Applying a Model to Estimate Demand for National Rural Intercity Bus Service

In Southern Cochise County, Arizona
Estimating Demand for Rural Intercity Bus Service in Southern Arizona

INTRODUCTION

Study Purpose

The expansion of intercity bus service is a planning priority for Southern Cochise County. Given the challenge of expanding transit service in rural areas, careful, targeted efforts are required to accomplish this objective. In working towards that goal, this paper will explore the following:

- Clarify the definition of "intercity" bus service in transit planning;
- Review planning priorities for intercity transit services; and
- Apply a toolkit for assessing demand for rural national intercity bus services, and address its usefulness to this scenario and future intercity transit planning efforts

The focus of this paper is intercity service between the communities of Douglas, Bisbee, and Sierra Vista (see Figure 1 below).

FIGURE 1 Study Area

Definition of Intercity Bus Service

National Intercity Bus Service: Connectivity to the National Intercity Bus Network

In transportation planning, the term "intercity" is often used to describe service connections to what is deemed the "national intercity bus service network." This network is comprised of both public and private bus service linkages between the nation’s urban and community centers. Historically, this service was provided by private, for-profit carriers, such as Greyhound Bus Lines. However, such service is in decline; in 2010, the Bureau for Transportation Statistics reported that 8.9 million rural residents had no access to intercity transportation, a substantial increase from 5.4 million in 2005 (1). The service was
typically used by college students and military personnel, or for long-distance vacationing in an era when car ownership was less widespread, and air travel less commonplace. In this paper, bus service that provides a link to this national, intercity bus network shall be referred to as "national intercity" bus service.

As "national intercity" bus service decreased, the routes typically were not taken over by public transit systems. However, federal legislation provided an incentive to do so; the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 Section 18(i) Program for Rural Intercity Services required states to set aside at least 15% of rural funding for intercity bus service (2). The program was continued under reauthorization of SAFETEA-LU, and government agencies and non-profit organizations are increasingly providers of national intercity bus service. National intercity bus service may be private or public, or subsidized by private or public funds.

*Intercity Bus Service: Service between Towns and Cities*

The term "intercity bus service" may be used to refer to the national intercity network, or simply to describe bus service between cities or towns. Nevertheless, both types of intercity service are important because they provide access to services and destinations that the rural communities may lack. As an indication of the ongoing importance of this topic, the Transportation Research Board hosts a Committee on Rural Public and (National) Intercity Bus Transportation.

**PLANNING FOR INTERCITY BUS SERVICE IN SOUTHERN COCHISE COUNTY**

*Intercity Service: A Planning Priority*

The *SEAGO 2012 Transportation Coordination Plan* (3) and *Regional Mobility Plan* (4) are planning documents that prioritize needed County transit improvements. The *Arizona Rural Transit Needs Study* commissioned by the Arizona Department of Transportation (ADOT) in 2008 is a comprehensive study of rural transit needs and priorities across the State that also addresses Cochise County priorities.

Review of these documents shows that intercity rural service is the highest priority transit need in Cochise County. Five of the six priority transit service needs identified in the *Coordination Plan* and *Regional Mobility Plan* are for intercity service. Specifically, service is needed between:

- Douglas, Bisbee, and Sierra Vista
- Huachuca City and Sierra Vista
- Tombstone and Sierra Vista
- St. David and Benson
- Elfrida and Douglas

Intercity service between Bisbee-Sierra Vista-Benson was identified as one of the State's eleven intercity priorities (5). In addition, at the Cochise County Coordination meeting on December 6, 2012, a City of Sierra Vista official and human services provider each suggested that service to Benson should be a priority. Benson offers both Greyhound and Amtrak (rail) service, and communities that connect to that City can access the "national intercity" bus network. The *Arizona Rural Needs Transit Study* notes that many rural communities are "highly dependent on larger cities and metropolitan areas for their employment, medical, and shopping needs" (p.4-20). In this case, access to Benson provides access to Tucson, Phoenix, and beyond.
The Arizona Rural Transit Needs Study identified goals and objectives, as well as demographic and economic trends that should inform future intercity transit planning. The study concluded that there is substantial unmet transit need in Benson, Bisbee, Douglas, and Sierra Vista, with substantially greater need projected by 2016. Overall projected County transit need is 900,000 annual trips by 2016. Intercity bus service is one important component of the overall strategy to meet this need. Creating connections to the national intercity bus network would meet a portion of the overall intercity service need.

