remaining six were evenly distributed among other DOT agencies, consultants, and University-based researchers. Among the 19 DOT-sponsored studies, 9 studies resulted in the development of a published report while the remaining 10 studies were provided to researchers as unpublished data summaries or raw data sets. Furthermore, only three of the published studies were developed by the DOT's administrative unit assigned to passenger rail; the other six were from studies that had been contracted to other internal DOT divisions or an external organization (consultant or University research consortium). These findings suggest that, within the rail

administrative unit of the DOT, resources for the development of formal documentation of on-board survey data are scarce.

In terms of formal survey programs, the Capitol Corridor Joint Powers Authority (CCJPA) manages the most robust on-board passenger survey program among all the state-supported passenger rail routes, conducting semi-annual on-board surveys of *Capitol Corridor* passengers since December 1999 supported by the Agency's annual marketing budget of approximately $1.2 million (*10*). On-board surveys of state-supported intercity passenger rail routes in other states appear to be relatively infrequent. Certain states, most notably Michigan, North Carolina, and Wisconsin, appear to have a quasi-regular program of passenger surveys within their departments of transportation, having engaged multiple rounds of on-board survey data collection on their routes in the last decade. Other reports or studies obtained in this literature review appear to have been ad hoc or one-time research efforts.

The purpose or motivation to deploy on-board surveys of state-supported corridor passengers also varied among the states currently supporting passenger rail service. Motivations cited by the studies reviewed included basic information gathering about the current users of state-supported rail service and the evaluation of on-board services, including customer service and amenities. Most of the studies identified in this review were generally designed to examine rail passengers' response to a central question, such as proposed high-speed rail service or measuring economic impacts. This was true for both continuing survey programs as well as ad hoc or one-time research efforts. In one study, on-board survey data were used to identify the residential location of passengers, which supported the negotiation of a cost-sharing agreement between the two states where the service operated. The infrequent nature of on-board rail passenger surveys is not surprising, given that the limited budget available for supporting intercity passenger rail service is oversubscribed, funding for service evaluation or marketing activities may be even harder to obtain.

Intercity Passenger Rail Planning

Planning for intercity passenger rail service encompasses a broad range of activities from adjusting service configurations (frequencies or on-board amenities, for example) to the establishment of new routes where no service currently exists. Presently, intercity passenger rail

planning faces a variety of challenges, including a lack of expertise and resources at the agency level, in part due to the relatively low investment in intercity passenger rail in the United States in the last 50 years. As a result, there are limited examples of "best practices" or "on-the-ground" implementation of passenger rail from which to build a knowledge base to guide new investments. This is less of an issue for other modes, where rich time-series and cross-sectional data sets are available to the analyst. Other challenges facing intercity passenger rail planning include evolving travel demand models, the need to develop multi-state partnerships, and the need to identify cost-sharing agreements with private freight railroad companies. Rail planning at the public-agency level, for both passenger and freight rail, is expected to increase in the coming years (mostly due to PRIIA language and regulations), which will ultimately result in better-defined participant roles and increased technical capacity at the public agency level.

Demand modeling for "conventional" intercity passenger rail services can vary in scope and complexity of data requirements. Sketch-level models can be applied with simple and easily accessible data elements (such as Census data) but are limited in accuracy. Comparison between the proposed passenger rail corridor and "peer" corridors is also used in practice. More complex models, including the Amtrak demand estimation model, require more advanced (and costly) specification and calibration but produce demand forecasts with greater detail. Demand modeling for high-speed passenger rail is particularly challenging, given that few high-speed rail projects exist in the United States today. As a result, the primary source of data for high-speed passenger rail planning is stated preference responses from potential users of the proposed service. In turn, analysts incorporate these responses into complex travel demand models that are often quite expensive to develop at an acceptable level of precision. The most common technique used to estimate demand for proposed high-speed passenger rail routes is to estimate passenger diversion from existing travel modes (generally automobile and air carrier) separately, as the characteristics of passengers using each of these modes and their propensity to divert to high-speed rail are different. Induced demand is generally related to the amount of diverted demand, and also depends upon increased travel accessibility resulting from the proposed service. In certain situations, rail planners can utilize data from a statewide travel demand model to estimate demand for proposed passenger rail services.

Survey Design

The on-board passenger survey is an efficient method for data collection involving transit properties. The primary advantage of the on-board survey is that it provides access to a target population that might not be otherwise easy to identify with other data collection methods (*11*). For intercity passenger rail, the on-board survey is particularly effective. Passenger trips on low-density intercity passenger rail routes may be rather infrequent and consist of only a small percentage of overall urban area residents; as such, data collection via a household travel diary survey would be substantially less effective than an on-board passenger survey (*12*). The on-board survey also offers the opportunity for direct sampling, which the analyst can use to draw conclusions about the entire population of passengers if he or she uses a robust sampling design.

There are several variations of the on-board survey data collection method, all involving the initial contact with the respondent and distribution of the survey materials taking place on-board the transit vehicle. Completed surveys can either be collected by survey staff on-board the vehicle (the "hand-in" option) or mailed back to a central processing facility by the respondent (the "mail-in" option). Each method has its advantages and drawbacks. If the research design calls for the passenger's completed survey is to be returned to the analyst during the trip, response rates are likely to be higher but time to complete the survey may be an issue if the respondent's trip is short in duration. The "hand-out/mail-in" option does provide the respondent greater time to complete the survey, although there is a greater chance the respondent will neglect the entire survey after departing the vehicle (*13*).

As with all survey-based data collection efforts, the design of the survey instrument is critical to the quality of the responses provided. While most of the literature on the subject of on-board surveys for transit properties was focused on the urban transit application, the lessons for survey design are generally still pertinent for on-board surveys of intercity rail passengers. In addition to guidance from survey design literature, researchers conducted an analysis of 18 survey instruments from past studies of state-supported intercity passenger rail routes to identify trends for the design of the survey instrument in this study. Surveys ranged in length between two and eight pages, but most surveys were four pages long. Common elements on the survey instruments reviewed included passenger trip frequency (100 percent of surveys), passenger origin, boarding, alighting, and destination (OBAD) data (94 percent), passenger demographics (89 percent), and passenger trip purpose (78 percent). Passenger alternative mode

of travel (in the absence of rail service) and passenger reasons for choosing rail for their trip were included on two-thirds of the surveys reviewed. Less common elements included on the survey instruments reviewed were service changes to increase rail trip frequency (28 percent) and non-rail related economic impacts (11 percent). Most survey items in the review were found to be "revealed preference" questions, except for the alternative travel mode question, which is characterized as a "stated preference" question. Detailed analysis of the alternative travel mode question wording and choice set found that questions presented the hypothetical scenario (where the rail service did not exist) in different ways while the choice set was generally consistent with available modes of travel in the intercity corridor. To identify passengers that would forgo their trips in the absence of the rail service, "Would Not Make Trip" or similar was included as a choice in this question, although some surveys took a different approach.

STUDY ROUTE: *HEARTLAND FLYER*

The route the authors selected for this study was named the *Heartland Flyer*, which operates along a 206-mile route between Oklahoma City, Oklahoma, and Fort Worth, Texas. Intermediate communities served by the *Heartland Flyer* included Norman, Purcell, Pauls Valley, and Ardmore in Oklahoma and Gainesville in Texas (*14*). The states of Oklahoma and Texas provide financial support for the *Heartland Flyer* route, with each state contributing nearly $2 million annually toward the route's operations (*15*). BNSF Railway Company owns the infrastructure over which the *Heartland Flyer* operates (*14*). In January 2010, the Texas Department of Transportation was awarded a $4 million ARRA grant to upgrade equipment and signal timing at 15 crossings along the route, which will increase train speeds and reduce running time on the *Heartland Flyer* by nearly 17 minutes (*4*). Expansion proposals for the route include northern extensions to Tulsa, Oklahoma, or Kansas City, Missouri, via Wichita, Kansas, and an additional station stop in Krum, Texas, near Denton.

Since the inaugural run of the *Heartland Flyer* on June 14, 1999 (10 years, 3½ months), more than 657,000 passengers have made trips on the service. For the 12-month period ending September 2009, a total of 73,564 passengers rode on the *Heartland Flyer*, and ridership has grown consistently at approximately 8 percent annually since 2003. Since 1999, ticket revenues have totaled more than $12.2 million and revenue from food and beverage has exceeded $1.4

million. Ridership during months when school is not in session (May, June, July, and August) is above average, with July ridership approximately 1.5 times the average levels. Ridership is also above average in March, which corresponds to traditional spring break weeks. January, February, and September appear to be the lowest-demand months while ridership during the remaining months (April, October, November, and December) is approximately average. The busiest station for the *Heartland Flyer* was Fort Worth, with more than 61,000 passengers boarding or alighting at the station for the 12-month period ending September 2009.

DATA COLLECTION

On-Board Passenger Survey

The survey instrument used in this study was two pages in length and contained 21 total questions about the passengers' origin and destination, travel modes to and from the rail station, trip purpose, alternative travel mode, trip frequency, reasons for choosing the *Heartland Flyer* for their trip, personal spending, and demographics. In the survey design process, researchers developed as many questions as possible as "closed" questions, or questions with a defined set of answers from which to choose. This was important because having closed questions reduced respondent burden (which increased response) and also aided the quality control process by eliminating the need to interpret the meaning of responses provided to "open" questions. Stakeholders provided guidance to the researchers on the design of the survey instrument and also the data collection procedure, which resulted in several modifications to the proposed data collection plan. One stakeholder recommendation was the use of an opaque box with an opening in the top located in the café car for passengers to drop off completed survey forms. Since this study involved interaction with human subjects, researchers were required to receive approval from the Texas A&M University Office of Research Compliance's Institutional Review Board (IRB) before undertaking any data collection.

The data collection procedure resembled a "hand-out/hand-back" scheme, with researchers passing through the train distributing surveys at the start of each train run and periodically passing back through to collect completed survey forms from the passengers. All passengers who appeared to be 18 years of age or older were asked if he or she wished to

participate in the study. Throughout the entire duration of the data collection effort, coordination between researchers and the *Heartland Flyer* on-board staff was extremely beneficial. The on-board staff allowed researchers to board the train before the passengers to prepare the data collection materials. Finally, on-board staff also provided researchers with estimated passenger counts for the particular run, in order to prepare for the number of surveys to distribute. The on-board staff provided guidance to researchers on where passengers who had boarded at intermediate stations were seated, to avoid confusion as to which passengers had already been surveyed. Without the valuable assistance and support provided to the researchers by the on-board staff, the data collection phase of this study would undoubtedly have been much more difficult.

On-board survey data collection for this study took place in April and July of 2009. The months of the data collection corresponded to the average (April) and the peak (July) travel seasons for the *Heartland Flyer*. In April, a total of 877 passengers boarded the *Heartland Flyer* during the ten data collection runs (April 22-26), from which researchers obtained a total of 435 valid survey forms. In July, 1,161 passengers rode the *Heartland Flyer* during the seven data collection runs (July 22-25), from which a total of 588 valid survey forms were returned. During both study periods, approximately two-thirds of passengers were eligible to participate in the study. Passengers that were not eligible for participation in the survey included minors, passengers traveling as part of an organized group, and a handful of other passengers. For both April and July, the total participation rate was 76 percent of those eligible. The causes of non-participation were not formally tabulated, but a majority of the non-participants consisted of those passengers that simply declined to participate in the study. In general, response rates for intercity passenger rail on-board surveys are high, likely due to the fact that the passenger is "captive" on the train for a long enough period of time to complete the survey.

Quality Control

Prior to initiating the analysis phase of the study, researchers performed a systematic quality control review of the raw data. Three major sources of error in transportation surveys are non-response (i.e., non-participation), inaccurate reporting, and non-reporting. Inaccurate reporting, also known as measurement bias, occurred when the analyst determined that a

response provided to a survey question was incorrect, inaccurate, or incomplete. In the *Heartland Flyer* survey, primary sources of inaccurate reporting included "other" responses to survey questions and respondents that provided multiple responses where only one response was requested. Inaccurate reporting was treated by recoding or discarding survey responses from the analysis. Non-reporting errors occurred when a survey form was returned with valid answers to one or more questions not provided. One example of non-reporting was when respondents neglected to complete the reverse side of the survey. A measure of effectiveness for non-response is the per-item response rate, defined as the percent of responses for a particular survey item that are valid for the analysis. While the per-item response rate could not be improved for most survey items (14 out of 23 total items), the quality control process used in this study increased the cumulative per-item response rate by about two percentage points to around 90 percent for both survey periods. The response rate for some survey items, such as annual household income, remained less than 90 percent even after the quality control.

DATA ANALYSIS

Survey Findings: Travel Characteristics

A majority of the passenger activity identified from the survey on the *Heartland Flyer* occurred at the route's endpoints of Oklahoma City and Fort Worth. This is not surprising as these are the two largest population centers along the route. Most *Heartland Flyer* passengers accessed the rail service in some sort of automobile, either as a driver or a passenger of a vehicle that parked at the station or a passenger being dropped off or picked up at the station. Collectively, these three modes accounted for at least two-thirds of the passengers' travel to or from the rail station during both study periods. Mode splits by station were generally consistent with the overall mode split and also reflected the number of available modes at each station. The median travel time reported by passengers to and from the rail station was approximately 20 minutes during both April and July. Frequently cited trip purposes among *Heartland Flyer* passengers were primarily non-business trips, including trips to visit family and friends and leisure or recreation trips. These trips accounted for more than 75 percent of the total passengers surveyed. Vacation travel comprised a relatively high percentage of trips on the *Heartland Flyer* in July, with about 15 percent of passengers reporting this purpose. Trips for personal business,

such as medical appointments or funerals, comprised approximately 5 percent of the total travel in both seasons. Business travel and personal business appeared to be more frequent on weekdays rather than weekends, another reasonable finding.

Survey Findings: Passenger Characteristics

Passenger characteristics examined in this study revealed a wealth of information about who is using the *Heartland Flyer* service. A majority of passengers were infrequent riders of the service, with 86 percent of those surveyed in April and 92 percent of those surveyed in July having made between one and four trips in the last year. The median trip frequency was approximately two one-way trips or the equivalent of a single round-trip in the last 12 months. Approximately half of the passengers surveyed reported making a round-trip on the *Heartland Flyer* on the day of the survey, but this trend was not reflected in passenger responses for the number of nights away from home on the trip. This suggests that the *Heartland Flyer* trip was part of a larger trip tour such as a weekend getaway or vacation. In both April and July, the two most frequently cited reasons for choosing the *Heartland Flyer* were passenger comfort and cost, with more than a third of passengers reporting these reasons. Approximately three-quarters of *Heartland Flyer* passengers reported an Oklahoma zip code for their residence, while 20 percent of passengers reported a Texas residence. Not surprisingly, a majority of *Heartland Flyer* passengers reported residences near Oklahoma City or Norman. The distribution of passenger zip codes around the Dallas-Fort Worth Metroplex was fairly uniform across the region. Also, a relatively high number of passengers reported residential zip codes around the Tulsa region.

Most travel parties consisted of solo travelers or couples, and a majority of *Heartland Flyer* passengers were traveling with no children under the age of 18 in the travel party. In July, there were a higher percentage of one- and two-child parties; this was not surprising, as it was during the summer when school was not in session. Females comprised at least 60 percent of the total ridership during both study periods. The distribution of passenger ages was fairly uniform with a slight skew toward passengers in older age groups, with a median passenger age of 51 in April and 48 in July. Approximately half of *Heartland Flyer* passengers were employed on a full-time basis, while approximately one-quarter of the passengers were retired. Nearly all of the *Heartland Flyer* passengers surveyed lived in a household with at least one vehicle, with the

median number of household vehicles reported as 1.7 and 1.6 in April and July, respectively. Zero-vehicle households comprised about 4 percent of the respondents in April and 3 percent of the respondents in July. Median annual household income was $65,900 in April and $57,000 in July. Low-income travelers (annual household incomes less than $20,000) accounted for about 16 percent of the travelers in each study period.

Mobility Impacts

The primary objective of this study was to identify the mobility impacts of providing passenger rail service in an intercity corridor, using the *Heartland Flyer* corridor as a case study. Examining how passenger rail supports mobility in an intercity corridor can reveal how the provision of service affects progress toward larger policy goals such as safety, transportation network efficiency, and asset preservation. The key measure used in this study to identify the mobility impacts of the rail service was the passengers' self-reported alternatives for travel if the *Heartland Flyer* were discontinued. Approximately 60 percent of passengers reported that they would use an automobile for their trip, with most of these passengers driving a private vehicle for the trip. Less frequently cited travel mode alternatives were commercial airline (6 percent) and intercity bus (3 percent). Notably, nearly 30 percent of *Heartland Flyer* travelers reported that they would forgo their trip if the service was discontinued.

Using the total *Heartland Flyer* ridership for the 12-month period ending September 2009, researchers estimated the number of modal diverted and induced trips on the service. Researchers estimated that the *Heartland Flyer* rail service diverted an estimated 39,427 vehicle-trips from parallel roadways in the intercity travel corridor between Oklahoma City and Fort Worth. A vast majority (95 percent) of these vehicles were personal vehicles, while the balance was either rental cars or company-owned vehicles. From these estimates of automobile traveler diversion onto the *Heartland Flyer*, other sketch-level measures can be computed to gauge how the passenger rail service supports other transportation policy goals. Assuming that, on average, each diverted vehicle-trip would have traveled approximately 200 miles, researchers estimate that the *Heartland Flyer* rail service removes approximately 7.9 million annual vehicle-miles traveled (VMT) from parallel roadways. Researchers estimate that almost 4,400 commercial airline passenger trips and more than 2,200 intercity bus passenger trips were diverted onto the

Heartland Flyer annually. Induced trips, or trips that would not have happened if the *Heartland Flyer* service did not exist, accounted for more than 20,000 rail passenger trips annually.

Economic Impacts

The economic impacts of a particular transportation system element (such as the *Heartland Flyer* passenger rail service) can be thought of as direct or indirect, with a variety of metrics available to evaluate these impacts (*16*). Direct economic impacts include the jobs of persons employed by Amtrak who work on the *Heartland Flyer* and Amtrak's expenditures for goods and services related to the *Heartland Flyer* operations. Indirect impacts include an increase in land values around rail stations or the spending on goods and services by rail passengers during their train trip, as well as the "multiplier" effects of the direct spending.

Researchers used a "direct measurement" approach to identify the economic impacts of the *Heartland Flyer* service. Specifically, passengers were asked to report on the survey how much they spent on certain items (lodging, meals, shopping, and entertainment) during their trip. Based on these responses, researchers computed the median spending level on these items per passenger to be approximately $120 in April and $160 in July. One potential economic benefit of passenger rail service easily identified from the survey responses by researchers was the spending level of passengers at their destination, both total spending and the associated sales tax revenue. Researchers estimated that *Heartland Flyer* passengers spent approximately $18 million on lodging, meals, shopping, and entertainment on their trips. Passenger spending in communities along the route ranged from around $50 per passenger in Pauls Valley to $170 per passenger in Fort Worth. Passenger spending in Oklahoma City and Norman was computed to be around $120 per passenger, while Gainesville was slightly over $100 and Ardmore slightly under $90 per passenger. No survey records were identified with Purcell as the destination station; as a result, no passenger spending is reported for that station. However, that does not mean there are no spending impacts in Purcell, just none reported in this survey.

The sales tax impact of the *Heartland Flyer* on the communities it serves appears to be rather substantial. Purchases made by *Heartland Flyer* passengers resulted in estimated total sales tax revenue of almost $1.4 million to the communities served by the *Heartland Flyer*. The distribution of this sales tax revenue is $731,412 in Texas (53 percent) and $654,254 in

Oklahoma (47 percent). Researchers estimate that passengers who reported that they would forgo their trip in the absence of the *Heartland Flyer* spent an average of $162.75 on lodging, meals, shopping, and entertainment during their trips, or about $14 more than passengers who would make their trip using alternative travel modes.

POTENTIAL APPLICATIONS

The findings of this study can be used in a variety of potential applications for all levels of passenger rail planning, including statewide rail planning, corridor-specific studies, and station-area planning. For the southwestern United States, the findings are particularly useful for rail planning activities, as they represent a comprehensive examination of the only intercity passenger rail route currently in operation in the region. For the formation of state transportation policy, these findings can be used to demonstrate the transportation system impacts of intercity passenger rail in short- to medium-distance intercity corridors to policymakers, agency executives, and other stakeholders with a contribution to the development of state transportation policy. The findings of this study can also be used to educate the public on the impacts of passenger rail in local areas. The economic impacts findings, for example, could support rail planners' efforts to obtain local stakeholder buy-in for passenger rail service improvements or expansion. Findings can also be utilized in the writing of grant applications related to specific provisions of PRIIA or future intercity passenger rail funding programs. Applications for infrastructure project funds, for example, can be supported with the findings of this study that demonstrate the congestion reduction benefits related to intercity passenger rail. The extent to which a project can contribute to reducing congestion on the highway or air network was specifically listed as a criterion for evaluating projects for funding under these provisions. Also, the development of state rail plans as described by PRIIA can benefit from these findings. Considerations for project inclusion in state rail plans also include criteria related to congestion reduction and economic development. Measures of both criteria were identified in this study.

In addition to statewide passenger rail planning applications, rail planners can also use the findings of this study to guide the development of planning studies and other activities related to proposed passenger rail service in short- to medium-distance intercity corridors where no service currently exists. Specifically, the mobility and economic benefits associated with the

Heartland Flyer identified in this study can be used as a starting point to identify the benefits that could be accrued from the development of passenger rail service in other intercity corridors. One strategy used by planners when considering new intercity passenger rail service is to identify an existing passenger rail corridor with characteristics that are similar to the proposed corridor and use information from these "peer" corridors to support their planning activities. New passenger rail routes, particularly those in the southwestern United States, may share many similar characteristics to the *Heartland Flyer*. As new passenger rail corridors in the southwest region of the United States are proposed, rail planners can use the findings of this study to develop sketch-level estimates of the impacts of the proposed service. Benefits of enhancing or expanding existing service, including the *Heartland Flyer* route, can also be identified through the findings of this study.

Another potential application of this study related to future intercity passenger rail planning is the lessons learned from the survey design, data collection procedures, and quality control methodology developed for and used in this study. The analysis of the content of the survey instruments used in past on-board surveys of intercity rail passengers in this study can provide valuable insight on the design of future studies of this type. Lessons learned during the data collection procedure (particularly the benefits of the support and involvement of the on-board staff) will be useful in the design and execution of future on-board surveys of intercity passenger rail passengers. Proposed development of high-speed passenger rail in the United States will likely result in the need to deploy studies similar to the one described in this report to measure progress toward major policy initiatives and ensure that funding is being distributed accordingly. While the characteristics of passengers using future high-speed rail routes are likely to differ from the characteristics of the *Heartland Flyer* passengers in this study, the methodology utilized in this study can be transferred into a high-speed rail on-board survey application with few, if any, modifications.

REFERENCES

1. National Surface Transportation Policy and Revenue Study Commission. *Transportation for Tomorrow: Report of the National Surface Transportation Policy and Revenue Study Commission*, Volume I: Recommendations, December 2007.
2. *Passenger Rail Investment and Improvement Act of 2008*. Public Law No. 110-432 (Division B-Amtrak), 122 STAT. 4907, October 2008.

3. U.S. Department of Transportation, Federal Railroad Administration. *Vision for High-Speed Rail in America: High-Speed Rail Strategic Plan*, FRA, Washington, D.C., April 2009.
4. U.S. Department of Transportation, Office of Public Affairs. "President Obama, Vice President Biden to Announce $8 Billion for High-Speed Rail Project across the Country." News Release No. DOT 18-10, Washington, D.C., January 28, 2010.
5. National Railroad Passenger Corporation. *Amtrak National Fact Sheet: FY 2008*. Amtrak Media Relations, Washington, D.C., February 2009.
6. *Rail Passenger Service Act of 1970*. Public Law No. 91-518, 84 STAT. 1328, October 1970.
7. National Railroad Passenger Corporation. "Amtrak Posts Second-Best Ridership in History." Amtrak Media Relations, News Release No. ATK-09-074, Washington, D.C., October 12, 2009.
8. National Railroad Passenger Corporation. *Amtrak: Corridor & State Trains Fact Sheet: FY 2008*. Amtrak Media Relations, Washington, D.C., February 2009.
9. Morgan, C.A., J.E. Warner, C.E. Roco, and S.S. Roop. *Funding Strategies and Project Costs for State-Supported Intercity Passenger Rail: Selected Case Studies and Cost Data*. Publication FHWA/TX-05/0-4723-1. Texas Transportation Institute, The Texas A&M University System, College Station, Texas, June 2005.
10. California Department of Transportation. *California State Rail Plan 2007-08 to 2017-18*. Sacramento, California, March 2008.
11. Schaller, B. *On-Board and Intercept Transit Survey Techniques*. Transit Cooperative Research Program, Synthesis of Transit Practice 63. Washington, D.C., 2005.
12. Cambridge Systematics, Inc. *Travel Survey Manual*. Prepared for U.S. Department of Transportation and U.S. Environmental Protection Agency. Washington, D.C., June 1996.
13. Richardson, A.J., E.S. Ampt, and A.H. Meyburg. *Survey Methods for Transport Planning*. Melbourne, Australia, Eucalyptus Press, 1995.
14. National Railroad Passenger Corporation. *Amtrak System Timetable Fall 2009-Winter 2010*. NRPC, Washington, D.C., Effective October 26, 2009.
15. Texas Transportation Commission. Minute Order #111936, August 27, 2009.
16. Weisbrod, G., and B. Weisbrod. *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*. Transportation Research Circular #477. Washington, D.C., October 1997.

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CHAPTER 1: INTRODUCTION

In its December 2007 *Transportation for Tomorrow* report, the National Surface Transportation Policy and Revenue Study Commission identified the need for a "fast and reliable" intercity passenger rail network as a key component of America's mobility future, citing increased congestion in existing highway and air transportation networks as well as the energy efficiency of rail passenger transport in support of its recommendation. The Commission further recommended that enhancements or additions to the nation's passenger rail network should focus primarily on intercity corridors between 100 and 500 miles in length (*1*). In these corridors, intercity rail can be a reasonably competitive alternative to highway or air travel on a travel time basis. By diverting some short- to medium-distance trips from highway or air modes, passenger rail can play a critical role in relieving congestion on major intercity corridors.

In September 2008, the Texas Transportation Institute (TTI) initiated this research study, funded by the Southwest Region University Transportation Center (SWUTC), to examine the impacts of intercity passenger rail on regional mobility. Since the study's inception, the rail policy and planning climate in the United States has shifted dramatically. In October 2008, Congress passed and President George W. Bush signed into law Public Law #110-432 (Division B), the *Passenger Rail Investment and Improvement Act of 2008*, or PRIIA (*2*). The provisions of PRIIA, discussed in greater detail throughout this report, represent the foundation for a new paradigm of passenger rail in the United States. Groundbreaking language in PRIIA included new capital investment programs with a substantial federal funding match structure and a new federal-state partnership for the development of state rail plans, including passenger rail components. In April 2009, the Federal Railroad Administration (FRA) released its *Vision for High-Speed Rail in America*, which outlined the use of $8 billion in funding from the *American Recovery and Reinvestment Act of 2009* (ARRA, which was signed into law by President Barack Obama in February 2009) to stimulate job growth by investing in the nation's passenger rail infrastructure (*3*). In January 2010, the distribution of the $8 billion of ARRA funding for intercity passenger rail investment was announced, with 31 states receiving funds (*4*). Collectively, these events have sparked a renewed interest for intercity passenger rail among policymakers, planners, and the general public. As a result, this research study is both relevant

and timely above and beyond the original motivation for studying passenger rail's impact on mobility in short- to medium-distance intercity corridors.

RESEARCH OVERVIEW

As the nation moves forward with the development of a more robust intercity passenger rail network, the burden falls upon policymakers to ensure that states utilize the significant investment of public resources necessary to build such a system in the most efficient manner possible Given that the future of passenger rail in the United States appears to be primarily in short- to medium-distance intercity corridors between 100 and 500 miles in length, a detailed understanding of the regional mobility provided by these corridors is critical to the nation's goals for expanding its passenger rail system. Understanding passenger rail's role in supporting regional and intercity mobility is important for rail planners, who are tasked with developing investment and service strategies for existing or proposed passenger rail service, and also for policymakers, who are responsible for the efficient use of public resources for improving mobility. Arguably, the southwest region of the United States has lagged behind other regions of the country in the development of intercity passenger rail corridors. Consequently, the problem examined by this study was to identify how passenger rail supports mobility in short- to medium-distance intercity corridors with an emphasis on the southwest region of the United States. The intercity passenger rail route that was selected for this study was the *Heartland Flyer*, a 206-mile route between Oklahoma City, Oklahoma, and Fort Worth, Texas. Amtrak operates the *Heartland Flyer* with financial support provided by the states of Oklahoma and Texas (*5*).

Study Objectives

The primary objective of this study was to gain a greater understanding of the mobility implications of providing passenger rail service in a short- to medium-distance (100 to 500 mile) intercity travel corridor through an analysis of responses to an on-board survey of passengers on the *Heartland Flyer*. Mobility was measured through stated passenger preferences for alternative travel arrangements if the rail service did not exist. An estimate of the number of automobile, intercity bus, and air trips diverted onto the passenger rail route, as well as the number of trips that are induced by the provision of passenger rail service in the Oklahoma City

to Fort Worth intercity corridor was also developed. The October 2008 passage of PRIIA (*2*) and its emphasis on the benefits associated with public investment in intercity passenger rail provided a secondary objective for this study, which was to develop a detailed methodology for the use of an on-board passenger survey to measure the impacts of intercity passenger rail. The need to develop a robust methodology was strengthened by the provisions of ARRA, which emphasized accountability and transparency in the use of ARRA funds, including funds for improving intercity passenger rail (*3*). While developing this methodology was already a task of the study, additional emphasis in this area was added.

Project Tasks

To accomplish the study objectives, seven tasks were proposed. A brief description and summary of the project tasks are provided as follows:

- **Task 1, Literature Review:** The focus of the literature review included identifying methods used by planners to forecast ridership for intercity passenger rail routes with an emphasis on estimating the diverted and induced travel components as well as the design of on-board surveys for intercity passenger rail routes.
- **Task 2, Design of Survey Instrument:** The design of the on-board survey instrument for the data collection task of this study utilized the lessons learned from Task 1 and input from stakeholders. Since the research involved human subjects, researchers received approval from the Texas A&M University Institutional Review Board before initiating the data collection.
- **Task 3, Pilot Study:** The original proposal included a pilot study to test the on-board survey instrument and the data collection process. For a variety of reasons, this task was not undertaken in full. However, researchers did participate in a "test ride" without the on-board survey to gain a full understanding of the train's operating protocol and how the proposed data collection procedures would fit into the operations.
- **Task 4, Data Collection:** Using the survey instrument designed in Task 2 and refined in Task 3, this task proposed a single round of on-board surveys of *Heartland Flyer* passengers. This task was completed in April 2009. Project funds allowed for a second

round of data collection, which took place in July 2009 and provided "peak" season data to compare with the "average" travel season data obtained in April.

- **Task 5, Data Input and Review:** After collecting the on-board passenger survey data, responses were keyed into a computer spreadsheet program for analysis. A thorough quality control process was developed and used to review the raw data set for inaccuracies and non-response errors.
- **Task 6, Data Analysis:** This task consisted of a full analysis of the travel survey data set. Analysis components included travel characteristics and passenger demographics. Also included in the data analysis was an identification of the mobility impacts of the *Heartland Flyer* rail service as well as an estimate of the economic impacts of the rail service on the communities it serves.
- **Task 7, Final Report:** This task consisted of the development of this report.

Project Stakeholders

Given the number of agencies and organizations involved with the implementation of intercity passenger rail service, it is not surprising that a research study of intercity passenger rail would involve many stakeholders as well. In addition to the TTI research staff that worked on this study, staff from the Oklahoma Department of Transportation (ODOT) Division of Rail and the Rail Division of the Texas Department of Transportation (TxDOT), formerly the Rail Section of the Transportation Planning and Programming Division, reviewed survey design and project status. Amtrak staff in Fort Worth was also integral to the project's implementation, as this office is the primary office for the management of the *Heartland Flyer*'s day-to-day operations. Amtrak staff in Chicago, Philadelphia, Washington, D.C., and other locations also provided support for this project.

REPORT ORGANIZATION

This report describes the study activities, findings, and recommendations. The remainder of this report is organized into five chapters, described as follows. Chapter 2 reports the findings of the literature review task (Task 1) of the study. The literature review includes:

- An overview of intercity passenger rail in the United States with a focus on state-supported intercity passenger rail corridors;
- A discussion of the context, challenges, and data needs for passenger rail planning;
- A review of on-board survey design literature; and
- An analysis of survey instruments used in past studies of state-supported rail corridors.

Chapter 3 introduces the *Heartland Flyer*, the 206-mile intercity passenger rail route between Oklahoma City, Oklahoma, and Fort Worth, Texas, that was the focus of this study. The chapter includes a description of the route, the route's history, operating details, and service data. Chapter 4 provides the details of the data collection process used in the on-board survey of *Heartland Flyer* passengers undertaken in Task 4 of the study. Information reported in Chapter 4 includes the development of the on-board survey instrument, a description of the on-board survey data collection process, and the details of the quality control process employed during Task 5 of the study. Chapter 5 reports the findings of the analysis of the on-board passenger survey data in four areas: travel characteristics, passenger characteristics, mobility impacts, and economic impacts. Also included in this chapter is an estimate of the number of diverted and induced trips on the *Heartland Flyer* service. The final chapter, Chapter 6, summarizes the research and discusses potential applications of the study's findings for statewide intercity passenger rail planning, corridor-level planning studies, station-area site planning, and future on-board surveys of existing and future intercity passenger rail routes.

CHAPTER 2: LITERATURE REVIEW

This chapter reports the findings of the literature review task of the study. A brief overview of intercity passenger rail service in the United States is provided for the purpose of background information. The chapter also gives additional details on state-supported intercity passenger rail corridors (the primary focus of this report), including a summary of past research studies of state-supported routes across the country. An overview of the planning environment for passenger rail along with a discussion of the methods used by planners to forecast passenger demand for new "conventional" and "high-speed" passenger rail lines is also provided. The chapter concludes with a review of relevant literature on the design of surveys for passenger rail and other transit properties, including an analysis of the design of survey instruments used in past research studies of state-supported intercity passenger rail routes.

OVERVIEW OF INTERCITY PASSENGER RAIL IN THE UNITED STATES

In the United States, the National Railroad Passenger Corporation (NRPC), better known as Amtrak, operates intercity passenger rail services. Amtrak's nationwide passenger rail system includes more than 21,000 miles of routes with 500 destinations in 46 states (*6*). The following paragraphs provide a general overview of Amtrak, including the company's history and a description of the components of the Amtrak system.

History

Amtrak was created by the United States Congress pursuant to Public Law 91-518, the *Rail Passenger Service Act of 1970* (RPSA), which was enacted by Congress on October 30, 1970 (*7*). The passage of the RPSA and the subsequent creation of Amtrak were designed to relieve the freight railroads of their obligation to operate passenger services and the financial losses associated with these operations. Provisions of the RPSA included the following (*8*):

- Participating freight railroads were allowed to transfer all passenger operations to Amtrak without receiving approval from the Interstate Commerce Commission (ICC). Freight railroad companies paid Amtrak with cash or equipment equal to one-half their rail

passenger deficit for the year 1969; in exchange, companies received Amtrak common stock or tax credits.

- Amtrak was granted the right to use tracks and other facilities owned by participating railroad companies. Freight railroads, in return, were to be compensated by Amtrak at an incremental cost level for use of their facilities and Amtrak trains would be given preference over freight trains for use of the tracks. Additional incentive payments to the freight railroads were available for providing dispatching and track access, allowing Amtrak to operate its scheduled service. These provisions were enforceable by the ICC (and its successor agency, the Surface Transportation Board (STB)). These provisions remain particularly relevant since most Amtrak routes continue to operate over tracks owned by freight railroads (*6*).
- Amtrak was required to operate a "basic system" of routes across the country. The RPSA provided that Amtrak, in conjunction with the Secretary of Transportation and Congress, determine the basic nationwide system. Additional services (known as 403(b) services) were also authorized under the act; forthcoming sections of this chapter discuss these services in greater detail. The "basic system" requirement was amended in 1997 to allow Amtrak to make route decisions based on market conditions.

After resolving the numerous issues associated with the transfer of the nation's passenger rail services from individual companies to a single national entity, Amtrak commenced its operations on May 1, 1971. Among the original goals for Amtrak was for the company to achieve operational self-sufficiency (i.e., show a profit) within the first several years of its existence, a goal that policymakers soon realized was impractical, given the challenges of operating a national passenger railroad system. Consequently, during all of its nearly 40 years in existence, Amtrak has required some level of public funding for its basic operations. While not a primary concern of this report, it is worth noting as Amtrak's continued reliance upon federal operating subsidies throughout its existence has no doubt hampered the company's ability to develop a strategic plan for its operations and maintain the financial stability necessary to invest in its product. Additional background information regarding the political issues that have faced Amtrak during its existence are included in the two following reference sources for this report:

Amtrak: The History and Politics of a National Railroad (*9*) or a compilation of the federal laws and regulations impacting Amtrak by the independent Amtrak Reform Council (*8*).

In recent years, federal government policies toward Amtrak have begun to push the company in a more sustainable direction. The *Amtrak Reform and Accountability Act of 1997*, for example, released the company from its mandate to operate a "basic system" of routes across the country (*8*). This allowed Amtrak to create a route structure that was more responsive to market conditions. The most recent legislation impacting Amtrak was the *Passenger Rail Investment and Improvement Act of 2008*, or PRIIA (*2*). Signed into law on October 16, 2008, PRIIA reauthorized Amtrak by appropriating funds to the U.S. Department of Transportation (U.S. DOT) for Amtrak's operations and capital investments. New financial provisions for the company in the areas of funding accountability and the restructuring of long-term debt and capital leases were also included. In addition to the reauthorization and financial reform language, PRIIA contained some additional provisions that are worth noting, as follows:

- Section 201 of PRIIA defined the national rail passenger system for the country and provided a refined mission for Amtrak.
- Section 213 of PRIIA provided additional regulatory powers for the STB to ensure high levels of train performance. One of the terms of the creation of Amtrak was that Amtrak trains would have statutory access to freight railroad-owned infrastructure. Under PRIIA, the STB can investigate delays to Amtrak trains and determine if the rail infrastructure owner (commonly referred to as the "host railroad") is liable for the delays and award damages to Amtrak if appropriate. Any damages awarded to Amtrak under this section would be used by Amtrak for capital or operating expenditures along the affected routes. This is significant as on-time performance and the reliability of intercity passenger train services are thought to have a profound impact on service patronage.
- Sections 301, 302, and 501 of PRIIA authorized several additional funding programs whereby states and other entities that support intercity passenger rail service can receive federal funds for certain projects impacting passenger rail service with a match of up to 80 percent. These Sections represented the most significant federal participation in passenger rail capital investment to date and established a federal matching program that is more equitable with the programs currently in place for other transport modes.

In April 2009, the Federal Railroad Administration released its *Vision for High-Speed Rail in America*, which outlined the use of $8 billion in funding from the *American Recovery and Reinvestment Act of 2009* (ARRA, which was signed into law February 2009) to stimulate job growth by investing in the nation's passenger rail infrastructure (*3*). In January 2010, the distribution of the $8 billion of ARRA funding for intercity passenger rail investment was announced, with 31 states receiving funds (*4*).

Description of Amtrak System Components

The Amtrak system route structure is divided into three components: the Northeast Corridor spine, state-supported and other short-distance corridors, and long-distance routes. A general description of each component and a discussion of system ridership follow.

Northeast Corridor Spine

Amtrak's Northeast Corridor extends from Boston south to New York, Philadelphia, Baltimore, Washington, D.C., and Newport News, Virginia. Operations on the Northeast Corridor consist of *Acela Express* premium high-speed rail service and *Northeast Regional* service. The *Acela Express* represents the only high-speed passenger rail service in the United States, reaching speeds of up to 150 miles per hour in certain areas along its route between Washington, D.C., New York, and Boston. Amtrak's Northeast Corridor operations are vital to the region's mobility, as it is estimated that rail serves 62 percent of the air/rail market between Washington, D.C., and New York; and 47 percent of the air/rail market between New York and Boston (*10*).

State-Supported and Other Short-Distance Corridors

The state-supported and other short-distance corridors component includes routes that operate primarily in the Northeast, Midwest, and along the Pacific Coast. The *Heartland Flyer*, the subject of this report, is also classified in this component although it operates outside those geographic areas. A majority of this component consists of routes that are financially-supported by states; subsequent sections of this chapter discuss these routes in greater detail. Routes included in this component not supported by states include routes between New York, Albany, Buffalo, and other cities in Upstate New York; *Shuttles* service that connects Springfield (MA)

to New Haven; Washington, D.C., to Newport News; New York to Pittsburgh; Chicago to Detroit; and Chicago to Indianapolis (*11*).

Long-Distance Routes

Amtrak's long distance routes component consists of 15 routes serving 39 states, including the only passenger rail service in 23 states. These trains have endpoint distances up to 2,800 miles with service frequencies once-daily in each direction or less. In many communities, Amtrak's long-distance trains represent the only common-carrier transportation option available. Amtrak's long-distance trains typically consist of sleepers, coaches, and a diner or lounge car (*12*). In Section 228 of PRIIA, Congress stated that it found that Amtrak's long-distance train routes are a "vital and necessary" component of the national transportation system. PRIIA also directed Amtrak to study the reinstatement of two discontinued Amtrak long-distance trains, the *Pioneer* and the *North Coast Hiawatha* (*2*).

Amtrak System Ridership

Amtrak reports ridership figures and other metrics using the federal fiscal year (FFY), which ends on September 30. For example, FFY 2008 started on October 1, 2007 and concluded on September 30, 2008. Authors use the designation "FFY" throughout this report to distinguish the federal fiscal year from individual state fiscal years, as the two do not necessarily cover the same 12-month periods. During FFY 2009, Amtrak trains carried more than 27 million passengers. Table 2-1 shows the FFY 2009 ridership and percent change of FFY 2009 compared to FFY 2008 and FFY 2007 for each system component.

Table 2-1: Amtrak System Ridership by Component, FFY 2009 (*13*)

System Component	Ridership	% Change	
		vs. FFY 2008	vs. FFY 2007
Northeast Corridor	9,946,027	-8.7	-0.9
State-Supported/Other Short-Distance	13,022,237	-4.6	+8.6
Long-Distance	4,198,750	+0.7	+9.9
Total Amtrak System	**27,167,014**	**-5.4**	**+5.1**

Amtrak reported that its FFY 2009 ridership figures were consistent with annual growth in ridership achieved between FFY 2002 and FFY 2007, with a spike in passengers during FFY 2008 attributed to record-high gasoline prices during the summer of 2008. Ridership decreases in FFY 2009 as compared with FFY 2008 were also credited in part to poor economic

conditions across the United States, which impacted the demand for travel—particularly business travel (*13*).

FOCUS ON STATE-SUPPORTED CORRIDORS

The primary concern of this report is Amtrak's state-supported routes and how these routes impact mobility in the intercity corridors they serve. As such, background on these corridors is necessary to understand the context in which this research was undertaken. In FFY 2008, 14 states contracted with Amtrak to operate services along 19 different routes, with a total of $164 million in financial support provided by states (*11*). These are routes where states or groups of states have entered into a contractual agreement with Amtrak to provide financial support for the operation of passenger rail service along intercity corridors. In the absence of state financial support, passenger rail service on these routes would be limited or non-existent. The following sections describe the policy structure and provisions allowing states to contract with Amtrak for service, the operating details of state-supported routes across the system, and a review of past studies of state-supported intercity passenger rail routes.

Policy Foundations

Amtrak's enabling legislation, the RPSA, mandated that Amtrak operate a "basic system" of national passenger rail routes. Section 403 of the RPSA provided Amtrak with the authority to add new service to the basic system as the company deemed necessary. Part (b) of this section allowed Amtrak to work with states or other agencies to provide additional passenger rail service beyond the basic system. Section 403(b) of the RPSA reads as follows (*7*):

> *"Any State, regional, or local agency may request of the Corporation rail passenger service beyond that included in the basic system. The Corporation shall institute such service if the State, regional, or local agency agrees to reimburse the Corporation for a reasonable portion of any losses associated with such services."*

A "reasonable portion" of the losses to be reimbursed by states, regional, or local agency was defined in Section 403(c) of RPSA as at least two-thirds of the costs attributed to the service, less any revenues gained by the service (*7*). Expansion of passenger rail service under this provision

took place almost immediately after Amtrak began operations, with the *Lake Shore* (New York-Buffalo-Cleveland-Chicago) commencing service on May 10, 1971, after the states of New York and Ohio agreed to subsidize the route's operations. Other 403(b) service that was added in Amtrak's first year of operations included a route from New Haven to Springfield supported by Massachusetts and the *Illinois Zephyr*, a route from Chicago to Quincy supported by Illinois (*14*). By 1981 (the first decade of Amtrak's existence), the number of routes with passenger rail service fully supported or partially supported (i.e., additional frequencies over existing corridors) through the provisions of Section 403(b) had increased to 17 (*15*). While these routes are sometimes still referred to as "403(b) routes," the 1997 Amtrak reform legislation repealed the original RPSA language that defined the sharing of costs between Amtrak and the states and provided Amtrak with the flexibility to negotiate these cost-sharing agreements as it wished. Amtrak's current policy is to charge all states for 100 percent of the direct operating costs of state-supported trains that are not covered by passenger revenues. This policy has been adopted to ensure equity among state contracts (*11*). Section 209 of PRIIA required Amtrak, in consultation with its stakeholders, to develop a "nationwide standardized methodology for establishing and allocating the operating and capital costs among the States and Amtrak" for Amtrak's state-supported routes (*2*).

Current Status of State-Supported Rail Services

At the end of FFY 2009, 14 states contracted with Amtrak to operate 19 intercity passenger rail routes (*11*). Table 2-2 lists these routes and states, along with route length, service frequency, and FFY 2009 service data. Total ridership on state-supported routes in FFY 2009 was 10,277,003 passengers, or about 38 percent of the total Amtrak ridership over that time period. Total ticket revenue on state-supported routes exceeded $224 million in FFY 2009, accounting for 14 percent of the total ticket revenue system-wide (*13*). In October 2009, new state-supported passenger rail service was established through a partnership between Amtrak and the Commonwealth of Virginia, providing new service extending *Northeast Regional* service to Lynchburg and a fifth daily round-trip between Washington, D.C. and Richmond (*5*). Table 2-2 does not include the recently-established Virginia-supported services. Amtrak also expects to add a state-supported third daily round-trip between Raleigh and Charlotte (North Carolina) in early 2010 (*5*).

Table 2-2: State-Supported Routes in Amtrak System (*5,13*)

Route Name (Endpoints)	Supporting State(s)[1]	Length (Miles)	Daily Frequency[2]	FFY 2009 Ridership	FFY 2009 Revenue
Adirondack (Montreal-New York)	New York	381	2	104,681	$5,312,772
Ethan Allen Express (Rutland-New York)	Vermont	241	2	46,748	$2,347,362
Vermonter (St. Albans-Washington, D.C.)	Vermont	611	2	74,016	$4,011,930
Downeaster (Portland to Boston)	Maine	116	10	460,474	$6,496,768
Keystone Service (New York-Harrisburg)	Pennsylvania	195	28	1,215,785	$25,105,076
Carolinian (New York-Charlotte)	North Carolina	704	2	277,740	$14,707,244
Piedmont (Raleigh-Charlotte)	North Carolina	173	2	68,427	$1,119,573
Lincoln Service (Chicago-St. Louis)	Illinois/Missouri	284	8	506,235	$11,327,352
Hiawatha Service (Chicago-Milwaukee)	Illinois/Wisconsin	86	14	738,231	$13,300,511
Illini/*Saluki* (Chicago-Carbondale)	Illinois	310	4	259,630	$7,126,732
Illinois Zephyr/*Carl Sandburg* (Chicago-Quincy)	Illinois	258	4	202,558	$4,657,372
Blue Water (Chicago-Port Huron)	Michigan	319	2	132,851	$4,111,375
Pere Marquette (Chicago-Grand Rapids)	Michigan	176	2	103,246	$2,818,294
Missouri River Runner (Kansas City-St. Louis)	Missouri	283	4	150,870	$3,274,897
Heartland Flyer (Oklahoma City-Fort Worth)	Oklahoma/Texas	206	2	73,564	$1,592,435
Amtrak Cascades (Vancouver-Eugene)	Washington/Oregon	467	10	740,154	$20,944,809
Pacific Surfliner (San Luis Obispo-San Diego)	California	350	26	2,592,996	$46,551,006
Capitol Corridor (Sacramento-San Jose)	California	168	32	1,599,625	$22,160,890
San Joaquin (Oakland-Bakersfield)	California	415	12	929,172	$27,816,923
			Total	**10,277,003**	**$224,783,321**
			Percent of Total Amtrak System	**37.8%**	**14.1%**

[1]Not listed in this table are two routes supported by the Commonwealth of Virginia that commenced service on October 1, 2009.

[2]Typical number of total train operations per day. Some routes may have fewer frequencies on weekends or holidays.

The details provided in Table 2-2 demonstrate the wide range of routes and service levels that encompass the state-supported routes component of Amtrak's system. The shortest state-supported route is the Milwaukee-Chicago *Hiawatha Service*, 86 miles in length, while the longest is the New York-Charlotte *Carolinian* at just over 700 miles total. For some routes in Table 2-2, the corridor length reflects the entire distance covered by trains as reported in the timetable while in some corridors, major city pairs are located within the corridor separated by a shorter distance than what is shown. For example, the *Pacific Surfliner* route from San Luis Obispo to San Diego includes the 128-mile segment between Los Angeles and San Diego, between which most of the corridor's 26 daily trains operate. Frequencies on state-supported trains vary from a single daily train in each direction on eight of the routes to 32 daily departures on the Sacramento-Oakland-San Jose *Capitol Corridor*.

In FFY 2008, contracts between Amtrak and the states for the operation of state-supported intercity passenger rail service provided $164.5 million in revenue to Amtrak, representing approximately 7 percent of the company's total revenue (*16*). Among participating states, California's operating contract with Amtrak in FFY 2008 was valued at $74 million, representing the largest contract for passenger rail services between Amtrak and a state (*11*). The contract values for the other partner states were not made available to researchers by Amtrak due to the proprietary nature of the information. Funding provided by the states to support intercity passenger rail is primarily from general revenue funds or federally designated grants to the states, although some states utilize gasoline tax, vehicle registration, or specialty license plate revenues to support service (*17*).

Past Studies of State-Supported Rail Corridors

The literature review element of this study included a comprehensive review of past studies of state-supported passenger rail corridors. In addition to library catalog and internet searches, each state that supported passenger rail service at the time of the review was contacted to identify existing studies. Of the 14 states that support passenger rail service, 10 states reported involvement in, or knowledge of, one or more studies of passengers on its routes that included an on-board survey component. The states of Oklahoma, Oregon, Texas, and Vermont indicated to researchers that no such studies of their routes had been undertaken. Note that the states of

Oklahoma and Texas support service on the *Heartland Flyer*, the route that was examined in this research study. In addition to formal studies or reports, many states provided raw data or internally compiled (unpublished) data summaries to researchers.

The reader should note that this review focused on studies of how passenger rail service impacts regional or intercity mobility, and primarily sought studies that included data on trip purpose, alternative travel mode, and similar measures. Researchers did not include on-board surveys for the purposes of customer service evaluation or other marketing functions in this search. It should also be noted that Amtrak's internal marketing research and analysis group also has a program that includes on-board surveys of passengers on its routes. A later section of this chapter provides a more detailed discussion of this program. The following sections describe the past studies of state-supported rail corridors that were identified in this review.

New York

The state of New York provides financial support for the Montreal-New York *Adirondack* (*5*). The New York State Department of Transportation Rail Program Delivery Bureau provided researchers unpublished summaries of survey data that had been obtained from *Adirondack* passengers in August 1992, April 1993, and October 1995.

Maine

The state of Maine supports passenger rail service on the *Downeaster* between Portland and Boston's North Station (*5*). Authority for these operations falls under the Northern New England Passenger Rail Authority (NNEPRA), an agency created in 1995 by the state of Maine to manage passenger rail service (*18*). NNEPRA contracts with Amtrak to operate the *Downeaster* service. The state of Maine released a study entitled *Final Report: Economic Benefits of Amtrak Downeaster Service*, which included responses from an on-board survey of *Downeaster* passengers taken in July 2004 (*19*). This report indicated that multiple on-board surveys of *Downeaster* passengers had been conducted but no additional studies or reports were made available to researchers.

Pennsylvania

The Commonwealth of Pennsylvania provides financial support for the *Keystone Service*, which operates between New York, Philadelphia, and Harrisburg (*5*). Researchers identified a

February 1995 report entitled *Learning About Our Customer: The Results of the 1994 Keystone Rail Service On-Board Survey*, published by the Pennsylvania Transportation Institute at The Pennsylvania State University with sponsorship from the Mid-Atlantic Universities Transportation Center (*20*). As the title suggests, this report contained the findings of an April 1994 on-board survey of *Keystone* passengers. Additional survey data in the form of an unpublished report were provided to researchers by the Pennsylvania Department of Transportation, Bureau of Public Transportation. These data were from a July 2006 on-board survey of certain *Keystone* trains.

North Carolina

The state of North Carolina, at the time of this report's writing, sponsors two passenger rail routes: the New York-Charlotte *Carolinian* and the Raleigh-Charlotte *Piedmont*. Amtrak reports that in early 2010, service on a third state-supported train over the existing *Piedmont* route will be initiated (*5*). The North Carolina Department of Transportation Rail Division provided researchers with two reports summarizing on-board surveys that had been deployed on their routes: a 1996 report entitled *Results of 1996 Piedmont Passenger Survey* and a 2001 report entitled *Piedmont and Carolinian Passenger Survey Summary Report* (*20,21*).

Illinois

The state of Illinois provides financial support for three routes operating in the state, plus a portion of the cost for the *Hiawatha Service* corridor with Wisconsin (*5*). Researchers identified one study, entitled *1993 Illinois Passenger Rail Survey*, which was sponsored by the Illinois Department of Transportation (*23*). Among the goals of the 1993 study included an assessment of passenger preferences toward the potential for high-speed rail development between Illinois and Milwaukee and Detroit. No other studies of Illinois routes were identified by researchers. The next section discusses additional studies and data obtained for the *Hiawatha Service* corridor.

Wisconsin

The state of Wisconsin supports passenger rail service on the *Hiawatha Service* between Milwaukee and Chicago (*5*). In addition to the 1993 Illinois Department of Transportation report mentioned previously (*23*), researchers identified two studies of *Hiawatha Service* passengers

conducted by the Southeastern Wisconsin Regional Planning Commission that included on-board survey elements (*24,25*). These on-board surveys were conducted in May 1989 and May 1991. The Wisconsin Department of Transportation (WisDOT) Bureau of Planning and Economic Development provided researchers with unpublished summary findings from an on-board survey of *Hiawatha Service* passengers in December 2002 and July 2003, as well as a raw compilation of on-board survey data obtained from *Hiawatha Service* passengers in March and October 2005. A WisDOT analyst indicated to researchers that no reports for these data had been produced by WisDOT due to the difficulty in finding staff time to formally analyze these data and produce documentation. An independently-prepared conference paper describes preliminary analysis of the 2005 *Hiawatha Service* surveys (*26*).

Michigan

The state of Michigan provides financial support for two passenger rail routes serving the state from Chicago: the *Blue Water* to Port Huron and the *Pere Marquette* to Grand Rapids (*5*). In addition to the state-supported routes, an Amtrak basic system route, the *Wolverine*, connects Chicago to Detroit and Pontiac (*5*). Researchers identified three on-board surveys of passengers on Michigan routes that were published; one from 1985 in a *Transportation Research Record* article (*27*) and two others (2002 and 2007) that were sponsored by the Michigan Department of Transportation (MDOT) examining statewide intercity rail and bus travel (*28,29*). MDOT also provided researchers with summaries from three additional studies. These studies, conducted in 1988, 1991, and 1995, only contained data from the *Wolverine* corridor.

Missouri

The state of Missouri supports passenger rail service across the state between Kansas City and St. Louis, the state's two major metropolitan areas. This service was recently renamed the *Missouri River Runner* as a portion of the route follows the Missouri River (*5*). The Missouri Department of Transportation (MoDOT) provided researchers with a report entitled *Evaluation of Passenger Rail Service: St. Louis to Kansas City,* which included an on-board survey of Kansas City-St. Louis rail passengers conducted in Fall 1998 (*30*).

Washington

The states of Washington and Oregon jointly support the *Amtrak Cascades*, which serve the Vancouver-Seattle-Portland-Eugene corridor (*5*). The Washington State Department of Transportation provided researchers with a study of *Amtrak Cascades* passengers that had been completed in 1994 for the purpose of evaluating the *Talgo* trainset demonstration project (*31*). Additional data summaries of on-board surveys of *Amtrak Cascades* passengers were provided to the researchers by Amtrak Market Research and Analysis Department.

California

Arguably, the state of California has the most robust state-supported intercity passenger rail program in the country, supporting more than 50 daily trains with an annual contract valued at more than $70 million. The California Department of Transportation (CalTrans) supports three passenger rail routes in the state (*5*):

- *Pacific Surfliner*: San Luis Obispo-Los Angeles-San Diego
- *Capitol Corridor*: Sacramento-Oakland-San Jose
- *San Joaquins*: Oakland (Sacramento)-Fresno-Bakersfield

Researchers obtained two published documents containing on-board survey findings from *Pacific Surfliner* passengers, the first being a 1987 Master's Thesis studying the route (*32*) and the second being a 1992 study undertaken by the San Diego Association of Governments (*33*). Additional passenger survey data from the *Pacific Surfliner* as well as data from on-board surveys of *San Joaquins* passengers were provided to researchers by CalTrans. These data were provided to CalTrans by Amtrak's Market Research and Analysis Department. A later section of this chapter provides more details about Amtrak's corporate on-board research programs. The Capitol Corridor Joint Powers Authority (CCJPA), a partnership between six local transit agencies in the Bay Area, manages the *Capitol Corridor* service (*5*). The CCJPA administers its own marketing and research program, and retains the firm of Corey, Canapary, and Galanis Research to administer on-board surveys to *Capitol Corridor* passengers twice per year. Researchers obtained two full reports from the *Capitol Corridor* survey program; one from June 2007 (*34*) and another from January 2008 (*35*).

Discussion of State-Supported Rail Corridors Survey Programs

This literature review identified a total of 41 past on-board surveys of passengers on state-supported intercity passenger rail routes. Collectively, these studies offered valuable insight on the current state of the practice for on-board surveys of state-supported intercity passenger rail corridors. A discussion of these programs follows, including a brief overview of the Amtrak Market Research and Analysis Department's on-board survey program and a summary of findings from selected past studies.

Survey Programs

This review of past studies of state-supported intercity passenger rail corridors provided a great deal of insight into the various on-board passenger survey programs currently in place across the country. Of the 41 studies identified in the literature review, slightly less than half (19) were sponsored by state DOTs. The remaining studies were sponsored by Amtrak (9), the CCJPA (8), metropolitan planning organizations (3), and a University Transportation Center (1). Additionally, one study identified was a Master's Thesis. It is not surprising that state DOTs are heavily involved with on-board surveys of passenger rail routes within their state, as one might expect this task to fall to the administrative agency responsible for the planning and evaluation of the passenger rail service. Of the 19 studies sponsored by a state DOT, 13 were undertaken within the department's administrative unit assigned to passenger rail while the remaining six were evenly distributed among other DOT agencies, consultants, and University-based researchers.

The publication status (that is, the development of a formal report documenting the on-board survey and its findings) of the DOT-sponsored research efforts is worth noting. Among the 19 DOT-sponsored studies, 9 studies resulted in the development of a published report while the remaining 10 were provided to researchers as unpublished data summaries or raw data sets. Furthermore, only three of the published studies were developed by the DOT's administrative unit assigned to passenger rail; the other six were from studies that had been contracted to other internal DOT divisions or an external organization (consultant or University research). These findings suggest that, within the rail administrative unit of the DOT, resources for the development of formal documentation of on-board survey data are scarce. One state DOT analyst confirmed to researchers that finding staff time to create formal analyses or reports was

problematic. This is likely to occur in other states, as agency resources for these types of activities are generally limited.

In terms of formal survey programs, the CCJPA manages the most robust on-board passenger survey program among all the state-supported passenger rail routes. The CCJPA has conducted semi-annual on-board surveys of *Capitol Corridor* passengers since December 1999 (*35*) supported by the Agency's annual marketing budget of approximately $1.2 million (*36*). Outside of the CCJPA's marketing program, on-board surveys of state-supported intercity passenger rail routes are relatively infrequent. Certain states, most notably Michigan and Wisconsin, appear to have a quasi-regular program of passenger surveys within their departments of transportation, having engaged multiple rounds of on-board survey data collection on their routes in the last decade. The North Carolina Department of Transportation has also produced several formal reports in recent years. Other reports or studies obtained in this literature review appear to have been ad hoc or one-time research efforts.

The purpose or motivation to deploy on-board surveys of state-supported corridor passengers also varied among the states currently supporting passenger rail service. Motivations cited by the studies reviewed in this study included basic information gathering about the current users of state-supported rail service and the evaluation of on-board services, including customer service and amenities. This was true for both continuing survey programs such as the marketing efforts of the CCJPA as well as one-time studies. Some of the studies that were reviewed in this task had specific motivations, most notably:

- Unpublished surveys of *Hiawatha Service* travelers from the early 2000s were deployed to gauge the preferences of current *Hiawatha Service* passengers on the addition of a station stop at Milwaukee-General Mitchell International Airport and the renovation of the Milwaukee Downtown Intermodal Center. Findings were also used to support negotiations for a cost-sharing agreement between the states of Wisconsin and Illinois for the *Hiawatha Service*.
- The *Economic Benefits of Amtrak Downeaster Service* report, as the title suggests, utilized responses from the on-board survey to measure the economic impacts of the *Downeaster* service to the state of Maine (*19*).

- The *1993 Illinois Passenger Rail Survey* included an evaluation of the demand for high-speed rail service in the Chicago hub network (*23*).

Amtrak Market Research and Analysis Department Survey Program

At this point, it is appropriate to provide a short discussion of Amtrak's corporate on-board passenger survey program, as it would not be prudent to suggest that the inventory of reports and summary data from on-board surveys of state-supported passenger rail corridors collected in this review represent the only such information available to planners and policy makers. The literature review identified 41 past studies of intercity rail passengers, which included 9 such studies for the *Pacific Surfliner*, the *San Joaquins*, and the *Amtrak Cascades* developed by Amtrak's Market Research and Analysis Department. Background information provided to researchers and subsequent discussions with Amtrak management revealed that these on-board passenger surveys are used to develop "ridership profiles" for most routes as an element of Amtrak's overall marketing strategy. Amtrak requested that these proprietary summary findings remain confidential and as such are not included in this report.

Summary of Findings

Table 2-3 provides a compilation of the findings of selected past studies of state-supported intercity passenger rail corridors. Findings from on-board surveys of rail passengers summarized include the passenger's self-reported trip purpose and alternative travel mode in the absence of the passenger rail service. The reader should note that these findings were compiled by researchers from independent studies of Amtrak's state-supported corridors across the country. Each of the cited studies utilized different methodologies and survey instruments; therefore, researchers strongly discourage direct formal comparison between the findings reported in Table 2-3. Rather, these findings are presented only for the purposes of providing the reader with a general sense of the types of trips accommodated by state-supported passenger rail corridors and how passengers on these trains might travel in the absence of the state-supported passenger rail service. Note that the data in Table 2-3 represent the most current information for each corridor that was made available to researchers.

The figures reported in Table 2-3 provide some perspective on the role of state-supported passenger rail in an intercity corridor. Collectively, these findings suggest that on low-density corridors, intercity rail passengers are primarily leisure travelers, with a majority of trips to visit

family or friends or for vacation/recreation. Conversely, higher-density corridors appear to have a considerable percentage of work commute passengers. Other individual trip purposes do not account for more than 10 to 15 percent of the total ridership on these routes.

Table 2-3: Selected Findings: State-Supported Rail Corridors On-Board Surveys

	Downeaster	***Piedmont***	***Carolinian***	***Hiawatha Service***	***Capitol Corridor***
Year	2005	2001	2001	2005	2008
Source	(*19*)	(*22*)	(*22*)	(*26*)	(*35*)
Trip Purpose (Percent)					
Work Commute	6	--	--	22	55
Visit Family or Friends	30	54	62	37	16
Leisure/Vacation	47	14	6	14	11
Shopping	3	3	1	4	1
Personal Business	2	7	8	5	4
Business Trip	6	13	12	12	10
Education	1	4	2	7	6
Alternative Travel Mode (Percent)					
Automobile	51	59	43	70	77
Intercity Bus	26	7	7	12	17
Airplane	4	12	35	5	3
Would Not Make Trip	18	20	14	14	10

-- Indicates no data available. Columns may not sum to 100 percent due to rounding.

Among modal alternatives to the rail service, it is clear from Table 2-3 that the automobile is the dominant choice in the absence of the rail service. The preference of intercity bus as an alternative to rail service appears to be higher in corridors where a robust network of bus service is available. Passenger diversion to airplane is the highest on the 700-plus mile long *Carolinian* corridor and lower along the other corridors in Table 2-3, which are shorter. Finally, there appears to be a fairly substantial percentage of rail passengers who, in the absence of rail service, would simply not have made a trip at all. This travel, often called "induced" travel, does not impact the transportation system (i.e., no trips are diverted from other travel modes) but may have measurable benefits elsewhere, such as increased tax revenue from passenger spending at destinations or increased social capital resulting from face to face interactions.

INTERCITY PASSENGER RAIL PLANNING

The following sections focus on intercity passenger rail planning and forecasting methods used to support decision-making for passenger rail investment. A discussion of the context of intercity passenger rail planning is given, including challenges and scenarios encountered in practice. Ridership and revenue forecasting methods for Amtrak and other conventional passenger rail services are also introduced, providing the reader with a general idea of the factors considered in the process. Also included in this section is a discussion of planning considerations and demand estimation for proposed high-speed passenger rail service in the United States

Context of Intercity Passenger Rail Planning

In practice, transportation planners rely upon a variety of estimates, forecasts, and other data to inform or guide policy decisions and provide support for recommended investment strategies. Fundamentally, the task for passenger rail planners does not differ substantially from planning for other modes of transport. However, for passenger rail planning in the United States, several challenges exist. Among them are (in no particular order):

- Due to the relatively low investment in intercity passenger rail in the United States in recent decades, there are limited examples of "best practices" or "on-the-ground" implementation of passenger rail from which to build a knowledge base to guide new investments (*3*). This is less of an issue for other modes, where rich time-series and cross-sectional data sets are available to the analyst.
- Intercity passenger rail services are likely to include multiple states. Agencies responsible for intercity passenger rail planning are required to work with agencies from other states to ensure full development of service. Regulations or agency policies may limit the efficiency of multi-state partnerships, necessitating a clear federal role (*1*). The issue of multi-state partnerships is likely to continue into future development of intercity passenger rail, as it is noted that only one of the ten federally-designated high-speed rail corridors are wholly-contained within a single state (*3*).
- The scarcity of resources at the agency level (state DOT or other entity) dictates that available funding should first be directed toward providing a basic level of passenger rail

service in the corridors where it is needed. Remaining funds, if any, can then be used for "lower-priority" functions to support planning activities, such as marketing or service evaluation. On a more fundamental level, some state DOTs do not have sufficient staff or technical capacity to implement these functions even if sufficient funds were available.

- As a whole, statewide travel demand forecasting models do not contain sufficient data to support intercity passenger rail planning. Furthermore, intercity travel demand models are still evolving and current data on intercity travel are often out-of-date or contain serious gaps (*37*).
- The involvement of private entities (namely, freight railroad companies over which most Amtrak trains outside the Northeast Corridor operate) adds to the complexity of intercity passenger rail planning. Specifically, investments in intercity passenger rail routes that operate over freight-owned infrastructure generally benefit the freight railroad company as well, which results in the need to identify a cost-sharing agreement between the public sector and the freight railroads for the capital improvement costs.
- The high level of capital investment required for new or improved passenger rail facilities and rolling stock demands that the data underlying the projections must be of the highest quality to ensure responsible spending of public resources. The high level of risk results in a greater need for forecasts with documented levels of accuracy.

Many states, such as California, have been quite successful at developing a robust statewide passenger rail system in spite of the financial risk and the other challenges mentioned above. It should be noted that state rail planning, both passenger and freight rail, is expected to increase in the coming years with the 2008 passage of PRIIA, which included language regarding the development, content, and continuing review of state rail plans (Section 303). Additionally, PRIIA requires that any project implemented under the infrastructure capital grant programs of the law (Sections 301, 302, and 501) must be included in a state rail plan (*2*).

Data Needs for Intercity Passenger Rail Planning

Intercity passenger rail planning encompasses a variety of scenarios, each with varying levels of complexity and requirements for data to support decision-making. Intercity passenger rail planning scenarios could include the following:

- Establishing new intercity passenger rail service where none currently exists;
- Extending of existing intercity passenger rail corridors to new market areas;
- Expanding of existing service in the form of additional service frequencies;
- Expanding of service in the form of additional station stops along the existing route;
- Increasing seating capacity; or
- Implementing new on-board amenities or services.

Data used to inform transportation planning decisions, including intercity passenger rail planning, are generally referred to as either "revealed preference" or "stated preference" data. Revealed preference is broadly defined as data about actual or observed choices made by individual travelers, while stated preference data are obtained by creating hypothetical situations and asking travelers what they might choose do to when presented with a particular situation and a set of alternative choices (*38*).

For a simple example of the difference between revealed and stated preference data, consider a situation where a rail planning agency wishes to invest in its current service by establishing or funding an additional frequency on an existing intercity passenger rail route. To aid in the decision to expand the service, the agency wishes to know the level of patronage (ridership) that might result from the additional frequency. A planner for the agency might estimate percentage growth in ridership resulting from an additional service frequency by examining ridership response on the route in question when service frequencies were increased in past years, or, if this is the first effort to increase frequency, the planner might identify other routes in the region or country where service frequencies were increased and examine how the changes impacted ridership. This is an example of the use of revealed preference data; that is, observations of actual choices travelers make, to support intercity passenger rail planning. In this scenario, the rail planner might also deploy an on-board survey of current riders of the service to gauge their level of interest in an additional frequency. Alternatively, a survey of

residents in the communities served by the route may also identify new ridership potential. In this case, the rail planner would be utilizing stated preference data, or data on the choices travelers might make if presented with a choice or set of choices, to support decision-making. Another example of the use of revealed and stated preference data in the context of passenger preferences between standard and high-grade rail cars is provided by Morikawa et al. (*39*).

As one might expect, there are limitations and uncertainties to consider when using revealed or stated preference data to support transportation decision-making. For example, revealed preference data can be useful if the planner is considering investments to a route where similar investments have been made in the past. In this case, the planner can estimate traveler response to the proposed investments using historical data. If no historical data are available, the use of revealed preference data from other routes is only as good as the similarity between the two routes. Other concerns about revealed preference data for intercity passenger rail are noted by Morikawa et al. (*39*). The primary concern with the use of stated preference data is the question of whether or not a respondent, having selected from one of the alternatives posed in a hypothetical situation, would actually behave as predicted by the data. Additionally, a respondent may struggle to answer a question about a hypothetical situation, finding difficulty placing their own decisions in a hypothetical or non-existent context. Given some of these concerns, there is a high premium placed on the design of data collection efforts, particularly those involving stated preference data, as these are likely efforts to support decision-making for large transportation investments, such as high-speed intercity passenger rail. Subsequent sections of this chapter provide additional discussion on the topic of the design of data collection and surveys for intercity passenger rail.

Conventional Passenger Rail Forecasting

For the purposes of this report, "conventional" rail service is defined as intercity passenger rail service with speeds up to 110 miles per hour, generally operating on right-of-way owned by a freight railroad company (i.e., mixed-traffic operations). It should be noted that this definition of "conventional" rail service is somewhat arbitrary and encompasses all Amtrak routes outside of the *Northeast Corridor* spine component, which includes Amtrak's state-

supported routes. The following paragraphs discuss approaches for demand estimation for conventional intercity passenger rail service used in practice, both by Amtrak and other entities.

Amtrak Ridership and Revenue Estimation Model

The literature review for this study obtained several documents that provided some insight into the model used by Amtrak to estimate ridership and revenue impacts of modifications to current service levels and to aid in projecting future ridership and revenue on existing services. These documents were the *California State Rail Plan 2007-08 to 2017-18* (*36*) and an Amtrak-prepared document entitled *Report on Proposed Operation of Passenger Train Service Between St. Louis and Southwest Missouri* (*40*), obtained from the MoDOT Rail Division. At the time of this writing, the Amtrak ridership and revenue estimation model was maintained by AECOM Consult, Inc. under contract with the company. Attributes considered in the model include:

- Population and income levels around station areas;
- Projected trip time based on proposed rail service, and trip times of automobile and other competing modes available on the route;
- Proposed fare structure for the route;
- Rail service frequency and departure/arrival times along the route; and
- Connectivity of the proposed rail service to other Amtrak trains.