Current and Historic Transit Service in Southern Cochise County

Background

Intercity bus service of both types is most effective when it provides connections to a local transit system because it becomes more feasible and affordable for riders to reach their desired destination. Therefore, it is important to inventory the existing transit services in each community. Community characteristics that indicate potential transit demand are also addressed. Of the four counties in the SEAGO region, Cochise County offers the highest level of fixed-route transit service: Benson, Bisbee, Douglas, and Sierra Vista each has a fixed-route system.

The U.S. Census Bureau defines the term “rural” as outside of a Metropolitan Statistical Area (and not a suburb of a major city) with a population density of less than 1,000 persons per square mile. In 2009, Cochise County population density was 13.8 persons per square mile (6). However, despite the low density, the relative proximity of the Sierra Vista, Bisbee, and Douglas communities to each other provides an advantage for intercity bus service.

It is notable that the County population distribution has shifted. In 1960, Douglas had the largest population - 11,925; however, Sierra Vista has accommodated about half the region's growth since (6); in 2010 it was the incorporated area in the County with the largest population estimated at 43,888.

City of Benson

Although Benson is not the focus of this study, the City is important because it provides access to the national intercity bus network through Greyhound Bus service, and Amtrak passenger rail service. The City also provides the most direct interstate highway access to Southern Cochise County via Interstate 10.

Benson now provides deviated-route and curbside bus service throughout the City and surrounding area, including the Village of St. David, fulfilling one of the Coordination Plan and Regional Mobility Plan intercity priorities (7).

City of Bisbee

The City of Bisbee is an historic community and County seat located proximate to the Mexican border. With its rich mines, the City hosted a population of over 20,000 in 1900. When the mines closed in 1974, population decreased substantially, and the 2010 U.S. Census recorded 5,575 persons. Top employers are Cochise County and the U.S. Border Patrol (see Table 1, below). The City has evolved into a cultural and tourism hub, with restaurants, shops, artists' studios, accommodations, and festivals and events throughout the year. The mine was recently reopened on a smaller scale. Major transportation access is by State Routes 90 and 80.
TABLE 1 Top 20 Employers in Cochise County, 2000

<table>
<thead>
<tr>
<th>Employer</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 US Army Intelligence Center &amp; Fort Huachuca</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>2 Sierra Vista Unified School District</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>3 Cochise County</td>
<td>Bisbee</td>
</tr>
<tr>
<td>4 US Border Patrol stations</td>
<td>Bisbee, Douglas</td>
</tr>
<tr>
<td>5 Aegis Communications Group</td>
<td>Douglas/Sierra Vista</td>
</tr>
<tr>
<td>6 Sierra Vista Regional Health Center</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>7 Cochise College</td>
<td>Douglas</td>
</tr>
<tr>
<td>8 City of Sierra Vista</td>
<td>Douglas</td>
</tr>
<tr>
<td>9 Safeway Stores, Inc.</td>
<td>Bisbee, Douglas</td>
</tr>
<tr>
<td>10 New Tech, Fort Huachuca</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>11 Sierra Southwest</td>
<td>Benson</td>
</tr>
<tr>
<td>12 City of Douglas</td>
<td>Douglas</td>
</tr>
<tr>
<td>13 Northrup Grumman</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>14 Wilcox Unified School District</td>
<td>Wilcox</td>
</tr>
<tr>
<td>15 Palominas Public Schools</td>
<td>Bisbee, Sierra Vista</td>
</tr>
<tr>
<td>16 ILEX</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>17 City of Douglas</td>
<td>Douglas</td>
</tr>
<tr>
<td>18 Palominas Public Schools</td>
<td>Bisbee, Sierra Vista</td>
</tr>
<tr>
<td>19 Cochise Private Industrial Council</td>
<td>Sierra Vista</td>
</tr>
</tbody>
</table>