In California, the ridership and revenue model estimates total city pair travel in one stage, then projects the mode split for each alterative in a second stage (*36*). Additional details of Amtrak's ridership and revenue estimation model, such as the model specification and the elasticities or other coefficients, are proprietary. Researchers could not identify from the literature if the Amtrak ridership and revenue estimation model incorporates a projection of the "induced" travel demand resulting from new passenger rail service, a topic of interest for this research study.

Other Forecasting Methods

In addition to Amtrak's model, other models and techniques exist for projecting ridership and revenue for new or improved conventional intercity passenger rail routes. Several other

models used in this application were identified in this study, with levels of complexity ranging from detailed to sketch-level.

As previously discussed, one of the complexities of the intercity passenger rail planning environment is demand modeling when a proposed corridor serves more than one state. One such model that accounts for the multi-state nature of passenger rail corridors is the COMPASS™ model, a proprietary model developed and owned by Transportation Economics & Management Systems, Inc. This model includes a three-step analysis process that estimates (*41*):

- Total travel demand and market growth for all modes of travel and trip purposes;
- Induced travel demand due to changes in the quality of service offered by any of the modal alternatives in a corridor; and
- Mode or network split using a hierarchical mode choice analysis.

The COMPASS™ model has been used to provide ridership and revenue estimates for more than a dozen proposed passenger rail corridors across the United States (*41*).

For sketch-level planning applications, several methods for estimating ridership and revenue for intercity passenger rail routes were identified. One model used by rail planners in Tennessee, called the "Comparable Corridors Model," identified existing rail corridors in Missouri and North Carolina that were similar in nature to the intercity passenger rail corridors that were being considered in Tennessee. The total passenger rail ridership per 1,000 population of the communities served by the two "comparable" corridors was used to compute ridership estimates for Tennessee corridors, and an adjustment was applied to these estimates to account for the relative train operating speed between the "comparable" corridors and the study corridors (*42*). Another sketch-level planning model used in Virginia used a five-step methodology to estimate ridership for the proposed *Trans-Dominion Express* rail service, as follows:

- First, the number of non-business trips (trips by college students, tourists, and non-vehicle households) were estimated using assumed trip rates.
- Second, six stations, one in each region of the state, were selected for analysis.

- Third, the total non-business ridership between city pairs was estimated using a singly constrained gravity model. Population, employment, and distance between city pairs were included in the model.
- Fourth, business trips were estimated using the U.S. Census journey-to-work travel data.
- Finally, the total rail ridership was computed as a function of travel time between automobile and the proposed intercity passenger rail modes (*43*).

The use of a complex or sketch-level planning model depends upon the level of detail required for the forecasting and the available resources for the task. A complex forecasting model, such as the COMPASS™ model, can produce detailed forecasts of a variety of measures but is likely to be relatively expensive, requiring the procurement of an external consulting firm to develop, run, and maintain the model. Conversely, sketch-level forecasting models are relatively simple to understand and can be implemented with readily available data, possibly even on an in-house basis within a rail planning agency.

High-Speed Passenger Rail Planning and Forecasting

The U.S. DOT *Vision for High-Speed Rail in America*, released in April 2009, outlines the most recent strategy for developing a high-speed passenger rail network in the United States (*3*). However, planning for "high-speed" passenger rail in the United States has been on-going in various forms since the mid-1960s. An excellent overview of planning for high-speed passenger rail in the United States is provided by Schwieterman and Sheidt (*44*), who reviewed 64 intercity corridors that had been identified for high-speed service and found that high-speed rail service (service above 110 miles per hour) was only available in two of these corridors. Many of the challenges facing the development of passenger rail in the United States previously discussed in this section have also slowed the development of high-speed passenger rail corridors across the country. To compensate for the country's lack of experience in high-speed passenger rail, planners and researchers have looked abroad for guidance in developing high-speed passenger rail in the United States. However, comparisons between proposed high-speed passenger rail service in the United States and successful implementation of the mode in other areas such as Europe or Asia can be problematic due to the obvious contextual differences between the locations (*37*). Additionally, the tastes and preferences of European or Asian

travelers likely differ from those of travelers in the United States, making the transferability of the international experience even more difficult. Additional challenges specific to the development of high-speed passenger lines is the lack of federal high-speed rail safety standards (*3*) and the unknown response of competing carriers (namely, airlines) to the implementation of high-speed passenger rail (*37*).

Since few high-speed passenger rail lines exist in the United States, complex models that estimate traveler response to the characteristics of the proposed service must be used to project demand. Brand et al. (*45*) describe three alternative approaches for the estimation of passenger demand for high-speed rail service. The first approach involves estimating the total demand for all corridor travel modes, then using a multinomial logit model to forecast diversion to the new high-speed rail service from existing modes. A second approach is similar to the first except that the model structure divides private automobiles and "common carrier" modes into separate "nests" in the model. This allows for more precise specification of the existing modes by further nesting the common carrier modes into existing air carrier service, the new high-speed rail service, and intercity bus service (where appropriate). The third approach described estimates the total demand for intercity travel by each mode separately then estimates the diversion from each current mode to the high-speed rail service using mode-specific models. This approach is advantageous because it gives the most flexibility in specifying diversion from existing modes, as users of each existing travel mode would likely demonstrate different propensities to divert to new high-speed passenger rail service. The third approach was used in the estimate of passenger demand for proposed high-speed rail services in Florida and the Texas triangle in the early 1990s. A similar methodology was used to estimate passenger demand in eight United States corridors in the seminal 1997 report *High-Speed Ground Transportation for America* (*46*). Development of investment-grade ridership studies for proposed high-speed rail routes can be quite expensive for an acceptable level of precision. One alternative to the development of a full ridership demand model is to develop sketch-level ridership estimates using demand models developed in other corridors. For example, ridership estimation for proposed high-speed passenger rail between Oklahoma City and Tulsa, Oklahoma, used three adaptations of demand models from California and Florida to forecast sketch-level estimates of service patronage (*47*).

In some cases, a statewide travel demand model can be utilized to estimate ridership on high-speed passenger rail routes. While the treatment of passenger rail in statewide travel

demand model varies, Horowitz and Farmer (*48*) found that most intercity demand models generally did not include mode-specific coefficients for entirely new modes, such as high-speed rail. Thus, additional passenger preference data are necessary if demand projections are supported by a statewide travel demand model. This approach was used in the estimation of ridership for the proposed California high-speed rail system, which used statewide travel survey data for the trip generation and destination choice component and travel survey data obtained specifically for the project in the mode choice component (*49*). The use of statewide travel demand model data for intercity passenger rail planning can also be problematic, as intercity passenger rail routes often cross multiple state boundaries. In this case, the use of a statewide travel demand model is not feasible unless the model structures are similar across the states. For high-speed passenger rail routes that are wholly contained in a single state, another option for demand modeling is to "wire" together travel demand models from adjoining urban areas along the proposed route. This approach was used in the investment-grade ridership study for proposed high-speed passenger rail between Tampa and Orlando, Florida (*50*).

In the estimation of passenger demand for high-speed rail, an induced demand component is often included in the forecast. The consensus among the literature reviewed in this section regarding induced travel is that the percentage of induced trips attributed to new high-speed rail service is generally a function of the relative rate of diversion from existing modes. If the diversion rate is high, a new travel mode is relatively popular and it is reasonable that there will be induced trips generated as well. A linear-type relationship between diverted and induced demand was used to estimate induced ridership in the Orlando-Tampa ridership study (*50*). The California ridership model also considered the increased accessibility of destinations in the high-speed network as a component of induced demand (*49*). As a percentage of total demand, ridership studies for proposed high-speed rail service around the United States identified induced travel rates between less than 10 percent to as much as 50 percent (*37*). This wide range reflects the challenge and uncertainty of predicting traveler response to new modal alternatives.

Discussion

At the present time, a variety of challenges confronts intercity passenger rail planning, including a lack of expertise and resources at the agency level, in part due to the relatively low investment in intercity passenger rail in the United States in the last 50 years. While better-defined participant roles and increased technical capacity at the public agency level are expected in the coming years (mostly from PRIIA language and regulations), the growth will not occur overnight. The lack of expertise is partially reflected in the methods used to estimate demand for intercity passenger rail or traveler response to rail system configurations, which vary in scope and complexity of data requirements. Demand modeling for high-speed passenger rail is particularly challenging, given that few high-speed rail projects exist in the United States today. As a result, data for high-speed rail planning are obtained primarily in the form of stated preference responses from travelers, which are incorporated into complex travel demand models that are often quite expensive to develop at an acceptable level of precision. Even with a high level of precision in a study, the outcomes estimated by stated response are affected by the extent that the traveler's actual behavior emulates the stated preference response.

SURVEY DESIGN

The need for high-quality data to support planning and decision-making for intercity passenger rail investments translates into the need to ensure that the methods and procedures used to obtain these data are also of the highest quality. One common method used by transit planners to obtain data for a variety of planning needs is an on-board survey of passengers of the transit service. Most literature on the topic of on-board passenger surveys focuses on the application of on-board surveys in the context of urban bus and rail transit planning. However, some of the principles that guide the development of on-board surveys for urban transit are also useful for the design of on-board surveys for intercity passenger rail. This study included a review of the literature on the design of on-board surveys for transit with a specific application to intercity passenger rail. The purpose of this task was to guide the researchers in the development of the on-board survey instrument for use in later tasks of this study. This task consisted of two elements: a review of the relevant literature on the topic of survey design, and analysis of survey instruments used in past on-board surveys of state-supported corridors identified previously.

Survey Design Literature

Deploying an on-board passenger survey is an effective method to evaluate service and support planning efforts for all mass transportation modes. Transit operating agencies can use on-board survey data can be used to support many data and information needs, including travel modeling, long-range planning, route-specific planning, marketing, and customer communications (*51*). In addition to supporting a variety of agency data needs, survey design literature reports several reasons why the on-board survey is particularly effective for the transit environment, as compared to other survey or data-gathering techniques. Since the survey is distributed to the passenger on-board the vehicle during the passenger's actual trip, a direct sample of the target population (transit passengers) is obtained (*51*). Additionally, since transit ridership generally encompasses a small percentage of residents in a region, the on-board survey is more effective at obtaining information than another extensively-used data collection technique, the region-wide household travel diary survey (*52*). Another benefit to on-board surveys for this application is the minimization of errors due to "telescoping," which is the inability of respondents to remember accurately details of events that took place in the past. While this is an issue in the design of all surveys, errors due to telescoping are minimized in the on-board survey, as the on-board survey is generally concerned with the current trip (*53*).

There are several variations of the on-board survey data collection method. All variants involve the initial contact with the respondent and distribution of the survey materials taking place on-board the transit vehicle. The variations arise in the return of the completed survey to the analyst. Survey staff can either collect completed surveys on-board the vehicle or the completed surveys can be mailed back to a central processing facility by the respondent (*54*). Each method has its advantages and drawbacks. If the completed survey is designed to be returned by the respondent during the trip ("hand-out/hand-in"), response rates are likely to be higher but time to complete the survey may be an issue if the respondent's trip is short in duration. The "hand-out/mail-in" option does provide the respondent greater time to complete the survey, although there is a greater chance of the entire survey being neglected after departing the vehicle. A third approach, a hybrid of the first two, incorporates both a hand-in and mail-in component. The hand-in component is short and provides basic information about the trip and respondent, while the mail-in component has greater detail. This method has the advantage of

obtaining more information and also identifying non-response bias between those respondents that send back the mail-in component and those that do not (*55*).

As with all survey-based data collection efforts, the design of the survey instrument is critical to the quality of the responses provided. Survey design literature (*51-54*) provides excellent guidance on the design of survey instruments for positive response and accuracy. Regarding the order of questions presented on the survey instrument, design literature recommends placing easier or less taxing questions early in the survey to avoid discouraging respondents, harder or more intimidating (i.e., personal) questions near the middle, and demographics questions at the end. Regarding question design, two types of questions, "open" and "closed," are used in survey design. Open questions allow the respondent to write-in the desired answer while closed questions provide the respondent with a set of choices from which to choose the most appropriate answer. Closed questions are generally easier for the respondent, who only needs to check or otherwise indicate the desired answer (rather than write-in). Closed questions are also beneficial from the analyst's perspective, as fewer resources are needed for the analyst to interpret and tabulate responses.

Survey Instrument Analysis

In addition to guidance from survey design literature, researchers conducted an analysis of survey instruments from past studies of state-supported intercity passenger rail routes to identify trends and considerations for the design of the survey instrument in this study. From the 41 past studies of state-supported intercity passenger rail corridors identified in the literature review task of this study, researchers obtained the survey instrument used in 17 of these studies (14 survey instruments obtained in total, as some instruments were used on multiple studies). Four additional survey instruments from studies where no data were made available were provided to researchers, resulting in a total of 18 survey instruments for this analysis. Surveys ranged in length between two and eight pages, but most surveys (eight) were four pages long. Table 2-4 summarizes the "elements" that were included on each of the 18 the survey forms reviewed by researchers in this analysis.

Table 2-4: Elements Included in On-Board Passenger Surveys

Survey Element	Frequency
Passenger Trip Frequency	18 (100%)
Passenger Origin, Boarding, Alighting, and Destination (OBAD)	17 (94%)
Passenger Demographics	16 (89%)
Passenger Trip Purpose	14 (78%)
Passenger Alternative Mode of Travel	12 (67%)
Reasons for Choosing Rail for Trip	12 (67%)
Changes to Increase Rail Trip Frequency	5 (28%)
Non-Rail Related Economic Impacts	2 (11%)

Source: TTI Analysis of On-Board Survey Instruments

Common elements on the survey instruments reviewed in this analysis included passenger trip frequency (100 percent of surveys reviewed), passenger OBAD data (94 percent), passenger demographics (89 percent), and passenger trip purpose (78 percent). Subsequent paragraphs of this section provide a more detailed discussion of the passenger trip frequency and demographics survey elements. Passenger alternative mode of travel (in the absence of rail service) and passenger reasons for choosing rail for their trip were included on two-thirds of the surveys reviewed. Less common elements included on the survey instruments reviewed were service changes to increase rail trip frequency (28 percent) and non-rail related economic impacts (11 percent). Non-rail economic impacts surveyed included passenger preferences for schedule changes to encourage travel to summer festivals and whether or not the passenger would remain on their trip an extra night if the schedule was modified to provide an early morning arrival time into Chicago.

Passenger Trip Frequency

All 18 of the survey instruments included in this review asked the passenger about his or her frequency of travel on that particular rail route. Arguably, this is a useful item to include in an on-board survey as it will identify the split between "regular" and "casual" or "infrequent" passengers on a route. In most cases, the time frame for the consideration of trip frequency (i.e., number of trips per time period) was related to other characteristics of the route. On high-density routes with frequent service, the time frame was weekly or monthly as it was likely that these routes had many regular users. For lower-density routes, passengers were asked to report how many trips they made by rail in the last 12 months. Some of the survey forms extended this question to include travel by other Amtrak routes or other travel modes in the corridor, while

others extended the question to identify the frequency of trips by business or non-business purposes. Another note of interest is that eight of the surveys reviewed requested that the respondent count a "round-trip" as two one-way trips for the purposes of counting trip frequency. This format is convenient for the data analyst, as Amtrak reports ridership figures in this manner (for example, a reported count of 5,000 passengers is the equivalent of 5,000 one-way trip segments). However, requesting trip-based survey responses in this format may confuse the respondent, who might consider the definition of "trip" as the complete trip tour (*51*).

Passenger Demographics

Questions regarding passenger demographics were included on 16 of the 18 survey instruments reviewed in this analysis. Table 2-5 reports the demographic questions included in these 16 survey instruments.

Table 2-5: Demographic Questions Included in On-Board Passenger Surveys

Demographic Item	Frequency
Age Group	16 (100%)
Household Income	16 (100%)
Gender	14 (88%)
Place of Residence	9 (56%)
Educational Attainment	7 (44%)
Employment Status	7 (44%)
Occupation	7 (44%)
Household Composition	6 (38%)
Household Vehicles	6 (38%)
Race/Ethnic Background	4 (25%)
Hispanic Origin	2 (13%)
Internet Access at Home	2 (13%)
Marital Status	2 (13%)
Has Driver's License	1 (6%)
Languages Spoken at Home	1 (6%)
Smoking Status	1 (6%)
Vehicle Available for Current Trip	1 (6%)

Source: TTI Analysis of On-Board Survey Instruments

Only two demographic elements, age group and household income, were included on every survey instrument with demographics questions. The household income question was placed as the final demographic question in all but four of the surveys, two of which included the questions regarding race/ethnic background and Hispanic origin following the household income

question. This pattern is consistent with the survey design practice of placing sensitive questions at the end of the survey to avoid non-reporting (not responding to the question) that might carry over onto other items on the survey. Passenger gender was asked on all but two surveys. Place of residence, a useful measure in determining the market area of passenger rail service, was included in nine of the survey instruments reviewed. Other demographic questions that occurred frequently on the surveys reviewed included educational attainment, employment status, occupation, household composition, household vehicles, and race/ethnic background, which were included on 25 to 50 percent of the reviewed surveys. Relatively infrequent demographics questions used in surveys included "Has Driver's License" and "Vehicle Available for Current Trip." These options were likely used as proxy data to estimate the number of "choice" riders on the rail service; that is, the percentage of passengers who have access to an automobile for their trip and the percentage that might have no other option. The "Smoking Status" question is not likely to be relevant in the future; as most Amtrak trains are non-smoking, the need to provide separate smoking and non-smoking facilities on the train no longer exists.

Passenger Trip Purpose

This analysis found that 14 of the 18 survey instruments reviewed asked the respondent the purpose of his or her trip. Table 2-6 summarizes response choices provided to respondents for the trip purpose question in these 14 surveys.

Table 2-6: Trip Purpose Response Choices Provided in On-Board Passenger Surveys

Trip Purpose	Frequency
Going To/From Business Trip	13 (93%)
Going To/From University/College	13 (93%)
Vacation	13 (93%)
Personal Business	12 (86%)
Shopping	12 (86%)
Commuting To/From Work	11 (79%)
Visit Friends/Family/Relatives	11 (79%)
Leisure/Recreation	6 (43%)
Commuting To/From Work (Less than Daily)	2 (14%)
Going To/From Entertainment	1 (7%)
Going To/From School (Not College)	1 (7%)
Medical	1 (7%)
Wanted to Ride Train	1 (7%)

Source: TTI Analysis of On-Board Survey Instruments

No single trip purpose was provided as a choice on all 14 survey instruments that included the trip purpose question. However, there is a group of seven choices that appeared on at least 80 percent of the survey instruments reviewed. Outside of the core group of response choices, six survey instruments reviewed chose to distinguish between leisure trips of different duration, providing both "vacation" and "leisure/recreation" as choices. Two survey instruments asked respondents to distinguish between a daily work commute and a less than daily work commute, likely related to the potential for passengers that are telecommuters who visit the office once or twice a week.

Passenger Alternative Travel Mode

A discussion of this element is relevant to this study, as one of the primary objectives of this study was to estimate the number of diverted and induced trips on the *Heartland Flyer*. As such, particular attention was paid to this element during the survey instrument review. This analysis found that 12 of the 18 surveys reviewed included a question about what the passenger might do for his or her trip in the absence of the rail service. Table 2-7 summarizes response choices provided for the alternative travel mode question.

Table 2-7: Alternative Mode Response Choices Provided in On-Board Passenger Surveys

Alternative Travel Mode	Frequency
Intercity Bus	12 (100%)
Airplane	11 (92%)
Would Not Make Trip	11 (92%)
Drive (Unspecified)	7 (58%)
Drive (Alone)	5 (42%)
Rental Car/Company Vehicle	5 (42%)
Ride From Friend/Family	4 (33%)
Carpool/Vanpool	2 (17%)
Amtrak Long-Distance Train	1 (8%)
Local Bus	1 (8%)

Source: TTI Analysis of On-Board Survey Instruments

Four alternative travel mode choices appeared almost universally in the 12 survey instruments reviewed: intercity bus, airplane, would not make trip, and automobile. For the automobile alternative, respondents were most frequently not provided the choice between "driver" and "passenger," although a small number of survey instruments did distinguish between these choices. Other choices were provided based on the other travel modes available in

a particular corridor. For example, the alternative of "Amtrak Long-Distance Train" would not be an alternative for travel in certain state-supported corridors (such as the *Heartland Flyer* corridor), and therefore would not be provided as a choice on a survey in that corridor.

Given the importance of the alternative travel mode question to this research study, additional details about this question were reviewed. Of the 12 survey instruments that included the alternative travel mode question, 10 provided the respondent with a set of alternative travel options, and included "would not make trip" as a choice. One survey instrument "nested" the question by first asking the respondent if he or she would make the trip in the absence of the rail service, then report the likely alternative mode if the response to the initial question was "yes." Respondents who selected "no" for the question were instructed to skip to the next question. The other survey instrument provided a list of choices and asked the respondent to rate the likelihood of choosing each alternative in the absence of the train service, utilizing a four-point scale.

The wording of the alternative travel mode question was also considered in this review. Since this is a stated preference-style question, passengers must place themselves in a hypothetical reality (one without rail service) then consider their behavior in that context. Thus, the wording of this question is critical in order to develop the hypothetical context in the mind of the respondent and elicit the most accurate response possible. The key consideration for the development of this context is the characterization of the current rail service (under the hypothetical reality) in the question wording. Out of the 12 survey instruments reviewed, phrases used to describe the hypothetical scenario were classified as follows:

- Rail Service "Not Available" (6)
- Rail Service "Did Not Exist" (4)
- Rail Service "Did Not Operate" (1)
- "No Train Service at All" (1)

The distinction made between these phrases is subtle, yet critical. Characterizing the rail service as "not available" or "did not operate" may create a scenario in the mind of the respondent where the train was canceled for that day or there was a different departure time. Arguably, passenger behavior is different in that situation than the scenario where there is no rail service at all along a particular intercity corridor. Of these four choices, the phrase "Did Not Exist" seemingly

provides the most clarity for the situation if the purpose of the survey is to identify how the rail service impacts large-scale intercity mobility.

Discussion

The on-board passenger survey is an efficient method for data collection involving transit properties. The primary advantage of the on-board survey is that it provides access to a target population that might not be otherwise easy to identify with other data collection methods. For intercity passenger rail, the on-board survey is particularly effective. Passenger trips on low-density intercity passenger rail routes may be rather infrequent and consist of only a small percentage of overall urban area residents; as such, data collection via a household travel diary survey would be substantially less effective than an on-board passenger survey. The on-board survey also allows for direct sampling, thus providing the ability to draw conclusions about the entire population of passengers if the analyst utilizes a robust sampling design.

Most of the literature on the design of on-board passenger surveys focuses on the urban bus or rail transit application. However, many of the lessons learned in those applications apply to the design of on-board surveys for intercity passenger rail. Lessons for both survey design and data collection procedures were discussed. An analysis of the content of 18 survey instruments used in past on-board surveys of state-supported intercity passenger rail routes was also conducted. This analysis revealed patterns and trends in the design of survey instruments used in this application. Most survey items were "revealed preference" questions. However, one "stated preference" question regarding the passengers preferred alternative travel arrangement if the rail service did not exist appeared on two-thirds of the survey instruments reviewed. Detailed analysis of the question wording and choice set found that questions presented the hypothetical scenario (where the rail service did not exist) in different ways while the choice set was generally consistent with available modes of travel in the intercity corridor. To identify passengers that would forgo their trips in the absence of the rail service, "Would Not Make Trip" or similar was included as a choice in this question, although some surveys took a different approach.

CHAPTER 3: DESCRIPTION OF *HEARTLAND FLYER* ROUTE

The *Heartland Flyer*, an Amtrak passenger rail route between Oklahoma City, Oklahoma and Fort Worth, Texas, was the focus of this study of the mobility impacts of passenger rail in short- to medium-distance intercity corridors. This chapter provides a detailed description of the *Heartland Flyer* route. Given first is a general overview of the service, including the timetable schedule. Also provided for the purposes of understanding the history of the route is a brief chronology of passenger rail service in the Oklahoma City to Fort Worth corridor. The chapter concludes with details of the train's operations and historical operating statistics.

GENERAL OVERVIEW OF *HEARTLAND FLYER* SERVICE

The *Heartland Flyer* operates along a 206-mile route between Oklahoma City, Oklahoma, and Fort Worth, Texas. Station stops in Oklahoma included Oklahoma City, Norman, Purcell, Pauls Valley, and Ardmore. Stops in Texas were Gainesville and Fort Worth. Figure 3-1 shows a map of the *Heartland Flyer* route. The route runs parallel to Interstate 35 (I-35) and U.S. Highway 77 (U.S. 77) for much of its duration. A general description of the route based on researcher observation and current at the time of this study, starting in Oklahoma City in the north, is as follows (communities with stations in bold face):

- Departing from the Santa Fe Depot in **Oklahoma City** (near the Bricktown entertainment district), the route crosses the Oklahoma River and passes through south Oklahoma City proper and the community of Moore before arriving at the first station stop in **Norman**. Norman is the home to the University of Oklahoma's main campus. Land adjacent to this segment of the route is fairly developed, but some areas of open space exist.
- South of Norman, the route follows the Canadian River through the community of Noble to the next station stop, **Purcell**. From Purcell, the route passes through the communities of Wayne and Paoli before entering the next station stop of **Pauls Valley**. Adjacent to this segment of route, the land is primarily used for agricultural purposes, either for growing crops or the raising of livestock. South of Pauls Valley, the route follows along the Washita River, passing through the communities of Wynnewood and Davis with the adjacent countryside dominated by agricultural land uses.

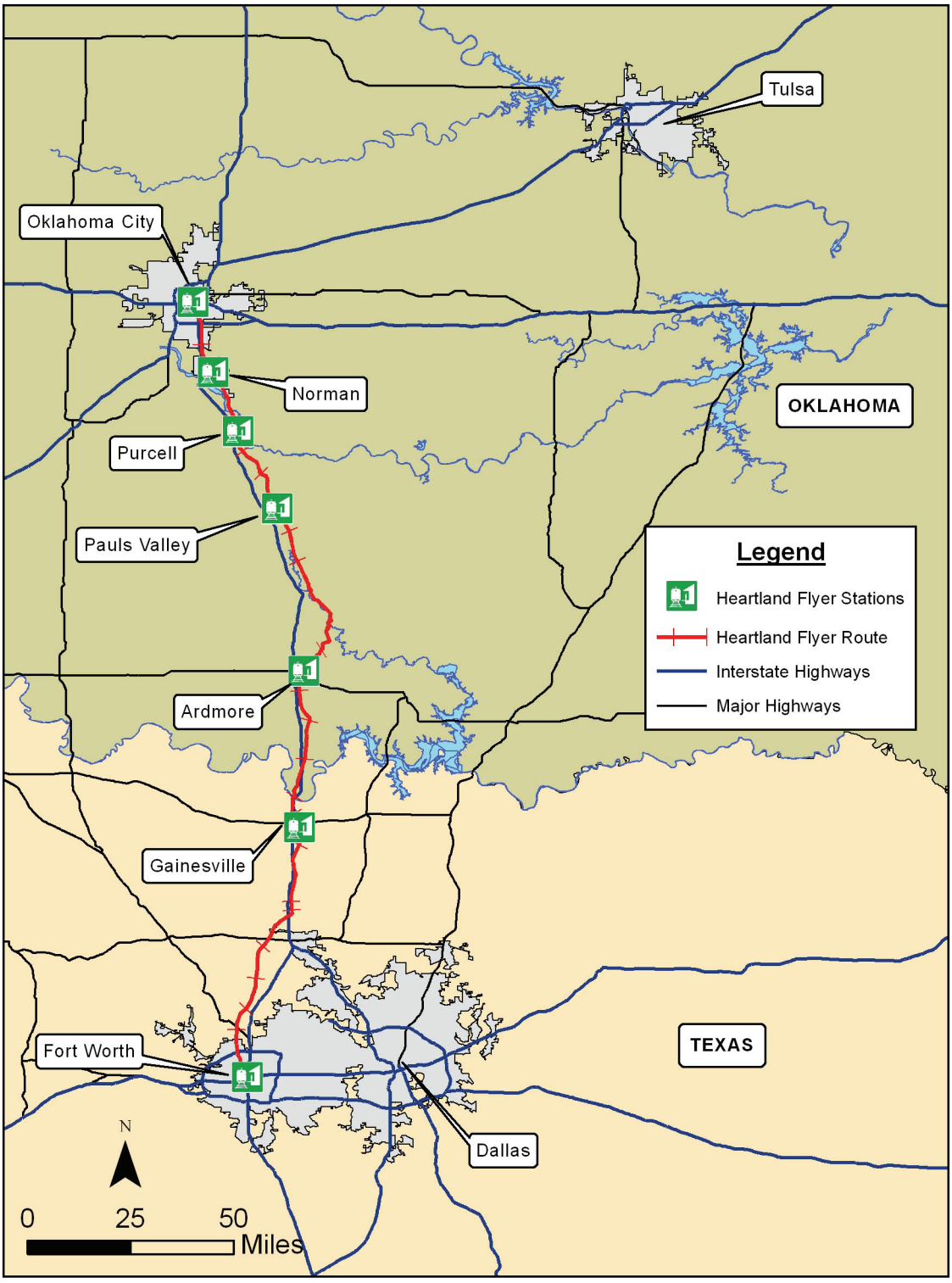

Figure 3-1: *Heartland Flyer* Route

- After passing through Davis, the route follows the Washita River through Dougherty before traveling through the Arbuckle Mountains by way of the Big Canyon of the Washita River. This section of the route is arguably the most scenic, with a variety of birds and other wildlife frequently seen by passengers, including the American Bald Eagle during the winter months.
- Upon leaving Big Canyon, the route passes through the community of Gene Autry before entering **Ardmore**, the next station stop on the line. After leaving Ardmore, the route passes through Marietta and Thackerville before crossing over the Red River into Texas. Almost immediately after entering Texas, the route reaches the station stop in **Gainesville**. South of Gainesville, the route passes through communities of Valley View and Sanger. Agricultural activities dominate the landscape in this segment of the route both north and south of the Red River.
- After passing through Sanger, the route transitions from the rural landscape into the far north suburban areas of the Fort Worth metropolitan area, passing through the communities of Krum, Ponder, and Justin. These areas were experiencing growth as new residential and other supporting development was evident near the route. South of Justin, the route passes by the Texas Motor Speedway racing complex and near the BNSF Alliance Intermodal Yard, a component of the Alliance Global Logistics Hub. The Fort Worth Alliance Airport is also visible from the route.
- South of the Alliance area, the route passes through Saginaw before entering the route's terminus in **Fort Worth**. Notable points along the route in this segment include Fort Worth Meacham Airport and the Fort Worth Stockyards area. The route crosses the Trinity River, passing through mixed industrial and residential areas before arriving at the final station stop, the Fort Worth Intermodal Transit Center.

A later section of this chapter provides more details of the station stops and the communities served by the *Heartland Flyer*. Appendix A contains researcher photos of major points of interest along the *Heartland Flyer* route.

Timetable Schedule

Figure 3-2 shows the *Heartland Flyer* schedule as published in the Amtrak system timetable. At the time of this study, the *Heartland Flyer* schedule provided for a single daily round-trip between Oklahoma City and Fort Worth. Train #821 operates south in the morning, departing Oklahoma City at 8:25 AM and arriving in Fort Worth at 12:39 PM. Train #822 makes the return trip northbound in the evening, departing Fort Worth at 5:25 PM and arriving into Oklahoma City at 9:39 PM (*5*).

821	◀ Train Number ▶					822
Daily	◀ Days of Operation ▶					Daily
R	◀ On Board Service ▶					R
ReadDown	Mile			Symbol		Read Up
8 25A	0	Dp	Oklahoma City, OK (CT) Tulsa, Kansas City—see page 61		Ar	9 39P
8 49A	20		Norman, OK			8 55P
9 06A	35		Purcell, OK			8 38P
9 31A	57		Pauls Valley, OK			8 12P
10 23A	102		Ardmore, OK			7 23P
11 05A	141		Gainesville, TX			6 42P
12 39P	206	Ar	Fort Worth, TX (CT)		Dp	5 25P

Figure 3-2: *Heartland Flyer* Timetable Schedule (*5*)

As scheduled, the *Heartland Flyer* covers the 206-mile route in 4 hours and 14 minutes in each direction. This time includes the following components:

- Running Time (actual travel time between individual stations);
- Station Dwell Time (time spent at each station unloading and loading passengers); and
- Recovery Time (time added to the schedule to account for unexpected delays).

On-board staff reported to researchers that the *Heartland Flyer* schedule is unique because Amtrak distributes the recovery time into the scheduled travel time between each station. This is in contrast to typical Amtrak routes, where the recovery time is added to the travel time between the final two stations on each run. As a result of this arrangement, a *Flyer* run that experiences no delays between stations will generally be early into the next station and will hold until the scheduled departure time even after completing all station business. Since there is no smoking allowed on the train, the station dwell time in Ardmore includes two extra minutes to allow passengers wishing to smoke to come off the train and do so, provided the train is running on schedule. Trains that operate with no delays generally arrive at the endpoint station up to 20

minutes early. A later section of this chapter provides further analysis of the factors impacting the operating speed of the *Heartland Flyer* and reasons for delays experienced by its passengers.

Connecting Services

The timetable schedule of the *Heartland Flyer* provided passengers with the ability to connect to other routes on the Amtrak system as well as local transit services. In Fort Worth, passengers can connect to the Amtrak *Texas Eagle* long-distance train for continuing travel south to Austin and San Antonio (tri-weekly service west to El Paso and Los Angeles) and east and north to Dallas, Little Rock, St. Louis, and Chicago. The *Heartland Flyer* schedule allows passengers to transfer between the *Flyer* and the *Eagle* with a minimal amount of waiting time. Passengers in Fort Worth can also connect to the *Trinity Railway Express* commuter rail that serves Dallas and intermediate points, including Dallas-Fort Worth International Airport. Connections to the Amtrak national network are also available from Oklahoma City via Amtrak Thruway Bus service, operated by Jefferson Lines. This service operates overnight between Kansas City, Tulsa, and Oklahoma City, connecting the *Heartland Flyer* with two services in Kansas City—the *Southwest Chief* long-distance train to Chicago and the *Missouri River Runner* service to St. Louis (*5*).

Corridor Travel Options

While not specifically related to the details of the *Heartland Flyer* route, a discussion of the modal options available to travelers in the Oklahoma City to Fort Worth intercity corridor is particularly relevant in light of this study's charge to identify modal diversion and induced travel as impacts of the *Heartland Flyer* service. In addition to the major highways Interstate 35 and U.S. Highway 77, intercity bus and commercial air service are modal options available to travelers in the corridor.

As previously mentioned, two major highways (I-35 and U.S. 77) run parallel to the *Heartland Flyer* route between Oklahoma City and Denton, Texas (north of Fort Worth). Throughout Oklahoma, these two highways run parallel, with U.S. 77 serving the local communities and I-35 bypassing these communities. Just north of the Red River, the two routes join and operate concurrently across the Red River to Denton. Near Denton, I-35 divides into

two sections—I-35W (toward Fort Worth) and I-35E (toward Dallas). U.S. 77 runs concurrent with I-35E from this point. The TxDOT Transportation Planning and Programming Division reports that the annual average daily traffic (AADT) for the section immediately south of the I-35/U.S 77 Red River crossing was 33,000 vehicles per day in 2008 (*56*). This figure represents the daily vehicle traffic traveling between Oklahoma City and Fort Worth, as the Red River Bridge is the only direct route between the two cities. This figure also includes traffic traveling to Dallas and other points in the North Texas region, as well as traffic passing through the intercity corridor traveling between external points. Additionally, a 2003 research study forecasting patronage on a proposed high-speed passenger rail route between Oklahoma City and Tulsa estimated that in 2001, more than 88 percent of the total person-trips in the intercity corridor between Oklahoma City and Dallas-Fort Worth were made in an automobile (*47*).