Source: Cochise College Center for Economic Research, 2000

The City operates Bisbee Bus, a deviated fixed-route service with annual ridership of approximately 33,000 (see Table 2, below). The City of Bisbee Comprehensive Transportation Plan describes the transit system as a useful component of its transportation network (8). The Plan notes that service expansion could tie various parking areas with service centers, lodging, retail and residential uses, appealing to "choice" riders and supporting tourism. The Plan notes the possibility of resuming intercity service between Bisbee and Cochise College and Douglas to the east, and Sierra Vista to the west, and cites that "providing four round trips eastbound to the college and six westbound to Sierra Vista could cost up to $380,000 annually in operations cost and about $60,000 in annualized capital costs.” The Plan recommends an $850,000 transit expansion program, a regional transit operations study, and a market demand analysis.

TABLE 2 Bisbee Bus Operating Characteristics

<table>
<thead>
<tr>
<th>Total trips</th>
<th>32,578 (October 2011-September 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily average ridership</td>
<td>106</td>
</tr>
<tr>
<td>Number of routes and headways</td>
<td>Two routes:</td>
</tr>
<tr>
<td></td>
<td>1. AM Commuter route, 1 hr-7 minutes, two runs daily.</td>
</tr>
<tr>
<td></td>
<td>2. &quot;Bisbee Route&quot; - 1 hr- 30 minutes, 8 weekday runs on weekday, 4 Saturday runs.</td>
</tr>
<tr>
<td>Route types</td>
<td>Circulator with 3 loops</td>
</tr>
<tr>
<td>Service time</td>
<td>6:00 AM-6:20 PM Weekday</td>
</tr>
<tr>
<td></td>
<td>9:30 AM-3:35 PM Sat (304 days/year)</td>
</tr>
<tr>
<td>Days of operation</td>
<td>Mon-Sat</td>
</tr>
</tbody>
</table>

Source: ADOT 5311Bisbee Bus Transportation 2011-2012

The Plan notes a critical need for parking and recommends that 800 new spaces be added in the City and environs. Additional parking could function as park and ride facilities supporting intercity transit, particularly for the tourism sector and weekend events.
To effectively support tourists arriving by intercity transit, local transit service hours on weekends must be extended.

City of Douglas

Located at the Mexican border, Douglas hosts the Agua Prieta Port of Entry where approximately 14,700 people pass through daily (9). The 2010 U.S. Census documented 14,312 population; the Arizona Office of Employment and Population Statistics estimates 2012 population at 16,673. The City's downtown hosts shops and restaurants that attract significant pedestrian activity (10).

The City recently assumed operation of Douglas Rides, a fixed-route bus service that offers short deviations. The 2012 ridership was projected at 45,000 trips (11). The need for park and ride lots has been identified.

TABLE 3 Douglas Rides Operating Characteristics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual ridership</strong></td>
<td>45,000 projected for 2012</td>
</tr>
<tr>
<td><strong>Daily average ridership</strong></td>
<td>45000/(365 days*.857 (6 days/week))= approximately 144</td>
</tr>
<tr>
<td><strong>Number of routes and headways</strong></td>
<td>Three weekday routes:</td>
</tr>
<tr>
<td></td>
<td>Approximately 60 minute headway for all routes</td>
</tr>
<tr>
<td></td>
<td>1. Pirtleville/Bay Acres - 8 daily runs</td>
</tr>
<tr>
<td></td>
<td>2. Bay Acres - 4 daily runs</td>
</tr>
<tr>
<td></td>
<td>3. Midtown Route - 9 daily runs</td>
</tr>
<tr>
<td></td>
<td>4. Cochise College Shuttle - 3 daily runs</td>
</tr>
<tr>
<td><strong>Route types</strong></td>
<td>Circulators converging at central transfer center, shuttle</td>
</tr>
<tr>
<td><strong>Service time</strong></td>
<td>7:20 AM-4:30 PM weekday.</td>
</tr>
<tr>
<td></td>
<td>Modified Saturday schedule</td>
</tr>
<tr>
<td><strong>Days of operation</strong></td>
<td>Mon-Sat</td>
</tr>
</tbody>
</table>