Two companies: Greyhound and Jefferson Lines, provide intercity bus service in the Oklahoma City-Fort Worth corridor. Both companies operate service out of the Oklahoma City bus depot as well as the Fort Worth Intermodal Transit Center. Greyhound serves Oklahoma City, Norman, Pauls Valley, Ardmore, and Gainesville with four scheduled departures in each direction, south to Dallas and north to Kansas City. Direct bus service to Fort Worth from the cities along the corridor is not available from Greyhound; passengers must transfer in Dallas to access Fort Worth (*57*). As of December 2009, Jefferson Lines offered direct service between Oklahoma City and Fort Worth via Lawton (OK) and Wichita Falls (TX), as well as service to several of the communities served by the *Heartland Flyer* on a route that operates between Oklahoma City and Dallas (similar in structure to the Greyhound routing). However, as of March 2010, Jefferson Lines reported a schedule that included a single daily non-stop bus between Oklahoma City and Fort Worth, perhaps signaling an expansion of the company's presence in this market (*58*). Fares for intercity bus travel in the corridor are not published, but several Amtrak on-board staff and *Heartland Flyer* passengers reported to researchers that the bus fares were more expensive than the train fares.

Two commercial air carriers provide regularly-scheduled service in the Oklahoma City-Fort Worth corridor: American Airlines, which serves Dallas-Fort Worth International Airport (DFW), and Southwest Airlines, which serves Dallas Love Field Airport (DAL). All regularly-scheduled commercial air service in Oklahoma City is at Oklahoma City-Will Rodgers World Airport (OKC). No other commercial air service airports exist along the *Heartland Flyer*

corridor. Table 3-1 shows a snapshot of air travel in the corridor, using calendar year 2008 air carrier data from the Office of Airline Information, Bureau of Transportation Statistics (BTS), Research and Innovative Technology Administration (*59*).

Table 3-1: Air Travel in Oklahoma City-Fort Worth Corridor, 2008

Route	Airline	Flights	Passengers	Load Factor
OKC-DFW	American Airlines	16	605,277	0.82
OKC-DAL	Southwest Airlines	10	318,587	0.70
	Total	**26**	**923,864**	**0.77**

Flights: Daily Flights; Load Factor: Passengers/Available Seats; *Source: TTI Analysis of BTS Data*

Figures from 2008 indicate that flights between Oklahoma City and airports in the Dallas-Fort Worth region carried nearly one million passengers. The reader should note that not all of these passengers had origin and destination at these airports and it is likely that many are transferring to or from other flights at DFW or DAL. No reliable estimate of air carrier travel between Oklahoma City and the Dallas-Fort Worth region inclusive was available.

CHRONOLOGY OF PASSENGER RAIL SERVICE IN CORRIDOR

To understand the current context of the *Heartland Flyer* service, the following paragraphs present a chronology of passenger rail service in the Oklahoma City to Fort Worth corridor. The chronology evolves from the early days of the Santa Fe Railway to Amtrak's *Lone Star* service of the 1970s and the restoration of passenger service in the corridor in 1999. Also discussed are proposals for expansion of the *Heartland Flyer* service.

Historical Development

Like much of the American west, the development of the Oklahoma City to Fort Worth corridor was linked to the development of the railroad through the region. The establishment of rail service in the corridor dates back to the late 1880s, when two railroad companies, the Atchison, Topeka, and Santa Fe (AT&SF); and the Gulf, Colorado, and Santa Fe Railway (GC&SF), agreed to connect their route systems via a route across the "unassigned lands" of the Indian Territory (the central portion of modern-day Oklahoma). With the AT&SF building south from its main line in Arkansas City, Kansas, and the GC&SF building north from Fort Worth,

the two lines met in Purcell in April 1887, opening a route from Chicago to the port of Galveston through Kansas City. Development along the route was limited to railroad activities until the opening of the "unassigned lands" for settlement in April 1889, which brought thousands of settlers to the region; almost overnight, tent settlements along the route grew into towns (*60*).

In 1948, the AT&SF established the *Texas Chief* along the route from Chicago to Galveston, through Kansas City, Newton, Fort Worth, and Houston. In branding the service with the "Chief" name, AT&SF hoped to capitalize on the success of its other "Chief" lines, the most famous of which was the Chicago-Los Angeles *Super Chief*. The *Texas Chief* covered the 1,355 mile route from Chicago to Houston in 25 hours. In 1955, service to Dallas was initiated by splitting off several coach cars in Gainesville (*61*). The *Texas Chief* coach and lounge cars incorporated symbols and themes of Texas. Service on the *Texas Chief* was popular enough to compete with trains like the Katy/Frisco *Texas Special*, to the point where the latter was discontinued due in part to competition provided by the former (*60*). As intercity passenger rail service began to lose patronage and become unprofitable for the company (and other lines across the country), the Santa Fe reduced service on the *Texas Chief*, first eliminating the segment from Houston to Galveston in 1967 followed by the branch from Gainesville to Dallas a year later (*61*). The Santa Fe would continue to operate the *Texas Chief* segment from Chicago to Houston until the company ceased all passenger operations in 1971.

Early Amtrak Era

Following Amtrak's creation in 1970, the Chicago to Houston route was retained in the company's basic national system of passenger rail service. On May 1, 1971, the operations of the *Texas Chief* were transferred from the Santa Fe to Amtrak. Amtrak initially operated the *Texas Chief* as a daily train with the route from Fort Worth to Houston via Temple, as the route had been operated by the Santa Fe. In 1974, citing poor quality of on-board service, the Santa Fe withdrew its permission for Amtrak to continue the use of its "Chief" trademark. In response, the train was renamed the *Lone Star*. In July 1975, the *Lone Star* route between Fort Worth and Houston was rerouted through Dallas (*14*). In 1979, the U.S. DOT found that the *Lone Star* was among the worst-performing trains in the Amtrak system, citing competition from alternative modes as the primary reason for the poor performance. Coupled with the lack of environmental

benefits resulting from the route's operations, the U.S. DOT recommended that the route be discontinued as part of a series of cuts to Amtrak services (*62*). The final trip for Amtrak's *Lone Star* was on October 8, 1979, leaving the corridor between Oklahoma City and Fort Worth without intercity passenger rail service (*14*).

Movement to Revive Service

In the years following the discontinuance of the *Lone Star*, several attempts to revive passenger rail service in Oklahoma were undertaken. In May 1984, members of Congress from Oklahoma, Kansas, and Missouri requested that the U.S. General Accounting Office (GAO) provide a review of Amtrak's ridership and revenue models; specifically, the models used to evaluate seven routing options for the reinstatement of Amtrak service in Oklahoma. The impetus for this inquiry was a report from Amtrak that same year finding that reinstated service to Oklahoma would be unable to meet financial benchmarks established for route performance. The GAO found that while the models used by Amtrak for estimating ridership and revenue did have some limitations, those limitations were not sufficient enough to cast uncertainty upon the estimates of ridership and revenue for the seven routes (*63*).

The movement to reestablish passenger rail service along the Oklahoma City-Fort Worth corridor gained momentum in the 1990s, fueled by actions of the Oklahoma Legislature and passenger rail advocacy groups. In 1993, House Bill 1078 was signed into law, which enacted a 4 cent per gallon increase in the state gas tax. The bill specified that 70 percent of the new revenue generated by the tax would be directed to transportation, with at least 4 percent allocated specifically to contract passenger rail services connecting "Oklahoma and Tulsa Counties" with other points in the national rail system (*64*). In 1996, Senate Bill 1192, the *Oklahoma Tourism and Passenger Rail Act*, was signed into law. The charge of this bill was to do "all things necessary" to restore passenger rail service in the state. The bill also created the "Oklahoma Tourism and Passenger Rail Revolving Fund" as a central account for passenger rail funds (*65*).

In 1996, Amtrak completed the *Oklahoma Rail Passenger Study* at the request of ODOT. This study evaluated the potential for rail passenger service in the state, including the restoration of service along the corridor between Oklahoma City and Fort Worth. Four alternative configurations of passenger rail service were considered: two that connected Chicago to the

Oklahoma City-Fort Worth corridor through Newton, Kansas (concurrent with the *Southwest Chief* service), the corridor between Oklahoma City and Fort Worth, and a route between Tulsa and Oklahoma City. The report provided an analysis of the rolling stock and capital investment requirements for each alternative, as well as demand and revenue forecasts (*66*). A more detailed report of operating times and demand forecasts for passenger rail service between Fort Worth, Oklahoma City, and Kansas City (via two alternatives; one through Newton with the *Southwest Chief*, another via Tulsa) was delivered in February 1999 (*67*).

Current Era

Funding to establish the *Heartland Flyer* and restore passenger rail service along the Oklahoma City-Fort Worth corridor that had been absent for nearly 20 years was made available through the *Taxpayer Relief Act of 1997* (*68*). The act provided funds to Amtrak, of which a specified percentage would be reserved for payments to states that were not currently served by Amtrak. Payments to Oklahoma, which totaled $23 million, were used to restore passenger rail service in the state, ultimately leading to the creation of the *Heartland Flyer* service. The inaugural run of the *Heartland Flyer* service occurred on June 14, 1999 (*69*). Ridership data show that during the first year of operation, more than 71,000 passengers rode the service.

In April 2005, a study prepared for ODOT examined the economic benefits to Oklahoma of the *Heartland Flyer* service (*69*). The study found that the *Heartland Flyer* ridership had exceeded projections during its first five years in service. The study also reported more than $11.4 million of direct spending attributed to the service, including earnings of Oklahoma residents employed by the service as well as tax revenues. The indirect effect of the state's investment in the *Heartland Flyer* was reported at more than $22 million over the five-year period. In May 2005, the Oklahoma Legislature approved $3.9 million to continue funding the *Heartland Flyer* service for FFY 2006 (*70*).

From the initiation of the service in June 1999 until 2006, the state of Oklahoma was the only state that provided financial support for the *Heartland Flyer* operations, in spite of the fact that the route served two cities in Texas. The state of Texas became involved with financially supporting the service in 2006, when the Texas Transportation Commission approved $1,838,000 to fund the *Heartland Flyer* service, matching the funding support contributed by the

state of Oklahoma (*71*). This action, representing the first time Texas had provided financial support for intercity passenger rail service, allowed the *Heartland Flyer* to continue operating in FFY 2007. Since 2006, both states have contributed equal amounts of funding support for the train's operations annually since 2006. For FFY 2010, both states contributed $1,950,000 for the operation of the *Heartland Flyer* service (*72*).

Proposed Service Expansion

Several configurations for the expansion of the *Heartland Flyer* service have been proposed during the route's 10-year history. Proposals for expanding the service have been concerned primarily with the extension of service north from Oklahoma City. In March 2010, Amtrak released a feasibility study of one proposed expansion to extend the route from Oklahoma City through the Oklahoma communities of Edmond, Guthrie, Perry, and Ponca City, toward Wichita (Kansas). The following four route configurations were considered in the feasibility study:

- Extending the current *Heartland Flyer* service to connect with the *Southwest Chief* at its scheduled stop in Newton, Kansas.
- Extending the current *Heartland Flyer* service utilizing the existing schedule with a new overnight component between Oklahoma City and Kansas City via Newton.
- Developing a new all-daylight service between Kansas City and Fort Worth supplementing the *Heartland Flyer* between Oklahoma City and Fort Worth.
- Developing a new all-daylight standalone service between Kansas City and Oklahoma City, without connections to the *Heartland Flyer* or the *Southwest Chief*.

Under any of the four proposed configurations, service would be reestablished along an intercity corridor that was lost when the Amtrak *Lone Star* was discontinued in 1979. The Kansas Department of Transportation (KDOT) was the key driver of this expansion proposal, in coordination with ODOT and TxDOT (*73*).

Expansion of the *Heartland Flyer* service toward Tulsa has also been considered. Service along this segment was considered in past feasibility studies (*66*,*67*), but no service has been established to date. The entire *Heartland Flyer* route and the intercity corridor between

Oklahoma City and Tulsa are included in the South Central High-Speed Rail Corridor, one of ten federally designated high-speed passenger rail corridors in the country (*3*). Much work on developing the Tulsa extension has been completed to date; most recently, ODOT released a Tier 1 environmental impact statement for this corridor (*74*). The approval status of the environmental impact statement is not known at the time of this writing but the document does contain detailed descriptions of the alternative routings under consideration as well as an overview of past studies of proposed service in the corridor. ODOT applied for $2 billion in funding provided through ARRA for the development of this corridor; however, the project was not awarded any funding (*4,75*).

Other proposals to expand the *Heartland Flyer* service have been focused on increasing the route's market area in Texas; specifically, the creation of a station stop in the north Fort Worth area to serve this growing area of the region. The proposed station would be located where the route crosses Farm-to-Market Road 1173 in Krum, Texas, approximately five miles west of Denton. The North Central Texas Council of Governments (NCTCOG) has been coordinating this effort, which could lead to a more direct connection to the Dallas central business district via the Denton County Transportation Authority commuter rail service (*76*).

HEARTLAND FLYER OPERATING DETAILS

This section provides more details of the operating context of the *Heartland Flyer*. The following paragraphs discuss information about the station stops along the route, the train's consist, ticketing arrangements, and the host railroad, the BNSF Railway.

Station Stops

The *Heartland Flyer* stops at five stations between Oklahoma City and Fort Worth. Four of these stops, Norman, Purcell, Pauls Valley, and Ardmore, are in Oklahoma while the fifth, Gainesville, is in Texas. Table 3-2 provides details of the seven *Heartland Flyer* station stops, including a description of the station facilities, parking, context, and amenities. Also provided in Table 3-2 is an estimate of the population of each city served by the *Heartland Flyer*, given as the July 1, 2008, estimate provided by the U.S. Census (*77*). The largest city served by the *Heartland Flyer* is Fort Worth, with an estimated population of 703,073 while the smallest cities

served by the route are Pauls Valley and Purcell, each with approximately 6,120 persons. The total estimated population of cities served by the *Heartland Flyer* is 1,415,331.

Table 3-2: *Heartland Flyer* Stations: Details

Station (Population)	Facility Type	Parking	Amenities
Oklahoma City (551,789)	• Former Santa Fe Depot • Privately Owned • Attached Retail	• On-Site • 47 Spaces • $6 Per Day	• Unstaffed • Indoor Waiting Area
Norman (106,957)	• Former Santa Fe Depot • City-Owned • Shared Space with Community Art Center	• Across Tracks • Adequate Spaces • Free	• Unstaffed • Indoor Waiting Area • Bicycle Parking
Purcell (6,129)	• Facility Opened 2001 • City-Owned	• On-Site • 27 Spaces • Free	• Unstaffed • Indoor Waiting Area • Local Transit Info
Pauls Valley (6,121)	• Facility Opened 2002 • City-Owned • Adjacent to Former Santa Fe Depot	• On-Site • 57 Spaces • Free	• Unstaffed • Indoor Waiting Area
Ardmore (24,810)	• Former Santa Fe Depot • Shared Space with Community Police and Main Street Coalition	• On-Site • 48 Spaces • Free	• Unstaffed
Gainesville (16,452)	• Former Santa Fe Depot • Santa Fe Museum	• On-Site • 15 Spaces • Free	• Unstaffed • Local Transit • Trolley to Outlet Mall
Fort Worth (703,073)	• Fort Worth Intermodal Transit Center • City-Owned	• Adjacent • Surface Lots/On-Street (Meter) • Parking Not Exclusive to Station	• Staffed Ticket Office • Indoor Waiting Area • Local Transit • Intercity Bus • Food Service • Rental Cars

Source: TTI Researcher Observations/U.S. Census

Stations along the *Heartland Flyer* route are either restored Santa Fe depots or recently constructed facilities. Appendix A contains photos of each of the seven *Heartland Flyer* stations. The distinctive southwestern-style architecture and décor of the traditional Santa Fe depots is evident at the restored stations in Oklahoma City, Norman, Ardmore, and Gainesville. Stations in Purcell and Pauls Valley were constructed in the early 2000s using funds provided by ODOT; the new Pauls Valley depot is adjacent to the former Santa Fe depot, which still bears

evidence of use during the Amtrak *Lone Star* era of the late 1970s. The Fort Worth Intermodal Transit Center is an extensive facility that includes Amtrak, local commuter rail and bus transit, Greyhound intercity bus and rental car services. Free parking is provided for passengers at all *Heartland Flyer* stations except for the endpoints in Oklahoma City and Fort Worth. The station in Oklahoma City is privately owned; while parking at the station is generally available for Amtrak patrons, parking can be restricted if the station's Great Hall has been reserved for an event. Stations are unstaffed (except in Fort Worth); however, "train hosts" from advocacy groups provide travel assistance to passengers at stations along the route.

Consist

The collection of rail vehicles (motive power and rolling stock) that comprise a train is known as the train's consist. The *Heartland Flyer*'s typical consist is a P42DC locomotive, two Superliner coach cars, one Superliner coach/café car, and a non-powered control unit (NPCU). Figure 3-3 shows a typical *Heartland Flyer* consist.

Figure 3-3: Typical *Heartland Flyer* Consist (Researcher Photo)

The inclusion of the NPCU allows for bi-directional or "push-pull" configuration, which means that the *Heartland Flyer* does not need to be turned around and pointed in the opposite direction at each end of the route. The following paragraphs describe additional details about each component of the *Heartland Flyer* consist.

Motive Power

A General Electric P42DC Genesis Series I diesel-powered locomotive provides motive power for the *Heartland Flyer*. Amtrak uses this locomotive on many of its routes across the country. Figure 3-4 shows a typical P42DC locomotive used on the *Heartland Flyer*.

Figure 3-4: Typical P42DC Locomotive Used on *Heartland Flyer* (Researcher Photos)

The P42DC Genesis Series I diesel-powered locomotive was built by General Electric Corporation Transportation Division in Erie, Pennsylvania. The locomotives used on the *Heartland Flyer* during the time of this study were constructed in late 1996 and early 1997, placing them at nearly 15 years in operation. The P42DC locomotive has a maximum speed of 110 miles per hour with 4,250 horsepower, although track geometries and signaling systems prevent the maximum speed from being achieved on most Amtrak routes.

Non-Powered Control Unit

The *Heartland Flyer* is equipped with a non-powered control unit for push-pull operations. The NPCU used on the *Heartland Flyer* and many other Amtrak routes equipped for push-pull operation is a former F40PH locomotive with the power element removed. In place of the engine is an empty space for the as-needed storing of passenger baggage, accessible from a rolling door on the side of the unit. Consequently, these units are also called cab-baggage or "cabbage" units. Figure 3-5 shows a typical NPCU used on the *Heartland Flyer*.

Figure 3-5: Typical NPCU Used on *Heartland Flyer* (Researcher Photos)

On the *Heartland Flyer*, the NPCU faces north. For the southbound run (morning #821), the engineer is located in the P42DC locomotive, operating in "pull" mode. For the evening (#822) northbound run, the NPCU is used and the P42DC locomotive operates in "push" mode. In the summer months, a second P42DC may replace the NPCU to provide backup power for the train, in the event that one of the engines malfunctions.

Rolling Stock

Rolling stock used on the *Heartland Flyer* includes the bi-level Superliner-series coach and coach/café cars. Amtrak uses the bi-level Superliner-series rolling stock on most of Amtrak's western routes and one route in the east (*5*). The typical *Heartland Flyer* consist includes two coach cars and one coach/café car. The coach/café car is generally located in the center of the train in order to minimize walking distance between the passenger seating and the café area, which is located on the lower level of the coach/café car. Figure 3-6 shows interior and exterior images of the Superliner-series cars used on the *Heartland Flyer*. The images in Figure 3-6 depict (clockwise from top left): upper-level seating area of Superliner-series coach car, lower-level seating area, passengers boarding a coach car at the *Heartland Flyer* stop in Norman, and the café area on the lower level of the coach/café car.

The coach cars contain 62 upper-level seats and 12 lower-level seats for a total seating capacity of 74 seats per car. Seating is in a "two-by-two" configuration, with two adjoining seats on each side of the center aisle throughout the length of the car. Lower-level seats are in compliance with Americans with Disabilities Act (ADA) accessibility guidelines and are also set aside for low-mobility passengers and their companions. The coach/café cars contain 62 upper-level seats, but no lower-level seating. A typical *Heartland Flyer* consist containing two coach cars and a single coach-café car has a total seating capacity of 210 seats, of which 24 (11 percent) are lower-level, ADA-accessible seating.

During peak travel periods (spring break and summer months), Amtrak adds an extra coach car to *Heartland Flyer* consist. The extra coach (also known as the "relief" or "protect" coach) is typically a second coach/café, although the second café component is not used in this arrangement. With the relief coach, the seating capacity increases to 272 persons. The number of ADA-accessible seats (24) does not change with this configuration, although it is a lower percentage of the total available seats (9 percent). The relief coach is also used in the consist

during non-peak times when the usual coach cars are removed for maintenance or inspection. Under this configuration, (one coach and two coach/café cars), the total seating capacity is 198 with 12 lower-level seats (6 percent of the total seating capacity).

Figure 3-6: Coach Cars Used on *Heartland Flyer* (Researcher Photos)

Several additional details of the *Heartland Flyer* coach cars are worth noting. Since the train is operated in "push-pull" mode, the coach cars are equipped for bi-directional operation as well, to avoid having passengers sit facing opposite of the direction of travel for one of the runs. Each block of two seats is oriented to face the direction of the train's travel either in Fort Worth during the day or overnight in Oklahoma City. Also worth noting are the loading patterns of passengers onto the train in Oklahoma City or Fort Worth. On-board staff generally try and load passengers at the start of the run based on the passengers' final destination. Passengers that depart the train at an intermediate station (called "shorts") generally load into the same car while the rest of the passengers load into the remaining cars. This allows the on-board staff to ensure

that the right passengers depart the train at the proper stations. The practice of seating passengers according to destination is commonplace across the Amtrak system.

The Superliner-series coach/café cars have been a regular part of the consist since the *Heartland Flyer*'s inauguration in June 1999. The Superliner-series coach cars, however, were incorporated into the consist on a regular basis starting in FFY 2008 (October 2007). Prior to the use of Superliner coach cars, older Santa Fe Hi-Line coach cars were used on the route. The Santa Fe Hi-Line cars used on the *Heartland Flyer* were inherited from the Santa Fe when Amtrak assumed the operation of all passenger routes in the country in May 1971. The Hi-Line cars used on the *Heartland Flyer* were constructed in the mid-1950s; by contrast, the Superliner equipment used presently was delivered in the early 1980s (*15*). While the Superliner and Hi-Line coaches are similar, one key difference is in the height of the car above the tracks, with the Superliner equipment slightly taller than the Hi-Line equipment. In photos of the consist taken before October 2007, one can identify the Hi-Line equipment by noting the elevation difference along the top edge between the Hi-Line coaches and the Superliner Coach/Café equipment.

Equipment Maintenance

Researcher discussions with Amtrak staff in Fort Worth indicated that most of the routine maintenance for the *Heartland Flyer* can be performed at the Amtrak maintenance shop in Fort Worth. This routine maintenance includes the required inspections of the locomotive, NPCU, and rolling stock. If maintenance cannot be performed in Fort Worth, the impacted equipment is attached to the *Texas Eagle* and taken to Amtrak maintenance bases in Chicago or Los Angeles.

Ticketing

The ticket price structure for the *Heartland Flyer* is based on the distance of travel and the time of ticket purchase relative to the date of travel (i.e., advance purchase). Typical fares on the *Heartland Flyer* during the time of this study ranged from $5 to $8 between Oklahoma City and Norman to $25 to $42 between Oklahoma City and Fort Worth. Several discounts are available that provide a reduced fare, both from Amtrak and special *Heartland Flyer*-only promotions. Standard fare discounts offered by Amtrak include seniors (age 62 and over), children (age 2 through 15, under age 2 free), military personnel, organized groups, and other specified passenger types or affiliations (*5*). One *Heartland Flyer*-only promotion that was in

effect during this research study was a special promotion, celebrating the *Heartland Flyer*'s tenth anniversary, which allowed passengers a 20 percent discount on the quoted fare (*78*).

One aspect of the ticketing arrangements that is unique to the *Heartland Flyer* (at the time of this writing) is worth discussing in greater detail. As previously mentioned, all of the stations along the route except for Fort Worth are unstaffed, meaning that no ticket agents are available to sell tickets or conduct other business in Oklahoma City or intermediate stations. Additionally, no automatic ticket dispensing machines (commonplace in Amtrak stations across the country) are available in the *Heartland Flyer* stations except for Fort Worth.

Because passengers are not ticketed before boarding the train (except in Fort Worth), the *Heartland Flyer* on-board staff (conductor and assistant conductors) must pass through the train and sell tickets or collect money for tickets that were reserved in advance. This is particularly an issue for the southbound train run (#821) because all passengers on that train board at stations with no ticketing capabilities. Researcher observation and on-board staff reports suggest that on high-demand runs of train #821, the on-board staff can spend most of the trip's four-plus hour duration completing ticket business in addition to their usual obligations to run the train safely. Since full ticketing facilities exist in Fort Worth, any ticket originating in Fort Worth that is purchased on-board is subject to a $9 penalty.

Host Railroad

Nearly all Amtrak routes outside of the Northeast Corridor spine, including the *Heartland Flyer*, operate over tracks owned by freight railroad companies, known as host railroads. Amtrak's access to freight railroad-owned infrastructure is guaranteed by the RPSA (*7*). The BNSF Railway Company owns the entire 206-mile route traveled by the *Heartland Flyer* (*5*). BNSF Railway is the largest host railroad for Amtrak trains, hosting an estimated 6.69 million train-miles in FFY 2008 (*6*). While Federal statute protects Amtrak's access to BNSF trackage (and enforceable by STB action if necessary), Amtrak and the BNSF maintain an incentive agreement for the *Heartland Flyer* service. The incentive agreement between BNSF and Amtrak for the *Heartland Flyer* is typical of incentive agreements in place with BNSF for other Amtrak routes, and is similar to Amtrak's older incentive agreements with other carriers. Under the incentive agreement, BNSF is provided with a financial incentive if the *Heartland Flyer* operates

on-time (as defined in the incentive agreement) and pays a penalty if the *Heartland Flyer* is delayed due to action by BNSF. BNSF has increased its focus on reducing delays on many routes, including on the *Heartland Flyer*, resulting in significant improvements in on-time performance. The "Service Data" section of this chapter provides additional details regarding the train's on-time performance.

The *Heartland Flyer* operates over BSNF Railway's Texas Division. Between Oklahoma City and Gainesville, the territory is a part of the Red Rock Subdivision. South of Gainesville, the tracks are part of the Fort Worth Subdivision. Freight activity over the BNSF Red Rock and Fort Worth Subdivisions averages approximately 22 trains per day. Freight generally hauled by these trains includes (*79*):

- Intermodal, auto, merchandise, and grain moving between the Pacific Northwest, California, Midwest, and Oklahoma, Texas, and the Gulf Coast;
- Coal from the Power River Basin of Wyoming to electric utilities in South Texas; and
- Grain and merchandise moving to and from Mexico.

A centralized traffic control (CTC) signaling system controls the entire 206-mile route, which means that a central dispatching center controls all signals and switches along the route. Maximum allowable speeds for passenger trains on the route are 79 miles per hour in Oklahoma and 55 miles per hour in Texas. Various locations along the route are subject to speed restrictions based on track geometry, passing clearance, or yard location. The ambient air temperature can also create the need for a speed restriction. Across both subdivisions, passenger trains may not exceed 60 miles per hour if the temperature is between 95 and 109 degrees Fahrenheit. Over 110 degrees Fahrenheit, passenger trains may not exceed 40 miles per hour (*80*). In January 2010, TxDOT was awarded a $4 million ARRA grant to upgrade equipment and signal timing at 15 crossings in the Fort Worth Subdivision (*4*). Upon completion of the project, maximum allowable passenger train speeds will be increased to as much as 79 miles per hour, reducing the running time of the *Heartland Flyer* by nearly 17 minutes (*79*).

HEARTLAND FLYER SERVICE DATA

The following paragraphs provide data on the key performance measures of the *Heartland Flyer* service. Measures reported include ridership and revenue, customer satisfaction, and on-time performance. All measures, unless otherwise noted, are reported for the federal fiscal year (FFY), which runs from October 1 to September 30. The most recent data are reported for FFY 2009, which ended on September 30, 2009.

Ridership and Revenue

Table 3-3 shows the annual (FFY) ridership on the *Heartland Flyer*. Since the inaugural run of the *Heartland Flyer* on June 14, 1999 (10 years, 3½ months), more than 657,000 passengers have made trips on the service. In FFY 2009, a total of 73,564 passengers rode on the *Heartland Flyer*, making the route the 17th-ranked state-supported route in the Amtrak system in terms of ridership (out of 19 routes). FFY 2009 ridership was 9.1 percent less than the FFY 2008 total, consistent with an overall decrease in ridership across the Amtrak system (*13*). Except for the spike in ridership during FFY 2008, ridership on the *Heartland Flyer* has grown consistently at approximately 8 percent annually since FFY 2003.

Table 3-3: *Heartland Flyer* Ridership and Revenue, FFY 1999-2009

Year (FFY)	Ridership	Revenue ($)	
		Ticket	Food & Beverage
1999[1]	26,832	532,985	37,098
2000	65,529	1,213,228	171,409
2001	57,799	1,069,520	118,150
2002	52,584	903,402	111,020
2003	46,592	756,268	124,540
2004	54,403	900,980	111,033
2005	66,968	1,187,567	135,098
2006	64,078	1,174,234	128,905
2007	68,245	1,260,566	155,518
2008	80,892	1,682,089	198,744
2009	73,564	1,592,434	152,312
Total	657,486	12,273,273	1,443,827

[1]FFY 1999 includes 3½ months; June 14 to September 30, 1999.

Source: Oklahoma Department of Transportation

Also reported in Table 3-3 is the annual revenue from *Heartland Flyer* passengers. Revenue is divided into two components: revenue from tickets and revenue from the sales of food and beverage in the café aboard the train. Since 1999, ticket revenues have totaled more than $12.2 million and revenue from food and beverage sales has exceeded $1.4 million. Not adjusting for inflation, the average price paid for a *Heartland Flyer* ticket is $18.67, although the average in FFY 2009 was nearly three dollars higher at $21.65. The average *Heartland Flyer* passenger spends approximately $2 on food and beverage purchases while on-board the train.

Figure 3-7 displays the monthly variation of ridership on the *Heartland Flyer*. The variation is reported with respect to the total average monthly ridership, which is normalized to a y-axis value of 1.0 and indicated by a solid horizontal line in the figure. In Figure 3-7, the solid line represents the average monthly variation from average calculated with 10 full years of ridership data (120 total months between FFY 2000 and 2009). The faded lines represent the monthly variation from average for each of the 10 years included in the 10-year monthly average.

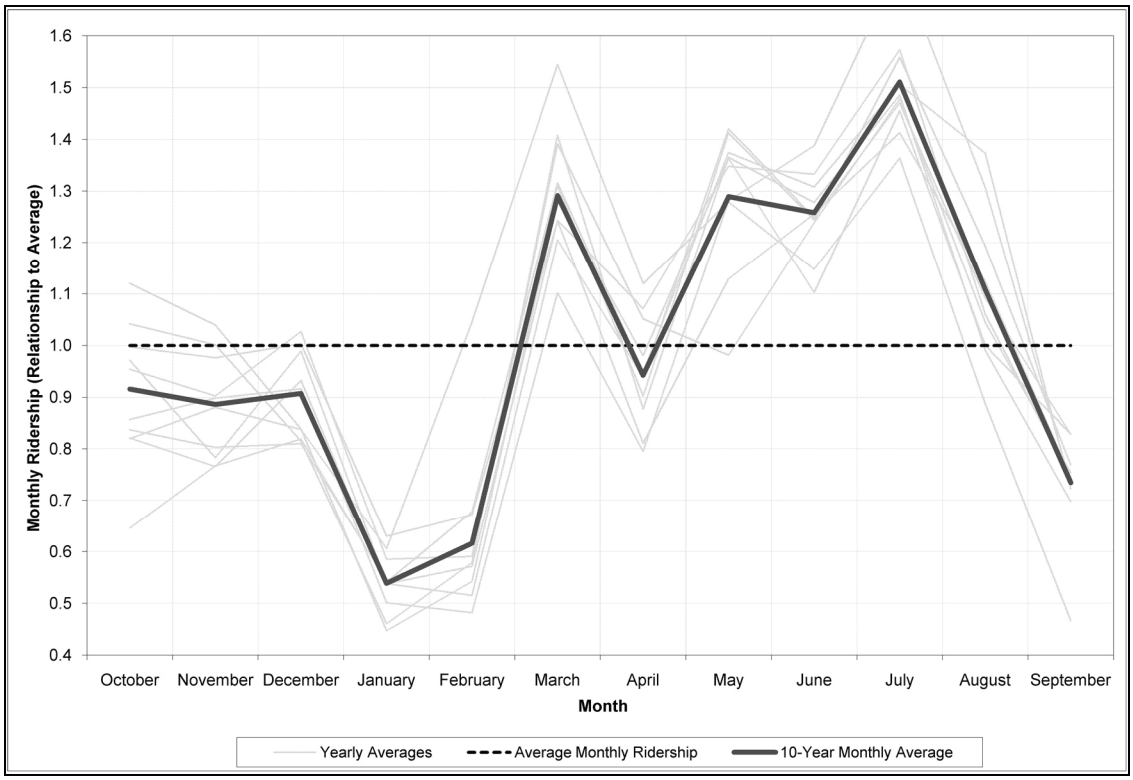

Figure 3-7: *Heartland Flyer* Monthly Ridership Variation against Average, FFY 2000-2009

Examining the 10-year monthly average variation, several seasonal patterns are immediately evident. Ridership during months when school is not in session (May, June, July, and August) is above average, with July ridership approximately 1.5 times average levels. Ridership is also above average in March, which corresponds to traditional spring break weeks. January, February, and September appear to be the lowest-demand months while ridership during the remaining months (April, October, November, and December) is approximately average.

Figure 3-8 displays the ridership variation by day of the week for the *Heartland Flyer*. Note that these data are for calendar year (CY) 2008 (January 1 to December 31). Figure 3-8 displays three lines, two for each train direction (#821 and #822) and a darker line for the total ridership for both directions together.

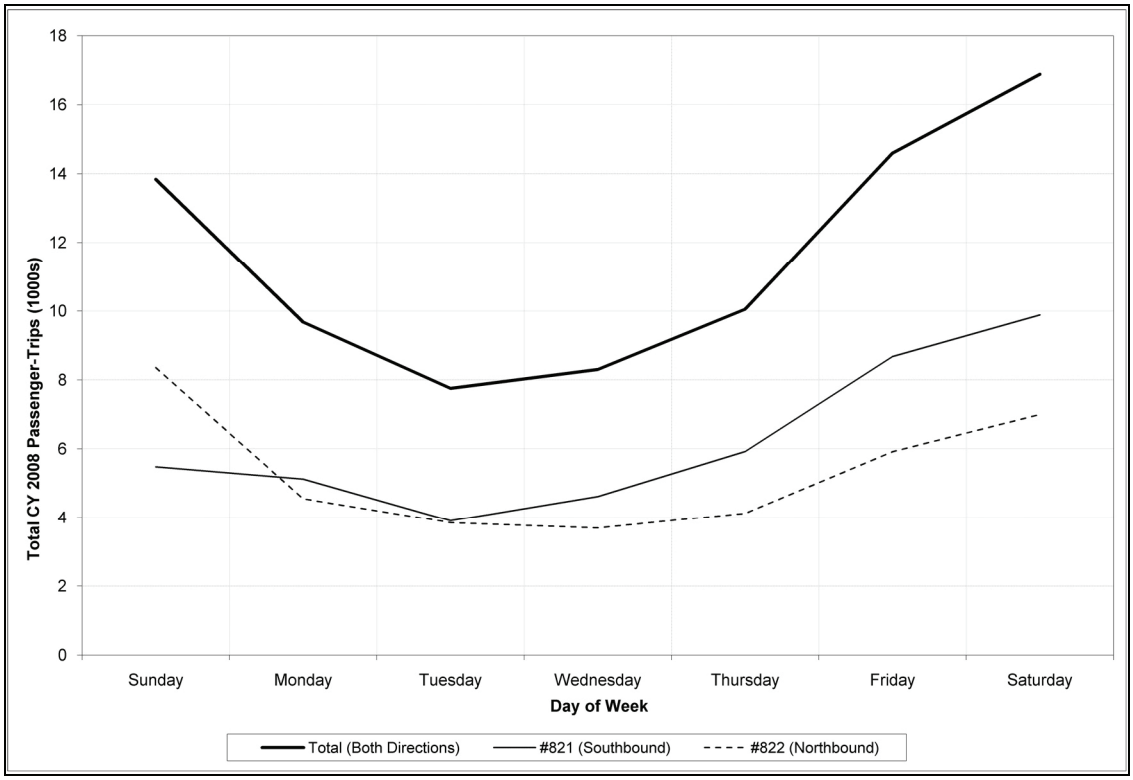

Figure 3-8: *Heartland Flyer* Daily Ridership Variation, CY 2008

Examining the variation of *Heartland Flyer* ridership by day of the week, it is noted that the total ridership is highest on Saturday and lowest on Tuesday. Other weekend days, Friday and Sunday, are also relatively high. Between the two train directions, ridership on train #821 (southbound) is highest on Friday and Saturday while the ridership on train #822 peaks on Sundays. This likely reflects weekend travel on the *Heartland Flyer*, with departures spread

across Thursday, Friday, and Saturday all returning on Sundays. Among Monday, Tuesday, and Wednesday, there appears to be very little difference between ridership on the two train runs.

Table 3-4 reports the total ridership activity at *Heartland Flyer* stations for FFY 2007, 2008, and 2009. Ridership activity at a given station consists of the count of passengers boarding trains at the station plus the count of passengers alighting trains at the station. In FFY 2009, the busiest station for the *Heartland Flyer* was Fort Worth, with more than 61,000 passengers boarding or alighting at the station. This is not surprising as Fort Worth is the largest city served by the *Heartland Flyer* and also the point of connection to other services in the Amtrak nationwide passenger rail network. The busiest station in Oklahoma is Oklahoma City, with more than 48,400 passengers served in FFY 2009. Consistent with nationwide ridership trends, FFY 2009 ridership activity at *Heartland Flyer* stations were lower than FFY 2008 except for in Ardmore, which increased 5.7 percent during FFY 2009.

Table 3-4: *Heartland Flyer* Station Boardings and Alightings, FFY 2007-2009

Station	Ridership			Percent Change	
	FFY 2009	FFY 2008	FFY 2007	vs. FFY 2008	vs. FFY 2007
Oklahoma City	48,434	55,015	43,293	-12.0	+11.9
Norman	12,573	13,414	11,033	-6.3	+14.0
Purcell	2,073	2,086	2,801	-0.6	-26.0
Pauls Valley	5,393	5,942	6,357	-9.2	-15.2
Ardmore	9,094	8,607	9,642	5.7	-5.7
Gainesville	8,108	9,249	9,589	-12.3	-15.4
Fort Worth[1]	61,181	67,190	53,588	-8.9	+14.2

[1]Only activity attributed to the *Heartland Flyer*; total activity in Fort Worth also includes *Texas Eagle*

Sources: Amtrak Government Affairs, Oklahoma and Texas State Fact Sheets

Activity at Purcell, Pauls Valley, and Gainesville was lower in FFY 2008 as well as FFY 2007, suggesting a general downward trend of demand at those stations. Compared to FFY 2007, station activity at Oklahoma City, Norman, and Fort Worth increased in FFY 2009. Note that the station activity in Fort Worth reflects only *Heartland Flyer* passenger activity at the station; station activity in Fort Worth can also be attributed to the *Texas Eagle*. Figures indicate that *Heartland Flyer* activity represents about 60 percent of the total activity in Fort Worth.

Among the 73,564 *Heartland Flyer* passengers in FFY 2009, Table 3-5 reports the five highest station-pairs by ridership. Collectively, the five city pairs reported in Table 3-5 represent more than 80 percent of the total demand. The city pair with the highest ridership, not

surprisingly, is Oklahoma City-Fort Worth, the route endpoints. This city pair accounted for more than half of all passenger trips on the *Heartland Flyer* in FFY 2009.

Table 3-5: Five Largest *Heartland Flyer* City Pairs by Ridership, FFY 2009

City Pair	Ridership	% of Total
Fort Worth-Oklahoma City	40,875	55.6
Fort Worth-Norman	9,358	12.7
Fort Worth-Ardmore	3,935	5.3
Oklahoma City-Gainesville	3,292	4.5
Fort Worth-Pauls Valley	2,586	3.5
All Other City Pairs	13,518	18.4

Source: TTI Analysis of ridership data provided by ODOT

Customer Satisfaction

Amtrak measures customer satisfaction on all its routes using a scoring system known as the CSI, which stands for Customer Satisfaction Index. Amtrak measures CSI by using a mail-based customer survey that rates the service during a specific trip. Customers are asked to rate 38 service elements on an 11-point scale (0 to 100 by 10). Table 3-6 presents CSI scores for the *Heartland Flyer* and a comparison with other state-supported and short-distance routes for FFY 2004 to FFY 2009.

Table 3-6: *Heartland Flyer* CSI Scores, FFY 2004-2009

Year (FFY)	Average Overall CSI Score		Percent Very Satisfied	
	Heartland Flyer	All Routes[1]	*Heartland Flyer*	All Routes[1]
2004	91	83	93	78
2005	90	83	89	78
2006	88	83	87	79
2007	86	84	83	79
2008	92	86	91	83
2009	94	88	94	85

[1]Composite group score for Amtrak State-Supported and Short-Distance Corridors

Source: Amtrak

In Table 3-6, the "Average Overall CSI Score" is the average CSI rating across all 38 survey items and the "Percent Very Satisfied" is the percentage of responses that are "very satisfied," defined as scores of 80, 90, or 100 on a survey item. Based on the Amtrak CSI measure, *Heartland Flyer* passengers are very satisfied with the level of service quality and other service elements on-board the train. Scores on the *Heartland Flyer* are consistently higher than

the average scores for its peer group, other state-supported and other short-distance corridors. In FFY 2009, the *Heartland Flyer* average overall CSI score and percent very satisfied ranked second among the 26 routes in this category.

On-Time Performance

One measure of importance to the patronage of current intercity passenger rail service and the development of new markets for passenger rail is the on-time performance of intercity passenger rail routes. Arguably, travel time reliability is likely a major determinant in travelers' decision to use passenger rail for a trip. Therefore, improving travel time reliability (i.e., consistent on-time performance) would likely increase ridership on a route. Amtrak defines trains as "late" with performance thresholds according to the total endpoint-to-endpoint distance of a route, as follows:

- Routes up to 250 miles: Arrival at endpoint more than 10 minutes behind schedule;
- Routes between 251 and 350 miles: more than 15 minutes behind schedule;
- Routes between 351 and 450 miles: more than 20 minutes behind schedule;
- Routes between 451 and 550 miles: more than 25 minutes behind schedule; and
- Routes above 551 miles: more than 30 minutes behind schedule.

Amtrak reports that for FFY 2009, the on-time performance of the 206-mile *Heartland Flyer* was 83.3 percent, which means that five out of every six *Heartland Flyer* trains arrived at the endpoint within 10 minutes of the scheduled time. Figure 3-9 shows the monthly percent on-time for the *Heartland Flyer* between January 2004 and the end of FFY 2009.

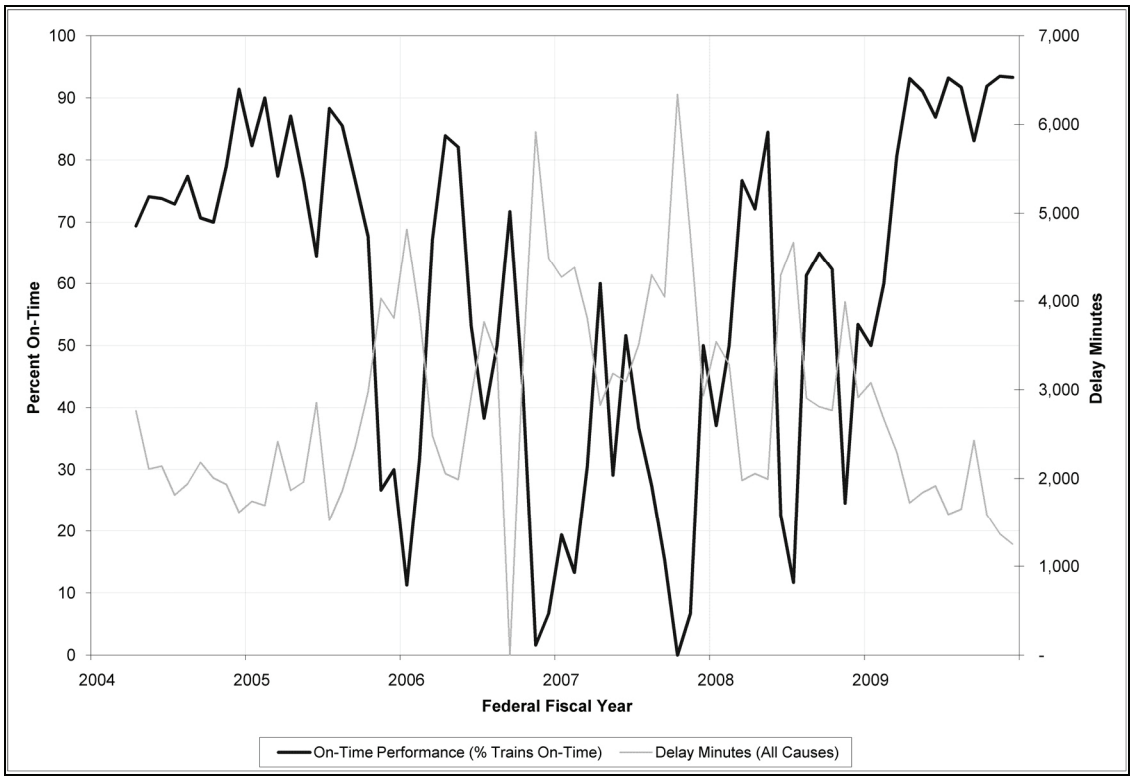

Figure 3-9: *Heartland Flyer* On-Time Performance and Delay Minutes

Amtrak also accounts for the causes of all minutes of delay of its trains and attributes them either to its own actions, actions of the host railroad, or other delays. Delays attributed to Amtrak include delays for passengers or equipment maintenance. Delays attributed to the host railroad include delays for slow orders, track or structures maintenance, or interference from freight train traffic. Other delay minutes include weather-related delays or grade crossing accidents. Figure 3-9 also reports total delay minutes for *Heartland Flyer* trains for each month between January 2004 and September 2009, graphed on the right vertical axis. On-time performance and delay minutes were compiled from Amtrak monthly reports available on Amtrak's website. Delay minutes for June 2006 were not available. The shapes of the time-series lines in Figure 3-9 indicate a mirror-image relationship between on-time performance and delay. It is not surprising that these variables would assume such a relationship. During FFY 2009, *Heartland Flyer* trains were delayed a total of 23,420 minutes, which were attributed to three sources as follows:

- Amtrak, 2,368 minutes (10.1 percent);
- Host Railroad, 19,160 minutes (81.8 percent); and

- Other Delays, 1,892 (8.1 percent).

The three longest delay causes in FFY 2009 attributed to Amtrak were the following:

- Holds for passenger boarding, 645 minutes (27 percent);
- Crew-related delays or delays in signal block, 469 minutes (20 percent); and
- Engine failure, 430 minutes (18 percent).

A majority of the delays attributed to the host railroad (BNSF Railway), and the largest single cause of *Heartland Flyer* delay for FFY 2009 was for slow orders, which accounted for 11,391 delay minutes in FFY 2009 (60 percent of host railroad-attributed delays). Other substantial causes of delay minutes attributed to the host railroad included freight train interference, 3,834 minutes (20 percent); and routing delays, 2,334 minutes (12 percent). The percentage of total delay attributed to the host railroad, BNSF Railway, has improved from more than 90 percent in past years to slightly more than 80 percent in FFY 2009. It is likely that this reduction is due, at least in part, to BNSF's increased focus on reducing delays on many of the passenger rail routes that operate over its trackage.

CHAPTER 4: DATA COLLECTION

The main objective of this study was to examine the role of state-supported passenger rail service in a short- to medium-distance intercity corridor and measure the benefits of providing the service. In pursuit of this objective, the key task of the study was an on-board survey of *Heartland Flyer* passengers. This chapter describes the data collection procedures in detail, including the design of the on-board survey instrument, the data collection process and results, and the data reduction process. The chapter concludes with a discussion of the lessons learned from this on-board survey effort that can be applied by researchers or analysts when planning future on-board surveys of intercity passenger rail routes.

SURVEY DEVELOPMENT

This section describes the development of the survey instrument used in the on-board survey of *Heartland Flyer* passengers in this study. Reported are the concepts and considerations for the preliminary survey design, feedback provided by project stakeholders, and the study's approval by the Texas A&M University Institutional Review Board.

Preliminary Design

Chapter 2 of this report included a discussion on the design of on-board surveys for other intercity passenger rail routes. Researchers used many of the lessons learned in the literature review and the analysis of past on-board surveys of state-supported intercity passenger rail routes to guide the design of the survey instrument and the development of the data collection procedures that were employed in this study.

In the initial stages of the survey instrument design, researchers decided that the survey for this study would be most effective if it were a maximum of two letter-size pages in length. This would allow for the survey to be no more than a single sheet of paper printed on both sides and would minimize the amount of burden on the respondent, in turn increasing participation in the study. Another decision for the design of the survey was to utilize as many "closed" questions as possible. These questions provide the respondent with a predetermined set of choices for each question and a check box or other space to indicate the selected choice. Closed

questions also reduce respondent burden, which in turn improves the quantity and the quality of the survey response. Using "closed" questions with specified answers also simplifies the analysis of survey data by greatly reducing the need to interpret the meaning and intent of written survey responses. Survey items that were considered essential for inclusion in the survey instrument for this study included the following:

- Introductory narrative explaining the purpose of the survey and project participants;
- Boarding and alighting information: station, travel mode, time/distance;
- Trip information: trip purpose, trip frequency, alternative travel mode;
- Passenger demographics; and
- Passenger comments area.

The boarding and alighting station and travel mode questions were designed as closed questions while the time and distance items were left open to allow the respondent to write in the appropriate answer. The purpose of including time and distance was to identify the market area for the service; that is to say, from how far away passengers travel to access the rail service. Both time and distance as a measure of market area were provided as options for passenger response as recommended in survey design literature (*51*). Passenger demographic questions on the survey included passenger residential zip code, gender, age, employment status, travel party size (adults and children), household vehicles, and household income. All demographics questions except for residential zip code and travel party size were closed questions. The residential zip code question provided five boxes for the passenger to write in each number of the five-digit zip code separately. At the bottom of the second page of the survey, a small space was provided for the passenger to write comments about the *Heartland Flyer* service. Researcher contact information was also provided in the event that a respondent had any questions or wished to submit the survey form at a later time. To aid in the accounting of survey forms during the data collection process and throughout the analysis, an index number was stamped on the upper right-hand corner of both sides of the survey form.

After adding all the above "essential" items to the draft survey instrument, some additional space remained in the two-page layout. Researchers considered several alternative questions pertinent to measuring the impacts of the rail service. Questions on service changes or

amenities that could increase rail trip frequency were considered, but researchers determined that this type of question would be inefficient considering that the current service arrangement was sufficient enough for the passenger to ride the train (as it was an on-board survey). Questions evaluating customer satisfaction with the *Heartland Flyer* on-board service and amenities were also considered, but Amtrak conducts its own customer service surveys on the route and including these questions on the survey for this study would add no new information. Researchers ultimately decided upon a question asking the respondent why he or she chose the *Heartland Flyer* for their trip and a question on passenger spending for purchases on their trip. Fourteen choices plus an "other" option were provided for the question on the passenger's reason for choosing the train. For the passenger spending question, five ranges were provided as choices and the question asked the passenger to consider only spending on lodging, meals, shopping, and entertainment during the trip. This question was added to provide data to estimate the economic impact of the *Heartland Flyer* on the communities it serves.

Stakeholder Input

Stakeholders for this study included Amtrak, ODOT, and TxDOT. Preliminary input from stakeholders regarding the design of the on-board survey instrument was obtained at a project meeting on December 11, 2008, in Fort Worth (e-mail comments were solicited from TxDOT). Based on the preliminary stakeholder input and the literature review/analysis, a draft survey was developed and submitted to stakeholders for review and comment. Stakeholders provided feedback which resulted in several minor changes to the draft survey document, mostly in the form of clarification to the wording of questions regarding the passenger's access and egress travel mode, trip purpose, alternative travel mode, and the reasons for choosing the *Heartland Flyer* for the trip. TxDOT requested that the survey instrument include a gauge of passenger interest in a new station stop in Krum, Texas (near Denton); specifically, if the proposed station would increase ridership. However, this question (and other questions on changes that could be made to increase ridership) was not included in the final survey for reasons that were discussed previously. Finally, stakeholders reported that a vast majority of the ridership was English-speaking, and that the development of survey forms in other languages would not be necessary. Appendix B contains a copy of the final survey form used in the data collection phase of this study.

Stakeholders also provided guidance to the researchers on the data collection procedure. One proposal for the data collection procedure involved leaving a blank survey form and pencil on every seat of the train before passengers boarded, in an attempt to maximize the distribution of the survey to all eligible passengers. However, Amtrak staff advised against this proposed method and advised that the researchers distribute the blank survey forms to the passengers personally. Additionally, both Amtrak and ODOT advised the use of an opaque box with an opening in the top located in the café car for passengers to drop off completed survey forms. Amtrak management also allowed researchers to access the train at the same time as the on-board staff (before passengers boarded), which would provide the researchers adequate time to prepare the data collection materials. Subsequent sections of this chapter discuss additional Amtrak on-board staff involvement in the on-board passenger survey. Amtrak also allowed researchers to utilize the crew hotel for overnight accommodations in Oklahoma City, including transfer between the station and the hotel. As a final step, researchers received approval from Amtrak for the specific dates of the data collection, as Amtrak was also scheduling its own internal surveys of *Heartland Flyer* passengers during this time period.

Institutional Review Board Approval

Since this research study involved interaction with human subjects, researchers were required to receive approval from the Texas A&M University Office of Research Compliance's Institutional Review Board (IRB) before undertaking any data collection. Researchers submitted an initial application to the IRB on March 12, 2009. The IRB application included a detailed description of the proposed data collection procedure, a blank copy of the survey instrument, and letters of support for the study from Amtrak, ODOT, and TxDOT. The IRB requested additional information and a revised application was submitted on March 26, 2009. The IRB protocol (#2009-0199) was ruled "exempt from full IRB review" and approved on April 2, 2009. The initial IRB application reported that approximately 1,200 subjects would participate in the study. When researchers scheduled the second round of data collection in June 2009, an amendment to the IRB protocol was necessary to increase the subject pool, as researchers anticipated that the original approved subject pool size would be exceeded with the second round of surveys. Researchers submitted an amendment to the IRB on June 22, 2009, requesting that the subject

pool be increased to 3,000. The IRB approved the amendment request on June 25, 2009. Appendix C of this report contains full IRB approval documentation.

DATA COLLECTION

The original project schedule provided for a single round of on-board surveys to be conducted in April 2009. On-board surveys of *Heartland Flyer* passengers were conducted on both southbound (#821) and northbound (#822) runs starting on Wednesday, April 22, and ending on Sunday, April 26 (ten survey runs total). In June 2009, researchers determined that sufficient funds remained in the project budget for a second round of data collection, which occurred starting on Wednesday, July 22, through Saturday, July 25, 2009 (seven survey runs total). The months of the data collection correspond to the average (April) and the peak (July) travel seasons for the *Heartland Flyer* (see Figure 3-7). Researchers designed the data collection to include *Heartland Flyer* runs on weekdays, Friday, and weekend days. This was done to ensure that the passenger characteristics of the different day types would be included in the survey. The following paragraphs describe in detail the data collection procedure. This section also includes a summary of the data collection efforts and discussion of non-response.

Data Collection Procedure

The procedure employed by the researchers to collect the on-board survey data was consistent for all surveyed runs. Researchers boarded the train in advance of the passengers and were directed by the on-board staff to a location on the train to set up an "office" to store survey supplies and personal items. Depending on the anticipated passenger counts for the specific day and run, the researchers were either seated in the rear of the train or on the unused coach car. In July, researchers were seated in the unused café area on the lower level of the "protect" coach. Attire for the researchers included a collared shirt, slacks, comfortable shoes, and a name tag identifying the researcher's affiliation with the Texas Transportation Institute. Researchers used tool bags to carry supplies, reducing the number of items carried by hand. In addition to the convenience, having the hands free allowed the researchers to balance and safely pass through the train on foot.

Once the train had departed the originating station, researchers waited for the on-board staff to complete a small amount of business with the passengers before allowing the researchers to begin the survey distribution. After receiving notification from the on-board crew, researchers passed through the train and asked each passenger who appeared to be 18 years of age or older if he or she wished to participate in the study. If the passenger wished to participate, the researcher provided him or her with a blank survey form and a golf-sized pencil. Some passengers elected to use their own writing utensil rather than the pencils provided. After passing through the train once distributing surveys, researchers passed through again to collect completed surveys and answer questions from the passengers. Completed surveys were placed in a manila-colored envelope if passed back to the researcher or deposited into the box in the café car by the respondent. At intermediate stations, on-board staff informed researchers of where in the train newly boarded passengers were seated. Surveys were offered to those individuals at that time. Passengers that were sleeping or on cell phones were not offered a survey. At the end of each run, the box in the café car was emptied out and researchers passed through the train to pick up any surveys or pencils left in the seats.

Throughout the entire duration of the data collection effort, coordination between researchers and the *Heartland Flyer* on-board staff was extremely beneficial. The on-board staff allowed researchers to board the train in Oklahoma City or Fort Worth before the passengers were allowed to board. This allowed researchers to set up an "office" area to prepare survey materials and also to store extra supplies and personal items. On-board staff also provided researchers with estimated passenger counts for the particular run, so as to prepare for the number of surveys to be distributed. The on-board staff provided guidance to researchers on where passengers who had boarded at intermediate stations were seated, to avoid confusion as to which passengers had already been surveyed. Finally, although it was not specifically requested by the researchers, the on-board staff would occasionally announce the presence of the researchers and the survey effort over the train's public address system at the start of the run. Without the valuable assistance and support provided to the researchers by the on-board staff, the data collection phase of this study would undoubtedly have been much more difficult.

Summary of Data Collection

Tables 4-1 and 4-2 show the details of the two rounds of on-board survey data collection for April 2009 and July 2009, respectively. Data reported in these tables include (for each run):

- The total number of passengers;
- The number of passengers ineligible for participation in the study;
- The number of passengers who declined to participate in the study;
- The number of blank survey forms distributed; and
- The number of surveys returned to researchers with valid data.

Also reported in Tables 4-1 and 4-2 are the totals of each of these measures for all southbound (#821) and northbound (#822), and the totals for all runs. The percentage of passengers eligible for the study is equal to the total eligible divided by the total number of passengers on the run. The participation rate is equal to the number of valid surveys returned divided by the number of eligible passengers on the run.

In April, a total of 877 passengers boarded the *Heartland Flyer* during the ten data collection runs. Of these, 570 passengers (65 percent) were eligible for the survey and a total of 435 valid survey forms were returned. In July, 1,161 passengers rode the *Heartland Flyer* during the seven data collection runs with 773 (67 percent) eligible. In July, a total of 588 valid survey forms were returned to researchers. For both April and July, the total participation rate was 76 percent of those eligible. Nearly all (more than 98 percent) of the surveys distributed to passengers were returned to the researchers. In April, six surveys were excluded from the analysis (three un-returned and three returned substantially incomplete); in July, 12 surveys (five un-returned and seven substantially incomplete) were excluded.

Table 4-1: Data Collection Details: April 2009

Date	Train	Total Passengers	Passengers Not Eligible			Total Eligible	Refused	Surveys Distributed	Surveys Returned	Percent Eligible	Participation Rate (%)
			Under 18	Groups	Other						
April 22	821	50	11	0	2	37	0	37	37	74	100
April 22	822	36	4	0	1	31	2	29	28	86	94
April 23	821	42	3	0	1	38	4	34	34	90	89
April 23	822	41	4	0	1	36	2	34	33	88	92
April 24	821	100	12	0	1	87	11	76	74	87	85
April 24	822	94	15	0	1	78	23	55	55	83	71
April 25	821	186	24	52	18	92	17	75	74	49	80
April 25	822	111	14	28	18	51	18	33	32	46	63
April 26	821	90	6	52	1	31	4	27	27	34	87
April 26	822	127	13	24	1	89	48	41	41	70	46
All	821	468	56	104	23	285	36	249	246	61	86
All	822	409	50	52	22	285	93	192	189	70	67
Total		877	106	156	45	570	129	441	435	65	76

Table 4-2: Data Collection Details: July 2009

Date	Train	Total Passengers	Passengers Not Eligible			Total Eligible	Refused	Surveys Distributed	Surveys Returned	Percent Eligible	Participation Rate (%)
			Under 18	Groups	Other						
July 22	822	135	38	0	2	95	11	84	84	70	88
July 23	821	206	42	63	2	99	23	76	74	48	75
July 23	822	135	40	0	2	93	21	72	71	69	76
July 24	821	199	53	0	2	144	41	103	102	72	71
July 24	822	119	32	0	2	85	14	71	70	71	82
July 25	821	204	63	0	2	139	22	117	111	68	80
July 25	822	163	43	0	2	118	41	77	76	72	64
All	821	609	158	63	6	382	86	296	287	63	75
All	822	552	153	0	8	391	87	304	301	71	77
Total		1161	311	63	14	773	173	600	588	67	76

Ineligible Passengers

Several groups of passengers were not eligible to participate in the research study. Passengers under age 18 (minors) were not surveyed as parental consent would have been necessary for their participation. Some past studies had included passengers as young as 16 in their surveys (likely wanting to obtain a response from all of the train riders who might have access to an automobile), but the requirement for parental consent made including these passengers impractical for this study. Passengers traveling as part of an organized group were also not included in the final study. Researchers obtained some surveys of passengers from groups in April, but researchers decided to not include these data in the final analysis. The decision to exclude data from groups was, in large part, due to the fact that these passengers did not choose to ride the train so much as they chose to participate with a group travel event that happened to include the train. On April 25, a group of passengers on two of the runs that were participants in and support staff of a contest sponsored by ODOT as part of the celebration of the *Heartland Flyer*'s tenth anniversary in service were also not eligible. Finally, researchers who were distributing and collecting surveys (one in April, two in July) were included in the passenger count but were obviously ineligible for the study.

Influences on Survey Non-Participation

The participation rate of this study in both survey periods was 76 percent, meaning that 76 percent of those passengers eligible to participate in the study returned a valid survey form to the researchers. The causes of non-participation were not formally tabulated, but a majority of the non-participants consisted of those passengers that simply declined to participate in the study. One possible reason why passengers did not want to participate in the study was because they had already taken the survey once and did not want to bother taking it again. This occurred frequently on the northbound run (#822) with passengers who were making day trips, having filled out the survey that morning. In April, the participation rate for train #822 was nearly 20 percentage points lower than #821. However, in July, passengers on train #822 participated in the study at a slightly higher percentage than #821. Other causes of non-participation include passengers that were sleeping, talking on a cell phone, or language barriers. Table 4-3 shows the participation rate from this study compared with similar rates for other past studies. In general, response rates for intercity passenger rail on-board surveys are high, likely due to the fact that

the passenger is "captive" on the train for a long enough period of time to complete the survey. The participation rate for this study appears to be approximately average among the studies identified that reported the information.

Table 4-3: Participation Rates for Past On-Board Passenger Surveys

Route	Date	Participation Rate (%)	Source
Hiawatha Service	1989	93	(*24*)
Hiawatha Service	1991	87	(*25*)
Capitol Corridor	2007	81	(*34*)
San Diegans	1992	81	(*33*)
Heartland Flyer	**2009**	**76**	**N/A**
Capitol Corridor	2008	76	(*35*)
Carolinian/Piedmont	2001	75	(*22*)
Piedmont	1996	66	(*21*)
Hiawatha Service	2005	62	(*26*)
Keystone	1994	52	(*20*)
Michigan Routes	2001	39	(*28*)
Downeaster	2004	39	(*19*)

Some of the variation among studies in Table 4-3 can be attributed to the data collection design utilized by each study. Specifically, the treatment of passengers on their second leg of a round-trip or multi-leg journey during the study period differed between certain studies. The *Capitol Corridor* surveys, for example, did not survey the same passenger more than once a day (recalling this route has a lot of commuters); however, those passengers were not included in the denominator for the calculation of the participation rate. The *Keystone* study included all passengers in the denominator for calculating participation rate but only asked passengers to complete the survey once, resulting in the low response rate. All other studies in Table 4-3 asked all passengers to participate in the study and included all eligible passengers in the denominator for computing the reported participation rate. In transportation surveys, researchers often use incentives to encourage members of the target population to participate in the survey, which in turn increases the participation rate. Incentives could include monetary or in-kind compensation, or entry into a drawing for a prize. None of the studies in Table 4-3 reported the use of an incentive to increase survey participation among rail passengers. In this study, researchers considered the use of incentives to improve participation but ultimately none were used.

QUALITY CONTROL

After completing the on-board survey data collection, survey responses were keyed into a spreadsheet program to prepare for the analysis phase. After completing the data input task, the next task was to perform a systematic quality control review of the raw data. Three major sources of error in transportation surveys are non-response (i.e., non-participation), inaccurate reporting, and non-reporting (*54*). The previous section discussed issues related to non-response in the survey of *Heartland Flyer* passengers in this study. The following sections address the remaining two sources of error and the treatment of these errors, where appropriate.

Inaccurate Reporting

The first source of error addressed in the quality control and cleaning process was inaccurate reporting. Inaccurate reporting, also known as measurement bias, occurs when the analyst determines that a response provided to a survey question is incorrect, inaccurate, or incomplete (*54*). It can also be described as the extent to which the respondent understood what was being asked in the question. Inaccurate reporting can be attributed to either the design of the survey or question, or the passenger's interpretation of either. In the *Heartland Flyer* survey, sources of inaccurate reporting included "other" responses to survey questions, respondents that provided multiple responses where only one was requested, and other errors that occurred in the data set. Inaccurate reporting can be mitigated by recoding or discarding survey responses from the analysis. Recoding of survey responses is a serious matter, as the analyst must be certain that the recoding retains the respondent's original intentions in the process.

"Other" Responses

Several items on the survey instrument included the option for an "other" response, where the respondent could write in an answer if he or she felt like the choice set provided did not include their preferred choice. These responses were reviewed to determine if any could be recoded to match one of the alternatives provided in the choice set for the question. Table 4-4 summarizes the treatment of these "other" responses in the data set. The "# of Other" column reports how many "other" responses were obtained in each survey round; for example, for the access mode to station item, 15 respondents in April and 14 in July marked "other" and provided an answer. This format is repeated in the "Recoded Values" column.

Table 4-4: Treatment of "Other" Responses in Data Set

Survey Item	# of Other (April/July)	Recoded Values (April/July)
Q2: Access Mode to Station	15/14	• Drove and Parked at Station (6/11) • Dropped off by Private Vehicle (4/0) • Local Transit/Bus/Trolley (1/0) • Walked (1/0) • Connecting Amtrak Train/Bus (0/2) • Taxi/Shuttle (3/1)
Q5: Egress Mode from Station	10/25	• Ride in Vehicle Parked at Station (7/21) • Picked up by Private Vehicle (1/1) • Connecting Amtrak Train/Bus (1/1) • Intercity Bus (1/0) • Taxi/Shuttle (0/2)
Q7: Trip Purpose	38/37	• Visiting Family or Friends (5/3) • Going To/From University/College (1/0) • Going To/From Business Trip (2/1) • Leisure/Recreation (4/6) • Personal Business (8/13) • Vacation (0/1) • Retained Other (18/13)
Q8: Alternative Travel Mode	13/11	• Drive a Private Vehicle (2/1) • Passenger in a Private Vehicle (1/0) • Intercity Bus (4/7) • Would Not Make Trip (3/1) • Retained Other (3/2)
Q11: Reason for Choosing *Heartland Flyer* for Trip	102/185	• Train Least Expensive (0/1) • Train More Comfortable (0/2) • On-Board Food/Drink (0/1) • No Vehicle Available (1/0) • No Other Reasonable Option (1/1) • Experience for Child/Grandchild (10/45) • First Time/Never Been (18/24) • Novelty of Train Travel (31/45) • Fun/Pleasure (22/45) • Retained Other (19/21)
Q18: Employment Status	9/24	• Employed Full-Time (5/13) • Employed Part-Time (1/0) • Unemployed (2/1) • Non-College Student (1/0) • Retained Other (0/10)

For the access mode to station question, a majority of the "other" responses indicated the use of a rental car or that the parking was off-site. These responses were recoded to "Drove and Parked at Station"; even though the respondents that reported off-site parking were correct in marking "other" for their answer to this question, it was recoded for the purposes of this analysis, which was not concerned with the location of parking. A similar pattern was observed for the "other" responses to the egress travel mode question. Many of the "other" responses to the trip purpose question were unable to be recoded; these responses included trips for "going home," relocating, transfer to the airport in Dallas, and BNSF Railway employee deadhead. In July, passengers traveling to a religious convention in Fort Worth marked "other" as their trip purpose, but these were recoded to "personal business" for the analysis. For the alternative travel mode question, respondents tended to mark "other" and report "Greyhound" in the "please specify" line even though the choice set included "Intercity Bus" as an option. On the "Reasons for Choosing the *Heartland Flyer* for Trip" question, many of the "other" responses were similar enough that researchers created four new response categories and reclassified the responses accordingly. For this question, "Other" was also retained as a valid response. For employment status, a majority of the "other" respondents indicated that they were self-employed, which was recoded to "employed full-time" for this analysis.

Multiple Responses

Some responses in the data set included multiple responses to questions that were designed for only one response. The treatment of multiple responses is less straightforward than some of the other corrections made in the quality control process, as it is difficult to identify the "primary" response from multiple responses. Table 4-5 shows the treatment of multiple responses in the *Heartland Flyer* data set.

Table 4-5: Treatment of Multiple Responses in Data Set

Survey Item	# of Multiple Responses (April/July)	Recoded Values (April/July)
Q2: Access Mode to Station	4/4	• Drove and Parked at Station (0/1) • Commuter Train (0/2) • Walked (1/0) • Taxi/Shuttle (1/0) • Retained Multiple Response (2/1)
Q5: Egress Mode from Station	8/3	• Local Transit Bus/Van/Trolley (3/1) • Commuter Train (0/2) • Walk (2/0) • Taxi/Shuttle (2/0) • Retained Multiple Response (1/0)
Q7: Trip Purpose	34/51	• Leisure/Recreation (1/0) • Personal Business (2/0) • Shopping (0/1) • Other (2/0) • Retained Multiple Responses (29/50)
Q8: Alternative Travel Mode	15/23	• Retained Multiple Responses (15/23)
Q11: Reason for Choosing *Heartland Flyer* for Trip	27/23	• Retained Multiple Responses (27/23)
Q18: Employment Status	6/25	• Retired (2/0) • Retained Multiple Responses (4/25)

For access and egress modes of travel, researchers identified the primary mode of travel based on the multiple responses given in tandem with other information on the survey form; for example, if a respondent that was going to Fort Worth marked commuter train, local transit, and walked, researchers concluded that person was using a commuter train to go to Dallas first, then the other modes. For other questions, such as trip purpose, alternative travel mode, and reasons for choosing the *Heartland Flyer*, the recoding of multiple responses was quite difficult.

Additional Corrections

In addition to the corrections for "other" and multiple responses in the data set, several other opportunities existed throughout the data set to reduce inaccuracy error. Two issues in particular, one related to the passenger rail trip frequency and the other related to the passenger boarding and alighting station, offer interesting lessons that can be applied by researchers or analysts to future on-board surveys of intercity passenger rail routes.

One question on the survey asked the respondent how many trips he or she had made on the *Heartland Flyer* in the past 12 months, including the one they were on at the time of the survey. Some respondents (25 in April, 39 in July) did not provide a response to this question but a substantial number (10 in April, 23 in July) of these did indicate somewhere on the form that the trip was their first on the *Heartland Flyer* (i.e., no previous trips in 12 months). This was an obvious misunderstanding of the question on the part of the respondent as the minimum answer would be one trip if answered properly. Respondents that indicated the current trip was their first trip were recoded into the first choice "1 to 4 Trips," the proper response to the question as designed.