*Source: Douglas Rides Schedule/Map*

Demand for intercity service by Douglas residents was demonstrated from 2003-2006, when the City provided Cochise Commuter service to Bisbee and Sierra Vista through a three-year HUD pilot program. At the time of program expiration, the service generated nearly 2,500 riders in four months (11). Shuttle service to Tucson and Phoenix is provided by private services. The City provides intercity service from Elfrida to Douglas on alternating weeks, providing a small group of riders with direct access to shops and businesses. As recently as 1976, the City hosted national intercity bus service to Benson by Greyhound Lines (12). The author was not able to determine when or why that service was discontinued.

City of Sierra Vista

The City of Sierra Vista hosts the region’s largest employers, notably Fort Huachuca, which has evolved from an historic military post to a primary military communications hub employing 10,146 FTE in 2009 (13). Other major employer groups are technology, defense, and education. The City has remained on a steady growth trajectory despite the current recession. The 2010 U.S. Census documented a population of 43,888. However, at the region’s December 2012 Coordination meeting, City official Ryan Kooi noted that the City's estimated population is approaching 50,000. As 50,000 population is achieved, the City will be designated as an urban area, and the region must be represented by a Metropolitan Planning Organization. The City also offers cultural, educational, and recreational amenities. Nearly 15% of the City's population is retirees, higher than the State percentage of 13.8%. The City is located along State Route 90.
The City of Sierra Vista provides the most comprehensive transit service in the region, with six fixed-route circulator routes that converge at a central transfer center. The *Arizona Rural Transit Needs Study* noted high productivity and cost effectiveness in 2006 (5). With an urban area designation, the City will be required to transition its primary transit funding source from Section 5311 to Section 5307 funds, which may not be applied toward operating costs. New sources will be needed to fund $250,000 in annual operating expenses.

**TABLE 4 Vista Transit Operating Characteristics (FY 2012)**

<table>
<thead>
<tr>
<th>Annual ridership</th>
<th>154,000 unlinked trips; 94,000 linked trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily average ridership</td>
<td>624</td>
</tr>
<tr>
<td>Number of routes and headways</td>
<td>Six weekday routes: Five routes have 30 minute headway, one route has 60 minute headway. Saturday route: modified loop with service to Fort Huachuca and 30 minute headways.</td>
</tr>
<tr>
<td>Route types</td>
<td>Circulators converging at central transfer center</td>
</tr>
<tr>
<td>Service time</td>
<td>7:00 AM-5:30 pm for three routes, approximately 10:00 am-3:00 pm for two routes. The #7 bus operating on Saturday has 30 minute headways.</td>
</tr>
<tr>
<td>Days of operation</td>
<td>Mon-Friday. The #7 Bus operates on Saturday.</td>
</tr>
</tbody>
</table>

*Sources: City of Sierra Vista Transit staff, City of Sierra Vista Transit Schedule/Map*

The City commissioned the firm Kimley-Horn and Associates to undertake the *Sierra Vista Transportation Efficiency Study*. The study objectives are to identify ways to make the existing transportation system work more efficiently; minimize the need for increased roadway capacity; and minimize congestion. Two key components are to increase alternative mode usage and transit demand programming (14). Once again, study findings identify intercity transit service between Sierra Vista-Bisbee-Douglas as a priority.