From the review of past studies, there was some indication that a number of surveys would be returned with the same response marked for boarding station and alighting station. This issue stems from the survey form requesting that the passenger provide responses about the current one-way trip segment, but passengers instead responding about the entire trip tour. In the case of this study, for example, a passenger making a one-day round-trip from Norman to Gainesville might indicate "Norman" as both the boarding and alighting station, which would be incorrect based on how the survey form was designed. General concerns in the study design for on-board surveys regarding this issue in the urban transit context are noted in the literature (*51*). This was an issue for 12 surveys in April and 28 surveys in July. Researchers utilized two sources of information to resolve this issue: the conductor origin-destination matrix and adjacent survey data. Also, researchers assumed that the station reported on the survey form was valid for at least one of the trip ends. The conductor's passenger origin-destination matrix showed a total count of all passengers traveling between each station pair. Continuing the example from above, if the matrix indicated that all the passengers boarding in Gainesville on train #822 were traveling to Norman, researchers assumed that the boarding station for the erroneous survey record was Gainesville and was recoded accordingly. The passenger loading procedures used by the Amtrak on-board staff (described in Chapter 3) resulted in passengers boarding at a particular station being seated in close proximity. Since the survey forms were individually numbered, there was a high probability that sequentially numbered survey forms were distributed to passengers boarding at the same station. Consequently, boarding station information from survey records adjacent to the erroneous record was also utilized by researchers to rectify these issues. A great majority of survey records with this particular issue were from train #822, the

northbound train, suggesting that many of these errors were from passengers making a round-trip on the *Heartland Flyer* (i.e., two one-way trip segments). Using two approaches, researchers were able to resolve this issue for all affected survey records except for one from the April data set. Additional corrections to the data set were made as follows:

- Station Not Valid: Some respondents marked a boarding or alighting station that was not valid (i.e., Oklahoma City as an alighting station for #821), or left one of the station questions blank. This was an issue for 11 surveys in April and 13 surveys in July. Resolution of this issue was handled using the passenger origin-destination matrix or adjacent survey information as described above.
- Number in Party: In April, one respondent indicated that their party contained 18 adults and 61 children. In July, one respondent indicated that their party contained 25 adults. Researchers were not able to confirm travel parties of this size from observation or other survey records, and recoded these records to "no response" so as to avoid skewing the analysis results.

Additional Measurement Error

Some errors in the data set could not be mitigated using a logical process that would have preserved the original intent of the respondent. One example of this was the "Number of Adults in Party" question. This question asked the respondent to report the number of adults in their travel party, including themselves. There were, however, numerous instances (22 in April and 44 in July) where the respondent wrote "zero" for the number of adults. Clearly, this is an invalid response as there must be at least one adult in the party to participate in the survey. However, researchers could not assume that these were all equal to one adult as there may have been more adults in the party. Since it was not known for sure, researchers discarded these responses.

External Factors

With any transportation survey there is a great potential for external influences upon the study, providing additional sources of bias that are difficult to address in the study design and the resulting analysis. One external factor that could have impacted the study response was the on-time performance of the train during the study periods. If the train were running late, responses may be biased against the rail service (for example in reasons why the train was selected for the

trip). However, researchers determined that this had a minimal impact as the train was late only twice during the entire duration of the study; furthermore, most surveys were completed during the initial stages of the ride when the train was generally running on-time. A related external factor that could have affected survey response was the attitude toward and treatment of passengers by the on-board staff. Poor service (either real or perceived), could have two impacts on the study, either biasing the results against the rail service or perhaps compelling a passenger to participate in the study under the premise that participation in the survey would provide an opportunity to voice displeasure with the service. However, being that the *Heartland Flyer* consistently scores very high in the Amtrak Customer Satisfaction Index (see Table 3-6), this was not likely an issue for this study either. A final external factor that was also not observed in this study but could potentially be an issue for on-board surveys of any intercity passenger rail route is the influence of rail advocacy groups to "stack" the survey or influence respondents to provide pro-passenger rail answers.

Non-Reporting Error

After the inaccurate responses were reviewed and revised as appropriate, the second source of error, non-reporting error, was examined. A non-reporting error occurs when a survey form is returned with valid answers to one or more questions not provided (*54*). One instance of non-reporting in this survey occurred when respondents simply neglected to complete the reverse side of the survey. This happened on four surveys in April and nine surveys in July. It is impossible to tell from the data whether the reverse was omitted on purpose or the respondent simply did not see the note at the bottom of the front page informing them that there was a reverse side to the survey form. One measure of effectiveness for non-response is the per-item response rate for the survey, defined as the percent of responses for a particular item that are valid for the analysis. Table 4-6 compares the per-item response rate for the *Heartland Flyer* survey data for the raw data set and the final data set after the quality control process.

In the context of item non-response, several survey items listed in Table 4-6 are worth mentioning. First, the total per-item response rate across all items was exceptional. If researchers had used these data in raw form with no quality control process, nearly 90 percent of all survey items would have been accurate and suitable for analysis. The quality control and

error cleaning used in this study appeared to increase the total per-item response rate by about two percentage points during both study periods. Second, the per-item response rate for most survey items (14 out of 23 in total) could not be improved from their original rates. The review and cleaning discussed in prior sections only addressed a few items on the survey, yet these items were important.

Table 4-6: Comparison of Per-Item Percent Response Rate, Raw and Final Data Sets

Survey Item	April (*435 Surveys*)		July (*588 Surveys*)	
	Raw	**Final**	**Raw**	**Final**
Boarding Station	96	100	94	100
Access Travel Mode	95	99	96	99
Access Time	94	94	94	94
Access Miles	43	43	38	38
Alighting Station	97	100	98	100
Egress Travel Mode	94	98	94	99
Egress Time	89	89	89	89
Egress Miles	27	27	25	25
Trip Purpose	83	88	85	89
Alternative Travel Mode	93	95	94	95
Round-Trip Today	98	98	98	98
Trip Frequency	94	97	93	97
Reasons for Choosing Rail	72	91	65	93
Nights Away from Home	93	93	94	94
Spending on Trip	98	98	92	92
Residential Zip Code	97	97	96	96
Gender	98	98	97	97
Age Group	98	98	97	97
Party Size-Adults	89	89	86	86
Party Size-Children	94	94	94	94
Employment Status	95	97	89	92
Household Vehicles	98	98	95	95
Household Income	89	89	85	85
All Survey Items	**88**	**90**	**87**	**89**

The following items had a response rate of less than 90 percent after the quality control:

- Access/Egress Miles: These items had the lowest response of all the items on the survey, with response rates for access miles around 40 percent and egress miles less than 30 percent. This was not a major issue as the survey did not specifically request the number of miles be reported; rather, it was given as an alternative to travel time for

reporting how far passengers were from the train. If the access and egress miles items are not considered, the total per-item response was above 90 percent for both study periods.

- Egress Time: Non-response for this item was likely due to the respondent not having a clear idea of an answer, either because they did not know (i.e., going to visit a friend and do not know the area well enough to estimate) or there were no set destinations (i.e., just going to walk around downtown Fort Worth).
- Trip Purpose: Non-response for this item was not an issue so much as there were many surveys returned with multiple responses that researchers could not interpret into a single response. As a result, less than 90 percent of the surveys had a valid response.
- Household Income: Non-response on this item was expected as some respondents are not comfortable telling researchers (or anyone else) about their household income. The response rate for this item in this survey was actually higher than researchers expected.

DISCUSSION AND LESSONS LEARNED

The data collection procedures used in this study, from the design of the survey through the data collection and reduction processes, revealed some valuable lessons learned that can be applied by researchers or analysts when planning future on-board surveys of intercity passenger rail routes.

In the survey design process, researchers developed as many questions as possible as "closed" questions, or questions with a defined set of answers from which to choose. This was important because having closed questions reduced respondent burden (which increased response) and also aided the quality control process by eliminating the need to interpret the meaning of responses provided to "open" questions. Another design element that provided a great deal of benefits in all subsequent study phases was the inclusion of an index number on each survey form before it was distributed to passengers. During the data collection, the index number was relied upon to identify survey forms that had been distributed but not returned to the researchers. During the quality control phase, researchers used the index number to identify missing information based on the information provided in adjacent surveys.

During the data collection process, support provided by the Amtrak on-board staff was invaluable to the researchers. From boarding the train before the rest of the passengers to providing information about passenger location in the train to providing the origin-destination matrix to the researchers, the support provided by the *Heartland Flyer* on-board staff made the data collection process go much smoother. The use of an opaque box in the café car for passengers to deposit completed surveys was recommended by project stakeholders but only used by about 3 percent of the total respondents. The response rate for survey items was excellent—near 90 percent during both April and July. The data cleaning process described identified several opportunities to reduce the error in the data set, improving the per-item response rate by two percentage points.

CHAPTER 5: DATA ANALYSIS

This chapter reports the key findings of the analysis of data obtained from the on-board survey of *Heartland Flyer* passengers. Provided is a brief discussion of the statistical methods used by researchers in this analysis. The analysis is divided into four components. The first two components, travel characteristics and passenger characteristics, summarize basic findings of the survey questions. The second two components, mobility impacts and economic impacts, delve further into the data set to measure the impacts of the *Heartland Flyer* service through a more detailed examination of the interrelationships between survey items.

STATISICAL CONSIDERATIONS

In the design of an on-board survey for intercity passenger rail, an important consideration is the development of a formal sampling plan to select passengers for participation in the study. There are three main reasons to employ a formal sampling plan in a study of this nature. First, a formal sampling design may allow the analyst to take fewer observations (i.e., passenger surveys) than originally expected, which reduces study cost. Second, equations for computing the variance of an estimator from a particular sampling plan can be utilized to report the precision of any estimates developed from the sample. Finally, the sample variances can be used to draw inferences about the larger population of rail passengers.

Several common sampling procedures are available when planning a data collection project such as an on-board survey of intercity rail passengers. These procedures include simple random sampling, stratified random sampling, and cluster sampling (*53*). These procedures are used to select a sampling unit from the target population for participation. In the case of this study, the target population was all *Heartland Flyer* passengers and the sampling unit was an individual passenger. Under simple random sampling, each sampling unit has an equal chance of being included in the sampled population (group of sampling units included in study). A random number generator, for example, might be used to select a sample of a desired size from the population. Since a sampling frame (i.e., a list of passengers) is not available or known before the start of the data collection, equal probabilities of each passenger being selected for participation in the study cannot be guaranteed, thus limiting the use of a simple random

sampling technique. A more efficient approach for the intercity rail passenger on-board survey is to use a stratified random sample or a cluster sample approach. Both approaches divide the population into smaller groups for the selection of sampling units. In the intercity passenger rail application, the smaller groups might be individual train runs during the day (for example, #821 and #822 for the *Heartland Flyer* might be considered separate groups). Under stratified random sampling, individual strata (train runs) would be selected for study and a simple random sample of units from within each strata is considered. For cluster sampling, a simple random sample of the smaller units (train runs) is made and all sampling units within a cluster are observed. A robust sampling strategy for an on-board survey of intercity rail passengers would likely resemble a multi-stage cluster sample, where a formal process would be employed to randomly select individual train runs for study and the survey distributed to all eligible passengers on those trains. While this approach would not require a complete sampling frame, a multi-stage cluster sample would still be problematic as the resource efficiencies realized without a formal plan (most notably, conducting on-board surveys on consecutive days) would likely be lost.

The tradeoffs between these efficiencies and the precision that is gained with a formal sampling plan do not appear to have been an issue for past on-board passenger surveys, as none of the surveys reviewed in this study reported using a formal sampling plan. In this study, researchers employed no simple random sampling procedures to select either the train runs to survey (cluster sample) or passengers to sample from an individual train run (stratified random sampling). Rather, researchers selected train runs in this study from within a particular month (April for average season, July for peak season) based on other factors such as the presence of holiday weekends (and the researchers' availability). Within each train run, all passengers aged 18 and over that were not part of a group were asked to participate in the research study. While it is likely that the analysis methods for stratified random sampling or cluster sampling could have been used to approximate the variance of any estimators developed from the *Heartland Flyer* on-board passenger survey data set, the absence of the random sampling component of each of these sampling strategies (an underlying assumption) would result in erroneous variance estimates being reported. Consequently, the analysis reports no variances for the estimators so as to avoid giving the perception that a certain level of precision exists in the estimates.

All of the analysis findings summarized in this chapter are reported as a percentage of the total sample, computed by dividing the total number of samples in a particular category of a

survey item by the total number of valid samples for that survey item. Responses of "other," multiple responses, and non-response were considered not valid for the analysis and not included in the computations. Categories were generally defined by the choice set in the survey for each survey item. For open questions, researchers grouped the responses into categories based on logical break-points for the analysis. Access and egress time and distance were assigned ranges. Residential zip codes were classified as being in Oklahoma, Texas, or other based on the response. The number of adults and children in the travel party were assigned categories for integer responses up to five adults and three children, with a final category for each being any responses greater than those values.

The final statistical consideration for this analysis is the treatment of bias in the sample set. Bias refers to the difference between the characteristics of the sample and the characteristics of the population. Some issues with bias can be addressed using the stratified random sampling or cluster sampling schemes discussed previously; however, since this study did not formally employ either of these strategies, the possible bias can only be identified and included in the context of the study findings. To examine possible bias in the data set, passenger counts by day of the week for calendar year (CY) 2008 were summarized and compared with the sample obtained during each survey period. Table 5-1 shows the percentage of passengers for each train run by weekday and weekend, compared to the CY 2008 total passenger activity.

Table 5-1: Comparison of Survey Sample Size to CY 2008 Passenger Activity (Percent)

Time Period	Train #	April 2009	July 2009	CY 2008
Weekday (Monday-Friday)	821	56	44	56
	822	44	56	44
Weekend (Saturday-Sunday)	821	58	59	50
	822	42	41	50
Total	821	57	49	54
	822	43	51	46

Source: TTI Analysis of ridership data provided by ODOT

Comparison between the sample sizes obtained in this survey and CY 2008 passenger counts indicates that a small amount of bias may be present in the data set. In April, the weekday surveys were approximately representative of CY 2008 while train #821 was slightly over-represented in the sample. In July, train #822 was over-represented for weekday trips but under-represented for weekend trips. These differences were not a cause for concern for this

analysis, as the sample appears to reasonably approximate the ridership patterns for the *Heartland Flyer* in CY 2008. It should be noted that the CY 2008 passenger totals include children and organized groups, two passenger segments that were excluded from this analysis.

TRAVEL CHARACTERISTICS

Travel characteristics examined in this analysis included *Heartland Flyer* passenger boarding and alighting station, mode of travel to and from stations, travel time and distance to and from stations, trip purpose, and alternative travel mode.

Boarding and Alighting Station

Table 5-2 shows the percentage of passengers boarding and alighting at each station along the *Heartland Flyer* route, plus the percentage of total activity at each station. A majority of the passenger activity on the *Heartland Flyer* occurs at the route's endpoints of Oklahoma City and Fort Worth. At least three out of every four *Heartland Flyer* passengers surveyed were boarding or alighting at one of the endpoints. This is not surprising as these are the two largest population centers along the route as well. Fort Worth was generally busier than Oklahoma City across the study periods. Among the intermediate stations, traffic in Norman was slightly higher in July while Ardmore and Gainesville were more active in April. Given that Norman is home to the University of Oklahoma, researchers expected more activity in April than in July, considering the school calendar. However, this difference in traffic was not observed.

Table 5-2: Passenger Boarding and Alighting Station, Percent of All Trips

Station	April			July		
	Boarding (*434*)	**Alighting (*435*)**	**Total (*869*)**	**Boarding (*588*)**	**Alighting (*588*)**	**Total (*1,176*)**
Oklahoma City	37	25	31	32	32	32
Norman	9	10	9	10	12	11
Purcell	1	1	1	1	1	1
Pauls Valley	3	2	2	2	4	3
Ardmore	8	9	8	5	3	4
Gainesville	5	6	6	3	4	4
Fort Worth	38	48	43	47	43	45

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Comparing the total column in Table 5-2 with the percentage distribution of FFY 2009 station activity reported in Table 3-4 indicates how the sample in this survey differs from the actual passenger traffic levels. The distribution of passenger boardings and alightings from both survey periods was approximately equal to the distribution of passenger activity in FFY 2009, with a deviation of three percentage points or less. Passenger activity at Ardmore was over-represented in the sample in April while activity in Norman and Fort Worth was over-represented in July. Passenger activity at Pauls Valley was under-represented in April while Ardmore and Gainesville were under-represented in July.

Travel Mode To/From Rail Station

Table 5-3 reports the modes of travel used by *Heartland Flyer* passengers to access the boarding station and travel from the train to their final destination. The reader can interpret the values reported in Table 5-3 (and subsequent tables with similar format) as follows: using the top left cell of results, in April 2009, 31 percent of *Heartland Flyer* passengers accessed the train by driving and parking at or near the station and 20 percent of passengers traveled from the train to their final destination as a driver of a vehicle parked at the alighting station.

Table 5-3: Passenger Travel Mode To/From Rail Station, Percent of All Trips

Travel Mode	April (To/From) (*432/428*)	July (To/From) (*584/582*)
Drove and Parked at Station	31/20	32/22
Rode with Someone Who Parked at Station	9/11	9/10
Dropped Off/Picked Up by Private Vehicle	37/35	36/38
Local Transit Bus/Van/Trolley	3/6	4/6
Commuter Train	2/3	2/2
Connecting Amtrak Train/Bus	6/8	11/5
Intercity Bus	0/0	0/0
Walked	6/6	2/8
Bicycle	0/0	0/0
Taxi/Shuttle	6/11	4/9

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Most *Heartland Flyer* passengers accessed the rail service in some sort of automobile, either as a driver or a passenger of a vehicle that parked at the station or a passenger being dropped off or picked up at the station. Collectively, these three modes accounted for at least two-thirds of the passengers' travel to or from the rail station during both study periods. As a

travel mode from the alighting station to the passenger's final destination, taxi or other type of shuttle service also captured a substantial proportion of trips. Non-motorized travel modes accounted for a relatively small share of these trips. Figures also show that for most travel modes, the split between access mode to the station and egress mode to the final destination did not vary between April and July. A substantially higher percentage of travelers accessed the *Heartland Flyer* via a connecting Amtrak service in July than in April, possibly reflecting longer-distance vacations or other travel during the peak season.

Table 5-4 displays a more detailed breakdown of passenger travel mode to and from the station, given by train number. Considering each train separately reveals some interesting results otherwise diluted by the combined percentages. For example, there was a wide discrepancy between the percentage of travelers driving to and from the station, with a much higher proportion of passengers driving to train #821 and from #822 than the reverse. The proportion of passengers traveling from the train to their final destination via local transit was also higher for train #821 than #822. Finally, there was a wide gap between the proportion of travelers on train #821 and #822 that connected to the *Heartland Flyer* via other Amtrak services. Passengers tended to connect from train #821 to other services and to #822 from these services, likely in Fort Worth. Use of a taxi or shuttle service was higher as an egress travel mode for train #821.

Table 5-4: Passenger Travel Mode To/From Rail Station, Percent by Train Number

Travel Mode	#821 (South)		#822 (North)	
	April (To/From) (*245/243*)	**July (To/From) (*285/282*)**	**April (To/From) (*187/185*)**	**July (To/From) (*299/300*)**
Drove and Parked at Station	41/10	49/14	17/32	15/30
Rode with Someone	9/8	7/7	10/15	10/12
Dropped Off/Picked Up	39/30	36/28	34/42	35/47
Local Transit Bus/Van/Trolley	1/10	3/12	6/1	6/1
Commuter Train	0/5	0/4	4/0	4/0
Connecting Amtrak Train/Bus	0/14	0/11	14/1	21/0
Intercity Bus	0/0	0/0	1/1	1/0
Walked	2/9	1/12	12/1	3/4
Bicycle	0/0	0/0	0/1	0/0
Taxi/Shuttle	8/14	4/12	3/8	6/5

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Tables 5-5 and 5-6 display another detailed examination of the passenger access and egress mode data, broken out by station, for April and July, respectively. Mode splits by station were generally consistent with the overall mode split and also reflected the number of available modes at each station. Tables 5-5 and 5-6 also indicate that the percentage of passenger pick-up and drop-off was highest in Oklahoma City. Researchers attributed this finding in part to the fact that there was a charge for parking at the Oklahoma City station. Also, a majority of the parking around the Fort Worth Intermodal Transit Center was pay parking as well. Passengers using connecting Amtrak services primarily connected with these services in Fort Worth, although there were a small number of passengers that reported using the Amtrak thruway bus connection in Oklahoma City. The relatively high proportion of passengers using local transit in Gainesville is likely an indication of passengers who utilized the trolley service that connected passengers at the Gainesville station with the local outlet mall.

Table 5-5: Passenger Travel Mode To/From Rail Station, Percent by Station (April 2009)

Travel Mode	Oklahoma City (To/From) (*160/106*)	Norman (To/From) (*37/43*)	Purcell (To/From) (*3/3*)	Pauls Valley (To/From) (*14/7*)	Ardmore (To/From) (*32/37*)	Gainesville (To/From) (*22/25*)	Fort Worth (To/From) (*163/207*)
Vehicle Driver	31/20	57/42	67/67	50/29	56/32	32/32	17/10
Vehicle Passenger	8/12	8/21		7/29	13/16	18/16	9/6
Dropped Off/Picked Up	44/51	32/33	33/33	36/43	31/30	27/32	33/29
Local Transit	1/1				0/5	9/8	6/10
Commuter Train							4/5
Connecting Train/Bus	1/1						16/16
Intercity Bus	1/1				0/3		1/0
Walked	3/2			7/0	0/3	14/12	11/9
Bicycle					0/3		
Taxi/Shuttle	12/12	3/5			0/8		4/14

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding. Blank cells indicate no data reported for station/mode pair.

Table 5-6: Passenger Travel Mode To/From Rail Station, Percent by Station (July 2009)

Travel Mode	Oklahoma City (To/From) (*189/188*)	Norman (To/From) (*58/72*)	Purcell (To/From) (*3/4*)	Pauls Valley (To/From) (*13/23*)	Ardmore (To/From) (*28/19*)	Gainesville (To/From) (*16/26*)	Fort Worth (To/From) (*277/250*)
Vehicle Driver	45/27	40/32	67/75	92/22	57/32	25/19	45/14
Vehicle Passenger	7/12	10/11		0/17	11/5	6/8	10/8
Dropped Off/Picked Up	40/48	41/47	33/25	8/57	25/53	38/42	34/25
Local Transit	4/1	2/3				31/27	4/11
Commuter Train							4/4
Connecting Train/Bus	0/1						22/12
Intercity Bus							1/0
Walked	1/5	3/4		0/4	7/0		3/14
Bicycle							
Taxi/Shuttle	4/7	3/3			0/11	0/4	7/13

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding. Blank cells indicate no data reported for station/mode pair.

Heartland Flyer Market Area

Researchers estimated the market area of the *Heartland Flyer*, that is to say, the area from which potential passengers are drawn, from the survey data using both time and distance. Table 5-7 displays the distribution of reported travel time for *Heartland Flyer* passengers to access the boarding station and travel from the train to their final destination.

Table 5-7: Passenger Travel Time To/From Rail Station, Percent of All Trips

Travel Time	April (To/From) (*408/387*)	July (To/From) (*553/523*)
10 Minutes or Less	23/16	18/15
11 to 20 Minutes	29/24	23/24
21 to 30 Minutes	14/16	19/16
31 to 45 Minutes	6/6	9/12
46 to 60 Minutes	7/9	7/6
61 to 90 Minutes (1-1.5 Hours)	6/5	8/5
91 to 120 Minutes (1.5-2 Hours)	5/5	5/4
121 to 180 Minutes (2-3 Hours)	3/5	3/4
181 to 240 Minutes (3-4 Hours)	3/8	3/6
241 Minutes or More (4 Hours+)	5/6	6/8

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

For a majority of passengers, access time to the *Heartland Flyer* and estimated travel time from the alighting station to the final destination was less than 30 minutes. The median access time was approximately 19 minutes in April and 25 minutes in July. Median travel time from the alighting station to the final destination was 16 minutes and 27 minutes in April and July, respectively. These medians suggest that the travel time to destination was longer than the travel time to access the rail service. Travel times in both directions above 30 minutes were distributed fairly uniformly across each range of values.

Table 5-8 displays the distribution of reported travel distances, in miles, to and from *Heartland Flyer* stations. In general, the distribution of distances resembled that of the travel times reported previously. Most passengers reported traveling 10 miles or less to access the *Heartland Flyer* service with approximately half traveling less than 20 miles. The median distance to access the train was 16 miles in April and 20 miles in July.

Table 5-8: Passenger Travel Distance To/From Rail Station, Percent of All Trips

Travel Distance	April (To/From) (*186/119*)	July (To/From) (*224/149*)
10 Miles or Less	35/39	32/38
11 to 20 Miles	26/20	18/17
21 to 30 Miles	9/12	11/9
31 to 40 Miles	3/3	8/7
41 to 50 Miles	3/3	4/5
51 to 75 Miles	2/4	5/7
76 to 100 Miles	5/4	10/7
101 to 150 Miles	7/3	6/3
151 to 200 Miles	5/5	3/4
201 Miles or More	5/8	4/3

Note: Sample size shown in parenthesis.

Columns may not sum to 100 percent due to rounding.

For travel from the alighting station to the final destination, almost 40 percent of passengers estimated that their final destination was less than 10 miles from the station. Median distance to final destination was approximately equal in April (16 miles) and July (17 miles). The reader should note that passenger response to this question was markedly lower than the other items on the survey form.

Passenger Trip Purpose

Table 5-9 shows passengers' reported trip purpose. Passengers on the *Heartland Flyer* reported primarily pleasure trips, with most passengers traveling to visit family or friends or for leisure/recreation purposes. Collectively, these trips accounted for more than three-fourths of all *Heartland Flyer* passenger trip purposes. As a percentage of all passengers, trips to visit family or friends composed a higher percentage in July while trips for leisure/recreation were a higher proportion in April. One possible cause for this discrepancy is that families with school-age children may be most likely to visit family or friends in the summer, when more time is available for discretionary activities. As expected, vacation comprised a relatively high percentage of trips on the *Heartland Flyer* in July, with about 15 percent of passengers reporting this purpose. The conceptual difference between "leisure/recreation" and "vacation" is the duration of the activity, with the latter being the longer of the two. While this distinction was not made on the survey form, it appears that the responses generally aligned with this definition.

Table 5-9: Passenger Trip Purpose, Percent of All Trips

Trip Purpose	April (*382*)	July (*522*)
Visiting Family or Friends	36	42
Going To/From University/College	2	1
Going To/From Business Trip	5	2
Leisure/Recreation	45	33
Personal Business	6	5
Shopping	1	2
Vacation	4	15

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Another comparison of note between the two survey periods is the percentage of business travel, which was higher in April than in July. Trips for personal business, such as medical appointments or funerals, comprised approximately 5 percent of the total travel in both seasons. Personal business is not likely to be impacted by seasonal variations in travel like other purposes might be impacted. Among the remaining trip purposes, the overall percentage and the difference between seasons were negligible.

Table 5-10 provides a more detailed summary of passenger trip purpose comparing weekday (Monday-Friday) and weekend travel. The findings in Table 5-10 show that leisure/recreation travel dominated weekend trips on the *Heartland Flyer*. Business travel and personal business appeared to be more frequent on weekdays rather than weekends, another reasonable finding. One finding that was surprising was the low proportion of trips going to or from higher education. Given the presence of the University of Oklahoma in Norman as well as several schools in Oklahoma City and Fort Worth, one might expect to find a much greater share of trips to or from a university or college among the route's passengers.

Table 5-10: Passenger Trip Purpose, Percent by Day Type

Trip Purpose	Weekday		Weekend	
	April (*233*)	July (*356*)	April (*149*)	July (*166*)
Visiting Family or Friends	40	44	30	39
Going To/From University/College	2	1	3	1
Going To/From Business Trip	6	2	3	1
Leisure/Recreation	39	29	55	43
Personal Business	8	7	4	2
Shopping	2	1	0	4
Vacation	4	17	5	11

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Passenger Alternative Travel Mode

One of the main tasks of this study was to estimate the number of diverted modal trips and induced trips on the *Heartland Flyer*. The alternative travel mode question provided support for this estimate. Table 5-11 provides a summary of the passengers' reported travel alternatives if the *Heartland Flyer* service did not exist.

Table 5-11: Passenger Alternative Travel Mode, Percent of All Trips

Alternative Travel Mode	April (*413*)	July (*560*)
Drive A Private Vehicle	47	55
Passenger in A Private Vehicle	11	8
Rental Car or Company Vehicle	3	2
Commercial Airline	7	5
Intercity Bus	3	3
Would Not Make Trip	29	27

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

The automobile was the primary alternative to the *Heartland Flyer* for a majority of passengers. Approximately 60 percent of passengers reported that they would use an automobile for their trip, with most of these passengers driving a private vehicle for the trip. Less frequently cited travel mode alternatives were commercial airline (6 percent) and intercity bus (3 percent). Notably, nearly 30 percent of *Heartland Flyer* travelers reported that they would forgo their trip if the service was discontinued. The "Mobility Impacts" section of this chapter provides more in-depth discussion and analysis of the responses to this survey item.

PASSENGER CHARACTERISTICS

Passenger characteristics examined in this study include the passenger trip frequency, duration of travel, reasons for choosing the *Heartland Flyer,* and passenger spending. Passenger demographics examined in this study included:

- Passenger residential location;
- Travel party size (adults and children);
- Gender;
- Age Group;
- Employment Status;
- Household Vehicles; and
- Household Income.

The following sections examine both in greater detail.

Trip Frequency

The survey asked passengers how many one-way trips they took on the *Heartland Flyer* in the last 12 months. As Table 5-12 indicates, a majority of passengers were infrequent riders of the service, with 86 percent of those surveyed in April and 92 percent of those surveyed in July making between one and four trips in the last year. The median trip frequency was approximately two one-way trips or the equivalent of a single round-trip in the last 12 months.

Table 5-12: Passenger Trip Frequency, Percent of All Trips

Trip Frequency	April (*420*)	July (*572*)
1-4 Trips	86	92
5-9 Trips	7	6
10-19 Trips	5	2
20 or More Trips	2	1

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

Travel Duration

Researchers evaluated the duration of passenger trips (i.e., number of day(s)) on the *Heartland Flyer* using two separate survey items. The first survey item asked the respondent if he or she was making a "round-trip" on the *Heartland Flyer* that day. Given the timetable schedule of the train, researchers expected that many travelers would be on day trips. However, as the findings in Table 5-13 show, this was not necessarily the case. Of the passengers surveyed in this study, less than half reported making a round-trip that day. The percentage of travelers making day trips was slightly higher in July as compared to April.

Table 5-13: Day Trips on *Heartland Flyer*, Percent of All Trips

Day Trip	April (*425*)	July (*575*)
Yes	40	45
No	60	55

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

The second survey item on the topic of trip duration asked the passenger how many nights he or she was away (or planned to be away) from home on their trip. Table 5-14 reports passenger responses to this question. Responses to this question suggest a fairly uniform distribution of trip durations ranging from day trips to weekend trips and longer.

Table 5-14: Passenger Duration of Trip Away from Home, Percent of All Trips

Duration Away from Home	April (*405*)	July (*555*)
None (Round Trip Today)	22	19
1 Night	23	19
2 Nights	20	23
3 to 5 Nights	24	25
6 or More Nights	10	14

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

The findings in Tables 5-13 and 5-14 raise several interesting points for discussion. In looking at the two questions, one might expect the percentages reporting "yes" to a day trip and "none" to the trip duration to be approximately equal. However, this is clearly not the case, suggesting a closer examination of the results is necessary. The first question asked the respondent if he or she were making a round trip that day on the *Heartland Flyer*, while the second question asked how many days the respondent would be away from home on the trip. It

is entirely possible that a passenger could make a day trip (that is, a same-day out and back on the *Heartland Flyer*) while also being "away from home" for one or more nights. For example, passengers might be on a multi-day vacation and include a day trip on the *Heartland Flyer* during one of those days. Another possible scenario could be that passengers drove to Oklahoma City and stayed the night in a hotel before making a day trip to Gainesville or Fort Worth the following day. After returning to Oklahoma City, the passengers would either drive back to their residence (1 night away from home) or stay in Oklahoma City and drive back the following day (2 nights away from home). The potential for this scenario can be loosely confirmed by noting the sum of the percentage responses for "None" and "One" on the nights away question approximately equals the total percentage of persons indicating a day trip.

One variable potentially impacting the trip duration is the current train schedule (see Figure 3-2), which makes shorter trips (one day or one overnight) more convenient for Oklahoma residents. Under the train schedule at the time of the survey, if a Texas resident wanted to travel to Oklahoma on the *Heartland Flyer*, he or she was required to stay at least one night in Oklahoma before having the opportunity to return to Texas on the train. To examine the impacts of the current train schedule on trip duration, Table 5-15 reports the passenger trip duration by state of residence in either Oklahoma or Texas. A later section of this chapter provides a more detailed discussion of how researchers obtained passenger state of residence.

Table 5-15: Passenger Duration of Trip Away from Home, Percent by State of Residence

Duration Away from Home	April		July	
	OK (*284*)	**TX (*85*)**	**OK (*409*)**	**TX (*98*)**
None (Round Trip Today)	25	19	22	6
1 Night	27	19	23	8
2 Nights	19	20	19	41
3 to 5 Nights	22	31	24	32
6 or More Nights	8	12	11	13

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

In April, the percent of Oklahomans making short trips was much larger than Texans making short trips, while the opposite was true for trips of longer duration. The percentage of Texas and Oklahoma residents making trips with two nights away from home was approximately equal in April. In July, the differences between Oklahoma and Texas residents' trip durations were even more profound. The percentage of Oklahomans making short (day or one-night) trips

was approximately three times the percentage of Texans making these trips, while the percentage of Texas residents making two-night trips was more than double that of Oklahoma residents. The distribution of trip durations in Table 5-15 suggest that Texans on the *Heartland Flyer* participate in longer trips away from home than their Oklahoma counterparts.

Reasons for Choosing *Heartland Flyer*

On the survey, passengers were asked to report the two main reasons why they selected the *Heartland Flyer* for their trip. Fourteen choices plus an "other" response were provided to respondents on the survey form. Post-processing of the survey responses (described in Chapter 4) defined four new categories of response based on the answers provided in the "other" field. Table 5-16 reports the reasons for choosing the *Heartland Flyer* listed by passengers. Note that the percentages in this table will sum to more than 100 percent since two answers were permitted.

Table 5-16: Reasons for Choosing *Heartland Flyer* for Trip, Percent of All Trips

Reason	April (*397*)	July (*547*)
More Comfortable/Relaxing	41	35
Trip Least Expensive by Train	33	32
Would Rather Not Drive	20	24
Avoid Traffic Congestion/Parking	12	12
Station Convenient to Destination	8	8
Novelty/Adventure/Train Experience	8	8
Fun/Pleasure	6	8
No Vehicle Available	6	3
Station Convenient to Residence	5	5
Other	5	4
First Time/Never Been	5	4
Would Rather Not Fly	5	3
No Other Reasonable Option	4	4
Schedule is Convenient	4	3
Fun/Experience for Child/Grandchild	3	8
Trip Fastest by Train	3	4
Do Not Drive	3	2
Ability to Work While Traveling	3	1
On-Board Food Service	0	1

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

In both April and July, the two most frequently cited reasons for choosing the *Heartland Flyer* were passenger comfort and cost, with more than a third of passengers reporting these two reasons. The next two most frequently cited reasons were related to automobile travel, with "Would Rather Not Drive" and "Avoid Traffic Congestion/Parking" cited 20 percent and 12 percent of the time, respectively. Among the less-frequently cited reasons, "No Vehicle Available" and "Do Not Drive" were listed by some travelers, suggesting that the *Heartland Flyer* facilitates travel for the non-automobile or "transit-dependent" population. Preference to avoid (or fear of?) flying was also cited by around 5 percent of respondents. The availability of on-board food service was cited by very few respondents as a reason to ride the *Heartland Flyer*. While it might not have been one of the two most important reasons why passengers chose to ride the train, food and beverage revenue (and researcher experience) suggest that the elimination of the on-board café would likely be met with a negative response from riders.

Passenger Spending on Trip

Table 5-17 reports levels of spending by *Heartland Flyer* passengers on lodging, meals, shopping, and entertainment during their trip away from home. Respondents were provided five choices with a range of spending amounts. Responses indicate that a majority of passengers spent at least $100 on these purchases during their trip. In April, 27 percent of respondents reported total spending in each of the two highest spending categories and the median spending level was around $120. In July, 35 percent of passengers spent more than $250 during their trip with a higher median spending of around $160.

Table 5-17: Passenger Spending on Trip, Percent of All Trips

Amount	April (*425*)	July (*543*)
Less than $25	16	11
$25 to $49	11	14
$50 to $99	19	14
$100 to $249	27	26
$250 or More	27	35

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

One potential issue was identified with this question. Passengers whose train ride was the first link of their trip may not have fully-known the amount of spending on the specified

items but rather estimated based upon the respondent's intended spending levels. However, researchers suspect that these responses were likely conservative estimates. Another issue for these responses is that for certain types of trips, this question may not seem applicable (i.e., passenger moving from one permanent residence to another). The "Economic Impacts" section of this chapter provides more detailed analysis of the response to this survey item.