**ESTIMATING RIDERSHIP DEMAND FOR NATIONAL INTERCITY BUS SERVICE IN COCHISE COUNTY**

**Background**

In response to declining national intercity bus service and the need to replace the eliminated services, the Transit Cooperative Research Program (TCRP) commissioned the firm KFH Group, Inc. to conduct a project to develop a "sketch planning guide" for public and rural national intercity providers to assess demand for national intercity bus services (15). The product was *TCRP Report 147, Toolkit for Estimating Demand for Rural Intercity Bus Services*, with an accompanying Microsoft Excel spreadsheet in CD-ROM format. The study scope had four components:

1. Gather information from interviews with stakeholders including federal and state officials, industry associations, key intercity carriers, and consultants to determine the current state of forecasting, and identify examples of current intercity service;

2. Conduct surveys to obtain data on rural intercity bus services;

3. Identify and evaluate existing methods for forecasting intercity bus service; and

4. Develop a sketch-planning guide and supporting tools, data, and methodology for administrators, planners, and managers to forecast potential intercity bus ridership.
The TCRP Report 147 methodology will be used to estimate demand for rural national intercity transit for two potential fixed routes in Southern Cochise County: Bisbee-Sierra Vista-Benson and Douglas-Bisbee-Sierra Vista.

**Project Definition of Intercity Bus Service**

The project team defined criteria for "rural intercity bus service" that included:

- Service connects rural areas with the national intercity bus network
- Service makes a stop within the network at a common location, or within a quarter mile of a national carrier, and within two hours of intercity bus departure
- Vehicles accommodate both passengers and baggage
- Service is fixed-route and fixed-schedule

Local rural transit routes connecting to other rural intercity routes that do not connect to the national intercity network, and commuter services, are not considered intercity

Service data for routes that met these criteria was collected in a database. Arizona communities with intercity service that were included are: the Navajo Nation, Show Low, Wickenburg/Phoenix area communities, Ajo, Marana, Green Valley Sahuarita, and Tucson Estates; all are Section 5311(f)-funded services (*see Attachment 1*).

**Methodology**

The study team selected a basic gravity model that operates on the principle that "demand for travel between two places is proportional to the populations and inversely proportional to the distance between them." A "sketch tool" with embedded formulas was selected, rather than a full planning toolkit. The team sought to develop a model, and several were developed and tested against sample data. Two models that exhibited high correlation were selected:

- A regression model based on the variables of average origin population from 2000 U.S. Census, number of route stops, presence of an airport, and presence of intercity provider service
- A trip rate approach model based on 2001 National Household Travel Survey data

**Application of the Sketch Tool**

To use the sketch tool to evaluate ridership for a proposed route, the following information is input into the Microsoft Excel spreadsheet (*see Attachment 2*):

- Name of State
- Whether the route serves one or more commercial airports, or the airport could be accessed with a transfer
- Whether the service will be operated by a national intercity bus carrier
- Whether the route serves a city or town with a state or federal correctional facility
- Route Length
- Locations served: names of urban areas or clusters along route (generated by the Sketch Tool)
- Final destination
Based on planning priorities identified in the Planning Section (p. 3), two scenarios for Southern Cochise County were developed:

**Route #1. Bisbee-Sierra Vista-Benson** (total length = 57.5 miles, Figure 2): This proposed route is the only one in the area that meets the study criteria for a national intercity bus route. The route would commence in Bisbee, with one or more stops in Sierra Vista and possibly along Route 90, and end in Benson, where national intercity bus and passenger rail service is provided.

**FIGURE 2 Route #1**

![Route 1 Map](image)

Route #2. Douglas-Bisbee-Sierra Vista (58.5 miles, Figure 3): This route does not meet the study criteria because it does not connect to national intercity service, but would meet the criteria if national intercity service is extended to Sierra Vista. The model run was an interesting exercise because the City of Douglas hosts a state prison facility, which is a national intercity trip generator.