Residential Location

The first demographic item on this survey was the passenger's self-reported home zip code. In the urban transit application, a more precise measure for a passenger's residential location is necessary for the data to be useful. However, for intercity travel, the passenger's home zip code is a sufficient approximation to identify where passengers live or for other planning applications. Table 5-18 shows the home states for *Heartland Flyer* passengers determined by reported residential zip code. The structure of postal zip codes allows for easy identification of the state associated with a particular zip code. Approximately three-quarters of *Heartland Flyer* passengers reported an Oklahoma zip code for their residence. This is not surprising, as there are more stations in Oklahoma. Also, the train schedule was more convenient for Oklahoma residents to schedule activities that involve riding the *Heartland Flyer*. Approximately 20 percent of passengers reported a Texas residence.

Table 5-18: Passenger State of Residence, Percent of All Trips

State	April (*421*)	July (*565*)
Oklahoma	70	76
Texas	22	18
All Other States	8	7

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

Among passengers not from Oklahoma or Texas (less than 10 percent of all passengers), a total of 19 states were represented, including all states that adjoin Oklahoma and Texas. Table 5-19 provides a more detailed summary of the residential location of *Heartland Flyer* passengers by train number. The proportion of Texas residents was markedly higher on train #822 as compared to train #821. This difference might be partially a function of the survey design, where Oklahoma residents on train #822 may have declined to participate in the survey because they had already participated on train #821 that morning.

Table 5-19: Passenger State of Residence, Percent by Train Number

State	#821 (South)		#822 (North)	
	April (*237*)	**July (*280*)**	**April (*184*)**	**July (*285*)**
Oklahoma	76	88	63	64
Texas	15	7	30	28
All Other States	9	5	7	8

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Figures 5-1 and 5-2 display a map of the geographic distribution of *Heartland Flyer* passenger zip codes for April and July, respectively. These figures each display approximately 87 percent of the passenger responses provided, with the remaining 13 percent falling outside of the map coverage area. In April, the zip code with the most surveys was 73401 in Ardmore. In July, the most-frequent zip code reported was 73013, belonging to the north Oklahoma City suburb of Edmond.

Not surprisingly, a majority of *Heartland Flyer* passengers reported residential zip codes near Oklahoma City or Norman. The distribution of passenger zip codes around the Dallas-Fort Worth Metroplex appeared to be fairly uniform across the region. In addition to having more responses in July, passengers in July appeared to come from more zip code areas than in April. Another interesting finding from Figures 5-1 and 5-2 was the relatively high number of passengers reporting residential zip codes around the Tulsa region. Expansion of the *Heartland Flyer* route toward Tulsa has been considered in the past; additionally, this segment is included in the South Central High-Speed Rail corridor. These data indicate that Tulsa-area residents already use the *Heartland Flyer*, and are willing to travel from Tulsa to connect to the rail service. Expansion into the Tulsa market would improve the convenience and accessibility of the rail service to the Tulsa-area residents currently using the service.

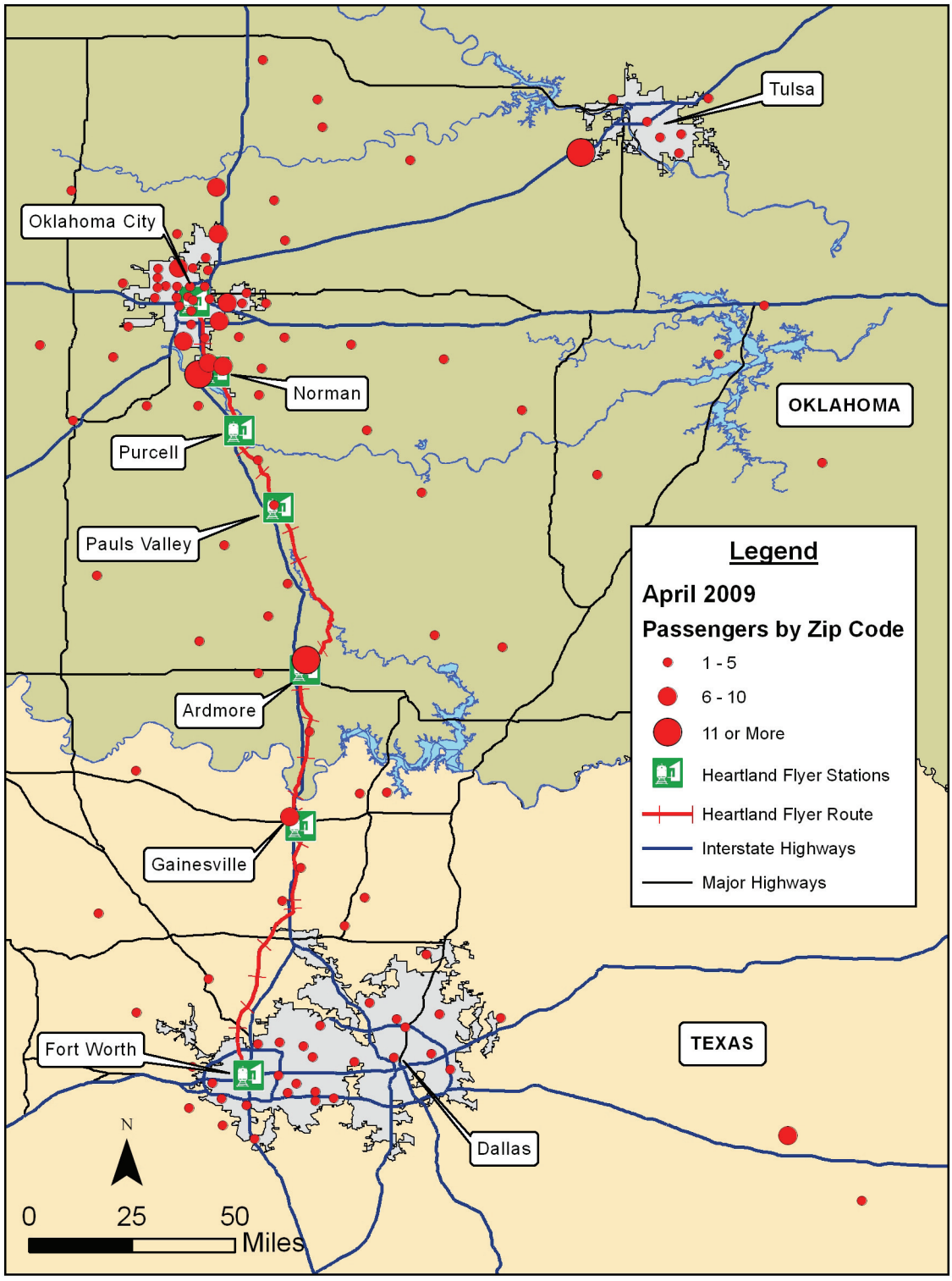

Figure 5-1: Residential Zip Codes of *Heartland Flyer* Passengers, April 2009

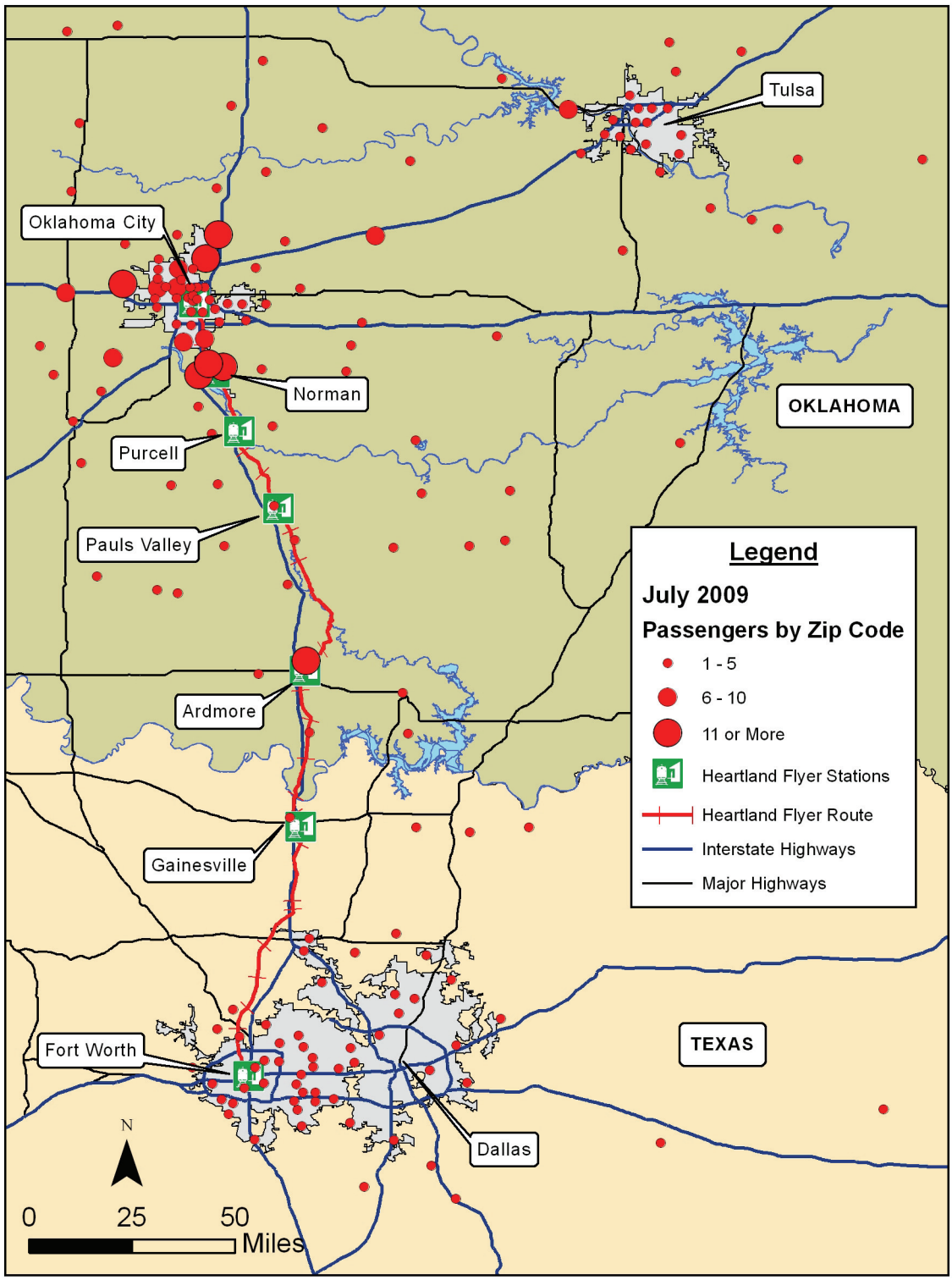

Figure 5-2: Residential Zip Codes of *Heartland Flyer* Passengers, July 2009

Party Size

Tables 5-20 and 5-21 report the travel party size for *Heartland Flyer* passengers for adults and children under the age of 18, respectively. Most travel parties consisted of solo travelers or couples, with four adults also reported on a less frequent basis. The median number of adults in a *Heartland Flyer* travel party was slightly over one for each survey period.

Table 5-20: Number of Adults in Party, Percent of All Trips

Number of Adults	April (*386*)	July (*507*)
One	48	42
Two	27	36
Three	5	8
Four	10	6
Five	3	3
Six or More	8	5

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

A majority of *Heartland Flyer* passengers traveled with no children under the age of 18 in the travel party. In April, 80 percent of passengers reported no children in the party while 52 percent of travelers reported this in July. In July, there were a higher percentage of one- and two-child parties; this was not surprising, as it was during the summer when school was not in session. The median number of children in a *Heartland Flyer* travel party was 0.6 in April and 1.0 in July, reflecting the increase in children during the summer months.

Table 5-21: Number of Children in Party, Percent of All Trips

Number of Children	April (*408*)	July (*550*)
None	80	52
One	8	23
Two	5	16
Three	4	4
Four or More	4	5

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

Gender

Table 5-22 reports passenger gender. Females comprised at least 60 percent of the *Heartland Flyer* passengers in each study period.

Table 5-22: Passenger Gender, Percent of All Trips

Gender	April (*427*)	July (*570*)
Male	39	35
Female	61	65

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

Age Group

Table 5-23 reports the age distribution of *Heartland Flyer* passengers. In general, the distribution of passenger ages was fairly uniform with a slight skew toward passengers in older age groups. The distribution of passenger ages in July appeared to be slightly younger than in April. This was reflected in the median passenger age of 51 in April and 48 in July.

Table 5-23: Passenger Age Group, Percent of All Trips

Age Group	April (*426*)	July (*569*)
18-24 Years	10	12
25-34 Years	11	14
35-44 Years	13	16
45-54 Years	23	20
55-64 Years	19	20
65 Years or Older	23	18

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

Employment Status

Table 5-24 displays employment status as reported by *Heartland Flyer* passengers. A majority of *Heartland Flyer* passengers were employed on a full-time basis, with approximately half of the survey respondents reporting full-time employment. Approximately one-quarter of the passengers were retired. Homemaker was also cited on a somewhat frequent basis, possibly indicating the presence of families among the passengers. University or college students

represented approximately 4 percent of the ridership, reflecting a similar trend that was displayed in the summary of passenger trip purposes. Non-college students included passengers traveling to the Job Corps training center in Guthrie, Oklahoma.

Table 5-24: Passenger Employment Status, Percent of All Trips

Employment Status	April (*424*)	July (*539*)
Employed Full-Time	49	55
Employed Part-Time	5	6
Unemployed	5	3
University/College Student	4	4
Student (Other Than College)	1	1
Retired	27	24
Homemaker	9	7

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

Household Vehicles

The number of vehicles owned or leased by a household is a common demographic item on transportation surveys as it reflects automobile availability, which in turn impacts a host of other measures that are applicable to the transportation planning process. Table 5-25 shows the number of household vehicles reported by *Heartland Flyer* passengers. A majority of passengers lived in households with two vehicles, with the median number of household vehicles reported as 1.7 and 1.6 in April and July, respectively.

Table 5-25: Passenger Household Vehicles, Percent of All Trips

Household Vehicles	April (*428*)	July (*561*)
None	4	3
One	18	20
Two	40	44
Three or More	37	32

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

Nearly all of the *Heartland Flyer* passengers surveyed lived in a household with at least one vehicle. Zero-vehicle households comprised about 4 percent of the respondents in April and 3 percent of the respondents in July. This suggests widespread availability of an automobile as an alternative to the rail service. Subsequent sections include additional discussion of this trend in the context of passenger alternatives to the *Heartland Flyer*.

Household Income

Table 5-26 reports the distribution of annual household income of *Heartland Flyer* passengers. Most *Heartland Flyer* passengers lived in households with annual incomes in excess of $50,000. The distribution of household incomes appeared to be slightly more uniform during the summer as compared to the average travel season. Median annual household income was $65,900 in April and $57,000 in July. Low-income travelers (annual household incomes less than $20,000) accounted for about 16 percent of the travelers in each study period.

Table 5-26: Passenger Household Income, Percent of All Trips

Household Income	April (*389*)	July (*502*)
Under $10,000	6	6
$10,000-$19,999	7	7
$20,000-$29,999	8	9
$30,000-$39,999	7	12
$40,000-$49,999	8	10
$50,000-$74,999	22	22
$75,000-$99,999	15	15
$100,000 or More	25	20

Note: Sample size shown in parenthesis.
Columns may not sum to 100 percent due to rounding.

MOBILITY IMPACTS

The main objective of this study was to identify the mobility impacts of providing passenger rail service in an intercity corridor, using the *Heartland Flyer* corridor as a case study. Examining how passenger rail supports mobility in an intercity corridor can reveal how the provision of service affects progress toward larger policy goals such as safety, transportation network efficiency, and asset preservation. The key measure used in this study to identify the mobility impacts of the rail service was the passengers' self-reported alternatives for travel if the *Heartland Flyer* were discontinued. From these responses, analysts can estimate the number of trips "diverted" from other modes onto the rail service, as well as the total number of "induced" trips on the service. This section provides a preliminary estimate of the total number of diverted and induced trips on the *Heartland Flyer*. Also examined are relationships between passenger alternatives and selected variables. Finally, the mobility impacts of the passenger rail service across the urban/rural continuum are investigated.

Diverted and Induced Trips

In this study, researchers defined a diverted trip as a trip that would have been made on an alternative travel mode in the absence of the *Heartland Flyer* service. Alternative travel modes to the *Heartland Flyer* rail service included:

- Driver or Passenger of a Private Automobile;
- Rental Car or Company Vehicle;
- Commercial Airline; or
- Intercity Bus.

Researchers defined an induced trip as a trip that would not have been made in the absence of the rail service. Passengers choosing "Would Not Make Trip" on the alternative travel mode question were considered to be on an induced trip. Using the percentages of each alternative reported in Table 5-11, researchers developed an estimate of the total number of diverted and induced trips on the *Heartland Flyer*. The total ridership on the *Heartland Flyer* during FFY 2009 was 73,564 passengers. Months were assigned as either "average" travel season (represented by the April survey data) or "peak" travel season (represented by the July survey data). In FFY 2009, "average" months for passenger demand were January, February, April, and September through December. The "peak" months were March (due to spring break travel) and May through August (due to summer vacation). Researchers computed the person-trip modal diversion and induced travel components by multiplying the percentage of passengers choosing each alternative travel mode from Table 5-11 by the total FFY 2009 ridership in each season. Table 5-27 summarizes this estimate, rounded to the nearest whole person-trip.

Table 5-27: Estimate of Diverted and Induced Person-Trips on *Heartland Flyer*, FFY 2009

Alternative Travel Mode	Average Season	Peak Season	Total FFY 2009
Drive A Private Vehicle	16,814	20,784	37,598
Passenger in A Private Vehicle	3,935	3,023	6,958
Rental Car or Company Vehicle	1,073	756	1,829
Commercial Airline	2,504	1,889	4,393
Intercity Bus	1,073	1,134	2,207
Would Not Make Trip	10,376	10,203	20,579
Total	**35,775**	**37,789**	**73,564**

In FFY 2009, the *Heartland Flyer* rail service diverted an estimated 39,427 vehicle-trips from parallel roadways in the intercity travel corridor between Oklahoma City and Fort Worth. A vast majority (95 percent) of these vehicles were personal vehicles, while the balance was either rental cars or company-owned vehicles. Rail passengers that reported a preference for "passenger in a private vehicle" accounted for approximately 7,000 person-trips. Based on these figures, the average occupancy of a diverted vehicle-trip was 1.2 persons per vehicle. While this was a relatively small number of vehicles on a daily basis (recall the AADT on the Red River bridge was 33,000 vehicles per day during the same period), there appears to be at least some traffic-reducing benefits associated with the rail service. From these estimates of automobile traveler diversion onto the *Heartland Flyer*, interested parties can compute other sketch-level measures can be computed to gauge how the passenger rail service supports other transportation policy goals. Assuming that, on average, each diverted vehicle-trip would have traveled approximately 200 miles, researchers estimate that the *Heartland Flyer* rail service removes approximately 7.9 million annual vehicle-miles traveled (VMT) from parallel roadways. Additional assumptions of vehicle speed, fleet composition, or fuel economy can be applied to this VMT estimate to project the impacts of passenger rail service on measures such as highway level-of-service, fuel consumption, and vehicle emissions.

Although the automobile was the primary alternative travel mode for *Heartland Flyer* passengers, other corridor travel options were reported in the survey findings. Researchers estimate that almost 4,400 commercial airline passenger trips and more than 2,200 intercity bus passenger trips were diverted onto the *Heartland Flyer* during FFY 2009. Induced trips, or trips that would not have happened if the *Heartland Flyer* service did not exist, accounted for more than 20,000 rail passenger trips in FFY 2009. These trips do not result in any net benefits to the parallel surface and air transportation networks in the corridor. However, other benefits from these induced trips (not directly related to transportation) are realized, some of which will be examined in subsequent sections.

Influences on Diverted and Induced Demand

Tables 5-28 and 5-29 present a more detailed examination of the patterns of passenger alternatives to the *Heartland Flyer* for the April and July surveys, respectively. These tables report the percentage of each alternative selected by each category of four survey items: trip purpose, age group, household vehicles, and household income. These four survey items were selected as they were expected to influence the patterns of alternative travel options. Also provided in the first row (for comparison purposes) is the total percentage for each alternative.

Examining Tables 5-28 and 5-29, several patterns of passenger preference toward certain travel alternatives to the *Heartland Flyer* are evident. Among trip purposes, diversion to automobile appeared to be higher than average for trips to visit family or friends and also business trips (in April only). Business travelers also appeared to prefer rental or company vehicles or commercial airplane service if the *Heartland Flyer* did not exist. Business travelers also reported a lower than average percentage of induced trips. These are reasonable findings, as one might not expect the business traveler to forgo his or her trip because a travel alternative is not available—business must go on as planned. There appeared to be a high percentage of induced travel among travelers making leisure/recreation or vacation trips. This possibly reflected the discretionary nature of these trips.

Travel alternatives for certain age groups were, for the most part, consistent with the average rates. Younger travelers appeared more likely to divert to an intercity bus than older travelers, possibly reflecting older passengers' negative perception of intercity bus relative to other modes. Diversion to automobile appeared to increase with the number of vehicles in the household while bus diversion decreased with increasing household vehicles. Increasing household income also appeared to have a similar effect on diversion to automobile (increasing) and intercity bus (decreasing). These findings are consistent with expectations as they reflect the travel alternatives available to passengers. Among the age groups, household vehicles, and household income levels considered, no pattern of induced travel activity was detected.

Table 5-28: Passenger Alternatives by Selected Measures, April 2009 (Percent)

Survey Item	Category	Driver	Passenger	Rent Car	Airplane	Bus	No Trip
	All Trips (413)	*47*	*11*	*3*	*7*	*3*	*29*
Trip Purpose	Visiting Family or Friends (*131*)	51	10	3	8	7	21
	University/College (*6*)	33	50	17	0	0	0
	Business Trip (*17*)	53	6	12	18	6	6
	Leisure/Recreation (*167*)	49	11	0	4	0	37
	Personal Business (*23*)	30	17	4	30	4	13
	Shopping (*4*)	50	50	0	0	0	0
	Vacation (*17*)	41	0	6	0	0	53
Age Group	18-24 Years (*37*)	24	24	0	5	5	41
	25-34 Years (*44*)	45	5	5	5	11	30
	35-44 Years (*54*)	56	7	4	11	2	20
	45-54 Years (*96*)	47	5	5	4	4	34
	55-64 Years (*79*)	52	11	3	9	0	25
	65 Years or Older (*95*)	48	17	0	9	0	25
Household Vehicles	None (*15*)	13	13	0	0	47	27
	One (*72*)	38	18	1	8	6	29
	Two (*166*)	51	14	3	8	0	25
	Three or More (*154*)	52	5	3	7	1	32
Household Income	Under $10,000 (*22*)	14	18	0	9	23	36
	$10,000-$19,999 (*24*)	42	8	0	13	8	29
	$20,000-$29,999 (*29*)	45	17	0	7	14	17
	$30,000-$39,999 (*29*)	59	7	10	0	0	24
	$40,000-$49,999 (*31*)	32	6	0	13	0	48
	$50,000-$74,999 (*83*)	55	11	4	6	1	23
	$75,000-$99,999 (*60*)	42	7	3	5	0	43
	$100,000 or More (*94*)	55	8	3	12	0	22

Note: Sample size shown in parenthesis. Rows may not sum to 100 percent due to rounding.

Table 5-29: Passenger Alternatives by Selected Measures, July 2009 (Percent)

Survey Item	Category	Driver	Passenger	Rent Car	Airplane	Bus	No Trip
	All Trips (560)	*55*	*8*	*3*	*5*	*3*	*27*
Trip Purpose	Visiting Family or Friends (*211*)	60	9	5	9	3	15
	University/College (*4*)	50	25	0	0	0	25
	Business Trip (*8*)	63	0	0	25	0	13
	Leisure/Recreation (*167*)	49	7	1	2	1	41
	Personal Business (*26*)	54	16	0	4	16	12
	Shopping (*9*)	44	0	0	0	0	56
	Vacation (*76*)	51	7	1	3	3	36
Age Group	18-24 Years (*62*)	52	15	2	5	6	21
	25-34 Years (*76*)	68	4	3	4	8	13
	35-44 Years (*84*)	54	6	7	2	4	27
	45-54 Years (*115*)	57	4	2	4	4	30
	55-64 Years (*105*)	56	8	2	7	0	28
	65 Years or Older (*102*)	47	9	1	7	0	36
Household Vehicles	None (*16*)	25	13	0	6	25	31
	One (*108*)	47	12	3	6	6	25
	Two (*239*)	59	5	3	4	2	28
	Three or More (*173*)	59	7	2	4	2	26
Household Income	Under $10,000 (*27*)	44	4	0	4	30	19
	$10,000-$19,999 (*34*)	50	9	0	9	15	18
	$20,000-$29,999 (*41*)	41	12	5	2	7	32
	$30,000-$39,999 (*58*)	57	9	0	2	0	33
	$40,000-$49,999 (*47*)	45	11	9	4	0	32
	$50,000-$74,999 (*105*)	63	4	2	9	0	23
	$75,000-$99,999 (*75*)	64	5	4	3	1	23
	$100,000 or More (*95*)	66	5	0	3	1	24

Note: Sample size shown in parenthesis. Rows may not sum to 100 percent due to rounding.

Urban and Rural Mobility

Another consideration for the evaluation of the mobility impacts of intercity passenger rail service is an assessment of how residents of urban or rural areas obtain mobility from the service. One might suspect, for example, that the rail service might be the only means of transportation available to rural residents other than private vehicle. Residents in urban areas have greater access to intercity travel, most notably, via air carrier services. Consequently, the alternative travel mode data from this study can provide some insight on this issue. For this study, an area was considered "urban" if it was in a county that was part of a metropolitan statistical area (MSA) as defined by the White House Office of Management and Budget (*81*). Counties not included in an MSA were considered "rural" for this analysis. Using spatial analysis tools, researchers assigned passenger zip codes to "urban" or "rural" locations. Table 5-30 shows the distribution of passenger alternative travel mode by urban or rural residence. Approximately 70 percent of passengers during both survey periods reported a home zip code that was located inside an MSA, considered urban for this analysis.

Table 5-30: Alternative Travel Mode, Percent by Urban or Rural Residence

Alternative Travel Mode	April		July	
	Urban (*278*)	**Rural (*135*)**	**Urban (*406*)**	**Rural (*154*)**
Drive A Private Vehicle	39	64	60	47
Passenger in A Private Vehicle	11	12	7	10
Rental Car or Company Vehicle	3	2	3	0
Commercial Airline	8	5	4	7
Intercity Bus	4	2	3	5
Would Not Make Trip	35	16	25	33

Note: Sample size shown in parenthesis. Columns may not sum to 100 percent due to rounding.

The findings reported in Table 5-30 suggest that no pattern of alternative travel mode preference was evident between rural or urban populations. In April, more rural residents diverted to vehicle while in July, more urban residents preferred automobile as an alternative. Induced travel percentages suggested a similar pattern, with the rural residents having a lower percentage of induced travel in April but slightly higher in July.

ECONOMIC IMPACTS

The economic impacts of a particular transportation system element (such as the *Heartland Flyer* passenger rail service) can be thought of as direct or indirect, with a variety of metrics available to evaluate these impacts (*82*). Direct economic impacts include the jobs of persons employed by Amtrak who work on the *Heartland Flyer* and Amtrak's expenditures for goods and services related to the *Heartland Flyer* operations. For example, the typical *Heartland Flyer* crew rotation included three crews of four persons each, for a total of 12 jobs directly related to the rail service. In FFY 2009, Amtrak reported an expenditure of more than $800,000 on goods and services in the state of Oklahoma (*83*). Additionally, more than $144,000 of ARRA funds were designated to be spent on enhancements for mobility-impaired passengers at stations in Oklahoma (*83*). Note that the state of Texas enjoys similar jobs and spending levels but the exact figures for the *Heartland Flyer* were not readily available, since Amtrak routes other than the *Heartland Flyer* serve the state. Indirect impacts include an increase in land values around rail stations or the spending on goods and services by rail passengers during their train trip. Indirect impacts also include the "multiplier" effects of the direct spending. An example of the "multiplier" effect would be the employment of persons by a firm that has a contract with Amtrak to provide goods or services for the *Heartland Flyer*.

The measurement of economic impacts related to transportation projects can be accomplished through several approaches (*82*). One approach, the input/output model, uses information on technologies and local trade to estimate economic impacts by applying known "multipliers" to these inputs. An example of the use of an input/output model to examine the economic impacts of passenger rail service is the use of the Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS-II) model in a 2005 study of the *Heartland Flyer* economic benefits (*69*). Another approach, the direct measurement technique, does not utilize multipliers but instead relies on primary (surveys of travelers or businesses) or secondary (employment or income changes) data sources for the identification of impacts. The research study described in this report used the direct measurement approach to identify the economic impacts of the *Heartland Flyer* service. Specifically, passengers were asked to report on the survey how much they spent on certain items (lodging, meals, shopping, and entertainment) during their trip. It was previously reported that the median spending level on these items per

passenger was approximately $120 in April and $160 in July (see Table 5-17). Additional analysis of survey responses to this question follows.

One potential economic benefit of passenger rail service that researchers could easily identify from the survey responses was the spending level of passengers at their destination, both total spending and the associated sales tax revenue. Table 5-31 provides a summary of the average passenger spending level and the sales tax revenue for each "destination" station area. Researchers assigned a "destination" station to each survey record based on factors including the boarding and alighting station and the passenger's residential zip code. Destination stations with passenger spending responses were identified for 417 survey records in the April data set (96 percent) and for 531 records in the July data set (90 percent). Researchers computed the average passenger spending level at each station per study period by using a midpoint value assigned to each range of spending given as choices on the survey form. Total spending was then calculated by distributing the average spending level for each station across the FFY 2009 boarding and alighting totals (see Table 3-4) for each station to either peak or non-peak travel seasons. An adjustment was made to the passenger activity in Fort Worth to account for passengers transferring to the *Texas Eagle*, as the expenditures by these passengers do not remain in the Fort Worth area. Table 5-31 also reports sales tax rates for each community served by the *Heartland Flyer*, provided by the Oklahoma Tax Commission and the Texas State Comptroller of Public Accounts. Researchers applied these tax rates to the passenger spending figures to estimate the total sales tax revenue generated from passenger spending.

Table 5-31: Spending and Sales Tax Revenue for *Heartland Flyer* Stations, FFY 2009

Destination Station	Tax Rate	Passenger Spending		Sales Tax Revenue	
		Total	Average	Total	Average
Oklahoma City, OK	8.375%	$5,876,150	$121.32	$454,097	$9.38
Norman, OK	8.25%	1,493,464	118.78	113,821	9.05
Pauls Valley, OK	9.0%	268,193	49.77	22,161	4.11
Ardmore, OK	8.75%	797,612	87.71	64,176	7.06
Gainesville, TX	8.25%	810,560	101.09	61,775	7.70
Fort Worth, TX	8.25%	8,786,451	170.97	669,637	13.03
Total	--	18,032,628	133.67	1,385,666	10.27

Note: No survey records were identified with Purcell as the "destination" station.

Researchers estimate that *Heartland Flyer* passengers spent approximately $18 million on lodging, meals, shopping, and entertainment on their trips. Passenger spending in

communities along the route ranged from around $50 per passenger in Pauls Valley to $170 per passenger in Fort Worth. Oklahoma City and Norman were both computed to be around $120 per passenger, while Gainesville was slightly over $100 and Ardmore slightly under $90 per passenger. It should be noted that no survey records were identified with Purcell as the destination station; as a result, the data report no passenger spending for that station. However, that does not mean there are no spending impacts in Purcell, just none reported in this survey.

The sales tax impact of the *Heartland Flyer* on the communities it serves appears to be rather substantial. Researchers estimate that purchases made by *Heartland Flyer* passengers resulted in total sales tax revenue of almost $1.4 million to the communities served by the *Heartland Flyer*. The distribution of this sales tax revenue is $731,412 in Texas (53 percent) and $654,254 in Oklahoma (47 percent). Recalling the percentage of passengers from each station (Oklahoma or Texas) using the *Heartland Flyer* service (reported in Table 5-18), there appears to be a discrepancy between the users of the service and the distribution of the resulting sales tax revenue. Specifically, while Texas residents account for about one-quarter of *Heartland Flyer* passengers, more than half of the sales tax revenue attributed to all passengers is generated in Fort Worth or Gainesville.

Researchers estimate that some of the spending patterns reported in Table 5-31 may have been related to the route's timetable schedule at the time of the study. Recall that the schedule (see Figure 3-2) provided for a southbound train in the morning (arriving in Fort Worth around 12:30 PM) and a northbound run in the evening (departing Fort Worth around 5:30 PM). This schedule could impact spending patterns in two ways. First, *Heartland Flyer* passengers may have spent more in Fort Worth or Gainesville because the schedule allowed for convenient day or weekend trips to these destinations. Second, passengers that wished to travel to Oklahoma City or Norman were required to stay at least one night in those communities (and at least two nights if any of the trip's activities take place during the following day) in order to complete the round-trip via train. This need for additional spending on lodging and other expenses was reflected in the survey findings for Oklahoma City and Norman.

Another lens through which to view the economic impacts of the *Heartland Flyer* rail service is the passenger spending levels by induced or non-induced trips. The passenger survey identified two groups of *Heartland Flyer* passengers: those that would shift to other travel modes

if the service did not exist (approximately 70 percent of passengers) and those that would not have made the trip at all if the service did not exist (30 percent). In the context of passenger spending, any spending by passengers who reported that they would forgo their trip in the absence of the service would also be lost if the rail service were discontinued. Table 5-32 reports passenger spending on lodging, meals, shopping, and entertainment, by induced or non-induced trip type. Researchers developed these estimates by multiplying average passenger spending by each trip type and study period by the estimates of induced and non-induced trips for each travel period, as reported in Table 5-27.

Table 5-32: *Heartland Flyer* Passenger Spending by Trip Type, FFY 2009

Trip Type	Total Spending	Average Spending
Induced	$3,349,214	$162.75
Not Induced	$7,897,806	$149.06

Researchers estimate that passengers who reported that they would forgo their trip in the absence of the *Heartland Flyer* spend an average of $162.75 on lodging, meals, shopping, and entertainment during their trips, which is about $14 more than passengers who would make their trip using alternative travel modes. While this is not a major discrepancy (approximately 10 percent difference), this finding demonstrates that discontinuing the *Heartland Flyer* would, on a per-visitor basis, have a larger impact on the communities it serves, since the lost revenue from induced trips is higher than the trips that would shift to other modes in the absence of the service.

There are several caveats that are worth noting regarding the passenger spending and economic impacts findings of this study. The estimates of passenger spending obtained in this survey are subject to some of the limitations previously discussed near Table 5-17, most notably the fact that it was necessary for some travelers to estimate spending levels, as the actual spending had not occurred at the time the survey was completed. It is also important to point out that not all the estimated spending took place immediately in the communities served by the *Heartland Flyer*. It is impossible to know exactly where the spending occurred; for example, the data do not indicate how much was spent in the local area (i.e., the area surrounding the station) and how much was spent elsewhere in the region surrounding the communities with stations. However, the averages reported in this section are likely good approximations of the true average spending levels. It should also be noted that the sales tax revenue computations only consider

sales tax and do not include hotel occupancy or other special taxes that a community might have in place. Including the revenue projections from these taxes would likely increase the overall tax generation attributed to the *Heartland Flyer* service. Finally, the computations in this section only address the economic impacts related to passenger spending and do not consider any "multiplier" effects from the spending. If these effects were incorporated, they would likely increase the impacts of the *Heartland Flyer* service beyond what was identified in this analysis.

SUMMARY OF ANALYSIS FINDINGS

The on-board survey of *Heartland Flyer* passengers in this research study resulted in an extensive database of traveler information from which to gain insight into the impacts of passenger rail in a short- to medium-distance intercity corridor. The analysis of this database described in this chapter revealed some expected and unexpected findings. Frequently cited trip purposes among *Heartland Flyer* passengers were primarily non-business trips, including trips to visit family and friends and leisure/recreation trips. These trips accounted for more than 75 percent of the total passengers surveyed. Automobile was reported as the primary alternative to the *Heartland Flyer* service (60 percent), but 30 percent of respondents indicated that they would not make the trip if the service were discontinued. Primary reasons for choosing the *Heartland Flyer* included train comfort and cost. Approximately 70 percent of passengers reported an Oklahoma zip code for their residence, while 20 percent were from Texas. Table 5-33 summarizes the median travel and passenger characteristics reported in this chapter.

Table 5-33: Summary of Median Travel and Passenger Characteristics, All Trips

Measure	April	July
Travel Time to Boarding Station (Minutes)	19	25
Travel Time to Final Destination (Minutes)	16	27
Travel Distance to Boarding Station (Miles)	16	20
Travel Distance to Final Destination (Miles)	16	17
Trip Frequency (Annual)	2.3	2.2
Passenger Spending	$121.20	$162.50
Number of Adults in Party	1.1	1.2
Number of Children in Party	0.6	1.0
Age	51	48
Household Vehicles	1.7	1.6
Household Income (Annual)	$65,900	$57,000

This study measured the mobility impacts of the *Heartland Flyer* service by examining passengers' response to a stated preference question on alternative travel modes if the rail service did not exist. The mobility analysis found that more than 39,000 annual vehicle-trips diverted onto the rail service from the I-35 highway corridor, eliminating approximately 7.9 million VMT from the corridor's roadways. Researchers also estimated that more than 20,000 trips were induced and can be attributed to the presence of the rail service. Researchers identified several patterns of modal diversion by trip purpose, age, household vehicles, and annual income. Economic impacts of the *Heartland Flyer* were measured through a question on the survey about passenger spending. Total spending by passengers on four specific items was estimated to be $18 million with nearly $1.4 million contributed to local sales tax revenues.

CHAPTER 6: CONCLUSIONS

This chapter summarizes the project activities and key findings of the data analysis components of this report. Selected findings from the analysis of on-board survey data from *Heartland Flyer* passengers are discussed in the context of the findings of similar studies of other state-supported routes in the Amtrak system. Applications of the study findings across the hierarchy of activities supporting intercity passenger rail planning are also proposed and discussed in detail. The chapter concludes by identifying the questions raised by this study and research efforts that could be undertaken in the future to further this work.

SUMMARY OF FINDINGS

In addition to the study's primary objective of measuring the impacts of intercity passenger rail on the *Heartland Flyer* corridor, relevant findings were identified during all phases of the study. A review of past surveys of state-supported passenger rail services found that most studies were undertaken on an ad hoc basis, although some states or operating agencies have formal on-board survey and evaluation programs. Amtrak also has its own corporate-level on-board survey program. Like many other transportation planning environments, intercity passenger rail planning encompasses a variety of tasks, contexts, stakeholders, and challenges. The relatively high investment cost and a lack of resources or expertise at the agency level makes planning for passenger rail difficult relative to other modes, which have established bodies of knowledge, planning protocols, and participant roles. The development of state rail plans and other language in PRIIA should help shift this paradigm and, ultimately, both raise the level of expertise and establish formal intercity passenger rail planning processes at public agencies such as state DOTs or the FRA. The design of survey instruments and data collection procedures for on-board surveys of intercity passenger rail resembles procedures used in the application of on-board surveys for urban transit properties. Trends and patterns in the content of survey instruments used in on-board surveys of intercity passenger rail were also identified from an analysis of survey instruments used in past studies.

The literature review findings and also input from project stakeholders guided the design of the survey instrument used in this study. A two-page form was utilized that contained

questions on the passenger's boarding and alighting station, trip purpose, alternative travel mode, reasons for choosing the *Heartland Flyer* for the trip, personal spending levels, and demographics. The data collection process resembled a basic hand-out and hand-back procedure, with a great deal of assistance provided by the *Heartland Flyer* on-board staff during the process. More than 1,000 valid responses were obtained from passengers during two rounds of data collection in April and July of 2009. Approximately 75 percent of eligible passengers participated in the study, and the per-item response rate was approximately 90 percent. A thorough quality control process was implemented that identified common measurement errors. Other errors, such as errors due to item non-response, were more difficult to mitigate.

Analysis of the on-board survey data set revealed many patterns of travel behavior among *Heartland Flyer* passengers. Most *Heartland Flyer* passengers reported traveling between the corridor endpoints, Oklahoma City and Fort Worth. Passengers generally traveled to or from the rail station via a private vehicle, with a substantial percentage of these passengers being dropped off or picked up by a friend or family member. Not surprisingly, leisure trips were prevalent on the *Heartland Flyer*, with most passengers reporting "visit family or friends" or "leisure/recreation" as their trip purpose. A vast majority of passengers were infrequent users of the service, with median trip frequencies reported at approximately one round-trip per year on the *Heartland Flyer*. Passengers cited comfort and cost advantages as the two main reasons why they chose the train for their trip. Most *Heartland Flyer* passengers were from the central Oklahoma metropolitan region (Oklahoma City/Norman), followed by the Dallas-Fort Worth Metroplex and the off-corridor Tulsa area. Analysis of passenger alternatives to the *Heartland Flyer* found that the majority of passengers would use an automobile for their trip if the rail service did not exist. Using FFY 2009 passenger data, researchers estimated that more than 39,000 vehicle-trips would be added to parallel roadways in the corridor if the service were discontinued. Analysis of passenger expenditures (spending on lodging, meals, shopping, and entertainment during the trip) estimated that, in FFY 2009, passengers spent $18 million on these items, resulting in nearly $1.4 million in sales tax revenue to the communities served by the *Heartland Flyer*.

Recalling the summary of the findings of past surveys of state-supported intercity passenger rail corridors reported in Table 2-3, the findings of this study of the *Heartland Flyer* appear generally consistent with other Amtrak corridor routes. Of all the routes in Table 2-3, the

Heartland Flyer most closely resembles the *Piedmont*, with similar frequency and service area characteristics. Examining the results of the 2001 *Piedmont* on-board passenger survey reveals that a high percentage of *Piedmont* passengers were making leisure trips (68 percent) and identified the automobile as the main alternative (59 percent) travel mode to the rail service (*22*). The 2001 *Piedmont* findings are generally consistent with what was identified in this study of *Heartland Flyer* passengers, which found a high percentage of leisure trips and automobile diversion among passengers of the route. However, the data collection procedures and analysis methodologies differed between the two studies; as such, formal comparison between the two is not valid even though the similarity in general trends is still evident.

POTENTIAL APPLICATIONS

The findings of this study can be used in a variety of potential applications for all levels of passenger rail planning, including statewide rail planning, corridor-specific studies, and station-area planning. This section discusses potential applications for each level. For the southwestern United States, the findings are particularly useful for rail planning activities, as they represent a comprehensive examination of the only intercity passenger rail route currently in operation in the southwest region.

Statewide Passenger Rail Planning

Intercity passenger rail planning at the state-agency level encompasses tasks including the formation of transportation policy recommendations, the development of grant application or appropriations requests, and public outreach. For the formation of state transportation policy, these findings can be used to demonstrate the transportation system impacts of intercity passenger rail in short- to medium-distance intercity corridors. For example, this study found that more than 39,000 vehicle-trips diverted to the *Heartland Flyer* in FFY 2009, resulting in an estimated reduction of 7.9 million vehicle-miles of travel on corridor roadways. In addition to reducing vehicle congestion and road wear, air quality and energy use are also optimized with this reduction. For policymakers, state transportation agency executives, and other stakeholders with a contribution to the development of state transportation policy, these findings can be meaningful to the decision-making process. Naturally, the extent that the comparison can be

made is related to the similarity between the *Heartland Flyer* corridor and other corridors in the southwest region and across the country. The findings of this study can also be used by planners to educate the public on the impacts of passenger rail in local areas. The economic impacts findings, for example, could help in obtaining local stakeholder buy-in for passenger rail service improvements or expansion.

At the state level, the funding of state-supported intercity passenger rail routes is likely to be scrutinized during the annual appropriations cycle for state budgets. The findings of this study can also be used by rail planners in the development of materials to support appropriations requests or to educate state legislators or committees on the impacts and outcomes of intercity passenger rail. Findings can also be utilized in the writing of grant applications related to specific provisions of PRIIA or future intercity passenger rail funding programs. Applications for infrastructure project funds, for example, can be supported with the findings of this study that demonstrate the congestion reduction benefits related to intercity passenger rail. The extent to which a project can contribute to reducing congestion on the highway or air network was specifically listed as a criterion for evaluating projects for funding under these provisions (*2*). Also, the development of state rail plans as described by PRIIA Section 303 can benefit from these findings. Considerations for project inclusion in state rail plans, as outlined in PRIIA Section 303, also include criteria related to congestion reduction and economic development. Measures of both criteria were identified in this study.

Corridor-Level Studies

In addition to statewide passenger rail planning applications, the findings of this study can also be used to guide the development of future planning studies and other activities related to proposed passenger rail service in short- to medium-distance intercity corridors where no service currently exists. Specifically, the mobility and economic benefits associated with the *Heartland Flyer* identified in this study can be used as a starting point to identify the benefits that could be accrued from the development of passenger rail service in other intercity corridors. One strategy used by planners when considering new intercity passenger rail service is to identify an existing passenger rail corridor with characteristics similar to the proposed corridor and use information from these "peer" corridors to support their planning activities. New

passenger rail routes, particularly those in the southwestern United States, may share many similar characteristics to the *Heartland Flyer*. As new passenger rail corridors in the southwest region are proposed, rail planners can use the findings of this study to develop sketch-level estimates of the impacts of the proposed service. Benefits of enhancing or expanding existing service, including the *Heartland Flyer* route, can also be identified through the findings of this study. Additional service frequencies on the *Heartland Flyer* route or expansion of the service to new markets, for example, would likely result in impacts similar to those identified in this study.

Station Area Planning

The findings of this study can be used to support station-area planning needs. Site-level planning tasks include the design of on-site parking and circulation systems and the provision of adequate capacity on the adjacent street system to manage new traffic associated with development (*84*). Passenger travel mode of access to and from the rail station data can be used to develop refined trip generation estimates for new stations that consider the high level of pick-up and drop-off activity at the rail station environment. Mode split and trip duration data can be used to design adequate parking capacity at the station that accounts for both day trips and longer-duration travel. This study identified this information for the seven *Heartland Flyer* stations, which encompass a variety of station area contexts. Site design requirements for urban stations such as Oklahoma City and Fort Worth, for example, are much different than stations in smaller towns such as Pauls Valley or Purcell. Findings from stations located in different types of cities can be used to guide site planning activities for new stations located in similar contexts along new intercity passenger rail routes. As with the corridor-level applications discussed previously, the results of this study will be particularly useful for station planning and development along proposed rail corridors in the southwest region.

Methodology Transfer

One potential application of this study related to future intercity passenger rail planning is the lessons learned from the survey design, data collection procedures, and quality control methodology developed for and used in this study. The analysis of the content of the survey instruments used in past on-board surveys of intercity rail passengers in this study can provide

valuable insight on the design of future studies of this type. Lessons learned during the data collection procedure (particularly the benefits of the support and involvement of the on-board staff) will be useful in the design and execution of future on-board surveys of intercity passenger rail passengers. Finally, although the quality control review employed in this study had only a small impact on the quality of the overall data set (per-item response rate increase of two percentage points), future surveys may benefit from the quality control procedures described in this report. It is recommended that researchers that are planning an on-board survey of intercity rail passengers consider the lessons learned in this study during all stages of future on-board surveys. Proposed development of high-speed passenger rail in the United States will likely result in the need to deploy studies similar to the one described in this report to measure progress toward major policy initiatives and ensure that funding is being distributed accordingly. While the characteristics of passengers using future high-speed rail routes are likely to be different than the characteristics of the *Heartland Flyer* passengers in this study, the study methodology utilized in this research can be transferred into a high-speed rail on-board survey application with few, if any, modifications.

FUTURE RESEARCH

Future research on the topic of intercity rail passenger behavior and the impacts of passenger rail on intercity mobility and the communities it serves can take many directions. Given a limited amount of resources, new data collection efforts could either focus on gathering additional data for the *Heartland Flyer* or other corridors where surveys have been done in the past or fund new data collection on corridors where surveys have not been done in some time or have not been done at all. Pre- and post-facto on-board surveys could also be deployed on a route where service improvements were made (such as travel time improvements) to observe any changes in traveler behavior resulting from the improvement. The "before and after" approach may be particularly useful if it is necessary to document how funding for certain passenger rail projects accomplished progress toward policy outcomes, such as reducing highway congestion. On-board surveys might also be useful in certain corridors where short-distance service may be established on an intercity segment currently-served by an Amtrak long-distance route.

Future research can also focus on improving the data collection and analysis methodology processes. The state of practice would definitely be improved if a formal sampling plan could be developed that allowed for the estimation of variance and the resulting inferences that can be made about the population while also acknowledging the need to optimize study-related costs. Innovative survey approaches, such as a two-part form (hand-in and mail-back) or the use of electronic "tablet" devices for the tabulation of passenger responses might also be an area for future study. Future surveys might also focus on obtaining more detailed origin and destination information, to develop a database of passenger information with increased geographic precision. This would allow for a more refined estimate of a route's market area. Finally, future surveys should take special care to identify passengers on a survey run who have already participated in the study and consider how these passengers might be accounted for in the total population of ridership without requiring them to complete a second survey form.

REFERENCES

1. National Surface Transportation Policy and Revenue Study Commission. *Transportation for Tomorrow: Report of the National Surface Transportation Policy and Revenue Study Commission*, Volume I: Recommendations, December 2007.
2. *Passenger Rail Investment and Improvement Act of 2008*. Public Law No. 110-432 (Division B-Amtrak), 122 STAT. 4907, October 2008.
3. U.S. Department of Transportation, Federal Railroad Administration. *Vision for High-Speed Rail in America: High-Speed Rail Strategic Plan*, FRA, Washington, D.C., April 2009.
4. U.S. Department of Transportation, Office of Public Affairs. "President Obama, Vice President Biden to Announce $8 Billion for High-Speed Rail Projects across the Country." News Release No. DOT 18-10, Washington, D.C., January 28, 2010.
5. National Railroad Passenger Corporation. *Amtrak System Timetable Fall 2009-Winter 2010*. NRPC, Washington, D.C., Effective October 26, 2009.
6. National Railroad Passenger Corporation. *Amtrak National Fact Sheet: FY 2008*. Amtrak Media Relations, Washington, D.C., February 2009.
7. *Rail Passenger Service Act of 1970*. Public Law No. 91-518, 84 STAT. 1328, October 1970.
8. Amtrak Reform Council. *A Summary of the Current Legislative Provisions Prescribing the Legal and Regulatory Framework Governing the National Railroad Passenger Corporation (Amtrak)*. Amtrak Reform Council Policy Paper, December 2000.
9. Nice, D.C. *Amtrak: The History and Politics of a National Railroad*. Rienner Publishers, Boulder, Colorado, 1998.
10. National Railroad Passenger Corporation. *Amtrak's Northeast Corridor Fact Sheet: FY 2008*. Amtrak Media Relations, Washington, D.C., February 2009.
11. National Railroad Passenger Corporation. *Amtrak: Corridor & State Trains Fact Sheet: FY 2008*. Amtrak Media Relations, Washington, D.C., February 2009.
12. National Railroad Passenger Corporation. *Amtrak: Long Distance Trains Fact Sheet: FY 2008*. Amtrak Media Relations, Washington, D.C., February 2009.
13. National Railroad Passenger Corporation. "Amtrak Posts Second-Best Ridership in History." Amtrak Media Relations, News Release No. ATK-09-074, Washington, D.C., October 12, 2009.
14. Goldberg, B. *Amtrak-The First Decade*. Alan Books, Silver Spring, Maryland, 1981.
15. Bradley, R.P. *Amtrak: The US National Rail Passenger Corporation*, Blandford Press, New York, 1985.
16. National Railroad Passenger Corporation. *Amtrak Fiscal Year 2010 Comprehensive Business Plan*, Washington, D.C., February 2010.
17. Morgan, C.A., J.E. Warner, C.E. Roco, and S.S. Roop. *Funding Strategies and Project Costs for State-Supported Intercity Passenger Rail: Selected Case Studies and Cost Data*. Publication FHWA/TX-05/0-4723-1. Texas Transportation Institute, The Texas A&M University System, College Station, Texas, June 2005.
18. *About NNEPRA*. Northern New England Passenger Rail Authority. URL: http://www.amtrakdowneaster.com/nnepra. Accessed October 28, 2009.

19. Economic Development Research Group, Inc. and KKO and Associates. *Final Report: Economic Benefits of Amtrak Downeaster Service*. Prepared for Maine Department of Transportation, Office of Passenger Transportation. Augusta, Maine, February 2005.
20. Miller, J.H., D. Diamond, and R.E. Brydia. *Learning About Our Customer: The Results of the 1994 Keystone Rail Service On-Board Survey.* Publication PTI 9517. The Pennsylvania Transportation Institute, University Park, Pennsylvania, February 1995.
21. North Carolina Department of Transportation, Office of Research and Policy Analysis. *Results of 1996 Piedmont Passenger Survey, August 1996.* Prepared for NCDOT Rail Division. Raleigh, North Carolina, October 1996.
22. North Carolina Department of Transportation, Office of Productivity Services. *Piedmont and Carolinian Passenger Survey Summary.* Raleigh, North Carolina, 2001.
23. Illinois Department of Transportation, Bureau of Railroads. *1993 Illinois Passenger Rail Survey.* Springfield, Illinois, 1993.
24. Southeastern Wisconsin Regional Planning Commission. *Amtrak Milwaukee-Chicago Passenger Survey Findings: May 1989.* Memorandum Report Number 43. Waukesha, Wisconsin, August 1989.
25. Southeastern Wisconsin Regional Planning Commission. *Amtrak Milwaukee-Chicago Passenger Survey Findings: May 1991*. Memorandum Report Number 57. Waukesha, Wisconsin, January 1993.
26. Sperry, B., and E. Johnson. Examining the Role of the *Hiawatha Service* in the Milwaukee-Chicago Corridor. In *Proceedings of the 2010 Joint Rail Conference*. CD-ROM. Paper No. JRC2010-36223, April 2010.
27. Kuehne, R.L., and K.A. Hundt. Michigan Intercity Rail Passenger Study and Intercity Bus User Comparison. *Transportation Research Record*, 1177, 1988, pp. 23-39.
28. Levine, J., and T. Penders. *Intercity Train and Bus Passenger Study*. Prepared for the Michigan Department of Transportation by the Urban and Regional Research Collaborative. Ann Arbor, Michigan, August 2002.
29. Grengs, J., Hu, C., and M. Weitz. *Intercity Bus and Passenger Rail Study*. Prepared for the Michigan Department of Transportation. Ann Arbor, Michigan, December 2009.
30. Corporate Strategies, Inc. and Science Applications International Corporation. *Evaluation of Passenger Rail Service: St. Louis to Kansas City*. Prepared for Missouri Department of Transportation. Jefferson City, Missouri, December 1998.
31. Schultz, J.T. *Northwest Talgo Demonstration Onboard Survey Final Report*. Washington State Department of Transportation, Public Transportation and Rail Division. Olympia, Washington, April 1995.
32. Schultz, J.T. *An Analysis of Origins and Destinations of Amtrak's San Diegan Ridership: 1987*. Master's Thesis. San Diego State University, San Diego, California, 1988.
33. San Diego Association of Governments. *Amtrak San Diegans Passenger Survey-1992*. San Diego, California, March 1993.
34. Corey, Canapary & Galanis Research. *Capitol Corridor Satisfaction Survey-Wave#16 Final Report*. Prepared for the Capitol Corridor Joint Powers Authority. Oakland, California, July 2007.

35. Corey, Canapary & Galanis Research. *Capitol Corridor Satisfaction Survey-Wave#17 Final Report*. Prepared for the Capitol Corridor Joint Powers Authority. Oakland, California, January 2008.
36. California Department of Transportation. *California State Rail Plan 2007-08 to 2017-18*. Sacramento, California, March 2008.
37. Transportation Research Board. *In Pursuit of Speed: New Options for Intercity Passenger Transport*. Special Report No. 233. Washington, D. C., 1991.
38. de Dios Ortuzar, J., and L.G. Willumsen. *Modelling Transport*, Third Edition. Wiley, Chichester, England, August 2004.
39. Morikawa, T., M. Ben-Akiva, and K. Yamada. "Forecasting Intercity Rail Ridership Using Revealed Preference and Stated Preference Data." *Transportation Research Record*, 1328, 1991, pp. 30-35.
40. Franke, M.W., and B.E. Hillblom. *Report on Proposed Operation of Passenger Train Service Between St. Louis and Southwest Missouri*. Prepared by Amtrak for the Missouri Department of Transportation. Chicago, Illinois, May 2007.
41. Transportation Economics & Management Systems, Inc. *High Speed Rail Feasibility Study Methodology Technical Report*. Performed in association with Quandel Consultants, LLC. Submitted to the Rocky Mountain Rail Authority, October 2008.
42. Tennessee Department of Transportation. *Tennessee Rail System Plan, Task 4: Potential Intercity Passenger Rail Corridors*. Nashville, Tennessee, 2003.
43. Miller, J.S., and B.F. Thorn. "A Sketch Method for Forecasting Intercity Passenger Rail Demand." *ITE Journal on the Web*, January 2009, pp. 69-75.
44. Schwieterman, J.P., and J. Sheidt. "Survey of Current High-Speed Rail Planning Efforts in the United States." *Transportation Research Record*, 1995, 2007, pp. 27-34.
45. Brand, D., Parody, T.E., Hsu, P.S., and K.F. Tierney. "Forecasting High-Speed Rail Ridership." *Transportation Research Record*, 1341, 1992, pp. 12-18.
46. U.S. Department of Transportation, Federal Railroad Administration. *High-Speed Ground Transportation for America*. FRA, Washington, D.C., 1997.
47. Marshment, R., M. Court, M. Mantell, and D. Karapanagiotis. *Patronage Forecast for the Proposed High Speed Passenger Rail Service between Tulsa and Oklahoma City*. Oklahoma Transportation Center. Norman, Oklahoma, July 2003.
48. Horowitz, A.J., and D.D. Farmer. "Statewide Travel Forecasting Practice: A Critical Review." *Transportation Research Record*, 1685, 1999, pp. 13-20.
49. Cambridge Systematics and Mark Bradley Consulting. *Bay-Area/California High-Speed Rail Ridership and Revenue Forecasting Study: Interregional Model System Development*. Prepared for the Metropolitan Transportation Commission and the California High-Speed Rail Authority. August 2006.
50. AECOM Consulting and Wilbur Smith Associates. *Investment Grade Ridership Study Summary Report*. Prepared for the Florida High-Speed Rail Authority. November 2002.
51. Schaller, B. *On-Board and Intercept Transit Survey Techniques*. Transit Cooperative Research Program, Synthesis of Transit Practice 63. Washington, D.C., 2005.
52. Cambridge Systematics, Inc. *Travel Survey Manual*. Prepared for U.S. Department of Transportation and U.S. Environmental Protection Agency. Washington, D.C., June 1996.

53. Robertson, H.D., J.E. Hummer, and D.C. Nelson. *Manual of Transportation Engineering Studies*. Institute of Transportation Engineers. Washington, D.C., 2000.
54. Richardson, A.J., E.S. Ampt, and A.H. Meyburg. *Survey Methods for Transport Planning*. Melbourne, Australia, Eucalyptus Press, 1995.
55. Sheskin, I.M., and P.R. Stopher. "Surveillance and Monitoring of a Bus System." *Transportation Research Record*, 862, 1982, pp. 9-15.
56. Texas Department of Transportation, Transportation Planning and Programming Division. Wichita Falls District Traffic Map-2008. URL: ftp://ftp.dot.state.tx.us/pub/txdot-info/tpp/traffic_counts/2008/wfs_base.pdf. Accessed November 6, 2009.
57. Greyhound Lines, Inc. *Greyhound Lines Timetable #362: Kansas City-Wichita-Oklahoma City-Dallas*. URL: http://www.greyhound.com/revsup/schedules/pageset.html. Accessed June 5, 2009.
58. Jefferson Lines, Inc. *Jefferson Lines Timetable Schedules*. URL: http://www.jeffersonlines.com. Accessed November 6, 2009.
59. Bureau of Transportation Statistics. *Air Carrier Statistics Database*. Form 41-Traffic, All Carriers. URL: http://www.transtats.bts.gov/databaseinfo.asp?DB_ID=111. Accessed November 6, 2009.
60. Bryant, K.L. *History of Atchison, Topeka, and Santa Fe Railway*. Macmillian, New York, 1974.
61. Yenne, B. *Santa Fe Chiefs*. MBI, St. Paul, Minnesota, 2005.
62. U.S. Department of Transportation. *Final Report to Congress on the Amtrak Route System*. Washington, D.C., January 1979.
63. U.S. General Accounting Office. *Review of Amtrak's Study of Rail Service Through Oklahoma*. Report No. RCED-86-140, April 1986.
64. Oklahoma State House of Representatives. Enrolled House Bill No. 1078, May 1993.
65. Oklahoma State Senate. Enrolled Senate Bill No. 1192, May 1996.
66. National Railroad Passenger Corporation. *Oklahoma Passenger Rail Study*. Prepared for the Oklahoma Department of Transportation. April 1996.
67. Transportation Economics & Management Systems, Inc. *Oklahoma-Amtrak Study Preliminary Study Findings: Operating Times and Demand Forecasts*. Prepared for Amtrak and the Oklahoma Department of Transportation. Washington, D.C., February 1999.
68. *Taxpayer Relief Act of 1997*. Public Law No. 105-34, 111 STAT. 788, August 1997.
69. Carter-Burgess, Inc. *The Heartland Flyer: Oklahoma's Passenger Rail Service: Economic Benefit Report*. Prepared for the Oklahoma Department of Transportation, Rail Programs Division. C&B Project No. 020874.010, April 2005.
70. Oklahoma State Senate. Senate Bill No. 389, 50th Legislature, 2005.
71. Texas Transportation Commission. Minute Order #110688, September 28, 2006.
72. Texas Transportation Commission. Minute Order #111936, August 27, 2009.
73. Franke, M.W., B.E. Hillblom, and R.P. Hoffman. *Feasibility Report of Proposed Amtrak Service: Kansas City, Missouri-Oklahoma City, Oklahoma to Fort Worth, Texas*. Prepared by Amtrak for the Kansas Department of Transportation. Chicago, Illinois, March 2010.

74. Able Consulting. *Tier 1 Environmental Assessment for North Section of the South Central High-Speed Rail Corridor in Oklahoma*. Prepared for the Oklahoma Department of Transportation and the Federal Railroad Administration. September 2009.
75. Oklahoma Department of Transportation, Media & Public Relations Division. "Input Needed on Preliminary Plans for Oklahoma's High-Speed Rail." News Release No. 09-061, Oklahoma City, Oklahoma, September 8, 2009.
76. City of Denton, Texas. *City Council Mobility Committee Agenda Item #2: Discussion of Establishing Passenger Rail Service in Denton County on Amtrak's Heartland Flyer*. August 28, 2007.
77. U.S. Census Bureau, Population Division. *July 1, 2008 Population Estimates of Incorporated Places and Minor Civil Divisions*. URL: http://www.census.gov/popest/cities/SUB-EST2008-states.html. Accessed December 11, 2009.
78. Oklahoma Department of Transportation, Media & Public Relations Division. "Tenth Anniversary Brings Savings for Amtrak *Heartland Flyer* Passengers." News Release No. 09-032, Oklahoma City, Oklahoma, April 15, 2009.
79. Texas Department of Transportation, Multimodal Section. *High-Speed Intercity Passenger Rail Program Application Form: Crossing Signal Timing, BNSF Fort Worth Sub*. Submitted to FRA August 24, 2009.
80. BNSF Railway. *Texas Division Timetable No.6*. Effective June 9, 2004.
81. Office of Management and Budget. Standards for Defining Metropolitan and Micropolitan Statistical Areas; Notice. *Federal Register*, Vol. 65, No. 249. December 27, 2000, pp. 82228-82238.
82. Weisbrod, G., and B. Weisbrod. *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*. Transportation Research Circular #477. Washington, D.C., October 1997.
83. National Railroad Passenger Corporation. *Amtrak Fact Sheet, Fiscal Year 2009, State of Oklahoma*. Amtrak Government Affairs, Washington, D.C., November 2009.
84. Stover, V.G., and F.J. Koepke. *Transportation and Land Development*. Institute of Transportation Engineers, Washington, D.C., July 2002.

APPENDIX A: PROJECT PHOTOS

Figure A-1: Oklahoma City Amtrak Station

Figure A-2: Norman Amtrak Station

Figure A-3: Purcell Amtrak Station

Figure A-4: Pauls Valley Amtrak Station

Figure A-5: Ardmore Amtrak Station

Figure A-6: Gainesville Amtrak Station

Figure A-7: Fort Worth Amtrak Station

Figure A-8: Big Canyon of the Washita River along *Heartland Flyer* Route

APPENDIX B: ON-BOARD SURVEY FORM

AMTRAK *HEARTLAND FLYER* CUSTOMER SURVEY

Welcome aboard the *Heartland Flyer*! The Southwest University Transportation Center (SWUTC), in cooperation with Amtrak and the Oklahoma and Texas State Departments of Transportation, is conducting a survey of *Heartland Flyer* passengers as part of a research study to better understand how the *Heartland Flyer* service impacts mobility in the region. Your participation in this survey is optional and all survey responses will be anonymous. A SWUTC representative is available to answer questions and will collect your survey before you reach your destination. You may also deposit your completed survey in the secure drop box in the café car.

Thank you for taking the time to participate in this research study and for riding the *Heartland Flyer*.

Please place an "X" in the box or fill in the blank space corresponding to your answer for each question.

1. At what station did you board the *Heartland Flyer* for this one-way portion of your trip today?

☐ Oklahoma City, OK ☐ Norman, OK ☐ Purcell, OK ☐ Pauls Valley, OK
☐ Ardmore, OK ☐ Gainesville, TX ☐ Fort Worth, TX

2. How did you travel to that train station?

☐ Drove and Parked At Station ☐ Commuter Train (*TRE*) ☐ Walked
☐ Rode with Someone Who Parked At Station ☐ Connecting Amtrak Train/Bus ☐ Bicycle
☐ Dropped Off by Private Vehicle ☐ Intercity Bus (*Greyhound*) ☐ Taxi/Shuttle
☐ Local Transit Bus/Van/Trolley ☐ Other (*Please Specify*): _____

3. Please estimate the time it took you to travel to the station where you boarded the *Heartland Flyer*:
Hours: _____ Minutes: _____ Miles: _____

4. At what station will you get off the *Heartland Flyer* for this one-way portion of your trip today?

☐ Oklahoma City, OK ☐ Norman, OK ☐ Purcell, OK ☐ Pauls Valley, OK
☐ Ardmore, OK ☐ Gainesville, TX ☐ Fort Worth, TX

5. How do you plan to travel from that train station to your final destination?

☐ Drive in Vehicle Parked At Station ☐ Commuter Train (*TRE*) ☐ Walk
☐ Ride with Someone Who Parked At Station ☐ Connecting Amtrak Train/Bus ☐ Bicycle
☐ Picked Up by Private Vehicle ☐ Intercity Bus (*Greyhound*) ☐ Taxi/Shuttle
☐ Local Transit Bus/Van/Trolley ☐ Other (*Please Specify*): _____

6. Please estimate the time you think it will take to travel to your final destination from the station in Question 4.
Hours: _____ Minutes: _____ Miles: _____

7. Which of the following best describes the purpose for your trip on the *Heartland Flyer* today?

☐ Visiting Family or Friends ☐ Leisure/Recreation ☐ Shopping
☐ Going To/From University/College ☐ Personal Business ☐ Vacation
☐ Going To/From Business Trip ☐ Other (*Please Specify*): _____

8. If the *Heartland Flyer* train service did not exist, how would you have made this trip today?

☐ Drive A Private Vehicle ☐ Commercial Airline ☐ Intercity Bus
☐ Passenger in A Private Vehicle ☐ I Would Not Have Made This Trip
☐ Rental Car or Company Vehicle ☐ Other (*Please Specify*): _____

9. Are you making a round-trip on the *Heartland Flyer* today? ☐ Yes ☐ No

10. In the last 12 months, how many one-way trips have you taken on the *Heartland Flyer*?
(*Please include the current trip and count a round-trip as two trips.*)

☐ 1-4 Trips ☐ 5-9 Trips ☐ 10-19 Trips ☐ 20 or More Trips

Please continue this survey on the other side.

11. Please mark the two (2) most important reasons why you chose the *Heartland Flyer* for your trip today.

- ☐ Trip Least Expensive by Train
- ☐ Train is More Comfortable/Relaxing Than Other Options
- ☐ Train Station is Convenient to My Place of Residence
- ☐ Train Station is Convenient to My Destination
- ☐ Train Schedule is Convenient for My Schedule Needs
- ☐ Ability to Work While Traveling
- ☐ Availability of On-Board Food Service
- ☐ Other (*Please Specify*): _____
- ☐ Trip Fastest by Train
- ☐ Avoid Traffic Congestion/Parking
- ☐ Would Rather Not Drive
- ☐ Do Not Drive
- ☐ No Vehicle Available
- ☐ Would Rather Not Fly
- ☐ No Other Reasonable Option

12. On your trip today, how many nights were you (or will you be) away from your primary place of residence?

☐ I am making a round-trip today. ☐ 1 Night ☐ 2 Nights ☐ 3 to 5 Nights ☐ 6 or More Nights

13. How much did you spend (or plan to spend) on lodging, meals, shopping, and entertainment during the entire duration of your trip? (*Please do not include the cost of purchases on-board the train.)*

☐ Less than $25 ☐ $25-$49 ☐ $50-$99 ☐ $100-$249 ☐ $250 or More

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Your responses to the following questions will help the researchers better understand the general characteristics of *Heartland Flyer* passengers. This information is completely anonymous.

14. What is the zip code of your primary place of residence? | | | | | |

(*College students please answer for your place of residence while attending school.*)

15. What is your gender? ☐ Male ☐ Female

16. Which age group are you in?

- ☐ 18 - 24 Years
- ☐ 25 - 34 Years
- ☐ 35 - 44 Years
- ☐ 45 - 54 Years
- ☐ 55 - 64 Years
- ☐ 65 Years or Older

17. Including yourself, how many adults and children are traveling with you today?

Adults (*Age 18 or Older*): _____ Children (*Under Age 18*): _____

18. Which of the following best describes your current employment status?

- ☐ Employed Full-Time
- ☐ Employed Part-Time
- ☐ Unemployed
- ☐ University/College Student
- ☐ Student (*Other Than College*)
- ☐ Other (*Please Specify*): _____
- ☐ Retired
- ☐ Homemaker

19. How many personal vehicles (cars, vans, or trucks) do the people living in your household own or lease? (*College students please answer for your place of residence while attending school.*)

☐ None ☐ One ☐ Two ☐ Three or More

20. What is your current annual household income (*total for all people who live in your household*)?

- ☐ Under $10,000
- ☐ $10,000 to $19,999
- ☐ $20,000 to $29,999
- ☐ $30,000 to $39,999
- ☐ $40,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 or More

21. Please share any comments or suggestions you may have for improving the *Heartland Flyer* service:

_____

_____

Thank you for participating in this research study and for riding the *Heartland Flyer*.

For more information, please contact: Curtis Morgan or Ben Sperry, Texas Transportation Institute, (979)-862-2854

APPENDIX C: IRB DOCUMENTATION

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

1186 TAMU, General Services Complex
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Human Subjects Protection Program

Institutional Review Board

DATE: 02-Apr-2009

MEMORANDUM

TO: MORGAN, CURTIS A

FROM: Office of Research Compliance
Institutional Review Board

SUBJECT: Initial Review

Protocol Number: 2009-0199

Title: Measuring the Benefits of Intercity Passenger Rail: A Study of the Heartland Flyer Corridor

Review Category: Exempt from IRB Review

It has been determined that the referenced protocol application meets the criteria for exemption and no further review is required. However, any amendment or modification to the protocol must be reported to the IRB and reviewed before being implemented to ensure the protocol still meets the criteria for exemption.

This determination was based on the following Code of Federal Regulations:
(http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm)

45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Provisions:

This electronic document provides notification of the review results by the Institutional Review Board.

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

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Human Subjects Protection Program

Institutional Review Board

DATE: 25-Jun-2009

MEMORANDUM

TO: MORGAN, CURTIS A

FROM: Office of Research Compliance
Institutional Review Board

SUBJECT: Amendment

Protocol Number: 2009-0199

Title: Measuring the Benefits of Intercity Passenger Rail: A Study of the Heartland Flyer Corridor

Review Category: Exempt from IRB Review

It has been determined that the referenced protocol application meets the criteria for exemption and no further review is required. However, any amendment or modification to the protocol must be reported to the IRB and reviewed before being implemented to ensure the protocol still meets the criteria for exemption.

This determination was based on the following Code of Federal Regulations:
(http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm)

45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Provisions: Expansion of the number of participants from 1200 to 3000 due to a second round of data collection with a larger participant pool.

This electronic document provides notification of the review results by the Institutional Review Board.