**FIGURE 3 Proposed Route #2**

![Route 2 Map](image)

**Analysis of Model Runs**

The results of the model run for Route #1 are provided in *Attachment 3*. The route does not serve a commercial airport or correctional facility. The regression model yielded an annual trip rate of zero, and the trip rate model yielded low ridership demand of 600 annual trips. The negative confidence interval indicates a weak correlation with the data samples, thus a low ridership value.
The model output notes the four comparable routes from the database used to generate the results. This comparable data may explain why the model isn't generating high ridership: the comparable routes are 75-145 miles long; include 5-7 stops; and three of the four have commercial airports. Major trip generators include: healthcare, government offices, airports, colleges/universities (enrollments of 718-2,880 students), and retail complexes. In general, the comparable routes are comprised of a string of small, well-developed, towns; none are from Arizona.

In comparison, the Bisbee-Sierra Vista-Benson route is shorter, with only one population center along the route to include as a stop. By manually adjusting the trip rate model, one can see that Sierra Vista is automatically defined as a “destination,” (the largest city along the route is automatically defined as the destination), whereas the desired destination, Benson, is defined as a stop. That factor is likely causing problems, and there is no ability to correct this feature.

The results of the model run for Route #2 are shown in Attachment 4. Under this scenario, if national intercity bus service were extended to Sierra Vista, both the regression and trip rate models indicate positive ridership demand; 4,800 and 6,500 annual trips respectively, or from 92-125 trips per week. The model predicts that if fixed-route, fixed-schedule service was extended to Sierra Vista from Benson, there would be demand for such service from the Douglas and Bisbee communities.

**Manual Adjustment of the Model**

The trip rate model can be manually adjusted to include additional known trip generators, such as a university/college, military base, or correctional facility. Table 5 summarizes the study’s approach for making manual adjustments.

**TABLE 5 Methodology for Additional Trip Generators**

<table>
<thead>
<tr>
<th>Trip generator</th>
<th>Steps to estimate annual ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>University or College</td>
<td>• Determine on-campus student population</td>
</tr>
<tr>
<td></td>
<td>• Multiply by an assumed number of off-campus trips</td>
</tr>
<tr>
<td></td>
<td>• Develop assumed number of long-distance trips</td>
</tr>
<tr>
<td></td>
<td>• Multiply on-campus population by assumed number of long-distance trips</td>
</tr>
<tr>
<td></td>
<td>• Determine whether there is a policy preventing personal vehicles, or if not,</td>
</tr>
<tr>
<td></td>
<td>multiply by 2% (bus mode share) to determine ridership at particular stop.</td>
</tr>
<tr>
<td>Military Base</td>
<td>• Determine number of persons stationed at military base</td>
</tr>
<tr>
<td></td>
<td>• Contact base staff to understand particular transportation needs</td>
</tr>
<tr>
<td>Correctional Facility</td>
<td>• Determine type of correctional facility, prison population, and release schedule</td>
</tr>
<tr>
<td></td>
<td>• Determine any data to assess visitor needs</td>
</tr>
</tbody>
</table>

Examples of the data needed make these manual adjustments are provided below.

*Cochise College*

The Cochise College-Sierra Vista campus population from Benson is estimated at 43 students; estimating that students may return from school to Benson four times a semester would generate demand for an additional 344 intercity bus trips during the school year.
Fort Huachuca

The Sierra Vista Transportation Efficiency Study concluded that service needs for Fort Huachuca are difficult to estimate, but that the population is relatively transit-dependent (14). Also, the facility provides classroom training for young adults for up to six months, and these students are encouraged not to have vehicles. Therefore, there is potential for intercity bus service demand by both permanent and short-term residents of the Fort.

Correctional Facility

The staff at the Douglas Arizona State Prison Complex confirmed that approximately three inmates are released daily (16). The facility provides its own bus service, transporting individuals to Benson, Tucson, and Phoenix. It is possible, but perhaps unlikely, that the service could be discontinued if national intercity service were provided to Douglas. However, since the facility houses inmates from across the State, visitors might wish to utilize national intercity service. More data on inmate visitation is needed to estimate this demand.

Assessment of the Sketch Model Tool

The study team that developed the Sketch Tool presented an assessment of the tool:

- Reiterated that the exercise is an "initial planning estimate," and that a full demand analysis requires more specificity, such as illustrated in the manual adjustment process methodology.
- The model has limitations: it does not address additional ridership generated from the broader transit network or population centers along the corridor, or the impact of fares or service frequency of the local transit service.
- It is likely that rural intercity bus service is becoming increasingly specialized, particularly since it is often subsidized by one or more major trip generators, such as colleges/universities and airports (11).
- It is difficult to estimate the positive effect of subsidies on ridership demand.
- A planner may use the comparable routes data to learn about service in study areas with similar characteristics to their own area.

How helpful was this model be for projecting demand for the two proposed routes in Southern Cochise County? Disadvantages include:

- The comparable routes that most closely matched Route #1 and Route #2 have very different characteristics from the study area, which needs to be considered in interpreting results.
- The model automatically defines the largest community as the destination, skewing the results.
- The model does not incorporate parameters such as trip schedule, frequency, or fare, factors that affect ridership demand.

Advantages include:

- The model identified key transit trip generators.
- The model showed that potential routes in the study area are more similar to services in other regions of the country than to Arizona routes.
- As the Sierra Vista-Benson corridor continues to develop there is the possibility that more destinations for transit stops will be created, and the model will become more relevant.
• The exercise reiterated that development patterns in different regions vary substantially, and that planning for this corridor must be customized. It is likely that the communities used in the model feature older development patterns. Transit service data from such areas is not readily transferable to a rapidly growing area such as Sierra Vista.

**Estimating Demand for Intercity Rural Bus Service**

The provision of intercity service between the communities of Bisbee, Douglas, and Sierra Vista - that is, service between cities that does not link to national intercity bus service - has also been identified as a critical need. The *TCRP Report 147 Sketch Tool* is not be applicable to this scenario since its database is based on national intercity service characteristics. However, the approach provided for making manual adjustments provides a methodology for conducting such an analysis.

**Considerations for Future Service and Planning**

The provision of national intercity bus service would help achieve other long-term planning objectives that may be desirable:

• National intercity bus service would provide better access for tourists: the City of Flagstaff’s accessibility to national and international travelers is a potential model. Potential tourist destinations in the region are Kartchner Caverns, numerous mountain ranges, the San Pedro Riparian Conservation Area, and the Mexican port of entry.

• Opportunities for shared commerce and economic development between individuals or small-scale businesses in the United States and Mexico would be increased.

Finally, as the region continues planning for intercity bus service, non-traditional modeling measures, such as the survey of targeted demographic groups and riders that use the region's non-profit transit services, must be utilized. The *TCRP Report 147 Sketch Tool* provides a starting point for more in-depth study of intercity and national intercity bus demand between Southern Cochise County communities.
TCRP Report 147 Study: Intercity Routes in the State of Arizona
TCRP Report 147 Model for Estimating Rural Intercity Bus Demand

TCRP B-37
ESTIMATION OF DEMAND FOR RURAL INTERCITY BUS SERVICE
TOOLKIT

INPUTS:
To use this toolkit please follow these instructions:
1. Select your state from the drop-down menu.
2. If the service will be operated by a rural intercity bus carrier, check the respective box.
3. Fill in the estimated length (in miles) of the route in the Route Length box.
4. Select the locations from the drop-down menu that will be served along the route.
5. To generate results click the "Output Results" button.
6. To clear existing inputs click the "Reset Fields" button.

<table>
<thead>
<tr>
<th>STATE</th>
<th>National Intercity Bus Carrier</th>
<th>Airport</th>
<th>Correctional Facility</th>
<th>Route Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td></td>
<td></td>
<td></td>
<td>75.13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCATIONS SERVED (INT)</th>
<th>POPULATION (INT)</th>
<th>LOCATIONS SERVED</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Fe, AZ Joint Center</td>
<td>41,941</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Route #1: Bisbee to Sierra Vista to Benson

Route origination: Bisbee
Route destination: Benson
Route: SR 80 to SR 90

OUTPUTS:
Based on the inputs that were provided, the projected annual rural intercity bus demand for the route is:

<table>
<thead>
<tr>
<th>Service Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Population</td>
<td>5,205</td>
</tr>
<tr>
<td>Number of Origin Stop</td>
<td>3</td>
</tr>
<tr>
<td>Length of Route</td>
<td>58.5</td>
</tr>
<tr>
<td>Airport on Route</td>
<td>No</td>
</tr>
<tr>
<td>National Intercity Bus Carrier</td>
<td>No</td>
</tr>
<tr>
<td>Correctional Facility</td>
<td>No</td>
</tr>
</tbody>
</table>

Regression Model
0

95% CI Upper Limit: 3436.10
95% CI Lower Limit: -5137.23

Trip Rate Model
600

Manual adjustments to the Trip Rate Model are possible. For more information about adjustments, see the clickable link.

<table>
<thead>
<tr>
<th>Comparable Routes</th>
<th>Origin Population</th>
<th>Frequency</th>
<th>Route Length</th>
<th>ICB</th>
<th>Airport</th>
<th>Ridership</th>
<th>More Info</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11,639</td>
<td>1</td>
<td>83</td>
<td>Non-ICB</td>
<td>Yes</td>
<td>5,754</td>
<td>More info</td>
</tr>
<tr>
<td></td>
<td>7,955</td>
<td>2</td>
<td>145</td>
<td>Non-ICB</td>
<td>No</td>
<td>877</td>
<td>More info</td>
</tr>
<tr>
<td></td>
<td>15,812</td>
<td>9</td>
<td>110</td>
<td>Non-ICB</td>
<td>No</td>
<td>8,760</td>
<td>More info</td>
</tr>
<tr>
<td></td>
<td>4,335</td>
<td>1</td>
<td>107</td>
<td>Non-ICB</td>
<td>Yes</td>
<td>997</td>
<td>More info</td>
</tr>
</tbody>
</table>
Route #2: Douglas to Bisbee to Sierra Vista

Route origination: Douglas
Route destination: SV Transfer Station, 1050 E. Wilcox Drive
Route: SR 80 to SR 90

OUTPUTS:
Based on the inputs that were provided, the projected annual rural intercity bus demand for the route is:

<table>
<thead>
<tr>
<th>Service Characteristics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Population</td>
<td>6,098</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Origin Stop</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of Route</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| National Intercity Bus Carrier| Yes   |     |     |
| Correctional Facility         | Yes   |     |     |

Regression Model
4,800
95% CI Upper Limit 8779.87
95% CI Lower Limit 803.33

Trip Rate Model
6,500

Manual adjustments to the Trip Rate Model are possible. For more information about adjustments, click here.

<table>
<thead>
<tr>
<th>Comparable Routes</th>
<th>Origin Population</th>
<th>Frequency</th>
<th>Route Length</th>
<th>ICB</th>
<th>Airport</th>
<th>Ridership</th>
<th>More Info</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4,325</td>
<td>1</td>
<td>107</td>
<td>Non-ICB</td>
<td>Yes</td>
<td>997</td>
<td>More Info</td>
</tr>
<tr>
<td></td>
<td>7,955</td>
<td>2</td>
<td>145</td>
<td>Non-ICB</td>
<td>No</td>
<td>877</td>
<td>More Info</td>
</tr>
<tr>
<td></td>
<td>3,549</td>
<td>6</td>
<td>75</td>
<td>Non-ICB</td>
<td>Yes</td>
<td>1,393</td>
<td>More Info</td>
</tr>
<tr>
<td></td>
<td>11,639</td>
<td>1</td>
<td>83</td>
<td>Non-ICB</td>
<td>Yes</td>
<td>5,754</td>
<td>More Info</td>
</tr>
</tbody>
</table>
REFERENCES


3 Southeast Arizona Governments Organization. 2012 *Transportation Coordination Plan.* April 2012.


7 City of Benson http://www.cityofbenson.com/index.asp?Type=B_BASIC&SEC=%7B768D52EE-579F-4A


11 Phone conversation with Connie Gastelum, Transit Coordinator, City of Douglas, December 10, 2012


